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Detailed history of the railways in the South African War, 1899-1902

Royal Engineers'
Institute (Great
Britain)

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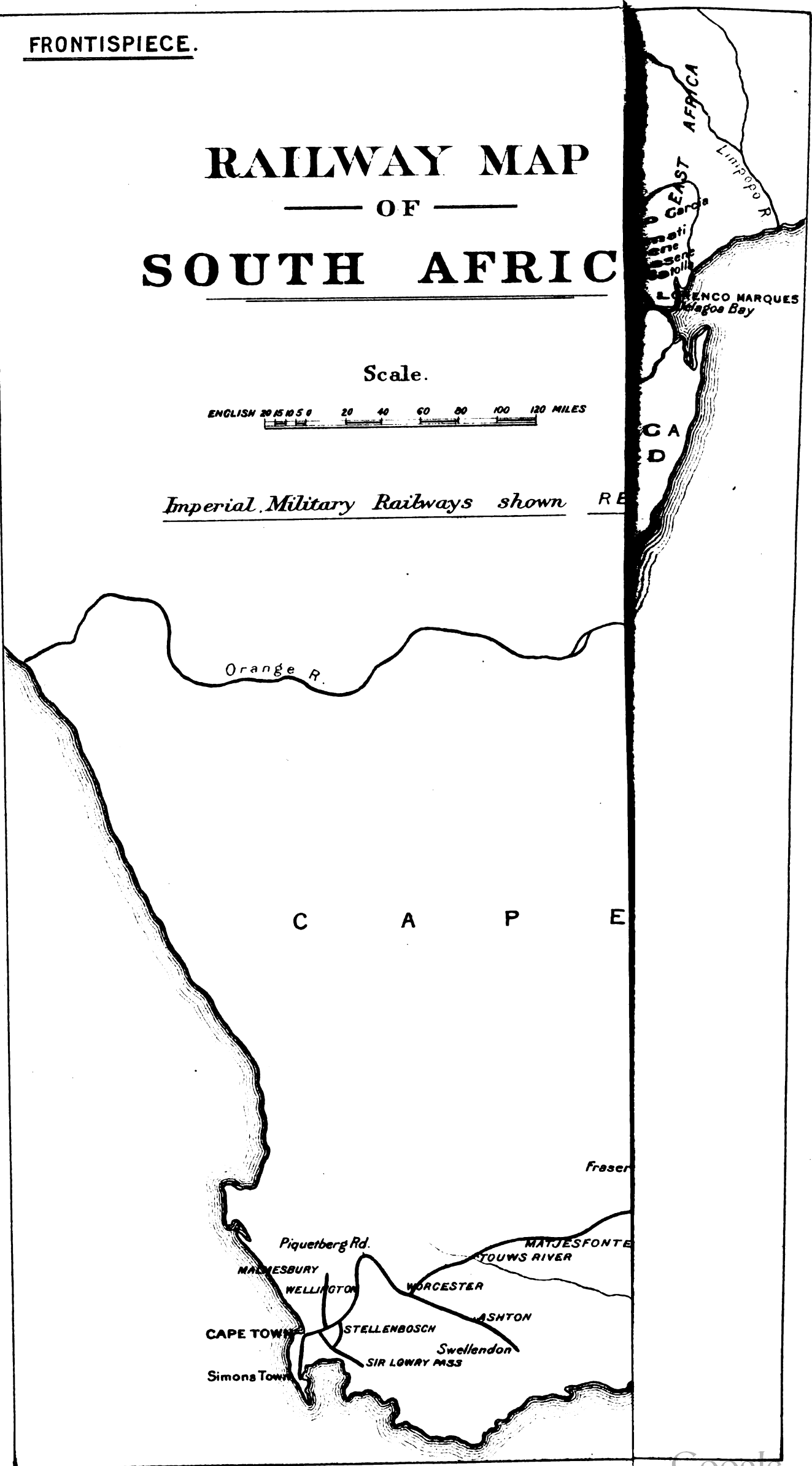
RAILWAY MAP — OF — SOUTH AFRICA

Scale.

ENGLISH 20 40 60 80 100 120 MILES



Imperial Military Railways shown RE



DETAILED
HISTORY OF THE RAILWAYS
IN THE
SOUTH AFRICAN WAR
1899—1902

VOL. I.—LETTERPRESS

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NOTE.

An explanation is considered desirable as to how these volumes came to be printed and issued by the Royal Engineers Institute.

After the War was over the various reports on Railway operations were abridged and re-arranged at the War Office to form a connected *History of the Railways during the War in South Africa, 1899—1902*. This compilation was divided into 4 volumes, each accompanied by its own illustrations; the first consisted of an original "General Report" by Lieut.-Col. Sir E. P. C. Girouard, K.C.M.G., R.E., Director of Railways; the remainder comprised abstracts of numerous other reports, concerning the Cape Government, Natal Government and Imperial Military Railways and also sundry special organisations which, though strictly speaking extraneous to Railway working, had been inaugurated and administered by Railway Officers under the control of the Director.

The *History* was completed in November, 1902, submitted for official publication, and accepted; but considerations of the expense involved subsequently caused the Lords Commissioners of the Treasury to sanction the printing of the 1st volume only, and this was issued at the end of 1903 under the above title.

The decision not to print the remaining 3 volumes came, in July, 1903, to the knowledge of the Royal Engineers Institute; and its Committee resolved, in October, 1903, to complete the publication themselves, rather than allow such a valuable record of the largest Railway operations ever undertaken by a British Army in the Field to be entirely lost to posterity.

The work of printing was at once taken in hand, and by the end of the year appreciable progress had been made and a considerable sum expended. A delay of eight months then occurred through a reconsideration, at the request of the War Office, of the question of printing at public expense; and this course was eventually sanctioned by the Treasury. On account, however, of so much having already been done by the Royal Engineers Institute, a final authority was given, at the end of July, 1904, for that body to complete the work of publication, and printing was then re-commenced.

The 3 last portions of the original compilation are now issued under the title *Detailed History of the Railways in the South African War, 1899—1902*, and consist of 2 volumes only, viz. :—I. Letterpress, II. Illustrations. Motives of economy and the exigencies of the compositor have necessitated a considerable departure from the first arrangement of the manuscripts; on this account the signatures of the authors have been omitted from such of the reports as have not been reproduced verbatim. A List of these original Authors is given in the Addenda.

To prevent confusion the official publication, *i.e.*, the 1st volume of the original, is referred to in the *Detailed History* as the "Director of Railway's General Report."

A. T. MOORE, MAJOR, R.E.,
Secretary, R.E. Institute.

December, 1904.

ERRATA.—An error has occurred in the spelling of the terminals *burg* and *berg* in some of the place names, all having been spelt *berg*. This was not noticed until a considerable portion of the letterpress had been printed off, when it was too late to rectify it; and for the sake of uniformity it was allowed to run through the volume. Johannesburg, Pietersburg, Middleburg, Pietersmaritzburg, Ventersburg, Edenburg and Vryburg should have been spelt as now given.

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PREFACE.

The *History of the Railways during the War in South Africa, 1899—1902*, published officially (see Note on page iii.), consists of a concise and complete epitome by the Director of Railways of all the work that was carried out under his control. It is especially valuable on account of certain tabular matter and diagrams, notably :—(1). A complete list of every item of damage effected on the Railways by the enemy during their retreat, showing how and by whom and in what space of time the temporary repairs were executed immediately in rear of the British advance, and also the nature and agency of the subsequent semi-permanent or permanent reconstructions ; (2). A complete list of every item of damage inflicted by the enemy's raids after the occupation of the lines by the British ; and (3) diagrams showing, month by month, the total number of interruptions to traffic caused by the enemy during 1900 and 1901.

This *Detailed History*, as its name implies, goes fully into the separate branches of Railway working on the various lines. Parts I. and II. deal respectively with the railways in the British Colonies of the Cape and Natal. In addition to general descriptions of the railways themselves, and of their normal technical organisation, will be found much valuable matter regarding the measures taken to work them under the stress of invasion and war.

The reader's special attention is directed to Chapter II., Part I., wherein are discussed at some length the questions of the establishment of a Military Controlling Staff and the relations which should exist between it and the Technical Staff of a railway in friendly country. The absolute necessity for arriving at a clear understanding on the subject of a Military Controlling Staff renders it incumbent on officers of the General Staff to educate themselves in this matter, and to widen their views by a study of the principles enunciated by other European Armies. Such extended studies, supplemented by the experiences of the South African War, will enable them to see clearly to what extent Military Control is necessary and at what point it becomes harmful.

The Appendices to Chapter III., Part I., will repay examination ; they show what can be done with limited rolling-stock in the way of large troop movements on making a strategic change of front. The Appendices to Chapter VI., Part II., furnish further examples from the work of the Natal railways during the War.

Part III. deals with the organisation and work of the Railway Pioneer Regiment, a unit which was specially raised in South Africa to assist in dealing with the immense amount of repairs rendered necessary on railway lines through the wholesale destruction carried out by the Boers in their retreat before the British Army in the Orange Free State.

Part IV. contains a full account of the Imperial Military Railways, a title given to the enemy's lines as they were successively captured. It divides itself broadly into the history of the Reconstruction, Management and Working of the Railways in the Orange River and Transvaal Colonies.

In Chapter I. the necessity of a Military Controlling Staff is further emphasised, reference being made also to the modifications found necessary in an enemy's territory. The Appendices to this Chapter all furnish useful information regarding the various railway problems which arose in the conquered territories. Appendices A, B, and N are perhaps the most important, containing as they do the instructions issued for the guidance of the Army generally and of Railway Staff Officers in particular ; the relation of these latter to the Director of Railways was much discussed, but after considerable experience it was finally agreed that they should be placed under the orders of the Director. Appendices E, G, and H furnish further examples of large troop movements undertaken for strategic purposes.

Chapter II. contains an account of the Engineering work,—temporary, semi-permanent and permanent,—which fell to the lot of the Works Department, and is of great interest to technical Engineer Officers ; the photographs and drawings will repay careful study. The detailed organisation and equipment of Construction Trains is

dealt with, and should prove useful to officers in charge of similar trains in future campaigns; the necessity for employing Military Officers and men on these trains (when time rather than economy in construction is the prime factor) is very clearly brought out. This Chapter further shows how advantage was taken of the presence of experienced civilian railway engineers when the enemy's lines had fallen into our hands.

The difficulties experienced by the various working departments of the Imperial Military Railways (viz.:—Traffic, Locomotive, Telegraph, Stores and Accounts) are set forth in Chapters III. to VII. These possess an interest which is primarily technical, but which will also furnish much food for thought to those who are anxious to gain an insight into the practical working of a great system of Railways on which an Army in the Field is dependent for all its supplies.

Chapter VIII. deals with the Railway Police; and Chapters IX. and X. with the Railway Staff Depôt and the Railway Employment Office, special organisations to meet somewhat peculiar circumstances, the former for the administration of troops employed on the Railways and the latter for the enrolment of Europeans for work on the same.

Chapter XI. is a report on Laurenço Marques, Delagoa Bay, and the arrangements made to work harmoniously with the authorities of Portuguese East Africa.

Part V. contains a most interesting account of the organisation, equipment and use of Armoured Trains.

Part VI. treats of the Army Labour Depôts, another special organisation, established by the Director of Railways to meet the demands of the Army at large for Native labour.

The student of this *Detailed History* would be much assisted by a previous perusal of the Director of Railway's "General Report" (referred to in para. 1 of this Preface), from which would be obtainable at the outset a clear grasp of the Railway conditions of the War and a full appreciation of the difficulties encountered and overcome by the officers responsible for the working of the Railways. But only a limited number of copies of the official publication were printed; and as these will eventually be difficult to procure, some of the statistics have been totalised and inserted here.

The following 7 Tables deal with the principal features of the Railway conditions:—
 (1). The enormous area covered by the theatre of war, even so far as Railway operations were concerned, *i.e.*, omitting Rhodesia and the northern Transvaal* ; (2). The scarcity of rolling stock; (3). The quantity of traffic dealt with, partly occasioned by large long-distance troop moves to repel the second invasions of Cape Colony and Natal and to place Columns in position for "drives"; (4). The wholesale destruction of Railways effected by the enemy during their retreat in the first (or regular) phase of the campaign; and (5). The interruptions to traffic in the second (or guerilla) phase by the enemy's raids, which broke out immediately after Pretoria was occupied, grew to a maximum at the end of 1900, commenced to decrease with improvements in the arrangements for protecting the Railways, and died out when the institution of blockhouse† lines (first on the Railways and subsequently across country) narrowed the enemy's areas for offensive movements and in the end, by means of enveloping "drives" across these restricted areas on to the defended boundaries, brought about their final surrender.

* A map of South Africa, superimposed on one of Europe to the same scale, with Cape Town placed on Bayonne, Port Elizabeth on Nice, and East London on Genoa, would approximately bring Bloemfontein on Heidelberg, Mafeking on Emden, Pietersberg along the Baltic coast, Pretoria on Berlin, Delagoa Bay in the neighbourhood of the Polish frontier and Durban on Vienna; that is to say, the theatre of war, exclusive of the Northern Transvaal and Southern Rhodesia, was approximately equal to the combined areas of France, Switzerland, Belgium, Holland and Germany.

† By the end of the war all the Railways in the Orange River Colony and the Transvaal were protected by blockhouses at close intervals, usually with continuous wire fencing between them, as also were the Railways in Cape Colony to the south of Warrenton and north of the line Beaufort West—Cradock—Queenstown. The principal cross-country blockhouse lines were;—(a) Lamberts Bay (about 100 miles north of Cape Town)—Calvinia—Carnarvon—Victoria West, (b) Kroonstad—Harrismith, and (c) Standerton—Ermelo—Wonderfontein. The total length of blockhouse lines was about 3,700 miles. In addition to the above, other Railway lines and cross-country routes, both in the above-named three Colonies and in Natal, were held by posts at varying distances.

The institution of armoured trains still further assisted in the reduction of raids and in the success of the "drives."

1. MILEAGE OF RAILWAYS.

In the theatre of war so far as the Railway History is concerned, *i.e.*, omitting the Rhodesia Railway north of Mafeking—

Cape Colony Railways	1,987 miles
Rhodesia Railways (Vryberg to Mafeking)	96 "
Natal Railways	567 "
Orange Free State Railways	392 "
Transvaal Railways	918 "
Total	<u>3,960 miles.</u> ^o

* There are also 126 miles of private railways in Cape Colony. The total length of the Rhodesia Railway worked by the Cape Government is 587 miles. The length of the Delagoa Railway is 55 miles.

2. DISTANCES IN MILES.

Cape Town	to Mafeking	870	
"	" Pretoria	1,041	
Port Elizabeth	"	741	
Durban	"	511	
Koomati Poort	"	291	
Cape Town	" De Aar Junction	500	} 870
De Aar Junction	" Orange River	70	
Orange River	" Kimberley	77	
Kimberley	" Mafeking	223	
Port Elizabeth	" Naauwpoort Junction	270	} 741
Naauwpoort Junction	" Norval's Pont	58	
Norval's Pont	" Bloemfontein	122	
Bloemfontein	" Vaal River	212	
Vaal River	" Pretoria	79	
East London	" Stormberg Junction	221	} 402
Stormberg Junction	" Bethulie	68	
Bethulie	" Bloemfontein	113	
Durban	" Ladysmith	189	} 474
Ladysmith	" Volksrust	119	
Volksrust	" Elandsfontein	166	
Elandsfontein	" Klerksdorp	127	
Pretoria	" Pietersberg	177	

3. MANIPULATION OF ROLLING STOCK PRIOR TO WAR.

	Engines.	Bogie Coaches.	8 and 6-Wheel Trucks.	Equivalent of Short Trucks.
Total C.G.R. and N.G.R. rolling stock running prior to war	621	910	1,525	8,581
Total of same on British territory on outbreak of war	563	779	1,363	7,041
Balance on enemy's side on outbreak of war	58	131	162	1,540

4. ROLLING STOCK CAPTURED AND REPAIRED AND NEW PURCHASES.

	Engines.	Coaches and Trucks : Equivalent of Short Trucks.
Captured from enemy or released	367	6,033
Damaged by enemy	102	1,013
Repaired by British	81	443
New purchases by C.G.R., N.G.R. and I.M.R.	112	2,026

Note.—As regards captures the greatest hauls were as follows:—At Bloemfontein (13. 3. 00) 28 engines, 27 coaches and 325 trucks; at Johannesburg (31. 5. 00) 7 engines, 600 trucks; at Pretoria (5. 6. 00) 17 engines, 400 trucks; at Koomatipoort (27. 9. 00) 103 engines, 2,645 trucks; between Kimberley and Mafeking (29. 5. 00) 27 engines; on Sanderton line (July, 1900) 19 engines; and at Kaapmuiden, Barberton and Avoca respectively (September, 1900) 19, 44 and 52 engines. On the relief of Kimberley (19. 2. 00) 20 engines, 15 coaches and 368 trucks were released. After the occupation of Koomatipoort (October, 1900) there were received from Delagoa Bay 8 engines and 1,260 trucks.

5. SUMMARY OF MILITARY TRAFFIC.

	C.G.R.	N.G.R.	I.M.R.	Totals.
	1. 10. 99 to 31. 3. 01.	1. 11. 99 to 31. 3. 01.	1. 4. 00 to 31. 3. 01.	
Passengers	1,247,060	384,045	935,817	2,566,922
Horses and other live stock	540,321	208,273	31,579	780,173
Goods, tons	1,057,795	533,432	621,673	2,212,900

Note.—The periods mentioned above do not cover the troop movements to repel the threatened second invasion of Natal or those connected with placing troops in position for “drives,” all of which took place late in 1901; nor do the figures include the very large number of guns, wagons and other vehicles which were transported.

6. DAMAGES TO LINES BY ENEMY DURING RETREAT, REPAIRED BY BRITISH DURING ADVANCE.

Section.	Total Mileage.	Bridges with Spans over 30 ft.	Culverts with Spans up to 30 ft. inclusive.	Permanent Way.	Remarks.
CAPE GOVERNMENT RAILWAYS.					
Orange River to Mafeking ...	300	5	36	14	Modder R. bridge, 8 spans of 80 ft., 5 destroyed. Vaal R. bridge, Fourteen Streams, 10 of 130 ft., 5 destroyed. 6 miles of track torn up between Kraaipan and Mafeking.
Rosmead to Stormberg ...	80 about	4	6	2	—
Naauwpoort to Norval's Pont ...	58	4	9	4	Oorlog's bridge, 3 spans of 100 ft. and 2 of 20 ft., 2 of former and 1 of latter destroyed. Orange R. bridge, Norval's Pont, 12 of 130 ft., 3 destroyed.
Molteno to Bethulie ...	76 about	5	3	3	Stormberg bridge, 3 spans of 150 ft. Orange R. bridge, Bethulie, 8 of 120 ft. and 2 of 50 ft., 5 of former destroyed.
NATAL GOVERNMENT RAILWAY.					
Highlands to Volksrust ...	167	14	52	28	Frere bridge, 2 spans of 100 ft. Tugela R. bridge, Colenso, 5 of 100 ft. Mile 220, 2 of 100 ft. Ingagane R. bridge, 3 of 100 ft. Incandu R. bridge, 1 of 100 ft. and 2 of 40 ft. Ingogo R. bridge, 1 of 100 ft. Laing's Nek tunnel, 50 yds. at S. end and 100 yds. at N. end blown in.
Harrismith branch ...	30	—	4	3	—
Dundee branch ...	—	1	—	—	—
IMPERIAL MILITARY RAILWAYS. ORANGE FREE STATE.					
Bloemfontein to Vaal R., Vereeniging ...	212	15	40	17	Glen bridge, 4 spans of 100 ft., 2 destroyed. Vet R. bridge, 5 of 100 ft., 3 destroyed. Doorn R. bridge, 1 of 100 ft. and 1 of 20 ft. Zand R. bridge, 5 of 100 ft., 3 destroyed. Valsch R. bridge, 5 of 100 ft. Rhenoster R. bridge, 1 of 100 ft. and 2 of 50 ft. Vaal R. bridge, Vereeniging, 5 of 37 m., 1 destroyed. 1½ miles of track torn up near Rhenoster. (Vaal R. to Elandsfontein, 42 miles, no damage).
TRANSVAAL.					
Volksrust to Elandsfontein ...	166	6	9	7	Blesbok Spruit bridge, 1 span of 30 m. Zuikerbosch bridge, 1 of 50 m. Sand bridge, 1 of 164 ft. Vaal R. bridge, Standerton, 1 of 164 ft. and 2 of 98 ft., former destroyed.
Elandsfontein to Klerksdorp ...	127	7	2	—	—
Pretoria to Koomati Poort ...	291	10	3	4	Wilge R. bridge, 1 span of 30 m. and 2 of 10 m. Kaapmuiden bridge, 3 of 30 m., 2 destroyed. Avoca bridge, 4 of 31 m., 3 destroyed.
Pretoria to Pietersberg ...	178	1	1	2	Pienaars R. bridge, 6 spans of 25 m., 4 destroyed. (Practically no damage Pienaars R. to Pietersberg).
Totals ...		72	165	84	

Note.—The above figures represent separate damages. In columns 3 and 4, each bridge or culvert is reckoned as 1 only, irrespective of number of spans. Of the bridges mentioned in column 6 all the spans were damaged or destroyed, except where otherwise stated. The above omits the numerous cases of damage to water supplies at stations and to telegraphs.

The lines from Norval's Pont and Bethulie to Springfontein and thence to Bloemfontein were left uninjured.

7. DAMAGES TO LINES BY ENEMY'S RAIDS, AFTER OCCUPATION BY BRITISH FORCES.

Date.	Bridges.	Culverts.	Permanent Way.	Trains derailed.	Remarks.
CAPE GOVERNMENT RAILWAYS.					
October, 1900 ...	—	—	1	—	
November, ,, ...	—	—	1	—	
December, ,, ...	—	3	—	1	
January, 1901 ...	—	—	2	—	
February, ,, ...	1	—	7	1	
March, ,, ...	—	—	2	—	
April, ,, ...	—	—	1	—	
May, ,, ...	—	—	2	1	
NATAL GOVERNMENT RAILWAY.					
August, 1900 ...	—	1	3	1	
October, ,, ...	—	—	1	—	Washbank station burnt down on 25. 10. 00.
March, 1901 ...	—	—	1	—	
May, ,, ...	—	—	1	1	
IMPERIAL MILITARY RAILWAYS.					
ORANGE RIVER COLONY.					
June, 1900 ...	11	1	2	1	Commandant De Wet's raid on night of 7. 6. 00 resulted in the following damages within a length of 14 miles:—Ten culverts, three 30-ft. bridges, four 50-ft. do., two 100-ft. do. (including Leeuwspruit) and one 120-ft. do. (Rhenoster), all burnt, and the station buildings at Roodeval also destroyed by fire. In addition a train containing 12,000 greatcoats and 1,500 mail bags was captured and burnt. On 11. 10. 00 two miles of track were torn up near Holfontein.
July, ,, ...	—	—	6	2	
August, ,, ...	2	2	8	1	
September, ,, ...	1	3	12	1	
October, ,, ...	—	13	15	2	
November, ,, ...	—	2	20	1	
December, ,, ...	—	—	2	—	
January, 1901 ...	—	1	3	—	
February, ,, ...	—	1	7	—	
March, ,, ...	—	3	5	—	
April, ,, ...	—	2	14	1	
May, ,, ...	—	—	8	3	
June, ,, ...	—	—	5	3	
TRANSVAAL.					
July, 1900 ...	—	2	5	2	Welverdiend bridge on S.W. line badly damaged on 26. 2. 01.
August, ,, ...	—	—	1	1	
September, ,, ...	—	1	7	6	
October, ,, ...	—	5	8	3	
November, ,, ...	—	1	12	—	
December, ,, ...	—	—	18	10	
January, 1901 ...	—	3	9	3	
February, ,, ...	2	1	16	10	
March, ,, ...	—	—	8	7	
April, ,, ...	1	—	7	4	
May, ,, ...	—	—	3	1	
June, ,, ...	—	—	1	2	
July, ,, ...	—	—	—	1	

Note.—The above figures do not represent separate damages, culverts and permanent way having been destroyed when trains were derailed, and *vice versa*. Many of the trains were completely wrecked, others only slightly injured. The frequent cases of destruction of telegraph lines, up to 2 miles at a time, have been omitted, also personal attacks on gangers and other Railway Officials. The total number of separate occasions on which traffic was interrupted was approximately 290.

In the Orange River Colony the raids increased in number steadily and reached their maximum in November, 1900, after which they suddenly declined, but recrudesced in April, 1901.

In the Transvaal the worst destruction took place on the Natal and Koomati-poort lines; on the former the raids were somewhat spasmodic, the greatest number occurring in October and December, 1900, and February, 1901; on the latter they were fairly continuous from December, 1900, to April, 1901, inclusive.

It will be observed that in the Transvaal special efforts were made to wreck trains, whilst comparatively little attention was paid to culverts.

LIST OF ABBREVIATIONS IN TEXT.

A.A.G.	...	...	Assistant Adjutant General.
A.D.R.	...	...	Assistant Director of Railways.
A.I.G.	...	...	Assistant Inspector General.
A.O.D.	...	...	Army Ordnance Department.
A.S.C.	...	...	Army Service Corps.
Asst.	...	...	Assistant.
C.G.R.	...	...	Cape Government Railways.
C.R.E.	...	...	Commanding Royal Engineer.
C.S.O.	...	...	Chief Staff Officer.
D.A.A.G.	..	...	Deputy Assistant Adjutant General.
D.A.D.R.	...	...	Deputy Assistant Director of Railways.
D.A.G.	...	...	Deputy Adjutant General.
D.A.T.	...	...	Director of Army Telegraphs.
Dept.	...	...	Department.
D.D.R.	...	...	Deputy Director of Railways.
D.I.G.	...	...	Deputy Inspector General.
Dir.	...	...	Director.
Dist.	...	...	District.
D.R.	...	...	Director of Railways.
F.R.S.	...	...	Field Railway Section.
G.O.C.	...	...	General Officer Commanding.
I.G.	..	...	Inspector General.
I.M.R.	...	...	Imperial Military Railways.
Loco.	...	...	Locomotive.
L. of C.	...	...	Lines of Communications.
M.I.	..	...	Mounted Infantry.
N.C.O.	...	...	Non-Commissioned Officer.
N.G.R.	...	...	Natal Government Railways.
N.S.A.R.	...	...	Netherlands South African Railway Company (= N.Z.A.S.M. = Nederland Zuid Afrikaansche Spoorurg Maatschappig).
O.C.	...	...	Officer Commanding.
O.F.S.	...	...	Orange Free State.
O.R.C.	...	...	Orange River Colony.
P.V.O.	...	...	Principal Veterinary Officer.
Q.F.	...	...	Quick Firing.
Qr.-Mr.	...	...	Quartermaster.
Q.M.G.	...	...	Quartermaster General.
Q.M.S.	...	...	Quartermaster Sergeant.
R.A.	...	...	Royal Artillery.
R.A.M.C.	...	...	Royal Army Medical Corps.
R.E.	...	..	Royal Engineers.
R.F.A.	...	...	Royal Field Artillery.
R.G.A.	...	...	Royal Garrison Artillery.
R.H.A.	...	...	Royal Horse Artillery.
R.N.	...	...	Royal Navy.
R.P.R.	...	...	Railway Pioneer Regiment.
R.S.O.	...	...	Railway Staff Officer.
R.T.O.	...	...	Railway Transport Officer.
S.O.	...	...	Staff Officer.
Supt.	...	...	Superintendent.
Vety.	...	...	Veterinary.

D.R.'s *General Report. The History of the Railways during the War in South Africa, 1899—1902*, by Lieut.-Col. Sir E. P. C. Girouard, K.C.M.G., R.E., Director of Railways, South African Field Force (published officially, see Note on page iii.).

PART I.
CAPE GOVERNMENT RAILWAYS.

CHAPTER I.

GENERAL DESCRIPTION OF CIVIL ORGANISATION AND WORKING DEPARTMENTS.

The whole system of 1,987 miles is made up of three trunk lines running inland General. from Cape Town, Port Elizabeth and East London respectively ; and these are divided into 4 Sections known as the Western, Midland, Eastern and Northern. In addition there is the extension northwards from Vryburg to Bulawayo, known as the Rhodesian Railway.

The Western Section runs from Cape Town to De Aar Junction	length 590 miles.
The Midland from Port Elizabeth to Norval's Pont, connecting through Naauwpoort with De Aar on the Western Section and through Rosmead with Stormberg on the Eastern Section (two routes from Uitenhage to Rosmead) ...	" 791 "
The Eastern Section from East London to Bethulie Bridge	" 333 "
The Northern Section, a continuation of the Western, from De Aar to Vryburg	" 273 "
Total ... ..	.. 1,987 miles.
Adding the Rhodesian Railway ... ..	... 587 "
Grand Total ... ..	... 2,574 miles.

The gauge of the whole of the above, excepting certain short suburban lines, is Permanent Way. 3 feet 6 inches.

The ruling gradient is $\frac{1}{40}$ between (a) Cape Town and De Aar, (b), Port Elizabeth and Naauwpoort, (c), East London and Albert Junction ; northward of these points gradients are $\frac{1}{80}$ and $\frac{1}{100}$.

The maximum curve is 5 chains (300 feet), and this is used for a distance of 16 miles through the Hex Mountains on the Western Section.

Banking engines are used for distances varying from 16 to 4 miles on the Western, Midland and Eastern Sections ; otherwise trains are broken and made up in accordance with the ruling gradient and curves on sections of the route.

Flat-footed rails weighing 60 lbs. per yard are used, except on one short branch. Fish plates, which are unflanged, weigh 16.2 lbs. per pair and are attached by 4 bolts.

1,760 sleepers are used per mile. The joint sleepers are 2 feet 6 inches apart, the remaining intermediate sleepers being spaced accordingly.

Ballast is either shale or river gravel.

Points are padlocked through the flange of the running rail and a small plate riveted on to the switch ; near Cape Town, Saxby and Farmer's "detector lock" is being adopted.

At principal stations platforms are built 3 feet above the rails ; elsewhere they vary from 12 to 18 inches above this level.

The height of tanks on the different systems varies between $12\frac{1}{2}$ and 15 feet above rail level.

Fencing is erected near the coast on the different trunk lines, but is dispensed with inland.

The principal locomotive shops of the three main Sections are at Salt River Locomotives. (Western), Uitenhage (Midland) and East London (Eastern) respectively, where the existing machinery and appliances allow 250 engines per annum to be dealt with ; but there is a prospect of increase in the near future. The Table at the end of this Chapter shews the distribution of the Locomotive Districts and charges on the whole of the System. The Districts represent a day's work for an engine, and the terminal stations

are provided with sheds, watering arrangements, fuel, and small workshops for minor repairs.

On the Northern Section intermediate Locomotive Stations are saved by working one engine the whole 490 miles, from Mafeking to Bulawayo, with a double engine crew and train staff, men off duty living in a travelling "running room" attached to the train. This method is economical both as regards Staff and engine mileage; but can only be done when water supply, etc., is good.

Watering Arrangements.

On the Western Section watering stations average 27 miles apart, on the Midland 18, and on the Eastern 16 miles. Engine tenders are capacious; and locomotives can therefore make long runs without refilling if water is short at the smaller stations. On the Midland Section the water is indifferent and in the Karoo district it is bad; elsewhere it is very good.

Engine Loads.

On gradients of $\frac{1}{80}$ and less, trains are drawn by six-wheel coupled tender engines with loads limited to 380 tons. Driving wheels are $4\frac{1}{2}$ feet in diameter, and the cylinders are 17 inches, with pistons of 26 inches stroke.

On the $\frac{1}{40}$ districts heavier engines are required; and these are eight-wheel coupled tender engines with driving wheels 3 feet 6 inches diameter, 17-inch cylinders, and pistons with 23 inches stroke. Their load on the $\frac{1}{40}$ gradient is 200 tons, increased to 400 on the $\frac{1}{80}$ districts.

The "Ton" is 2,000 lb. weight as commonly used in the Colonies.

To obtain the best economical results from local coal, large grates are required, and these are not easy to arrange on a gauge of 3 feet 6 inches. The problem is now under consideration and a solution will, it is hoped, be shortly found.

Coal.

Coal supplies in the Autumn of 1899 were not very satisfactory and the cost of drawing on supplies from Natal and the Transvaal was prohibitive; to a certain extent English coal was therefore imported.

Speed.

Speeds, judged by European standards, are low, averaging 13 miles per hour for goods and 19 miles per hour for passenger trains; but the disabilities of gauge, gradients, curves and inferior maintenance should be borne in mind if a comparison be instituted.

The speeds named above are inclusive of stoppages.

Rolling Stock available.

In October, 1899, the rolling stock available was as follows:—

	Total.
Locomotives—Heavy 245, Light 212	457
Coaching stock, Bogies (capacity 50 soldiers)	449
Cattle trucks (capacity 8 horses or 10 mules)	1006
Goods wagons (average capacity 9 Colonial tons)	5755

In the above one bogie = two short trucks.

Traffic Staff.

The division and sub-division of the various portions of the C.G.R. into Sections and Districts is shown in the Table at the end of this Chapter. In addition to the officers there enumerated there are, in the office of the Chief Traffic Manager, a Chief Traffic Inspector and a Train Inspector. It is the business of the latter officer to enquire into irregularities in the train service, and it is his duty to elaborate remedies and improvements; whilst the special examination of tickets, detection of frauds and thefts, regulation of lost luggage, railway prosecutions, and kindred matters, are referred to the Chief Traffic Inspector.

On the various Sections the Traffic Managers have District Traffic Inspectors and Station Masters. The former look to train working over their own length, take charge of small stations if required and aid the Traffic Manager. Station Masters, generally speaking, have charge of Passenger and Goods departments at their Stations. The exceptions are the three ports and Kimberley, where there are special Goods Superintendents.

Where night running is carried on, the duty is taken by a Night Inspector.

System of Signals.

At two-thirds of the stations on the Cape Railways, station limits are protected by Home Signals at the outer facing points, with Distant Signals beyond them. At the remainder an improvement has been made by removing Home Signals to positions 400 yards outside facing points, with which they are connected by wires; in this manner the driver of an approaching train is apprised of the line on which he is being received.

Complete interlocking has at present only been installed at the most important junctions.

Train Services.

There are two through passenger trains per day carrying passengers, mails and parcels; and these are arranged to accommodate traffic at the various junctions. In addition, local traffic near the coast is also dealt with, the largest number of trains, *i.e.*, 132 per day, being run on the Capetown-Simonstown line.

The bulk of trade is inland from the ports, entailing a certain amount of empty Goods Traffic. mileage on the return journey ; but on occasion the downward loads to the coast (consisting of grain, wool, firewood and locomotive coal) are considerable.

At the various ports there are Harbour Boards which deal with all cargo going inland, loading, securing and invoicing it on behalf of the Railway, to whom it is delivered by the Board at the terminal goods stations. Local cargo for the ports is handled by the Railway itself.

The lines are nearly all single, and trains can cross either at Stations (which are of Method of Working. two kinds) or at Intermediate Sidings.

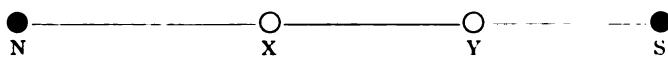
Stations are described as "Telegraph" and "Intermediate." At the former the telegraph is working and an officer is on duty. At the latter there is telegraph communication only at specified times, and an officer may or not be on duty ; if he is there it is treated as a Station, if not, as an Intermediate Siding.

There may be three or four Intermediate Stations between every pair of Telegraph Stations, and also several Intermediate Sidings.

The Working Time Table shows the times of running of all trains on a section, and such as are running in accordance with it or with "special train notices" are said to be "In course" ; all other trains are termed "Out of course." When specials are running or trains are cancelled, notice is sent to all concerned either by means of printed notices or by telegram, and each person notified must acknowledge receipt. As a further precaution, the rear of a train preceding a special is targetted with coloured boards by day and lamps by night. If delay can be saved by running trains "out of course," it is the duty of officers in charge of stations to arrange accordingly.

Before allowing a train to proceed on its journey the officer in charge of a station must (after arranging by telegraph with the next station) issue to the guard of the train a written permit. After signing it, the guard must hand the paper to the driver. An exception to this procedure occurs when a train is running "in course" from station to station on "line clear" ; in this case separate copies are given to guard and driver.

As an example of "in course" running we may refer to the diagram below. N and S are Telegraph Stations, X and Y are Intermediate Sidings, and it is intended that No. 4 (up) shall cross Nos. 1 and 3 (down) at Y and X respectively.



The Station Master at N issues the following permits :—

- (a). For No. 1 to proceed to Y, and also for No. 4 from Y to X.
- (b). For No. 3 to proceed to X, and also for No. 4 from X to N.

The Station Master at S similarly issues permits for No. 4 to proceed to Y, and also downward permits for Nos. 1 and 3 from Y to S and X to S respectively.

The system is cheap and suited to the existing traffic ; but, owing to the lack of intermediate telegraphic communication, it is liable to cause delay when a large number of trains are running.

Guards and drivers are held equally responsible with the person on duty at a station that everything connected with the crossing of trains is in order, as well as the permit on which the train proceeds.

Copies of all documents, instructions and telegraph messages are kept at stations ; whilst guards hand in, at the end of their run, all orders received by them.

If a train fails between stations, a light engine may proceed cautiously in the opposite direction, starting not less than an hour after the train delayed was due.

If the telegraph fails, only "in course" running is allowed, except under very special circumstances.

Department.	Officers.	MIDLAND.			RHODESIAN.		
		Head Qrs. at	Limits of District.	Mileage.	Head Qrs. at	District.	Mileage.
TRAFFIC.	Traffic Manager.	Port Elizabeth.	Port Elizabeth to De Aar. Vryburg	—	Bulawayo ...	Vryburg to Bulawayo.	
	Assist. do.	do.	do.	—	—	—	
	Assist. Traffic Manager.	Naauwpoort	Port Elizabeth to De Aar, with branches to Norvals Pont and Stormberg	273	—	—	587
LOCOMOTIVE.	Locomotive Superintendent.	Uitenhage...	Port Elizabeth to De Aar.	—	—	—	—
	Assist. do.	do.	Port Elizabeth to Craddock.	—	—	—	—
	Dist. Loco. Supt.	—	— Vry-	435	Bulawayo ...	Vryburg to Bulawayo.	587
	Foreman...	—	Port Elizabeth to De Aar Cookhouse.	162	—	Vryburg to Mafeking.	97
	Do.	—	Cookhouse to Cradimberdock.	146	—	—	—
	Do.	—	— Vry-	127	—	Mafeking to Bulawayo.	490
	Dist. Loco. Supt.	Naauwpoort	Craddock to De Aar, Uitenhage to Graaf Reinet; also Norvals Pont and Stormberg branches.	—	—	—	—
	Foreman...	—	Craddock to De Aa.	—	—	—	—
	Do.	—	Craddock to Norval Pont.	—	—	—	—
Do.	—	Graaf Reinet to Rosmead.	—	—	—	—	
ENGINEERING.	Resident Engineer.	Port Elizabeth.	Port Elizabeth to De Aar, and branches to Norvals Pont and Stormberg.	—	—	—	—
	District Engineer.	No. 1.....	Port Elizabeth to Sandflats. Do. to Mile 120.6.	—	No. 1.....	Vryburg to Mahalapye.	310
	Do.	No. 2.....	Sandflats to Rosmead. Grahams Tower branch.	—	No. 2.....	Mahalapye to Bulawayo.	277
	Do.	No. 3.....	Rosmead to De Aar Stormberg branch. Norvals Pont do. Colesberg do.	—	—	—	—
	Do.	No. 4.....	Mile 120.6 to Rosmead. Vryburg	273	—	—	—

CHAPTER II.

MILITARY CONTROLLING STAFF.

The war waged in South Africa, lasting as it did not for weeks or months but for years, has emphasised the necessity for an organisation within the British Army designed to deal with all the work and difficulties attendant on the movement of troops and stores on the L. of C. and in the theatre of operations.

Necessity for Organisation.

Continental nations have agreed upon the organisations and have laid down the broad outlines of instructions considered necessary; and the matter has received considerable attention in India, where on occasion 50,000 men and more have been moved to the frontier. In England, on the other hand, the great Railway Companies have from time to time moved troops as required, and it has not been necessary to ask for Military assistance; as a consequence neither the organisation nor the necessary rules had been thought out in 1899. Even after the system described below had been in operation in South Africa for over a year and a half, the necessity for it and the scope of duties of the Military Controlling Staff were often liable to be misunderstood.

The main duties of an A.D.R. and his Staff may be briefly summed up as follows:—

Duties of A D.R. and Staff.

- (1). To be the intermediaries between the Army and the technical working administration of the Railway.
- (2). To see that the ordinary working of the Railway is carried on in such a manner as to ensure the greatest Military efficiency.
- (3). To see, on the other hand, that the demands of the Army on the Railway are such as can be complied with without disorganising the working of the Railway system as a whole.

Of these the third is of great importance; for it can be easily understood that the officers of a Civil Railway administration cannot well discriminate between the demands of the various branches and departments of the Army, nor can they class them in any definite order of urgency in regard to Military efficiency.

A staff of technical advisers on the General Staff of the Army is therefore required, and such a staff was furnished in South Africa by the A.D.R.s and the officers with them.

So long ago as 1873 M. Jacqmin (General Manager of the Chemin de Fer de l'Est during the Franco-German War of 1870) wrote on the subject of the working of the French lines during that struggle; and he was fully impressed with the necessity for an organisation, thought out in peace time, which must take its proper place in the Army in time of war.

In South Africa lack of knowledge on the part of officers of all grades and corps regarding the capabilities and limitations of a Railway, combined with the necessity for formulating an organisation at the outbreak of hostilities, caused many difficulties and mistakes; and whilst the existence of the organisation to be described minimised their evil effects, it further emphasised the absolute necessity for the creation of a system workable in war and suited to the varied needs of the British Army.

ORGANISATION IN SOUTH AFRICA.

The question of organisation having been discussed during the voyage of Brevet-Major E. P. C. Girouard, R.E., D.R., to South Africa, it was agreed that:—

- (i.). As regards lines of railway under efficient civil control in friendly country, the Director would act as intermediary between the General or other Staff of the Army and the Civil Administration.
- (ii.). In disaffected country the Director would assume full control of lines, naming them "Communication Sections" for military purposes. To enable him to carry out his duties he was to be in close communication with the Governing Power, the Railway Boards and the General Managers of the various Railways.
- (iii.). It was necessary to appoint a staff of R.E. officers acquainted with technical railway working, whose duty would be to co-operate with the civilian Traffic and other staff of the Railways in meeting military demands. As a natural sequence, tact and non-interference with the routine work of the railways was required to obtain the best results.

Tentative Organisation—October, 1899.

- (iv.). "Communication Sections" were to be controlled by officers styled "A.D.R." They were to be under the orders of the General of Communications within whose district their line ran, and also under the D.R., and were to co-operate with the General Managers of lines within the district.
- (v.). D.A.D.R.s were to be stationed at Divisional Traffic points. These officers were to be under the A.D.R.s and were to co-operate with the civil Traffic officers.
- (vi.). Under the orders of D.A.D.R.s were to be R.S.O.s, who were to superintend the movement and transport of troops at railway stations.
- (vii.). An A.D.R. "Communications" was to act for the Director in details of civil railway policy; it would be his duty also, in consultation with the officers already named, to formulate and to submit for the approval of the G.O.C. and of the Director all orders and proposals relating to movements of troops and stores, diversions of rolling stock, interruptions to ordinary traffic and the protection of trains and railway property.

Weak Points of
System in Practice.

The principle underlying these proposals was the creation of a Military Staff corresponding grade by grade with the Civil organisation; but a lack of properly trained officers was at once felt on landing. For the Cape lines three D.A.D.R.s were required, as well as an A.D.R. and a S.O. at Cape Town; whereas only two officers in all were available. Accordingly the Eastern and Midland Sections were not provided for at first, and as a matter of fact were not greatly used by troops in the opening phases of the war.

No clearly defined rules had as yet been laid down regarding the relative duties of, and co-operation between, the General Staff of the L. of C. and the Staff of the D.R. Consequently Commandants on the L. of C. were mystified regarding the position and duty of the Military Controlling Staff under the D.R. The appointment of R.S.O.s to serve under the orders of Station Commandants, instead of under the D.R., also tended towards misunderstandings. In December, 1899, an attempt was made to remedy matters by the publication of the following order:—

L. OF C. ORDERS. NO. 687 DATED 27TH DECEMBER, 1899.

Improvements made.

Duties of Staff Officers, L. of C. Railways:—

1. The working of the railways is carried out by the Civil Staff of the C.G.R., with a Staff of Military Officers to assist and direct the military traffic. This Staff forms part of the Staff of the L. of C., and is the only means of communication authorised between the military authorities and the civil railway officials.
2. The Military Railway Staff will consist of:—
 - (i.). One A.D.R., on the staff of the I.G. L. of C. (head office, Cape Town),—in charge of all communications.
 - (ii.). One D.A.D.R., on the staff of the A.I.G. L. of C., Western Section (head office, De Aar),—in charge of Western Section, Cape Town to Modder River.
 - (iii.). One D.A.D.R., on the staff of the A.I.G. L. of C., Midland Section (head office, Naauwpoort),—in charge of Port Elizabeth to Naauwpoort, Naauwpoort to De Aar, and Rosmead to Stormberg.
 - (iv.). One D.A.D.R., on the staff of the A.I.G. L. of C., Eastern Section (head office, Queenstown),—in charge of East London to Stormberg.
 - (v.). One D.A.D.R., on the staff of the Base Commandant and as S.O. to A.D.R. (head office, Cape Town),—in charge Cape Town only.
 - (vi.). R.S.O.s, on the staffs of the Station Commandants, at stations as required.

Duties of Officers.

3. The duties of the various Staff Officers on the Railways are as follows:—

The *Assistant Director of Railways* is responsible for the whole working of Railway L. of C., and is the channel through which should pass all communications on Railway (Communications) matters from the I.G. L. of C. and the D.R. He should keep up a complete account of the state of traffic and position of rolling stock on the railway, and should keep in touch with the General Traffic Manager of the system. He should keep himself informed, through the D.I.G. and A.I.G. L. of C., of the work carried out by D.A.D.R.s, and see that proper control is exercised over the districts in their charge.

4. *Deputy Assistant Directors of Railways*, under the orders of the D.I.G. and A.I.G. L. of C., should keep themselves completely informed of the state of traffic in their sections. They should, through the Station Commandants, exercise a general

supervision over the work of the Railway Staff in their districts. They should keep careful watch on the distribution of rolling stock on their sections, and are responsible that it is utilised in the best way. They should keep in touch with the Traffic Manager of their sections of the Railway. No work of any nature will be undertaken by the Civil Railway Department for the Military, unless the approval of the D.A.D.R. has previously been obtained. The D.A.D.R. is responsible that any irregularity on his section, which he cannot rectify himself, is reported to the A.I.G. L. of C. The office of the D.A.D.R. should be located at the same station as that of the District Traffic Manager, and he is responsible that either himself or his Staff Officer is present at that station.

5. *Railway Staff Officers*, under the orders of the Station Commandants, are responsible for the traffic at the stations where they are located. They are responsible that no train is delayed for military requirements, except in extremely urgent cases on the authority of the Station Commandant. They are especially responsible for seeing that trucks loaded with military stores are released as quickly as possible. They should report immediately to their D.A.D.R. any deficiency or irregularity of traffic in their stations. They should similarly address their D.A.D.R. on any questions concerning railway matters on which they require information or orders. They are responsible for all detraining and entraining operations at their stations, and the comfort of all troops passing through. They will furnish such returns on railway matters as may be required to their D.A.D.R. direct. All communications from R.S.O.s must be sent through Station Commandants.

In accordance with the above Orders the instructions previously issued were revised.

The weak point of the original organisation had been discovered. It was sought to remedy this by allotting the A.D.R.s and D.A.D.R.s definite positions on the L. of C. Staff; and, though R.S.O.s remained on the staff of Station Commandants, the circumstances under which they were to refer to D.A.D.R.s were clearly specified.

By a regular chain of sequence, movements of troops and military stores were to be arranged for in such a manner that the railways (viewed as transportation machines) were to perform a maximum of work with a minimum of friction. In practice, however, the system did not work quite so smoothly, chiefly because the channels of communication so carefully provided for were not adhered to. In many cases Station Commandants (and sometimes A.I.G.s L. of C.) arranged for movements by rail without referring to officers of the Military Railway Staff with whom they should have conferred; and the effects of the dislocation thus caused were at times far reaching.

Criticisms in the Light of Experience.

It was perhaps unfortunate that R.S.O.s were on the staff of Station Commandants; for the orders of the latter were at times carried out without reference to the D.A.D.R.s, and, similarly, orders issued by Commandants to subordinate Civil railway officials were complied with to the detriment of traffic on other parts of the section.

In all that has been said on this subject, it is to be understood that there was no question of military emergencies; had such questions arisen, the action of Commandants would have been in strict accordance with the spirit of paragraph 5 of the L. of C. Order already quoted.

Owing to a misapprehension of the term "Station" the headquarters of Station Commandants were often fixed on the platforms of the railway stations; on several occasions interference with, and dislocation of, railway traffic would have been avoided had the headquarters been located elsewhere.

The system as sketched above was tried for rather more than a year, and in 1901 R.S.O.s were placed under the D.R.

Further Changes made in 1901.

The aptitude or otherwise of officers for the particular duties required of them was thus more easily ascertained; whilst the interest manifested by officers in the details of their work increased when they knew definitely that they were not likely to be transferred to other employment at short notice.

Further information regarding the practical working of the Military Controlling Staff will be found in Chapter I., Part IV., which deals with the I.M.R., and wherein the mistakes which were most common and the endeavours made to remedy them are shown. The greater number of these mistakes could have been avoided if the officers engaged had possessed, prior to the war, greater experience and a practical knowledge of the working of railways.

CHAPTER III.

WORKING OF THE RAILWAYS DURING THE WAR.

Civil and Military
Traffic, July—
October, 1899.

The tide of immigration from the Boer Republics into British territory began to flow in July, 1899, and by October the railway was in such straits to provide accommodation that goods wagons were being used to supplement passenger stock.

At the same time military demands on the railway became more pressing day by day; and when to these was added the prospect of an early interruption of communication between the systems, it will be understood that the railway problems facing the heads of the Army and the C.G.R. in the month of October were complicated. But the officers concerned settled on a joint plan of action, and rolling stock had been distributed to the various Sections before communications were cut, thus enabling each of them to carry on an independent service during the next few months. At the time the war began, it was intended to utilise all the three Sections equally for the movement of troops and supplies. But the invasion of Cape Colony necessitated a concentration of British troops, and consequently the Western Section was the only railway which was at all secure.

Military Traffic,
1899—1900.

Cape Town therefore became the principal base and the Western Section the main L. of C.; and for five months the latter carried two-thirds of the total military traffic on the C.G.R.

Changes made in
1900 to equalise
traffic.

In March, 1900, the condition of affairs had changed. Bloemfontein was in Lord Roberts' hands and more troops were available to guard the railways; whilst, on the other hand, as the enemy had removed all engines and wagons, the length of lines of communication had increased without corresponding additions to rolling stock.

To meet the needs of the Army it was therefore arranged to disembark all *personnel* (and also stores for places north of Kimberley) at Cape Town, whilst Port Elizabeth and East London were to be used for supplies, stores and remounts for the forces operating in the enemy's country.

The traffic passing northwards from the three ports was thus equalised, there being a slight preponderance from Port Elizabeth.

Aid rendered to the
Army by C.G.R.
Staff.

The heaviest strain on the carrying powers of the railway was experienced in February, 1900, during the great concentration at Modder River, but the Civil Staff worked so cheerfully and well that all difficulties were successfully surmounted.

In the same way nearly half the rolling stock was detained for considerable periods on the I.M.R., and the services of various officials were demanded to allow those railways to be worked on behalf of the Army.

All these demands were loyally met by the Civil administration, and notwithstanding the resulting inconvenience the delays to military traffic within the Cape borders were infrequent.

These satisfactory results were only attained by a careful redistribution of rolling stock from time to time, and the remarkable freedom from accidents points to unceasing vigilance on the part of the Civil Staff of all ranks.

Restriction of Goods
Traffic, 1899.

Shortly before hostilities commenced, consignments of goods and merchandise passing over the C.G.R. to the Boer republics were stopped by the military authorities; and during the war priority was claimed and conceded for all military traffic. But civil traffic (especially for up-country towns and districts which depended on the ports for necessaries of life) could not be entirely suspended, and wagons were accordingly allotted for this traffic after military needs had been met. The supply of wagons being thus limited, the Cape Government prescribed from time to time the precedence of various classes of goods to be accepted for transportation.

In disturbed districts and in sections whence the enemy had only recently been expelled additional restrictions were imposed for military reasons, and a system of permits for goods was instituted; the wagons available for civil traffic were allotted to districts by the military authorities, the further task of allotting them to the various claimants for carriage being left to the civil administration.

Permits were also necessary in the case of civilians travelling in districts under martial law. It will thus be seen that, whilst ordinary civil traffic was dislocated, steps were taken to lighten the unavoidable hardships suffered by civilians and merchants; and restrictions were gradually removed as the country became more settled.

Precautions taken
to Safeguard the
Railways.

To ensure the safety of the railways on the L. of C., the principal stations and bridges, also tunnels and lines of water supply, were occupied by military guards.

Officers in command were brought into close touch with the civilian engineering staff and measures were jointly concerted to effectually patrol and guard the various lengths. Patrolling was usually done by unarmed men of the engineering branch, who, as they passed guards and sentries, reported "All well." In case of damage or danger they adopted the ordinary precautions to warn approaching trains and also apprised the nearest military post or sentry. That these precautions were necessary is proved by the fact that during the 12 months ending September, 1900, 39 deliberate attempts were made to wreck trains or damage the line. The majority of the offenders were traced, tried and sentenced, and the civil officers of disturbed districts reported that the careful watch kept upon the railways impressed the population and deterred them from making more frequent attempts upon the permanent way and works.

"Railway Protection Troops" passed free on the lines on production of a written order from their commanding officer, whilst water and rations for troops posted between stations were carried free of charge. Camps for troops were also arranged by the railway engineering department, on railway land if possible. Wherever lines were damaged by the enemy communication was restored by railway troops, who then handed the line back to the civil administration to work; the permanent repairs were also relegated to the civil administration.

Concessions to Protection Troops.

(a). *Engineering*.—A number of additional sidings and platforms were required to enable the traffic department to deal with the large number of troops, animals and stores which poured in. The work connected with them was done at times by the railway troops, but generally by the engineering department of the C.G.R.

Additional Work entailed by the War.

(b). *Traffic*.—Special troop time-tables were made out at an early period, and telegraphic advice was sent of the running of troop trains carrying men or animals to such stations as had been fixed on for stoppages for meals or for watering. At these places arrangements had been made for hot water for men and for drinking water and buckets for animals; and on receipt of telegrams the R.S.O. or station master saw that everything was in readiness on the arrival of the in-coming train. Where parties of 10 men or under travelled by train they were given "Hot meal" tickets, and meals were then provided at refreshment rooms by the railway contractor under a special contract.

The following rates and concessions were agreed upon by the Army Staff and the Civil railway administration, and applied to military traffic on the C.G.R. and on the Rhodesian Railway respectively as shown.

Rates and Concessions.

A vehicle rate, no matter how wagons were loaded, was considered the simplest way of settling accounts for railway carriage between the Army and the Railway. The figure adopted on the Cape Railways was arrived at by taking the average civil freight charged during a certain period. This works out as follows:—

Per passenger	...	...	...	...	0'33 pence per mile.
„ animal	...	...	...	...	0'66 „ „
„ ton of goods	...	...	...	...	1'00 „ „

On the Rhodesian section, between the 14th October, 1899, and 12th June, 1900, no civil traffic was moved, and it was agreed to pay the administration the actual cost of working expenses as having been incurred on military account; the rates adopted after the latter date are shown in the second table.

TABLE OF CONCESSIONS.

CAPE GOVERNMENT RAILWAYS.

Item.	Nature of Concession.
1. Special rates for officers, N.C.Os. and men.	Officers travel 1st Class for 2nd Class fare. N.C.Os. and men travel 2nd Class for 3rd Class fare. Applicable to all ranks paying their own way.
2. Goods and parcels addressed to soldiers and sailors, messes, canteens, Soldiers' Homes, and certain Army Contractors.	To be carried as per Items 1 and 2 of previous Table, or half rate of Item 4, carriage prepaid. "Perishables" to travel at Goods rate by ordinary passenger train.
3. Gifts for free distribution, literature, re-consigned parcels for sick and wounded, stores of Red Cross and National Societies.	When consigned to troops or the societies named, to be carried free.

TABLE OF SPECIAL RATES.

Cape Government Railways.				Rhodesian Railway.		
Item.	Rate.	Per.	Remarks.	Rate.	Per.	Remarks.
1. Vehicle	7d.	Mile.	Bogies count as two vehicles. Rate includes shunting, sheeting, and terminal charges, but not loading. Rate applies to full vehicle whatever nature of load.	7d.	Mile.	For live stock only.
				9d.	„	For troops and stores. Bogies count as two vehicles.
2. Ton rate	2d.	Ton mile.	Applicable to consignments of 3½ “Colonial” tons or less, forwarded by ordinary goods train.	3d.	Ton mile.	Applicable to consignments of 3 tons or less.
3. Individual rate ...	Half ordinary Civil rate.	rate.	For parties of 14 men or under travelling by ordinary train.	Half ordinary Civil rates.	rates.	Applicable to parties of 14 or less.
4. Parcels and excess luggage.	Ordinary rate.	parcels rate.	Applicable to military parcels under 25 lbs. and to excess luggage, all such being forwarded by ordinary passenger train.	Ordinary rate.	parcels rate.	

The various Appendices to this Chapter give details of the Military Traffic and some other particulars.

APPENDIX A TO CHAPTER III.

PERMIT SYSTEM—GOODS AND PARCELS TRAFFIC.

The information here given is a *résumé* of the official instructions issued at the time, the essential points of the system being carefully emphasised.

It was considered necessary to keep the control of the despatches of goods and stores in military hands and the R.S.O. was the Executive Officer. At the station or district of destination, he received copies of the permit from a recognised Military Authority and from the consignor, and he in turn communicated them to a Military Authority at the station of despatch.

The detailed forms of authority to be given to the Railway were left to D.A.D.R.s, but it was essential that every way bill should bear the Permit number and every car the initials of the authority issuing the permit. R.S.O.s at ports advised A.D.R.s at Johannesburg and Bloemfontein and D.A.D.R.s at Pretoria and Kimberley of the execution of permits from those places and from Bulawayo to the last named.

MESS STORES.

These, when duly authorised and consigned to regiments, were carried at special rates by the C.G.R. and free by the I.M.R. Freight was therefore chargeable to Orange River Bridge only, and warrants were endorsed accordingly.

When trucks were loaded with public stores, two warrants were required for each of the consignments, and these referred to one another for purposes of check by the Audit Office. The proportionate weight of Mess Stores to total weight in the truck (worked out to the nearest fourteenth for short trucks and the nearest twenty-eighth for bogies) was noted on the Mess Stores warrant which was booked to Orange River; whilst that for public stores was marked to destination, wherever that might be, with its proportionate weight. The fraction chosen gives a rate of one halfpenny per truck mile and was convenient for settling accounts. Recoveries against regiments were eventually made through the Chief Paymaster. To obtain the advantages of full truck loads “Transit Stores” were established at ports under R.S.O.s, to whom Mess Agents, armed with due authority, might hand over consignments to await despatch.

A.—ARTICLES PASSING TO I.M.R.

Directors (or Controllers) of Civil Supplies were the officers who granted permits, and Merchandise when issued they notified the merchants and officers concerned as follows:—

For traffic emanating from	{	stations north of De Aar	to D.A.D.R., Kimberley.
		western stations, Touws River to De Aar inclusive	„ D.A.D.R., Beaufort West.
		Cape Town and stations south of Touws River	„ A.D.R., Cape Town.
		stations north of Graaff Reinet and Cradock and west of Stormberg	„ D.A.D.R., Naauwpoort.
		southern stations	„ R.S.O., Port Elizabeth.
		eastern stations	„ D.A.D.R., East London.

These in turn advised R.S.O.s and Commandants at stations of destination, and copies of all permits were filed in the office of A.D.R., Cape Town.

The Q.M.G. dealt with these and issued two series of permits, A.Q. and C.Q., for military and civil stores respectively. No consignment could be accepted without this authority, and the Q.M.G. sent copies of permits to A.D.R. (Cape Town), who in turn informed the officer at the station of despatch. R E. Stores. Private Consignments. Mess Stores, etc.

Authority for the despatch of goods and furniture, the property of employes of the I.M.R., was granted by the D.R. The A.D.R. (Cape Town) reported despatch of these to the D.R., and they were sent on a "Forwarding Vote" chargeable against the I.M.R. Furniture for I.M.R. Employes I.M.R. Stores, etc.

The authorising officer for I.M.R. stores and provisions was the Chief Storekeeper, I.M.R.

Gifts, when sent in truck loads, could be despatched under authority from A.D.R. (Cape Town). Those destined for Burgher Camps had to be consigned to the Superintendent of the Camp. Gifts for Soldiers and for Burgher Camps.

B.—ARTICLES PASSING TO STATIONS NORTH OF DE AAR.

Kimberley District.—In accordance with the terms of a notice issued by the Financial Adviser. Civil Goods Traffic.

Bulawayo District.—Generally as in the Kimberley District.

Permit Lists were issued by the Controller of Civil Supplies for all traffic consigned to civilians, and were sent direct to R.S.O.s or Commandants at stations of despatch, except in the Eastern Section, for which all permit lists were sent to D.A.D.R., East London. Permit Lists.

Mess Stores consigned to regiments, etc., were conveyed at military rates under authority of the G.O.C., issued through the A.D.R. (Cape Town). The system, as described above, of giving warrants for proportional weight was followed. Mess Stores.

C.—GOODS AND PARCELS TRAFFIC IN CAPE COLONY (SOUTH OF DE AAR).

Under Martial Law O.C.s Districts were empowered to arrange a system of distribution through certain centres only of such articles as might be of use to the enemy. To this end foodstuffs were allowed to be sent without restriction to certain named stations only, and distribution thence to minor stations was controlled by the Commandant.

Mess Stores consigned to regiments, etc., were forwarded as under (B) above. Mess Stores.

APPENDIX B TO CHAPTER III.

REPORT FROM RAILWAY TRANSPORT OFFICER, CAPE TOWN.

Duties.

On the 28th October, 1899, Lieut.-Col. C. E. Wyncoll, A.S.C., took over the duties of D.A.A.G. for Railway Transport (R.T.O.) at Cape Town, these duties being :—

- (a). Making all arrangements with Railway Authorities for trains for troops, animals, supplies, stores, etc.
- (b). Entrainment of troops, animals, etc.
- (c). Issuing of warrants to officers and soldiers going by ordinary trains.
- (d). Granting of permits to civilians to send goods on the railway.
- (e). The auditing and passing of all railway accounts.
- (f). Drawing up all railway orders for O.C.s Units, R.S.O.s, Warrant books, etc., and inspection of R.S.O.s.

System of entraining Troops on Arrival.

For the first three or four months dismounted troops were entrained at the South Arm, direct from the ships in which they arrived; the order for their proceeding was given by the C.S.O., L. of C., and the R.T.O. arranged with him the hour at which it would be convenient to entrain each unit. A vessel having been brought alongside the South Arm, the R.T.O. at once proceeded on board and handed to the O.C. Unit a copy of the entraining orders and a time table of his train, and handed over trucks for the baggage, horses and vehicles, which consequently proceeded direct from the ship.

The greater portion of the officers and men of a Battalion (from 580 to 650) proceeded in the first train, accompanied by only one truck containing tents and blankets. The remainder loaded the luggage, etc., and proceeded in the second train. The guard's van of each train carried three days rations for the men and forage for the horses borne on the train.

The train stopped at least three times a day for an hour for meals and there was hot water ready for the men's tea; a few camp kettles for making tea were carried in the guard's vans of trains, and the men carried their canteens in the train to drink from.

Mounted Units as a rule went first to Maitland Camp, so that the horses might recover from the voyage; they were then entrained at the Timber Siding in the Goods Yard, Cape Town.

Dismounted Units which came from any camp were also entrained at the Goods Yard.

Piquets to prevent civilians from entering the railway premises during entrainments were requisitioned from the Base Commandant.

Trains.

From four to seven trains daily were placed at the disposal of the military, each consisting of an engine and 25 short vehicles (a bogie counting as two). It is not possible to furnish the carrying capacity of each train, as it was entirely dependent on the class of rolling stock supplied, some 3rd class coaches containing 9 compartments and some 2nd class saloons $4\frac{1}{2}$ only.

Four officers, or eight non-commissioned officers and men, were allotted to each compartment. Officers were always provided with 1st Class accommodation, but the rank and file were entrained into 1st, 2nd, or 3rd Class as it fell to their lot.

Delays through Faulty Stowage on board Ship.

A Battalion, Squadron or Battery required two trains. When entraining at the Goods Station any one of these Units could be entrained, and both trains got away, in $4\frac{1}{2}$ hours; but at the South Arm this was not so, owing to the difficulty experienced in getting baggage and stores from the ship on account of the careless and bad stowing in the holds. This question is particularly brought to notice as having caused serious delay. Trains have been wasted owing to the tents of a Unit being stored at the bottom of a hold under hundreds of tons of wagons and other general stores. When a vessel brought out two Units, and it was desired to land one at Cape Town and send the other round the coast, the baggage, vehicles, etc., of the two Units was so hopelessly mixed that the whole had to be sorted on the quay, the trains waiting and being lost the while. It is therefore submitted that, when time is an object (and it always is an object in a campaign), such care should be exercised in the stowing of the baggage and equipment of a Unit on board ship that it may be able to disembark with the greatest possible expedition.

Animals.

Animals were carried in cattle trucks, eight to eleven in a truck, according to the size of the animals and trucks, the latter varying considerably. The forage accompanied the animals on the trains, and there was abundance of water at the feeding stations, where standpipes were erected and hoses laid on.

The gauge of the railway being only 3 feet 6 inches the trucks were narrow, and it was found necessary to leave the animals loose in the trucks; when tied they could not rise again if they slipped down, but got kicked to death; whereas if loose they could get up. There

were casualties till the necessity for this was discovered ; afterwards there were practically none. Animals were therefore packed as tightly as possible in the vehicles and left loose with only a head collar on ; head ropes and blankets were apt to get loose and bring animals down ; being packed tightly in covered trucks the animals were sufficiently warm.

Stores, etc., were forwarded on waybills. The Base Reserve supplies, A.S.C. and Supplies. A.O.D., were given as many trucks daily as possible, which were despatched as soon after loading as engine power could be obtained, the waybills being given direct to the Goods Superintendent at the Docks, and the duplicate sent to the R.T.O. the following day. Other Units requisitioned the R.T.O. by 5 p.m. daily for trucks they required the following day, and these were allotted to them as circumstances admitted.

When less than a truckload was to be sent, the waybill was forwarded to the R.T.O. Having made arrangements with the Railway Authorities for the loading of the stores, the R.T.O. countersigned the waybill and returned it to the consignor, stating at what hour the stores would be received at the Goods Yard. Stores unaccompanied by waybills so countersigned were not received.

The trucks on the C.G.R. are of various carrying capacity, and naturally the weight carried by each depends on the bulkiness of the stores carried. Below is a Table showing the quantities of the principal stores and supplies that experience taught should be loaded on each class of truck.

The R.T.O.'s Office was situated at the East end of Waterkant Street, close to the Goods Station gate, a most suitable situation as it enabled him to be in constant communication with the Railway Authorities. Railway Transport Office.

The R.T.O.'s staff consisted of three S.O.s, one Lieut. and Qr.-Mr., A.S.C., one Sergeant-Staff. Major, one Sergeant, one Private, and eight civilian Clerks.

CAPE GOVERNMENT RAILWAYS.

CARRYING CAPACITY OF ROLLING STOCK.

	Long Bogie.		Short Bogie.		Covered Bogie.		Sheep Bogie.	
Full Capacity.	45,000 lbs.		25,000 lbs.		22,500 lbs.		22,500 lbs.	
ACTUAL AVERAGE LOADING.								
Consignment.	Weight.	% of full.	Weight.	% of full.	Weight.	% of full.	Weight.	% of full.
Hay	22,000	48·8	18,000	72	21,000	93·3	11,000	48·8
Biscuits	22,000	48·8	15,000	60	18,000	80	13,000	58·2
Bran	21,000	46·6	15,000	60	18,000	80	12,000	53·5
Meal	40,000	88·8	22,000	88	22,000	97·7	18,000	80
Oats	42,000	93·2	20,000	80	22,000	97·7	18,000	80
Sugar	45,000	100	25,000	100	22,500	100	22,500	100

	Short Sheep Truck.		Cattle Truck.		Horse Box.	
Full Capacity.	11,000 lbs.		18,000 lbs.		11,000 lbs.	
ACTUAL AVERAGE LOADING.						
Consignment.	Weight.	% of full.	Weight.	% of full.	Weight.	% of full.
Hay	9,000	81·8	9,000	50	6,000	54·5
Biscuits	10,000	90·9	12,000	66·6	10,000	90·9
Bran	10,000	90·9	12,000	66·6	7,000	63·6
Meal	10,000	90·9	16,000	88·8	11,000	100
Oats	11,000	100	16,000	88·8	11,000	100
Sugar	11,000	100	18,000	100	11,000	100

APPENDIX C TO CHAPTER III.

CONCENTRATION OF TROOPS BY RAIL BETWEEN ORANGE RIVER AND MODDER RIVER, FEBRUARY, 1900.

The following are the details of the concentration by rail at the commencement of February, 1900, of Lord Roberts' force for the relief of Kimberley and the march on Bloemfontein.

The troops, transport and stores were railed from Cape Town, Stellenbosch, Port Elizabeth, Grahamstown, Cradock, Rosmead, Thebus, Rensburg, Naauwpoort, De Aar and Orange River. All were consigned to Orange River, where they received orders either to detrain or to proceed until ordered to detrain.

Every Unit was designated by a letter of the alphabet, as shown in the following list; and, in order to preserve secrecy, was always referred to in telegrams and orders by its distinctive letter.

This was the largest and most successful movement of troops by rail during the campaign.

ORDERS BY CHIEF OF STAFF TO G.O.C. LINES OF COMMUNICATION.

For Concentration of Troops by Rail to Stations between Orange River and Modder River.

The following moves will be carried out in consultation with the D.R. by your A.I.G.s—, all to Modder River.

- | | |
|--|--|
| <p>I.—From RENSBURG (through General French) :—</p> <ul style="list-style-type: none"> A. Cavalry Division Headquarters. B. 6th Dragoon Guards. C. 6th Dragoons. D. 10th Hussars. E. Household Brigade Regiment. F. 2 Batteries R.H.A. G. 150 New South Wales Lancers. H. 300 Imperial M.I. (2nd Regiment). I. 70 Rimington's Scouts. <p>II.—From NAAUWPOORT (Gen. Kelly-Kenny) :—</p> <ul style="list-style-type: none"> J. 1st Battn. Essex Regiment K. 1st Battn. Yorkshire Regiment L. 1st Battn. Welsh Regiment (½ Battn. to come from Rensburg), 13th Brigade Staff (Maj.-Gen. Knox) and Brigade Details. M. 2nd Battn. Gloucestershire Regiment. N. 1st Battn. Welsh Regiment. O. 1st Battn. Oxfordshire Light Infantry. P. 2nd Battn. East Kent Regiment. Q. Divisional Troops 6th Division. <p>From THEBUS :—</p> <ul style="list-style-type: none"> R. 2 Guns 20th Battery, R.F.A. S. 2 Companies Imperial M.I. (on arrival from Sterkstroom). <p>III.—From ORANGE RIVER (through Gen. Tucker) :—</p> <p>Troops for which railway transport cannot be provided by Director of Railways will march.</p> <ul style="list-style-type: none"> T. Details (detachment of Cornwall Light Infantry) 6co from Zoutpans Drift. Details (Shropshire Light Infantry) 900, on relief. 14th Brigade Staff (Maj.-Gen. Sir H. Chermiside) and Brigade Details. V. 2nd Battn. Norfolk Regiment. W. 2nd Battn. Hampshire Regiment. X. 2nd Battn. Lincolnshire Regiment. Y. 1st Battn. King's Own Scottish Borderers. Z. Headquarters 2nd Dragoons (to be joined by detachments <i>en route</i>). AA. 4 Guns 20th Battery, R.F.A. (from Prieska, due Orange River 2nd Feb.). | <ul style="list-style-type: none"> BB. 38th Battery, R.F.A. CC. Ammunition Column and Brigade Division Staff. DD. 76th EE. 81st FF. 82nd <p>Batteries, R.F.A.</p> <ul style="list-style-type: none"> GG. Ammunition Column and Brigade Division Staff. HH. 1st Regiment M.I., 2 Companies (march Prieska to De Aar). II. 2nd Regiment M.I., 1 Company (march from De Aar). JJ. 3rd Regiment M.I., 4 Companies. KK. 4th Regiment M.I., 4 Companies (march from De Aar). LL. 6th Regiment M.I., 4 Companies (at Orange River). MM. 7th Regiment M.I., 4 Companies. NN. 29th Company, R.G.A. OO. 1st Field Park, R.E. PP. "C" Pontoon Troop, R.E. QQ. Telegraph Division, R.E. RR. SS. } 1st and 3rd Field Hospitals. <p>IV.—From NORTH OF ORANGE RIVER (through Gen. Tucker) :—</p> <ul style="list-style-type: none"> TT. } 12th Lancers and P Battery, UU. } R.H.A. VV. } 1st Battn. Gordon Highlanders WW. } and detachments Cornwall and Shropshire Light Infantry. XX. Royal Canadian Regiment. <p>V.—From LINE OF COMMUNICATION SOUTH OF ORANGE RIVER :—</p> <ul style="list-style-type: none"> YY. 2nd Battn. Warwickshire Regiment (from De Aar on relief by Suffolk Regiment). 15th Brigade Staff (Maj.-Gen. Wavell) and Brigade Details. AAA. 2nd Battn. Cheshire Regt. (already gone). BBB. 1st Battn. East Lancashire Regt. CCC. 2nd Battn. South Wales Borderers. DDD. 2nd Battn. South Staffordshire Regt. EEE. Divisional Troops, 7th Division (already landed). FFF. 5th Regiment M.I. from Maitland. GGG. 2 Naval 4.7" guns with crews from Port Elizabeth. |
|--|--|

TRAINS FORWARDED.

(1).—FROM CAPE TOWN.

Date.	Troop Trains.	Supplies Trucks.	Troop Trucks.	Animal Trucks.
January 21st	3	71	—	—
.. 22nd	1	61	—	2
.. 23rd	2	99	—	—
.. 24th	2	69	—	—
.. 25th	3	80	—	—
.. 26th	5	64	—	—
.. 27th	5	84	—	—
.. 28th	4	81	—	—
.. 29th	2	72	—	—
.. 30th	—	84	1	—
.. 31st	1	64	—	—
February 1st	4	76	—	—
.. 2nd	3	30	—	—
.. 3rd	3	34	—	—
.. 4th	5	42	—	—
.. 5th	4	65	—	—
.. 6th	1 (special)	17	—	—
.. 7th	2	—	—	—
.. 8th	2	—	—	—
.. 9th	3	45	—	—

Total—485 officers, 14,964 men, 3,617 horses, 1,202 supplies trucks, 480 transport animals.

(2).—FROM STELLENBOSCH.

Date.	
January 21st	2 Mule trains, 480 Mules.
.. 22nd	2 " " 480 "
.. 23rd	2 " " 480 "
.. 24th	2 " " 480 "
.. 25th	2 " " 480 "
.. 26th	1 " " 240 "
.. 27th	4th Company, Army Service Corps.
.. 28th	3 trains Cobs, 609 Cobs.
February 2nd	2 trains Horses and Cobs.
.. 9th	1 train Cobs.

(3).—FROM PORT ELIZABETH.

Date.	
January 21st	15 Supplies trucks (Sunday).
.. 22nd	46 " "
.. 23rd	43 " " 12 Mule trucks.
.. 24th	66 " " 1 Horse truck.
.. 25th	58 " "
.. 26th	73 " "
.. 27th	71 " " 2 Horse trucks.
.. 28th	26 Troop trucks, 72 Animal trucks, 22 Supplies trucks; 16th Lancsrs.
.. 29th	6 Horse trucks, 38 Supplies trucks.
.. 30th	40 Supplies trucks.
.. 31st	12 Troop trucks, 30 Horse trucks, 71 Supplies trucks; J Battery R.H.A.; 6 officers and 59 men, Naval Brigade.
February 1st	16 Troop trucks, 4 Horse trucks, 72 Supplies trucks; 6 officers and 371 men, Suffolk Regiment.
.. 2nd	58 Supplies trucks
.. 3rd	16 Troop trucks, 2 Horse trucks, 4 Supplies trucks; 10 officers and 311 men, Derbyshire Regiment.
.. 4th	15 Supplies trucks.
.. 5th	Nil.
.. 6th	26 Supplies trucks.
.. 7th	6 " "
.. 8th	7 " "
.. 9th	12 " "

} Engine power and rolling stock withdrawn north.

For entrainments at Rensburg see report on Midland Field Railway Section, Appendix B, Chap. 4, Part I.

(4).—NAAUWPOORT TO DE AAR.

Date.	Trains.	Troop Trucks.	Animal Trucks.	Supplies Trucks.
January 31st	3	63	10	27
February 1st	3	38	58	36
.. 2nd	7	95	66	47
.. 3rd	6	32	72	36
.. 4th	7	67	83	77
.. 5th	2	18	38	19
.. 6th	7	72	132	20
.. 7th	7	37	118	47
.. 8th	3	21	20	36
.. 9th	4	33	79	44
.. 10th } Trains from	About 6	—	—	—
.. 11th } Cradock				
.. 12th	4	11	31	19
	Total—59 trains.			

(5).—NORTHWARDS FROM DE AAR.

Date.	No. of Trains.	Troop Trucks.	Animal Trucks.	Supplies Trucks.
January 21st	5	—	—	136
.. 22nd	6	—	2	208
.. 23rd	6	28*	3	142
.. 24th	5	14	3	139
.. 25th	7	—	2	228
.. 26th	4	—	1	137
.. 27th	10	115	30	192
.. 28th	7	62	39	112
.. 29th	9	42	88	113
.. 30th	12	74	192	181
.. 31st	10	76	58	201
February 1st	9	111	60	148
.. 2nd	11	109	122	172
.. 3rd	8	70	92	92
.. 4th	9	31	118	114
.. 5th	9	68	86	124
.. 6th	14	162	134	83
.. 7th	11	48	168	126
.. 8th	10	16	142	157
.. 9th	9	27*	51	154
.. 10th	10	28	119	142
Total	181	1081	1510	3101

Days. 21 Men. 27,025 Horses, Mules, Oxen. 13,590 Tons, Stores. 24,168

* 16 ambulance trucks.

TRANSPORT CONCENTRATION.

(1).—DESPATCH OF OXEN AND WAGONS FROM CRADOCK (WEIL).

Date.	Ox Trucks.	Horse Trucks.	Mule Trucks.	Trucks containing Wagons.	Natives.
January 21st	59	1	—	22	—
„ 22nd	59	1	—	42	—
„ 23rd, to Krankuil	51	1	—	32	—
„ 24th, „	65	1	—	10	—
„ 25th, „	92	—	—	20	—
„ 26th, to Orange River	77	1	—	16	—
„ 27th, „	1	2	—	22	—

1st Batch. Total—3,329 oxen, 58 horses, 201 wagons.

January 29th	62	1	—	18	1
„ 30th	68	1	—	28	4
„ 31st	7	—	—	38	—
February 1st	15	—	—	24	—
„ 9th	—	1	44	30	—

2nd Batch. Total—1,231 oxen, 19 horses, 505 mules, 235 wagons, 6 carts.

(2).—DESPATCH OF OXEN AND WAGONS FROM GRAHAMSTOWN.

Date.	Ox Trucks.	Horse Trucks.	Trucks containing Wagons.	Natives.
January 28th	4	—	—	—
„ 29th	2	—	—	—
„ 30th	—	—	6	14
„ 31st	20	—	39	—
February 1st	6	—	22	—
„ 2nd	—	—	9	—
„ 3rd	—	—	2	—
„ 6th	—	—	10	—

Total—336 oxen, 101 wagons.

TROOPS PASSING NAAUWPOORT.

FOR CONCENTRATION AT MODDER RIVER.

Date.	
January 30th and 31st	5 Troop trains from Thebus passed to De Aar; they contained Section R.F.A., Oxfordshire L.I., East Kent Regiment, 13th Brigade Staff.
January 31st	1 Battn. Essex Regiment } 1 Battn. Yorkshire Regiment } passed from Rensburg, both for De Aar.
February 1st	Section 38th (Field) Company, R.E., Thebus to Naauwpoort. 1 Battn. 2nd Gloucestershire Regiment, Naauwpoort to De Aar. 1 Battery R.H.A. ½ Battn. Welsh Regt. } ex-Rensburg for De Aar. Ammunition Column } 1 train Australians, ex-Western, arrived Naauwpoort.
February 2nd	2 Naval Guns (4·7"), ex-Port Elizabeth for West. 1 Battery, R.H.A., ex-Port Elizabeth for Rensburg. 38th (Field) Company, R.E., Naauwpoort for West. 175 Australians, Naauwpoort for Rensburg. 1st } 2nd } Household Brigade Composite Regiment passed for West. 3rd } ½ Battn. Welsh Regiment, ex-Schoombie, arrived Naauwpoort. 6th Division Staff and Divisional Field Hospital and 1 Battn. West Riding Regiment, from Naauwpoort for Western. ½ Battn. Suffolk Regiment, ex-Rensburg for West.
February 3rd	1 train Australians, from Naauwpoort for Rensburg. 1 Squadron 6th Dragoons } from Naauwpoort for West. 1 Ammunition Column } 1 train R.H.A. and Imperial M.I., ex-Rensburg for West. Bearer Company and Field Hospital, from Naauwpoort for Rensburg. 1 Squadron 10th Hussars, Rensburg for West 2 Battns. Militia (4th Battn. Royal Lancashire and 9th Battn. King's Royal Rifles), arrived Naauwpoort.
February 4th	1 train Australians, from Naauwpoort for Rensburg. Midland Field Railway Section, from Naauwpoort for West. ½ Battn. Welsh Regiment, from Naauwpoort for West. Field Troop, R.E. Field Hospital Bearer Company } ex-Rensburg for West. "T" Transport Company }
February 5th	1 Squadron 10th Hussars, from Naauwpoort for West. 1 Squadron 10th Hussars } ex-Rensburg, detained on account 1 train New Zealand Mounted Rifles } of telegram from De Aar that no trains could be accepted there.
February 6th	1 Squadron 10th Hussars } from Naauwpoort for West. New Zealand Mounted Rifles } 2 Squadrons 6th Dragoon Guards } 2 trains M.I. } ex-Rensburg for West. General French's special } 47th Company, R.E. } arrived Naauwpoort ex-West. 6th Company, Army Ordnance Corps }
February 7th	3 trains S. Transport Company } from Naauwpoort for West. 1 train New South Wales Lancers } 3 trains New Zealand M.I. and 1 Squadron Carabineers, ex-Rensburg for West.
February 8th	Rimington's Scouts Bearer Company and Field Hospital } from Naauwpoort for West. Field Railway Section }
February 9th	½ Battn. Suffolk Regiment, ex-Arundel 1 Section Telegraph Division, R.E., ex-Rensburg } for West. 2 Companies M.I., ex-Thebus } 75 Nesbit's Horse, ex-Cookhouse }
February 10th and 11th	42nd Transport Company, A.S.C., passed from Cradock for West.
February 12th	2 trains M.I., ex-Thebus for West.

APPENDIX D TO CHAPTER III.

D.R. Form (Comm.) No. 18.

Section.

DETAIL OF TROOP MOVEMENTS.

6 a.m. to 6 a.m.

Rendered by R.S.O.

OUTWARDS.

Regiment, etc.	Destination.	Officers.	Men.	Horses.	Guns.	Vehicles.		Train.	
						4 Wheels.	2 Wheels.	No.	Time.

INWARDS.

Regiment, etc.	From	Officers.	Men.	Horses.	Guns.	Vehicles.		Train.	
						4 Wheels.	2 Wheels.	No.	Time.

R.S.O.,

Station.

To D.A.D. Railways.

Section.

APPENDIX E TO CHAPTER III.
 ABSTRACT OF MILITARY TRAFFIC.

D. R. FORM
 COMMUNICATIONS,
 No. 19.

HISSE 1,000,12,1900.

Week ending _____ Section.

RENDERED BY D. A. D. R.

Date.	No. of Military Trains.	Rolling Stock used for Military Traffic.						Traffic Carried.						Remarks.	Names of Units.										
		Military Trains.			Ordinary Trains.			Military Trains.			Ordinary Trains.														
		Passngs.	Cattle.	Goods.	Passngs.	Cattle.	Goods.	Officers	Men.	Animals	Guns.	Vehicles. 4-wheel, 2-wheel.	Stores. Tons.			Officers	Men.	Animals	Guns.	Vehicles. 4-wheel, 2-wheel.	Stores. Tons.				
TOTAL.....																									

Average Cost per Passenger per Mile = pence.
 " " Animal " = pence.
 " " Ton " = pence.

NOTE.—Each vehicle costs 7d. per mile. Bgies reckoned = 2 vehicles.

To A. D. R. (Com.)

D. A. D. R.

APPENDIX F TO CHAPTER III.

CAPE GOVERNMENT AND RHODESIA RAILWAYS.

INTERRUPTION AND RESTORATION OF COMMUNICATION.

Stations.	Communication interrupted on.	Communication restored on.
NORTHERN SECTION.		
Belmont	24th October, 1899	8th December, 1899
Modder River	14th October, 1899	15th December, 1899
Kimberley and Beaconsfield	„	16th February, 1900
Riverton Road... .. .	„	16th March, 1900
Windsorton Road	„	19th March, 1900
Warrenton	„	8th May, 1900
Vryburg	„	24th May, 1900
MIDLAND SECTION.		
Rensburg and Colesberg Junction	1st November, 1899	4th March, 1900
Colesberg	„	6th March, 1900
Achtertang and Norvals Pont	„	17th March, 1900
Schoombie, Thebus and Steynsburg... ..	1st December, 1899	24th January, 1900
Stenning	25th November, 1899	10th March, 1900
EASTERN SECTION.		
Dordrecht	2nd December, 1899	26th February, 1900
Stormberg	26th November, 1899	13th March, 1900
Burghersdorp	14th November, 1899	15th March, 1900
Albert Junction	„	22nd March, 1900
Aliwal North	13th November, 1899	„
Knapdaar	16th October, 1899	„

RHODESIA RAILWAY.

Through communication to Mafeking and Buluwayo re-established on 12th June, 1900.

APPENDIX G TO CHAPTER III.

CAPE GOVERNMENT AND RHODESIA RAILWAYS.

MILITARY SIDINGS AND PLATFORMS ERECTED.

Stations.	Sidings and Loops.		Platforms and Loading Banks.		Remarks.
	Number.	Total length in yards.	Number.	Total length in yards.	
Cape Town and Environs	8	3,654	6	301	
De Aar	6	2,790	2	280	
Orange River	11	4,480	9	345	
Modder River	13	6,980	7	415	Including diversion.
Naauwpoort	11	3,464	2	42	
Queenstown	3	3,216	1	150	
Bethulie	6	5,825	Nil.	Nil.	Including diversions South of Orange River.
Smaller Stations :—					
1 on Western Section	1	300	1	62	
7 on Midland ,,	11	2,600	4	120	
6 on Eastern ,,	11	5,020	3	150	
8 on Northern ,,	11	5,915	10	465	Including diversion at Fourteen Streams
1 on Rhodesia ,,	2	370	1	10	
Total	94	44,614	46	2,340	
Maximum	—	1,072	—	150	
Minimum	—	185	—	10	

NOTE.—In some cases the material was taken up and relaid elsewhere.

APPENDIX H TO CHAPTER III.
CAPE GOVERNMENT RAILWAYS.

COMPOSITION AND DISTRIBUTION OF MILITARY TRAFFIC FROM PORTS.
FROM 1ST OCTOBER, 1899, TO 31ST OCTOBER, 1900.

Month.	CAPE TOWN.							EAST LONDON.							PORT ELIZABETH.							TOTALS.								
	Officers.	Men.	Animals.	Guns.	Vehicles.	Stores.	Supplies.	Officers.	Men.	Animals.	Guns.	Vehicles.	Stores.	Supplies.	Officers.	Men.	Animals.	Guns.	Vehicles.	Stores.	Supplies.	Officers.	Men.	Animals.	Guns.	Vehicles.	Stores.	Supplies.		
October ...	35	1,718	3,570	—	95	250	1,936	14	281	36	—	—	6	274	2	156	47	—	20	14	293	51	2,255	3,653	—	115	270	2,503		
November	532	16,832	7,113	32	207	923	6,500	106	2,929	1,935	—	59	209	1,005	10	413	52	—	24	232	1,057	648	20,174	9,100	32	290	1,364	8,562		
December	479	12,854	7,625	29	294	1,356	6,556	167	4,680	2,516	36	145	464	1,788	52	894	553	—	63	496	2,092	698	18,428	10,694	65	502	2,316	10,436		
January ...	571	15,285	9,756	42	232	2,301	14,039	75	1,585	111	2	104	255	4,105	180	4,915	2,489	8	96	1,253	8,722	826	21,785	12,356	52	432	3,809	26,866		
February ...	782	17,222	8,457	61	147	3,049	1,817	78	1,576	481	6	62	279	3,990	65	1,788	455	—	3	820	5,887	925	20,586	9,393	67	212	4,148	11,694		
March	1,005	21,179	9,459	35	295	2,596	3,946	298	6,478	1,894	13	116	911	4,527	67	1,485	2,210	—	31	1,143	5,619	1,370	29,142	13,563	48	442	4,650	14,092		
April	729	14,758	7,502	82	148	1,785	6,999	346	9,263	7,039	2	145	1,148	7,599	258	8,100	4,479	—	60	1,800	12,038	1,330	32,121	19,020	84	353	4,733	26,546		
May	525	11,196	8,723	37	111	2,523	4,159	61	1,150	6,315	2	130	489	7,985	160	4,926	8,448	—	115	1,917	11,749	746	17,272	23,486	39	356	4,929	23,893		
June	339	7,067	2,686	10	32	1,593	5,476	55	906	5,265	—	52	485	8,115	64	1,660	3,713	—	18	1,486	7,637	458	9,533	11,664	10	102	3,564	21,228		
July	229	8,264	1,960	2	11	1,802	3,642	70	1,371	6,757	—	14	278	5,664	25	1,305	6,776	—	48	933	6,548	324	10,940	15,493	2	73	3,013	15,854		
August	280	3,816	1,290	6	—	1,969	3,471	56	772	3,376	—	2	262	8,875	21	506	6,032	—	62	969	8,107	357	5,094	10,668	6	64	3,200	20,453		
September	140	4,657	846	—	—	1,759	5,773	12	606	6,272	2	4	1,478	8,794	35	1,134	3,143	—	58	600	10,863	187	6,397	10,261	2	62	3,837	25,430		
October ...	152	5,371	232	4	—	1,848	5,987	29	399	181	—	14	263	10,409	26	651	3,233	—	6	741	14,414	207	6,421	3,646	4	20	2,852	31,231		
	5,798	140,219	69,219	340	1,572	23,754	70,301	1,367	31,996	42,178	63	847	6,527	73,040	965	27,933	41,630	8	604	12,404	95,026	8,127	200,148	153,027	411	3,023	42,685	238,788		
									Average per 1,000 men							41	—	765	2	15	213	1,193								

NOTES.—(i.). The averages may prove of use in estimating railway requirements in a short campaign. For a longer period compare next Appendix.
(ii.). Calculations are in English tons of 2,240 lbs.

APPENDIX J TO CHAPTER III.

CAPE GOVERNMENT AND RHODESIA RAILWAYS.

SUMMARY OF MILITARY TRAFFIC.

OCTOBER, 1899, TO JUNE, 1901.

I.—DESPATCHED FROM PORTS.

1. October, 1899, to September, 1900, inclusive.
2. October, 1900, to March, 1901, „
3. April, 1901, to June, 1901.

	Officers.	Men.	Animals.	Guns.	Wagons.	Stores. Tons.	Supplies. Tons.
Cape Town 1	5,646	134,848	68,987	336	1,572	21,906	64,314
2	1,880	35,244	3,539	31	96	8,634	29,195
3	1,644	32,132	742	5	35	5,370	17,722
Total.....	9,170	202,224	73,268	372	1,703	35,910	111,231
Port Elizabeth 1.....	939	27,282	38,397	8	598	11,663	80,612
2.....	319	8,895	14,910	1	343	5,379	85,389
3.....	393	9,668	11,482	—	335	4,800	44,014
Total.....	1,651	45,845	64,789	9	1,276	21,842	210,015
East London 1.....	1,338	31,597	41,997	63	833	6,264	62,631
2.....	286	4,578	8,600	2	61	3,153	71,142
3.....	280	3,327	4,702	—	302	2,164	39,437
Total.....	1,904	39,502	55,299	65	1,196	11,581	173,210
Grand Total.....	12,725	287,571	193,356	446	4,175	69,333	494,456
Average per 1,000 men*...	44	—	672	1'5	14'5	241	1,719

* NOTE.—Compare Appendix D above and also Appendix E to Chapter VI., Part II, which summarises for a similar period on the N.G.R.

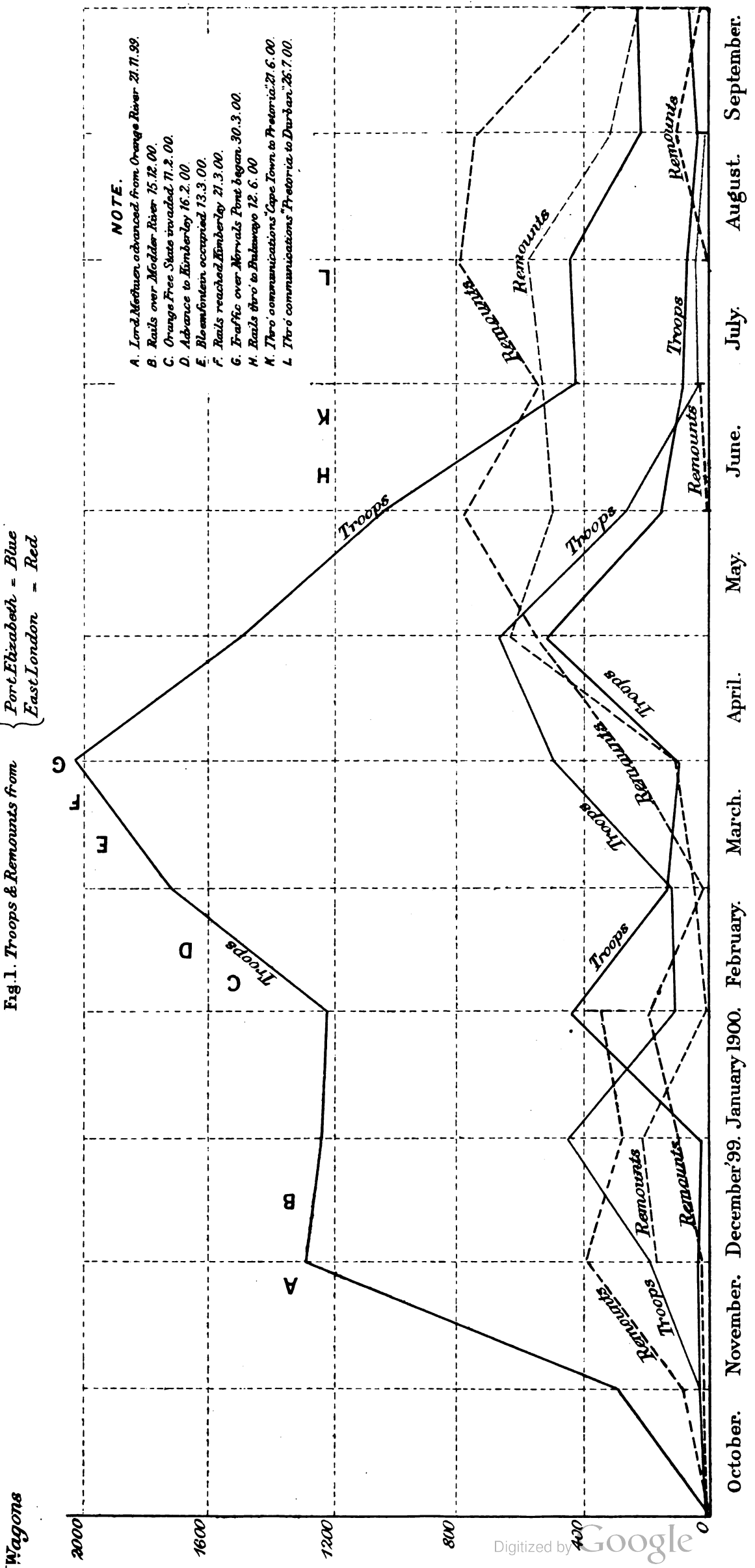
II.—INTERMEDIATE TRAFFIC (ORIGINATING AT STATIONS OTHER THAN PORTS).

Passengers.	Troops.	Animals.	Various Trucks.	Supplies and Stores. Tons.
November, 1899, to August, 1900, inclusive.				
433,642	503,640	120,993	4,281 and 3,486 Ambulance.	197,410
September, 1900, to June, 1901, inclusive.				
—	438,124 (Including proportion for Ambulance Trains).	225,972	2,727	191,656

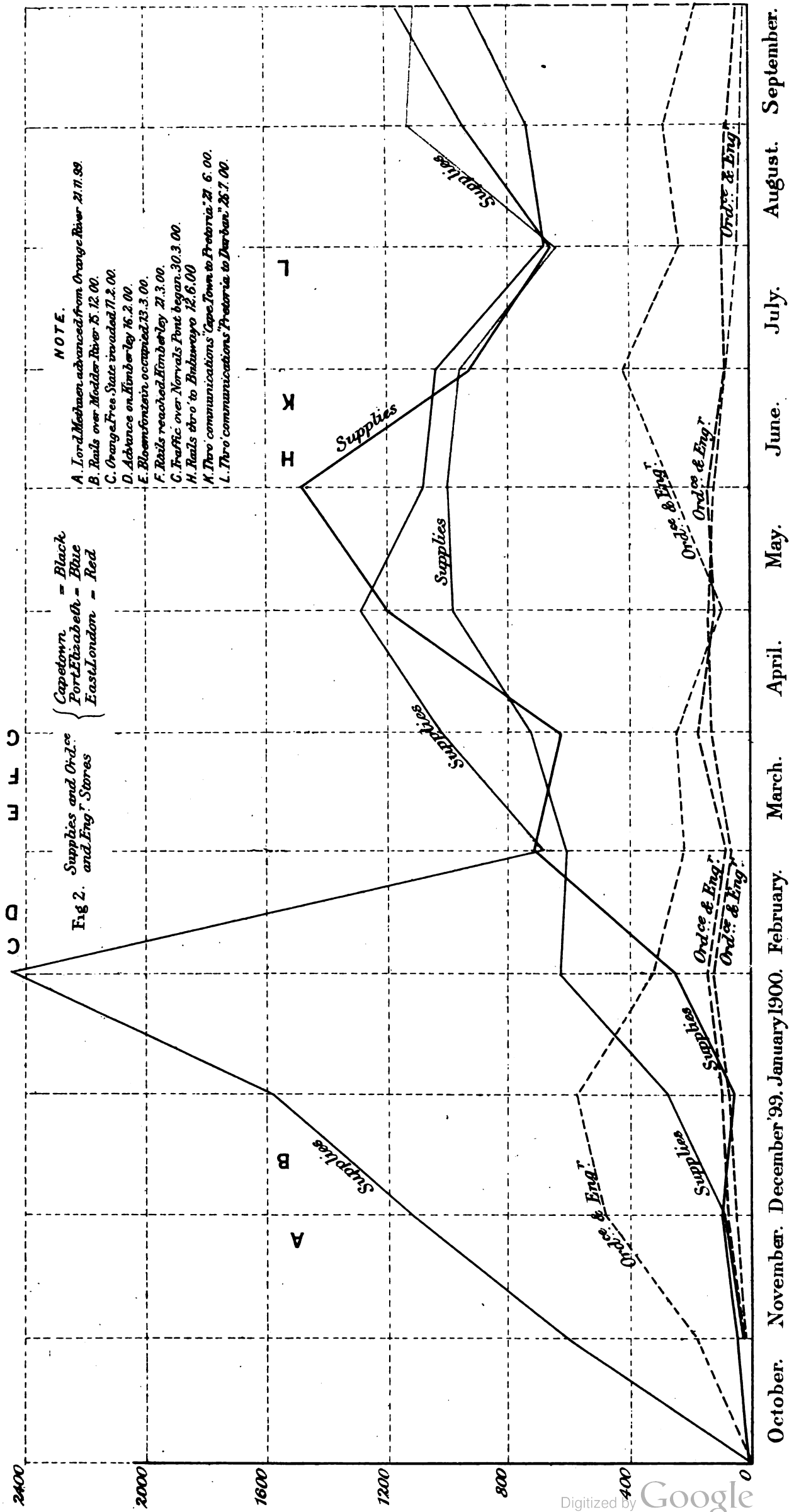
Appendix K to Chapter 3.
DIAGRAMS OF MILITARY TRAFFIC ON CAPE GOV. RAILWAYS ORIGINATING AT PORTS.
 PERIOD 1ST OCTOBER 1899 - 30TH SEPTEMBER 1900.

Cape Town - Black
 Port Elizabeth - Blue
 East London - Red

Fig. 1. Troops & Remounts from



Appendix K to Chapter 3.
DIAGRAMS OF MILITARY TRAFFIC ON CAPE GOV. RAILWAYS ORIGINATING AT PORTS.
 PERIOD 1ST OCTOBER 1899 - 30TH SEPTEMBER 1900.

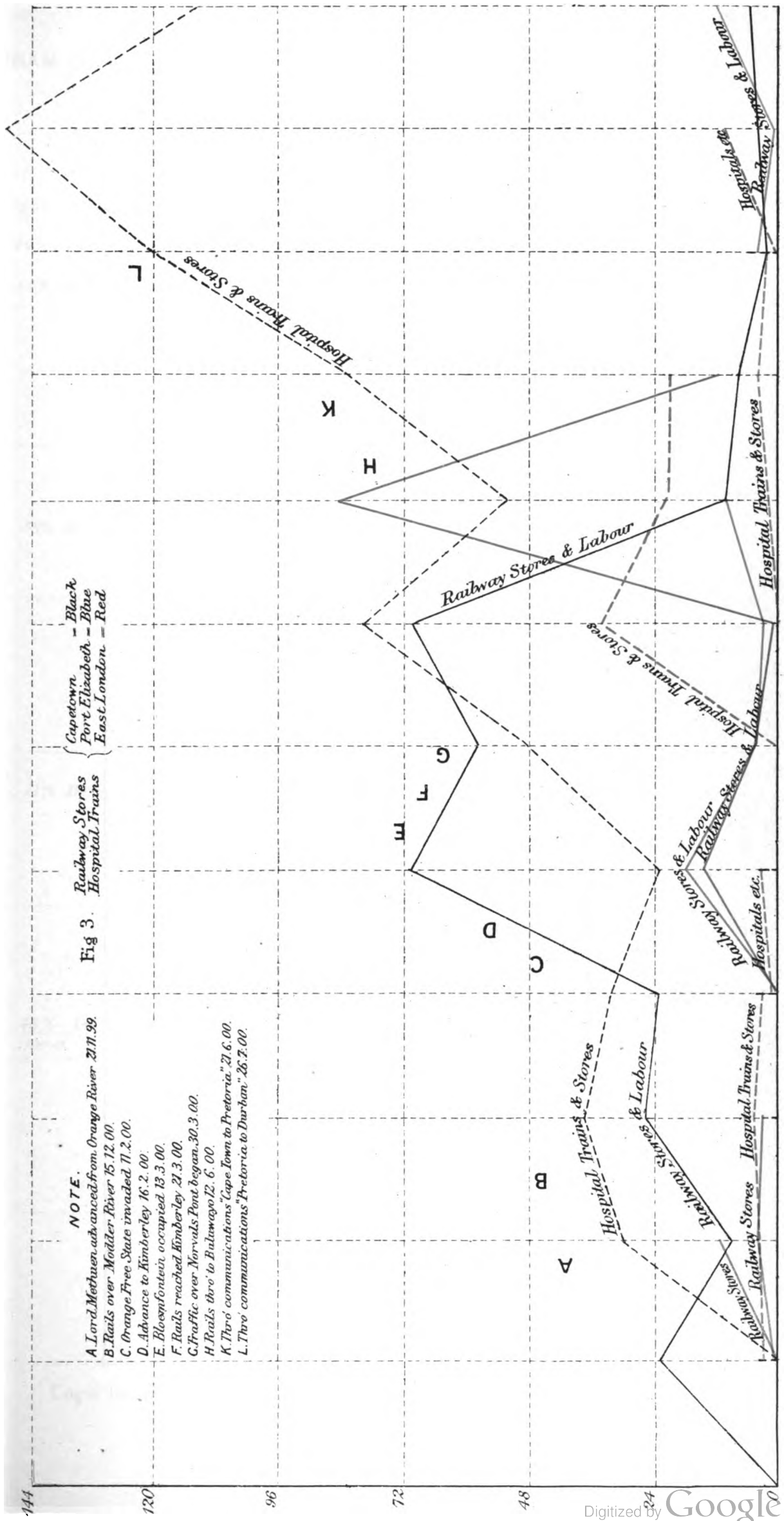


NOTE.
 A. Lord Methuen advanced from Orange River 21.11.99.
 B. Rails over Modder-River 15.12.00.
 C. Orange-Free State invaded 11.2.00.
 D. Advance on Kimberley 16.2.00.
 E. Bloemfontein occupied 23.3.00.
 F. Rails reached Kimberley 21.3.00.
 G. Traffic over Norval's Pont began 30.3.00.
 H. Rails thro' to Bulwer's 12.6.00.
 I. Three communications "Cape Town to Pretoria" 21.6.00.
 L. Three communications "Pretoria to Durban" 26.7.00.

Capetown - Black
 Port Elizabeth - Blue
 East London - Red

Fig 2. Supplies and Ordnance & Eng. Stores

**DIAGRAMS OF MILITARY TRAFFIC ON CAPE GOV^t RAILWAYS ORIGINATING AT PORTS.
PERIOD 1st OCTOBER 1899 - 30th SEPTEMBER 1900.**



NOTE.
 A. Lord Methuen advanced from Orange River 21.11.99.
 B. Railets over Modder River 15.12.00.
 C. Orange Free State invaded 11.2.00.
 D. Advance to Kimberley 16.2.00.
 E. Bloemfontein occupied 13.3.00.
 F. Railets reached Kimberley 21.3.00.
 G. Traffic over Norval's Pont began 30.3.00.
 H. Railets thro' to Bulwer's 12.6.00.
 K. Thro' communications "Cape Town to Pretoria" 21.6.00.
 L. Thro' communications "Pretoria to Durban" 26.7.00.

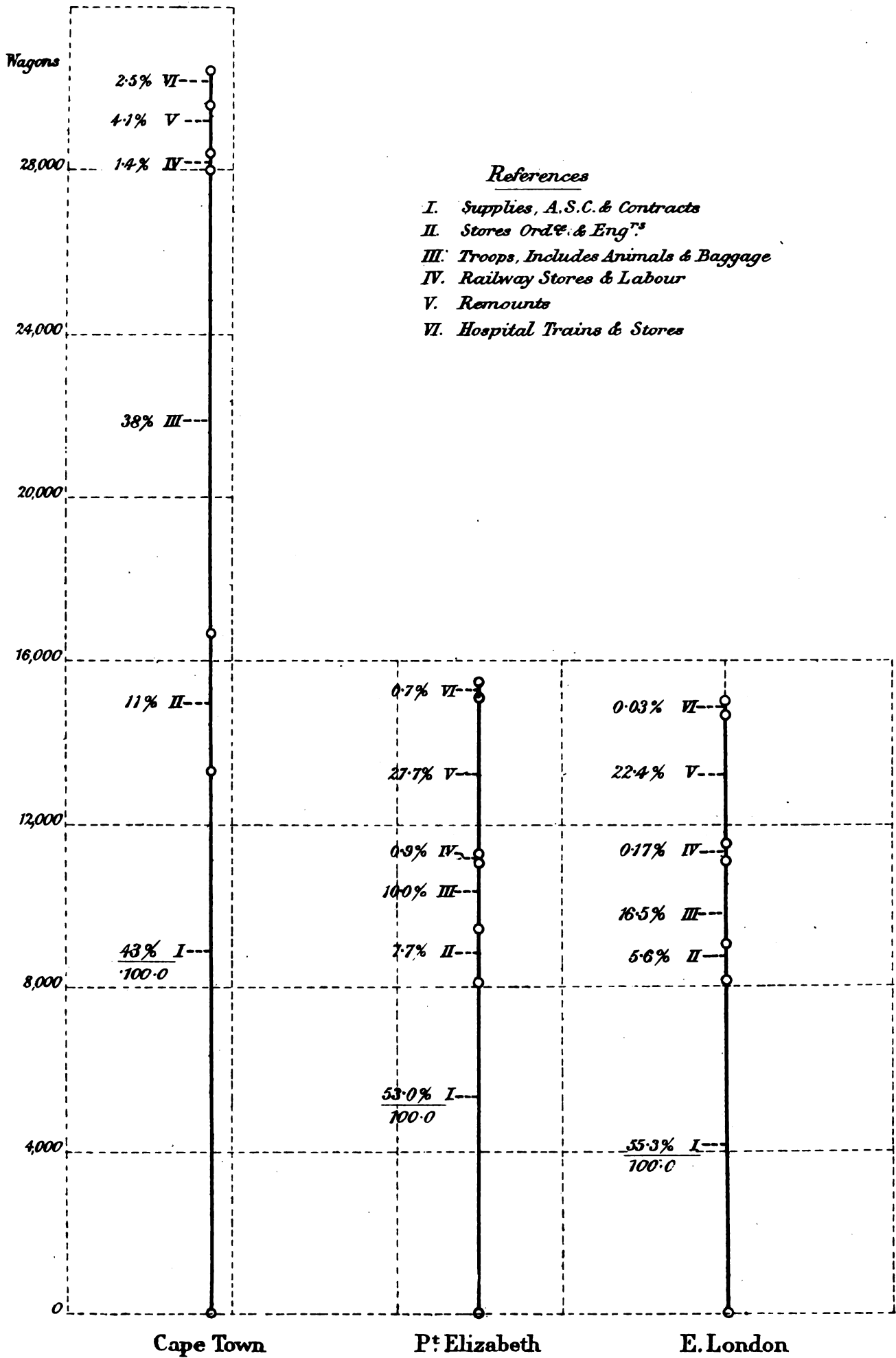
Fig 3.
 Capetown - Black
 Port Elizabeth - Blue
 East London - Red
 Railway Stores
 Hospital Trains

October. November. December '99. January 1900. February. March. April. May. June. July. August. September.

Appendix K to Chapter 3.

DIAGRAM OF ABSTRACT OF TOTAL MILITARY TRAFFIC FROM PORTS.

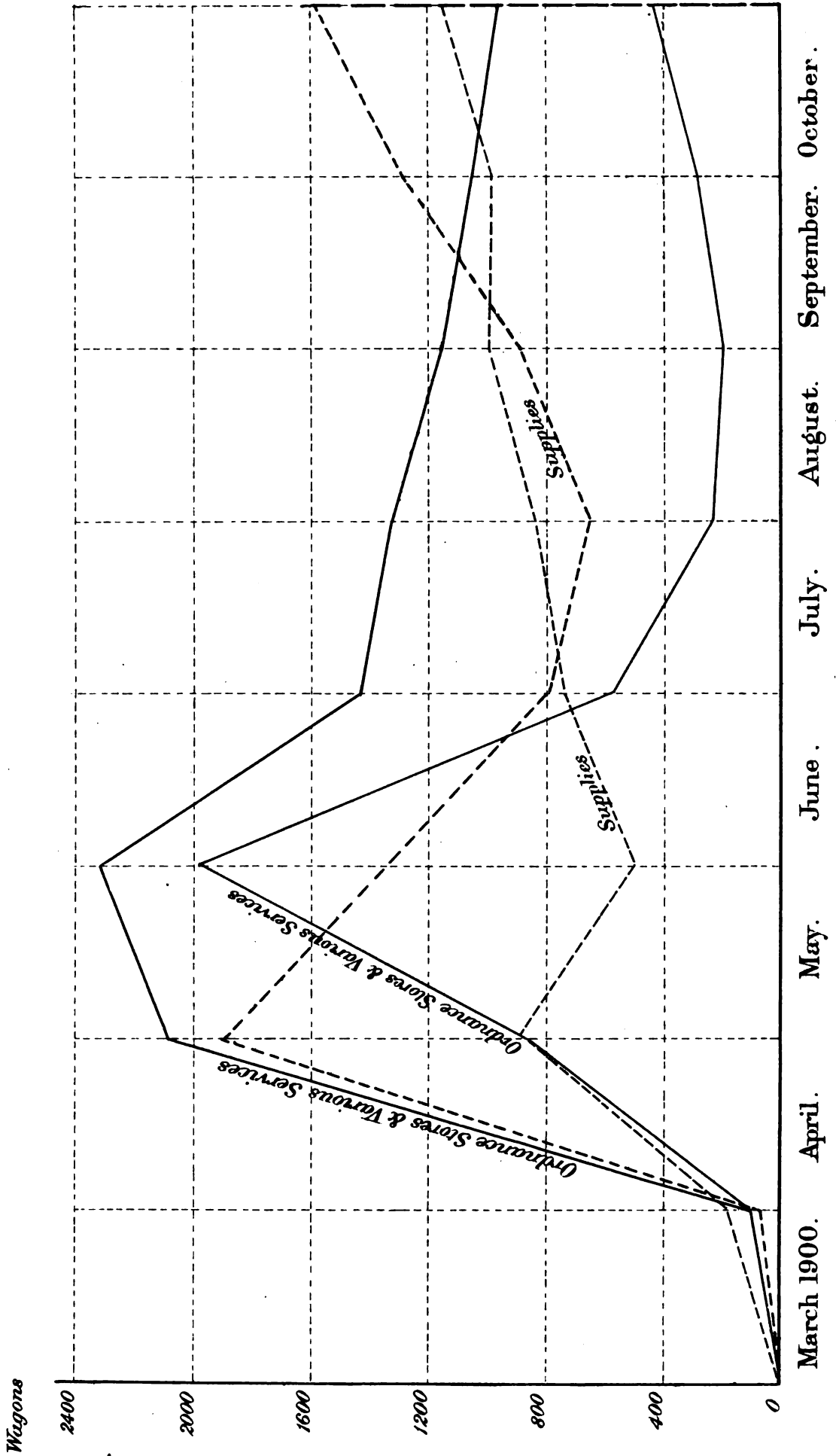
OCT. 1ST 1899 - SEP. 30TH 1900.



DIAGRAMS OF MILITARY TRAFFIC FROM CAPE COLONY PASSING NORVALS PONT AND BETHULIE BRIDGES.

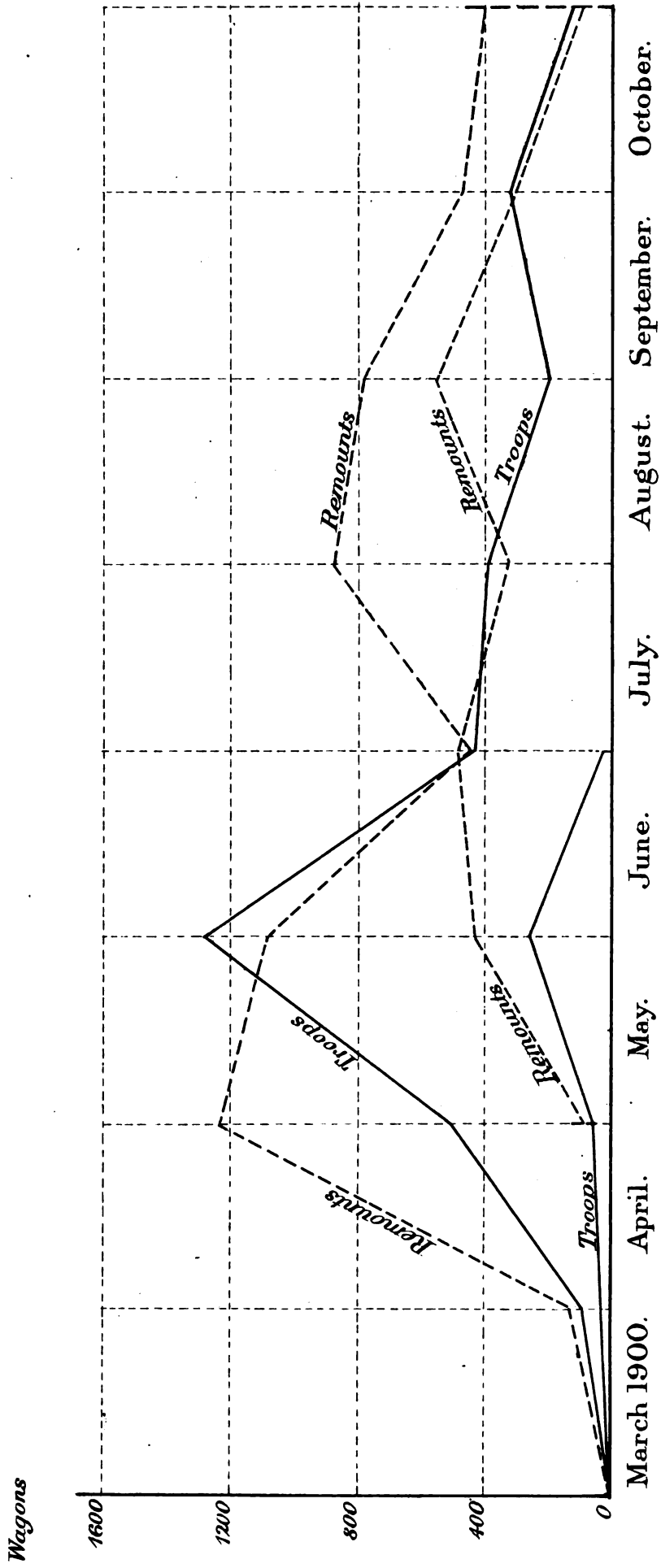
PERIOD .MARCH - OCTOBER 1900.

Fig. 1 *Ordnance & Various Stores* } *Norvals Pont - Black.*
Supplies } *Bethulie - Red.*



DIAGRAMS OF MILITARY TRAFFIC FROM CAPE COLONY PASSING NORVALS PONT AND BETHULIE BRIDGES.
 PERIOD MARCH - OCTOBER 1900.

Fig. 2. Troops & Remounts
 { Norvals Pont - Black.
 Bethulie - Red.



CHAPTER IV.

REPAIR OF LINES DAMAGED BY THE ENEMY.

(A).—WORK OF WESTERN FIELD RAILWAY SECTION.

On the 11th November, 1899, this F.R.S. was organised at Orange River (*Plate 1*). The Staff of the Section was constituted as follows :—

Staff.	A.D.R.	Major W. R. Stewart, R.E.
	S.O.	Lieut. H. O. Mance, R.E.
	do. (tempy.)	Lieut. H. L. Pritchard, D.S.O., R.E.
	Supt. of Works	Capt. W. D. Waghorn, R.E.
	Traffic Officer	Lieut. A. M. Henniker, R.E.
	Loco. Supt.	Lieut. R. Oakes, R.E.

Railway Troops at Disposal of A.D.R.

The Railway Troops at the disposal of the A.D.R. were :—

8th (Railway) Company, R.E., with Lieuts. G. R. Frith and R. H. Grieg, R.E. ; 31st (Fortress) Company, R.E., with Capt. F. G. Fuller and Lieut. R. Oakes, R.E. ; a portion of the 11th (Field) Company, R.E., with Major G. F. Leveson and Lieuts. F. C. Puller, A. Meares and R. F. A. Hobbs, R.E., which had left its transport behind and was placed at the disposal of the A.D.R. by order of the G.O.C.

In addition to these troops, the A.D.R. had 40 civilian employes of the O.F.S. Railways and 200 natives.

Advance Northwards from Orange River.

Between the 11th and 21st November a much needed siding had been laid and a stores depôt formed at Orange River. On the latter date Lord Methuen advanced and the F.R.S. followed close with five trains marshalled as follows :—(a). Armoured train ; (b). Material ; (c). R.E. ; (d). Divisional Commissariat, with five days supplies, drawn by two engines ; (e). Ammunition, baggage and water. These were augmented the next day by a train conveying the Naval Brigade with their guns. Repairs to permanent way, some culverts and station water supplies were carried out for the next four days, the railway troops progressing with the rest of the Division.

Engagements at Graspan and Modder River.

On the 25th they were engaged, during the fight at Graspan, in escorting Naval guns on the field. As Lord Methuen advanced to the Modder River the railway troops kept pace with him, making good all damage, and on the 28th the General pushed the R.E. Companies into the fight on the Modder River. They crossed the river with a mixed body of Infantry and for eighteen hours occupied a position on the right bank. The next day the trains enumerated above advanced to the river, but found the bridge broken, and for the next 2½ months the F.R.S. was employed almost continuously at this spot.

At Modder River.

The work done during this period may be broadly summarised as follows :—(a). Construction of a temporary diversion over the river ; (b). Semi-permanent repairs to the high level bridge ; (c). Miscellaneous works and duties connected with the great concentration in February, 1900.

The destruction wrought by the enemy will be dealt with in further detail, but for the present a glance at the upper figure in *Plate 2* will show the necessity for planning a diversion to re-establish railway communication of some sort at an early date. *Plate 3* shows the diversion selected and made, the various sidings laid on both banks of the river and the low level bridge in the bed of the stream. Under the supervision of Capt. Waghorn, R.E., the deviation was completed on the 7th December, on which date the enemy cut the railway to the southward near Enslin, the line, however, being put into working order again within 24 hours.

When the advance from Orange River commenced, all drivers not required with trains accompanying the F.R.S. remained under Lieut. Oakes, R.E., to work trains northward. The bulk of traffic men on the other hand moved forward and were distributed along the line as stations were opened ; their food, etc., was arranged for by running a daily ration train.

Progress of Telegraphs.

The telegraphs under Lieut. J. P. Moir, R.E., kept up well with railhead. Two wires were run, of which one was reserved for railway messages. Nevertheless, so great was the pressure at times that delays were caused to traffic, as "Line Clear"

messages could not be got through. The system of working in vogue on the C.G.R. has already been described and was adhered to on the F.R.S.

The want of water was much felt until the beginning of December. During the whole period of the advance to the Modder water was forwarded daily in tanks; and engines had to water at crossing places, where they ran alongside the tanks and were detained two hours to fill up tenders.

Difficulties of Water Supply.

Orange River was made a "Joint Station," *i.e.*, the junction of the Civil Administration and the F.R.S., and Lieut. Henniker, R.E., acted as R.S.O. there. He was assisted by Lieut. Mance, R.E.; but there was often work enough for four officers, two of whom should have been R.S.O.s pure and simple. At railhead Lieut. Pritchard acted as R.S.O.

When the F.R.S. was first organised, railway stores were issued from Cape Town to the A.D.R.; but when an advanced base depôt was formed all stores passed through it and were taken on charge on a Field Ledger at railhead, kept by Capt. Waghorn, whilst coal, oil, waste and other "running stores" required for locomotives and rolling stock were accounted for by Lieut. Oakes.

Stores.

The railway to Kimberley crosses the Modder River a few hundred yards below the point where the Riet River joins the larger stream. The bridge has eight spans of 80-foot girders, on masonry piers and abutments, and the maximum height from water to rail level is 40 feet. *Plate 3* shows the deviation and temporary bridge, whilst *Plate 2* and *Photo 1* illustrate the damage done and the semi-permanent repairs. Piers J and P had been wholly, and O partially, destroyed; of the girders four spans, *viz.*:—A, B, G and H, had been badly damaged and span F slightly so. It was also necessary to replace nine cast-iron bed-plates which were missing or hopelessly smashed up.

Modder River Bridge.

The 8th and 31st Companies, R.E., were told off to the north and south ends of the bridge respectively, the 11th Company and a gang of 200 natives being withdrawn on the 11th December; so that the two Companies named furnished practically all the labour available for executing the work to be done.

The lower illustration on *Plate 2* shows the temporary expedients adopted pending permanent reconstruction of the piers. The end panels of girders had in many cases been so damaged that it was necessary to replace them by new material; and the various methods adopted to support them temporarily (shown in *Plate 2*) are worthy of study. By December 24th spans A and B were lifted and supported; by January 20th, 1900, all was in readiness to erect trestles at the north end of the bridge; and by March 3rd all masonry was complete. The bridge was tested on 31st March with satisfactory results, and four days later the structure was handed over to the C.G.R. complete in every respect.

On the advance of the Columns towards Kimberley, repairs on the railway were resumed on the 16th February under the direction of Capt. Waghorn, who was assisted by Lieut. H. A. Micklem, R.E., and the Works Section of the Midland F.R.S. Damage had been done chiefly to rails and girder spans of culverts, but steady progress was made.

Advance to Kimberley and Warrenton.

On the afternoon of the 19th February a junction was effected with a repairing party from Kimberley; and the same evening a coal train, followed by a supply train, ran into the town. Two days later Lieut. Micklem and his Section returned to Naauwpoort.

For the next three weeks the Western F.R.S. was employed in removing the various sidings which had been laid down at Modder River and south of it for the concentration of Lord Roberts' force. On 15th March the working party under Capt. F. G. Fuller resumed repairs north of Macfarlane's (see *Plate 1*). *Plates 4* and *5* illustrate the damage done by the enemy and the nature of repairs effected under various circumstances; the result of one week's work was the re-opening of communication as far as Warrenton Station.

Between 21st March and 2nd May no progress was possible, as the country immediately to the north was held in force by the enemy. It was known that the important bridge over the Vaal River at Fourteen Streams was broken; but no details could be ascertained beyond the information brought in by Capt. Fuller, who, after a night reconnaissance and sketch, stated that it would be impossible to repair the permanent bridge for some time but that the piers of the low level bridge built during the construction of the line were apparently intact.

On May 3rd the armoured train under Major Stewart, R.E., taking with it a 6-inch gun mounted on a truck, accompanied Maj.-Gen. Paget's Column to Warrenton. The gun was fired from a special siding; though trained at an angle of 15 degrees with the line and fired at an elevation of 19 degrees, no evil effects were observed, and the

truck, which recoiled up a grade of 1 in 40, was run up by hand. The firing was directed from a balloon on certain Boer laagers.

Vaal River Bridge,
Fourteen Streams.

Maj.-Gen. Paget effected a junction with Gen. Hunter on the 7th May, when railhead was at once brought to the left bank. Capt. Fuller's observations were confirmed (*Photo 2*), and accordingly a deviation was arranged for (*Plate 6*). The alignment of the old construction deviation was adhered to; but, after the time that had elapsed since it was used, practically the whole of the work on it had to be done afresh.

Plate 7 gives information regarding the low level deviation bridge and the work executed, with a statement of the working parties. Considering the length of the diversion (1.9 miles) and the work required, the time taken to complete it—viz., eleven days—reflects credit on all concerned.

Advance to Kraaipan.

It was desirable to join hands with Maj.-Gen. Barton to the north, and accordingly the armoured train advanced on the 19th May, effecting repairs where necessary. Gen. Barton's troops were met at Phokwani, where telegraphic communication with the south was made good. The train proceeded northwards to Taungs and found the bridge there (one span 100 feet) damaged; repairs were taken in hand and completed on the 22nd. Two days later Vryburg had been occupied and the line reconnoitred to Devondale; and by the 31st trains could reach Kraaipan, notwithstanding numerous delays at damaged culverts.

Brigadier-General Mahon's Column from the relief of Mafeking was met at Kraaipan. Though they had to report that north of that station six miles of line had been torn up and fastenings removed, they also brought the welcome intelligence that a repairing party was working south from Mafeking.

Junction with
Repairing Party from
Mafeking.

A junction was effected with this party on 9th June, just north of Maritsani, and the work of the F.R.S. in this part of the theatre of war was successfully concluded. The British forces invading Boer territory were now in Pretoria; and so long ago as the end of March all locomotive and traffic men who could be spared from the Section had been sent to Bloemfontein for employment on the I.M.R. The remainder of the Western F.R.S. now followed suit, ceasing to exist as a separate organisation on the 15th June, on which date they reached Bloemfontein.

Experience gained.

As a result of the experience gained during this advance several points are more or less clearly evident.

(a). Night Work.

First, that night working as a rule does not lead to any advantage, except in bridge construction. In that event excellent lighting arrangements must be provided, such as was afterwards done through the O.F.S. where the Electrical Engineers, R.E. (Volunteers), were available with their plant.

At the same time attention should be called to a most excellent form of portable lamp which had been brought out to South Africa by Capt. H. C. Nanton, R.E. This light was worked by acetylene, was extremely simple in construction, and in competent hands never failed to give the greatest satisfaction with an illuminating power almost equal to that of an arc lamp.

(b). Railway
Demolition in War.

The only method of destruction which can be commended is that of blowing up alternate joints of rails for many miles. Had the enemy adopted this method for a length of 50 miles when retiring from Bloemfontein, there is but small doubt that the general advance of the Army would have been delayed for many weeks; for the damage done would have necessitated the employment of large working parties, and the permanent way material to be moved (300 tons per mile of line re-laid) would have taken precedence of such necessaries as food supplies for the Army.

(c). Use of Railway
Water Supply by
Troops.

Lastly, experience shows that it is of great importance that clear and definite orders should be issued that troops are not to interfere with a railway water supply without reference to the officers in charge. Considerable delay occurred from time to time owing to misunderstandings on this point; as a consequence not only were the railway working parties hampered, but the efficiency of the railway as a means of transport for the Army was impaired.

(B).—WORK OF MIDLAND FIELD RAILWAY SECTION.

On November 29th, 1899, the Midland Field Railway Section arrived at Naauwpoort from Cape Town, constituted as follows:—

Staff.	A.D.R.	...	...	...	...	Capt. (local Major) J. H. Twiss, R.E.
	S.O.	...	...	...	...	Lieut. H. L. Pritchard, D.S.O., R.E.
	Supt. of Works	...	...	...	...	Lieut. H. A. Micklem, D.S.O., R.E.
	Traffic Officer	...	...	...	...	Lieut. C. E. Vickers, R.E.

The Railway Troops at the disposal of the A.D.R. were :—

- 10th (Railway) Company, R.E., under Lieut. L. B. Millington, R.E.
- 42nd (Fortress) Company, R.E., under Lieut. A. G. T. Cusins, R.E.
- 20th (Fortress) Company, R.E., under Capt. C. S. Wilson, R.E.

Troops at Disposal of
A.D.R.

In addition 200 Natives, with 8 Civilian Gangers and 1 Civilian Inspector, were attached. Mr. Carolin, Assist. Loco. Supt. of the O.F.S. Railways, who had left the Free State on the outbreak of War, was placed under the orders of Major Twiss and looked after 93 late O.F.S. Railway employés who were waiting at Naauwpoort. The remainder of the refugee employés were either in the C.G.R. service or else working under Major W. R. Stewart, R.E., in the Western F.R.S. (see Appendix A to this Chapter).

On arrival at Naauwpoort it was found that the place was absolutely blocked with rolling stock, loaded with every sort of supplies and stores.

Congestion of Trucks,
etc., at Naauwpoort.

The A.S.C. intended to make Naauwpoort an advanced depôt ; but Lieut.-Gen. French, who was in command, had not yet received definite instructions as to whether he was to hold or evacuate the place. At that time he had at his disposal very few troops and the enemy were in considerable force at Arundel, only some 12 miles north of Naauwpoort. The consequence was that the A.S.C. continued to send up large numbers of trucks loaded with stores, but Gen. French was unable to allow them to be off-loaded until it was settled whether they should go to De Aar or remain at Naauwpoort. This absolute blocking of Naauwpoort Junction to such an extent as to prohibit any shunting naturally caused chaos in the Traffic Department. This is a typical instance of the difficulties which occur on Railways in war time.

Major Twiss on his arrival informed Maj.-Gen. French that he had been instructed by the D.R. to arrange for all the General's railway requirements to be carried out, and asked therefore that he should be made the sole channel of communication with the C.G.R. The General had received no information of Major Twiss's appointment ; but, on receipt of a telegram from Cape Town confirming Major Twiss's statements, Gen. French fell in with the arrangement and always conveyed his orders to the C.G.R. through the A.D.R.

Position of A.D.R.

The A.D.R. now proceeded to organise his F.R.S. into the four departments customary on Railways, viz., Traffic, Locomotive, Works and Stores. All men of the R.E. Railway Companies who had had experience in Traffic working were told off under the orders of Lieut. Vickers, so that when the advance began station masters, shunters, etc., could be installed at stations captured from the enemy until such time as we were able to hand back a repaired section of the line to the C.G.R.

Organisation.

Engine drivers, firemen, fitters, etc., from the Companies were placed under the orders of Lieut. Cusins, who was to act as Loco. Supt. of the F.R.S.

Q.M.S. Lockwood, R.E., was appointed Storekeeper, with a small staff of non-commissioned officers and sappers to assist him.

All the remaining men of the 10th and 42nd Companies were detailed as Works Section under the orders of Lieut. Micklem, who was assisted by Lieuts. C. N. North and R. H. Cunningham, each in command of that portion of their Company which was in the Works Section.

Capt. C. S. Wilson and the 20th Company, with Lieut. W. H. Jones as his subaltern, did not form part of the Works Section, but were held in reserve for any work that might turn up.

Owing to the continued halt of our troops just south of Colesberg, it was some time before the Midland F.R.S. was required to do much work beyond putting in 350 yards extra sidings for the A.S.C., a siding for the Hospital and 420 yards sidings for railway material depôt at Naauwpoort, and two sidings (one for the A.S.C. and one to assist entrainments and detrainments) at Rensburg.

At Naauwpoort and
Rensburg.

Four bogie trucks were also fitted up as Hospital Coaches to bring the sick from railhead to Naauwpoort Hospitals.

On the 16th December Lieut. Cunningham, R.E., took a party of platelayers to Orange River and put in several lengths of sidings which were urgently needed there.

In connection with the latter sidings, platforms made with sleeper cribs, spanned by rails which were again covered over with sleepers, were quickly put up. This is the most suitable form of hasty military platform ; it can be made in an hour or two, with a ramp at each end and one at the back, and, as soon as the entrainment or detrainment is completed, it can be loaded up again undamaged for use in railway repairs.

Sleeper Crib
Platforms.

On the 4th January, 1900, the Midland F.R.S.—strength 5 officers and 222 rank and file, R.E., 93 O.F.S. Railway civilians and 200 natives—moved by order of the D.R. to Modder River.

Move to Modder
River.

Construction of Line
from Modder River
to Bloemfontein.

At this time a scheme was under discussion for laying a new line from Modder River to Bloemfontein; and it was also proposed to start laying a line along the Modder River westwards in order to delude the enemy and prevent them guessing the reason for the concentration of railway material and troops at Modder River.

The A.D.R. accordingly commenced the construction of a line westwards from the south bank of the Modder River, but he was told confidentially not to proceed with it too fast. At the same time 15 miles of permanent way material was railed up to Modder River, and 592 yards of sidings were put in to form the advance base of the proposed new line; a smiths' shop was built, water tanks erected, and an engine pit constructed.

On the arrival of Lord Roberts this scheme was countermanded; the work which had been completed for 2,000 yards was therefore stopped, and the Midland F.R.S. returned on the 13th January, 1900, to Naauwpoort. The sidings laid down at Modder River afterwards came in very useful during the subsequent concentration of troops.

Repair of Line
Eastwards from
Rosmead.

On the 24th January, 1900, the A.D.R. was instructed to repair the line eastwards from Rosmead, behind the advance conducted by Maj.-Gen. C. Knox.

The first break encountered was at Thebus bridge, where Gen. Knox's force halted for some time. Lieut. H. A. Micklem with the Works Section repaired the bridge in two and a-half days. Gen. Knox was instructed not to advance any further in that direction, and the Section returned accordingly to Naauwpoort on 2nd February.

On the same day the A.D.R. (Cape Town) arrived and informed the A.D.R. (Midland) confidentially that Gen. French with the majority of his forces was to be entrained partly at Rensburg and partly at Naauwpoort and railed round to detrain at Modder River, and that the A.D.R. (Midland) was to superintend the entrainments at Naauwpoort and Rensburg.

The Works Section at once proceeded to Rensburg and put in another troop siding and erected about 150 feet additional length of platform. They left on 5th February for Honey Nest Kloof on the Western Section, and put in two sidings and a platform for the expected detraining of large numbers of troops. On 7th February part of this Section went to Graspan where they put up detraining platforms and made additional sidings.

The entrainments at Rensburg and Naauwpoort began on 31st January and were completed on 7th February; a full report on these entrainments, with all details, is given in Appendix B to this Chapter.

R. S. O.s at
Naauwpoort.

The A.D.R. appointed two of his officers as additional R.S.O.s at Naauwpoort, while he himself kept in communication with Gen. French's Staff and the Assistant Traffic Manager of the C.G.R.

As soon as the railway concentration of the troops between Orange and Modder Rivers had been completed the portion of the Midland F.R.S. at Naauwpoort moved round to Modder River to join their Works Section already there; and on 17th February commenced to assist the Western F.R.S. with the repair of the line to Kimberley. The Western F.R.S. repaired the line by day and the Midland F.R.S. worked by night, and on 19th February the line to Kimberley was opened.

Repair of Line to
Kimberley.

Sidings at
Naauwpoort.

Immediately this work had been completed the Midland F.R.S. again moved back to Naauwpoort, and at once commenced to put in 1,100 yards sidings for the advanced depôt of railway material which was coming up to be off-loaded at Naauwpoort in readiness for repairs to the line through the O.F.S.

These sidings and the off-loading of the railway material and the erection of two store sheds (40 feet by 40 feet) were barely completed when orders were received on 26th February to commence the repair of the line north of Arundel behind Maj.-Gen. Clements' advance. Lieut. Micklem's report of these repairs will be found in Appendix C to this Chapter.

As soon as Colesberg Station was reached the C.G.R. took over traffic working up to that point, which then became the "Junction Station," north of which traffic was worked by the F.R.S. until its arrival at Norvals Pont, when the C.G.R. took over traffic up to Orange River.

Engines lent by
C.G.R.

Traffic.

Four engines were handed over by the C.G.R. to the Midland F.R.S. and placed under the supervision of Lieut. Cusins.

Traffic on the Field Section was worked by an officer at Colesberg, while another officer was Traffic Master at railhead.

Traffic difficulties were increased by the fact that Gen. Clements' force was exceedingly short of transport and depended on the railway practically acting as their convoy. This meant that the supplies had to be delivered absolutely in the camp of Gen. Clements, he being unable to send wagons even three or four miles to the last siding. The result was that one day Gen. Clements encamped half-way between

Colesberg and Joubert Siding and wanted a train load of stores to be off-loaded at that point, and the next day the A.S.C. would have required them loaded up again, thereby necessitating a train standing for several hours on the main line between stations. The General however afterwards agreed that supplies should only be delivered at sidings, which on this part of the line are never more than six miles apart, and that he would manage to send transport to the siding to bring the supplies to his camp ; and the Supply Officer entirely concurred with the necessity for not keeping trucks under load when there was only one loop siding available for shunting and off-loading, etc. By this means it was possible to prevent trains being delayed at railhead, and at the same time to shunt off and despatch to the Construction Party railway material, trucks, etc., and to send back all the empty rolling stock.

Attention is drawn to the necessity of a clear understanding being made with the G.O.C. of an advancing force as to the following points :—

1. As the whole of the line will probably be under repair and the railhead station will usually be merely one loop siding, it is absolutely necessary that all stores arriving at railhead be off-loaded there or else sent back to the advance depôt. Experience gained.
(a). Necessity for off-loading all Stores at Railhead.
2. Any stores off-loaded should not be reloaded again until working on the line has been restored to its normal conditions, possibly a week or two later. It is more convenient to the railway, instead of reloading these stores dropped at a wayside station, to rail up fresh stores from the Advance Depôt.
3. Precedence must be given to railway material for the Construction Party, who should not be called upon (except in cases of great urgency) to lay additional sidings for entrainments or detrainments but should be entirely occupied in pushing the line through with temporary repairs, on which work all material able to be supplied should be used. (b). Precedence to be given to Railway Material.

The subsequent advance through the O.F.S., during which these principles were clearly laid down and worked on, fully proves the correctness of the regulations. Advance to Bloemfontein.

On 15th March, 1900, Gen. Clements crossed the Orange River, and on the evening of the same day the Midland F.R.S. arrived at Norval's Pont and commenced to lay a deviation and construct a low-level bridge over the Orange River. Full details of this work will be found in Lieut. Micklem's report (Appendix C).

On 27th March traffic was opened ; and, as the line between the Orange River and Bloemfontein was undamaged, communication with Bloemfontein was restored fourteen days after the arrival of Lord Roberts in that town.

The Midland F.R.S., as such, was then abolished. The Locomotive, Traffic and Stores portions of it were incorporated in the newly organised I.M.R., while the Works Section was handed over to the Supt. of Works, I.M.R. The A.D.R. was appointed C.S.O. to the D.R.

APPENDIX A TO CHAPTER IV.

EMPLOYMENT OF O.F.S. RAILWAY CIVILIANS WITH RAILWAY COMPANIES, R.E.

The greater number of the officers and employés of the O.F.S. Railways were British subjects, who had been previously employed on the Northern Section of the C.G.R. and had transferred their services to the Free State on the said line being acquired by that State from the Cape Government under existing conventions. Organisation.

On war becoming imminent, one of the officers (Mr. Carolin, the District Loco. Supt.) and a considerable number of the employés decided that it was their duty to throw up their employment and to proceed to British territory ; for it was evident that in the course of their duties they would be obliged to render very important aid to the Boer Republican Forces in moving bodies of Burghers, with their guns, ammunition columns, transport and supplies, to Natal and Mafeking and to and from the borders of the Republics.

There was also a considerable likelihood of all able-bodied men being commandeered in person, which would have forced the said employés to take up arms against their own countrymen.

On these facts being placed before the R.E. authorities in Cape Town by Mr. Carolin, who had left the O.F.S. towards the end of September, 1899, it was decided to collect suitable men from among those coming out of the O.F.S. and attach them to the Railway Companies of the R.E. until the time arrived when they could be used on the O.F.S. Railways.

Mr. Carolin was appointed Supt. of Railway Employés, O.F.S., and instructed to proceed to Naauwpoort and there to engage any suitable men as they arrived from the north. Eventually about 100 men of various trades were engaged and camp formed at De Aar. Foremen were appointed and work started.

During the following months rather more than 50 men beyond the above number were engaged. In addition, some 130 men were handed over to the Cape Administration in various capacities to relieve the pressure caused by the war.

The men were employed on condition that they conformed to military discipline and did any work that was necessary. All received free rations and tent accommodation, in addition to their pay. All were promised that, if they behaved satisfactorily, they would, when it became possible, be reinstated in their positions on the railway and enjoy again any advantages they had given up.

Pay. The rates of pay were as follows:—

Blacksmiths 7s.	per day.	Plumbers 5s.	per day.
Bricklayers 5s.	„	Tinsmiths 5s.	„
Boilermakers 7s.	„	Painters 5s.	„
Carpenters 5s. to 7s.	„	Pumpers 5s.	„
Coppersmiths 5s.	„	Station Masters ... 10s.	„
Engine Drivers ... 7s.	„	Train Foremen ... 7s.	„
Engine Firemen ... 4s.	„	Shunters 5s.	„
Fitters 5s. to 7s.	„	Shedmen 5s.	„
Gangers 7s.	„	Truck Examiners ... 5s.	„
Guards 5s.	„	Foremen (various) ... 8s. to 10s.	„
Masons 5s.	„	Apprentices & Lads... 3s.	„

The above pay was made up monthly. Men were liable to be fined for misconduct, etc.

It should be pointed out, so that the foregoing rates may not be supposed to be any guide to the wages current for skilled labour in South Africa, that most of those engaged were married men with families to support at the coast and had to obtain some employment; and the promise of being reinstated had a great deal to do with their joining.

A few average rates of pay for skilled workmen in railway employ are appended for information:—

Blacksmiths 10s. to 15s.	per day.	Foremen 5s. to 6s. 6d.	per day.
Boilermakers ... 12s.	„	Fitters 10s. to 13s.	„
Carpenters 10s. to 12s.	„	Gangers 8s to 10s.	„
Coppersmiths ... 12s.	„	Painters 12s.	„
Drivers 8s. to 11s. 6d.	„	Pumpers 9s.	„

with overtime in most cases. Married men usually have houses provided at nominal rent or, in some cases, free.

Work done.

Of the men first engaged, 52 were sent from De Aar to Cookhouse early in November, 1899, to guard the railway line, culverts, etc., in the district. The men were armed and did this work until December 6th, when they were relieved by Volunteers from the Colony. The remainder were ordered to Orange River and worked there under Major Stewart, R.E.

Men worked at their trades as far as possible. Engine drivers and firemen worked on Armoured Trains, patrolling the line, etc.; also on ration trains, etc. Fitters repaired damaged pumps and machinery. Gangers with their natives moved with the troops repairing the line, as possession of it was regained. Carpenters repaired and renewed flooring of Orange River Bridge, making same ready for animal transport. Blacksmiths prepared bridge work for Modder River temporary bridge, making wire cutters, etc.

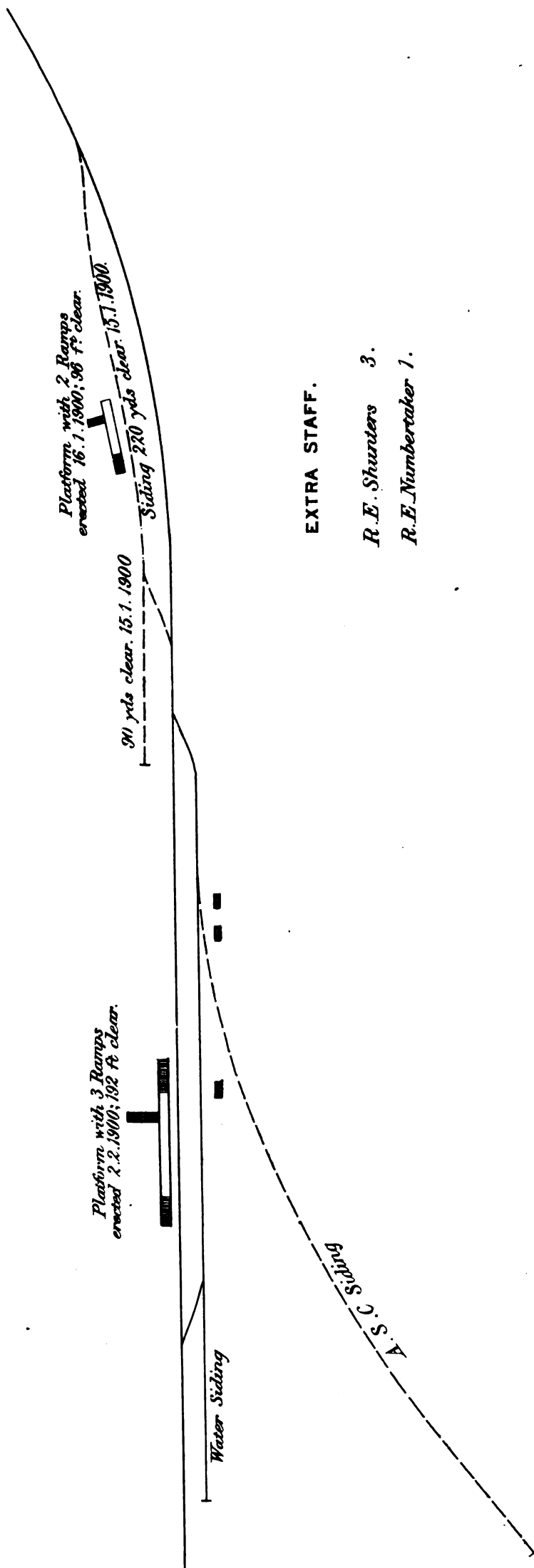
Fatigue parties of all the men also loaded and off-loaded railway material and did similar general work.

Some 30 men of this party proceeded with Major Stewart to Modder River, where:—Carpenters built and erected smith's shop and carpenter's shop, prepared and fitted up coaches for offices and dwellings for officers, made office furniture, etc; and other men did similar work to what they had done at Orange River.

On their return to Naauwpoort the men sent to Cookhouse were attached to the A.D.R. (Midland) with the men who had been engaged there. Meanwhile some of the number served in their own capacity as shunters, guards and enginemen under the military at Naauwpoort and elsewhere. Eight enginemen were sent to work trains to Kimberley immediately on the relief of that place. Fitters repaired pumps and travelling water tanks for supply to Arundel. Carpenters made water tanks with stands, office fittings and furniture, fitted trucks as offices, built a portable office, made derricks, etc. Blacksmiths made wire cutters, iron work for tanks, and other work in hand. Gangers in charge of boys worked on railway repairs, etc.

RENSBURG STATION.

Additions shown thus - - - -



EXTRA STAFF.

R.E. Shunters 3.

R.E. Numbertaker 1.

To face page 35.

Fatigue work was performed by all the men, such as loading and off-loading railway material and bridge work, preparing material for use, and many other similar jobs.

Early in January, 1900, the whole party proceeded to Modder River where they were chiefly engaged with the R.E. on the railway sidings there and on the earthwork, loading of material, etc., for the line to Douglas, afterwards abandoned. They returned to Naauwpoort in the middle of January and resumed work much as before.

At the time of the withdrawal from Rensburg, about February 10th, all men were armed and drilled and formed No. 2 Company of the Town Guard, Naauwpoort outpost; they did duty for several nights, and were occupied erecting wire obstacles and repairing wire fencing, etc., outside the camp.

On 20th February all the men left for Modder River and were joined there by the men under the A.D.R. (Western); and all started to march across country to Bloemfontein. They were turned back at Jacobsdal and returned to Modder River, where work on the ironwork and woodwork of the railway bridge was done. One of their tasks was the preparation of trucks for the reception and retention of the prisoners captured with Gen. Cronjé at Paardeberg.

On 13th March all men left Modder River for Norval's Pont and, crossing the Orange River on 17th March, proceeded to Bloemfontein, where as far as possible they were immediately reinstated at their old posts.

APPENDIX B TO CHAPTER IV.

ENTRAINMENTS AT RENSBURG.

On the 30th January, 1900, Major Twiss, R.E., A.D.R., instructed Lieut. Vickers to proceed to Rensburg from Thebus to assist the R.S.O. there in entraining troops, taking with him 3 men of the Traffic Section.

On 1st February, 1900, Lieut. L. B. Millington arrived at Naauwpoort from Thebus, and his services were placed at the disposal of Capt. W. V. Scudamore, R.E., D.A.D.R., for work as R.S.O.

On 2nd February, 1900, Major Twiss proceeded to Rensburg with Lieut. Pritchard, to superintend the entrainments of troops at that place. Lieut. Vickers was sent back that evening to Naauwpoort to act as second R.S.O. there under Capt. Scudamore.

On 4th February, 1900, 2 R.E. shunters were sent for from Naauwpoort to assist Mr. Carr, the Traffic Manager at Rensburg.

The details of the entrainments are shown on the Tables which follow, and the accompanying rough sketch of Rensburg Station shows the additional accommodation provided.

In addition, the following troops were sent by march route to Naauwpoort to entrain there:—

- 1 Squadron 6th Dragoons.
- 1 Squadron 10th Hussars.
- 1 Field Hospital.
- 1 Bearer Company.
- 1 Ammunition Column.
- Headquarters and 2 Squadrons 6th Dragoon Guards.
- New South Wales Lancers.
- Rimington's Guides.
- S. Transport Company.

Besides departures from Rensburg, the undermentioned trains arrived at Rensburg between the 31st January and 7th February, 1900:—

- J Battery, R.H.A., 2 trains.
- Australian Contingent, 2 trains.
- Detachment of Berkshire Regiment.
- and the ordinary ration trains.

REMARKS :—a Station like Rensburg is not capable of sending away more than four trains in the day, as there is not sufficient accommodation. A shunting engine is a necessity for any punctual working, and this we had not got, at all events continuously. Want of punctuality on the 4th February was due partly to a delay of one hour caused in the middle of the

day by the failure of an engine, but chiefly to the abnormal number of vehicles and mules that had to be loaded; the loading of the last train was carried out in the dark, and was therefore necessarily slow and laborious.

Lieut. Lawrence, South Wales Borderers, the R.S.O. at Rensburg, was indefatigable, and was a most thorough and efficient R.S.O. Mr. Carr, the Military Traffic Manager at Rensburg, was prompt and willing in the performance of his duties, and dealt with the traffic in a most able manner; he was efficiently assisted by the R.E. shunters.

The entrainments would have been completed by Tuesday evening the 6th February but for orders received at mid-day on the 5th to the effect that no more loaded military traffic was to leave Naauwpoort till 12 noon the following day. The operation was therefore delayed 24 hours, and the entrainments were not concluded till the evening of the 7th.

The entrainments could not have been carried out with this despatch had it not been for the additional platform erected on the 2nd; built of sleepers and rails, it was ready for use in a few hours and completed to a length of 192 feet clear during the day.

SPECIMEN OF FORM SENT DAILY TO C.S.O. TO G.O.C.

ARRANGEMENTS FOR ENTRAINING TROOPS AT RENSBURG ON 4TH FEBRUARY, 1900.

First Train.—

Entrainment to begin at 5.0 a.m. Departs 9.0 a.m.
Portion of Field Troop, R.E.

Second Train.—

Entrainment to begin at 8.0 a.m. Departs 11.0 a.m.
Remainder Field Troop, R.E. Supply Officer and his equipment. Portion of "T"
Transport Company, sufficient to load 6 bogies with vehicles and 9 cattle trucks with
animals.

Third Train.—

Entrainment to begin at 11.30 a.m. Departs 2.30 p.m.
Sufficient of "T" Transport Company to load 7 bogies with vehicles and 25 cattle
trucks with animals.

Fourth Train.—

Entrainment to begin at 4.0 p.m. Departs 4.30 p.m.
Sufficient of "T" Transport Company to load 7 bogies with vehicles and 24 cattle
trucks with animals.

Fifth Train.—

Entrainment to begin at 4.0 p.m. Departs at 7.0 p.m.
Bearer Company. Field Hospital. Remainder of "T" Transport Company.
D.A.A.G. and horses of ditto.

REPAIR OF LINES DAMAGED BY THE ENEMY.

ENTRAINMENTS AT RENSBURG, 31. 1. 1900 TO 7. 2. 1900.

Date.	Unit.	Troops Carried.					Composition of Trains.				Time of Departure.		Remarks.
		Officers.	Men.	Horses & Mules.	2-Wheel Vehicles.	4-Wheel Vehicles.	Bogies.	Shorts.	Cattle Trucks.	Coaches.	Advertised.	Actual.	
31. 1. 00	1 Battn. Yorkshire Regiment ...	19	963	44	7	—	14	6	5	—	—	3.0 p.m.	
—	1 " Essex " ...	24	902	51	7	—	2	30	6	1	—	6.20 p.m.	
1. 2. 00	1st Cavalry Brigade, Ammunition Column ...	3	87	209	8	14	6	3	22	1	—	10.30 a.m.	
—	R Battery, R.H.A. ...	6	173	205	1	17	7	17	28	—	—	4.0 p.m.	
—	1/2 Battn. Welsh Regiment ...	16	442	26	7	—	—	24	4	1	—	6.20 p.m.	
2. 2. 00	Household Cavalry ...	7	160	166	1	—	3	4	24	—	—	10.5 a.m.	A new entraining platform constructed by Lieut. Micklem, see sketch.
—	" " ...	6	164	176	2	—	3	—	24	4	—	1.50 p.m.	
—	" " ...	13	180	192	2	—	5	—	30	1	—	5.40 p.m.	On 2. 1900 an Ambulance Train of sick and wounded also left Rensburg.
—	O Battery, R.H.A. ...	4	8	206	—	—	6	—	29	1	—	10.10 a.m.	
3. 2. 00	" and M.I. ...	7	308	2	1	17	7	9	1	—	—	12.30 p.m.	
4. 2. 00	Field Troop, R.E. ...	3	90	196	—	8	6	5	18	—	9. a.m.	9.30 a.m.	
—	" and T Transport Company ...	1	29	132	5	14	12	—	12	1	11 a.m.	12.25 p.m.	
—	T Transport Company ...	2	13	245	1	15	7	—	24	—	2.30 p.m.	4.20 p.m.	
—	" and Bearer Companies ...	—	10	219	2	13	7	1	19	—	4.30 p.m.	8.35 p.m.	
—	Bearer Co. and Field Hospital and part T Transport Co. ...	9	104	6	1	14	8	3	6	1	7.0 p.m.	11.55 p.m.	
5. 2. 00	1st Squadron 10th Hussars ...	11	146	192	1	2	5	4	28	—	9.0 a.m.	10.40 a.m.	
—	1 Company New Zealand Mounted Rifles ...	7	118	128	1	—	2	4	17	—	12 noon	1.20 p.m.	
6. 2. 00	" M.I. ...	6	152	153	2	—	2	5	16	—	2.30 p.m.	2.50 p.m.	Entrainment stopped by wire from Naauwpoort; resulting delay 24 hours.
—	" " ...	6	152	179	1	—	2	4	28	1	12 noon	10.55 a.m.	
—	Headquarter Staff, Cavalry Division ...	16	73	84	1	—	4	—	12	2	5.30 p.m.	5.30 p.m.	
7. 2. 00	1 Company New Zealand Mounted Rifles ...	6	94	116	—	—	—	4	16	2	9.0 a.m.	9.30 a.m.	
—	" M.I. ...	4	126	116	1	—	3	5	18	1	12 noon	12 noon	
—	1 Squadron 6th Dragoon Guards ...	6	162	145	1	—	3	11	27	—	6.0 p.m.	6.0 p.m.	
Totals ...		182	4,656	3,188	53	114							

APPENDIX C TO CHAPTER IV.

REPAIRS TO THE RAILWAY BETWEEN ARUNDEL AND BLOEMFONTEIN.

Personnel.

The personnel of the Works Section, under Lieut. H. A. Micklem, D.S.O., R.E., which conducted the repairs between Arundel and Bloemfontein was as follows :—

Lieut. C. N. North, R.E., with detachment of the 42nd (Fortress) Company, R.E., consisting of 52 non-commissioned officers and men.

Lieut. R. H. Cunningham, R.E., with detachment of the 10th (Railway) Company, R.E., consisting of 52 non-commissioned officers and men.

Permanent Way Inspector Strever with 6 gangs of Natives, about 25 boys in each, each gang being in charge of a civilian conductor.

A certain number of employed men such as storekeepers, cooks, cooksmates, etc., reduced the number available for work slightly below these figures. Further gangs of boys joined during the advance as will be found noted below.

Organisation.

The 10th Company was divided into three sections, the 42nd Company into two. Each of these sections worked independently. Generally speaking, the 10th Company repaired the permanent way and did platelaying work throughout, and the 42nd Company, assisted by the carpenters of the 10th, replaced the bridges. Both Companies however assisted each other at times, according to whatever class of work predominated.

Rations.

Three days reserve of rations for men and boys were carried on the train, and fresh rations were sent out daily from the advanced base. This arrangement did not prove satisfactory, as owing to defective train service the rations rarely arrived at railhead before 3.0 or 4.0 p.m.

Tents.

No tents were carried at first and the men bivouacked alongside the train. Wet weather was met with during the advance and the exposure, combined with very hard work, was the cause of a deal of sickness. Tents were accordingly obtained at Norval's Pont, and were always used afterwards whenever the train halted for any length of time at one place. Apart from the question of comfort, there is no doubt that the small extra space occupied by the tents on the train is repaid many times by the increased health of the men and their consequent greater efficiency on the works.

No night work was done before reaching Norval's Pont as a sufficient number of natives were not available to render it advantageous. Moreover, no difficulty was experienced in keeping pace with the advance without resorting to it.

Composition of Construction Train.

The composition of the Construction Train, which was propelled by the engine when any work was anticipated, was as follows :—

1 d.b. 30' rails	...	...	...	...	...	...	...	2 trucks.
1 d.b. 24' rails	...	...	...	...	...	...	...	2 "
2 d.b. sleepers	...	...	...	...	...	...	...	4 "
1 d.b. timber 12" x 12"	}	...	...	...	...	...	...	2 "
16" x 8"								
18" x 9"								
1 d.b. tools and stores, planks, etc.	...	...	...	...	...	...	...	2 "
1 short (covered) small tools and stores	...	...	...	...	...	...	...	1 "
3 d.b. troops	...	...	...	...	...	...	...	6 "
3 d.b. natives	...	...	...	...	...	...	...	6 "
1 d.b. office and officers	...	...	...	...	...	...	...	2 "
1 brake van	...	...	...	...	...	...	...	1
1 engine								
1 tank truck	...	...	...	...	...	...	...	1 "
1 coal do.	...	...	...	...	...	...	...	1 "

Total 30 trucks.

Note d.b. = double bogie, equivalent to 2 short trucks.

Arrangements were made that further material should be sent up as required from an advanced Store Dépôt, which had been established by Major Twiss at Naauwpoort where labour was left to ensure prompt loading and despatch. Material was always quickly obtainable from there, and greatly facilitated the work and the rapidity with which it was possible to carry it out.

Telegraphs.

A railhead Telegraph Office accompanied the train.

DIARY.

It has been thought best to present the report of work actually done from day to day in the form of a diary from which, for the sake of brevity, details of construction have been eliminated.

27. 2. 00.

Received orders to advance from Arundel station in the evening. Found track damaged in two places, repaired same, and reached Rensburg after dark.

Delayed at Rensburg till afternoon owing to there being no engine available. Line as far as Plewman's siding undamaged. Beyond Plewman's line badly blocked by a train which had run away from Rensburg, separated into two portions, and been derailed badly at this point. 28. 2. 00. Plewman's Siding.

Found one small culvert damaged;

Two culverts, one of 15 feet and one of 10 feet clear span on high bank, completely destroyed;

Extensive damage also done to track, partly by enemy, but chiefly by runaway train derailling on curve.

Re-railed trucks near the line, and cleared broken and badly derailed trucks from the track. Started repairs to culverts and track.

Completed repairs of track and three culverts. Re-railed second portion of runaway train, consisting of about 15 trucks. Found the following further damage between here and Colesberg Junction:— 1. 3. 00.

Culvert destroyed 1 mile from Plewman's.

" " 1½ " " " 30-foot clear span girder bridge damaged near Colesberg reservoir.

25 lengths of track torn up and destroyed. Large number of heavy boulders, 1 to 2 tons in weight, rolled into cuttings. Fishplates removed from track in many places.

10-foot culvert on high bank north of reservoir destroyed.

30-foot clear span bridge, both abutments destroyed and girders in bed of stream, but girders themselves little damaged.

Commenced repairs on above and filled in second of these culverts; heavy rain throughout day and night. Culvert, which had been filled in, washed out again behind by rain during the night.

Made good last-named and completed other repairs, reaching Colesberg Junction at 2.0 p.m. 2. 3. 00. Colesberg Junction Bridge.

Bridge at Colesberg Junction, three clear spans of 50 feet each, 1st pier destroyed, 2nd shaken, ends of girders at 1st pier in bed of stream; a few floorbeams destroyed, girders otherwise intact. Decided to crib girders each side of 1st pier, lift girders, repair flooring, and trust masonry of 2nd pier.

Work on Colesberg Junction bridge. Party repaired branch line into Colesberg, replacing one or two small damages to track. 3. 3. 00.

Completed repairs to bridge and moved on to Joubert siding, and there remained till 4.30 p.m., awaiting permission to advance. Erected platform and detrained Battery. Received orders to proceed, and reached Achtertang bridge at dark. 4. 3. 00. Achtertang Bridge.

One abutment completely shattered, and 15 feet length of girders (which are 55 feet overall) and floor destroyed. Unloaded supply train.

Work at Achtertang bridge all day. Jacked up girders on crib. Bed of stream, steep sloping rock ledge, rendered work more difficult and use of subsidiary crib in foundations necessary. Rode forward and inspected Oorlog's bridge. 5. 3. 00.

Finished Achtertang 1.0 p.m., and moved on. Delayed in Achtertang station and on road beyond, where train failed to climb steep grade. Reached Oorlog's at dark. 6. 3. 00.

Oorlog's Poort bridge, three spans 100 feet and two spans 20 feet, wrecked beyond hope of quick repair. Decided on deviation east of line and close to old bridge. The enemy had attempted to make a deviation at this point, which had not however been successful and had never been used. Cleared damaged girders out of the way and worked on deviation. Two more gangs of boys arrived making eight gangs in all. 7. 3. 00. Oorlog's Poort Bridge.

Oorlog's Poort bridge. 8. 3. 00.

Completed deviation and passed over at 5.30 p.m., and advanced to Van Zyl siding. 9. 3. 00.

Bridge of deviation composed of six spans of varying width, rail level about 15 feet above water, of which 3 feet in stream. All piers of sleeper crib; foundations of cribs over water on stone rubble; track on south side in earth cutting, on north side had to make stone rubble bank across bare rock surface. Maximum grade either side 1 in 38. Trains were able to pass over the deviation with full loads and without banking, rushing the bridge at about 20 to 30 miles an hour.

The Section awaited the advance at Van Zyl siding. Occupied time in making platform, re-railing trucks, etc. Maintenance party worked back to Colesberg Junction. Made siding at Oorlog's. Repaired four places where track had been broken between Van Zyl and Norval's Pont station. 10. 3. 00 to 14. 3. 00.

Received orders to advance to Norval's Pont station after dark. 15. 3. 00.

Norval's Pont bridge (*Plate 8*); three spans of 135 feet down, girders destroyed, and one pier destroyed to base. Impossible to repair quickly, deviation necessary. 16. 3. 00. Norval's Pont Bridge.

Old deviation existed here. River was crossed by a rock bank of 1,100 feet length in which was a bridge of 230 feet overall, comprised of two clear spans of 40 feet, one of 30 feet and eight smaller spans, with a separate span at another channel of 20 feet clear. Bridge

was approached from the main line by a deviation slightly over a mile in length on either bank. The concrete piers of the bridge remained standing, their tops being just above water level; all top structure had been removed and all rock bank completely washed away. The approaches on either side had been much washed away or silted up, in one place 15 feet of cutting being necessary for some distance, and in another as much bank.

The R.P.R. undertook the construction of the approach and bank on north side, the R.E. Section the bridge and south bank.

It had been decided that Bate's girders should be used for the larger spans, and spans had been erected for the purpose; but the current was found to be so swift, and the water level so close to the tops of the piers, that these were discarded and timber used in their place, the 40-foot spans being bridged by eight baulks of 18 inches square section; this timber did not arrive however till the 23rd.

The best way to have bridged these spans would no doubt have been with trussed beams, and it was understood that these were being prepared in Cape Town. This was not done however; and the iron for trussing the beams not being available on the spot, the above arrangement was followed to save time.

22. 3. 00. The approaches and bank on the south side were completed, and the track laid, lifted and packed, and fit for permanent traffic by this date.

23. 3. 00. Launching commenced on the arrival of the baulks on the 23rd; and, although interrupted by the treacherous state of the river, which rose over the tops of the piers and caused a cessation of work for nearly 48 hours, the bridge was complete, all but the last span of 40 feet, by midday of the 27th when news was received from Aliwal North of a 5-foot flood.

27. 3. 00. The north bank still required a good deal of work, and a battalion of Infantry was obtained to assist the R.P.R. in completing it sufficiently to get a track laid on it over which trucks might be passed. The last span of the bridge was finished off temporarily to serve the same purpose. At night 160 trucks were propelled over by engines; but the track on the north side did not admit of an engine coming down to the bridge, and a block was consequently established.

28. 3. 00. Took over completion of north side from R.P.R. Took up and re-laid portions of deviation on north side over which engines could not pass, and completed bridge so as to take all classes of engines; also started lifting, packing and boxing in the track on north side, which as yet had only been linked in.

29. 3. 00. Shunting engine on north side by evening cleared block of trucks from faulty bank, which owing to water it had been impossible to reach with a view to improving; this enabled work to be resumed on bank, which was raised and widened, the track being lifted and packed and trains of stone and ballast being run on it.

30. 3. 00. This allowed deviation to be opened for through traffic on the afternoon of 30th, much work still remaining on north side to render it fit for permanent traffic.

31. 3. 00. Continued widening and ballasting bank, also lifting and packing track on north side.

The 20th Company, R.E., assisted in the construction of the bridge. The time taken in getting a road through from the south to the north bank was twelve days, which appears long but was regulated entirely by the labour available. Very heavy work was foreseen here and extra labour had been requisitioned some time in advance, but unfortunately none was available.

The bridge was securely lashed with wire cables to holdfasts established up stream; at a later date it withstood a flood reaching to rail level and passing over the bank, without appreciable damage to either bridge or bank or any serious interruption of traffic. The deflection produced on the 40-foot spans by a 6th class engine passing over was $1\frac{1}{2}$ inches.

1. 4. 00 to 7. 4. 00. Laid down reversing station on north bank, to be used as approach to low level bridge, thereby obviating the use of a very sharp curve and gradient; also a loop on the north side, comprising about 1 mile of track and five sets of points. Also altered site of points where deviation joins main line, to avoid sharp twist in deviation. Placed whole of deviation in thorough order.

8. 4. 00 to 2. 5. 00. Construction train left for Bloemfontein on the evening of the 7th, arriving next day.
Bloemfontein.

The Section was employed during the halt, pending the main advance being resumed, in the construction of sidings at Springfontein and Bloemfontein and erection of platforms, sheds, etc. All Kaffirs, previously accompanying Construction Train, were discharged here,

All the repairs were so effected as not to interfere with repairs of a permanent nature, and to allow of traffic being carried on without interruption whilst the latter were in hand.

All tools and stores on the Construction Train were taken on charge at Bloemfontein by the Maintenance Department of the newly formed I.M.R.

The following is a brief summary of repairs effected:—

Norval's Pont, deviation	...	...	...	...	...	...	...	...	1
Oorlog's Poort	..	...	...	...	...	...	...	...	1
Other Bridges	...	...	...	...	...	...	...	...	4
Culverts	...	...	...	...	...	...	...	...	6
Damaged places on track	...	...	...	...	...	...	...	...	12
Trains re-railed	...	...	...	...	...	...	...	...	1

CHAPTER V.

SUPPLY OF STORES TO RECONSTRUCTION PARTIES.

On receiving orders from the D.A.G., R.E., to report to Major E. P. C. Girouard, R.E., D.R., on 29th September, 1899, Lieut. and Qr.-Mr. G. Tucker, R.E., was informed that he had been selected to organise the Railway Stores Department; and he left with the Director for the seat of war. The general lines of procedure were arranged on the voyage, and on arrival at Cape Town the D.R. and the General Manager, C.G.R., discussed and formulated the following principles of purchase, delivery and accounts of stores as between the Military and Civil Administrations:—

Agreement regarding Stores between the Imperial Government and the C.G.R.

1. The Imperial Military Authorities agreed to hand over to the C.G.R. all stores and materials they had ordered in England and elsewhere on this account to date, on the arrival of such stores and materials in South Africa.
2. The C.G.R. Stores Department were to obtain for the Imperial Military Authorities all stores and material required in connection with the above works, and all such articles were to be supplied at cost price plus railway freight and percentage for manipulation.
3. On completion of the works, the Imperial Military Authorities agreed to take over at cost price all stores and materials, specially purchased on their account, which might be on hand and were not required by the C.G.R.
4. Requisitions were to be made out in triplicate by officers in need of stores. One copy was to be retained, and two copies were to be sent to the D.R., who would retain one and signify his approval on the other, passing it on to the Chief Railway Storekeeper for supply. Full details of every article ordered were to be given, so that what was actually required might be supplied. In case of special articles, sketches or drawings were to be sent. Each requisition was to be numbered, dated and signed, and the title and address of the officer to whom the articles were to be sent were to be distinctly stated.
5. The C.G.R. Stores Department were to supply the stores and materials ordered at the earliest practicable date. Advice of the articles despatched to each officer were to be sent as follows:—One copy to the Staff Quartermaster direct, three copies to the requisitioning officer; of these latter, one copy was to be retained by the indenting officer, and, on receiving the articles advised, he was to sign and return the other two copies, one to the D.R. and the other to the Railway Storekeeper who despatched the articles.
6. The Chief Railway Storekeeper was also to send to the D.R. a priced Invoice of all the articles supplied to the various officers as per paragraph 5, quoting against each article the number and date of the original requisition.
7. As soon as practicable after the close of each month the Chief Railway Storekeeper was to furnish the D.R. with a summary, showing the numbers, dates and amounts of the various Invoices for stores supplied during the previous month, together with the total sum claimed by the Stores Department of the Cape Railways.
8. Lastly an account for the railway carriage of stores and materials so supplied was to be rendered monthly by the Traffic Department of the Civil Administration.

In this way the Military Administration obtained technical railway stores in the cheapest market, besides the advantages of warehouses, sound packing by experienced men, and the services of the manufacturing departments of the existing railways in Cape Colony.

As regards the internal economy of Military Railway Stores it was arranged that the Staff Quartermaster (Stores) should keep a complete ledger of stores received from the Civil Administration, reporting to the D.R. himself, whilst he would pass on to the Staff Accountant after check all debits for stores raised by the Administration. He would further pass Bills of Lading, and all other information regarding stores ordered in England, to the Chief Railway Storekeeper.

Method of Dealing with Military Railway Stores.

The Staff Quartermaster was also directed to hold the technical stores belonging to the R.E. Railway Companies, O.C.s dealing direct with him.

The Staff Accountant was held responsible for the correct up-keep of a complete account of stores, the expenditure being classified under proper heads.

A.D.R.s were responsible that all vouchers for stores issued to them were duly posted for future reference, together with information showing how the stores had been expended.

To ensure prompt and satisfactory supply of stores to officers and others entitled to demand them, the system referred to in paragraphs 4 and 5 above was explained in greater detail, and was intended to apply to stores to be provided by the Chief Storekeeper, Cape Town.

To obtain articles urgently required and known to be in a railway store or station near at hand, officers were authorised to indent direct on the person in charge, one copy of the requisition being also sent to the D.R. The advice notes referring to the issue of such stores emanated, as in paragraph 5, from the Chief Storekeeper.

The issue of stores from Advanced Bases was authorised on receipt of the proper requisition forms; these were authority for the person in charge of the store to strike such articles off his charge and were filed for reference.

The principle underlying the instructions referred to above was simplicity of procedure combined with prompt delivery of articles demanded, whilst the articles were to be properly accounted for and charged to works.

Settlement of
Accounts with C.G.R.

Debits raised by the Civil Administration for stores supplied in any month were accepted promptly, to allow the accounts of that particular month to be dealt with. If any charges were disputed and found to be in error, the necessary adjustments were made in the accounts of a succeeding month.

Lieut. Tucker had under him seven clerks, of whom three were civilians; and this staff enabled him to keep the Field Railway Sections well supplied in accordance with their demands.

Stores and Tools
ordered in England
by the D.R. before
Embarkation.

It is of interest to note what stores were ordered by the D.R. before he left England in anticipation of his wants in the field. The chief articles were:—

(a). STORES.

Baulks, 14" x 14" and 12" x 12", and timber of sizes from 16" x 8" to 9" x 7"	152,000 cubic feet.
Bolts, $\frac{3}{4}$ ", of lengths	4,400
Bolt heads and ends with washers	5,800
Spikes, timber, $\frac{3}{8}$ ", 7" to 10" long	12,000
Piping, iron galvanized, 2", 3" and 4" diameter	29,000 running feet.
Collars, flanges, bends, sockets, elbows, tubes, connecting cocks, plugs, valves and bibcocks for pipes as above	20 to 250 of each.
Stocks, taps and dies, pipe tongs, spanners and vices for pipes as above	4 to 24 of each.

(b). TOOLS.

A large number of tools of various kinds was ordered, of which the following were some of the principal:—

Axes, pick, 5-lb.	200
Helves for do.	500
Shovels, universal, helved	100
Spades	200
Bars; boring, jumping and tamping, $1\frac{1}{2}$ " and $1\frac{1}{4}$ "	300
Dogs, sawyers, straight and crossended	5,000
Saws, cross cut, blade 5 ft.	50
Wire, steel telegraph, $7\frac{1}{2}$ B.W.G... ..	20 tons.
Iron wrought, bars, round and square of sizes	33 tons.
Screws, iron flatheaded, 5" to 2"	225 gross.
Blocks, wood, with sheaves for rope, 5", $4\frac{1}{2}$ " and 3", single, double, treble and snatch	165
Rope, manilla, 5" to $1\frac{1}{2}$ "	5,000 fathoms.
Jacks, screw, traversing, 6 to 20 tons	30
Winches, crab, double purchase, to lift from 25 to 60 cwt.	10
Pile drivers, steam, 30 cwt. with boiler complete	2
Pile drivers, hand, 15 cwt.... ..	4
Forges of sorts	12
Well boring tools complete, to bore 50 ft.	2 sets.

Rope, wire, Bullivant's, 4½" to 1½"	11,000 running feet.
Clamps, shackles, thimbles, turnbuckles, nippers and chain slings for above wire rope	2 to 12 of each.
Well's lights, with 3 extra burners	10
Cable, interruption, 4-core... ..	2 miles.
Pumps, hand and steam	42
Tanks, water, 1,500 gals.	60
Bridges, 50-ft. span... ..	10
„ 30-ft. „	30

The unsuitability of some of the vessels chartered to carry particular kinds of stores (*e.g.*, timber), and the congestion at the wharves at ports of arrival, caused considerable delay and confusion, which, under the circumstances, was unavoidable; but through the exertions of the Chief Storekeeper and his staff, articles ordered from England were gradually transferred from the miscellaneous heaps on the wharves to the railway stores, and eventually it was found that losses had been very inconsiderable.

Arrival of Stores in South Africa.

In anticipation of a shortage of coal, 58,000 tons were bought in England and transferred to the C.G.R. on arrival; and all requisitions, whether from the Military Railways or from the Directors of Supply and Steam Transport, passed through the hands of the Staff Quartermaster (Stores) and were complied with by the Civil Administration. In due course debits were raised against other Departments of the Army by the D.R., after he had settled with the Civil Administration.

Coal Supply for Army.

The system already outlined at the beginning of this chapter was found to work well and smoothly; and, where local purchases were necessary, these were made in the cheapest market by officers with good local knowledge. When the R.P.R. was raised it was equipped through the Railway Stores Department, and the officers of the regiment supplied much valuable information regarding the nature of stocks held by local merchants. It was therefore possible, from the information then at hand, to prepare and keep up to date lists of stores and tools either in the Colony or on order from England; and in this way indenting officers could see at a glance what they should enter in their requisitions.

The paucity of goods wagons told heavily against rapid delivery of stores when required at the front; and when the advance from Orange River began, arrangements were made to form Advanced Store Depôts for the Western and Midland F.R.S.s.

Advanced Depôts for Field Sections.

The first of these was established at Modder River in January, 1900, under the charge of Q.M.S. Murray, R.E., and one-third of the general stores from Cape Town were sent to him. As time and opportunity offered, stores sidings were laid down and the available shelter was improved; and eventually a very satisfactory depôt was established.

(a). Western.

For the Midland F.R.S. a depôt was opened at Naauwpoort in March, 1900; and to this place were despatched the remainder of the stores ordered from England, as well as timber and permanent way material. Here also sheds and necessary sidings and buildings gradually found place, and the permanent European staff of six men was assisted by Cape "boys" whose number varied from thirty upwards.

(b). Midland.

Detailed instructions were drawn out for the guidance of the Storekeepers and their staffs, which need not be referred to further as they were based on the principles already given at some length.

The advent of these Advanced Depôts implied some change in procedure by A.D.R.s in charge of F.R.S.s when requisitioning for stores, but the changes need not be specified here.

The R.P.R. arrived at Naauwpoort when the Advanced Depôt was opened, and their services were utilised in unloading material. It was not possible to store everything immediately, and certain parts of Bate's girders (links, etc.,) found their way to the ground where the aerial tram was being erected, and that without proper requisition. The Stores Staff did their best both to expedite work and to keep pace with the stores as they arrived from the south, and on the whole they succeeded in both objects.

The zeal which animated all ranks led to some little confusion at times; *e.g.*, when the advance from Colesburg began various Staff Officers wired independently to Cape Town for materials for Oorlog's Poort, Norval's Pont and Bethulie bridges, entailing unnecessary labour at Cape Town, for the stores when they arrived were not required and had occupied valuable truck space for some days previous.

The British force in the Midland district crossed the Orange River at Norval's Pont on the 13th March, 1900; from that date onwards all issues made from the Naauwpoort Depôt were debited to the I.M.R. The occupation of Bloemfontein threw open the

Transfers from Advanced Depôts to I.M.R.

railway stores at that place, relieving to a corresponding extent the strain on Naauwpoort; and the more useful articles at the Advanced Depôt were gradually transferred to Bloemfontein.

Advanced Store
Depôts closed.

The completion of the line to Mafeking had terminated the present necessity for an Advance Depôt at Modder River, and accordingly instructions were received to close both this depôt and that at Naauwpoort.

Storekeepers were informed that they should take on to their Ledgers all surplus material returned to them by F.R.S.s and then balance the Ledgers, forwarding them with all vouchers to the Staff Quartermaster (Stores). As the whole of the stores in the Depôts were to go to Bloemfontein, they were instructed to pack small stores in cases, with lists of contents inside, and advice notes (in duplicate) were to accompany all despatches. One copy signed by the consignee was to be returned to the depôt and forwarded to the Staff Quartermaster. Technical stores were in all cases to be kept separate from others, but were to be accounted for in the same way. Consignments were in every case to be clearly labelled, showing depôt or origin and nature of stores, *i.e.*, RETURNED STORES OR TECHNICAL STORES.

These instructions were carried out; and, the Ledgers having been closed, a Board of Officers was assembled to deal with stores lost *en route* or on works. The documents and books were thus prepared for audit, and Lieut. Tucker was employed in completing accounts and in forwarding stores for the I.M.R.

Organisation for
Future Campaigns.

The experience gained was most valuable, and the following points stand out as worthy of consideration:—

1. The necessity, when organising a system, for exercising a wise discrimination between the indenting officer (who cares for nothing but to push on work by every means in his power) and the accountant (who wishes to produce perfect ledgers in which it is possible to trace each transaction from start to finish). To insist on multifarious receipts and requisitions for a packet of screws manifestly hampers work; but, on the other hand, to hold that because an article is drawn from store there is no further reason to account for it is equally absurd.

The system should be so organised as to obviate any chance of a repetition of orders or of lack of full information regarding stores in stock.

2. Each F.R.S. should therefore have a recognised Stores Staff consisting of:—

- 1 Q.M.S. (Stores).
- 1 Clerk.
- 1 Yardman.
- 1 Checker.

The Q.M.S. (Stores) should have absolute control over his stores under his F.R.S. Commandant. It would be his duty to post issues and receipts, to keep a rough stock book, and to deal with all orders or telegrams for stores from the Base. In this way repetitions of orders would be avoided, whilst the Q.M.S., occupied with stores duties only, would have all information regarding articles required and their whereabouts. In issuing he would see that proper entries were made, and in the case of petty stores would issue to any man applying, merely ascertaining the name of the officer sending him. At the end of the day a combined list of issues made on such orders would be sent to each officer to sign.

The object of thus keeping a record of issues, great and small, is threefold; firstly, it prevents waste and carelessness regarding tools which might, on an emergency, prove of great value; secondly, it allows of proper allocations, so that the cost of the stores or tools used on any work can be accurately determined; and thirdly, it ensures smartness on the part of the Storekeeper, who will be obliged to keep all classes of stores in order and to work by method.

In Appendix A is shown a sample of Ledger which might be used by the Storekeeper of an Advanced Depôt such as has been sketched out.

Appendix B shows the quantity, weight or number of the principal stores and tools issued in South Africa to F.R.S.s, Advanced Depôts and the R.P.R. As it may be assumed that the whole of these were used on works, the figures form a useful index of the scale of requirements of a large force making war with long lines of railway communications.

Detail of Principal
Stores and Tools
expended in South
Africa.

APPENDIX A TO CHAPTER V.
SAMPLE LEDGER FOR STOREKEEPER OF AN ADVANCED DEPOT.

Article _____

RECEIPTS.				ISSUES.					State of Stock.	Remarks.	
Date.	No. on Advice Letter.	From whom Received.	Quantity.	No. under which A.L. filed.	To whom Issued.	No. of Advice Letter.	Quantity Issued.	Quantity received by Consignee.			Place Consigned to.

APPENDIX B TO CHAPTER V.

LIST OF PRINCIPAL STORES AND TOOLS ISSUED TO:—

Railway Pioneer Regiment.
Advanced Store Depôt (Midland)
Field Railway Section (Midland).
Advanced Store Depôt (Western).
Field Railway Section (Western).

(a). STORES.	(b). TOOLS.
Asbestos	Axes, felling and hand
Bolts and nuts	Augers, screw
Bolts, fish	Braces, ratchet
Blowcocks... ..	Bars, boring, etc.
Bridge work	Beaters, platelayers
Cement	Bits for ratchet brace
Crossings and points	Braces, carpenter's
Coal	Bits for do.
Cocks	Blocks, various
Candles	Buckets, various... ..
Copper	Bullivant's gear complete
Carbide of Calcium	Belting
Dogs, sawyers	Cans, oil
Detonators	Crowbars... ..
Dynamite	Chisels
Ends, bolt	Drills for ratchet, cramps,
Flanges, pipe	braces... ..
Ferrules, tube	Emery cloth
Fuse	Files, various
Grease	Forges
Glasses, gauge	Hammers, various
Heads, bolt	Handles, various
Iron, corrugated galvanized	Hose
Iron, bar, peak, etc.	Jacks, screw, etc.
Links, coupling... ..	Lamps, various
Lead, red, white and black	Levels
Lead	Lines, various
Matches	„ log
Nails	Mallets, carpenter's, etc.
Nipples	Needles, sailmaker's, etc.
Nuts	Pile drivers, hand and steam
Oil	Picks
Piping	Pencils, carpenter's
Pipes, earthenware, etc.	Pumps and boilers complete
Pins, coupling, etc.	Pumps
Plates, fish	Phonophores
Pitch	Rules, carpenter's, etc.
Rope	Ramps, rail
Rails	Shovels
Rivets	Saws, various
Stays and washers	Spanners... ..
Steel	Stones, oil and grind
Screws	Set Saws, cold, etc.
Spikes, dog	Stocks and dies
Sleepers	Tapes, measuring
Sal Ammoniac	Tarpaulins
Tubing	Trolleys
Tees	Tongs
Tallow	Tools, chests of, etc.
Tin	Wheelbarrows
Timber	Winches
„	Wedges, hardwood and iron
Valves	Wrenches
Vices	
Waste	
Washers of sorts... ..	
Zinc	

PART II.
NATAL GOVERNMENT RAILWAYS.

CHAPTER I.

GENERAL DESCRIPTION.

The following table of the mileage of the various important centres of operations from the Point, Durban, together with the respective dates railway communication was interrupted and restored and the total height through which men and stores had to be lifted, gives a good idea of the length and nature of the L. of C. in Natal during the various phases of the campaign :—

	Mileage.	Communication Interrupted.	Communication Restored.	Altitude in feet.	Total Height in feet.
Durban Point to Maritzburg	70½	—	—	2,218	3,750
„ „ Estcourt	146½	21. 11. 99	26. 11. 99	3,833	7,550
„ „ Frere	161	15. 11. 99	28. 11. 99	3,436	7,750
„ „ Colenso	173½	2. 11. 99	20. 2. 00	3,156	7,950
„ „ Ladysmith	189½	2. 11. 99	19. 3. 00	3,285	8,400
„ „ Elandslaagte	205½	24. 10. 99	19. 3. 00	3,613	9,000
„ „ Dundee	237	19. 10. 99	24. 5. 00	4,100	10,150
„ „ Newcastle	268½	12. 10. 99	28. 5. 00	3,892	10,850
„ „ Mount Prospect	296	12. 10. 99	14. 6. 00	4,984	12,150
„ „ Frontier	307	12. 10. 99	18. 6. 00	5,385	12,600
„ „ Harrismith <i>vid</i> Ladysmith ...	250	11. 10. 99	9. 8. 00	5,300	11,050
„ „ Greytown <i>vid</i> Maritzburg ...	135½	—	—	—	—
„ „ Tugela (North Coast Line)...	69½	—	—	—	—

The gauge is 3 feet 6 inches, the usual gauge of South African railways; and from the nature of the country passed through gradients and curves abound. Full information regarding the line will be found on the sectional diagram on *Plate 9*, and it will there be seen that the ruling gradient south of Ladysmith is 1 in 30 and north of it 1 in 50, whilst the maximum curve is 300 feet radius. The diagram also shows to what extent gradient and curvature are combined on the various sections.

There are three types of steel rail in use, viz. :— 78-lb. flat footed, on cast-iron chairs (used throughout the main line), 61-lb. flat footed (used for all new branches and extensions) and 45-lb. flat footed (in sidings and branches). The 45-lb. light rail is gradually being replaced by the 61-lb.

Both of the lighter types rest on bearing plates of steel, which are fastened to wood sleepers by three spikes. To prevent “creep” on lengths laid with the medium section the foot of the rail is held down by coach screws passing through the outer flange and bearing plate, the three sleepers on each side of a joint being treated thus; with the heavy section no special precautions are required.

Sleepers are 7'.3" × 10" × 4½", and until 1897 were universally of fir, creosoted. Their average life, when fully impregnated, was fifteen years, but otherwise only five or six years. Karriwood is now being used, as it is harder and cheaper; but it is not quite clear yet whether it will withstand the ravages of white ants.

Guard rails are used on all curves of 450 feet radius or under. For this purpose 45-lb. rails are fastened to chairs of special pattern, so that the top table of running and check rails are at the same level. For the heaviest rail angle fish-plates are used, and for the two lighter sections flat plates, all with four bolts per joint,

Crossings have a lead of 1 in 8, and any variations from this are gradually being eliminated.

Locomotives.

Plate 10 shows details of 8-wheeled and 10-wheeled engines. In the 8-wheeled type the leading drivers, and in the 10-wheeled both leading and trailing drivers, are flangeless, thereby reducing the rigid wheel base to 7 feet 4 inches and 8 feet 4 inches respectively. The loads, taken on grades of 1 in 30, are 137 and 205 tons respectively, at a speed of 8 miles per hour. In addition there is a light type of engine, 6-wheel coupled, weighing 29 tons and hauling 93 tons on the ruling gradient; it carries 35 cwt. of coal and 700 gallons of water; this engine consumes on an average 60 lbs. coal and 50 gallons of water per train mile.

Rolling Stock.

The bulk of goods wagons are either high or low-sided; details and dimensions are shown on *Plate 10*. These are 8-wheeled, but there are also 6 and 4-wheeled wagons of this class. In addition there are a few cattle trucks; also cold storage wagons for meat, and other miscellaneous types.

Passenger carriages are either 8 or 6-wheeled, with a few 4-wheelers.

The low-sided wagons were most suitable for loading guns and wagons, as their sides let down. The central door of high-sided wagons, on the other hand, caused difficulty and delay; and they would have been far more useful had both ends and sides let down, as loading could then have been carried on rapidly and without overcrowding.

Train Loads.

Owing to variations in gradients, train loads are altered thirteen times during the journey from Durban to the border, and these are detailed in the Appendix to this Chapter. No banking engines are employed, but spare engines at Estcourt, Maritzburg and Inchanga dealt with half the load of a down goods train, hauling it to Highlands, Fox Hill and Botha's Hill respectively.

Speed.

The maximum speed permitted for mail trains is 30 miles, and for goods, 18 miles, per hour; but in practice little more than half these speeds are attained, including stoppages on the road.

Rolling Stock and Locomotives available in October, 1899.

The following were available at the outbreak of hostilities:—

Engines, 106, of which 64 were 8-wheeled coupled.
Goods Wagons, 1,615.
Passenger Cars, 272.

Additions during the War.

During the war 21 locomotives, 270 goods wagons and brake vans and 36 carriages were added; at the relief of Ladysmith 18 engines, 145 goods wagons and 7 passenger cars were released; and later 200 trucks were found at Dundee.

Bridge Guards and Line Patrols.

As a precautionary measure, steps were taken to establish bridge guards and to institute night patrols in October, 1899.

A certain number of civilians were sworn in as special constables and were posted in pairs at twenty of the most important bridges between Durban and Estcourt. Pay at 7s. per day, arms, fuel, rations, uniform and tents were provided; and it was their duty to keep a watch on the railway within their beats, reporting suspicious characters or circumstances to the nearest Police post or patrol. They were supervised by four Inspectors. As the campaign progressed the guards moved forward, and the number of bridges thus specially guarded was gradually reduced to eight.

In addition to these men, twelve Europeans and thirty Indians were enrolled and employed as night Patrols. The Europeans only were armed and they carried carbines.

From October, 1899, till March, 1900, the length Gillitts-Inchanga was nightly patrolled by an engine, as it was feared that damage might be done to the heavy cuttings in this length.

APPENDIX TO CHAPTER I.

LOADS TABLE.

GOODS TRAINS—DUBS ENGINES.

Empties, 8-Wheelers.		Between.	Loaded Vehicles.	
Up.	Down.		Up.	Down.
MAIN LINE.				
20	20	Durban—South Coast Junction... ..	13-8	13-8
9	20	South Coast Junction—Malvern	4-8	11-8
9	20	Malvern—Pinetown	4-8	10-8
9	20	Pinetown—Gillitts	4-8	10-8
9	14	Gillitts—Botha's Hill	4-8	6-8 1-6
11	9	Botha's Hill—Inchanga	4-8 1-6	4-8
11	17	Inchanga—Cato Ridge	4-8 1-6	7-8
20	20	Cato Ridge—Camperdown	10-8	10-8
20	20	Camperdown—Umlaas Road	8-8	9-8
14	20	Umlaas Road—Manderston	6-8 1-6	10-8
20	20	Manderston—Thorneville Junction	10-8	8-8 1-6
20	14	Thorneville Junction—Fox Hill	10-8	6-8
20	11	Fox Hill—Umsindusi	10-8	4-8 1-6
14	11	Umsindusi—Maritzburg	6-8 1-6	4-8 1-6
9	20	Maritzburg—Hilton Road	4-8	8-8 1-6
14	13	Hilton Road—Howick	6-8	5-8
11	13	Howick—Dargle Road	4-8 1-6	5-8
11	18	Dargle Road—Lidgetton	4-8 1-6	7-8 1-6
11	20	Lidgetton—Balgowan	4-8 1-6	10-8
11	20	Balgowan—Nottingham Road	4-8 1-6	13-8
20	20	Nottingham Road—Thompson's Siding	13-8	7-8 1-6
20	17	Thompson's Siding—Mooi River	10-8	7-8
12	20	Mooi River—Highlands	5-8	12-8
12	10	Highlands—Willow Grange	5-8	4-8
12	10	Willow Grange—Estcourt	5-8	4-8
12	20	Estcourt—Ennersdale	5-8	1-6 8-8
20	14	Ennersdale—Frere	12-8	6-8 1-6
13	17	Frere—Chieveley	5-8 1-6	7-8
20	14	Chieveley—Colenso	12-8 6-8	1-6
12	20	Colenso—Pieters	5-8	8-8
20	17	Pieters—Ladysmith	12-8	7-8
20	20	Ladysmith—Elandsplaagte	10-8	13-8
20	20	Elandsplaagte—Wessels Nek	10-8	13-8
20	20	Wessels Nek—Waschbank	12-8	12-8
20	20	Waschbank—221½ miles	12-8	13-8
19	20	221½ miles—Glencoe Junction	8-8	13-8
20	20	Glencoe Junction—Hatting Spruit	12-8	13-8
20	20	Hatting Spruit—Dannhauser	12-8	13-8
20	20	Dannhauser—Ingagane	12-8	11-8
20	20	Ingagane—Newcastle Colliery Siding	12-8	13-8
20	20	Newcastle Colliery Siding—Newcastle	13-8	12-8
20	20	Newcastle—Ingogo	12-8	12-8
19	20	Ingogo—Charlestown	8-8	12-8
ORANGE FREE STATE BRANCH.				
14	20	Ladysmith—Besters	6-8	10-8
14	20	Besters—Brakwal	6-8	10-8
9	14	Brakwal—Van Reenen	3-8 1-6	6-8
20	20	Van Reenen—Harrismith	13-8	13-8
DUNDEE BRANCH.				
20	20	Glencoe Junction—Coalfields	10-8	8-8

NOTE.—10-8 means ten 8-wheeled trucks,
1-6 means one 6-wheeled truck.

CHAPTER II.

TRAFFIC WORKING.

Traffic Control.

The General Traffic Manager at Durban has under him District Traffic Supts. at Maritzburg, Ladysmith and Newcastle; but the daily distribution of rolling stock is regulated by the General Manager in direct communication with the station masters at Harrismith, Charlestown, Newcastle, Ladysmith, Maritzburg, Durban and Point, respectively.

During the war an Inspector was appointed at railhead to control traffic; but, owing to the exigencies of the case, he was obliged at times to act contrary to instructions sent him from Durban.

Mode of Working.

Trains are worked on the "Train Staff and Ticket" system, except between Durban and Maritzburg and between Newcastle and Charlestown, where the "Electric Train Staff" has been introduced.

A variation, viz., the "Permissive Staff and Tablets," was also working on long sections without crossing stations. Under this system the tablets were all contained in a locked box, the key to which was in one end of the staff; this latter was kept in a column, but when taken out could unlock the tablet box. The last train of a group going in one direction carried the staff, and until this was received at the other end no trains were allowed to enter the section in the opposite direction.

Under the stress of service conditions, the "Train Staff and Ticket" system was found unsuitable; and it became necessary, at times, to suspend staff working, lock up the staff and run contrary to it.

At the beginning of 1900 the A.D.R. tried to persuade the Civil Administration to introduce working on "Line Clear," but without avail, as it was considered that the existing system had been tried and had answered under all possible conditions. That the system used is safe there is no doubt, but it is by no means flexible; when traffic is being dealt with in war time, the system leads to unnecessary delay which may cause needless suffering to sick and wounded men, whilst senior officers or reinforcements whose presence at the front is important are delayed *en route*. These are not imaginary cases, but are taken from actual incidents that occurred during the war.

The "Electric Train Staff," if employed as a "Permissive Staff," is fairly elastic; but in a country where the railway has been lately in an enemy's hands the instruments will probably have been removed and are not easily replaced. Moreover this system requires at least one, and if possible two separate, wires for itself, and the instruments at stations cannot, like the Morse, be used for ordinary messages.

For these reasons, the "Line Clear" system is better adapted for use on a railway in war; and when it is remembered that the exigencies of Military service often allowed the railway the use of only one telegraph wire, the disadvantages of the Electric Staff system are more clearly brought out.

Composition of Troop Trains.

The following is a list of the composition of the normal trains used for the conveyance of troops, together with the average time taken to load up at the Point, Durban:—

Cavalry—One Squadron. Average strength:—7 officers, 158 men, 190 horses.

3 trains, totalling 3 seated trucks, 10 horse trucks, 2 baggage trucks, and 3 composite vans (consisting of one 1st class composite and brake van).

Infantry—One Regiment. Average strength:—24 officers, 2 warrant officers, 7 horses and 900 men.

3 trains, totalling 15 seated trucks, 3 composite carriages (three 1st and two 2nd class), 2 brake vans and 1 cattle brake van.

The first train started 2 hours after a ship was berthed and the third about 3¼ hours.

Artillery—One Battery R.F.A. Average strength:—5 officers, 170 men, 155 horses, 6 guns and 14 carriages.

3 trains, totalling 9 horse trucks, 3 seated trucks, 5 low-sided trucks and 3 composite vans.

The first train started 4 hours after a transport was berthed, and the third within about 7 hours.

Medical—One Indian Field Hospital. Average strength :—16 British non-commissioned officers, 190 natives and 7 horses.

One train, consisting of 3 seated trucks, 2 baggage trucks, 1 cattle brake van, 1 composite carriage (three 1st and two 2nd class).

Train left about 2½ hours after arrival of the vessel.

The fitted trucks average 36 feet long by 7 feet 3 inches wide, interior measurements. Each seated truck held 60 men, 12 seats and 5 men per seat, and the men's kit bags were placed under the seats.

Each truck fitted for horses held from 17 to 19 horses, according to size, or about 22 mules.

It was found from experience that horses travelled best in these trucks when tied up fairly tightly by the head to the bars (about 18 inches of rope play was best) and when as many horses were jammed into a truck as could be got in.

Until the end of November, 1899, indents for transport by rail which required special arrangements were made on the R.T.O., Durban. This officer consulted the Assistant Traffic Manager and communicated by telegram with all concerned. A troop time table, arranged to suit the existing traffic arrangements, was made out, and special troop trains all worked on this table. Indenting for Transport.

From December, 1899, onwards (Major G. S. McD. Elliot, R.E., having arrived in Natal as A.D.R.) the post of R.T.O. was abolished; and moves were concerted between the D.A.A.G. (B.) at Maritzburg and the R.S.O. at Durban. The system was not a good one, and would not have been adhered to if there had been more R.E. officers in South Africa with previous railway experience.

To provide for the wants of troops travelling by rail the Director of Supplies entered into agreements with the refreshment room contractors to supply meals at a fixed rate per head at places where there were refreshment rooms. In other cases, *e.g.*, Mooi River, a small party of men under a non-commissioned officer made the necessary arrangements. A small Staff with buckets and other appliances was stationed at places where troops stopped for a meal, and thus horses were also fed and watered. Feeding Arrangements for Men and Animals en route.

The rates charged by the N.G.R. to the Imperial Government were as follows ;— Rates charged for Military Traffic.

Passengers.—1st Class	...	...	...	...	...	2d. per mile.
2nd Class	...	...	...	...	...	1d. " "
3rd Class	...	...	...	...	...	½d. " "

Goods.—From 2·89 to 2·67 pence per ton per mile according to load.

Animals.—In full truck loads from ⅔d. to ½d. per animal per mile.

On the C.G.R. the rates were :—

Passengers	...	...	...	...	...	0·33 pence per mile.
Goods	...	...	...	...	...	1·00 " " "
Animals	...	...	...	...	...	0·66 " " "

Thus the rates in the Cape were more favourable to the Imperial Government; but it should be remembered that the working expenses of the N.G.R. are greater and that their paying mileage during the greater part of the war was less than half that of the C.G.R.

CHAPTER III.

ARMoured TRAINS.

Description of Trains first employed.

The normal composition of an armoured train was one locomotive, one tender and three trucks. There were in all five trains, but one had only two armoured trucks.

The engines were 8-wheel coupled, completely encased in $\frac{3}{8}$ -inch steel plate and provided with steel doors for the cabs. The tender was a 4-wheeled truck protected by steel plate, and carrying 800 gallons of water in iron tanks and 3 tons of coal in sacks above the tanks. There were thus $5\frac{1}{2}$ tons of coal and 2,000 gallons of water per train ; but in addition a Valiant pump was carried on the buffer beam of the engine for use in emergency. The trucks were high sided as shown in *Plate 11*, and would hold 60 men each.

To each truck were bolted 32 steel plates, $6' \times 3' \times \frac{3}{8}"$, each plate being pierced with loopholes for one man standing and another kneeling.

Finally there were three bells on the train, viz., one on the engine and one on each end wagon, the engine taking a position in the middle of the train.

Cost.

The cost for each train was £311 13s. 10d., made up as follows :—

	£	s.	d.
Labour	87	11	0
Steel plates	177	18	8
Electric fittings, bells, connections, etc.	46	4	2
Total	£311	13	10

Improvements introduced.

At the end of 1899, when some experience had been gained, certain improvements were made at the suggestion of the A.D.R.

Better protection to the engine was afforded by covering it with rope mantlets, and these were also hung between the wagons to form a screened passage. Holding plates, which let down over the buffers, gave a continuous footway through the train. Head cover was secured by supplying the trucks with semi-circular shields and also flat plates sloping from front to rear of the train. Within the trucks steel shields were used to form cross partitions to localise the effect of pom-pom shells, care being taken to leave communication free.

The two trains intended for the defence of Durban were armed with 3-pounder Q.F. naval guns (one per train), but these were never brought into action against an enemy ; on the other three trains rifle fire alone was provided for.

Experience gained.

Tactically it was found useless to employ armoured trains for reconnaissance unless covered by cavalry ; and in mountainous and enclosed country such as Natal their sphere of usefulness is in any case limited. For covering working parties, however, a *rdle* is open to them, and a train was successfully employed for this purpose at Colenso on January 20th, 1900.

To enter or leave the train it was necessary for the garrison to climb over the steel shields which were 6 feet high and therefore some 9 feet from the ground, and thus the men were greatly exposed during that time.

The doors giving communication through the train were used as ways of exit, but were inconvenient, and an improvement would be to remove entirely the ends of intermediate trucks, providing movable steps also.

Use made of Heavy Guns.

A 4.7-inch gun, mounted on a boiler truck under the directions of Capt. Percy Scott, R.N., was used on several occasions with good effect. When employed, the gun was on the leading truck on the Armoured Train, and would open fire at 5,000 yards or so. When the enemy found the range the position of the train was shifted a few hundred yards, thereby spoiling the enemy's ranging, whilst his range was ascertained by our keeping count of rail lengths or quarter-mile posts passed.

NOTE.—For Armoured Trains on Cape Colony side see Part V.

CHAPTER IV.

HOSPITAL TRAINS.

Three Hospital Trains in all were employed on the N.G.R. during the campaign. Two were fitted up by the N.G.R., and were running by the beginning of December, 1899. The third, which came out from England complete, was erected in Durban and began to run on 17th March, 1900; it was known as "Princess Christian's Train," and was the first to enter Ladysmith after the siege had been raised. Description.

Plate 11 illustrates the marshalling of a Hospital Train and the structural features of a corridor carriage and a kitchen car. The two-berthed compartment was intended for the use of attendants, but more often than not was given up to cases requiring seated accommodation. The brake van was fitted with electric accumulators, whilst the rear compartment of the kitchen could also be used as a brake van; the train did not therefore require re-marshalling on the return journey.

To have provided a corridor throughout the train would have reduced the accommodation for sick. Without a through corridor food and drink could therefore only be served from the kitchen at stations. Experience gained.

The doors were found to be too narrow to allow the service stretcher to pass, and wounded men were therefore placed on a special stretcher and from thence transferred to the carriage bunk; this entailed needless suffering. The "Princess Christian" train was found to be provided with stretcher beds; sick and wounded therefore only had one move—from the ambulance to the bed—but the weight of these stretcher beds entailed considerable exertion on the bearers.

In other ways also aid was given to the Army Medical Department by the N.G.R., *e.g.*, a goods shed at Durban was used as a Base Depôt Store, three vans were fitted up as an Advanced Depôt and were in use from December, 1899, till May, 1900, and lastly accumulators for lighting Stationary Hospitals and for the "X Ray" apparatus were provided and re-charged periodically. Aid given by
N.G.R. to
Army Medical
Department.

CHAPTER V.

REPAIR OF LINES DAMAGED BY THE ENEMY.

GENERAL ARRANGEMENTS.

An agreement (Appendix A to this Chapter) was entered into between the D.R. and the General Manager, N.G.R., whereby the latter undertook to carry out all reconstruction, the G.O.C., Natal, undertaking on his part to afford military protection and working parties if required.

Trestles *versus*
Crib-Piers.

The Engineer-in-Chief (J. W. Shores, Esq.) having considered the various merits of trestles or sleeper cribs decided on the former, chiefly because of the economy in material, the possibility of preparing frames beforehand and of utilising them for the erection of the permanent bridges, and because the timber could be bought in the market, whereas the employment of sleepers for cribs would cripple the supply of permanent way. Moreover crib piers, which must be limited in height, involve deviations with steep gradients and deep cuttings, the former limiting loads, the latter being difficult to maintain in wet weather and requiring large working parties to construct them.

The general principle underlying the first group of arguments is ordinary economy, but in military operations the truest economy is a saving of time; the arguments in the second group lose a good deal of their force when it is remembered that the railway officials were free to demand military working parties if they were short of labour and that the reconstruction work was carried on in the dry season (May and June) when floods are unknown.

Effect of Decision
arrived at.

Whilst it must be admitted that the trestle work erected was well and expeditiously done by skilled workmen employed by the N.G.R., and that a great deal of time would not have been gained on the whole by using sleeper cribs, nevertheless at Colenso the provision of a crib pier bridge would have allowed the military authorities to clear the sick out of Ladysmith a fortnight earlier than they did, and the question of food supplies for the troops there would never have become serious.

A complete list of damage done to bridges and structures, with the measures taken to repair them and the time so employed, is given in the D.R.'s *General Report*.

ENGINEERING DETAILS.

(a). Trestles.

Plate 12 shows in detail a type of trestle which was much used in temporary bridges. Where the trestle did not exceed 6 feet in height no rakers were used, and cross bracing was not introduced unless the height was over 12 feet. *Plates 13* and *15* to *21* give examples of trestles of 50 feet height and under, and the measures taken to secure stability, both longitudinally and across the bridge.

It may be noted that it was not found advisable to fasten caps to plumb-posts and rakers by drift bolts (as in *Plate 12*) in any but semi-permanent bridges, because the timber suffers when the trestles are eventually dismantled.

To obtain an even running road it was necessary to level up over each trestle after erection. This was done when stringers were in position and before platelaying began. To bring the trestles to proper height, wood wedges and packing were driven in between the sills and foundations.

Clear spans between trestles were 15 feet and under. For the former four baulks 12" x 12" were used as stringers; three baulks were used for spans of 8 feet to 13 feet and only two baulks for smaller spans. On occasion 9" x 9" timbers were used for rakers and now and again for plumb-posts, but the dimensions shown in *Plate 12* are the minima consistent with safety in rough work of this sort.

(b). Foundations.

In most cases the foundations offered no difficulty, as rocky bottoms were usually encountered close to the original bridge, such places being generally selected in fixing the alignment of a railway in order to ensure safety.

(i). *Rock*.—When practicable the rock was levelled off and the sill rested on it direct; but in most cases it was found necessary to level off a foundation platform with concrete.

(ii.). *Wet.*—Where foundations were in water, the concrete was made up in bags and placed in position by natives. The deepest water encountered was at the Tugela, where in places there was as much as 3 or 4 feet. The Kaffirs used to strip and work in the water, while a raft or wooden staging was provided for the Europeans to stand on in directing operations.

As a rule the end trestles resting on the bank were laid on a cross platform of sleepers, cut down to 3 feet 6 inches, and laid parallel with the direction of the bridge. All sills below flood level were anchored down at each end by wire rope, twisted round the lower end of the raking post and fastened into an eyebolt let into the solid rock. Where the bed of the river was rough and had any boulders in it, the sills were held down with bags of concrete laid across. This work was however carried out in anticipation of wet weather after the line was open for traffic.

(iii.). *Sand.*—Where the foundations were sandy, two or three layers of sleepers were used to distribute the weight of the sill over the ground. This was notably so in the case of the Ingagane River bridge.

(iv.). *Bog and Sludge.*—In one case only was it necessary to resort to pile driving, *i.e.*, at Ingogo River. The ground on either side was not very suitable for a long low deviation, and consequently it was decided to make the diversion close alongside the old line. As the bed of the river was very muddy, it was decided to erect a bridge containing one 40-foot, one 30-foot and five 15-foot spans.

For the foundation on the south side of the river a trench was dug through the sand down to the rock, which was of a soft shaly nature. This trench was in places nearly 4 feet deep and was filled up solid with concrete. Owing to there being a good deal of water in the river, there was considerable difficulty in keeping it out of the trench sufficiently long to enable the concrete to dry.

On the north side, two rows of piles of 6 feet each, at 5 feet centres and with rows 5 feet apart, were driven. No monkey being procurable in the N.G.R. store at Durban, a temporary one was made. A baulk of 12" x 12" pitch pine, 4 feet 6 inches long, was bound head and foot with $\frac{1}{2}$ -inch iron bands; ten 35-lb. cast-iron chairs were then screwed on to it, making a total weight of about 500 lbs. This monkey stood about 400 blows, by which time five piles had been driven, when the coach screws holding the chairs sheared and had to be refastened on. A 40-foot 9" x 9" baulk was used as a pile driver as there was no frame to be had close at hand. The piles were driven about 6 feet into the ground, and were then cut off about 4 feet from water level. They were connected at the top by 12" x 12" baulks, braced diagonally with 9" x 9" timber, and were also fastened longitudinally with pieces of 12" x 6".

Having been carried out in the dry season all deviations stood well, but in the rains deep cuttings with steep gradients and sharp curves would have become impassable. The maximum gradient advisable is 1 in 30 and the minimum curve 300 feet radius; beyond these limits it is difficult to work traffic except with greatly reduced loads. (c). Deviations.

Plates 15 to 17 show good examples of semi-permanent bridges, so constructed as to allow traffic to run over them without interfering with repairs to the permanent bridge, whilst affording a useful staging for the erection of the girders later on. In cases where, for military reasons, it was advisable to push the line on as far as possible, the order of operations at a stream was:—(i.). Construction of deviation and low level bridge, followed later by (ii.) semi-permanent trestle bridge at original level, and lastly (iii.) repairs to masonry and re-erection of girders of the permanent bridge, utilising the semi-permanent structure.

A list of the water tanks which were destroyed by the enemy, together with the capacities of the temporary supplies erected to replace them and the dates on which they were completed, is given in Appendix B to this Chapter. (d). Water Supplies.

Photo 3 shows a wrecked tank; a charge put into the tank when filled with water had been exploded, and as a result both the tank and its columns, etc., were rendered useless.

Pipes were at times broken by sledge hammers, and pumps were here and there damaged, but this was rare.

Temporary tanks of 1,000 and 400 gallons capacity were erected on cribs of sleepers or boards, and a supply thus obtained, the delivery pipe being 3-inch leather hose. Some trouble was experienced in keeping tanks filled, and eventually the reconstruction party was supplied with two "Valiant" steam pumps and also with one hand pump. In addition travelling tanks of 2,400 gallons capacity were used for carrying water for troops and engines; but as the latter had no steam pumps there was considerable delay in filling engine tanks. A "Valiant" pump might therefore be fitted to engines working at railhead, and they could then water at any convenient stream.

RECONSTRUCTION DEPARTMENT.

The Reconstruction Department was composed of Civil Engineers, with a varying number of European artisans, platelayers, gangers, etc., and natives.

The numbers varied, but reached a maximum of 1,000, of whom 120 were Europeans.

Officers.

Under the Engineer-in-Chief were at first Messrs. Humby and Cox ; after the relief of Ladysmith Messrs. Dempster and Garrett also joined the Department. Other members of the Engineering Staff of the N.G.R. also lent their aid when work pressed.

European Subordinates.

The artisans were chiefly men from the Rand and were satisfactory and willing workmen ; the platelayers and gangers were employés of the N.G.R. ; and the discipline of the reconstruction parties was on the whole good.

Having signed no regular agreement there was some difficulty in persuading men to limit their personal baggage, and this, combined with lack of transport, caused delay. The use of a train specially fitted up to house the working parties was suggested ; but the General Manager vetoed the proposal, and it was not entertained until July, 1900, when trucks belonging to the N.S.A.R. had been obtained. The presence of a train of this sort would have been an economy, and also a boon to the men who were often wet through in their tents.

Native Labour.

Kaffir gangs were supplied by the Labour Agents usually employed by the N.G.R., and were under the orders of railway gangers though paid by representatives of the Agents. This dual control was ill-advised and many men left their work, especially at Newcastle. Had they been enrolled as Volunteers and made amenable to Martial Law matters would have been different, and their feeding, clothing, and housing would have been simplified. The proposal was put forward by the A.D.R. in November, 1899, but was not concurred in by the General Manager.

Rates of Pay.

The men were paid on the following scale :—

Carpenters	...	12s. per day, and 2s. 6d. night or camp allowance.
Masons	... ..	13s. " " " "
Fitters	... ..	13s. " " " "
Gangers	... ..	7s. to 8s. per day, and rations in lieu of night allowance.
Platelayers	... ..	£12 per month average, and rations in lieu of night allowance.
Natives	... ..	1s. 5d. per day and rations.

Night work was paid for as $1\frac{1}{2}$ ordinary time ; and Sundays and Public Holidays as double time, except that Natives received 3s. per day instead of 2s. 10d. on Sundays.

Subsistence whilst on Works.

When gangs were necessarily separated, there was some difficulty in feeding the Europeans. The Resident Engineer drew rations as he required them from the nearest Column or Army Supply Depôt, and from 25th June to August 1st, 1900, this was regularly done.

Experience gained. (a). Night Work.

Gangs were ordered to work by night whenever there appeared to be any urgent reason for it ; as a result of experience it may be laid down that, when railhead is moving, the advantage of giving the men sufficient rest more than counterbalances the additional work done. In cold weather it is advisable to issue an allowance of rum to Europeans and occasionally to natives, and to work only till midnight. Where trestles are being lifted, and the number of men who can work at one place is limited, night shifts may with advantage be adopted.

As regards military labour, the experiment was only tried once and was never repeated ; the results are not worth the trouble.

(b). Methods of Lighting.

Naval search lights were tried on work at Waschbank, but the concentrated beam was unsatisfactory ; other lights, such as Wells' and hurricane lamps, were preferred. The best means of lighting a work would appear to be electric arc lights, rigged on derricks, which can be moved about as required.

MILITARY LABOUR.

The R.E. units employed from time to time on Railway work were :—

17th (Field) Company, under Major F. M. Glubb, R.E., with 2nd Infantry Division.

37th (Field) Company, under Major W. A. Cairnes, R.E., with 5th Infantry Division.

" A " Pontoon Troop, R.E., under Major J. L. Irvine, R.E.

All the Infantry Battalions of the following Brigades were also employed at one time or other, viz. :—2nd, 4th, 5th and 10th.

The assistance of the R.E. Companies was most valuable. As they moved on with their Divisions they were not as a rule able to carry a job through ; but the work they did in clearing sites of wreckage enabled the reconstruction parties to begin a deviation or semi-permanent bridge on arrival without losing any time.

Military labour was of value in so far that it was organised and disciplined. But where, as at Hussar Hill, platelaying was to be done, the want of technical knowledge stood in the way of rapid progress ; and, as the working parties were constantly changed, the strain on the superintending Staff was very great.

STORES.

All stores used on reconstruction were supplied by the Stores Department, N.G.R., from Durban.

They were consigned to the Resident Engineer on reconstruction at railhead, and taken over on their arrival there by his Storekeeper.

The camp at railhead constantly shifted position ; it was therefore a difficult matter to keep a proper check on the tools, and a large number were consequently mislaid or lost. This was especially the case when camp was struck and shifted after dark, small stores being left behind and not being forthcoming when required at the next gap. Mr. Humby's Storekeeper used to form a depôt as close to railhead as convenient, and issue from it to the men at the front. Depôts were formed at Frere, Colenso, O.R.C. Junction (beyond Ladysmith), Newcastle and Volksrust.

It would appear to be advisable in future to appoint a couple of Assistant Storekeepers, not only to collect stores and tools lying about, but also to see that the gangs as they went forward were supplied with all the plant they would require. This duty in most cases fell on the shoulders of the Assistant Engineers, whose hands were already sufficiently full.

DESCRIPTION OF DAMAGE DONE BY ENEMY.

Photos 4, 7 to 11 and 14 give a good idea of the damage done by the enemy to bridges as far as Standerton in the Transvaal, and it is easy to see that the demolitions were carried out by masters of the art. (a). Bridges.

Dynamite, roburite and gelnite were used, the charges being ignited by an electric exploder, which was afterwards found at Glencoe Junction.

To destroy abutments, a shaft 2 feet in diameter was sunk behind to a depth of 6 or 8 feet and there the charge was placed. The girders would remain undamaged, but the masonry was quite destroyed.

For spans from 20 to 60 feet, charges were placed at the ends of the girders on the abutment ; and the result of the explosion was to force the girder off the masonry, bending and twisting it at the same time.

The charges used in the larger bridges were 50 lbs. or more ; and in some cases 50 lbs. were placed in each of the bottom booms of a span and the charges fired simultaneously.

Arches were blown in by means of charges placed on the crown (which had been exposed), either near the ends or at the centre, with equally good results ; many bridges were found prepared in this way. At one place an attempt made to destroy an arch by exploding a charge on the concrete floor had been unsuccessful.

Both ends of Laings Nek tunnel were destroyed (*vide* Photo 12), 150 yards in all ; but the damage appeared greater than it really was. Holes 2 feet long were drilled through the side walls at intervals of 30 feet, and these contained the charges ; when exploded the arch was brought down with the side walls and blocked the tunnel. In addition vertical shafts were found at each end and at other points in the length ; only one had been loaded and used, but that with good effect. These shafts were about 12 feet square, but the labour of excavating them seems to have prevented their being completed. (b). Tunnels.

APPENDIX A TO CHAPTER V.

No. 1.

MEMORANDUM OF ARRANGEMENTS MADE BETWEEN D.R. AND GENERAL
MANAGER, N.G.R.

RECONSTRUCTION OF RAILWAYS.

1. The work of reconstruction will be carried out by the Engineer-in-Chief of the N.G.R., in co-operation with the D.R. Military protection will be provided as required. Military labour will not be provided unless demanded by the Engineer-in-Chief.

Accounts for labour employed on the work will be submitted monthly by the Engineer-in-Chief in the ordinary way, and paid on voucher of the D.R.

STORES.

2. All stores for reconstruction of railways to be procured by the Engineer-in-Chief of the N.G.R., and a special ledger opened, termed "Reconstruction Ledger, N.G.R." They will be paid for by the Imperial Government, and will be charged against works as expended. On conclusion of the works of repair, the remainder, if any, will, so far as useful, be taken over by the N.G.R., or, if not required, sold by them and the amount realised placed to the credit of the Imperial Government. Accounts will be submitted monthly by the Engineer-in-Chief in the ordinary way, and will be paid on voucher of the D.R.

CONTRABAND OF WAR.

3. Stores seized as Contraband of War, handed over by the D.R. to the Railway Department, will be placed to account in a special ledger to be opened in the Railway Stores Department. This account will be a Debit and Credit Account properly vouched, but without values being dealt with. Stores handed over to the Railway Department by the D.R. from his own stores will be dealt with in the same manner.

SEPARATE IMPREST ON ACCOUNT OF RECONSTRUCTION.

4. Agreed the Railway Department should have a separate Imprest of £10,000 on account of Reconstruction expenses.

(Signed), E. P. C. GIROUARD, *Lieut.-Col.,*
Director of Railways, South African Field Force.

DAVID HUNTER,
General Manager, Railways, Natal.

DURBAN, NATAL.

December 2nd, 1899.

Approved, subject to any general settlement of expenditure that may hereafter be agreed on between the Imperial Government and the Government of Natal.

R.B.

No. 2.

SECOND MEMORANDUM OF ARRANGEMENTS MADE BETWEEN D.R. AND
GENERAL MANAGER, N.G.R.

1. It is agreed that in the case of Bridge reconstruction the cost of permanent super-structure payable by the Imperial Government shall be the value of the tonnage of the Bridges which have been destroyed, the Colony itself paying for the difference between such value and the cost of Bridges of the tonnage now to be ordered.

EXAMPLE:—Thus, if it is determined to replace a structure, which at the present time weighed 68 tons, by one of 108 tons, the Imperial Government shall pay the cost of 68 tons and the Natal Government of 40 tons; the Imperial Government further bearing the cost of the erection of 68 tons in place.

RECONSTRUCTION.

2. It is agreed that the Imperial Government should pay for the cost of replacing in their original condition any destroyed piers, abutments or other under-structures.

3. It is further understood that the value, if any, of the destroyed and of the temporary structures if dismantled, shall be credited to the Imperial Government, such value to be determined by a Board consisting of a representative of the D.R., or of the Military Authorities, and of the Railway Department. In the event of difference of opinion the two representatives shall agree upon an umpire, whose decisions shall be final.

4. In the case of Buildings and other Railway Works, which may have to be reconstructed, the principles laid down in the foregoing will apply, if it is desired, in reconstructing, to introduce any betterments.

5. It is understood that any Bridges and material for works of any kind shall be ordered by the Engineer-in-Chief of the Railway Department through the ordinary channels.

6. Damage to, or loss of, Engines and Rolling Stock and any other material connected with the Locomotive Department will be assessed between the D.R. and the Loco. Supt., and shall be paid for by the Imperial Government.

(Signed), E. P. C. GIROUARD, *Lieut.-Col.*,
Director of Railways, South African Field Force.

DAVID HUNTER,
General Manager, Railways, Natal.

DURBAN, NATAL.
December 2nd, 1899.

Approved, subject to any general settlement of expenditure that may hereafter be agreed on between the Imperial Government and the Government of Natal.

R.B.

APPENDIX B TO CHAPTER V.

LIST OF DESTROYED TANKS AND TEMPORARY ONES ERECTED BY THE N.G.R.

Station.	Mileage.	Capacity of Tanks destroyed.	Capacity of Temporary Supply.	When Completed.
NATAL RAILWAY :—				
Modder Spruit	200	2,500	2,000	March 18th, 1900.
Sundays River	209½	10,000	7,800	April 5th, ,,
Near ,,	209½	50,000	—	—
Waschbank	220½	—	6,600	June 27th, 1900.
Wallsend	225	10,000	4,400	July 15th, ,, Permanent Tank, 15. 9. 00.
Hatting Spruit	239	50,000	9,800	June 30th, 1900.
Ingagane	259½	10,000	8,800	„ „ „
Newcastle	268½	20,000	8,400	„ 3rd, ,,
Ingogo River	282½	—	5,400	August 15th, ,,
Ingogo	283½	10,000	9,400	June 14th,
Mount Prospect	295½	10,000	4,400	„ 17th, ,,
ORANGE RIVER COLONY BRANCH :—				
Brakwal	219	20,000	4,400	August 15th, ,,
NETHERLANDS SOUTH AFRICAN RAILWAY :—				
Moorgraff Spruit	18	—	3,400	July 13th, ,,
Paardekop	29	—	6,000	„ 17th, ,,
Katbosch Spruit	55	—	3,400	June 26th, ,,
Standerton, South	61	—	2,400	„ 30th, ,,
Standerton, North	For Hospital purposes.	—	6,000	August 14th, ,,
Greylingstad	98	6,000	3,400	July 13th, ,,

CHAPTER VI.

NARRATIVE OF RAILWAY EVENTS.

Decision regarding
Control of N.G.R.,
June, 1899.

When, in June, 1899, an increasing number of troops were being moved by rail, it was decided that the Civil Administration should continue to control and manage the Government Railway.

Appointment of
R.T.O.

At the same time a R.T.O. was to be appointed as a channel of communication ; and on 10th August, Lieut. C. G. Fuller, R.E., took up the duty, under the orders of the Director of Transport and Supplies.

Preparatory Works
on Line.

After he had inspected the line in September and made recommendations, additional loading banks were begun at Ladysmith and Estcourt, as well as sidings at the latter place ; a horse ramp was made at Point (Durban) ; and also movable ramps for use with various patterns of wagons carrying horses. Electric light was fitted up at Point ; a goods shed was transferred from Charlestown to Ladysmith ; material for trestle bridging was stacked at the latter place ; and preparations were made to relay the old deviation and reversing stations at Laing's Nek, if required.

Earlier in the year it had been decided that troops should travel on goods wagons seated on their baggage, and when news came in September that a force would shortly land from India the Civil Administration agreed to fit certain trucks with seats for men and others with rails and wooden gratings for horses. But the Administration would not agree to provide cover to troop wagons. The number of carriages on the railway was limited and to have used them for trooping purposes would have dislocated Civil traffic, and this at a time when large numbers of refugees from the Rand were crowding into Natal.

Movements of troops began on September 19th, and between this date and the end of the month became more frequent. Appendix A to this Chapter shows the trooping arrangements adopted for the Natal Volunteers between 30th September and 2nd October.

October, 1899.
Arrival of Indian
Contingent.

R.S.O.s had now been appointed at Maritzburg, Ladysmith and Glencoe, and from 3rd to 25th October the troops of the Indian Contingent kept the Railway employed (*vide* Appendix B). The total strength of the contingent was 8,311 officers and men, 2,792 animals and 29 guns.

Lieut.-Gen. Sir George White (appointed G.O.C. in Natal) reached Ladysmith on the 11th October from the south, and on the same date hostilities were commenced by the enemy seizing the Harrismith-Van Reenen line together with some rolling stock.

Invasion of Natal by
the Enemy.

The invasion of Natal began on the 12th, and the next day the train service was restricted to Glencoe. On the 20th and 21st were fought the battles of Glencoe and Elandsplaagte ; on the latter day the railway was freely used to bring up reinforcements as well as an armoured train.

The other incidents worthy of note during this month were the safe passage of two 4·7-inch and eight 12-pounder Naval guns from Durban to Ladysmith and the disembarkation of a Balloon Section R.E., whose factory was, by arrangement with the Civil Administration, established in the railway workshops at Durban.

November, 1899.
Ladysmith cut off.

Telegraph and railway communication with Ladysmith were severed on November 2nd and the train conveying Maj.-Gen. French and his Staff southwards got through with difficulty. To be prepared for eventualities an armoured train (No. 3) was sent to Estcourt, where a gang of labourers was also collected by the Civil Administration. At about the same time Lieut. Fuller applied to the G.O.C. L. of C. for the services of a Railway Company R.E., but the General Manager of the N.G.R. demurred to the proposal which was not therefore pressed.

Nos. 4 and 5 Armoured Trains were now reported ready for service, and on November 8th were handed over to bluejackets from H.M.S. *Tartar* for the defence of Durban.

Another batch of transports was now due to arrive, and between 12th November and 6th December 4 brigades of Infantry, 3 batteries of Field Artillery, 2 regiments of Cavalry, 2 regiments of Mounted Infantry and other Corps were sent up to the front by rail.

Derailment and
Capture of Armoured
Train by Enemy.

The Armoured train at Estcourt had been used to patrol the line to the north, and on November 15th ran out with a force of 120 rifles (Royal Dublin Fusiliers and Durham Light Infantry) under Capt. J. A. L. Haldane, Gordon Highlanders. The enemy, having placed obstructions at a curve in rear of the train, fired on it as it ran back and caused it

to be derailed. The engine, which was in the centre of the train, cleared the wreckage with great difficulty and the driver then returned to Estcourt, carrying a number of wounded men ; the rest of the garrison were either killed or made prisoners.

A few days later the enemy cut the wire between Mooi River and Estcourt and shelled the former place. Communication to Estcourt was restored on the 26th November, on which day Major G. S. McD. Elliot, R.E. (A.D.R.), reached Estcourt, having landed 3 days earlier.

Gen. Sir Redvers Buller, G.O.C.-in-Chief South African Field Force, with his Staff and the D.R. landed on the 25th. After interviews with the General Manager of the N.G.R. (at which the agreements shown in Appendix A to Chapter V. were made), the D.R. sailed again on the 4th December for Cape Town.

December, 1899.

The A.D.R. and the Engineer-in-Chief having examined the line from Frere to Chieveley and the enemy's position at Colenso on the 8th December, arrangements were made for repairs which were begun at Chieveley on the 15th. On this day the battle of Colenso was fought and 2 ambulance trains removed wounded from the field, the first of them standing only a mile or so in rear of the British gun position. Two more ambulance trains ran up on the 16th and two on the 17th, and all returned to Maritzburg full of wounded.

Battle of Colenso.

The British camps were now at Chieveley and Frere. To accommodate their wants additional sidings and unloading banks were put in at both places between the 19th and 30th, whilst the troops at Chieveley were supplied with water from travelling railway tanks.

Chieveley and Frere.

In the middle of December the A.D.R., impressed with the necessity for increasing and organising the labour available for railway work, made proposals for working the advanced sections of the line with Volunteer Corps, and applied for the services of a Railway Company R.E. He was informed that no Railway Company could be spared, and his other proposals did not meet with the approval of the G.O.C.-in-Chief.

During this month the work of the reconstruction party was confined to the neighbourhood of Mooi River, Frere and Chieveley stations, where additional sidings and improvements in the water supply were urgently required. The party was also freely employed in adding to the defences of Chieveley station and camp. On the 6th (the day of the Boer attack on Ladysmith) volunteers from the platelayers stood ready with the armoured train to repair the road in rear of the Columns which on that day demonstrated from Chieveley towards Colenso.

January, 1900.

A 4.7-inch Naval gun, mounted on a boiler truck, arrived at Chieveley and was experimented with both as to fire ahead and at right angles to the track. In the latter case packing was employed under the truck at the breech end ; at 3,000 yards the outer wheels jumped $1\frac{1}{2}$ inches ; at 6,000 yards the jump was inappreciable. This gun put a Boer search light out of action on the 3rd, and for the next few days supported demonstrations before Colenso. It was fired by indirect laying from a siding just completed in rear of Shooters Hill, and was thus secure from the enemy's guns which ineffectually searched the position.

February, 1900.

A supply siding, begun on the 1st and completed on the 4th, was put in on the north bank of the Blaauwkrantz stream near Frere station and proved a boon to wagons serving Spearman's Camp. Sir Redvers Buller having decided on a branch line from Chieveley to Hussar Hill, it was located on the 13th ; by the evening of the 18th permanent way for $1\frac{3}{4}$ miles of track had been laid out by working parties and wagons of the 5th Infantry Brigade. Two days later, Colenso having been occupied, work on the Hussar Hill branch was countermanded and the attention of the reconstruction party was thereafter concentrated on the main line and Colenso bridge.

The A.D.R. visited the bridge on the 21st ; his suggestion to build a deviation and low level crib bridge was not concurred in by Mr. Humby, who was of opinion that a trestle bridge with approaches of 1 in 30 (*vide Plate 14* and *Photo 5*) would be ready in a fortnight. The next two days were spent by the reconstruction party in shifting camp and making a footbridge (*vide Photo 5*) ; on the 24th work commenced on the trestle bridge and approaches, whilst additional sidings were also laid in at Colenso between this date and the 28th.

Colenso Bridge.

Immediately after Ladysmith had been relieved, working parties from that place began to make their way towards the Tugela, repairing damages as they went, and the reconstruction gangs of the N.G.R. set out to meet them. During the first fortnight of March, the whole of the trestle work and bank at Colenso bridge were completed, as gangs worked day and night from the 8th onwards ; and on the 19th the first train (*vide Photo 6*) passed into Ladysmith. Meanwhile the A.D.R., with the reconstruction party and the 17th (Field) Company, R.E., had pushed on towards Elandsplaagte, which place was reached on the 19th.

March, 1900.
Ladysmith.

On the 6th the Governor, and on the 9th the Prime Minister and General Manager, paid visits to Ladysmith; His Excellency emphasised to Mr. Humby the necessity for making temporary connection over the Tugela at the earliest possible date, leaving the construction of a semi-permanent bridge to a later date. The party with the Prime Minister inspected the O.F.S. branch, where an engine, run out of the besieged town, had been derailed by the enemy; the damage to engine and permanent way had been considerable, but all was put right in 48 hours.

The 17th Company, R.E., were busy at deviations near Elandslaagte. The 37th Company, R.E., also did good work at the cuttings and banks on the Sunday's River deviation, where there was much rock excavation; the Civil Administration began the temporary bridge on the 22nd and completed it in 10 days time.

Appendix C to this Chapter shows the larger troop movements which took place during the month; these interfered somewhat with the supply of material and consequently with the progress on repairs.

April, 1900.

As time passed, additional sidings were required both for the troops and for reconstruction purposes; and during April sidings and platforms were put in at the O.F.S. Junction (Ladysmith) for the Supply and the Railway Reconstruction Departments. Near Estcourt a loop with platform and the necessary buildings served the Hospital stationed there.

Maintenance and permanent repairs between Chieveley and Elandslaagte occupied the greater portion of the reconstruction party. The difficulty of supplying water to the 5th Infantry Division (camped near Elandslaagte) called for early action. It was therefore arranged by the C.R.E. of the Division and the A.D.R. that a branch colliery line should be extended a mile so as to reach the neighbourhood of the camp, in order that tank trucks from Ladysmith might deliver water daily. The 37th Company, R.E., surveyed and located the line on the 4th, and on the following day began constructing stationary tanks at the camp terminus; the reconstruction party (aided by Infantry and R.E. in reliefs 200 strong) completed the extension on the 7th.

Advance from
Ladysmith.

The A.D.R. had been warned of an early advance of the troops and he therefore prepared to carry out repairs close in rear of the Army. Sunday's River bridge was inspected by him on the 14th and, though three miles beyond the British picquets, was found intact. The advance began the following day.

The repairs executed between the 15th and 28th April, on which date the reconstruction train entered Newcastle, are given in detail in the D.R.'s *General Report*.

It was during this period of rapid reconstruction that difficulties in connection with the "Train Staff" system, the want of a train for the construction party to live in, and the want of control over Kaffir labour caused most trouble. These matters have been referred to in Chapters II. and V. and are worthy of careful consideration in any future campaign under similar circumstances.

The help given by the R.E. Companies and by Infantry working parties made a very material difference to progress; had it not been for them, communication by train with Newcastle could not have been established for another fortnight at least.

On the other hand, it is due to the reconstruction party to state that they carried on work in a most determined manner, even under fire; and so dangerous did their position become at Sunday's River on the 10th April that their camp was ordered back to Pepworth's.

June, 1900.

Though application to continue repairs north of Newcastle had been made at the end of April, the G.O.C.-in-Chief was not able to grant permission until the 3rd June, on which day the reconstruction party commenced on the Incandu deviation, also sending forward gangs to the Umbazane and Ingogo Rivers. The "A" Pontoon Troop, R.E., assisted on the Donga Spruit deviation, and in this way railhead reached Mount Prospect on the 14th.

Laing's Nek Tunnel.

No time was lost in repairs to Laing's Nek Tunnel (*vide Photos 12 and 13*), and the work done by the 17th Company and Pontoon Troop, R.E., and the Kaffir gang enabled the reconstruction train to run through the tunnel and to stable at Volksrust on the evening of the 18th.

In obedience to orders received on the 20th that the railway was to keep in touch with the Army, every effort was made to expedite progress notwithstanding damage to bridges and want of coal and water. On the evening of the 23rd the reconstruction train met with disaster near Kroomdraai, where several rails had been removed; five trucks were derailed and some damage done to rolling stock, but within 24 hours the train was again on its way to Standerton, and reached that place on the 25th.

Photo 14 illustrates the way in which the bridge over the Vaal had been demolished, and *Plates 18* and *19* show the deviation laid in. The temporary bridge of trestles, nowhere exceeding 11 feet, calls for no particular description.*

Vaal R. Bridge,
Standerton,
Transvaal,
June, 1900.

Capt. H. A. A. Livingstone, R.E., D.A.D.R., having reported himself on the 25th, was placed in charge of the deviation; by the 30th the alignment and grading had been finally decided on, though no working parties were available for earthwork, etc., till the beginning of July.

Water supply for engines between Volksrust and Standerton caused much anxiety; but by the end of June tanks and a pump had been installed at Standerton South station, and travelling tanks at Paarde Kop.

It was known vaguely that Greylingstad, on the Standerton-Johannesberg line, had been damaged by the enemy on the 1st, and on the 3rd the line was reconnoitred, the trolley engaged on this duty being followed by a Supply train. All was well to a point 350 yards from the station; beyond this the permanent way had been thrown down the bank, and in or beyond the station several trucks were derailed or run into a culvert, whilst the watering arrangements had been destroyed. Repairs were started at once by the R.E., aided by civilian plumbers and fitters, and were soon completed. The enemy were in considerable force near the railway and did constant damage to the way and works; approval was accordingly given to a scheme for preventing train wrecking by means of trolley patrols.

July, 1900.

A bad accident occurred on the 9th near Standerton, when two trains (24 trucks) of empties, which were stabled on the main line for want of space in the yard, broke away during the night and ran into a truck of ballast standing further up the line between two timber bridges. Sixteen trucks in all were derailed, of which nine were damaged beyond repair. A Court of Enquiry reported that in all probability the trucks had been started by some evil-disposed person, and the station staff at Standerton were absolved from blame. The line was cleared on the 10th, and four days later the completion of Groot Spruit bridge, 7 miles south of Greylingstad, gave through communication to Johannesburg.

As the enemy still continued active on the railway the G.O.C.-in-Chief approved of the A.D.R.'s proposals to safeguard the line between Standerton and Greylingstad by means of blockhouses, defended by small garrisons, at all important points. The task of building these defensible posts was undertaken by "A" Pontoon Troop, R.E., and was begun on the 18th. A week later similar proposals for the section Volksrust-Standerton had been approved and works begun.

Blockhouses to guard
Railway.

To reduce the inconvenience following on constant interruptions to the line at high bridges certain deviations were proposed by the A.D.R., approved and proceeded with (*vide* Appendix D to this Chapter).

Communication had now been re-established with Pretoria; on the 31st July the D.R. passed through Standerton to Durban, and the Loco. Supt. I.M.R. arrived to take over the locomotive shops.

Major Elliot, R.E., joined the Intelligence Branch of the Army on 3rd August and was succeeded as A.D.R. by Capt. Livingstone, R.E. The enemy still continued to damage the line occasionally, and on the 13th they penetrated to Donga Spruit, south of Ingogo, and made it necessary to trans-ship traffic there for 24 hours.

August, 1900

On the following day the Heads of Departments of the I.M.R. and the D.A.D.R. (Johannesberg) arrived at Standerton and took over the section Vlakfontein-Volksrust, together with Inspector Duncan and 114 men of various departments on the N.G.R. who wished to transfer their services to the I.M.R.

In consequence of the changed condition of affairs, the A.D.R. and Lieut. Fuller, R.E., proceeded to Durban on the 16th August, and were employed in regulating military traffic over the N.G.R. in conjunction with the General Manager. They also dealt with all questions of accounts, connected with reconstruction, which were outstanding between the Imperial and Natal Governments.

Appendix E to this Chapter shows the total Military Traffic from Durban and Point between 20th September, 1899, and 30th June, 1901.

* *Photo 15* and *Plates 20* and *21* show the semi-permanent trestle work subsequently erected.

APPENDIX A TO CHAPTER VI.

CONVEYANCE OF NATAL VOLUNTEERS TO THE FRONT.

Date.	Troops.	Officers and Men.	Horses.	From.	To.	Time of Departure.	Time of Arrival.
30th September, 1899	Durban Light Infantry...	400	6	Durban.	Colenso.	2.0 p.m. 2.40 p.m.	2.57 a.m. 5.21 a.m. on 1st Oct.
	Natal Naval Volunteers	45 and 3 guns.	—	„	„	2.0 p.m.	2.57 a.m. on 1st Oct.
	Natal Field Artillery ...	110 and 6 guns.	120	„	Ladysmith.	10.0 p.m. 10.10 p.m.	12.13 p.m. 12.30 p.m. on 1st Oct.
	Natal Royal Rifles ...	180	4	Maritzburg.	Estcourt.	6.10 p.m.	12.10 a.m. on 1st Oct.
1st October, 1899 ...	Border Mounted Rifles ..	70	90	Park Rynie.	Ladysmith.	1.0 p.m.	6.18 a.m. on 2nd Oct.
	Natal Mounted Rifles ...	195	221	Durban.	„	6.10 p.m. 6.20 p.m. 6.30 p.m. 6.40 p.m.	8.10 a.m. 8.20 a.m. 8.30 a.m. 8.40 a.m. on 2nd Oct.
	Natal Carbineers ...	270	319	Maritzburg.	„	7.30 a.m. 7.50 a.m. 8.0 a.m. 8.10 a.m. 8.20 a.m.	5.0 p.m. 4.15 p.m. 4.25 p.m. 4.35 p.m. 4.45 p.m. on 1st Oct.

In addition to the above, some 93 Officers and Men, including the Volunteer Staff, reached their destinations by the ordinary passengers trains.

APPENDIX B TO CHAPTER VI.

ARRIVAL OF INDIAN TROOP TRANSPORTS AT DURBAN AND THE DESPATCH AND ARRIVAL OF THE TROOPS.

Date. 1899.	Steamer.	Berthed at.	Trains despatched at.	Destination.	Trains arrived at.
Oct. 3rd	“Lalpoora” ...	5.25 a.m.	11.25, 12.45, 2.0, 2.45 p.m.	Ladysmith.	4.20, 5.40, 6.12, 6.17 a.m.
„ 4th	“Secundra” ...	5.30 a.m.	12.45, 2.0, 2.25 p.m.	„	4.22, 4.27, 4.34 a.m.
„ 5th	“Purnea” ...	11.30 a.m.	5.15, 5.30, 5.50 p.m.	Maritzburg.	10.40, 10.47 a.m., 12.9 p.m.
„ „	“Booldana” ...	12 noon.	6.55, 8.30, 9.15 p.m.	Ladysmith.	10.35 a.m., 1.35, 2.25 p.m.
„ „	“City of London” ...	2.50 a.m.	6.8, 10.0 p.m.	„	9.50 a.m., 2.35 p.m.
„ „	“Sütlej” ...	4.55 a.m.	11.0, 12 midnight.	„	5.33, 5.43 p.m.
„ 6th	“Pandna” ...	4.35 a.m.	2.0, 2.25, 2.35 p.m.	„	6.13, 6.18, 6.25 a.m.
„ 7th	“Vadalla” ...	11.0 a.m.	5.30, 5.45, 6.5 p.m.	„	7.31, 8.42, 8.50, 9.35 a.m.
„ „	“Ellora” ...	9.0 a.m.	2.0, 2.25 p.m.	„	5.0, 6.30 a.m.
„ 9th	“Palitana” ...	7.10 a.m.	10.5, 10.25 a.m.	„	1.0, 2.43 a.m.
„ „	“Warora” ...	1.50 p.m.	7.30, 8.42, 9.20 p.m.	„	2.40, 2.54, 3.0 p.m.
„ „	“Nurani” ...	7.0 a.m.	2.0, 2.25, 2.35 p.m.	Ladysmith. and Maritzburg.	6.17 a.m. 8.7 p.m. 6.20 a.m.
„ „	“Sirsa” ...	1.45 p.m.	5.15, 5.30 p.m.	Ladysmith.	6.22, 10.55 a.m.
„ 11th	“Lindula” ...	2.0 p.m.	7.35, 8.45, 9.12 p.m.	„	11.5 a.m., 12.50, 5.45 p.m.
„ 12th	“Avoca” ...	8.30 a.m.	12.40, 1.50, 2.32 p.m.	„	4.45, 4.55, 6.20 p.m.
„ „	“Nevassa” ...	4.0 p.m.	8.55, 10.55, 11.10 p.m.	„	3.20, 3.25, 3.35 p.m.
„ 13th	“Henzada” ...	7.40 a.m.	5.30, 6.15, 7.30 p.m.	„	10.20, 11.7 a.m.
„ „	“India” ...	11.15 a.m.	2.5, 2.55, 3.35 p.m.	„	4.35, 6.3, 6.5 a.m.
„ 16th	“Sirdhana” ...	7.55 a.m.	2.0, 2.20 p.m.	Maritzburg.	7.0, 8.9 p.m.
„ 18th	“Nerbudda” ...	11.30 a.m.	5.50, 6.20 p.m.	Ladysmith.	8.8, 9.45 a.m.
„ 20th	“Upada” ...	2.45 p.m.	7.30, 9.15, 9.30 p.m.	Maritzburg.	1.30, 2.59, 3.45 a.m.
„ 22th	“Patiala” ...	9.0 a.m.	5.55, 6.20 p.m.	Ladysmith.	10.10, 9.55 a.m.
„ 25th	“Virawa” ...	7.0 a.m.	12.35, 2.17, 2.40 p.m.	„	5.7, 5.50, 6.0 a.m.

APPENDIX C TO CHAPTER VI

CONVEYANCE OF 5TH AND 10TH INFANTRY DIVISIONS OVER N.G.R.

Date.	Corps.	From.	To.	Officers.	Men.	Natives.	Horses.	Mules.	Carts.	Wagons.	Cauns.	Raggage (Tons).	Ex-Steamer.
1899. Dec. 31.....	Dorsetshire Regiment	Point.	Estcourt.	34	1184	18	3	—	—	—	—	—	" Simla."
" 23.....	Lancashire Fusiliers	"	"	25	1081	—	3	—	—	—	—	—	" Roslin Castle."
" "	South Lancashire Regiment	"	"	23	1031	—	3	—	—	—	—	—	" Canada."
" 30.....	4th Battalion Royal Lancaster Regiment	"	"	24	1044	—	3	—	—	—	—	—	" Dilwara."
1900. Jan. 1.....	Middlesex Regiment	"	"	28	1066	—	4	—	—	—	—	—	" Mongolian."
" 3.....	York and Lancaster Regiment	"	"	25	831	—	4	—	—	—	—	—	" Majestic."
" Mar. 7-9...	10th Infantry Brigade and Headquarter Staff, Middlesex, Dorsets, Lancashire Fusiliers, Bearer Co., etc.	Colenso.	Pietermaritzburg.	110	4283	—	123	—	6	69	—	100	—
" 10.....	Detachment 10th Infantry Brigade	Pietermaritzburg.	Durban.	—	40	—	80	—	4	—	—	—	—
" "	5th Infantry Division Staff, 10th Infantry Brigade Staff, Middlesex, Lancashire Fusiliers, etc.	"	"	50	1862	—	80	—	—	31	—	50	—
" 14.....	5th Infantry Division Staff	Durban.	Pietermaritzburg.	15	66	—	35	—	—	—	—	2	—
" "	10th Infantry Brigade and Bearer Company	Point.	"	25	700	—	27	—	—	—	—	—	—
" 15.....	10th Infantry Brigade Staff	"	"	3	24	—	30	—	—	—	—	2	—
" 20-23	5th Infantry Division	Pietermaritzburg.	Lady Smith.	143	5207	—	125	—	—	—	—	100	" Yorkshire," "Howard Castle," "Jamaican," "Cephalonia," "Idaho."
April 9-14	10th Infantry Division	Lady Smith.	Point.	22	641	18	479	343	12	12	18	30	" Templemore."
" "	" "	"	"	223	7904	18	81	183	27	36	—	100	" Urmston Grange."

APPENDIX D TO CHAPTER VI.

PRECAUTIONARY DEVIATIONS CARRIED OUT ON THE N.S.A.R.

Mileage.	Nature of Work.	Completed.	Carried out by.
Vanderschieff Spruit, 7 miles	400 yards ; formation only	9. 8. 00.	Natal Government Railway.
Sassenburg Spruit, 11 miles	400 yards ; formation only	5. 8. 00.	"
Zand Spruit, 13 miles	600 yards ; formation and preparation of trestles.	9. 7. 00.	"
Katbosch Spruit, 55 miles	590 yards ; formation, platelaying, preparation of trestles and concrete foundations.	1. 8. 00.	"
Kaffir Spruit, 66 miles	500 yards ; formation only	24. 7. 00.	"

APPENDIX E TO CHAPTER VI.

MILITARY TRAFFIC FROM DURBAN AND POINT BETWEEN 25TH SEPTEMBER, 1899, AND 30TH JUNE, 1901.

Year.	Month.	Officers.	Men.	Animals.	Guns.	Vehicles.	Stores and Supplies. (Tons).
1899	September	41	1,482	131	6	6	1,000
"	October	451	10,751	4,637	22	68	8,905
"	November	694	15,809	2,296	38	213	2,790
"	December	413	14,178	4,546	36	96	7,804
1900	January	211	8,580	3,727	14	56	8,581
"	February	65	1,053	410	22	13	7,222
"	March	215	7,778	635	7	81	6,864
"	April	155	4,513	2,407	9	34	11,848
"	May	97	2,219	3,056	7	35	14,633
"	June	88	2,665	3,989	2	33	9,426
"	July	54	2,304	3,749	—	6	15,095
"	August	27	512	3,103	—	4	20,927
"	September	36	1,781	3,134	—	2	17,372
"	October	7	191	3,193	—	4	17,857
"	November	28	685	3,488	—	2	21,076
"	December	17	1,091	1,013	2	4	22,099
1901	January	66	850	3,776	—	5	22,814
"	February	32	825	2,662	—	2	21,451
"	March	187	4,829	5,326	—	18	21,005
"	April	70	2,692	6,130	—	4	17,772
"	May	129	3,270	8,839	—	4	24,870
"	June	13	1,341	6,175	1	9	21,191
	Totals	3,096	89,399	76,423	166	699	323,982
	*Average per 1,000 men	34.7	—	855	1.9	7.8	3,624

* Compare Appendix E to Chapter III., Part I., which summarises for a similar period on the C.G.R.

PART III.
THE RAILWAY PIONEER REGIMENT.

CHAPTER I.

FORMATION, EQUIPMENT AND TRAINING.

In the early autumn of 1899, Messrs. Goodwin & Seymour, of the Rand, opened a register of mining officials and workmen who were out of employment owing to the war. Origin and Formation.

After their representations had been considered at Headquarters, an order was issued in December authorising the formation of a regiment to be entitled the "Railway Pioneer Regiment." The first battalion was to be raised at once from the classes mentioned above, and was to be employed, as required, on the railways in the theatre of war, Major J. E. Capper, R.E., being appointed Commandant, and Capt. E. D. Swinton, R.E., Adjutant.

The original idea of having 3 sections per company, with a Lieutenant in command of each, was abandoned in favour of two-section companies with two Lieutenants. But the change was not for the better; the three-section system works well when detailing reliefs, and, with three Lieutenants, the Captain can more easily supervise his company as a whole. The organisation of the Regiment in a Battalion of three Wings, each of three Companies, is given in detail in the Appendix to this Chapter.

Officers of the regiment were mostly appointed from the more prominent mining officials on the Rand. Messrs. Seymour and Goodwin were appointed Majors Commanding Wings, the third wing being ultimately commanded by Capt. Swinton, R.E. Officers.

The list of the Officers originally appointed, is as follows :—

Major Commanding Regiment	Major (local Lieut.-Col.)	J. E. Capper, R.E.
"	" Wing	... L. I. Seymour (killed in action at Zand River, 14th June, 1900).
"	"	... G. A. Goodwin.
Captain and Adjutant	...	... Capt. E. D. Swinton, R.E. (appointed to command Left Wing on 13th February, 1900).
Captain	... ..	... Capt. J. P. Fisher, R.G.A. (killed on 20th November, 1901, on Vaal River when commanding 2nd Battalion R.P.R.).
"	... ..	... C. P. Barchard (late West Yorkshire Regiment).
"	... ..	... L. G. Langmore.
"	... ..	... W. Godsal (late R.E.).
"	... ..	... Capt. S. H. Wilson, R.E.
"	... ..	... N. Wilson.
"	... ..	... F. C. Gale (killed in action at Roodeval, 7th June, 1900).
"	... ..	... L. P. Cazalet.
"	... ..	... S. Handcock (Honorary).
Captain and Qr.-Mr.	...	... J. W. Quinn (Resigned 10th April, 1900).
"	"	... G. B. Poore (Appointed 10th April, 1900).
Paymaster (Captain)	...	... A. E. Page.
Medical Officer (Captain)	...	... R. E. Drake-Brockman.
Lieutenant	... ..	... H. L. Stark (Promoted Captain on 13th February, 1900).
"	... ..	... G. Stonestreet.
"	... ..	... J. F. Berry.
"	... ..	... C. B. Saner.
"	... ..	... H. W. Ablett.
"	... ..	... J. J. Garrard.
"	... ..	... C. J. Price.

Lieutenant	...	...	...	L. Evans.
"	...	...	...	J. Davies.
"	...	...	...	Lieut. A. C. FitzG. Homan, R.G.A. (died at Norvals Pont).
"	...	...	...	B. C. Bartley.
"	...	...	...	E. F. Mitchell.
"	...	...	...	J. D. Leech (Resigned on 21st March, 1900, through ill-health).
"	...	...	...	W. Mitchell.
"	...	...	...	A. W. Stockett.
"	...	...	...	D. Morton.
"	...	...	...	F. J. Pollard.
"	...	...	...	C. W. Thompson (Resigned on 13th April, through defective eyesight).
"	...	...	...	C. E. Hutton.
"	...	...	...	H. Symons.
"	...	...	...	L. C. Boyle.
"	...	...	...	G. Thurston (Appointed on 19th April, 1900).
"	...	...	...	W. Fischer Wilkinson (Appointed Lieutenant without pay on 19th April, 1900).
"	...	...	...	Maclean.
Attached Lieutenant	...	...	...	Lieut. and Qr.-Mr. G. Taylor, R.E. (Appointed Adjutant on February 23rd, 1900).

Recruiting.

Enlistment began at Christmas at Cape Town, East London, Port Elizabeth and Durban; and, notwithstanding rejections by the Medical officers, recruits poured in to the headquarters at Cape Town in such numbers as to tax for a time the resources of the officers and non-commissioned officers told off to ground them in duties and discipline.

A leavening of officers and non-commissioned officers of the Regular Army was seen to be a necessity; and an officer and 20 non-commissioned officers and men of the 20th (Fortress) Company, R.E., were drafted to the battalion. Their presence was of material help to the Commandant, for the great weakness of this and other similar Corps lies in the non-commissioned ranks whose business it is to enforce obedience and discipline with tact and adroitness.

All recruits on joining signed a probationary form, and later were regularly enlisted for service for any period required by Her Majesty. The powers vested in the Commandant enabled him to draft out "undesirables," thus leaving a fine body of men, a number of whom were distinctly good artisans and mechanics, whilst some of the officers were highly qualified mechanical engineers. The proportion of men without a trade was small.

Recruiting was opened on 23rd December, 1899, and on 14th February, 1900, it was possible to send two wings (six companies) to Orange River. Between this date and the 3rd March, the remaining companies were drafted out on service.

Camp.

The camp was fixed near Stellenbosch, where a site on a hillside had been cleared and water laid on for a large number of troops. It was a very windy dusty spot, but possessed a spacious parade ground and proved an excellent place in which to train the young battalion.

Equipment.

Tools to be serviceable for any length of time must be heavy. In order to allow a fair proportion of such tools to be present with the battalion under all circumstances, a "Pioneer Equipment" was agreed upon, and the tools were carried on stretchers consisting of light wooden frames covered with Willesden canvas. To convey the tools of two reliefs required 28 stretchers and 56 men per company, and this expedient proved most satisfactory. The weight of a load, including the stretcher, was 50 lbs. approximately.

In addition to this, a "Light Railway Equipment" was approved for each wing of the battalion, and this was carried in a railway wagon which invariably accompanied the wing. It contained light jacks and tackle, and also such tools for carpenters, masons, riggers and fitters as would enable them to execute repairs to culverts and bridges of small span; for larger works it would in any case be necessary to indent for more tools on the Depot Store.

Military Training.

The military training through which the recruits were put was as follows:—

Squad, company and battalion drill, exclusive of ceremonial but inclusive of some of the rifle exercises, to get men handy with their arms: instruction in attack and defence, route marching with advance and rear guards, and outposts; musketry, 42 rounds per man at ranges from 200 to 500 yards. The targets used were small, only

2 feet by 3 feet, instead of the regular size. The men were also instructed in camp discipline and necessary camp field works and, by the time the Battalion was raised, were in general bearing and discipline well able to hold their own as soldiers; whilst from their superior status and intelligence they promised to be an efficient fighting unit. The average shooting was very fair, the result of field firing at Naauwpoort, at very small targets at distances varying from 1,000 to 400 yards, giving a percentage of 2·54 hits on the head and shoulders; the heads were about 9-inch diameter and the shoulders about 2 inches by 3 feet.

APPENDIX TO CHAPTER I.

ORIGINAL ORDER GIVING DETAILS OF ORGANISATION, ETC.

1.—PURPOSE OF RAISING REGIMENT.

The Regiment will be raised for temporary services during the war, chiefly from the officials and workmen formerly employed in the Witwatersrand Mines. Duties.

Its primary duty will be to execute works on the railways under the orders of the D.R. When not required for such duties it will be available, with his concurrence, for pioneer work and general duties on the L. of C. With the concurrence of the G.O.C. L. of C., it may be used for any military duty required of it in the field.

The Regiment will at all times take its share of the guard and fatigue duties in the camp in which it, or detachments of it, may be stationed; and will assist in the preparation for defence, and in the actual defence, of the camp where it may be temporarily placed.

2.—ORGANISATION.

The Regiment will at present consist of one Battalion, divided into three Wings, which are each subdivided into three Companies.

The Wings will be called Right Wing, Centre Wing, and Left Wing.

The Right Wing will consist of Nos. 1, 2 and 3 Companies.

Centre " " " 4, 5 and 6 "

Left " " " 7, 8 and 9 "

Each Company will form a separate unit in itself, complete in officers, men, staff, equipment, supply and transport, ready at any time to be detached for independent duty.

The strength of the Battalion will be as follows:—

Strength of Battalion.

- 1 Lieutenant-Colonel commanding.
- 3 Majors commanding Wings.
- 9 Captains commanding Companies.
- 1 Captain-Adjutant.
- 18 Lieutenants.
- 9 Company Sergeant-Majors.
- 9 Company Quartermaster-Sergeants.
- 18 Sergeants.
- 72 Corporals.
- 864 Privates, 5 Batmen—869.
- 10 Buglers.

There will also be included the following staff:—

- 1 Captain as Paymaster.
- 1 Captain as Quartermaster.
- 1 Quartermaster-Sergeant Instructor.
- 1 Quartermaster-Sergeant for base.
- 4 Clerks.

The Medical Staff of the Regiment will be as follows:—

- 1 Medical Officer with rank as Captain.
- 1 Corporal.
- 9 Privates.

Total of all ranks, 1,038.

NOTE.—The Commanding Officer and Adjutant must hold, or have held, commissions in Her Majesty's Regular Forces or Militia.

Strength of Wing. The strength of each Wing will be as follows :—

- 1 Major commanding.
- 3 Captains commanding Companies.
- 6 Lieutenants.
- 3 Company Sergeant-Majors.
- 3 Company Quartermaster-Sergeants.
- 6 Sergeants.
- 24 Corporals.
- 288 Privates, 1 Batman—289.
- 3 Buglers.

Total of all ranks, 338.

Strength of Company. The strength of each Company will be as follows :—

- 1 Captain.
- 2 Lieutenants.
- 1 Company Sergeant-Major.
- 1 Company Quartermaster-Sergeant.
- 2 Sergeants.
- 8 Corporals.
- 96 Privates.
- 1 Bugler.

Total of all ranks, 112.

Strength of Section. Each Company will be divided into two sections, strength as follows :—

- 1 Lieutenant.
- 1 Sergeant.
- 4 Corporals.
- 48 Privates.

Total of all ranks, 54.

Each section will be divided into four squads, consisting of :—

- 1 Corporal.
- 12 Privates.

Total of all ranks, 13.

The following horses are authorised :—

For Lieutenant-Colonel, 2	...	...	...	2
For each Major, 1	...	...	...	3
For Adjutant, 1	...	...	...	1
				6*

Organisation of
Company by Trades

The organisation of the Company as regards trades will be approximated to Table A, which includes numbers of all 2nd Corporals and Privates.

As far as is possible, giving consideration to the proportions of the various trades, men joining the Regiment as friends will be posted to the same section.

Men known to officers of the Regiment will, as far as possible, be posted to the companies or sections to which such officers belong.

NOTE.—* O.C.s Companies were afterwards allowed horses.

TABLE A.

TRADES OF PRIVATES IN A COMPANY.

	No. 1 SECTION.				No. 2 SECTION.				Total.
	1st Squad.	2nd Squad.	3rd Squad.	4th Squad.	1st Squad.	2nd Squad.	3rd Squad.	4th Squad.	
Wheelwrights	1	—	—	—	1	—	—	—	2
Coopers	1	—	—	—	1	—	—	—	2
Boat Builders	1	—	—	—	1	—	—	—	2
Joiners	2	—	—	—	2	—	—	—	4
Tailors	—	—	—	1	—	—	—	1	2
Telegraphists	—	—	—	1	—	—	—	—	1
Draughtsman	—	—	—	—	—	—	—	1	1
Plumber	—	1	—	—	—	1	—	—	2
Shoemaker	—	—	—	1	—	—	—	1	2
Typewriter	—	—	—	1	—	—	—	—	1
Tinsmiths	—	—	—	—	—	—	—	1	1
Carpenters	4	—	—	—	4	—	—	—	8
Platelayers	—	—	3	—	—	—	3	—	6
Miners... .. .	—	—	9	—	—	—	9	—	18
Boilermakers	—	4	—	—	—	4	—	—	8
Engine Drivers, Fitters, etc...	—	3	—	—	—	3	—	—	6
Riggers and Splicers... ..	3	4	—	—	3	4	—	—	14
Masons	—	—	—	4	—	—	—	4	8
Wiremen	—	—	—	4	—	—	—	4	8
	12	12	12	12	12	12	12	12	96
Totals of Sections ...	48				48				
	Total of Company ...				96				

3.—PAY AND RATIONS.

Unless special sanction is given for other rates, pay will be the same as for other Infantry Volunteer Corps in the Colony.

Officers and men of the Regiment are entitled to draw the same rations as are issued to Regular Troops, and will draw such, except when on detached duties where it is inconvenient for them to be rationed by Government.

Officers authorised to obtain chargers will be entitled to draw forage for them, as for chargers belonging to officers of Infantry Regiments of the Regular Forces, at all places where forage can be conveniently supplied by Government.

Pay will be issued weekly, as far as is possible, at the discretion of the Officer Commanding, who can delegate authority in the matter. Arrangements will be made for forwarding any desired proportion of a non-commissioned officer or man's pay to any address to which he gives a written authority to forward it. As regards pay of officers, it will be handed over weekly if possible, or placed at their written request to their credit in any Bank at Cape Town, Port Elizabeth, East London or Durban.

Pay, when issued to non-commissioned officers and men, will be issued by an officer, who will initial all payments made in his ledger. At stated intervals the men's accounts will be balanced, and their signatures obtained in the ledger to the correctness of their individual accounts.*

4.—TERM OF SERVICE.

The period of service for which an officer, non-commissioned officer or man is engaged is for three months from the date of his actual enlistment or for such time as his services may be required.

* It was found that this could not be adhered to.

Men will be preliminarily enrolled for seven days from date of arriving in camp, during which seven days they may either leave at their own request, on forfeiting pay for those days, or may be paid up to date, given a warrant to Cape Town, and their services dispensed with by the Adjutant of the Regiment.

5.—APPOINTMENTS, PROMOTIONS AND DISCHARGES.

Officers.

The O.C. Regiment will be appointed, with the concurrence of the D.R., by the G.O.C. L. of C.

The O.C. is empowered to appoint officers of the commissioned ranks, with the concurrence of the I.G. L. of C., subject to confirmation by the G.O.C. L. of C.

The O.C. is further empowered to promote officers within the Regiment, and to post officers to staff appointments in the Regiment, with the concurrence of the I.G. L. of C., subject to confirmation by the G.O.C. L. of C.

Officers once posted to the commissioned ranks in the Regiment can only be removed from the Regiment by the G.O.C. L. of C. They are, however, subject to dismissal or cashiering by sentence of Court-Martial, in the same way as officers of the Regular Forces.

N.C.O.s and Men.

The N.C.O.s and men will be appointed to the Regiment by the O.C., subject to no confirmation.

Appointments to the non-commissioned ranks, and promotions to and within those ranks, or reversions from and within those ranks, can only be made by order of the O.C.

The O.C. is empowered to remove from the Regiment any N.C.O. or man enlisted in the Regiment, and to revert to ordinary duty any N.C.O. or man appointed from the Regular Forces, Militia or Volunteers of Her Majesty's Army, whose services he wishes to dispense with.

Any N.C.O. or man can be removed from the Regiment by sentence of or in consequence of sentence of Court-Martial.

All ranks of the Regiment are subject to the Army Act and Articles of War, and to the General Regulations of the Service in the same manner as Regular Troops.

6.—CLOTHING AND EQUIPMENT.

Officers.

Officers will provide the whole of their own clothing and accoutrements as below, but will be supplied by Government with one carbine, Martini Lee-Metford.

1 waterproof sheet, or 1 valise.	Spare boot laces.
2 blankets.	1 tin dubbin.
2 khaki jackets, 1 on person.	Handkerchiefs, 1 on person.
2 pairs Bedford cord breeches, 1 pair on person.	1 compass, on person.
1 hat with puggaree, on person.	1 pair field glasses, on person.
1 field service cap (khaki).	1 cloak or mackintosh, on person.
2 pairs boots, 1 pair on person.	1 carbine and sling, "
2 pairs putties, 1 pair on person.	1 set valise equipment, "
2 flannel shirts, 1 on person.	1 note book, "
3 pairs socks, 1 pair on person.	1 housewife, "
2 pairs drawers, 1 pair on person.	1 water-bottle, "
1 knife, table, } In haversack on person.	1 lantern to take candles.
1 fork, table, }	2 pairs braces, 1 pair on person.
1 spoon, }	1 writing case.
1 plate, }	1 basin (enamelled) with cover, containing brush and comb, sponge and washing materials, folding looking glass, shaving things (if going to shave) and two towels.
1 mug, }	
1 knife, containing tin-opener and corkscrew, on person.	

The above-mentioned articles are necessary; but provided the weight does not exceed 35 lbs., not including articles on the person, additional clothing may be carried. The following articles are suggested :—

1 khaki serge jacket, Cardigan waistcoat or jersey.	1 pair khaki trousers, drill or serge.
1 pair of canvas shoes.	2 suits pyjamas.

Officers while in standing camp may have :—

1 camp table.	1 folding bath.
1 " chair.	1 tent pole strap.
1 " bed.	

All N.C.O.s and men, whether joining from the Regular Forces or from civil life, will be supplied with clothing, equipment and arms as follows :—

2 khaki drill coats.	2 blankets.
2 pairs khaki trousers.	2 towels.
1 railway pattern hat, with chin strap and puggaree.	1 haversack.
1 pair putties.	1 waterproof sheet.
2 pairs boots with laces.	1 water-bottle with strap.
1 pair canvas shoes.	1 mess tin.
2 pairs socks.	1 holdall, with knife, fork and spoon.
2 pairs drawers.	1 clasp knife.
2 shirts.	1 kit-bag.
1 jersey.	1 rifle, Martini Lee-Metford, complete.
1 cap.	1 valise equipment, consisting of :—
1 greatcoat.	waistbelt, 2 pairs braces, 2 pouches,
	2 greatcoat straps, 2 mess tin straps.

The following tents are authorised :—

Camp Equipment.

For each squad of 13 men	...	...	...	...	...	...	1
For 1 section of 4 squads	...	...	...	...	...	...	4
For 1 company of 2 sections	...	...	...	...	...	...	8
Additional for 2 Lieutenants	...	...	...	...	...	...	1
" for Captain and office	...	...	...	...	...	...	1
" for guard room	...	...	...	...	...	...	1
" for hospital and surgery	...	...	...	...	...	...	1
Per company	...	...	...	...	...	...	12
For 1 wing of 3 companies	...	...	...	...	...	...	36
For Major, 1 per wing	...	...	...	...	...	...	1
For 1 battalion of 3 wings	...	...	...	...	...	...	111
Additional for headquarters, 1 for Commanding Officer	...	...	...	...	...	...	1
For Paymaster and Quartermaster	...	...	...	...	...	...	1
For Adjutant	...	...	...	...	...	...	1
For Clerks and Bugler	...	...	...	...	...	...	1
For Batmen and Servants	...	...	...	...	...	...	1
For Pay Office	...	...	...	...	...	...	1
For Quartermaster's Office	}	...	...	...	...	...	3
For Adjutant's Office							
Total for Battalion	...	...	...	...	...	...	119.*

7.—DISTINCTIVE MARKS.

Each Company will have its own distinctive colour, as follows :—

No. 1 Company, Red.	No. 5 Company, Green.
" 2 " Blue.	" 6 " Red and Blue.
" 3 " Black.	" 7 " Yellow and Green.
" 4 " Yellow.	" 8 " Black and Red.
No. 9 Company, Red and Yellow.	

Captains Commanding Companies will be responsible that all tents, kit-bags, equipment boxes, transport carts, camp colours, in fact as far as possible all articles issued as part of the equipment of their company, are marked clearly with the company colour.

8.—CORRESPONDENCE.

O.C.s Companies will correspond direct with the Headquarter Office on all subjects concerning the organisation, equipment, etc., of their companies. Such correspondence will be addressed to the Adjutant, Qr.-Mr. or Paymaster of the Regiment, according as it refers to the question of "A" Branch, "B" Branch, or pay. All correspondence respecting Ordnance stores and supplies will be held with the Qr.-Mr. of the Regiment.

Each Company having its own distinctive colour will be supplied on demand by the Qr.-Mr., if the articles are available, with small gummed slips of paper of the company colour, which will be pasted on the right-hand corner of all correspondence between Companies and Headquarters. This will very much facilitate dealing with correspondence in the Headquarter Office.

As regards their equipment and the engineering stores, pay, etc., issued to them, each O.C. Company will be sub-accountant to the Headquarters, Qr.-Mr., or Paymaster, as the case may be; and articles bought direct in an emergency by O.C.s Companies must be

* Additional tents, 1 per cent. and 1 for Medical Officer, were afterwards sanctioned.

treated by them as having been taken into the Regimental Stores and issued to them out of these stores. They must, therefore, be extremely careful that full details of any such stores or articles purchased are given to the Qr.-Mr. of the Regiment, in order that they may be brought on the Regimental books and proper issue and receipt vouchers made out to regularise the transaction.

Excepting in cases of emergency, O.C.s will make no cash payments. They will simply forward the bill for articles purchased, signed by them as correct, to the Regimental Qr.-Mr., who will arrange payment in the usual way.

9.—DUTIES OF THE ADJUTANT.

The Adjutant will be primarily responsible for the routine work of Headquarters in connection with all orders received from higher authorities and issue of orders to the Wings and Companies of the Regiment.

He will also act as General Instructor in fieldworks, and will be responsible that the men attain to a fair knowledge of simple fieldwork construction. For drill and musketry purposes he will be assisted by one or more Assistant Adjutants and as many non-commissioned officers (suitable for the purpose) as can be lent from other Corps.

As regards fieldwork construction he will arrange his work on some general scheme, not making haphazard trenches here and batteries there, but assuming that it is necessary to put some selected position into a state of defence, drawing out or working out in his mind a general scheme, perhaps elaborating it somewhat more for instructional purposes than he would do in reality, but still carrying out each piece of work as part of one main general scheme, so that all under instruction may be able to grasp the whole situation and the comparative importance or special reason for the particular piece of work which they are actually carrying out.

Any R.E. troops attached to the R.P.R., who may be available and are not required for instruction in drill and musketry, will be at the disposal of the Adjutant to assist him in the instruction in fieldworks.

Throughout the fieldworks course Officers of Companies should, as far as possible, arrange to be with their men while they are undergoing instruction.

Care must be taken not to break ground on private property without the written consent of the owner.

10.—WORKS.

In carrying out works consideration will be paid to the special fitness of officers for the particular work required. It is possible also that Special Companies will be raised of various trades, which can be put *en bloc* into any specially heavy work that is their particular business.

An order that such and such a company will be the leading company on the work means that, irrespective of military seniority, the Captain of that company will take general control of the work in so far as detailing the method in which it is to be carried out, Captains of other companies being responsible that his directions are followed and that their men do their proper proportion of work.

By this method it is hoped that the man with most experience of a particular work will always be in general charge of it, though it is of course understood that Captains so directing are to obtain the approval of their Wing Commander or of the Commanding Officer as to their arrangements.

Where no company is detailed to direct, the regimental senior will take general charge of the work, each Captain being responsible for the amount of work carried out by his own company.

Companies will be kept together as far as possible, though it may at times be necessary, in order to obtain a large number of men of one trade, to order squads from several companies to work together. In such cases details sent from any one company must always be under an officer of that company, and an officer will be appointed by name to general supervision of the whole work.

CHAPTER II.

ACCOUNT OF WORK DONE.

During the months of January and February, 1900, 5 companies erected Bate's girders (see Appendix to this Chapter), pile drivers and trestles at Cape Town. Later on 6 companies (Right and Left Wings) made trenches and built huts at the Orange River.

Finally the whole battalion was concentrated at Naauwpoort on 3rd March, 1900. They were employed for some days on hutting, building a siding and platform, making entrenchments, loading and unloading stores, and putting together Bate's girders, materials for aerial tram, etc.

Naauwpoort, 3rd March, 1900.

On the 6th the left wing moved on to the Stormberg line to execute repairs between Thebus and that place. The detachment lived in their train and worked continuously in reliefs. Between the 6th and 11th, several broken culverts were repaired, cuttings cleared, damaged water supplies put in order, and portions of the track relaid; and on the 12th the wing rejoined the battalion.

Stormberg—Thebus, 6th—12th March, 1900.

Two officers and 55 men of No. 1 Company proceeded to Colesberg Junction on the 5th March to strengthen an existing temporary bridge and to lay sidings at Rensburg; and between the 16th and 20th the whole battalion, with the exception of a fatigue party at Naauwpoort and No. 4 Company, moved to Norval's Pont.

Colesberg, Rensburg, and Norval's Pont.

OORLOG'S POORT BRIDGE.

No. 4 Company, under Capt. Swinton, proceeded to Oorlog's Poort on 14th March, and there repaired the bridge, of which one shore span of 20 feet and two 100-foot spans had been destroyed by the enemy. It was intended to rebuild pier No. 2 (see *Plate 22*); and this, combined with the fact that no large baulks of timber or materials were available, determined the officer in charge to erect trestles and to carry the line on stringers 16" x 8". The greater number of foundations for trestles were on rock, of which only half were levelled, as time pressed. All details of trestles, with longitudinal and cross bracings, are given on *Plates 22* and *23*. To protect the bridge from fire, corrugated iron sheets were nailed down between the rails of the track.

14th March to 7th April.

Up to date experience proved the necessity for more heavy trollies and tools, larger jacks and forges, and the desirability of telling off two engines for the repair train so that it might not be delayed for want of water. No. 4 Company rejoined the battalion on 7th April at Norval's Pont.

ORANGE RIVER BRIDGE, NORVAL'S PONT.

Photos 16 and *17* show the damage done to the bridge over the Orange River at Norval's Pont; the fact that No. 5 pier with its girders fouled the old construction deviation added considerably to the difficulty of restoring the latter. The works allotted to the battalion were:—(a) a deviation on the right bank and a heavy stone embankment in the river bed, (b) the construction of an aerial tram, (c) repairs to the Bridge.

March 16th—May 20th.

On the 18th March, 3 companies (Nos. 6, 7 and 8) crossed to the right bank and pitched their camp, experiencing some difficulty and delay, through lack of boats, in moving baggage and stores; No. 5 Company camped on the left bank and erected a flying bridge which was of considerable service for some days.

The deviation on the left bank and the low level bridge were being carried out by Lieut. H. A. Micklem, R.E., and a party of R.E., and on the 19th March the companies of the R.P.R. began work. Difficulties were met with only to be overcome, and by the 27th it was possible to pass loaded trucks over the river, though the temporary bridge still required strengthening. Nos. 7 and 8 Companies were ordered to Bethulie on the 25th, but Infantry working parties were furnished in their stead. Damage by flood was feared, and, as no engine could enter the deviation, it became necessary to pass wagons over by hand; this was a herculean task, as heavy bogies required 100 to 120 men with ropes to haul them up the right bank; but so good was the progress made that 84 wagons were in O.F.S. territory at 6.30 on the morning of the 28th, when the R.P.R. ceased to work on the deviation.

Low Level Deviation.

Photo 19 and *Plate 24* give general views of the arrangement of the aerial tram designed by Major Seymour, and *Plate 25* gives full details.

Aerial Tram.

The "ways" were two steel wire ropes, 1½" diameter, passing over frames or "jumpers" erected on the piers of the existing bridge. The ropes were 8 feet apart, and carried a trolley and platform on which was placed the load to be moved. A winding engine actuated a light endless wire rope attached to the trolley, hauling it backwards and forwards as desired. The work of erection was begun on the 17th; although the bulk of the stores and timber had to be taken into the river bed and up the opposite bank, the tram was ready in a week, and between the 25th and 27th stores for the Army were transported across the river by this means. On the first day only 20 tons were carried; but when details of loading were perfected it became possible to carry 3½ to 4 tons per hour, and a maximum of 150 tons per 24 hours could be counted on with further practice.

Experience shows that the time and labour necessary to erect an aerial tram would be better employed in building a light trestle or floating road bridge, unless these would require more than a fortnight to complete.

High Level Bridge.

The railway bridge at Norval's Pont consists of 12 spans of 136-foot iron girders, carried on cast-iron cylinders filled with concrete, the abutments being constructed of masonry. The piers are founded on rock in the bed of the river, except those on the banks which appear to be taken down into the sand. The average height of the piers is about 45 feet.

State on March 16th.

Spans 5, 6 and 7 (*vide Photo 16 and Plate 24*) had been demolished, and both top and bottom booms of each girder had been cut through by dynamite, of which about 80 lbs. per span had been used by the enemy. The girders of spans 5 and 6 in their fall had demolished No. 5 pier; and the massive wrought-iron platform on top of this pier, crashing on to the wreckage in the river bed, had tightly wedged the whole into a solid mass which fouled the line of deviation just below the main bridge. Immediate reconstruction of the permanent bridge was decided on. It was agreed that No. 12 span was not necessary to allow the passage of flood water; two more spans however were still required in the centre of the bridge, and it was decided to utilise Nos. 1 and 11, replacing them by 40-foot Bate's girders on timber trestles.

The work to be done was very considerable. It involved dismantling and launching into their new positions the spans already named; heavy earth filling in span 12; the erection of trestles and girders in spans 1 and 11; the removal of débris near No. 5 pier and the reconstruction of the latter from a point below water level; the erection of large temporary trestles in spans 5, 6 and 7 for construction purposes; and finally the fitting of cross girders, bracing and track on these six spans.

Distribution of Work.

Major Seymour was in command and had 5 companies at his disposal, a sixth (No. 4) joining him on the 7th April.

The tasks were distributed as follows:—No. 1 Company to replace No. 1 span by Bate's girders on trestles, and to launch girders for No. 5 span; No. 2 Company to erect No. 5 pier, including the removal of wreckage around it; No. 3 Company to remove wreckage and to erect the trestle in No. 7 span; No. 5 Company to erect trestles in Nos. 5 and 6 spans, to clear wreckage, and to assist No. 1 Company when launching girders; No. 6 Company to remove spans 11 and 12, replacing them by temporary girders and earth filling respectively, and to launch girders for spans 6 and 7; this last company was assisted by No. 4 from 15th April onwards.

Major Seymour took charge of the work allotted to Nos. 1, 2, 3 and 5 Companies, whilst Capt. Wilson was in command of the remainder on the O.F.S. side of the river.

No. 2 Company began work on the 20th and by the 23rd had cleared the site of the deviation, but it was not until the 29th that it was possible to put rough coffer-dams round the base of No. 5 pier.

Repairs to No. 5 Pier.

Photo 17 shows clearly the nature of the piers; and when it was known that No. 5 had been demolished, two new wrought-iron cylinders were ordered in Cape Town and were ready in the short space of 10 days. The chipping of the broken columns, fitting of fresh cones, drilling bolt holes and other similar work was tedious; nevertheless one of the cylinders was at site on 11th April and was hoisted into position by means of a 45-foot derrick. Six days afterwards the second cylinder was raised; and, though the fitting of the web plate connecting the cylinders caused trouble and delay, all riveting had been completed and the cylinders were ready for filling with concrete on the 22nd. A temporary platform with shoots to each cylinder was erected on top of the pier; the concrete (which was mixed on a car) was run out in two half casks slung on the trolley of the aerial tram and shot into the cylinders. Hoppers with movable trap doors would have been an improvement, but the arrangement described worked sufficiently well, and it was found that the concrete spread well within the cylinders. Eighty cubic yards were filled in 41 working hours, and the cast-iron pier caps were in position by May 2nd (one of these having been cast and sent up from Cape Town). Two days

later the wrought-iron bed plate (undamaged) had been hoisted from the river bed by two 60-foot derricks, and the pier was ready to receive its girders.

To allow of continuous work, Capt. A. H. Dumaresq, R.E., in charge of a Search Light Section, R.E., fitted up the necessary arc and incandescent lights; later on a travelling dynamo and engine were obtained from the C.G.R.

Capt. Wilson worked by day only (7 a.m. till noon, and 2 p.m. till 5 p.m.), whilst Major Seymour told off his parties into shifts (8 hours on and 12 hours off) through the month of April. The conclusion arrived at was that day working is to be preferred, as shifts are hard on all ranks and especially on the officers.

Comparison of Day
and Continuous
Shifts.

No. 6 Company (assisted from time to time by working parties of Infantry and natives) was employed until the 17th April in filling in No. 12 span. The ballast wagons containing earth were delivered on the bridge by an engine, and the earth was discharged below the bridge between the girders. When the bank was nearly completed, an ingenious method (suggested by Lieut. Davies, R.P.R.) was adopted for rapidly removing the substructure of the span. Sleeper packing, resting on the newly made bank, was put in between the cross girders; the longitudinals were then disconnected from the main span and were jacked up at the ends; next the cross girders were cut out and removed, the longitudinals being lowered on to the packing mentioned above; eventually, when the main girders had been launched on to No. 7 span, the bank was completed, the longitudinals and packing were removed, and ordinary sleepers were laid in.

Work on No. 12 Span.

Meanwhile the trestles for Bate's girders had been erected (*vide Photo 20 and Plate 24*).

Work on No. 11 Span.

Profiting by experience gained on the south bank, the girders (3 per span) were spaced to equalise the strains in them, and, having been completed with cross bracing, were run out on a car to No. 11 span.

Temporary beams were laid across the main girders, and the smaller span was suspended from them by tackle, and the car removed. The longitudinals were next unbolted, and put to one side, the cross girders being cut out and lowered to the river bed. Lastly the 40-foot span was lowered into place, and the longitudinals, rails, etc., replaced in position. The first span laid was that nearest No. 10 pier, and the last of them took only 3 hours to bring into position.

On *Plate 26* are given full details of the foundations, holding bolts, trestles and bearings for girders.

The last task allotted to No. 6 Company was to launch spans 6 and 7. After much careful consideration, it was decided to draw the main girders close in together and to move them forward through the existing spans by means of car wheels running on the track. At first 8, and later 6, pairs of wheels, with axle boxes only, were spaced along the span; the girders having been jacked up as high as possible, rough timber frames were fitted to the axle boxes to prevent their turning and these were connected to planking laid in the bottom of the lattices. On top of the axle boxes short timber columns, 12" x 12" section, supported triangular wooden cross beams, which were passed through the girders at the intersection of lattices, where they were protected by light iron plates. Thus the two main girders were balanced on either side of the car wheels, and to prevent any chance of overturning light temporary cross bracing (*vide Photo 18*) was added.

Spans 6 and 7.
Method of Launching
Girders.

All being now ready, an engine pushed the span forward to the outer end of the bridge. On the top of the pier from which the span was to be launched was placed a wooden frame (*vide Plate 24*, piers 4 and 7), on which were bolted four rails specially bent at their outer ends. On these lay 3-inch steel rollers, 3 feet long, whose function was to take the weight of the main girders as the car wheels successively reached the end of the bridge. As the girders moved forward they carried the rollers with them; and when the rollers reached the bent portion of the rails they rolled out, and were used again farther back. Special links, dropped between each pair of rollers, prevented them from over-running one another.

On the central launching trestle, special launching wheels (which had been found at Bloemfontein) had been erected (*vide Plate 27*); but the adoption of the two devices on the same span led to difficulty and some delay. Iron bars, 2½" x 1", had been bolted on to the underside of the main booms to allow rivet heads to run clear of the rollers, but when the launching wheels were reached, it was necessary to remove these bars; this can be understood by examining *Plate 27*.

Spans were hauled forward by tackle and winch, with heavy preventer tackle in rear; including all delays the average time taken to launch a span was 12 hours.

When in their new positions, the two main girders were jacked up clear of the launching wheels, and then very cautiously traversed outwards until they were at

15' 6" centres (*vide Plate 25*). To obviate any chance of overturning, the temporary bracings connecting main girders were only gradually extended. When the main girders were in position, cross girders were brought up by the aerial tram, and lastly the longitudinal and arches. A considerable amount of riveting was necessary and the tram, derricks, etc., were kept busy.

The detailed description of launching given above applies also to No. 5 span, except that the main girders were slung by means of iron straps bolted on to the axle boxes and to the bottom booms of girders. This was not found satisfactory, as it entailed much boring of ironwork and slight inequalities of wheels and axles prevented a fair distribution of load on all wheels.

The work of Nos. 3 and 5 Companies calls for little remark. The masonry foundations under the launching trestles gave some trouble, especially where coffer-dams were necessary. When the water immediately under the feet of the trestles was found to be deep, foundations were laid where it was shallower, and the trestles rested on 16" x 16" baulks bolted to the foundations.

The Norval's Pont bridge was completed (*Photo 21*), and the aerial tram removed, on May 20th; and the Right Wing left for the north on the 25th. It was found advisable to strengthen the base of No. 5 pier by enclosing it in a block of concrete 30' x 12' x 12'; this work was mainly executed after the 20th May and the Centre Wing followed the Right by detachments during the next three weeks.

ORANGE RIVER BRIDGE, BETHULIE.

Bethulie Bridge,
March 25th—June
16th.

Nos. 7 and 8 Companies left Norval's Pont for Bethulie on the 25th March, No. 9 Company following a week later, as the work to be done was heavy. At this point the Orange River is spanned by two bridges, for road and railway, about a mile apart; of these the enemy had only crippled the railway bridge (*vide Photo 22*). The British outposts having seized the right bank of the river, the enemy was prevented from damaging the road bridge, and it was over this that communication was first established by means of a diversion (*vide Plates 28 and 29*). Though no engine could cross the road bridge, the diversion was of great value as communication by railway could be maintained without breaking bulk at the river side.

Diversion over Road
Bridge.

The work done by the Left Wing, though unpretentious, was of very real benefit to the Army. The diversion *via* the road bridge was kept in repair, improved and ballasted; whilst additional sidings and a low level diversion and bridge (*Plate 30*) were also laid in. For the low level diversion the old piers of the construction bridge on the original deviation were utilised, some little difficulties being experienced in getting a proper bearing for the bed timbers for stringers, as the piers had been overturned after the permanent bridge was completed. As will be seen from *Plate 28* and *Photo 22* there were sharp curves at each end of the bridge, and guard rails were therefore added on these curves.

The work of rebuilding the permanent bridge was deferred, and accordingly Nos. 7 and 8 Companies entrained at Bethulie on May 10th. On the 14th the whole Left Wing was assembled at the Vet River.

VET RIVER BRIDGE.

Vet River Bridge.

This bridge consists of 5 spans of 105-foot girders, on masonry piers, the maximum height from water to rail level being over 60 feet. The enemy had destroyed the girders of Nos. 2, 3 and 4 spans and parts of the masonry of Nos. 2, 3 and 4 piers; whilst No. 1 span on the south bank had been damaged and the northern end was lying against No. 1 pier (*Plate 31*).

It was decided to execute semi-permanent repairs and *Plate 31* shows the type of trestle bridge adopted, with spans of trussed beams 30 feet in the clear.

Distribution of Work.

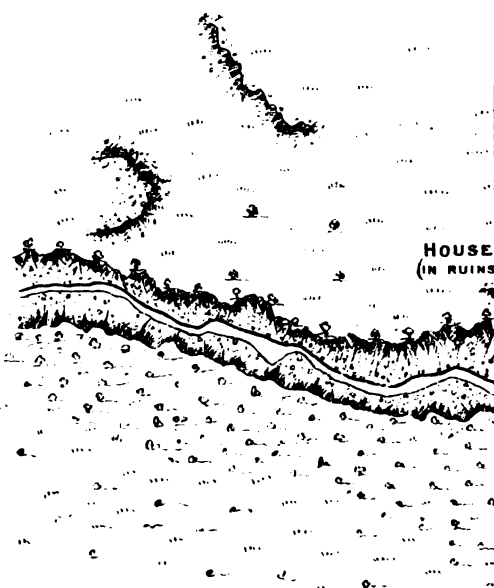
The tasks were distributed as follows:—To No. 7 Company the raising of No. 1 span and erection of trestles and girders in No. 3 span; to No. 8 Company erection of trestles, etc., in No. 2 span; and to No. 9 the work in No. 4 span.

The outer end of No. 1 span was damaged, and the whole span was jacked up and supported by sleeper crib-work. The masonry of the pier having been rebuilt, the span was replaced and one crib pier was left under the girders, which were weak. *Plates 32 and 33* and *Photo 26* explain very clearly the construction of the trestles.

Owing to scarcity of timber a start on trestles was not made till 21st May, but in the meanwhile there was much to be done in clearing wreckage, building foundations and similar jobs.

MENT AT THE ZAND RIVER.

JUNE 14TH 1900.



References.

- A Head Quarters at Station.
- B Hospital in Station Shed.
- C Rduit Commt Stores.
- D Kaffir Kraals
- E, G, H, } Shelter Trenches
- L, M, N, }
- K Rifle Pits
- O Enemy's Pom-Pom & Field Gun
- P Enemy's Pom Pom.
- Y, Z Temporary Deviation

Disposition of Garrison.

North Bank.

- L, M - N^o 4 Coy. R.P.R. } Cap^t Swinton, R.
- N - " 6 " " }

South Bank.

- F. 2 Coys R. Lancashire Militia Lt. C.
 - G N^o 2 Coy. R.P.R. } Major Seymour, A.
 - H, K. " 3 " " }
 - D, E. 60 Rifles R. Lincs. } Major Field, "
 - C. 20 " " }
 - Q 1 Coy. R. Lincs. - Reserve.
- Kaffir Huts etc. thus: -

Scale 4



RGINIA KOPJE

To face page 83.

To obtain the necessary camber on the trussed beams, two baulks, 32' x 16" x 8", were laid back to back with jacks inserted between them. They were securely lashed in the middle with chains, and the jacks applied until it was possible to fit in the queen posts. Experience proved that $\frac{3}{4}$ -inch was sufficient camber, and it was reduced from 2 inches to 1 inch. Owing to the shortness of some of the baulks sent up, it was deemed advisable to add false caps to obtain a fair bearing for the trussed beams on the trestles.

The construction of the bridge proper was completed by 11th June, and the working parties had then been reduced, No. 8 Company moving to Kroonstad on June 6th. Five days later the permanent way had been completed over the bridge, and it satisfactorily stood the test applied.

FIGHT AT ZAND RIVER BRIDGE.

The Right Wing arrived at the Zand River on May 28th, and Nos. 4 and 6 Companies and the headquarters of the battalion joined them on the 12th June. May 28th—
August 1st.

Rumours of an impending attack were persistent. On the evening of the 13th the garrison consisted of 4 companies R.P.R. (320 rifles), 4 companies 3rd Battalion Royal Lancaster Regiment (Militia, about 300 strong), 16 Mounted Infantry (Royal Irish Rifles) and a section of a Field Hospital; the whole force was under Lieut.-Col. J. E. Capper, R.E., Commandant R.P.R. No. 1 Company had been sent to Doorn Spruit, 11 miles down the line, to reinforce that post, whilst during the 13th the Zand River garrison took up a more defensible position than that they had hitherto occupied.

The accompanying rough sketch (compiled from an account of the engagement which took place) explains the position of affairs at daylight on the 14th June. Soon after the fight began the reserve (Q in sketch) slightly changed their position, and finally took shelter behind two trains standing in the station, the contents of which were improvised as breastworks. During the night of the 13th—14th it had been definitely ascertained that no reinforcements would arrive before noon next day, when 170 Imperial Yeomanry might be looked for from Doornspruit; on the other hand, from Ventersburg Road came news of the advance of a hostile force. The river divided the defence into two portions, and communication either by messenger or by signal was not an easy matter. Furthermore the presence of thick scrub in the neighbourhood of the trenches and dongas gave the enemy an advantage of which he quickly availed himself. The garrison stood to arms at 4.30 a.m. on the 14th, and as dawn broke opened fire on scattered riflemen moving in the scrub and amongst the hollows. By 6 a.m. it was ascertained that there were small parties of the enemy posted between K and H in the scrub, and as the attack on this flank developed the position of the men at K became critical. At 9 a.m. reinforcements from Nos. 2 and 3 Companies, and later 50 rifles from the reserve, pushed forward under the command of Major Seymour; and these gradually forced their way out to K, meeting with determined opposition and suffering some loss; amongst others Major Seymour, commanding this part of the line, was killed. The garrison of the rifle pits had also suffered, losing 1 officer and 2 men killed and 1 officer wounded. The garrison of the Kaffir Kraal and trenches D,E held their own and inflicted loss on the enemy, four of whom were eventually taken prisoners. Engagement at the
Zand River, June
14th, 1900.

At 6 a.m. a field gun and pom-pom at O opened at a range of 1,400 yards on the station buildings, and forced the reserve Q to retire from their position. The men left their great coats behind, and later in the day when the coats were examined it was seen that the enemy's artillery had made excellent practice at them. The enemy also opened fire from a pom-pom at P, but the firing was slow and did no great execution.

On the north bank, No. 6 Company soon abandoned their trench N, which had no great field of fire owing to the contour of the ground beyond. The donga to the south and the cutting near M were occupied by them, and from thence they hastened the movements of the enemy retiring south of the river. The trenches M were on a spoil bank, and from these and from L No. 4 Company directed a steady fire on the advancing enemy, entirely checking him.

The Boers began to draw off soon after 10 a.m.; at 11.30 the Yeomanry, who had meanwhile arrived, proceeded to clear the scrub west of the line, when the enemy drew off altogether. It appeared that he had intended to lay an ambush for the working parties, but the change of camp and the measures taken by Lieut.-Colonel Capper on the 13th entirely frustrated his intention and the enemy himself was surprised. His force was ascertained to have been 800 strong, and his losses were 21 killed, 31 wounded

and 10 prisoners. On the side of the British 1 officer and 5 rank and file were killed, 1 officer and 11 men were wounded, and one man was reported missing. The behaviour of the men, especially those in the rifle pits K,K was exemplary, and they showed great coolness under fire.

ZAND RIVER BRIDGE.

Description of Bridge
and Damage done.

The bridge over the Zand River is of the same length as that over the Vet, and is similar in general appearance, except that the height from water to rail level was just under 60 feet (*vide Plate 34*). Nos. 3, 4, and 5 spans had been destroyed, as well as Nos. 3 and 4 piers (see *Photo 31*); the wreckage strewed the channel, and greatly interfered with progress on repairs, as the ironwork had to be cut to pieces. It was decided to undertake semi-permanent repairs, a diversion having already been made previous to the 11th June.

The general design of the semi-permanent bridge was very similar to that for the Vet, and *Plates 34 to 37* give all necessary information regarding details.

The aerial tram was fitted up, and freely used in erecting trestles (which were prepared and fitted in the timber yard), and also in moving cut stone as required to the sites of the various trestle foundations.

From the 11th to 13th June, Nos. 1, 2 and 3 Companies were at work on the bridge, on which date No. 1 went southward. The attack of the 14th disorganised work for a day or two; but Nos. 2, 3 and 6 Companies then carried on whilst No. 4 was doing picquet duty, etc., on the north bank.

The necessity for ascertaining that the neighbourhood was clear of an enemy before beginning work caused a delay every morning; nevertheless the bridge was completed and tested on the 16th July, and by the 24th all stores had been loaded up. Anchorages for a wire rope were put in on either bank and the materials for a rope way were left behind to be used in case of necessity.

ENGAGEMENT AT ROODEVAL.

No. 5 Company at
Roodeval.
7th June, 1900.

When the Norval's Pont bridge was approaching completion, No. 5 Company was ordered northwards and reached Roodeval on the evening of the 6th June, to execute repairs to the Rhenoster bridge.

At Roodeval station was a small military post of 40 rifles under Capt. Grant, Cornwall Light Infantry, whilst the 4th Battalion Derbyshire Regiment (Militia) was camped three miles away at Rhenoster. Anticipating an attack on the 7th, the Post Commandant had telegraphed for reinforcements from the south. These, though promised, did not arrive; but in the meanwhile his command was strengthened by No. 5 Company, R.P.R. (3 officers, 69 rank and file) and half a company of the Derbyshire Regiment, bringing his total available strength up to 150 rifles. The defences consisted of breastworks of bales of clothing between the buildings on the west and between the cars on the east of the line, but the shelter was of little use against artillery fire. Lieuts. Stockett and Thurston, R.P.R., each with half of No. 5 Company, occupied the eastern and western faces of the position.

At dawn on the 7th a Boer arrived with a message from General De Wet, demanding the unconditional surrender of the garrison and stating that he would otherwise attack with 4 field guns and 1,000 men. Capt. Grant refused to surrender, and as the messenger cleared the Post he dropped his flag, whereupon a shell was fired from a field gun at a range of 800 yards, Capt. Gale, R.P.R., and two men who were outside the defences being killed. The rifle fire of the garrison forced the enemy to withdraw his artillery beyond rifle range, but at noon there were 5 field guns (9, 12, and 15-pounders) in position round the Post, whilst no sign of any reinforcements could be observed. A slight diversion had been created to the southward at 9 a.m. by a few mounted men, but these had disappeared.

Capt. Grant accordingly agreed to surrender, his casualties amounting to 8 killed and 20 wounded (all from shell fire). Of the killed 1 officer and 3 men, and of the wounded 2 N.C.O.s, belonged to the R.P.R.; No. 5 Company distinguished itself, both in the action and afterwards as prisoners, by its discipline and general behaviour under trying conditions.

The enemy under General De Wet took possession of the Post and its stores. They helped themselves to such clothing as they required; opened and examined the mails (of which there were 1,500 bags); and finally, piling the whole into heaps, loaded down with lyddite shell, they set fire to the wreckage and marched eastwards with their prisoners on the afternoon of the 8th. The prisoners were, on the whole, well treated, though the lack of shelter and blankets and the scarcity of tea, coffee and flour caused

a good deal of privation. By order of the Boer Government officers and men were separated on the 26th June; the men of No. 5 Company were handed over to Sergt. Marchant and Corpl. Shannon, and eventually reached Natal Territory.

Lieut. Thurston made his escape on the 19th June. Lieut. Stockett also got away on the 14th July and, moving by way of Ficksburg, Ladybrand and Bloemfontein, rejoined the Regiment at Zand River on 28th July.

It now only remains to follow the fortunes of the Left Wing, from which No. 8 Company was detached on the 8th June, whilst Nos. 7 and 9 Companies had completed the Vet River bridge on the 16th June.

Movements of Left Wing.

News of the engagement at Roodeval came into Kroonstad on 7th June, and it was also known that the enemy had burned the temporary bridge over the Rhenoster river. No. 8 Company was therefore told off to proceed northwards to repair damages.

No. 8 Company, 7th June—25th July, 1900.

Between the 7th and 12th, trestles for the Rhenoster bridge had been prepared at Kroonstad under the orders of Capt. W. D. Waghorn, R.E. Entraining on the evening of the 12th, the Company, together with a gang of natives, was busily employed during the next 24 hours in executing repairs to culverts, etc.

On the 14th whilst at work near Roodeval, the party was obliged to take post on the railway bank against a threatened attack, and a party of men and officers (sent forward to Roodeval some little time before) were captured by the enemy. A diversion was effected by Lord Methuen with 2,000 men, and the enemy then drew off.

Roodeval, 14th June.

Roodeval station, which was reached on the 15th, presented a woeful scene of wreckage and charred remains of clothing and mails; the explosion of 9-inch shells charged with lyddite had made huge craters in the ground; and all the station buildings had been razed. It needed a party of 70 natives with gangers to clear and restore the station and sidings, the party being employed for nearly a week at this work alone.

RHENOSTER RIVER BRIDGE.

An inspection of the ruins of the Rhenoster bridge on the morning of the 16th shewed how complete had been its destruction, and the work of repair was at once started. The crib-piers of the former bridge had been 28 feet high and were considered unsafe; the spans were accordingly reduced to 15 feet and one more trestle was added. Work on the trestles progressed steadily, and on the 18th a construction train from the north had also reached the bridge and took over the erection of the remaining trestles. No. 8 Company, being free to launch spans, proceeded with this work, and by the 22nd the bridge itself was finished. For the next five days the working parties were busy clearing wreckage.

Rhenoster Bridge, 16th—27th June.

On the evening of the 27th all stores and men had entrained and the Company arrived at Kroonstad at midday June 28th. For the next month it was employed on detached duties, and on sidings and other preliminary works connected with the semi-permanent construction of the Vaal River bridge at Vereeniging.

Kroonstad.

From the 16th June until the 8th July, Nos. 7 and 9 Companies were employed on clearing a field of fire, making defences and finding the garrison for No. 1 Section of defence at the Vet River position; and, to improve internal communications, a suspension bridge of 70-foot span for foot passengers was erected at a point nearly a mile below the railway bridge.

Nos. 7 and 9 Companies, 16th June—27th July.

VAAL RIVER BRIDGE, VEREENIGING.

Nos. 7 and 9 Companies joined No. 8 at the Vaal River on the 25th July and prepared for the reconstruction of the bridge.

Vaal River Bridge, July 25th—August 31st.

The river dividing the Transvaal from the Orange Free State is crossed by a bridge of six spans, of 120-foot girders, resting on masonry piers. The depth of water under span 5 (*vide Plate 38*) is 15 feet and the height from water to rail level is 57 feet. This was the span selected by the enemy for demolition; the girders had been cut through and the span lay as shown in *Photo 36* and *Plate 38*. As trestles could not well be erected in this span, it was decided to haul Nos. 1 to 4 spans northward, and to make the permanent way in No. 1 span on trestles and trussed beams.

After consideration it was decided to launch the 4 spans in pairs. The inner ends of Nos. 3 and 4 were accordingly connected at the bottom booms, the end cross girders at top were clamped together, temporary diagonal bracings were added at the inner ends of each span, and lastly king posts (*vide Photo 38* and *Plate 38*) were erected and connected by guys of 1-inch steel rope with the ends and middle of the girders as shown. Three guys were used for the outer and two for the inner stays, and they were tightened up by 10-foot screws whose nuts bore against built-up beams of rails which, in their turn, were fixed against the diagonal bracings of the girders. It should be mentioned that

Method of Launching Girders.

additional cross bracings were erected in four bays on either side of the centre, in each span ; these may be seen in *Photo 36*.

Girder bed plates were removed ; and the launching pulleys having been put in position on the piers, the work of moving the girders forward was begun on 12th August. Two treble blocks with 5-inch rope, and a treble and double block with $3\frac{1}{2}$ -inch rope, were first used ; but two tackles, each of two treble blocks, were afterwards substituted to obtain uniform speed on the girders. Two 3-ton winches were used for hauling, the tackles being made fast to 1 inch diameter steel ropes. At the other end of the tackles the hauling ropes were made fast to $\frac{3}{4}$ -inch chains lashed round the last cross girder. Some difficulty was experienced owing to the parting of ropes, but these were rectified and the two spans were safely in their new positions on August 13th.

The king post was dismantled and re-erected over spans 1 and 2, which were ready for removal on August 22nd. With the advantage of experience already gained, these spans were launched without incident in $1\frac{3}{4}$ hours, a very smart piece of work. The maximum sag was $10\frac{1}{2}$ inches with the first, and 9 inches with the second, pair of spans. The trussed beams and trestles were similar to those erected at other bridges, and are shown in detail on *Plates 39* and *40*.

Traffic was running over the bridge on the morning of August 31st ; subsequently check rails and galvanised sheeting were added, foundations were made good with dry stone and rammed earth, and bracings were added to the trestles.

No. 7 Company left on the 19th August, and No. 9 moved to Standerton on the 25th, whilst No. 8 Company remained to get the damaged girder out of the river and to complete the works detailed above. During August and September No. 8 also furnished parties of about 30 strong for the Construction Train whenever called on to do so.

The Zand River bridge was the last to be repaired on the line to the northward by the Right and Centre Wings, which received orders to proceed to Johannesburg on completion. The 5 Companies arrived at that town between the 28th July and 1st August, and were detailed for police duty in the district.

Nos. 7, 8 and 9 Companies were also gradually withdrawn from the railway during October and November, 1900, and they too undertook the duty of policing the Johannesburg district in common with the rest of the Regiment.

Police Duty in
Johannesberg
District.

APPENDIX TO CHAPTER II.

REPORT ON BATE'S GIRDER BRIDGE.

(*Plate 41.*)

As the R.P.R. in South Africa had probably more experience than any other corps or unit of the actual construction of bridges with the composite girders invented by Major (now Lieut.-Col.) C. McG. Bate, R.E., a report embodying these experiences appears desirable.

Spans of 30 feet, 40 feet, 45 feet and 135 feet were built at Cape Town.

Large Spans.

An experiment was also tried with the 135-foot span ; it was not erected at any height above the ground, but four girders 10 feet deep were placed side by side for the span ; the pins were not easily fitted, owing to the necessity for boring out burred holes in damaged links. A bridge of this size is capable of rapid construction on the ground, when mechanical appliances are alongside. With only hand labour, however, experience shows that, though the pieces are comparatively small, there is so much fitting up to be done that the actual construction takes a considerable time. The bridge as originally designed does not possess lateral stiffness. Even with light cross bracings on the top, the girders, when jacked up at either end, "snaked" badly ; and no satisfactory result can ever be obtained without a great deal of cross bracing.

With regard to the erection of a span of this size, there are considerable practical difficulties in the method of launching as proposed in the original design. The want of lateral stiffness would, if girders were launched singly, necessitate the use of stays ; this would be easy in the case of the first girder, but not with the remainder. Cross bracing also would of necessity be fitted when the girders were in place, and this in practice is attended with many difficulties. To launch the whole span built up would mean handling a weight

half as great again as the ordinary Cape Government type of girder for this span, and therefore nothing would be gained.

After the experience gained at Cape Town, Bate's girders were not considered suitable for the Orange River bridge with spans of 135 feet.

Of the spans already named only six of 40 feet were used on the railway; these were at Norval's Pont bridge where the girders rested on trestles. A slight departure was made from the original design, the spacing being altered in order to use the links as cross bracings. Smaller Spans.

As regards cross bracing, the ordinary links have been used for the horizontal bracing of the top boom; and links have been bent so as to fit in, when set up on edge, between the top and bottom booms respectively of the girders, and these links again have been connected vertically by cross links, making a stiff vertical bracing for the whole span.

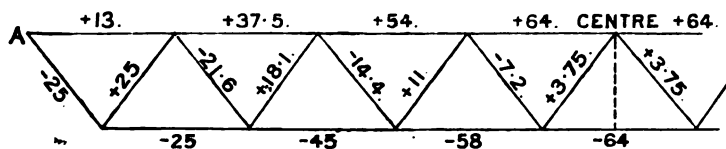
Several defects have come to notice as regards details of the girders:—

Defects in Details.

1. The section of bulb iron used instead of channel iron, presumably for convenience in packing, is inconvenient for construction. If the bulb is placed downwards in the top boom, the horizontal cross bracings have to be placed on the top of the girders. This necessitates the cutting out of each individual sleeper in order that it may take a firm bearing on the booms, or else packing has to be placed on the booms up to the level of the cross bracing, either method entailing a great deal of careful fitting.

On the other hand, if the bulb is placed upwards, the bridge ties have no proper bearing and are crushed, or they must be hollowed out to fit the boom, thereby reducing their section and strength.

2. As regards the strength, the calculations in *The Principles of Structural Design* by Major G. K. Scott-Moncrieff, R.E., are correct, as far as they go; but one important point is omitted, and that is the amount of bearing surface of the pins on both webs of the bulb irons and on certain of the links. With the 40-foot span (calculated to take a load of two tons per running foot, inclusive of the weight of the girder) the central girder takes somewhat more than half the load; omitting alterations due to rolling load, which only affect some of the central diagonals seriously, the strains work out as follows:—



all strains being in tons.

At the point "A" is a $2\frac{1}{2}$ -inch bolt running through the webs of the two bulb irons. The webs being $\frac{1}{2}$ inch thick, the strain per square inch on the webs works out to 11.1 tons, which is far too great for safety. Again, the pins at either end of the horizontal links of the central triangle are $2\frac{1}{4}$ inches diameter and bear on four $\frac{5}{8}$ -inch links; the strain here works out to 11.4 tons per square inch in bearing.

It has been thought advisable to increase the number of links in the tension members in this triangle to 8; in the next triangle to it, and in the one next again, to 6; and in the end triangle to 4. The three sloping members nearest the points of support at either end should be made of three links instead of two.

To strengthen the webs, small pieces of the links have been cut off and riveted on to each bulb iron where the pin at "A" passes through it. Lieut.-Col. Capper sums up:—"I consider the chief defects of the Bate's girder, as regards use on railways, to be:—

1. Want of lateral stiffness, rendering it difficult to launch, or even hoist, from either end as a single girder. Principal Defects.
2. Difficulty of building at any considerable elevation above the ground.
3. The ordinary rubs of travel make it difficult in some cases to fit the pins in, whilst at the same time the pins play too much in their bearings for stiffness.
4. To make a satisfactory bridge a large amount of extra work has to be done in cross bracings, which have to be extemporised on the spot.
5. It is heavy for the work it is called on to do.
6. The bulb iron is an inconvenient section for the top of a girder.
7. I look on it as unsafe for large spans, of over 45 feet to 50 feet.
8. For small spans I consider it inferior as a girder to an ordinary plate girder.
9. It is not so easy to erect as a plate girder.

Its sole merit appears to me to be that the loss of various parts is immaterial, as all parts are interchangeable; but, as special cross bracing is required, this advantage is somewhat discounted.

Speaking generally I am adverse to the use of the Bate's girder. I can safely say that any span we have mended would have been mended quicker and easier by the use of an ordinary girder; and, where railway transport is available to the site of the bridge, I do not see what advantage is to be gained by the use of small pieces of iron or steel whose only *raison d'être* is convenience of transport.

I can understand that Bate's girders may be suitable for road bridges where only mule or camel transport is available, or where timber is not readily procurable ; but they are not economical as regards weight necessary to obtain a given strength, some portions being greatly in excess of the necessary strength and others too weak.

If given the choice between it and any ordinary form of girder for railway work, I should unhesitatingly accept any other in preference to the Bate. At the same time, I must admit that the Bate's material has been of the greatest use for a large number of small jobs for which it was never intended.

I consider that the Bate's girder has had a very fair and extended trial by experienced men who are capable of forming an opinion as to its merits. A great many men in the R.P.R. were drawn from amongst the best mechanics in the Transvaal, whilst a number of the officers had very superior qualifications as mechanical and constructional engineers and a greater experience in actual construction of iron structures than usually falls to the lot of R.E. officers. I am authorised to state that the officers (whose opinion I value on engineering points) have read through this report and agree with me generally.

The girders actually in position at Norval's Pont were run out bodily on the existing track, which was taken away from under them, and the girders were then lowered on to the trestles. No attempt was made to launch them. Now they are fixed they stand the test of an engine well, the 40-foot span deflecting $\frac{3}{8}$ inch under a sixth class engine."

PART IV.
IMPERIAL MILITARY RAILWAYS.

CHAPTER I.

MANAGEMENT.

In Part I., Chapter II., the system adopted for a Military Controlling Staff for the C.G.R. has been described at some length ; a similar system was put into force when Lord Roberts advanced into the O.F.S. and the Transvaal, and the I.M.R. organisation was created. The obstacles to smooth and rapid handling of traffic in the O.F.S. were sufficiently serious, for the bridges at Norval's Pont and Bethulie (giving access to the railways of Cape Colony) were broken, all rolling stock on the north bank of the Orange River had been withdrawn by the retreating enemy, and no staff remained at the stations.

Railway Position in the O.F.S.

It therefore became a matter of paramount importance to centralise the control of the railway, and to prevent its unauthorised use by isolated officers whose action might cause serious delay, if not a positive breakdown. For it must be borne in mind that an Army of 35,000 men, being daily increased by reinforcements, was fighting at distances of 450 miles from Port Elizabeth and 750 miles from Cape Town, and was dependent (for part of the distance) on a single line of railway operated under the adverse conditions already referred to.

Necessity for Centralising Authority over the Railways.

Accordingly the instructions printed *in extenso* in Appendix A to this Chapter were issued by Army Headquarters, and it was at last decided to place R.S.O.s under the orders of the D.R. The importance of this change cannot be too much insisted on, and results justified the wisdom of the decision.

Instructions issued by Army Headquarters. Transfer of R.S.O.s to D.R.

As the O.F.S. and Transvaal gradually fell into British hands, so the mileage of the I.M.R. increased ; and it became necessary to appoint A.D.R.s at Bloemfontein and Johannesburg, with deputies at Kroonstad, Johannesburg and Pretoria. The A.D.R.s were on the staff of the G.O.C.s, O.R.C. and Army Headquarters respectively, whilst deputies were not on any particular staff. This was a mistake, and it would have been better if each General on the L. of C. had had one D.A.D.R. as a technical adviser.

Creation of Special Staff for the I.M.R. (a). Controlling.

In the absence of a railway working staff it became necessary to create one, and though many of the members were military officers, the technical and controlling staff were (as in the Cape Colony) kept separate and distinct.

(b). Technical.

After the occupation of Pretoria, when further experience had been gained, applications of all kinds for the use of the railways were sent to the Chief of the Staff, who, after consulting the A.D.R., issued the necessary permits. At the same time the A.D.R. was informed and he communicated with all railway officials concerned.

Further Centralisation at Army Headquarters of Authority over Railways, June, 1900.

The resulting efficiency of the railway was thereafter most marked ; the practice of detaining wagons in anticipation of a move (which might never take place) was checked, and the railways were thus able to return stock to the Ports where supplies and remounts were awaiting carriage to the front.

DIFFICULTIES ENCOUNTERED IN WORKING RAILWAYS.

(a). *From Internal Causes.*

A general description of the C.G.R., and their system of crossing stations and traffic working, has been given in Part I., Chapter I. ; it is therefore only necessary to say here that that description applies generally to the lines in the Boer States. The Midland and Eastern Sections of the C.G.R. met the O.F.S. Railway at Norval's Pont and Bethulie, and the lines running northwards from these points met at Springfontein, whence there was only a single line to Pretoria ; from the latter place single lines ran east to Koomati Poort and north to Pietersberg, whilst from Elandsfontein other single lines ran south-west through Johannesburg to Klerksdorp and south-east to connect with the Natal line at Charlestown.

Lines in British Territory and the O.F.S. available to serve the Invading Army, Spring, 1900.

It was therefore evident in April, 1900, that for a long time the railway from Springfontein would form the main artery for the supply of the Army ; and the lack of rolling stock, and especially of engines, added to the anxieties of the controlling staff.

Limitations to the Power and Capacity of the I.M.R.

Whilst the strain from lack of these necessities was somewhat relieved after the occupation of Koomati Poort, in September, 1900, the activity of the enemy made it impossible to run trains by night, and consequently the carrying capacity of the line was again sensibly reduced.

Instances of
Improper Use of the
Railways by the
Army and
Consequences thereof.

Enough has been said to show how serious were the limitations to the power of the railway to perform its first and main duty, the supply of the Army; and in the following pages instances will be given to show how the unauthorised and unnecessary use of the line and its rolling stock yet further hampered the administration, and led at times to serious loss of men, provisions and stores. And here let it be stated that these instances are not quoted in any spirit of animosity, but dispassionately as showing what does occur in War and what it is therefore necessary to avoid in the future. The zeal which animated officers and others caused interruptions and delays to traffic because it was zeal misapplied; if the lessons taught by the South African War are laid to heart, such untoward instances will not mar the working of the railways on the L. of C. in a future campaign.

(i.). Detention of
Trucks under Load
on Arrival at
Destination.

The first point to be noted,—and this was one which had far-reaching effects,—was the neglect by all ranks of the Army of the fundamental rule that wagons, on arrival at destination, must be off-loaded with the least possible delay, and that in this matter there should be no room for argument, whether the necessity be apparent or not to officers on the spot. It was the constant endeavour of A.D.R.s and their staffs to see that this rule was carried out; but time after time, as De Aar, Orange River, Modder River, Naauwpoort, Norval's Pont, Springfontein, Bloemfontein, Kroonstad, Pretoria, and Middleberg successively became depôts, each of them became blocked with wagons under load. It is easy therefore to understand that delays occurred in off-loading trains of animals and in entraining troops to time, whilst it became a sheer impossibility to marshal trains properly. At the same time the length of the railway communication increased daily, and the lack of rolling stock resulted in serious consequences.

Any attempt to improve matters by providing additional sidings and platforms only led to further evil consequences, for the radical fault remained—trucks were still kept under load.

Steps taken to
prevent Detention.

Appendix B to this Chapter contains the instructions issued to R.S.O.s for their guidance; a perusal of paragraph 5 will show that steps were taken to impress upon them the absolute necessity for giving this matter the closest attention, and it will be seen that labour was provided to enable an R.S.O. to off-load wagons himself if necessary.

Officers in charge of Supply Depôts were on several occasions responsible for the detention of wagons; and it was not easy to persuade them that it was better to off-load wagons, and if necessary re-load them again later, than to allow them to remain and block lines and sidings. A most noticeable instance of this occurred at Bloemfontein, and that at a time when the Administration were particularly short of wagons.

(ii.). Indiscriminate
Loading by Army
Departments.

Lord Roberts' force invading the O.F.S. had advanced by way of the Orange River-Kimberley line, and had perforce reduced its impedimenta to a minimum. Several actions had been fought, and when Bloemfontein was occupied it was imperative to halt and refit.

No sooner was news received at Base Depôts that the Army had reached Bloemfontein than every Department proceeded to load up and forward to Norval's Pont stores of all kinds. Moreover officers from each unit at the front went southwards to collect and bring up regimental baggage, and this alone filled 300 trucks.

The bridge at Norval's Pont was not repaired at this time and consequently this station and many others south of it were choked with loaded wagons, none of which could proceed; and eventually orders were issued that only supplies were to go forward.

Regulations to check
the Evil.

In the resulting chaos it was by no means easy to separate wagons of supplies, and much baggage was therefore off-loaded where it stood. Springfontein was made a subsidiary base, beyond which only Supplies, Hospital Trains and a limited amount of Ordnance Stores could proceed. Remounts and mounted units were detrained here and marched north by road, whilst dismounted units, for whom separate accommodation could not be provided, proceeded to Bloemfontein seated on trucks of supplies.

Great had been the inconvenience and delay hitherto, but worse was to follow as soon as the Army began the advance northward.

(iii.). Supply Depôts
at Railhead.

The enemy had destroyed many bridges and culverts, not to mention other damages to way and works, all of which it was necessary to repair and which required the presence of special construction trains. The reconstruction parties, in spite of all their efforts, could not always keep railhead close behind the Army; and it was consequently necessary to transport the contents of supply trucks by carts and wagons

from railhead to the camps. Thus it came about that Supply Depôts were formed at places on the line as close as possible behind the construction engineers, irrespective of the fact that there might be no station near the spot.

Furthermore, as the amount of wheeled transport was limited, it was desirable that it should be "nursed" in every way, and the sites of Supply Depôts were shifted every few days as railhead pushed on. But the quantities of supplies sent up from the south were often so largely in excess of actual requirements that it was impossible to remove them to the front before the depôt was shifted, and equally impossible to re-load and carry them on by railway. Consequently the surplus was left behind, unguarded and exposed to weather, thereby becoming deteriorated or even lost; whilst the carrying capacity of the wagons, which had transported the surplus, had been wasted to the detriment of the Army it was meant to serve.

Result of forwarding Excessive Quantities of Supplies to these Depôts.

The railway authorities were often called upon to load up and carry forward supplies left behind in this way, and on several occasions they complied, but under protest. It can easily be understood what a strain this brings on a crippled line; not only is the running of trains disorganised and the work of reconstruction needlessly hampered, but engines and wagons are withdrawn just at the moment when the demands on all rolling stock are greatest.

It would therefore seem advisable to establish an invariable rule that surplus supplies left at a depôt in the above manner should not be loaded again for transport to the front, unless they are required for immediate consumption and can be delivered more quickly than a similar quantity despatched direct from the Base.

Suggestions to deal with this Difficulty.

The loss of stores consequent on rigid adherence to this rule would not compare with the gain to the Army represented by the increased power of transportation by railway.

The question at once arises why supplies were forwarded so greatly in excess of requirements; possibly one of the main reasons was a want of co-operation between the various Supply Officers, *i.e.*, those with the main body and those in charge of depôts or columns, and this was probably due to lack of telegraphic communication between railhead and Army Headquarters.

Reason why Surplus Supplies came forward.

As an instance, the railway authorities were on one occasion warned by Army Headquarters (then 40 miles away from railhead) that 120 wagons of supplies must be at railhead within 48 hours, and, a similar message having been sent to the Supply Depôt, the wagons were loaded. But in the meanwhile information from other sources had reached the railway officers, on which only 40 trucks were sent up and no more were then required. But here another difficulty came in, *viz.*, what class of supplies were most wanted? As it was impossible either for the supply or railway officers to answer this question, the first 40 trucks of the 120 demanded were despatched; and of course they contained many articles which need not have been forwarded just then.

Within limits the fault was on the right side, for at least the Army was sure of sufficiency of food; but where other departments were concerned, each of them received urgent indents for stores and equipment, and one and all claimed priority for their various consignments. When the order of procedure had not been fixed by Army Headquarters, the Military Controlling Staff exercised their own judgment, even to refusing despatch, and it is manifest that this duty could not have been discharged by a Civil Administration however capable.

There were several occasions when the sequel showed that officers making urgent demands on depôts for stores and other things had given no thought regarding the onward progress of their consignments when they had been off-loaded at railhead; and thus it came about that 12,000 greatcoats and 1,500 bags of mails were captured at Roodeval on June 7th, 1900, together with the garrison defending that post (*vide* Part III., Chapter II.).

The anxiety of Departmental Officers to pour in supplies and stores to stations without railway facilities for dealing with them led to many difficulties; these might have been avoided if the indenting officer, or the one in charge of the Depôt, had freely consulted with the proper representative of the Railway Controlling Staff. Instructions with a view to remedy were eventually given to R.S.O.s (*vide* para. 5a of Appendix B to this Chapter).

It remains now to show how the railways operated in transporting troops. The causes of delay were more easily ascertained, and delays themselves were not as a rule followed by such serious consequences.

Transportation of Troops.

To keep events in their chronological order it is necessary to refer first to the Cape Colony lines, and here there were frequent instances of dislocation of traffic due to the unauthorised use of the railway by Commanding Officers and Station Commandants who wished to move troops a short distance. After a time, these became more infrequent

because each case was referred to Army Headquarters and there investigated; but early in 1901, when Commandant De Wet invaded Cape Colony, the various Columns which were put in motion against him were often transported by rail without any reference to the Military Controlling Staff, and the consequent chaos and confusion can be imagined. As a natural result the Cape lines were dislocated and could not supply the Army operating beyond the Orange River.

Interference with
Traffic Working.

Instances occurred of unwarranted interference with traffic working which would appear ludicrous were not the consequences so serious; it will suffice to quote two as examples. On one occasion a Section Commandant delayed traffic for 3½ hours by using an armoured train to escort a convoy of cattle on the march; on another, an officer refused to allow an engine to take locomotive coal from a station, because the coal stack formed part of his defences.

In the O.R.C. and the Transvaal the I.M.R. Staff were in constant touch with Army Headquarters, the evils already alluded to having been observed; and proposed movements by rail were freely discussed with the A.D.R. at Headquarters, whose duty it was to advise on these matters.

Lack of transport made it necessary at times to move troops short distances by rail, but an instance of an unnecessary movement by rail occurred about 12th May, 1900, when the Army was rapidly advancing northward. On this occasion the 13th Infantry Brigade, fully equipped with transport, was ordered to move from Bloemfontein to Winburg, a distance of 80 miles by railway and 60 by road. The move was fitted in with other services, but it resulted in the Brigade assembling at its destination 48 hours later than if it had marched by road throughout.

One notable case occurred in July, 1900, when the evacuation of Heilbron was ordered. The A.D.R. (Major V. Murray, R.E.) learnt, when passing through Viljoen's Drift, that a large quantity of rolling stock had been ordered to Heilbron without any reference to him; when he arrived at the latter place he discovered the cause, and found matters in great confusion as no experienced staff was on the spot. All this could have been obviated had the Military Controlling Staff of the railway been given information as to the facts in good time.

Improper Use of
Armoured Trains.

It is appropriate to point out difficulties which occurred in the working of Armoured Trains. The primary duty of these trains, viz., to facilitate the safe passage of a maximum amount of traffic, was lost sight of; and the trains were sometimes used by senior officers for inspection purposes, and thereby claimed priority over other military traffic. Trains were run out of stations without the Station Master's orders and in face of trains in the opposite direction; and in these and other ways some of the most important and elementary rules for working railways were broken by armoured trains, to the detriment of traffic and to the risk of lives and invaluable rolling stock.

The facts which have here been set down make it abundantly clear that for the management of railways in war there must of necessity be a Military and not a Civil Controlling Staff; and further, that it would be to the advantage of the Army generally that there should be an appreciable number of officers conversant with at least the elements of railway traffic work.

DIFFICULTIES ENCOUNTERED IN WORKING RAILWAYS.

(b). *Caused by the Enemy.*

The above-mentioned difficulties were due to want of experience and other avoidable causes, but concomitant with these were others due to an enemy who was alert, intelligent and for a long period indefatigable.

Withdrawal of
Rolling Stock by
Enemy.

As the Boers retreated northward to the Transvaal, and then eastward towards Portuguese Territory, they consistently withdrew all rolling stock; and thus it came about that when the British Forces reached Johannesburg and Pretoria, in June, 1900, the line of communication had been lengthened by over 360 miles, whilst the available rolling stock had only been increased by 1,200 trucks and 33 engines, the latter having been captured at the two places named, the vital parts of many of them removed.

Some engines were lent to the I.M.R. by the Civil Administrations of Cape Colony and Natal; but when it is remembered how many were required for Armoured and Construction Trains and for use as banking engines at temporary diversions, the magnitude of the task which confronted the Loco. Dept. may be realised.

As the Army moved eastward from Pretoria the intensity of the strain increased until the end of September, 1900, when 222 engines and 4,250 trucks were captured in the neighbourhood of Koomati Poort. During the advance from Bloemfontein to Pretoria, railway communication was most fortunately uninterrupted, and traffic was continuous day and night over the military railways.

But a change came in the early days of June, 1900. On the 7th, Commandant De Wet made a descent upon Roodeval and Rhenoster, capturing the garrisons and destroying the line and the temporary bridges in the neighbourhood; and so persistent were his attacks that for 3 weeks the section Kroonstad-Vaal River was practically closed to traffic.

Enemy's Raids on the Railway.

The Boers at this time also wrecked and captured several trains running by night, and it was consequently decided that night running must be discontinued in the O.R.C. north of Bloemfontein, though it was continued on certain sections in the Transvaal.

In October, 1900, the activity of the enemy's marauding parties south of Bloemfontein rendered night running dangerous there also; and finally, on the 1st January, 1901, traffic on the whole system was restricted to the hours of daylight, thereby seriously reducing the carrying capacity of the various lines.

Appendix C to this chapter gives the text of instructions issued from Army Headquarters regarding night running; and it will be observed that trains could pass from one section of the L. of C. to another after dark only by permission of the highest Military Authority.

Instructions regarding Night Running.

Another point worth noting is that the Railway Authorities and not the Commandants were made responsible for the state of way and works before traffic was resumed. This was done to prevent undue delay to trains whilst the line was patrolled.

Balked in their attempts on night trains, the Boers devoted their attention to those running by day; and when it was found that the destruction of the line caused but little inconvenience, owing to the presence of Construction Trains at various points, the train-wreckers used "contact" and "observation" mines.

Contact and Observation Mines.

"Contact" mines were laid beneath the rail and were exploded by a passing train. They were very difficult to discover, and caused the death of several gangers on patrol duty and of enginemen whose locomotives fired the mines and became derailed. To meet these tactics, a few loaded trucks were attached to the front of the first train of the day; these exploded the mines and took the shock, whilst human life was not endangered.

Such precautions however were of no avail against "observation" mines, which were laid in the same way but were fired by means of a wire manipulated by an observer concealed in the neighbourhood.

Himself in security the observer was able to choose any particular train; and on one occasion at least, when the enemy were in want of supplies, pilot, armoured and mail trains in succession passed safely over a mine whilst a subsequent supply train was wrecked and captured.

The marauding parties were weak in numbers; and in order to ensure the capture of a wrecked train, would ride up behind it when moving slowly up a gradient, and detach the vacuum brake hose, bringing the whole to a standstill. To meet this difficulty one or two trucks were attached in rear of the brake van, their hose pipes being disconnected from the train brake, and in these rode an armed escort. To acquaint all ranks with their duties in case of an attack a copy of certain Instructions (*vide* Appendix D to this Chapter) was given to the senior officer or non-commissioned officer on every train by the R.S.O. of the station whence the train started.

The D.R.'s General Report gives a detailed statement of the damage done to the line at various times by the enemy, and only a close perusal of this can convey an adequate idea of the extent to which they interfered with the railway service.

The lines which suffered most were the Transvaal Eastern and South Eastern, but the gradual extension of the system of blockhouses procured immunity, and by April, 1901, the worst was over.

In the D.R.'s General Report are two interesting diagrams which show clearly the course of the struggle carried on between the British and the Boers on the railways and the eventual discomfiture of the latter.

In the course of this narrative the risks and dangers to life attendant on the operation of the lines of railway has been referred to; and it is therefore but fitting that the behaviour of the staff, and especially the running staff, should be brought to notice, and that their devotion to duty should be recorded. They were nearly all civilians and it is no exaggeration to say that all to some degree, and the enginemen especially, carried their lives in their hands. Exposed to dangers from mines, from train wreckers and from parties in ambush, they nevertheless persevered; and the driver who, with his fireman dead beside him and himself shot through both arms, brought his train safely through a force of the enemy, one hand on the lever and one on the brake, affords a stirring example of what the civilian staff could and did do to further the British cause.

Bravery of the Civilian Staff.

Considering the circumstances it is not a matter for great wonder that there was some reluctance to travel after dark.

GENERAL REMARKS.

Regulation of Civil
Traffic on the
Railways.

When discussing, in Part I., Chapter II., the duties of an A.D.R. and his Staff in their broadest sense, it was laid down that they should watch the ordinary working of the line to ensure the greatest military efficiency. This duty requires the exercise of tact towards the members of the Civil Administration, and to carry it out satisfactorily the officers referred to should have practical experience of railway working and its limitations.

On the I.M.R. the entire control was in the hands of the A.D.R. and his staff. It was of course necessary to import supplies for the civil population of the conquered States, and in Appendix A to Part I., Chapter III., will be found the rules which governed the issue of permits and the channels through which these authorisations reached the proper railway officers. By these means it was possible to guide the stream of loaded vehicles from the Ports so as to make each line of railway do a fair share of work.

In the O.R.C. and Transvaal certain officers were authorised to issue local permits. Provided that local civil traffic was moving in the opposite direction to military traffic and did not interfere with it, permits were issued to consignors and their goods were carried by rail. If any interference was likely, the special sanction of the A.D.R. or his staff was required, and it may be mentioned that these officers were several times called on to give decisions regarding coal traffic in the Johannesburg district.

Channels of
Communication to
meet various Army
Requirements.
(i.). On the C. G. R.

On the Cape Colony lines additional facilities at stations were early required to deal with military traffic; as unnecessary demands had been made at times on the Civil Administration, a D.A.D.R. had been appointed (under the A.I.G., L. of C.) as the proper channel for the conveyance of these demands if approved. For the provision of additional sidings, platforms, etc., Station Commandants applied to the D.A.D.R.; for leave to occupy railway buildings the application was made by the C.R.E.; for stores required by the A.O.D., the Ordnance Officer addressed the D.A.D.R.; and in each case this officer communicated authority to the proper railway department concerned.

(ii.). On the I.M.R.

On the I.M.R. the principle remained the same, but the responsibility lay wholly on the Military Staff; the instructions issued are given in full detail in Appendix B to this Chapter. As regards loading and off-loading animals, it would be of great advantage if troops were instructed how to construct platforms of rails and sleepers. With a little practice these can be erected most expeditiously and save much time.

Arrangements for
Dealing with
Live Stock.

In the early days of the campaign, live stock of all kinds was hurriedly entrained at the Ports and despatched long distances under the care of a conductor and a few natives, who watered and fed the animals as best they could *en route*. Later on depôts were established where the animals could be detrained for food and rest; in many instances, through want of proper co-ordination between the Remount Department and the Railway Military Controlling Staff, depôts were fixed at important stations which were already busily employed in dealing with large numbers of wagons of stores, etc.; as a consequence animals could not be rapidly unloaded on arrival, and blame was thrown, often unfairly, on the railway authorities.

A more satisfactory plan would be to choose small stations, situated about 10 hours apart by train, at which places the depôt should be established close to the station. Live stock would thus be journeying for 10 hours, and would then be detrained and kept at the depôt for any period considered advisable, whilst the empty trucks could be utilised to send forward a fresh batch of animals to the next depôt. Thus a continuous stream of animals would proceed to the front; and having been in the train under 12 hours, would arrive at the terminus in good condition. Those who have seen animals detrain after travelling by railway continuously for two or three days can realise the advantages of this proposal.

These rules might well be applied also to mounted units, whose horses would then be fit for duty within a very short time of their arrival at their destination.

Instances of Troop
Movements on a
Large Scale.

The railways were used on at least two occasions for large concentrations of troops:—(i.) prior to the advance into the O.F.S. from the Orange River-Kimberley line, and (ii.) to meet Commandant De Wet's invasion of Cape Colony. The details of the train movements on these occasions will be found in Appendix C to Part I., Chapter III., and Appendix E to this Chapter; in Appendix F to this Chapter will be found extracts from a despatch, dated March 8th, 1901, in which the Commander-in-Chief makes some reference to the matter when describing the steps taken to counter Commandant De Wet.

Appendices G and H to this Chapter furnish useful examples of other large troop movements executed during 1901. Appendix K gives the troop moves through Pretoria in one month in 1901. Appendix L shows, in tabular form, the Railway accommodation required for 1st and 2nd line Transport accompanying various Units of the different arms of the Service.

Considering that at one time there were over 260,000 men in the theatre of war, it is fortunate that there were but few isolated bodies travelling by railway. During the advance to Pretoria there were of necessity a certain number of small parties making their way to join units at the front, and these were usually forwarded in batches of about 100 on the loaded trucks of each train. When Pretoria had been occupied and more rolling stock had been secured, regular passenger traffic was gradually organised, and this was kept under strict check as shown in Appendix M and paragraph 10 of Appendix A to this Chapter; and though there were, in spite of all precautions, a certain number of men travelling without authority, the interest taken in this matter at Army Headquarters, seconded by the energetic efforts of Station Commandants, reduced their numbers. The location of convenient rest camps also aided materially in reducing the labours of the railway staff in dealing with these small isolated parties, who might or might not be under adequate control.

Appendix N to this Chapter gives extracts from the "Regulations for the Working of the Railways," which were issued by the D.R. at the commencement of the campaign.

APPENDIX A TO CHAPTER I.

INSTRUCTIONS TO COMMANDANTS IN REGARD TO THE WORKING OF
THE RAILWAYS.

HEADQUARTERS, BLOEMFONTEIN,
April 23rd 1900.

1. The D.R. is alone responsible to the Chief of Staff for the working of the lines.
2. All Commandants must consider themselves responsible to the D.R. in seeing that railway orders are strictly carried out, and that military requirements do not in any way interfere with the regular despatch of trains or working of stations.
3. For this purpose Commandants will have under their orders R.S.O.s, to deal with Station Masters and carry out entraining and detraining of troops and military stores, etc.
4. The Military and Civil Railway Staff on the I.M.R. are under the sole control of the D.R., and cannot be moved by Commandants except in cases of emergency and for reasons unconnected with the working of the railways. When such cases occur the Commandants will immediately report the matter to the D.R.
5. Commandants will see that all Army Orders with reference to railways are strictly carried out. Copies of such orders attached. Particular attention is called to Army Order No. 8, of 24. 1. 1900, directing that railway buildings are not to be occupied by troops and that tarpaulins are not to be used except for railway purposes.
6. Commandants and other O.C.s along the line, who require train accommodation for any purpose, must communicate their requirements through their R.S.O.s to the A.D.R., Bloemfontein, who will make the necessary arrangements.
Except under arrangements with the A.D.R., no train must be stopped or delayed except in case of great emergency.
7. All communications with the Railway Staff must be made through the R.S.O.s at stations where such are posted.
8. Commandants must, as far as possible, render all necessary assistance to the Railway Staff in the performance of their duties, and see that they are in no way hampered in their duties by the action of the troops.
9. In cases of great emergency, the railway arrangements already made may be disturbed only on the written order of the Commandant*; and this order will be forwarded by the Station Master through the Traffic Manager to the D.R., for the information of the Chief of Staff, who will judge of the expediency of the order.
10. As serious delay has been and is now being caused to traffic by unauthorised orders from officers, serious attention should be devoted towards prevention of such irregularities. It is doubted if officers have knowledge of the far-reaching ill effects upon railway working of their unauthorised orders.

By Order,
KITCHENER OF KHARTOUM,
Chief of Staff.

* Form of order attached.

H

IMPERIAL MILITARY RAILWAYS.

COPIES OF ARMY ORDERS.

ARMY ORDER No. 8 OF 24TH JANUARY, 1900.

Railway trucks must only be kept under load at stations for the shortest possible time, not in any case exceeding 48 hours, unless sanction of D.R. has been obtained. Officers Commanding and Departments are warned against annexing any railway property (*e.g.*, material, tarpaulins, etc.) or occupying railway buildings without authority of the D.R. or his Staff. No orders should be given to Civil Staff of Railways, unless in case of emergency, except through D.R. or his Staff.

ARMY ORDER No. 6 OF 12TH APRIL, 1900.

As the transmission of non-urgent public and private messages from Railway Telegraph Offices interferes very materially with the Railway Traffic work, the Railway Telegraph system is in future to be used only in cases of emergency.

No telegram, public or private, is to be sent from any Railway Telegraph Office, unless previously countersigned by the Commandant of the Station.

Commandants will be held responsible for the urgency of the messages so sent.

ARMY ORDER No. 8 OF 14TH APRIL, 1900.

Attention is called to A.O. 8, of 24th January, 1900. Any railway property, such as materials, tarpaulins, etc., that has been annexed by Officers Commanding or Heads of Departments without the authority of the D.R. or his Staff, will be at once returned.

FORM OF AUTHORITY FOR INTERRUPTING TRAFFIC.

I.M.R.

Order necessitating interruption of any kind in the ordinary Traffic working of the Railways.

To the Railway Staff Officer,

or

Station Master (if no R.S.O.) _____

or

Guard of Train.

You are directed to _____

 Officer issuing the order.

Station _____

Date _____

This order must invariably be signed and made over to the Railway Staff Officer or Station Master, who will transmit it to Headquarters for the information of the Director of Railways and the Chief of Staff.

Railway Staff Officers, Station Masters or Guards are directed to obtain this order in all cases where Military requirements necessitate interference with ordinary Traffic working, and no interference is permissible or to be allowed except on the written instruction contained in this order.

By Order,

V. MURRAY, *Major, R.E.*,

Asst. Director of Railways.

JOHANNESBERG.

7th July, 1900.

APPENDIX B TO CHAPTER I.

DUTIES OF RAILWAY STAFF OFFICERS.

1. (a). The R.S.O. is appointed to act as the sole channel of communication between the troops and the railway employees, whether civil or military, at his station. Relations with the Railway Staff.

(b). His attention is drawn to the absolute necessity for preserving harmonious relations with the railway staff. It is only by following such a course that the working of the station, in regard to military requirements, can be properly effected.

(c). He must bear in mind that the Station Master, or other official in charge of the station, is solely responsible for the discipline and efficiency of the working staff, whether civil or military. All cases of neglect or disobedience of orders in regard to military requirements, either reported to him or noticed by him, must be reported to the Station Master, who is responsible for rectifying matters. The R.S.O. himself must invariably refrain from personal controversy with any of the subordinate staff. The subordinate staff recognise only the authority of the Station Master, and consequently all instructions the R.S.O. desires to give must be conveyed through the medium of that official.

(d). It must always be remembered that the appointment of the R.S.O. is as much for the purpose of safeguarding the interests of the railway staff as of looking after the interests of the troops. There is always a tendency on the part of troops using or passing through a station to interfere with the working of trains and to give direct orders to the railway staff. This procedure must be at once put down by the R.S.O. with a firm hand; and the working staff, on the other hand, will always be instructed, on receipt of an order otherwise than from the R.S.O., to refer the officer or soldier giving such order to the R.S.O.

(e). Troops travelling will occasionally have complaints to make against the running staff of the train, viz., the guard or driver. In such cases the R.S.O. should forward all complaints to the D.A.D.R. for necessary action and disposal by competent authority.

It must be impressed on the O.C. of a train that the running staff, whether civil or military, must on no account be interfered with; and that the fact of the guard, for instance, being a soldier does not give the O.C. of the train any power over him.

(f). The R.S.O. is, similarly, the medium through whom must pass all railway demands or requirements on the part of military departments or depôts established at his station.

2. The R.S.O. will be in constant communication with the Station Master, and will consult with him on all matters affecting military requirements. He will as a rule follow the course indicated by the Station Master; but, in cases where he considers military requirements necessitate the adoption of a contrary course, he can act upon his own responsibility in directing any particular course to be followed. In such cases he must give his orders in writing in the prescribed form, and at the same time report his action by wire to the D.A.D.R., explaining the reasons thereof. General Duties.

No rule can be laid down for the guidance of the R.S.O. in this respect; but he should bear in mind that, except under the most exceptional circumstances, more favourable results from the military point of view are likely to accrue from a strict adherence to the ordinary rules and regulations for working a railway than from any deviation therefrom.

Similarly in cases where, under the orders of a senior officer, a course is directed to be followed at variance with the necessities of regular working, the R.S.O. must only act after obtaining a written order from such officer to that effect, and must immediately report the matter to the D.A.D.R. In no case, however, must an order be given or acted upon, which, upon the advice of the Station Master, involves danger in working.

Particular attention is drawn to the following extract from the *Queen's Regulations for the Army*, 1899:—

“Para. 1378.—Officers in command of troops moving by railway are responsible that the regulations of the Railway Companies are complied with by the troops, and they are not to interfere with the prescribed running of trains or the general working of the railway service.”

Any infringement of this rule must be immediately reported by the R.S.O. to the D.A.D.R.

3. One of the first and most important duties of a R.S.O., on being appointed to a station, is to thoroughly investigate what facilities are available for entraining and detraining. The success of military moves by rail depends so entirely on the quickness and promptitude with which trains can be loaded and unloaded and got out of the way that the importance of having the necessary facilities ready cannot be over-estimated. The *Queen's Regulations*, 1899 (para. 1402) say that “On service, portable ramps should accompany each horse-train, so as to render possible the detraining of horses and wagons where there is no platform Entraining and Detraining Facilities.

available." At a station, however, this is a most unsatisfactory and slow means of detraining, and the presence of the ramps cannot be depended on. It is most desirable, where such a course is possible, that a platform of the proper height for the purpose should be provided. As regards its length a good deal depends upon the position of the station; but it may be assumed that at all stations where an R.S.O. is necessary an unloading platform of sufficient length to hold, say, six trucks at a time, will be required at some time or other.

At important stations and junctions there should be sufficient platform accommodation to deal with at least two whole trains at one time, and this accommodation should, as a rule, be provided apart from the ordinary station platforms and on separate sidings, which will probably have to be laid down.

The R.S.O. will report fully on all these points to the D.A.D.R., and will at the same time also report on what extra accommodation, if any, is required for service of the various departments. His report should be made in conjunction with the Local Traffic Official of the railway.

The R.S.O. will find the provision of a small kraal or enclosure, in close proximity to one of the off-loading platforms, of valuable assistance to him in releasing animals from trucks.

Delays to Trains.

4. The R.S.O. is responsible for seeing that no trains are delayed for military requirements, except on the written authority of the Station Commandant.

Off-Loading of Trucks
and Watching of
Military Goods Traffic.

5. One of the most important duties of the Railway Staff Officer is to keep a careful watch on the state of his station in regard to military goods traffic. It is essential that trucks consigned to the various departments of the Army should be off-loaded and released as quickly as possible. Not only is the locking up of trucks a serious loss of carrying power, more especially where the number of trucks available is limited, but the blocking of station yards caused thereby is most detrimental to military requirements.

As a rule, at large stations, sidings and accommodation are set apart for the various departmental services,—such as Supplies, Ordnance, Ammunition Park, Engineer Park—into which, as they arrive, the trucks consigned to these departments are placed.

It is the duty of the R.S.O. to see that such trucks are dealt with promptly and released at once. He should arrange for a daily statement to be submitted to him, showing the individual numbers of all trucks, whether loaded or empty, standing in the various departmental sidings; and he should immediately take up with the departments concerned any cases of trucks standing under load for more than twelve hours, reporting, if necessary, to the D.A.D.R.

It should be most exceptional for a truck to appear as "under load" in more than one return.

The R.S.O. should obtain a daily statement from the Station Master, showing what military traffic is at the station, which cannot be placed in the military depôt sidings owing to the latter being blocked. He should arrange with the Station Master to be constantly kept advised on this point; and, in cases where supplies and other material are coming in faster than they can be dealt with, he should immediately communicate with the D.A.D.R. so that the necessary steps can be taken to rectify matters.

When, owing to the blocked state of the sidings and yard, immediate action is necessary, the R.S.O. has full authority to arrange himself for the off-loading of any consignment whatsoever in any place he may select; but, if the instructions previously given are carefully adhered to, such a course will rarely be necessary.

The R.S.O. will find that numerous consignments, generally of baggage and kit, will arrive at his station for units no longer there. When he is unable to forward such consignments by rail to the units concerned, he should either arrange with the A.O.D. to take them over or else arrange for a baggage store himself. In any case the trucks must not be allowed to stand under load.

The R.S.O. will be provided with a permanent fatigue party to carry out such duties as are indicated above.

It is essential that supply and other military traffic should be carefully watched at a time when large troop movements by rail are taking place. It will be found that it is invariably at this time that the tendency for the station to get blocked occurs, and a clear station at such a period is of incalculable value in facilitating and expediting a big move.

- (a). (i.). A frequent and most important cause of congestion and delay, which seriously affects the military efficiency of the railway, is the forwarding of great quantities of supplies and material to stations which have no facilities for dealing with such quantities. It is noticed that this takes place without considering what accommodation the destination station has for dealing with a large number of trucks, how the trucks will reach their destination, or how the trucks will be off-loaded or dealt with when they arrive.
- (ii.). To avoid this it is absolutely necessary that the R.S.O. should keep in constant touch with the Supply and other despatching Officers. The latter, on receipt of an order to send on large quantities of supplies or stores, will immediately obtain from the R.S.O. information as to what number of

trucks can conveniently be dealt with per diem at the proposed station of destination, and such number only will be loaded or re-consigned and forwarded. The R.S.O. will obtain the required information from the D.A.D.R. or through the Station Master at his station.

(iii.) In connection with this subject R.S.O.s must always bear in mind that urgent orders for supplies are not intended as a rule to be complied with so literally as to cause disorganisation. Such orders are generally only for the purpose of filling up reserves, and as such can be completed gradually. In special cases, when matters are really urgent, such as the forwarding of a large quantity of supplies for an outgoing convoy or column, special advice will be given to the R.S.O. and special railway arrangements will be necessary.

(b). When supplies and other stores are once off-loaded at a station other than a main dépôt, the R.S.O. must not arrange for trucks to be supplied for such stores to be reloaded except upon the authority of the D.A.D.R.

6. The particular attention of R.S.O.s is drawn to the following circular which was issued by the German Headquarter Staff to their R.S.O.s during the war of 1870-71. It summarises very completely the duties and the responsibilities of R.S.O.s:— German Orders.

“In order to cope successfully with the numerous obstacles and difficulties which have so far made it impossible to carry out in a regular manner military moves by rail, Railway Staff Officers are requested to give us their assistance and their most effective co-operation, especially under the two following circumstances:—

“I. In all matters which conduce to the preservation of free circulation within stations, and particularly at those where the principal detrainments take place. On arrival at destination, all trains, whether of troops, supplies or material, must be unloaded as quickly as possible, in order that the empty trains can be taken away and other arriving trains allowed to enter the station. This is the one essential condition for the maintenance of a regular train service, and infractions of this fundamental rule have been the principal cause of all the irregularities and interruptions, as well as the blocks, which have occurred.

“The Railway Staff Officer who, not recognising the importance of the above condition, does not devote the greatest energy and the strictest diligence to carrying out the duties which devolve on him incurs the gravest responsibility.

“II. In all matters which conduce to the maintenance of military discipline within the stations, and to the correct and punctual despatch of trains.

“*The most serious delays, sometimes even the cancellation of entire trains*, have been, in many cases, the consequence of troops not being ready in good time, of their entrainment not being carried out with the necessary promptitude, or of halts at stations while *en route* being prolonged unnecessarily and contrary to pre-arrangements, owing to various actions caused by the troops.

“Station Inspectors have received orders to start trains punctually, and to adhere carefully to the time tables.

“To carry these orders out they must in a great measure depend on the co-operation of the Railway Staff Officers, and this co-operation must be given without fail.

“The Railway Staff Officer is the intermediary between the troops and the railway staff, whose interests and duties he must safeguard. It is absolutely necessary that either he or his Assistant should be present at the departure and arrival of all trains, to see that no delay takes place and to use his power and take the necessary steps according to circumstances.

“All other considerations must be subordinate to the maintenance of the time table. No delay, for example, must be allowed on the pretext that the troops have not finished their meals. In case of the halt being too short, the rations should be distributed to the men for consumption while travelling; or, better still, arrangements should be made for the meal to take place at a station where the halt is more suitable. Besides, it would be showing misplaced sympathy if the train was stopped to remedy neglect, oversight or carelessness on the part of the troops.

“The length of halts should be notified; the warning of departure should be given in good time. In short nothing should be left undone, on these points, in all which concerns the troops. But, on the other hand, the train must be started punctually and according to traffic requirements.

“If under these circumstances someone or something is left behind, the fault will rest with the Officer Commanding the troops; while, if the Railway Staff Officer allows too great leniency, he exposes himself to grave blame.”

TROOP MOVEMENTS.

Troop Movements.

7. (a). The following procedure must be followed by the R.S.O. when troop movements, necessitating the provision of special trains or of special accommodation not already available at his station, are required.

(b). Immediately on receipt of the order for the move, the R.S.O. must obtain full information as to the strength of troops to be moved, in :—

- | | |
|-------------------------|-------------------------------|
| I. Personnel. | IV. Guns. |
| II. Animals. | V. Wagons—Ox, Mule, or other. |
| III. Carts { 2-Wheeled. | VI. Supplies. |
| { 4-Wheeled. | |

and as to the order in which it is desired the move is to be carried out.

If the order has been received other than through the medium of the D.A.D.R., the R.S.O. will immediately acquaint the latter officer by wire with what has been ordered, and will advise him what he proposes doing.

(c). Having done this, the R.S.O. will, *at stations where engines are available*, at once arrange with the Station Master for the carrying out of the move in accordance with any special instructions he may receive from the D.A.D.R.

(d). *At stations where no engines are available* the R.S.O. will at once communicate the information referred to in paragraph (b) to the D.A.D.R. and to the R.S.O. of the nearest station where engines are stabled, at the same time stating what stock, if any, is available at his station. He should also, after consulting with the Station Master at his station, state at what intervals he requires trains to be sent to him, bearing in mind the importance of not blocking the station or the line with trains he cannot promptly utilise and despatch. The R.S.O. of the station which he advises will then be responsible for seeing that trains are sent to him, made up as far as possible to meet his requirements and in accordance with any special instructions issued by the D.A.D.R.

For small moves of this nature, the R.S.O. will ask the Station Master to arrange for the necessary stock and to clear it after being loaded; but he will keep both the R.S.O. of the nearest large station where engines are stabled and also the D.A.D.R. advised of his requirements.

(e). It will often be impossible to supply stock of the exact description and in the exact order asked for. In such cases the R.S.O. must arrange with the O.C. Troops to alter the order of despatch, so that the train accommodation provided is fully utilised.

(f). A certain proportion of *personnel* must invariably accompany wagons and animals. The arrival at their destination of trains, loaded with wagons or live stock and unaccompanied by men in sufficient numbers to promptly off-load them, causes serious delay.

(g). Every endeavour must be made to utilise every available cubic inch of carrying capacity.

(h). If the R.S.O. sees that delay is likely to take place in loading up, he must, in conjunction with the Station Master, exercise his judgment as to altering the composition of trains or despatching them underloaded; but this latter course it should be rarely necessary to adopt.

(i). The R.S.O. will keep the D.A.D.R. fully advised of all arrangements made and of the progress of the move.

(j). The R.S.O. at the detraining station is responsible for seeing that, immediately the train arrives, detrainments are carried out as quickly and promptly as possible. Except under special orders, all carriages and trucks must be vacated at once.

(k). At stations where limited platform accommodation is available, it will often be found more convenient to do the shunting of the trucks, both for live stock and wagons, by hand. For this purpose the O.C. Troops should be called upon to furnish a fatigue party.

(l). As moves are often required to take place at stations where insufficient or no loading and unloading facilities exist, R.S.O.s must be prepared to arrange for temporary platforms and ramps, both for entraining and detraining, if the work is thereby likely to be facilitated. For this purpose they should call upon the Commandant or O.C. Troops for assistance. With sleepers or rails a temporary platform, sufficient for the purpose, can be built with unskilled labour in a very short time.

Railway Buildings.

8. The R.S.O. is responsible for seeing that no railway buildings of any kind at his station are occupied by troops, except with his express permission. Before giving such permission he must satisfy himself, in conjunction with the Station Master or other responsible official, that such buildings can be spared, and he should then obtain the approval of the D.A.D.R. Intending occupants of such buildings should always be warned that they are liable to ejection at short notice on the buildings being again required for railway purposes.

Railway Material.

9. The R.S.O. is responsible that no railway material is utilised by the troops, except with the permission of the D.A.D.R.

Civil Traffic.

10. In working railways in an enemy's country or in a country under martial law, no civil traffic, whether passenger or goods, will as a rule be carried, except under the authority of some authorised officer (the Station Commandant or Military Governor). This authority

will be addressed to the R.S.O., who will give the necessary authority to the working staff of the railway to accept the goods or book the passenger. All such traffic will be carried only on payment of the usual rates, unless carriage at Government expense is authorised.

11. The R.S.O. must advise the R.S.O. of the next important station of all troops leaving his station by rail. It will also be necessary, as a rule, for the R.S.O. of each engine-changing or large station to advise the R.S.O. of the next similar station of the composition and contents of each train as it leaves. Notice of Troop Trains.

12. If the running staff of any train make any report to the R.S.O., or if he otherwise hears, of the presence of the enemy on the line, he will at once take the orders of the Commandant as to the advisability of stopping or suspending traffic. Traffic will not be stopped except under the orders of the Commandant. Presence of Enemy on the Line.

13. The R.S.O. will at once communicate to the D.A.D.R. full particulars of any circumstances or orders affecting traffic or suspending it in any way; and will also keep him informed of any incident of railway interest which may come to his notice. This information must also be sent at once by wire to the A.D.R. with Army Headquarters. General Advices.

14. (a). The R.S.O. will direct all movements of troops on his section. Other General Duties.

(b). He will arrange for a "Field of Assembly" in the vicinity of, but clear of, the railway premises. This field should be supplied with watering arrangements, if possible. Such watering arrangements should be kept entirely clear of the station.

(c). He will meet troops both on arrival and departure, and lead them to the "Field of Assembly" or entraining platform, as the case may be. He will allot to the different arms, horses, vehicles, baggage, etc., their respective carriages or trucks.

(d). It will be his duty to give all assistance to the troops travelling by rail, and to generally carry out the provisions of the *Queen's Regulations* as far as they may be applicable.

(e). On due notice being sent, the R.S.O. will arrange for rations to be drawn and cooked in anticipation of the arrival of troops, taking care that the ration return is duly rendered by the Commanding Officer to replace the temporary receipt that will have to be given by him to the Commissariat Department.

(f). The R.S.O. at the entraining station will notify all R.S.O.s at stations where the troops will stop for refreshments of the despatch of the troop train. Further, each R.S.O. along the line will wire to the next, informing him that the troop train has left his station.

(g). He will be the medium for passing instructions from the civil railway authorities to the troops regarding the loading or unloading of trucks.

(h). On arrival of troop trains at halting places he will inform the O.C. of the duration of the stoppage, and give him due notice of the re-starting of the train, the order for which will be given by the Station Master after consultation with the R.S.O.

(i). He will requisition upon the Station Commandant daily for such fatigue parties and military police as he may require, and assist the Station Commandant on all questions of defence of the station, line and train.

(j). He will have water boiling, in the pots issued for the purpose, ready for the troops on arrival.

(k). He will endeavour to arrange with refreshment contractors to have milk, butter, vegetables, etc., for sale to the troops.

15. At stations where no R.S.O.s are posted, the Commandant will be responsible for carrying out these instructions, so far as they may be applicable at any time. Commandants to Act where no R.S.O.

By Order,

V. MURRAY, *Major,*
Assistant Director of Railways.

PRETORIA.

12th October, 1900.

APPENDIX C TO CHAPTER I.

INSTRUCTIONS IN REGARD TO NIGHT RUNNING
AND PATROLLING OF LINES PRIOR TO THE DESPATCH OF TRAINS.

Night Running.

1. Night running is not permissible on any section of the I.M.R. in the O.R.C. and Transvaal, subject to the exceptions noted in paragraphs 2 and 3.

2. Under special instructions, Commandants will give order to the R.S.O. or Station Master, as the case may be, for any trains to run by night ; but trains running either by day or night are at all times liable to be stopped by Commandants in view of local danger on the sections adjacent to their stations.

3. On certain small sections, close to important stations, night running is generally permissible, subject to being suspended at any time by order of the Commandant concerned in view of local danger.

Such sections will be advised locally from time to time by the A.D.R.

4. When trains are running at night under the authority of paragraph 2, the R.S.O. of the last large station which the train leaves will advise by wire all Commandants forward to the next large station that such is the case ; and at intermediate stations the Station Master will advise the Commandant at his station similarly.

5. When trains are stabling out of course for the night the R.S.O. or Station Master will advise the Commandant that such is the case.

6. Other than as mentioned in paragraph 1, no trains are to run after 7 p.m. until daylight and until permission has been given by the Commandant to the R.S.O. (or Station Master where no R.S.O. is posted) that traffic may be resumed.

7. The Station Master will be responsible that no train leaves his station in the morning until he has received permission (through the R.S.O., if there is one) from the Commandant that traffic may be resumed.

8. The Station Master will (through the R.S.O., if there is one) keep the Commandant advised of any reports he may receive from the running staff of any train, or through any other source, in regard to the presence of the enemy.

Patrolling Line.

9. When possible, in addition to the Commandant giving the requisite permission to resume traffic as required by paragraph 6, the line will be reported in running condition in the morning by Gangers to Station Masters before a train is started ; but, as in many cases this would seriously delay traffic, trains should not be delayed on this account. The running staff, however, of the first train leaving a station in the morning must be warned to go cautiously and to keep a very careful look-out for any danger or signals from Gangers.

10. The Supt. of Works has issued special instructions in regard to patrolling by Gangers.

11. As it is of the utmost importance to get the traffic through, it must be clearly understood that these rules are not intended to cause detention to trains pending the line being reported intact and the neighbourhood clear, save in exceptional cases where certain danger is apprehended ; in all such cases the Commandant alone will be the judge.

12. It must also be understood that the Railway Staff, and not the Commandant, are responsible for the actual condition of the railway line, and that the Ganger's services are not normally at the disposal of the Commandants for the purpose of patrolling.

APPENDIX D TO CHAPTER I.

INSTRUCTIONS FOR OFFICERS AND MEN TRAVELLING BY TRAIN.

(EXTRACT FROM ARMY ORDERS).

1. All officers and men travelling by train *on all occasions* must be properly armed.
2. The senior officer travelling on a train is responsible for its defence if attacked.
3. For this purpose every officer travelling should satisfy himself whether he is the senior officer on the train or not.
4. The senior officer on the train should see that the men travelling by the train have their rifles handy, and that one or two men are detailed to keep a look-out.
5. It has been lately noticed that the enemy, when they attempt the capture of a train, ride up behind the train, when it is slowly going up a grade, and detach the vacuum hose from the rear of the break van. They then open fire along both sides of the train to prevent anyone getting out.
6. To avoid this, a truck is attached to the rear of each train, with the vacuum hose disconnected. If any troops are travelling on the train, the senior officer should see that some of them are posted, if possible, on the rear truck.
7. Engine drivers have instructions to blow a long blast on the bass whistle, if they have reason to think that anything is wrong. Troops should be instructed to stand to arms on hearing this warning.
8. When a delay occurs at any Post on the line, the senior officer on the train will report personally to the Commandant of the Post.

By Order,

KITCHENER OF KHARTOUM, *Chief of Staff.*

JOHANNESBERG.

November 27th, 1900

APPENDIX E TO CHAPTER I.

MOVEMENT OF TROOPS ON I.M.R., BETWEEN 30. 1. 01 AND 8. 2. 01,
TO REPEL INVASION OF CAPE COLONY.

SUMMARY.

During the period 31. 1. 01 to 8. 2. 01 inclusive (9 days), 89 troop trains were despatched from Bloemfontein, containing 315 officers, 8,980 men, 7,632 horses, 6,810 mules, 47 guns and 373 trucks of oxen and wagons. Of this number the following were entrained at Bloemfontein:—90 officers, 2,814 men, 330 trucks horses, 160 trucks mules, 20 guns, 330 trucks oxen and wagons; the remainder arrived from the north in 27 trains, during the period 30. 1. 01 to 3. 2. 01 inclusive. They all proceeded south to Cape Colony. A serious block to these trains occurred at Norval's Pont, owing to a flood washing the line away.

At the same time General Bruce Hamilton's force was entrained at Smalldeed and Winburg in about 40 trains in two days, and detrained at Bloemfontein on 30. 1. 01.

At Bloemfontein, therefore, between 30. 1. 01 and 8. 2. 01 inclusive, the contents of 40 troop trains were off-loaded; at the same time the troops mentioned above entrained and proceeded south, or passed through from north to south, whilst a certain amount of Supply traffic was passing through from south to north.

There was therefore an enormous amount of work at Bloemfontein to prevent an absolute block and to carry out the programme speedily.

IMPERIAL MILITARY RAILWAYS.

(1). DETAILS OF TROOP TRAINS ARRIVING AT AND DEPARTING FROM BLOEMFONTEIN BETWEEN 30. 1. 01 AND 8. 2. 01 INCLUSIVE.

(a). DEPARTURES.

Date.	No. of Trains.	Officers.	Men.	Trucks, Horses.	Trucks, Mules.	Guns.	Trucks, Wagons, and Oxen.
30. 1. 01	1	10	491	2	2	—	—
31. 1. 01	8	36	1041	56	73	8	22
1. 2. 01	22	96	2486	126	27	14	43
2. 2. 01	17	91	2810	238	37	6	—
3. 2. 01	9	21	517	60	79	5	24
4. 2. 01	10	21	587	120	27	7	48
5. 2. 01	8	2	70	24	—	—	157
6. 2. 01	8	25	450	34	80	2	40
7. 2. 01	3	3	116	14	15	—	39
8. 2. 01	3	10	402	38	—	5	—
Totals ...	89	315	8980	712	340	47	373

(b). ARRIVALS.

Date.	No. of Trains.	Officers.	Men.	Trucks, Horses.	Trucks, Mules.	Guns.	Trucks, Wagons, and Oxen.
30. 1. 01	9	102	2052	186	41	9	21
31. 1. 01	7	33	1101	56	73	8	—
1. 2. 01	6	52	1450	81	56	4	22
2. 2. 01	2	29	1334	26	10	2	—
3. 2. 01	3	9	229	31	—	4	—
Totals ...	27	225	6166	382	180	27	43

(2). TROOP MOVE FROM TRANSVAAL AND ORANGE RIVER COLONY TO SOUTH IN DECEMBER, 1900.

Date.	Journey.	Trains	Trucks.
December 18 ...	Viljoen's Drift ...	2	52
„ „ ...	Ventersberg Road ...	1	35
„ 19 ...	Bloemfontein ...	13	340
„ „ ...	Ventersberg Road ...	5	133
„ 20 ...	Bloemfontein ...	10	267
„ 21 ...	Brandfort ...	1	23
„ 22 ...	Viljoen's Drift ...	1	32
„ „ ...	Kroonstad ...	2	67
„ 23 ...	Ventersberg Road ...	2	63
„ „ ...	Bloemfontein ...	3	60
„ 24 ...	Krugersdorp ...	5	134
„ „ ...	Bloemfontein ...	3	50
„ 26 ...	Ventersberg Road ...	1	16
„ „ ...	Potchefstroom ...	1	16
„ 27 ...	Bloemfontein ...	1	17
	To Norval's Pont	52	1305

APPENDIX F TO CHAPTER I.

EXTRACTS FROM COMMANDER-IN-CHIEF'S DESPATCH OF 8. 3. 01,
SHOWING USE MADE OF RAILWAY.

INVASION OF CAPE COLONY AT END OF NOVEMBER, 1900.

"On the intention of De Wet becoming apparent, the following troops were despatched by rail from the Transvaal to reinforce Maj.-Gen. C. Knox (on the Orange River line) and to strengthen the hands of Maj.-Gen. MacDonald, whom I despatched to take command of Aliwal North:—

- 1st M.I.
- 2nd Brabant's Horse.
- Strathcona's Horse.
- "M" Battery, R.H.A.
- 2 Guns, 86th Battery, R.F.A.
- 4 Guns, 85th Battery, "
- 1st Batt. Suffolk Regiment.
- 1st Batt. Connaught Rangers.

"On the 2nd and 3rd December Gen. C. Knox, who had already been joined by some of these reinforcements, had an obstinately contested engagement with the enemy east of Slick Spruit, in the vicinity of Good Hoop Farm, which resulted in the retirement of Gen. De Wet in a north-easterly direction."

De Wet was headed off and retired northwards.

"To endeavour to debar De Wet's further retreat north, I had two days previously moved out Thorneycroft's M.I. under Lieut.-Col. Thorneycroft, Royal Scots Fusiliers, and the South African Light Horse under Lieut.-Col. Byng, 10th Hussars, (which corps had been railed to Bloemfontein from Standerton and Volksrust respectively) to strengthen the Thabanchu-Ladybrand line, and these troops were in position there on 10th December."

"On the morning of 14th December Col. Thorneycroft, who had been apprised of the approach of the Boer Commandos from the direction of De Wetsdorp, engaged the enemy midway between Thabanchu and Ladybrand, and, though checking the efforts of their advanced parties to penetrate his line, was ultimately unable, owing to the extent of front necessarily occupied, to prevent the Boers breaking through to the north."

On December 16th, Kritzinger succeeded in crossing into the Colony.

"To meet these inroads it became necessary to send large bodies of troops into the Colony, and the columns under Lieut.-Cols. Thorneycroft, Byng, Williams, Sir C. Parsons, and De Lisle, all operating in the O.R.C., were marched to the railway and entrained for Naauwpoort Junction, whence they followed the march of the invaders southward.

"Additional troops, including the 7th Dragoon Guards under Lieut.-Col. Lowe, with 2 R.H.A. guns and the 1st Brabant's Horse, were also despatched by rail from the Transvaal to Cape Colony."

After concentrating in the Doornberg, north-east of Winburg, De Wet started south for a second attempt on Cape Colony, passing between the columns of Gens. Knox and Hamilton.

"Gen. Bruce Hamilton's troops, though much delayed by a continuous downpour of rain, which turned the country into a quagmire, were marched with all possible haste into Winburg and Smaldeel, to be entrained for Bloemfontein with the object of intercepting De Wet on the Bloemfontein-Ladybrand line. Owing to the serious delays caused by bad weather this scheme proved unsuccessful. On the night of the 30th De Wet, disengaging himself from the pursuit of Gen. C. Knox, who was hampered by transport difficulties, and anticipating Gen. Bruce Hamilton in spite of the latter's forced march from Bloemfontein, effected his purpose, crossing the Bloemfontein-Thabanchu line near Israel's Poort.

"De Wet now trekked rapidly southward, outpacing our troops; and it became evident that his mobility would enable him to enter Cape Colony, unless he was headed off by a rapid concentration of our troops by rail on the line of the Orange River.

"Accordingly I recalled Gens. C. Knox and Bruce Hamilton to Bloemfontein for entrainment to Bethulie, and brought the troops under Gens. Paget and Plumer from Balmoral and Brugspruit by rail to Naauwpoort. I also transferred the Essex Regiment from Wonderfontein in the Eastern Transvaal to Norval's Pont, and the Royal Fusiliers (which replaced the Royal Munster Fusiliers in Gen. Paget's Force) from Brugspruit to Rosmead Junction.

"The withdrawals of Gens. C. Knox and Bruce Hamilton from the close pursuit of De Wet permitted his commandos to pause in the De Wetsdorp district; and when these resumed their march towards the Orange River east of the railway, De Wet found his way so strongly blocked on this side by the troops which had only shortly before been driving him south that he gave up the attempt to cross the river east of Norval's Pont, and on the night of the 4th February began to cross the railway line near Pompei Siding, moving west."

APPENDIX G TO CHAPTER I.

MOVEMENT OF TROOPS BETWEEN 5. 9. 01 AND 11. 10. 01, TO REPEL
INVASION OF NATAL.

<p>COL. GARRETT'S COLUMN. 80 officers. 1,373 other ranks. 1,191 horses. 750 mules. 600 oxen. 117 trucks of wagons.</p>	<p>Total No. of trains—12.</p> <p>1st train left Vereeniging 12.20 p.m., 5th September. 12th " " " 1.0 a.m., 8th " "</p> <p>1st train arrived Paardekop 8.45 a.m., 6th September. 12th " " " 7.45 p.m., 8th " "</p>
<p>GEN. BRUCE HAMILTON'S COLUMN. 85 officers. 1,901 other ranks. 1,934 horses. 1,100 mules. 7 guns. 36 oxen. 64 wagons.</p>	<p>Total No. of trains—14.</p> <p>1st train left Springfontein 11.30 a.m., 8th September. 14th " " " 1.20 p.m., 12th " "</p> <p>N.B.—1st, 2nd and 14th trains detained at Heilbron, remainder at Vredefort Road.</p> <p>1st train arrived Heilbron 8.0 p.m., 9th September. 14th " " " 1.30 a.m., 15th " "</p>
<p>COL. PULTENEY'S COLUMN. 38 officers. 793 other ranks. 948 horses. 214 mules. 20 carts. 20 trucks of wagons.</p>	<p>Total No. of trains—8.</p> <p>1st train left Newcastle 12.30 a.m., 9th September. 8th " " " 3.45 p.m., 9th " "</p> <p>1st train arrived Volksrust 5.40 a.m., 9th September. 8th " " " 4.10 a.m., 10th " "</p>
<p>GOUGH'S MOUNTED INFANTRY. 14 officers. 524 other ranks. 644 horses. 242 mules. 62 oxen. 16 trucks of wagons.</p>	<p>Total No. of trains—4.</p> <p>1st train left Kroonstad 5.0 p.m., 10th September. 4th " " " 3.0 a.m., 11th " "</p> <p>1st train arrived Dundee 5.45 p.m., 12th September. 4th " " " 10.30 p.m., 12th " "</p>
<p>GEN. ALLENBY'S COLUMN. 44 officers. 1,474 other ranks. 1,280 horses. 630 mules. 8 guns. 18 trucks of wagons.</p>	<p>Total No. of trains—16.</p> <p>1st train left Pretoria 5.50 p.m., 16th September. 16th " " " 7.5 a.m., 18th " "</p> <p>1st train arrived Newcastle 12.45 a.m., 18th September. 16th " " " 8.25 a.m., 19th " "</p>
<p>53RD BATTERY, FIELD ARTILLERY. 4 officers. 153 other ranks. 6 guns.</p>	<p>Total No. of trains—2.</p> <p>1st train left Pretoria 2.30 p.m., 16th September. 2nd " " " 12.50 p.m., 17th " "</p> <p>1st train arrived Volksrust 7.40 p.m., 17th September. 2nd " " " 7.30 a.m., 18th " "</p>
<p>2ND BATT. SCOTTISH RIFLES. 27 officers. 880 other ranks. 135 horses and mules. 16 wagons.</p>	<p>Total No. of trains—2.</p> <p>1st train left Springs 4.30 p.m., 18th September. 2nd " " " 8.30 p.m., 18th " "</p> <p>1st train arrived Newcastle 6.30 p.m., 19th September. 2nd " " " 11.50 p.m., 19th " "</p>
<p>YORKSHIRE REGIMENT. 16 officers. 434 other ranks. 4 horses. 47 mules.</p>	<p>Total No. of trains—2.</p> <p>1st train left Pretoria 8.50 p.m., 18th September. 2nd " " " 9.10 p.m., 18th " "</p> <p>1st train arrived Ladysmith 11.0 a.m., 20th September. 2nd " " " 12 noon, 20th " "</p>
<p>COL. GARRETT'S COLUMN. 25 officers. 650 other ranks. 355 horses. 130 mules. 12 wagons.</p>	<p>Total No. of trains—5.</p> <p>1st train left Volksrust 8.40 p.m., 19th September. 5th " " " 4.25 p.m., 19th " "</p> <p>5 trains arrived Newcastle and detained by 12 noon, 20th September.</p>

MOVEMENT OF TROOPS (continued).

<p>GEN. SPENS' COLUMN. 62 officers. 1,298 other ranks. 1,191 horses. 950 mules. 6 guns. 78 trucks of wagons.</p>	<p>Total No. of trains—10.</p> <p>1st train left Kroonstad 8.55 a.m., 19th September. 10th " " " 9.45 a.m., 20th "</p> <p>1st train arrived Dundee 2.30 a.m., 21st September. 10th " " " 6.15 p.m., 22nd "</p>
<p>NATAL MOUNTED RIFLES. 7 officers. 118 other ranks. 130 horses.</p> <p>NATAL FIELD ARTILLERY. 3 officers 67 other ranks. 60 horses. 2 guns.</p>	<p>Left Durban 19th September; arrived Pietermaritzberg 9 p.m., 19th September.</p>
<p>COL. DU MOULIN'S COLUMN. 27 officers. 688 other ranks. 1,217 horses and mules. 3 guns.</p>	<p>Total No. of trains—5.</p> <p>1st train left Springfontein 12 noon, 20th September. 5th " " " 6.25 a.m., 21st "</p> <p>5 trains arrived Bloemfontein by 12 noon, 21st September.</p>
<p>GEN. GILBERT HAMILTON'S COLUMN. 47 officers. 1,650 other ranks. 1,100 horses. 650 mules. 54 wagons.</p>	<p>Total No. of trains—12.</p> <p>1st train left Klerksdorp 10.30 a.m., 20th September. 12th " " Potchefstroom 9.45 a.m., 23rd "</p> <p>2nd and 3rd trains both broke down between Bank and Krugersdorp; delayed 2 hours. 2nd train derailed between Zandspruit and Paardekop; 22 hours delay. 1 engine and 18 trucks derailed; six persons injured; 25 horses killed, 30 injured.</p> <p>1st train arrived Dundee 12.45 a.m., 23rd September. 12th " " " 10.15 p.m., 24th "</p>
<p>CAMERON HIGHLANDERS. 10 officers. 344 other ranks.</p>	<p>Left Pretoria 3.50 p.m., 20th September. Arrived Dundee 3.0 p.m., 22nd "</p>
<p>GEN. SIR H. RAWLINSON'S COLUMN. 77 officers. 1,605 other ranks. 2,740 horses and mules.</p>	<p>Total No. of trains—13.</p> <p>1st train left Aliwal North 7.30 p.m., 21st September. 13th " " Burghersdorp 5.45 p.m., 23rd "</p> <p>3 trains loaded at Aliwal North; remainder at Burghersdorp. Last 3 trains detained at Heidelberg; move delayed owing to suspension of night running north of Bloemfontein by order of Gen. Knox.</p> <p>1st train arrived Elandsfontein 3.0 p.m., 23rd September. 13th " " Heidelberg 1.0 a.m., 26th "</p>
<p>BLACK WATCH. 6 officers. 290 other ranks.</p>	<p>Left Bloemfontein 2.25 p.m., 23rd September. Arrived Ladysmith 2.0 a.m., 26th "</p>
<p>NATAL MOUNTED RIFLES. General Depôt Composite Battalion. 9 officers. 166 other ranks. 156 horses and mules.</p>	<p>Total No. of trains—3.</p> <p>1st train left Pietermaritzberg 2.30 a.m. 3rd " " " 4.30 a.m.</p> <p>3 trains arrived Greytown, 23rd September.</p>
<p>GEN. W. KITCHENER'S DETAILS. GEN. ELLIOTT'S DETAILS. 26 officers. 745 other ranks.</p>	<p>1st portion left Middelberg, 22nd September. Last portion arrived Volksrust, 24th "</p>
<p>IMPERIAL LIGHT HORSE. 26 officers. 459 other ranks. 443 horses. 250 mules. 23 wagons.</p>	<p>Total No. of trains—5.</p> <p>1st train left Harrismith 7.0 a.m., 25th September. 5th " " " 11.0 p.m., 25th "</p> <p>1st train arrived Dundee 9.0 p.m., 25th September. 5th " " " 3.10 a.m., 26th "</p>

IMPERIAL MILITARY RAILWAYS.

MOVEMENT OF TROOPS (*continued*).

<p>NATAL CARBINEERS. 3 officers. 62 other ranks. 85 horses and mules.</p>	<p>Left Pietermaritzberg 9 30 a.m., 26th September. Arrived Greytown 5 30 p.m., 26th "</p>
<p>SCOTS GUARDS. 22 officers. 825 other ranks. 121 horses and mules.</p>	<p>1st portion left Potchefstroom 9.30 a.m., 24th September. Last portion arrived Volksrust 9.20 a.m., 29th "</p>
<p>GEN. PLUMER'S DETAILS. 5 officers. 328 other ranks. 16 horses. 7 officers. 554 other ranks. 380 horses.</p>	<p>Left Springfontein 4.30 a.m., 25th September. Arrived Bloemfontein 10.30 a.m., 25th " 1st train left Kroonstad 12.30 p.m., 1st October. 2nd " " " 5.25 p.m., 1st " 1st train arrived Volksrust 10.0 p.m., 2nd October. 2nd " " " 11.50 p.m., 2nd "</p>
<p>WEST YORKSHIRE REGIMENT. 21 officers. 717 other ranks. 216 horses and mules.</p>	<p>1st portion left Fredrickstad 2.25 p.m., 26th September. Last portion arrived Volksrust 4.30 p.m., 29th "</p>
<p>IMPERIAL LIGHT HORSE. 3 train loads of men, horses, mules and wagons. 2 train loads do.</p>	<p>Left Glencoe Junction 27th September. Left Pietermaritzberg 27th " Last train left Durban for Tugela 29th "</p>
<p>DURHAM AND EDINBURGH GARRISON ARTILLERY MILITIA. 4 officers. 115 other ranks.</p>	<p>Left Ladysmith 5.50 a.m., 27th September, for Volksrust.</p>
<p>OX TRANSPORT. 180 ox wagons. 2,880 oxen.</p>	<p>1st portion left Middelberg 7.15 a.m., 26th September. Last " " " 4 0 p.m., 30th " Last portion arrived Volksrust 4 30 p.m., 2nd October.</p>
<p>COMPOSITE INFANTRY BATTALION. AMMUNITION COLUMN. VOLUNTEER MEDICAL STAFF. 10 officers. 400 other ranks. 43 horses and mules.</p>	<p>Left Pietermaritzberg in 3 trains for Greytown on 28th September.</p>
<p>DRAFTS, EX-S.S. <i>Lake Erie</i>. 15 officers. 525 other ranks.</p>	<p>Left Durban at 4.20 p.m. and 6.0 p.m., 27th September. Arrived Pietermaritzberg at 12.30 a.m. and 1.30 a.m., 28th September.</p>
<p>AMMUNITION COLUMN. FIELD HOSPITAL. BORDER MOUNTED RIFLES. 2 officers. 20 other ranks. 190 horses and mules.</p>	<p>Left Pietermaritzberg in 3 trains for Greytown on 28th September.</p>
<p>BLACK WATCH. 4 officers 183 other ranks. 22 horses and mules. 4 carts.</p>	<p>Left Ladysmith 8.50 p.m., 29th September. Left Durban 2.45 p.m., 30th September, for Tugela.</p>
<p>21ST BATTERY, FIELD ARTILLERY. 1 officer. 38 other ranks. 70 horses and mules. 2 guns.</p>	<p>Left Pietermaritzberg in 3 trains 30th September, 1st October. Left Durban 1st October, for Tugela.</p>

MOVEMENT OF TROOPS (*continued*).

<p>ROYAL IRISH FUSILIERS. "S" POM-POM SECTION. 83RD BATTERY, FIELD ARTILLERY. ROYAL ENGINEERS. 16 officers. 406 other ranks. 208 horses and mules. 80 oxen. 24 wagons. 3 guns.</p>	<p>Total No. of trains—2.</p> <p>1st train left Newcastle 1.10 p.m., 30th September. 2nd " " " 3.35 p.m., 30th " "</p> <p>1st train arrived Dundee 5.30 p.m., 30th September. 2nd " " " 10.0 p.m., 30th " "</p>
<p>COL. BETHUNE'S COLUMN. 63 officers. 839 other ranks. 1,342 horses. 1,374 mules. 2 guns. wagons.</p>	<p>Total No. of trains—9.</p> <p>1st train left Harrismith 1.45 p.m., 30th September. 9th " " " 5.0 a.m., 2nd October.</p> <p>1st train arrived Durban 8.0 p.m., 1st October 9th " " " 3.25 p.m., 4th " "</p>
<p>BLACK WATCH. 11 officers. 319 other ranks. 6 trucks of horses and mules. 4 trucks of wagons.</p>	<p>Left Kroonstad 12.30 p.m., 1st October. Arrived Dundee 9.30 p.m., 2nd " "</p>
<p>COL. DAMANT'S COLUMN. 15 officers. 405 other ranks. 970 horses and mules. 40 trucks of wagons.</p>	<p>Total No. of trains—4.</p> <p>1st train left Bloemfontein 1.50 p.m., 2nd October. 4th " " " 6.45 a.m., 3rd " "</p> <p>1st train arrived Heilbron 10.30 a.m., 3rd October. 4th " " " 8.0 a.m., 4th " "</p>
<p>DRAFTS, EX-S.S. <i>St. Andrew</i>. 1 officer. 250 other ranks.</p>	<p>Left Durban 6.5 p.m., 2nd October. Arrived Dundee 9.15 a.m., 4th " "</p>
<p>GEN. PLUMER'S FORCE. Details { 4 officers. 260 other ranks. Column { 45 officers. 618 other ranks. 650 horses. 645 mules. 6 guns.</p>	<p>Left Springfontein 12.40 p.m., 3rd October. Arrived Volksrust 10.30 p.m., 5th " "</p> <p>Total No. of trains—7.</p> <p>1st train left Springfontein 9.30 a.m., 8th October. 7th " " " 7.45 p.m., 8th " "</p> <p>1st train arrived Volksrust 1.0 p.m., 10th October. 7th " " " 7.10 a.m., 11th " "</p>
<p>REMOUNTS. 4,798 horses. 168 horses. 70 mules.</p>	<p>Left Mooi River for north between 2nd September and 8th October. Left Pietermaritzberg for Greytown 23rd September.</p>

GRAND TOTAL MOVED BY RAIL.

Officers	...	...	...	882
Other Ranks	...	...	...	23,536
Animals	...	...	...	32,836
Guns	...	...	...	45

APPENDIX H TO CHAPTER I.

(1). TROOP MOVES ON EASTERN LINE BETWEEN 5TH AND 12TH APRIL, 1901, TO FORM COLUMNS UNDER GENERAL BINDON BLOOD.

Date.	Trucks.	Officers.	Men.	Trucks of			Wagons.	Guns.	Date.	Trucks.	Officers.	Men.	Trucks of			Wagons.	Guns.
				Horses.	Mules.	Oxen.							Horses.	Mules.	Oxen.		
April 5th, 1901.									April 9th, 1901.								
12.25 p.m.	90 23	2 —	265 —	26 16 &	18 mules	2 —	12 4	—	4.30 a.m.	23	—	—	1	—	4	4	—
1.15 p.m.	22	—	—	12	do.	—	6	—	4.42 a.m.	22	—	—	12	—	—	—	—
1.35 p.m.	20	—	—	12	do.	—	6	—	5.40 a.m.	29	3	60	10	8	—	7	—
2.10 p.m.	22	13	500	19	do.	—	—	—	Totals ...	74	3	60	23	8	4	11	—
Totals ...	177	15	765	85	18	2	28	—	April 10th, 1901								
April 6th, 1901.									4.20 a.m.	24	—	—	13	2	—	6	—
5.5 a.m.	5	—	—	—	—	—	—	—	4.40 a.m.	31	—	—	20	—	—	5	—
6.15 a.m.	23	—	15	6	—	2	1	—	5.20 a.m.	23	13	250	18	—	—	—	—
10.48 a.m.	23	1	139	—	6	—	14	—	11.0 a.m.	20	—	38	1	2	2	4	—
11.15 a.m.	23	2	110	12	—	—	6	3	2.10 p.m.	18	—	33	—	9	—	8	—
12.20 p.m.	28	4	80	5	5	7	6	—	Totals ...	116	13	321	52	13	2	23	—
1.15 p.m.	23	3	90	12	—	—	6	—	April 11th, 1901								
1.55 p.m.	24	4	70	10	3	—	4	—	4.5 a.m.	24	2	99	—	—	14	10	—
Totals ...	149	14	504	45	14	9	37	3	5.10 a.m.	25	5	49	14	—	1	8	—
April 7th, 1901.									5.20 a.m.	25	1	38	5	5	5	7	—
4.0 a.m.	26	—	28	20	—	—	—	—	7.5 a.m.	22	3	108	9	3	—	4	—
4.25 a.m.	21	14	257	—	—	—	2	—	10.25 a.m.	23	5	111	12	2	—	4	—
5.5 a.m.	11	1	50	3	—	—	—	—	11.35 a.m.	26	1	27	1	1	17	6	—
5.50 a.m.	19	1	20	—	10	—	8	—	1.25 p.m.	29	8	95	10	5	—	8	—
6.45 a.m.	22	4	80	3	5	2	6	—	3.20 p.m.	—	—	—	—	—	—	—	—
7.40 a.m.	33	6	139	16	2	—	11	—	9.25 p.m.	22	6	100	10	4	—	2	—
11.45 a.m.	24	2	106	5	13	—	4	—	Totals ...	196	31	627	61	20	37	49	—
2.0 p.m.	16	1	125	10	—	—	—	—	April 12th, 1901								
4.23 p.m.	28	3	120	16	8	—	—	—	12.25 a.m.	30	10	100	19	—	—	—	—
Totals ...	200	32	925	73	38	2	31	—	7.15 a.m.	25	2	69	11	4	—	7	—
April 8th, 1901.									10.50 a.m.	31	3	125	—	—	20	10	—
4.0 a.m.	32	8	248	1	5	—	15	—	12.50 p.m.	32	3	130	—	13	2	14	—
4.35 a.m.	24	9	300	1	3	2	3	—	1.35 p.m.	40	9	220	4	—	20	6	—
5.58 a.m.	30	3	136	20	—	—	1	—	3.30 p.m.	16	1	66	—	—	7	9	—
6.0 a.m.	23	2	77	10	2	—	8	—	5.0 p.m.	35	5	187	10	11	—	8	4
6.45 a.m.	23	2	20	2	1	9	10	—	10.55 p.m.	32	3	130	7	4	—	11	2
4.35 p.m.	24	—	35	4	16	—	4	—	Totals ..	241	36	1027	51	32	49	65	6
5.5 p.m.	31	—	14	8	—	—	10	—	Grand Totals..	1340	168	5059	436	170	116	295	9
Totals ...	187	24	830	46	27	11	51	—									

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(2). MOVE OF GENERAL GILBERT HAMILTON'S COLUMN FROM GREYLINGSTAD TO KRUGERSDORP, 1ST TO 4TH JUNE, 1901.

The Force, strength as under, was ordered on May 30th, to march to Greylingstad and entrain on arrival :—

Troops.	Officers.	Men.	Horses.	Mules.	Wagons.	Guns.
13th Hussars	16	678	760	127	20	
Q Battery, R.H.A.	2	45	90		10	2
64th Battery, R.F.A.	1	41				2
East Lancashire Regt.	13	360	10	80	8	
3rd Field Troop, R.E.	1	39	90		12	
Transport				130	16	
5th Dragoon Guards	20	379	428		16	
Bearer Company	5	34		210	14	
	58	1576	1925		96	4

The time of arrival was indefinite at first, but later was stated to be about midday on June 1st. On first intimation of the move, Greylingstad was ordered to detach suitable empties from passing trains. Traffic officers were further ordered to collect all available empties at Elandsfontein and Heidelberg, in readiness to be despatched as soon as some definite information as to the probable time of arrival could be obtained. It was not thought advisable to block Greylingstad itself with trucks in anticipation, as with trains running at short intervals on the S.E. Line a total congestion of traffic might have resulted. Gen. Hamilton's Force arrived at 10 a.m. June 1st, and the regular entrainment began at midday. Krugersdorp was ordered to off-load at once and return empties to point of departure.

Trains left as under :—

1st ... 4.30 p.m. ...	June 1st	10th ... 7.25 a.m. ...	June 3rd
2nd ... 5.25 " ...	" "	11th ... 10.20 " ...	" "
3rd ... 10.0 " ...	" "	12th ... 12.40 " ...	" "
4th ... 3.0 a.m. ...	2nd	13th ... 3.15 p.m. ...	" "
5th ... 11.25 " ...	" "	14th ... 7.25 " ...	" "
6th ... 1.30 p.m. ...	" "	15th ... 8.35 " ...	" "
7th ... 6.1 " ...	" "	16th ... 11.35 " ...	" "
8th ... 10.30 " ...	" "	17th ... 2.50 a.m. ...	4th
9th ... 1.10 a.m. ...	3rd	18th ... 1.10 p.m. ...	" "

The R.S.O., Greylingstad (Lieut. F. A. C. Hamilton, Scottish Rifles), reports as follows :— "The only occasion of delay of trains, which I can specially remark on, was the detention of 8th and 9th specials on night of June 2nd, each being delayed some two hours through damage having been done to the vacuum brake, in both cases after the train was made up. Any other delays were the result of the small shunting accommodation at this station when a considerable quantity of trucks has to be dealt with. The troops were always punctual and ready to start loading at the appointed time."

Another difficulty which caused some delay was the shortage of flats. This improved as the move progressed and flats were obtained from O.R.C.

H. C. SUTTON, *Capt., Coldstream Guards,*
Deputy Assistant Director of Railways.

NOTE.—Up and down mail trains and supply trains ran as usual without interruption to or from this move.

APPENDIX K TO CHAPTER I.

TROOP MOVES IN ONE MONTH THROUGH PRETORIA STATION, 19TH MARCH TO 19TH APRIL, 1901.

	Trains.	Trucks.	Horses.	Mules.	Oxen.	Carts and Wagons.	Guns.	Men.
Arrivals from South ...	136	3632	10882	4796	1143	659	26	14960
Departures East	74	1828	4509	2660	2524	501	11	6479
Departures North	64	1272	2350	580	972	185	8	4224
Totals	274	6732	17741	8036	4639	1345	45	25663

APPENDIX L TO CHAPTER I.

AUTHORISED SCALE OF ROLLING STOCK FOR CARRIAGE OF TRANSPORT OF VARIOUS UNITS.

	1st Line.										2nd Line.					Rolling Stock required.	
	Mules.	Water Carts.	Small Arms Ammunition Carts.	Scotch Carts.	Ambulances.	Tool Carts.	Wagons.	Forge Wagons.	Mules.	Wagons.	Frollies.	Scotch Carts.	Cape Carts.	1st line 2nd line	Short Cattle Trucks.	Short Trucks.	
Infantry Regiment (1,000 strong)...	54	2	4	1	—	—	—	—	102	10	—	—	—	1st line 2nd line	5 9	3 10	
Company M. I. (120 strong) ...	12	1	1	—	—	—	—	—	20	2	—	—	—	1st line 2nd line	1 2	1 2	
Bearer Company, R.A.M.C. ...	112	2	—	—	10	—	—	—	26	2	1	1	1	1st line 2nd line	9 2	11 3	
Field Company, R.E. ...	73	1	—	—	—	8	1	—	60	6	—	—	—	1st line 2nd line	6 5	7 6	
Battery, R.A. ...	6	1	—	—	—	—	—	—	10	1	—	—	—	1st line 2nd line	1 1	1 1	
Divisional Headquarter Staff ...	6	1	—	—	—	—	—	—	26	2	—	1	—	1st line 2nd line	1 2	1 2	
Brigade do. ...	6	1	—	—	—	—	—	—	16	1	—	1	—	1st line 2nd line	1 2	1 2	
Squadron Cavalry (160 strong) ...	6	1	—	—	—	—	—	—	30	3	—	—	—	1st line 2nd line	1 3	1 3	
Field Hospital ...	12	2	—	—	—	—	—	—	46	4	—	1	—	1st line 2nd line	1 4	1 5	
Headquarters, Cavalry, M. I. or Imperial Yeomanry Regiment ...	6	—	1	—	—	—	—	—	12	1	—	—	1	1st line 2nd line	1 1	1 1	

APPENDIX M TO CHAPTER I.

ARMY ORDERS DEALING WITH PASSENGER TRAFFIC ON IMPERIAL MILITARY RAILWAYS.

(1).

GOVERNMENT HOUSE, BLOEMFONTEIN,
31st March, 1900.

IMPERIAL MILITARY RAILWAYS.

(a). No troops or military traffic can travel over the I.M.R. except under proper authority.

When transport is required, an order authorising the journey must be produced in all cases. This order must distinctly say whether the journey to be performed is on the public service or otherwise.

At stations where R.S.O.s are posted, the order must be presented to the R.S.O. If the order authorises the journey to be performed on the public service, the R.S.O. will issue a warrant, which must be presented at the booking office and exchanged for a ticket. If the order authorises the journey to be performed otherwise than on the public service, the order must be countersigned by the R.S.O. and then exchanged on payment at the booking office for a ticket.

At stations where no R.S.O. is posted, the order must be presented to the Station Master, who will issue a ticket free if the order authorises the journey on public service, and on payment if otherwise.

(b). The working of the I.M.R. must not be interfered with except in cases of great emergency. In cases of great emergency officers must give their orders in writing to R.S.O.s (or Station Masters at stations where no R.S.O.s are posted); but all orders so given will invariably be transmitted through the D.R. for the information of the Chief of Staff, who will judge of the expediency of such orders.

(2).

ARMY HEADQUARTERS, PRETORIA,
9th January, 1901.

ISSUE OF RAILWAY TICKETS.

(a). No Officer, N.C.O., man or camp follower is to be allowed to travel on the C.G.R., N.G.R. or I.M.R. free (*i.e.*, at Imperial Government expense) unless travelling on duty.

(b). Officers, N.C.O.s, men and camp followers proceeding on leave are allowed the indulgence of travelling at half price for the class they may select to travel by.

(c). G.O.C.s on L. of C. should see that Commandants of all stations where railway traffic takes place are supplied with "Order for Military Ticket" M.T. 5,* and "Authority to proceed by rail" M.T. 6.*

(d). M.T. 5 should be issued by the Commandant to all Military details travelling on duty, and is to be exchanged for a railway ticket by the Station Master.

N.B.—On no account is M.T. 5 to be issued as a railway ticket.

(e). Every Officer, N.C.O., man or camp follower proceeding on leave must, after his leave has been approved by competent Military authority, obtain from the Commandant an "Authority to proceed by rail" M.T. 6. On presentation of this form to the Station Master he will be permitted to purchase a ticket at indulgence rates.

(f). All Officers, N.C.O.s, men or camp followers are to voluntarily give up their railway ticket at the termination of their journey to the R.S.O. or other railway official (without necessarily being asked for it).

(g). The senior Officer or N.C.O. on any train should, as far as possible, prevent anyone travelling without a ticket; and any suspicious person, whether in uniform and in possession of a ticket or not, should be called upon for an explanation of his presence, and should be brought to the notice of the R.S.O. or Railway Military Police. In this way all ranks should make every endeavour to prevent unauthorised persons travelling on the railways.

(h). All civilians (other than camp followers) travelling from one place to another in the Transvaal or O.R.C. should be in possession of a special permit—M.T. 7*—which can only be issued by the Adjutant-General, Military Governors, G.O.C.s Districts, District Commissioners, Provost Marshal, Army Headquarters, or Director of Military Intelligence. Camp followers should always be in possession of Army Book 41 (Last Pay Certificate) and Commandants should not issue M.T. 5 or M.T. 6 unless they can produce their A.B. 41, which book acts as a sort of guarantee at Intermediate stations that they are bona-fide camp followers.

* See below.

This Order must on no account be used for travelling with.

ORDER FOR MILITARY TICKET.—DETAILS.

This Order is to be presented to the Booking Clerk at the Station where the holder is authorised to commence the journey, when a Railway Ticket will be issued in Exchange.

.....
..... 190.....

The Station Master, Imperial Military Railways.....Station, is hereby requested to issue the undermentioned tickets, and to charge the cost thereof against the Imperial Military Transport Ledger Account.

Station to.....		
No. of Passengers (in words).	Class (in words).	Here write "Single" or "Return."

NOTE.—This Order is to be used for passengers only. For Troops in bulk, Goods, Live Stock and Baggage, M.T. 2 Ticket should be made out and handed to Station Master for booking purposes.

For use of Station Staff only.	Signed
Here insert number of Tickets issued.	Rank
	Countersigned.....
	Railway Staff Officer.

This Order must be forwarded with the Monthly Ledger Account, in support of debits.

M.T. 6.

This authority is to be presented at the Station Master's Office, and there exchanged for a Railway Ticket on payment at Military Rates.

O.H.M.S.

No. of Ticket issued.....

Credit £

AUTHORITY TO PROCEED BY RAIL.

.....Office.

Date.....

(Rank, Name and Regiment).....

proceeding on furlough has authority to travel by rail from.....

to.....
SingleClass at half ordinary fare
Return

Approved,
By order,

.....Commandant.

To the Station Master,

.....Station.

M.T. 7.

COUNTERFOIL
No 25006

To R.S.O. 190

Rail Accommodation authorized

for

from

to

with

at Government expense; Class...

or

on payment.

Issuing Officer.

M.T. 7.

TO BE RETAINED BY HOLDER AND GIVEN UP AT DESTINATION TO R.S.O. OR RAILWAY POLICE (STATION MASTER WHERE NEITHER EXIST).
No 25006

RAILWAY PERMIT FOR CIVILIANS.

THIS IS NOT A RAILWAY TICKET.

To the R.S.O., 190

Ticket may be issued and Railway Accommodation provided for

and pounds weight Baggage from

to

At Government expense; Class

or

on payment.

Signature of Issuing Officer.

Signature of Holder.

Signature of R.S.O.

TO BE FILLED IN BEFORE ISSUING OFFICER.

M.T. 7.

No. of Ticket issued

Credit, £

TO BE COUNTERSIGNED BY R.S.O. AND GIVEN IN EXCHANGE FOR A RAILWAY TICKET.
No 25006

RAILWAY PERMIT FOR CIVILIANS.

THIS IS NOT A RAILWAY TICKET.

To the R.S.O., 190

Ticket may be issued and Railway Accommodation provided for

and pounds weight Baggage from

to

At Government expense; Class

or

on payment.

Signature of Issuing Officer.

Signature of Holder.

Signature of R.S.O.

(TO BE FILLED IN BEFORE R.S.O.)

APPENDIX N TO CHAPTER I.

EXTRACTS FROM *REGULATIONS FOR THE WORKING OF RAILWAYS*,
ISSUED AT THE COMMENCEMENT OF THE CAMPAIGN BY THE DIRECTOR OF RAILWAYS.

Note.—It was found necessary, during the progress of the War, to considerably modify the original regulations; footnotes give references to other Chapters, where the amended regulations may be found.

Director of
Railways.

1. The general control of all military railways within the sphere of operations, and the requisite control of civil lines utilised as lines of communication, will be vested in a Director of Railways.

Duties.

2. (a). This officer will fulfil the double duty of—

(i.). Assuming absolute military control of any lines in the enemy's country, or arranging for any necessary extension of the same. Such lines will hereafter be referred to as "Field Sections."

For the purpose of carrying out these duties, the D.R. will have under his orders:—(1). All R.E. railway troops; (2). Any other troops that may be detailed to assist; (3). All civil labour he may find necessary to employ.

(ii.). Assuming the position of intermediary between the general or other staff and the various civil lines of railway utilised. Such lines will be hereafter referred to as "Communication Sections."

For the purpose of carrying out these duties, the D.R. will be in close communication with the Governing Power, Railway Departments or Boards, and the General Managers of the various communication railways.

The working of the railways will be carried out by the civil staff of the railways, with a staff of military officers to assist in and direct the military traffic. This latter will be under the orders of the D.R., and is the only channel of communication authorised between the military authorities and the civil railway officials.

3. If there is more than one distinct line of advance, the D.R. will be attached to the headquarter staff of the army, in order that he may exercise general control.

Field Sections.*

4. (a). "Field Sections" include all lines beyond the advanced bases (also railway telegraphs). They will be controlled by A.D.R.s, "Field," with adequate staffs.

(b). The A.D.R.s will be responsible to, and under the orders of, the D.R. and their I.G., L. of C.

All R.E. railway troops will be under their absolute control; also troops told off by G.O.C., L. of C., to assist in railway operations will, when on the works, be under their direction and required to conform to their working hours and orders.

(c). They will have delegated power from the D.R. to employ any civilian labour they may find necessary, and to organise it if necessary into units, companies or labour depôts, under military control, as laid down by regulation.

Communication
Sections.

5. (a). "Communication Sections" include all civil lines in rear of advanced bases, likely to be used for military purposes during operations.

These lines will be controlled by A.D.R.s, under the orders of the D.R. and on the staff of the I.G., L. of C. They will be in close co-operation with the Chief Traffic Manager of the system to which they are appointed.

These A.D.R.s will be styled A.D.R.s, "Communications."

(b). Military Officers will be appointed to act in co-operation with the Traffic Manager of sections of each railway system. These officers will be under the orders of the A.D.R., and will be on the staff of A.I.G., L. of C.

These officers will be styled D.A.D.R.s.

(c). R.S.O.s, on the staff of Station Commandants, will be detailed to superintend the movement of Military traffic at principal stations and over sections of line within limits to be defined by I.G., L. of C.

For all technical matters they will correspond and take orders from D.A.D.R.s of the sections on which their stations are situated. For Military purposes they will be under the orders of the Station Commandants.

* See Part I., Chapter IV.

(d). The A.D.R.s, "Communications," will be empowered, after approval of the I.G., L. of C., and the D.R. and after consultation with Civil Railways, to assume absolute control of any line where civil officials may be wanting owing to hostilities or disaffection.

After approval they may in such cases make arrangements with "Field Sections" for provision of Military Railway working staff.

They will have the same delegated powers from the D.R., with reference to employment of civil labour, accorded to "Field Sections."

(e). The names of all Officers appointed to these posts, and their headquarter stations, will be notified in L. of C. orders.

6. The preparation and disposal of requisitions for Military Transport of all kinds will not come under the cognisance of the D.R., except as locally arranged. These matters will be dealt with by the proper authority, in accordance with instructions which will be detailed in orders.

Requisitions for Transport.

° ° ° ° ° ° °

DUTIES OF STAFF OFFICERS ON "COMMUNICATION SECTIONS."

7. A.D.R.s are responsible for the whole working of the Railway Branch of the Lines of Communication; and all references on railway matters (Communications) from the I.G.s, L. of C., and from the D.R. should pass through them. They should keep up complete records of the state of traffic and the position of rolling stock on the Railway, and for this purpose should keep in touch with the Chief Traffic Managers of the system.

Assistant Directors of Railways.

They should keep themselves cognisant of the work carried out by D.A.D.R.s and see that the latter maintain a proper control of the sections in their charge.

8. D.A.D.R.s should keep themselves completely informed of the state of traffic in their sections, and should exercise a general supervision over the work of R.S.O.s on their sections. They should keep a careful watch on the distribution of rolling stock on their sections and are responsible that it is utilised to the best advantage. They should keep up records of all military traffic on their sections, and for this purpose should be in touch with the Traffic Managers on their sections.

D.A.D.R.s should open their offices at the same stations as those of the Traffic Managers, and when away from their offices are responsible that a trustworthy person is left in charge.

D.A.D.R.s are responsible that any requirements of District Engineers for the protection of the line are communicated to the A.I.G., L. of C.

D.A.D.R.s will assent to no action entailing cessation of traffic without informing A.D.R.s (Communications). The railway traffic is not to be stopped without direct orders of A.D.R.s (Communications), except when it is considered that such cessation of traffic is, for military reasons, absolutely necessary. The orders for such cessation will be given either by I.G.s or A.I.G.s, L. of C., or Station Commandants. Under these circumstances D.A.D.R.s should report fully by telegram to A.D.R.s (Communications).

D.A.D.R.s should make themselves thoroughly acquainted with all technical conditions of their sections in all departments.

° ° ° ° ° ° °

NOTE.—For organisation of "Field Sections" see Part I., Chapter IV., and for full and later instruction concerning "Duties of Railway Staff Officers" see Appendix B to this Chapter.

ENTRAINING INSTRUCTIONS FOR COMMANDING OFFICERS.

GENERAL.

The following instructions regarding entraining should be carefully observed:—

1. The maximum number of vehicles which can be hauled on military trains on the C.G.R. is as shown below. Loads on Trains.

- Cape Town to De Aar, 25 short vehicles.
- Port Elizabeth to Naauwpoort, 25 short vehicles.
- East London to Stormberg, 20 short vehicles.
- Other sections as advised by Local Civil Railway Authorities.

These numbers include 1 brake van on each train; and bogie vehicles (*i.e.*, vehicles with four pairs of wheels) are counted as two short trucks.

2. There is also a limit to the number of trains that can be run during one day on each section.

3. In order, therefore, to accelerate the despatch of troops, every endeavour must be made to utilise the carrying capacity of each train as fully as possible.

4. As no single train can carry a complete unit, except in the case of a Field Company R.E., a Bearer Company or a Field Hospital, O.C.s are advised that it will be necessary to break up units. Breaking up Units.

Accommodation
Provided.

5. The accommodation provided for the troops will be on the following scale :—

Officers—4 per compartment.

Men—8 per compartment (3 being loaded in the conductors' compartments when such are provided on carriages).

Rations.

The number of compartments in each carriage varies considerably ; but the above scale must be carefully followed, especially in regard to the accommodation for the rank and file.

6. The three days' train rations for the number of men proceeding in a train must be lodged in the brake van of the train. No rations required for consumption by men during train journey are to be loaded into trucks.

Baggage and
Equipment.

7. In cases where a unit is proceeding intact to one station, its baggage and equipment (except tents, which will usually go on the first train) will not be divided up among the trains conveying the unit, but will as a rule proceed with the last train utilised in conveying the unit.

8. Officers' baggage will either go with the regimental baggage, or be taken in the carriage provided for officers.

9. The following details, if attended to regimentally at entraining stations, will be found to conduce to the comfort of the journey, having regard to the strictly limited time available for meals at halting places :—

(a). Nose bags (full) can be placed in van if space available ; otherwise in a covered truck clearly marked with chalk. Also a few sacks of corn and bran, to be replaced from forage trucks when exhausted.

(b). Camp kettles ; as for nose bags.

(c). Cooks and cooks' orderlies should be told off before departure, and should be sent to the van to draw rations and camp kettles immediately on arrival of train at halting places. Boiling water for tea is always ready at these stations.

UNMOUNTED UNITS.

Accommodation
Provided.

10. When more than one train is required, the first train will consist only of 1 carriage for officers, 1 truck for tents and the remaining carriages for men. The balance of the unit, together with its equipment and baggage, will be despatched in the last train conveying the unit.

Other Detachments.

11. Portions of other units proceeding in the same direction will also be loaded in any spare accommodation available on the last train.

Other Units.

12. If not already known, C.O.s of all units proceeding by train must advise the R.S.O. of the strength for whom accommodation is required.

Detail for First
Train.

13. The actual number of officers and men required for the first train will be advised by the R.S.O. to the C.O. of the unit, by whom that number will be detailed.

Balance of First
Unit.

14. As soon as the troops are detailed for the first train, the C.O. must advise the R.S.O. of the balance for whom accommodation is still required.

Horses.

15. Officers' horses will be loaded as a rule six in a truck, and are liable to be detained in order that that number may be completed. C.O.s should detail men to look after the horses, in case the latter are separated from the trains conveying the unit to which they belong.

MOUNTED UNITS.

16. The first train will usually carry horses and a party of men to look after them.

Picketing Gear,
Forage, etc.

17. The whole of the picketing gear of a unit, with three days' forage rations for the number of horses sent by the first train, will be loaded in a truck to be placed on the first train. Forage for horses proceeding in later trains will be loaded in the brake vans of these trains.

18. Guns, limbers, carriages, etc., will as a rule travel by the last train conveying the unit.

ARTILLERY.

Guns, Carriages.

19. All guns, limbers and wagons of one battery must be loaded up on 6 flat bogie trucks (side loading).

The best way is as under :—

(i.). Gun (unlimbered) at one end of each truck, muzzle pointed over end.

(ii.). Then the gun limbers close up to the gun.

(iii.). Then 4-wheeled carts at other end of trucks.

(iv.). Then ammunition wagons and limbers and other 2-wheeled carts in the vacant intervals. In some cases there will probably be room for the last 2-wheeled wagons loaded to be simply run on to the trucks, there being no necessity to bring their wheels parallel to the sides of the trucks.

All shafts should be removed and placed under the carriages.

(v.). All saddlery, baggage and equipment, not required during the journey, to be loaded up on the same trucks as guns, carriages, etc., after the latter have been loaded.

BAGGAGE (Applicable to all Units).

20. (a). When entraining is being carried out from standing camps, all baggage for despatch must be carefully sorted at time of loading into carts, so that the baggage for each train is kept separate.
- (b). Baggage not required during the journey must be kept together.
- (c). Officers' baggage and men's rations, equipment, etc., required for the train journey, must if possible be kept together and loaded into carts separate to the rest of the baggage, as this latter is loaded in a separate part of the train to the baggage not required on the journey.

ORDERS APPLICABLE TO CAPE TOWN DOCKS ONLY.

21. All troops on disembarking will be drawn up on the side of the docks nearest the ship, and will only be moved therefrom on receipt of instructions from the R.S.O. Disembarking.

22. The carriages of the troops will be drawn up, as a rule, on the siding furthest from the ship. Troop Carriages.

The troops will be marched to the carriages through the spaces between the sheds. They will form up on the road, be told off to the carriages and entrain.

The troops will be told off to carriages commencing from the rear of the train, *i.e.*, the brake van.

23. Baggage, equipment, etc., will be loaded direct through the sheds into trucks which will be pointed out by the R.S.O. Baggage.

Every endeavour must be made to see that the minimum accommodation necessary is used.

In carriages which have top bunks, personal equipment can be loaded thereon.

E. P. C. GIROUARD, *Lieut.-Col.*,
Director of Railways, S.A.F.F.

CHAPTER II.

ENGINEERING (OR WORKS) DEPARTMENT.

Charts in the D.R.'s General Report show in broad outlines the position held by the Works Department in the railway organisation of the British Army in South Africa; the work carried out on the C.G.R. has been described in Part I., Chapter IV. and Part III., Chapter II., whilst that on the N.G.R. has been dealt with in Part II., Chapter V.

In *this* Chapter is given a detailed account of this branch of the I.M.R. and of the works executed by its agency under the most varying circumstances. The distribution of officers after the enemy's lines had been taken over is shown in the Chart in Appendix D.

I.—WORK IN THE ORANGE RIVER COLONY.

Military and Railway
Situation, March,
1900.

The D.R. formally took over the lines captured in the O.F.S. on 17th March, 1900, and appointed Capt. W. D. Waghorn, R.E., to be Supt. of Works. This officer took over charge from the Chief Engineer of the late O.F.S. Railway, and found a Civilian Engineering Staff at their posts between Norval's Pont and Glen Bridge, whilst the office staff and records at Bloemfontein placed valuable information in his hands.

There were also at Bloemfontein large well-equipped workshops and stores containing many things likely to be required.

Traffic with Cape
Colony Restored.

The advanced guard of the Army was at this time at Glen Bridge, with the main body at Bloemfontein, and it was necessary to halt for some time to refit. The length of line from Glen Bridge to Norval's Pont was intact, and 11 days later (30th March, 1900) it was possible to run traffic over the temporary bridge at Norval's Pont.

(I). TEMPORARY REPAIRS AND DEVIATIONS.

Glen Bridge.

The retreating Boers had destroyed the Glen Bridge and a deviation and temporary bridge were therefore required (*Plates 42 and 43 and Photo 23*). The work was done by a Field Company, R.E., together with a few civilians and natives.

Railway Preparations
for the Advance.
(i.). Materials.

It was necessary to press forward preparations for repairing the line northwards as soon as the Army should advance; and arrangements were made for the supply of rails, sleepers and baulks from the south. The demands on traffic trains at this time were heavy, but sufficient railway stores were sent through to enable the Works Department to provide for the first needs of the Construction Trains accompanying the advance.

(ii.). Labour.

Large gangs of unskilled labour were also required, and the Director arranged for at least 1,000 Basutos. But when the force moved, so great was the demand on all sides for natives that for some time only 300 men were available for the Works Department. This number was increased later to 800.

Nature of Work
to be Done.

The information gathered by Capt. Waghorn went to show that between Glen and Vereeniging the railway crossed a number of rivers, large and small, most of which ran in ravines, necessitating high piers and girder spans, and that many of these would in all probability be found damaged.

On the other hand, the original construction engineers had made deviations with low level bridges at many of the crossings; and although the bridges were no longer in existence, the formation could be easily put in order, and the bulk of work to be done would therefore be reduced to making temporary bridges and laying rails on the deviations.

The rainy season was fortunately past and there was no risk of heavy floods in the rivers.

The order of work was therefore settled as follows:—Lieut. H. A. Micklem, D.S.O., R.E., with the party under his orders (late Midland F.R.S.) would push on immediately in rear of the troops, putting in deviations and low level bridges and executing temporary repairs at speed so as to keep railhead as near the Army as possible. He would be followed by other parties who would undertake semi-permanent high-level trestle bridges, thereby obviating the disadvantages inseparable from the sharp curves and steep gradients of the deviations. At the same time, wherever possible, the permanent repairs would be begun and carried through without interruption to traffic, so as to make the line secure before the next rainy season.

Sequence of Repairs and Allocation of Duties.

An Appendix in the D.R.'s General Report gives a complete list of the damage wrought by the enemy, and detailed descriptions of each one would be wearisome. To give some idea however of the work done it may be stated here that the enemy destroyed

Résumé of Damage done by the Enemy.

- 22 spans of 100 feet and over.
- 13 „ of 50 feet and 75 feet.
- 26 „ of 30 feet and 20 feet.
- 35 culverts (many being treble spans of 9 feet) aggregating 57 spans.
- 28 sets of points and crossings.
- 6 watering stations, involving extensive repairs or renewal of tanks and pumping machinery.

There were also 17 separate breaks in the line itself, varying from 4 rail lengths to 5 furlongs.

This wholesale destruction took place between Glen Bridge and the Vaal River at Vereeniging, a distance of 200 miles, and a bare statement such as that given can convey but a faint idea of the wreck which the Works Department was called on to transform into an efficient means of communication in rear of the invading army.

Lieut. Micklem, on leaving Bloemfontein on 3rd May, 1900, had available 1 officer, R.E., 88 N.C.O.s and men of 10th (Railway) and 42nd (Fortress) Companies, R.E., 13 N.C.O.s and men of Infantry details, 1 civilian Permanent Way Inspector and 9 gangs of natives averaging 23 per gang, or a total of 2 officers, 102 europeans and 207 natives.

Personnel of Construction Train.

Before the end of May the strength of his party had been increased by 4 officers and 105 N.C.O.s and men,* 2 Permanent Way Inspectors and 22 gangs of natives, making in all 6 officers, 209 europeans and 720 natives.

Capt. H. G. Joly de Lotbinière, R.E., and Lieut. H. L. Pritchard, R.E., also assisted for short periods.

The men of the 20th and 42nd (Fortress) Companies, R.E., and Volunteer Engineers undertook bridge work, the 10th (Railway) Company with Infantry details were responsible for platelaying, and the native gangs furnished unskilled labour under their own petty chiefs as gangers; this last class of labour was unsatisfactory, the men being of poor physique and very idle.

Distribution of Tasks.

A Construction Train, equivalent to 36 short trucks, accompanied the party and furnished quarters for the officers and europeans. The natives found accommodation on the material trucks; but this method of carrying them was not satisfactory, as it was necessary to remove their impedimenta each time any material was to be handled, and this always caused delay.

Arrangements on Train for (i.). Shelter.

Tents were carried, and were pitched when the train halted for more than a few hours. Time was of the utmost value and reliefs were therefore arranged to allow work to continue day and night without intermission.

The train carried 6 days' rations, which were replenished from the Advanced Supply Depot, whilst fresh meat could generally be obtained from the country passed through.

(ii.). Food.

An Electric Light Section of the Electrical Engineer Volunteers, under Capt. F. L. Lloyd, R.E., installed electric light at the Vet, Zand, Rhenoster and Taibosch bridges (see Appendix B to this Chapter); in other cases 2 Wells lights were employed, and were of great use.

(iii.). Light for Night Work.

* Belonging to 20th (Fortress) Company, R.E., Devon and Somerset Engineer Volunteers, Cheshire Engineer Volunteers and Infantry details.

Composition and
Marshalling of the
Train.

The "Construction Train" was marshalled as follows, from front to rear:—

	Equivalent in short trucks.
1 double bogie, 24-foot rails, points and crossings	2
2 double bogies, 30-foot rails	4
2 " " , baulks 12" × 12", 16" × 8", 18" × 9"	4
3 " " , sleepers	6
2 " " , tools and stores	4
1 short truck (covered), small stores	1
1 " " " for gangers	1
2 double bogies, N.C.O.s and men	4
1 " " , telegraph material	2
1 " " , office and officers	2
1 brake van	1
1 engine and tender	—
1 double bogie, water tanks	2
1 " " , coal	2
1 caboose for engine crew	1
Total in short trucks	36

This was a heavy load, but was well within the power of the engine at speeds required for construction purposes.

Telegraphic
Communication on
Train.

The telegraph material allowed necessary repairs to be made, and a "railhead" telegraph office enabled the party to connect with the "through" and "station to station" wires as required.

Supply of Materials
from Advanced Base
Depôt.

Materials were forwarded from time to time from Bloemfontein, and the reconstruction party were thus able to work continuously, except for 24 hours at the Zand River when a block at Smaldeel delayed the material trucks on their way to railhead.

ITINERARY.

The party began repairs at Mile 477 on the afternoon of May 3rd; and, having jacked up and supported two 50-foot spans in 22 hours, reached Brandfort the next afternoon. The water tanks and bridge at Brandfort and other bridges between Brandfort and the Vet River were made passable, and "railhead" reached Vet River siding on the morning of May 7th.

Vet River,
May 7th to 13th.

Here both pumps and tanks were found demolished as well as the bridge (*Photo 24*). Lieut. Pritchard laid out the deviation (*Plate 45*), which involved making 4 temporary bridges (*Plates 46 and 47 and Photo 25*).

Labour was scarce, and large working parties from the North Stafford Regiment and King's Royal Rifles were told off to help on the earthwork of the deviation.

Communication was restored early on the 13th; but a small party, with 4 ox wagons carrying materials, had already been sent on under an N.C.O. to repair minor culverts and damage to the track. The transport was inadequate; nevertheless the work done by this party enabled the train to reach Smaldeel late on the 13th, and at daylight next day it was on the bank of the Doorn River.

Doorn River,
May 14th to 16th.

The majority of the platelayers were still at the Vet River, and Lieut. Micklem accordingly decided to build a high-level crib-pier bridge, entailing only 200 yards of new track, in preference to making a deviation $\frac{3}{4}$ mile long.

The height was great—37 feet 6 inches. *Plate 48* shows the construction of the bridge and *Photo 30* gives a view of it completed.

The deviation occupied 3 days (the working party being as shown on *Plate 48*); but, in order to expedite progress, the advance party moved ahead on the 14th, it being known that 5 culverts had been destroyed and that there were 4 breaks in the permanent way between the Vet River and Virginia siding.

So well did this advance party work that by the evening of the 17th railhead was at the siding, *i.e.*, 61 miles had been made passable for trains in 14 days.

Zand River,
May 17th to 22nd.

The Zand River is crossed a few hundred yards beyond the station. *Photo 31* shows well the wreck left by the Boers. As at the Vet River, a long deviation was necessary, involving gradients of 1 in 40 and 3 temporary bridges, the latter including one skewed at 45° to the line at the river crossing.

Advantage was taken of the existence of an old bridge at this point. *Plate 49* shows plan and section of the deviation, and *Plate 50* gives details of the 3 bridges. The alignment passed under the permanent bridge at its northern end, and it was

necessary therefore to lift the damaged girders of the shore span to give clearance over the deviation.

Work at the river, and on the damaged boiler serving the water pumps at Virginia siding, was begun on the night of the 17th, whilst the advanced party moved on 5 miles to commence repairs on 1,000 yards of track and on points and crossings at Riet River siding. The construction party, together with Infantry working parties (see *Plate 49*), completed the deviation at midnight on the 22nd, notwithstanding a delay of 24 hours for want of material.

The Construction Train was then divided into two portions, each with its own engine, with a total capacity equivalent to 80 short trucks. The increasing distance of "railhead" from Bloemfontein rendered this subdivision necessary, and the results were satisfactory. Division of
Construction Train

A party of 300 natives, under Lieut. R. H. Cunnington, R.E., remained at the Zand River to improve the diversion, and the train moved on to Riet Spruit Bridge early on the 23rd.

Girders, piers and abutments were in ruins; but a crib bridge, 120 feet long and 15 feet high, was in position before dark, *i.e.*, in 10 hours time. Riet Spruit,
May 23rd.

At Ventersburg Road tanks, points and crossings were found to be damaged, and a party was left there to repair them, whilst the train ran on to Kroonstad, reaching that place at midnight of the 23rd.

Fortunately a deviation 2 miles long with bridges (*Plates 52, 53 and 54*) had been completed at the Valsch River by the working parties shown on *Plate 52*, and this allowed the Construction Train to pass on to Kroonstad. The damage to the permanent bridge is shown on *Plate 51* and *Photo 33*. Valsch River.

Roodeval station was reached on the morning of the 25th May. Here it was found that for 1½ miles onwards the permanent way had been destroyed by charges laid at alternate rail joints, whilst in the same length 3 bridges (including the large one over the Rhenoster River) had also been destroyed. Roodeval.

Accordingly a deviation (*Plate 57*) was decided on. The bridge over the river was 34 feet high (*Plate 58*); but time pressed, and it was decided to use stiffened sleeper cribs. Rhenoster River,
May 25th to 30th.

Material for the bridge and deviation had to be carried to site in 10 ox-wagons; and the want of water north of Kroonstad entailed many difficulties, not the least of which was a congestion at Roodeval where engines of troop trains failed on this account.

As on former occasions, the advanced party moved ahead to execute repairs to culverts and points and crossings, whilst work at Rhenoster was in progress. Acting on information received, two sections of Engineer Volunteers (under Lieuts. Peyton and Hutchison respectively), one section 42nd (Fortress) Company, R.E. (under Lieut. C. N. North), and 4 gangs of natives were sent forward between the 28th and 30th, and 14 ox-wagons were told off to carry material to them from the Train. These wagons were quite inadequate, but no more were available; and, as no more material could be sent forward, it was arranged that the original advance party under Corpl. Taylor (Canadian Mounted Rifles) should move ahead merely clearing débris.

The Construction Train, crossing Rhenoster deviation at 10 p.m. on 30th, completed work at 3 bridges beyond it, and arrived at Leeuwspruit Bridge at noon next day. This and 5 other bridges were renewed or completed, and the Train reached Vredefort at midnight of June 1st. Leeuwspruit.

Here 5 sets of points and crossings had been destroyed. Owing to some mistake these had not been repaired, so that shunting was impossible; the Train therefore passed through, leaving parties to execute repairs. Progress was now very slow, for both the Construction Trains were empty and the material train in rear at Vredefort could not come within ½ mile of "railhead." Vredefort.

Eventually an exchange of wagons was effected, and Wolvehoek was reached on the 5th, notwithstanding the destruction of a large number of culverts and one or two major bridges of 50 feet spans. Profiting by the experience at Vredefort, special parties had preceded the train to Wolvehoek Station and had laid in or repaired 3 sets of points and crossings; 3 others remained to be attended to and, provision having been made, the Train made its way towards the camp at Steenpan. Wolvehoek.

At this time the enemy was threatening the right flank of the Army, and renewed efforts were necessary. This bore hardly on the reconstruction party, as the failure of their engine prevented the night shift coming on from a bridge in rear. Nevertheless the work was completed and the train steamed into Steenpan at 3 a.m. June 6th.

At 11 a.m. Taibosch bridge was reached and was found to be utterly wrecked, entailing a diversion and high crib bridge as shown on *Plate 60*. The advanced party Taibosch Spruit,
June 6th to 9th.

had now rejoined the Train, as there were no minor repairs required ahead ; and thus strengthened the reliefs made good progress with the bridge and the deviation of $\frac{1}{2}$ mile.

Commandant
De Wet's Raid,
June 7th.

On the 7th, Commandant De Wet attacked the posts at Roodeval and Rhenoster and took possession of Vredefort, cutting the railway communication.

But the Construction Train was well supplied with material, and obtained from Vereeniging such baulks as were required to complete Taibosch bridge.

There were now only 3 engines north of Vredefort and a very inadequate water supply for these ; it was therefore with a sense of relief that the Taibosch was crossed at midday on the 9th, giving access to a temporary water supply on the far bank. A party was left to improve this and to erect more tanks.

Vaal River,
June 9th.

At 10 p.m. that evening the Vaal River at Vereeniging was reached, and it was found that Capt. G. A. Travers, R.E., and the troops under his direction had nearly completed the deviation and bridge over that important river, as shown on *Plates 61 and 62* and *Photos 36 and 37*.

Lieut. H. A. Micklem, R.E., took over the work and completed it on the evening of the 11th.

Temporary Repairs
to Line damaged by
Enemy on 7th-8th
June, June 13th to
20th.

On the following day, orders having been received to return and repair damages to the south, the train ran into Johannesburg to collect material and stabled that night at Vredefort on its return journey.

Between Mile 622 and Leeuwspruit Bridge (Mile 619) 5 temporary bridges and culverts (including Leeuwspruit Bridge itself, which had only recently been erected) had been burnt by the enemy, and the 13th was employed in re-erecting them. Some delay was experienced at Leeuwspruit from lack of material, a train load of which was now overdue ; and, as nothing more could be done, Lieut. Micklem ordered the Construction Train back to Leeuwspruit siding at 1 a.m. on the 14th.

Attack on the
Construction Train
at Leeuwspruit,
June 14th.

The train was in two portions about 500 yards apart, and these had not moved $\frac{1}{4}$ mile before the leading portion was derailed and fire was opened on both sections. The enemy pressed his attack home, and actually gained possession of part of the leading train ; but after four hours' fighting he was beaten off, having failed to capture the trains or to injure the bridge. The strength of the attacking party was found afterwards to have been 1,800, and the effective defence of the trains reflects great credit on those on board. Lieut. Micklem, R.E., having received two wounds, handed over command of the train to Lieut. Pritchard, R.E., who brought it back to Vredefort Road. The Leeuwspruit bridge was again burnt by the enemy the same night.

Between the 15th and 20th June the party were busy repairing damages on $4\frac{1}{2}$ miles of the line between Leeuwspruit and Rhenoster River, including these bridges ; *Photo 35* and *Plate 59* illustrate the more substantial structure erected over the Rhenoster in place of the first sleeper-crib bridge. The new bridge was begun by No. 8 Company, R.P.R., and was completed by the two construction parties from north and south which met at this point of the line.

Communication
between Bloemfontein
and Johannesburg
restored, June 22nd.

Through traffic between Bloemfontein and Johannesburg was thus restored on June 22nd.

Between Vereeniging and Pretoria the only bridge destroyed was that over the Hennops River at Irene (*Plates 63 and 64*), and this was repaired by the 9th (Field) Company, R.E.

Recapitulation of
Work done since
May 31st.

It will be convenient to recapitulate now the repairs effected since May 3rd, *i.e.*, between Mile 477 and 662 (Vaal River).

Eighteen bridges, aggregating 2,600 running feet, had been erected, spanning gaps varying from 43 to 550 feet between abutments.

Deviations had been made at the Zand and Rhenoster Rivers, and partly at the Vaal, and sidings put in at Vet River and Virginia stations.

Lastly, all the remaining damages to culverts, water supply, track and cross-overs had been made good and serviceable once more.

Conclusions regarding
Construction Trains.
(a). Subsidiary Cart
Transport.

From the experience here gained it would seem to be the truest economy to provide ample cart transport for a Construction Train of this kind, if on any section of the line there are a number of comparatively small breaks close together. To be constantly moving the Construction Train short distances, in order to keep up to "rail-head," is not economical ; for this entails keeping an engine under steam and men on duty, and is very disturbing to the shift which is then "off work." To leave this shift behind to rest, trusting that they will come up with the Train in time for duty, is not advisable, and they must therefore perforce accompany the Train when it moves.

(b). Tools and Stores.

In Appendix A to this Chapter will be found a list of the principal tools and stores with which the train was first equipped. It should be borne in mind that several articles were expended and replaced during the time the train was at work.

(2). SEMI-PERMANENT AND PERMANENT RECONSTRUCTION.

Whilst attention is concentrated on the length Bloemfontein-Pretoria, it will be well to refer to the semi-permanent and permanent repairs which were carried out, though most of these were not undertaken till some time after the temporary repairs had been completed. Some information, in condensed tabular form, is given in an Appendix to the D.R.'s General Report.

Semi-permanent repairs on the Vet, Zand and Vaal Rivers were entrusted to the R.P.R. (Part III., Chapter II.).

At the Valsch River semi-permanent repairs were carried out by L. H. Grier, Esq., C.E., who, with an aerial tram, erected 4 spans from wreckage at the Valsch and Zand and also put trestles and trussed beams in another. (*Plates 55 and 56 and Photo 34*).

In all cases the masonry of piers and nearly all the girders had been damaged or destroyed; and the task which confronted the Supt. of Works was to re-build all masonry and to distribute new girders to the various bridges from the stock in the country or on the way out from England. Ten spans of 50 feet and thirty of 30 feet had been ordered by the D.R. before leaving England; unfortunately "deck" instead of "through" spans were supplied, and thus the available headway was reduced by nearly 4 feet in the larger girders, a serious disadvantage in places where ample waterway had not originally been allowed.

For the Zand River new girders were ordered from England. Elsewhere, whenever possible, use was made of undamaged portions of old spans to construct new ones; for example the 100-foot girders over the Valsch River were built up from portions recovered from the Glen, Vet, Zand and Valsch bridges. Fortunately there was a fair stock of small spans at Bloemfontein; and certain girders, originally ordered for the Selati Railway, were in the country and were impressed; these latter had pin joints, but by riveting they were made strong enough to carry a load of 2 tons per foot, which is expected to be an ordinary load when the traffic of the new Colonies is developed. The girders ordered from England were also strong enough to carry the same load.

European contractors were available, who could undertake the masonry and, in some cases, the erection of girders.

The Supt. of Works, being in supreme charge, divided the portion Bloemfontein-Vaal as follows:—

- | | |
|--|---|
| (a). Bloemfontein-Valsch River (exclusive) | A. W. Herbert, Esq., C.E. |
| (b). Valsch River | L. H. Grier, Esq., C.E., and
A. W. Herbert, Esq., C.E. |
| (c). Valsch River-Vredefort Road ... | E. Bromley, Esq., C.E. |
| (d). Vredefort Road-Vaal River | Lieut. H. L. Pritchard, D.S.O., R.E. |

Arrangements to replace Girders on Bridges.

Distribution of the Supervision of Permanent Repairs.

Artisans were obtained (a) from R.E. Companies, (b) from the ranks of the various Regiments and Corps on active service, and (c) from the civilians in the country; unskilled labour was furnished by the Native Labour Depôts.

Supply of Labour.

The following brief descriptions of permanent repairs will be of interest:—

Plate 44 shows the nature of damage done, and it was decided to build new spans on the break at the south end and to launch them forward as shown. Span A, though undamaged, was to move forward to replace span No. 3, and it was accordingly raised and supported on launching pulleys. Spans B and C were in the meanwhile being erected and each, as completed, was bolted to the span in front. When all was ready the three were hauled into position by a powerful winch and steel wire rope. Special tracks of inverted rails were placed under the girders of B and C to facilitate their passage along the bank.

(a). Bloemfontein to Valsch River.

Glen Bridge.

The launching took place on 13th July, and the bridge was completed within ten days; the gangs were then employed for three weeks in cutting up and removing damaged girders for use as required.

To rivet on the new ends of girders and to allow the pier to be rebuilt, the girders were supported on sleeper cribs, and work on repairs proceeded without interruption of traffic.

Alleman's Bridge.

Some slight delay occurred when running out the new deck span, as the trolley wheels carrying the girders dropped between the track; but on 29th July the old main and cross girders were cut out, and the new span put in position. The old girders were then removed between trains and run into Bloemfontein for repair. The gang employed consisted of 1 bridge inspector, 3 masons, 7 riveters, 1 blacksmith, 1 ganger, 6 Sappers, 12 natives.

Brandfort Bridge.

The same gang also carried out reconstruction of the Houltenbeck bridge, where the deck span was run out on two trucks and then lowered into position,

Mile 492.1.

Mile 498·36.

The new spans, built alongside the bridge, were begun on 14th August, and ten days later the temporary bridge was removed and the permanent spans were put in position at once. The gang mentioned above were at work here also, save that the R.E. were replaced by 23 men of the Monmouthshire Engineer Militia.

Vet River.

Of the three damaged piers, No. 1 (which is the furthest away in *Photo 27*) had been rebuilt by the R.P.R.; and during July, August and September the other two were rebuilt by contract, lack of railway carriage for stone hindering progress considerably.

Inspector Taylor's bridge gang (see above) in the meanwhile cut up and removed the old girders; and these were replaced by five new spans, put up by a contractor (Mr. Garrett) who also undertook other girder erection on this section. *Photos 27, 28 and 29* illustrate the use made of bogie trucks to run the girders forward.

Doorn River.

A span of Selati type 100-foot girders replaced those damaged by the enemy, whilst the ends of the smaller span were obtained from the Glen bridge. An accident, entailing loss of life and injuries to six natives in all, occurred whilst hoisting girders on September 14th. The immediate cause was the parting of a hemp rope which appears to have been tampered with.

Zand River.

Photo 31 shows the state of the destroyed bridge, and will give some idea of the heavy nature of the work of repair. The semi-permanent bridge of trussed beams and trestles was "in situ," and materially helped the permanent reconstruction. The contractor for ironwork also engaged to remove trestles and the girders of spans 1 and 2.

The five spans were erected in a siding to the north; and those intended to replace the trussed beams were brought into position, one span at a time, slung (as shown in *Photo 28*) on bogie trucks. The girders, when lowered into position, were used as a temporary way for a travelling gantry. The trussed beams were removed, and the cross girders and rail bearers brought to position by the gantry.

In dealing with Nos. 1 and 2 spans, the new girders were brought to site inside the old, and were temporarily supported on the piers, clear of the cross girders. These latter having been cut out, the old main girders were lifted and short lengths of rail were placed under them. Both new and old girders were next lowered on to these rails, which served as ways to slide the new girders into position and the old ones clear. New cross girders were then riveted on and the bridge completed for traffic; the old girders were removed slung on bogie trucks.

Girder erection took a month; but there was a delay of 10 days, as the deviation had been destroyed and all traffic, which was heavy at the time, had to pass over the semi-permanent bridge.

(b). Valsch River.

The masonry was rebuilt at the time the semi-permanent bridge was made; the contractor for ironwork had therefore to erect 5 new spans and to remove the old ones, including trussed beams and trestles.

The description already given of work at the Zand river applies here also, save that 10-ton cranes were used to lower girders and to remove the semi-permanent work (shown on *Plates 55 and 56*). The advantage of dispensing with trestles or staging for erecting the spans of the permanent bridge will be apparent from *Plate 55*.

(c). Valsch River to Vredefort Road.

On the death of Mr. Bromley in October, 1900, Mr. Herbert took over charge and completed the works on this section.

Rhenoster River.

To allow the new girders of the 100-foot span to be run out, the old girders, with damaged ends, were supported on sleeper cribs, their top booms being nearly at rail level. Cranes handled the new girders when run into position on bogie trucks; and when the bridge was ready the old girders were hoisted by cranes, slung on to bogies and run into Kroonstad. The new 50-foot deck spans were built on or near the bridge.

Mile 613·78.

The original bridge (six spans of 20 feet) was replaced by four of 30 feet, which were hauled into position when the piers and abutments were ready.

Leeuwspruit.

The foundations of the north abutment were taken down to solid rock, and the masonry was rebuilt throughout.

The 3 spans of 30 feet were then built beside the line, and were hauled into position by the Bridge Erector and his gang without detention of traffic.

(d). Vredefort Road to Vereeniging.

On 10th August, 1900, Lieut. Pritchard, R.E., took over charge of this section, in addition to the works in progress on a new line from Vereeniging to Johannesburg.

He had under him—

- 3 N.C.O.s, R.E., employed as foremen of works or keeping time sheets of labour and distributing tools.
- 1 civilian travelling inspector of masonry.
- 1 civilian permanent way inspector, giving levels for culverts and replacing girders, etc.
- 1 storekeeper and 1 clerk at Vereeniging.

Plate 65 shows the dimensions adopted for abutments, wing walls, piers, formation, etc.

Plate 38 and *Photo 36* show the state of affairs left by the enemy, and the *Plates 38 to 40* also show the semi-permanent repairs effected by the R.P.R. The damaged span was cut into 4 pieces by them and removed to the south bank; and, after a careful examination, extensive repairs to main girders, bracings (vertical and horizontal), cross girders and rail bearers were arranged for, and were eventually executed at Johannesburg. Vaal Bridge.

The bridge being decked, there were two alternatives:—(1), either to build the span on the bank and haul it into position, or (2) to cut out all cross girders and bracings and, having repaired the main girders, to put the latter in place, gradually substituting cross girders and rail bearers for the trussed beams of the semi-permanent work. As it was essential that traffic should not be interrupted the second alternative was adopted.

Work began on 27th December, 1900, with a few riveters; and on 27th January the arrival of Sergt. Harland, R.E., with a gang of natives and civilian riveters, enabled the work to progress. Such repairs as could be done on the spot were undertaken; the remaining damaged pieces were sent to Johannesburg, Sergt. Harland's party in the meanwhile erecting parts of the main girders in position.

It was now the end of January, but 7 weeks elapsed before the arrival of various parts allowed of one main girder being put in place. To do this two 50-foot derricks were employed, carrying 6-inch rope tackle; the falls passed to 30 cwt. crab winches and the girder was moved into place without difficulty. Owing to a slight error in spacing the other span, it was found necessary to recess the ballast wall to accommodate the ends of the new girders.

The other main girder was in position on March 28th, 1901; and between this date and April 7th the 3 spans of trussed beams and 2 trestles were removed and the rails carried on the permanent decking. The work of shifting was done at night to accommodate traffic, and on April 19th the bridge was completed.

Photo 39 shows the permanent as well as the temporary bridge. Taaibosch Spruit.

II.—WORK IN THE TRANSVAAL.

The D.R., on reaching Johannesburg on 29th May, 1900, found the officials of the N.S.A.R. to be hostile, and they refused to work the line for the British. He accordingly relieved them and re-organised a staff drawn from the ranks of the Army and from civilians in the Colonies, supplemented by such staff as could be spared by the C.G.R.; in this manner a Works Department for the Transvaal was formed. Owing to the importance of the line through the O.R.C., and the heavy work to be done to bring it up to standard, it was impossible for the present for Capt. Waghorn to move northward (with his office) to Johannesburg. The D.R. therefore himself took charge of repairs north of the Vaal, and was assisted by Capt. Greenwood, R.P.R., who was appointed Acting District Engineer, Johannesburg. Organisation of Works Department.

The well-equipped workshops of Johannesburg were available for the execution of girder work, etc., and Lieut. Thurston, R.P.R., late of the Simmer and Jack mine, was placed in charge there; see Appendix C of this Chapter. Workshops of the Rand Mines utilised by the Railway.

As yet (June, 1900) no considerable lengths of the railways in the Transvaal were in the hands of the British, and those that were in their possession were not of supreme importance. But as the year passed, the south eastern section towards Natal, the Johannesburg-Klerksdorp branch, the eastern section to Koomati Poort and the northern to Pietersberg passed into British possession. An Appendix to the D.R.'s General Report bears ample testimony to the scale of destruction on these sections and the repairs entailed on the Works Department. Military and Railway Situation.

(1). TEMPORARY REPAIRS AND DEVIATIONS.

The temporary repairs on the Natal line were begun by the 9th (Field) Company and "C" Pontoon Troop, R.E., and were carried on by Capt. F. G. Fuller, R.E., with the 8th (Railway) and 31st (Fortress) Companies, R.E. (late Western F.R.S.). Capt. Greenwood did what was required on the Klerksdorp branch; Capt. Fuller, R.E., and subsequently Lieut. H. A. Micklem, D.S.O., R.E., carried out the repairs on the eastern section. Distribution of Work.

(A).—SOUTH EASTERN LINE TO NATAL.

It was known at Army Headquarters that a railway repairing party from Natal was working towards Standerton from Volksrust, and on the 26th June "C" Pontoon Troop (under Capt. G. A. Travers, R.E.) moved from Vereeniging to Blesbok Spruit bridge to assist in carrying "railhead" southwards to meet them.

Blesbok Spruit, June
26th to July 2nd.

The 9th (Field) Company under Major H. J. W. Jerome, R.E., was already at work on a diversion, as it was inadvisable to raise and utilise the broken girders of the permanent bridge (vide *Plate 66*). Formation level at the deviation bridge was 6 feet lower than on the permanent one, and the temporary structure consisted of cribs and trestles, similar to others already described. The 9th (Field) Company returned to Pretoria on the day the diversion was completed (2nd July), whilst "C" Pontoon Troop moved on to Zuikerbosch spruit, where a single 50-mètre span girder bridge had been destroyed.

Zuikerbosch Bridge,
July 4th to 12th.

Plate 68 and *Photo 40* show the state of affairs; and after consideration it was decided to make a diversion. The bridge across the stream was skew and 240 feet long (*Plate 67*). The southern approach was in rock, and advantage was taken of the trace of an old existing road, the curves being eased and the cutting deepened to improve the gradient of the approach. Work was begun on the 4th July and on the 9th Capt. Fuller, R.E., and the troops of the Western F.R.S. arrived; this party reinforced the Pontoon Troop working on the bridge, and good progress was made with the trestles.

On the 10th, in consequence of information received from Gen. Sir R. Buller, all preparations were made for a withdrawal to Heidelberg, material which could not be removed being buried; but in the evening work was resumed, as Maj.-Gen. Hart had decided to hold the place and had despatched 2 companies Dublin Fusiliers as a reinforcement.

The bridge was completed on the 12th; as no covering troops could be spared and the enemy was in force in the neighbourhood, the reconstruction party also entrenched the camps.

Attack on Camp at
Zuikerbosch, July 21st.

"C" Pontoon Troop, R.E., returned to Johannesburg on the 18th July; 3 days later the enemy, over 1,000 strong with two field guns and two pom-poms, attacked the camp at dawn, and persisted until 1 p.m. when Gen. Hart appeared with reinforcements and drove him off.

Through
Communication on
Natal Railway
restored, July 26th.

On the 26th the construction party again moved forward, as Gens. Clery and Hart had joined hands. At Vlakfontein a junction was effected with the party from Natal, thus opening through railway communication between Elandsfontein and Durban.

(B).—EASTERN LINE TO KOOMATI POORT.

Bronkhorst Spruit,
July 26th.

On the 25th July Capt. F. G. Fuller with the 31st (Fortress) Company, R.E., was ordered to the Koomati line for work on temporary repairs; and on the following day he reached "railhead" at Bronkhorst Spruit where a Construction Train in charge of Lieut. R. H. Cunningham, R.E., was at work, having arrived 24 hours before.

In addition to the officers named there were with the train 4 R.E. officers, 2 officers of Volunteer Engineers, working parties of 160 R.E. and Infantry and 300 natives. On the 27th Lieut. H. A. Micklem, R.E., joined the train with 200 natives, thus making 9 officers in all.

Photo 41 shows how completely the bridge had been destroyed. A deviation was at once laid out and work begun. From marks on the masonry pier (shown in *Photo 41*) high flood level appeared to be 20 feet above the bed of the sluggish stream, and in designing the temporary bridge (*Plate 69*) plenty of waterway was allowed. Army Headquarters passed the deviation on the 26th July; and, as the Commander-in-Chief wished to know when trains could run into Middelberg, Capt. Fuller, R.E., and Lieut. Pritchard, R.E., examined the line as far as Wilge River and found it seriously damaged. They were informed that beyond this point the line to Middelberg was intact, and the Commander-in-Chief was therefore informed that trains would be running into Middelberg on August 3rd.

Kilomètre 401.

In order to execute repairs as rapidly as possible beyond Bronkhorst Spruit, the Construction Train was divided into two, and the two breaks in the line and two damaged culverts were allotted to separate parties to repair. *Plate 70* shows the manner in which the two culverts had been destroyed, and how they were repaired with baulks and trestles. By 9 p.m. of 29th work was finished and the trains reached Wilge River shortly after.

Wilge River, July
28th to August 3rd.

It had been seen on the 27th that a deviation would be necessary at the Wilge River, where the 30-mètre and two 10-mètre spans had been blown up (*Photo 42*), and Lieut. Pritchard, R.E., accordingly laid out the deviation shown on *Plate 71*. The curves were necessary to avoid heavy earth work, which would take time. As there was a considerable volume of water in the river, trussed beams of 50 feet span (*Photo 43*) had been requisitioned from the D.R., and these were received on the

2nd August. The erection of crib piers and shore spans (*Plate 71*) had in the meanwhile made good progress, day and night shifts being employed, and at 4 p.m. on the 3rd communication to Middelberg had been made good.

In obedience to orders Capt. Fuller, R.E., then divided the Construction Train ; and a second train under Lieut. Micklem, R.E., was organised, the working party allotted to him consisting of the 10th (Railway) and 42nd (Fortress) Companies, R.E., and 500 natives. All stores were also handed over to him to enable him to carry on repairs without delay.

Division of
Construction Train.

The Train was thus constituted in 2 portions, each with an engine and 16 short trucks or their equivalent. The marshalling of the leading portion was much the same as that in the O.R.C. (*vide* page 124), except that the baulks and rails were transposed and fewer rails and sleepers were carried. In the rear portion of the Train the engine led, followed by the caboose tanks and coal trucks, and these again by rails, sleepers, rations, gangers, smiths' shop, kits and tents in the order here given.

Constitution of Train
and Marshalling
of Rolling Stock.

The supply of stores from the west was uncertain and intermittent, partly because they were not all loaded from the same place or by one person, but chiefly because trucks containing them were delayed on the road and at times could not be traced. Although the total distance from Elandsfontein to Koomati Poort is under 350 miles, trucks were often a month or more on the road, since precedence was not here granted to construction material as had been done in the O.R.C. Fortunately the eastern line had not suffered such serious damage, and so the lack of material did not entail very evil consequences.

Arrangements for
Further Supply of
Stores to Train.

Night shifts between Middelberg and Waterval Onder were only occasional ; east of the latter station they were more frequently used. Two Wells' lights, carried with the train, illuminated the works when night shifts were ordered.

Night Work.

From August 4th until the 24th the Construction Train remained at Middelberg. On the latter date a portion moved to Wonderfontein, repairing small damages to track between that place and Belfast, a few miles further east.

Middelberg,
August 4th—24th.

The troops had begun their advance from Wonderfontein on the 24th, and 3 days later the train followed to Belfast, the construction party being employed for a week in erecting platforms and helping to unload troop trains which were now coming forward in rapid succession.

On September 2nd Waterval Boven was reached, and 2 days later the party moved to Waterval Onder, where the bridge (one span of 65 feet) had been destroyed. The damaged girders were removed and replaced by a trestle bridge of 5 spans, with a crib pier in place of the west abutment.

Waterval Onder,
September 2nd.

Between the two stations named above is a "rack" section of the line, on which special engines are used to negotiate the gradient ; these locomotives had been withdrawn by the enemy, and only a few trucks could therefore be handled at a time. The Construction Train was passed down the rack, a few trucks at a time, on the 5th, and stood at Waterval Onder for a week, awaiting permission to advance.

The working parties in the meanwhile facilitated the movements of the 11th Infantry Division by bridging Elands River. On September 13th it was possible to proceed, and that day was employed in repairs to permanent way and a damaged culvert near Godwan Station.

The bridge over the Godwan River, close to the station, had been seriously damaged. The repairs effected are shown on *Plate 72*, from which it will be seen that one span of girders was utilised, the *débris* of the other being replaced by trestles and banks. Fortunately the stream, which is 8 feet deep, is sluggish, and accordingly the central trestle was made to rest on rubble filling forming an island in the water.

Godwan River,
September 14th.

Between Godwan and Krokodil Poort stations but little damage had been done ; nevertheless the train did not reach the latter place till the evening of the 18th, as the enemy offered some resistance to the advancing Columns.

An inspection of the Krokodil River bridge on the morning of the 19th showed that the girders of the two 50-mètre spans had been rendered useless, the intermediate pier also being damaged ; and from *Photo 44* and *Plate 73* it will be seen that the rocky torrent with steep cross section made any diversion impossible.

Krokodil Poort
Bridge, September
19th to 21st.

The only thing to be done, therefore, was to clear the *débris* and erect a crib pier bridge, the details of which are recorded in *Plate 73*. The broken girders were only removed with difficulty, and the men engaged were obliged to use ropes when moving about, for on one side of the line was a wall of rock and on the other a sheer precipice.

By the night of the 21st the work was completed, and the party reached Kaapmuiden Bridge in the early hours of September 22nd.

Kaapmuiden Bridge,
September 22nd to
26th.

The distance between abutments here was 312 feet, the height from water to formation level being 50 feet, and *Plate 76* and *Photo 45* show the state of the bridge ;

not only had the top of the masonry pier been destroyed by explosives, but the base also had been shaken by a derailed engine.

A deviation and low level bridge were decided on; the maximum gradient was 1 in 18.5, but even with this the rail level at the bridge was 21½ feet above water. The deviation bridge was 330 feet long, and at one end was on a curve of 400 feet radius; it was constructed of trestles and crib piers as shown on *Plate 75* and *Photo 45*.

It was known that at kilometres 42 and 48 respectively two single span culverts had been destroyed; the reconstruction of temporary repairs having been assigned to the C.R.E., 11th Division, gangs from the Construction Train were employed from the 23rd to 25th September in carrying materials across the river at Kaapmuiden to allow the Divisional Engineers to execute the work. The want of labour at Kaapmuiden Bridge was greatly felt, and Infantry working parties were called in to assist.

Hector Spruit.

The deviation was completed early on the 26th, and the train, delayed *en route*, passed over the temporary bridge erected by the Boers at Malalane (*Plate 78*) and reached Hector Spruit after dark the same night. The centre line of the temporary bridge here (*Plate 79*) did not quite correspond with the old centre line, and this involved some slewing of the track on the approaches.

Koomati Poort,
September 27th.

Having completed the bridge the Construction Train ran into Koomati Poort at 3 a.m. on the 27th September. No more repairs were required on this line, and in obedience to orders from Army Headquarters the Train ran back the following day to Avoca to carry out repairs on the Barberton Branch.

Repairs on the
Barberton Branch,
Kaa River, Avoca,
September 28th to
October 2nd.

The 31st (Fortress) Company under Lieut. R. Oakes, R.E., had preceded the Train; but when the latter joined them it was found that the material ordered some days before had not arrived, and no progress had been made. *Plate 80* shows the damage done to girders and piers, and a deviation nearly 1½ miles long (*Plate 81*) had been laid out by Major A. G. Hunter-Weston, R.E., under whose supervision the bulk of the earth-work had already been completed by the Field Troop, R.E., of the Cavalry Division, aided by Infantry working parties.

As only a very temporary bridge was required, it was decided to use crib piers, placed at 17 feet centres and spanned by baulks (*Plate 82*). Lack of material of all kinds considerably interfered with progress, and on September 30th the Construction Train brought in old light rails, etc., which were laid down temporarily, being replaced when rails of proper section were received.

The deviation was completed on the 2nd October, and for some days the Train was employed in improving it; work was also carried out at Kaapmuiden, where an accident occurred (*Photo 45*) fortunately without damaging the temporary bridge.

(C).—NORTHERN LINE TO WARMBAD.

It was not until the 20th August that Capt. F. G. Fuller, R.E., received orders to carry out repairs on the northern line from Pretoria towards Pietersberg. On that day he left the capital and repaired as far as Hamman's Kraal, having found one culvert damaged and nine pairs of rails destroyed. On the 22nd he again left Pretoria, and moving north of Hamman's Kraal found a number of rails blown up on a length of 2 miles.

Piennaars River,
August 23rd to 28th.

Want of material caused some delay, but by the afternoon of the 23rd the Train arrived at Piennaars Bridge (six spans of 25 metres) which had been destroyed. A diversion 1 mile long was laid out, and the stream crossed by means of a low trestle bridge with baulks (*Plate 83*). This work took 5 days, and on the evening of August 28th the train ran over it. Finding that the line was undamaged as far as Warmbad, the Train was recalled to Pretoria, as no further advance northwards was intended for the present.

(2). ORGANISATION FOR REPAIRS NECESSITATED BY ENEMY'S RAIDS.

October, 1900.
Re-Arrangement of
Construction Trains
on Completion of
Temporary
Reconstruction.

By the beginning of October, 1900, temporary repairs had been completed on all lines in the enemy's country with the exception of the length Warmbad—Pietersberg, of which the British had not yet taken possession. There was therefore no further necessity for maintaining large Construction Trains, and a redistribution in the O.R.C. and Transvaal was necessary.

(a). In the O.R.C.

The enemy persistently attacked the lines of railway, especially in the O.R.C.; to meet this difficulty a separate branch of the Works Dept. was established and a number of small Construction Trains were equipped.

Organisation and
Personnel.

To the O.R.C. 5 trains were allotted; these were placed under Major Morgan Lindsay, Monmouthshire Militia Engineers, who was appointed Deputy Supt. of Works. To man the trains Major Lindsay had 3 District Engineers (civilians), 3 officers and 102

rank and file of the Monmouthshire Engineer Militia, 3 officers and No. 8 Company of the R.P.R., and 8 permanent way inspectors with gangers, sub-gangers and natives.

To obtain the best results from the Trains allotted to him, Major Lindsay fixed on stations which were (1) places where engines stabled at night, (2) provided with sufficient siding accommodation for the train, (3) the headquarters of a permanent way inspector and gang; and these he designated as the headquarters stations for Trains.

Principles laid down by Deputy Supt.

Being in close touch with the D.A.D.R., Bloemfontein, Major Lindsay was kept informed of those places or sections of the line most liable to be attacked; and he could then arrange to post a section of one of his companies at the nearest Construction Train station, with orders to take charge of the train if required.

Intelligence of Probable Raids.

Time was an essential factor; and therefore every effort was made to ensure the transmission of news of a break, so as to reach the Deputy Supt. and the officers commanding Trains by 3 a.m. at latest.

Intelligence of Occurrence of Damage.

To this end, gangers patrolled their lengths at daybreak, and they and Military posts were instructed to report any alarm to the nearest telegraph station, whence news was forwarded to the officers named. On one occasion (January 1st, 1901) information of a break near Wolvehoeck reached Major Lindsay at Kroonstad at 2.30 a.m. The distance to the break was 63 miles; nevertheless this distance had been traversed and the break repaired by 8 a.m., at which hour another Construction Train at Vereeniging, only 16 miles away, had only just heard of the damage.

It was further impressed on officers commanding Trains that they must proceed with all speed to a reported break, without waiting for confirmation or details of damage.

It was arranged with the Traffic Manager that an officer in charge of any such train should have first claim on the engine which was ready at daybreak; and it was further settled that the train must leave at the first glimmering of dawn, reporting "Line clear" by telegraph from the station nearest to a break.

Precedence for Construction Trains.

To give an account of each individual break would unduly swell the pages of this account; it must therefore suffice to state that during 8 months 78 successful raids were made on a length of 420 miles of line, and the damage done to way and rolling stock was very considerable. But after a time the system of intelligence and the steps taken to carry out repairs worked most satisfactorily; and eventually it was found sufficient to put a few R.E. on each Armoured Train, and these, as they moved out in the morning, executed any repairs required.

Résumé of Work done, October, 1900—May, 1901.

A somewhat similar arrangement of Construction Trains was also adopted in the Transvaal; but the direct control remained in the hands of the Supt. of Works, who moved his office to Johannesburg in October, 1900.

(b). System adopted in the Transvaal.

(3). SEMI-PERMANENT AND PERMANENT RECONSTRUCTION.

(A).—SOUTH EASTERN LINE TO NATAL.

On this line no semi-permanent repairs were necessary; and the permanent repairs, as far as Standerton, were entrusted to Lieut. G. R. Frith, R.E., under whom were working parties of the 8th and 10th (Railway) Companies, R.E., some Infantry details, civilian riveters and masons and native labour. From Standerton to Volksrust Mr. J. Wilson, C.E., was in charge.

On the 23rd August, 1900, Lieut. Frith began work at Blesbok Bridge (*Plate 66*). Stout derricks and two 10-ton differential blocks were used to raise the two broken portions of the central span; and these having been supported on trestles, it was possible to rebuild the masonry. New panels to replace those destroyed were not received until late in September, and on the 17th October the bridge was completed and tested.

Blesbok Spruit, August 23rd—October 17th, 1900.

On the 27th August permanent repairs to the Zuikerbosch Bridge were begun (*Plate 68*).

Zuikerbosch River, August 27th—December 16th, 1900.

The two portions of the 50-mètre span appeared to be quite separate, and an attempt was made to haul up the northern half by means of derricks and differential pulleys; the attempt failed with some damage to plant, and the bridge slid downward some feet. This seemed to show that the two halves were foul, and temporary stone platforms were therefore built in the river to accommodate four jacks, aggregating 170 tons lifting power. As the two portions were raised, it was found possible to cut out a tension bar of the southern half which fouled the northern; and then, by means of differential pulleys and holdfasts, to haul the latter back in a horizontal position, resting on crib piers and a timber slideway. Derricks and pulley blocks were then used, and the northern portion was raised bodily and supported as shown in the *Plate*.

The southern half was similarly treated, and it was found that the girders had sagged considerably. The damaged tie bars were therefore removed, their places being

taken by 12" × 12" baulks. 50-ton jacks were fitted at the ends of the baulks and the panels were then squared by means of the jacks. Each panel was treated separately, and the joints of top and bottom booms were hammered whilst the jacks were at work, to prevent any springing at these points. This method was quite successful, and a temporary line and gantry were next laid between the two damaged portions to allow of new ironwork being rapidly handled.

It was now the end of October, but the new panels did not arrive for 4 weeks, and accordingly it was not possible to open the bridge for traffic till December 16th.

On the length Standerton-Volksrust, only minor culverts had been damaged, and repairs on them were executed between January and April, 1901, under Mr. Wilson's supervision.

(B).—EASTERN LINE TO KOOMATI POORT.

Waterval Onder to Koomati Poort, November, 1900—February, 1901. Semi-Permanent Repairs.

No semi-permanent repairs were contemplated between Pretoria and Waterval Boven, but east of that place Lieut. Micklem, D.S.O., R.E., was placed in charge of this work, with orders to take in hand each of the bridges which have already been noticed between Waterval Onder and Koomati Poort.

Speaking generally, crib piers were replaced by more substantial trestles on concrete foundations; and where these already existed in the temporary bridges, their foundations were secured by a grouting of cement. In no case was traffic to be interfered with; but, where necessary, damaged girders were to be cleared from the sites of semi-permanent trestles.

Plates 74, 76, 77 and 78 illustrate the various semi-permanent structures which replaced the temporary bridges, and these works were carried out between the 2nd November, 1900, and 15th February, 1901.

The heaviest task was at Kaapmuiden bridge (Plates 76 and 77), where the trestles were over 40 feet high and it was necessary to clear the *débris* of girders and masonry before they could be erected.

Permanent Repairs.

In nearly every case the masonry had been so thoroughly shattered that it was necessary to rebuild it from the foundations. A careful examination of these showed that the engineers in charge of construction had not aimed at very secure foundations, and piers and abutments were carried down in some cases as much as 10 feet lower than formerly.

A valuable quarry was opened out at Bronkhorst Spruit, which supplied stone for bridges and culverts as far as Wilge River to the east. Haulage was arranged for by the construction engine, and in no case was ordinary traffic interfered with either by the material trains or by the reconstruction parties whilst at work.

Heavy charges had been used against the girders, which varied from 10 to 30 mètres span, and it was necessary to cut out damaged portions and to replace them from the workshops, or from portions of other damaged girders of similar dimensions.

The enemy interfered with the progress of work by sniping at workmen from the adjacent hills, and by making it difficult to run out stone on account of the serious breaks in the line; but the whole of the work to be done was completed in 3½ months, *i.e.*, at the beginning of January, 1901.

Both military and civil labour was employed, on piece work and on contract, and the results were quite satisfactory as regards quality and cost of works. A detailed statement of bridges rebuilt is given in an Appendix to D.R.'s General Report.

(C).—NORTHERN LINE.

Resumption of Temporary Reconstruction, March, 1901.

In previously referring to the temporary repairs on the Northern line it was stated that nothing was done beyond Warmbad, as the line beyond that place was not in the possession of the British.

But at the end of March, 1901, preparations were being made at Pretoria for the rapid advance of a Column commanded by Gen. Plumer, and Capt. F. G. Fuller, R.E., was warned to have a Construction Train in readiness. Secrecy being necessary, the party to man the train made Bronkhorst Spruit their rendezvous and left Pretoria on March 28th, *i.e.*, 2 days after the column had marched.

Warmbad, March 30th.

Joining Gen. Plumer at Piennaars, the Train followed him towards Warmbad; this place was reached at noon on March 30th and sidings and a platform were made.

The Construction Train was as usual marshalled in two portions. On 2nd April the leading portion pushed on with mounted men and took possession of two bridges beyond Nylstroom, whilst the rear portion brought up garrisons, tools and stores for constructing blockhouses on the line, a supply train being also utilised for the same purpose.

From the experience gained it would seem advisable to entrust the arrangements for making blockhouses and posts to the C.R.E. of the section of L. of C. concerned, rather than to the officer in charge of the Construction Train, who has other duties to attend to.

Furthermore, carriage for the garrisons, tools and stores for such blockhouses should follow separately behind the Construction Train and should not be carried on the latter.

On the evening of the 3rd the Construction Train ran into Naboom Spruit station in advance of the Column, with which it had lost touch; and, as the telegraph ahead was intact, it was ascertained that a train load of Boers was on its way to Pietersberg from Piet Potgieters Rust. The operator at this latter station further said that a trolley load of dynamite was being brought to Naboom Spruit. Unfortunately the noise of the engine of the Construction Train warned the enemy with the trolley and they retired, laying mines on the line as they went.

Naboom Spruit,
April 3rd.

Piet Potgieters Rust was reached on the 5th, and on the 7th the Column, moving by road, left for Pietersberg. The road and railway lie some distance apart, and an escort was told off for the protection of the train, as it was known, that the enemy were close at hand and that their demolition parties were busy on the railway. The train moved cautiously, and soon after midday viewed a bridge of 15 mètres span, the girders of which had been damaged. In three hours the necessary repairs had been completed; but as the leading portion moved forward to test the bridge, a mine exploded under the engine, damaging a spring bracket. Temporary packing was put in over the axle box, and the trains had to remain where they were for the night. Next day, at a point 93 kilomètres further along the line, another mine exploded under the leading truck of the first train, derailing it and causing a delay whilst the truck was unloaded and re-railed. Pietersberg was finally reached at noon on April 9th.

Potgieters Rust,
April 5th.

The only bridge of any size on the Northern line was over the Piennaars River and consisted of six spans of 25 mètres. This appeared to allow excessive waterway, and was therefore reduced to four spans, and the stone of abutments and superfluous piers was utilised for the new abutments. Similarly, undamaged and slightly damaged girders were selected for the new bridge, and the spans were jacked up, rested on trestling and repaired, whilst the masonry below them was removed. When the new masonry was ready, temporary stagings were put up to carry slide-ways, and the spans already mentioned were hauled forward into position with a six-ton winch. The whole of the work was done in one month, *i.e.*, between 10th October and 11th November, 1900.

Pietersberg,
April 9th.

Permanent
Reconstruction,
Piennaars River.

(D).—SOUTH WESTERN LINE TO KLERKSDORP.

Plates 84 to 87 give details of the semi-permanent repairs carried out on bridges at Bank, Koekmoer and Fredericstad and at two other crossings.

III.—EXPERIENCE GAINED.

The conclusions arrived at by Capt. Waghorn, R.E., on various subjects connected with the Works Department may be summarised as follows:—

For railway works of any magnitude large gangs of unskilled labour are required, and this is especially true of temporary repairs to be executed rapidly. Infantry working parties, though often of great value, are not as a rule satisfactory, partly because they require a good deal of supervision and partly because reliefs and Regiments are constantly changing so that the work of supervising them becomes very arduous.

The proportion of unskilled to skilled labour on temporary repairs is as 7 to 1, on semi-permanent and permanent repairs as 3 to 1.

An advance depôt for railway material and stores must invariably be formed at some place within 50 miles of the starting point for repairs, and that before work begins. During the campaign such depôts were formed at Orange River, at Colesberg, at Naaupoort and at Bloemfontein before the Columns advanced, and the results justified their location. To have attempted to keep the construction parties supplied from Cape Town or De Aar would have been hopeless.

Sufficient wagon transport to carry 60 tons should, if possible, be available at "rail-head" to allow an advanced party to move on, repairing minor breaks; much time is thus saved.

Provided that the arrangements for lighting works at night are good, an equal amount of work can be done by day and night shifts; and when repairs are being pressed, day and night shifts are essential.

The only class of work which cannot well be carried on by night is platelaying, which requires plenty of light along the track.

Conclusions drawn
by Supt. of Works
regarding —

(1). Labour.

(2). Material Depôts.

(3). Wagon
Transport at
Railhead.

(4). Night Work.

As regards patterns of lights the Wells' flare light and Capt. H. C. Nanton, R.E.'s acetylene light gave, on the whole, more satisfactory results than electric light. The latter is undoubtedly more powerful, but requires time to adjust leads and lights and takes up room in a train where space is limited. The deep shadows thrown by electric light are a great disadvantage; for while one party may be dazzled the next is in absolute darkness.

(5). Temporary
Bridges

Up to 18 feet height, crib piers and timber baulks make satisfactory bridges which can be rapidly built, as a large number of men can be employed to handle materials. Between 18 and 25 feet the speed at which such bridges can be built decreases rapidly, not only on account of the additional height but because so much more material is used.

Up	to 8 feet	height	piers	are	of	single	sleeper	width.
From	8 to 18	feet	"	"	double	"	"	
Above	18	feet	"	"	treble	"	"	

Sleeper cribs do not stand floods well unless filled with stone, and are easily burnt unless filled with earth. As a rule the maximum height of a crib pier should not exceed 25 feet.

(6). Water Supply.

The enemy's demolitions of water tanks caused much inconvenience to engines; difficulties were increased where bodies of troops appropriated the scanty supplies available and so prevented engines from moving at all. A Worthington pump and boiler, carried on a truck, did excellent service, and rapidly filled an engine from a travelling or stationary tank. Lift and force pumps worked by manual power and several lengths of hose should be carried. Engines can then make shift with the temporary watering arrangements.

(7). Demolition of
Railways in War.

To effectively destroy bridges, the girders should be attacked; but piers should be ignored unless there is a plentiful supply of explosives.

The water supply of a line should invariably be attacked, and the more complete the destruction of tanks and pumps the better.

All points and crossings should be completely destroyed.

To block a tunnel, 2 trains of *débris* and old rails should be made to collide in the middle.

The only really efficient way to delay an advancing Army is to damage 50 continuous miles or so of permanent way by exploding charges at alternate rail joints. In this way every rail is destroyed, and the enemy must bring up new material, of which he probably will not be able to lay down more than a mile a day. Intermediate stretches of line should be left intact, with contact mines under the rails; the moral effect of these is great, and will make the enemy cautious and so delay him yet more.

APPENDIX A TO CHAPTER II.

LIEUT. H. A. MICKLEM R.E.'S CONSTRUCTION TRAIN.

LIST OF PRINCIPAL TOOLS AND STORES TAKEN FROM BLOEMFONTEIN IN MAY, 1900.

Spanners, platelayers'	50	Bags, waterproof, for explosives	3
Drills for ratchets, long and short, $\frac{1}{4}$ " to 2"	100	Tools, riveters' : -	
Augers, long and short, $\frac{3}{8}$ " to $\frac{3}{4}$ "	100	Spanners and snaps, $\frac{3}{8}$ " and $\frac{1}{2}$ " ... of each	6
Tongs for cold sets pair	1	Hammers with 30" handles	12
Drills, 1" and $\frac{3}{4}$ " of each	6	Tongs pairs	4
Forges, smiths', round	2	Drifts, $\frac{3}{8}$ " and $\frac{1}{2}$ " of each	24
Pumps, lift and force	3	Hammers, sledge, 8-lb., with 36" handles ...	6
Hose for ditto lengths	24	Squares, carpenters', 20", 12", 9" and 6" ... of each	2 to 4
Jacks, traversing, of sizes 10 to 20 tons	10	Chisels, brick, 18"	12
" , Pearson's pair	1	Punches, centre	6
Spun yarn, tarred coils	2	Saw sets, hand and cross-cut of each	3
Grindstone, general service	1	Planes, jack and smoothing "	3
Vice, standing	1	Rules, carpenters'	12
Wells' lights, No. 3	2	Bellows, tinsmiths'	2
Pickets, iron shod	30	Couplings, screw	5
Blocks wood for $\frac{3}{4}$ " rope, single and double ...	8	Flags, hand, red	20
" , iron, " keying and hand	200	Brushes, paint, 6-oz.	8
" , beaters and pickaxes	150	" , No. 8 and liners, $1\frac{1}{2}$ " and 1" ... of each	2
" , axes and adzes	15	Slings, chain	4
" , augers	75	Rope, manilla, 3" coils	2
Waste, cotton lbs.	50	" , $4\frac{1}{2}$ ", $2\frac{1}{2}$ ", $2\frac{1}{4}$ " ... coil of each	1
Lead, red and white	168	Packings, iron, $\frac{1}{2}$ ", 1", 2", and 3" thick ... pieces	210
Oil, olive, castor, colza, linseed ... gallons of each	5	Driers, patent lbs.	14
" , paraffin gallons	30	Turpentine gallons	5
Tallow, Russian lbs.	200	Solder lbs.	15
Lamps, tail	4	Wick for lamps, hand, tail and hurricane.	
" , hand and hurricane	20	Glue lbs.	5
Anvils and blocks	3	Bunting, red, white and green ... yards of each	10
Spanners of sorts	22	Twine balls	12
Gauges, rail	14	Canvas yards	36
Levels, spirit	13	Locks for points, with key and plate ... sets	6
Irons, expansion	40	Elbows and T-pieces, 1", galvanised iron ... of each	12
Bars, boring and tamping, $1\frac{1}{2}$ "	17	Nipples, plugs and sockets, 1" galvanised iron, and bibcocks, brass of each	6
" , crow	60	Sockets, reducing, 2" to 1" and $1\frac{1}{2}$ " to 1" ... "	6
" , pinch	25	Piping, galvanised iron, 1" ... running feet	340
Buckets, galvanised iron	20	Tongs, pipe, 1", $1\frac{1}{2}$ " and 2" of each	1
Saws, 26" hand, cross cut, and pit	42	Bolts and nuts ($\frac{3}{8}$ ") 8", 14", 20", 24", 30" and 36" long of each	100
Tapes measuring, 100' and 50'	12	" , ($\frac{1}{2}$ ") 2", 4" and 6" long	75
Chisels, cold	25	" , ($\frac{1}{2}$ ") 9" and 3" long	100
" , smiths', round-nose and cross-cut	25	" , ($1\frac{1}{2}$ ") 30" long	24
Tanks, water, galvanised iron, 200 gallons ...	1	Bolt heads, $\frac{1}{2}$ "	200
" , " 50 "	3	" , ends, $\frac{1}{2}$ "	200
Trolleys of sorts	10	" , heads, $1\frac{1}{2}$ "	100
Bellows, smiths', with frame	1	Bolts, drift ($\frac{3}{8}$ ") 19", 22" and 26" long ... of each	100
Barrows, wheel, wood	12	Washers, iron, 1" x $\frac{1}{2}$ "	224
Tarpaulins	4	Sheets, galvanised iron, corrugated, 10' and 6' long of each	100
Axes pick, helved	350	Screws and washers, galvanised iron .. gross	2
Shovels	400	Dogs, timber, 24", 18" and 12" long ... of each	75
Beaters, platelayers', helved	100	Hinges, T and butt, assorted pairs	120
Hammers, keying and spiking	50	Nails, iron, cut, 6" and 5" lbs of each	100
" , sledge, 4 lbs. to 14 lbs.	33	" , wire, 6" and 5" cwt. of each	2
" , hand and claw	16	" , " 4", 2", $1\frac{1}{2}$ ", and 1" "	1
" , stone	24	Spikes, iron, 10" cwt.	3
Levers, platelayers'	10	" , 8" "	$1\frac{1}{2}$
Spikes, hand	6	Screws, wood, 5" to $\frac{3}{4}$ ", of sizes ... gross of each	4 to 10
Crows, jim	5	Iron, bar, round, $1\frac{1}{2}$ ", $1\frac{1}{4}$ ", 1" and $\frac{7}{8}$ " ... bars	20
Ratchets, platelayers'	13	" , " , $\frac{3}{4}$ ", $\frac{1}{2}$ " and $\frac{3}{8}$ "	50
" , fitters	3	" , " , 3" pieces	3
Cramps for ditto	14	" , " , flat, 6" x 1" to 2" x $\frac{1}{4}$ ", of sizes ... bars	24
Cold sets	50	Steel, tool, octagonal, $1\frac{1}{2}$ ", $1\frac{1}{4}$ ", 1", $\frac{3}{4}$ " and $\frac{1}{2}$ " bars of each	2
Adzes, carpenters'	10	" , blister lbs.	28
Gimlets of sizes	12	Lead, bar	200
Billhooks	29	Pins, split, steel, assorted gross	1
Axes, hand and felling	30	Rivets, iron ($\frac{3}{8}$ ") $4\frac{1}{2}$ " to $2\frac{1}{2}$ ", of sizes	600
Levels, field	4	" , ($\frac{3}{8}$ ") 4" to $2\frac{1}{2}$ "	700
Cans, oil, feeding	8	Boards, deal, 20' x 3" to 19' x $\frac{1}{2}$ ", of sizes ...	120
Ladles, melting	2	Baulks, 18" x 9", from 36' to 20' lengths ...	10
Staves, levelling, 6'	5	" , 16" x 8", " 32' to 17'	25
Kegs, water, with taps	2	" , 12" x 12", " 35 $\frac{1}{2}$ ' to 30' "	8
Files of sizes	40	Keys, steel, for trough sleepers	1,000
Gouges	24	Plates, fish, special junction pairs	36
Bags, sand	400	" , " , I.M.R. "	50
Chests, tool, filled, 6 D and 12 B of each	2	Bolts, " , " , " , " , " , " cases	3,000
" , " 11 C	4	Spikes, dog	30
" , " 12 D	1	Sleepers, 7', wood, of sorts	672
Stocks and dies, 2" to $1\frac{3}{8}$ ", $1\frac{1}{2}$ " to $\frac{3}{8}$ ", and $1\frac{1}{4}$ " to $\frac{1}{2}$ " set of each	1	Rails steel, C.G.R. pattern, 24' and 30' ... of each	80
Gas taps set	1	Points and crossings, I.M.R. set	1
Gauge, wheel	1	Sleepers, crossing	23
Hot sets	20	Theodolite, level, pair of staves and chain ... of each	1
Padlocks, galvanised iron	6		
Sprags for wheels	6		

APPENDIX B TO CHAPTER II.

ELECTRIC LIGHTING FOR NIGHT WORK OF CONSTRUCTION PARTIES,
ETC.

[BY ELECTRICAL ENGINEERS, ROYAL ENGINEERS (VOLUNTEERS)].

(1). ORANGE RIVER ROAD BRIDGE, BETHULIE.

On arrival on morning of 20th April, 1900, steps were at once taken to unload the trucks of all gear and to erect the projectors and other search light equipment.

At 11 a.m. on 21st the Traffic Officer asked whether the Electrical Section could light the road bridge so as to allow traffic to be carried on there by night. As none of the arc lamp gear had been unpacked and the two traction engines were still on their truck, it was impossible to get this completed by nightfall.

The engines were steamed off their truck as soon as steam had been raised, and a dynamo was unpacked and mounted on No. 2 Engine. (The ramp had to be specially strengthened with sleepers to allow of this being done). While this was in progress the assistance of a gang of natives was obtained, and the water tanks were erected at a point near the river and close to the first arch of the bridge. A party also unpacked 6 arc lamps and lanterns and fixed 440 yards of insulated, and 440 yards of bare, conductor on one of the cable carts of the Search Light trains, hauled them to the bridge and laid them out along the roadway for feeder mains. Some lengths of water pipes were found which were utilised as poles (none being with the equipment); and, with the addition of some cross bars and pulleys, six lamps were erected along the bridge, the poles being lashed to the hand rail. The engine was brought across the rails on sleepers, and arrived at the end of the bank leading up to the bridge by evening.

On Sunday, 22nd, the engine was moved to a convenient position near the water tanks above mentioned. This was a somewhat difficult operation, as the ground was very soft and sandy by the river; the engine became buried in the sand, and it was necessary to move her by hauling her out by her own wire, made fast round one of the bridge pillars. The water tanks were filled with water by buckets from the river and coal was stacked by the engine, and at 1 p.m. the whole installation was tested and proved satisfactory.

The lights were run that night and every following night, until the 30th, from 6 p.m. (nightfall) until the traffic had ceased. Hours for ceasing work varied from 6 p.m. to 11.30 p.m.

There were no casualties. The lamps gave no trouble and the bridge was efficiently lighted. Had longer poles been available, better general illumination would have been possible with four lights.

The lamps were 10-ampère lamps, run in pairs in series, the three pairs being parallel with each other.

The engine maintained 110 volts at terminals of dynamo.

(2). LOW-LEVEL RAILWAY DEVIATION BRIDGE, BETHULIE.

At 10.30 a.m. on 30th April, 1900, the D.A.D.R. notified that lights were no longer necessary on the road bridge, but were required on the approaches to the low-level railway bridge just completed and on the ends of the bridge itself.

No. 1 engine was therefore moved down to the river bank near this bridge and a party was sent off to lay the leads along it, whilst another party dismantled the lamps on the road bridge and erected them in their new positions.

One lamp was erected on a pole over the south side cutting, three lamps on the old railway bridge piers and two lamps over the north side cutting.

The whole work was completed by 5 p.m. and the lights were used as required through the night.

A field telephone was also laid across this bridge between the points at the deviation on either bank.

The lights described above were continued by night whenever trains were running over the bridge, warning being received from the station master when the trains were approaching.

On the evening of the 2nd May orders were received to move the whole of the Electrical Detachment, one Section to "railhead" and one Section and Dépôt to Bloemfontein.

On the morning of the 3rd inst. work was commenced on dismantling all the installations erected and packing up; and trucks having been obtained on the 4th, everything was loaded up and ready to move by 5 p.m. that night.

It is interesting to note that, from a ramp strengthened to bear them, the traction engines steamed easily on to their bogie trucks, although the latter were only just broad enough to take the wheels. The engines, before being shipped themselves, were employed to haul, by means of their hauling drums, the heavy loaded wagons up the ramp and on to their trucks, thus saving much time and labour.

The detachment moved from Bethulie at 8.30 a.m. on the 5th of May, reaching Bloemfontein at 5 a.m. next day.

(3). STATION YARD, BLOEMFONTEIN.

On arrival at Bloemfontein on Sunday morning the 6th of May, No. 2 Section under Capt. Leaf, E.E., R.E., was detailed to erect 6 arc lamps and some incandescent lamps as required at the station yard and loco. shops.

This installation was completed on the 7th, and run that night and every night subsequently. All the lights were satisfactory and there were no casualties.

(4). VET RIVER DEVIATION.

No. 1 Section arrived at Vet River at 5 p.m. on the 7th of May, 1900, and arrangements were at once made to erect lights as required.

A pair of leads were buried across the camping ground and road the same night; lamps were erected during the 8th, and were ready by 5.15 p.m.

As there were only 6 arc lamps with the Section, it was necessary to follow the work along the deviation as it progressed. This entailed the lights being shifted almost daily.

The only casualties experienced were on the night of the 8th inst. (the first night the lights were run), when, owing to the use of only Colonial coal, supplied at Bloemfontein, the fires choked badly and after four hours running it was found necessary to shut down, draw the fires and relight after clearing out the fire completely. The subsequent use of a proportion of Welsh coal obviated the difficulty, the fire bars being also somewhat further spaced to allow of the clinker being run out from below.

Later on the same night (about 12.30 a.m.) the boiler fusible plug began to leak, and at 2 a.m. it was found necessary to draw fires for the night; the plug was replaced next day.

The installation was dismantled on the 12th, and on the 14th the train moved to Smaldeal.

(5). ZAND RIVER AND RHENOSTER RIVER.

The Electrical Engineers also put up lights to facilitate night working at the Zand River and Rhenoster River deviations, and later assisted in bridge construction.

(6). TELEPHONE WORK IN CONNECTION WITH FLYING COLUMN FROM BETHULIE.

Sergt.-Major Brown and one Sapper were sent on the night of the 2nd of May, 1900, with a Flying Column, which left Bethulie to join hands with Gen. Hart who was moving south from Smithfield.

As the telegraph line between Bethulie and Smithfield was disconnected, and as the Commandant at Bethulie wished to keep in touch with his Column, an Ericson Field Telephone was fixed on the Smithfield wire at Bethulie station and a similar one was sent to Sergt.-Major Brown.

With these instruments communication was continually kept up while the Column advanced along the telegraph line; and when Gen. Hart was met, he was able to be put in communication at once *via* Bethulie with the Commander-in-Chief, his camp, which was $1\frac{1}{2}$ miles from the telegraph line, being connected by a bare copper No. 23 wire, paid out from the drums carried by a man on a belt designed for this purpose.

This very small and light telephone equipment is strongly recommended for further consideration.

F. LINDSAY LLOYD, *Capt., R.E.*,
Commanding E.E., R.E.

APPENDIX C TO CHAPTER II.

WORK IN MINE WORKSHOPS AT JOHANNESBERG FOR REPAIR OF GIRDERS.

Simmer and Jack Mine.

The first work done for the I.M.R. at the Simmer and Jack Mine shops consisted of four 50-foot trusses for the deviation at the Wilge River. This was during the month of July, 1900; the order was placed by the D.R. on a Saturday, and was completed and on the way to Pretoria by 12 p.m. on the Wednesday following. The 16" x 15" timber, and also the 14" x 14" for struts, was taken from the Rand Mines timber store. Some of the iron was obtained from merchants in Johannesburg and some from the Simmer and Jack Mine. The work was done under my supervision by mechanics employed by the Simmer and Jack Company.

In August I was ordered to inspect the broken bridges between Elandsfontein and Standerton and to arrange for the manufacture in Johannesburg Mine shops of new girders and pieces required, with instructions to report to Capt. Greenwood who was at that time acting Supt. of Works, Johannesburg.

The first work done was the repair of the Blesbok Spruit bridge. This bridge, which was broken in the centre, required a new panel to make it complete. To do this work I obtained the permission of the D.R. to get mechanics from Cape Town; and, as the Directors of the Simmer and Jack Mine kindly placed the shops of the Company at his disposal, it was decided to open them for the repair of bridges. When the mechanics arrived from Cape Town, a start was made on the new panel of the Spruit Bridge, the steel plates and rivets being obtained from merchants in Johannesburg. When the panel was finished it was shipped out to the bridge, and the mechanics accompanied it for the purpose of riveting it in place, the men working to the orders of Lieuts. G. R. Frith, L. B. Millington and R. H. Greig, R.E.

The next work in the Simmer and Jack shops was the repair of the Zuikerbosch Spruit bridge. In order to carry this work on at the same time that the repair of Blesbok was being effected, more civilians were brought up from Durban. To complete the repair of Zuikerbosch Bridge three new panels had to be made; the greater portion of the steel used in them was obtained from the broken span of the bridge over the Vaal River at Standerton. The steel plates and rivets required to complete were obtained, as in the case of the former bridge, from merchants in Johannesburg. On the completion of the panels, which were erected in the shops, they were marked, taken apart, and shipped out to the bridge, a gang of boilermakers and riveters being sent with them.

City and Suburban Mine.

At the time this work was going on I received an order from Lieut. H. L. Pritchard, R.E., who was in charge of the reconstruction of Taaibosch Spruit bridge, to repair the ends of the old spans of that bridge. To facilitate this and get the work out in the quickest possible time, I decided to open the shops of the City and Suburban Mine and to get more mechanics up from Durban and Cape Town. A few of the parts of the old girders were used, but the major portion was made from steel plate obtained in Johannesburg. As the girders of this bridge were destroyed at the ends, the new pieces were fitted together in the shops and then shipped out to Lieut. Pritchard, who fitted them to the old pieces which lay in the bed of the river.

The next work was a new panel for the Vaal River bridge at Vereeniging. The new panel was erected in the shops in the same manner as those for the Blesbok and Zuikerbosch bridges. The material was obtained from Johannesburg with the exception of the rivets, which were obtained from the Coast, the supply in Johannesburg having run short.

The tools used in the repair of the Blesbok and Zuikerbosch bridges were obtained from the Village Deep, City and Suburban, and Simon and Jack Mines, and from Mr. R. P. Whitelaw, Contractor. The drawings were made by draughtsmen under my supervision.

List of Machines used.

The following machines were used for the above work :—

	Simmer and Jack Mine.	City and Suburban Mine.
Shearing and punching machine	1	1
Roll	1	1
Drilling Machines	2	1
Planing do.	1	1
Lathe	1	—
Steam hammer (10 cwt.)	1	—
do. (5 cwt.)	—	1

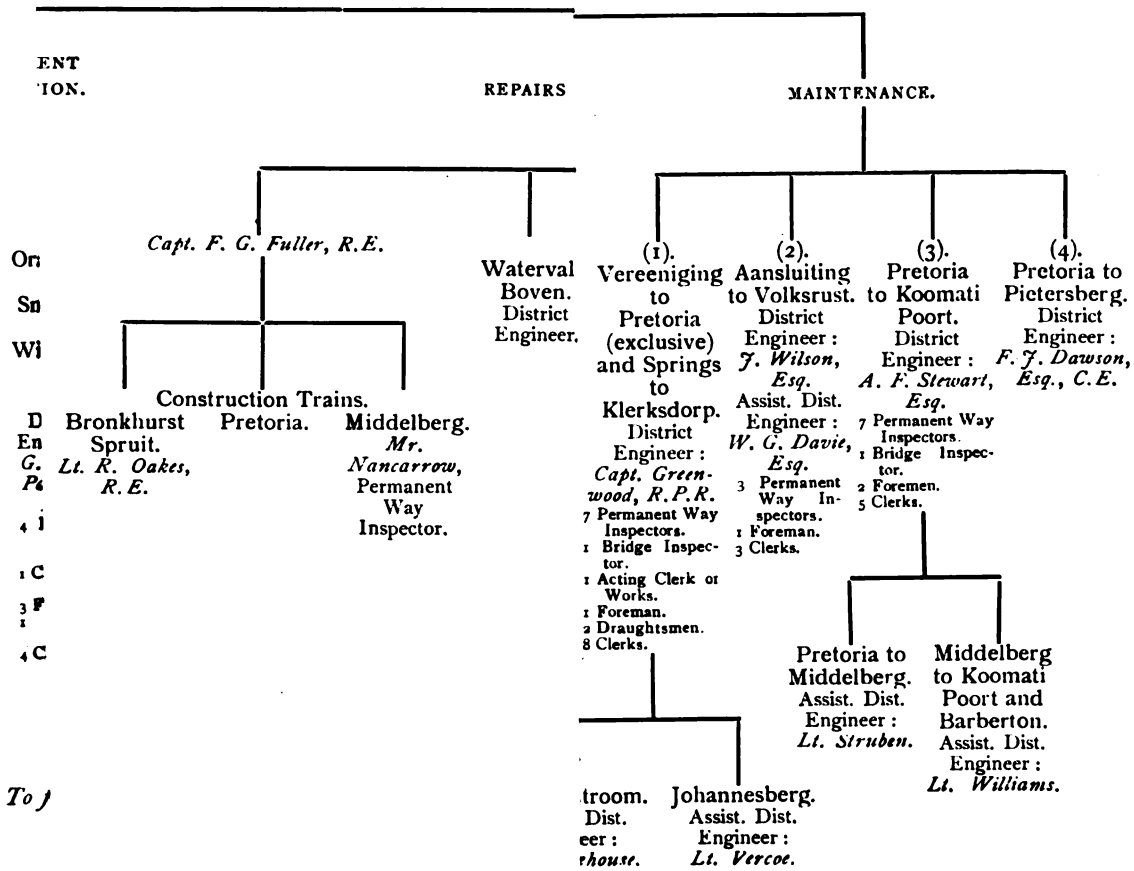
G. H. THURSTON,
Lieut., R.P.R.

HAD BEEN TEMPORARILY

R.E.

Scott, Esq.

I



CHAPTER III.

TRAFFIC DEPARTMENT.

On the 17th March, 1900, the D.R. assumed control of the railways in the O.F.S. (this control extending, for the time being, from the Orange River to Glen), and appointed Mr. W. H. Hoy of the C.G.R. as Traffic Manager of the military lines. Creation of I. M. R. Traffic Department.

Within the area specified, the Army had captured from the enemy 28 engines, 27 coaches and 325 trucks, the bulk of the latter belonging to the Boer States.

In the O.F.S. there were, before the war, 74 locomotives, 27 coaches and 820 trucks, and it will be seen therefore that the enemy had successfully removed a large proportion of rolling stock before retreating from Bloemfontein.

The condition of the line and appliances south of Bloemfontein as regards the Engineering and Telegraph departments has been described elsewhere, and it will be understood what difficulties stood in the way of an efficient train service. Traffic Working up to Bloemfontein.

Nevertheless, traffic began both from Bethulie and Norval's Pont on 27th March, 1900. Appendix G to Part I., Chapter III., illustrates the volume of traffic of various kinds passing northwards from each place; and it is now only necessary to summarise as follows the results for the period 27th March—30th September, 1900:—

	From Bethulie.	From Norval's Pont.	Totals.
Wagons, Troops	731	4,782	5,513
Do., Stores and Live Stock	11,542	21,829	33,371
Totals	12,273	36,611	38,884

No attempt was made to work traffic beyond Bloemfontein until the general advance northwards began in May, 1900; but once the Construction Trains had moved out and got to work, the Traffic Department followed hard behind them, gradually taking over the stations as communication was re-established both by rail and on the telegraphs. Extension of Traffic Working Northward.

The progress of engineering repairs, both in the O.R.C. and the Transvaal, has been dealt with at length in the previous Chapter. The operations of the Traffic Department were extended, month by month, as follows:—

- May, 1900. Bloemfontein to Kopjes.
- June, 1900. { Kopjes to Vaal River and Heilbron branch.
Vereeniging to Pretoria.
Springs Branch.
- July, 1900. { Johannesburg to Krugersdorp.
Elandsfontein to Heidelberg.
Krugersdorp to Klerksdorp.*
Pretoria to Elands River.
- August, 1900. { Heidelberg to Volksrust.
Elands River to Belfast.
- September, 1900. { Belfast to Koomatipoort.
Barberton Branch.
- November, 1900. Krugersdorp to Klerksdorp.
- April, 1901. Pretoria to Pietersberg.

The various stations north of Bloemfontein were taken over in a state of utter disorder; not only were the offices looted, telegraph instruments destroyed, cash safes blown up and furniture removed, but goods sheds and offices had been burnt, and the majority of buildings had been rendered uninhabitable.

As Military considerations over-rode all others, various railway buildings which were more or less intact were seized and occupied by various arms of the service; thus it came about that the traffic employes of the railways were often without proper accommodation, and much sickness resulted, with many deaths from enteric and other diseases. The absence of bare necessities of life, such as meat, bread and groceries, Hardships endured by Traffic Staff.

* Temporarily abandoned on the withdrawal of the British forces from Klerksdorp.

added to the strain on the staff; and it was not until supplies could be obtained from the coast that regular provision trains were run to furnish employés with such food stuffs as they required. These hardships told more or less on all the Traffic staff, but more especially on those men who had been imported from English railways, and their death rate was abnormally high.

The European Traffic Staff was recruited from various sources; of the total of 1,156 employed in September, 1900, 16 came from the R.E., 374 from the ranks of the Army, and 214 from the railways in Cape Colony and Natal; 168 were former employés of the enemy's lines who were reinstated; and 117 were obtained from England.

The majority of soldiers who were eligible were gradually transferred to the civil staff, and took permanent employment in the new Colonies.

Rolling Stock.

The disabilities arising from lack of rolling stock have already been fully commented on in Part I., Chapter III., and Part IV., Chapter I. These difficulties existed till October, 1900, by which time 367 engines and the equivalent of 6,033 short trucks had been captured from the enemy.

Re-Opening of Traffic with Natal.

With the re-establishment of railway communication with Natal, affairs became a little brighter, and on August 15th, 1900, the I.M.R. assumed complete control of the south-eastern line from Elandsfontein to Volksrust. During June, July, August and September, there were passed northwards over this line 770 wagons of passengers and 4,584 wagons of goods and live stock.

Rates.

In Part I., Appendix A to Chapter III., and Part II., Chapter II., the rates and concessions for Military Traffic on the C.G.R. and N.G.R. have been referred to, and the former were adopted on the I.M.R. also. In Appendix A to this Chapter will be found a comparison of rates charged, for equal distances, by the S. African Railways, and it will be seen that the tariff of the I.M.R. was, under the circumstances, reasonable.

During 1901, negotiations were conducted with the various lines leading to the coast with a view to reducing Military rates, and the following were finally agreed to:—

C.G.R.	7d. per "short truck" per mile, reduced to 5d.
N.G.R.	2½d. per ton mile, reduced to 1d.
Portuguese Railway	£2 17s. 9½d. per ton for goods, reduced to 9s. 2d. per ton within the Portuguese border.

Until August, 1901, all conveyance charges for military traffic over the I.M.R. were charged to a separate "Imperial Transport Ledger Account"; after that date local military traffic in the new Colonies, as well as re-consigned through traffic, was carried free over the I.M.R.

Coal Traffic.

During 1900 considerable difficulty was experienced in providing vehicles in which to transport the limited coal required by the railway Loco. Dept. and by the Gold Mines for pumping purposes.

The traffic was principally conveyed from the Springs, Brakpan, Witbank and Vaal River collieries, the output for 1900 and 1901 being as follows:—

	1900.	1901.
Springs and Brakpan	June to December. 135,466 tons.	445,886 tons.
Vereeniging	July to December. 60,112 "	209,164 "
Witbank and Belfast	August to December. 39,998 "	214,976 "
Total	235,576 tons.	870,026 tons.

Civil Traffic.

The rates and fares in operation prior to the war for local and through traffic (Civil) were generally adhered to.

The following statement represents the tonnage of civil goods received at I.M.R. stations during 1901:—

	From C.G.R.	From N.G.R.	Totals.
In Transvaal	45,224 tons.	81,885 tons.	127,109 tons.
In Orange River Colony	37,493 "	1,367 "	38,860 "
Totals	82,717 tons.	83,252 tons.	165,969 tons.

During September and October, 1899, 131,000 refugees left the Transvaal, of whom 78,000 were natives. When the country began to settle down the various Railway Administrations agreed that persons who had originally taken return tickets to ports in 1899, and were still in possession of them, should be allowed to use them, whilst those who had taken single tickets should only pay the difference between single and return fares.

Destitute refugees, armed with certificates from the Secretary or Chairman of a Refugee or Relief Committee, or from a Resident Magistrate, were carried back to their homes free of charge; and up to the end of April, 1902, 45,000 white refugees, exclusive of Government employes, had returned.

At Bloemfontein and Johannesburg, the railway Traffic Department organised a cartage and delivery service, to deal with the luggage of returning refugees at reasonable rates; at other important centres, the former cartage contracts were renewed.

The damage done to the signalling and interlocking apparatus at stations precluded the possibility of utilising it whilst military operations were in progress; and with the resumption of normal traffic, a safer and more efficient system of block working was seen to be necessary. On the southern line the "Absolute electric block" was working near Braamfontein early in October, 1900, whilst Webb and Thompson's "Electric train staff and tablet" was introduced the following year to harmonise with the Natal system. On the eastern line, "Tyers absolute tablet" was installed on the rack section, and the advisability of further extensions of the combined "absolute" and "permissive" systems on this section were under consideration.

Systems of Train Working and Control.

Appendix B to this Chapter gives the "General Instructions" and "Rules and Regulations" which were issued, as well as special orders concerning engine loads, etc.

During 1901, the total train mileage of the I.M.R. was 4,315,000, of which 1,600,000 was run in the O.R.C. Nearly the whole of this was run in the hours of daylight; as a result engine working was not always economical, but there does not appear to have been any occasion when the railway was unable to carry supplies to an advanced force, no matter how adverse were the traffic conditions. By the spring of 1902, the volume of traffic had considerably increased, and pointed to an annual train mileage of 6½ millions, being an increase on the mileage before the war.

Train Mileage in 1901.

Whilst the transportation of military stores and supplies was a matter of urgency, passenger coaches were not attached to trains; and officers and others, who moved from point to point by train, found accommodation either on goods wagons or in brake vans. But when a Military Government was firmly established at Pretoria and Johannesburg, a local passenger service was run for the benefit of the general public, and was much appreciated.

The baneful results of keeping rolling stock under load have been very fully commented on in Part IV., Chapter I., and it may be truthfully asserted that the exercise of forethought and discretion on the part of the Army generally would have resulted in a material increase in the carrying power of the railways.

Rolling Stock.

The new bogie goods wagons ordered by the I.M.R. proved their superiority conclusively over the older types of wagons on the South African railways, for the proportion of nett to gross loads was greater; but, in designing cars of increased carrying capacity for the carriage of general merchandise, it should be remembered that a limit is reached when the load in trucks begins to cause damage to the packing cases in which goods travel; when these are damaged, complaints are loud, and claims against the Administration multiply rapidly.

Working agreements governing the exchange of through traffic between the Cape, Natal and Portuguese Railway Administrations and the I.M.R. were entered into with regard to the following points:—

Working Agreements with Foreign Administrations.

1. The conditions for working a Joint Boundary Station, common to both Administrations.
2. Regulations for the interchange of rolling stock and goods in through traffic; payment for the hire of rolling stock; through traffic in passengers, goods and animals; facilities for loading, unloading, collection and delivery of goods; a system for dividing and accounting for the proportions of fares and carriage due to the respective railway Administrations; and all other practicable details which are necessary to secure efficient, amicable and economical working.
3. The assimilation of the systems, whereby the rolling stock of the respective Administrations, with continuous brakes and other appliances, might be conveniently coupled and interchanged.

Railway Staff
Officers.

The R.S.O.s were of very great assistance to the civil railway staff, forming as they did a medium of communication between this staff and the Army. Had they been of higher rank and possessed of a knowledge of the working of railway traffic, the results would have been better still. Cases were not unknown where military officers, in virtue of their army rank, over-rode the representations of R.S.O.s, and thus caused delay in dealing with traffic instead of expediting it.

Appreciation by
Military Authorities
of Work performed.

In closing this account of the work done by the Traffic Department, it is pleasant to be able to record the appreciation of the Commander-in-Chief and of Lord Kitchener, both of whom bore testimony to the zeal and energy displayed.

Lord Roberts, in his dispatch on Field Transport in South Africa, says:—

“The difficult and arduous work performed by the Railways reflects the greatest credit on all concerned.”

APPENDIX A TO CHAPTER III.

COMPARISON OF RATES CHARGED FOR IMPERIAL MILITARY TRAFFIC.

(1). EQUAL DISTANCES.

Goods Traffic.	N.G.R. Durban to Natal Border, 307 Miles.	C.G.R. and I.M.R., 307 Miles.
	£ s. d.	£ s. d.
Truck conveying (say) 5 tons supplies	15 6 3	8 19 1
“ ” “ 10 ” “	30 12 6	8 19 1
“ ” “ 15 ” “	45 18 9	17 18 2
“ ” “ 20 ” “	61 5 0	17 18 2
Short truck conveying live stock	7 14 6	8 19 1
Bogie “ ” “	11 11 3	17 18 2
Short truck or coach, conveying Troops, say 20 men ...	12 15 10	8 19 1
Bogie truck “ ” “ say 40 men ...	25 11 8	17 18 2

Men travelling on trucks for which 7d. rate has been paid over C.G.R. and I.M.R. are not charged extra.

(2). PORTS TO STANDERTON.

	Durban to Standerton, 369 Miles.	East London to Standerton, 745 Miles.
	£ s. d.	£ s. d.
1 short truck carrying (say) 7 tons	23 4 11	21 14 7

(3). PORTS TO JOHANNESBERG.

	East London to Johannesburg, 666 Miles.		Durban to Johannesburg, 484 Miles.	
	C.G.R. portion. 289 m.	I.M.R. portion. 377 m.	N.G.R. portion. 307 m.	I.M.R. portion. 177 m.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Short truck carrying (say) 7 tons ...	8 6 10	11 1 3	21 8 9	5 3 3
“ ” , say 20 men	8 6 10	11 1 8	12 15 10	5 7 3
Bogie coach, say 40 men	16 13 8	22 3 4	25 11 8	10 6 6

APPENDIX B TO CHAPTER III.

ENGINE LOADS, GENERAL INSTRUCTIONS, RULES FOR WORKING, ETC.

TRANSVAAL : LOADS OF ENGINES WORKING GOODS TRAINS.

SECTIONS.	AXLES.	
Pretoria-Elandsfontein	36	...
Elandsfontein-Vereeniging	60	...
Vereeniging-Elandsfontein	60	...
Elandsfontein-Pretoria	56	...
Springs-Johannesberg	50	...
Johannesberg-Randfontein	44	...
Randfontein-Klerksdorp	60	...
Klerksdorp-Randfontein	50	..
Randfontein-Johannesberg	44	...
Johannesberg-Elandsfontein	60	...
Elandsfontein-Springs	50	..
Elandsfontein-Volksrust	36	...
Volksrust-Elandsfontein	36	...
Pretoria Belfast	Loaded 26	Empty 50
Belfast-Waterval Boven	38	60
Waterval Boven-Koomatipoort	28	50
Barberton-Kaapmuiden	24	36
Waterval Boven-Pretoria	25	50
Koomatipoort-Waterval Boven	22	38
Kaapmuiden-Barberton	14	24

Every 5 trucks loaded with men, live stock, or vehicles, to be counted as four heavily loaded trucks.

The loads shown for Eastern Line are exclusive of van.

NOTE. —From Vereeniging to Elandsfontein trains of coal or other heavy material not to exceed 50 axles.

DIVIDING TRAINS.

Should it any time be necessary to divide a Train or uncouple an Engine the Automatic Brake must not be relied on to hold the Train as the Brake will after a time leak off. A Train must, therefore, be secured by Van Brake, side levers, and spraggs. Miscellaneous Orders.

EMPTIES.

Two Empties to count as equal to one loaded, but long trains of more than 90 axles must be avoided as much as possible, as the vacuum is difficult to maintain and the draw-bars are not strong enough.

BANKING ENGINES.

When more than one Engine is engaged in working a Train, the Train Load will be the sum of the loads of the Engines employed, unless specially provided for.

CROSSING PLACES WITHOUT TELEGRAPH COMMUNICATION.

The following Crossing Places, at which there are Pointsmen, are without Telegraphic Communication, and in consequence the men stationed there are not in a position to know whether Trains will, or will not, Cross at their Stations, viz. :—

MEYERTON.
NATAL SPRUIT.

It will be the duty of the Pointsmen at these Stations to admit Trains, whether crossing or not, on the left hand road, and Drivers will be held responsible for seeing that the Points are properly set for such roads before entering the Station.

ORANGE RIVER COLONY : LOADS OF ENGINES.

FROM	TO	MIXED TRAIN.	GOODS TRAIN.		
		No. of Bogies.	5th Class. Tons.	6th Class. Tons.	7th Class. Tons.
Norval's Pont	Springfontein	10	320	360	420
Springfontein	Bloemfontein	11	370	420	500
Bloemfontein	Viljoen's Drift... ..	11	410	470	570
Viljoen's Drift	Bloemfontein				
Bloemfontein	Norval's Pont	11	370	420	500

5 tons may be taken over prescribed load when necessary.

NOTE.—The following must be taken as the weights of Passenger Vehicles (loaded or empty) on Mixed Trains, when the tare is not marked :—

	Tons.
Bogie Saloons	26
Bogie Carriages, including 3rd Class and Composite Van	23
Bogie Officers' Coaches	15
Bogie Vans	20
Short Vans	7
Officers' Coaches—Short	Nil.

Banking Engines.—When more than one Engine is engaged in working a Train, the Train load will be the sum of the loads of the Engines employed, unless specially provided for.

The maximum length of any Train not to exceed 100 axles.

Dead Engines.—Dead Engines with Tenders must be counted as follows :—

1st Class	41 Tons.
2nd and 3rd Class	46 „
4th Class	50 „
5th Class	56 „
6th and 7th Class	70 „

Empties.—All Empty Four-Wheeled Trucks to be counted as equal to 7 tons each, and all empty Bogie Trucks to be counted as equal to 14 tons each.

Partially Loaded Trucks.—The Gross weight of a Short Truck, containing Men, Live Stock, Vehicles, and Empty Cases or Light Goods, to be counted as equal to 9 tons.

Tank Trucks.—Tank Trucks not marked must be counted as follows :—

Full	15 Tons.
Empty	6 „

BANKING TRAINS BETWEEN KROONSTAD AND JORDAAN.

Miscellaneous Orders.

All Up Goods Trains with full loads are banked from Kroonstad Station to a point at or about 583rd mile, from which mileage the Banking Engine returns immediately to Kroonstad.

The Shunter in charge of the Banking Engine will, before leaving Kroonstad, take with him a Train Staff, specially supplied for the purpose, and the line will be kept clear for the return of the Banking Engine until the Staff has been replaced in the Trains Board at Kroonstad Station.

All Engine Drivers working Up Trains, must, before leaving Kroonstad, satisfy themselves that the Train Staff is at Kroonstad Station, thus ensuring Banking Engine not being on the line.

The Station Inspector at Kroonstad when handing Guards of Up Trains proceeding orders, will also hand them the Banking Engine Train Staff and Guards will carry this staff to Engines for the purpose of satisfying the Drivers before departure that the Staff is held at Kroonstad Station; after doing so, Guards will immediately hand back Staff to Station Inspector, who will at once replace it in the Trains Board.

These instructions are in place of those contained in Clause 47 of Regulations for working Trains over Single Lines, and refer to Section Kroonstad to Jordaan *only*.

INTERVAL BETWEEN TRAINS.

A Passenger Train must not follow another Passenger Train under ten minutes, nor a Goods Train at a less interval than fifteen minutes. No Goods Train must be despatched in front of a Passenger Train unless it can reach the next Station or Siding at least ten minutes ahead of the following Passenger Train.

A Goods Train must not follow a Passenger Train at a less interval than ten minutes, or another Goods Train under an interval of fifteen minutes.

EXPEDITION OF THROUGH GOODS TRAINS.

With a view to expediting the running of Through Goods Trains, arrangements must be made, when such trains are running In Course and there is no crossing at the next intermediate siding and no work to be performed at the Station, for the train to run through Telegraph Stations without stopping. The Official in charge must have the Station to Station In Course Order prepared before arrival of train and hand same to the Driver and Guard at the facing points as the train passes.

The Driver and Guard must carefully peruse the Order and see that same has been correctly compiled before exchanging "Right Away" Signals.

Guards must notify to their Drivers at commencement of journey the Stations for which traffic is being carried.

DEAD ENGINES.

When one or more Dead Engines are despatched on one Train, they are to be separated by at least three (3) Short Vehicles from each other. When an Engine is employed in hauling Dead Engines only (the number of which must not exceed two) no Trucks need be placed between them.

ENGINES TRAVELLING TENDER FIRST.

Engines must not travel *Tender first*, except from unavoidable necessity, when the speed must not exceed *fifteen miles an hour*, whether running light or working a Train—unless Tender is carried on a Bogie Frame and provided with a Cow-Catcher.

PASSENGER AND MIXED TRAINS PASSING GOODS TRAINS AFTER DARK.

Passenger and Mixed Trains, when passing Goods Trains at Stations or Sidings after dark, must come to a dead stop at the facing points.

At several Stations "Catch Points" have been provided; Drivers must when shunting at such Stations satisfy themselves that such "Catch Points" are being held before commencing to shunt.

SIGNALS AT STATIONS AND TELEGRAPH SIDINGS.

At Stations where there are no Permanent Signals, Trains must on no account pass over facing points until Driver is satisfied that they are being held, and Hand Signal exhibited for Train to move forward.

Note.—The points at south of Smaldeel Station leading off Main Line into Construction Siding must be kept locked for Construction Siding. These points must be held by Foreman admitting Up Trains to Station or despatching Down Trains, the points to be locked again to Construction Road immediately after passing of Trains.

ENGINES TAKING WATER, AND CROSSING TRAINS, AT RIET RIVER, VET RIVER AND VIRGINIA.

Until additional water columns are provided, which will enable Up and Down Trains to take water while travelling on their proper lines, and without delaying each other at Riet River, Vet River, and Virginia, the following instructions must be observed:—

GENERAL.

1. When Goods Trains cross Passenger or Mixed Trains, the Passenger or Mixed Train must have preference in taking water, unless in the case of Virginia the Foreman in charge is satisfied that there is ample time for the Goods Train Engine to take water and get on to the other line before the arrival of the Passenger or Mixed Train.

2. Should two Passenger or Mixed Trains, one up and one down, cross at either of the Sidings, the Engines working such Trains will take water in the same order, and the Trains will observe the same practice as laid down for Goods Trains.

3. When Trains do not cross at either of the Sidings, they will travel over the line most convenient for the Engines to take water.

RIET RIVER.

4. When a Down Goods Train arrives before an Up Goods Train it will draw up to water tank on Main Line, and after taking water set back over north end points and enter Loop.

5. Down Goods Trains due to cross Up Passenger or Mixed Trains must always enter Loop and remain until departure of Passenger Trains, when they can set back over north points and draw up to water tank on the Main Line.

6. In the case of a Down Passenger or Mixed Train crossing an Up Goods Train, the Goods Train will take the Loop and allow the Passenger or Mixed Train to enter the Main Line, and after Engine has taken water proceed on its journey on receipt of the necessary authority.

VET RIVER AND VIRGINIA.

7. When a Down Goods Train, which has to cross an Up Passenger or Mixed Train, arrives first, it will travel on Main Line to Water Tank, and, after the Engine has taken water, set back and enter the Loop through north end points. The Up Passenger or Mixed Train will enter on the Main Line, and, after taking water, will proceed on its journey on receipt of the necessary authority.

8. Down Passenger or Mixed Trains will cross Up Goods Trains by travelling over the line of rails as laid down in Book of Rules and Regulations.

9. When Goods Trains cross at these Sidings, and an Up Goods Train is the first to arrive, it will proceed as far as Water Tank on the Main Line, and, after taking water, will set back and enter Loop Line through south end points.

10. When an Up Goods Train is the last to arrive, and has to take water, it will enter the Loop, and, when the line is clear for it to do so, will pass out on to Main Line through points at north end, and when the Main Line is clear will set back to the Water Tank.

ENGINE WATERING PLACES.

AT 13TH MILE, VAN ZIJL, KAFFIR RIVER, RIET SPRUIT, RHENOSTER RIVER AND TAAIBOSCHSPRUIT.

The above watering places, at which Trains may be expected to stop, being on Main Line and unprotected, drivers must at all times approach same cautiously, and have their Trains under such control as to be able to stop should a train be standing at tank.

VACUUM AUTOMATIC BRAKE.

Working the Brake.

The Brake can be applied throughout the Train by the Driver from the Engine, or by the Guard from the Van.

ENGINE DRIVER'S INSTRUCTIONS.

Engine Driver's Instructions.

Before starting, the Driver must see that the gauge indicates at least 18 inches of vacuum, and that not less than this is maintained during the journey and while standing at Stations. The vacuum is created by admitting steam to the small ejector, by means of the steam cock on the combination ejector.

To apply the Brake, move the handle on the combination ejector in the direction marked "BRAKE ON."

To release the Brake, move the handle on the combination ejector in the direction marked "BRAKE OFF."

In ordinary running this handle must stand at "RUNNING POSITION."

Steam Stop Valve.

This Valve has two positions, "open" and "closed," and must always be full open when running, and closed when the Engine is in the shed, to avoid condensation in the steam pipe. By its use the ejector may be examined while the boiler is under steam.

The small ejector steam valve must not be closed without first destroying the vacuum by applying the Brake.

The ejector drip pipe and the drip valve on train pipe must be kept clear and free from dirt.

When in the shed, the hose pipes between the Engine and Tender should be uncoupled. If water be found in these pipes it is a sign that the back stop valves in the ejector require attention.

GUARD'S INSTRUCTIONS.

Guard's Instructions.

When the Guard has occasion to apply the Brake, he must press down the handle on the valve placed in his Van. This admits air throughout the train pipe and is only to be employed in cases of emergency. The valve in the Van opens automatically when the brake is applied suddenly by the Driver and ensures rapid action.

The Guard must see by the gauge in his Van that a vacuum of at least 15 inches is maintained or report otherwise to the Driver.

See that all hose pipes between carriages, wagons, and engines are coupled together and that the coupling on the last coach is properly placed upon the plug.

Whenever the pipes between the vehicles are disconnected the coupling must be placed upon the stop plug at the end of the vehicle.

GENERAL INSTRUCTIONS.

General Instructions.

To release the brake for shunting purposes (the engine having left the train) first see that the hose coupling at one end of the train is off the plug, then pull the wire or cord fixed under the frame of each carriage. This admits air to the top side of the cylinder and the brakes fall off by gravity.

To couple the pipes, the Shunter must take one in each hand and lift them sufficiently high to hook the bottom horns of the coupling together first, and then by lowering them place the top horns of the coupling in the slots.

To uncouple the pipes, the Shunter must simply lift them straight up, when the horns at the top will come off the slots and the coupling will then separate.

The brake blocks should be kept evenly adjusted throughout the train. When this is attended to, better and easier stops can be made.

When coupling up the Vacuum Pipes care must be taken to see that the wire clips do not get wedged between the faces of the hose pipes and left in that condition; also that the indiarubber ring does not curl up, as it results in the brake being rendered non-effective.

It has been found that the practice of allowing the vacuum hoses to be drawn apart by the Engines in shunting, instead of personally disconnecting them, is on the increase, and Shunters and Guards are therefore impressed with the necessity for uncoupling the clip and vacuum tube prior to withdrawing the coupling pins.

Traffic Inspectors must report any instance of failure to observe these instructions coming under their notice.

Should at any time, through an accident or other cause, a leakage take place causing the Brake to be faulty, the Driver must turn the converting cock to "through pipe"; and if no cock, he can take off the small hose-bag connection to Vacuum Cylinder and plug the hole in the pipe, which will then make it a through pipe; and proceed with his train, reporting same on his return, and also advise the Examiner at the first Station where one is stationed.

Under no circumstances must the train, or a vehicle, be converted into Simple Vacuum Brake.

No Driver must have less than $\frac{2}{3}$ (two thirds) of his load working on the Automatic Brake, and if there are more than 6 (six) vehicles attached to the Brake Van not coupled to the Automatic Brake, the Driver must inform the Guard and request him to attach two Chain Brake vehicles to his Van.

The Natal Rolling Stock, being fitted with Automatic Brake, can be mixed with Cape and Imperial Military trucks and worked on that Brake.

GENERAL INSTRUCTIONS.

- (1). Traffic must be despatched in the following preferential order:—
- Preferential Order of Despatch of Traffic.
1. Live stock and vehicles accompanying passengers.
 2. Meat, fish and perishable goods.
 3. Live Stock—Oxen before sheep.
 4. Tranship goods and Refrigerator Trucks (Fruit and Perishables).
 5. General Goods.
 6. Trucks containing sheets and chains.
 7. Material.
- (2). In despatching accumulated traffic from Stations, the oldest dated traffic (taking distance into consideration) must be despatched first, unless instructions have been received indicating the urgency of other specific vehicles.
- Oldest Dated Traffic to be despatched first.
- (3). Trains arriving at a Station with a full load must pick up trucks left there by a previous Train, even if, to do so, it be necessary for them to put off some of their own load, unless it appears prudent to the Official in charge to order otherwise, in which case he must wire immediately to the Assistant Traffic Manager full particulars concerning the trucks that are still being delayed.
- Changing Traffic.
- (4). Carts and wagons are to be loaded, if possible, so that they shall travel with their backs to the engine; no combustible material may be conveyed in the same truck, unless properly protected from sparks from the engine.
- Loading of Vehicle Traffic.
- (5). At the different Locomotive Depot Stations, where engines of trains are changed, the Official giving the train authority to leave will be held responsible for seeing that all vehicles are correctly marshalled, and he will also be required to give a full load of through traffic, subject to any special instructions which may have to be taken into consideration.
- Correct Marshalling of Trains.
- (6). The following instructions are to be observed in marshalling trains:—
- Marshalling Instructions.
1. Trucks containing forage, chaff, live stock, as well as vehicles containing inflammable goods, must be placed on the train as far away from the engine as practicable, subject to other conditions requiring to be observed.
 2. Trucks containing explosives must be placed in the middle of the train, and not next the engine or van.
 3. Empty trucks to be placed behind loaded.
- Having due regard to the foregoing, trucks must be marshalled in station in order from the engine.
- (7). In case any bogie vehicle on the passenger trains should fail and another not be available, short vehicles fitted with heavy axles may, if absolutely necessary, be substituted, and must be placed next to the Engine Tender. If Tender has bogies then such short vehicles must be placed behind the Guard's van.
- Short Vehicles must be placed next the Engine.

- Loaded Trucks. (8). The employé who labels and affixes loading notes to loaded trucks will be responsible for seeing that the trucks are not loaded beyond their carrying capacity, and that the contents are safely loaded, and evenly distributed throughout truck.
- Short Trucks not to be placed singly between Two Bogies. (9). Short Trucks used on goods trains should not be placed singly between two bogie vehicles, but two or more short vehicles coupled together may be so placed. When one short truck only is available it must be placed next to the van.
- Equalising Loads of Trains. (10). Station Masters and others should endeavour to equalise the loads on trains as far as possible, consistent with the proper despatch of traffic ; for example, a full load of empty trucks must not be sent away when there may be other traffic waiting to go forward, and the load of the train could be made up of (say) half empty and half loaded trucks, the latter to be placed next to the Engine.
- Screw Couplings between Saloons. (11). The screw couplings connecting saloon carriages should not be screwed up too tightly when saloons are coupled together. The couplings should be just tight and no more, when the faces of the buffers are half an inch apart, then the buffer spring and screw coupling spring will each do their share of work and prevent jerking when the engine starts the train.
- Hand Lever Brake on Bogie Trucks. (12). Some hand lever brakes on bogie vehicles, through faulty construction, cannot be relied on to arrest the speed of the vehicle, and must therefore not be used in shunting ; such vehicles must in no case be detached from the engine or other vehicles till they have stopped.
- Precautions in Shunting at Stations near a Gradient falling from the Station. (13). When vehicles are being shunted by an engine into an open siding close to a falling gradient, or into a siding with a dead end abutting a building, they must in no case be detached from the engine before it has stopped with the vehicles placed in the required position ; and when vehicles are being shunted by an engine into any other siding, or on to the through line, they must not be detached from the engine before they are placed in the required position. At Stations situated near a gradient falling from the Station, vehicles must not be left on the open line, when uncoupled from an engine, unless they are properly spragged, or the brakes safely pinned down, to prevent the possibility of their running away ; nor must vehicles be hand-shunted about such yard unless under the personal supervision of Trains Foreman, Checker or other responsible Traffic Official.
- Shunting on Safety Chains. (14). Vehicles when being shunted must be attached by means of the proper centre buffer coupling, and in no instance must they be shunted when the safety chains are alone connected.
- Links hanging on Trucks. (15). Vehicles must not be allowed to travel on the Main Line with links hanging on the Chain Brake or other hooks which are affixed to the end of vehicles, as the falling of the links on the rails may cause an accident.
- Conductor's Examination of Vehicles, Broken Windows, etc. (16). Guards and Conductors must examine Carriage Windows, Cushions, Lamp and Electric Light Glasses, etc., when taking charge of any train, and at terminal stations immediately upon arrival thereat, with a view to ascertain whether any damage has been done on the journey. Any passenger breaking a window, lamp glass or electric light glass, must be required to pay the cost of a new one, viz. :—Window Glass, large size, 12s. 6d. ; small size, 10s. 6d. ; Lamp Glass, 2s. 6d. ; Electric Light Glass, 3s.
- Point Locks. (17). The points at all crossing loops, where there is no Staff, are provided with locks, and every Guard must have a points key with him when on duty.
- Facing Point Locks out of Order. (18). When point locks at Sidings, where there is no one on duty, are found damaged, the Guard must (when practicable) report the fact to the Ganger, and in every case to the Official in charge at the next Station, as well as recording it on his journal. He must also exchange damaged lock with the one on the Dead End Stop Block.
- Speed over Facing Points. (19). The speed of trains over facing points must not exceed 10 miles an hour in the night and 15 miles in the day, and entering a loop from the Main Line 8 miles an hour by day or by night.
- Examination of Empties detached at Sidings. (20). When detaching empty trucks at Sidings where there is no one on duty, Guards must examine them, with a view to prevent stray articles being left in such trucks.
- Exchanging Hand Signals between Guard and Driver. (21). Guards must exchange signals with Drivers after leaving Stations and Sidings, and when crossing loops without stopping. These signals should be exchanged after passing the last pair of points leading from Main Line.
- Careful Examination of Pins of Sheep Truck Doors. (22). Care must be taken to see that both pins are used for fastening the doors of sheep and cattle trucks, to prevent their falling down *en route*, and causing damage to the heads of Culverts and other Railway property. The fastening of sheep truck doors, as well as the doors of other trucks conveying live stock, requires careful examination by the Guard at each station and stopping place, so as to ensure that they have not worked loose.
- Gauging and Detaching of Vehicles when derailed. (23). When a vehicle on a train has been derailed, and a Carriage Examiner is not available, the Guard must request the Driver to gauge the vehicle when re-railed, and satisfy himself before taking it forward that the vehicle is safe to travel to the next station, where it must be detached for inspection. Any defective stock must be pointed out to the Carriage Examiners and noted on the Guard's Journal, showing the station where taken on.
- Trucks left at Sidings where there is no one on Duty. (24). At Sidings where there is no Staff on duty, the Guard who attaches or detaches vehicles is responsible for seeing that in each case the vehicle detached is placed in the dead end, the Stopblock is placed across the rail securely locked, that all Main Line points are set

and securely locked for the Main Line, the points leading into dead end set and locked for the loop, and that the brake of each vehicle detached at Siding is securely pinned down and, where from any cause it is necessary, that a hand scotch is also used to prevent the truck from moving.

(25). As complaints have been made from time to time of losses alleged to have been occasioned through natives being allowed to travel on loaded trucks, the Staff must be careful to see that natives are not permitted to ride on or next to trucks which contain goods of a nature likely to be easily pilfered. Natives travelling by Goods Trains.

(26). When oxen are put into trucks with fixed tarpaulins on the top, the greatest care must be taken to furl the sheet so closely as to prevent "bagging," as the sheets, if they hang down, are liable to be damaged by the oxen's horns being caught in them. Sheeting Cattle Trucks.

(27). When animals are discovered dead in a truck during transit by rail, the earliest opportunity must be taken to have them removed and disposed of to the best advantage; unless it appears more prudent to carry them to their destination. An unbiased witness should be called to see the condition of the animals, and notice facts as to death, etc., so far as they can be ascertained. Animals falling from trucks are to be similarly dealt with. Should animals be removed from trucks in transit owing to death or injury, and disposed of, the Station doing so must insert the necessary information on Way-Bill and truck ticket, and also advise sending and ultimate destination stations and the Assistant Traffic Manager of the system. Animals Dead and Down in Trucks.

(28). It must be distinctly understood that no Cash Bag is to be forwarded loose. Station Masters are responsible for placing their bags in the Cashbox in the Guard's Van and in the Guard's presence, and they will be held personally responsible for any loss resulting from any departure from this order. Guards are forbidden to take charge of any loose Cash Bag. In the event of the Cashbox not being in the proper train, the cash is to be retained in the custody of the Station Master, and an immediate telegram forwarded to the Assistant Traffic Manager and Accountant reporting it. Remittances.

(29). Station Masters must be careful when receiving wool for conveyance by rail, to examine it and see that the bales have not been damaged by wet, or in any other way; and should they (although apparently dry at the time of arrival at the station) show marks of stains, indicative of the wool having got wet, the greatest care is to be taken to give a receipt with a remark as to its wet or other state, and the invoice must also bear similar remarks. Precaution with Wool.

(30). Any defects or failure of the water arrangements at the water tanks must be communicated by telegraph or first means to the District Engineer and Maintenance Inspector, and to the Locomotive Superintendent and Locomotive Inspector, by the first party becoming aware of the defect or failure. Reporting Defects, etc., in Water Arrangements.

(31). All Signals, Weighing Machines, Warehouse and Water Cranes are kept in repair by the Maintenance Department, and inspected at intervals of not more than one month. Any defects that may occur during such intervals must be immediately reported to the Maintenance Inspector. Repairs of Weighing Machines, Signals and Cranes.

(32). Trucks and other vehicles, excepting trollies, must not be taken on the line beyond the limits of a station yard, without being attached to an engine. Detached Vehicles not to be taken outside Station Yards.

(33). Sheets must not be lent to other departments or the public without written authority from the Assistant Traffic Manager. The Station Master will be held accountable when sheets are found out of traffic working at or in the vicinity of his station, and in all cases will be required, when called upon, to produce the authority for the lending of the sheets. When circumstances are such as to render it desirable that sheets should be lent, they should be carefully examined as to condition, and steps taken to see that they are either returned in like good order or any defects noted and reported. Sheets not to be Lent without Authority.

(34). Representatives of well-known traders only are allowed to travel by pay and provision train, on payment of double the first-class return fares, whether for single or return journey. Paper tickets to be issued and endorsed "Pay Train." Fares by Pay Train.

(35). Passenger and Mixed Trains must have priority over Live Stock, Perishables, Goods or Mineral Trains. Preference of Passenger over Goods Trains.

(36). At Stations and Sidings where employes exchange duties, the official taking over the same by day or night, as the case may be, must, in company with the employe to be relieved, inspect the station yard, train telegrams, orders, etc., and must see that all points are locked, scotch blocks closed and locked, and vehicles standing in Siding properly secured, and acquaint himself with such matters as he should be aware of before taking over duty. It will be the duty of the employe to be relieved to give to the one relieving him the needful information as to the state of the yard, running of trains, special instructions, and such other particulars as may be necessary to ensure proper working. Exchange of Duties at Stations and Sidings.

(37). Night Inspectors, Foremen, and all others engaged in any way with the control or working of trains, must be given every opportunity of examining and becoming familiar with the contents of any order, circular, special or cancelled train, or any other notice or instructions in force and affecting the running of trains or working of traffic, for which purpose the books, etc., in which they are filed must be placed at the disposal of such Staff for reference. All circulars, instructions, or other notices, with which the night or other Examination of Circulars by Night Staff.

Staff should be acquainted, must be brought to their notice by the Officer whose duty it is to do so, and he must see that the Staff concerned read and understand them.

Trains Register Books.

(38). A correct register of the times the trains arrive and depart must be kept in the book provided for that purpose, which must also contain particulars of Special Trains announced to run and any Regular Trains cancelled.

(39). This book must be ruled across immediately below the last entry thereon; and the Officials exchanging must sign their names when coming on and going off duty, and enter the exact time during which each Official was in charge of the Station daily.

(40). It will be the duty of the Official in charge of a station to satisfy himself that the foregoing regulation is observed, to examine the trains register book frequently, and to sign it daily.

Telegraphing Trains.

(41). The exact time of the departure of every train must be officially telegraphed to the Station on duty in advance, immediately after the train leaves.

(42). The Official despatching the telegram must promptly record in the Train Book the time of doing so. The Official receiving the telegraphic advice must also record in his train book the time of receipt, and it will be his duty to report, by wire or letter, any case of delay in receiving the advice.

(43). No Station Master, unless in possession of instructions to the contrary, must permit his Station to be closed, or absent himself, until he has ascertained that the train or engine leaving his station has reached the next station; and the time and particulars of this information must be recorded in his trains register book, which he must sign, and show thereon the hour he leaves the office.

Copies of Train Telegrams to be sorted separately.

(44). All copies of telegrams relating to train movements must be sorted out separately, and each day's messages fastened together in pads, which must be suitably endorsed.

(45). At all Stations, as distinct from Sidings, it will be the duty of the Station Master to look through these pads each morning, and satisfy himself that the Night Inspector or Night Foreman has properly recorded and retained copies of all messages.

Holding of Facing Points at Stations and Sidings.

(46). At all Stations and Telegraph Sidings the duly appointed person must be at, and hold, points (which must be locked when locks are provided) to admit every train; and he must, before lowering or exhibiting a signal, satisfy himself that the points are set for the proper road.

Absence from Duty.

(47). Foremen must not absent themselves from their Stations or Sidings during the time they are off duty without proper authority. It is impossible for them to satisfactorily discharge their duties without having had proper rest.

Transfer of Contents of Disabled Trucks.

(48). Whenever it is necessary, from any cause, to transfer the load of any truck, a notification, giving the number of truck into which the contents have been transferred and the train by which despatched, must be forwarded to sending station, and also to the ultimate destination, by the Station at which such transfer has taken place. Care must be taken to detach any invoices, loading notes, or other documents which may be affixed to the disabled truck, and to attach them to the wagon into which the goods are transferred, unless they can be forwarded to their destination by a more expeditious means. Particulars of the transfer of the Goods must be shown on the documents by the transferring station. When informing Assistant Traffic Manager and Locomotive Superintendent by either telegram or letter of the detachment and detention of a disabled vehicle, the number and class of vehicle, the owning Administration, and full particulars of damage must be given.

Re-Railing Vehicles.

(49). Some confusion has occasionally arisen in the process of re-railing vehicles owing to a feeling of uncertainty as to who should direct the operations, and it has been decided that in future the following rules shall be observed:—

1. When a vehicle is derailed and a Locomotive Officer, Driver, Fitter, Examiner or Lifter is present, the superintendence of replacing the vehicle on the rails must be left entirely in his hands, and men belonging to other departments, who are not engaged on more important work, must render any assistance that may be required under his direction.
2. In the absence of a Locomotive Representative as above described, the superintendence of the work shall devolve upon a Maintenance Engineer or Inspector if one be at hand, and if not upon the Station Master if the mishap has taken place at or near a Station, or upon the Assistant Traffic Manager if it has taken place away from the Station and either of the Officers last named is not first on the scene. As soon, however, as one of the above-named Officers of the Locomotive or Maintenance Department arrives, the control shall be handed over to him by the Traffic Officer.
3. Should an accident occur whereby several vehicles are derailed, and it should appear expedient to remove some vehicles further from the rails in order to clear the line at risk of further injury, that plan must be adopted which would appear likely to occasion the least delay to the traffic.
4. A record should be kept of the time at which the Locomotive or Maintenance Department (as the case may be) was informed of the occurrence and of the time at which the vehicle was re-railed, and should it be thought that the work has not been performed with sufficient rapidity, the Station Master must report the matter to the Assistant Traffic Manager for investigation.

5. In case of derailments the senior Locomotive Officer present must take full particulars of damage to rolling stock and what Railway they belong to, also damage to road.

(50). Guards are not supplied with Ticket Books, as at all places where there is a Staff provision has been made for issuing Tickets to Passengers. When Passengers join goods trains at Intermediate Sidings or Halts, where there is no one on duty, Guards will be held responsible for handing them over at the next Siding or Station and *seeing* that tickets are issued to them. Issuing Tickets to Passengers travelling by Goods Trains.

Guards are to enter on their Journals particulars of all Passengers joining their trains at Intermediate Sidings. When Passengers alight at an Intermediate Siding Guards must collect their Tickets and hand them to the Official in Charge of the next Telegraph Station.

These instructions do not apply to the Heilbron and Winburg Branch Lines, where Guards are supplied with Ticket Books and are responsible for the issuing of Tickets to Passengers joining Trains at Halts where there is no one on duty.

(51). Trucks put off at Stations must on no account be allowed to stand in the Loop, but must be placed in Goods Shed Road or Cattle Dock. Trucks detached at Stations to be placed in Goods Shed Road.

Sidings having no Goods Shed Road must have all trucks put off in the Dead-end and properly secured.

(52). To ensure all Stations and Sidings having correct time the following is to be carried out :—

At 10 a.m. daily all Stations breaking in on main telegraph line must receive "time" from Bloemfontein Station. All Stations connected with Station to Station line must then in turn be advised from Transmitting Stations. In the event of any Station being overlooked it is the duty of the Station Master or Foreman in Charge at such Station to ask for the "time" signal and report any delay to the Assistant Traffic Manager. Daily Time Signal, O. R. C.

(53). To provide a check being exercised over the detention which trucks, loaded or empty, sustain at outlying Sidings where there is no one on duty, the following arrangements are to be observed :— Trucks standing on Sidings where there is no one on Duty, O. R. C.

Trains mentioned below must stop at each intermediate crossing place or outlying Siding so that the GUARDS may obtain particulars of any vehicle there may be standing, there, recording number and class of Vehicle, whether loaded or empty, and if loaded description of contents, date put off, and, if possible, why still in the Siding.

Written statements containing these particulars must be made out by the Guards before going off duty, and handed to the Officials in charge of the Stations responsible for clearing the section, and it will be the duty of the Station Masters to record upon the documents what steps have been taken to have the trucks removed. These statements may be detained, if necessary, for 24 hours by the Station Masters, for the purpose of reference and for comparison with the statements of the preceding day. They must then be signed and forwarded to the ASSISTANT TRAFFIC MANAGER.

No. 24 Up between Norval's Pont and Bloemfontein.

No. 12 Up between Bloemfontein and Kroonstad.

No. 24 Up between Kroonstad and Viljoen's Drift.

RULES AND REGULATIONS.

The attention of all concerned is drawn to the following rules, which must be strictly adhered to :—

SIGNALS.

The public safety, which must be the chief care of every servant of the Department, being largely dependent upon the proper use and observance of Signals, all persons whose duties are in any way connected with the Service of the Line are particularly required to make themselves familiar with all the codes and instructions relating to Signals which are now or may hereafter be issued. Signals, Observance of.

Officers and servants connected with the working of trains, including Station Masters, Yardmen, Foremen, Guards, Signalmen, Shunters, Porters, Engine Drivers, Firemen, and men employed on Permanent Way and Works, are to make themselves acquainted with the following Regulations, their knowledge of which they are liable to be examined in periodically :—

All persons connected with the line must bear in mind that engines may, under special circumstances, pass at any time during the day and night, whether or not they be mentioned in the Time Table or signalled in any way, and the same precautions must always be taken in signalling, whether engines are expected or not.

Red is a signal of " Danger "—Stop.

Green is a signal of " Caution "—Go slowly.

White is a signal of " All right "—Go on.

HAND SIGNALS.—These Signals will be made by hand or with flags by day; and with lamps by night or in foggy weather.

DANGER SIGNAL.—In the absence of flags, both arms raised above the head denotes “Danger.”

CAUTION SIGNAL.—One arm raised above the head denotes “Caution.”

ALL RIGHT SIGNAL.—One arm held in a horizontal position across the rails denotes “All right.”

In the absence of a red light, any light waved violently denotes “Danger” — Stop.

In shunting operations by night, a white flag waved slowly up and down means “Move forward”; a white light moved slowly from side to side across the body means “Move back.”

A green light, used instead of a white light as above, means “Move forward slowly” and “Move back slowly.”

A red light always, or any other light waved violently, means “Stop.”

All shunting after dark must be done with great steadiness and caution. Before commencing any shunting, the Driver must be informed, as far as possible, what he is expected to do.

FIXED SIGNALS consist of Home Signals, Distant Signals, Starting Signals, and Siding Signals.

The “Danger Semaphore Signal” is shown in the day time by the arm on the left hand side of the post being placed in a horizontal position; and by the exhibition of a red light by night.

The “Caution Semaphore Signal” is shown in the day time (Transvaal) by the arm on the left hand side of the post being placed half-way up from the horizontal position, (O.R.C.) by the arm being placed half-way down from the horizontal position, and (Transvaal and O.R.C.) by the exhibition of a green light by night.

Home and Distant Signals must always be kept at danger, being raised or lowered only in answer to the Driver’s whistle if the line is clear. Home signals at Junctions must never be passed when at Danger. When a train has stopped at a Junction Home Signal, and it is necessary to bring it within the Home Signal before the section ahead is clear, the Signalman may, when a Starting Signal is provided and that Signal is at Danger, place the Home Signal for the train to draw ahead. The Engine Driver of any train which has thus been stopped at a Junction Home Signal must, after the Signal has been placed at Caution, go slowly forward towards the Starting Signal, but must not pass the Starting Signal until it is raised or lowered.

When two trains are approaching a Junction in the same direction on different lines, all Signals must be kept at Danger till one of the trains has stopped.

When an Engine Driver finds a Distant Signal at Danger he must immediately reduce the speed of his train, so as to be able in case of need to stop at such signal; but if he sees that the way in front of him is clear, he must proceed slowly and cautiously within the Distant Signal, having such control of his train as to be able to stop it short of any obstruction that may exist between such signal and the Home Signal, and must bring his train to a stand as near the Home Signal as the circumstances of the case will allow. *Should any obstruction prevent the train from coming a train’s length within the Distant Signal, the Guard must go back to protect his train.*

Every train travelling on the line must have a Tail Lamp attached to the last vehicle, by day as well as by night. The Lamp need not be lighted in the day time, except during inclement weather; but its presence in the rear of each passing train will furnish evidence to the Signalman and others along the line that no portion of the train has become detached along the road; and when trains cross each other at a station, neither train may leave the station *until* the Station Master has seen the Tail Lamp on the last vehicle of each, and ascertained from the Guards that the whole of their respective trains has arrived.

The absence of a signal at a place where a Signal is ordinarily shown, or a Signal imperfectly exhibited, must be considered a Danger Signal and treated accordingly, and the fact reported to the Signalman or Station Master.

STATION MASTERS.

Every Station Master, or person in charge of a Station, must direct his most vigilant attention to the Signals, and use them, or see they are used, in accordance with the Rules and Regulations in force from time to time. He is the only person at the Station authorised to alter (under the regulations provided) the crossing places of trains, fixed in the Working Time Tables or Special Train Notices. This matter must at all times receive his prompt and most careful attention.

He must see that high or wide loads on vehicles or trucks are tested by the loading gauges, where provided, or measure to ensure that they do not exceed the maximum height or width allowed by the regulations.

He must see that the blocks are removed from the top of the springs of breakdown or travelling cranes; that the jib is lowered, so as to pass the gauge, fixed, and secured pointing to rear of the train. A Locomotive Official should when practicable attend to this duty and travel with the crane. In the absence of the Locomotive Official, the crane and its fastenings

must be examined at each stopping station, and should doubt exist as to the safety thereof, which cannot be rectified, the crane must be removed from the train. Whenever a crane is in use, and the jib or any portion of it obstructs or fouls any line of rails in use for traffic, or whenever the loading or unloading of any article of great breadth may obstruct the through line, steps must be taken and the proper signals exhibited to ensure safety.

At Terminal and Refreshment Stations a warning bell of one long and one short beat will be given, followed shortly afterwards by a starting bell of one long and two short beats; proceeding "right-away," will thereafter be given by officer in charge to guard, and by him to driver.

No unauthorised person must be allowed to interfere with the Train Register Book, or the working of the Signals or Points.

Station Masters must not allow Signalmen and Pointsmen to leave the signals and points of which they have charge, during the regular hours of duty, without relieving them with qualified substitutes. Signal cabins, both inside and out, are to be kept in a state of order and cleanliness, and no unauthorised persons are to be allowed to frequent them.

GATEKEEPERS.

The signal lamps must be lighted as soon as it commences to be dusk; and during the intervals between daylight and dark, both day and night signal must be used.

SIGNALS.—A white flag waved across the line by day, or a white light waved horizontally by night, will indicate "All right" signal.

A red flag by day, and a red light by night, will indicate "Danger." These signals to be used as special signals in accordance with the regulations.

Gatekeepers are required to report all cases where Drivers' neglect or disregard the signals exhibited.

GUARDS, DRIVERS AND FIREMEN.

No train must be allowed to travel on the line after sunset, or in inclement weather, unless there shall be attached thereto, and lighted, a Red Tail Lamp and two Red Side Lamps (except when it is otherwise provided); and the Guards, if there be more than one, must see that these lamps are kept properly burning throughout the journey.

Trains must not be started before the time stated in the Working Time Book or Special Train Notice, unless under special instructions from a superior Officer, and the following signals to start must in every case be strictly adhered to.

The Station Official shall give "Right away" to the Guard, who will blow his whistle, and exhibit a green flag or green light in the same manner to the Driver, who shall take it as his authority to proceed, provided he is in possession of an order authorising him to do so when one is required.

When there are two or more Guards with one train, the signal to the Engine Driver to start must only be given by the Guard nearest the Engine, and not until after he has exchanged signals with the Guard or Guards in the rear, and received information from the person in charge of the Station that all is right for the train to proceed.

When a train is about to start from a Station or Siding, the signal to start given by the Guard merely indicates that the Station duties are completed. Previous to starting the train, the Driver must satisfy himself that the line before him is clear, either by observation or by obtaining by means of a whistle the exhibition of the necessary signals as the circumstances may require, and that he is in possession of the necessary orders authorising him to proceed.

When starting, the Fireman must look back to the platform side until the last vehicle has drawn clear of all facing points, to see that the whole of the train is following in a safe and proper manner, indication of which will be given him by the Guard holding out a green flag or green light, which must be acknowledged by the Fireman giving him an "All right" hand signal. When a Guard omits to give this signal the Driver shall call for it by whistle, and if still not exhibited must stop the train.

A Red Board or a Red Flag by day, or an additional Red Tail Lamp by night, carried on the last vehicle of a train or on an engine, indicates that a Special Train or Engine is to follow.

As, however, Special Trains or Engines have frequently to be run without previous notice of any kind, it is necessary for the Staff along the Line to be, at all times, prepared for such extra trains or engines.

Trains, when approaching a Station at which a crossing takes place, must proceed cautiously over the facing points until the Driver has ascertained that the points are set for the proper line of rails for his train to enter.

A Train brought in, or standing, on the through line or a loop, for the purpose of crossing another Train, must not foul the points at either end.

At the end of the journey the Guard in charge must despatch to the Assistant Traffic Manager a journal containing, in addition to the time of the running of his Train, a record of every circumstance of an unusual kind, such as detention, etc., if any, that has taken place on the journey; of any error in Parcels, Luggage, or Goods, and of the state of the weather at various points. When any occurrence has taken place involving in any respect the safety of the Train or Line, he must, in addition to mentioning it in his journal, send in a special report thereof.

Guards' Journals,
Rendering of.

Derailements—
Permanent Way Men
to be advised.

In any case where an engine, tender, carriage or other vehicle has left the road, or where, from collision or any other cause soever, there has been a disturbance of the road bed, the Guard must send written notice of the circumstance to the nearest Ganger or Platelayer, in order that the road may be properly examined, in addition to reporting it to the Station Master of the next station he comes to; and the Station Master must also take steps to communicate with the Permanent Way men. Should the accident take place in a Station Yard whilst the Shunter is in charge, he is to report to the Station Master, who will communicate with the Permanent Way men.

Train stopped by
Accident or
Obstruction—
Assistance required.

When a train meets on any part of the line with an accident or obstruction of a nature to call for assistance which is not procurable near at hand, the Driver and the Guard (or, in his absence, the Fireman) must at once protect their train by going sufficiently far back (at least two hundred yards) and conspicuously exhibiting his hand danger signal from the rear of his train to enable him to sight and stop a following train in sufficient time to prevent its running into the rear of his own train. The Guard (or, in his absence, the Driver) must then despatch a special messenger by the most expeditious means to the nearest station and, if practicable, to the Station on each side of the scene of the accident or obstruction, with a written statement of the nature and extent of the mishap and of the kind of assistance required; the Guard himself (or, in his absence, the Fireman) must act as messenger if no other is available. The Station Master who receives the message must communicate it to the Drivers and Guards of trains arriving at his Station, and advise all concerned as laid down in Director's Circular 250 of 1st August, 1901.

Protection of Trains
standing on Line
outside Fixed Signals.

When a train is stopped by an accident or from any cause (except where it is efficiently protected by fixed signals), the Guard if there be only one, or the rear Guard if there be more than one, must immediately go back to protect his train, taking with him flags or hand lamp, as the case may be, and detonators. He must go sufficiently far back (at least two hundred yards), conspicuously exhibiting his Hand Danger Signal from the rear of his train to enable him to sight and stop a following train in sufficient time to prevent its running into the rear of his own train. He must not return to his train until recalled by the Engine Driver sounding the whistle of his engine, and not even then if he can sight or hear a following train, in which case he must, before returning, wait until he has brought such train to a standstill and informed the driver of the obstruction in front. Should he not sight or hear a coming train when he is recalled by his Driver, he must place a detonator on the line, after which he must return to his train, keeping a good look out the whole time for a following train, and be prepared to immediately turn back again for the protection of his own train.

In the event of the delayed train arriving at the next Telegraph Station, after a detonator has been placed on the line, before a following train has left the Telegraph Station in the rear, the trainmen of the next train over the section, whether following or opposite, must be advised of the locality of the detonator and the reasons for it being placed there.

Trains stopping at
Places other than the
Recognised Crossing
Places.

Whenever a train has been ordered to stop at any place other than the recognised Crossing Places (*i.e.* Telegraph Stations and Intermediate Sidings), intimation of such instruction must be endorsed on the Train Proceeding Order of any train following in the same section; full particulars of the nature of the stoppage to be given.

This applies to standing instructions to trains ordered to stop at Military Camps, etc.

When the instructions to stop are given by a Depôt Station or by a Station short of the section where the stoppage is to take place, the guard of the train will be held responsible for advising the official in charge of the Station previous to where the stoppage will take place, in order that the latter official can endorse the Proceeding Orders of the following trains.

Accident caused by
Defective Engine.

When the accident is caused by any defect of the Engine, and the Driver is of opinion that the assistance of another Engine is required, he must not, after sending for it, attempt to proceed until it arrives, even if the defects of his Engine have been made good, unless he is positively assured in writing that the line is clear for him to do so.

Line broken by Floods
or Washaways—
Maintenance Dept.
to have possession of.

When the Line has been broken by floods, the Maintenance Department must have possession of the section between the two nearest Stations, until it is made passable and handed over to the Traffic Department; and no train or engine must be allowed on the blocked portion of the line without the consent of the District Engineer or his representative.

Accidents to Live
Stock.

Every precaution must be taken, both by day and by night, to prevent injury to live stock straying on the railway. When a Driver sees live stock on, or close to, the railway, where the line is unfenced, he must slacken the speed of his train and be prepared to stop, if necessary, to avoid running over them. In cases where contact cannot be avoided, the train must be stopped as quickly as possible, and the line cleared of the obstruction.

Information as to livestock killed or injured must be given to the nearest Station Master, and to the owner where known, by the responsible resident employé who becomes aware of the casualty.

Should the owner decline to take possession, be unknown, or live at such a distance that he cannot be communicated with in a reasonable time, injuries should be attended to as far as practicable; animals killed should be skinned (or, if ostriches, plucked), and skins, horns (if any) and hoofs, or in the case of ostriches the feathers, be despatched with the carcasses (if they are of any value) to the nearest Station Master, who will dispose of the whole to the best advantage.

CHAPTER IV.

LOCOMOTIVE DEPARTMENT.

(A).—WORK IN ORANGE RIVER COLONY.

When Bloemfontein was captured, Lieut. A. G. Stevenson, D.S.O., R.E., was appointed Loco. Supt. of the I.M.R., with headquarters at Bloemfontein. Appointment of Loco. Supt., I. M. R.

The whole of the Loco. Staff of the O.F.S. Railway (with the exception of the Supt.) were ready to serve the new administration, and the system hitherto in force on the railway was continued, so that work was carried on without interruption. Description of Loco. Dept. of O. F. S. R.

The two branches of the Loco. Dept. were entitled "Works Branch" and "Running Branch."

The former was in charge of a Works Manager with headquarters at Bloemfontein; he was responsible to the Loco. Supt., and controlled the *personnel* of the Workshops and carriage and wagon yard; to aid him there were foremen in charge of the various shops and manufacturing operations. (a). Works Branch.

A District Loco. Supt. was in charge of the "Running Branch"; he was responsible for out-stations, pumping depôts, and for all details connected with engines, carriages, wagons and locomotive machinery when not under repair. To exercise proper supervision, two Loco. Inspectors constantly patrolled the line; at the larger engine stations were District Foremen, at the smaller ones shed men or drivers-in-charge. (b). Running Branch.

The main line of the system (from mid-bridge, Norval's Pont, to mid-bridge, Vaal River) was 334 miles, divided into sections as follows:— Locomotive Districts.

- | | | | |
|---|-----|-----|------------|
| (i.). Norval's Pont to Bloemfontein | ... | ... | 121 miles. |
| (ii.). Bloemfontein to Kroonstad | ... | ... | 127 " |
| (iii.). Kroonstad to Viljoen's Drift | ... | ... | 86 " |

The branches to Bethulie, Winburg and Heilbron were respectively included in the above sections.

There were engine depôts at Norval's Pont, Springfontein, Bethulie, Bloemfontein, Kroonstad and Viljoen's Drift.

The important business of examining carriages and wagons, and of effecting minor repairs or returning damaged wagons to shops, was in the hands of a separate staff under Loco. Foremen, with headquarters at the engine depôts. There were also special men on this staff at the boundary stations to North and South, who carefully inspected cars entering from, or returning to, the adjacent States. Carriage Examining.

As regards engines and *personnel* on them, the Foremen prepared enginemen's rosters, and the latter furnished trip sheets, showing in detail how they and their firemen were employed. Detailed returns of engines, showing mileage run, date and cost of repairs, cost per train mile, etc.—in fact, history sheets for each individual engine—were compiled in the Loco. Supt.'s office from data supplied by the Running and Works Branches, and mileage statements were furnished monthly to the Accounts Branch of the Administration. Engine Run Returns.

Coal was obtained in bulk by the Stores Dept. from mines at Vereeniging; it was then issued to the Loco. Dept. as required. To ensure good and even quality, an Inspector and two Assistants were stationed at the mines to watch the operation of picking over; these men were paid by the railway authorities. This system was continued, and Messrs. Durrant & Carolin, late of the O.F.S. Railway, were reinstated in their former posts in charge of the Works and Running Branches respectively. Coal Supply.

(I). TEMPORARY WORK FOLLOWING UP ARMY.

Immediately Bloemfontein was occupied (13th March, 1900), steps were taken by the Loco. Supt. to meet demands on his department. Though the daily train service southward was not heavy at first, it gradually increased to thirteen trains each way, and when the enemy captured and held the water supply at Sannah's Post, near Bloemfontein, an additional water train was run to Glen Station on the north. Taking over Line and Temporary Running Arrangements.

Of the 28 locomotives captured at Bloemfontein, one-half were in fair running order and the remainder under repairs. Of the latter, nine were ready for work in less than three weeks, and four more by the end of April. But of the whole 28, only 16

(which were 5th and 6th class, C.G.R. pattern) were suitable for main line work, the rest being 4th class shunting engines.

To meet the heavy demands for trains of all kinds, 19 engines were obtained on loan or hire from the C.G.R., and these arrived during April, May and June. They included three powerful 7th class 8-wheel coupled goods engines.

Banking Engines at Norval's Pont and Bethulie.

It will be remembered that the Norval's Pont and Bethulie railway bridges had been destroyed, and that the deviations had steep gradients. Accordingly, one "banking" engine was temporarily stationed at each place to shunt and assist trains on the bridge approaches; whilst at Springfontein was stationed another engine to work traffic from Bethulie to Bloemfontein.

Before the outbreak of hostilities, Norval's Pont locomotive station was the joint property of the C.G.R. and O.F.S. Railways, in charge of a Foreman of the first-named line; coal and stores were supplied by the latter administration. This arrangement was continued under the new *régime*. In the same way, Springfontein had formerly been a joint locomotive station of the two lines, controlled by the O.F.S. Railway.

Pending the reconstruction of Bethulie bridge, the Eastern Section of the C.G.R. sent three heavy engines to the I.M.R. to work the Bethulie traffic; and when the bridge was finally opened, these locomotives ran, as formerly, from Burghersdorp to Springfontein.

The carriage examining staff and stations have already been referred to; at the end of May, at a meeting of representatives of the C.G.R. and I.M.R., it was decided to make Springfontein a joint examining station, with a staff of eight men, including a Foreman; but the arrangement did not come into force until the beginning of September, 1900.

Advance Northwards from Bloemfontein.

North of Bloemfontein, trains could not proceed beyond Karree siding until the advance of the Army had begun and the battle of Brandfort (May 3rd, 1900) had been fought. In conjunction with the Works Supt., the head of the Loco. Dept. had given much thought to the preparations he should make for the advance.

Distribution of Engines available.

The Construction Train was given a prior claim for engine power; second in order came trains carrying materials for the reconstruction parties; and, lastly, trains carrying supplies to the advancing Army. At the same time, it was also necessary to arrange power for the train service to and from the south, which at this time amounted to seven trains per day. Three engines in all were detailed for the Construction Train and their crews remained permanently with them. The account given in Part IV., Chapter II. (A), shows the steeply-graded temporary deviations which were made, and their existence rendered it necessary to withdraw four engines from main line work to act as "banking engines" to trains for the north. Thus, of the 27 engines available on May 31st, 7 could not be counted on for main line traffic.

Most fortunately night running was not, at this time, prohibited, and main line engines were permanently on duty; and to each were allotted two engine crews working twelve hours on and twelve hours off. These men lived in a "caboose" or running room on wheels, attached to the train which the engine was hauling. In this way, any damage or ill usage could be rapidly and definitely traced to a particular crew, whilst the locomotive was performing its maximum of work. At a later date, crews took out engines as they fell to their lot; but for the opening period of the advance the system described worked well though the strain on crews was severe.

For the Loco. Dept., the period of the advance from Bloemfontein to the Vaal divided itself into two portions, viz., to Kroonstad and beyond. When the important engine depôt at Kroonstad was reached (May 24th), it was re-opened with the necessary staff of foremen, enginemen, fitters, etc.; and five engines, some with double crews, were detailed to stable there.

The Army entered Viljoen's Drift on 26th May, and the officer representing the D.R. at Army Headquarters (Lieut. E. H. M. Leggett, R.E.) engaged all the members of the late O.F.S. Loco. Staff who were willing to work for the British. As the reconstruction parties were some distance behind, and it was necessary to have a staff at hand to work the lines near Johannesburg which would shortly fall into Lord Roberts' hands, the fourteen men thus recruited were transferred to the Transvaal railways.

Steps taken to remedy Deficient Watering Arrangements.

The probability that tanks and locomotive watering arrangements would be extensively damaged was foreseen, and one of the cars of the Construction Train was therefore specially fitted up as a repairing shop for pumps and tanks. A supply of coal, oil and stores for the Construction Train engine was put on board that train and further supplies were regularly forwarded by material trains.

Water Supply.

In Table A are details regarding the various water supplies in the O.F.S., and it will be seen how systematically the enemy damaged these supplies and the machinery connected with them, entailing considerable delay on the reconstruction parties and many anxieties on the Loco. Dept. *Photo 46* gives a sample of the damage done.

TABLE A.
ORANGE RIVER COLONY; LOCOMOTIVE WATERING ARRANGEMENTS,
SHOWING DAMAGE DONE, AND REPAIRS EFFECTED IN 1900.

Distance to next Tank, Miles.	Mileage from Norval's Pont.	Station	TANKS.			PUMPS.			Damage done by Enemy.	Temporary and Permanent Repairs effected.
			Nature.	Capacity: Gallons.	Source of Water Supply.	Description and Number of.	Motive Power.			
	0	Norval's Pont to Bloemfontein.	—	No details available.				Nil.	Temporary:— Pump and boiler erected on the north side of Orange River, 1 mile from bank, pending the completion of through communication.	
	122	Bloemfontein.	Cast iron.	40,000	Sannah's Post Water-works, 14 miles away.	2 compound pumping engines.	Steam.	Slide valves removed; main cut.	Temporary:— 64,000 gallons brought in 4 water trains daily from Gen Station, Modder River. Permanent:— New slide valves made in Railway work-shops.	
35	157	Brandfort.	Cast iron.	10,000	Not known.	Not known.	Oil engine and windmill.	Tank and pump blown up; windmill destroyed.	Repaired without delay to traffic.	
21	178	Vet River.	do.	20,000	Well, 4-mile distant.	Three-throw Middleton.	Steam.	End of tank blown out; pump damaged and thrown down well; boiler blown up.	Temporary:— Locomotive boiler lowered into river; pumps repaired, and work re-started in 48 hours. Permanent:— Pump duplicated.	
7	185	Smaldeel.	—	No details.	—	—	Oil engine and windmill.	Engine and pumps tampered with.	Repaired in a few hours.	
25	210	Virginia.	—	No details.	—	—	—	Boiler blown up; pump damaged.	Temporary:— Repaired in a few hours. Permanent:— Pump duplicated.	
6	216	Reit Spruit.	—	No details.	—	—	—	—	A temporary station, opened to relieve the strain on Virginia.	
7	223	Ventersberg Road.	Cast iron.	10,000	Not known.	Worthington	Steam and windmill.	Windmill smashed; boiler and pump blown up, also end of tank.	Repaired without delay to traffic.	
27	250	Kroonstad.	do.	20,000	Valsch River.	Double Cameron and Worthington.	Steam in locomotive boiler.	Nil.	Camp supply of 6,000 gallons added to existing supply.	
35	285	Rhenoster.	Settling tanks. Cast iron.	4,000 20,000	Well.	Middleton.	Steam.	Pump, piping, boiler and tank blown up.	Temporary:— Tank erected; also pump and boiler to draw direct from the river. Permanent:— Pump duplicated.	
14	299	Vredefort Road.	do.	Not known	—	Worthington.	do.	Pump and boiler damaged.	Repaired in a short time; supply left little margin for accidents.	
27	326	Taibosch Spruit.	Wooden.	12,000	Not known.	Gravitation.	—	Nil.	—	
4	330	Viljoens Drift.	do.	—	do.	—	—	Boiler and tanks damaged.	do. do. do.	

The greatest strain was felt north of Kroonstad, where, owing to the destruction of tanks and pumps, there was a run of 70 miles without water. To meet this difficulty, travelling water tanks were attached to each train; but the number available did not suffice to attach them invariably, and delays to trains occurred until the various water supplies had been improved.

The travelling tanks were of 1,200 and 1,500 gallons capacity, and were supplied fore and aft with stop cocks and short lengths of flexible hose, so that they might be connected together or to any engine whose tender was provided with a stop cock in rear. Fourteen engines were thus provided.

Coal.

In March, 1900, the stock of coal found in Bloemfontein was low. As the source of supply in peace (*viz.*, the mines at Vereeniging) was in the enemy's hands, Colonial coal from the Indwé district and Welsh coal from the ports was brought up and mixed in the proportion of 2 to 1 with good results. The expedient was expensive, for Colonial coal cost 32s., and Welsh coal 70s., per ton at Bloemfontein; but there was no other alternative.

When Kroonstad was reached, an attempt was made to utilise local coal mines there; but the distance of the mines from the railway (20 miles) made the cost prohibitive, and no permanent relief was given in this matter until the capture of Vereeniging and its mines. These were at once set to work, and thenceforward the supply was assured, its cost was reasonable, and the comparatively short lead allowed coal cars to circulate rapidly.

(2). PERMANENT ORGANISATION AND WORK.

Running.

Lieut. H. A. Micklem, R.E., with the Construction Train reached Viljoen's Drift on the 9th June, 1900; but two days previously the line near Rhenoster had been raided and destroyed by the enemy, through communication not being restored until 22nd June.

A diagram in the D.R.'s General Report shows the number of occasions on which the lines in the O.R.C. were successfully raided by the enemy, and it is easy to understand how traffic was paralysed and time-tables rendered valueless. Of the strain which all Departments had to endure the Loco. branch took its full share.

The enemy's activity in the neighbourhood of the line rendered it necessary to cease night traffic north of Bloemfontein in July, thus reducing the number of through trains from 8 to 6 per diem. The maximum of work was required from the locomotives, the numbers of which were limited; at the same time the fact that they could not stable nightly at engine depôts entailed additional expense and inconvenience. In October, 1900, night running south of the Vaal River was countermanded, and, though it was resumed from time to time in certain districts, the presence of an enterprising body of the enemy might at any time cause its discontinuance. To men experienced in the traffic working of railways the full significance of these conditions will be apparent, especially when it is remembered that the troops depended throughout on the railway for ammunition, food and all other necessaries.

The Loco. sections already enumerated as existing on the O.F.S. Railway were continued; and to afford some relief four N.S.A.R. engines were transferred from the Transvaal. Table B shows the distribution of the various locomotives in July, 1900.

TABLE B.
DISTRIBUTION OF LOCOMOTIVES IN JULY, 1900.

Miles.	Depôt Station.	O.F.S. 4th, 5th and 6th Class.	C.G.R. 5th and 6th Class.	N.S.A.R. 46 tons.	Shunting Engines.	Totals.
122	Norval's Pont	4	6	—	—	10
	Springfontein	—	1	—	1	2
	Bloemfontein	8	3*	—	4	15
128	Glen	—	—	1	—	1
	Vet River	1	—	—	—	1
	Smaldeel	1	—	—	—	1
	Zand River	1	—	—	—	1
80	Kroonstad	5	5	3	2	15
	Viljoen's Drift	—	—	1	—	1
	Under repair:— Bloemfontein	1	1	—	—	2
	Totals	21	16	5†	7	49

* Including one 7th class engine borrowed from the Cape Central Railway.

† One of these engines was found at Bloemfontein on occupation, the other four were sent down from the Transvaal.

The accompanying Tables C and D show the mileage run by the engines of the I.M.R. :—(a) in the Orange River Colony and (b) in the Cape and Transvaal Colonies, respectively; the returns show the periods they cover. As regards Table C, it is interesting to note the large proportion that “shunting” bears to total engine mileage; *c.g.*, whilst the Army was halted at Bloemfontein the proportion reached 0·45, and the average over the whole period of fifteen months was 0·31.

TABLE C.

TOTAL MILEAGE RUN BY ALL ENGINES IN THE ORANGE RIVER COLONY UP TO THE END OF JUNE, 1901.

	Train Miles.	Shunting, etc., Miles.	Total Miles.	Percentage Shunting.
1900.				
March 15th to April 30th	55,475	46,070	101,545	0·45
May	61,130	26,761	87,891	0·30
June	88,516	41,732	130,248	0·32
July	109,644	49,991	159,635	0·31
August	106,936	48,982	155,918	0·31
September	101,115	43,486	144,601	0·30
October	99,887	53,002	152,889	0·35
November	105,574	56,580	162,154	0·35
December	127,983	52,758	180,741	0·39
1901.				
January	113,897	46,952	160,849	0·29
February	95,521	41,491	137,015	0·30
March	116,743	46,602	163,345	0·29
April	113,497	41,360	154,857	0·27
May	113,504	45,054	158,558	0·29
June	115,830	43,142	158,972	0·27
Totals	1,525,255	683,963	2,209,218	0·31

TABLE D.

MILEAGE OF O.R.C. ENGINES RUN IN CAPE COLONY AND TRANSVAAL.

	Cape Colony.			Transvaal.		
	Train.	Shunting, etc.	Total.	Train.	Shunting, etc.	Totals.
1900, December	6,440	1,054	7,494	1,122	210	1,352
1901, January	1,588	270	1,858	8,383	1,121	9,504
February	5,732	1,796	7,528	6,332	996	7,328
March	3,732	6,354	10,086	12,604	1,286	13,950
April	1,438	4,890	6,328	—	—	—
May	558	3,832	4,390	—	—	—
June	5,838	804	6,642	—	—	—
Totals	25,326	19,000	44,326	28,501	3,613	32,114

The Loco. shops were at Bloemfontein; a short description of them and of the Workshops. machinery they contained will be of interest.

The machine shop, though large, was being extended, when war broke out, to allow (i.). Machine Shop. of increased work and economy in existing space. The machinery installed was good and modern in pattern; but owing to lack of some tools, it was necessary to allot certain lathes, etc., to two or more classes of work; negotiations were, however, in progress with a view to further purchases. Those most urgently required were milling machines (2), also pneumatic caulking and drilling tools for repairs to boilers and iron car frames.

(ii.) Smiths' Shop.

The smiths' shop was commodious and well ventilated, and was utilised for steel and copper work. It was provided with 2 steam hammers, a Roots' blower, and 20 cast iron smiths' hearths.

(iii.) Erecting and Tender Shops.

The erecting shop, communicating directly with the machine shop, was provided with 5 pits and an overhead travelling crane of 50 tons capacity; whilst the tender shop also had 3 pits, but no overhead traveller.

(iv.) Engines for Machinery.

One 30 h.p. horizontal high-pressure engine and 2 old loco. boilers served to drive the whole of the machinery by means of shafting and cotton and rope gear. Both engine and boilers were more than 20 years old, and were showing signs of wear and tear.

(v.) Boilermakers' Shop.

The boilermakers' shed was really only a shelter for rolling and shearing machines, all heavy repairs to boilers being executed in the open.

(vi.) Foundry.

The foundry, in which iron and brass castings were dealt with, was already too small for the calls made upon it. It was provided with a cupola, capable of dealing with 30 cwt. castings, but extensions of buildings and plant were urgently demanded.

(vii.) Carpenters' Shop.

The carriage shop contained good accommodation for carpenters, with ample light and space for benches; but the wagon builders were relegated to a temporary structure pending the completion of a proper wagon-builders' shed, work on which was at a stand-still in March, 1900. The wood-working machines were not conveniently grouped, and this matter was also under consideration with a view to effecting improvements.

Repairs executed.

As soon as a staff of employés had again been collected, work was begun and repairs taken in hand. Table E shows repairs executed to wagons and locomotives, whilst Table F gives a detail of jobs executed for the Army and for other than railway purposes.

TABLE E.

REPAIRS EXECUTED IN BLOEMFONTEIN WORKSHOPS TO (a) WAGONS AND CARRIAGES, (b) LOCOMOTIVES AND (c) BOILERS.

DURING THE PERIOD 17TH MARCH—30TH NOVEMBER, 1900.

(a). WAGONS AND CARRIAGES.

	C.G.R.	N.G.R.	N.S.A.R.	O.F.S.R.	I.M.R.	Totals.
Cattle and sheep trucks	103	—	1	14	—	118
Flat „	15	—	35	1	—	51
Ballast „	6	—	—	4	—	10
Water tank „	7	—	—	—	7	14
Box „	1	—	4	3	—	8
Horse box	1	—	—	—	—	1
Fruit vans	4	—	—	—	—	4
Refrigerator „	1	—	—	—	—	1
Meat „	1	—	—	—	—	1
Powder „	1	—	—	—	—	1
Short „	2	—	—	2	—	4
Brake „	10	—	2	3	—	15
Bogies	98	1	4	6	—	109
Saloons	4	—	16	—	—	20
Dining saloon	1	—	—	—	—	1
Ambulance „	—	—	1	—	—	1
Ambulance van	—	—	1	—	—	1
Cranes	2	—	1	—	—	3
Kitchen cars	1	—	—	—	1	2
3rd class coaches	2	—	—	—	—	2
Short „	—	—	—	—	1	1
Trucks	—	—	63	7	—	70
Bom	—	—	—	—	1	1
Totals	260	1	128	40	10	439

(b). LOCOMOTIVES.										
6th Class	15
5th "	13
4th "	4
3rd "	1
2nd "	1
N.S.A.R.	1
Saddle tank	2
Van Galen	1
Total										
...										
...										
38										
—										
(c). BOILERS.										
6th Class	3
4th "	1
Total										
...										
...										
4										
—										

TABLE F.

OUTSIDE WORK OF SPECIAL INTEREST EXECUTED IN BLOEMFONTEIN WORKSHOPS.
DURING THE PERIOD 17TH MARCH - 30TH NOVEMBER, 1900.

-
- Brass casting of one long auxiliary sighting bar for 5-inch howitzer.
 - Brass casting of one socket bracket for 15lb. B.L. gun carriage.
 - 12 fire grates for Field Bakery.
 - Spring case for maxim gun
 - Repairing machinery of "Friend" printing works.
 - Charging accumulators of X Ray apparatus.
 - Making set of sight fittings for gun.
 - Fitting up 2 box trucks as travelling Telegraph Office.
 - Fitting up 4 bogie trucks as armoured carriages.
 - Brass casting of one spur pinion wheel for St. Michael's Home.
 - Brass casting of one socket bracket and one angle piece for 15lb. B.L. gun carriage.
 - Fitting up one box truck as Canteen.
 - Sundry castings and repairs for Steam Road Transport.
 - Riveting up 12 tanks for water stations.
 - Fitting valves to pumping engines at Sannah's Post Waterworks.
 - Making one scraper, 4 iron ladders and 4 valve key rods for Town Engineer.
 - Fitting water tanks on 6 short flat trucks.
 - Fitting new ejector on Field Boiler.
-

(B).—WORK IN TRANSVAAL.

The Army, crossing the Vaal on May 26th, entered Elandsfontein two days later, and found that nearly all the rolling stock had been withdrawn. The N.S.A.R.'s Loco. Supt. had taken steps to render all engines useless by ordering the removal of vital parts; but these orders, for one reason or another, had not been thoroughly carried out.

Position of Affairs
in the Transvaal,
May, 1900.

The following engines were captured :—

At Vereeniging	...	...	...	...	1 shunting engine.
„ Elandsfontein	...	...	...	...	7 46-ton engines.
In mines in the neighbourhood	...	...	...	...	5 chiefly small, but in fair order.
At Johannesburg	...	...	...	...	9 ditto.
„ Springs	...	...	...	...	3 ditto.
Total					
...					
...					
25					
—					

Many of these engines were in need of repair, and certain parts had been removed from some of them; whilst the small repairing shops at Johannesburg had been rifled, and the motor actuating the shafting had been fused.

Steps taken to obtain Staff.

The civil Loco. Staff of the line were hostile, and in obedience to the orders of their superiors refused to work. Volunteers from the Army were accordingly summoned and joined the Railway Staff Depôt. On 6th June, Lieut. E. O. A. Newcombe, R.E., with eleven men—mechanics and tradesmen—joined from Johannesburg, and a few O.F.S. employés were found at Vereeniging; with the staff thus obtained steps were taken to begin repairs to engines, to re-establish engine sheds and pumping machinery, and to commence an efficient train service. As was to be expected, it took time to ascertain the qualifications of the Army volunteers, and the process of weeding out incompetent men was only gradual.

(a). MAIN AND SOUTH-WESTERN LINES.

(i.). Staff at Elandsfontein.

An English driver (an ex-O.F.S. employé) was placed in charge of the Elandsfontein depôt, with a staff of enginemen and mechanics, 18 in all, and 15 soldier firemen under a sergeant. The sergeant kept discipline and saw to rations, whilst the men learnt their work under civilian drivers.

(ii.). Johannesburg.

At the Johannesburg (Braamfontein) depôt, a fitter was placed in charge of a small staff, whilst the workshop was entrusted to a sergeant of the City of London Imperial Volunteers with a military staff. Four trains a day were arranged for between Elandsfontein and Johannesburg, and also other trains to Springs and Krugersdorp, the last named being the limit of uninjured line on the South-Western system.

General Hunter occupied Potchefstroom on the 11th June, and there found eight more locomotives, of which only one was in good order. From the others fusible plugs, safety valves, valve gear and running gear had either been removed or damaged; but the 3rd Balloon Section, R.E. (under Lieut., local Major, R. B. D. Blakeney, R.E.), together with some mechanics of the Scottish Yeomanry, executed the necessary repairs, and a train service was established between Klerksdorp and Bank, at which place a bridge was broken.

Coal for these trains came from Klerksdorp, and oil, stores, etc., from the adjacent mines.

(iii.). Pretoria Engine Depôt.

On the occupation of Pretoria, six engines were found, of which two belonged to the Northern line; of these, five were fit to work and the other required minor repairs. An experienced driver, with a staff of 18 men in all, was stationed at the engine depôt. Until the 17th June trains from Pretoria and Elandsfontein, respectively, ran to each end of the Irene bridge, and there trans-shipped, pending the completion of repairs to the bridge.

(iv.). Pretoria Workshops.

The Pretoria workshops (see Appendix A to this Chapter) were found intact, and were guarded by troops. The thirteen engines waiting repairs in them were taken in hand as soon as possible. The want of mechanics and other workmen pressed hardly on the Loco. Dept.; and, as the Transvaal railway employés were hostile, steps were taken with the concurrence of the Military Governor to commandeer burghers for work on these thirteen engines. The Transvaal Works Manager (Mr. Uggla) was accordingly addressed, and he submitted a list of men, of whom 36 were called out and commenced work under a foreman brought up from Bloemfontein.

In the last week of June, 1900, the Loco. Supt., I.M.R., came north, and established his headquarters at Pretoria. A staff of enginemen, fitters and mechanics (including 25 R.E.) accompanied him; and Mr. Elliott, late of the C.G.R., was appointed District Loco. Supt., with headquarters at Johannesburg, his charge embracing all the lines in the Transvaal at that time in British hands.

Lieut. E. O. A. Newcombe, R.E., shortly afterwards returned to the O.R.C. to continue organising the department in that colony, whilst the Loco. Supt. and the officers with him took in hand the newly captured lines.

The administration of the Loco. Dept. of the N.S.A.R. contained few good points, and it was decided to introduce the Cape and O.F.S. system, which has already been described.

The depôts in existence at this date (June, 1900) were Vereeniging, Elandsfontein, Pretoria, Johannesburg and Springs; another was subsequently established at Randfontein.

The total number of whites employed was 250, of whom rather more than half joined from the ranks of the Army. As may be imagined, many mishaps occurred to locomotives through the ignorance and inexperience of drivers and firemen, few of whom had been recently engaged in this work, and two instances may be quoted:—A driver could not keep up steam, and it was found that whether on a grade or level, or just starting, he kept his engine full-gear and the regulator wide open; another, driving an assisting engine, was found to have his regulator wide open and engine at

mid-gear. The men of the R.E. and some Army Reservists, who had recently driven engines, were those who could really be relied upon.

Foremen made out rosters for the locomotives and running staff, rendered the necessary returns regarding engines, stores and *personnel*, and had charge of sections of the line so that watering stations and pumping staff came under their ken. The fitters at depôts executed minor repairs, which were demanded in the first instance by drivers, who made entries in the "Shed Repair Book."

Distribution of Duties and Responsibility.

Each Foreman maintained discipline, and could, within limits, use his discretion about employing or dismissing natives; he could also suspend any of the staff. Fines could only be inflicted by the District Supt., who also retained the power to appoint or dismiss Europeans.

The ordinary train service on the South-Western and Springs branches was worked from the Johannesburg depôt: Pretoria found engines for the Witbank coal traffic and for special trains south and east; whilst engines for the service of all other trains in the Transvaal were, for the present, found by the Elandsfontein depôt.

Details of Train Service, June, 1900.

Table G gives information regarding the various sheds, their accommodation, and the staff of engines maintained in 1901, *i.e.*, about a year later than the time now under reference.

Table H is a list of the water supplies on the various lines, and it will be seen that the damage done was smaller in degree than in the case of the O.R.C. Nevertheless, owing to insufficient supply and small bore of delivery pipes (2"), considerable difficulty was experienced in maintaining full supplies for trains.

Water Supply.

TABLE G.
MAIN AND SOUTH-WESTERN LINES, TRANSVAAL.
ENGINE AND SHOP ACCOMMODATION, OCTOBER 31ST, 1901.

(1). WORKSHOPS AT JOHANNESBERG.

Machine and Erecting Shop	1 lathe. 1 engine wheel do. 1 wagon wheel do. 3 small do. 12 vices. 1 shaping machine.	2 drilling machines. 1 screwing do. 1 emery buff. 1 engine. 1 motor. pits for 4 engines.
Smiths' Shop	1 fan. 7 forges.	1 coppersmith's hearth. tinsmiths' tools.
Wagon Shop	5 benches. 1 circular saw.	wagon accommodation. (100 trucks).

(2). ENGINE ACCOMMODATION.

	Main Line Engines.	Shunting Engines.	Accommodation for Engines.	Coal, tons.	Stores.
Johannesberg (2 sheds)	16	4	14	400	small oil.
Elandsfontein (2 sheds)	18	4	20	500	general.
Pretoria (1 shed)	13	5	20	600	do.
Springs (1 shed)	2	2	20	700	do.
Randfontein	1	—	15	400	do.
Vereeniging	—	1	8	200	—

TABLE H.
MAIN AND SOUTH-WESTERN LINES, TRANSVAAL; LOCOMOTIVE WATERING ARRANGEMENTS.
 SHOWING DAMAGE DONE AND REPAIRS EFFECTED IN 1900.

To last Tank : Miles.	Watering Station.	TANKS.			PUMPS.			Repairs executed.
		Nature.	Capacity : Gallons.	Source of Water Supply.	Description and Number of.	Motive Power.	Damage done by Enemy.	
				MAIN				
0	Vereeniging.	Wrought iron.	10,000	Vaal River, 400 yards away.	1 Hollandia.	Steam.	Safety valve and manhole door removed.	Repaired.
21	Klip River.	Cast and wrought iron.	32,000	Klip River, $\frac{1}{2}$ mile away.	3 do.	Steam and windmill.	Safety valves, etc., removed, also valve covers and chests; windmill pump tampered with.	do.
9	Natalspruit.	Cast iron.	2,000	—	1 do.	Steam.	Nil.	—
19	Elandsfontein.	Wrought iron.	39,000	Well.	2 do.	do.	Boiler tampered with.	do.
5	Rietfontein.	do.	10,000	Natural dam.	2 do.	do.	Nil.	—
9 from Elandsfontein.	Zuurfontein.	Cast iron.	2,000	Well, $2\frac{1}{2}$ miles.	1 do.	do.	Nil.	—
8	Irene.	Cast and wrought iron.	18,000	Stream, 800 yards away.	1 Hollandia, 1 Pulso-meter.	do.	Pumps and boiler tampered with.	do.
9 $\frac{1}{2}$	Pretoria.	Wrought iron.	30,000	Stream.	3 Hollandia.	do.	Nil.	—
				SOUTH-WESTERN LINE.				
10 from Elandsfontein.	Braamfontein (Johannesberg).	Cast and wrought iron.	44,000	Johannesberg water-works.	6	Steam and electricity.	Only 1 pump and boiler intact.	—
7	Maraisburg.	Wrought iron.	18,000	Wells.	1 Hollandia, 1 Pulso-meter.	Steam.	Nil.	—
5	Roodepoort.	Cast iron.	2,000	—	—	Windmill.	Windmill destroyed.	Not an engine supply.
8	Krugerdsorp.	Wrought iron.	10,000	Mines.	1 Hollandia.	Steam.	Nil.	—
8	Randfontein.	do.	10,000	Reservoir, 4 miles.	1 Hollandia, 1 Pulso-meter.	Steam and windmill.	Windmill destroyed.	—
16	Bank.	do.	10,000	River, $\frac{1}{2}$ mile away.	1 Hollandia.	Steam.	June, 1900, nil. November, 1900, tools, etc., removed.	Replaced.
28	Frederickstad.	do.	10,000	Well and pool.	1 do.	do.	Pipes, valves, gauges and tools removed.	do.
15	Potchefstroom.	do.	10,000	Water race.	G geared pump.	Turbine.	June, 1900, turbine tampered with. November, 1900, turbine destroyed and pump broken.	New turbine supplied.
30 $\frac{1}{2}$	Klerksdorp.	do.	10,000	Well.	—	Windmill.	Windmill destroyed and pump broken.	Windmill repaired and again destroyed. Steam pump and boiler installed.
7 from Elandsfontein.	Boksburg.	do.	10,000	SPRINGS	BRANCH.	Steam and windmill.	One manhole door removed.	Replaced.
14	Springs.	do.	20,000	Two wells.	1 Hollandia, 2 Pulso-meters.	do.	Eccentric and valve gear of pump at Loco. shed removed.	Small loco. used to steam shed pump.

(b). SOUTH-EASTERN LINE.

The progress of engineering repairs on the South-Eastern line towards Natal has already been described in Chapter II. (B). On the 8th July, 1900, the Loco. staff proceeded to Heidelberg to organise the depôt there.

The shed was found to contain no engines, and was stripped of tools; but during the next three weeks, 19 abandoned locomotives were recovered, many with important parts missing.

When communication with Natal was re-established the Loco. Supt. proceeded to Standerton, and obtained staff from the N.G.R.; many of these, however, returned a few weeks afterwards to their own administration, and recourse was then had to military enginemen. On August 15th, Mr. Carolin (from the O.R.C.) joined as District Supt. of the S.E. section, and its whole length as far as Volksrust passed under the control of the I.M.R.

Incorporation of South Eastern line with I. M. R.

The watering stations on the length Elandsfontein-Greylingstad were Roodekop, Rietvlei, Heidelberg and Zuikerbosch. Pumps, etc., at Heidelberg were found intact, but at other places they had been tampered with, and parts had been removed; beyond Greylingstad all watering stations had been put in order by the construction party of the Natal Army.

Water Supply.

The provision of a Merryweather portable pump and flexible hose on this section of the line proved of very great service whilst the water supplies were disorganised. The pump is light and can easily be installed, and appears therefore to be eminently suitable for use on campaigns under similar conditions.

On August 1st there were in the Transvaal 64 engines in British possession, of which 16 were shunting engines and 7 of the remainder were in the shops at Pretoria.

The ordinary train services at this time were:—

- On Main, S.E. and S.W. sections—4 to 6 trains each way daily;
- On Eastern section, Pretoria to Bronkhorst Spruit—2 each way;
- On Northern section, Pretoria to Waterval—2 each way;

Train Services in the Transvaal, August, 1900.

but in addition there were large and sudden calls to meet troop movements, and these irregularities caused considerable strain as they occurred.

By the end of August, 1900, the South-Eastern line was settling down to normal running conditions.

Permanent Working.

Table K contains detailed information regarding the loco. sections, engine depôts, *personnel*, etc., of the running branch.

TABLE K.
SOUTH-EASTERN LINE.
DISTRIBUTION OF ENGINES, STAFF, ETC.

Section.	Station.	No. of Locomotives.	Personnel.				
			Foreman.	Inspector.	Drivers.	Firemen.	Other Staff.
Miles.							
61	Volksrust	10	—	1	12	10	46
	Standerton (Locomotive Head-quarters of the Line)	24	1	—	25	31	91
111	Heidelberg	2	—	1	1	1	20
165	Elandsfontein	—	—	—	—	—	—
	Totals	36	1	2	38	42	157

The enemy's attacks caused frequent interruptions to the line during the autumn and winter of 1900 and the opening months of 1901, and security was only obtained by the constant extension of the system of blockhouses.

Although trains were constantly blown up, derailed and otherwise wrecked, the behaviour of the enginemen was uniformly good; though many were wounded on duty, there was never any reluctance on the part of the staff to do their best in clearing wreckage to restore the line for traffic.

The running of trains was necessarily confined to the hours of daylight, and thus it came about that intervals between trains were reduced from 20 minutes to 5. As a consequence slight collisions and accidents were not infrequent, though all precautions were taken; moreover this section of the I.M.R. was very liable to sudden and dense fogs.

From 16th August, 1900, to 30th September, 1901, 8,680 trains were run, whilst the total engine mileage was 916,231. Of this total 196,000 or 0.21 were shunting, banking, etc.; this percentage, though high, compares favourably with the engine mileage during the same time in the O.R.C.

Train and Engine Mileage.

From all that has been said regarding the manner in which a Loco. staff was collected

it is easy to understand that considerable "weeding out" was necessary, and not the least of the difficulties which the District Loco. Supt. had to overcome were those due to fever, dysentery and influenza. The prevalence of disease was, it is thought, due to bad water and indifferent accommodation, but these conditions were gradually improved as funds became available.

Defects noticed in
Engine Axles.

The axles of the N.S.A.R. type of main line engine appear to have been unsatisfactory; six broke during the year under review, whilst locomotives were on traffic trains. Experience also goes to prove that pony axles cannot carry more weight; if engines are armoured, a full bogie should therefore be substituted for the pony truck under the trailing end of the locomotive.

(c). EASTERN LINE.

August, 1900.

By the last week of July, 1900, the advance of the Army eastwards from Bronkhorst Spruit was imminent. Profiting by previous experience, the Loco. Dept. fitted up a mule wagon as a temporary workshop, with a few spare parts for engines and wagons, oil and other stores; and this shop was accompanied by a small party of drivers and fitters, all soldiers. The wagon marched with the 11th Infantry Division and did much useful work.

Middelberg
reached.

This Division entered Middelberg on 4th August, and between that date and the 6th (when railhead reached the town) a temporary train service of trollies, drawn by small colliery locomotives, worked supplies from the gap at the Wilge river to Middelberg.

Belfast entered.

A depôt was formed at this place; but though there was shed accommodation for 12 engines, it could not be used, as the turn-table leading to the shed was unsafe. Engines were therefore obliged to stable on the main line, and this occasioned delays to traffic. For the next fortnight, the two Construction Train engines at Middelberg worked traffic from that place eastwards to Wonderfontein. On 23rd August the British force entered Belfast. No engines were found there, and the strain thrown on the locomotives available was very great indeed, for as many as 14 trains entered Belfast in one day. Six main line engines were now stationed at Middelberg, the colliery siding at Witbank was tended by a shunting engine, and the Construction Trains moved on to execute repairs in rear of the troops.

Double crews were allotted to the locomotives, which worked almost incessantly; and double-engine trains were run from Middelberg to Belfast, though with questionable success, as the deficient water supply and steep gradients combined to cause dislocation of traffic.

Capture of
Waterval Boven,
September, 1900.

Waterval Boven, the main depôt of the N.S.A.R., was reached at the beginning of September, and was found practically intact, with 6 engine pits, 2 repairing pits and a small workshop available for use. The locomotive and oil stores were empty, and but one engine was found.

Supplies for the Army were at this time all unloaded at Machadodorp; and to provide for the comfort of the enginemen, the "caboose" system was instituted. It was however discarded again on the representation of the men themselves, and engines ran forward to Waterval Boven where crews were changed and the engines then returned.

Temporary
Arrangements on
Rack Section.

Between Waterval Boven and Waterval Onder is a rack section, but the special engines required to work it had been removed by the enemy prior to the arrival of the British. Ordinary engines, with loads reduced to 4 wagons, were therefore employed, and every truck was carefully examined before being sent east from Pretoria; on the steep gradient all brakes were pinned down and a brakesman rode on each truck.

Upon the arrival of two heavy tank locomotives from Natal, they were allotted to this rack section, which they worked for 6 weeks, taking a load of 6 wagons instead of 4 as hitherto.

Preparations for
Further Advance.

In the meanwhile the staff of enginemen (mostly soldiers) at Waterval Boven was steadily increased, and on September 15th came news of the capture of 44 locomotives at Barberton on the Avoca branch.

Lieut. E. O. A. Newcombe, R.E., immediately left for Barberton with a Loco. staff; he intended to march across country, but received orders to accompany the Construction Train to Kaapmuiden *via* Nelspruit. At this station were 6 locomotives, of which 4 were badly damaged and the others only slightly so.

Kaapmuiden
entered.

Owing to breaks in the line Krokodil Poort was not reached till the 19th; 2 days later the locomotive party entered Kaapmuiden, where they found the engine shed rifled and burnt, piles of stores still on fire, and many wagons loaded with flour and coal (which had been soaked with paraffin) also ablaze. Eighteen engines (nearly all shunting ones) were captured; only 10 of these were in good order, the remainder having been rendered useless or burnt. Crews from the 12th (Field) Company, R.E., now brought

in two engines from Avoca. All hands were employed on repairing work at Kaapmuiden, and in two days 6 shunting engines were ready.

At Avoca were 53 engines, chiefly N.S.A.R. 46-ton; and at Barberton 44, of which 29 belonged to the O.F.S. and N.G.R., and 13 were N.S.A.R. main line engines of 40 and 46 tons weight. By the time the Avoca deviation was ready nearly all the Barberton engines were fit to work, and these were at once sent to Kaapmuiden.

On September 27th, the Kaap River deviation being completed, it was possible to transfer several engines westwards, and so to relieve the overworked mechanics at Barberton.

The 11th Division occupied Koomatipoort on 27th September, and the next day the bulk of the Loco. Staff (which had been reinforced a few days before by an officer, a loco. inspector and 12 sets of enginemen) moved there from Kaapmuiden.

A survey of captured rolling stock showed that 84 engines and 2,654 coaches and wagons had fallen into our hands. Of the coaches 2,000 were in fair running order and 115 had been totally destroyed. Of the engines 5 had been burnt and were useless, whilst several others had been damaged by fire; and though there was now no question, as far as numbers went, of the adequacy of engines and trucks for the work in hand, their condition left much to be desired.

Before retiring the enemy had soaked many truck loads of stores with paraffin, and had set these and the coal stage on fire; though the whole burning area was covered with a layer of earth the fire smouldered for days. Fortunately a few trucks loaded with coal had not caught fire, and served to supply engines pending the arrival of fresh consignments from the west. Sufficient oil also was found, but no other locomotive stores.

The Koomatipoort engine shed could accommodate 9 locomotives on pits, and from the turn-table several other lines also radiated; but engines standing on them were in the open and could not be easily overhauled as there were no examining pits. The only line connecting the engine shed with the station ran past the blazing coal stage, and great care was therefore necessary whilst working engines to or from the station.

The tide of traffic, which hitherto had set eastwards, was reversed as soon as Koomatipoort was occupied; and on the 28th two trains filled with men of the Guards Brigade set out for Pretoria, the drivers being men from their own ranks.

Ten trains per diem were demanded; but with little or no return traffic from Pretoria, it became impossible to establish any kind of roster for enginemen, who consequently did not return to Koomatipoort for several days. Under these circumstances, further calls were made on the Army, ex-N.S.A.R. employés were engaged, and other men were obtained from Lourenço Marques. Eventually engine stages were established from (i.) Pretoria—Middelberg. (ii.) Middelberg—Waterval Boven. (iii.) Waterval Boven—Kaapmuiden. (iv.) Kaapmuiden—Koomatipoort.

Waterval Onder—Waterval Boven is a rack section; the special engines to work it, having been found at Koomatipoort, were at once transferred. This doubled the capacity of the Eastern line, and released the heavy Natal engines which returned to their own Administration.

At Koomatipoort, all available lines were choked with rolling stock, making it very difficult to shunt and marshal trains. Many of the locomotives had been standing idle for several weeks and were consequently covered with rust, inside and out, and it was impossible to overhaul and clean them before they were put on the road; as a result there were a good many engine failures and mishaps, but none were very serious. The worst engines were taken "dead" to the Pretoria workshops.

During the month of October Koomatipoort, Waterval Boven and Barberton were gradually cleared of captured engines and rolling stock; whilst 5 locomotives and 1,260 trucks, which had been worked over the Portuguese border, were handed back to the I.M.R.

A re-distribution of locomotives was now possible. O.R.C. engines were returned to that Colony, releasing Cape Coast engines, and those belonging to the Transvaal were allotted to the various engine districts in accordance with traffic requirements.

As regards the rolling stock recovered, most of the vacuum-brake gear required repair or renewal; though large orders for material had been placed in England, several months elapsed before delivery was effected. In the meanwhile traffic on the steep gradients of the Transvaal had to be worked with extreme caution, and the risks of accident were great.

A description of the engines and trucks on the Transvaal Eastern line is given in Appendix B to this Chapter.

In Table L are given details regarding the distribution of locomotives, *personnel*, etc., when the Eastern line had settled down to normal traffic. At the end of 1900 the depôts were Middelberg, Waterval Boven, Kaapmuiden and Koomati Poort. Nelspruit and Barberton were also provided with one engine each, so that damage to the line at any point should not entirely dislocate traffic on either side of the break.

Barberton Branch.

Occupation of Koomatipoort, 27th September, 1900.

Engine Stages after the Occupation of Koomatipoort.

Improved Service on Rack Section.

Re-Distribution of Locomotives.

N.S.A.R. Rolling Stock.

Permanent Working-Traffic.

IMPERIAL MILITARY RAILWAYS.

TABLE L.

TRANSVAAL EASTERN LINE.

DISTRIBUTION OF ENGINES, STAFF, ETC.

Section.	Station.	No. of Locomotives.		Coal Depot.	Workshop.	PERSONNEL.										Remarks.		
		Train.	Shunting.			Foremen.	Inspectors.	Clerks, etc.	Drivers in Charge.	Drivers.	Firemen.	Mechanics.	Storemen.	Gangers.	Natives.			
I.	Pretoria ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	For Pretoria-Middelberg Section.
	Balmoral ...	—	—	Yes	—	—	—	1	—	—	—	—	—	—	—	—	16	All trains coal here.
	Witbank ...	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	For work on Colliery siding.
	Middelberg ...	18 (15)	2	Yes	—	—	—	—	1	21	4	—	—	—	—	—	46	
II.	Belfast ...	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Crew for 1 engine found by Colliery.
	Waterval Boven ...	14 (14)	1	Yes	Yes	—	—	8	1	20	27	—	—	—	—	—	59	All but heavy repairs to locomotives done here,—no heavy repairs to wagons.
III.	Nelspruit ...	— (1)	—	Yes	—	—	—	—	—	—	—	—	—	—	—	—	—	Engines stable nightly, though none are stationed here.
	Barberton ...	1 (1)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	
IV.	Kaapmuiden ...	1 (5)	—	—	Yes	—	—	—	—	—	—	—	—	—	—	—	—	1 Fireman acts as night shedman.
	Koomatipoort ...	16	2	—	Yes	—	—	—	—	—	—	—	—	—	—	—	—	1 engine works to and fro the Portuguese frontier station only; 1 shunter works on the Selaati line when required. Staff of drivers, etc., is necessarily high on account of the bad climate of this length.
	Totals ...	50	8			1	2	11	4	69	74	39	4	1		232		

* The figures in brackets are the numbers at the end of 1950.

At first the bulk of the traffic was coal from Witbank and Belfast eastwards, together with troops and stores from Pretoria. As the country settled down supplies poured in from Delagoa Bay and the call for locomotives at Koomati Poort was greater, but the total number could not be increased. As the road between Waterval Boven and Witbank became in better order, it was possible to station 10 engines at Koomati Poort and Kaapmuiden by reducing those at Middelberg and Waterval Boven. Working of Sections, 1901.

By May, 1901, the locomotives at the two last-named places totalled 35, and later on the Kaapmuiden engines were moved to Koomati Poort.

Night running was not allowed except between Koomati Poort and Kaapmuiden, and trains accordingly stabled at the first station they reached after dark. As a result drivers' hours were very irregular, and this was especially the case on the Waterval Boven—Nelspruit run which included the rack section. Waterval Onder (at the foot of the rack section) was therefore opened as a depôt, and for a month the experiment of running locomotives through Koomati Poort and Waterval Onder was tried; but at the end of this time the original arrangement (viz., of making Nelspruit a changing station) was reverted to. Owing to the high temperatures and heavy and continuous grades between Koomati Poort and Waterval Onder (a rise of 3,500 feet) the enginemen found the journey of 120 miles very trying, and it was decided that the disadvantages outweighed the advantages.

Had the experiment been tried during the unhealthy season, there appears little doubt that the staff of enginemen would not have been sufficient. Improvement in the general state of the engines accounts for the comparatively small increase of locomotives at Waterval Boven and Middelberg notwithstanding the great increase of traffic. But it should also be borne in mind that the bulk of the supplies, etc., from Delagoa Bay terminate at Machadodorp and Middelberg, so that there is comparatively little through traffic to Pretoria on the Eastern line.

(d). NORTHERN LINE.

Immediately Pretoria was captured, arrangements were made to run trains to Waterval, 16 miles distant on the Northern line, in order to bring in the British Prisoners of War confined there. The enemy interfered from time to time with shell fire; but one train a day was run until all the sick, etc., had been removed, and the line was then temporarily abandoned. Waterval. June, 1900.

A Construction Train under Capt. F. G. Fuller, R.E., started on the 20th August, and by the end of the month the line was open again to Warmbad, beyond which place no present advance was contemplated. Warmbad. August.

The storage tanks at Pienaars (10,000 gallons) were intact, but the pumps were not satisfactory. Early in September, therefore, improvements were undertaken at Warmbad; but a few days later, a steam pump, etc., was installed at Pienaars River, as Warmbad was evacuated on September 9th.

A Driver-in-Charge was established at Pienaars River, and a regular daily train service between Pretoria and Warmbad was inaugurated. All rolling stock at Warmbad was withdrawn to Pienaars River, which became the terminus of the Northern line until the end of March, 1901. Pienaars River. September.

On the 28th of that month Gen. Plumer left Pienaars for Pietersberg, and Capt. Fuller's Construction Train followed closely behind. Pietpotgietersrust was reached on 5th April; here there is a small engine shed and coal stage, and the Driver-in-Charge was accordingly transferred from Pienaars. Between Pietpotgietersrust and Pietersberg the leading section of the Construction Train was twice delayed by mines, viz., on the 7th near Pietpotgietersrust and on the 8th a short distance further towards Pietersberg. In the first case the engine exploded the mine, and though damaged it was temporarily repaired and able to proceed; in the second case a truck was derailed, but was unloaded and thrown over to clear the line, allowing the remainder of the train to reach Pietersberg terminus on April 9th. March, 1901. Advance to Pietersberg begun.

The station machinery such as engine shed, pumps and tanks, coal stage, etc., were found intact. A Driver-in-Charge having been appointed, the Loco. Dept. was kept fully employed, as for some time there was considerable traffic between Pietersberg and Pretoria; troops, live stock and stores came north, and refugees, prisoners and baggage moved south. Eventually the normal traffic settled down to one train a day each way, and for this the existing watering and locomotive arrangements were sufficient. Occupation of Pietersberg. April, 1901.

Excluding Pretoria, coaling depôts on this line were established at Pienaars River, Nylstroom, Pietpotgietersrust and Pietersberg. Watering arrangements existed at or near every station, and also 8 miles beyond Pietpotgietersrust and at the Zand River near Pietersberg, so that locomotives were not delayed for want of fuel or water. Coal and Water Supplies.

Capture of Rolling Stock.

Two engines and 51 trucks fell into British hands at Pietersberg. Neither of the former were fit for work, as they had been badly used and patched up in a most slipshod way; springs and other fittings were therefore taken from one of them to repair the British locomotive damaged by a mine on the 5th, and eventually both the captured locomotives were run "dead" to Pretoria shops for repairs.

The Boer supply of lubricants had apparently run out, for the engine shed at Pietersberg was littered with tins which had contained bicycle oil, and lard also had been used when no more oil could be obtained.

(C.)—PERMANENT ORGANISATION.

Distribution of Officers, etc.

Having now traced the course of events on each of the lengths of line included in the I.M.R., reference may be made to Appendix C to this Chapter, the diagram in which represents the organisation of the Loco. Dept. on the whole system.

The only further change made was the amalgamation of the Northern and Eastern sections, the former being of comparative unimportance.

WORKSHOPS AND ROLLING STOCK.

Formation of Separate "Works Branch."

By the end of the first week in August, 1900, matters were beginning to settle down, and accordingly a separate "Works Branch" of the Loco. Dept. was formed in the Transvaal. Lieut. Press was appointed Works Manager with a separate staff; his headquarters were at Pretoria, and his duty was to execute all heavy repairs to engines and rolling stock, for which purpose the N.S.A.R. workshops were available. A total of 47 engines damaged by the enemy went into these shops, besides large numbers of carriages and trucks. A lack of spare parts caused considerable delay; though many deficiencies were supplied locally, such things as rubber vacuum gear, engine tyres and crank pins were of necessity ordered from Europe.

Repairs executed by Works Branch, May—October, 1901.

Excluding minor jobs executed at engine depôts, the following is a summary of repairs effected by the Works Branch in the six months May—October, 1901.

	Pretoria.	Johannesberg.	Bloemfontein.	Total.
Locomotives	... 70	41	30	141
Coaches	... 116	377	65	558
Trucks	... 556	1,089	310	1,955

Rolling Stock, etc., ordered in England in 1900.

The necessity for additional engine power and trucks was early realised, and in April, 1900, an indent to England demanded 25 C.G.R. 7th class locomotives and 6 West Australian K class 8-wheel coupled tank engines, together with 300 steel bogie cars of 30 tons capacity.

In 1901.

Later in the year orders were given for 240 cars of 30 tons capacity (including 73 of American pattern) and 15 locomotives of the 10-wheel coupled Natal type; and in the following year further orders were placed for 1,200 steel bogie cars of 30 tons capacity, 20 engines of the Natal type and 40 engines, 7th class.

When all the above are delivered and erected, the rolling stock will thus have been increased by 106 locomotives and 1,740 30-ton cars.

Summary of Work done, 1900-01.

In reviewing the work done in the Pretoria shops it will be convenient to divide the period October, 1900—September, 1901, into two half-years. In the first period the repairs, especially to locomotives and wagons, could not be so complete, as it was necessary to put engine power and trucks at the disposal of the Running branches; the pressing need for armoured trucks also kept all hands busy, and therefore the ordinary routine of repairs, etc., as understood on a commercial railway system, could not be instituted for some months.

October, 1900—March, 1901. Locomotives and Rolling Stock.

99 locomotives were repaired, of which 69 were of the 46-ton N.S.A.R. type, whilst 6 more engines were armoured. During the same period 13 new trucks were built; and 1,000 carriages and wagons passed through the shops, of which 781 were repaired. These latter included saloons, open trucks, bogies, guards vans and tank trucks; of the remaining 219, 61 were armoured, fitted with cow-catchers and vacuum brakes, etc., and 154 were converted into horse boxes, whilst others again were specially fitted for hospital and church work.

Miscellaneous.

16 pumps were turned out, of which 4 were supplied with boilers. 4 travelling cranes were repaired, viz. :—one 10-ton and three 5-ton. 40 vans were charged for electric lighting, and 150 pairs of wagon wheels were turned up.

Work for the Army.

The shops were further called upon to execute work for the Army which, under other circumstances, would have been attended to by the Ordnance Manufactories.

For example, improved trunnion bearing-brackets for the field carriages of 6 Vickers-Maxim guns were made; not only were these stronger than the original iron brackets, but they also lightened the carriages. Similarly, when it was desired to mount two of these guns for use on armoured trains, the special steel cones (somewhat similar to naval mountings) were made in the shops and gave satisfaction; by this means the gun, when in position, could be traversed completely round the circle without any difficulty.

Again, it was found that the wheels of the 4.7-inch Naval gun ("Little Bobs") were defective, as the naves were weak and fractured. These were strengthened by riveting on $\frac{3}{8}$ " steel plates, and the wheels, thus reinforced, stood the wear and tear of active service.

Lastly, a special mounting for a 12-pr. Quick Firing gun (*Plate 89*) was devised and executed in the shops, the whole being fitted to an armoured truck. By means of slide bars and traversing gear, it became possible to traverse the gun into a convenient position for use on the truck. Special gear was also added, which enabled the firer to lock the gun when the necessary elevation had been obtained by means of the shoulder piece. The mounting withstood the preliminary tests to which it was subjected and was passed out of the shops in February, 1901.

During the second period 82 locomotives passed through the shops, of which 66 were 46-ton and 40-ton of the N.S.A.R. type; whilst 5 locomotives were armoured, and the cabs of 63 more were fitted with steel plates, thereby affording greatly increased protection to the enginemen.

1st April—30th
September, 1901.
Locomotives.

The wear and tear of engine wheels was also in evidence, and 300 pairs were turned up during the half-year.

163 trucks were specially fitted or altered for military purposes; this figure including 100 converted to horse boxes, and 48 armoured or strengthened and altered to carry guns on armoured trains.

Rolling Stock.

14 trucks, which had been blown up or burnt by the enemy, were again made fit for use, and the ordinary repairs included nearly 800 trucks. In addition, 11 trucks were built for special purposes, and 6 portable loading ramps were constructed.

PERSONNEL.

The total number of Europeans employed in September, 1900, was 2,052. Of these 79 came from the R.E., 279 from other branches of the Army, and 193 from the railways in Cape Colony and Natal; 524 were former employes of the enemy's lines who were reinstated, and 12 were obtained from England.

A distribution chart is given in Appendix C to this Chapter.

APPENDIX A TO CHAPTER IV.

DESCRIPTION OF WORKSHOPS AT PRETORIA.

The Pretoria Workshops are extensive and consist of the following buildings, etc. :—

2 Engine fitting and erecting shops	...	...	...	each	22½' × 52'
1 Machine shop	...	...	...		187' × 79'
2 Blacksmiths' shops	...	...	...	40' × 37' and	81' × 79'
1 Wheel and tyre yard	...	...	...		—
1 Coppersmiths' and tinsmiths' shop	...	...	...		38½' × 30'
1 Moulding shop and foundry	...	...	...		—
1 Boiler house	...	...	...		37' × 29'
1 Tool store	...	...	...		48' × 22'
1 Pattern stores (above Works Manager's Office)	...	...	...		36½' × 27½'
2 Carriage makers' shops	...	...	...	104' × 27½' and	48½' × 45'
1 Wagon erecting and fitting shop	...	...	...		224' × 59'
1 Carpenters' shop	...	...	...		103' × 42'
1 Paint shop	...	...	...		104' × 59½'
1 Sailmakers' shop	...	...	...		—

A list of the principal tools in each shop is given below.

Engine Fitting and Erecting Shop.

107 employés (of whom 70 were white) worked under a foreman and 8 charge men. There were 23 pits, of which one was suited for weighing locomotives and rolling stock ; also 12 hydrants for boiler filling, washing out, etc. A traverser was also provided for hauling locomotives in and out of the shops ; it ran on two sets of rails, 12-foot gauge, and was driven by a vertical steam engine, provided with capstan gear and a 27-foot table capable of carrying 50 tons. This engine also supplied steam for an apparatus for boiling and cleaning engine gear.

Machine Shop.

A foreman and chargeman were at the head of this shop, with 87 men (20 natives) under them. The brass finishers (15 men) also worked in this building, under a separate chargeman. Two lines of rails, of 3-foot 6-inch and 2-foot gauge respectively, ran through the centre of this shop to the engine erecting shop, thereby facilitating communication. Each wheel lathe was supplied with a pair of rails of 3-foot 6-inch gauge for adjusting wheels.

Driving power for the various machines was supplied by 2 horizontal compound engines, one on each side of the shop.

To extinguish fire a 2-inch standpipe, with lengths of armoured hose and a $\frac{1}{2}$ -inch nozzle, was erected close outside the machine shop.

Blacksmiths' Shops.

One foreman and 52 employés, of whom one half were natives, worked here, as well as boilermakers (1 chargeman and 21 employés), millwrights and pump fitters (1 chargeman and 13 employés).

Power was supplied by a 10-h.p. horizontal engine, and the 32-inch blast-fan was capable of supplying the 28 blacksmiths' furnaces installed in the shop.

A certain number of tools were in the open, notably 5-ton shear legs, punching and shearing machines, a case-hardening furnace, and a brass finishing grinding machine.

Wheel and Tyre Yard.

This work was carried out in the open, and the most noticeable fittings were a Tangye hydraulic press, of 400 tons capacity, for pressing wheels on to axles, and an open furnace for heating tyres.

Coppersmiths' and Tinsmiths' Shops.

One chargeman was responsible for 22 employés, of whom 7 were natives. The blast for the 3 forges was supplied from the fan in the Blacksmiths' shop.

Moulding Shop.

22 employés under one chargeman worked in the Moulding shop and Foundry.

Boiler House.

A driver and 8 native stokers attended to the furnaces. The building contained 4 horizontal boilers of locomotive type with a working pressure of 150 lbs. ; they were fed by steam injectors and auxiliary Tangye pumps.

Pattern Stores.

Here were registered, and kept in safe custody for use or reference, the patterns of the various parts of locomotives, pumps, wagons and other fittings.

Carriage Makers' Shops.

27 employés (6 natives) worked under a chargeman. Room was also found in the same shop for the pattern-makers, of whom there were 4 under a chargeman.

Wagon Erecting and Fitting Shop.

This building was roofed, and enclosed on 3 sides ; in it worked 58 employés, of whom the greater number were natives.

The vacuum cylinder testing gear was capable of testing 4 cylinders at a time, and was worked by a vacuum ejector in the boiler house. It was capable of creating a vacuum equivalent to 11 lbs. per square inch.

Carpenters' Shop.

This was an open shed, under a chargeman with 36 employés, mostly white.

The foreman also had under him pattern and sail makers, trimmers and wagon makers. Power for machinery was supplied by a 6-h.p. portable engine, actuating a driving pulley of 40-inch diameter.

A 2-inch standpipe with hose, etc., similar to that near the Machine shop, was also available here in case of fire.

Paint Shop.

The chargeman had under him 32 men, of whom 13 were natives.

Of the 4 berths into which the shop was divided, one contained a 30-foot pit. The power for driving the paint grinding machine was derived from the engine in the carpenters' shop.

Sailmakers' Shop.

This was an open shed, temporarily covered with canvas, and accommodated drying frames for 100 sheets. A chargeman and 2 employés worked in this shop.

Lighting.

The shops and buildings were lighted throughout by electricity, the lamps employed being of 16 candle power and the number per shop varying according to requirements. The generating plant was installed in an extension of the machine shop, and consisted of a dynamo of 50 ampères capacity, driven by a 6-h.p. portable engine.

LIST OF TOOLS AND MACHINERY.

ENGINE FITTING SHOP.

- | | |
|--|---|
| 16 pairs Engine jacks, fixed. | 74 Vices, fitters'. |
| 16 " " " portable. | 1 Press, hydraulic, Tangye, 80 tons capacity. |
| 29 sets, Blocks and tackle, to lift 20 and 30 cwt. | 2 Anvils, ordinary. |
| 34 " Weston tackle, to lift 60 cwt. | 1 Table, testing, for coupling rods. |

MACHINE SHOP.

- | | | |
|---|--|------------------------|
| 10 Wheel lathes, 6 for engine, 3 for bogie wheels. | 1 Tool grinder. | |
| 30 Lathes, screw cutting, centres 19" to 6". | 3 Emery wheels and grindstones for tools, 18" and 36". | |
| 8 Lathes, ordinary, " " " | 2 Jacks, 10-ton. | |
| 3 Machines, screw cutting. | 70 Lamps, electric, 16 c.p. | |
| 16 " planing, slotting and shaping. | 13 Vices, ordinary. | } For brass finishers. |
| 14 " drilling; three radial arm 8', one traversing bed 3'. | 1 Pump, hand, for testing pressure gauge. | |
| 11 Machines, grinding, for crank pins, axle journals, pins, piston rods, and for surfacing. | 14 Lamps, electric, 16 c.p. | |

BLACKSMITHS' SHOP.

- | | | |
|--------------------------------------|---|----------------------|
| 26 Anvils, ordinary. | 5 Lamps, electric, 16 c.p. | |
| 6 Swedge blocks. | 4 Fires and vices for riveters. | } For boiler-makers. |
| 1 Travelling table, 5' square. | 1 Plate rolling machine. | |
| 1 Tube testing pump, hand. | 1 Cutting slab, 6' x 3'. | |
| 3 Hammers, steam. | 18 Vices, ordinary. | } For mill-wrights. |
| 1 Saw, 28" diameter, for hot iron. | 1 Stand and connections for pump testing. | |
| 2 Drilling machines. | | |
| 1 Press, hydraulic vertical, 80-ton. | | |

WHEEL AND TYRE YARD.

- | | |
|--|---------------------------|
| 1 Crane, double-action, 2 tons capacity. | 2 Vices. |
| 1 Jack, 10-ton. | 1 Wheel trolley, special. |

COPPERSMITHS' AND TINSMITHS' SHOP.

- | | |
|----------------------|----------------------------------|
| 1 Jenny and bidder. | 1 Shears, guillotine, 26" blade. |
| 1 Circle cutter. | 14 Vices, ordinary. |
| 1 pair Rolls. | 2 Anvils, ordinary. |
| 1 Folder. | 3 Lamps, electric, 16 c.p. |
| 1 Machine, grooving. | |

MOULDING SHOP AND FOUNDRY.

- | | |
|---|----------------------------|
| 3 Furnaces, 2 for brass, 1 for white metal. | 1 Scales, beam, 12 cwt. |
| 1 Stove for baking cores. | 2 Vices, ordinary. |
| 1 Cupola, atmospheric, worked by ejector. | 6 Lamps, electric, 16 c.p. |
| 1 Steam hoist, capacity 10 cwt. | |

TOOL STORES.

- | | |
|---|---|
| 7 Augurs, carpenters'. | 11 Drills, ratchet, 3 of which for boiler-makers. |
| 2 Braces, breast, for iron. | 4 boxes Reamers. |
| 17 Bars, boring, of sizes. | 85 " " of sorts and sizes. |
| 9 Bits, rose " " | 21 Spanners of sizes, shifting, claw, box and double ended. |
| 1 pair Blocks, ordinary. | 3 Surface plates. |
| 10 boxes Chasers, inside and outside. | 1 Tube expander, 2½". |
| 25 Chisels, wood of sizes. | 24 Taps, various, for boiler plugs. |
| 13 pairs Cutters, pipe. | 12 " " square threads. |
| 7 Cramps of sizes. | 25 sets Taps, gas, sizes ¼" to 4". |
| 1 Machine, portable, cylinder boring. | 7 Taps, gas meter, ¾" to 3". |
| 40 sets Dies, Whitworth's, of sizes from ¼" to 2". | 2 Vices, large, for fitters' bench. |
| 1 box Stocks, taps and dies. | 4 Tanks, large, for oil. |
| 5 sets Dies, machine, of sizes for screwing machines. | 109 Wheels for lathes, spare. |
| 12 sets Dies, gas, ¾" to 4". | 3 Machines, weighing, of sizes. |
| 1 " Drawers for drawing cross-head. | |
| 140 Drills, twist, of sizes from 7/16" to 2¾". | |
| 96 " for traverse " ¾" to 1½". | |

CARRIAGE MAKERS' SHOPS.

27 Benches, carpenters' and trimmers'.	16 Lamps, electric, 16 c.p.	} For pattern } makers.
1 Grindstone, 36" diameter.	3 Benches, carpenters'.	
1 Machine, sewing.	2 Lamps, electric, 16 c.p.	

WAGON ERECTING SHOP.

2 Hoists, Weston, capacity 1 ton.	1 Traverser, base 13'.
18 pairs Jacks, wagon, portable, with girders.	5 Forges, portable, and anvils.
9 " " 10-ton, traversing, ratchet and bottle.	20 Vices, portable.
	5 Cranes, travelling, 1 ton to 10 tons.

CARPENTERS' SHOP.

11 Benches, carpenters'.	1 Band saw, 48", with bed.
3 Machines, drilling, wood boring and planing.	1 Saw bench, 24" saw, with bed.
1 Wheel, emery, for saw sharpening.	1 Lathe, wood, 10" centres.

PAINT SHOP.

10 Lamps, electric, 16 c.p.

APPENDIX B TO CHAPTER IV.

DESCRIPTION OF ENGINES AND TRUCKS OF NETHERLANDS RAILWAY COMPANY.

(1). LOCOMOTIVES.

Criticisms on Various
Types of N.S.A.R.
Locomotives.

The locomotives of the N.S.A.R. were of 7 types; viz.: 10-ton, 14-ton, 18-ton, 19-ton, 40-ton, 46-ton and rack. Some remarks, based on practical experience, may be of interest.

The first four types were only used for shunting, and call for no comment, save that they were light for the work.

The 40-ton locomotives (of which there were only 20) were not well suited for a line with sharp curves, and for this reason the new engines ordered were of 46 tons weight or over. The tenders of the last 36 of the 46-ton engines ordered were slightly enlarged, so as to increase the capacity for coal and water by 20 and 10 per cent. respectively.

Motion.

The 40-ton and 46-ton engines stood on outside frames and were fitted with Walschaert valve gear; the valves were "D" pattern uncompensated, succeeded later by trick valves.

Wheels.

The plan of making coupled wheels lead with a trailing bogie, does not seem suitable for lines with sharp curves, such for example as the Eastern line. The coupled wheels being tight to gauge caused considerable wear of flanges; consequently the leading wheels, when worn, were exchanged with the trailing coupled wheels, and after that the engine was sent to shops to allow the tyres to be re-turned—an expensive and uneconomical process.

The leading bogie wheels bore against the fire-box, grinding away the heads of staves and rivets. The addition of stops to the engine frame reduced this evil, but on the other hand the play of the bogie wheels was thereby restricted.

Axles.

Records and photographs in the Loco. offices at Pretoria showed that, in the two years ending March, 1900, there had been 28 cases of fractured driving axles, these being only $5\frac{1}{4}$ inches in diameter. In later engines therefore this was increased to $5\frac{3}{4}$ inches.

Horn Blocks.

White metal was used for all bearing surfaces, and for the lining of the steel axle boxes. The bearing surface, viz.: $3\frac{1}{2}$ inches, was very small, and might well be increased.

Boilers.

The boilers were eminently satisfactory, and the records showed that in the past they had given no trouble. Their condition may be accounted for by the excellent water used for locomotives. With Witbank coal, a good and even head of steam could be maintained.

Blast.

The exhaust pipe had an annular nozzle, more surface area being presented to the blast than in the ordinary round nozzle, and the space much sooner collects oil and dirt, lessening the force of the blast and creating back pressure. These exhaust pipes had very frequently to be taken out and thoroughly cleaned.

The fire-grate had bars placed $\frac{3}{8}$ inch apart, with a drop grate at the forward end of firebox, and answered well for Witbank and Welsh coals; but a shaker grate would have been better with Colonial coal. The ashpan had no slides. Fire-Grate.

Boiler mountings were of fairly modern type. Boiler Mountings.

Valves were of two kinds:—(1) Ordinary "D" valves. (2) Trick potted. The latter were introduced at a later date. As these valves had a constant lead of $\frac{3}{16}$ inch in the trick potted valve, the actual lead was $\frac{3}{8}$ inch, which would seem abnormally large. The exhaust "D" rather choked the escape of steam, particularly when the valve wore down. Motion.

Diagrams taken in September, 1901, showed a very high back pressure when the engine was worked in full gear. The fact of the valve being unbalanced was the cause of considerable wear on the valve and motion rod pins. Another cause of wear and tear in the motion rods was the fact that the valve spindle guide bracket was fixed too far forward, instead of the spindle being supported at each end by the guide and gland respectively.

The slide bars would appear to have been extremely slight in design; they were 3 inches wide, and $2\frac{3}{8}$ inches deep in the centre, and gave considerable spring.

On the earlier engines the crank pins were very small, only $3\frac{3}{8}$ inches for connecting rod and $4\frac{1}{8}$ inches for coupling rod, and there were many cases of these crank pins breaking. In the later engines a crank pin of $5\frac{3}{8}$ inches diameter was used. Crank Pins.

The buffing gear was very weak, wooden buffer beams, 5 inches thick, being used; these were afterwards replaced by steel buffer plates, 1 inch thick. Buffers.

RACK LOCOMOTIVE.

This type is a six-coupled engine, with radial axle-boxes fitted to trailing axle. The intermediate, or driving, axle has a spur wheel keyed on at the centre, which gears into the rack laid midway between the rails. Construction.

At each end of the axle, between the outside of the frames and the driving cranks, is fixed a brake drum, fitted with a band brake. On the leading axle is fitted a loose spur wheel, which also gears into the rack; a brake drum is bolted to each side of it, also fitted with a band brake. The band brakes are applied by hand from the footplate, those in the driving and loose wheels being controlled separately.

The vacuum gear on the engine, which is similar to that on the main line engines, is only used to control the brakes on the train. The band brakes on the leading and driving wheels, worked by separate levers, are invariably controlled by hand, although those on the driving wheels (which are the last to be put on in cases of emergency) can be worked by the vacuum if desired. It would be a great improvement to the engine to fit to the coupled wheels ordinary brake motion and brake blocks controlled by the vacuum; for at present, since the band brakes are advisedly never connected to the vacuum, an engine when coupling up to a train has to reverse in order to come to a standstill.

The loose spur wheel acts as a brake only.

A special feature of this engine is the manner in which the cylinders are utilised as an "air brake" on going down hill.

There is a valve in the exhaust pipe under the smoke box, just above where the branch pipes come from the cylinders. This is worked by means of levers from the footplate. When open, this valve closes the exhaust pipe and acts as an air inlet valve for the cylinders. The air enters through the exhaust ports, thus reversing operations, is exhausted through the steam ports into the steam pipe, and is led away by a $1\frac{1}{2}$ -inch branch pipe to the rear of the engine. On this is another valve by which the driver can regulate the amount of compression in the cylinders. There is also an arrangement whereby water is allowed to enter the cylinders to keep them cool, but care must be taken or broken cylinder covers will result.

The other parts of the engine are of very similar design to the 46-ton locomotives, and call for no special mention.

The valve gear is Walschaert's.

There were four of these engines, Nos. 991—994, all of a similar type, except that No. 994 had a larger coal and water capacity than the others.

At Waterval Boven the rack engine is coupled to the front of the train, the train engine being at the back, and does little work beyond propelling itself until the rack is reached. It is then put in reverse gear, the valve in the exhaust pipe closed, and the amount of compression of air in the cylinders regulated by the valve on the footplate; water from the tanks is admitted to the cylinders, the regulator in the meanwhile, of course, being closed. Method of Working down the Rack.

The driver of the rack engine controls the vacuum brake of the train, and should this prove insufficient he applies the band brakes on his engine, according to the requirements of the road.

On going from Waterval Onder to Waterval Boven the train engine remains in front of the train, and the rack engine is coupled on at the rear end. Up the Rack.

The train engine pulls the train until the rack is reached; when well on the rack, the regulator of the rack engine is opened out and the whole train and engine propelled up the 1 in 20 grade.

(2). TRUCKS.

Few comments are necessary as to the design of trucks used. Attention, however, may be drawn to the standard underframe, which appears weak in design. The solebars and headstocks of channel mild steel are in section 200mm. x 75mm. x 8.5mm., or roughly $7\frac{7}{8}'' \times 3'' \times \frac{5}{16}''$; a centre longitudinal channel steel 117.5 x 65 x 10mm., or $6\frac{7}{8}'' \times 2\frac{1}{2}'' \times \frac{3}{8}''$; cross bearers of same dimensions as longitudinal; transoms of angle iron 65mm x 65mm x 8mm, or $2\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{5}{16}''$.

The buffing arrangements were weak. The buffer rod was fixed to the crossbearer 2,000 mm. (or about 6 feet 6 inches) from the headstock, the buffer rod being only 2 inches in diameter. Any rough shunt was liable to cause the buffer rod to buckle, or even fracture at the shoulder, and in many cases to buckle the frame of the truck. Compare this frame with the Cape type:—

	N.S.A.R.	C.G.R. Short Truck.
Wheelbase	11' 6"	10' 0"
Solebars	$7\frac{7}{8}'' \times 3'' \times \frac{5}{16}''$	$7\frac{7}{8}'' \times 2\frac{1}{2}'' \times \frac{5}{16}''$
Headstocks	$7\frac{7}{8}'' \times 3'' \times \frac{5}{16}''$	do.
Longitudinals	$6\frac{7}{8}'' \times 2\frac{1}{2}'' \times \frac{3}{8}''$ (1 only)	do. (two)
Crossbearers	do. (two)	do. (two)
Diag. Stays	—	$3\frac{1}{2}'' \times \frac{1}{4}''$ flat
Transoms	$2\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{5}{16}''$	—

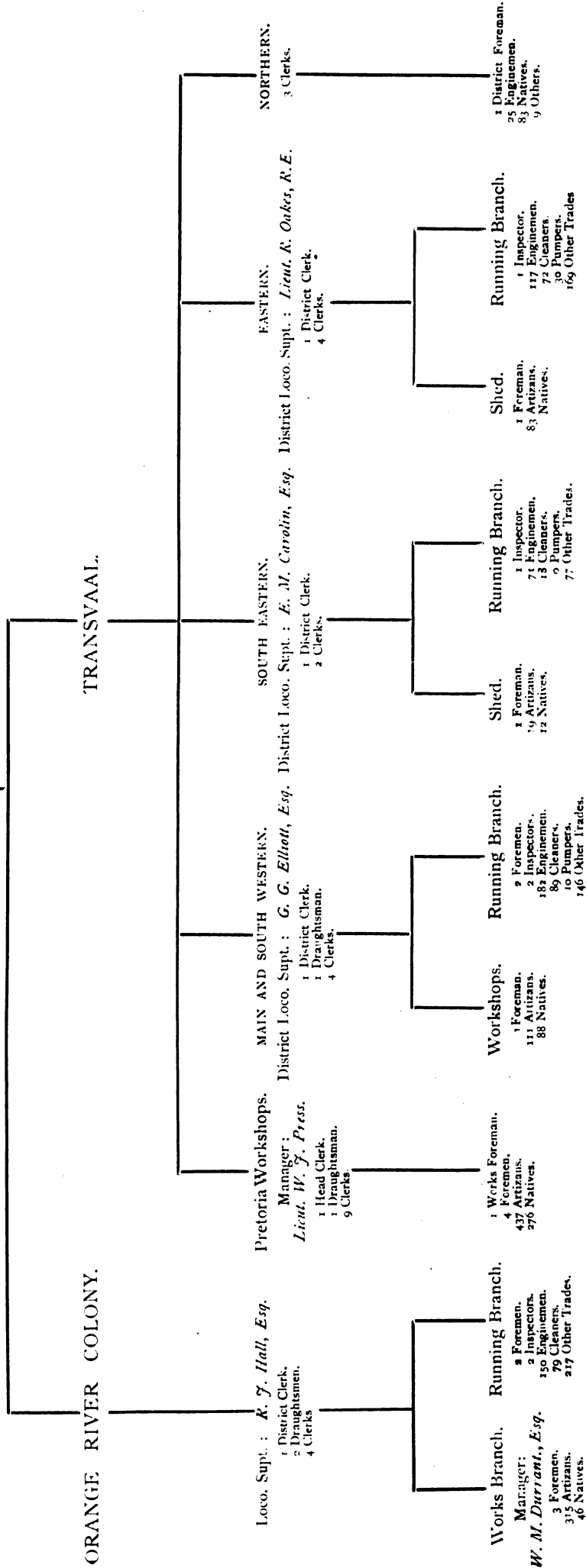
ORGANISATION OF LOCOMOTIVE DEPARTMENT, I.M.R.

Locomotive Superintendent: *Capt. A. G. Stevenson, D.S.O., R.E.*

Acting Locomotive Superintendent: *Lieut. E. O. A. Newcombe, R.E.*

Headquarter Office: Pretoria.
Office Superintendent: *A. L. Remie, Esq.*

5 Draughtsmen.
14 Clerks.



CHAPTER V.

TELEGRAPH DEPARTMENT.

Conditions at
Outset.

In Part I., Chapter I., some account has been given of the procedure followed by the Traffic Department of the C.G.R. when crossing trains on a single line, and a system, similar in all essentials, existed on the O.F.S. Railways. "Electric Block" instruments were seldom used, and it is apparent therefore to what extent all train movements were dependent on the Railway Telegraph.

The various circumstances which might arise, *e.g.*, failure of telegraph, running of special trains, etc., had been carefully considered beforehand by the O.F.S. Railway Authorities; and at the end of this Chapter will be found samples of the various forms used to ensure safe working.

Even in peace time the Telegraphs were used for the transmission of information, orders, etc., by the various departments, and in War this was doubly necessary as the postal service could not be relied on. It would therefore seem a self-evident proposition that under such circumstances the Railway Telegraph should be an integral department of the Railway administration, thus ensuring sympathetic and harmonious working.

In the *Manuals for Military Railways* and *Military Telegraphs* it is laid down that one wire shall be at the disposal of the D.R. for working block instruments, and that all other telegraphic work for the Railways shall be entrusted to the D.A.T.

After consideration it was decided that the "Electric Block" system was not suitable for the Military Railways, and Morse recorders were demanded with a view to introducing the Cape system. These instruments were ordered by the D.A.T., but were not delivered till the middle of 1900, and in the meanwhile other arrangements had been made for the lines in the O.R.C.

Creation of the
Telegraph
Department.

After Bloemfontein was captured, it was definitely decided that the Railway Telegraph Department should be under the D.R. and the new department was therefore inaugurated.

The members of the civil staff of the O.F.S. Railways, who remained at their posts on the advent of the British, formed the nucleus of the department and had charge of Railway Telegraph lines from Bloemfontein to Norval's Pont and Bethulie. The staff was further strengthened from the ranks of the Army and from civilians in the southern Colonies; and train foremen for working trains and the telegraph instruments at intermediate stations were supplied from the Railway Staff of the O.F.S.R. and C.G.R.

No men could be obtained from the Telegraph Division, R.E., either to operate or to repair the railway telegraphs, and it is evident that it would have been by no means an easy matter to find a military staff fully qualified for this work.

To facilitate Army Telegraph work, one of the Railway through wires was lent to the Army, whilst the D.A.T. reciprocated by undertaking the temporary repair of railway wires in advance of railhead. He further added wires for Army use on Railway poles, and it was arranged that permanent repairs should be carried out to Railway Telegraphs by two parties, one of which accompanied the Construction Train, whilst the second was 50 miles in rear.

As the Construction Train advanced, station offices were re-opened, and at railhead a moving office was connected up both on the "station to station" and on the "through" Bloemfontein wires.

In the railway stores was found a quantity of poles, wire, fittings, etc., all of which proved of value; but the lack of instruments made it necessary to patch up and utilise damaged instruments with consequent increased risk of failure.

WORK IN ORANGE RIVER COLONY.

On the 13th March, 1900, the D.A.T. took possession of the Railway telegraph office at Bloemfontein; and having connected up this place with Lord Roberts' Camp, he further bridged the Railway and Town telegraph offices.

O. F. S. Telegraphists
re-instated.

The next day the Controller of Railway Telegraphs, O.F.S., expressed the willingness of himself and his staff to work for the British, and the staff was re-instated *en bloc* between Bloemfontein and Norval's Pont; also repairing parties were despatched to make good damage done to the wires by the Army whilst advancing.

Diagrams 1 and 2, at the end of this Chapter, show the position of affairs on the 14th and 31st March; but the forces on the Orange River were in telegraphic communication with Bloemfontein by the 16th.

Further, the main line from Port Elizabeth was connected up at Norval's Pont, and so great was the pressure on the Railway Staff that two Military clerks were sent to Springfontein by the D.A.T. This pressure of Military business continually increased, and the eviction of Railway instruments at Bethulie and Springfontein (the offices being occupied by Army Telegraphs) caused great difficulty and delay in the train service.

At Norval's Pont and Bethulie, traffic over the deviations was worked by means of phonophores, and on March 27th it was found possible to reinstate Railway instruments at Springfontein and to re-establish Railway telegraph working on one wire.

The separation of Railway and Army Telegraphs had now become a pressing matter; and this separation having been decided on, it was arranged that Army Telegraphs should hand over such wires as were not absolutely necessary, that these should be worked and maintained by the Controller of Railway Telegraphs, and that on Railway wires Railway messages should have priority.

Separation of
Railway and Army
Telegraphs.

By the last day of March there was telegraphic communication *via* the Bethulie road bridge over the Orange River, whilst Karree Siding had also been connected with Bloemfontein.

The pause in the advance during the month of April was utilised to improve the *personnel* and *matériel* of the Railway Telegraphs. Test boxes were inserted at convenient places between Bloemfontein and Norval's Pont, Military Telegraph Offices were gradually removed from Railway wires, and Lieut. M. G. E. Bowman-Manifold, R E., was posted to the Staff of the D.R. as Supt. of Railway Telegraphs.

At various intermediate stations on the railways Military Telegraph Offices had been opened, but telegraphists had not been supplied; accordingly the "station to station" wires were becoming blocked by the numerous Military telegrams handed in for transmission by Railway telegraphists. To obviate this, the following Army Order was issued on the 12th April, 1900, and considerable relief was obtained thereby.

Interference with
Railway Telegraphs
by other than
Railway Messages.

EXTRACT FROM ARMY ORDERS, SOUTH AFRICA.

ARMY HEADQUARTERS,
GOVERNMENT HOUSE,
BLOEMFONTEIN,
12th April, 1900.

6.—RAILWAY TELEGRAPHS.

As the transmission of non-urgent public and private messages from Railway Telegraph Offices interferes very materially with the Railway traffic work, the Railway Telegraph system is in future to be used in cases of emergency only.

No telegram, public or private, is to be sent from any Railway Telegraph Office unless previously countersigned by the Commandant of the Station.

Commandants will be held responsible for the urgency of the messages so sent.

By Order,

(Signed), W. F. KELLY, *Major-General*,
D.A.-General.

As an instance of interference with Railway Telegraphs the following may be mentioned:—By order of a General Officer the instrument and batteries were removed from a roadside station and a new office was opened in the General's camp, a Military Telegraphist being detailed by him to work the instrument, using the "station to station" wire. This naturally caused confusion to Railway working; and the matter was not set right even when the D.A.T. opened a Military office at the camp, for the General Officer refused to allow the Railway instruments to be removed until he had received an order from the Chief of the Staff.

To meet the pressing wants of the D.A.T. 30 miles of wire (increased later to 60 miles) were issued on loan from the Railway stores at the end of April, 1900, and other help was given whenever possible.

Lord Roberts' advance through the O.F.S. was resumed at the beginning of May, 1900, and a telegraph party with Railhead office left Bloemfontein on 3rd May on board the Construction Train. Diagram 3 shows the lines then in order north of Bloemfontein; by the 7th of May the Railhead office at Vet River was in communication with Army H.Q. on the Army Telegraph wires. The vibrators used by the Army interfered somewhat with the Railway phonophores, but this was unavoidable.

Progress Northwards
from Bloemfontein.

On May 8th the Railway Telegraph staff was strengthened by the transfer of one officer and six men of the Electrical Engineer Volunteers ; this party rapidly picked up the technicalities of telegraph construction, and proved very useful as linemen.

Virginia station was re-opened on the 17th May, although the office had been utterly wrecked ; and on the following day an advance party with ox transport went forward to effect permanent repairs north of Ventersberg Road, where heavy damages were reported.

On 20th May railhead was in communication with Ventersberg Road, and two days later Kroonstad Station had been re-established.

The existence of faults on the wires lent to the Army caused great delay, and it was accordingly arranged that the Railway "through" wire should be used at intervals during the night for the transmission of messages from Army H.Q. Diagram 4 illustrates the progress made north of Bloemfontein, and the stations working, on May 31st.

Interruptions, however, were frequent, being chiefly due to the presence of many working parties, and delays were therefore of common occurrence.

The number of messages dealt with during May, as far as the records can be obtained, is as follows :—

Forwarded messages	...	...	...	...	...	...	15,647
Received	„	...	...	...	...	...	13,666
Transmitted	„	...	...	...	...	...	10,602
							<hr/>
						Total	39,915
							<hr/>

Out of this total Bloemfontein Station Office dealt with 21,659 messages of an average of 28 words per message.

Telephone construction in and around Bloemfontein was also making rapid progress and the Central Telephone Exchange was very busy.

On 1st June the Army had reached the Vaal, whilst "railhead" was a considerable distance in rear. A telegraph party accordingly left Groot Vlei by trolley on 3rd June, with orders to push on to Viljoen's Drift and re-open the office there. This was done on June 6th ; but for the next ten days the activity of the enemy on the L. of C. effectually prevented any messages from passing between Army Headquarters and Bloemfontein.

In the interval Railway wires between Kroonstad and Bloemfontein (which were intact) were freely used by the G.O.C.s at those places ; and on the 15th June, when the Railway telegraphs were re-instated, the Chief of the Staff and the G.O.C. at Kroonstad conversed on these wires.

An attack on Honing Spruit on 22nd June again severed communication for a time ; and working parties were therefore stationed at Smaldeel, Kroonstad and Viljoen's Drift to allow of repairs being rapidly effected in the event of further raids.

The want of linemen was severely felt, there being only 5 available for 200 miles of telegraphs in the O.F.S. ; and the enemy constantly interfered with working parties, making prisoners of small ones moving along the railway between stations.

The number of messages dealt with during June, from the Telegraph Message Branch records, is as follows :—

Forwarded messages	...	...	...	...	...	...	11,808
Received	„	...	...	...	...	...	9,232
Transmitted	„	...	...	...	...	...	9,383
							<hr/>
						Total	30,423
							<hr/>

These figures, however, cannot be considered correct, as doubtless a considerable number of message records were lost.

The Table in the Appendix to this Chapter shows the damage done to the Telegraphs by the Boers in their retreat northwards.

WORK IN THE TRANSVAAL.

(a). Main Line.

Railway telegraphs at Elandsfontein and Johannesburg were in utter confusion at the beginning of June ; the various telegraph and telephone instruments had been damaged or tampered with, and in the absence of plans it was impossible to trace any one wire through the maze around the two places.

It was not until 5th June that a small repairing party could be spared from work in rear; they proceeded at once to Viljoen's Drift. The existence of telegraph lines on the road (which were seized by the Army Telegraphs) allowed the Railway telegraphs to be allotted for purely Railway purposes.

The D.A.D.R., on reaching Johannesburg, arranged to inaugurate a telephone service between that place and Elandsfontein. This was carried out (*vide* Diagram 5) by Military Telegraph parties, and for nearly a week traffic trains were worked by telephone. South of Elandsfontein the telegraph lines were still unrepaired, and trains were therefore worked on the "Train Staff" system.

Telephone Service between Johannesburg and Elandsfontein.

The instruments found in the Transvaal were of a pattern worked on "closed circuits"; and as the stock of spare instruments was exhausted, these were of necessity altered to suit the new conditions.

Diagram 5 shows the telegraph communications which had been made to the evening of June 6th, and from Diagram 6 it will be seen that very appreciable progress had been made by the end of the month on the Main line to Pretoria, on the South-Eastern line to Heidelberg, on the Springs branch, and on the Eastern line to Erste Fabrieken.

The damage on the South-Eastern and Springs lines had been chiefly caused by our own troops, and much of the subsequent work of repairs might therefore have been saved with the exercise of a little discretion.

The telegraph parties of General Buller's Army repaired the lines as his force advanced; and by the middle of August, the I.M.R. telegraphs having been extended beyond Heidelberg, a junction was effected at Greylingstad and the Railway system extended to Standerton.

(b). South-Eastern Line.

On the last day of this month the system had been further extended to the Natal border as shown on Diagram 7. The single needle instruments, which were originally found on the length Greylingstad --Charlestown, were replaced by Morse recorders, and thus uniformity was obtained. The enemy raided this line on several occasions, and the telegraphs did not escape; heavy repairs were therefore necessary at short notice.

As General Hunter's column advanced through Krugersdorp and Potchefstroom towards Klerksdorp the Railway Telegraphs were repaired, and by July 15th there was communication throughout this length.

(c). South-Western Line.

But Railway wires were worked for purely railway purposes only between Johannesburg and Randfontein; on the rest of this line all but two wires were used for Army work. Between Randfontein and Potchefstroom the enemy constantly interfered with the wires and captured isolated linemen and repairing parties, and eventually the British forces withdrew to Bank. The line was therefore temporarily abandoned; and though it was re-opened and closed from time to time, efficient repairs could not be undertaken for a considerable period.

When Pretoria fell into British hands a considerable quantity of telegraph stores and a well-appointed workshop and test room were found. These came into the possession of the Railway Telegraph Staff, and the machinery in the workshops was started again, workmen being obtained from the ranks of the Army and from amongst local civilians, under a O.F.S. telegraph mechanic from Bloemfontein.

The Construction Train arrived at Bronkhorst Spruit on July 25th and was accompanied by a telegraph repairing party, who had made communications and connections (as shown on Diagram 8) by July 31st.

(d). Eastern Line.

The enemy had apparently neglected to damage the telegraphs, and consequently rapid progress was maintained as far as Wonderfontein by the 15th August and Waterval Onder by the 31st (Diagram 9). On the rack section between Waterval Boven and Waterval Onder temporary arrangements were made to pass trains in the absence of the special engines, and a telephone wire was therefore added for Railway purposes on this section.

For the next few weeks progress eastward was steadily maintained; by the 28th September (*vide* Diagram 10) the wires were working as far as Koomati Poort and Ressana Garcia and also on the Barberton branch, whilst improvements and additions were also in hand throughout the Eastern line.

When the British forces advanced from Bronkhorst Spruit it was the intention of the D.A.T. to repair and keep open the road lines, but this was found impracticable. Consequently Railway wires were temporarily taken for Army purposes, and at times only the "station to station" wire was available for use by the Railway Telegraph Department. This entailed a good deal of delay to Railway telegrams, especially between Waterval Onder and Koomati Poort (where all wires were requisitioned for purely Military purposes); and normal Railway working was not resumed until the

Army Telegraphs had vacated Railway offices and had restored one or more wires to the Railway Telegraph Department.

The Portuguese authorities at Lourenço Marques displayed extreme caution in making connections with the Eastern railway system; at first only telephone communication from their frontier station (Ressana Garcia) was sanctioned, but later they consented to allow telegraphic communication to this place and also to Lourenço Marques.

The Staff and equipment of the telegraph car on the Construction Train during the advance eastward from Pretoria was as follows :—

Telegraph Repair
Equipment on
Construction Train.

Staff.	3 Linemen.	
	2 Clerks.	
	12 Native Labourers.	
Stores and Tools.	50 Base plates and screws.	2 Boxes (6) Military recorders.
	50 Pole rings.	2 Recorders.
	50 Pole bases.	1 Coil G.P. lead.
	6 Netherlands Railway poles, complete with brackets and bolts.	24 Cells, ebonite.
	150 Insulators.	180 Cells, Leclanché, small.
	40 Spindles.	40 Cells, large, in 10-cell boxes.
	10 Stay rods.	30 Spare zincs.
	3 Stay plates.	1 Box salammoniac.
	20 Shackles.	1 Box stationery.
	1 Coil binding wire.	Ink, tape.
	45 Coils No. 8 wire.	1 Box candles.
	1 Drum D. 5.	4 Ladders.
	6 Picks.	5 Ratchets.
	6 Shovels.	1 Tackle.
	2 Crowbars.	2 Claws.
	2 Punners.	1 Detector.
	1 Wire barrow.	2 Bottles acid.
	2 Tents.	7 lbs. solder.
	1 Table.	2 Bolts, soldering.
	1 Stool.	2 Fire pots.

RELATIONS BETWEEN ARMY AND RAILWAY TELEGRAPHS.

Whilst Military operations were in progress the interests of Army and Railway Telegraphs unavoidably clashed at times. On the other hand there were many occasions when these two branches of the telegraphs were able to render mutual help; of these the following appear noteworthy.

Supply of Staff for
Railway Telegraphs.

The D.A.T. could not supply linemen and telegraphists, whilst no Army organisation existed for the provision of a Railway Telegraph Staff. It became necessary therefore to provide a makeshift staff for this special work from civilians in the country and from reservists from the Infantry battalions. This staff was to operate under Military conditions to which many were utterly unaccustomed, and, as may be imagined, smooth working could only be attained gradually.

Repairs to Railway
Telegraphs beyond
Railhead.

It was agreed that the working parties of the Field Telegraphs should do all that was possible with limited time and materials. In many instances, where damage was slight, they were able to execute repairs which were to all intents and purposes permanent; and thus they greatly helped the railway.

Substitution of
Permanent for
Temporary Repairs
at Railhead.

When permanent repairs were necessary on account of the extent of damage done, lines were entirely re-constructed. During the progress of work interruptions were frequent and unavoidable under the circumstances, and one contributory cause was the "earthing" of wires which touched the iron poles. A larger supply of cable would have allowed the working parties greater freedom in removing the temporary repairs without interfering with the telegraph service.

Supply of Military
Portable Instruments
and Cable.

Demands on the Army Telegraphs for such things as portable batteries, vibrators, relays and galvanometers on Railway Telegraph account could not be met; and it was only after the Army had arrived in Pretoria that a supply of Army pattern Morse recorders was forwarded to the railways by the D.A.T. These instruments had been demanded from England some months earlier, but great delay had occurred in supplying them.

No steel cable could be spared by the Army Telegraphs until the advance eastward from Pretoria, and then only a small quantity; but the cable then issued proved invaluable, and much more could have been utilised.

On the other hand, in the O.F.S. the Railway Telegraphs received some ordinary batteries and instruments, and a portion of the instruments in the telegraph store at Pretoria was in due course handed over to the Supt. of Railway Telegraphs.

The many occasions on which the permanent Telegraph lines were cut by the enemy taxed not only the maintenance staff but also the special gangs stationed at Kroonstad and Smaldeel. These were unable to cope with the work and received timely aid from Military Telegraph parties, who, with supplies of cable and portable stores and instruments, could execute rapid repairs.

Raids on the I.M.R.

The presence of a travelling telegraph office and staff on certain Armoured Trains (supplied and equipped by the D.A.T.) allowed communication to be rapidly restored, as these trains were often the first to reach the scene of a break. Had circumstances allowed, such offices should undoubtedly have been supplied and equipped by the D.R.

When an advancing Column found a Railway Telegraph office complete with instruments, batteries and furniture, it was very often occupied for Army purposes, the railway officials being displaced and sometimes also the instruments.

Occupation of Railway Offices by Army Telegraphs.

The inconvenience and delay in working the railways was considerable; but it was gradually brought home to the Army generally that the efficiency of the Railway service was a vital matter and that Railway offices should not be seized, or instruments evicted, save for grave Military reasons.

At minor stations it was often possible to accommodate Army telegraph stations in Railway offices and this arrangement was found convenient.

During the continuance of hostilities a total length of 650 miles of Railway lines in the O.F.S. and the Transvaal was permanently occupied for Army purposes, and in some cases two wires were thus lent. The greatest length was throughout the O.F.S., viz., 350 miles.

Railway Wires Lent to Army Telegraphs.

In addition there were many instances when wires were lent temporarily, the period varying from a few days to some weeks. This was generally the case when Military wires were being erected on Railway poles.

The "protection troops," posted on lines of Railway, safeguarded the telegraphs as far as they could; and in order to afford protection to Army wires without increasing protection troops these wires were in many places erected on Railway poles by the Army Telegraphs. The length of Army wires thus erected exceeded 500 miles, of which nearly 270 miles were in the O.R.C.

Wires fixed by Army Telegraphs on Railway Poles.

The Railway poles, being of iron, were well able to stand the additional wires, but where miscellaneous materials were used the work of maintenance was heavy.

A road line from Johannesburg *via* Heidelberg to Vereeniging was lent to the Railway Telegraphs to facilitate working between Bloemfontein and Johannesburg stations. Unfortunately this line was frequently cut by the enemy; but while intact it was of great use.

Army Wires lent to the Railway.

A telephone service between Johannesburg station and Elandsfontein was worked on wires lent by Army Telegraphs; this system was installed when Johannesburg was first occupied (see above, page 183).

In order to prevent complications in accounts, it was made a rule as far as possible not to accept any private telegrams at Railway offices. At small stations, where troops were temporarily halted, Military telegrams were dealt with only when countersigned "Urgent" by the Station Commandant; but this was not an invariable rule, and at many stations in the Transvaal the D.R. supplied additional operators to cope with Military telegraph work.

Army and Private Messages taken on Railway Wires.

The difficulties of the railway (whether through a temporary break down or the retention of Railway wires for Army purposes) were from time to time decreased by the D.A.T. consenting to the use of Army wires (especially over long distances) for Railway messages.

Railway Telegrams on Army Wires.

Certain railway officers, chiefly at Pretoria, Johannesburg, Kroonstad and Bloemfontein stations, were authorised to prefix really urgent messages "D.S."; and such telegrams were privileged above all others tendered to Military offices. The system worked well, and the privilege was but sparingly used.

The Telephone Exchange at Bloemfontein had been erected by the Railway Telegraph Department of the O.F.S. On the occupation of Bloemfontein it was decided that its working should be continued by the I.M.R., and telephonic communication was established with most of the Heads of Departments of the Army. This Exchange worked well throughout.

Telephones at Bloemfontein.

RELATIONS BETWEEN RAILWAY TELEGRAPH AND TRAFFIC DEPARTMENTS.

It may be considered that all departments of a Railway exist for one main purpose, viz., to ensure the maximum of efficiency of the Traffic working.

The Railway Telegraph Department is more intimately connected with the Traffic Department than with any other. By means of the telegraph the Traffic Department arranges its trains, and also obtains quickly the essential information it requires regarding the supply of rolling stock, forwarding of goods, the distribution of staff, etc.

Special Traffic
Telegraph Forms.

For the movements of trains no less than 27 varieties of special telegraph forms were used by the Traffic Department of the O.F.S. Railways. This system was continued on the I.M.R., subject to some modifications; at first the same forms were used, but later on the number was reduced. Specimen Forms are given at the end of this Chapter; the backs of those used for Traffic working were printed for the endorsement of the Guard or Guards concerned.

Overlap of Duties
of Telegraphists and
Traffic Foremen.

During the advance of the Army and the re-opening of the railway, telegraphists and traffic foremen frequently assisted each other in their duties. Telegraphists were provided for stations where the only foremen available for Traffic were unacquainted with Morse telegraphic working; this particularly occurred on the section of line handed over by the N.G.R. between Volksrust and Greylingstad.

In a few cases the station masters and foremen experienced difficulty in adjusting their telegraph instruments. The small number of linemen available rendered it necessary that all those who used the instruments should be able to alter the adjustment to suit the varying conditions of the line.

Loading Trucks
too High.

A number of cases occurred where telegraph wires crossing the line were pulled down by trains, the loads of which were over the maximum height, owing to the trucks not having been passed under a loading gauge.

Re-Opening of
Electric Block
System,
Johannesberg.

The "Electric Block" system was at first disconnected; and, at the request of the Traffic Manager, telephones were put in at every station between Johannesburg and Elandsfontein in order to deal with the traffic on this section which was peculiar on account of the stations being at most only a mile apart.

Later it was decided to re-establish the existing Dutch system of block working, and a Signal Inspector was brought from Cape Colony. He cleaned up the instruments and reconnected them in working order. Block working was also re-established at Fortuna Coal siding, near Vlakfontein; and the electric rail contacts and interpolators were put into working order at Park and Johannesburg stations.

Phonophores.

A number of phonophores were put up to enable conversations to be held between stations. These instruments were satisfactory though liable to get out of adjustment.

ELECTRIC LIGHTING.

Bloemfontein.

At Bloemfontein the Electrical Engineer Volunteers installed electric light as a temporary measure in May, 1900. By January of the following year it was found that extensive repairs to wires were required, and that the boiler and engine were failing; these repairs were undertaken, and by May, 1901, great progress had been made, though much remained to be done.

Elandsfontein and
Johannesberg.

At Elandsfontein and Johannesburg the state of the electric light installations showed want of care in maintenance by the Transvaal Administration. During the winter of 1900-01 considerable inconvenience was caused from time to time by the failure of the Power Company to supply current to Elandsfontein. The railway supply failed at about the same time, and the Company took the opportunity to charge greatly increased rates for current.

Pretoria.

At Pretoria the Electrical Engineers executed work which was necessarily of a temporary nature. This lasted a few months, and it then became necessary to renew wires, etc. By May, 1901, the station, with the exception of the goods shed, was well lighted.

New Work.

The lack of materials, which were ordered from England but delayed in delivery, greatly hampered progress; nevertheless a considerable amount of new work was undertaken.

At Pretoria the stores and offices, together with the station yard, were supplied with additional lights, whilst the goods yard also received eight arc lamps to facilitate loading by the A.S.C. The light thrown by these lamps allowed great reduction in the numbers of watchmen.

At Elandsfontein the Remount platform and Customs offices were provided with additional lights.

At Braamfontein the illumination of the locomotive sheds was completed; and improvements were also effected in the lighting of the stations and offices.

PERMANENT WORKING.

By the end of 1901 the Railway Telegraph Department had settled down to normal conditions, and was working smoothly. 118 offices were open, and in most of them the fittings had been thoroughly overhauled and repaired or renewed; on the Eastern line, however, some work still remained to be done. Offices.

The total number of telegraphists employed at this time was 91; indifferent men having been weeded out, an efficient and hard-working staff remained. The number of linemen employed on maintenance was 34, but this was too small a staff to cope with heavy repairs. Staff.

To reduce the telegraph staff and to improve the working of the lines the following innovations were made:—(a). Double current working was introduced on main lines, whereby battery power was economised, cost of instruments was reduced, and the rate of transmission was increased. Improvements to Lines etc.

(b). A large number of test boxes were added, thereby allowing faults to be rapidly localised.

(c). The addition of fore and aft rocking stays on heavily loaded poles prevented faults due to wind or weak poles.

(d). New stationery forms ensured uniformity throughout the I.M.R., as well as a saving of time in the transmission of daily "Yard Reports" to various Traffic Officers.

Want of information regarding the probable date of delivery of various stores caused difficulties in arranging the proper progress of works, whilst the pattern of instruments supplied by Messrs. Siemens did not prove satisfactory. Previous experience in the Soudan had brought their defects to light, and the indent sent to England specified instruments by Messrs. Elliott & Co.; this specification was however over-ruled at Home, but the reason has not been stated officially. Stores

By December, 1901, all wires were working satisfactorily; but, in order to produce yet better results, arrangements were being made to carry out heavy repairs on all lines in the Transvaal as well as south of Bloemfontein. The large number of additional wires on railway poles (1,400 miles in all) accounted for a number of faults, as many poles were seriously overloaded. Of the total given, 1,100 miles were erected by Army Telegraphs for Military use; their transfer to the Railway on the restoration of peace was under consideration. Heavy Repairs.

An additional wire was required for Railway purposes between Bloemfontein and Johannesburg, whilst at the same time the Army Telegraphs were desirous of adding a wire between Vereeniging and Norval's Pont. By arrangement between the heads of the Telegraphs (Army and Railway) the latter erected two wires between Bloemfontein and Kroonstad, whilst the Army Telegraph parties the remainder. On completion, the Railway took possession of the wire it required (263 miles) at the cost of putting up two wires over a length of 128 miles. New Lines.

Many telephones and phonophores were added as required, and both in Bloemfontein and Brandfontein considerable improvements were made in the telephone systems and central exchanges. A separate exchange appeared to be necessary in the Headquarters of the Railway (Henwood's Buildings, Johannesburg) to connect up the various offices, but no definite decision had been arrived at by the beginning of 1902. Telephones.

EXPERIENCED GAINED.

The Supt. of Railway Telegraphs, in reporting to the D.R. at the close of 1900, summarised the history of the Railway Telegraphs as follows:— Report of Supt. of Railway Telegraphs.

"On arriving in Bloemfontein in April last I found that the Railway Telegraphs existed in good order but were contending against great difficulties. The Military situation had to a great extent disorganised Railway work, and Railway Telegraphs suffered in consequence.

"My first endeavour was to get the Railway Telegraphs recognised as a distinct Department of the Railway, and to define its position in relation to the Army Telegraphs.

"The whole of the O.F.S. Railway Telegraph Staff had remained at their posts; and the Controller, Mr. W. J. Higley, greatly exerted himself in attempting to re-establish the work under the new conditions which arose.

"The Telephone Exchange at Bloemfontein was largely made use of for Heads of Departments of the Railway and of the Army.

"The G.O.C.s Divisions, having been asked to send in men, reservists, etc., of railway experience, a small staff of soldier linemen and clerks was collected; and this was added to continually throughout the advance. Some of the men thus obtained were well qualified; others not so skilled as one would wish, but still useful.

“During the advance northwards through the O.F.S., the need of portable instruments, cable, etc., was greatly felt; the telegraph office at “railhead” was constantly moving and had to be worked with ordinary instruments and batteries. Much valuable time was lost in fitting these up, and this might have been saved if suitable portable instruments had been obtainable. The “railhead” telegraphic office ought to have been furnished with a Field Telegraph equipment, single current set, with relays, vibrators and separators; much delay would have been saved if these had been available.

“At Vet River I was joined by a party of Electrical Engineers, R.E. (Volunteers), under Capt. Bain; this party was of great assistance, especially later on in the Transvaal when they had become more experienced in telegraphic construction.

“After the occupation of Pretoria a number of telegraphists and a few linemen were obtained from the Regiments.

“Of the relations between Army Telegraphs and Railway Telegraphs, it is very difficult to give a decided opinion. On the one hand the efficiency of the traffic would probably have suffered if the Railway Telegraphs had not been under the direct control of the D.R.; on the other hand the efficiency of the Railway Telegraphs undoubtedly did suffer from want of materials, need of staff and lack of the through wires monopolised by the Army Telegraphs.

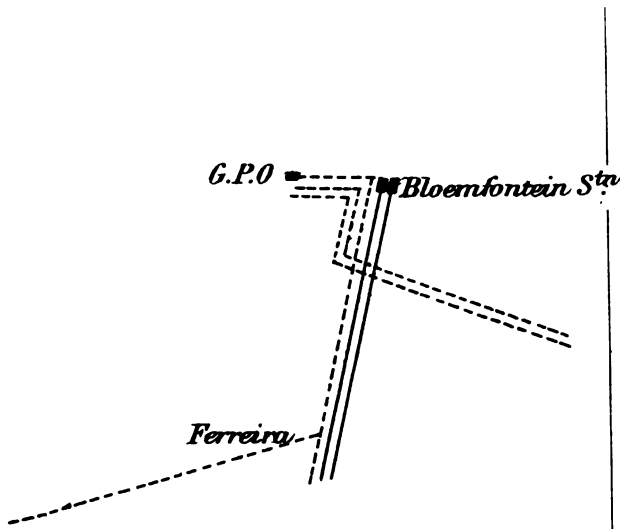
“If the Railway Telegraphs had been so connected with the Army Telegraphs as to be able to get their share of the special materials and staff which existed for Military use, I think it is probable that better efficiency would have been secured, not only to Railway Telegraphs but to the Army Telegraphs as well. Owing to the existing arrangements, a certain amount of duplication of work necessarily existed; and had it been possible to arrange to avoid this duplication, a saving in staff would have been effected.

“The general relations of the Railway and Army Telegraphs were harmonious throughout, and mutual assistance was rendered in a great many cases.

“It is to be hoped, however, that the question of providing for Railway Telegraphs on a long line of communications and in a hostile country may be fully considered and an organisation evolved before the next war; many of the difficulties recently experienced might have been avoided if the special organisation for Railway Telegraphs had been planned before the commencement of this campaign.”

DIAGRAM 1.

Position of Lines South of Bloemfontein
14th March 1900.



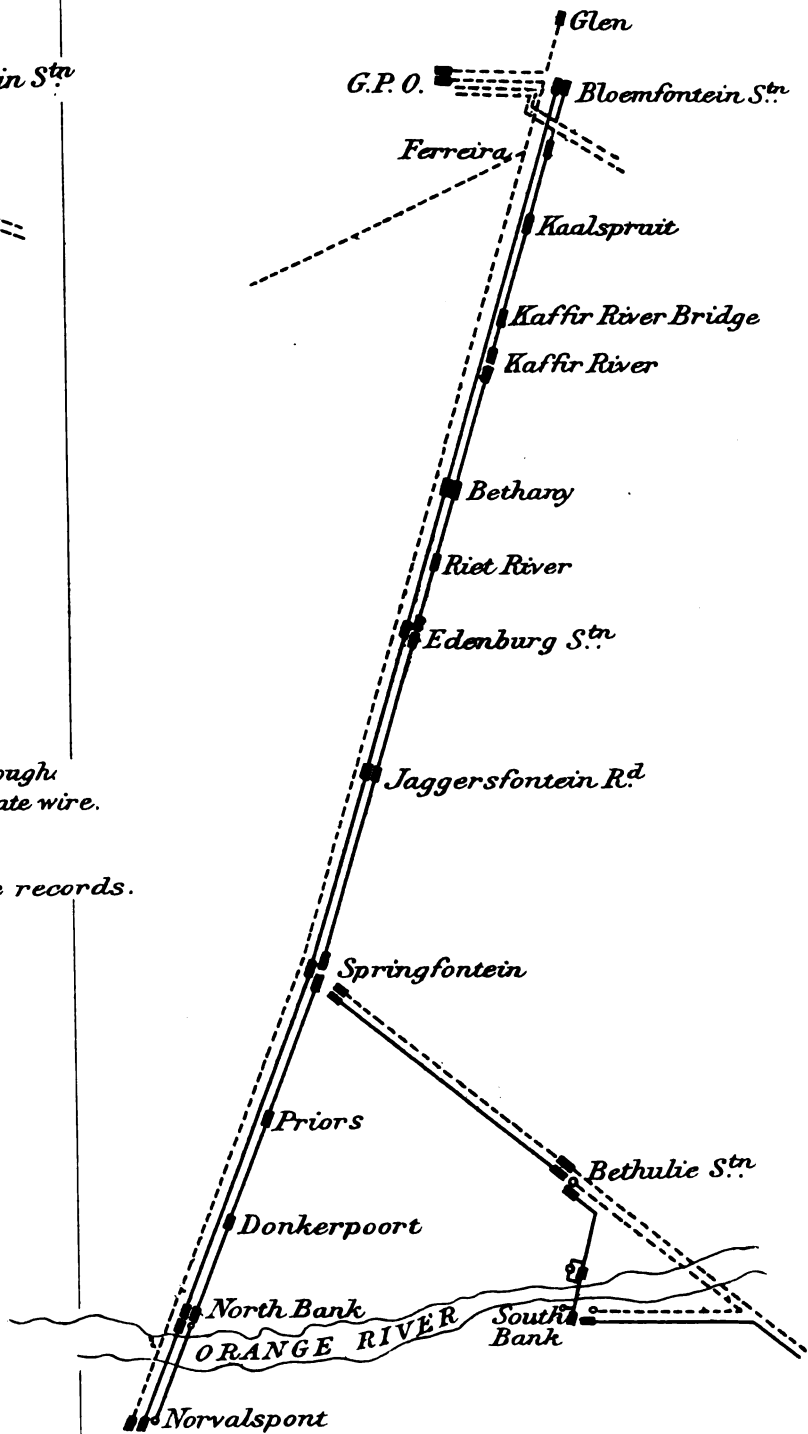
References.

- Morse recorder (inker)
- do. do. capable of extension through
- do. do. each at the end of a separate wire.
- Phonophore on separate wire.
- ⎓ } do on same circuit as Morse records.
- 8 Magneto Telephone

Railway Telegraphs —————
Army do - - - - -

DIAGRAM 2.

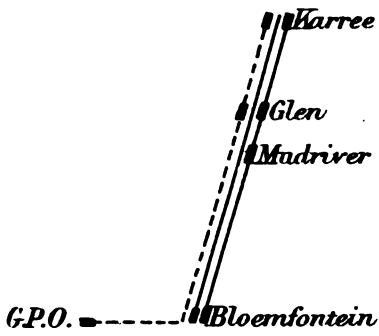
Position of Lines South of Bloemfontein
31st March 1900.



To face page 188.

DIAGRAM 3.

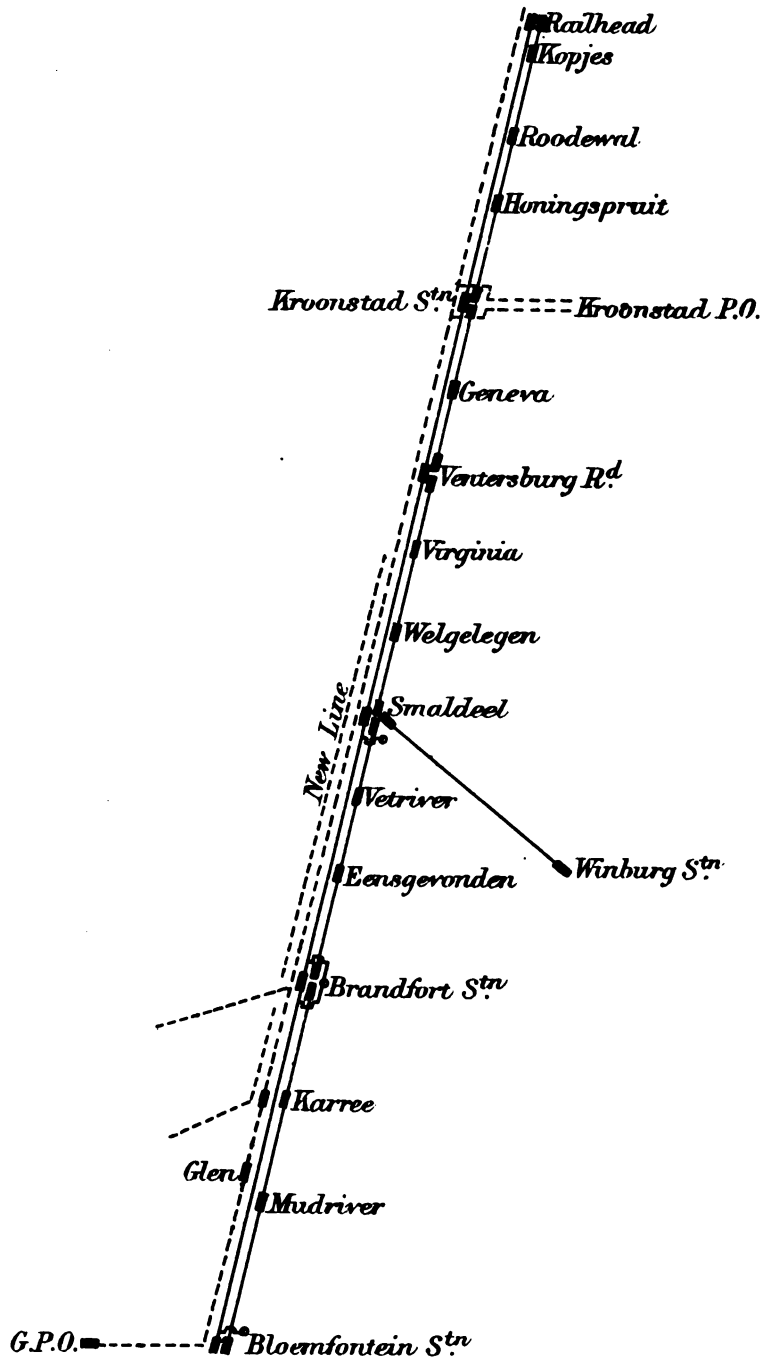
Position of Lines North of Bloemfontein on
2nd May 1900.



Railway telegraphs —————
Army " - - - - -

DIAGRAM 4.

Position of Lines North of Bloemfontein on
31st May 1900.



To face page 188.

DIAGRAM 5.

Position of Lines North of Vaal River on
6th June 1900.

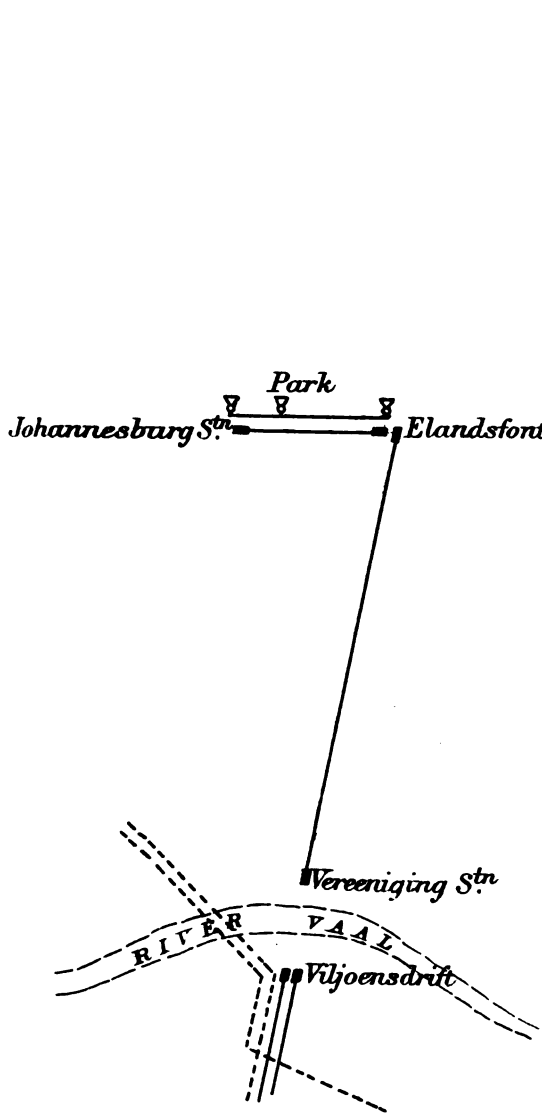
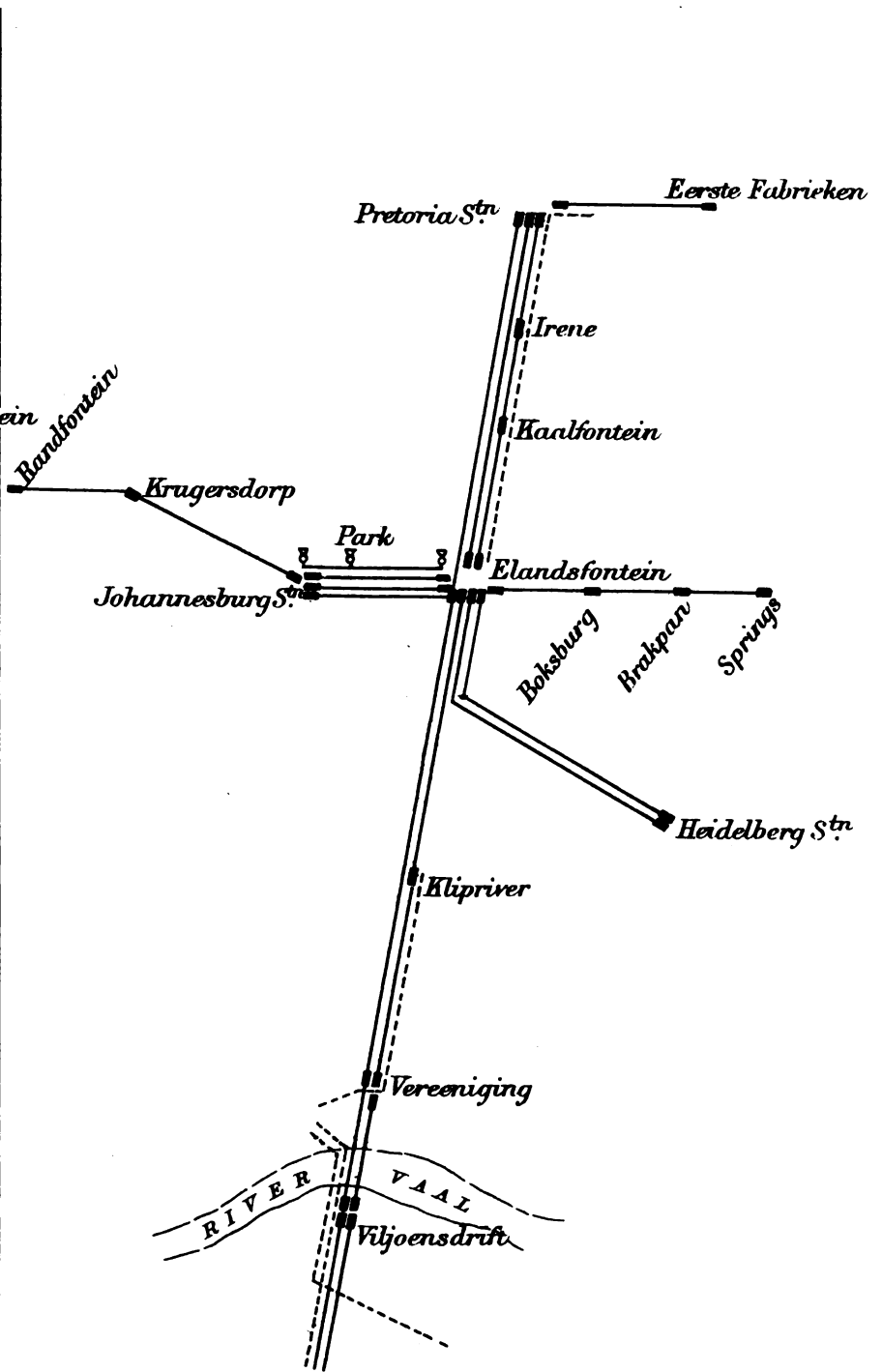


DIAGRAM 6.

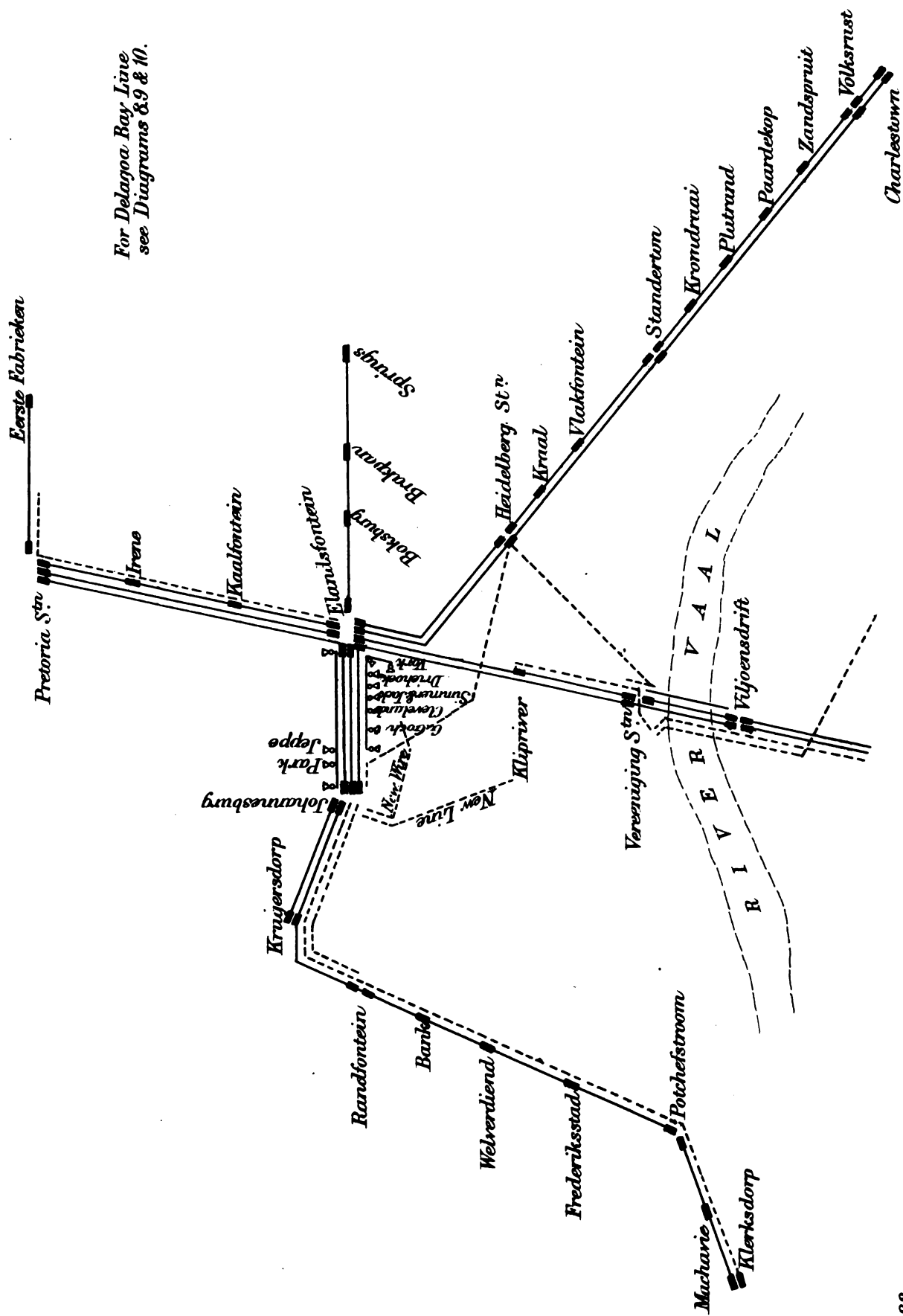
Position of Lines North of Vaal River on
30th June 1900.



Railway telegraphs —————
Army " - - - - -

To face page 188.

Position of Lines in South Transvaal on 31st Aug. 1900.



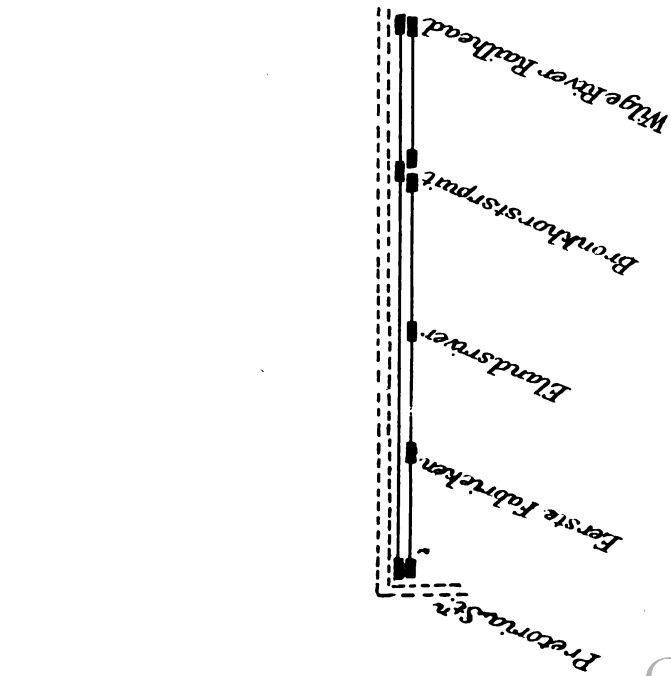
For Delagoa Bay Line
see Diagrams 8, 9 & 10.

To face page 188.

Railway telegraphs

DIAGRAM 8.

Position of Lines East of Pretoria on
31st July 1900.



To face page 188.

DIAGRAM 9.

Position of Lines East and North of Pretoria on
7th Sept. 1900.

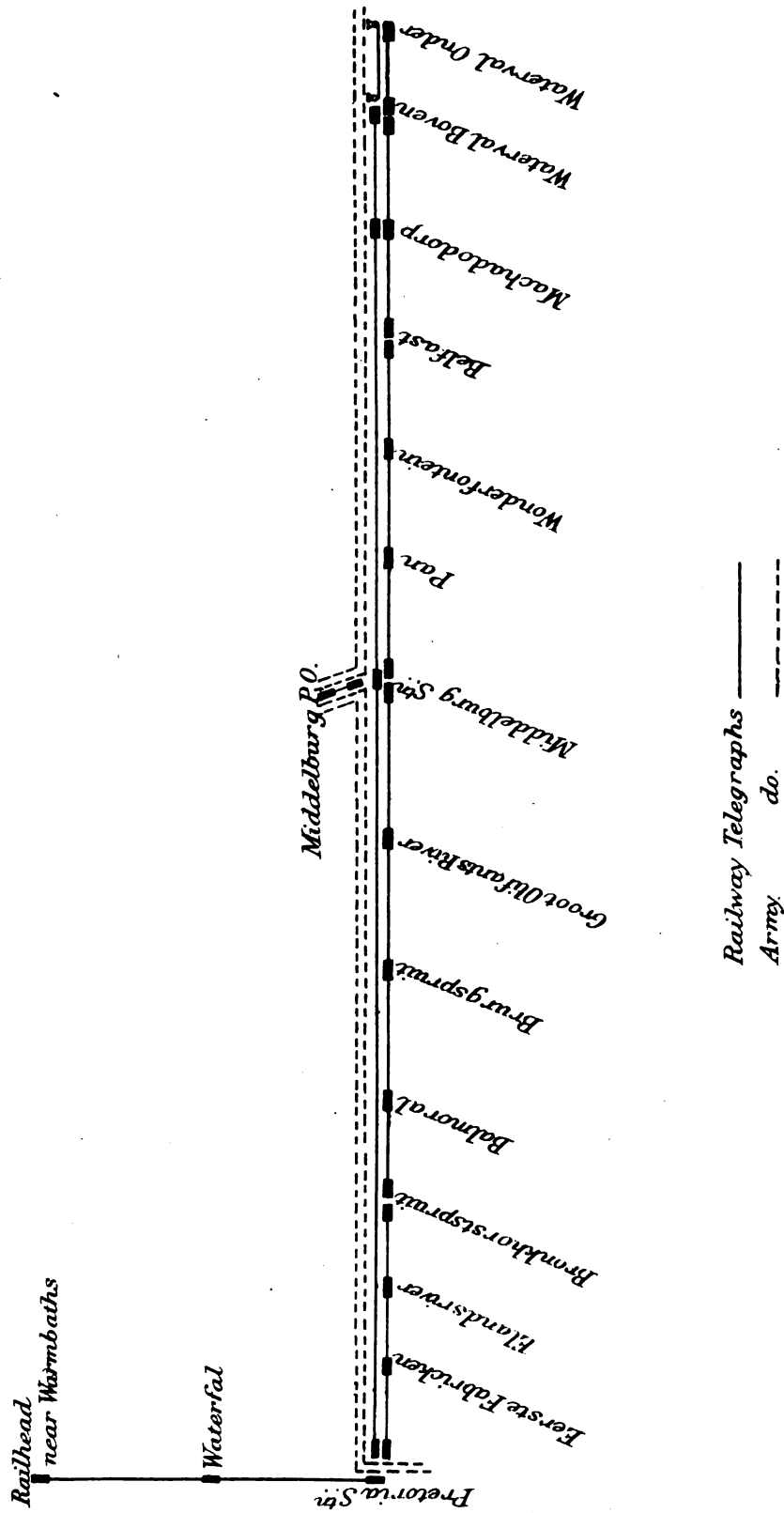
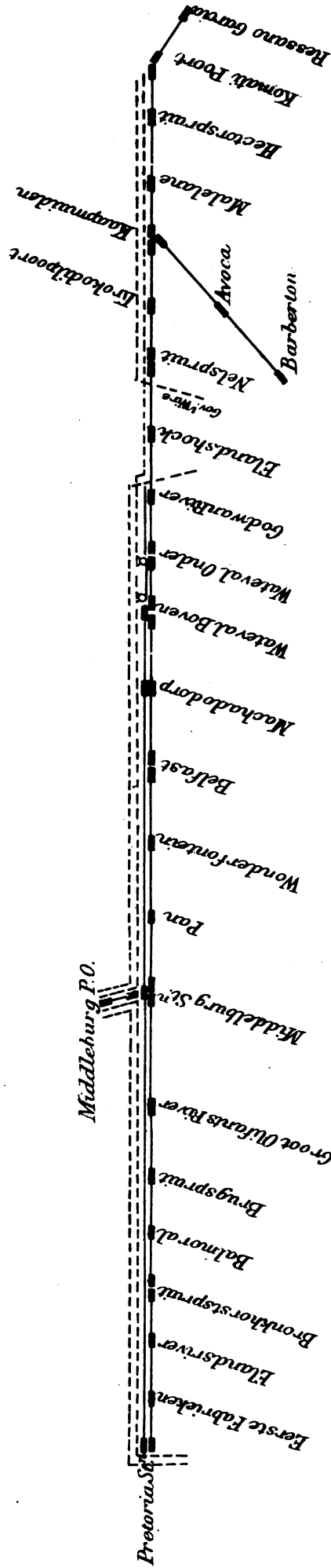


DIAGRAM 10

Position of Lines East of Pretoria on

28th Sept. 1900.



To face page 188.

Railway Telegraphs ———
 Army do. - - - -

DAMAGE TO TELEGRAPH LINES ON RAILWAYS.

STATION OR PLACE.	BATTERIES.	INSTRUMENTS.	TEST BOX.	LEADING-IN WIRES.	POLES.	INSULATORS.	WIRES.	REMARKS.
4 miles North of Bloemfontein	—	—	—	—	Several broken.	—	Cut.	Possibly by British Cavalry.
Glen	—	—	—	—	—	—	Cut and run back.	
Karree to Brandfort	—	—	—	—	15 broken.	Large number damaged.	Cut in places.	5 miles of line damaged.
Brandfort	Broken.	Removed.	Removed.	Broken down.	Broken.	Broken.	Cut near Station.	Damage extended over 1 mile.
Houtenbeck	—	Removed.	—	—	Several broken.	Several broken.	Cut in places.	
Eensgevonden	Fair.	Removed.	—	—	—	Damaged.	—	3/4 mile of land line damaged and river span broken down.
Vet River	—	—	—	—	—	—	Cut.	
Smaldeel	Fair.	Some removed.	Good.	Good.	—	—	—	
Doornspruit	—	—	—	—	4 broken.	A few broken.	Cut.	3/4 mile damaged.
Waijgelegen	Fair.	Good.	—	Good.	—	—	do.	3/4 mile of land line and span over Zand River broken.
Virginia	Removed.	Removed.	Removed.	Destroyed.	—	—	do.	
Rietspruit	—	—	—	—	6 broken.	—	—	Damage entailed the construction of a temporary line across the break.
Ventersburg Road	Removed.	Removed.	—	Broken.	—	Destroyed over 2 miles length.	Cut.	Line damaged over 1 mile length.
Geneva	do.	do.	—	do.	Some broken.	Several damaged.	do.	
Boschrand	—	—	—	—	—	Several broken.	do.	
Kroonstad	Fair.	Removed.	Good.	Good.	—	—	—	Several instruments found in Post Office.
Honingspruit	Removed.	do.	—	Broken.	5 broken.	Some damaged.	Cut.	
Serfontein	—	—	—	—	—	Broken over 1/4 mile.	do.	
Rooodeal	Damaged.	Removed.	—	—	Broken.	Broken.	do.	Damage done to line between Rooodeal and Rhenoster.
Kopies	Office utterly wrecked, 4 miles of line destroyed.	—	—	—	—	—	do.	Office wrecked by our troops.
Leeuwspruit	—	—	—	—	—	—	—	
Vredefort Road	Removed.	Removed.	—	Cut.	Line damaged on 1 mile.	—	do.	
Kromellenberg	—	—	—	—	1/4-mile line cut and damaged.	—	—	
Wolvehoek	Fair.	Removed.	—	Removed.	—	—	—	
Viljoen's Drift	In bad order.	do.	—	Intact.	—	—	—	
Vaal River	—	—	—	—	Broken.	Destroyed.	Cut.	River span broken down and repaired with difficulty.
Vereeniging	Removed.	Removed.	Removed.	Cut.	—	Broken.	do.	
Meyerton	do.	do.	do.	—	—	—	3/4 mile damaged.	
Klip River	Wires cut and station burnt to ground by station officials.	Wires cut and station burnt to ground by station officials.	—	—	—	—	—	
Natal Spruit	Removed.	Removed.	Removed.	Cut.	—	—	Cut	
Aansluiting	No damage.	—	—	—	—	—	—	
York	Removed.	Removed.	Removed.	Cut.	—	—	Cut.	
Elandsfontein	Wires confused and difficult to extricate, but instruments and office intact No damage onwards to Johannesburg.	Wires confused and difficult to extricate, but instruments and office intact No damage onwards to Johannesburg.	—	—	—	—	—	

Line Clear Question Message.

Prefix A. Code		SENT		Words..... No. of Message... ..	Dated Office Stamp or Date.
		At. ....H.....M.....			
		To.....			
From		To			
STATION MASTER,		STATION MASTER,			
Number			last	departure.	
°After			has	arrived.	
Will	line	be	clear	for	
		to	your	Station.	
Time.....		 Officer in Charge.		

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° NOTE.—If incoming Train has already arrived before this message is to be despatched, the words “after” “will” “be” must be erased and “is” substituted for “will.”

IMPERIAL MILITARY RAILWAYS.

Line Clear Reply Message.

Prefix AI. Code		SENT.		Words..... No. of Message.....	Dated Office Stamp or Date.
		At.....H.... M.....			
		To.....			
From		To			
STATION MASTER,		STATION MASTER,			
Correct			last	arrival.	
Correct			last	departure.	
After	arrival	of	which	train	
	at	your	Station.		
Line	will	be	clear	for	
		to	this	Station.	
Time.....		 Officer in Charge.		

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Conditional Departure Order Telegram.

		SENT.		
		AtH.....M.....	Words	Dated Office Stamp or Date.
Prefix B.		To	No. of Message....	
Code		By		
From STATION MASTER,			To STATION MASTER,	
°(W.) Preceding	train	in	Section	
°(Y.) Ballast	train	in	Section	
May	number			depart
for	your	Station	after	number
	has	arrived		

Time..... Officer in Charge.

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 ° NOTE.—Any one or both of these two lines to be used as required.

Conditional Departure Order Telegram.

		SENT.		
		At .....H.....M.....	Words.....	Dated Office Stamp or Date.
Prefix BI.		To	No. of Message....	
Code		By		
From STATION MASTER,			To STATION MASTER,	
Number			last	departure
Number			may	leave
for	this	Station	with	warning
of				
°(W.) Preceding	train	in	Section	
°(Y.) Ballast	train	in	Section	

Time..... Officer in Charge.

..... 190
 ° NOTE.—Any one or both of these two lines to be used as required.

“All-Right” Exchange Crossing Message.

FOR INTERMEDIATE STATIONS AND SIDINGS.

	SENT			Dated Office Stamp or Date.
Prefix C.	At ... H ... M	Words		
Code	To	No. of Message		
	By			
From STATION MASTER,		To STATION MASTER,		
Number			last	departure.
◦ After			has	arrived.
I	will	send	on	
	to	cross		
at				

Time.....
.....
 Officer in Charge.

.....189

◦ NOTE.—If incoming train has already arrived before the message is to be despatched the word “after” must be erased.

“All-Right” Exchange Crossing Message.

FOR INTERMEDIATE STATIONS AND SIDINGS.

	SENT			Dated Office Stamp or Date.
Prefix CI.	At ... H ... M	Words		
Code	To	No. of Message		
	By			
From STATION MASTER,		To STATION MASTER,		
Correct			last	arrival.
Correct		last	departure	I
will	send	on		
to	cross			at

Time.....
.....
 Officer in Charge.

.....189

“Caution out of Course” Exchange Crossing Message.

Prefix CX. Code	SENT		Dated Office Stamp or Date.
	At .....H.....M.....	Words.....	
	To.....	No. of Message.....	
By			

From	To
STATION MASTER,	STATION MASTER,

		about		minutes
late	propose			crossing.
		at		instead
of	at			

Time
.....
 Officer in Charge.
189

“Caution out of Course” Exchange Crossing (Reply) Message.

Prefix CXI. Code	SENT		Dated Office Stamp or Date.
	At .....H.....M.....	Words.....	
	To.....	No. of Message.....	
By			

From	To
STATION MASTER,	STATION MASTER,

I	agree	to		
crossing			at	
instead	of	at		

Time.....
.....
 Officer in Charge.
189

Trains Not Running Advice Message.

SENT		Words.....	Dated Office Stamp or Date.	
Prefix N.	At.....H.....M.....			
Code.....	To.....			
		No. of Message ..		
From STATION MASTER,		To STATION MASTER,		
Number		is	not	
running				
Time.....		Officer in Charge.		
		.....189		

Trains Not Running Acknowledgment Message.

SENT		Words.....	Dated Office Stamp or Date.	
Prefix NI.	At.....H.....M.....			
Code.....	To.....			
		No. of Message		
From STATION MASTER,		To STATION MASTER,		
Correct	number	is	not	
running				
Time.....		Officer in Charge.		
		.....189		

IMPERIAL MILITARY RAILWAYS.

“All Right.”

A

Line Clear Order.

Station..... 19

To Guard and Driver of No.....

The following telegrams required by the Regulations having been duly exchanged, viz. :—

Words.....	From Station Master	To Station Master	Time sent.....
.....

Number.....last departure. After has arrived will line be clear for.....to your Station.

Words.....	From Station Master	To Station Master	Time received.....
.....

Correct.....last arrival. Correct.....last departure, after arrival of which Train at your Station, line will be clear for.....to this Station.

This is your authority to proceed to.....Telegraph Station.

Time.....
.....
Officer in Charge.

LAST ARRIVAL ADVICE.—No.....the last opposite Train arrived here at.....and no other train has been given Line Clear to this Station.

(N.B.—The original of this Form was YELLOW).

Orange Free State Railways.



LAST DEPARTURE ADVICE.

B

Preceding Train in same direction, No....., left here at.....

“ALL-RIGHT”

CONDITIONAL DEPARTURE ORDER.

.....Station.189

To Guard and Driver of No.....

The following telegrams required by the Regulations having been duly exchanged, viz.:—

Words.....	From Station Master	To Station Master	Time sent.....
.....

May Number.....depart for your Station after Number.....has arrived.

Words.....	From Station Master	To Station Master	Time received.....
.....

Number.....last departure. Number.....may leave for this Station with warning of.....

This is your authority to proceed to.....Telegraph Station.

Time.....
.....
Officer in Charge.

LAST ARRIVAL ADVICE.—No.....the last opposite Train, arrived at..... and no other Train has been given Line Clear to come on to this Station.

Orange Free State Railways.

T. 142



LAST DEPARTURE ADVICE.—Preceding Train in same direction, No.....
left here at.....

“ALL-RIGHT”

C

EXCHANGE CROSSING ORDER.

FOR INTERMEDIATE CROSSING PLACES ONLY.

.....Station.189

To Guard and Driver of No.....

The following telegrams required by the Regulations having been duly exchanged, viz. :—

Words..... From Station Master To Station Master Time sent.....
.....

Number.....last departure. After.....
has arrived, I will send on.....to cross.....at.....

Words..... From Station Master To Station Master Time received
.....

Correct.....last arrival. Correct.....last departure
will send on.....to cross.....at.....

LAST ARRIVAL ADVICE.—No..... the last opposite Train, arrived here
at..... and no other Train has been given Line Clear to this Station.

This is your authority to proceed to.....and there remain to cross.....

NOTE.—This order when in possession of the Driver of.....at.....
will be his authority to proceed to and the line will be kept clear until
his arrival there.

Time.....
.....

Officer in Charge.

(N.B.—The original of this Form was GREEN).

Orange Free State Railways.

.....

LAST DEPARTURE ADVICE.—Preceding Train in same direction, No.....left here at.....

D "ALL-RIGHT"
FORWARD PERMIT.

.....Station.189

To Guard and Driver of No.....

This is your authority to proceed to.....Intermediate Crossing Place, and there remain to cross No.....

Time.....
Officer in Charge.

LAST ARRIVAL ADVICE.—No..... the last opposite Train, arrived here at.....and no other Train has been given Line Clear to this Station.

Orange Free State Railways.

.....

E "ALL-RIGHT"
OPPOSITE TRAIN PERMIT.

.....Station.189

This order, when in the possession of the Driver of No.....at..... Intermediate Crossing Place, will be his authority to proceed to..... after the Guard has signed the All-Right Exchange Crossing Order, and the line will be kept clear until his arrival there.

Time.....
Officer in Charge.

This order is being carried for the Opposite Train by Guard of No.....

(N.B.—The original of this Form had a horizontal GREEN BAR across it).

T. 145

Orange Free State Railways.



LAST DEPARTURE ADVICE.—Preceding Train in same direction, No.....
left here at.....

“CAUTION OUT OF COURSE”

BX

DEPARTURE ORDER.

FROM TELEGRAPH STATION TO TELEGRAPH STATION ONLY.

.....Station.189

To Guard and Driver of No.....

The following telegrams required by the Regulations having been duly exchanged, viz. :—

Words..... From Station Master To Station Master Time sent.....

.....

.....about.....minutes late, propose.....

crossing.....at.....instead of at.....

Words..... From Station Master To Station Master Time received.....

.....

I agree to.....crossing.....at.....

instead of at.....

LAST ARRIVAL ADVICE.—No.....the last opposite Train, arrived at.....

and no other Train has been given Line Clear to this Station.

This is your authority to proceed to.....Telegraph Station.

Time.....

Officer in Charge.

(N.B.—The original of this Form had a RED CROSS on it).

Orange Free State Railways.



LAST DEPARTURE ADVICE.—Preceding Train in same direction, No.....
left here at.....

CX "CAUTION OUT OF COURSE"
EXCHANGE CROSSING ORDER.

FOR INTERMEDIATE CROSSING PLACES ONLY.

.....Station. 189

To Guard and Driver of No.....

The following telegrams required by the Regulations having been duly exchanged, viz. :—

Words..... From Station Master To Station Master Time sent.....

.....

.....about.....minutes late, propose.....

crossing.....at.....instead of at.....

.....

.....

Words..... From Station Master To Station Master Time received.....

.....

I agree to..... crossing..... at

.....instead of at

.....

.....

LAST ARRIVAL ADVICE.—No.....the last opposite Train, arrived here
at.....and no other train has been given Line Clear to this Station.

This is your authority to proceed to.....and there remain to cross.....

NOTE.—This order when in possession of the Driver of.. ...at.....

will be his authority to proceed to.....and the line will be kept clear until his
arrival there.

Time.....

Officer in Charge.

(N.B.—The original of this Form had a RED CROSS on it).

Orange Free State Railways.



LAST DEPARTURE ADVICE.—Preceding Train in same direction, No.....left here at.....

“CAUTION OUT OF COURSE”

DX

FORWARD PERMIT.

.....Station.189

To Guard and Driver of No.....

This is your authority to proceed to.....Intermediate Crossing Place, and there remain to cross No.....

Time...
.....
Officer in Charge.

LAST ARRIVAL ADVICE.—No.....the last opposite Train, arrived here atand no other Train has been given Line Clear to this Station.

(The original of this Form had a RED CROSS on it).

Orange Free State Railways.



“CAUTION OUT OF COURSE”

EX

OPPOSITE TRAIN PERMIT.

.....Station.189

This order, when in possession of the Driver of No..... at..... Intermediate Crossing Place, will be his authority to proceed to..... after the Guard has signed the Caution Exchange Crossing Order, and the line will be kept clear until his arrival there.

Time.....
.....
Officer in Charge.

This order is being carried for the Opposite Train by Guard of No.....

(N.B.—The original of this Form had a RED STAR on it).

Orange Free State Railways.



K

BALLAST TRAIN WARNING.

.....Station.189

To Guard and Driver of No.....

WARNING.

Ballast Train is in section, as per Notice No....., dated... ..

and is booked to cross your Train at... ..

Time.....

Officer in Charge.

(N.B.— The original of this Form was YELLOW).

Orange Free State Railways.



BALLAST TRAIN PROCEEDING ORDER.

.....Station.189

To Guard and Driver of No.....

Proceed in accordance with Working Notice, No, dated

Time... ..

Officer in Charge.

T. 151

Orange Free State Railways.



LAST DEPARTURE ADVICE.—Preceding Train in same direction, No left here at.....

EXCHANGE CROSSING ORDER.

T FOR INTERMEDIATE CROSSING PLACES ONLY.
WHEN THE TELEGRAPH HAS FAILED.

.....Station. 189

To Guard and Driver of No.....

As the Regulations for Crossing Trains cannot be complied with, in consequence of the failure of the Telegraph between this Station and.....

This is your authority to proceed to....., the place appointed on.....for crossing No....., and to remain there until arrival of that Train.

(See Rules 46 and 47, Instructions for Crossing Trains when Telegraph has failed).

This order, when in the possession of the Driver of.....at..... will be his authority to proceed to....., and the line will be kept clear until his arrival there.

LAST ARRIVAL ADVICE.—Nothe last opposite Train, arrived here at..... and no other Train has been given Line Clear to this Station.

Time.....
.....
Officer in Charge.

(N.B.—The original of this Form was BLUE).

Orange Free State Railways.



LAST DEPARTURE ADVICE.—Preceding Train in same direction, No.....left here at.....



“TELEGRAPH FAILED”

FORWARD PERMIT.

.....Station. 189

To Guard and Driver of No

This is your authority to proceed to.....Intermediate Crossing Place, and there remain to cross No.....

Time.....
.....
Officer in Charge.

LAST ARRIVAL ADVICE.—No.....the last opposite Train, arrived here at.....and no other Train has been given Line Clear to this Station.

(N.B.—The original of this Form was BLUE).

Orange Free State Railways.



“TELEGRAPH FAILED”

OPPOSITE TRAIN PERMIT

.....Station. 189

This order, when in possession of the Driver of No.....at..... Intermediate Crossing Place, will be his authority to proceed to..... after the Guard has signed the Telegraph Failed Exchange Crossing Order, and the line will be kept clear until his arrival there.

Time.....
.....
Officer in Charge.

This order is being carried for the Opposite Train by Guard of No.....

(N.B.—The original of this Form had a BLUE CROSS on it).

Orange Free State Railways.



LAST DEPARTURE ADVICE.—Preceding Train in same direction, No.....left here at

W "TELEGRAPH FAILED"

CONDITIONAL DEPARTURE ORDER

FROM TELEGRAPH STATION TO TELEGRAPH STATION.

.....Station. 189

To Guard and Driver of No.....

As the Regulations for Crossing Trains cannot be complied with, in consequence of the failure of the Telegraph between this Station and

The No.....booked to cross your Train at has not been advised to run.

This is your authority to proceed to.....Telegraph Station. Driver to keep a good look out, and be prepared to stop at any place it may be necessary.

(See Rules 46 and 47, Instructions for Crossing Trains when Telegraph has failed).

LAST ARRIVAL ADVICE.—No.....the last opposite Train, arrived at.....and no other Train has been given Line Clear to this Station.

Time.....

..... Officer in Charge.

(N.B.—The original of this Form was PINK).

Orange Free State Railways.



F TRAIN NOT RUNNING ORDER.

Station..... 19

To Guard and Driver of No.....

The following telegrams required by the Regulations having been duly exchanged, viz. :—

Words..... From Station Master To Station Master Time sent..... m.

.....

Number..... is not running.....

Words..... From Station Master To Station Master Time received..... m.

.....

Correct. Number.....is not running.

As No.....Train, booked to cross your train at.....is not running, you will therefore not wait to cross it.

Time..... m.

..... Officer in Charge.

(N.B.—The original of this Form was YELLOW).

IMPERIAL MILITARY RAILWAYS.

Station-to-Station Order Message (Question).

		SENT.		
Prefix S. Code	At.....	H.....	M.....	Words
	To	No. of Message.....		
	By			
From STATION MASTER,			To STATION MASTER,	

Number		last	departure.	
Number		last	arrival.	
Number		reported		minutes
late.				
Is	line	clear	for	Number
	to	your	Station.	
Number		not	running.	

Time..... ..
Officer in Charge.
190

IMPERIAL MILITARY RAILWAYS.

Station-to-Station Order Message (Reply).

		SENT.		
Prefix S. Code	At.....	H.....	M.....	Words.....
	To	No. of Message....		
	By			
From STATION MASTER,			To STATION MASTER,	

Number		last	departure	noted.
Number		last	arrival	correct.
Line	is	clear	for	Number
	to	come	on	to
this	Station.			
Number		not	running	correct.

Time..... ..
Officer in Charge.
190

IMPERIAL MILITARY RAILWAYS.

A. TELEGRAPHS. No. of Message

Prefix	Code	Class	SENT. At ____m. To ____ By ____	OFFICE STAMP.
Office of Origin and Service Instructions.		Words.		
		Charges.		

FROM **PLEASE WRITE DISTINCTLY.** TO

A SEPARATE FORM TO BE USED FOR EVERY TROOP TRAIN

To be signalled.	No. of Telegram.	Date.	Train No.	Column and No. of Troop Train.	TIME.			No. of Engines, Coaches, Armed Trucks. (2)	NUMBER OF TRUCKS CONTAINING:—				
					Arrd.	Detained	Left. (1)		Horses.	Troops and Baggage.	Mules.	Oxen.	Vehicles.
	A	B	C	D	E	F	G	H	K	L	M	N	O
<i>Tp.</i>													

To be signalled.	Corps.	Officers.	Other Ranks.	Horses.	Mules.	Oxen.	Guns.	Vehicles.	Destination. (3)	Remarks.
	P	Q	R	S	T	U	V	W	X	Z
Details -										

See IV. and V. below.

INSTRUCTIONS TO R. S. OFFICERS.

(1) If train is broken up after arrival and despatched in two or more portions the original number in (D) will still be retained and the words "1st portion" or "2nd portion," as the case may be, inserted in column (G) as well as the time of departure.

(2) Armoured Trucks must not be entered in column (K) — Description of Coaches to be given, i.e., "2 s Coaches" or "1 B Coach."

(3) Should it be thought necessary to send destination of Troops in cypher, (X) will be left blank and destination wired on ordinary message form.

IV. At intermediate reporting stations, should there be no alteration in the composition of a Troop Train, columns "H" to "X" will be left blank and the words "Train left as arrived" inserted in the lowest division of the form.

V. The lowest division of the form will also contain the information as to whom the telegram is addressed to and to whom repeated.

(N.B.— This form was used by Railway Staff Officers).

B. Prefix _____ Code _____ Class _____ **TELEGRAM.** No. Message _____

Received.	At _____ M.	Office of Origin and Service Instructions.	Words.	Sent.	At _____ M.	Office
	From _____				To _____	
	By _____				By _____		Stamp.
FROM				TO		

A SEPARATE FORM TO BE USED FOR EVERY TROOP TRAIN.

	No. of Telegram.	Date.	Train No.	Column and No. of Troop Train.	TIME.			No. of Engines, Coaches, Armed Trucks. (2)	NUMBER OF TRUCKS CONTAINING:—				
					Arrd.	Detained.	Left. (1)		Horses	Troops and Baggage.	Mules.	Oxen.	Vehicles.
To be signalled.	A	B	C	D	E	F	G	H	K	L	M	N	O
<i>Tp.</i>													

	Corps.	Officers.	Other Ranks.	Horses.	Mules.	Oxen.	Guns.	Vehicles.	Destination. (3)	Remarks.
To be signalled.	P	Q	R	S	T	U	V	W	X	Z
Details -										

IMPERIAL MILITARY RAILWAYS.
TELEGRAPHS (OFFICE COPY).

C. PREFIX _____ CODE _____ CLASS _____ No. of Message {

Recd. } from)	SERVICE INSTRUCTIONS.	Words.	Sent.	OFFICE
			At _____	
			To _____	
By _____			By _____	
Handed in at _____ at _____ M.		Received here at _____		STAMP.
FROM		TO		
_____		_____		

A SEPARATE FORM TO BE USED FOR EVERY TROOP TRAIN.

To be signalled.	No. of Telegram.	Date.	Train No.	Column and No. of Troop Train.	TIME.			No. of Engines, Coaches, Armed Trucks. (2)	NUMBER OF TRUCKS CONTAINING:—				
					Arrd.	Detained.	Left. (1)		Horses.	Troops and Baggage.	Mules.	Oxen.	Vehicles.
	A	B	C	D	E	F	G	H	K	L	M	N	O
<i>Tp.</i>													

To be signalled.	Corps.	Officers.	Other Ranks.	Horses.	Mules.	Oxen.	Guns.	Vehicles.	Destination. (3)	Remarks.
	P	Q	R	S	T	U	V	W	X	Z
Details -										

(N.B.—The original of this Form was PINK).

CHAPTER VI.

STORES DEPARTMENT.

WORK IN ORANGE RIVER COLONY.

Soon after the occupation of Bloemfontein (13th March, 1900) the D.R. appointed Mr. Arundel (late of the O.F.S. Railways) to take charge of Railway Stores.

Stores obtained through C.G.R.

The bulk of these, consisting of coal, cement, waste, oils and other expendable stores, was at Bloemfontein and was valued at £40,000 odd. It was necessary to increase stocks of "running stores," and orders were therefore placed with the C.G.R. in accordance with the agreement already referred to in Part I., Chapter V. Coal also was supplied by the C.G.R. for some months and was used by all engines running to Bloemfontein.

Owing to lack of rolling stock it was of paramount importance that no wagons should stand under load, and it was therefore necessary to employ large gangs of labour to unload and again reload coal, etc., for use by the various railway departments.

Supply of Stores to Army.

During the month of March, *i.e.*, whilst stock was being taken and matters were in some confusion, officers of all branches of the Army requisitioned articles for use in the field, for water supplies, sanitary purposes and camp equipment; and later on, when debits were raised by the Railway Stores Department against the Army for articles supplied, considerable difficulty was experienced in obtaining acceptances, chiefly because officers who had received these things had moved on with the Army or had been invalided. Even in May, 1901, there were many outstandings on this account.

Supply of Provisions to Railway Employés.

On the O.F.S. Railways it was the custom to issue certain provisions to railway employés, debiting them in due course, and a firm of contractors in Bloemfontein supplied what was required. The D.R. decided to continue the system, but the firm in question refused to accept the commission of 5 per cent. which was offered on the ground that it was insufficient. Mr. Arundel was therefore directed to undertake this work from the main store, and he enlisted the services of several grocers and packers. To add to his difficulties, the Traffic Department was unable to supply trucks as required; but the number of complaints received was, under the circumstances, of trifling amount.

Coal Supply.

The capture of Kroonstad, and the opening up of the country towards the Vaal, solved many difficulties in connection with coal supply, as the Vereeniging mines were again working. A contract was entered into with a coal company to supply 10,000 tons at 10s. per ton, and this contract was subsequently renewed monthly.

WORK IN THE TRANSVAAL.

In the middle of June, 1900, when the Army had reached Pretoria, the D.R. ordered Lieutenant and Quartermaster A. N. Tucker, R.E., to hand over his duties at Cape Town and to proceed to Johannesburg to make local purchases of stores for the I.M.R.

Appointment of Railway Purchasing Agent at Johannesburg.

From enquiries made in Cape Town, Lieut. Tucker ascertained that there were few if any representatives of British firms left in Johannesburg, and that the only persons on the spot were Jews and other foreigners who had traded freely with the enemy. He therefore engaged Mr. Rees, of the firm of Rees & Cawse, Purchasing Agents, Johannesburg, as Railway purchasing agent, and this gentleman accompanied him northward.

Mr. Rees' knowledge of local stocks and prices current before the war was of material service in enabling Lieut. Tucker to obtain such articles as were required in Johannesburg at reasonable rates.

At this time (June, 1900) the Stores Branch of the railway in the O.F.S. was in fair working order, but in the Transvaal all was chaos. The officials of the N.S.A.R. Company had retreated with the enemy, leaving Hollanders in charge of the main stores at Braamfontein and Pretoria; but elsewhere stores found, either on the line or in the smaller depôts, had been seized by officers of the Works and Locomotive Departments of the I.M.R.

Appointment of Chief Storekeeper, I.M.R.

On his arrival in the Transvaal, Lieut. Tucker took over charge of the railway stores from Capt. H. G. Joly de Lotbinière, R.E., and began to inaugurate a regular

system of store accounts. Additional staff was obtained from the Modder River and Railway Staff Depôts, and a shed at Braamfontein was made the storehouse for Local Purchases.

To obtain a record of materials, etc., on the line a non-commissioned officer of the Australian Contingent was sent on tour; and, all stores having been listed, receipts were passed to him by the different departments in whose charge they were found. A Stores Inspector of the N.S.A.R. Company accompanied him and a fairly complete inventory was thus obtained, though in several instances sub-depôts appear to have been looted before the arrival of the Army.

During the summer of 1900 demands on the Transvaal Stores were incessant; and in order to replenish stocks, especially of timber, steps were taken to ascertain the contents of stores on the Rand mines and of those belonging to timber merchants in the district. From the gold mines timber was taken on requisition, on the understanding that it should be paid for at 5s. per foot or else replaced.

As regards demands for Permanent Way materials, these were complied with by the District Engineer, Johannesburg (Capt. Greenwood), thus relieving the Stores Department.

Matters of most pressing urgency at this time were:—

- i. Coal Supply
- ii. Provisions for employés
- iii. General supplies for railway purposes
- iv. Stationery for the railways

Stores obtained from Rand Mines and Local Timber Merchants.

and it was necessary to organise an efficient system for each.

The Vereeniging mines (already referred to) served the wants of the O.R.C. as regards coal; for the Transvaal recourse was had first to the collieries at Springs and later to the Witbank colliery in the Middelberg District. A contract was made with this latter colliery to supply 60,000 tons at 7s. per ton at pit's mouth, and later the contract was renewed monthly at 6s. 6d. per ton.

Replenishing Stock.
(i.) Coal.

No stores, food stuffs or materials could be sent from any town to the mines without the sanction of the Director of Civil Supplies, an exception being made for mines working for the railways. For these, permits were signed by the D.R., and covered coal bags, candles, dynamite, fuze, meal and salt for natives, ordinary supplies for Europeans, and machinery and timber for repairs.

Dynamite was issued by the Railway Storekeeper from a factory at Modderfontein near Johannesburg; and the issuing of cases, arranging for escorts and kindred matters entailed much work.

The system in vogue in the O.R.C. for supplying employés with provisions has already been noticed, and a similar system was approved for the Transvaal. A contractor had been found to take over the work in Bloemfontein; and the same firm was allowed to open a branch at Johannesburg (storage room being given by the railway) on the understanding that its goods were carried free and that it should charge in the Transvaal the rates already accepted in the O.R.C.

(ii.) Provisions for Railway Employés.

The system may be shortly described as follows:—On the 7th of each month every railway employé forwarded to the head of his department an indent for provisions for the succeeding month. These, having been scrutinised and certified to, were forwarded to the Chief Storekeeper, by whom invoices in triplicate were prepared. One copy was retained by him for reference when checking bills, one was forwarded to the Provision Contractor for compliance, and the third was the authority of the head of a department to make deductions from the employé's pay sheet in accordance with the schedule of rates. The contractor took all risk of loss, paid customs dues and all charges for delivery at the depôt, and then presented his bill to the Chief Accountant through the Chief Storekeeper; a deduction of 5 per cent. was made for manipulation, haulage and delivery to the consumer, and the bill was then settled. If goods were not supplied, credit notes for the amount were passed to the employé and were redeemed by Chief Accountants or paymasters. As regards coal, employés were allowed to draw their supplies from the Chief Storekeeper's nearest depôt at 14s. 6d. per ton.

The difficulty experienced by the civil population in obtaining supplies caused an enormous influx of applicants to the Railway Store Depôt; and although every endeavour was made to exercise proper supervision, there is not much doubt that some of the provisions found their way to the enemy in the field. This is scarcely to be wondered at when it is remembered that some of the railway employés were Boers, whose relations were on commando in the neighbourhood.

Yet another difficulty arose when it became reasonably certain that the Provision Contractor was utilising his position to lay in stocks which were not required by railway employes, and which he would therefore be able to dispose of to the public at considerable profit. To meet this, a fixed number of trucks was allotted to him per month, viz., 16 for the O.R.C. and 32 for the Transvaal. Before applying for trucks at the ports it was incumbent on the contractor to specify to the Chief Storekeeper the quantities required of general groceries, meal and vegetables. The wagons were consigned from ports to the contractor, care of Chief Storekeeper, and on arrival at destination were taken charge of by the District Storekeeper; their contents were only handed over to the contractor on production of an invoice of contents. By these means it was possible to keep a check on the contractor's importations as these could be compared with the requisitions forwarded by employes.

When it was decided to supply nothing but necessaries to employes in the Transvaal, the contractor demurred on the plea that he could make no profits on O.R.C. prices. His contract was accordingly terminated, and the tender of a firm at Port Elizabeth was accepted for a period of 12 months.

On the Eastern line, owing to the shortage of trucks, the only arrangement possible to prevent famine was to send canteen trucks up the line monthly, taking cash payment for stores sold.

(iv.). Stationery.

In the O.R.C. all printing for railway and other Government Departments was executed by the Railway Printing Office at Bloemfontein. Similarly at Pretoria there was a large stationery store and a ticket printing office.

The two stores were now amalgamated and located at Johannesburg, whither the staff, presses, etc., were transferred.

The presses were kept busy with the issue of Traffic and Locomotive "Forms"; and the stocks of paper found at Koomatipoort and Waterval Boven were made use of as far as possible.

Permanent
Organisation.

The future of the N.S.A.R. Company had not been finally settled when the line was captured; but when it was decided that the line was to pass under the administration of the I.M.R., it became necessary to elaborate details of a permanent organisation to succeed the temporary system hitherto in force.

Staff.

The necessary staff was obtained from the Railway Staff Depot and from the ranks of the Army, both regular and irregular units being applied to for men. Their lack of previous knowledge put them at a disadvantage; this gradually disappeared, however, as all worked zealously and loyally to perfect themselves. The rates of pay for various members of the staff was at first fixed without reference to their qualifications; but later on men were appointed as probationers at 10s. per day, and each man's scale of pay was finally settled in accordance with individual acquirements.

In making a final report to the D.R. the Chief Storekeeper brought to notice the services of the following, viz. :—

Mr. J. Arundel	...	...	in the Headquarter Office
Mr. Buchanan	...	...	District Storekeeper, Johannesburg
Q.M.S. Murray, R.E.	...	...	Yard Foreman
Mr. Conlon	...	...	District Storekeeper, Bloemfontein
Mr. Jefferson	...	...	Yard Supt., Pretoria

as well as the clerical and other staffs under each of them.

Stocktaking.

Lack of time in which to take careful stock, the fact that all the stores correspondence of the N.S.A.R. Company had been carried on in Dutch, and the absence of all Main Store Accounts (which were in Holland) rendered the task of reorganisation difficult. As a first step the rough Stock Books left by the former Administration were translated and a small proportion of stock was checked from them; and it appeared that these books showed approximately the quantities of stock in hand.

To ensure uniformity throughout the I.M.R. a system of store ledger accounts was promulgated;—this system was already working at Bloemfontein, and it would therefore be comparatively easy to introduce it into the Transvaal.

To ascertain values and balances of stock in hand in the Transvaal, a general stock-taking was necessary; and here again, for the sake of uniformity in nomenclature and units, the "Quarterly Balance of Stock" in Bloemfontein was printed for distribution to stocktakers.

Stores were classified and arranged at the various depôts in accordance with these lists. As the stock of each article was taken a Tally Card (*vide* Appendix A) was issued for it, showing the balance then on hand; on this any subsequent issues or receipts were entered, with dates. From these cards Stock Books were compiled; and as the

former were kept by the Storeman and the latter by the Stock Clerk, checks were easy and discrepancies could be brought to light on inspection.

Pricing the various articles took a long time, and as the N.S.A.R. Company records (excepting rough Stock Books) were in Holland, such stores as were issued before the price list was complete were charged in accordance with values in the rough stock books.

Appendices B to F of this Chapter give summaries of Stores Transactions on the I.M.R.

APPENDIX A TO CHAPTER VI.

TALLY CARD.

IMPERIAL MILITARY RAILWAYS.

Johannesberg Stores.

Oliver, Storeman.

ARTICLE :—NUTS, HEXAGONAL, $\frac{1}{2}$ ".

Ledger Folio No. B. 246.

Denomination _____ lbs.

Stock to be maintained _____

Date.	Stock in Hand.	Date.	Stock in Hand.	Date.	Stock in Hand.
	1201				
27. 11. 00	73				
	1128				
20. 12. 00	20				
	1108				
28. 12. 00	12				
	1096				
15. 1. 01	7½				
	1088½				
6. 2. 01	164				
	1252½				
24. 3. 01	85				
	1167½				

APPENDIX B TO CHAPTER VI.

STATEMENT SHOWING VALUE OF PURCHASES AND ISSUES OF STORES

DR.	FROM OCTOBER, 1900, TO MARCH 31ST, 1901.		CR.	
	1900. October 31.	1900. March 31.	£ s. d.	£ s. d.
To actual balance of stores on hand :—				
Bloemfontein	29,949 17 8	53 235 1 7		
Pretoria (Stationery)	9,146 18 3	20,094 6 2		
Approximate balance of stores on hand, October 1st, 1900, Pretoria (General)	100,000 0 0	174,234 10 0		
Johannesberg	37,219 12 10	191,247 10 0		
			438,811 8 6	
To purchases made October, 1900, to 31st March, 1901 :—				
Bloemfontein	156,056 3 2	63,676 14 2		
Pretoria	25,900 3 3	11,771 10 10		
„ (Stationery)	36,334 14 6	72,665 1 8		
Johannesberg	216,736 17 9	24,419 12 11		
			172,532 18 11	
	435,027 18 8			
			£611,344 7 5	
			£611,344 7 5	

STATEMENT SHOWING VALUE OF PURCHASES MADE BY STORES DEPARTMENT.

STORES DEPARTMENT.

	BLOEMFONTEIN.			JOHANNESBERG.			PRETORIA.			PRETORIA (STATIONERY).			GRAND TOTALS.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Amounts purchased in South Africa (Local Purchases) ...	55,464	17	6	168,529	19	2	3,979	9	9	25,388	8	4	253,362	14	9
Amounts allowed for stores returned into stock :—															
Other Government Departments (Bridge work) ...	17,273	1	2	—	—	—	—	—	—	—	—	—	17,273	1	2
" " (Permanent Way material) ...	12,974	8	4	—	—	—	—	—	—	—	—	—	12,974	8	4
Ordinary Departmental... ..	1,878	17	3	—	—	—	487	6	6	968	6	3	3,334	10	0
Amounts paid C.G.R. for purchases made ...	36,585	15	1	16,068	4	5	2,954	6	5	5,991	14	8	61,600	0	7
Transfers to other Railway Storekeepers ...	26,489	15	8	5,092	4	7	16,132	7	9	3,828	18	0	51,543	6	0
Amounts purchased from other Railway Departments ...	5,389	8	2	—	—	—	—	—	—	—	—	—	5,389	8	2
Amounts purchased from Chief Paymaster (Army) ...	—	—	—	65	9	0	—	—	—	—	—	—	65	9	0
Carriage Department ...	—	—	—	142	19	6	—	—	—	—	—	—	142	19	6
N.G.R. ...	—	—	—	3,212	8	11	616	13	4	58	19	0	3,888	1	3
Other Railway Departments... ..	—	—	—	23,497	19	9	656	13	10	—	—	—	24,154	13	7
Other Government Departments ...	—	—	—	127	12	5	1,073	5	8	—	—	—	1,200	18	1
C.G.R. (Carriage) ...	—	—	—	—	—	—	—	—	—	87	10	3	87	10	3
Locomotive Department ...	—	—	—	—	—	—	—	—	—	10	18	0	10	18	0
Totals ...	£ 156,956	3	2	216,736	17	9	25,900	3	3	36,334	14	6	435,027	18	8

APPENDIX D TO CHAPTER VI.

STATEMENT SHOWING VALUE OF STORES AND MATERIAL ISSUED
BY STORES DEPARTMENT

FROM OCTOBER, 1900, TO MARCH 31ST, 1901.

DEPARTMENT.	Totals.	Grand Totals.
	£ s. d.	£ s. d.
<i>Superintendent of Works :—</i>		
Bloemfontein	54,973 17 1	
Johannesberg	59,856 0 7	
Pretoria	13,448 16 8	
Pretoria (Stationery)	1,087 5 8	
		129,366 0 0
<i>Locomotive :—</i>		
Bloemfontein	43,422 6 9	
Johannesberg	48,532 12 4	
Pretoria	21,905 16 2	
Pretoria (Stationery)	1,377 17 3	
		115,238 12 6
<i>Traffic :—</i>		
Bloemfontein	984 0 2	
Johannesberg	2,175 8 4	
Pretoria	959 5 0	
Pretoria (Stationery)	10,049 16 2	
		14,168 9 8
<i>Chief Accountant, Railway Telegraphs, Sick Fund, Director and Sanitary :—</i>		
Bloemfontein	3,052 3 3	
Johannesberg	4,821 7 6	
Pretoria	1,432 2 7	
Pretoria (Stationery)	4,768 5 10	
		14,073 19 2
<i>Transfers :—</i>		
Bloemfontein	14,820 8 6	
Johannesberg	51,392 19 4	
Pretoria	1,575 19 6	
Pretoria (Stationery)	2,321 7 5	
		70,110 14 9
<i>Provisions to Employés :—</i>		
Bloemfontein	22,924 16 10	
Johannesberg	27,088 16 10	
		50,013 13 9
<i>Coal to Employés :—</i>		
Bloemfontein	995 7 10	
Johannesberg	181 7 11	
		1,176 15 9
<i>Cape Government Railways :—</i>		
Bloemfontein	16,673 0 10	
Johannesberg	4,976 8 11	
Pretoria	592 2 3	
		22,241 12 0
<i>General Public :—</i>		
Bloemfontein	2,693 4 9	
Johannesberg	7,458 19 6	
Pretoria	953 2 9	
		11,105 7 0
<i>Other Government Departments :—</i>		
Bloemfontein	3,695 3 11	
Johannesberg	4,763 9 6	
Pretoria	2,367 16 8	
Pretoria (Stationery)	489 13 10	
		11,316 3 11
Total		£438,811 8 6

APPENDIX E TO CHAPTER VI.

STATEMENT SHOWING COST OF MANIPULATION OF STORES

FROM OCTOBER, 1900, TO MARCH 31ST, 1901.

	£	s.	d.	
Total value of stores issued in O.R.C. and Transvaal ...	438,811	8	6	} 5·015 per cent.
Cost of manipulation (including all inter-departmental debits for labour, material, haulage of provision train, salaries, wages, etc., etc.)	22,000	0	0	

NOTE.—In the O.R.C. the value of stores issued between 13th March and 30th September, 1900, was £144,352 16s. 7d.; the cost of manipulation amounted to £4,224 8s. 9d. = 2·923 per cent.

APPENDIX F TO CHAPTER VI.

STATEMENT OF ACCOUNT OF BLOEMFONTEIN DEPÔT STOREKEEPER.

13TH MARCH TO 30TH SEPTEMBER, 1900.

DR.			CR.		
	£	s. d.		£	s. d.
March 13th.— Value of stores found	40,184	8 3	By issues to Works Department	42,253	6 4
March and Sept.— Local purchases and purchases through C.G.R.	134,118	6 0	Locomotive ,,	64,543	6 9
			Traffic ,,	3,226	10 6
			D.R.	453	19 4
			Chief Accountant ...	569	5 9
			Medical Department	200	19 0
			Stores	423	18 5
			Sick fund	748	11 3
			Provisions for employes	13,290	17 5
			Coal to do.	897	19 5
			General public	4,187	1 5
			Railway Telegraphs	7,155	19 9
			Other Departments	4,066	14 4
			Army (through C.R.E.)	1,807	17 9
			C.G.R.	6,526	8 2
			30th September.— Balance of stores in hand	29,949	17 8
	<u>£174,302</u>	<u>14 3</u>		<u>£174,302</u>	<u>14 3</u>

CHAPTER VII.

ACCOUNTS DEPARTMENT.

The Accounts Department, organised by the D.R., consisted of :—

Chief Accountant { Accountant (Transvaal),
 } Accountant (O.R.C.),
Revenue Auditor,
Clearing Officer,
Expenditure Auditor.

REVENUE AUDITOR.

Staff.

The Revenue Auditor had under him :—A Chief Clerk, a First Clerk, 22 other Clerks, and 5 Audit Inspectors.

He and his staff were, for disciplinary purposes, under the control of the Chief Accountant; and he was responsible for the efficient auditing of the Revenue, and for rendering returns of the earnings for transmission to the D.R. It was, however, his duty to exercise an independent audit, which was necessarily a final one; and he reported to the Chief Railway Auditor if he took exception to the Chief Accountant's instructions or ruling on any point affecting the Revenue of the Department.

Returns.

The following Revenue returns were forwarded monthly by Stations to the Revenue Auditor :—

(1). COACHING ACCOUNTS.

Coaching Account Current,
Appendix to Do.,
Coaching Outstandings (forwarded through Traffic Manager in duplicate),
Passenger Ticket Abstract (Card),
Cancelled and Half Tickets (Card),
Paper Tickets issued (with Concession Orders, Cancelled Tickets, etc., securely attached),
*Parcels Summaries Forwarded,
*Do. Received,
*Parcels Abstracts Forwarded,
*Do. Received,
*Live Stock and Vehicle Summaries Forwarded,
*Do. Received,
*Live Stock and Vehicle Abstracts Forwarded (with cancelled tickets attached),
*Do. Received,
Received Live Stock and Vehicle Waybills,
List of Excess Fares and Counterparts (with Concession Orders, Cancelled Tickets, etc., securely attached),
Excess Debit and Credit Returns,
List of Coaching Credit Vouchers (with vouchers securely attached),
*Parcels, } Supplementary Abstracts and Summaries,
*Live Stock and Vehicles, }
Quarterly Ticket Requisition (rendered quarterly),
Classification of Live Stock and Vehicles,
Summary of Excess Fares,
Return of "Through" Passenger Traffic,
Do. Excess Fares Collected,
Do. "Through" Credit Vouchers,
Summary of Ledger Accounts.

(2). GOODS ACCOUNTS.

Goods Account Current,
Appendix to Do.,
*Goods Summaries Forwarded,
*Do. Received,
*Goods Abstracts Forwarded,
*Do. Received,

NOTE.—In the case of returns marked *, separate ones were rendered for Cape, Natal, Local, Orange River or Transvaal traffic, respectively.

Excess Debit and Credit Returns,
 List of Certified Overcharges (with vouchers),
 Goods Outstandings (forwarded through Traffic Manager in duplicate),
 Sidings Traffic,
 *Goods Supplementary Abstracts and Summaries,
 Summary of Coaching and Goods Account Current,
 Classification of Local Goods,
 Summary of Ledger Accounts.

A "Collected Ticket" return was also forwarded daily by each Station.

All Passenger tickets were issued to stations through the Revenue Auditor's office, each Card ticket being numbered consecutively, and each Paper ticket book also numbered, both as regards the book itself and the tickets contained therein. They were recorded against the station when issued, and then become an actual cash debit to the Station-Master, who had to account for every ticket on his monthly returns, showing the fare charged on tickets issued and the opening and closing numbers of issues for the month. Passenger Tickets.

The returns were checked, as regards the correct fares charged and with the ticket stock book, to see that all tickets had been accounted for.

Distinctive Paper ticket books—single and return—were supplied for "Local" and for "Through" traffic with each Administration. Card tickets were issued to all stations where the bookings were sufficiently large to justify them.

Excess fares were dealt with in a similar manner to Paper tickets.

In addition to the ordinary returns, forwarded to the Revenue Auditor, of Card and Paper tickets issued for "Through" traffic, special returns (R.C.H. 1, 2, and 3) were rendered which, after being checked, were sent to the Clearing Officer, for division of the several proportions between the various Administrations.

The collected tickets, accompanying the "Daily Collected Ticket" returns from the various stations, were examined for the purpose of detecting any irregularities; and were further checked with the "Monthly Issue" returns, to see that the fares charged to the public agreed with amounts brought to debit.

Abstracts were rendered by stations of Parcels, Live Stock, Vehicles and Goods Traffic, forwarded and received during the month (each description of traffic on separate abstracts). The "Forwarded" abstracts sent in by one station were compared with the "Received" abstracts from another station; a balance was then struck, and differences adjusted by "Appendix" debits or credits. The Local "Forwarded" charges were examined by the Audit Inspectors at stations, charges on "Through" traffic being checked in the Clearing Office from copies of invoices. Parcels, Live Stock,
Vehicles, and Goods.

Separate "Accounts Current" for Coaching and Goods were rendered by each station monthly, showing the actual debits and credits for the month and the balance brought and carried forward. Accounts Current.

The Coaching "Account Current" included on the debit side:—Passengers, Excess Luggage, Parcels, Live Stock and Vehicles, and Cloak Room and Miscellaneous receipts (such as Lavatory and Storage charges, etc.), and, on the credit side;—Remittances to Cashier, Overcharges, Ledger Accounts, etc.

The Goods "Account Current" included Goods traffic forwarded "Paid" and received "To pay," Demurrage, Cartage, Customs Dues, etc., as debits; and credits similar to the Coaching "Account Current."

Customs Dues were collected by Station-Masters at stations where there was no Customs Official, and paid over monthly by the Chief Accountant to the Collector of Customs, Transvaal or O.R.C.

Errors discovered in the Audit Office were adjusted by the issue of debits and credits by the Revenue Auditor; these were taken to account by stations in their "Account Current."

A statement of "Through" traffic was furnished by the Clearing Officer to the Revenue Auditor, the same having been thoroughly checked, and the correct division between the various Administrations ascertained.

The whole was journalised under various heads, and posted to the Ledger.

A complete balance-sheet of the Revenue for the month was then compiled by the Revenue Auditor and sent to the Chief Accountant for transmission to the Chief Railway Auditor.

The "Earnings," as distinct from Receipts, were then classified under various heads and sent to the Chief Accountant for incorporation in the "Results of Working" statement which was forwarded to the D.R.

All Civil Ledger Account charges were checked and adjusted to correct amounts before being rendered. Ledger Accounts.

Audit Inspectors.

The duties of an Audit Inspector, when he visited a station, were :—To verify the cash on hand with unremitted debits; to see that Parcels and Goods were on hand for all outstanding items; to check Paper tickets from counterfoils into "Trains" book, and see that the amounts were accounted for on the day of issue; to make a sample check of the Card tickets in the tubes, and see that none had been issued out of course; to check the fares for the current work; to see that all waybills and invoices had been duly accounted for; to check the charges of all Local waybills and invoices, and create debits for any undercharges discovered, which the station had to bring to account; to check all account books, and see that they were properly compiled; to see that all trucks received and forwarded were referenced off to entries, that all unentered traffic was duly recorded, and that steps had been taken to obtain charges entries.

He had to render to the Revenue Auditor a balance-sheet covering the unaudited period, with comments on how the work had been performed, drawing attention to anything which he considered prejudicial to the Revenue of the Department.

This report was checked as far as possible by the Revenue Auditor, and any points which he deemed necessary were submitted through the Chief Accountant to the Traffic Manager, for the latter to take any needful action.

In the case of a station being transferred from one Station-Master to another, an inspection was made prior to the handing over.

An Audit Inspector was also appointed to a District temporarily for the purpose of making surprise visits, under instructions from the Revenue Auditor or at his own discretion; he kept the office advised of all his movements by telegraphing under a special code known only to the Revenue Auditor and himself.

CLEARING OFFICER.

Owing to it not being found possible to establish a Central Clearing House, to deal with the "Through" Traffic between the respective South African Railway Administrations, the system of clearing was based on an exchange of returns between the various Administrations.

Staff. The Clearing Officer had under him a staff of one Chief Clerk and 31 others. This Office was also under the control of the Chief Accountant.

The work performed in the Clearing Office consisted of checking and dividing "Through" Traffic from and to I.M.R. stations, and Traffic between the two sections of the I.M.R. (Transvaal and O.R.C.).

Division of
"Through" Traffic.
(a). Passengers.

Returns (R.C.H. 1, 2, and 3) were forwarded to the Clearing Officer by the Revenue Auditor, for the purpose of ascertaining the proportion due to each Administration.

All "Refund Fare Claim" vouchers were, prior to payment, carefully examined in the Clearing Office, and the proportion payable by each Administration ascertained.

Summaries of the Abstracts from all I.M.R. stations were compiled, showing the total Passenger Traffic between each station and all other stations on foreign lines during the month; and also a Grand Summary, showing the total Traffic from all I.M.R. stations to each foreign Administration, giving each Administration's proportion.

(b). Goods, Live
Stock and Vehicles,
and Excess Luggage.

Copies of all waybills for Forwarded Parcels, Live Stock, Vehicles and Excess Luggage and invoices for Goods, for "Through" traffic, were sent in by stations to the Clearing Office daily. These were checked as regards charges being made under the correct classification, and also as regards calculations, etc., such check being accepted in the Audit Office. Any undercharges discovered were taken up with stations, and instructions given for passing undercharge entries. Overcharges on "Through" traffic were submitted to the Clearing Office for verification, before refund could be made.

The detection and adjustment of undercharges and overcharges necessarily entailed a very considerable amount of work.

An Abstract of each station's traffic was prepared from the waybills and invoices when checked, showing the proportions due to the Transvaal, O.R.C. and other Administrations on all "Through Forwarded" traffic.

Summaries and Grand Summaries were then prepared in the same way as for Passenger Traffic.

Copies of Abstracts, Summaries and Grand Summaries were prepared and forwarded to the foreign Administrations, to be checked and agreed to by them; a balance-sheet was also made out from the totals of the Grand Summaries, showing :—

- (i.). The collections of each Administration,
- (ii.). The proportions due to each Administration,

leaving the balance to be paid over by the one Administration to the other.

In the case of Coaching and Goods traffic from other Administrations to the I.M.R., a more or less similar course was adopted by each of the various Administrations; and their statements, when received, were completely checked and agreed, any differences forming the subject of correspondence and being adjusted in a subsequent month.

To exercise a more complete check, the whole of the Forwarded and Received traffic passing to or from I.M.R. lines was balanced with the Abstracts and Summaries sent by stations to the respective Audit Offices. It was therefore impossible for any entry which had been passed to be omitted without being discovered in the balance.

Daily returns were sent from all Border stations to the respective Clearing Officers, showing all Rolling Stock (*viz.*, coaches, vans, trucks, sheets and chains) passing from one Administration to another. These returns quoted the owning Administration, number of vehicle, etc., and the train on which each vehicle passed. From these returns movements of Stock were entered in the Tracing Books; and a monthly account was prepared, showing the time foreign vehicles, etc., were on I.M.R. lines, and *vice versa*.

Interchange of
Rolling Stock.

Accounts were similarly sent by the other Administrations, which were checked with the returns and agreed. These accounts involved a considerable amount of work, including, as they did, claims for rebate for Stock damaged and delayed, etc.

EXPENDITURE AUDITOR.

The General Book-keeping and Expenditure Branch of the Accounts Department consisted of the Expenditure Auditor and a staff of:—1 Chief Book-keeper, 1 Book-keeper, 1 Assistant Book-keeper, 3 Cashiers, 4 Paymasters, 8 Examiners of Vouchers and 24 Clerks. Staff.

The payments for expenditure of the Railways were made by cheques from the Head Office and cash payments by Paymasters, all payments being supported by special forms of voucher. Details of Account
Keeping.

The vouchers were numbered consecutively, and entered in special "Abstract Books" under the various Departments incurring the expenditure; particulars were given as to the nature of the expenditure and the manner of payment, payments by cheque and by the various Paymasters being kept distinct. Salaries, wages, travelling expenses, stores purchases, etc., were shown separately.

The Abstract Books also gave full particulars of all amounts deducted from pay-sheets for Pension Fund, Guarantee Fund, Rents, Institute Subscriptions, Fines, Provisions and Coal supplied to Employés, Medical Fund, School Fees, etc., owed by employés, these being subsequently dealt with through the Journals.

The amounts of the vouchers were also entered in the various "Departmental Distribution (or Classification) Books," under the numerous sub-heads of expenditure, every voucher being allocated by the Department concerned to the work for which the expenditure was incurred.

Expenditure incurred by one Department on behalf of another was adjusted by minus debits from the Department originally charged to the Department against which it was chargeable; special transfers (G. 64), signed and allocated to the proper sub-heads by both Departments concerned, supported the Journal entries in all cases.

Subsidiary Journals, or "Waste Books," in which full details of the entries were given, led up to the main Journal, in which all the debits and credits to each Department were journalised in one total, thus obviating unnecessary work in posting to the Ledgers. Full references to the subsidiary books were given, and each individual item could be traced from the Ledger without difficulty.

The books were balanced each month, and a Statement of the Ledger Balances was submitted to the Chief Accountant for examination.

Vouchers and Books were then submitted to the Chief Railway Auditor for final audit. Any payments queried or taken exception to by him were noted on a special form, and taken up with the Department concerned. Where necessary, adjustment was made in a subsequent month, or a surcharge was levied on the officer by whom the irregular payment had been made.

All vouchers were examined before payment by the Chief Accountant's examining staff, with a view to detecting any errors, unauthorised expenditure or irregularities of any kind; registers and records of authorities, contracts, etc., being kept in the Examining Office.

Any payment of an extraordinary nature, or not duly authorised, was submitted to the D.R., and approved in writing by him before being passed.

The time quoted on wages-sheets for daily-paid staff was certified to by two officers

of the Department in which the employés were engaged as being correct according to the time books.

Bank Balances were taken out daily, and submitted to the Chief Accountant.

Cashiers' and Paymasters' Accounts were examined on the completion of payments for the month, balances in hand being re-deposited in the bank. Surprise inspections were made at times.

The Chief Accountant, or some responsible officer of his Department, proceeded to Bloemfontein and Pretoria to check the balances each month.

A large amount of work fell upon the Expenditure Auditor in collecting sums for stores supplied to, and work done for, other Military and Civil Departments, and in the recovery and distribution of amounts payable by employés for provisions, coal, etc. Reconciliation statements were compiled each month, showing amounts payable, collected and outstanding. Special subsidiary books were used for many of these accounts.

Settlements between the various Administrations on account of balance of "Through" traffic, payments made by one on behalf of another, supplies purchased from one for the other, etc., were dealt with in a Monthly Account Current and adjusted monthly.

All expenditure was provided for by Imprest with the Chief Army Paymaster, Cape Colony.

The Revenue Receipts were paid in daily to a special account at the bank, and were afterwards withdrawn on the authority of cheques signed by the D.R.; they were debited in the Monthly Imprest Account with the Chief Army Paymaster, Cape Colony, in accordance with War Office instructions.

Revenue receipts from stations where there was no bank were remitted daily, in travelling steel cash-boxes, to the Head Office or to the District Offices at Bloemfontein or Pretoria; "Remittance" forms, showing coaching and goods receipts, were enclosed in the cash-bags. These remittance forms were receipted by the cashiers, and returned to the Station-Masters. The Revenue Auditor compared these receipts with those brought to debit by Station-Masters in their monthly Accounts Current.

Stations at which there was a bank deposited in the bank for transfer to Johannesburg, sending a "Remittance" form daily to the Chief Accountant, with a deposit slip certified by the bank.

All cash was transmitted in special sealed bags, which were opened by the cashiers on receipt in the presence of witnesses. A separate Revenue Cash Book was used in this connection, showing amounts received from stations and deposited in the bank, the monthly total being transferred to the Main Cash Book by the Chief Book-keeper for incorporation in the Ledger.

Where stations had no receipts to remit, a "Nil" return was forwarded, any irregularity being immediately taken up by wire.

Monies paid to Station-Masters in respect of amounts other than Revenue were transferred in a similar way, special "Extraneous Remittance" forms being sent. Such amounts did not figure in the Revenue remittance notes.

Subsidiary Cash Books were kept for receipts other than Revenue, the monthly totals being transferred, in the same way as Revenue, to the Main Cash Book.

Official receipts, numbered consecutively, were given for all monies received; and all receipts, of whatever kind, were deposited in the bank daily, no officer, under any circumstances, being allowed to use cash received for making payments. All disbursements were made from cash supplied by or through the Head Office.

The Accountant at Bloemfontein and the Cashier at Pretoria similarly dealt with receipts deposited locally for transmission to Johannesburg, sending a return to the Head Office daily. Only subsidiary, or memorandum, books were kept at these District Offices, all main books being kept at the Head Office.

Payments for salaries and wages were made throughout the Railways by the Paymasters, pay trains being sent at the beginning of each month to the various sections. The Paymaster of each section took with him an Examiner, who examined the vouchers received on the train and witnessed the payments made. A representative of the Department concerned was also present as a witness.

CHAPTER VIII.

RAILWAY POLICE.

The force of Railway Police may be said to have passed through three phases :—

(a). From June to September, 1900, there was a force of 30 men attached to the Railway Staff Depot for discipline, etc.

(b). From September, 1900, to February, 1901, the force was increased to 4 officers and 116 non-commissioned officers and men, and was separated from the Staff Depot. The Commissioner (Major Macdonald, D.S.O., Reserve of Officers, Hampshire Regt.) was graded as A.A.G., and had under him two Assistant Commissioners and one Pay and Quartermaster. First Organisation.

The headquarters were fixed at Pretoria, and non-commissioned officers and men were obtained from the ranks of the Regular Army and from Colonial and Volunteer Corps.

At this time the force, though nominally separate for Railway purposes, was really under the Provost Marshal and was a species of Military Police. It was paid at first from the Civil Treasury and later from Railway funds, but was not in close touch with the Railway Authorities.

(c). On February 14th, 1901, the force was re-organised on lines laid down by Capt. C. J. Lloyd Carson, who was appointed Assistant Commissioner. The strength was as follows :— Final Organisation.

- 1 Assistant Commissioner (in command).
- 5 Superintendents (including 1 Chief Superintendent) in charge of sub-districts.
- 14 Inspectors.
- 16 Sergeants.
- 109 Constables.

The rates of pay for Superintendents and other ranks under scheme (b) had varied from 20s. to 10s. per day with rations ; these were now altered as follows :— Rates of Pay.

Chief Superintendent	20s.
Superintendents	20s. to 14s. 6d. according to stations.
Inspectors	23s. to 13s. " " "
Sergeants	19s. to 9s. 6d. according to stations and class.
Constables	12s. 6d. to 7s. according to stations.

The highest rates of pay in every case were given to men at or near Koomati Poort, the lowest to those in the O.R.C.

The headquarters were now fixed at Johannesburg, where all other Railway offices were, and a fresh enrolment was undertaken. Only men with police and railway experience were selected ; and these signed agreements to serve till the 30th September, 1901, on the understanding that, if found satisfactory, they would be guaranteed further employment in this or some other Government Department of the new Colonies. They were then, in accordance with Army Orders, given furlough pending discharge or demobilisation, and joined the police force to take up their new duties.

In addition to the scales of pay noted above, members of the Railway Police were entitled to 3s. 6d. travelling allowance for every night they were absent on duty from their headquarters, and were also privileged to obtain provisions and coal under conditions similar to other railway employés.

The Assistant Commissioner was the "Commanding Officer," and all communications from any member of the Police force reached him through the Chief Superintendent. All Superintendents ranked as Warrant Officers of the Army, and received compliments as such. Organisation and Duties.

To each Superintendent a section of railway was allotted, and within those limits each was responsible for the maintenance of efficiency and discipline amongst all ranks. He was empowered to suspend for inefficiency or breaches of discipline, such action being reported by telegraph, followed by details in writing addressed to headquarters.

An Inspector ranked as Army "Class 17" and was appointed to a sub-district. He was charged with detailed superintendence of all Railway Police matters, and it was essential for the proper performance of his duties that he should be constantly on the move.

Each station at which Railway Police were quartered was in charge of a Sergeant. It was his duty to attend all trains, to give any necessary aid to the R.S.O. and railway officials, and to see that all constables knew and carried out their orders, that a regular roster of duty was kept and that men when on duty were properly dressed. He was directed to make reports without delay, and to submit weekly a diary chronicling all doings at the station within his charge.

Constables were enjoined to use tact, combined with firmness, and to remember that they existed as a body to prevent crime and disorder, not to create it.

One of the Superintendents, together with two men, carried on detective work, and was instrumental in obtaining several convictions.

Appendix A to this Chapter gives the strength and distribution of the police over the whole railway system.

Appendix B shows, in summary form, the results of police operations during a period of 9 months, giving an average of over 150 convictions per month.

We may now consider very shortly the most common offences committed on railways, and the instructions issued regarding each of them.

Permits to travel within the limits of the O.R.C. and the Transvaal were issued to civilians by :—

- (a) the Chief of the Staff
- (b) the Military Governor
- (c) the Director of Railways
- (d) the Provost Marshal
- (e) the Commissioner of Police

and (f) by the Press Censor (to War Correspondents only)

whilst the Commander-in-Chief alone could grant permits to travel by rail into the adjacent Colonies.

Railway Police were authorised to examine the permits of all travellers, and in suspicious cases were to arrest the traveller after consulting the R.S.O., if present. They were not empowered to interfere with traffic arrangements to enable them to carry out their examination, but could communicate with the next Police Post by telegraph if necessary.

The lack of foodstuffs and liquor, together with the strict censorship over letters, was instrumental in creating an illicit traffic on the railways; and the Police were empowered to make such search as they could whilst trains were standing at stations, arresting the offenders when discovered.

Ill-disposed persons, and emissaries of the enemy acting as spies, were found to be using the railways, disguising themselves in British uniforms. Such persons would be unprovided with the necessary authority from a Military Officer, and were to be removed from the train in custody.

The number of cases of theft of stores was causing considerable loss to the Army, and the Police were directed to question closely any person found on railway premises in possession of Government stores. If the answers given were unsatisfactory, they were directed to hand civilians over to the Provost Marshal and soldiers to the nearest Military Authority.

To preserve the inviolability of telegraph offices, and to prevent confusion and risk of accident, the Police were enjoined to forbid any person whatever from loitering or bivouacking within railway limits, or in the neighbourhood of stations and platforms; whilst no one was allowed to ride or drive through the premises without permission from the railway authorities.

It was clearly laid down that Police Sergeants and Constables were primarily stationary, and could not therefore leave their station except by order of superior authority. Inspectors and travelling examiners, on the other hand, were directed to be constantly on the move, to ensure the greatest efficiency amongst all ranks on their respective lengths.

Offences on
Railways.

(i.). Unauthorised
Travelling.

(ii.). Unauthorised
Conveyance of
Letters, etc.

(iii.). Spies.

(iv.). Theft and
Pilfering.

(v.). Loitering and
Bivouacking on
Platforms, etc.

APPENDIX A TO CHAPTER VIII.

DISTRIBUTION OF RAILWAY POLICE.

ORANGE RIVER COLONY.				TRANSVAAL.			
STATIONS.			Number of Sergeants and Constables.	STATION.			Number of Sergeants and Constables.
Norval's Pont	...	...	4	Vereeniging	...	...	4
Bethulie	...	...	2	Elandsfontein	...	...	10
Springfontein	...	...	7	Springs	...	...	3
Bloemfontein	...	...	10	Pretoria	...	...	13
Brandfort	...	...	1	Pietersberg	...	...	4
Smalldeel	...	...	3	Middleberg	...	...	4
Kroonstad	...	...	7	Waterval Boven	...	...	4
Viljoen's Drift	...	...	4	Kaapmuiden	...	...	3
				Barberton	...	...	2
				Koomati Poort	...	...	5
				Heidelberg	...	...	4
				Standerton	...	...	7
				Volksrust	...	...	5
				Johannesberg	...	...	14
				Krugersdorp	...	...	2
				Potchefstroom	...	...	2
				Klerksdorp	...	...	1
Totals	...	...	38				87

Superintendents at :—Bloemfontein, Pretoria, Johannesburg, in charge of sections.
Inspectors at various stations in charge of sub-districts.

APPENDIX B TO CHAPTER VIII.

SUMMARY OF THE PRINCIPAL ARRESTS AND CONVICTIONS FOR OFFENCES ON THE IMPERIAL MILITARY RAILWAYS

FROM SEPTEMBER, 1900, TO MAY, 1901.

Month.	Looting.	Travelling without Permits.	Contravening Government Notices.	Miscellaneous.	Total.
1900.					
September	5	3	—	5	13
October	20	19	—	21	60
November	36	67	4	43	150
December	35	253	3	92	383
1901.					
January	25	60	13	58	156
February	57	21	6	104	188
March	63	27	18	37	145
April	*114	9	11	47	181
May	21	12	16	45	94
Grand Total					1,370

* Troop moves very heavy at this time.

CHAPTER IX.

RAILWAY STAFF DEPÔT.

Reasons for Origin.

As soon as the advancing British forces took possession of the railways in the neighbourhood of Pretoria, it was clear that the staff of the N.S.A.R. Company was hostile and that the Army must therefore look to other sources for the supply of men required to operate the railways.

To deal with all the volunteers from the ranks of the Army who responded to the call to take up special employment, a Railway Staff Depôt was formed at Johannesburg in June, 1900, under the superintendence of Capt. C. J. Lloyd-Carson and Lieut. Leatham. The former was the "Commanding Officer" of all men attached to the Depôt; he became responsible that soldiers who joined the railway had done so with their regimental commander's consent, and that men whose services were no longer required rejoined their corps without delay; he also attended to all details of rations, accommodation, clothing and discipline.

It took a little time to bring the Depôt into working order, and at first the absence of a proper staff and the constant stream of arrivals and departures of men made it difficult to ensure that all details were attended to with order and regularity. By July, 1900, matters were settling down into a regular routine, and reliable non-commissioned officers at Johannesburg and various out-stations saw to the rationing of men and to the provision of clothing and boots.

Appointment of A.D.R. (Troops).

It was now decided that Major W. R. Stewart, R.E., should take up the appointment of A.D.R. (Troops), being charged with the administration of troops employed on the Railways in the two new Colonies. These included five R.E. Companies, viz.: 8th and 10th (Railway) and 20th, 31st and 42nd (Fortress), the Johannesburg Depôt, and all details on any part of the I.M.R.

Organization.

The skeleton diagram given in Appendix A to this Chapter will show that these bodies of men were divided into three groups, for purposes of administration, viz. :—

- (a). R.E. Companies.
- (b). Troops and details in the O.R.C.
- (c). Troops and details in the Transvaal.

Of (a), the headquarters of the 10th and 42nd Companies remained at Johannesburg under Lieut. A. G. T. Cusins, R.E. (Acting Adjutant, R.E. Troops), whilst the 8th and 31st Companies moved complete to "railhead." The 20th Company had been replaced on the Railways by No. 8 Company, Royal Monmouthshire Engineers (Militia), and the latter's commanding officer (Major Morgan Lindsay) became O.C. Troops in the O.R.C.

The Johannesburg Depôt commander was in a similar position as regards all troops in the Transvaal.

Pay.

In the early days of the Johannesburg Depôt, before the staffs of the various Railway Departments had arrived in the Transvaal, the pay sheets of soldiers employed in the Locomotive, Traffic and Maintenance branches were made out by the Depôt staff, and the men were paid by them. Later on the O.C. Railway Staff Depôt only made out working-pay sheets for clerks of R.S.O.s and for orderlies and unattached men in the Transvaal; for all other men, these pay sheets were made by the Departmental officers under whom they were working and were paid in arrears by travelling Pay Clerks. The Engineer working pay varied from 8d. to 1s. 8d. per day, and it was found that men were generally satisfied to draw sums due from the railways, leaving their regimental pay to accumulate with their corps; if, however, men wished to draw on the latter, their demands were forwarded to their Commanding Officers.

The documents of all Infantrymen were left with their respective units, as this was found to simplify procedure.

Rations.

At several of the larger stations in the Transvaal, ration stores were established in charge of non-commissioned officers. Rations were drawn in bulk from the A.S.C., and issued in detail to military employées. Payment (at the rate of 2s. 1d. per ration) was made by the Chief Railway Accountant, the sums due being deducted from the men's wages on information supplied by the Railway Staff Depôt to Heads of Departments,

When it was impossible for civilian railway employées to obtain food for themselves, rations were also issued to them by the Railway Staff Depôt on cash payment.

As far as possible, clothing was supplied to men passing through the Depôt at Johannesburg or the Sub-depôt at Pretoria (which was opened when work began on the Eastern line); but in addition it was found necessary to despatch a truck containing clothing for men who could not draw direct from either of these stores. The truck was sent out in October and February, carrying hot and cold weather clothing, and thus the men, though detached from their regiments, were well supplied. To meet the wants of such employées as drivers, fitters and boilermakers, a special issue of "dungaree" suits was made; these are easily washed, and do not take up oil and grease so readily as serge. Clothing.

In all matters of military discipline, the O.C. Johannesburg Depôt exercised authority; and he delegated powers to R.S.O.s to deal with minor offences or to apply for a Court-Martial. Such applications were made to the nearest Station Commandant so as to avoid correspondence and delay. All details of offences and punishments awarded were communicated to the O.C. Depôt, who passed them on to the offender's own Commanding Officer for record in the defaulter sheet concerned. Discipline.

Various Army Orders published in October and November, 1900, authorised the discharge of members of the Imperial Yeomanry, City of London Imperial Volunteers, Militia and Militia Reserve to take up civil employment. Discharges from the Army to take up Civil Employment.

Similarly, in the case of men of the Regular Army, eligible for re-transfer to the Reserve, a grant of furlough was permissible to allow them to work on the railways pending their transfer.

By Army Order dated June 8th, 1901, all men then serving under the above-noted conditions were formally transferred from 1st June. The limit of colour service was placed at 7 years, and men transferred under this Army Order were held to be super-numerary to the Army Reserve, drawing no pay from Army funds until the termination of their Colonial engagement.

The Army Order further directed that in all subsequent cases men should not be granted furlough, but should be transferred at once to the Army Reserve, the necessary certificates regarding colour service accompanying each application to Army H.Q.

It was also laid down that, if it was intended to dismiss from civil employment a man so transferred, Heads of Departments should invariably report the circumstances to Army H.Q.

All the detail and routine work in connection with these discharges and transfers was attended to in the Staff Depôt. The fact that the Corps to which many men belonged had in the meanwhile left South Africa (whilst some had even been disbanded) entailed much lengthy correspondence with England, Canada and Australia.

Appendix B to this Chapter gives numbers of the military employées taken for employment on the I.M.R. by the Johannesburg Depôt.

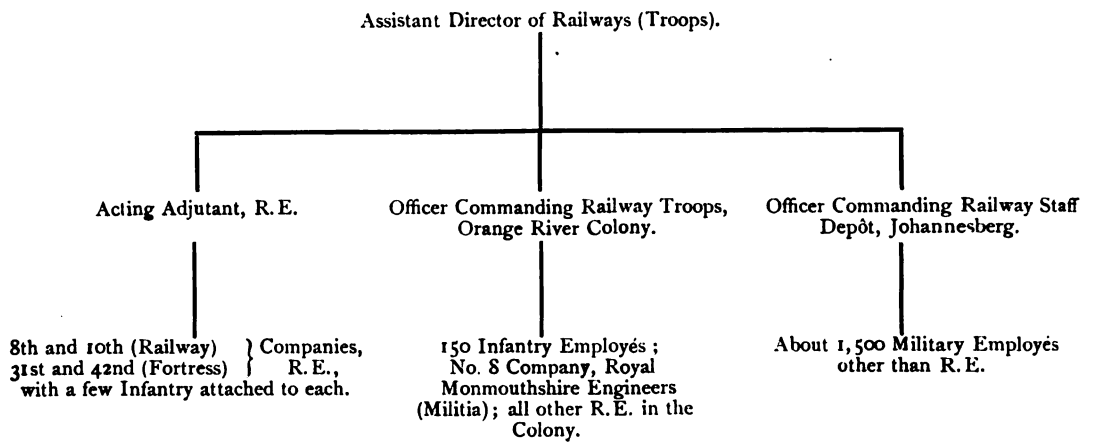
The system in the Transvaal, which has been described in detail, was followed out also in the O.R.C., but the number of men required there in the first instance was not so great and the work of the depôt was proportionately lessened. System in O.R.C.

As regards the R.E. units, it was found in practice that returns and information came in but slowly from the 8th and 31st Companies, as their headquarters remained with them. Procedure with R.E. Companies.

It would have been better if the headquarter office staffs of all 4 Companies had been in Johannesburg, with two officers to supervise; in this way, an effective chain of communication would have been maintained, whilst the number of officers with the Companies would not have been very greatly reduced.

APPENDIX A TO CHAPTER IX.

ORGANISATION OF RAILWAY TROOPS.



APPENDIX B TO CHAPTER IX.

RAILWAY STAFF DEPÔT, JOHANNESBERG.

RETURN OF MILITARY EMPLOYEES ON IMPERIAL MILITARY RAILWAYS.

	June to August, 1900.	September to December, 1900.	January to June, 1901.	Total.
Number of Soldiers taken on for employment ...	1,171	895	541	2,607
Number returned to their Regiments			739	
Number discharged from the Army for permanent employment on Railways			296	
			1,035	1,035
Total Number on Railways in June, 1901				1,572

DESCRIPTION OF MEN ENGAGED.

Army Reservists.	British Volunteers.	Oversea Colonials.	South African Colonials.	Others.	Total.
599	241	291	210	1,266	2,607

CHAPTER X.

RAILWAY EMPLOYMENT OFFICE, CAPE TOWN.

The necessity for creating some organisation capable of supplying white civilian employes for the various departments of the Railway had been recognised soon after the occupation of Bloemfontein. As a result of negotiations, a Railway Employment Office was formed in July, 1900, under the superintendence of Mr. A. L. Secretan, late of the Pietersberg Railway, with Mr. Hopkinson (Retired List, R.N.) as his assistant, the headquarters being fixed in Cape Town.

During the succeeding nine months, 7,500 applications were dealt with, and 770 employes were engaged (see Appendix below).

Before the office was opened, and for a short time after it had started work, several men from the C.G.R. and N.G.R. were passed direct to the I.M.R. But this procedure gradually ceased; on the one hand all departments notified their requirements to Mr. Secretan's office, whilst on the other hand applicants in civil life, wherever resident, and also reservists and time-expired men from the Army, forwarded their requests for employment to the same quarter.

It was the business of the officer in charge to make enquiries regarding an applicant's antecedents. If the result was satisfactory, the man was examined personally as to his qualifications, either at Cape Town or by the nearest A.D.R. or D.A.D.R., to whom he was directed to report himself.

In the case of men from the Army (reservists, etc.) enquiries were made from their Commanding Officers; and many were granted furlough pending discharge, in order to enable them to proceed to Johannesburg for work on probation.

The Employment Office was freely advertised in all South African newspapers; and at first applications poured in so fast, whilst at the same time the demands of all departments for labour were so urgent, that it was not always possible to make very full enquiries regarding men's capabilities and character. After the first rush was over it became possible to exercise more discrimination; and preference was then given to refugees and discharged volunteers, provided they possessed the necessary technical qualifications.

The existence of a central office to which all departments could refer for additional civil staff proved a great boon. District and other officers of the Railways were saved the trouble of making all preliminary enquiries; whilst at the same time it was possible to institute a regular system of registration, so as to ensure the admission of none but desirable men to the ranks of the Railway staff.

APPENDIX TO CHAPTER X.

RAILWAY EMPLOYMENT OFFICE.

RETURN OF CIVILIANS ENGAGED FOR EMPLOYMENT ON IMPERIAL MILITARY RAILWAYS.

DEPARTMENT ENGAGED FOR.	ENGAGED FROM.				Total.
	Cape Town.	Cape Colony and Rhodesia.	Natal.	England and other Countries.	
Locomotive	201	48	109	22	380
Traffic	48	12	18	146	224
Telegraph	32	5	11	1	43
Stores	6	2	2	1	11
Works	30	11	44	4	89
Accounts	8	4	5	—	17
Totals	325	82	189	174	770

CHAPTER XI.

LORENÇO MARQUES, DELAGOA BAY.

Lorenço Marques in Delagoa Bay was the only place on the South African coast, north of Durban, which possessed any pretensions to be called a shipping port, and it was of special importance to the British Forces in the Transvaal on account of the great saving in point of distance (see Preface).

General Description. This port is in Portuguese territory and questions connected with its use were therefore of a delicate nature, but before entering upon them, it will be well to describe, in general terms, the facilities of the port and the Portuguese railway connecting it with the Transvaal.

Landing Difficulties. Delagoa Bay, though spacious in area, does not possess deep water close in shore. The average rise and fall of the tide is 12 feet and the foreshore is a muddy flat.

Steamers lie out in the Bay and discharge their cargo into iron lighters or wooden flats, locally called "punts." Their capacity varies considerably, viz.:—from 100 tons to 20 tons or less; and they are owned by various Lighter Companies, of which there are eight established at Lorenço Marques.

These Companies land the goods, supplying labour and plant for this purpose, and charge from 7s. 6d. to 5s. 6d. per ton of 2,000 lbs., according to a Schedule of classification.

Piers. There are four piers known respectively as—

- (i.). N.S.A.R. Company's.
- (ii.). Customs.
- (iii.). Portuguese Railway Company's.
- (iv.). Lingham's.

(i.). N.S.A.R. Company's Pier.

(i.). This is a substantial wooden structure, 66 feet long and 23 feet wide, resting on steel screwed piles. It has no "T" head, and the average depth of water at the outer end is 22 feet, the minimum at high spring tides being 11 feet. It is provided with four tracks, of which the outer were reserved for cranes and the inner for railway wagons; also with three 5-ton steam cranes, one 10-ton hand crane, and one shear legs (floating) capable of lifting 15 tons. The whole was, in 1900, the property of the N.S.A.R. Company, and was erected by them on a site conceded by the Portuguese, the lease of which expires in 1919. The "site" includes an adjoining strip of ground on the foreshore.

It would be impossible, save at great expense, to dredge the neighbourhood of the pier; and even if this were done, a steamer lying at its head could only work one hatch conveniently.

During 1900–01 it was generally used to land or load such things as grain, forage and coal; and the arrangements were under the superintendence of a pier-master who was an employé of the Company.

(ii.). Customs Pier.

(ii.). This is Portuguese Government property and is under the superintendence of its officials. It occupies a convenient position in that it is close to the Customs sheds; bonded goods can thus be conveniently transferred from lighters direct to the sheds, where they are secured and held in charge of Customs officials.

(iii.). Portuguese Railway Pier.

(iii.). This is a small wooden structure facing the railway station, but it never appeared to be used for any purpose whatever. The water alongside is so shallow that none but the smallest draft "punts" can be moored to it.

(iv.). Lingham's Pier.

(iv.). This is a pier belonging to the Lingham Company, and is situated at the head of Delagoa Bay on a strip of ground conceded by the Portuguese Government. It is 5 miles away from the N.S.A.R. Company's pier and for this reason is not particularly convenient, as there is a long lead by lighters.

The Company control the pier and the service of lighters, and also the sheds and storehouses which are conveniently close to the pier. There is railway connection with the Portuguese line by means of a branch, 5 miles long, which runs to Matolla, the first station out of Lorenço Marques.

The Delagoa Bay Railway, which is really a Portuguese State concern, is of 3-foot 6-inch gauge, and runs from Lorenzo Marques in a north-westerly direction to the Transvaal frontier at Ressano Garcia (near Koomati Poort) where trains run on to the Transvaal system. Delagoa Bay Railway.

The total length to the frontier is 89 kilometres (55 miles), the greater portion passing through undulating country which does not entail heavy gradients. At the frontier end, near Ressano Garcia, the hills close in and the river runs close beside the line; but there is no reason to anticipate danger in the maintenance of this portion.

The largest stations are at Lorenzo Marques and Ressano Garcia, all others being unimportant roadside stations.

At Lorenzo Marques the yard is well laid out, but neither goods sheds or passenger station could cope with any considerable increase of traffic without alteration. Ressano Garcia appears to be sufficiently large for the immediate future.

Lorenzo Marques possesses an engine shed with accommodation for 24 locomotives, also workshops and general offices for the Administration.

The rolling stock and locomotives are, generally speaking, of similar type to those found on the Transvaal railways, and were obtained from Europe through the N.S.A.R. Company. The totals in 1900 were 25 locomotives, 22 passenger and brake vans, and 600 wagons and trucks of various types.

The cost of carriage by rail over the Delagoa Bay railway has already been referred to in Chapter III. of this Part, and until the beginning of 1902 there was no through booking. The Portuguese line insisted on obtaining daily cash payment from consignors, and the rate of exchange for local currency was fixed by the Government in a somewhat arbitrary manner, which acted in favour of the railway.

In September, 1900, when the British had taken possession of the Transvaal Eastern line throughout its length, Lieut. (local Major) R. B. D. Blakeney, D.S.O., R.E.,* was nominated A.D.R. (Delagoa Bay) and proceeded to Lorenzo Marques to represent the Army at that port. Arrangements with the Portuguese.

Official relations with the Portuguese Government and the Delagoa Railway Company were opened through the British Consul-General.

During this and the following month, as a result of negotiations, an Agent of the I.M.R. was located at Ressano Garcia, a temporary Customs Post was established at Koomati Poort, and permission was received to take over all rolling-stock belonging to the Boer States which had been sent by them to Delagoa Bay.

It was further arranged that food stuffs for the Army should go forward to the Transvaal *via* Lorenzo Marques; and the General Manager of the Delagoa Bay Railway, acting as a go-between, came to an agreement with the N.S.A.R. Company's Agent to allow the I.M.R. the use of the former's pier for landing stores. The Company charged 1s. 6d. per ton, in consideration for which they handled cargo on the pier, performed all shunting, and gave the use of cranes, etc., as required. All dues for the N.S.A.R. Company were collected by the Delagoa Bay Railway Administration, and transferred by them. The pier-master superintended the loading of trucks on the pier, assisted by a representative of the I.M.R.

Many railway questions had political bearings and entailed references to the Governor-General of Portuguese Africa or to the Portuguese Home Government at Lisbon; and thus decisions could not be given rapidly.

One of such questions was the waiving by the Portuguese Government of storage charges for goods the property of the British Government in the customs and railway sheds. A favourable answer was eventually received, on the understanding that sheds should be cleared of British Government property if the accommodation were required by the customs or railway authorities.

Early in 1901 it was agreed that no supplies should be allowed to enter Swaziland *via* the Portuguese railway; and further that Boer munitions (taken by the Portuguese from refugees) and other contraband of war detained at Lorenzo Marques should be taken over by the British, and shipped south to Durban.

Finally, in May, 1901, the purchase from the N.S.A.R. Company of railway material and stores lying in Lorenzo Marques was negotiated through the Portuguese Railway Administration.

The normal procedure in dealing with stores for the British Army to be despatched by rail was as follows:— Method of forwarding Stores and Supplies.

The invoices showed stations of origin and destination, name of consignee, and a statement as to whether goods were liable to customs dues. These documents were despatched under proper cover by daily passenger train by the A.D.R. to the R.S.O.

* Major Blakeney was subsequently succeeded by Capt. Hely, Imperial Yeomanry.

at Koomati Poort. The documents were examined and checked by the latter, and, if all was in order, he handed them together with the trucks to the Station-Master.

When this had been done the responsibility of the A.D.R. (Delagoa Bay) ceased as regards that particular consignment.

The Appendix gives some details of the traffic from Lorenzo Marques.

The relations between the British and Portuguese officials remained cordial throughout; and the latter were uniformly anxious to do all in their power to meet the A.D.R.'s wishes, provided that Portuguese interests had been sufficiently safeguarded. The tact and great local knowledge of the British Consul-General aided not a little in producing the harmony so happily established.

APPENDIX TO CHAPTER XI.

TRAFFIC RETURNS FROM LORENÇO MARQUES.

JANUARY TO JUNE, 1901.

Month.	SUPPLIES, TONS.		STORES, TONS.		Animals, Nos.
	Civil.	Imperial Military Railway.	Civil.	Imperial Military Railway.	
1901.					
January	168	7,138	—	73	—
February	91	2,156	—	48	—
March	308	3,142	—	305	210 Oxen.
April	342	3,349	54	342	582 „
May	385	7,657	15	339	30 Horses.
June	708	8,181	11	292	—
Totals	2,002	31,923	80	1,399	822

PART V.
ARMoured TRAINS.

CHAPTER I.

EMPLOYMENT IN FIRST PHASE OF CAMPAIGN.

Shortly before the beginning of the war in 1899, four Armoured Trains were constructed in the C.G.R. workshops in Cape Colony.

Armoured Trains
constructed by
C. G. R.

The questions of what functions these trains were to have, and what part they were to take in the active operations against the Boers, do not appear to have met with much consideration.

Each train consisted of a rather weak engine and two bogie box trucks, the whole cased in bullet-proof steel sheets.

Construction.

The engine ran between the plated bogie trucks, in which the garrison was accommodated and from which they were to fight with rifles and maxims. Each truck was freely pierced with Infantry loopholes, and was also provided with one small Maxim port to fire along the line and one on each side for broadside fire. The horizontal arc through which the guns could move was so limited that about three-quarters of the ground round the train was "dead ground" so far as the Maxims were concerned. Bell communication with the driver was provided in each bogie truck, as also were vacuum hand brakes, which the O.C. of the train could apply.

Of the four trains in existence at the outbreak of the war, two had reached Kimberley, one took part in Lieut.-Gen. Lord Methuen's advance on that place, and the other was with Lieut.-Gen. Gatacre's force near Stormberg.

Use.

In the various battles of these two Generals at the beginning of the campaign, their Armoured Trains took part whenever possible. It was, however, manifestly too unequal a contest for Armoured Trains to withstand the fire of Boer artillery, the trains having nothing more formidable to reply with than Maxims, the limited range of which, as a rule, prevented them ever reaching the enemy's guns.

The same fate met the two Kimberley trains, they also carrying nothing heavier than Maxims.

On the other hand a locally made train at Mafeking, armed with rifles and one small gun, took a very prominent part in the fighting at the beginning of the siege of that place; and by its clever handling inflicted severe losses on the enemy, the train and its garrison suffering but little.

Mafeking Armoured
Train

Of the use of the Armoured Train in Natal during the early stages of the war there is little to say, except that the Officers and men who fought it behaved with undoubted bravery and devotion. The loss of this train through its being derailed in broad daylight by the enemy, and the capture between Vryburg and Mafeking of another, which was brought to a standstill by a rail being removed, brought Armoured Trains into bad repute; and their use was for a time practically abandoned.

Natal Armoured
Train.

Such trains, however, came to the front again to some extent when Lord Methuen seized the south bank of the Vaal at Fourteen Streams; two trains were then found useful in protecting the weakly-held railway north of Kimberley, and the timely appearance of one, and sometimes two, trains at Windsorton Road on several occasions staved off an attack on that place.

Employment of
Trains at Windsorton
Road.

Both trains also took part in Maj.-Gen. Paget's operations when he, in conjunction with Lieut.-Gen. Sir A. Hunter, drove the Boers from the neighbourhood of Fourteen Streams in order to clear the way for Brig.-Gen. Mahon's column marching to the relief of Mafeking.

Later on the use of Armoured Trains again came to the fore when De Wet and his followers took to blowing up and wrecking the railway, first about Kroonstad and afterwards throughout the whole length of the O.F.S. The blowing up of culverts and long lengths of rails became a nightly occurrence, and it became necessary to keep fully equipped Construction Trains standing ready at about every third station throughout the Free State.

On the O.F.S. Line.

It was essential that the resumption of traffic during the daylight hours should be effected with the least possible delay ; yet the provision of a suitable escort to protect the Construction Train and its workmen was often quite beyond the power of the local Commandants who, as a rule, had difficulty in efficiently holding even the stations under their charge.

With Construction
Trains.

It soon became the recognised *rôle* of an Armoured Train to escort a Construction Train to the station nearest any destroyed portion of the line, and then run on by itself to reconnoitre the break and drive off any of the enemy who remained in the vicinity with a view to preventing the work of reconstruction. After seeing that the site of the break was clear, the Armoured Train ran back and brought up the Construction Train in front of it, and then stood on guard whilst the reconstruction party was mending the line.

The importance of this class of work alone will be recognised from the fact that No. 1 Armoured Train (*Photo 52*) was present at, and guarded, the repairing of breaks on the railway on sixty-one different occasions.

Naval Guns on
Armoured Trucks.

About September, 1900, four pedestal-mounted 12-pounder Q.F. Naval guns were mounted by the Naval authorities at Simonstown on two steel-plated bogie trucks, and despatched to Pretoria. After considerable opposition, one of these trucks was detained in the O.R.C. and seized by the O.C. No. 1 Armoured Train.

Very shortly afterwards, at dawn one day, this same train encountered De Wet crossing the railway from east to west a few miles south of Wolvehoek. The severe handling which De Wet received from the rifles, Maxims and 12-pounders of the train attracted some notice at Army H.Q. On this occasion De Wet brought two 6-pounder Krupp guns into action against the train, and these, together with riflemen, endeavoured to cover the crossing of the main body ; although the enemy exploded a mine in front of the train, and prevented it taking up the most advantageous position, De Wet was forced to withdraw his guns and abandon two mule wagons of Krupp gun ammunition ; the train suffered the loss of one man only. Next day it was again in action, beating off a considerable force of Boers who made a determined attack on it near Heilbron ; on this occasion too its garrison had one man wounded.

Necessity for
Heavier Armament.

These, and other actions, proved the necessity of Armoured Trains being provided with weapons of longer range than rifles and Maxims ; but, as there was no recognised Officer responsible for the efficiency of the trains, the necessary guns and pom-poms were difficult to obtain.

Eventually, however, the three O.R.C. trains (now numbered 1, 2, and 3) and the two Transvaal trains (now Nos. 4 and 9) were each provided with a gun or pom-pom in addition to their rifles and Maxim (*Photos 52 to 55*).

Action at Holfontein.

As an instance of the advantage of the stronger armament, No. 1 Train was able to re-take a mail train captured by a large force of the enemy near Holfontein, and at the same time rescue a whole company of Infantry Volunteers who had been captured near by ; and this without the loss of a single man, and before the enemy had time to damage the mail train or remove more than a few rifles of the captured Infantry.

Action near
Pompi Siding.

Trains Nos. 1 and 2 drove a strong force of the enemy from a position held by them near Pompi Siding, from which the repairing of the blown up line and the resumption of traffic was being prevented.

Trains Nos. 3 and 4 engaged Haasbrook on several occasions ; and the constant patrolling by these trains, and the daily shelling of parties of the enemy who approached the line, enabled day traffic to run almost unmolested between Springfontein and Bloemfontein at a time when the enemy were most active in their endeavours to destroy the railway.

It is true of course that on such a long stretch the Boers were able to reach some point on the railway each night, and for a time it was unusual for a night to pass without a culvert, or from 20 to 40 rails, being destroyed by dynamite. Here again the Armoured Trains were of great value, for at the first streak of dawn, or at any part of the night if the moon was up, they reconnoitered the break. If the wreckers were still on the ground they were driven off. If the break was small it was repaired at once, for by this time the practice of carrying a small quantity of repairing material on each train had been adopted ; if the damage was too great for the train to repair, the nearest "breakdown train" was called up. In either case it seldom happened that through traffic was resumed later than 9 a.m. ; and in many cases the line was put through before daybreak and before the hour that trains were allowed to run.

Material carried for
repairing Permanent
Way.

On the Western
Line.

The Boers now began to show considerable activity along the Western line, more especially north of Kimberley where some trains were captured and burned. The Cape Colony Government, at their own expense, built and equipped two Armoured Trains for work on this section, and one of the old Kimberley trains was again put in commission, as were one or two of those which originally worked about Mafeking.

Following on this came De Wet's futile invasion of Cape Colony. When the Boer Commander, hard pressed by Maj.-Gen. Plumer, crossed the railway from east to west near Houtkraal, the "Ubique," "Pioneer," "Spitfire" and "Cock o' the North" (No. 3) interposed at dawn between him and his convoy at Bartman's Siding. For two hours De Wet made an ineffectual attempt to re-cross to the east of the railway in order to regain his wagons; but the above four Armoured Trains, maintaining an interval of 800 to 1,000 yards, poured such a heavy fire from guns, Maxims and rifles into the enemy that De Wet finally desisted. On this occasion, with the loss of two men wounded, the Armoured Trains captured 24 ox-wagons loaded with ammunition and dynamite, in fact all that De Wet's force possessed beyond what his men carried in their bandoliers.

Action with De Wet
at Bartman's Siding.

The above engagements, and the work done by Nos. 2 and 3 Trains in Cape Colony and No. 9 on the Eastern section of the Transvaal, made apparent the necessity of arming all Armoured Trains with long range guns.

CHAPTER II.

RE-ORGANISATION TOWARDS END OF 1900.

Appointment of
A.D.R., Armoured
Trains.

The new Commander-in-Chief (Lord Kitchener), having decided on the necessity of regularly organising the Armoured Trains, which he recognised as fighting units, appointed on his staff an officer termed A.D.R. for Armoured Trains. This officer was also on the staff of the D.R., and was placed in charge of all Armoured Trains in South Africa, now twenty in number.

Duties.

He was held responsible for the efficient garrisons, armament and equipment of all trains; and it was his duty to see that the Armoured Train rolling stock was in good working condition, and that the O.C.s were instructed in the best manner of fighting their trains and were conversant to the necessary extent with ordinary traffic working.

Like other officers on the H.Q. Staff, he had access to all telegrams sent and received by the Chief; with this privilege, and that of seeing the Commander-in-Chief daily, he was able to some extent to foresee events and to manipulate his trains accordingly.

It was his duty also, whenever a concentration of trains was decided upon, to attach himself to one of them and take personal charge of the concerted action of the whole.

Garrisons of
Armoured Trains.

One of the first points to take up in the organisation of the Armoured Trains branch of the Army was the effective garrisoning of all trains; the garrisons had hitherto consisted of details from various Regiments and Corps of the Army, who had been extracted with some difficulty from various rest camps in Cape Colony, O.R.C. and the Transvaal.

This re-organisation was simplified, after the trains had been told off to the different Sections of the L. of C. for normal work, by the Q.M.G. ordering the Infantry escort of each train to be supplied and maintained by a specified Regiment, at the same time giving instructions to the C.O.s of these Regiments that only men of known good character and good shots were to be detailed and that each Infantry escort was to be commanded by an officer of the same Regiment from which the men were drawn. The fact of a Train being withdrawn from a Section of the L. of C. in no way entitled the O.C. of that Section to withdraw the Infantry escort supplied by him, except after consultation with and with the concurrence of the A.D.R.

The garrison of an Armoured Train was however a complex one, and, in addition to the Infantry escort, contained an R.A. Detachment (usually under an R.A. Subaltern) and an R.E. Detachment. The last named generally consisted of 1 good N.C.O. and 6 Sappers, skilled in railway repairing work and in re-setting derailed engines and trucks, 2 telegraph linemen, 1 telegraph clerk, 2 engine drivers and 2 firemen; all the men of this detachment were counted as effective rifles when the train was engaged, with the exception of the driver and fireman on the footplate; and the latter even carried their rifles in the engine cab to drive off an enemy endeavouring to gain possession of their engine.

Qualifications for
O.C.s Armoured
Trains.

More important than all was the necessity that the O.C. Train should be an officer possessed of judgment and discretion; mere bravery and dash were quite insufficient. The O.C. was often called upon to act on his own responsibility; with his strong armament and defences he was to be prepared to attack forces immeasurably superior in numbers, yet in the excitement of the fight he was also to remember that he should not allow his opponent to cut the line behind him.

Contact and
Observation Mines.

In addition to the visible enemy, there was another and far more disconcerting one to contend against, viz. :—the automatic and observation mines so skilfully used by the Boers; and the roar of a dynamite mine fired by the leading truck passing over it was apt to shake even the strongest nerves. It was obvious therefore that both the Infantry and Artillery officers should be carefully chosen. The senior of these two usually took charge, but for a few exceptionally strong trains special O.C.s were appointed.

The preceding few paragraphs explain the necessity of using every endeavour to minimise the effects of the enemy's mines. The danger from contact mines was to a certain extent obviated by a standing order that each train should propel a heavily-loaded bogie truck. Such trucks had low sides and ends; they in no way obstructed the view, or fire, from the train, and performed the double purpose of exploding contact mines and carrying the railway and telegraph materials; it is perhaps needless to

remark that no one travelled on them. If the train was not moving at a high rate of speed at the time its propelled material truck exploded a contact mine, the O.C., by instantly applying the vacuum brake, could as a rule prevent any of the fighting portion of his train from being derailed; although a severe shock would be felt by the train being brought to a sudden standstill, yet prompt action on the part of the O.C. would usually save the fighting portion of his train and the lives of his men. To enable the O.C. to act instantly, the bell signals to the driver and the vacuum brake valve in the leading truck were arranged conveniently to his look-out position.

The necessity of the propelled unoccupied bogie was exemplified on several occasions.

Necessity for
Propelled Unoccupied
Bogie Truck.

For example No. 6 Armoured Train exploded a mine near Kroonstad, but through some unfortunate oversight it was not propelling its material truck; the O.C. was killed instantly, whilst the leading fighting truck was overturned and several men in it were injured; all this would undoubtedly have been avoided if a loaded bogie had been in front.

A few days later this same Train, having again been put in commission, exploded a contact mine near Heilbron when running in front of a fast "special." On this occasion the propelled bogie exploded the mine and a length of 3 feet of rail was blown out; but as the mine was laid on a straight portion of the line, the whole train bumped across the break and kept the rails, and three minutes after the explosion it was engaging the enemy with the 12-pounder Q.F. gun; there were no casualties on the train, the only damage being the floor of the propelled bogie blown out.

No. 5 Armoured Train was similarly blown up west of Middelberg, Transvaal, when running to reinforce Uitkyk which the Boers had attacked by night. The propelled bogie again fired the mine, but in this case two box trucks in rear of the engine were thrown off by the broken rail; the O.C. promptly disconnected these, and steamed forward with the front portion of his train to assist in the defence of Uitkyk.

The contact mine used by the Boers was a simple contrivance, yet it worked exceedingly well. The barrel and stock of an old Martini rifle were cut down to the size of a pistol, and the trigger guard was removed, only enough of the lever being left to enable the breech to be opened. After having been loaded with a cartridge from which the bullet had been withdrawn, the pistol was firmly fixed (trigger up) in a box, by the sides of which it was gripped. The whole was placed under the base of the rail, the trigger being about $\frac{1}{4}$ inch from the flange; a priming charge of dynamite was put in front of the pistol, with detonators sticking in it like plums, their mouths facing the muzzle; the main charge, of about 10 lbs. of dynamite, was laid between the sleepers. The complete apparatus was then concealed by replacing the ballast. A train passing over the mine depressed the rail sufficiently to press the trigger, and the cartridge flashed into the open mouths of the detonators.

Description of
Contact Mines used
by Enemy.

An exactly similar arrangement was used for an observation mine. The pistol was sunk low enough to prevent the trigger being acted on by the depression of the rails. The mine was fired by a man lying hid among the adjoining bushes with string or wire attached to the trigger; the remainder of the train wreckers took up a position near by and followed their usual practice of opening a heavy fire the moment the explosion occurred.

Description of
Observation Mines.

Observation mines were of course difficult to guard against, and it was only by constant and careful Infantry patrolling that the danger could be minimised. However when Hinton, the master train-wrecker, was between Waterval Onder and Nelspruit, with the avowed intention of blowing up the Armoured Train, the tactics adopted by No. 1 Train appear to have frustrated his attempt to use his crude observation mine. Although he succeeded in blowing up a supply train during the ten days which he occupied in making his attempt, the practice adopted on the Train of a few picked men firing as it approached into any likely place for men to hide appears to have disconcerted the wreckers, who were never certain whether they had been discovered or not. At any rate the train was not blown up, although a heavily charged, but abandoned, mine of Hinton's was discovered by it.

Each Train carried a special gun truck, on which was a pedestal-mounted Q.F. gun.

Armament.

All trains also carried a machine gun at each end, arranged with a lateral sweep to allow the fires to cross at either side of the train at a distance of from 50 to 80 yards.

Armoured Trains were officially recognised as moving telegraph offices, and equipped with field sounders, vibrators, phonophores and telephones. The D.A.T. made himself responsible for the efficiency of the trains in this respect; and whenever trains stopped away from a regular office, which they did nearly every night, they were still in communication with the neighbouring stations and blockhouses.

Armoured Trains
used as Moving
Telegraph Offices.

With several trains patrolling a section, especially at night, it was found advisable

that they should all halt at fixed intervals and connect up with the telegraph wires to receive instructions and news. The "Ubique" carried out the whole of Maj.-Gen. Plumer's telegraph work when he crossed the railway near Houtkraal in Cape Colony in pursuit of De Wet.

Electric Light on
Armoured Trains.

One of the latest improvements made to Armoured Trains was the addition of a strong electric light. The steam for the engine and turbines working the dynamos was supplied by a flexible pipe from the engine dome, the pipe being fairly protected by steel plates.

No. 1 Train near Brugspruit worked itself into the middle of Viljoen's Commando when attempting to cross the Eastern Transvaal line. With the aid of the two search lights carried by this train 26 Boers were killed and wounded, and a considerable quantity of wagons and horses captured.

A more technical description of the search lights in use is given in Appendix A to this Part.

CHAPTER III.

DETAILED DESCRIPTION OF AN ARMoured TRAIN AS USED LATTERLY.

The train was marshalled with the machine gun trucks at either end and the engine in the middle (*Plate 88*). Immediately at one end of the engine was the tank truck, and between this and the Maxim was the gun truck. At the other end of the engine, between it and the other Maxim truck, were the dynamo and enginemen's van, the officers' coach and the telegraph and ration van. The Maxim and gun trucks were bogies, the remainder usually short trucks. Every truck of an Armoured Train was provided with hand brakes. Marshalling.

Sometimes the dynamo truck was in front of the engine and then the gun bogie preceded by the leading Maxim bogie; behind the engine then came, firstly the tank truck (with a tender connection to enable the train to remain away from watering stations for a considerable time), secondly a box truck divided into two compartments (one for the telegraphist and his instruments, the other for the officers) and finally the second Maxim truck.

It will be seen that the train so marshalled was ready to move instantly in either direction, although possibly not in accordance with Board of Trade ruling on the subject.

If a material truck or bogie be taken it should always be propelled in front of the train, and be provided with cow-catchers at either end; in South Africa these latter were made extra strong, and successfully cleared considerable obstructions such as heaps of stones placed on the line by the enemy.

The O.C. Train travelled in the leading Maxim truck and the second officer usually in the gun truck. Under no circumstances should both officers travel in the same truck, as a successful mine or derailment may place both *hors-de-combat*, thereby leaving the train without an officer. Posts of Officers.

INTERNAL SIGNALLING COMMUNICATION.

Leading from the engine to the Maxim trucks at either end of the train were signal wires connected with the gong and whistle; and beside the O.C.'s post on the train in either Maxim truck was the vacuum hand brake lever. The whistle and gong wires were brought conveniently to the O.C.'s post; thus, without moving his position from where he had the best view in front and on either side of the train, he was in direct signalling communication with the driver of his engine and was also able to apply the brake instantly to the whole train should occasion demand; this alone was sufficient signal to the driver to stop, whereas taps on the vacuum valve lever were enough to attract his attention if the signal wires were broken by bullets or from other causes; in the latter case the display of flags or lanterns could be seen by the driver through his look-out slit, and the train worked accordingly. Signal Wires and Vacuum Brake.

At first but little care was taken to protect the vacuum brake pipe from rifle bullets. To do so would have necessitated a considerable quantity of plating along the full length of the trucks and the provision of overlapping plates between them; the latter arrangement makes coupling a dangerous operation, and the advantage gained was not sufficient. To overcome the danger of the vacuum pipe being cut, thus putting on the brakes, a wire was led into every truck from the vacuum release valve; a series of shrill whistles from the engine was the signal that the vacuum brake gear had gone wrong; the release valve wires were then pulled by the garrison of the trucks, the brakes fell away, and the train then proceeded under brake power of the engine only. Vacuum Brake Pipe.

Another internal communication was the installation of telephones in the two Maxim trucks. These enabled the O.C. to give directions to the garrison at the extreme end of his train, and let him know that it was on the alert; and as the gun truck was next to one of the Maxim trucks, the O.C., so long as the wires were not cut, could transmit orders to the gunners when under hot fire. The telephones were in direct charge of the R.E. linemen, one of whom travelled in each Maxim truck. It is almost unnecessary to say that all wires between trucks were joined with draw clips, which pulled asunder without damage if the train for any reason became parted. Telephones.

MAXIM TRUCKS.

Armouring.

These trucks, which were the leading ones at either end of the train, accommodated the Maxim guns and their detachments as well as the majority of the Infantry escort. The trucks used were roofed bogies, sheathed on the sides and ends with $\frac{1}{2}$ -inch steel plates from floor to roof.

The space between sides and roof provided light and air, and admitted of an extended view of the surrounding country ; it was available also for rifle fire by men standing on ammunition boxes, which were stacked along each side of the truck and used as beds. Firing through this space was, however, discouraged on account of the risk of men being shot from behind through the opposite slit, which happened more than once when a train was under short range rifle fire ; these slits should only be used by look-out men when the train is in places of danger.

A row of fairly large horizontal loopholes, with sliding steel covers, was provided on either side and each end of the truck for fire kneeling. The loopholes on either side broke joint, to prevent an uninterrupted view across the truck when the slides were open.

The side and end plates of the leading portion of each truck were cut at a height of 3 feet from the floor to provide a horizontal slit 2 feet wide along the front and 5 feet back on each side ; this formed a species of barbette in which the Maxim, itself provided with a shield, was mounted. The barbette was cut off from the Infantry portion of the truck by two vertical steel shields, which were fixed at right angles to the sides of the truck and placed overlapping, but 15 inches apart to provide a passage from the barbette into the main body of the truck. These shields protected the Infantry from bullets coming over the 3-foot parapet of the barbette.

Search Light.

The armour plating was carried round the upper portion of the barbette to the roof level, to provide cover for the search-light man who was perched on a seat above the Maxim ; this man's head and shoulders projected through the manhole in the roof so that he could manipulate the search light ; his head was protected by three hinged plates which could be let down at pleasure.

The drinking water tank was placed in the barbette, in the corner formed by the rearmost shield.

Cape Colony Pattern Truck.

The most recent Maxim trucks were six constructed in Cape Colony under the supervision of Capt. F. G. Fuller, R.E. They were designed for use in the hilly parts of that Colony, and were provided with sloping roofs of $\frac{3}{8}$ -inch steel sheets to deflect bullets fired from heights above.

In these trucks armoured wings projected on either side immediately behind the Maxim barbette ; and the O.C. Train could manipulate the vacuum brake and engine signals both from the barbette and from inside the truck. The wings were a very great improvement, and enabled the O.C., while still under protection, to have a very fair view down the line as well as ahead ; this would be a great advantage to a train that had worked itself into the midst of a Commando in the act of crossing the line. These trucks were also provided with sliding end doors in addition to those at the sides ; and thus through communication on trains could easily be arranged from either end to the engine.

Truck Armoured with Rails.

An ingenious and rapidly constructed truck was designed by Lieut. H. O. Mance, R.E., in which rails were exclusively used for the armouring.

A wall of rails, laid horizontally and supported between uprights, was carried up each side of the truck to a height of 5 feet, one rail 4 feet from the floor being omitted to provide a horizontal slit for rifle fire. Bogie trucks were used ; and the ends were built up with layers of sleepers, laid across the truck, against which the rails were butted ; this was essential to prevent a collision causing the rails to shoot forward or back. When these trucks were used on Armoured Trains, the Maxim was fixed to the sleepers at one end.

Lieut. Mance turned out many of these trucks, which are suitable for fighting on flat country and were extensively used both on Armoured Trains and as escort trucks on the C.G.R. north of the Orange River.

The following description has been furnished by Lieut. Mance :—

“ By means of a set of six clips and wedges, any bogie can be armoured all round to the height of its sides with ordinary rails and sleepers in less than an hour. Three clips are required on each side ; the two outer ones are put on first, just catching the ends of the rails ; these are removed one at a time for each rail to be inserted ; when all the rails are in position the clips are slid inwards a few feet, and the third clip put on at the centre of the rails. Two wooden wedges are driven in between the clip and the outside of the truck to make everything tight. The ends of the truck are protected with sleepers. The material can be used for repairs to the line if required ; neither the truck nor the material is damaged in any way by this method of armouring.

The cost of one set of six clips made at Kimberley was 30s. A set was issued to each R.S.O. on the Kimberley section, so that, in the event of the line being cut, the working party and escort might have some protection without the necessity of keeping a permanently armoured truck at each station."

GUN TRUCKS.

On the twenty Armoured Trains in active use there were several classes of gun trucks, in which were mounted respectively 12-pounder, 6-pounder and 3-pounder Q.F. guns (*Photos 49 and 57 to 59*). The 12-pounders predominated, there being 13 of these guns, and the trucks in which they were mounted were of the most recent design (*Plate 89*).

The 12-pounder gun was mounted on either a Naval pedestal or a Land Service Mark II. mounting, firing over a 3-foot steel parapet. The bogie truck carrying the gun measured 36 feet long by 7 feet 6 inches wide, and the pedestal was placed exactly in the centre of the floor. To allow the gun to fire at right angles to the line, the armour plating of the truck sides was curved outwards at a radius of 5 feet, struck from the centre of the pedestal; and the truck floor was extended on each side to take the two sponsons so formed. These sponsons easily cleared the moving structure gauge for South African railways.

One 12-pounder
Q.F. Gun.

Commencing from 5 feet fore and aft of the centre of the truck, the side armour-plates were cut tapering, from the full height of 3 feet to 2 feet at either end, to allow for depressed fire along the line of rails. From the curve of the sponsons the end portions of the truck were completely decked over with $\frac{3}{8}$ -inch overlapping steel plates. A central well was thus formed in which the gun was worked; and the decked portions at either end provided blast-proof magazines, over which the gun could fire with safety when required to come into action up and down the line.

One of the vexed points in designing a gun truck for all-round fire was the provision of suitable accommodation for the storage of ammunition. This was overcome by the blast-proof magazines at either end of the truck, each of which held comfortably 100 rounds and also left room for those men of the detachment whose duty it was to serve out the ammunition; these men worked under perfect protection. To provide for the safety of the officer, layer and loading number, a horseshoe-shaped $\frac{1}{2}$ -inch steel shield was fixed to the cradle of the gun, therefore travelling with it; this shield was 3 feet 6 inches high, thus bringing up the protection to a height of 6 feet 6 inches from the floor of the truck, and through it the gun projected; the sides were brought back past the breech of the gun, thus providing cover except from reverse fire coming in over the top of the truck armouring. For protection from reverse fire up or down the line flap shields were fixed across the truck, hinged to the deck plates at either side of the gun well. For reverse fire at right angles to the line two curved shields, bent to the same radius as the sponsons, were provided; these shields had clips fixed by which they could be set up on the curved side of the sponsons, along which they slid easily; and they were light enough for two men to lift easily from side to side of the truck. A combination of the flap and curved shields provided against reverse fire coming from any angle of the line.

To shelter the gun detachment from rain and sun, an awning was provided over the gun well. This was attached to a ridge pole, supported by two uprights standing on the centre line of the truck just clear of the sweep of the muzzle; the awning was held at the sides by hinged ribs fixed to the uprights; and the whole could be furled to the ridge pole by pulling on two halliards. Even when the awning was not furled to the ridge pole the gun could be fired in any direction except exactly up and down the centre of the line. To allow of this latter fire also, the two uprights were hinged just above the deck plates, being held in their upright position by ferrules; when the ferrules were slid up free of the hinges, the whole furled awning and uprights could be swung to one side and laid flush with the decks, thus enabling the gun to be fired at any angle to the line.

The garrison of this class of gun truck consisted of one officer and five men, R.A., and 11 of the 20 Armoured Trains were thus manned.

The 12-pounder guns were mounted, and the trucks armoured, in the I.M.R. workshops. The former work was usually done under the supervision of a skilled Ordnance Officer; and before being passed out to the trains the gun trucks were submitted to an exhaustive test by a committee of R.A. experts headed by the O.C. R.G.A. At these tests the guns are fired at all angles, both with the truck empty and loaded with ammunition,

Two 12-pounder
Q.F. Guns.

Two out of the twenty Armoured Trains were provided with bogie gun trucks carrying two 12-pounder Q.F. guns (*Photo 52*). These were designed and constructed in the Naval workshops at Simonstown, Cape Colony; they were considerably more roomy and comfortable and more easily roofed than the latest class of one-gun truck, but were not economical in guns.

The armouring consisted of boxing in the truck with $\frac{1}{2}$ -inch steel plates, and the guns were mounted on pedestals at diagonal corners. The steel plates across half each end and half each side were cut down to a height of 3 feet from the floor of the truck, to allow the guns to fire over them, the diagonally opposite portions of the plating being left high and loopholed. Each gun could fire on an arc from along the line in one direction to very nearly down the line in the opposite direction; so that the two guns could cover practically every angle of the circle. The enemy were, however, usually found to one side of the line; and out of the many times these guns engaged the enemy, only on three occasions was it possible to bring both guns into action.

Mounting of
12-pounder Q. F. Gun
Pedestal.

Before going on to describe the remaining trucks of an Armoured Train, it is here necessary to give details of the mounting of the 12-pounder Q.F. gun pedestal in the gun trucks. These guns are quickly handled and, having a range of 8,000 yards, are strongly recommended for use on future Armoured Trains.

In the Land Service mounting the foundation ring (usually buried in concrete) and the long holding-down bolts formed important parts in securing the pedestal to the ordinary board flooring of a truck. A 6ft. \times 6ft. plate of steel or wrought iron, $\frac{3}{8}$ inch thick, was laid in the centre, and on this the pedestal stood; the steel plate was introduced to distribute the shock of discharge over a considerable area of the floor, and it was fastened down by numerous $\frac{1}{2}$ -inch diameter bolts passing through the floor and the longitudinal channel-iron frames of the truck. The holding-down bolts of the pedestal, having been cut to a suitable length, were passed through the floor of the truck and through the heavy foundation ring, which was placed below, bearing on the longitudinal channel-irons supporting the flooring of the trucks. By setting up all bolts rigidly the pedestal was secured to the truck floor frames, which safely withstood the shock of discharge of the gun.

The ordinary bogie trucks in use on the I.M.R. and C.G.R. were suitable for 12-pounder Q.F. guns; and no alteration of the springs was necessary. The guns of No. 1 Armoured Train fired over 500 rounds, and the truck required no repairs after it was put in commission.

6-pounder and
3-pounder Q. F. Guns.

The 6-pounder and 3-pounder guns on the Armoured Trains were very similarly mounted to the single 12-pounders described above, but in short trucks; blast proof magazines were not, however, found necessary.

Plates 90 and 91 show types of earlier patterns of these trucks.

Heavy Guns

Although not within the scope of this report, it is worth noting that 6-inch and 9.2-inch guns (*Photos 50 and 51*) were mounted and fired from railway trucks during this war. The larger gun only fired its testing shots, but both of the two 6-inch truck-mounted guns were in action at Modder River and Fourteen Streams, when special curved sidings were built for them.

Later on, a more adventurous use was made of one of the 6-inch guns. It was temporarily attached to No. 2 Armoured Train, being dropped at fortified stations at night. By means of a girder, which could be swung out at right angles to the truck and set up with jacks, the R.A. in charge were able to come into action within five minutes of the stopping of the train. The gun fired a considerable number of rounds at right angles to the line without damage to the truck or permanent way. This is a practical proof of the feasibility of a scheme for the coast defence of England which was put forward some years ago by Captain (now Brevet Major Sir Percy) Girouard, R.E. There is no doubt that on the 4-foot 8 $\frac{1}{2}$ -inch gauge of English railways 6-inch guns can be mounted on railway trucks from which an all-round fire can be obtained.

Photos 47, 53, 54, 56, 60 and 61 show some other examples of trucks for guns of various calibres.

ARMOURED ENGINES.

The armoured engine requires but little description. It consisted latterly of a good strong traffic engine, with the cab and tender and injector pipes protected with steel plates. To protect the enginemen from reverse fire, a curved hood was fixed from the cab roof down over the front portion of the tender; from the sides of the cab projected small plated wings, into which the driver could put his head and get a view front and back through the spy holes.

Windows were provided on each side which could be closed by sliding steel plates.

The steel door was invariably made sliding and not hinged. The boiler did not require to be armoured as it was bullet proof.

Engines used for this purpose should be strong. Although the load may appear light at first glance there are occasions when long intervals must elapse between the times an engine can be washed out. For this, and to provide against accident, there should be one spare armoured engine for every group of five Armoured Trains.

Photo 48 shows one of the first armoured engines.

DYNAMO TRUCKS.

Next in importance to the fighting trucks was the dynamo truck. This was simply a box truck, loopholed and plated to a height of about 5 feet. At one end was placed the search-light dynamo, which should preferably be driven by a small steam turbine, receiving its steam from the locomotive; for this purpose the dome of the engine was bored, and connected with the dynamo truck by a flexible steam pipe. The dynamo truck always travelled next to the engine. In it were fixed six bunks, and the only men allowed in it were the four enginemen, the guard and the electrician.

The two enginemen off duty and the electrician should fight from this truck; from the loopholes at one end they can bring a good flanking fire on the engine and so prevent its being rushed.

TELEGRAPH TRUCK AND OFFICERS' COACH.

These were seldom armoured. The telegraph clerk and servants took post in one of the Maxim trucks when in the presence of the enemy.

CHAPTER IV.

ADMINISTRATION OF ARMoured TRAINS.

The following are some of the Army Orders issued in reference to Armoured Trains ; these give a fair idea of the system adopted in working them.

Appointment of
A.D.R., Armoured
Trains.

A.O. 3 of 20th April, 1901.—Appointment—Captain (Local Major) H. C. Nanton, R.E., is appointed A.D.R., Armoured Trains.

He is responsible for the efficient equipment, garrisoning and technical working of all such trains, and should report to the A.G., Army H.Q., Pretoria. Attention is invited to A.G. (Circ. Memo.) No. 34 which has been issued this day to all concerned.

The following is a copy of Memo. referred to :—O.C.s Sections of L. of C. who consider that, owing to the near approach of the enemy, it is desirable that an Armoured Train or Trains should be placed on their Section, should communicate with the A.D.R., Armoured Trains, who, with the approval of Headquarters, will as far as possible place the trains as desired to act under the orders of O.C.s L. of C.

Duties of Armoured
Trains.

The normal duty of Armoured Trains is the protection of traffic ; and for this reason the O.C. Train should be allowed the greatest possible freedom of movement on the section on which he is placed, it being his duty to acquaint himself with the most threatened part of the section and the daily movement of trains over it, so that he may afford them the greatest possible protection.

It must be distinctly understood that Trains are placed on a section to meet certain contingencies ; and when these no longer exist, the A.D.R. will remove them for duty elsewhere. To carry out these duties effectively Armoured Trains should not have their headquarters at strongly held stations, and should as a rule only run into these for the purpose of coaling, repairs, etc. ; and it is preferable that the halting place, whether by day or night, should be at small stations and should constantly vary. For these reasons it must be distinctly understood that O.C.s Sections, L. of C., are on no account to look upon Armoured Trains as conveniences for inspection purposes ; but there is no objection to their being used for this purpose, provided it does not interfere with their patrolling duties.

Communications to the A.D.R., Armoured Trains, should be addressed to Headquarters, I.M.R. Offices, Pretoria.

Position of A.D.R.,
Armoured Trains, on
the Army Staff.

A.O. 2 of 17th May, 1901. :—Referring to A.O. No. 3, of 20th April, 1901, it is notified that the A.D.R., Armoured Trains, is solely responsible to the A.G., Army H.Q., for the *personnel* (officers and men) and armament of Armoured Trains ; and changes are not to be made in such *personnel* or armament without reference to him.

The A.D.R. is of the Army H.Q. Staff, and has the privilege of seeing the Chief daily and taking his orders as to the distribution of the trains. Being on the H.Q. Staff he has the advantage of learning the strategic moves in progress, and his railway knowledge enables him to inform the Chief definitely what the trains can or cannot do, which would be difficult for a staff officer unacquainted with railway working.

The A.D.R. is also one of the D.R.'s staff officers ; and this is essential to secure the smooth working of Armoured Trains with other traffic, for Armoured Trains must not hamper traffic but should assist it when it would otherwise come to a standstill in the presence of the enemy. It is to the D.R. that the A.D.R., Armoured Trains, must turn for the railway staff of his trains and the construction of armoured trucks, etc. The D.R. does not control the positions or fighting arrangements of the trains ; but in all conveying it is essential that the A.D.R., Armoured Trains, and the A.D.R. who controls the traffic should be immediately under the same Chief, viz., the D.R., who also was the originator in South Africa of Armoured Trains in their present state.

D.A.D.R.s,
Armoured Trains, in
Cape Colony.

The A.D.R., Armoured Trains, is assisted in Cape Colony by Capt. F. G. Fuller, R.E., D.A.D.R., Armoured Trains, on Lieut.-Gen. French's Staff ; this officer controls all trains working in Cape Colony south of the Orange River, as does Lieut. H. O. Mance, R.E., D.A.D.R. at Kimberley, all trains in Cape Colony north of same. Both these Officers apply to the A.D.R., Armoured Trains, for more trains should their Generals require them or give them up for other sections according to circumstances.

Search-Lights.

Capt. R. S. Walker, R.E., O.C. Search-Light Section, R.E., has complete charge of all search-lights on Armoured Trains and is responsible for their efficiency.

Engine Inspectors.

In addition to the above staff there are three Armoured Train engine inspectors (Sergeants, R.E.), and most useful men they are ; the enginemen are soldiers, and the O.C.s of Trains have seldom the technical knowledge necessary to judge if the enginemen are up to the standard required of them.

Appendix B to this Part shows the "Monthly Return" rendered by O.C.s of Armoured Trains, giving details of their commands.

CHAPTER V.

RELATIONS BETWEEN ARMoured TRAINS AND TRAFFIC DEPARTMENT.

As previously stated Armoured Trains, if properly handled, should add but little to the traffic difficulties; and it is often due to their presence that movement of ordinary trains is possible. At the same time it must be distinctly understood that badly handled Armoured Trains give rise to great traffic delays and defeat the very purpose for which they are sent.

It is essential therefore that O.C.s Armoured Trains should have a rudimentary knowledge of train working; otherwise they will not grasp the confusion created by unreasonable demands. Each Armoured Train was provided with a guard or passed soldier and the O.C. was directed to make the best use of this man's knowledge.

As a rule the movements of Armoured Trains should be made to fit in with ordinary traffic, the O.C.s taking care, in consultation with Station Masters, not to delay the regular up and down flow of ordinary trains. At the same time Armoured Trains proceeding at speed to any point, either by order or on account of the presence of the enemy, should take precedence of all other trains, and be able if necessary to stop all traffic temporarily. Throughout the I.M.R., provision was made for this by the Traffic Manager issuing a circular to all Station Masters, directing that an O.C. of an Armoured Train, on presentation of a written order, should be given preference over all other trains; and that, if the O.C. demanded it, traffic on a section should be entirely suspended while the Armoured Train went out to investigate. Precedence of Trains.

Similarly, throughout the I.M.R., an O.C. of an Armoured Train was entitled to send telegrams prefixed "A.T.," which gave them precedence over all other telegrams and enabled him even to break into train crossing arrangements. Privileged Telegrams.

When an O.C. availed himself of these powers each case was gone into by the Traffic Manager and the Supt. of Railway Telegraphs, who passed their remarks on to the A.D.R., Armoured Trains. All O.C.s of trains clearly understood that each case would be investigated and that they would be held personally responsible for a wrongful use of their powers.

In view of the above remarks it will be seen how essential it is that cordial relations should exist between the O.C. of an Armoured Train and the Railway Traffic Staff; and one of the duties of a train commander is to make himself personally acquainted with the Station Masters in the section on which he is working; a dictatorial manner in dealing with these officials should be avoided.

Occasional mistakes occurred on both sides, by O.C.s making unreasonable demands and by station-masters at times taking upon themselves the grave responsibility of deciding that the movements of Armoured Trains were of secondary importance and thereby needlessly delaying them. On the whole, however, the arrangements were satisfactorily carried out, and the Armoured Trains and Traffic Officials worked amicably together.

CHAPTER VI.

TACTICS OF ARMoured TRAINS.

Positions of Gun
and Maxims in
Action.

It was always considered advisable to have the Maxim truck and the gun truck together ; this enables the two to be detached at favourable points if necessary, and the gun is under sufficient protection and should be safe.

This practice should be adopted if the enemy are in a position astride of the line. A Maxim truck and the gun should be detached clear of the enemy's rifle fire, in a position most advantageous for the use of the gun ; the remaining portion of the train should then move forward into close action, engaging the enemy with the rifles and the machine gun of the second Maxim truck. This manœuvre can easily be carried out if it happens that the gun truck is in the drawn portion of the train ; but, should it be in the propelled portion, the whole train must move forward into close action and there detach the leading Maxim truck ; the remaining portion of the train including the gun truck is then drawn back into a suitable artillery position.

This manœuvre has many advantages, and was carried out under both the above conditions on several occasions. Pre-supposing that the enemy are without guns, the advanced Maxim truck should be able to hold out against any odds, and it tends to hold the enemy in position and make it difficult for him to get round the train and cut the line behind it. The fact that the gun and second Maxim truck are drawn back, often a mile or even more in flat open country, would make the attempt on the part of the enemy much more difficult than if the train were kept intact.

As to dividing the train in the presence of the enemy, some of the new 6-pounder Q.F. gun trucks were most convenient for this purpose. The gun was mounted on a bogie truck, and being much smaller than a 12-pounder there was also room to carry a fair Infantry escort. The truck was therefore self-contained, and could be safely detached by itself, the last Maxim truck being able to prolong the line still more.

In taking groups of trains into action the same principle should be observed, viz., an interval should be maintained between the trains in open country of at least 1,000 yards. The last train of the group should keep up a constant patrol to the nearest body of troops or fortified post, to prevent the line being cut behind the trains ; for example, during the engagement at Bartman's Siding, the last train of the group kept up communication with the troops at Potfontein.

Amongst the duties of Armoured Trains are :—

Duties of Armoured
Trains.

- (1). In conjunction with Columns in the field, placing themselves before the enemy whom the Columns are driving on to the line.
- (2). Acting on the flank of a Column or line of Columns, the train being well advanced to prevent the enemy breaking to that flank.
- (3). Reinforcing stations and camps on the Railway which are threatened by the enemy.
- (4). Escorting ordinary traffic trains.
- (5). Reconnoitring.
- (6). Patrolling by day and night.

(1) and (2). Action
in Conjunction with
Columns.

In the case of (1) and (2) but little description is necessary. The line must be divided into sections, each train taking a section. Trains should, especially at night, be usually on the move in their section ; and where the line is not held by blockhouses or posts fairly close together, endeavour should be made to place small parties at short intervals along the line to give warning of the approach of the enemy ; these parties should be provided with rockets. With native watchmen, providing them with bundles of straw to light is a fairly effective means of attracting the attention of the trains.

System of Signals
with Posts on the
Line.

Blockhouses and Posts should always be provided with rockets arranged in racks, in order that they may be conveniently and quickly fired. A system of signals should be adopted ; in South Africa one rocket meant "Enemy attacking," whilst two was a call for help.

All trains, whilst moving as much as possible during the night, should halt at prearranged hours and come in on the telegraph wires ; with their phonophores or telegraph instruments they should get into communication with each other and

with the neighbouring stations. It is essential that this should be done several times during the night, both to get news and to receive orders from the senior officer of the group of trains acting together.

In the case of (1) the trains would probably not use their search-lights until quite sure that the enemy were within effective rifle range, the closer the better; whereas in the case of (2) search-lights would be used to a considerable extent, for in this case probably the best *role* of the trains is to make a show to prevent the enemy breaking to the flank. This of course might be the case in (1) also when the object was to delay the enemy for the pursuing columns to catch up; a display of force would then be correct, and search-lights would be used freely.

(3) Requires no description except to state that the arrival of a train often adds to the peace of mind of some of the posts, and the existence of Armoured Trains available for this purpose admits of much weaker garrisons than would otherwise be warranted.

(4). Escorting ordinary traffic is one of the most important duties of Armoured Trains. When engaged on this work the ordinary trains are either run in convoys under the protection of Armoured Trains, or the latter remain on the threatened section escorting trains each way. By adopting this precaution scores of trains in South Africa were saved from falling into the hands of the Boers.

When the threatened section is reasonably short it is better that trains should be escorted one by one, but when a long stretch is threatened the convoy system must be adopted. The objections to the latter system are :—The danger of collisions from a mass of trains moving at close interval, the hampering of traffic by the necessity of despatching several trains together from crowded yards, the loss of time at crossing and watering stations, and the slow rate of speed necessary with a mass of trains moving at close interval.

When escorting, the place for the Armoured Train is behind, whence it can keep the train it is protecting in view. It may at times be necessary to run in front to give the civil enginemen confidence, but as a rule the correct place is behind.

When running in convoys the trains should be marshalled with an ordinary train leading, then the Armoured Train, and last a second or even third ordinary train. When the convoy consists of more than two ordinary trains it is best to have the majority of the train escorts (if any) collected in armoured escort trucks on the last train.

The convoy system was worked for many months north of Kimberley and also on the Pretoria-Pietersberg Line. In the former case an additional precaution was taken by propelling a rail-armoured bogie, garrisoned with Infantry, in front of the engine of the leading train.

(5). When employed on reconnoitring, and there is reason to believe the enemy is in force, it is quite wrong to send an Armoured Train miles in front of the main body, unsupported by troops to prevent it being cut off. An Armoured Train should not in these cases be looked upon in the same light as a few horsemen sent out to obtain news; for the latter there would probably be several different roads by which they could return.

In reconnoitring towards a large force of the enemy an Armoured Train should work in conjunction with mounted troops, the principal duties of the latter being to assure the line of retreat of the train (*viz.*, the rails) and to scout on the flanks, the Armoured Train keeping well in advance of the horsemen.

Gorges where the train cannot use its guns and rifles to advantage must be scouted before the train enters, either by the mounted troops or by the train garrison.

Used to advantage an Armoured Train can keep at bay a force infinitely its superior in numbers, and can cover the safe retirement of the mounted troops acting in conjunction with it. It will also form a rallying point for the mounted troops should they be hard pressed.

(6). Patrolling by day on blockhoused lines is not a very important duty, as the blockhouses, which are provided with telephones, can usually report anything that can be seen from the line. A certain amount of day patrolling is however advantageous.

As most trains in South Africa were supplied with powerful telescopes, extensive views could often be had from the tops of rises and from neighbouring heights; some trains were provided with native scouts, their horses being accommodated in a cattle truck attached to the train. Good work and important information was often obtained by trains lying in intermediate sidings by day and putting out their mounted scouts.

It is better that the enemy should not be certain that the Armoured Train will be in the same station all day.

Patrolling by night is one of the very important duties of Armoured Trains, for it is

Use of Search Lights.

(3). Reinforcing Stations or Posts.

(4). Escorting Traffic.

(5). Reconnoitring.

(6). Patrolling. By Day.

By Night.

at night that an enemy most frequently makes attempts to cross a railway ; this is almost invariably the case when he has to cross with guns and wagons.

Trains should have sections blocked for them and arrangements made for the line to be set through small stations on the blocked section, so that the trains may pass through without sounding a whistle or displaying a signal. Fires should be properly shaken out before starting on the night patrol, so that the constant dropping of live coals may be avoided. Enginemen should so control their fires that there will be no noisy escape of steam, and no lights should be burning. If these precautions are taken, and the trains move slowly, they will be almost noiseless ; they may, and in South Africa often did, arrive unnoticed in the midst of a Commando crossing the line ; then, by suddenly turning on the search-light, good work may be done.

In night patrolling it is not expected that a train should be constantly on the move. It should halt hidden in a cutting or behind a hill, here for an hour there for an hour, always moving from place to place slowly and as noiselessly as possible. At each halt it should connect on to the telegraph wires to get the latest news.

CHAPTER VII.

ESCORT TRUCKS, ARMoured ENGINES, AND GUARDS VANS FOR ORDINARY TRAFFIC TRAINS.

In close connection with Armoured Train work proper was the provision of armoured escort trucks and vans for attachment to ordinary trains on threatened sections. The garrisons for these trucks were usually found from various details travelling by rail, it being the duty of Station Commandants and R.S.O.s to see that the escort trucks were properly garrisoned. Escort Trucks.

A cheap and efficient truck, which could be quickly constructed, was designed in the Locomotive workshops in Pretoria (*Plate 92*).

The armouring consisted of simply a double walling of corrugated-iron sheets, about 9 inches apart. Loopholes and doors (preferably steel plates) were pierced through the corrugated iron, and the space between the double walling was filled with sound broken stone of 1-inch gauge. These trucks were bullet proof, and cost about £20 each to make up. There were some eighty in use in the Transvaal.

In Cape Colony north of the Orange River the armoured bogies designed by Lieut. H. O. Mance, R.E., were in general use (see Chapter III. *ante*).

A new pattern of escort truck was latterly turned out in the I.M.R. workshops, Pretoria. It was designed for work on the hilly portion of the line in the low veldt. Its special feature was that the garrison was safe from plunging fire from the hillsides above, and the men could use their rifles with equal facility when shooting up hill or on the level. The design consisted of a steel-plated truck, armoured in the ordinary manner to a height of 3 feet; side plates were hinged in sections to the fixed portions, and arranged in connection with counter weights so that each section could be tilted inwards at an angle of 45 degrees to the vertical. The loopholes were cut in the hinged sections, so that when the sections were in a vertical position the men could fire on the level as from ordinary loopholes, and when they were inclined fire from a kneeling position could be delivered upwards at an angle of 45 degrees without inconvenience. A strip of steel plating, fixed to the roof, deflected all bullets not intercepted by the inclined sections. When all the sections were in the inclined position, the garrison was practically protected from descending fire at an angle of 45 degrees. I.M.R. Pattern for Hilly Country.

Armour plating the cabs of traffic engines was adopted for practically all those working on the Pretoria-Pietersberg line, and at times on other threatened sections. As a rule the plating was carried only half way up the cab, so that the drivers were not subjected to excessive heat. Armoured Engines.

The necessity of this class of armouring was proved by the number of enginemen, mostly civilians, who met a soldier's death while driving in unprotected engines in the presence of the enemy.

Brake vans were also protected (*Plate 93*) and provided with projecting wings for look-out purposes. Armoured Brake Vans.

APPENDIX A TO PART V.

SEARCH LIGHTS ON ARMoured TRAINS.

By November, 1901, twelve electric-light plants, suitable for armoured train work, were tried in South Africa, and thirteen more were to be tried shortly.

A great deal of experience was gained with the former; but it is hardly possible, without knowing the results of the others, to decide exactly on the best form of plant for armoured train work.

Description of
Plants.

The twelve plants first used were made up from :—

- (a). Five steam engines of 5—10 B.H.P.; all except one (which had its own boiler and petrol furnace) taking steam from the loco. boiler with a flexible steam connection between loco. and dynamo truck.
- (b). One steam turbine 5 B.H.P. do. do.
- (c). One petrol engine of 5 B.H.P. do. do.
- (d). Five oil engines of 3—8 B.H.P., which, being prime movers, were not dependent on the loco.
- (e). Dynamos of all makes, speeds and voltages, from 52—115 volts and 15—40 ampères.

The dynamos were driven by belts in all cases except:—the steam turbine through wheel gearing, one steam engine direct coupled, and one steam engine through chain gear.

- (g). Three 18-inch metal mirrored projectors, }
 Two 12 " " " " " } All hand control.
 Seven 12 " glass " " " }
 Two 8 " glass lensed " " }

The thirteen later plants were to consist of :—

- (i). Nine steam engines of 5—7 B.H.P., all but four being provided with their own boilers and petroleum or petrol furnaces.
- (ii). Four steam turbines, 3—5 B.H.P., with their own boilers and petroleum or gasoline furnaces, or fixed on loco.
- (iii). Eleven light high-speed dynamos, 100—110 volts, 15—25 ampères, four to be belt driven, four by wheel gearing, and three by chain. Two direct-coupled dynamos 65 volts 30 ampères.
- (iv). Three of the oil plants already fitted, supplemented by accumulators.
- (v). Two 18-inch projectors with mechanical controlling arrangements, and eight 12-inch projectors for hand control; all with glass mirrors.

Experience gained.

Steam Engines.—These were very satisfactory in working. They should have their own boiler and so be independent of locomotive; they could probably be got into $\frac{1}{4}$ truck, even for two lights.

Experiments with petroleum furnaces with this object were initiated.

Steam Turbines (De Laval).—These were most compact little plants, and could be fixed in the loco. itself; even if supplied with their own boiler and furnace, they could be accommodated in 6 square feet of floor space; they are virtually noiseless. It is anticipated that such a plant could be arranged to run without any attention and, with an automatic lamp, could be worked by an unskilled man for a long time.

Oil Engines were not satisfactory; they are slow to start and unreliable.

Even with accumulators (which are a great additional expense) oil plants will probably continue to be a source of worry.

Petrol Engines have the same disadvantages as oil engines, but not to such an extent. The plant used on trek gave very little trouble after it was adjusted, and could be started in about one minute. These engines are more noisy, however, than steam.

Dynamos.—To run a single light a voltage of about 75 volts is best, and a current up to 25 ampères is used for a 12-inch projector. Such a dynamo requires an engine doing about 3—3½ B.H.P. To run two lights 75 volts 45 ampères is necessary, requiring an engine of about 6 B.H.P.

Direct coupled dynamos take up least room, unless the boiler is with the engine, when there is little to choose. The turbine dynamos were virtually direct coupled.

Projectors.—A 12-inch projector is amply large enough and might be made lighter than it is at present. Mechanical control may be found advantageous. Glass mirrors give the best light, but they are shattered if hit; metal mirrors are very difficult to make, but experiments were started in Pretoria to see whether a satisfactory one could be evolved.

As far as present experience goes, it would appear that the two best types of plant for Armoured Train search-lighting are :— Plant recommended.

- (i.). A De Laval turbo-dynamo fitted in cab of locomotive and controlled by loco. driver.
Or a gasoline or petroleum furnaced boiler, with high-speed steam engine or turbine and high-speed dynamo, in a corner of one of the armoured trucks.
- (ii.). One or two 12 inch projectors with automatic lamp, metal mirror and C.C. signalling shutter.

APPENDIX B TO PART V.
ARMoured TRAINS.

Return for the Month of 190...

No. A.T.

(c). Armament.	Ammunition.	(A). Garrison, showing Units.	(B). Truck and Engine Numbers with Administration and Description of Train.	REMARKS.
Search Light. (Show class of engine, whether steam or oil. If oil, state if the train has accumulators or not). Phonophore. Sounder. Vibrator.	Total S.A.A. on Train. per Gun. per Rifle. Shrapnel Complete. Common " Case Shot " 6 Pr. 3 Pr. 450 S.A.A. 1" Nord. 450 G.G. Chamber.	Gun Detachment Coy.. R.E. " Coy., R.E. Infantry Escort Batn..... Regt. Telegraphist T.D.R.E. Lineman " " Signallers { Batn..... Regt. Batn..... Regt. Electricians. { Coy., R.E. S. 4 Sec. R.E. Medical Orderly Coy. or Hospital. Enginemen { Civilian or Coy. of R.E. or Regt. to be shown. Guard Ditto. Details. { State how employed and Regt.	Engine usually working Train and Class. Engine actually on Train and Class.	2nd in Command. Regt. Section on which working.

(A). Under Garrison, the Coy. or Battery of Artillery; Coy. of R.E.; or Battn. of Infantry, etc., must be shown.

(B). Administration must be shown with truck numbers, e.g., C.G.K. or L.M.R. 6749 2345 etc.

The registered number and class of the engine usually working the train should be shown, and a note made of the reason of its being off the train when the return is rendered if this should happen; also the same details of the engine actually on the train should be shown.

(C). All numbers and positions of same on guns, or tripods, etc., to be shown.

..... Regt.

Commanding No. A.T.

PART VI.
ARMY LABOUR DEPÔTS.

ARMY LABOUR DEPÔTS.

ORIGIN.

It is hoped that the following report may be of some value from the point of view of Army Organisation, as so many of our wars are undertaken in countries where Native Labour is indigenous and where white manual labour is only possible in special cases. It should therefore be accepted as a recognised principle that all Departments of an Army operating in a tropical country should consider how far they can supplement their trained units by employing the native labour of the country, thereby considerably reducing the number of soldiers for many fatigue duties. This particularly applies to the Engineer, Supply, Ordnance, and Remount Departments.

Necessity for
Employing Native
Labour.

It can confidently be asserted that it would have been impossible to carry out the rapid repairs on the railway lines in South Africa, or to handle the large amount of Supply and Ordnance stores, without having first secured the ample supply of native labour always available and rendered possible by the Army Labour Depôts during the war. It may therefore be regarded as one of the first duties of every commander of an Army in the Field to appoint a competent officer (local, if possible) to organise and maintain a sufficient supply of unskilled native labour for the requirements of every department of his army.

War Establishments, 1898, page 143, contains the skeleton formation of a Labour Depôt, and lays down on a military basis the staff authorised to deal with a battalion of 1,000 labourers.

An organisation of this sort depends entirely on local considerations; and if considerable freedom is allowed the head of the department authorised to raise the Depôts (as was the case in South Africa), nothing further is necessary than the present fixed establishment as already laid down.

It should be clearly understood, however, that the services of the best local men should be procured, and that they should be consulted on all matters of pay, rations, enlistment, etc.

Army Order No. 4 of the 7th November, 1899, granted Lieut.-Colonel Girouard, R.E., D.R., the necessary authority to take up the question of forming Native Labour Depôts for the requirements of the British Army during the campaign in South Africa. He was given a free hand in the matter; and, from his experience of native labour when constructing the Soudan Railway, he had no difficulty in forming the three Depôts at De Aar, Bloemfontein and Johannesburg, on the basis laid down in *War Establishments*, page 143, but with considerable modifications to meet the local requirements, which varied considerably at each of the above-mentioned places.

Formation of three
Depôts in South
Africa.

This report can be of value only in so far as it gives a detailed statement of the organisation and arrangements made to meet the various local requirements as they arose in South Africa. A few general points may however be of interest.

General Remarks for
Future Guidance.

It is imperative that the Departments of an Army should, in dealing with native labour, avoid all competition; natives are quick to take advantage of the highest bidder, and great chaos would ensue if each Department recruited on its own terms.

With the objects therefore of avoiding all inter-departmental competition and of having a ready reserve of Native Labour always available, the first Depôt at De Aar was started for the requirements of the Army operating in Cape Colony itself. Two shillings per diem or £3 per month, with rations, was the rate fixed for paying the "boys," who were classed as unskilled labourers.

On the Army reaching Bloemfontein, a new Depôt was started there for the O.R.C., the pay being 1s. 4d. per diem, or £2 per month. Unfortunately it was found impossible to maintain this rate, as the natives discovered what had previously been given and objected to taking less. It would have been advisable to have started at £2 or £2 10s. in the first instance.

The Transvaal Depôt being under completely different conditions, a reduced rate of 1s. per day was fixed there and maintained from the time this Depôt was formed.

It may be noted here that all Departments of the Army were supplied with native labour, except the Transport Department; this enlisted its own drivers and leaders (classed as skilled labourers) at £4 10s. per month, with rations; this rate was, however, subsequently reduced to £3 and £2 respectively per month.

It was realised very early in the campaign that it would be necessary to enlist natives for the heavy earthworks connected with the railways; for loading and off-loading the Supply trains; for looking after horses in the Remount and Veterinary establishments; for work in the Hospitals; for sanitary work in the large military camps; for messengers, harness-menders, policemen, guards over supplies, water-boiling, and in some cases as scouts; for herding sheep and cattle; and finally for assisting the soldier and relieving him as far as possible from many of the fatigue duties incidental to active service.

Treatment of
Natives.

If these Depôts enjoyed the success that they are generally credited with, and if they fulfilled their mission, it is undoubtedly because the following simple maxims in dealing with natives were always adhered to:—

- (1). Every native employed by a Depôt received the same equal treatment, pay, rations, working hours, etc.
- (2). Natives were always paid regularly, and as far as possible by an officer.
- (3). Every endeavour was made to keep faith religiously with the natives, and to break no promises.
- (4). The men who were employed to take charge of the Depôts were in every way fitted for the task, from their local experience of natives and from their business training in other capacities.
- (5). The Depôts were run on the very simplest lines, and all tendency to a complication of accounts and management was avoided.

DE AAR DEPÔT.

At the outset it was decided to begin operations by raising 1,000 natives with headquarters at De Aar; Capt. W. S. Scott, of the Vryberg Rifles, and in the employ of the Forestry Department of Cape Colony, was entrusted with the formation of this Depôt, and appointed "Officer in Charge, Army Labour Depôt, De Aar." Recruiting commenced on the 28th November, 1899, and 1,000 natives were enlisted by the 18th January, 1900.

Appendix A shows, on the usual form employed for submitting this return weekly to the D.R., the distribution of the first 1,000 boys enlisted.

These natives were enlisted chiefly from King William's Town in the Kaffrarian district of Cape Colony. The Superintendent of Native Affairs for Cape Colony very kindly authorised certain local magistrates to assist in the matter. Great assistance was also rendered by Mr. R. Dick, Special Magistrate for Natives, King William's Town, by Mr. E. M. Eustace, Assistant Resident Magistrate, and by his Clerk, Mr. E. F. C. Moriarty. Owing to the assistance voluntarily afforded by these gentlemen it was found unnecessary to employ the usual Native Labour Agent, and thus no risk was run of promises, which could not be fulfilled, being made in order to induce the natives to enlist. The only expenses incurred in recruiting were the actual expenses of collecting, transporting and feeding the boys.

Conditions of
Enlistment.

The conditions of recruiting were briefly as follows:—

- (1). "Boys" were enlisted for three months.
- (2). The pay was £3 per month with free rations.
- (3). Passages were paid both ways, and ration money was supplied in lieu of rations whilst travelling to the Depôt.
- (4). The free passage back was subject to a boy giving satisfaction during his term of enlistment.
- (5). No women were allowed at any time to accompany the "boys."

Organisation.

The 1,000 native labourers enlisted were subdivided into gangs of thirty, with one headman (native) and one civilian conductor (white) in charge of each gang.

The gang or unit was made the basis of the Depôt Organisation, and the number (30) was arrived at as being the average number of boys one white man could effectively supervise at their work. In practice it was found that the work performed by a gang depended entirely on the energy of the white conductor and his experience in dealing with natives. Unfortunately the rapid increase in the Depôt did not always permit of

the choice of good men as conductors or of natives with good physique and with previous experience of railway and other government work. It was found essential that the conductor should speak Kafir, and that he should have experience in dealing with natives.

The one headman per gang was a relic of the tribal system,—the headman being supposed to be a chief or influential Kafir who would watch over the interests of the gang. In practice, however, the headmen were of little use so far as work was concerned, and they rarely gave much assistance to the conductors. In a few cases, however, the headmen were sufficiently reliable to take charge of their gangs without any white conductor.

A short memorandum was drawn up for the guidance of everyone employing native labour from the De Aar Depôt, the most important rules in which were approved by the G.O.C. L. of C. Questions of pay, rations, working hours, camp equipment, discipline, term of engagement, sickness, fines, dismissals, etc., were dealt with in this memorandum; and a memorandum card was issued to each white conductor in order that he could answer all questions likely to arise affecting his gang.

Medical attendance was provided for as laid down by L. of C. Order, No. 622, dated 17. 12. 99, Cape Town, which read as follows:—"The sanitary and medical supervision of natives detached from the Labour Depôt, De Aar, to the various stations on L. of C. is vested in the Station Commandant, who will see that in each case a Medical Officer is permanently detailed for this duty." Medical Attendance.

Owing to the heavy demand for labour it was found necessary to increase the De Aar Depôt, which by the 28th February, 1900, reached the number of 2,215; but notwithstanding this large increase practically no addition to the staff was found necessary.

All Departments of the Army (the Transport Department excepted) were authorised to requisition for labour; this was generally done by telegram to the Officer in Charge, Army Labour Depôt, De Aar, who forwarded the gangs as soon as possible, with their conductor in charge and with tents, equipment, cooking-pots and rations for the journey.

BLOEMFONTEIN DEPÔT.

The De Aar Depôt continued to supply all Native Labour until the British occupied Bloemfontein.

One of the first steps taken by the D.R. on reaching Bloemfontein was to obtain the Commander-in-Chief's authority to telegraph to Sir Godfrey Lagden (Resident Commissioner in Basutoland), requesting him to enlist if possible 2,000 Basutos for the purpose of forming an Army Labour Depôt for the supply of natives to the Army during operations in the O.R.C. Of course it was clearly understood that the natives would on no account be called upon to take up arms. The terms of enlistment were to be the same as for the De Aar Depôt, with the exception that the monthly pay was fixed at £2 instead of £3.

The De Aar Depôt was composed of Cape Colony Natives, chiefly Kafirs, the Bloemfontein Depôt of Basutos only.

Great hopes were entertained of the Basutos, but the first batch was long delayed in arriving by the unsettled state of the country between Maseru and Bloemfontein. They arrived however in time to take part in the advance of the Army northwards to the Vaal River. At one time 600 of these natives were employed under Lieut. H. A. Micklem, R.E., on his Construction Train, repairing bridges and constructing deviations across all the big rivers of the Free State. As a matter of interest it may be said that the rapid work performed by the Construction Trains could not have been carried out without the help of these native labourers, who, if well looked after, are very good with pick and shovel and work cheerfully night or day. Work of Basutos on Railway.

It is unnecessary to make comparisons, but a selected Kafir or Basuto will compare favourably on earthwork with the average European navvy in his own country, and in South Africa will far outdo him. Our Infantry working parties could not compete with them on earthwork excavations.

These natives worked well on 3 lbs. of mealie meal per day, with salt, and 1 lb. of meat twice a week, on which days only half the mealie ration was allowed. Rations.

The great difficulty with all natives in South Africa was the fact that they will not remain at hard manual labour for more than a few months at a time, preferring to return to their own country as soon as they have earned a little money. It was necessary, therefore, to constantly recruit fresh batches of "boys" all through the war, a great deal of additional work being thus thrown on the staffs of the Depôts.

Besides being so useful with the reconstruction work on the railway, the Basutos from the Bloemfontein Depôt were employed in many other ways. The whole of the loading and off-loading of supplies from railway trucks was performed by them, and also the loading up of the transport carts and all the heavy work attached to the Commissariat Department.

Only a few occasions occurred of natives having to be punished for stealing supplies in their charge. The custom in such cases was to deal with them very severely, and to administer a fine or a flogging, in some cases both. In most instances punishment was administered by the Commandant of the Station where the native was employed.

Appendix B shows the distribution of the first 1,000 Bloemfontein "boys."

The organisation of the Bloemfontein Depôt was in every way similar to that of De Aar; Capt. W. S. Scott was placed in charge of both. Appendix C gives the list of the Staff he employed, with their rates of pay, etc., as approved by the Chief of the Staff.

It should be noted that the War Office establishment allows 5 sergeants and 5 corporals for every 1,000 men. The system of employing civilians as conductors in charge of gangs was, however, more suitable for South Africa, as these men knew the natives and their language, whereas a soldier without the necessary experience was very often useless in dealing with them. As far as possible Infantry working parties were never mixed with native ones, the two being kept strictly apart.

Appendix F contains the regulations approved by Chief of the Staff for the working of the Bloemfontein Depôt. All recruiting for this Depôt was done by the Resident Commissioner of Basutoland. The "boys" were employed as a rule only in the O.R.C., though a few worked for a short time in the Transvaal.

On two occasions the Basutos came under fire, once with the Construction Train at Leeuw Spruit and on another occasion at Henning Spruit. Ten natives were killed or died of wounds, nine were wounded, and 300 taken prisoners; one conductor was also killed, and six taken prisoners.

Care was taken to compensate the families of the men killed, and the following scale of compensation was adopted:—

Natives Killed.—Their families received 5 head of cattle.

Natives permanently Injured, entailing loss of a limb, received 5 head of cattle.

Natives taken Prisoners, received one month's pay. (These the Boers released and sent back to their own country).

JOHANNESBERG DEPÔT.

On reaching Johannesburg it was decided to open a fresh Depôt for the requirements of the Army in the Transvaal. This was comparatively easy as some 14,000 "boys," chiefly East Coast natives from Portugese territory, were still on the Mines. A large proportion of these had been employed to assist in working certain Mines by the late Boer Government.

It is impossible to write a sketch of the Army Labour Depôts without touching slightly on the Native Labour Question in South Africa, especially as regards the Rand Mines, and it will not be out of place to point out that, if the employment of Natives on Army work had not been left entirely under the control of one department, considerable harm might have resulted; the whole of the mining community were on the watch to see whether the Military were prepared to be guided by their experience of past years and by their hopes for the future, or whether they would establish some new precedent which might take years to eradicate, thus doing great harm to the future development of the Mines.

On the troops first reaching Johannesburg, practically the whole of the Mine labour was placed by the Military Governor of Johannesburg at the disposal of the D.R., who had the advice and assistance of the Mine managers and of the engineers in the R.P.R.

In order to find employment for the 14,000 Mine natives, a new railway coal line was started along the gold reef; this took about 8,000 men, the rate of pay being fixed at 10d. per diem with rations. Another 2,000 were taken on to form a new Army Labour Depôt at 1s. per diem, with rations. The balance was retained by the Mines, a fixed establishment of about 40 "boys" being allowed to each Mine to assist with the pumping and other necessary work at rates for unskilled labour not exceeding 1s. per diem.

It was known that, in addition to the Mine "boys," there were a great number of loose natives, who had deserted from their former masters on the approach of the troops and were looting and committing depredations. On being captured these latter were handed over to the Native Affairs Department (under the orders of the Military Governor), and ultimately found employment with the Army Labour Depôt or on the new railway.

Compensation for
Families of Men
killed

Native Labour
Question in South
Africa.

Employment for
Natives from the
Mines.

The Johannesburg Depôt rose very rapidly to over 4,000 boys. Appendix D shows the Staff and their salaries ; and Appendix E is a copy of a fortnightly return, showing the distribution of the Depôt at the end of 1900. By this period of the campaign, Departments had fully realised the importance of native labour, and it became very difficult to meet every requisition. Capt. H. H. Cowie, of the Bechuana-land Rifles and Assistant Magistrate in the service of Cape Colony, was placed in immediate charge at Johannesburg, under the orders of Major Scott, who was appointed Superintendent of all three Depôts. Capt. Cowie had had previous experience with both the De Aar and Bloemfontein Depôts, and was very successful in his manage-ment of this new one.

Appendix G contains an extract from Army Orders, informing all Departments of the Army that a third Depôt had been formed for the Transvaal, and containing instruc-tions for working Native Labour.

The native gangs soon became so scattered it was found necessary to employ two paymasters, who visited each gang monthly for the purpose of making payments. This enabled Capt. Cowie to employ the whole of his time in the administration and organisation requisite to manage such a big undertaking.

GENERAL REMARKS.

A very important detail which should not be overlooked was the system of identification. With natives it was necessary that each man should have a distinctive badge in order that he might be easily recognised, a name being no clue to a native's identity ; metal badges with distinctive numbers were therefore issued. System of Identification.

In addition a system was adopted from the Mines, which worked exceedingly well in the Johannesburg Depôt and deserves recording. Each native was given a small cardboard ticket, on which was written his name and number ; 31 small spaces, one for each day of the month, were ruled round the edge of the ticket and numbered 1 to 31, and the conductor of the gang initialed one of the spaces each day the "boy" worked ; thus the ticket became a check on the time sheet, as well as affording the native a means of ascertaining if his monthly pay was correct. The tickets were changed each month and the old ones destroyed. When a large number of natives were employed together, a timekeeper with a metal punch was found advisable, to punch each man's card on completing a day's work in the space allotted for that day.

The most important book kept at the Headquarters of each Depôt was the Cash Book, from which a monthly account was submitted through the D.R.'s Office to the Chief Paymaster ; Army Form N. 1531 was used for this purpose. This Cash Account was accompanied by the usual vouchers for each item. Pay List vouchers were submitted on Army Form O. 1623 and Store vouchers on Army Form P. 1922. Accounts.

In addition to the above, two Registers were kept :—one for Europeans, giving the following particulars :— Registration.

Name.	Rank.	Date of Birth.	Date of Enlistment.	Rate of Pay.	Remarks.

and one for Natives, giving :—

No.	Name.	Tribes.	Date of Enlistment.	Rate of Pay.	Where Enlisted.	Remarks.

A regular printed discharge form, with counterfoil, was kept for the purpose of issuing "Certificate of Discharge" to Europeans employed ; this gave the following particulars :— Discharge.

Date of Joining.	Rank.	Promotion.	Date of Discharge.	Character.	Abilities.

This was very necessary, especially in war time, as men should not be discharged without a record being kept, nor should men be discharged without receiving a certificate stating their record of service.

Financial Details.

A few words on the financial aspect are necessary. It is almost impossible to run a Labour Depôt in war time on economical lines. In the first place a few spare gangs must always be kept on hand at each Depôt in case of urgent necessity. Appendix H is a very carefully compiled statement which shows the allocation of expenditure to each Department in South Africa month by month, the number of "boys" and staff, and the cost of administration; from this it will be seen that a considerable sum was spent on Depôt reserve gangs. The administration charges were not high, thanks to the smallness of staff and the very businesslike qualities of Major Scott and his officers.

As the Army moved forward it was hoped that, on the opening of the Bloemfontein Depôt, the one at De Aar might be maintained with 800 boys only; and the same applies to the Bloemfontein Depôt on the opening of that at Johannesburg. This however did not prove to be the case; partially no doubt on account of the Boers continuing their resistance in the O.R.C., and partly also on account of their invasion of the Cape Colony, which caused the figures of the De Aar Depôt to go up. To have practiced economy and to have insisted on Departments reducing their requisitions on the Depôts would have been an ideal arrangement, but a most difficult task in practice; it is suggested, however, for future guidance that a monthly statement should be sent to the head of each Department, showing the number of "boys" employed by that Department and their cost. The only statement of this description which was kept was an "Allocation of Vouchers" (Appendix J); this was attached to the monthly accounts, and forwarded to the D.R.'s Office at Cape Town for examination and transmission to the Chief Paymaster.

O.C.s Depôts were supplied with Imprest accounts by the Chief Paymaster, amounting to about £10,000 per month; and the money was generally credited by telegram to the branch of the Standard Bank at the headquarters of the Depôt.

The above three Depôts were not abolished until June and July, 1901, when Departments were instructed to take on their own labour departmentally, the rates being fixed by Army Orders. These Depôts had then fulfilled their purpose, and there was no necessity for maintaining them after the Army had taken over the country and the requirements of the various Departments had become practically fixed. They gave place to a civil organization, called "The Native Affairs Department."

ARMY LABOUR DEPÔTS.

APPENDIX A TO PART VI.
DE AAR LABOUR DEPÔT.
STATE ON 18TH JANUARY, 1900.

DISTRIBUTION.	Officers.	Interpreters.	Clerks.	Warrant Officers.	Sergeants.	Conductors.	Chiefs and Native Interpreters.	Headmen.	Labourers.	Totals.	REMARKS.
Depôt	—	—	—	—	1	15	—	11	359	386	
Dir. of Supplies, A.D.R. Western, De Aar	—	—	—	—	—	5	—	4	146	155	
Dir. of Ordnance, R.A.M.C.,	—	—	—	—	—	—	—	—	2	2	
Dir. of Supplies, Commandant, Orange River... ..	—	—	—	—	—	7	—	7	200	214	
C.R.E.,	—	—	—	—	—	1	—	1	29	31	
Dir. of Supplies, A.D.R. Midland, Modder River	—	—	—	—	—	1	—	1	19	21	
A.D.R. Western,	—	—	—	—	—	4	—	2	35	37	
Dir. of Supplies, C.R.E.,	—	—	—	—	—	1	—	1	50	56	
Veterinary Dept., A.D.R. Midland,	—	—	—	—	—	2	—	2	30	32	
Dir. of Supplies, Arundel	—	—	—	—	—	1	—	1	57	61	
Totals	1	1	1	—	1	42	—	36	1,111	1,193	

Officer Commanding: CAPT. W. S. SCOTT.

Officer Commanding.

APPENDIX B TO PART VI.

BLOEMFONTEIN LABOUR DEPÔT.

STATE ON 24TH APRIL, 1900.

	Officers.	Interpreters.	Clerks.	Warrant Officers.	Q. M.-Sergt.	Conductors.	Chiefs and Native Interpreters.	Headmen.	Labourers.	Totals.	REMARKS.
<i>Officer Commanding: CAPT. W. S. SCOTT. Assistant: CAPT. L. W. GRIER.</i>											
DISTRIBUTION.											
Depôt Staff ...	2	1	—	1	1	3	2	1	1	12	
Supt. of Works,											
Dir. of Supplies,						2	—	4	116	122	
Dir. of Ordnance,						14	—	14	394	422	
R.S.O.,						2	—	2	58	62	
I.M.R. Stores,						1	—	1	29	31	
Dir. of Supplies, Karree						1	—	1	29	31	
R.P.K., Bethulie						3	—	3	88	94	
Engineer-in-Chief						8	1	7	203	219	
Depôt ...						—	—	1	19	20	
						4	—	3	76	83	
Totals ...	2	1	—	1	1	38	3	37	1,013	1,096	

Officer Commanding.

APPENDIX C TO PART VI.

BLOEMFONTEIN AND DE AAR DEPÔTS.

LIST OF STAFFS AND SALARIES.

Headquarters:—BLOEMFONTEIN.

Commanding Officer:—CAPT. W. S. SCOTT (Vryberg Rifles), 30s. per diem.

(1). BLOEMFONTEIN DEPÔT.

Staff.	Strength (as authorised).
Capt. L. H. Grier (Rimington's Guides) 25s. per diem.	70 Conductors at 7s. per diem.
1 Interpreter 10s. ,,	3,000 Native Labourers at 1s. 4d. ,,
1 Clerk 8s. ,,	(Headmen, if authorised, 2s. per diem).
1 Warrant Officer 8s. ,,	
1 Qr.-Mr.-Sergt. 8s. ,,	

(2). DE AAR DEPÔT.

Staff.	Strength (3. 3 1900).
Lieut. and Qr.-Mr. H. H. Cowie, Bechuanaland Rifles (wounded—absent on sick leave) 19s. per diem.	1 Sergeant 7s. per diem.
Lieut. and Asst. Paymaster C. G. Reynolds 20s. ,,	72 Conductors (4 head do.) 7s. and 7s. 6d. ,,
Interpreter, W. Callaghan 10s. ,,	1,793 Native Labourers £3 per mensem.
Clerk, J. H. Wellbeloved 8s. ,,	56 Headmen £4 ,, ,,
Warrant Officer, W. J. Lishman 8s. ,,	

APPENDIX D TO PART VI.

JOHANNESBERG LABOUR DEPÔT.

LIST OF STAFF AND SALARIES.

		Salary.
1	Officer	Capt. H. Hugh Cowie (Bechuanaland Rifles) 25s. per diem.
1	Interpreter	Henrics 3s. ,,
5	Clerks:—	
	Chief Clerk	H. D. Williamson £21 per mensem.
	First Pay ,,	J. B. Gibbons £25 ,,
	Second ,, ,,	P. Herbst £21 ,,
	Assistant ,,	H. M. Minnaas 10s. per diem.
	” ”	J. Waldie 10s. ,,
2	Compound managers	{ G. Wrigley 9s. ,,
		{ E. Chiappini (Pretoria) 10s. ,,
1	Qr.-Mr.-Sergt.	A. Chiappini 10s. ,,
144	Conductors ... ..	... .. From 8s. to 9s. ,,
4,432	Labourers ... ..	... .. 1s. per diem and rations.
Total ...	4,586	

APPENDIX E TO PART VI.

JOHANNESBERG LABOUR DEPÔT.

STATE DURING NOVEMBER—DECEMBER, 1910.

STAFF.						Officer.	Interpreters.	Clerks.	Compound Manager.	Q.M.-Sergt.
Depôt, Johannesburg	...	...	...	...	...	1	1	5	1	1
Pretoria	...	...	...	...	...	—	—	—	1	—
Totals						1	1	5	2	1

DISTRIBUTION.	DISTRIBUTION.			DISTRIBUTION.	DISTRIBUTION.		
	Conductors.	Headmen.	Labourers.		Conductors	Headmen.	Labourers.
				Brought over	109	21	3152
Depôt, Johannesburg	16	3	275	Supplies,	1	—	30
Pretoria	2	2	56	P.V.O.,	Belfast	—	15
Supplies,	3	1	125	Traffic, I.M.R.,		1	26
New Construction, I.M.R.,	1	—	31	Supplies, Machadodorp	3	86	
Chief Engineer,	1	—	22	Telegraphs, I.M.R., Waterval Boven	—	6	
Traffic R.S.O.,	—	—	14	Loco. Supt., I.M.R., Waterval Onder	—	14	
Ordnance Dep't.	1	—	15	Reconstruction, I.M.R., Godwan River	—	13	
A.S.C. Govt. Farm,	4	—	230	Supplies,	2	43	
Supplies,	12	4	362	Army Telegraphs,	Kaapmuiden	—	6
Chief Engineer,	1	—	25	Reconstruction, I.M.R.,		5	287
Traffic, I.M.R.,	1	—	20	Traffic, I.M.R.,	—	6	
Principal Vety. Officer,	6	—	195	Supplies,	Klerksdorp	1	25
Reconstruction, I.M.R., Irene	6	2	201	D.R.,		—	22
Supplies,	18	6	430	Supplies, Krugersdorp	3	94	
Chief Engineer,	9	3	373	„ Welverdiend	3	76	
Stores Dept.,	1	—	20	Supplies,	Vereeniging	1	15
Ordnance do.,	4	—	130	New Construction, I.M.R.,		1	30
Traffic, I.M.R.,	1	—	16	Reconstruction, I.M.R., Standerton	—	15	
Army Post Office,	—	—	6	„ „ Wilge River	2	60	
P.M.O.,	5	—	140	Supplies,	Koomati Poort	2	50
Reconstruction, I.M.R.,	3	—	75	Traffic, I.M.R.,		4	90
Army Telegraphs,	1	—	19	Reconstruction, I.M.R., Frederickstad	—	15	
Supplies,	1	—	25	Supplies, Potchefstroom	1	16	
Reconstruction, I.M.R.,	4	—	80	Reconstruction, I.M.R., Van der Merwe	1	20	
Chief Engineer,	1	—	26	„ „ Malalane	2	150	
Reconstruction, I.M.R., Bronkhorstspuit	4	—	94	Traffic, I.M.R., Hector's Spruit	—	11	
Supplies,	3	—	135	Army Telegraphs, Nooitgedacht	—	4	
P.V.O., L. of C.,	—	—	12	Reconstruction, I.M.R., Krokodil Poort	2	25	
Carried forward	109	21	3,152	Totals	144	30	4,402

Grand Total of all ranks ... 4,586.

APPENDIX F TO PART VI.

BLOEMFONTEIN LABOUR DEPÔT.

REGULATIONS APPROVED FOR WORKING OF NATIVE LABOUR.

BLOEMFONTEIN,
1st May, 1900.

1. Each gang will consist of the following men, who will be paid monthly at the rates shown :—	Composition and Rates of Pay.
1 Ganger (white) 5s. to 7s. per diem.	
1 Headman (native) 1s. 10d. „	
29 Labourers 1s. 6d. „	

When several gangs are working under one Department in the same station, a Head Ganger may be appointed at 7s. per diem for controlling the several gangs.

2. The O.C. Labour Department is responsible for all payments, and must see that the same are made to his men by an officer. Payments.

3. Whenever called upon (Sundays included), subject to the following provision :— Working Hours
Native labourers from the Depôt are not to be employed for more than 10 hours per day. The usual working hours are from 6 a.m. to 6 p.m., two hours out of this time being allowed for meals.

4. Camp equipment will be issued to the various gangs by the O.C. Labour Department. Each native employed will be given a numbered metal ticket, and will wear a red band round the right arm. Camp Equipment.

5. Gangs are subject to strict Military discipline. Native headmen and labourers may not be called out on military service. Discipline and Service.

6. Gangers will at once report all cases of sickness to the officer under whom they are serving, who will see that medical attendance is provided. Sick natives will draw rations, but will receive no pay during the time they are sick. Sickness.

7. Gangers will report all cases of disobedience or insubordination to the O.C. Labour Depôt, or to the officer under whom they are serving at the time. Fines for any misconduct may be inflicted at the discretion, or with the concurrence, of the O.C. A list of fines inflicted upon men working away from the Depôt must be forwarded to the O.C., Bloemfontein, not later than 25th of each month (by wire if necessary). Fines for Misconduct.

8. Rations will be arranged for by the Department for whom the native labour is provided, on the following scale :— Rations.

- Gangers; a soldier's ration.
- Native headmen; same as labourers, with addition of soldier's ration of groceries.
- Labourers; 3 lbs. mealie meal and ½ oz. salt on 5 days per week. 1½ lbs. mealie meal, 1 lb. meat (fresh) and ½ oz. salt on remaining 2 days per week.

N.B.—The issue of meat should be made, preferably, on Sundays and Wednesdays.

9. By special request of the Resident Commissioner, Basutoland, orders should be conveyed to the gangs through the gangers and native headmen as far as possible, to ensure efficient working and to avoid the possibility of orders being misunderstood. Management of Gangs.

10. It is imperative that the O.C. Labour Depôt be cognisant of all matters affecting gangs, or the working of gangs, organised by him. Officers employing labourers from this Depôt should, therefore, notify him direct of the transfer of gangs from one officer to another or from one Department to another. Similarly, complaints respecting the inefficient working of a gang or members thereof, and recommendations thereon, should be submitted by the officer for whom the labourer is provided to the O.C. Labour Depôt on the latter's periodical inspection tour.

E. P. C. GIROUARD, *Lieut.-Col.,*
Director of Railways.

APPENDIX G TO PART VI.

JOHANNESBERG LABOUR DEPÔT.

(EXTRACT FROM ARMY ORDERS).

HEADQUARTER OFFICE,

PRETORIA,

26th July, 1900.

2. ARMY LABOUR DEPÔT.

A Labour Depôt for the Army has been formed at Johannesburg by the Director of Railways, and will supply all departments of the Army (Transport Department excepted) in the Transvaal.

The following Regulations have been drawn up for the information of Departments employing natives from this Depôt. These rules must be strictly enforced by the officers and men of the Labour Depôt and by all Departments concerned, as it is essential for the successful working of the Depôt that all natives should receive the same wages, ration and treatment.

REGULATIONS FOR WORKING OF NATIVE LABOUR.

(1). *Enlistment and Rates of Pay.*—The term of service of all employés enlisted for the Labour Depôt will be three months from date of enlistment.

The rate of pay will be as follows:—

Gangers, 5s. to 8s. per day and free rations.

Natives, 1s. per day and free rations.

Headmen, £2 10s. per month and free rations.

(2). *Composition of Gangs.*—Gangs will be composed of 1 ganger (or conductor), one native headman and 30 natives. Where several gangs are working together under one Department an additional ganger may be appointed to supervise and otherwise assist in the management of the several gangs.

(3). *Rations.*—The scale of rations to be issued to labour gangs will be as follows:—

White ganger,—A soldier's rations.

Labourers,—Three lbs. mealie meal and $\frac{1}{2}$ oz. of salt per diem five days per week; 1 lb. fresh meat, $1\frac{1}{2}$ lbs. mealie meal, and $\frac{1}{2}$ oz. salt two days per week (Wednesdays and Saturdays).

N.B.—When mealie meal is not procurable, Boer meal or flour may be issued, 2 lbs. of Boer meal or flour being the equivalent of 3 lbs. mealie meal.

(4). *Payments.*—The O.C. is responsible for all payments to Labour Depôt employés, and will arrange for such payments the last day of each month.

(5). *Sickness.*—Pay will not be allowed to natives for any time lost through sickness; and all cases of sickness will be reported to the O.C. not later than the 25th of each month.

(6). *Fines for Misconduct.*—Any employé neglecting his work, or guilty of any misconduct, may be fined by the officer under whom he is working. A list of the fines inflicted during the month should, if possible, be submitted to the O.C. Labour Depôt not later than the 25th of each month. Should this be impossible, fines can be submitted to the Pay Officer at the time of making payments.

By Order,

W. F. KELLY, *Maj.-Gen.*,

D.A.G.

ARMY LABOUR DEPÔTS.

ARMY LABOUR DEPÔTS.

ALLOCATION OF EXPENDITURE TO ARMY DEPARTMENTS AND STRENGTHS OF DEPÔTS DURING 1900.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	£	£	£	£	£	£	£	£	£	£	£	£
	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.	d.
ALLOCATION TO DEPARTMENTS.												
Depôt, Administration	—	—	—	—	—	—	66 19 0	22 13 0	41 4 11	39 8 3	72 19 11	83 12 4
„ Labour	—	—	—	—	—	—	252 0 0	115 19 8	132 16 0	295 9 10	316 7 0	376 9 2
Director of Railways	—	—	—	—	—	—	724 16 0	1617 17 6	—	—	—	—
Divisional R.E. 7th	—	—	—	—	—	—	55 8 0	—	—	—	—	—
Director of Supplies	—	—	—	—	—	—	539 2 6	1285 10 0	1805 0 0	2223 8 0	2680 0 0	2957 0 0
„ Ordnance	—	—	—	—	—	—	30 14 0	192 16 0	140 18 6	150 0 0	—	264 0 0
„ Telegraphs	—	—	—	—	—	—	16 8 0	—	64 0 0	110 8 0	248 0 0	60 0 0
Accountant, I.M.R.	—	—	—	—	—	—	—	117 8 0	—	—	55 0 0	—
Principal Medical Officer	—	—	—	—	—	—	—	102 8 0	134 11 0	198 0 0	248 0 0	166 0 0
Director of Army Telegraphs	—	—	—	—	—	—	—	66 8 0	—	—	—	—
Electrical Engineers	—	—	—	—	—	—	—	55 18 0	45 0 0	—	—	—
Traffic, Loco., and Stores Depts., I.M.R.	—	—	—	—	—	—	—	—	246 0 0	333 8 0	411 0 0	338 12 0
Post Office	—	—	—	—	—	—	—	—	8 10 0	9 0 0	9 0 0	18 0 0
Chief Engineer	—	—	—	—	—	—	—	—	446 0 0	549 0 0	597 0 0	868 0 0
Reconstruction, I.M.R.	—	—	—	—	—	—	—	—	1829 0 0	1852 8 0	1270 0 0	1249 0 0
New Construction, „	—	—	—	—	—	—	—	—	77 0 0	100 0 0	97 0 0	—
Remount Department	—	—	—	—	—	—	—	—	14 8 0	—	—	—

JOHANNESBERG DEPÔT.

ALLOCATION OF EXPENDITURE TO ARMY DEPARTMENTS AND STRENGTHS OF DEPÔTS DURING 1900.—Continued.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
ALLOCATION TO DEPARTMENTS.												
Principal Veterinary Officer	—	—	—	—	—	—	—	—	—	256 0 0	257 0 0	522 0 0
Commandants	—	—	—	—	—	—	—	—	—	—	—	145 0 0
Cavalry Brigade	—	—	—	—	—	—	—	—	—	—	—	87 0 0
Maintenance, I.M.K.	—	—	—	—	—	—	—	—	—	—	—	100 8 0
Totals	—	—	—	—	—	1685 7 6	3486 18 2	4984 8 5	6116 10 1	6261 6 11	7335 1 6	
JOHANNESBERG DEPÔT.—Continued.												
STRENGTH.												
Officer Commanding	—	—	—	—	—	—	1	1	1	1	1	1
Clerk	—	—	—	—	—	—	1	2	3	3	5	5
Qr.-Mr.-Sergeant	—	—	—	—	—	—	1	1	1	1	1	—
Compound managers	—	—	—	—	—	—	2	2	2	2	3	1
Head conductors	—	—	—	—	—	—	1	2	3	—	3	2
Special "	—	—	—	—	—	—	1	—	1	6	—	—
Conductors	—	—	—	—	—	—	39	73	81	112	123	119
Gaugers	—	—	—	—	—	—	3	—	—	—	—	—
Labourers	—	—	—	—	—	—	1244	2540	2916	3417	3273	3811
Headmen	—	—	—	—	—	—	—	—	—	14	—	42

ALLOCATION OF EXPENDITURE TO ARMY DEPARTMENTS AND STRENGTHS OF DEPÔTS DURING 1900.—Continued.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
ALLOCATION TO DEPARTMENTS.												
Depôt, Administration	—	—	—	103 0 6	116 1 7	123 11 10	100 2 0	86 8 6	353 8 3	1864 11 9	69 6 0	144 19 6
„ Labour	—	—	—	1617 12 4	1949 3 11	1385 7 0	441 12 11	1871 18 11	635 1 8	222 18 10	649 9 2	533 15 3
Director of Supplies	—	—	—	478 6 2	1602 16 7	3164 4 0	3013 6 0	2604 0 8	2616 11 0	2766 0 2	2963 4 6	3613 8 4
„ Ordnance	—	—	—	54 14 6	417 3 11	994 8 6	978 1 1	898 7 6	1158 3 0	864 0 10	1086 5 0	1153 4 10
Superintendent of Works, I.M.R.	—	—	—	103 2 6	1848 5 1	4293 18 6	1305 16 5	844 7 10	145 0 0	39 11 3	24 6 0	37 6 8
Chief Engineer	—	—	—	67 12 8	884 8 8	1148 6 6	460 14 1	366 8 3	495 1 6	460 12 2	435 11 0	484 9 5
R.S.O., Bloemfontein	—	—	—	28 18 8	73 9 9	106 8 0	95 17 9	84 17 8	100 10 0	85 17 0	84 4 0	120 14 0
Stores Dept., I.M.R.	—	—	—	25 6 10	51 11 7	101 5 0	154 18 5	258 5 0	—	—	6 5 0	3 5 1
Army Veterinary Dept.	—	—	—	23 14 0	189 14 1	501 11 0	509 12 0	432 16 2	562 0 6	677 15 4	739 7 6	103 0 0
R.A.M.C.	—	—	—	5 4 8	30 11 8	100 19 6	109 19 11	176 12 0	183 15 0	176 12 0	179 5 6	176 12 0
Remount Depôt	—	—	—	9 19 4	101 12 0	101 5 0	22 18 10	—	—	—	—	—
Railway Pioneer Regiment	—	—	—	311 5 4	33 13 4	—	—	—	—	—	—	—
Director of Railways	—	—	—	—	58 19 11	—	—	—	—	—	—	—
„ Telegraphs	—	—	—	—	93 10 2	177 14 0	223 1 9	72 0 8	—	—	—	—
„ Steam Road Transport	—	—	—	—	48 0 2	303 15 0	402 3 3	436 12 4	362 9 0	326 6 2	305 16 0	151 8 9
C.R.E., Orange Free State	—	—	—	—	14 2 0	31 10 0	—	—	—	—	—	—
Locomotive Dept., I.M.R.	—	—	—	—	32 2 10	531 0 0	88 18 3	88 10 6	91 2 0	77 0 8	12 8 0	—
Inspector of Civil Telegraphs	—	—	—	—	—	33 5 0	—	—	—	—	—	—
Commandant, Springfontein	—	—	—	—	—	37 5 0	119 12 0	58 17 0	58 10 0	49 8 0	60 0 0	58 17 0

BLOEMFONTEIN DEPÔT.

ALLOCATION OF EXPENDITURE TO ARMY DEPARTMENTS AND STRENGTHS OF DEPÔTS DURING 1900.—Continued.

	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.						
	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.			
ALLOCATION TO DEPARTMENTS.																													
A.D.R., Kroonstad	—	—	—	—	—	—	—	—	—	—	—	—	—	263	8 9	293	18 4	212	17 6	200	1 1	226	10 0	203	6 11	—	—		
Director of Transport	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Commandant, Viljoen's Drift	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
R.E. Stores, Bloemfontein	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Division Officer, R.E. (C.R.E.)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Veterinary Dept., Ferreira Siding	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Veterinary Field Hospital, Kroonstad	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Totals	—	—	—	—	—	—	2828	17 6	7545	7 3	12,835	13 10	8290	3 5	8574	1 4	6944	9 5	7871	10 3	6841	17 8	7757	10 6	—	—	—		
STRENGTH.																													
Officer Commanding	—	—	—	—	—	—	1	1	1	1	—	—	—	—	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Second Officer (Captain)	—	—	—	—	—	—	1	1	1	1	1	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Qr.-Mr.-Sergeant	—	—	—	—	—	—	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Warrant Officer	—	—	—	—	—	—	1	1	1	1	—	—	—	—	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Clerks	—	—	—	—	—	—	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Interpreters... ..	—	—	—	—	—	—	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Head gangers	—	—	—	—	—	—	1	1	1	1	6	6	6	6	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6
Special "	—	—	—	—	—	—	39	39	159	159	163	163	116	116	97	97	75	75	72	72	76	76	84	84	84	84	84	84	84
Chiefs	—	—	—	—	—	—	1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Headmen	—	—	—	—	—	—	38	38	126	126	125	125	87	87	80	80	18	18	17	17	28	28	22	22	22	22	22	22	22
Special labourers	—	—	—	—	—	—	—	—	—	—	—	—	9	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Labourers	—	—	—	—	—	—	1000	1000	3470	3470	3630	3630	2421	2421	3705	3705	1975	1975	1786	1786	2984	2984	2525	2525	2525	2525	2525	2525	2525

ALLOCATION OF EXPENDITURE TO ARMY DEPARTMENTS AND STRENGTHS OF DEPÔTS DURING 1900.—Continued.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
ALLOCATION TO DEPARTMENTS.												
Depôt, Administration	299 10 6	75 12 0	73 7 6	129 0 0	42 12 6	49 16 0	42 12 6	290 1 6	42 5 0	43 7 0	35 15 0	42 7 6
„ Labour	302 9 0	676 9 4	65 10 0	181 10 6	682 12 8	721 11 4	170 5 9	388 0 0	96 2 0	133 4 2	209 11 0	188 3 3
Director of Supplies	1503 5 4	2379 7 5	1952 15 11	1109 3 8	1446 8 5	1888 1 0	2059 11 0	1680 14 7	1447 3 4	1280 16 6	1802 6 4	1855 11 5
„ Ordnance	84 4 1	129 8 0	13 11 5	97 9 4	224 16 3	468 16 4	552 3 7	681 7 3	576 14 0	663 10 0	657 7 0	636 4 4
„ Telegraphs	9 15 2	324 0 0	565 9 6	379 18 8	149 8 8	141 14 0	103 17 0	48 0 0	23 14 0	21 0 0	21 0 0	21 0 0
A.D.R., Midland	401 18 6	775 12 7	1376 5 1	1021 5 4	—	441 8 0	—	—	101 10 0	101 17 0	—	—
„ Western	282 10 5	1129 8 5	1132 18 11	602 10 0	446 17 4	—	204 18 3	106 12 9	—	—	109 0 8	101 9 3
‡ Chief Engineer	188 12 2	276 5 2	235 2 6	103 6 0	136 17 6	73 8 8	36 15 1	38 11 7	68 5 0	104 6 8	131 15 8	144 3 4
R.A.M.C.	9 2 3	11 12 6	36 17 0	40 6 0	23 18 1	111 6 0	149 15 11	177 10 1	279 14 0	277 12 4	176 7 4	350 18 4
Remount Depôt	131 11 8	392 14 8	249 12 0	73 1 0	—	—	—	—	—	—	—	—
Veterinary „	150 8 5	370 14 11	585 12 11	532 3 4	316 11 7	167 10 8	97 19 4	62 16 8	26 12 8	—	—	—
Commandant, Orange River	136 8 6	110 1 5	138 18 6	136 0 0	131 8 11	123 16 0	126 6 8	116 19 3	103 16 0	93 14 5	92 4 0	89 17 0
„ „ Rensburg	24 11 5	82 16 0	—	—	—	—	—	—	—	—	—	—
„ „ De Aar	—	8 7 2	9 0 0	11 2 0	12 0 0	15 0 8	17 2 7	51 7 0	29 3 4	84 16 7	166 18 4	95 8 9
R.S.O., Kimberley	—	—	—	86 10 0	96 4 9	99 10 0	69 0 10	70 0 3	70 14 0	71 17 0	72 2 0	68 12 6
Director of Railways	—	—	174 8 5	203 7 0	154 9 1	216 18 0	200 3 11	206 9 0	138 5 4	—	—	—
A.D.R.	—	—	—	6 10 0	6 0 0	—	8 9 0	6 10 0	6 10 0	6 0 0	6 0 0	9 0 0
C.R.E., Orange Free State	—	18 9 7	40 17 0	39 8 0	6 2 1	—	—	—	—	—	—	—
Railway Pioneer Regiment	—	—	—	250 3 0	—	—	—	—	—	—	—	—
C.G.R. Workshops, De Aar	—	—	—	—	—	8 10 8	—	—	7 0 0	—	43 5 0	86 5 5

ALLOCATION OF EXPENDITURE TO ARMY DEPARTMENTS AND STRENGTHS OF DEPÔTS DURING 1900.—Continued.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
ALLOCATION TO DEPARTMENTS.												
R.A.M.C., Kimberley	—	—	—	—	9 17 2	—	—	—	—	—	—	—
D.A.A.G., Mafeking	—	—	—	—	—	—	—	—	—	—	—	—
A.I.G., Naauwpoort	—	—	—	—	—	—	—	101 17 0	—	—	—	—
Commandant, „	—	—	—	—	—	—	—	14 0 2	—	—	—	—
Totals	3524 7 5	6760 19 2	6650 6 8	4992 13 10	3886 5 0	4527 7 4	3849 1 5	4040 7 1	3017 8 8	2882 1 8	3523 12 4	3689 1 1
DE AAR DEPÔT.—Continued.												
STRENGTH.												
Commanding Officer	—	1	1	—	—	—	—	—	—	—	—	—
Lieut. and Quartermaster	—	1	1	1	1	1	—	—	—	—	—	—
Assistant Paymaster	—	—	—	1	1	1	—	1	1	1	1	1
Quartermaster	1	1	—	—	—	—	—	—	—	—	—	—
Warrant Officer	—	1	1	1	1	1	—	—	—	—	—	—
Sergeant	1	1	1	1	1	1	1	1	1	1	1	1
Clerk	1	1	1	1	1	1	1	1	1	1	1	1
Interpreter	1	1	1	1	1	1	1	1	1	1	1	1
Head gangers	1	4	4	5	3	2	6	2	1	1	2	2
Gangers	49	78	75	57	44	39	40	35	31	28	36	35
Headmen	43	87	70	65	72	45	42	159	42	33	36	31
Special labourers	—	7	12	13	11	11	18	21	18	16	10	14
Labourers	1299	2309	2083	1800	2081	1335	1121	1444	1087	822	1130	1198

APPENDIX J TO PART VI.

DE AAR LABOUR DEPÔT.

ALLOCATION OF VOUCHERS, APRIL, 1900.

DEPARTMENT.	Voucher 18. £817 2s. od.	Voucher 19. £71 1s. 6d.	Voucher 20. £548 9s. od.	Voucher 21. £3,477 1s. 9d.	Voucher 22 £80 0s. od.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Depôt, Administration	—	—	49 0 0	—	80 0 0
„ „ Labour	—	—	31 8 6	151 2 0	—
Director of Supplies	817 2 0	71 1 6	58 15 6	162 4 8	—
„ „ of Ordnance	—	—	10 10 0	86 19 4	—
A. D. R., De Aar	—	—	—	6 10 0	—
R. A. M. C., „	—	—	10 10 0	29 16 0	—
Commandant, „	—	—	—	11 2 0	—
C. R. E., „	—	—	10 10 0	92 16 0	—
C. R. E., Orange Free State	—	—	10 10 0	28 18 0	—
Director of Telegraphs	—	—	42 0 0	337 18 8	—
Commandant, Orange River	—	—	22 10 0	113 10 0	—
Army Veterinary Dept.	—	—	63 0 0	479 3 4	—
Remount Depôt	—	—	19 19 0	53 2 0	—
A. D. R., Western	—	—	65 16 0	536 14 0	—
R. S. O., Kimberley	—	—	10 10 0	76 0 0	—
A. D. R., Midland	—	—	85 8 0	915 17 4	—
Director of Railways	—	—	31 17 0	171 10 0	—
Railway Pioneer Regiment	—	—	26 5 0	223 18 0	—
Total	£ 817 2 0	71 1 6	548 9 0	3,477 1 9	80 0 0

ADDENDA.

LIST OF ORIGINAL REPORTS

EMBODIED IN THE DETAILED HISTORY.

PART.	CHAPTER.	SUBJECT.	AUTHOR.		
I.	I.	Traffic Department, C.G.R.	} Heads of Departments, C.G.R.		
		Engineering " "			
		Locomotive " "			
	II.	II.	Military Controlling Staff, C.G.R.	Bt. Maj. V. Murray, R.E., A.D.R., Cape Colony. Bt. Lt.-Col. C. H. Cowie, R.E., A.D.R., Cape Colony.	
			Railway Transport Office, Cape Town	Lt.-Col. C. E. Wyncoll, A.S.C.	
		III. App. B.	IV.	Western Field Railway Section	Bt. Lt.-Col. W. R. Stewart, R.E.
				Midland " "	Bt. Maj. J. H. Twiss, R.E.
		App. A.	B.	Employment of O.F.S. Employés	J. M. Carolin, Esq., late Dist. Loco. Supt., O.F.S.
				Entrainments at Rensberg for Concentration at Modder R.	Bt. Maj. J. H. Twiss, R.E.
				Repairs between Arundel and Bloemfontein ...	Bt. Maj. H. A. Micklem, D.S.O., R.E.
		III.	—	Supply of Stores to Construction parties on C.G.R.	Qr.-Mr. and Hon. Capt. A. N. Tucker, R.E.
				Description and Working of N.G.R.	Lieut. C. G. Fuller, R.E., S.O. to A.D.R., Natal.
				Organisation, equipment and work of the R.P.R. (including reconstruction of Norval's Pont, Bethulie, Vet R., Zand R. and Vaal R. bridges). No. 8 Company, R.P.R.	Bt. Lt.-Col. J. E. Capper, R.E., O.C., R.P.R. Capt. P. Cazalet, R.P.R.
		IV.	I.	Action at Zand R. on 14th June, 1900	Lieut. A. W. Stockett, R.P.R.
				Management of I.M.R.	Bt. Maj. V. Murray, R.E., A.D.R.
App. H.	II.		Troop moves on Eastern Line, 5th—12th April, 1901.	Capt. H. C. Sutton, Coldstream Guards.	
			Reconstruction on I.M.R.	Bt. Maj. W. D. Waghorn, Supt. of Works.	
			Temporary repairs, Bloemfontein to Vereeniging.	Bt. Maj. A. H. Micklem, D.S.O., R.E.	
			Temporary repairs, Elandsfontein to Volksrust	Bt. Maj. G. A. Travers, R.E. Bt. Maj. F. G. Fuller, R.E.	
			Temporary repairs, Pretoria to Wilge R. ...	Bt. Maj. F. G. Fuller, R.E.	
			" " Wilge R. to Koomati Poort and Barberton.	Bt. Maj. H. A. Micklem, D.S.O., R.E.	
			" " Pretoria to Pietsersberg ...	Bt. Maj. F. G. Fuller, R.E. Capt. E. H. M. Leggett, D.S.O., R.E., D.A.D.R.	
			Permanent reconstruction, Bloemfontein to Vredefort.	A. W. Herbert, Esq., C.E. G. E. Pauling, Esq., C.E. L. H. Grier, Esq., C.E.	
			" " Vredefort to Vereeniging.	Capt. H. L. Pritchard, D.S.O., R.E.°	
			" " Vaal R. bridge ...	Lieut. G. R. Frith, R.E.	
			" " Elandsfontein to Volksrust.	Lieut. G. R. Frith, R.E. J. Wilson, Esq., C.E.	
			" " Pretoria to Irene ...	Bt. Maj. F. G. Fuller, R.E.	
			" " Pretoria to Pietersnaars R.	Bt. Maj. F. G. Fuller, R.E.	
Minor repairs in O.R.C. of damages due to enemy's raids.	Capt. H. E. M. Lindsay, R.M.E.M., Deputy Supt. of Works.				

PART.	CHAPTER.	SUBJECT.	AUTHOR.
IV.	App. B.	Electric Lighting for Night Work	Capt. F. L. Lloyd, R.E.
	„ C.	Johannesberg Workshops	Lieut. G. H. Thurston, R.P.R.
	III.	Traffic Department, I.M.R.	W. W. Hoy, Esq., Traffic Manager, I.M.R.
	IV.	Locomotive „ „	Capt. A. G. Stevenson, D.S.O., R.E., Loco. Supt., I.M.R.
		Southern and South Western Lines... ..	G. G. Elliot, Esq., Dist. Loco. Supt., I.M.R.
		South Eastern Lines	E. M. Carolin, Esq., „
		Eastern Lines	Lieut. E. O. A. Newcombe, R.E.
		Bloemfontein Workshops	M. N. Durrant, Esq., Manager.
	App. A.	Pretoria „	W. I. Press, Esq., „
	V.	Telegraph Department, I.M.R.	Capt. M. G. E. Bowman-Manifold, D.S.O., R.E., Supt., Railway Telegraphs.
	VI.	Stores	Qr.-Mr. and Hon. Capt. A. N. Tucker, R.E., Chief Storekeeper, I.M.R.
	VIII.	Railway Police	Capt. C. J. Lloyd Carson, East Lancashire Regt., Commr. of Police.
	IX.	Railway Staff Depôt	Capt. B. A. Warry, Essex Regt., O.C. Depôt.
	X.	Railway Employment Office	A. L. Secretan, Esq.
	XI.	Lorenço Marques, Delagoa Bay	Capt. Hely, Imperial Yeomanry, A.D.R.
V.	—	Organisation, equipment, and use of Armoured Trains.	Bt. Lt.-Col. H. C. Nanton, R.E., A.D.R.
	App. A.	Search lights on Armoured Trains	Capt. R. S. Walker, R.E.
VI.	—	Army Labour Depôts	Bt. Maj. H. G. Joly de Lotbinière, D.S.O., R.E.

* Capt. H. L. Pritchard, D.S.O., R.E., also obtained and collated all the Reports furnished for submission to the War Office, where they were subsequently further edited and re-arranged.

LIST OF ROYAL ENGINEER OFFICERS

EMPLOYED ON RAILWAYS DURING THE WAR.

RANK.	NAME.	BRANCHES IN WHICH EMPLOYED, AND APPOINTMENTS HELD.
REGULARS.		
Brevet Major (local Lt.-Col.)	Girouard, E. P. C., d.s.o.	D.R. South African Field Force (graded as D.A.G.); Commissioner of Railways, Transvaal and O.R.C.
Major	Maclagan, R.S.	Military Controlling Staff. D.D.R. at Cape Town.
Major (local Lt.-Col.)	Capper, J. E.	Engineering. O.C. R.P.R.
Major (local Lt.-Col.)	Cowie, C. E.	Management and Military Controlling Staff. A.D.R. Cape Colony (graded as A.A.G.); General Manager I.M.R.
Major	Stewart, W. R.	Engineering and Military Controlling Staff. A.D. Western F.R.S.; A.D.R. Cape Colony.
Major	Elliot, G. S. McD.	Military Controlling Staff. A.D.R. Natal.
Capt.	Livingstone, H. A. A.	Military Controlling Staff. A.D.R. Natal (graded as A.A.G.).
Capt.	Nanton, H. C.	Military Controlling Staff and Armoured Trains. D.A.D.R. Western and Northern Sections, Cape Colony; D.A.D.R. Kroonstad, O.R.C.; A.D. Armoured Trains (graded as A.A.G.).
Capt. (local Major)	Twiss, J. H.	Engineering. Management and Military Controlling Staff. A.D. Midland F.R.S.; C.S.O. to D.R. (graded as A.A.G.).
Capt.	Prentice, H.	Engineering.
Capt.	Scudamore, W. V.	Military Controlling Staff. D.A.D.R. Midland Section, Cape Colony (graded as D.A.A.G.).
Capt. (local Major)	Murray, V.	Management and Military Controlling Staff. A.D.R. Cape Colony; A.D.R. O.R.C.; A.D.R. I.M.R. (graded as A.A.G.); Asst. General Manager I.M.R.
Capt.	Burn, J. M.	Military Controlling Staff. D.A.D.R. Eastern Section, Cape Colony (graded as D.A.A.G.).
Capt.	Nathan, W. S.	Military Controlling Staff. D.A.D.R. Bloemfontein (graded as D.A.A.G.); Railway Secretary to Commissioner of Railways.
Capt.	Wilson, C. S.	Engineering. O.C. 20th (Fortress) Company, R.E.
Capt.	Waghorn, W. D.	Engineering. Supt. of Works Western F.R.S.; Supt. of Works I.M.R.
Capt.	Crookshank, C. de W.	Military Controlling Staff. S.O. to D.R.
Capt.	Grant, P. G.	Armoured Trains.
Capt.	Swinton, E. D.	Engineering. Adjutant R.P.R.; Wing Commander R.P.R.
Capt.	Fuller, F. G.	Engineering and Armoured Trains. O.C. 31st (Fortress) Company, R.E.; in charge of reconstruction, temporary and permanent; in charge Armoured Trains Kimberley line.
Capt.	Joly de Lotbinière, H. G.	S.O. to D.R. (graded as D.A.A.G.); in charge Native Labour Dept. I.M.R.; in charge Army Labour Depôts.
Lieut.	Henniker, A. M.	Military Controlling Staff and Armoured Trains. D.A.D.R. Armoured Trains.
Lieut.	Lubbock, G.	Management and Military Controlling Staff. D.A.D.R. Beaufort West, Cape Colony; Asst. to General Manager I.M.R.
Lieut.	Leggett, E. H. M.	Military Controlling Staff. D.A.D.R. Pretoria (graded as D.A.A.G.); D.A.D.R. with Army Headquarters.
Lieut.	Faber, S. G.	Military Controlling Staff.

RANK.	NAME.	BRANCHES IN WHICH EMPLOYED, AND APPOINTMENTS HELD.
REGULARS.— <i>Continued.</i>		
Lieut.	Stevenson, A. G.	Locomotive. Loco. Supt. I.M.R. (graded as D.A.A.G.).
Lieut.	Bowman-Manifold, M. G. E.	Telegraphs. Supt. of Railway Telegraph I.M.R.
Lieut.	Barnardiston, E.	Management. Asst. to General Manager I.M.R.
Lieut.	Cusins, A. G. T.	Locomotive and Armoured Trains. Loco. Supt Midland F.R.S.; O.C. 42nd (Fortress) Company, R.E.
Lieut.	Pritchard, H. L., D.S.O.	Engineering and Telegraphs. In charge reconstruction, temporary and permanent; Acting Supt of Railway Telegraphs I.M.R.
Lieut.	Sewell, J. W. S.	Management. In charge Cartage Dept. I.M.R.
Lieut.	Blakeney, R. B. D.	Military Controlling Staff. A.D.R. Delagoa Bay (graded as D.A.A.G.).
Lieut.	Micklem, H. A., D.S.O.	Engineering. Supt. of Works Midland F.R.S.; Asst. Supt. of Works I.M.R.; in charge of reconstruction, temporary and permanent.
Lieut.	Jones, W. H.	Engineering. 20th (Fortress) Company, R.E.
Lieut.	Vickers, C. E.	Management and Military Controlling Staff. D.A.D.R. Cape Town (graded as D.A.A.G.); Asst. to General Manager I.M.R.
Lieut.	Wilson, S. H.	Engineering. Company Commander R.P.R.
Lieut.	North, C. N.	Engineering. 42nd (Fortress) Company, R.E.
Lieut.	Newcombe, E. O. A.	Locomotive. Asst. Loco. Supt. I.M.R.
Lieut.	Fuller, C. G.	Management and Military Controlling Staff. D.A.D.R. Natal (graded as Staff Captain); A.D.R. Delagoa Bay; Asst. to General Manager I.M.R.
Lieut.	Mance, H. O.	Engineering and Military Controlling Staff. D.A.D.R. Kimberley (graded as Staff Captain).
Lieut.	Frith, G. R.	Engineering. O.C. 8th (Railway) Company, R.E.
Lieut.	Millington, L. B.	Engineering. O.C. 10th (Railway) Company, R.E.
Lieut.	Greig, R. H.	Engineering. 8th (Railway) Company, R.E.
Lieut.	Oakes, R.	Locomotive. District Loco. Supt. I.M.R.
Lieut.	Cunnington, R. H.	Engineering. 10th (Railway) Company, R.E.
2nd Lieut. ...	Lefroy, H. P. T.	Engineering. 31st (Fortress) Company, R.E.
Qr.-Mr. and Hon. Lieut.	Taylor, G.	Quartermaster, R.P.R.
Qr.-Mr. and Hon. Lieut.	Tucker, A. N.	Stores. Chief Storekeeper I.M.R.
Qr.-Mr. and Hon. Lieut.	Samson, H. R.	General duties Base Office.
Qr.-Mr. and Hon. Lieut.	Friar, R.	Stores. General duties Base Office.
MILITIA.		
Lieut.	Lloyd, L. H. G. (Anglesey Militia).	
Major (late Capt., R.E.)	Lindsay, H. E. M. (Monmouthshire Militia)	Deputy Supt. of Works I.M.R., O.R.C.
Capt.	Matthews, R. L. (do.).	
Capt.	Forestier-Walker, R. S. (do.).	
Lieut.	Crawshay, C. H. R. (do.).	

RANK.	NAME.	BRANCHES IN WHICH EMPLOYED, AND APPOINTMENTS HELD.
VOLUNTEERS.		
Capt.	McLean, J. L.	(1st Cheshire).
Capt.	Collins, F. R.	(2nd Cheshire).
Lieut.	Sidgwick, C. K. D.	(do.).
Lieut.	Tweedie, A. C.	(do.).
Lieut.	Lake, G. H. (Devon and Somerset).	

Notes.—Except for Major Girouard, D.R., Columns 1 and 2 give the officers in order of regimental seniority, with ranks at beginning of 1905; local ranks in South Africa are shown in brackets in Column 1.

Column 3 gives the Branches of employment in which the officers mentioned served; also the principal Appointments held by them, the Military Staff ranks at which some of these were graded being shown in brackets.

It is regretted that it has been found impossible to compile a list of the officers of other branches of the Army who served on the Railways during the war, mostly as R.S.O.s.

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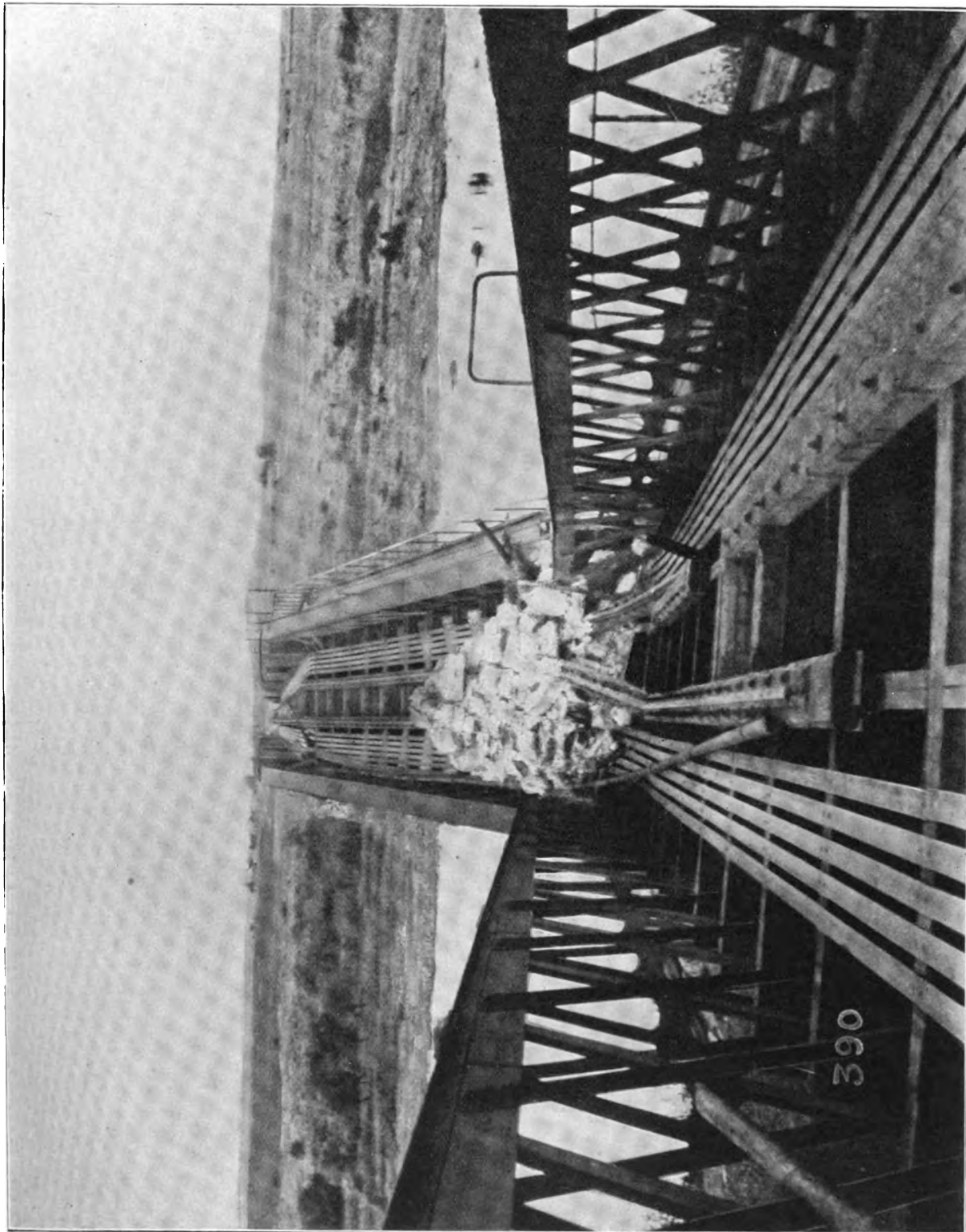
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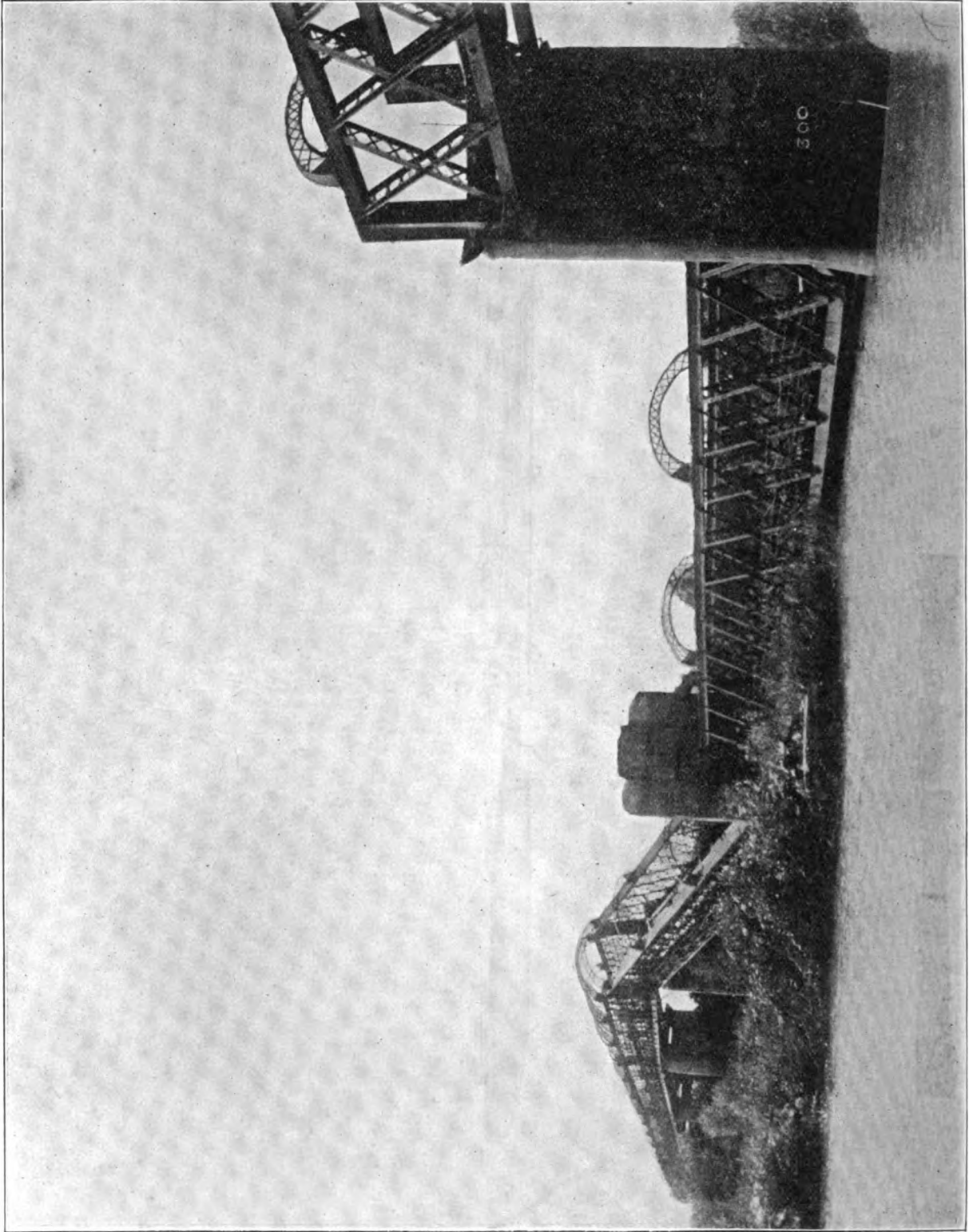
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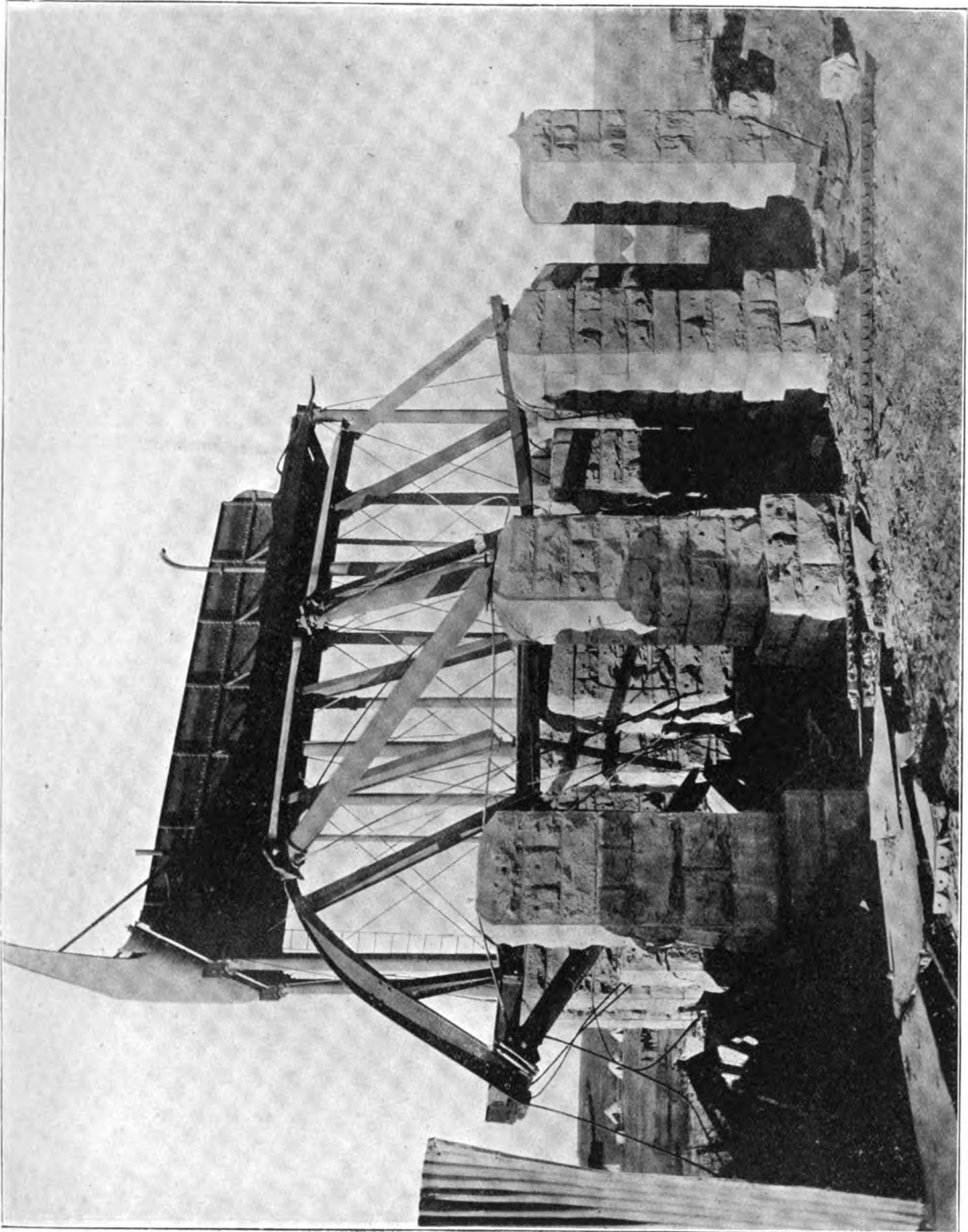


Modder R. Bridge, Kimberley line.
View from south bank, showing damage by enemy.

PHOTO 2.



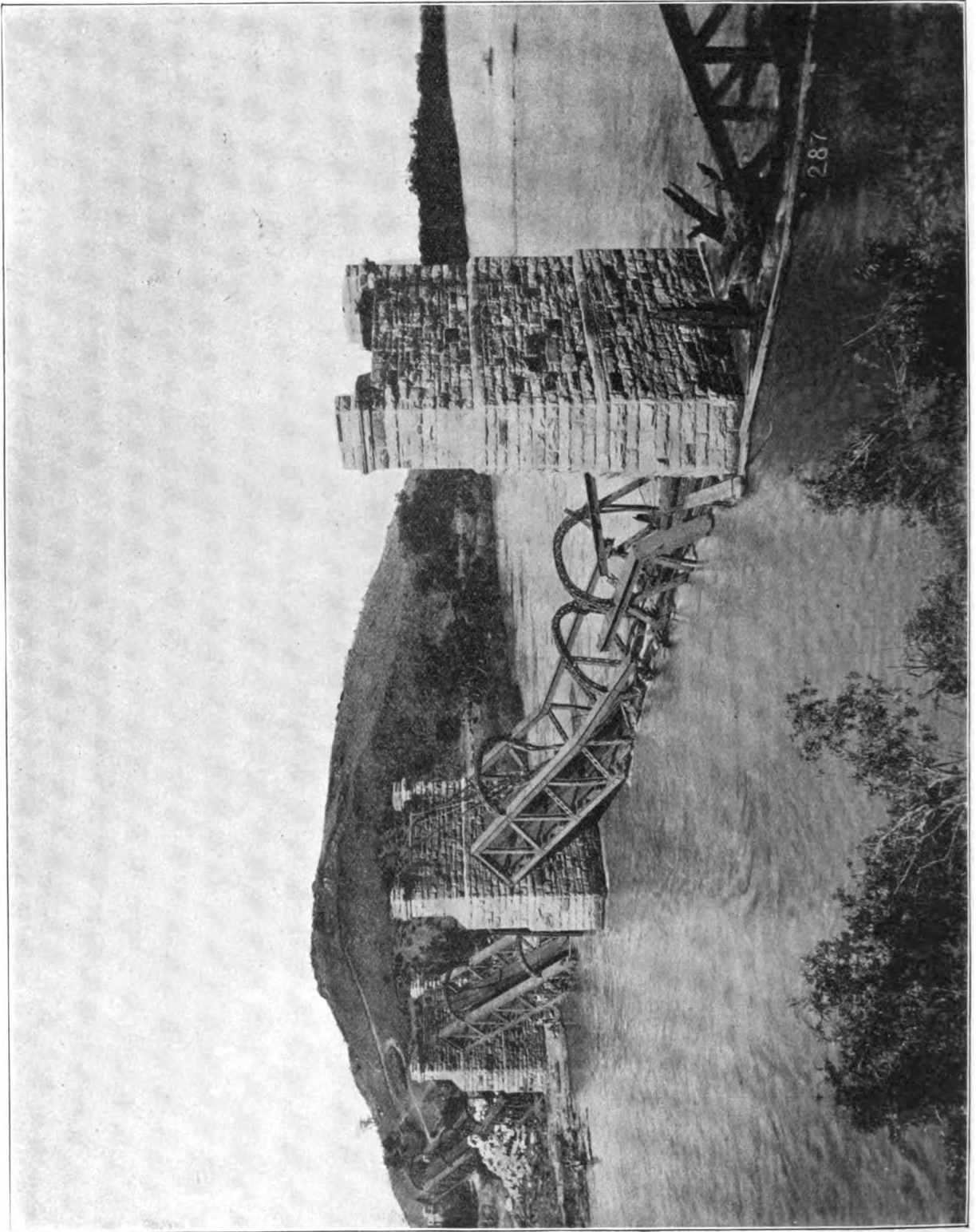
Vaal R. Bridge, Fourteen Streams, Mafeking line.
Showing damage by enemy.



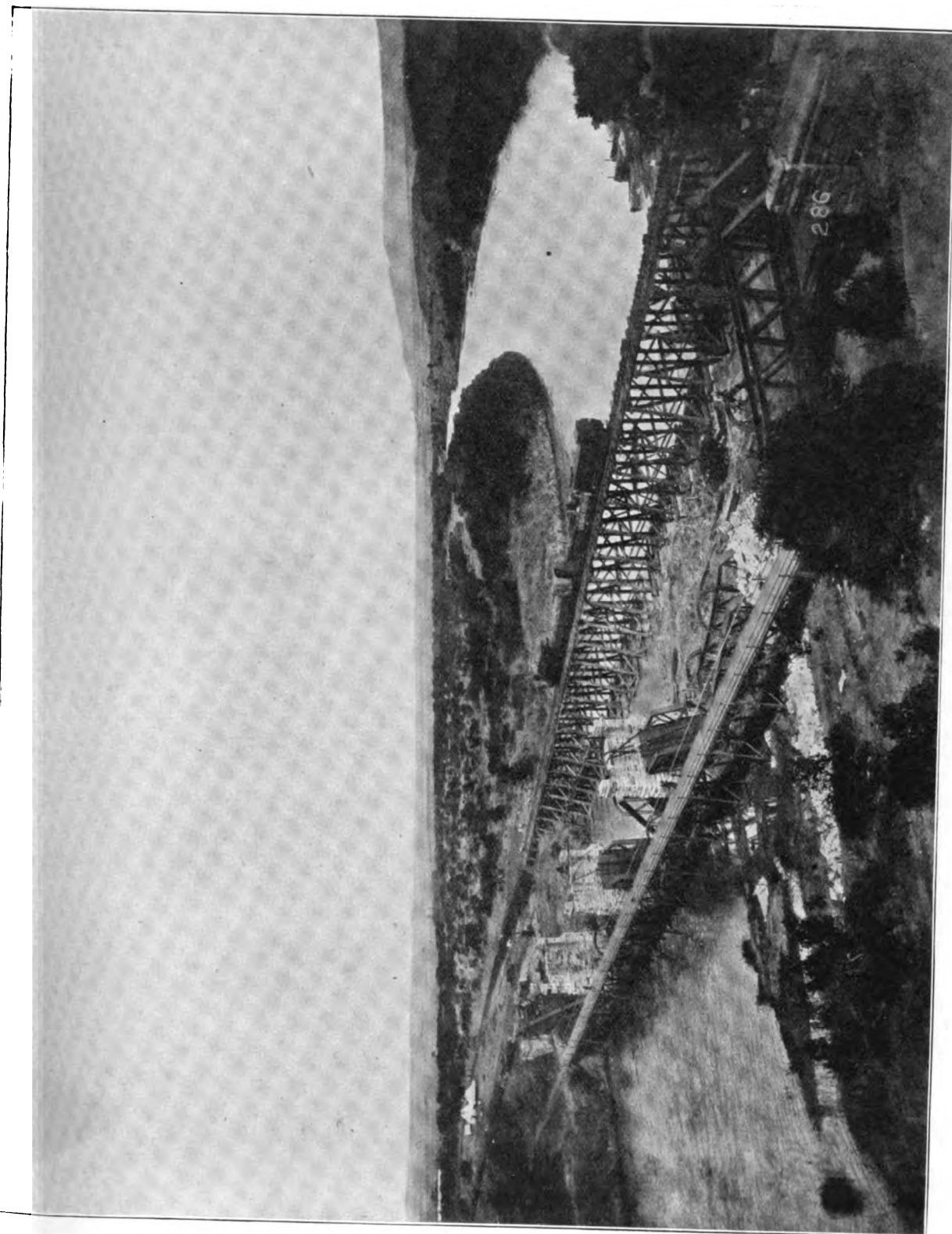
Newcastle, Natal.

Water tank destroyed by enemy.

PHOTO 4.

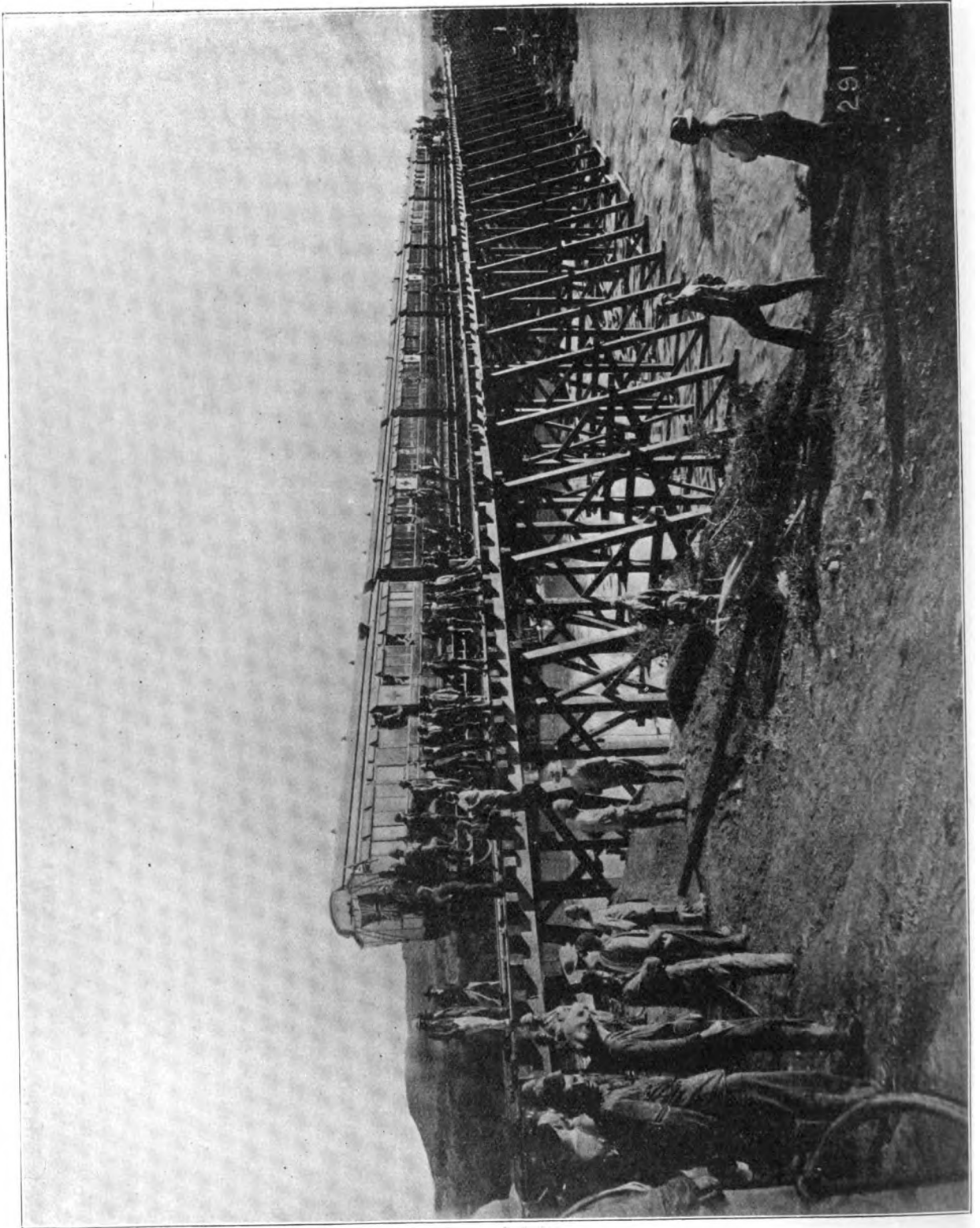


Tugela R. Bridge, Colenso, Natal.

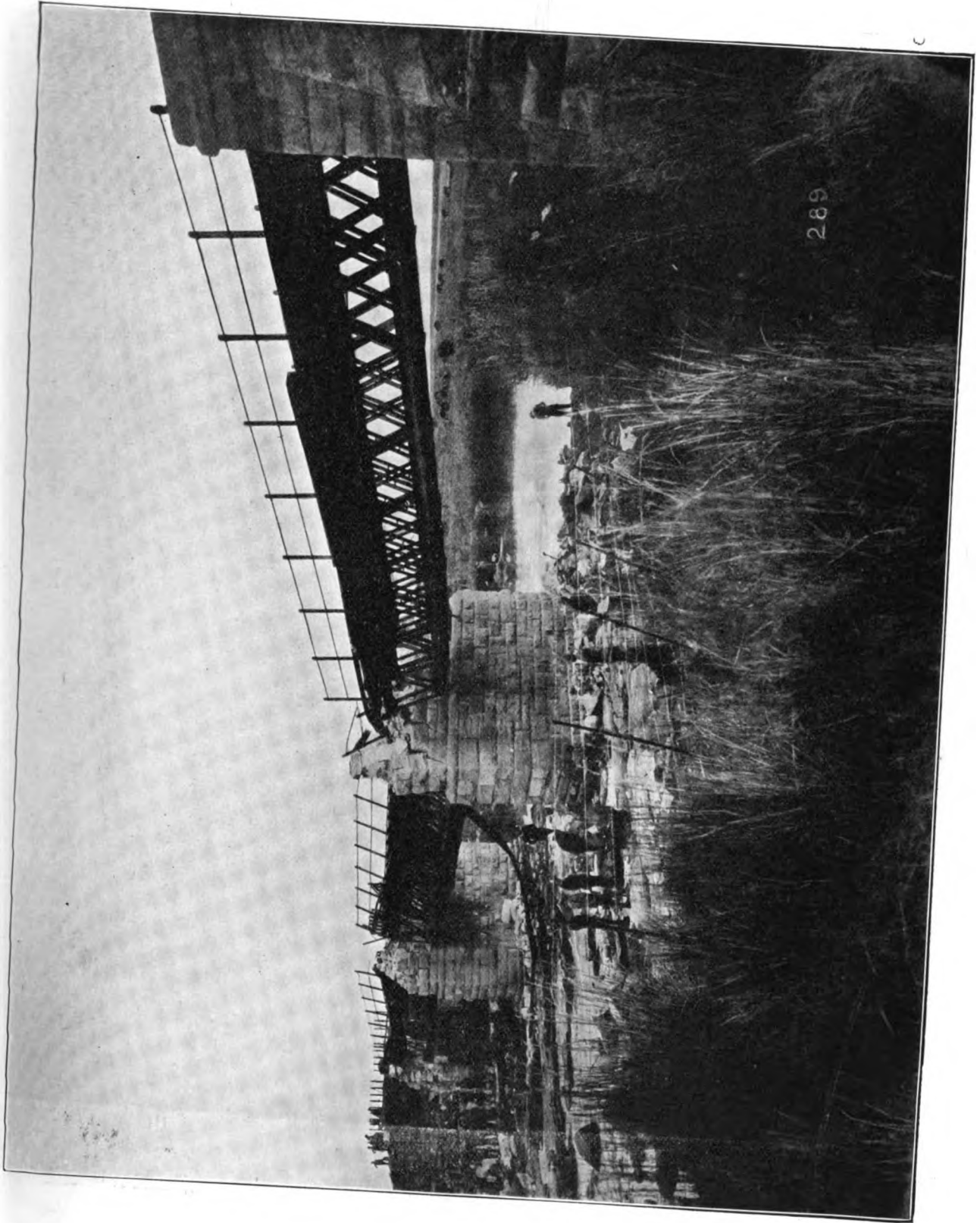


Tugela R. Bridge, Colenso, Natal.
Deviation railway bridge and footbridge; looking South.

PHOTO 6.

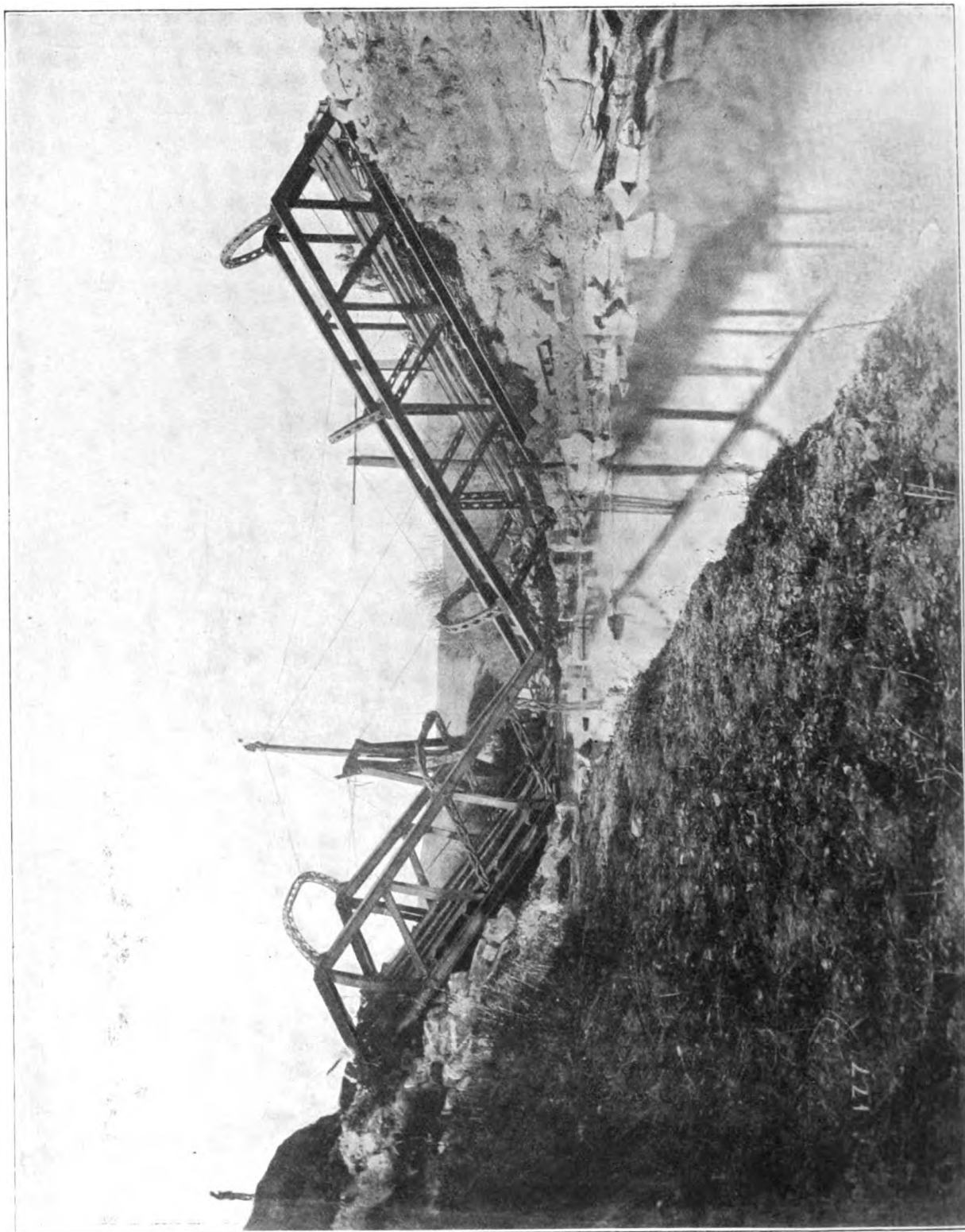


Tugela R. Bridge, Colenso, Natal.

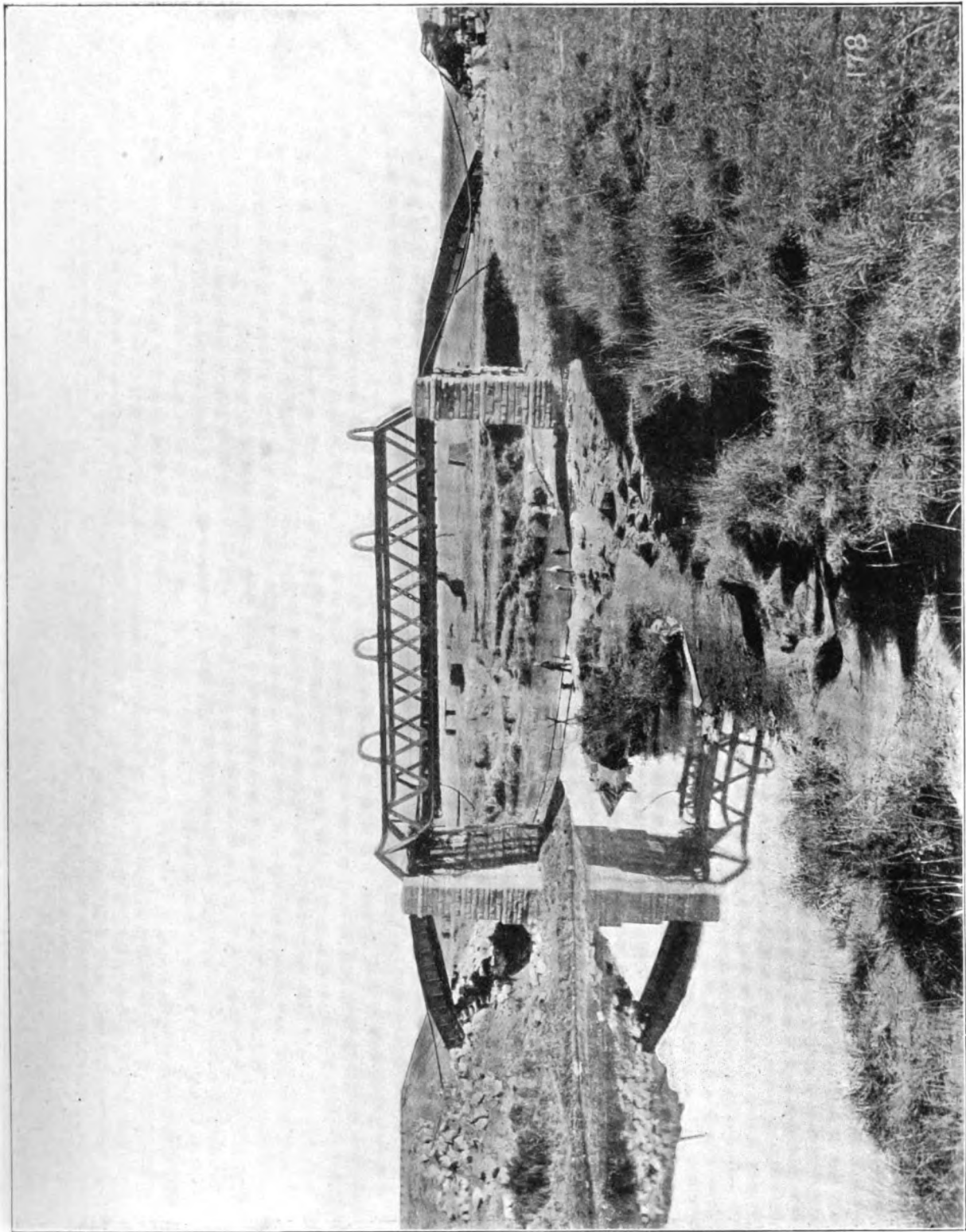


Sunday R. Bridge, Natal.
Showing damage by enemy.

PHOTO 8.

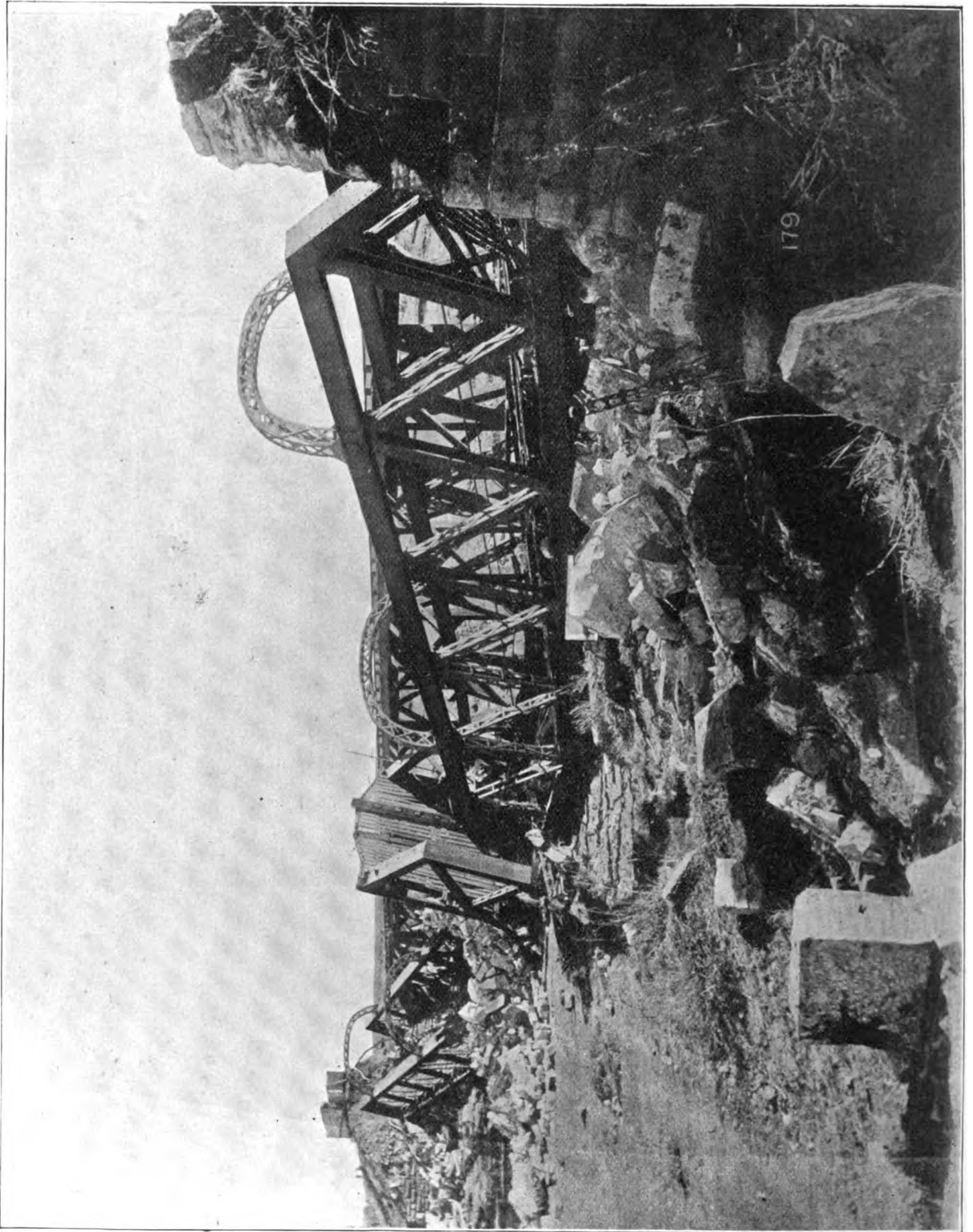


Ingogo R. Bridge, Natal.



Incandu R. Bridge, Natal.
Showing damage by enemy.

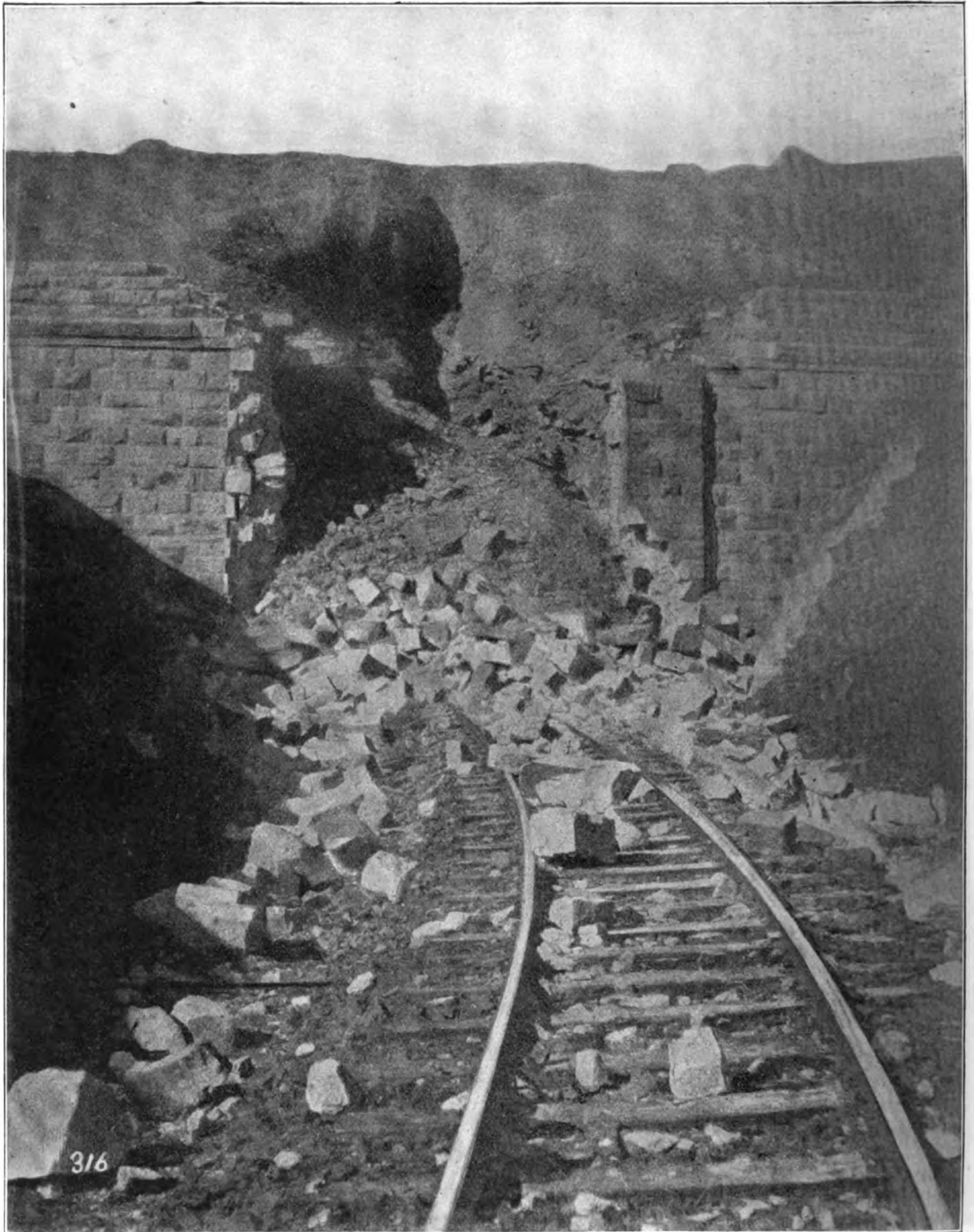
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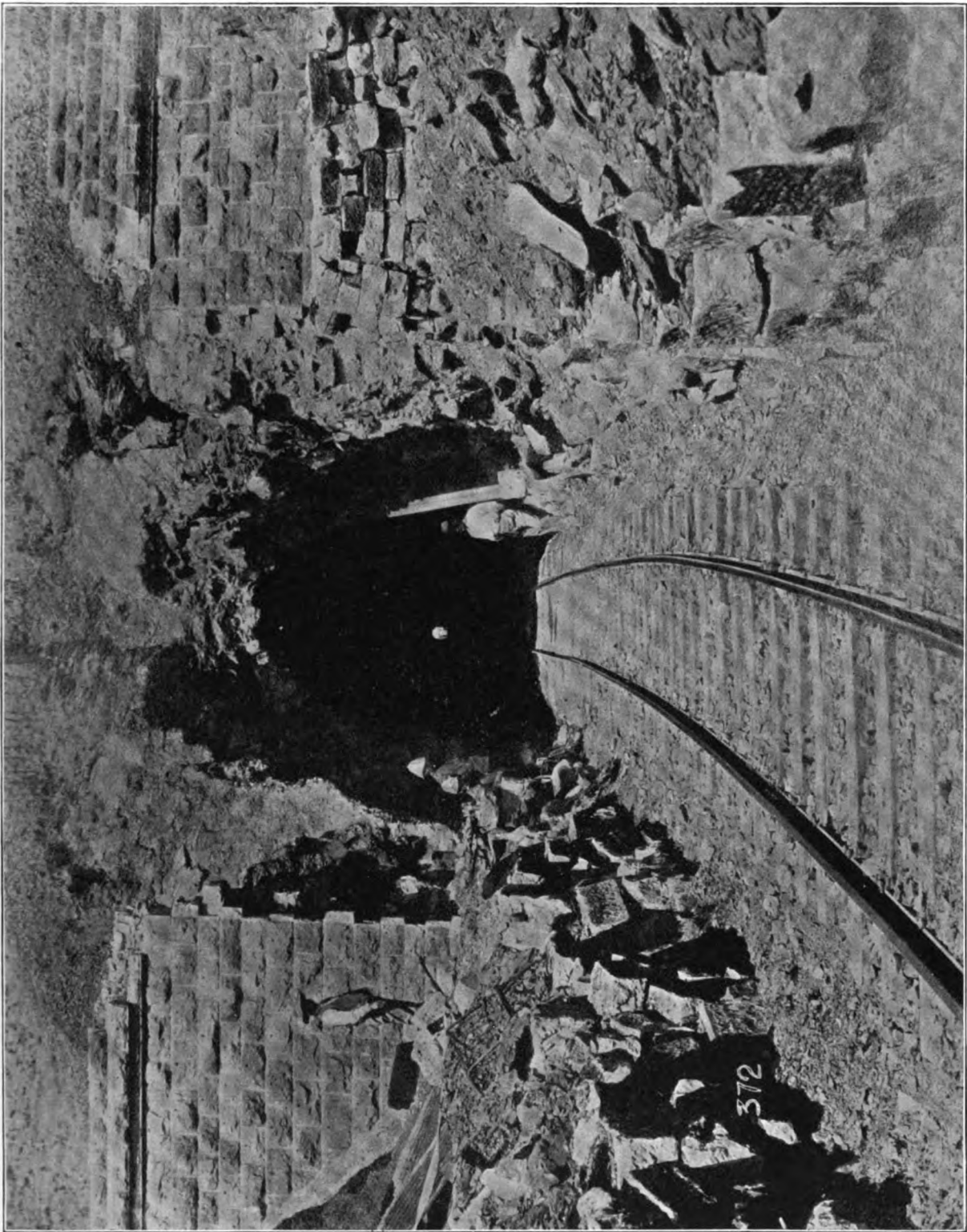
Washbank R. Bridge, Natal.



Zandspruit Bridge, Natal.
Showing damaged girders supported on trestles.

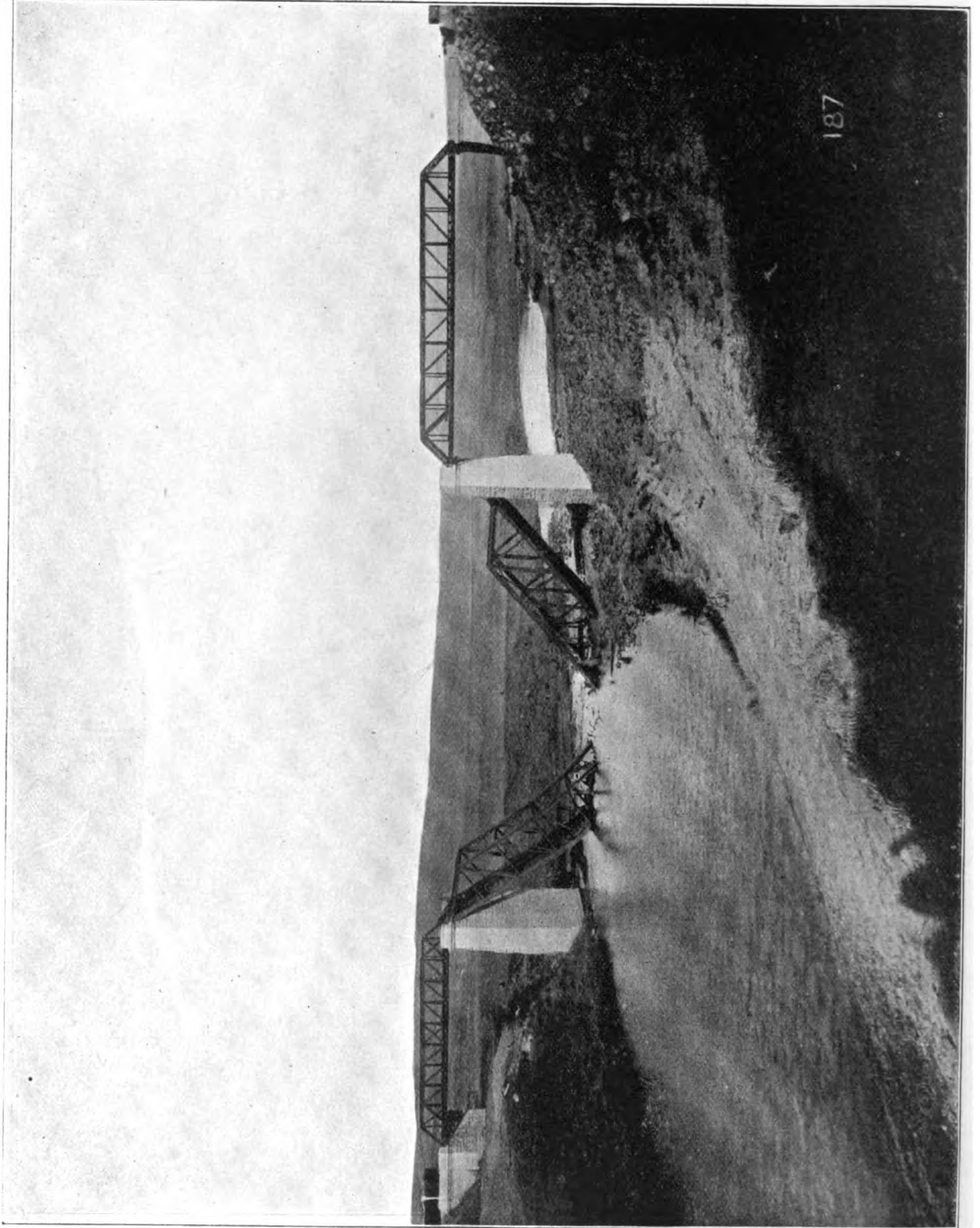


Laing's Nek Tunnel, Natal.
Showing damage by enemy at South end.

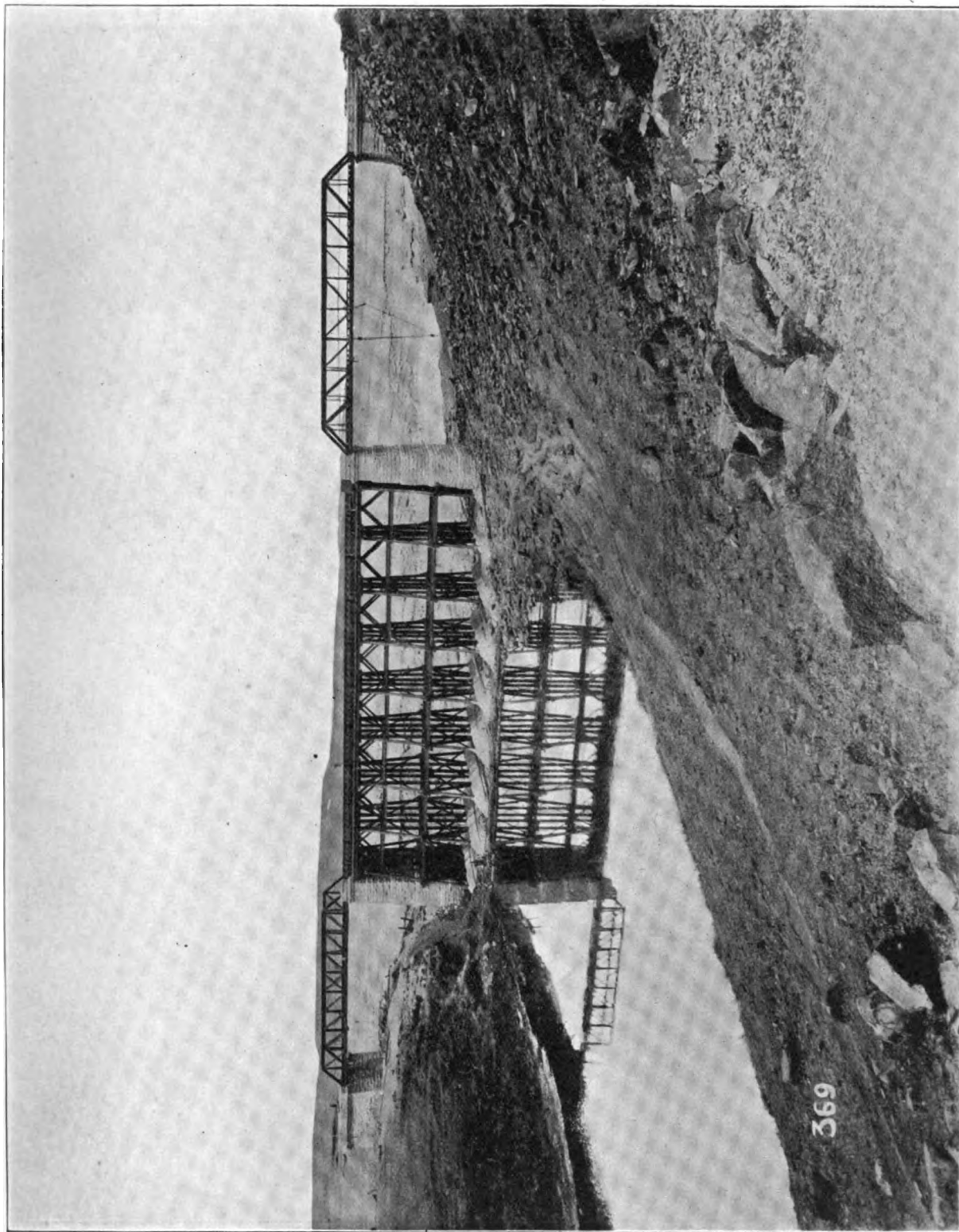


Laing's Nek Tunnel, Natal.
South entrance cleared.

PHOTO 14.

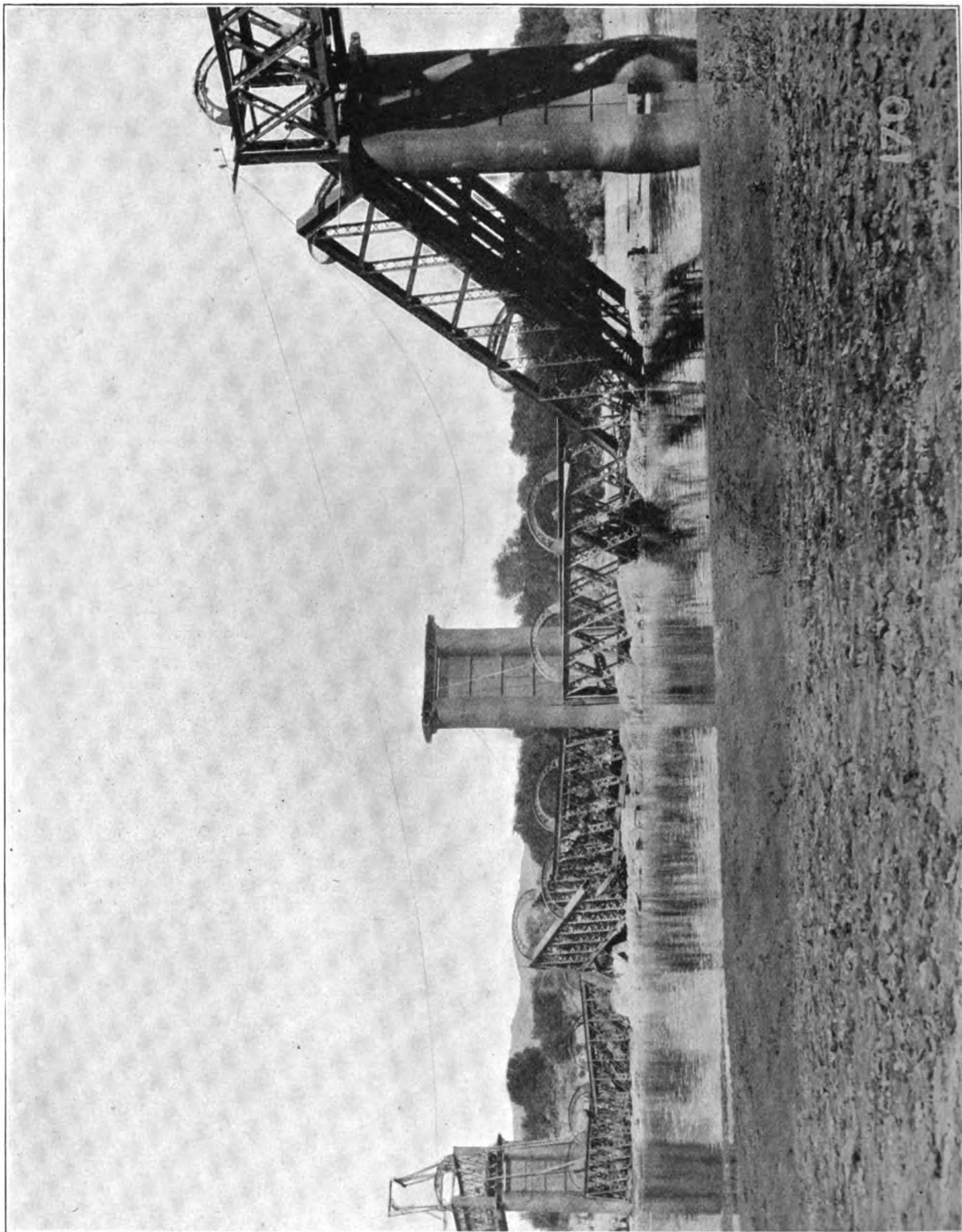


Vaal R. Bridge, Standerton, Elandsfontein—Natal line.

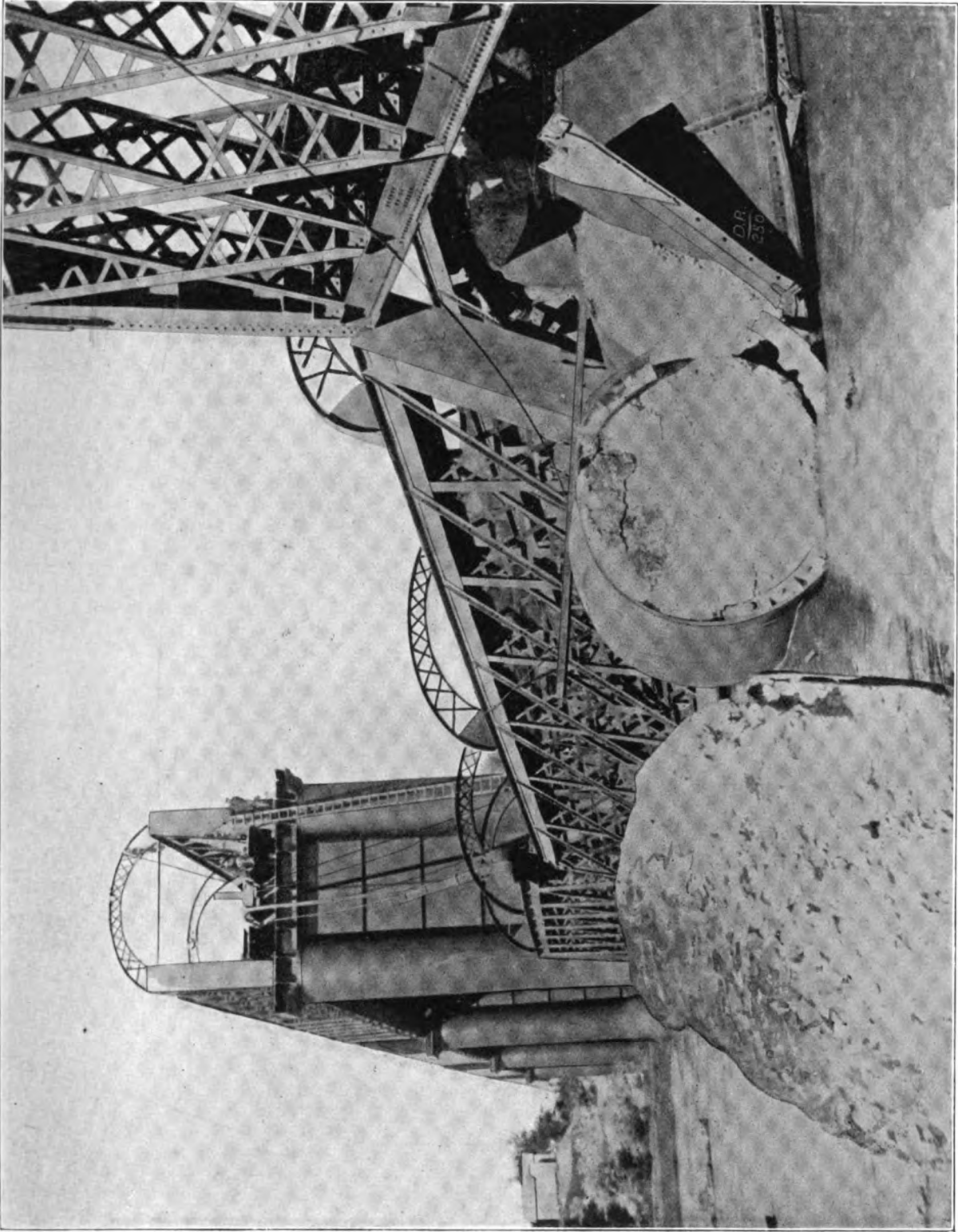


Vaal R. Bridge, Standerton, Elandsfontein—Natal line.
Semi-permanent reconstruction.

PHOTO 16.



Orange R. Bridge, Norval's Pont.

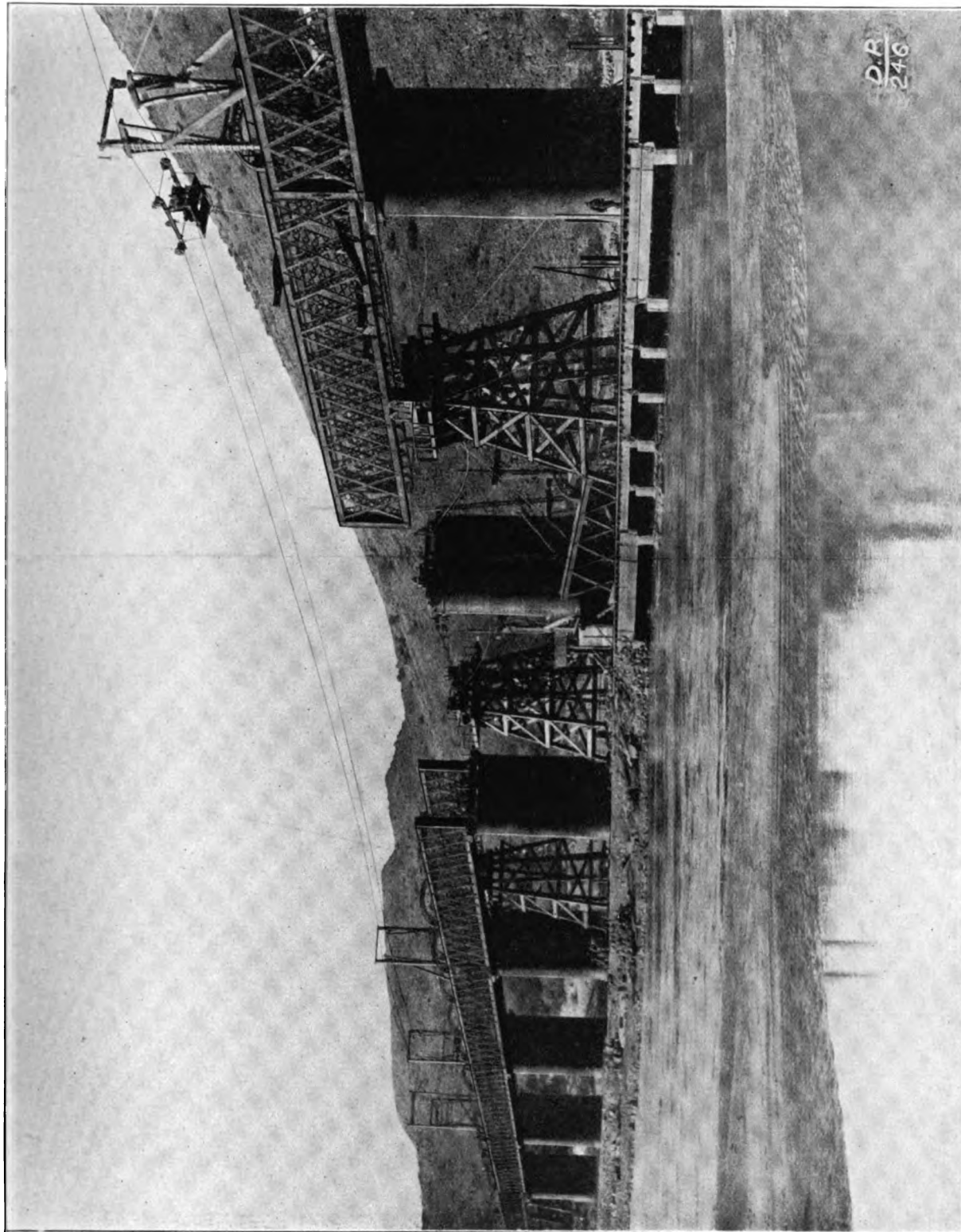


Orange R. Bridge, Norval's Pont.
Near view of destroyed pier and span.



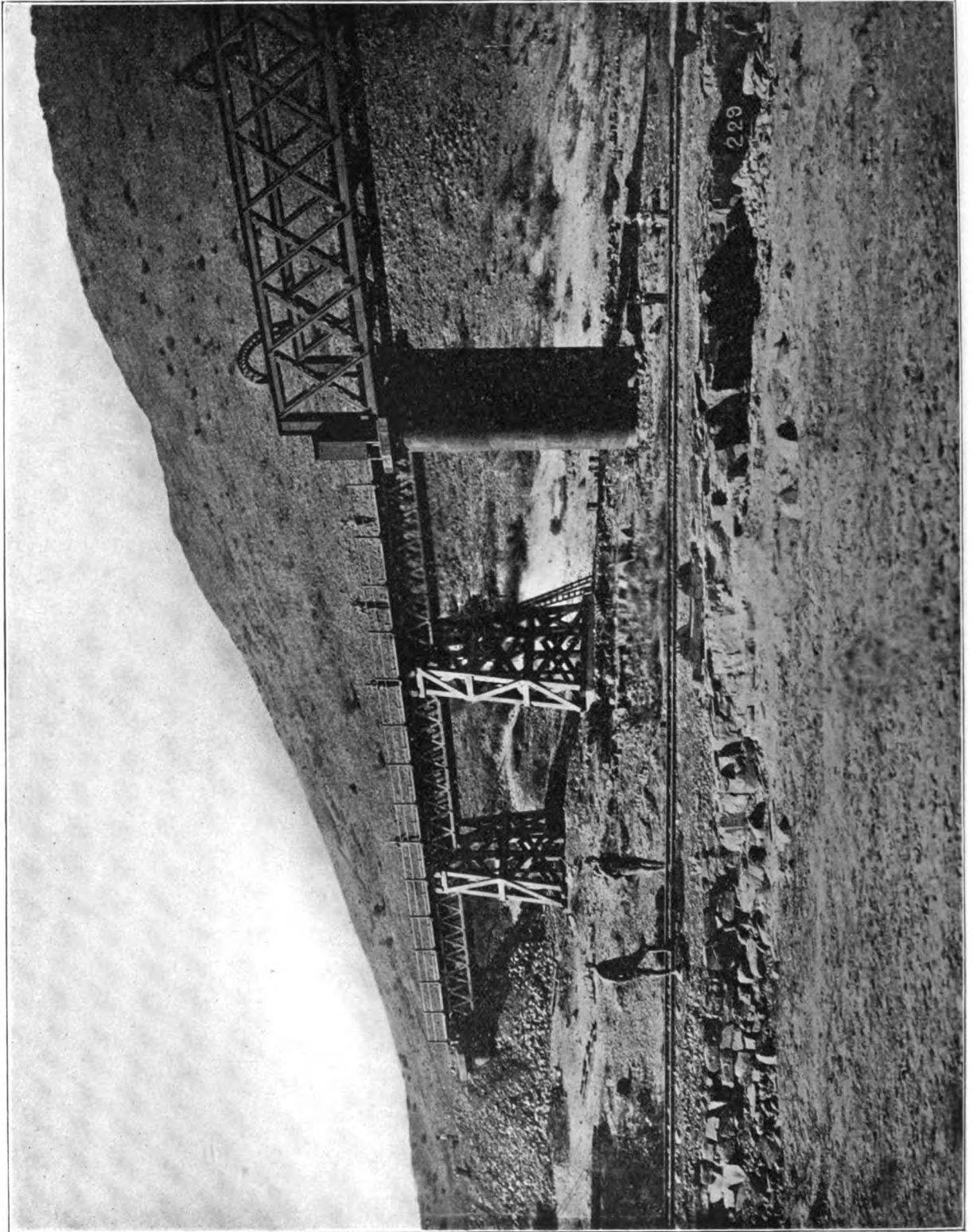
Orange River Bridge, Norval's Pont.

Reconstruction; inside view of pair of girders before lifting on trolleys for launching.

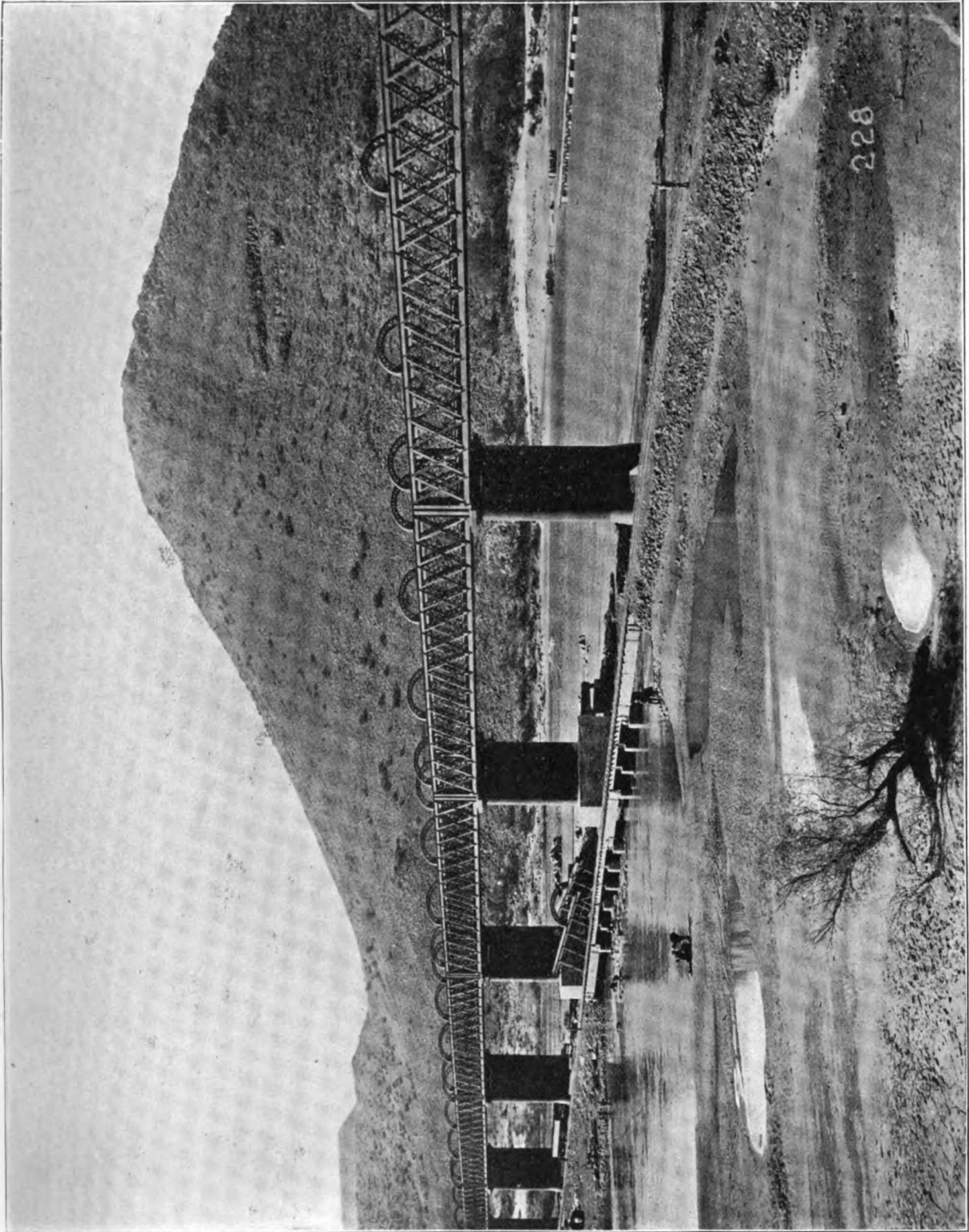


Orange R. Bridge, Norval's Pont.
Launching girders on reconstruction.

PHOTO 20.

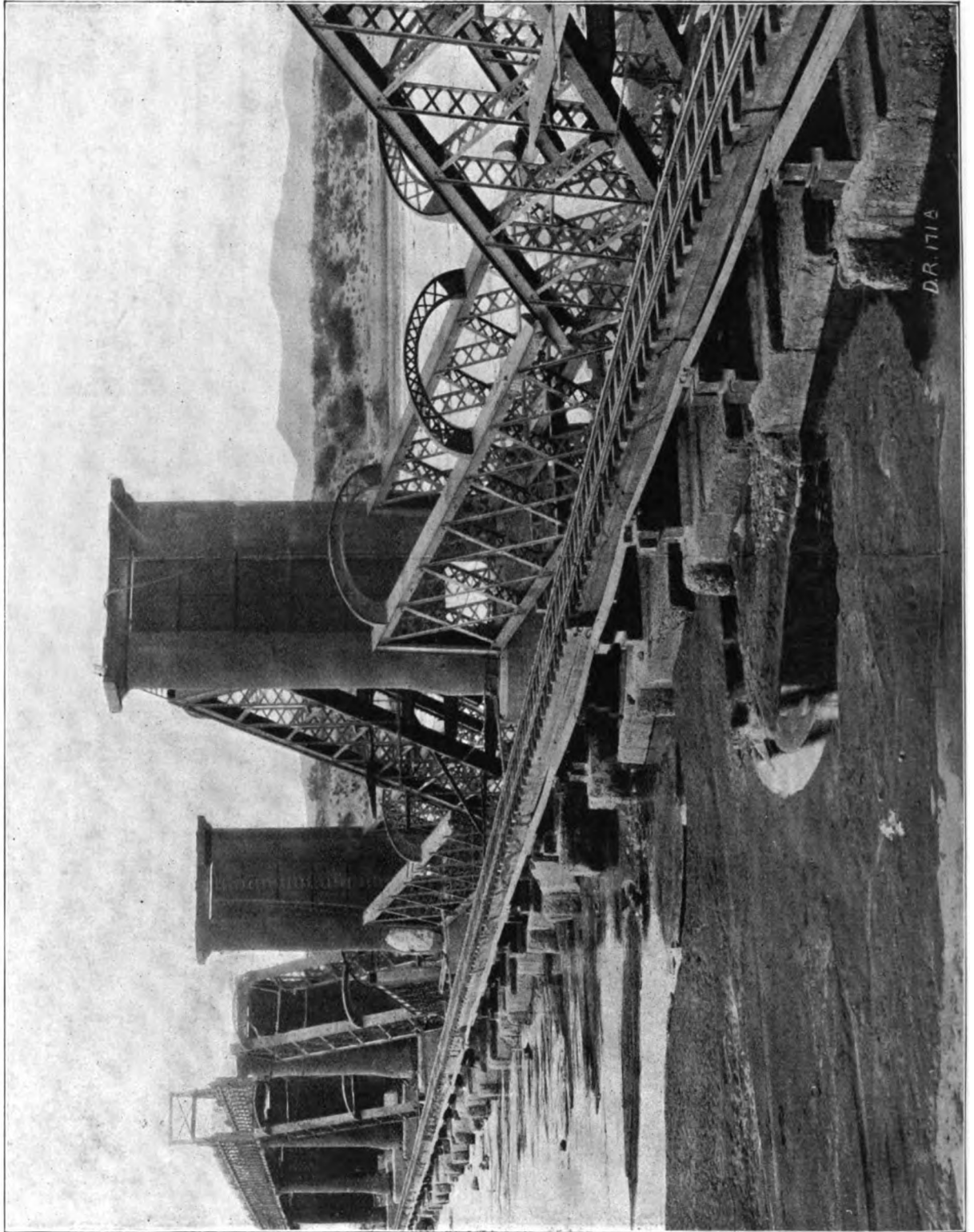


Orange R. Bridge. Norval's Pont.

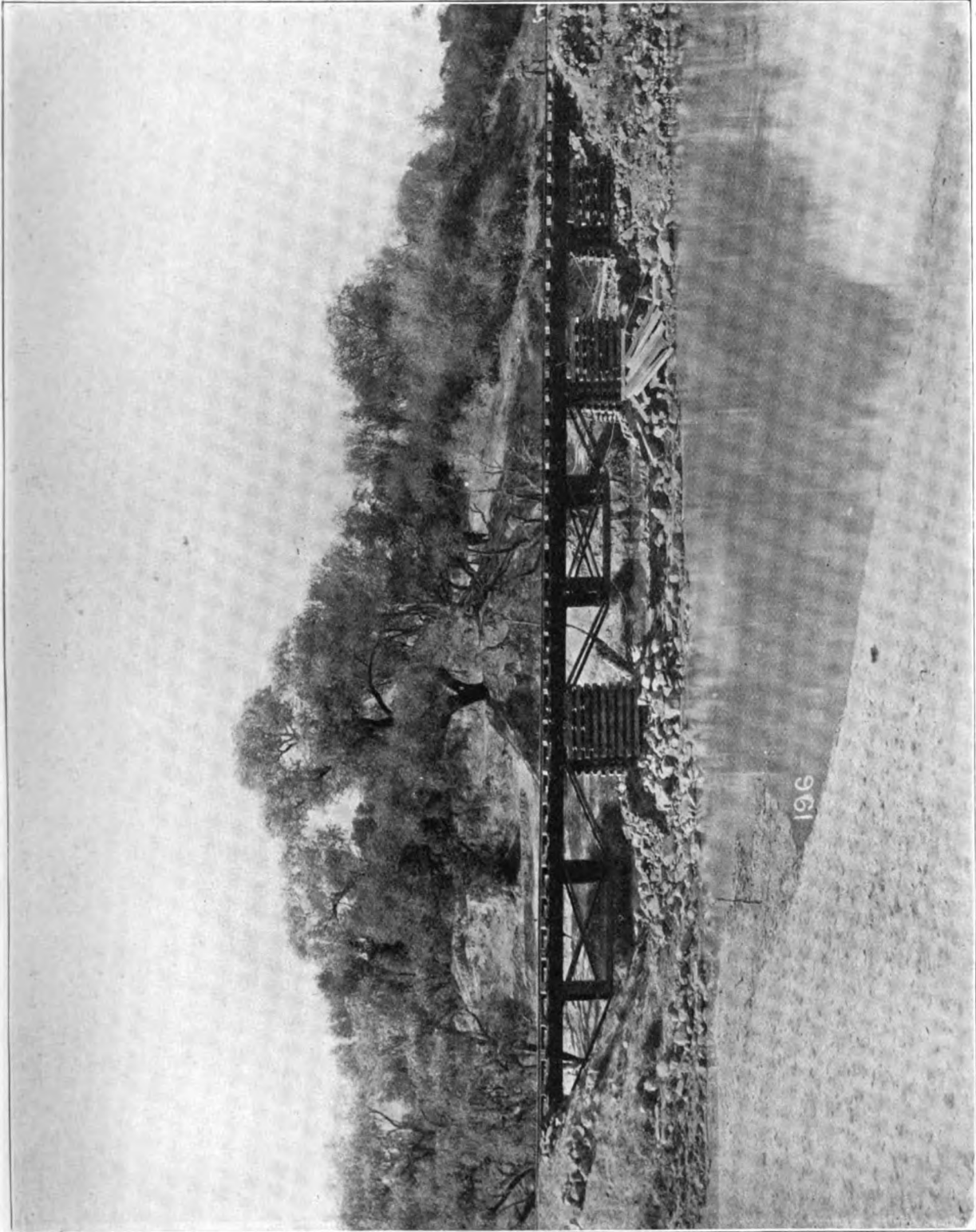


Orange R. Bridge, Norval's Pont, repaired.
Showing low level deviation alongside and pontoon bridge in background.

PHOTO 22.

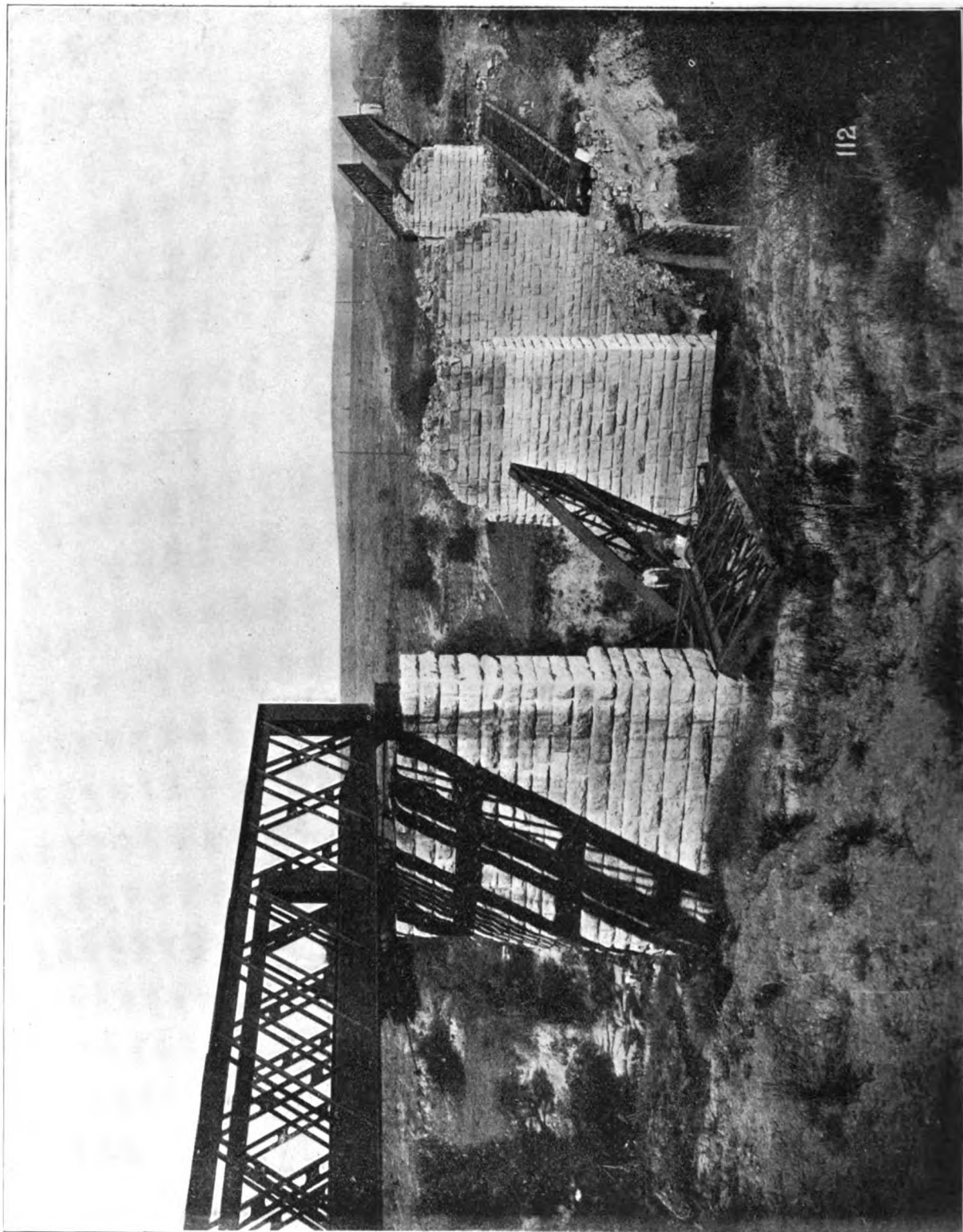


Orange R. Bridge, Bethulle.

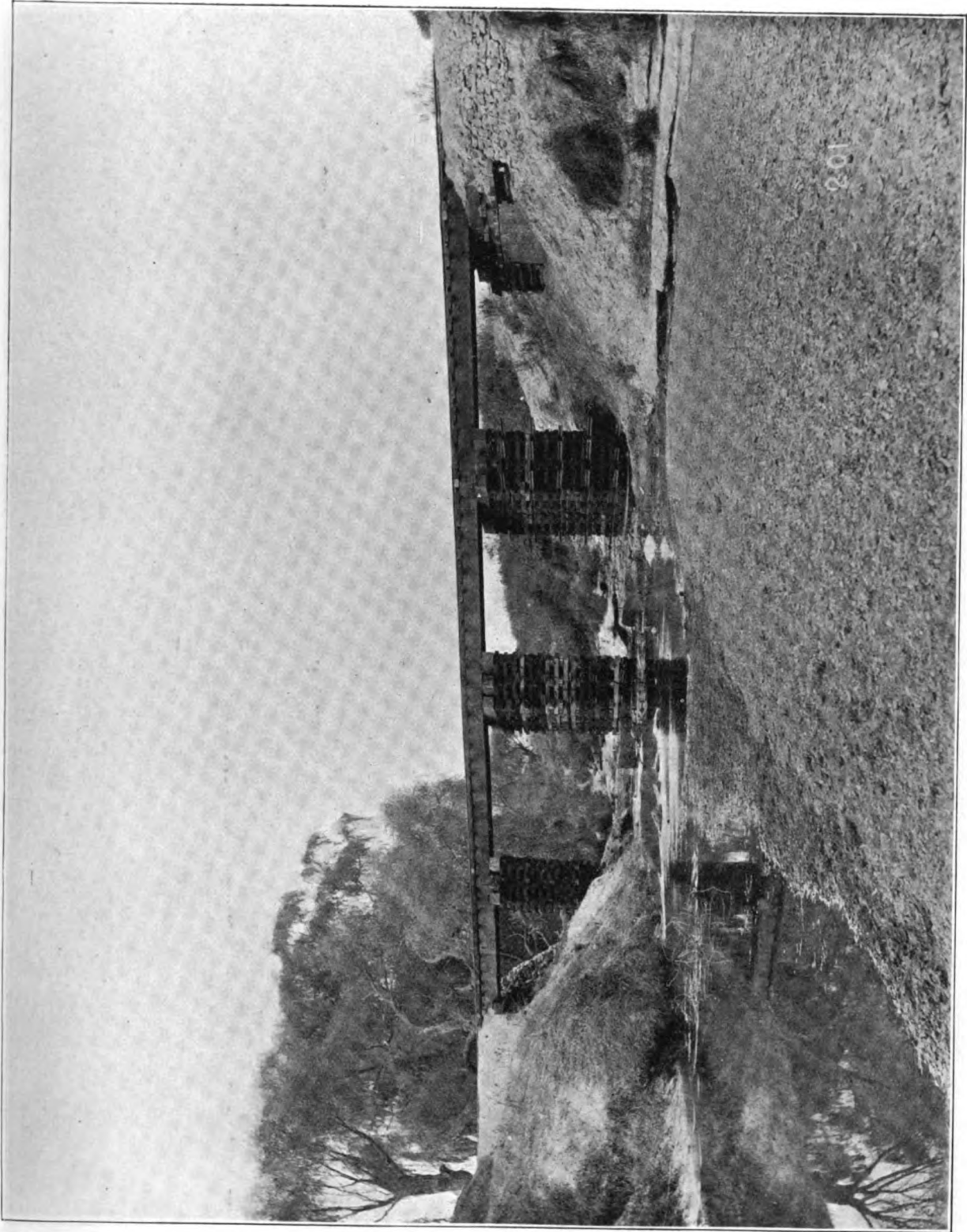


Modder R. Bridge, Glen, Bloemfontein—Pretoria line.
Bridge of crib piers and trussed beams on deviation.

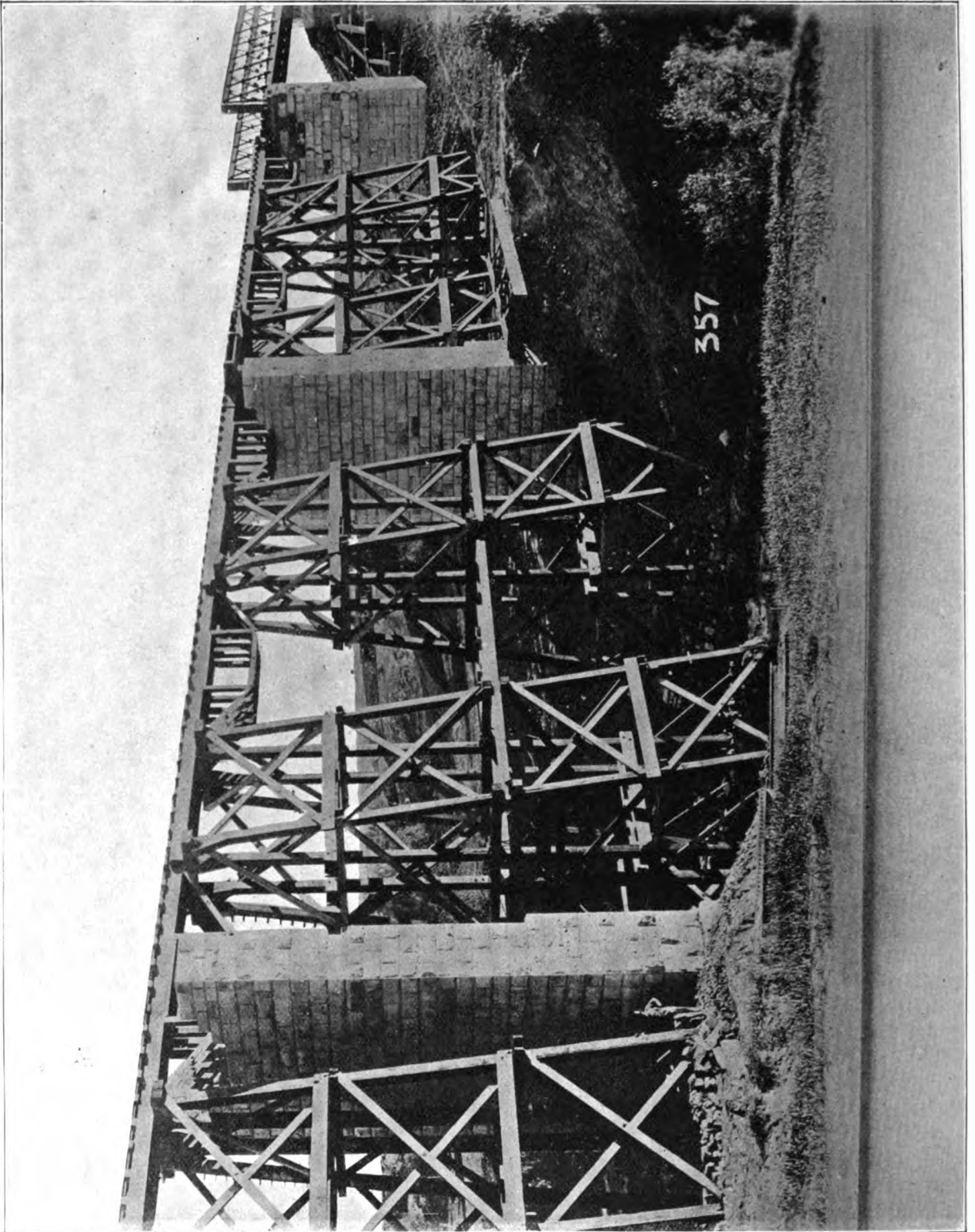
PHOTO 24.



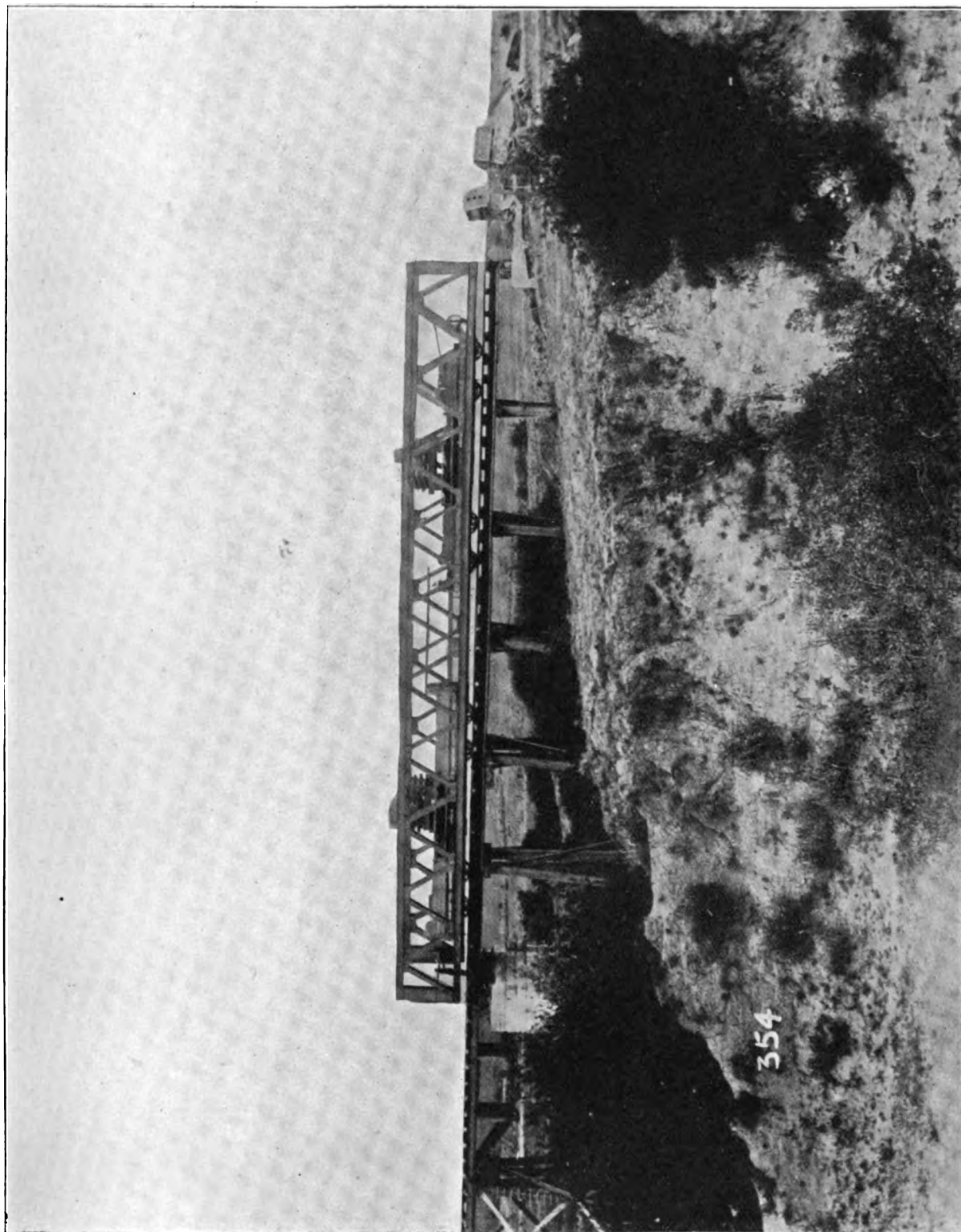
Vet R. Bridge, Bloemfontein—Pretoria line.



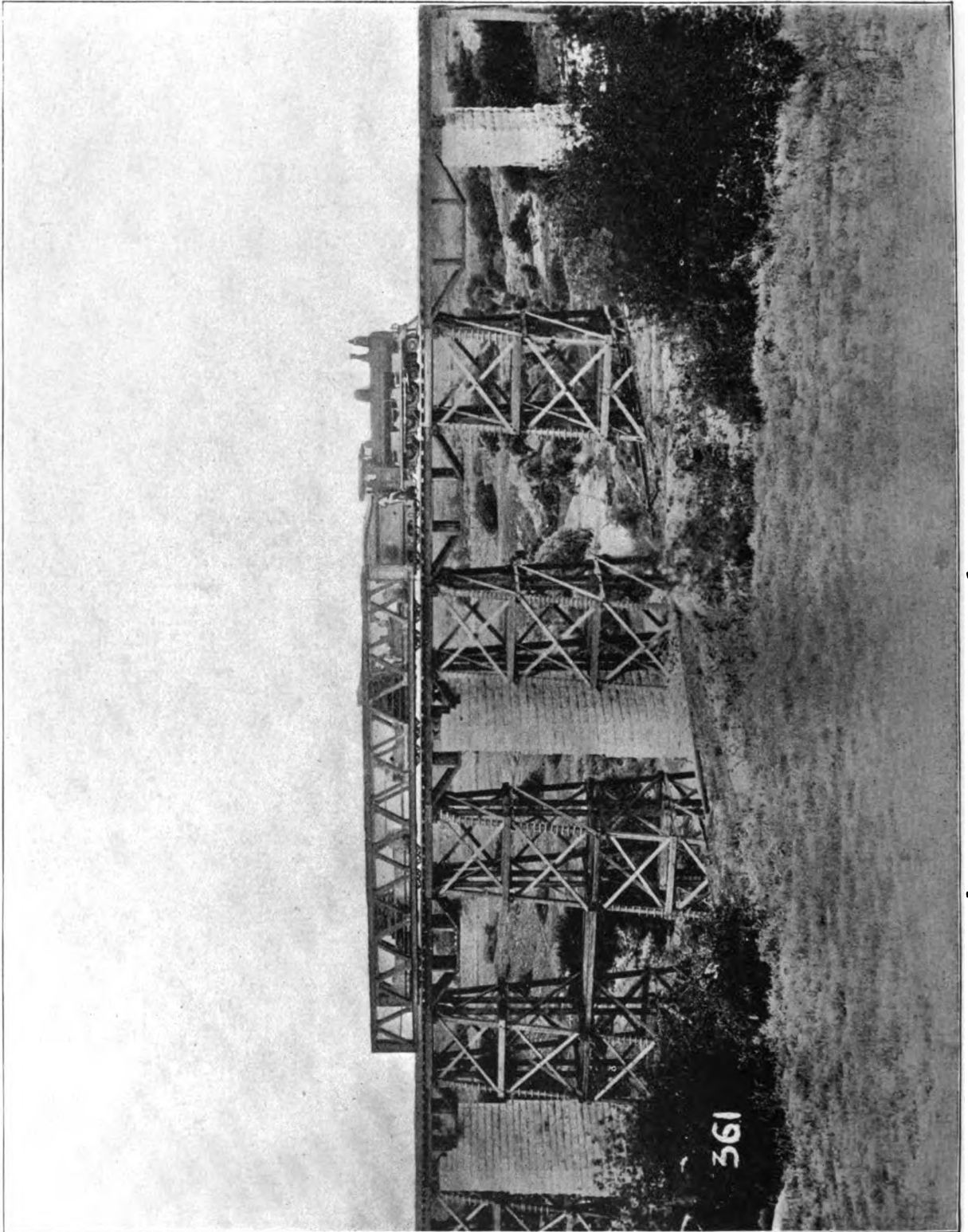
Vet R. Bridge, Bloemfontein—Pretoria line.
Skew bridge on deviation.



Vet R. Bridge, Bloemfontein—Pretoria line.



Vet R. Bridge, Bloemfontein—Pretoria line.
Girders waiting to be drawn out during reconstruction.



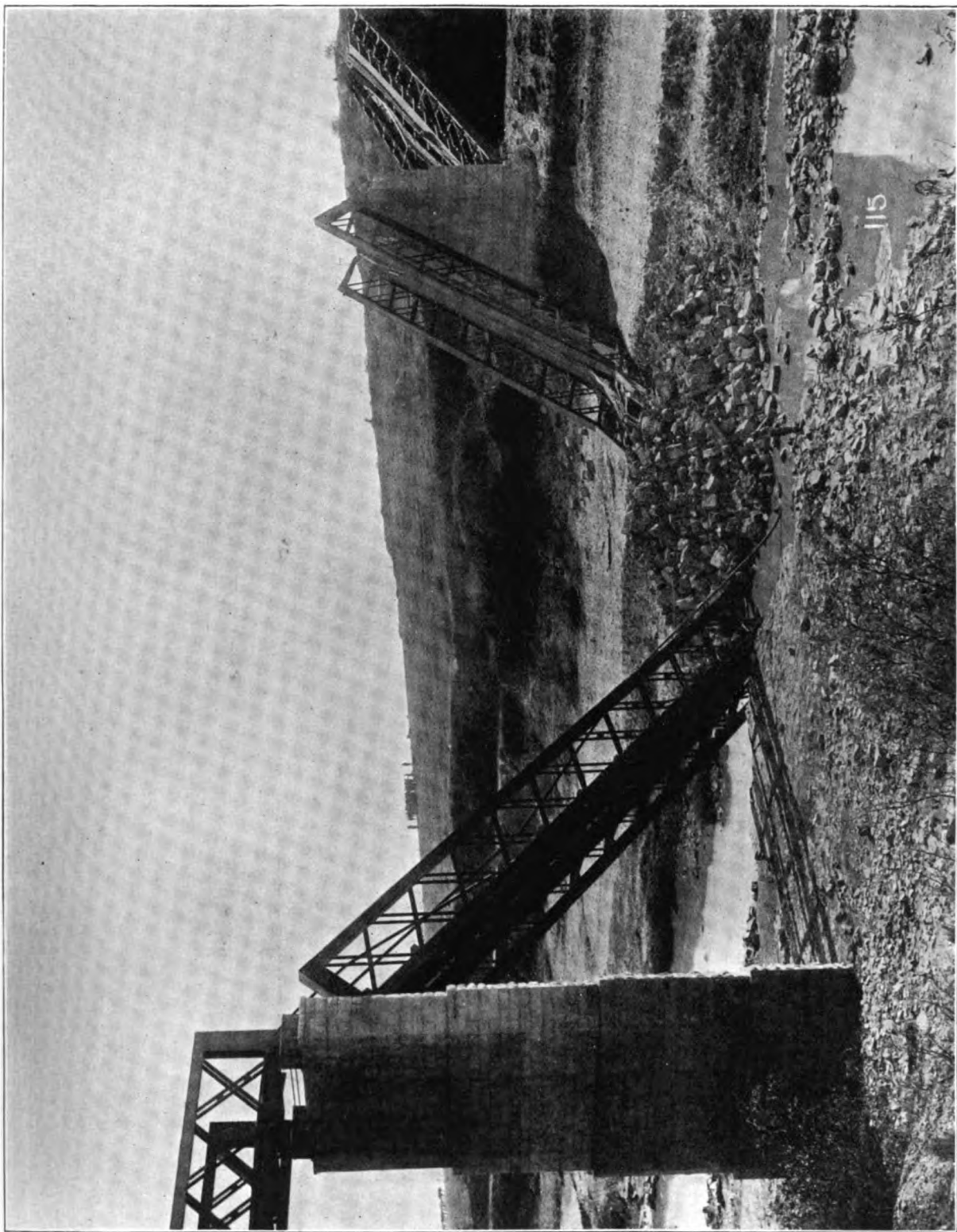
Vet R. Bridge, Bloemfontein -Pretoria line.
Locomotive drawing girders out during reconstruction.



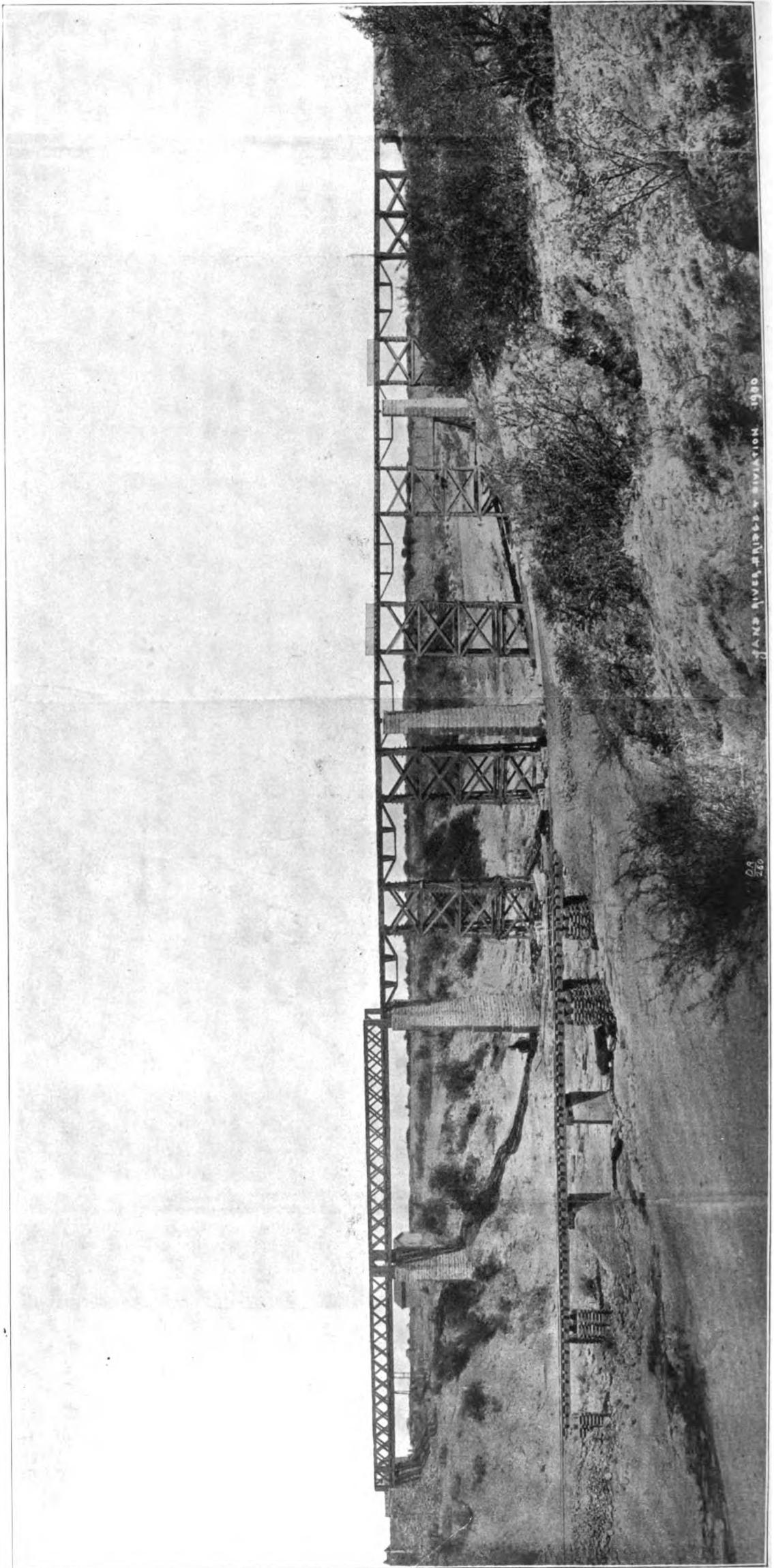
Vet R. Bridge, Bloemfontein—Pretoria line.
Launching girders during reconstruction.



Doorn Spruit Bridge, Bloemfontein - Pretoria line.



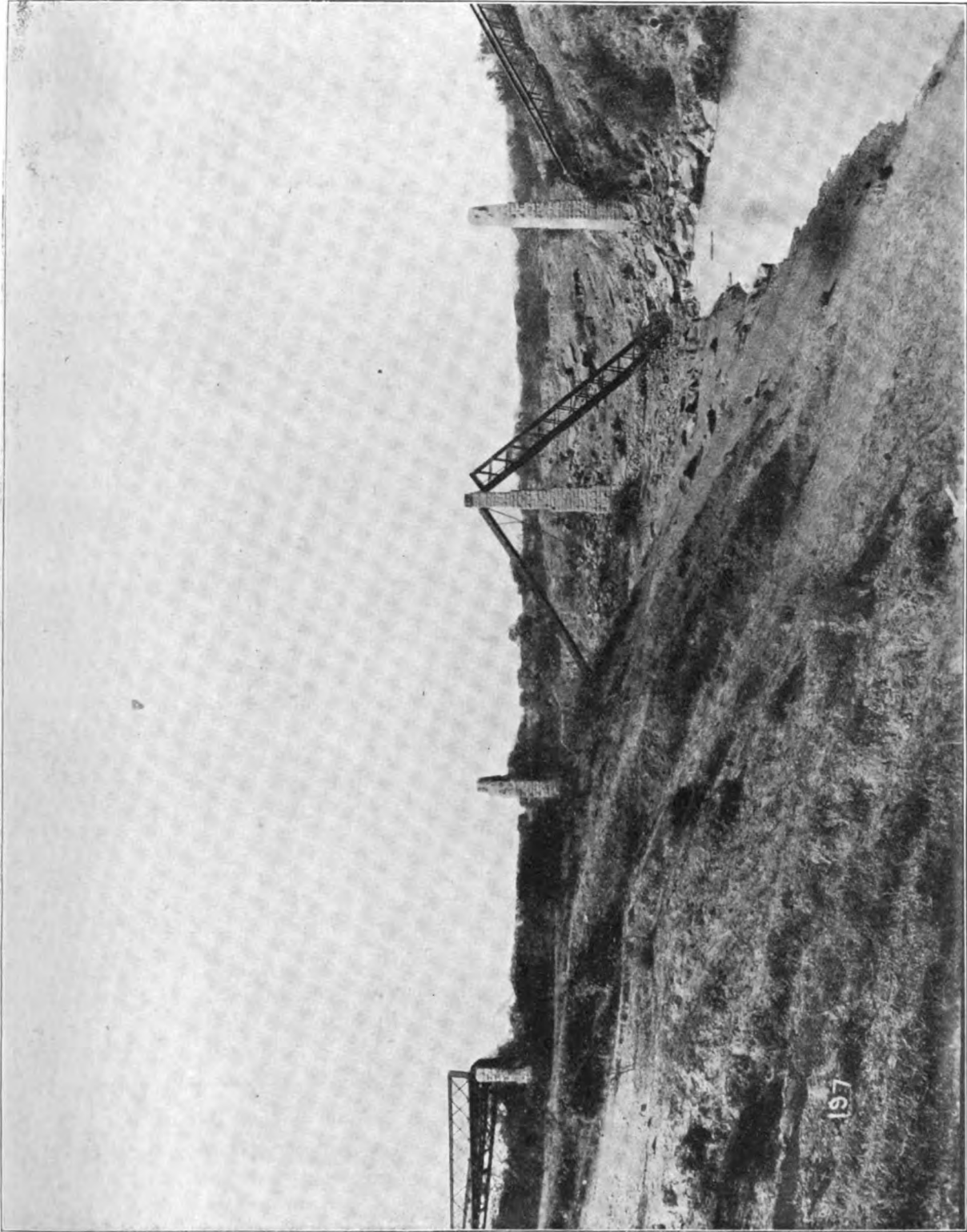
Zand R. Bridge, Bloemfontein—Pretoria line.
View from South bank, showing damage by enemy.



ZAND RIVER BRIDGE & DIVISION 1980

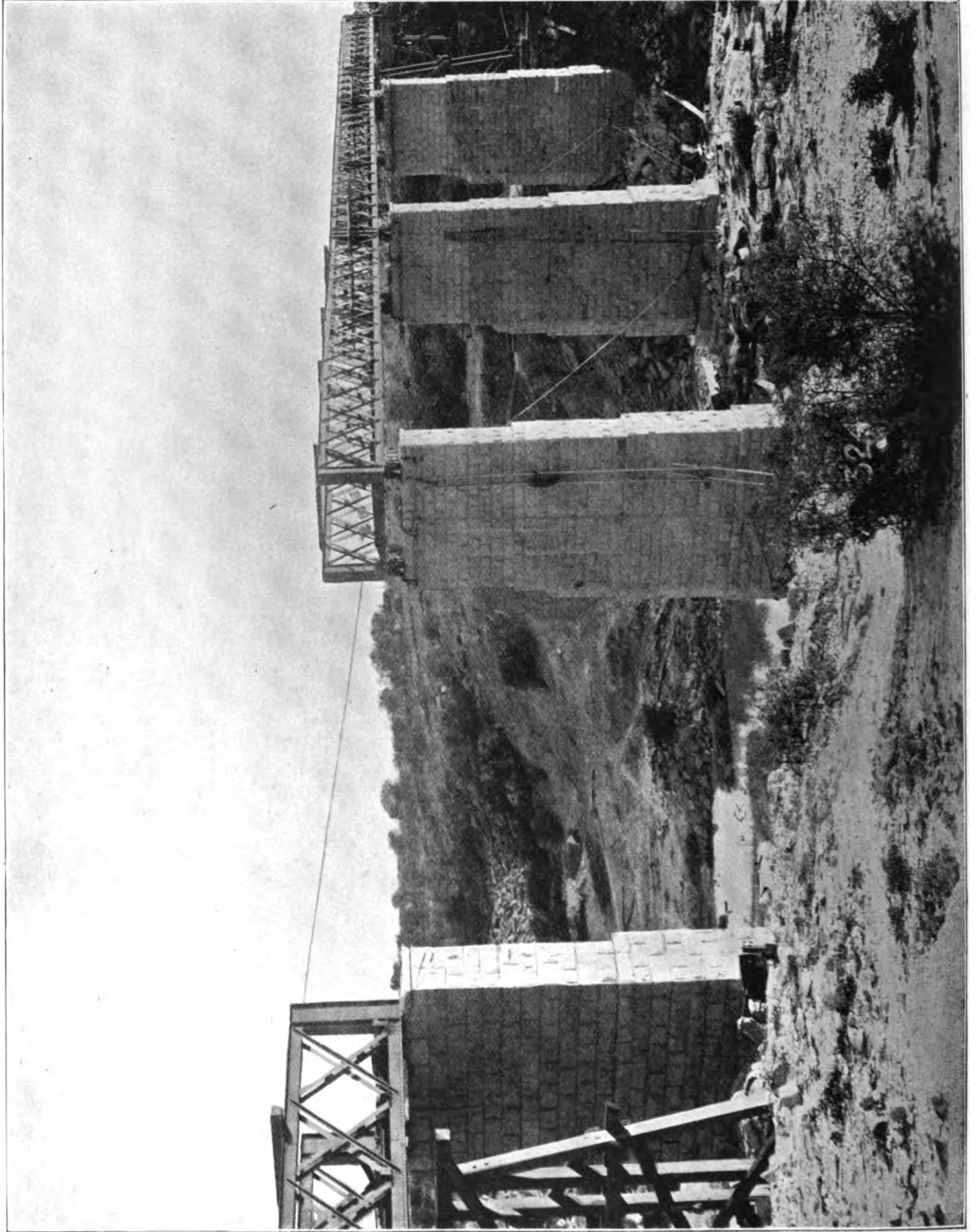
24
260

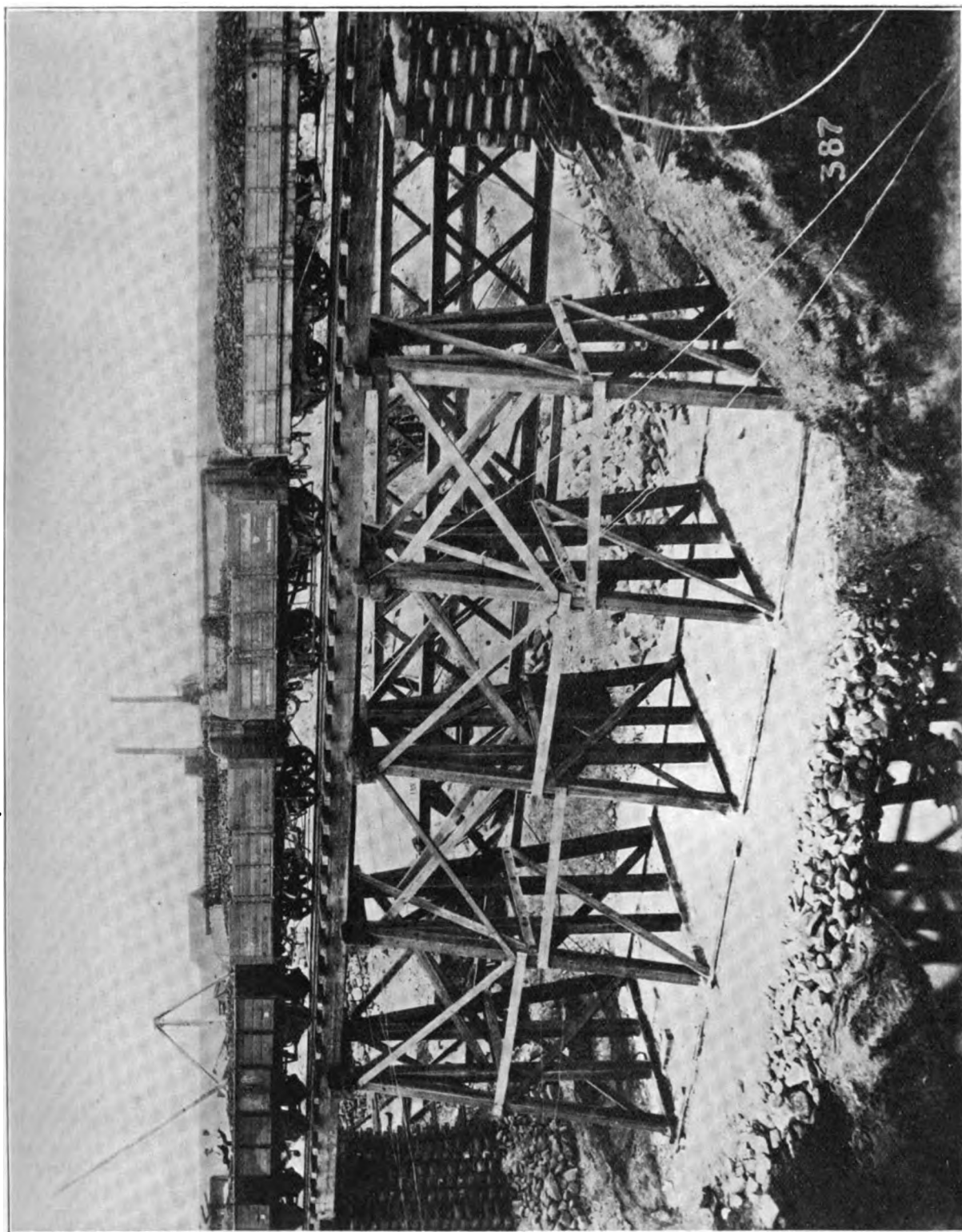
Zand R. Bridge, Bloemfontein—Pretoria line.
Semi-permanent reconstruction.



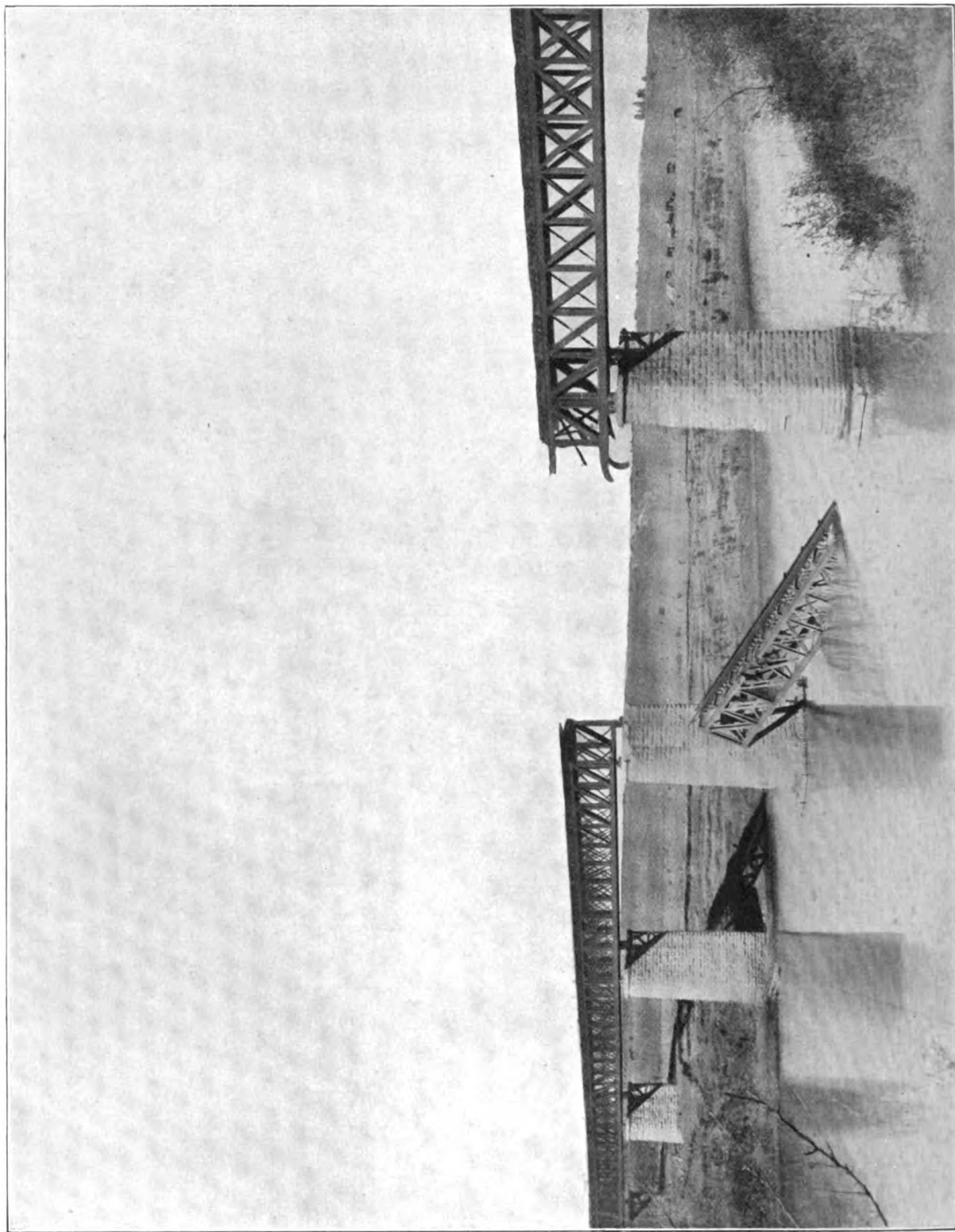
Valsch R. Bridge, Bloemfontein—Pretoria line.
Showing damage by enemy.

PHOTO 34.

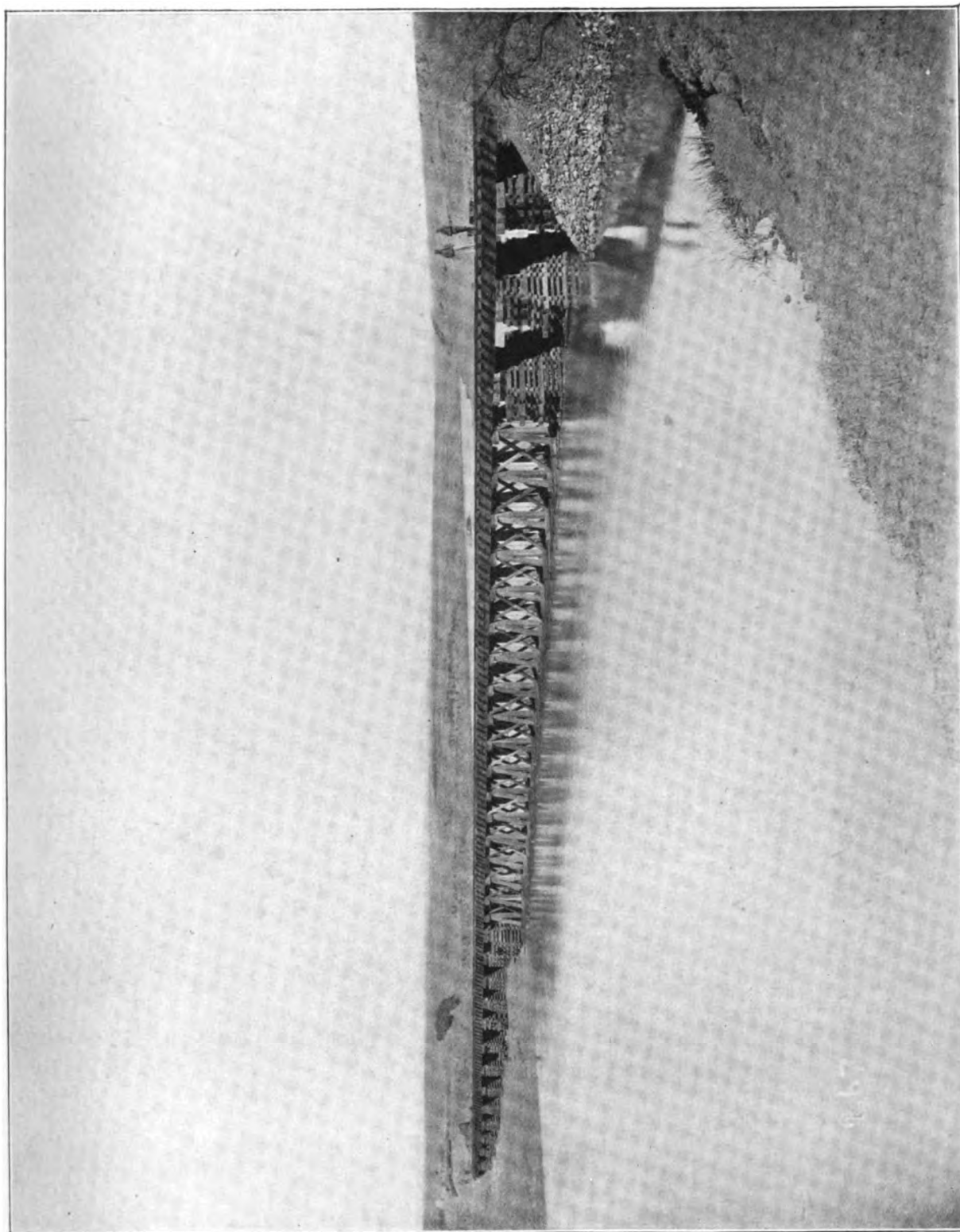




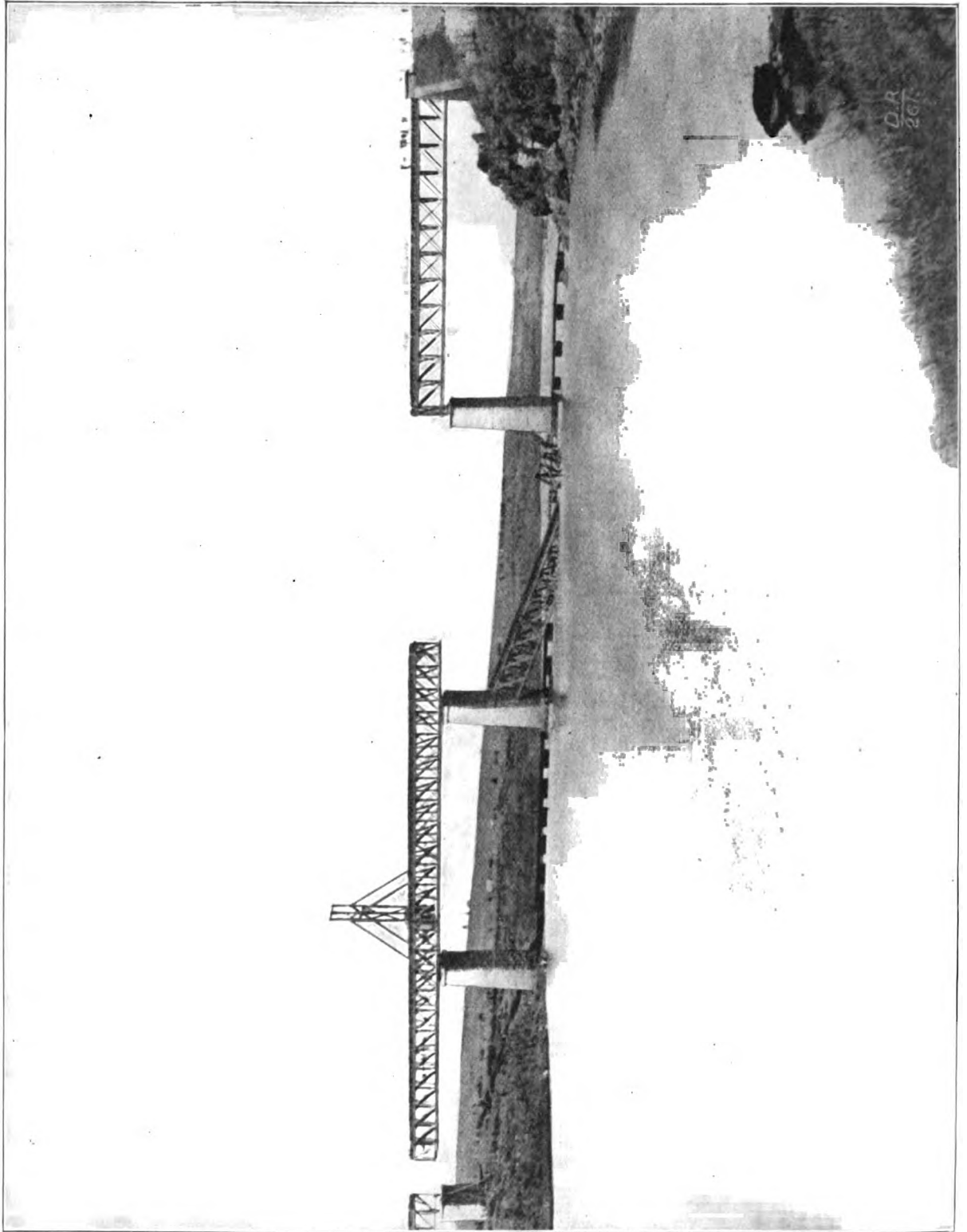
Rhenoster R. Bridge, Bloemfontein—Pretoria line.
Second temporary bridge, replacing bridge burnt by enemy.



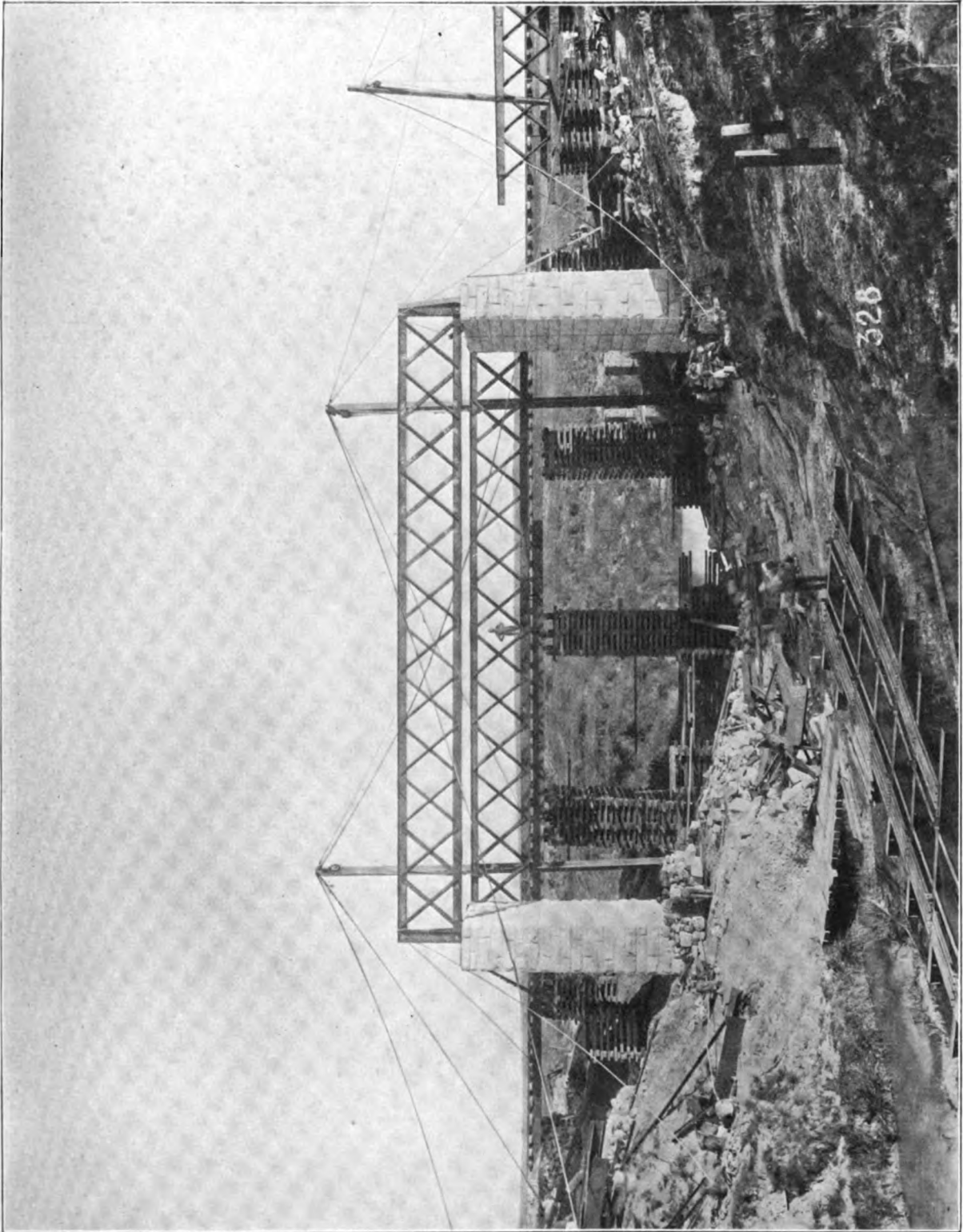
Vaal R. Bridge, Vereeniging, Bloemfontein Pretoria line.



Vaal R. Bridge, Vereeniging, Bloemfontein—Pretoria line
View from north bank of low level bridge on deviation.

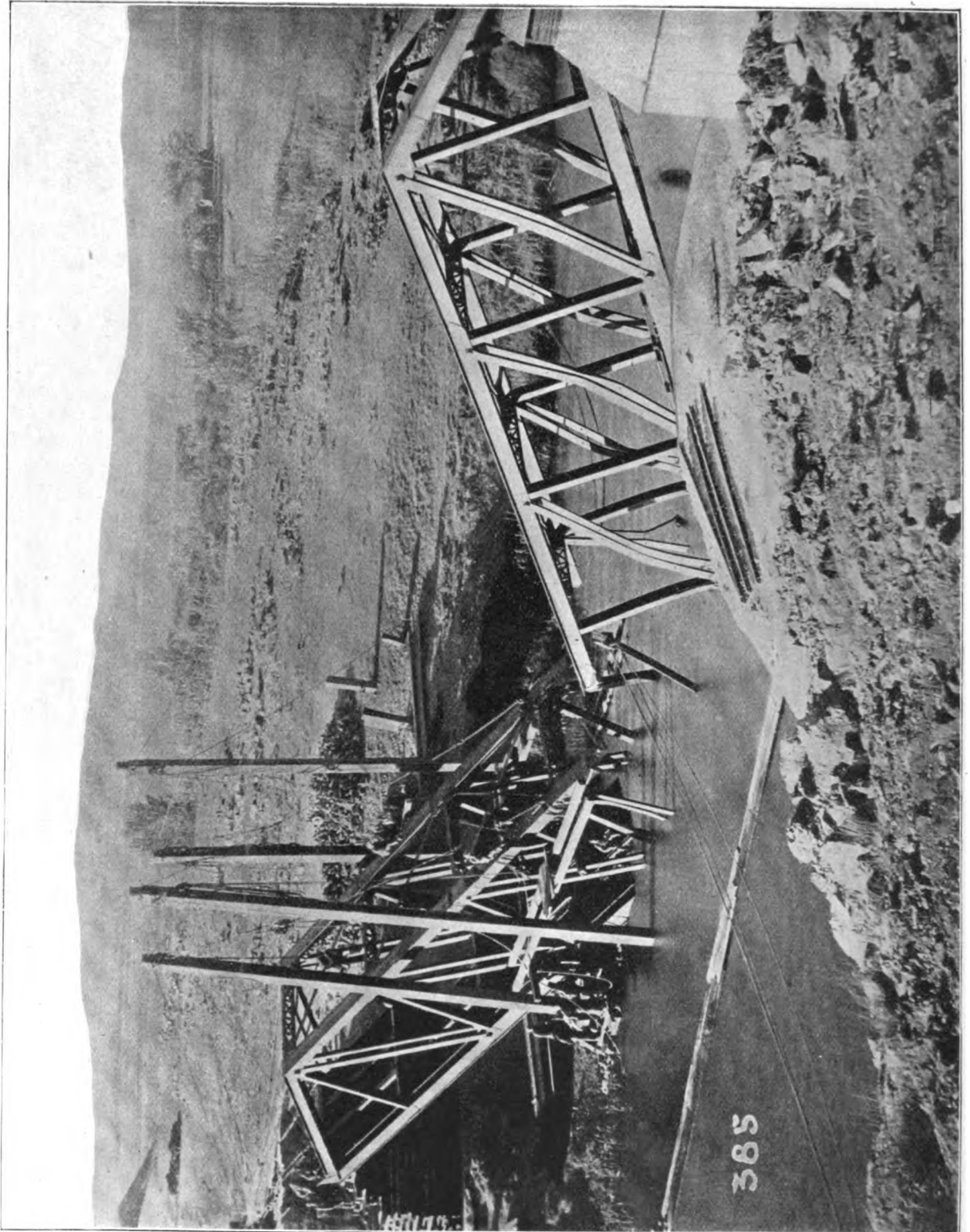


Vaal R. Bridge, Vereeniging, Bloemfontein—Pretoria line.

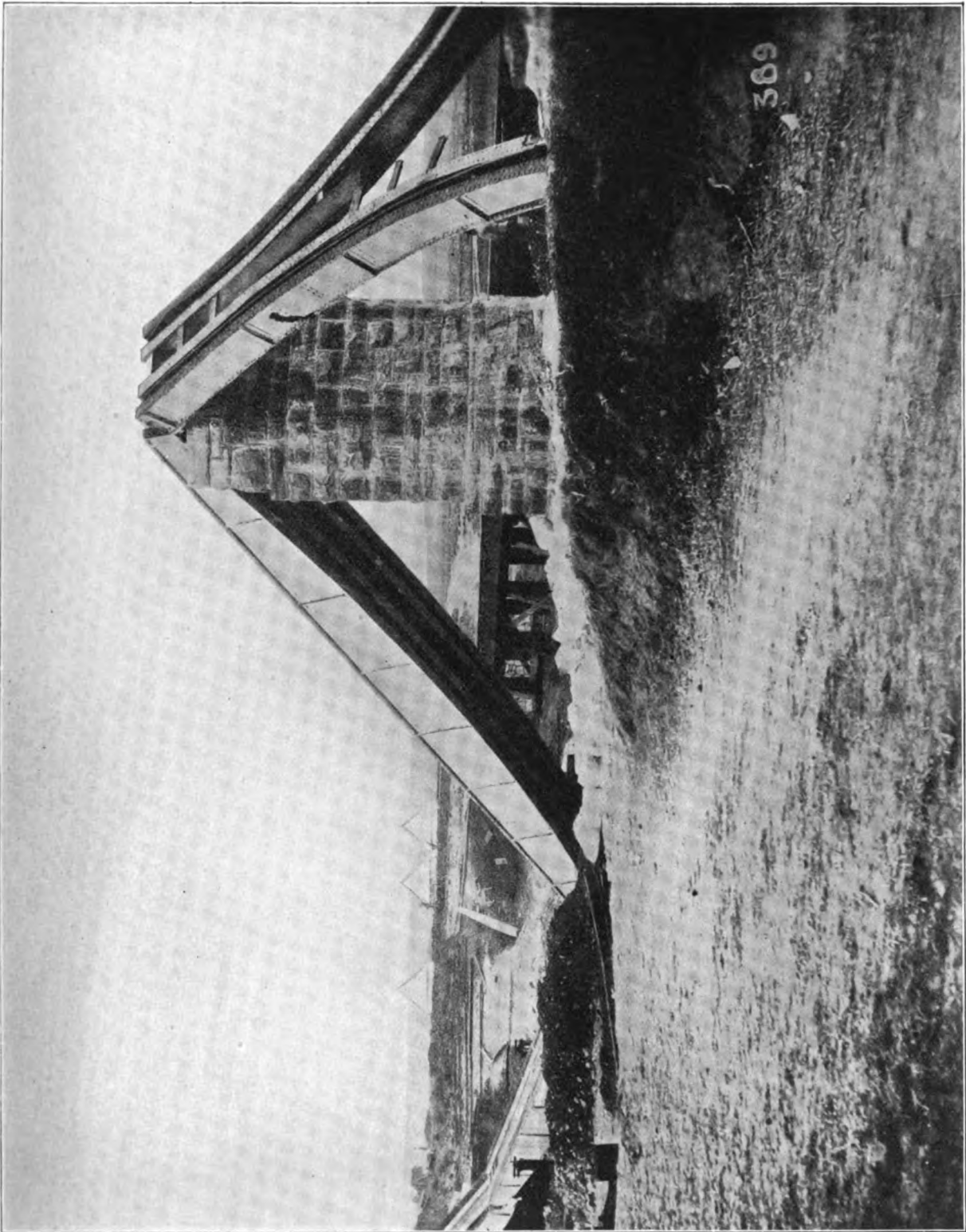


Taaibosch Spruit Bridge, Bloemfontein—Pretoria line.
Girders being drawn up for permanent reconstruction; temporary bridge behind.

PHOTO 40.

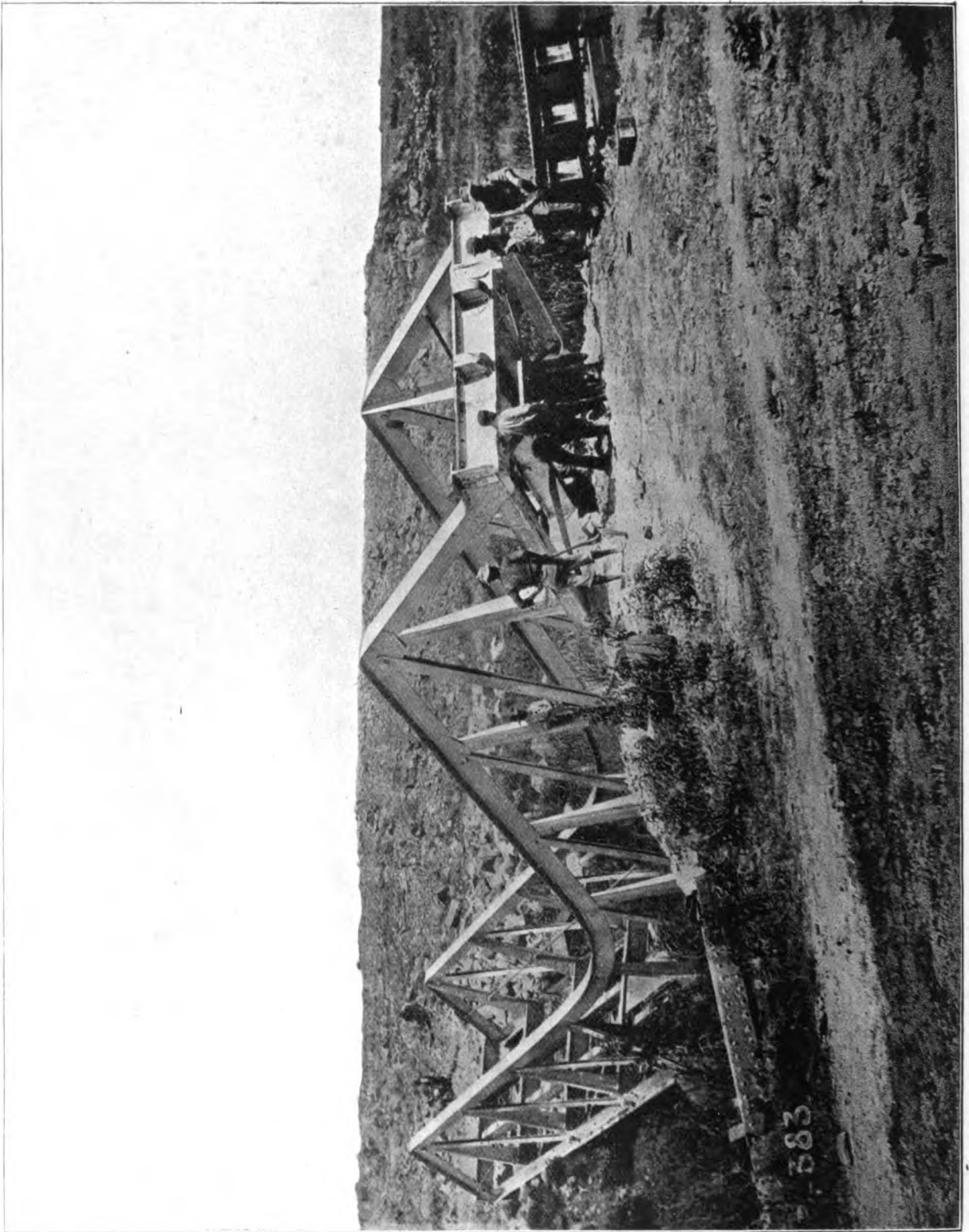


Zuikerbosch Spruit Bridge, Elandsfontein - Natal line.

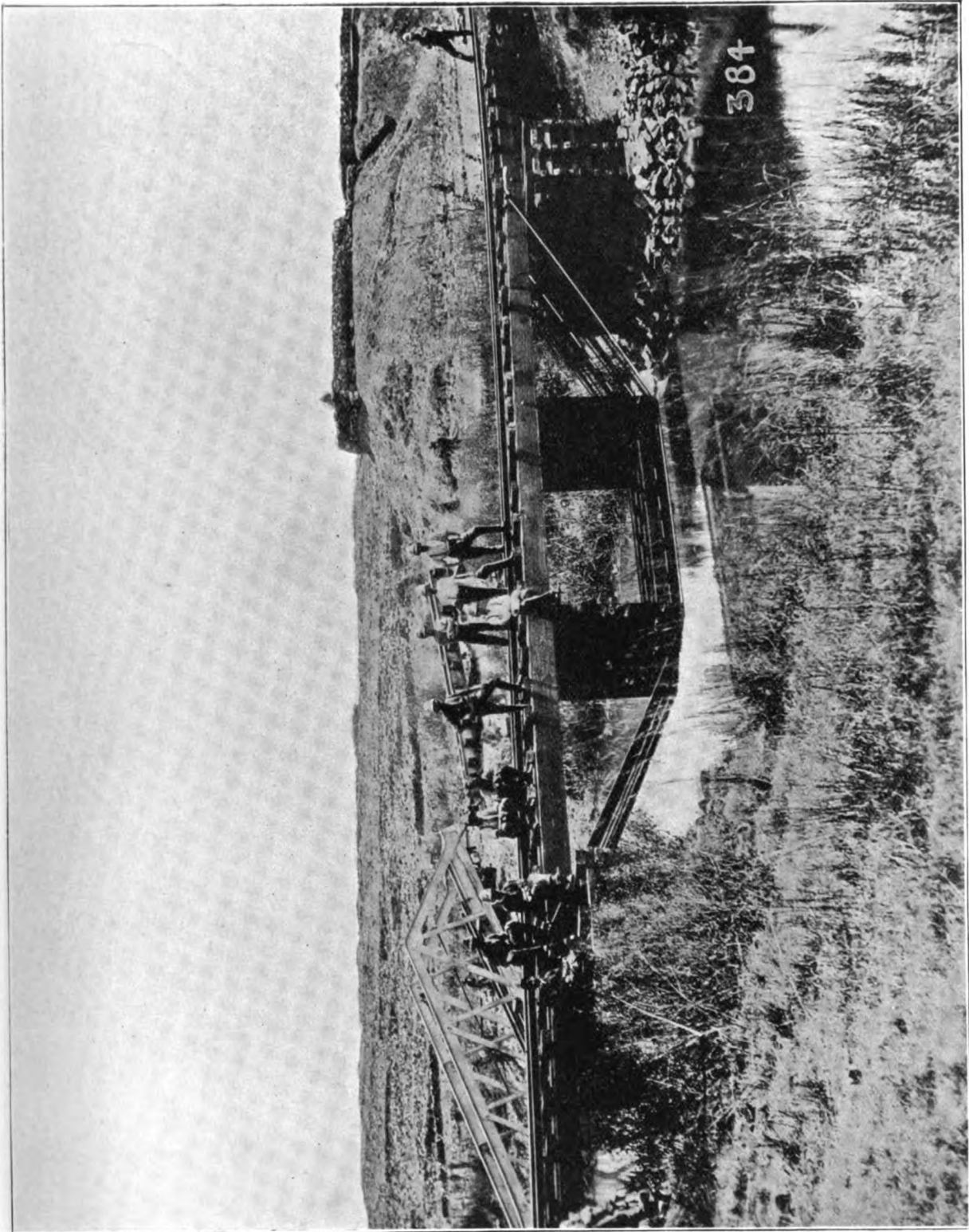


Bronkhorst Spruit Bridge, Pretoria—Delagoa Bay line.

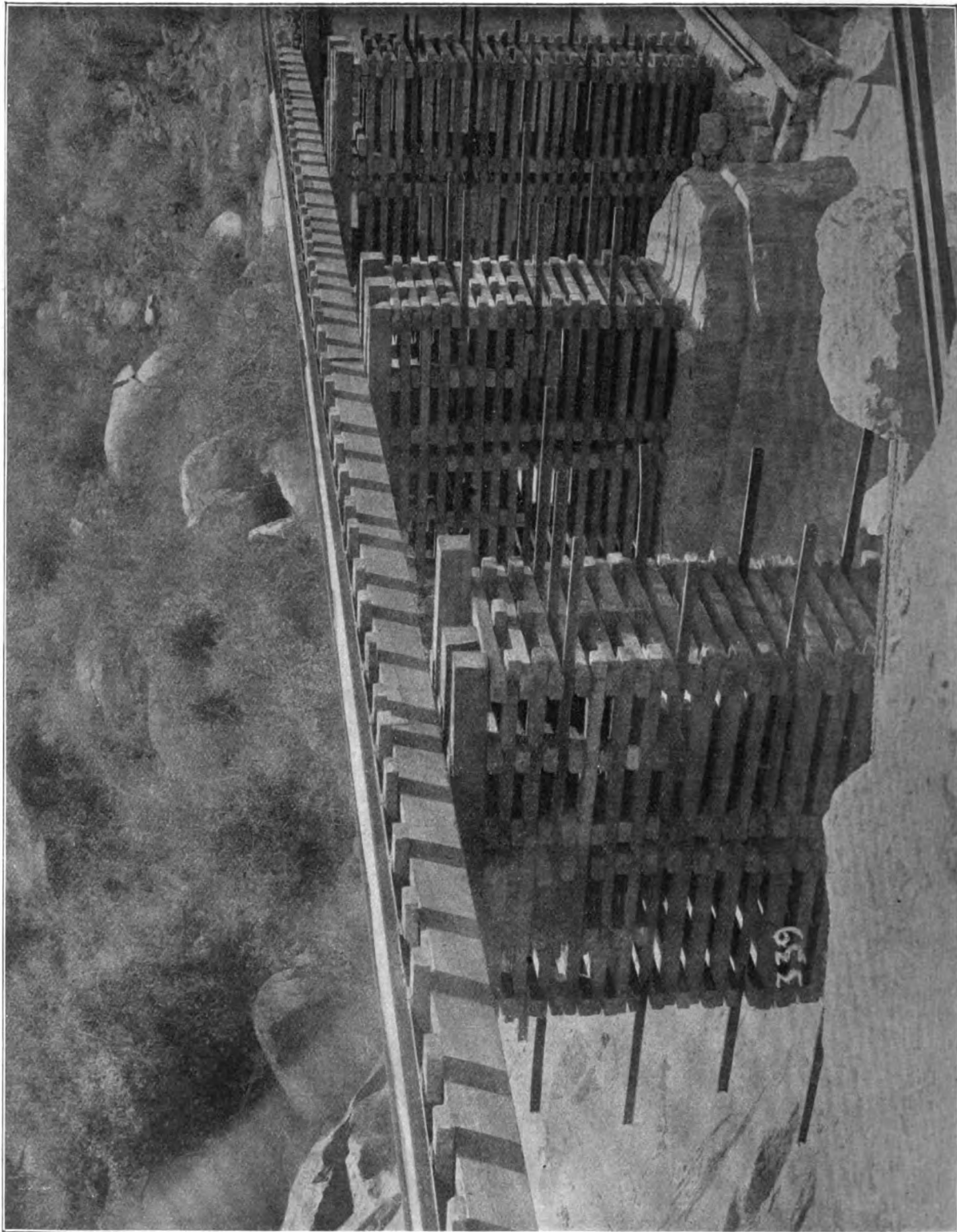
Showing damage by enemy.



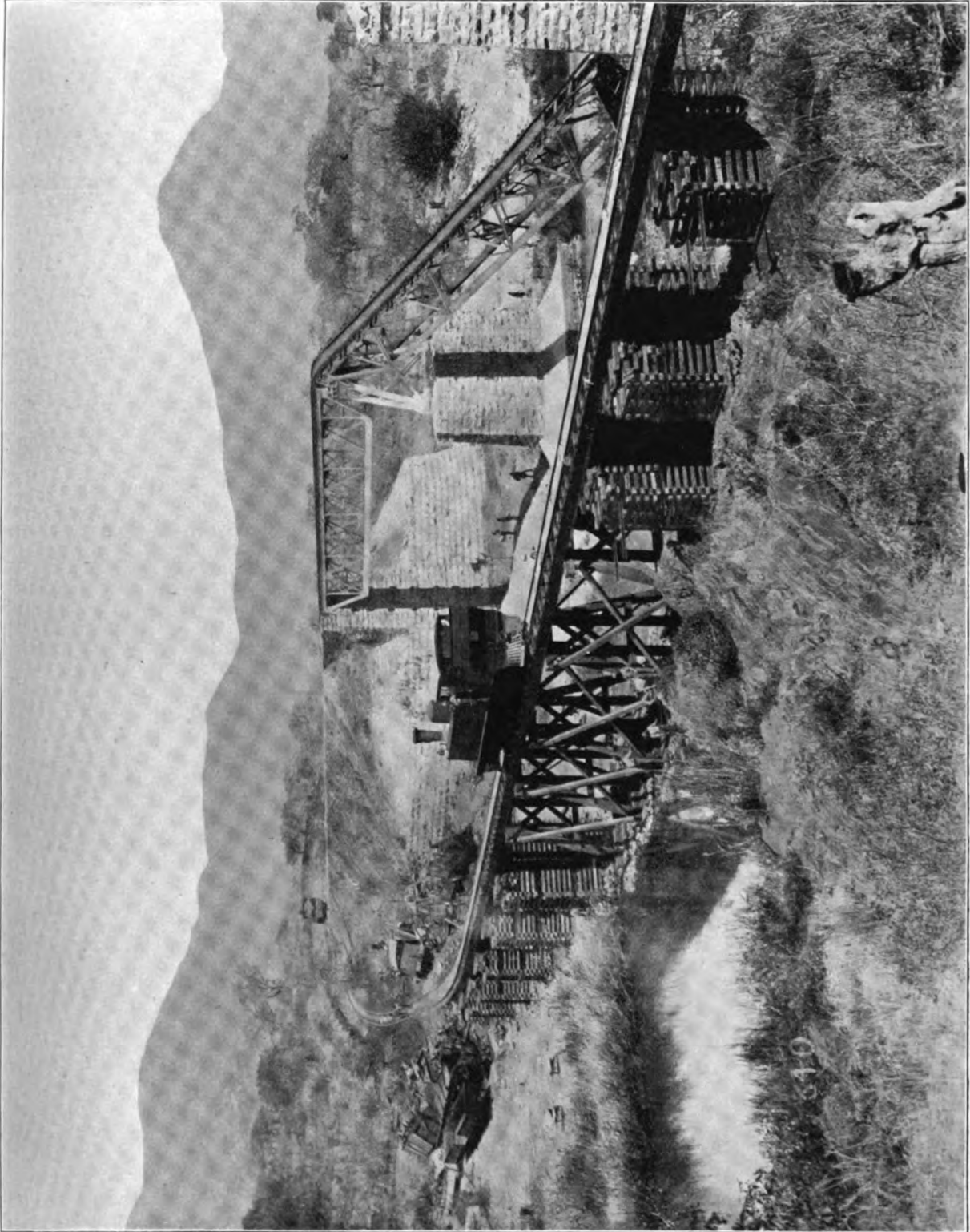
Wilge R. Bridge, Pretoria—Delagoa Bay line.



Wilge R. Bridge, Pretoria—Delagoa Bay line.
Temporary bridge with 50-foot span trussed beams.

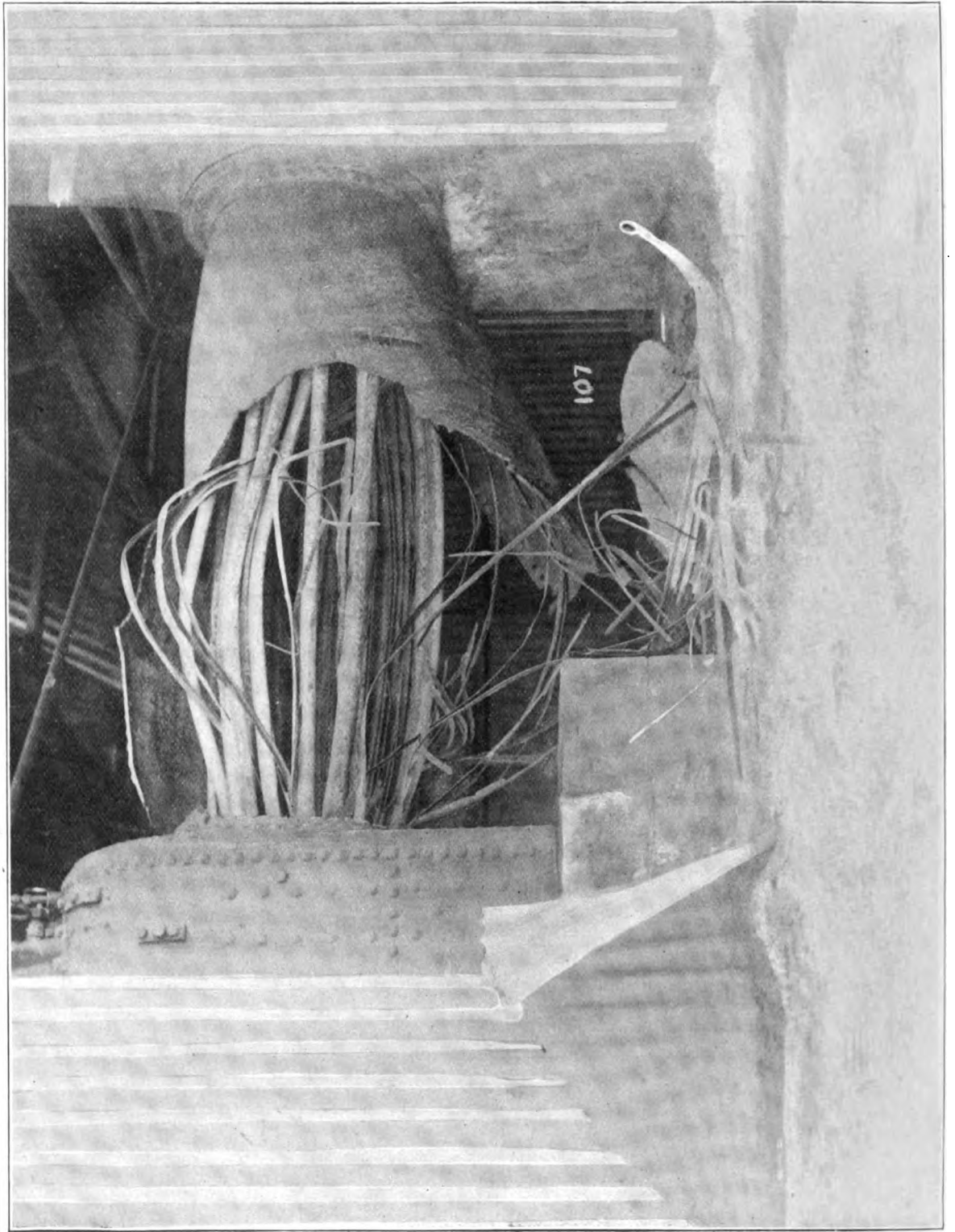


Krakodil Poort Bridge, Pretoria, Delagoa Bay line.

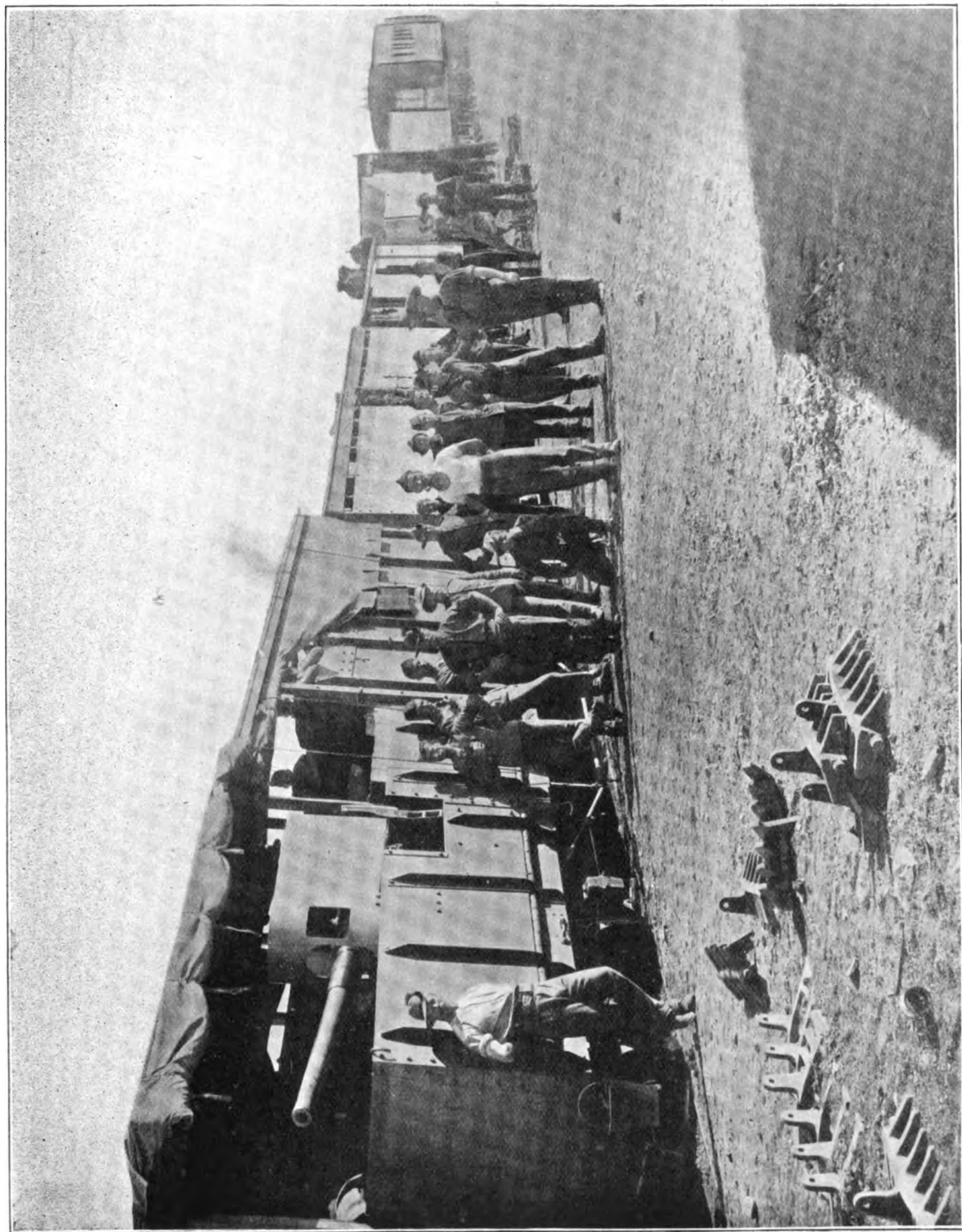


Kaap R. Bridge, Kaapmuiden, Pretoria—Delagoa Bay line.
Showing bridge damaged by enemy, deviation bridge, and wreck of train.

PHOTO 46.

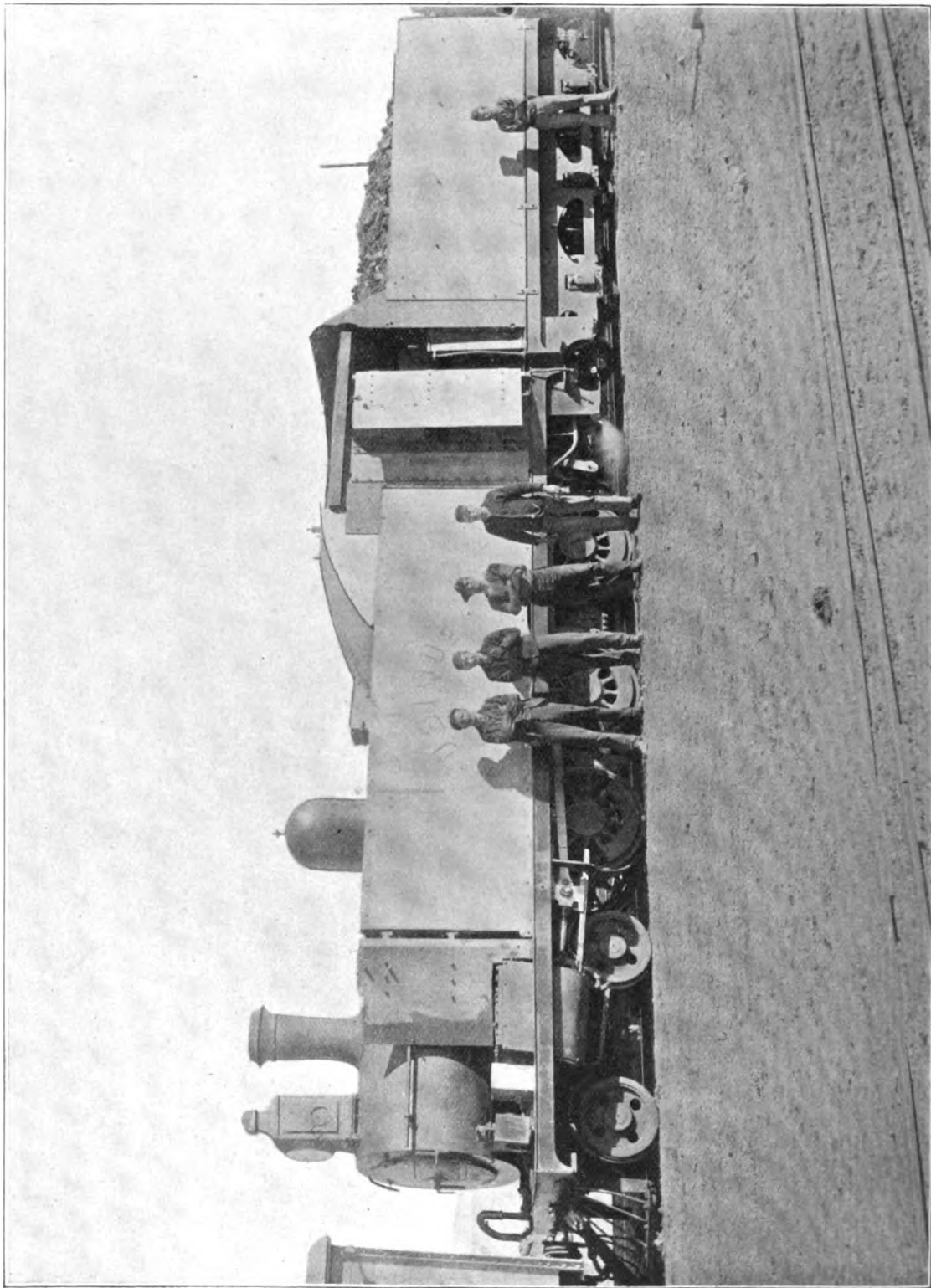


Zand R., Bloemfontein—Pretoria line.

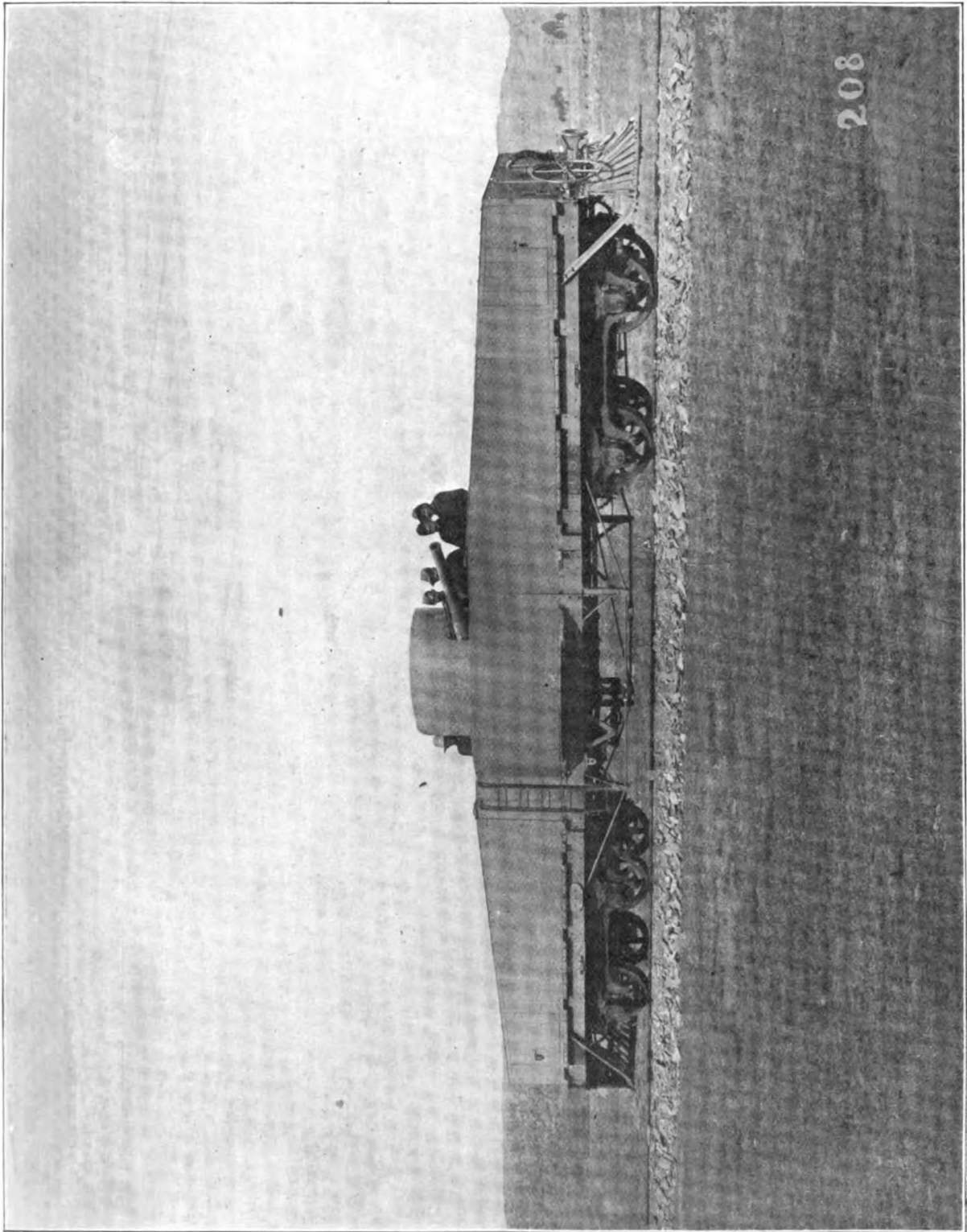


First pattern Gun Truck, No. 1 Armoured Train

PHOTO 48.

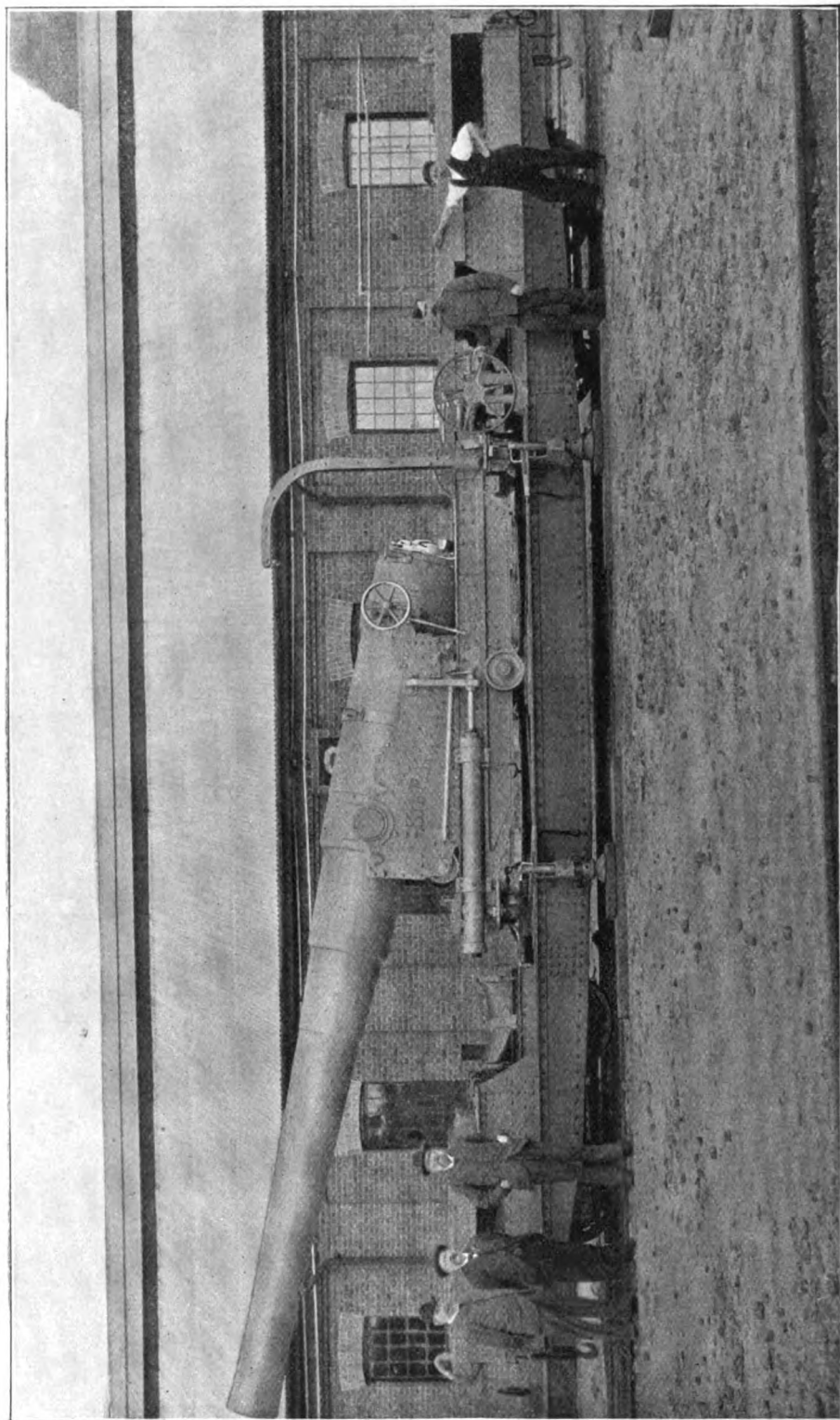


First pattern of Armoured Engine.

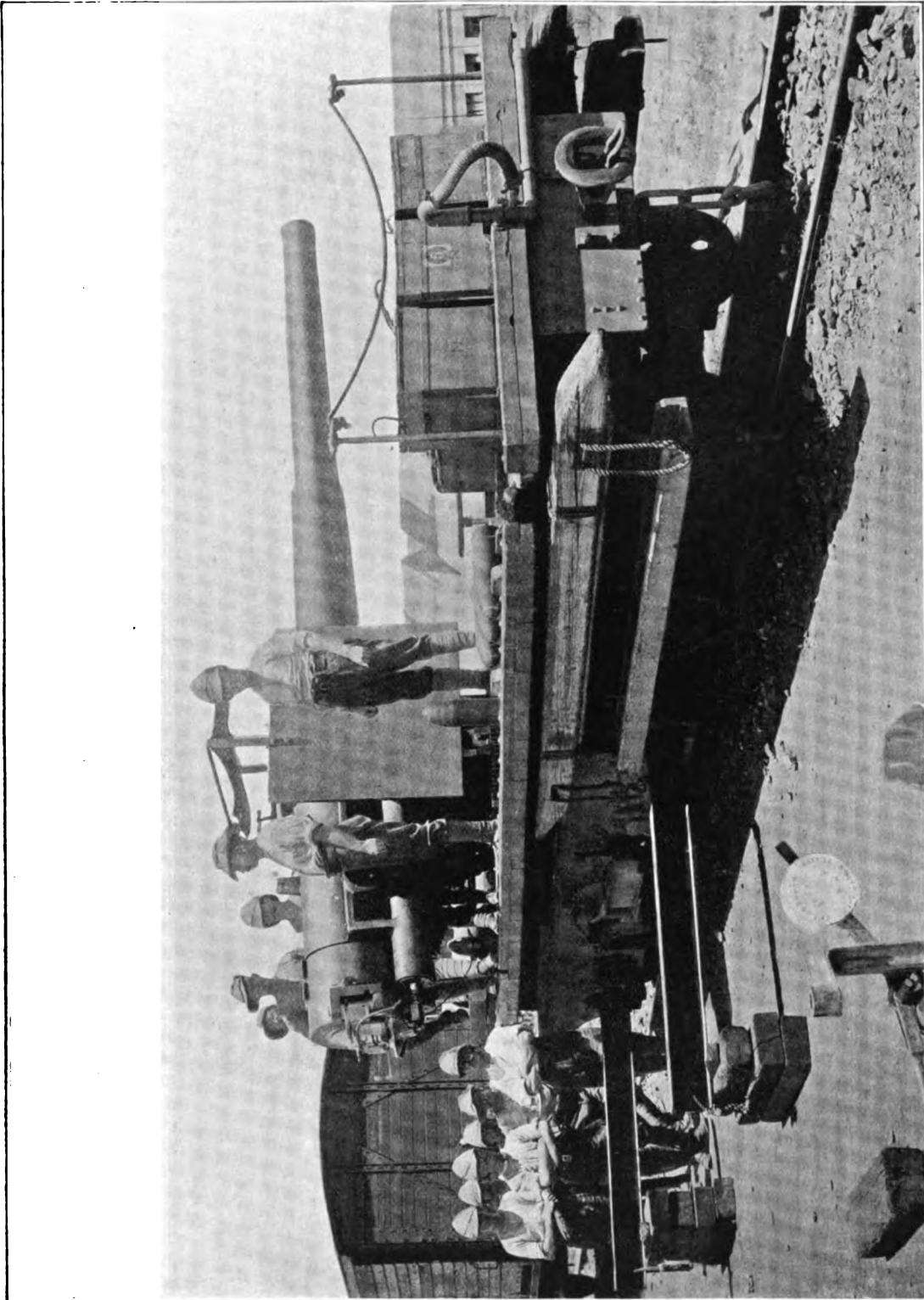


New pattern Gun Truck for 12-pounder Q.F. Gun.

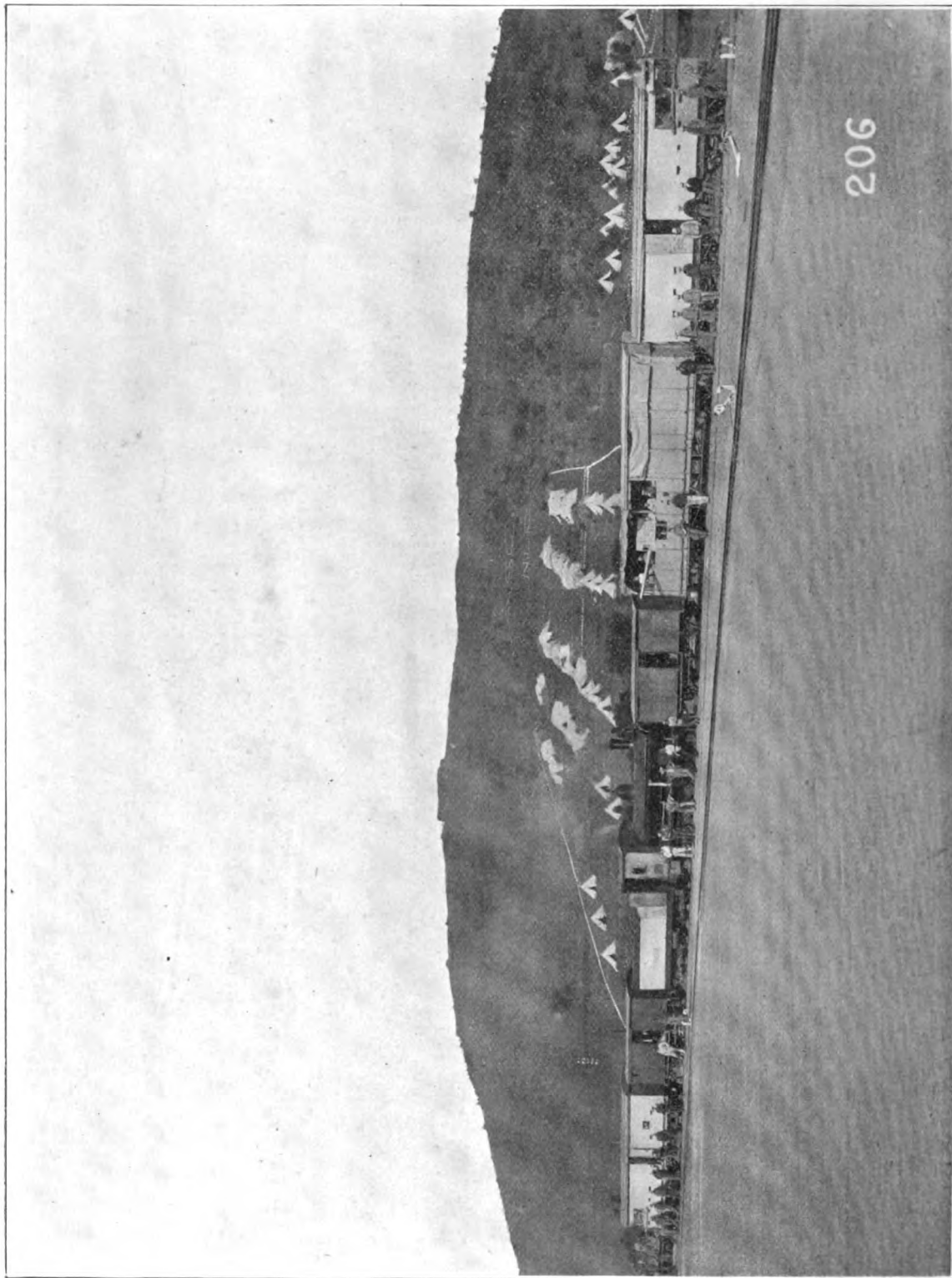
PHOTO 50.



9.2-inch Gun mounted on engine frame.



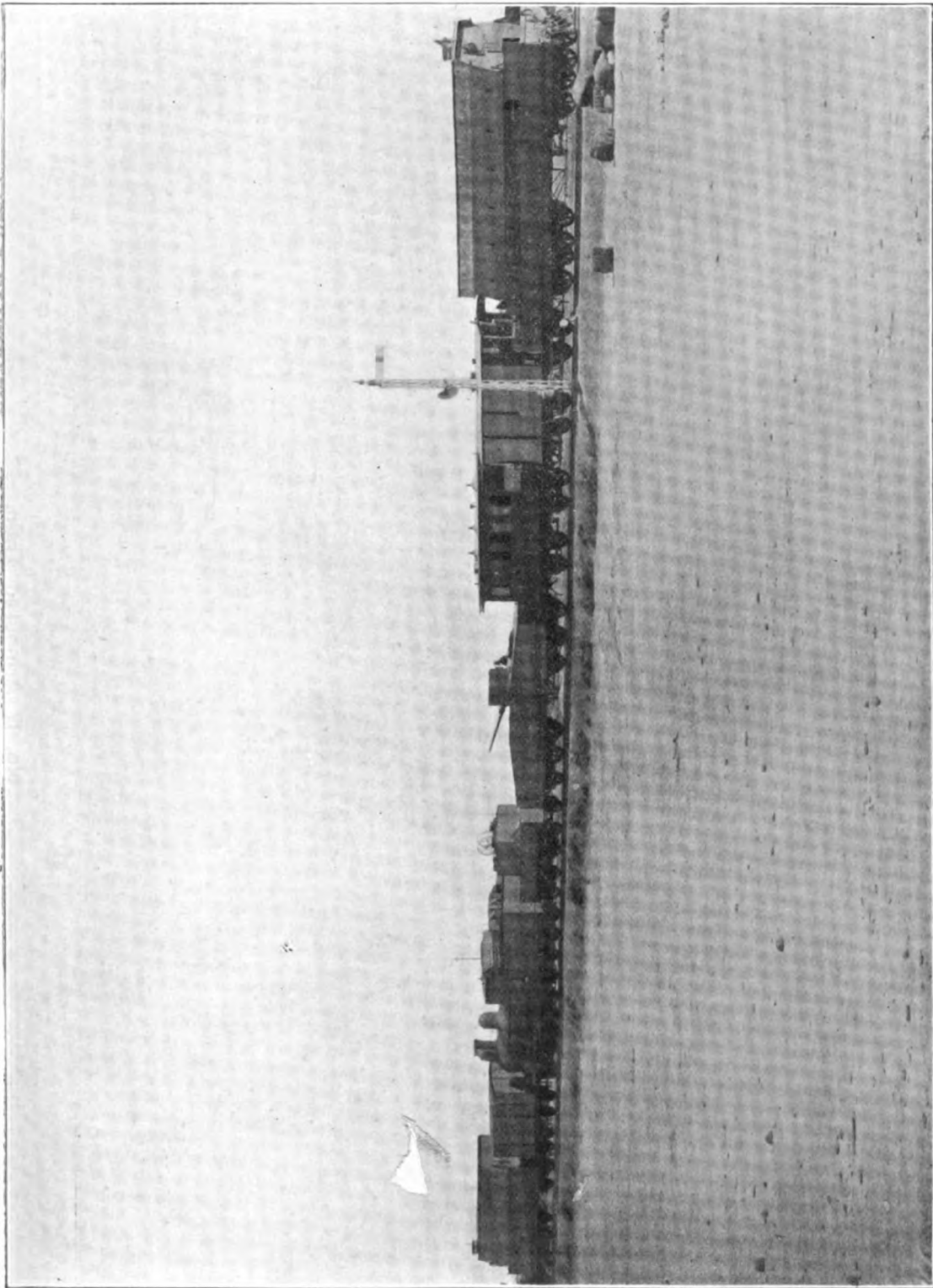
6-inch Gun Truck, frequently attached to Armoured Trains.



No. 1 Armoured Train.

Armament—2 12-pounder Q.F.

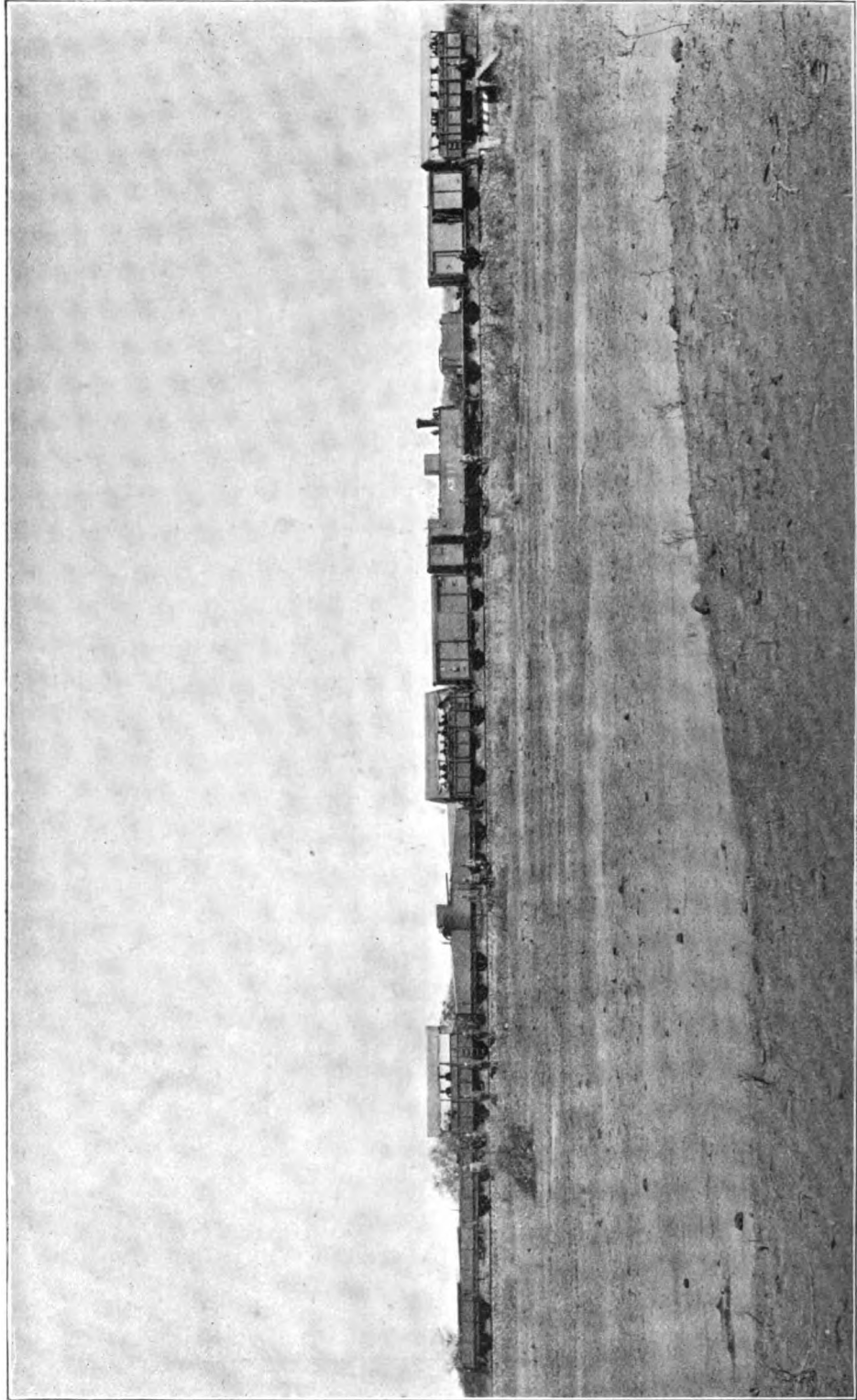
G.O. Lieut. A. G. T. Cousins, R.E.



No. 2 Armoured Train.

Armament - 1 12-pounder Q.F.
2 .303 Maxims.

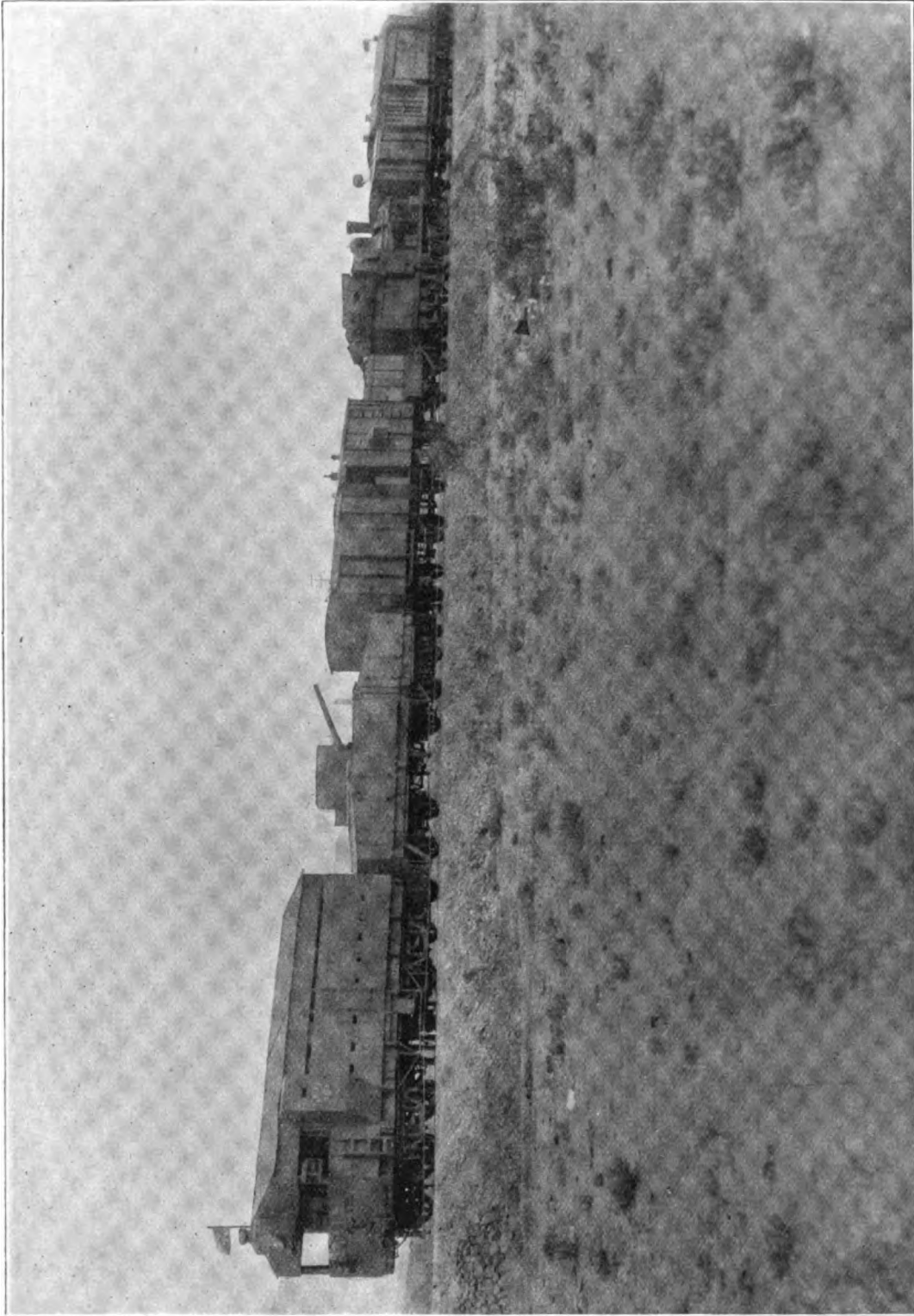
C.O. Capt. A. M. Henniker, R.E.
2nd Officer... 2nd Lieut. Jickell, R.G.A.



No. 17 Armoured Train.

Armament—1 12-pounder Q.F.
2 .303 Maxims.

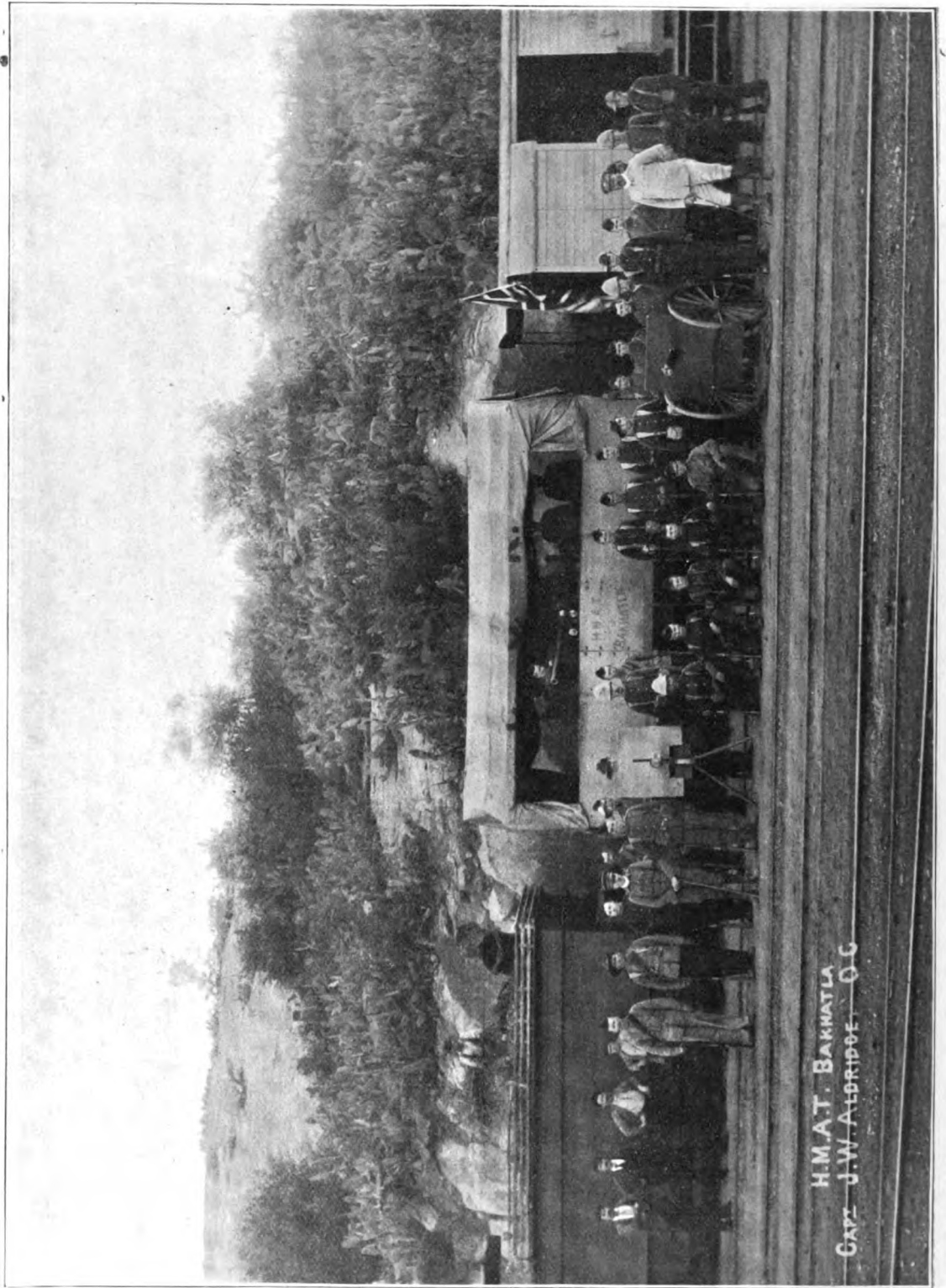
C.O. Major C. S. Pritchard, Northampton Regt.
2nd Officer.. Capt. Bedford, R.G.A.



No. 18 Armoured Train.

**Armament—1 12-pounder Q.F.
2 450 Maxims.**

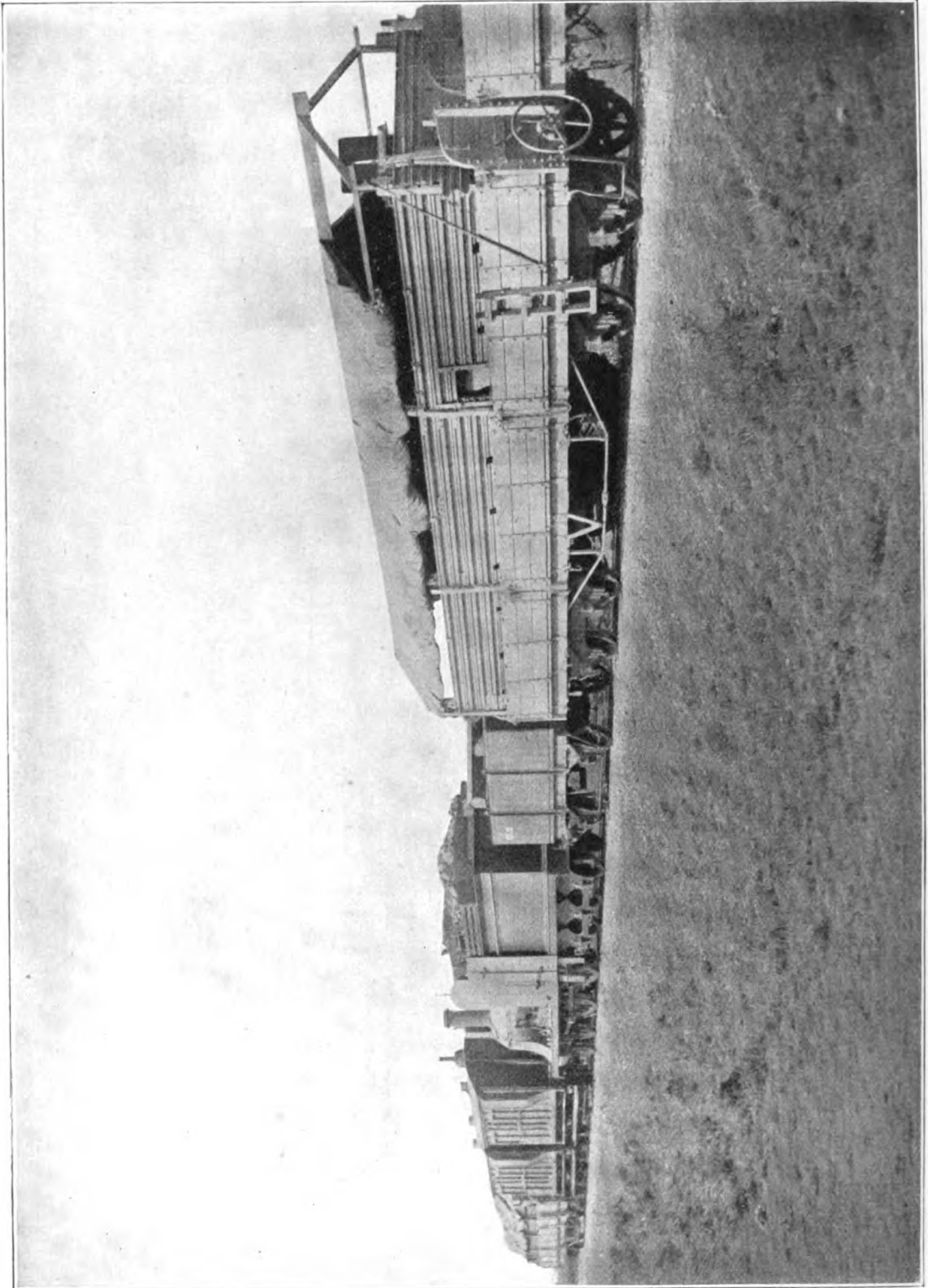
**C.O. Lieut. Baring, Coldstream Guards.
2nd Officer... Lieut. Murray, R.G.A.**



6-pounder Gun Truck on No. 11 Armoured Train.

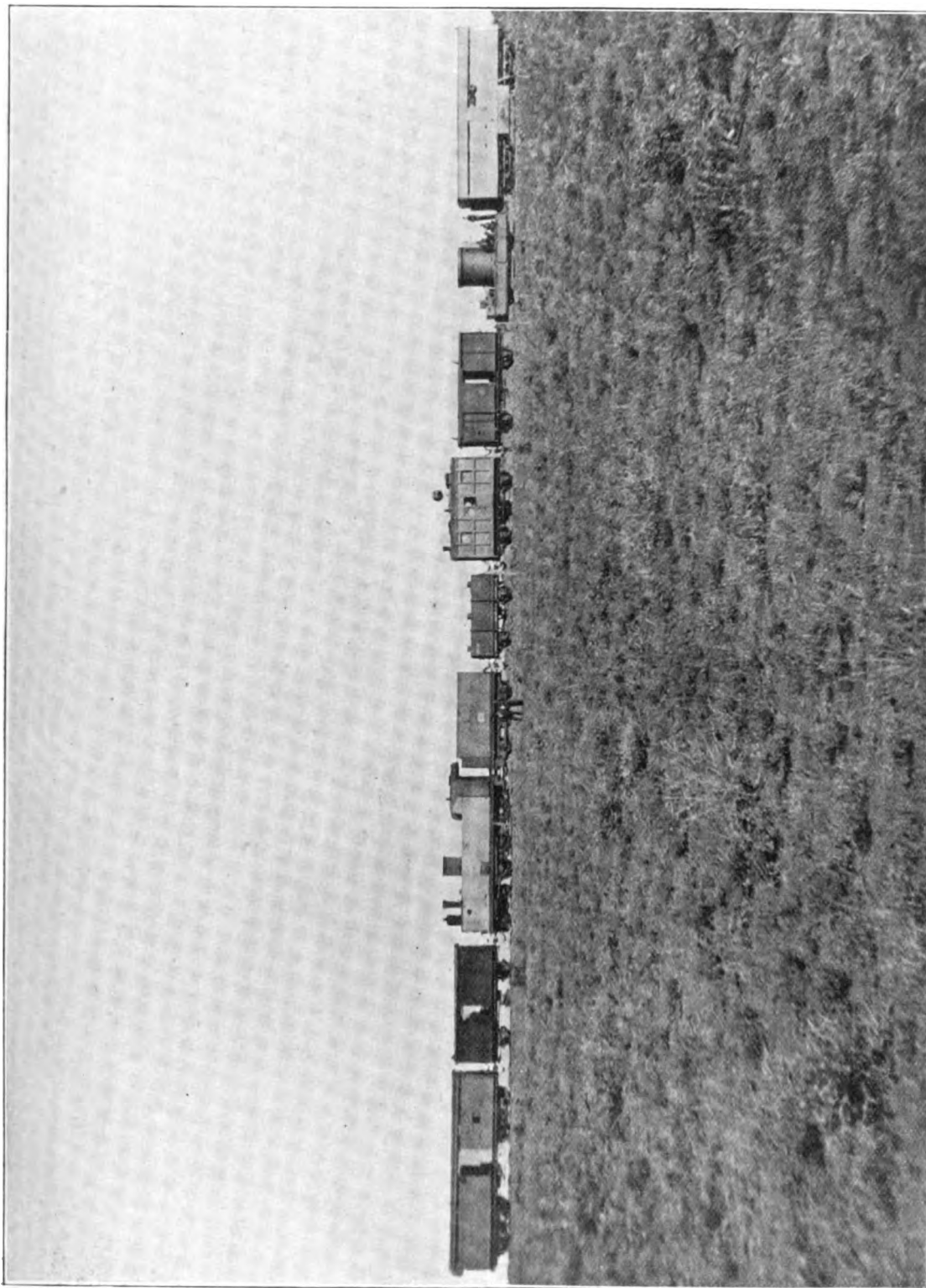


**New pattern bogie on No. 12 Armoured Train
With 8-pounder gun and Infantry.**

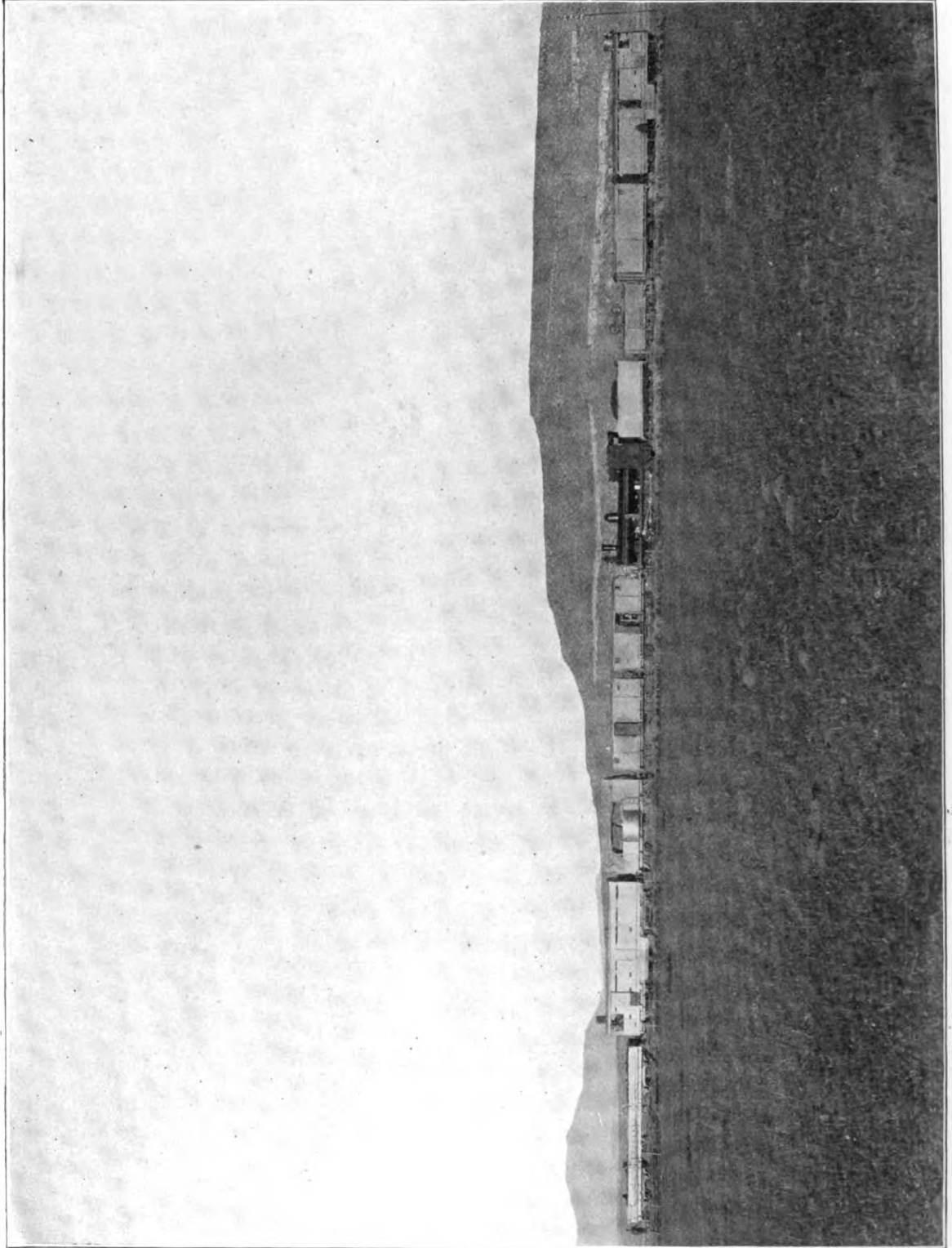


No. 20 Armoured Train.
C.O. _____ Lieut. Russell, 4th Scottish Rifles.
2nd Officer _____ Lieut. Brunton, K.O. Scottish Borderers.

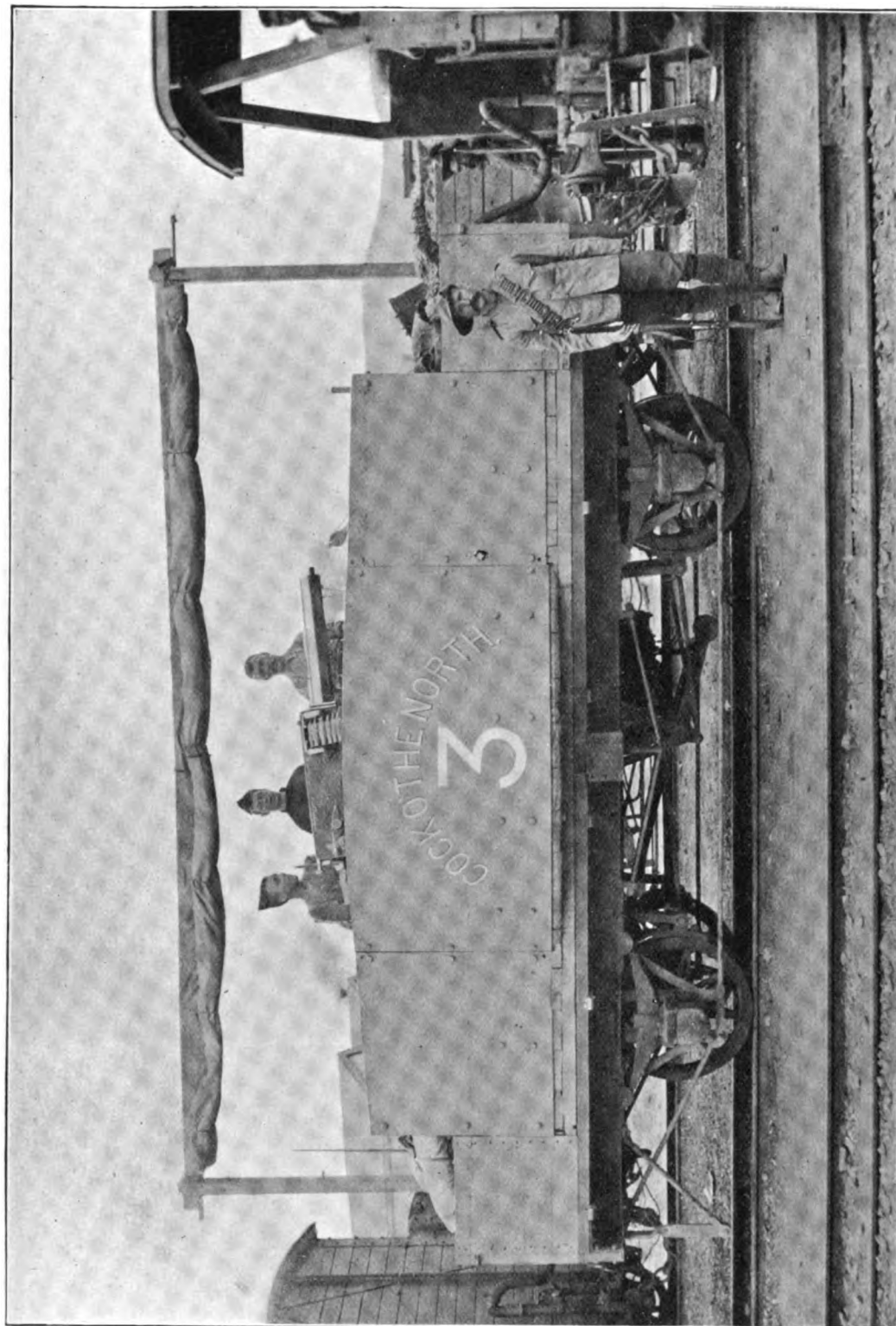
Armament—1 double-barrel 1" Nordenfält.
1 502a Maxim.



No. 16 Armoured Train, before alteration.
With 3-pounder gun in turret.

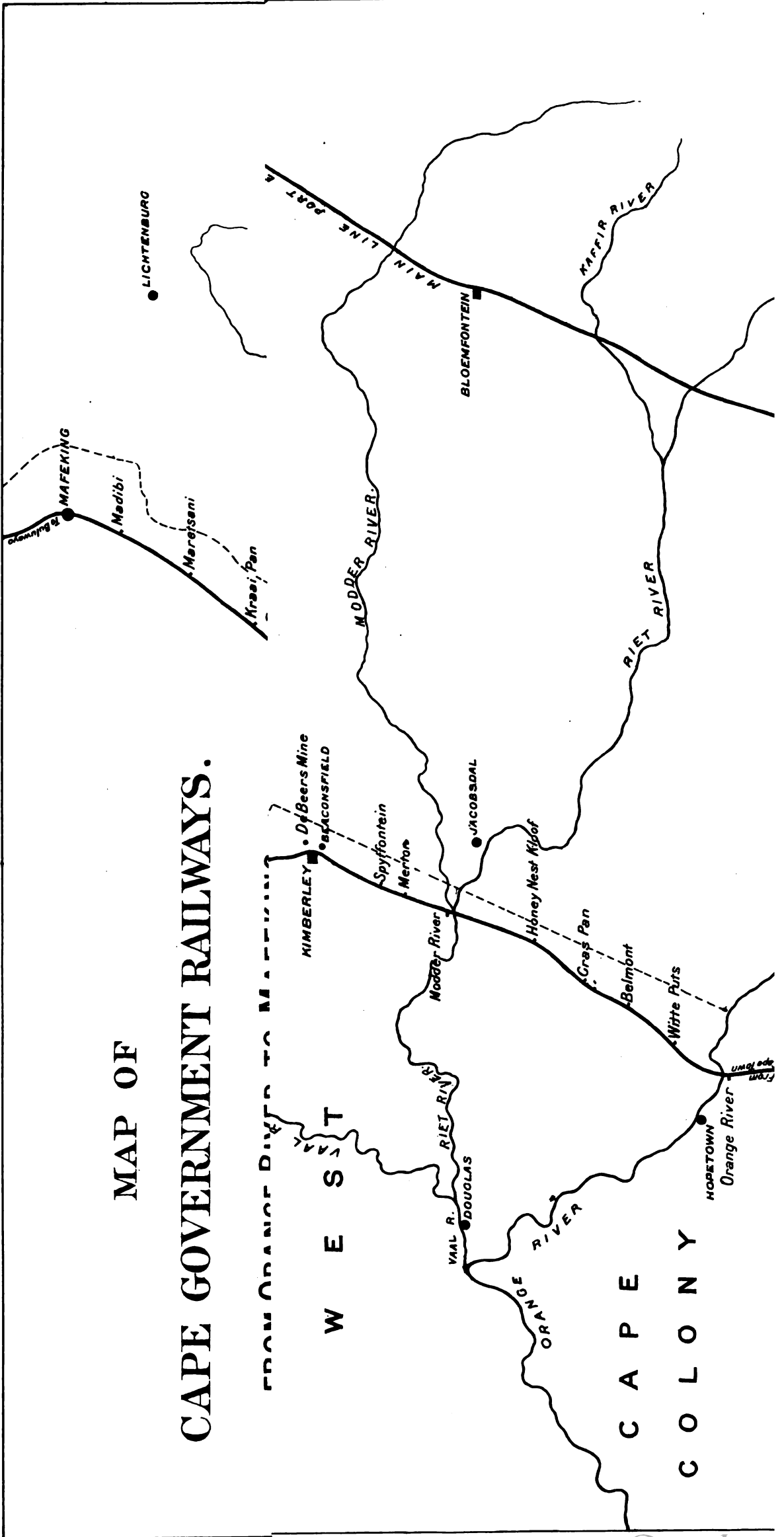


U.S. ARMY PHOTOGRAPHIC SERVICE
No. 16 Armoured Train, after alteration. Mant. Great. Goldstream. Guards.

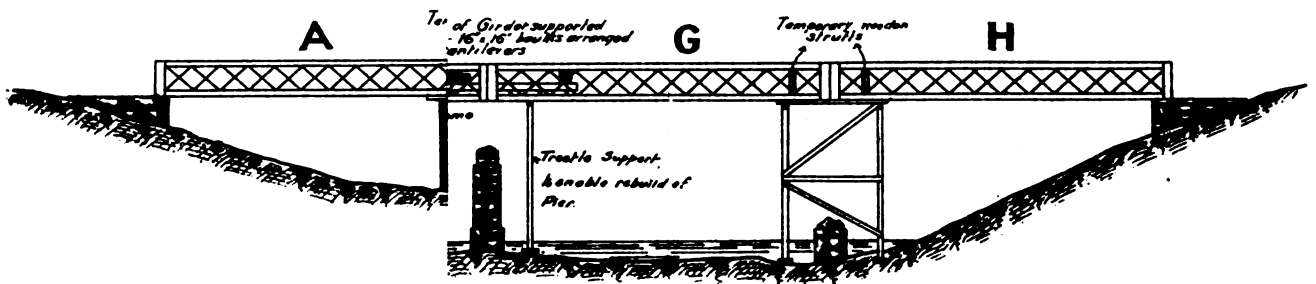
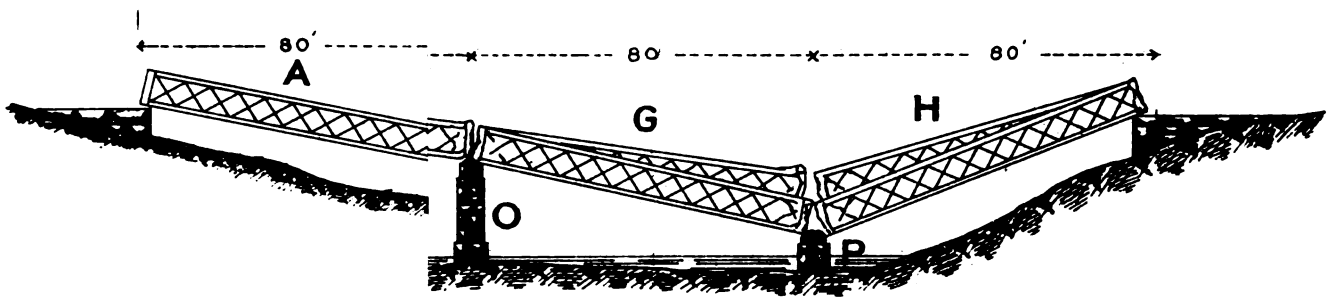


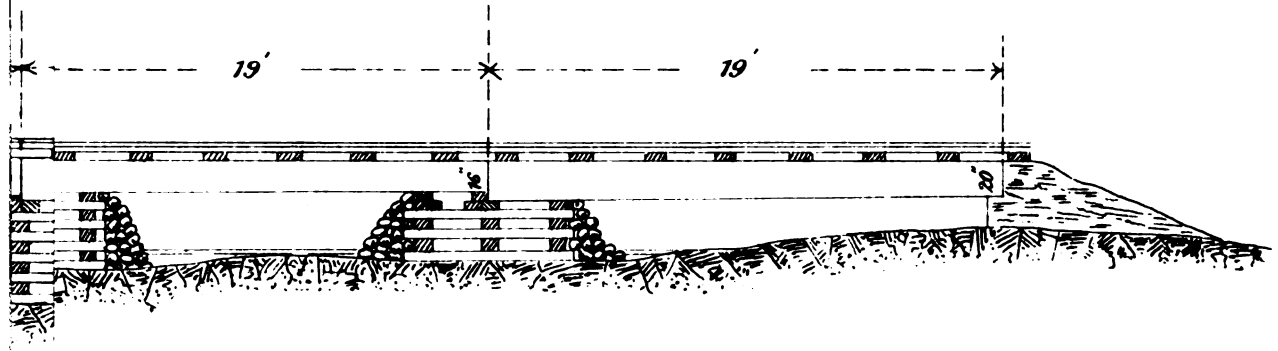
Pom-pom Truck on No. 3 Armoured Train.

MAP OF CAPE GOVERNMENT RAILWAYS.



Officer in Charge : Capt. W. D.
 Working Party : 8th (Railway)
 31st (Fortres
 Time taken : 110 days (de
 girder pi





A

F DEVIATION.

Inch.

"

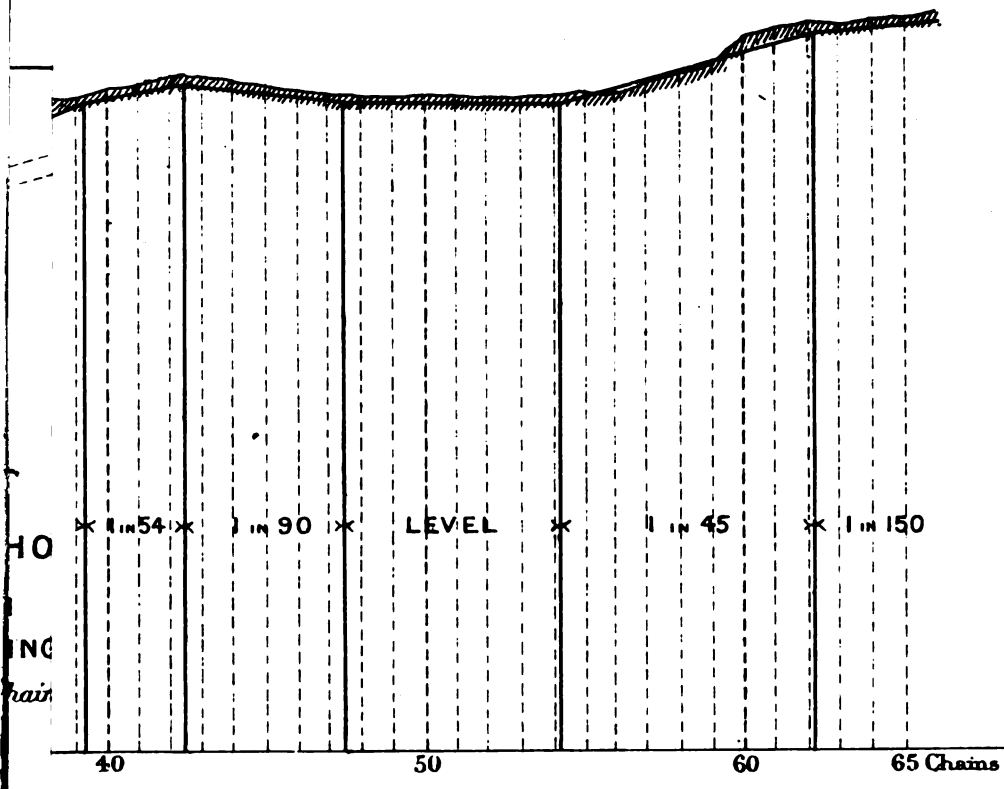
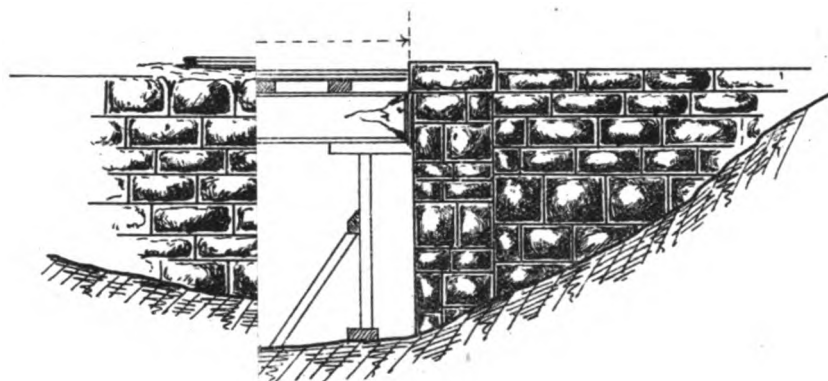
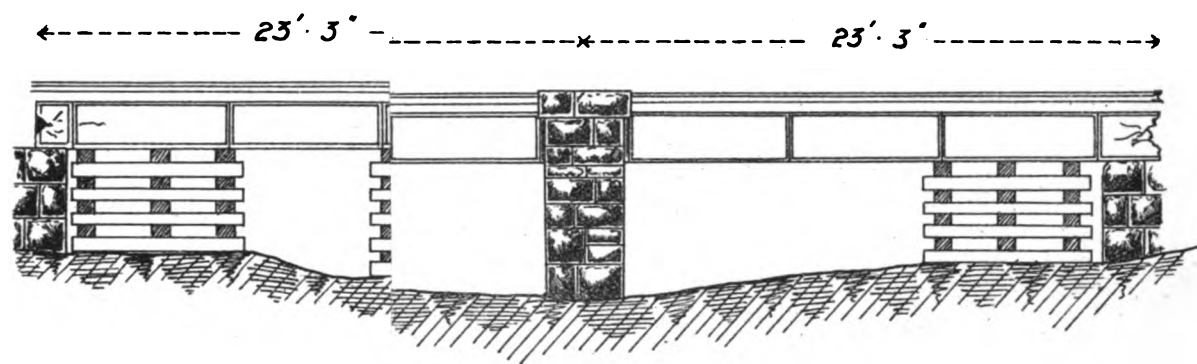


PLATE 4.



Officer in Charge : Capt. F.
Working Party : Part of
Time taken : 32½ hour

TYPES OF REPAIRS TO CULVERTS.

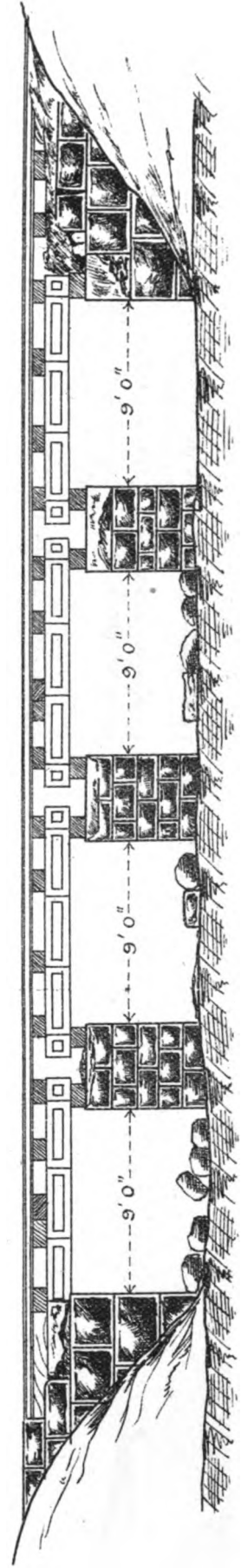
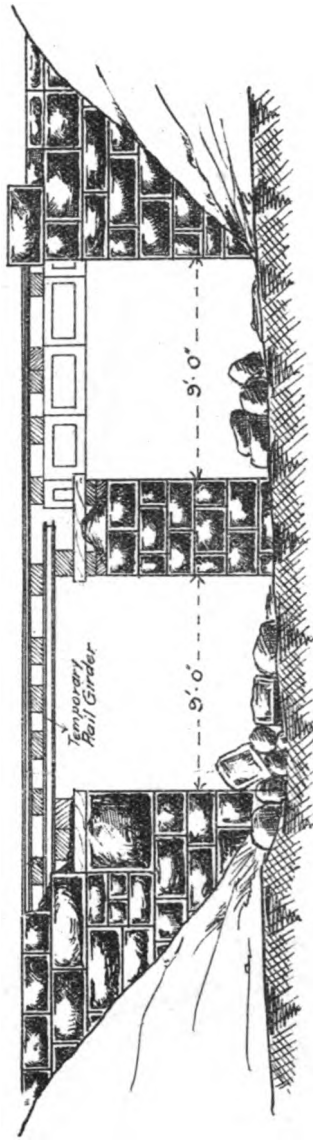
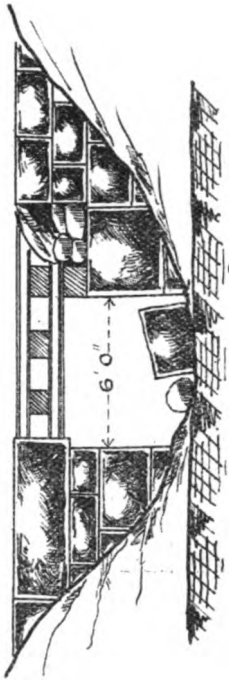
KIMBERLEY—MAFEKING LINE.

Scale—8 Feet=1 Inch.

Officer in Charge: Capt. F. G. Fuller, R.E.

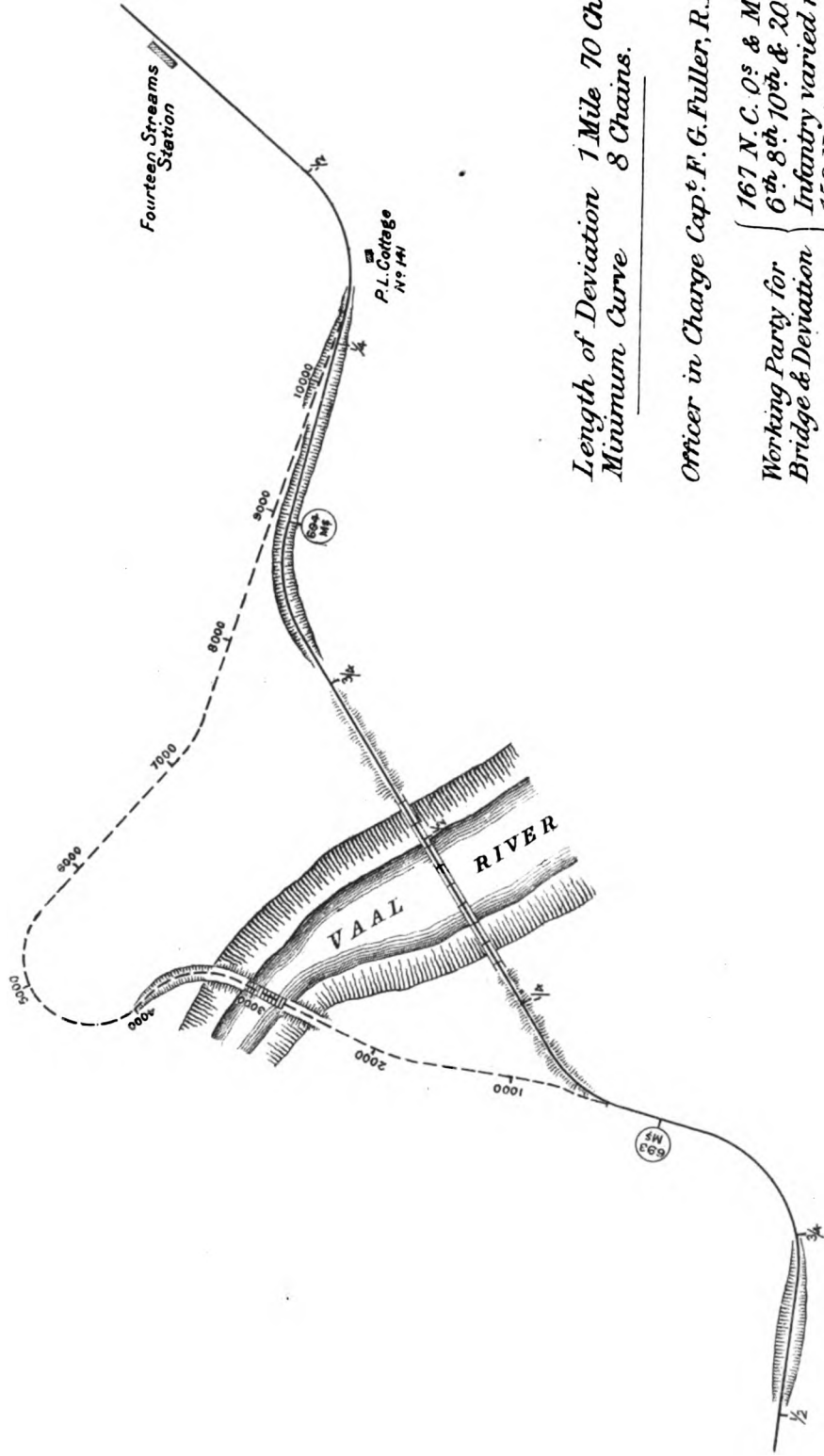
Working Party: Part of Western Field Railway Section.

Time taken: 33½ hours, including one other culvert and one set of points and crossings.



VAAL R. BRIDGE, FOURTEEN STREAMS.

KIMBERLEY-MAFEKING LINE.



*Length of Deviation 1 Mile 70 Chains.
Minimum Curve 8 Chains.*

Officer in Charge Cap^t F. G. Fuller, R.E.

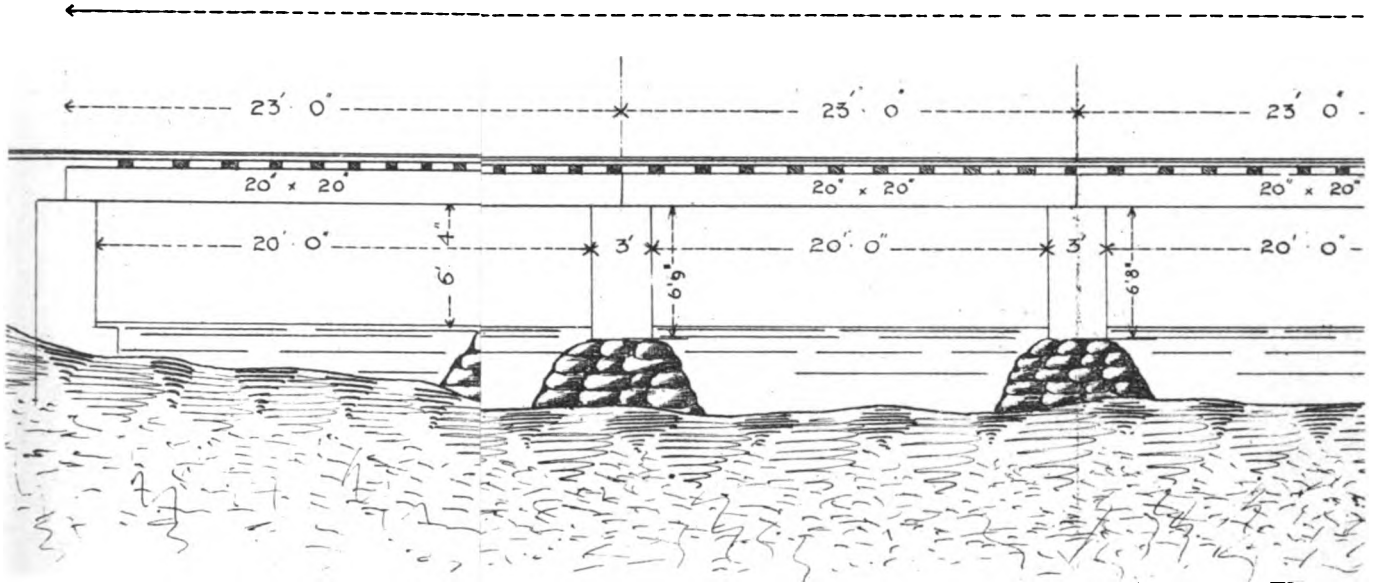
*Working Party for
Bridge & Deviation* { *167 N. C. O's & Men from
6th 8th 10th & 20th Coys R.E.
Infantry varied from 150 to 700.
150 Natives.*

Time taken to construct Bridge & 3300 yds. Deviation, 11 days.

PLAN OF DEVIATION.

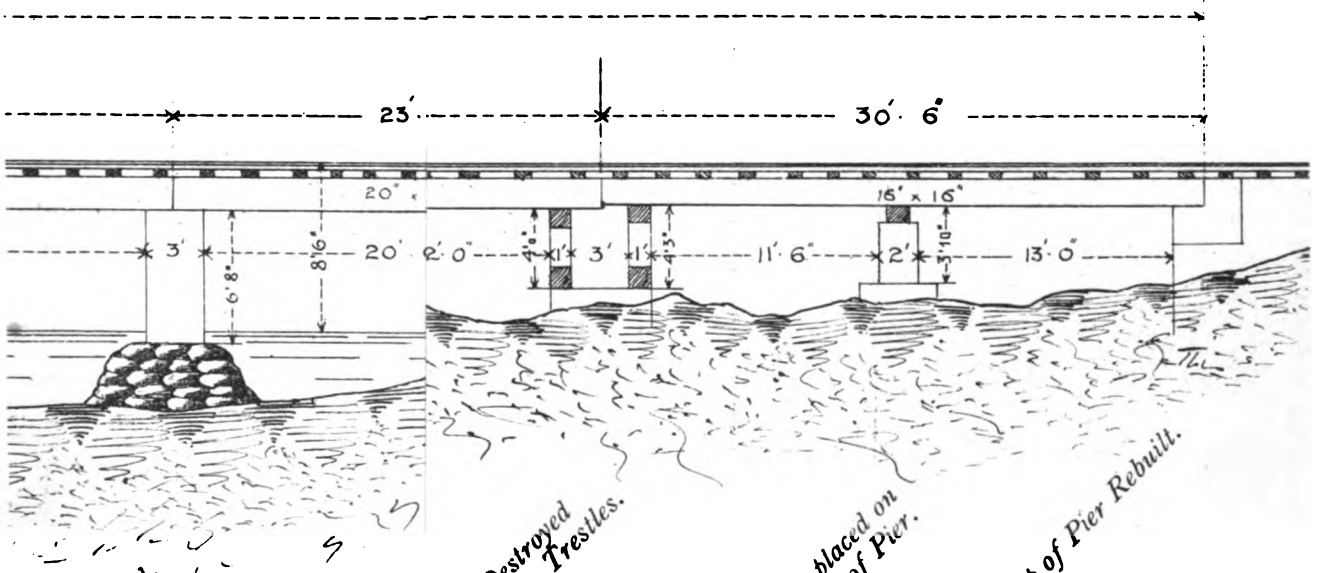
Scale 20 Chains = 1 Inch.

Officer in Charge : Capt. F.
 Working Party for Bridge and Deviation ... 8th (Rai.
 ... 31st (For
 ... 1,200 In)
 ... 300 Nati
 Time taken : 11 days,
 Devia



Top of Pier Repaired.
 Replaced.
 Joistings Re-Made.

Top Repaired.



Top Repaired.

Pier Destroyed
 Replaced by 2 Trusses.

Block placed on
 Top of Pier.

Top of Pier Rebuilt.

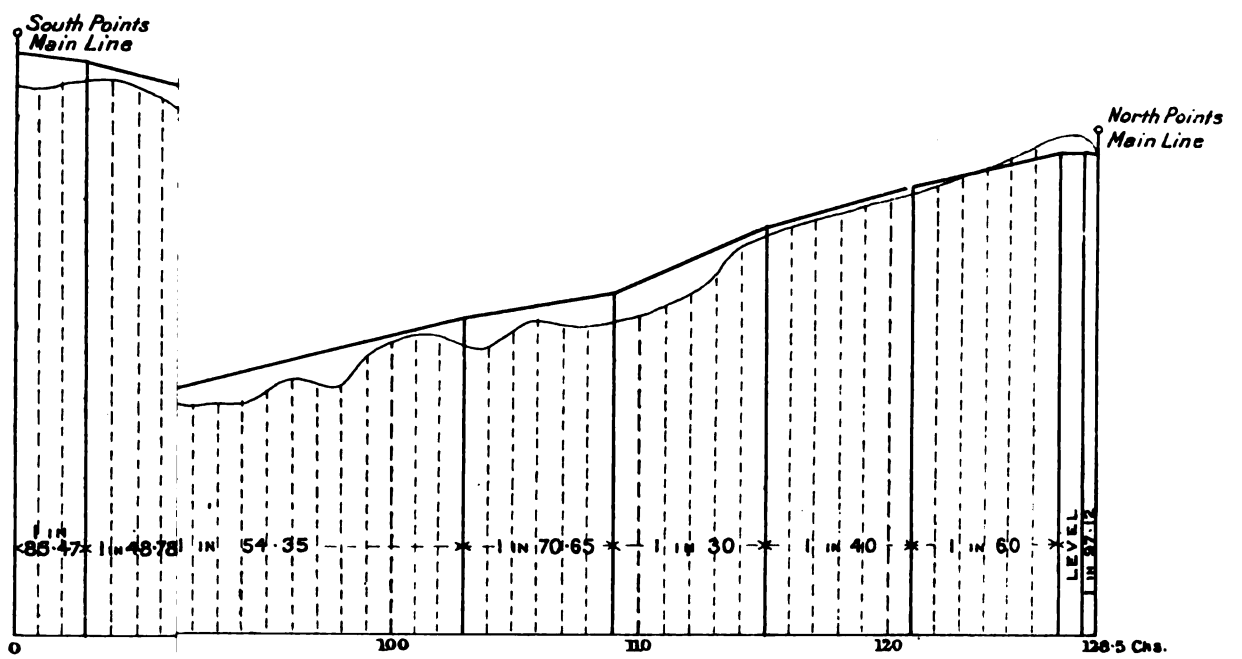
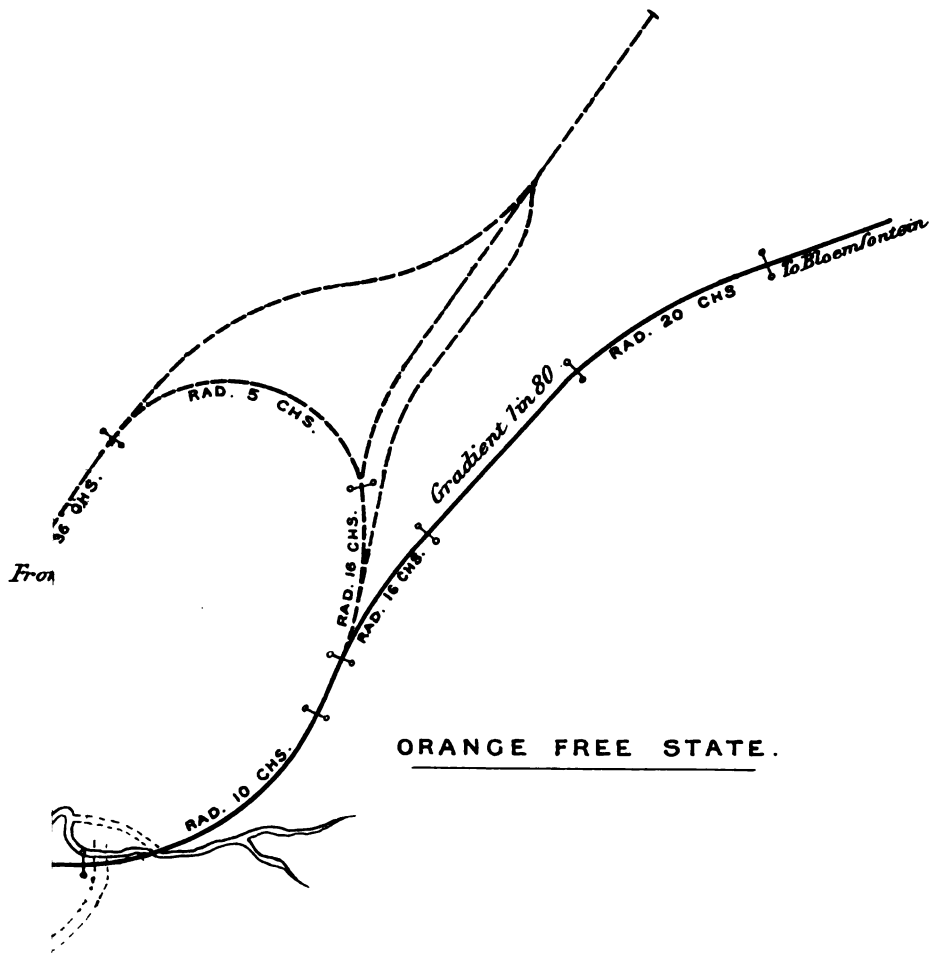
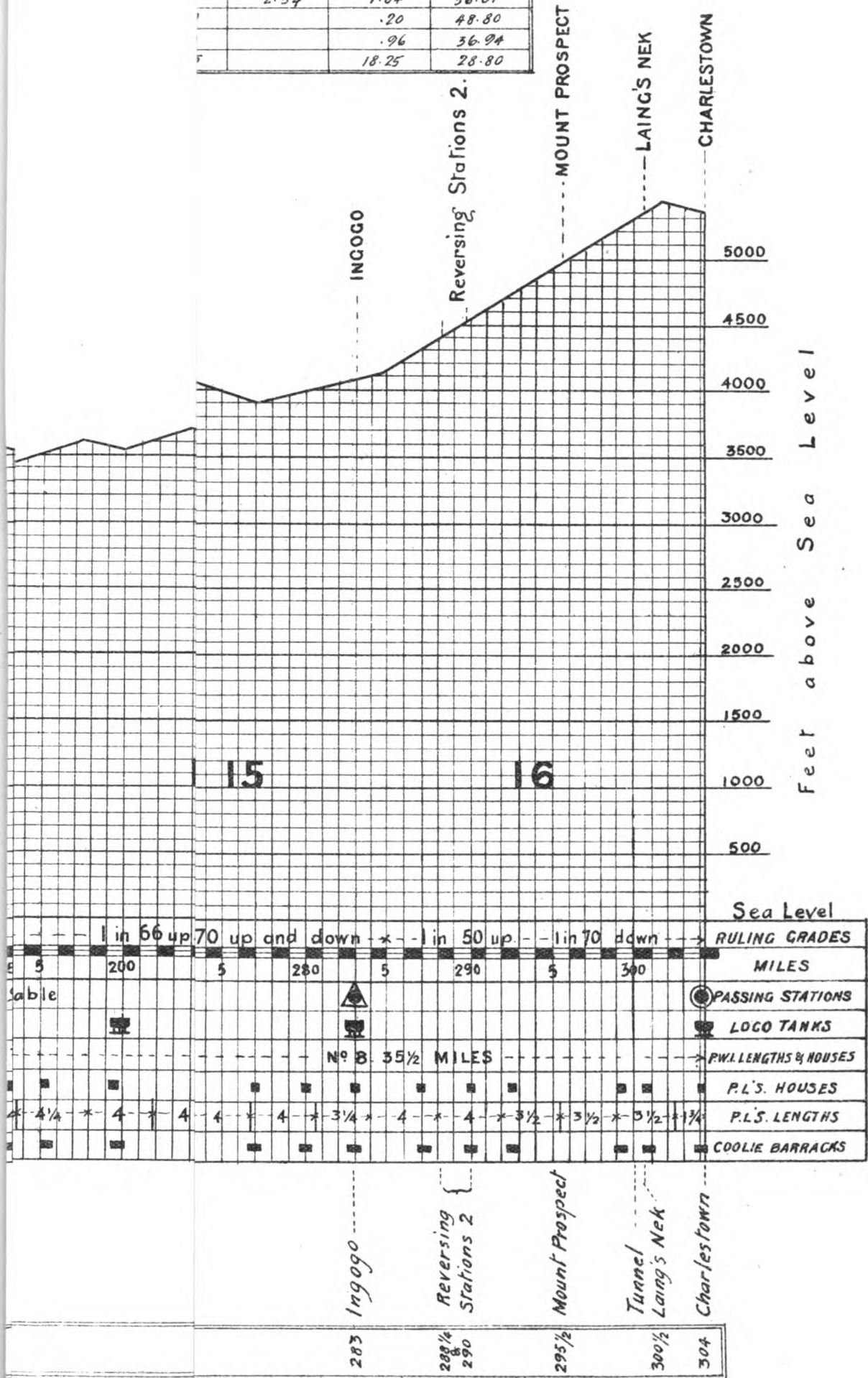


TABLE
STATISTICS OF STRAIGHTS & CURVES
FROM INGOGO TO CHARLESTOWN

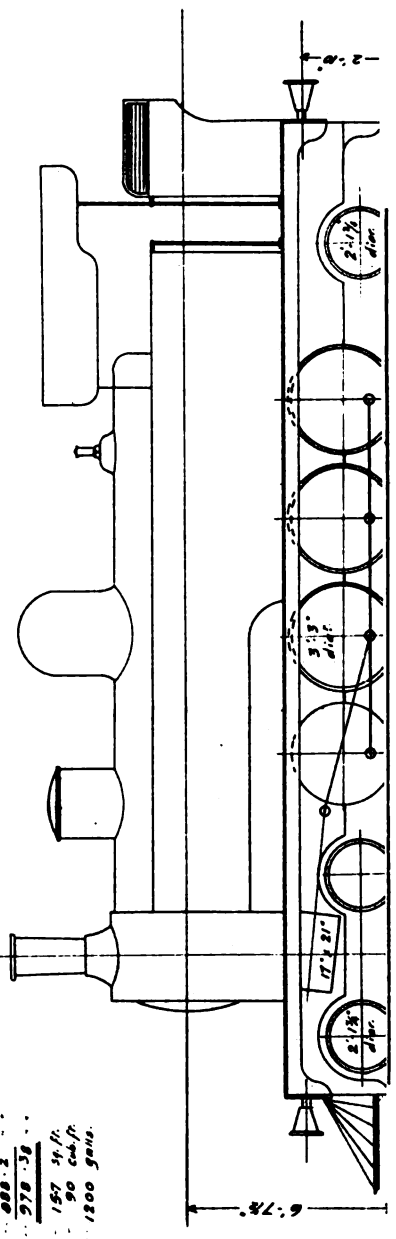
MILES	300 Curves	300 to 450 Curves	Over 450 Curves
1	0	.49	35.78
2	2.54	1.84	56.01
3		.20	48.80
4		.96	36.94
5		18.25	28.80



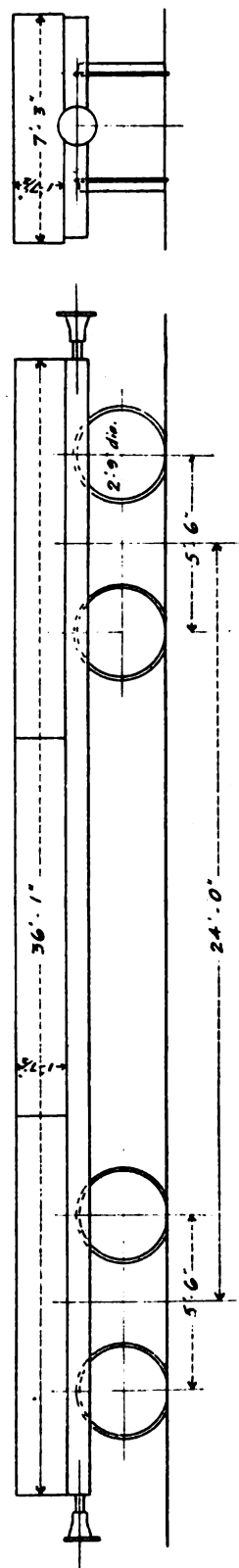
EIGHT-WHEELED COUPLED DUBS ENGINE

WEIGHT IN RUNNING ORDER 46 TONS 4 CWT.

HEATING SURFACE	FIRE BOX	90.18 sq. ft.
"	TUBES	888.2
"	TOTAL	978.38
GRATE AREA		157 sq. ft.
FUEL SPACE		90 cu. ft.
CAPACITY OF TANKS		1200 gals.

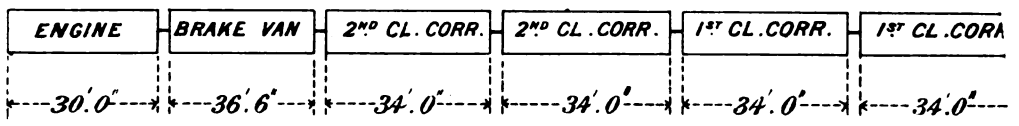


TO CARRY 20 TONS
TARE 11 TONS 13 CWT.



NATAL GOVERNMENT

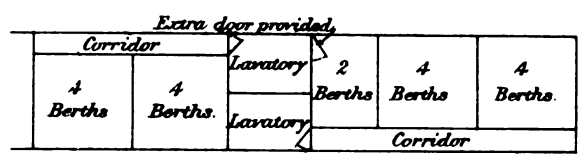
ARRANGEMENT OF COACHES IN HO



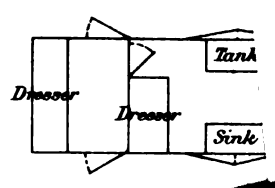
46 tons. 4cwt. 16 tons. 6cwt. 14 tons. 9cwt. 14 tons. 9cwt. 16 tons. 12cwt. 16 tons. 12cwt.

Total weight approx + 162 tons
Total length approx + 320 ft.
Total N^o of sick + 98 Lying-down Case

GENERAL ARRANGEMENT.



DETAIL OF 2ND CLASS CORRIDOR CARRIAGE.

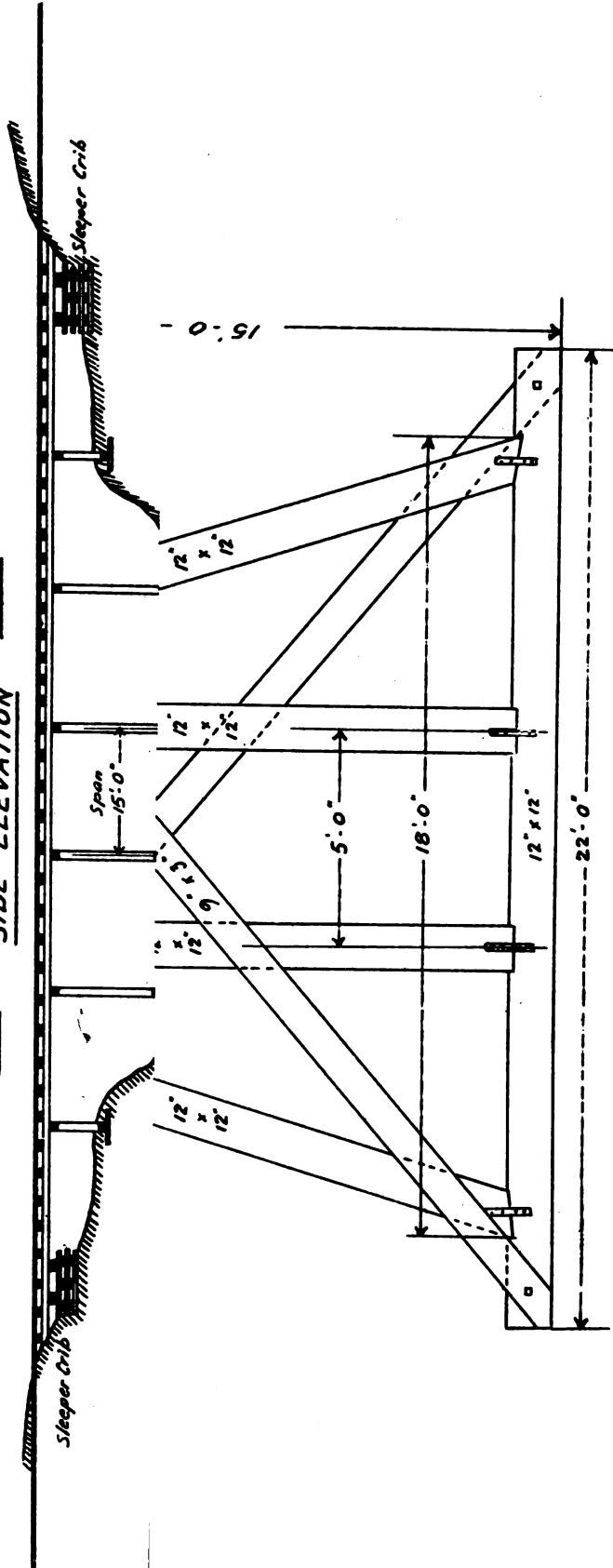


DETAIL OF

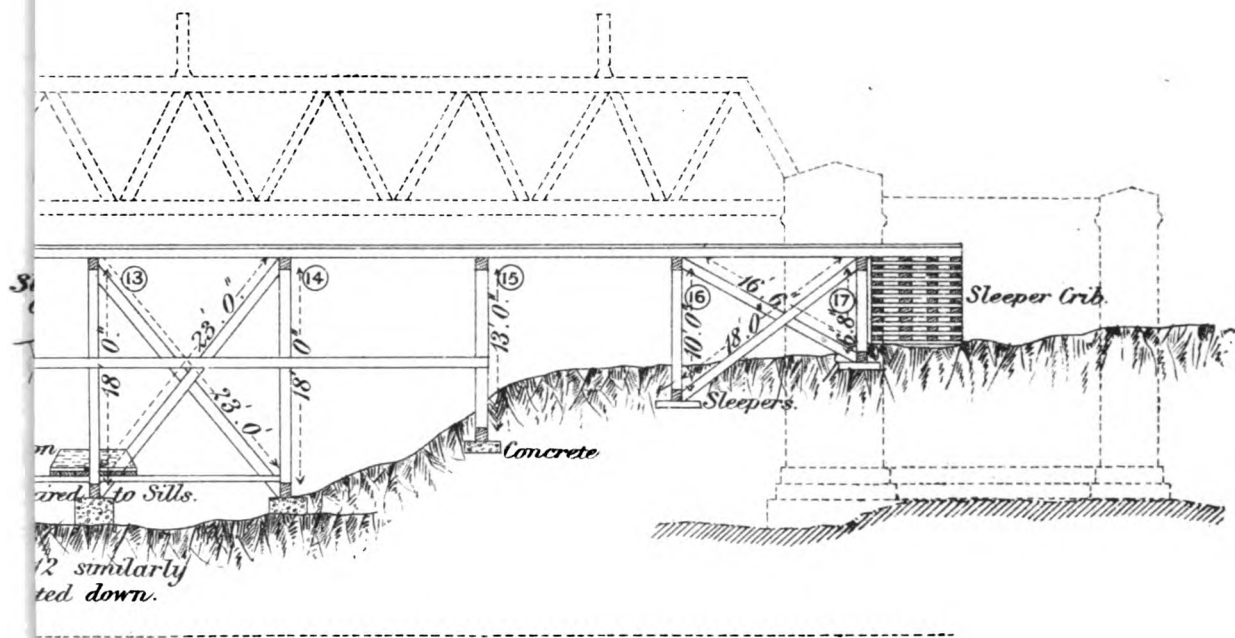
NATAL GOVERNMENT RAILWAYS.

TYPE OF TEMPORARY BRIDGE ERECTED BY N.G.R. RECONSTRUCTION DEPT.

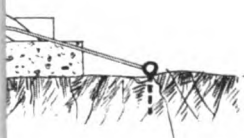
SIDE ELEVATION



ANTZ.

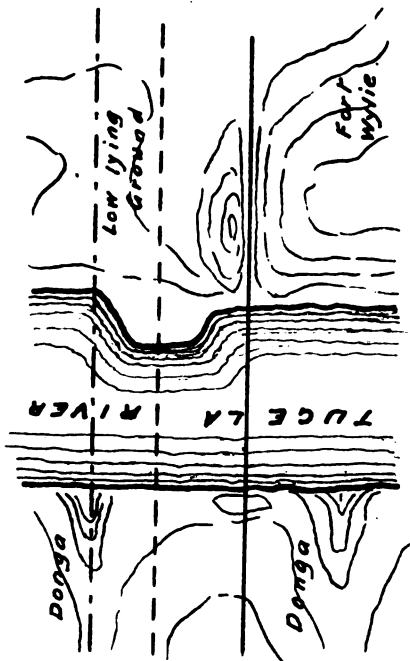


NOTE— Each of the trestles in the bed of the river was locked down at each end of the sill by wire rope to eyebolts sunk into the rock.

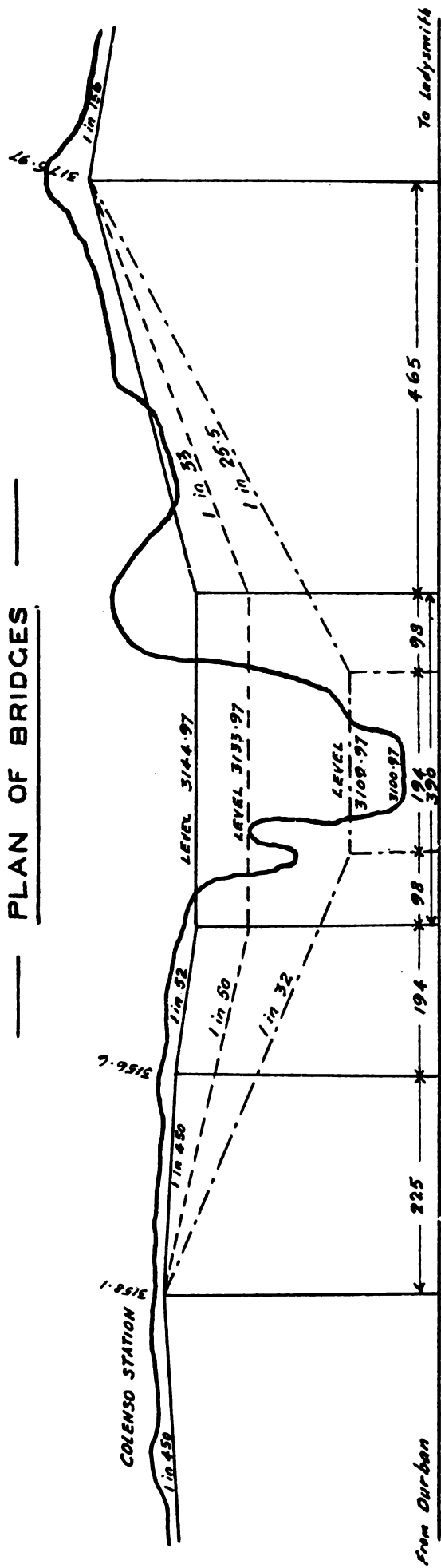


TUGELA RIVER BRIDGE, COLENZO.
NATAL LINE.

PLAN AND SECTIONS OF DEVIATIONS.



PLAN OF BRIDGES



SECTION OF LINES ACROSS TUGELA

taken from N.G.R. Official Sections
Distances Approximate.

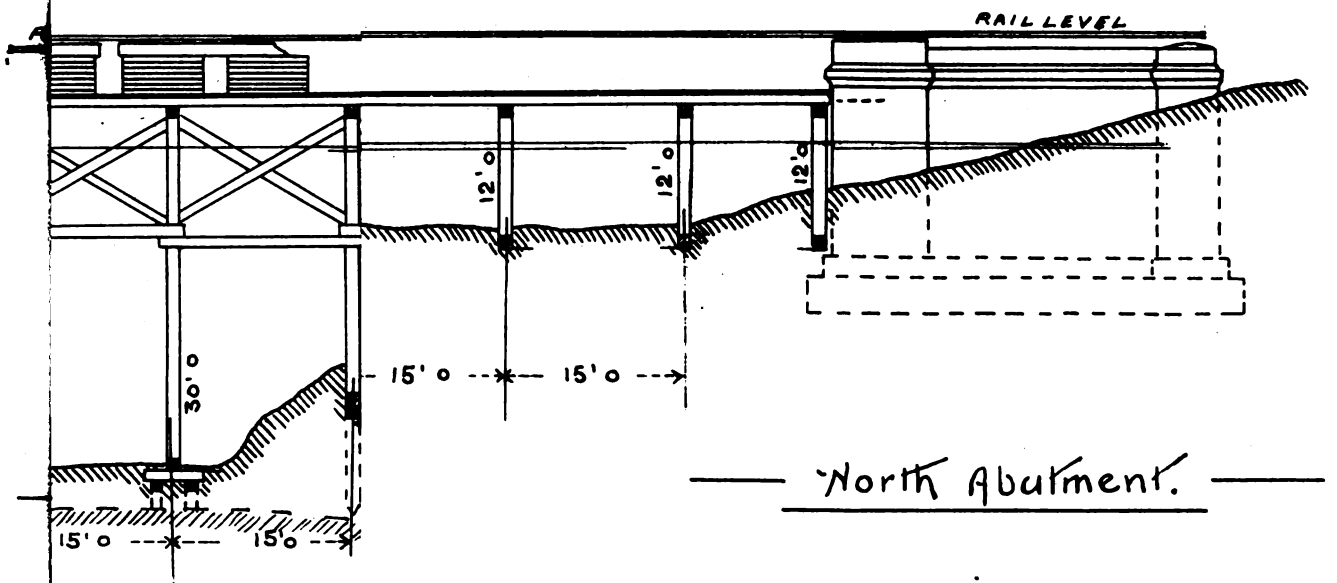
SECTION OF ORIGINAL LINE

APPROX. SECTION OF DEVIATION & BRIDGE IN COURSE OF CONSTRUCTION

APPROX. SECTION OF DEVIATION WITH MAX. GRADE OF 1 IN 25

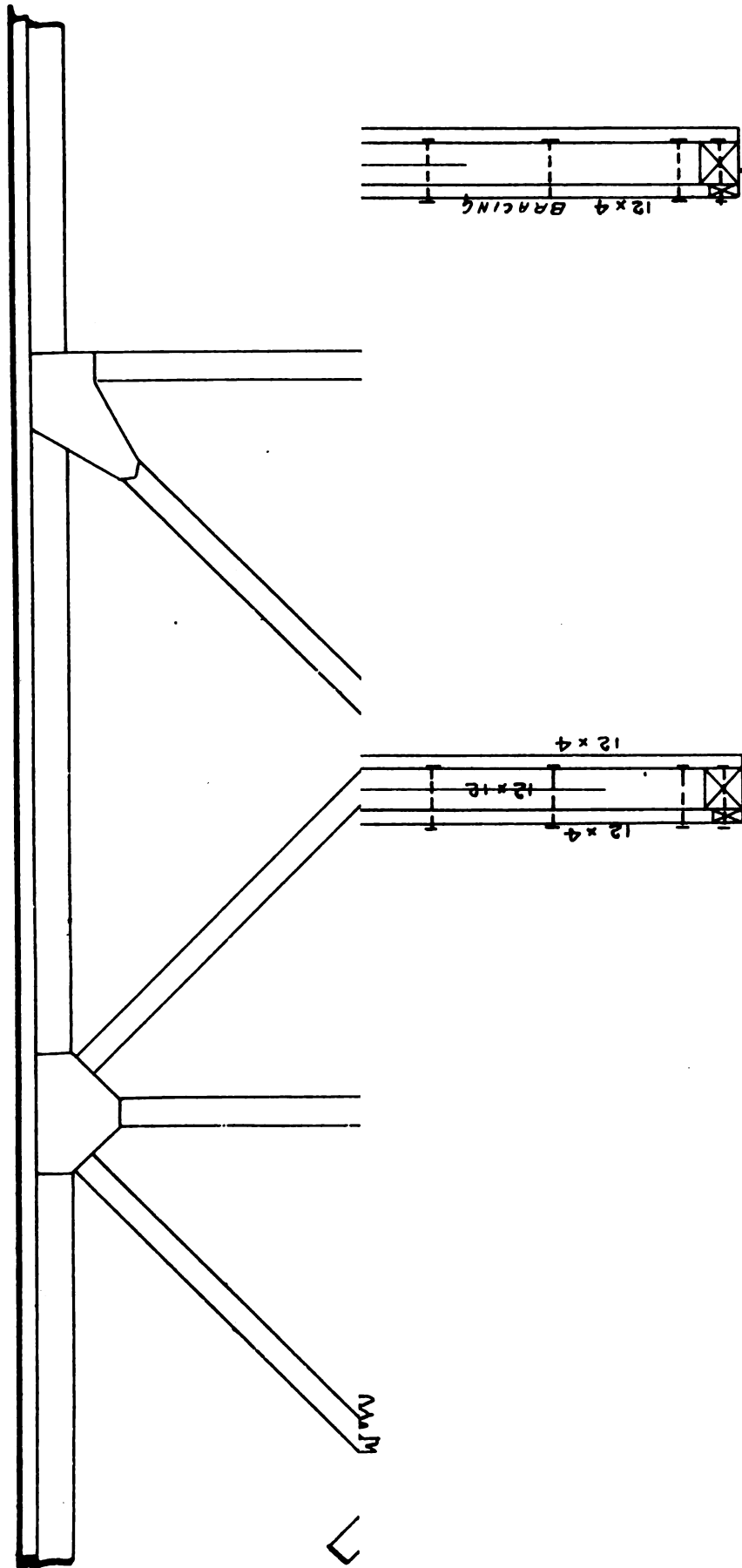
DGE.

NOT CLEAR SPANS.



RESTLE STAGIN

REAM



INGAGANE RIVER BRIDGE.
NATAL LINE.
TRESTLE STAGING FOR ERECTING 100-FOOT CLEAR SPANS.

Scale—4 Feet=1 Inch.

*mile
in 31
chs radius*

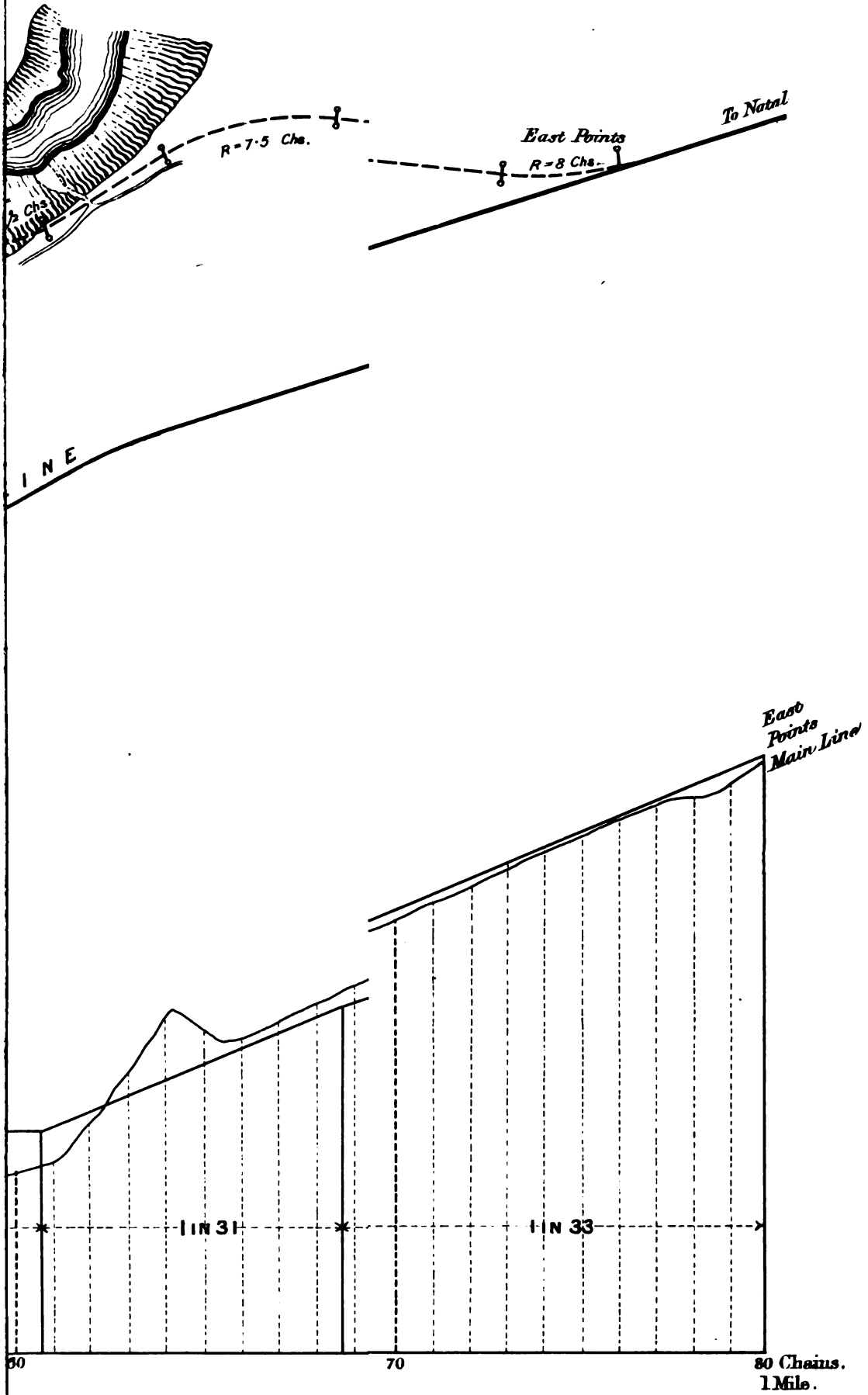
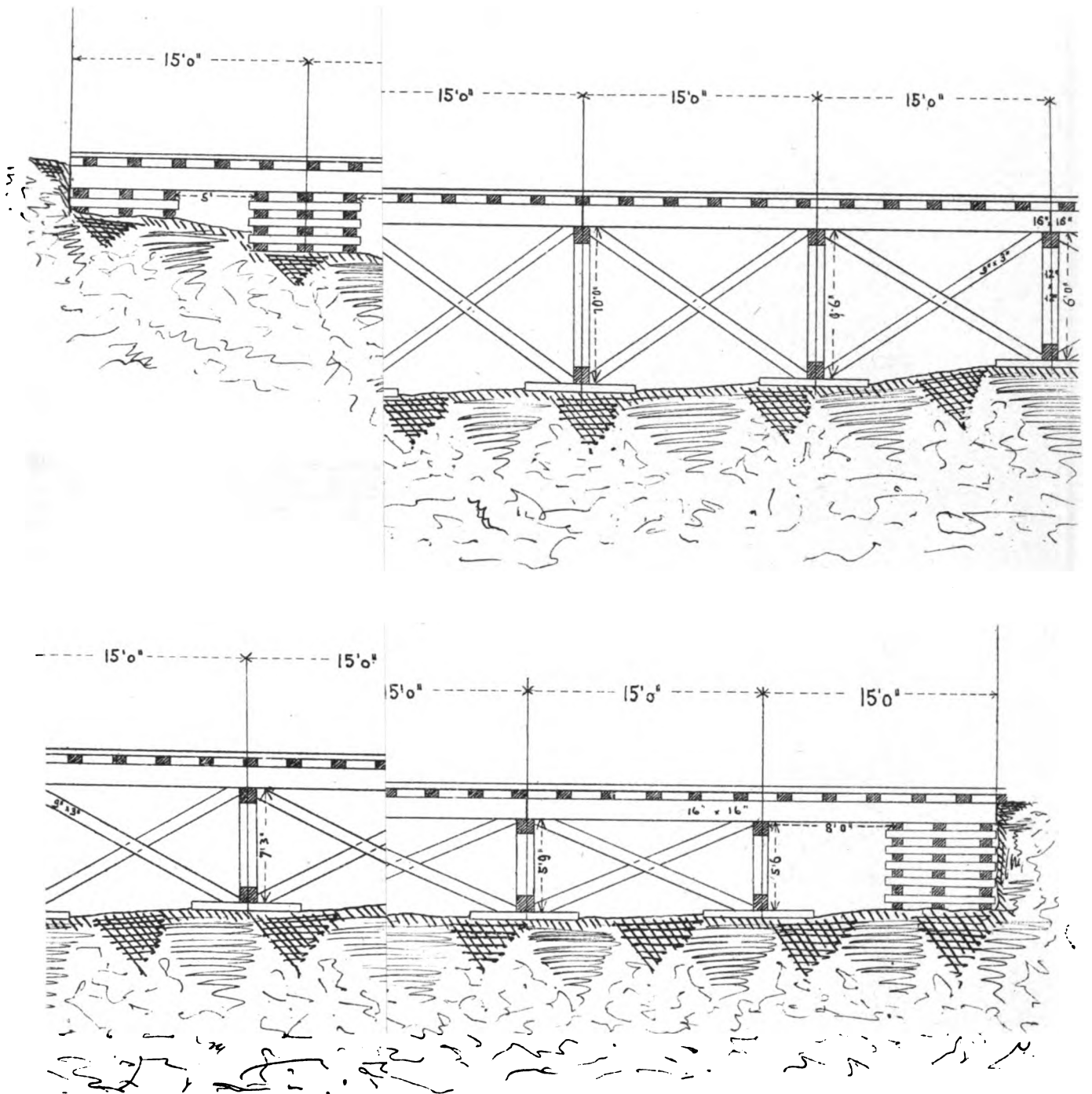


PLATE 19.

Carried out by A
" "
r

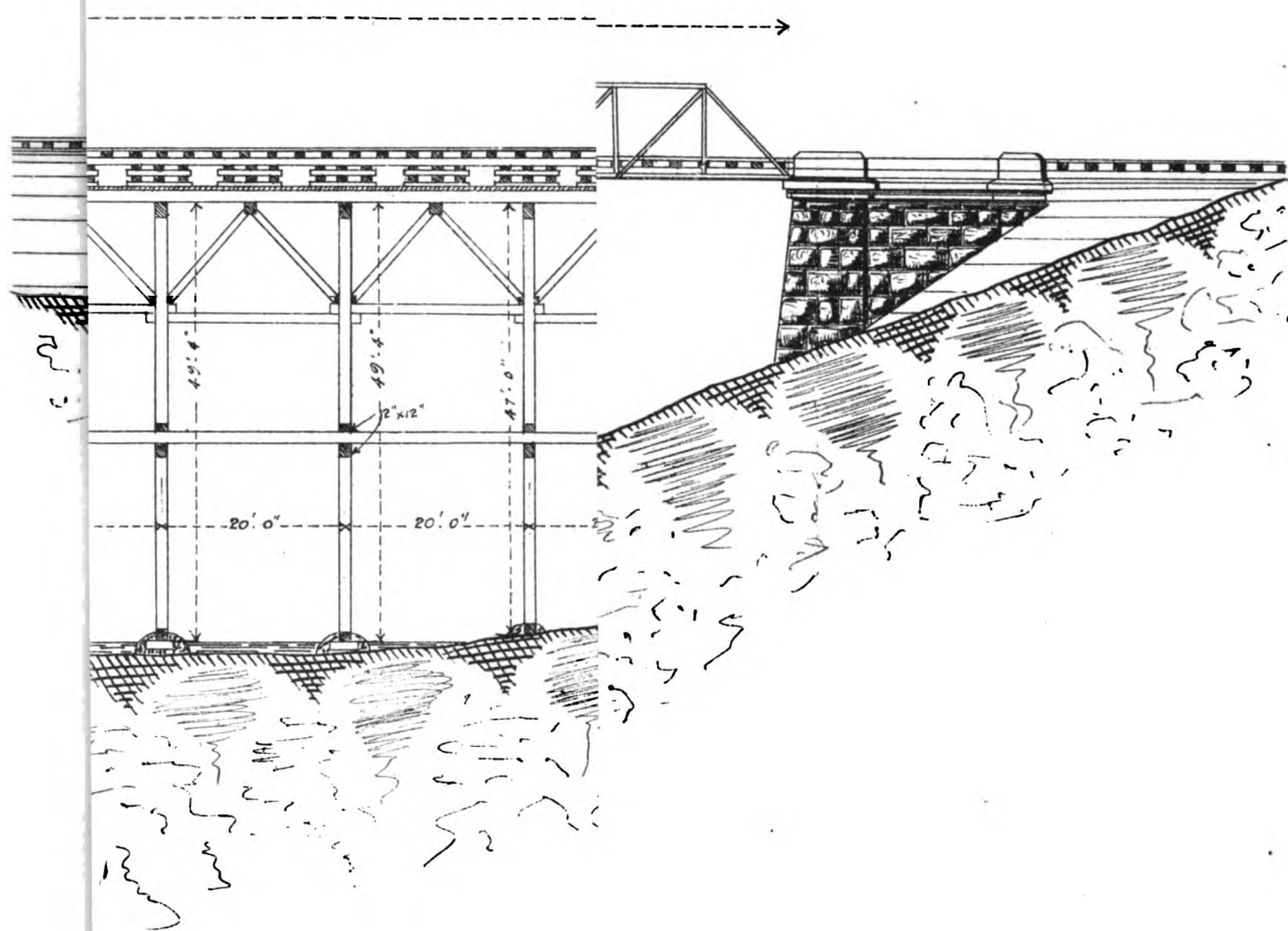


STANDERTON.

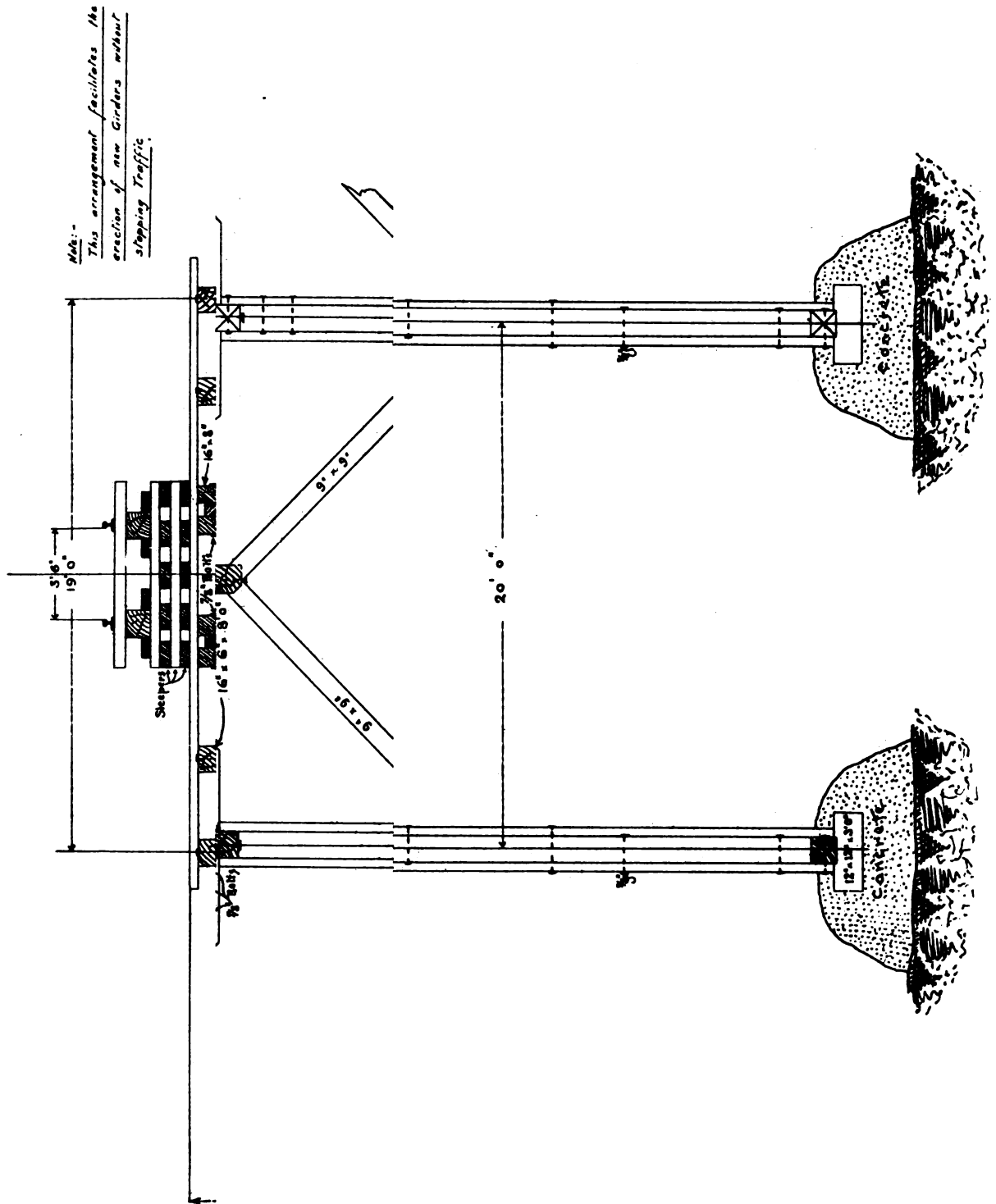
LE BRIDGE.

h.

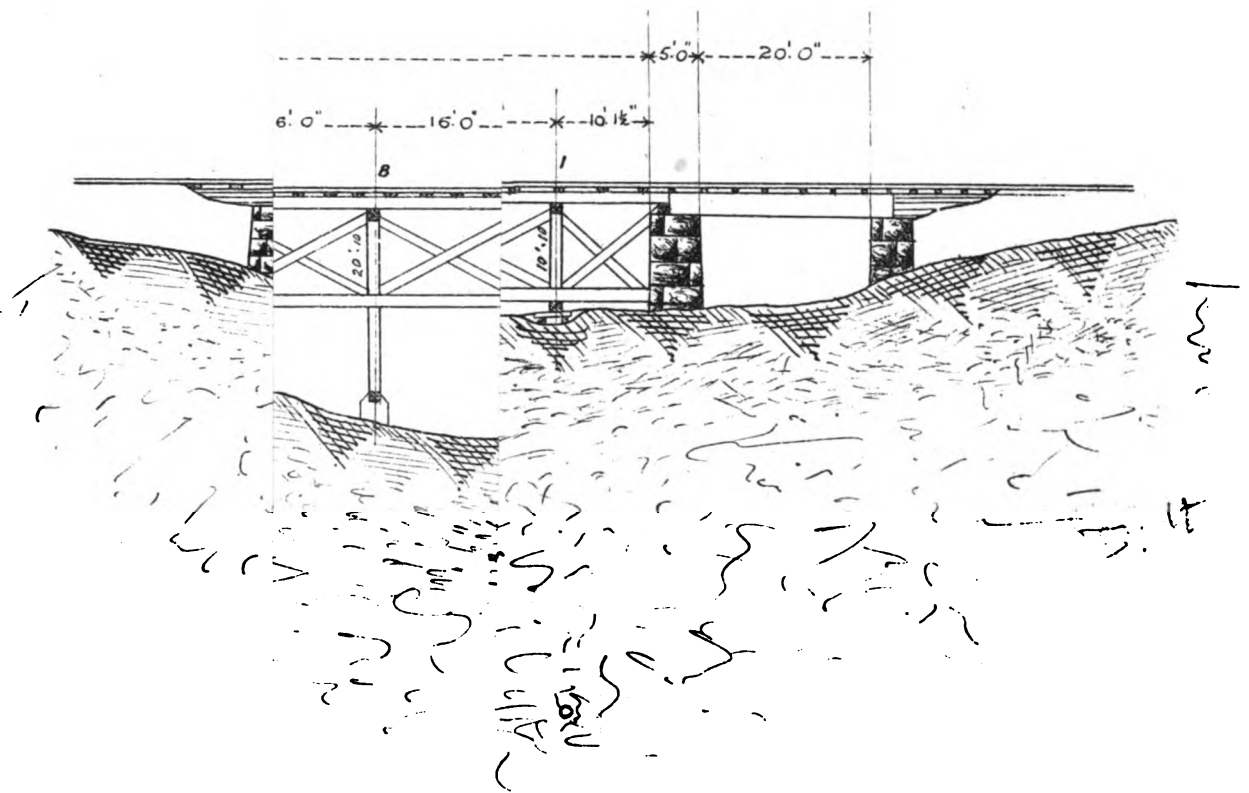
o Girders without stopping Traffic.



.ES.



IDGE.
CAPE COLONY
ESTLE BRIDGE.



R.E.
Pioneer Regiment.

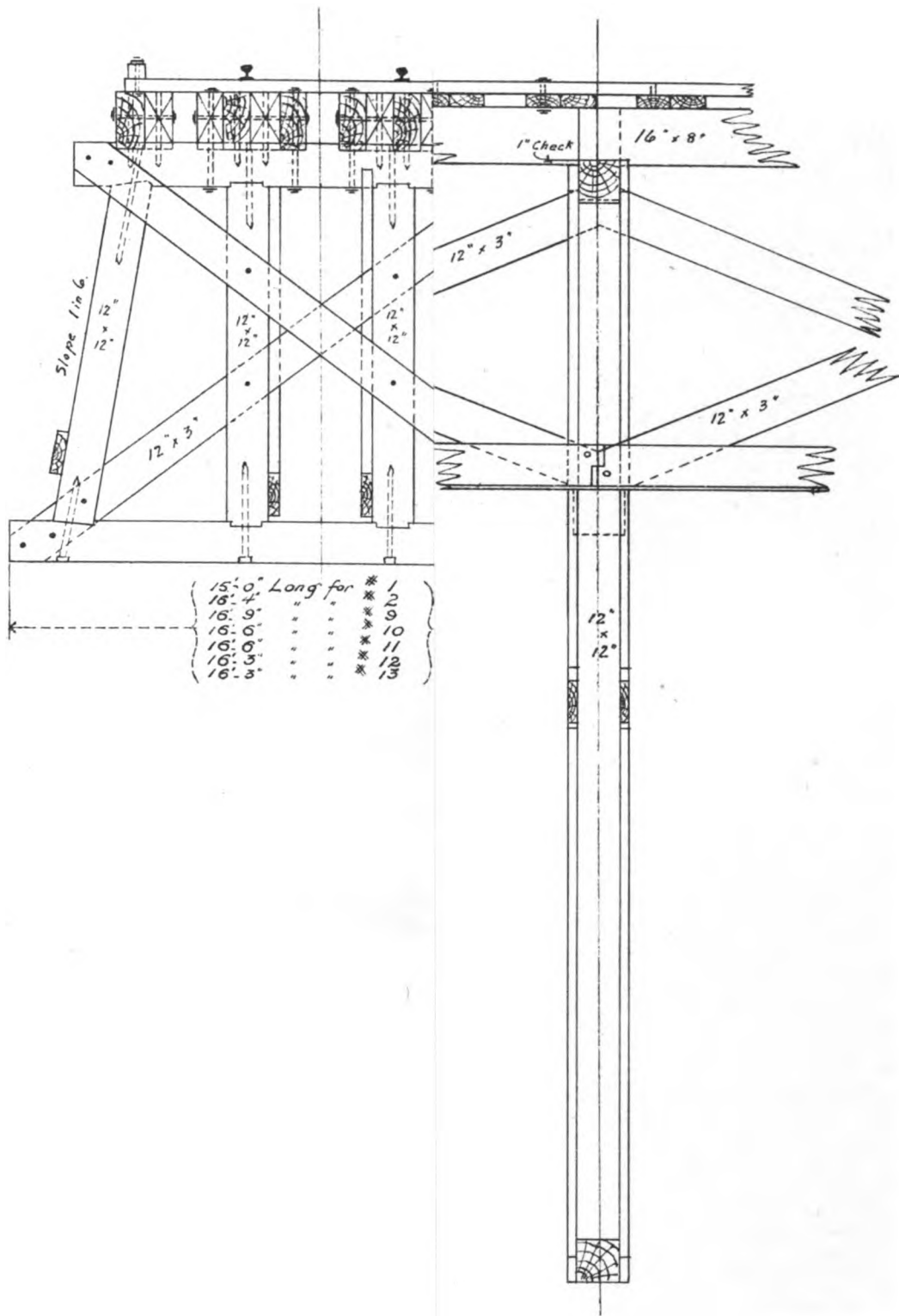
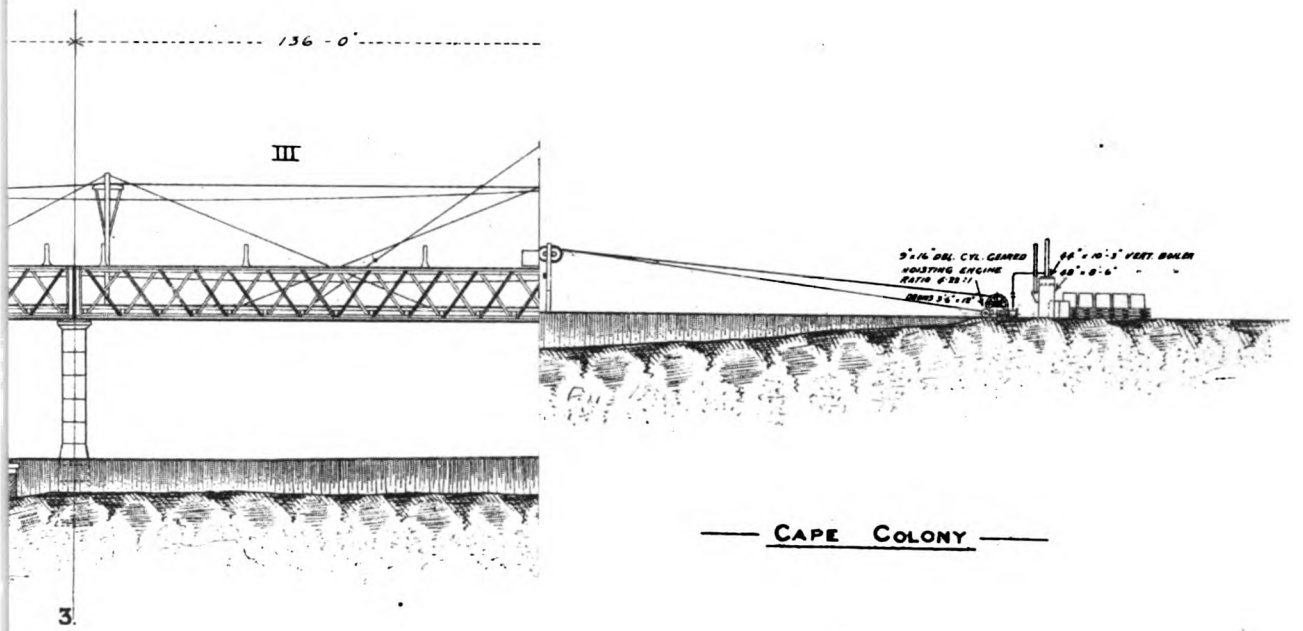


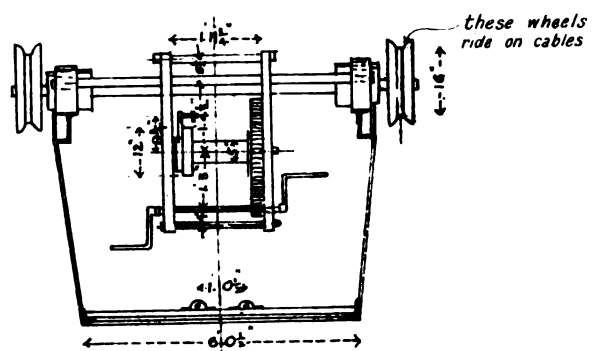
PLATE 24.



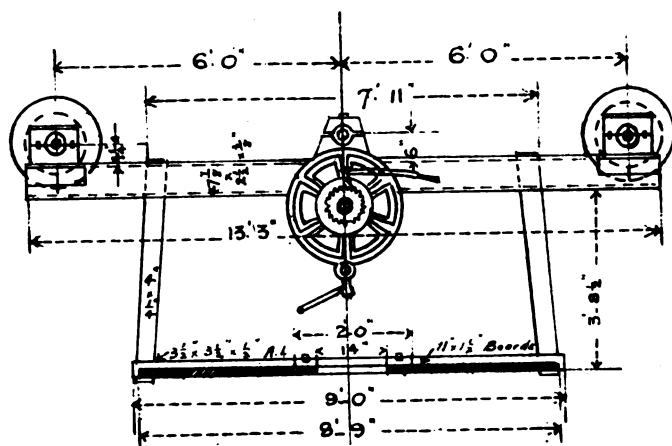
OVER BRIDGE, NO
 BLOEMFONTEIN LI
 DETAILS OF AERIAL

Scale—4 Feet=1 Inch.

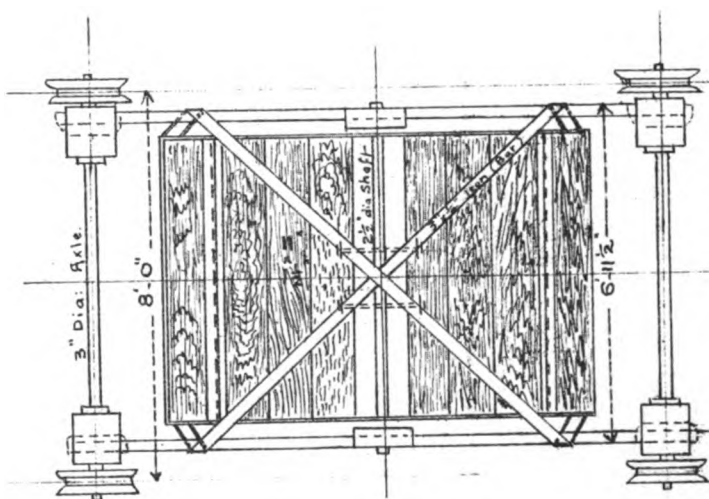
PLATE 25.



CROSS SECTION.

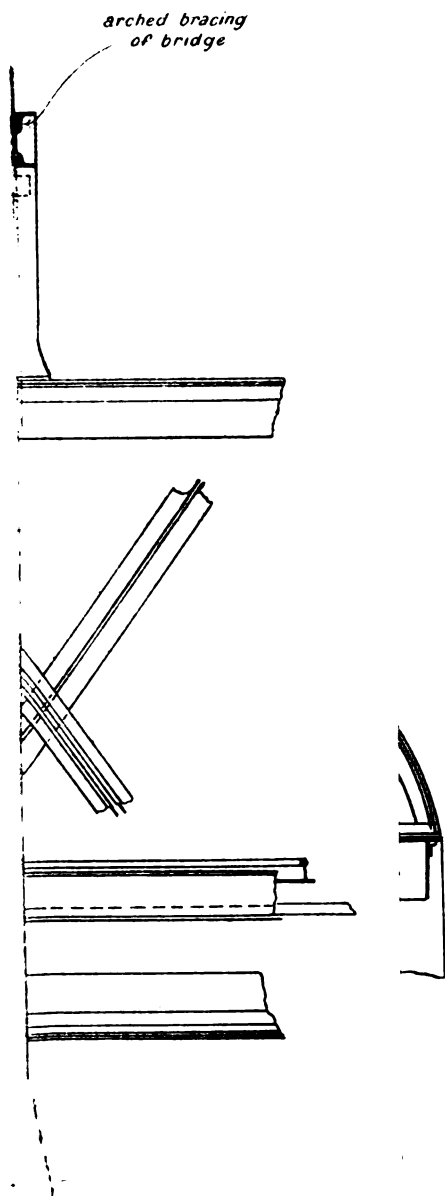


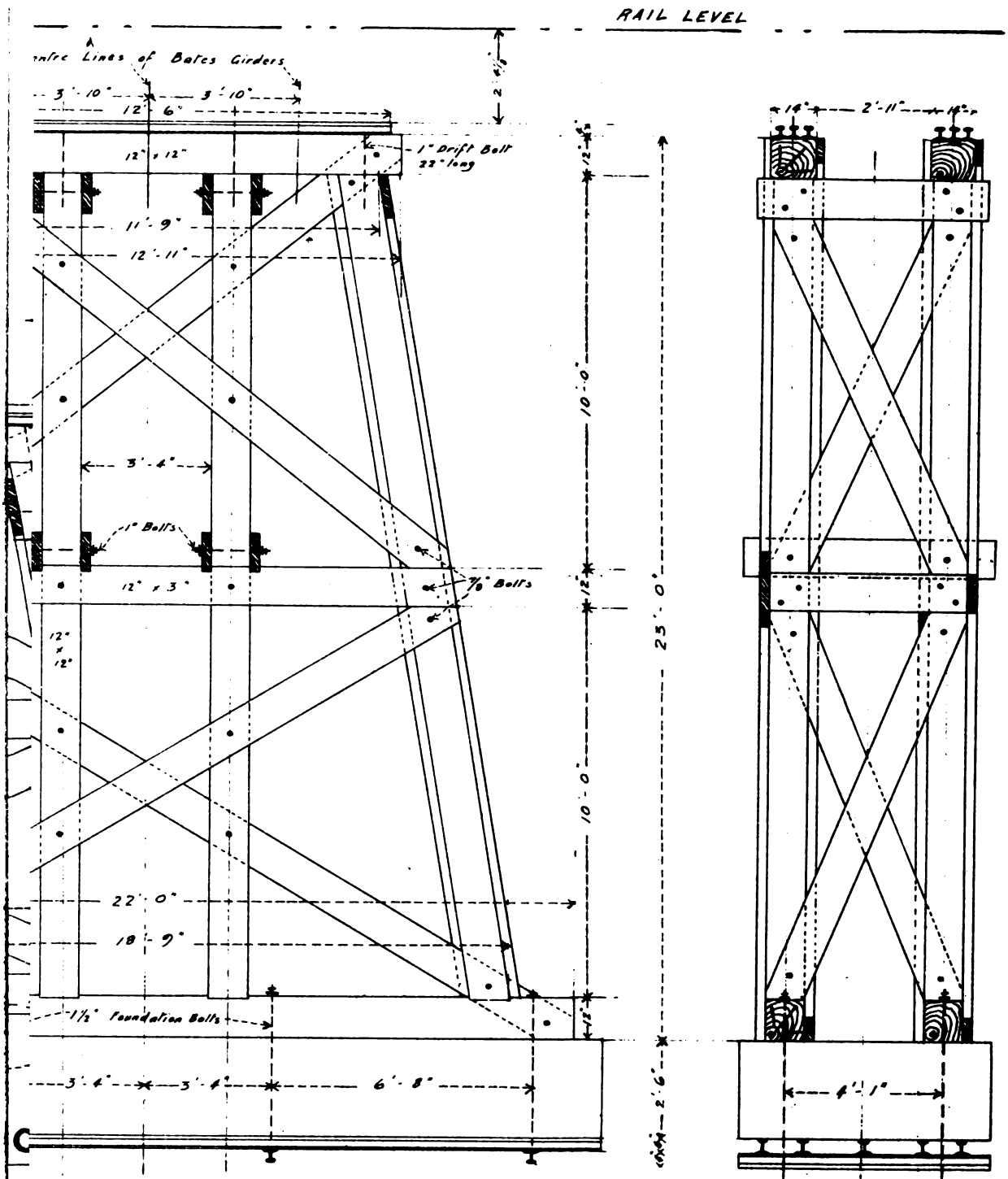
LONGITUDINAL SECTION.



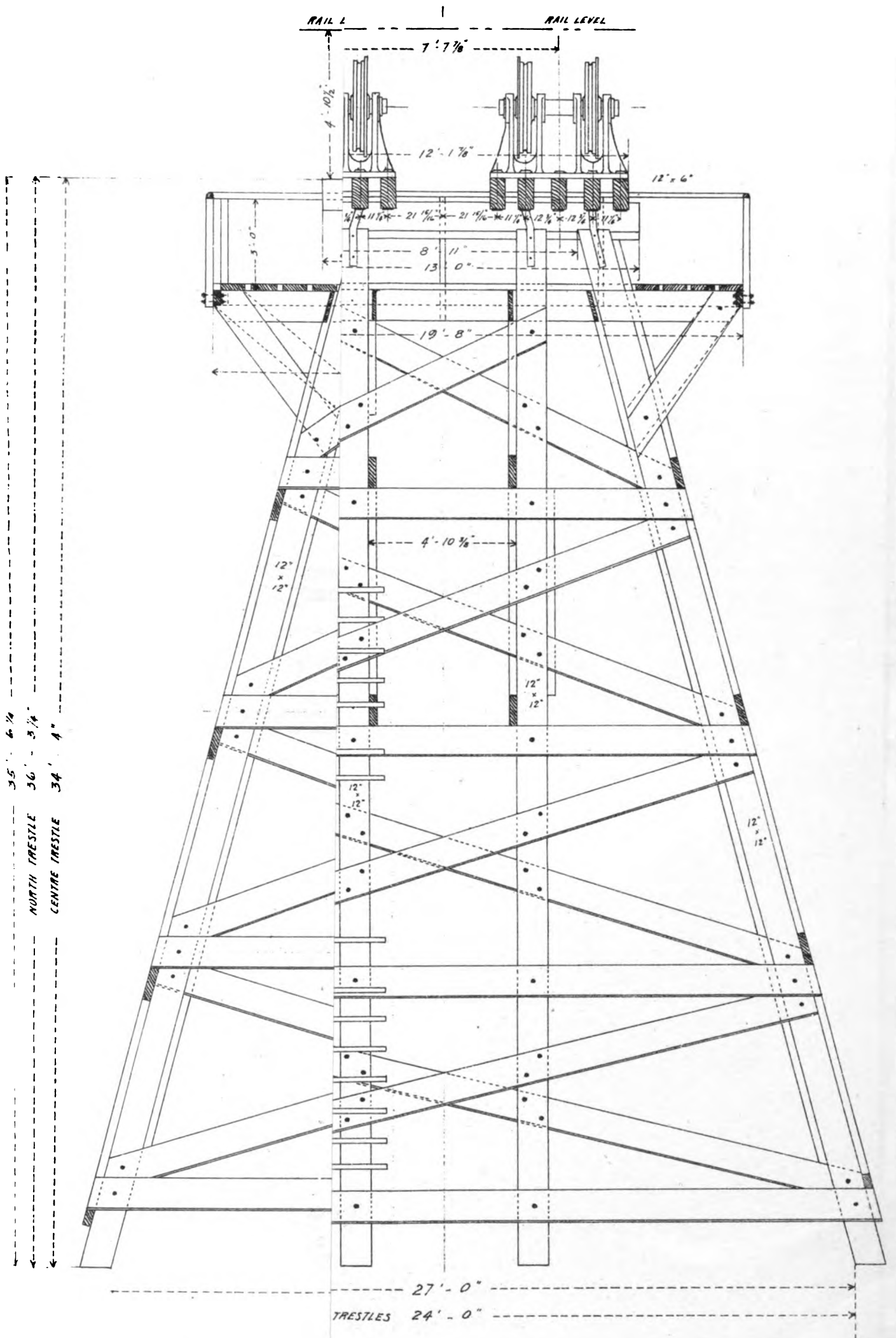
TOP PLAN, HAND WINCH REMOVED.

DETAILS OF TROLLEY.





5' TRESTLE, NORTH SPAN

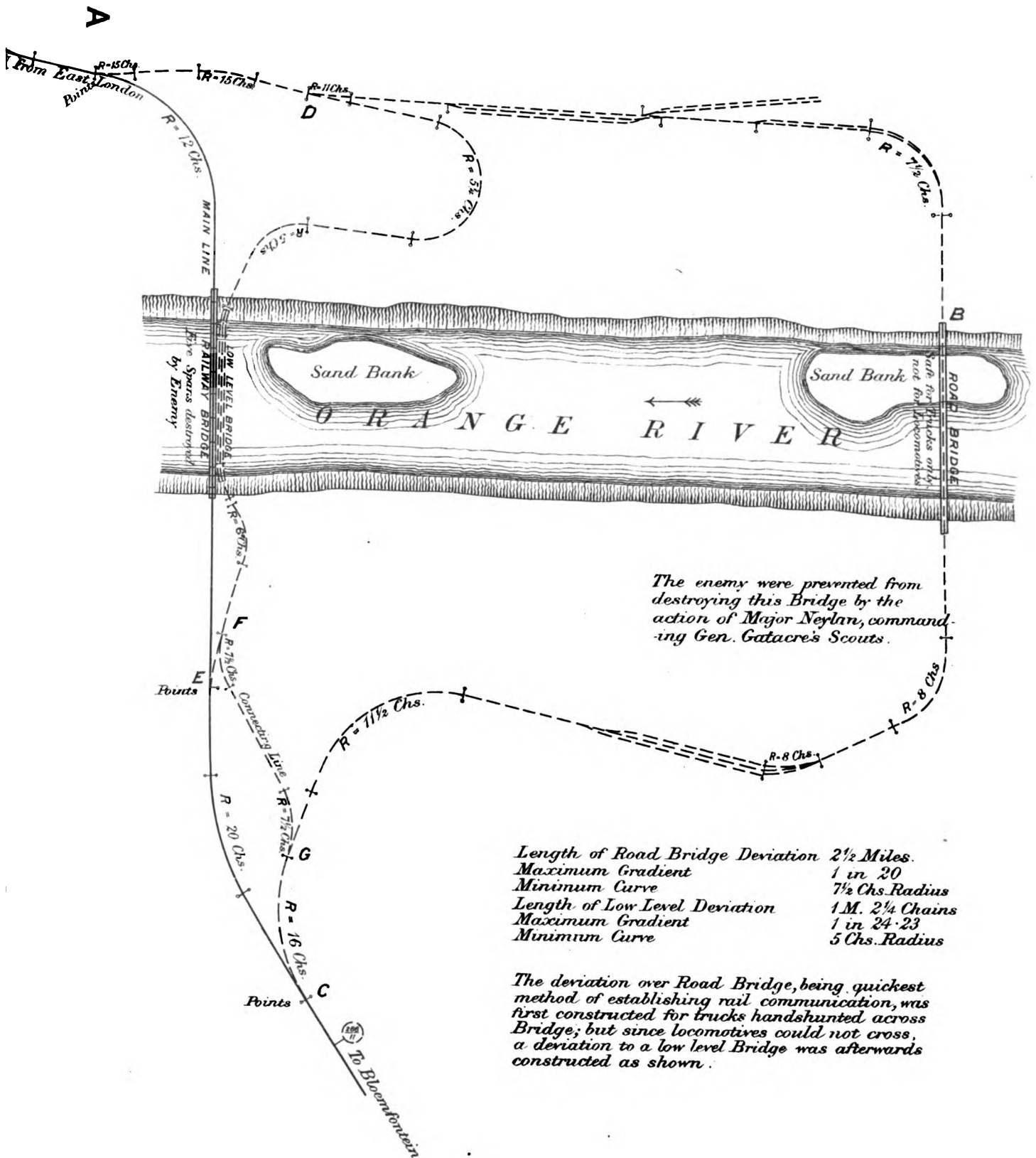


ORANGE R. BRIDGE, BETHULIE.

BLOEMFONTEIN LINE.

PLAN OF DEVIATIONS

Scale, 12 Chains - 1 inch.

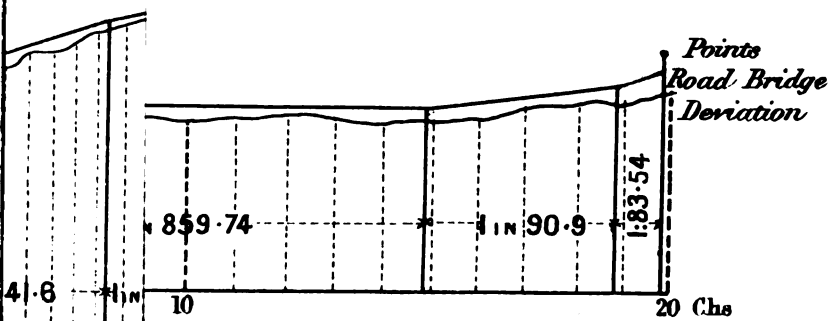
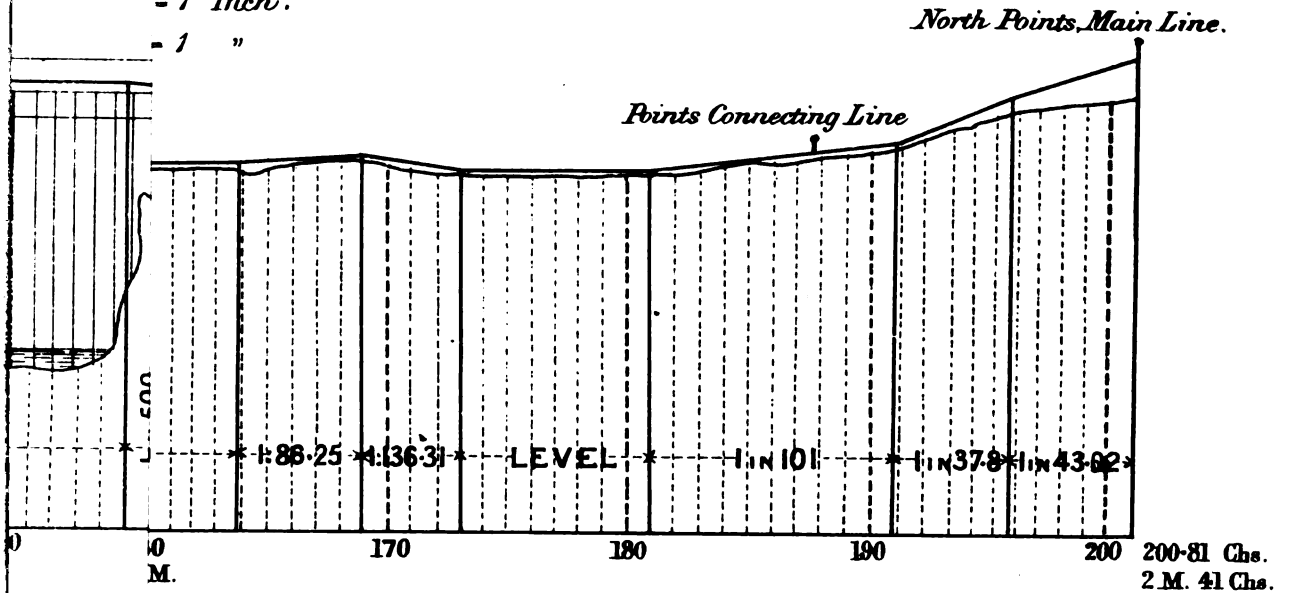


BRIDGE
 IN LINE
 DEVIATION

PLATE 29.

A. B. C. PLATE 28.

- 1 Inch.
 - 1 "



LINE F. G. PLATE 28.

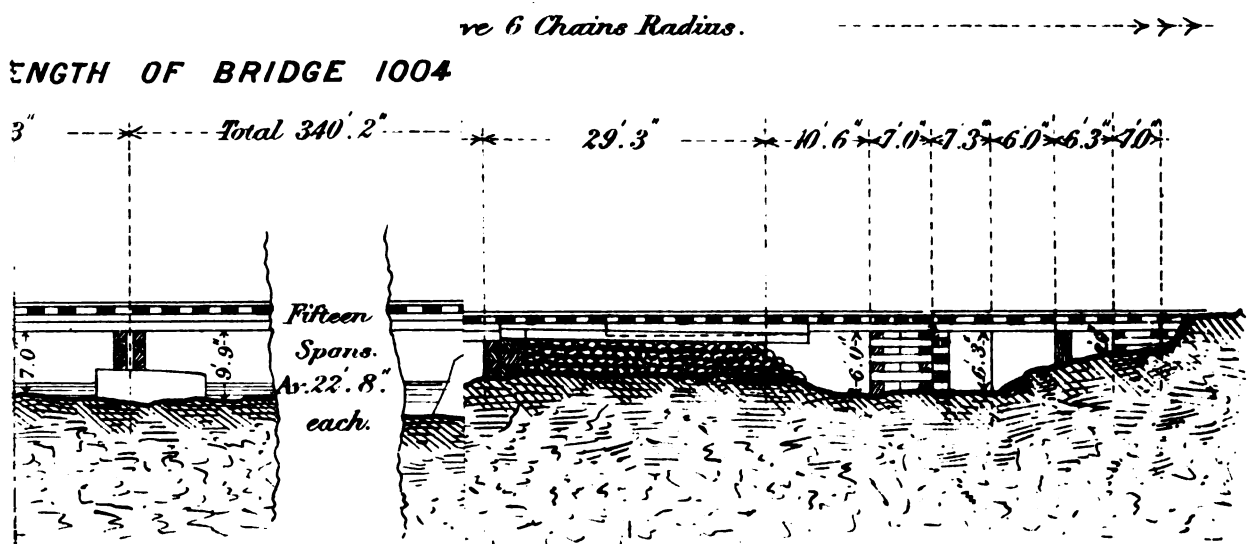
8
 11 4 Chains = 1 Inch.
 20 Feet = 1 "

**DAD BRIDGE, BET
AFONTEIN LINE.**

PLATE 30.

TEMPORARY LOW LEVEL DEVIATION

Scale 20 Feet = 1 Inch.

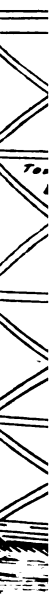


*used by C.G.R on first construct
consequently their bearing on river b*

3RI
TOR
STLI

prax

-- '7



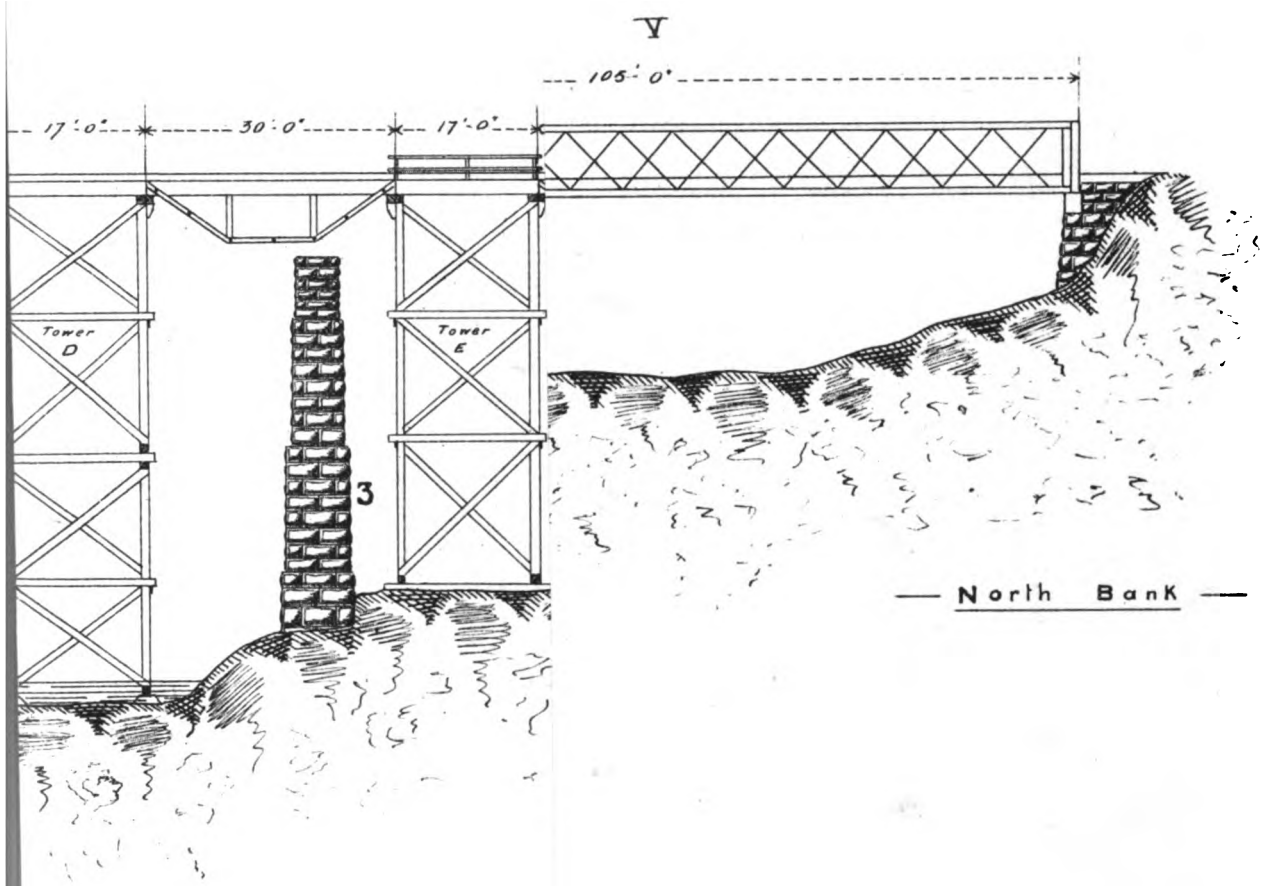
5

BRIDGE.

TORIA LINE.

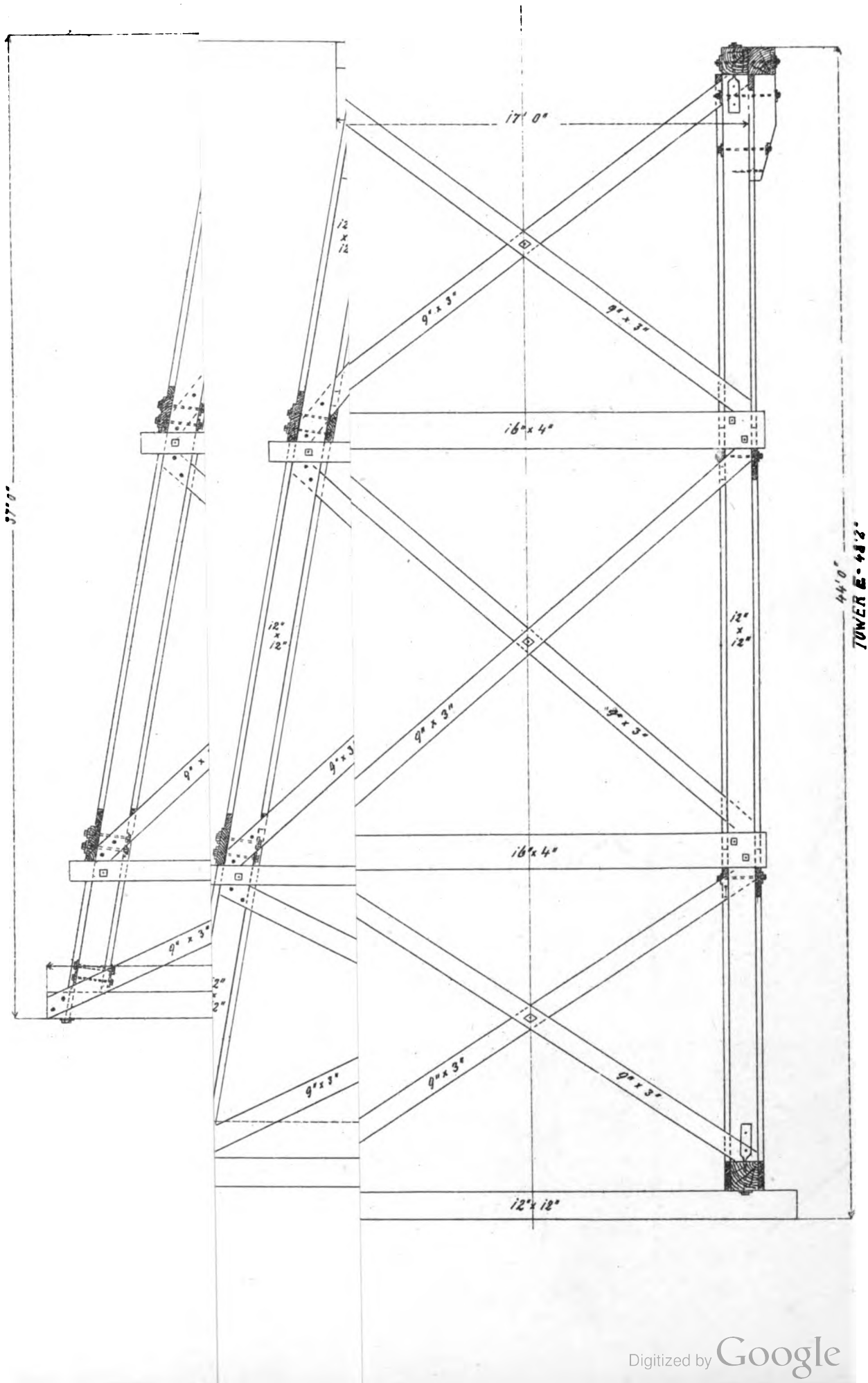
STLE BRIDGE.

approximately.

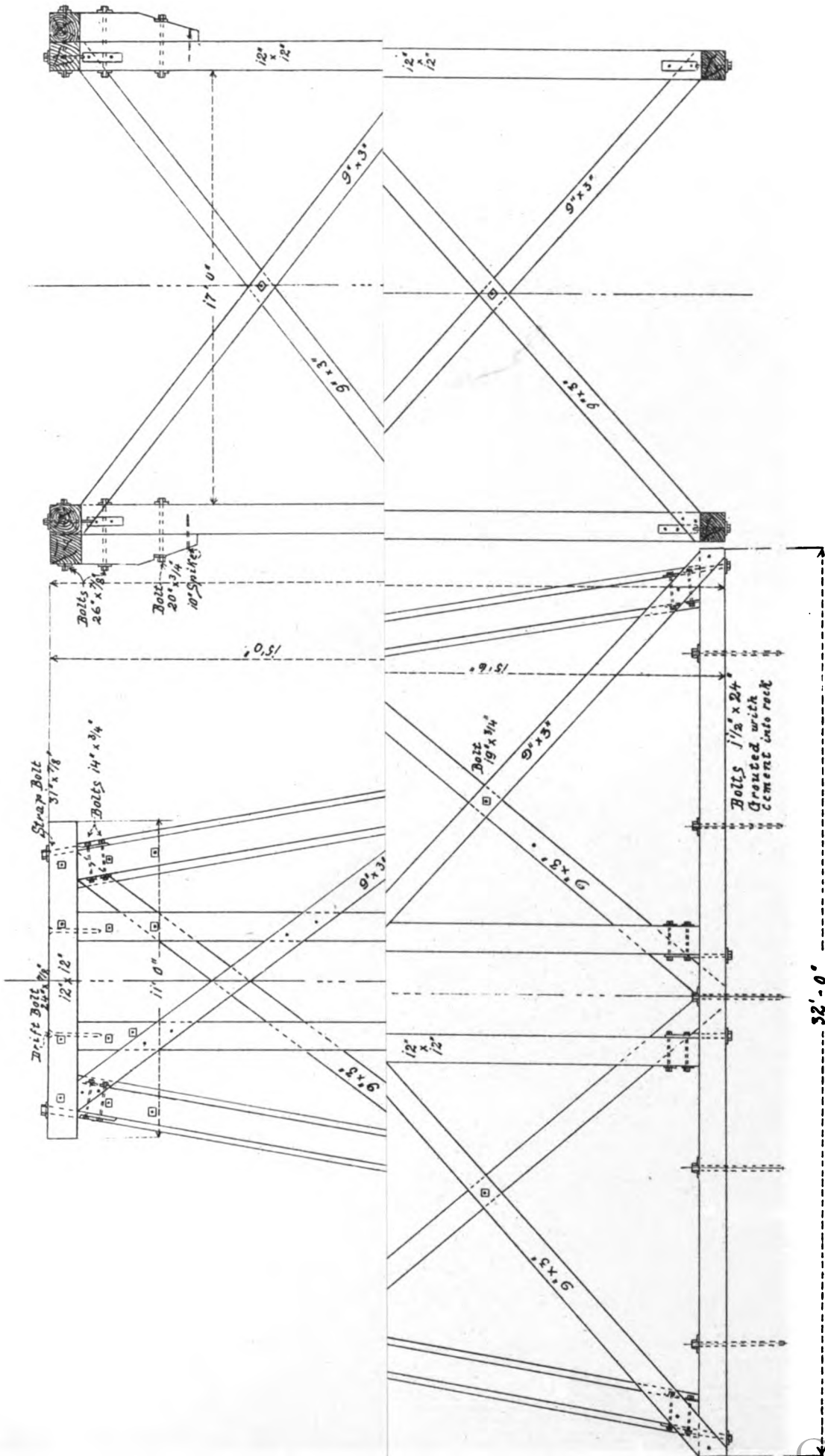


3E.
LINE.
TRESTLES.

PLATE 32.

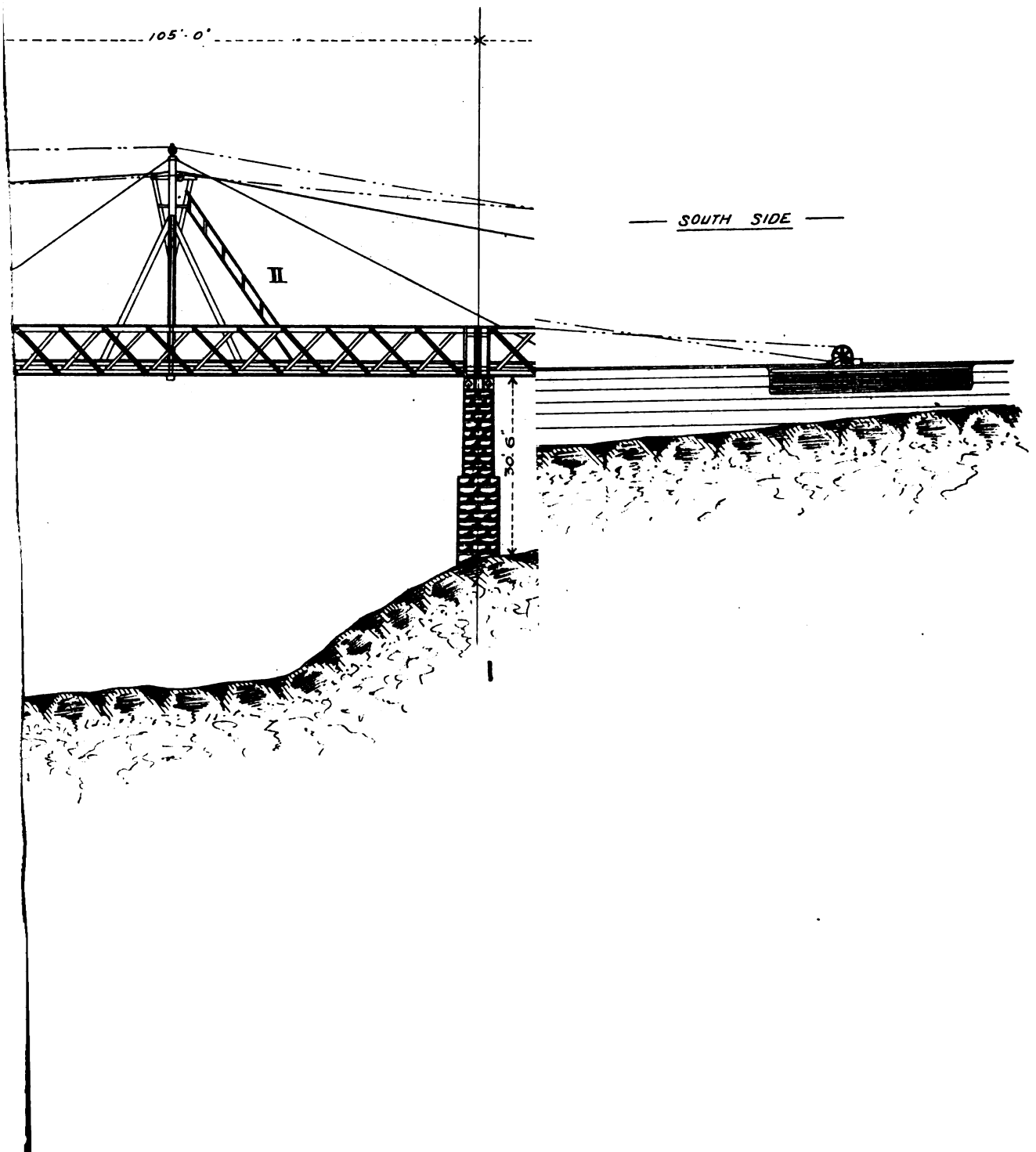


TOWER E-483



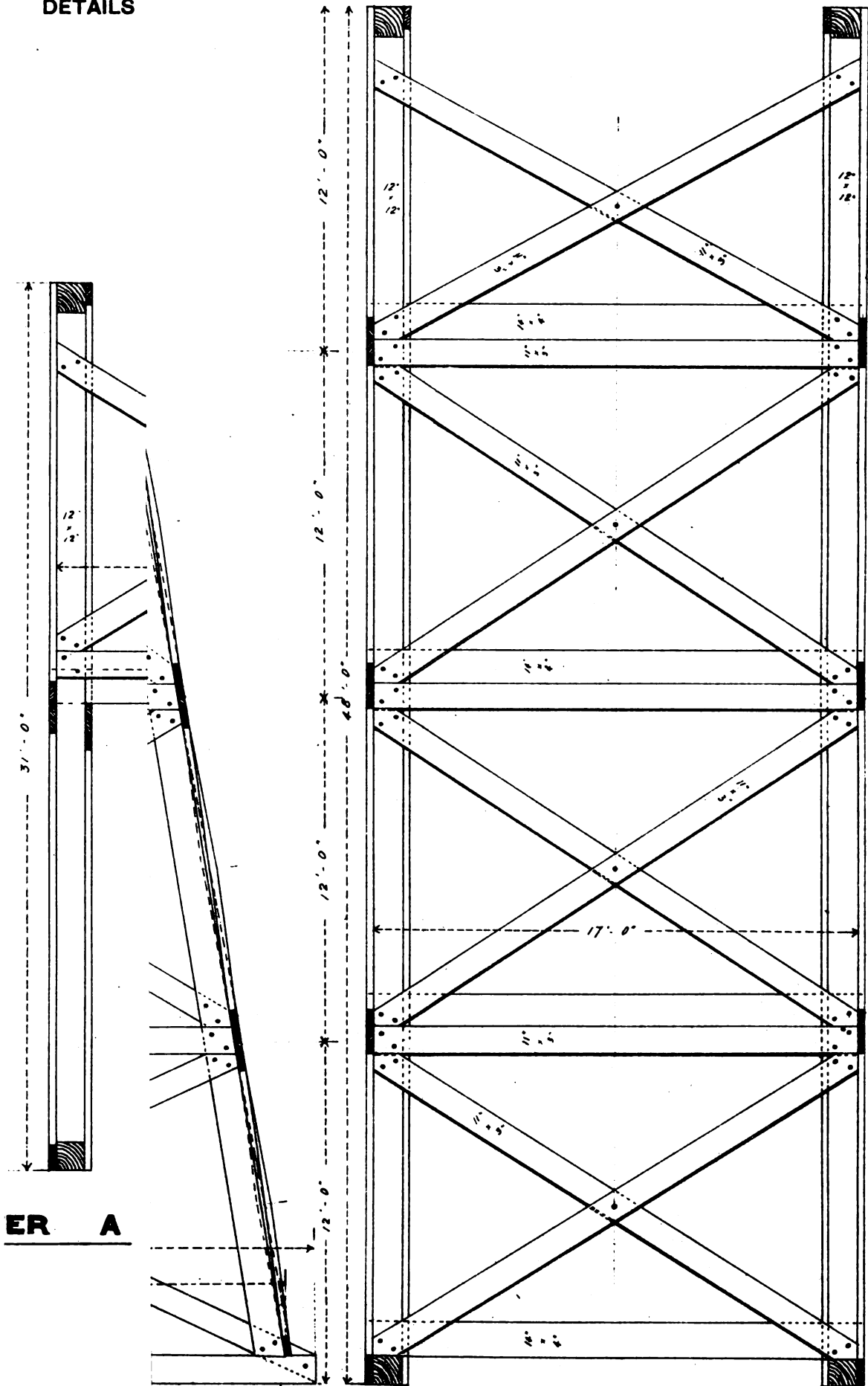
TOWERS C & D

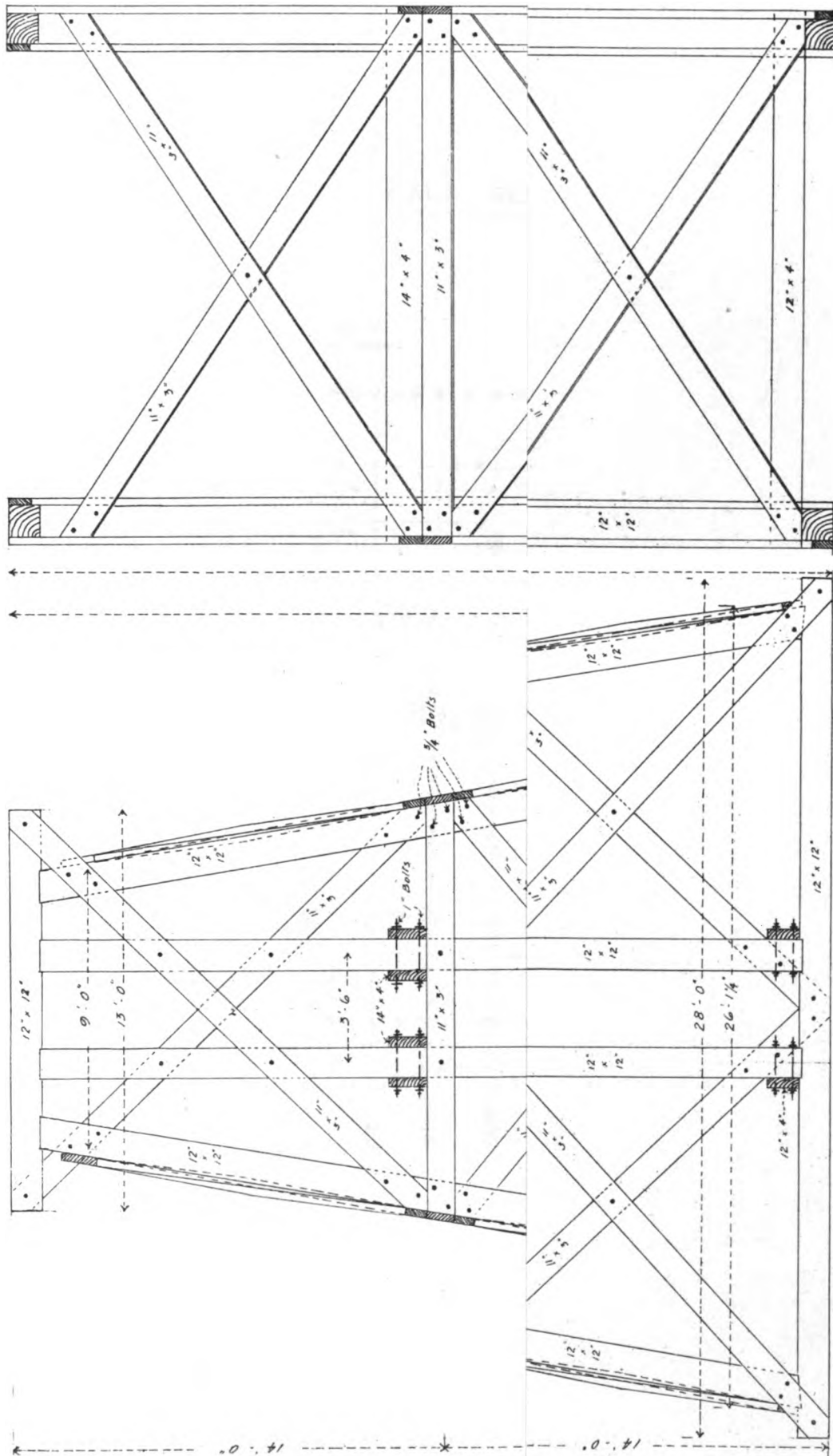
PLATE 34.



Z
BLC

DETAILS

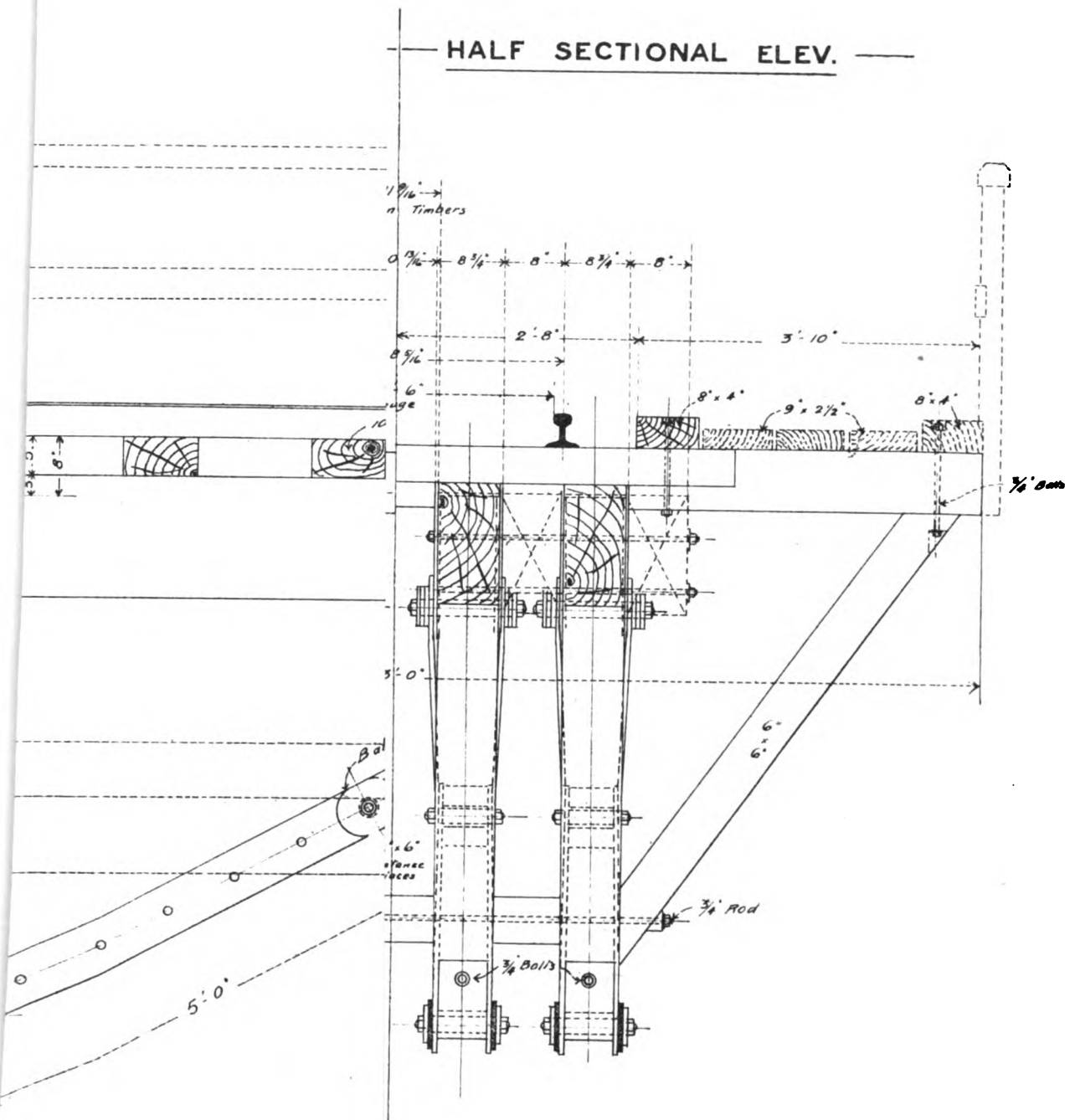




— TOWERS D, E & F —

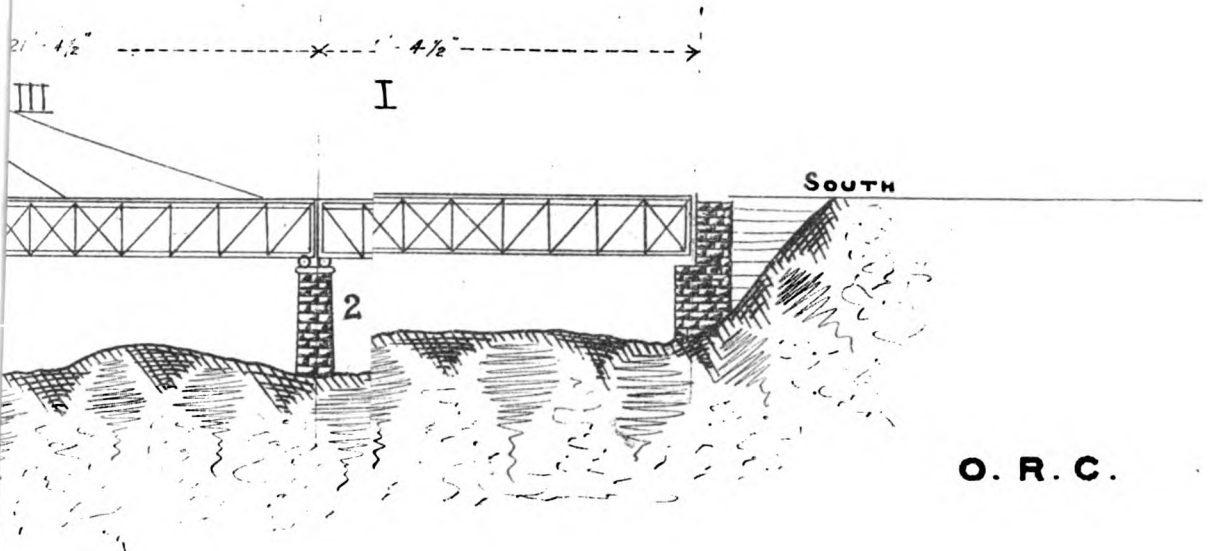
ZAND RIVER BRIC
BLOEMFONTEIN—PRETORIA
DETAILS OF TRUSSED BI

Scale—1 Inch=1 Foot.



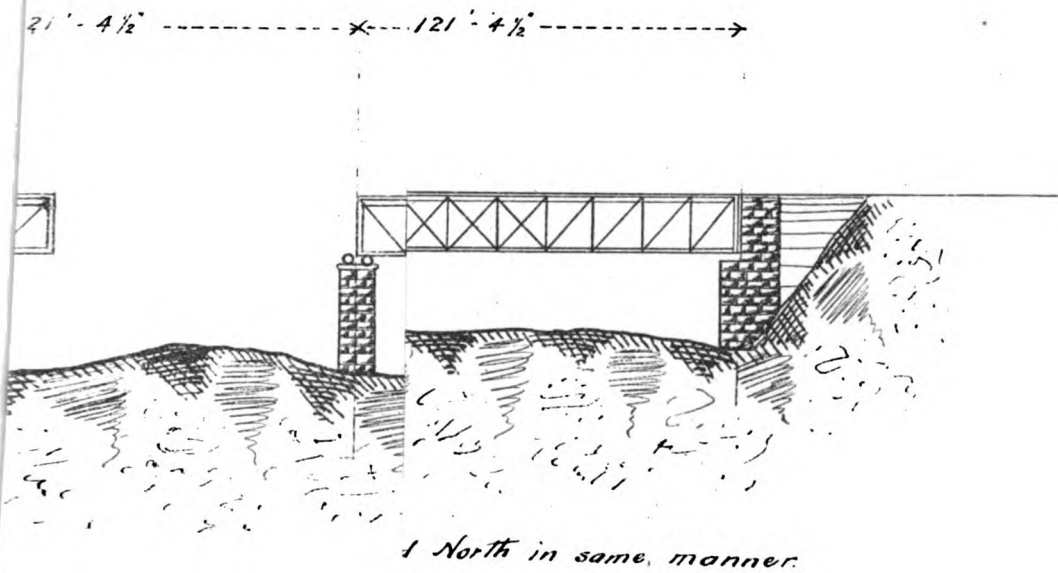
INGING.

F GIRDERS.



O. R. C.

E ENEMY -



GIRDERS ———

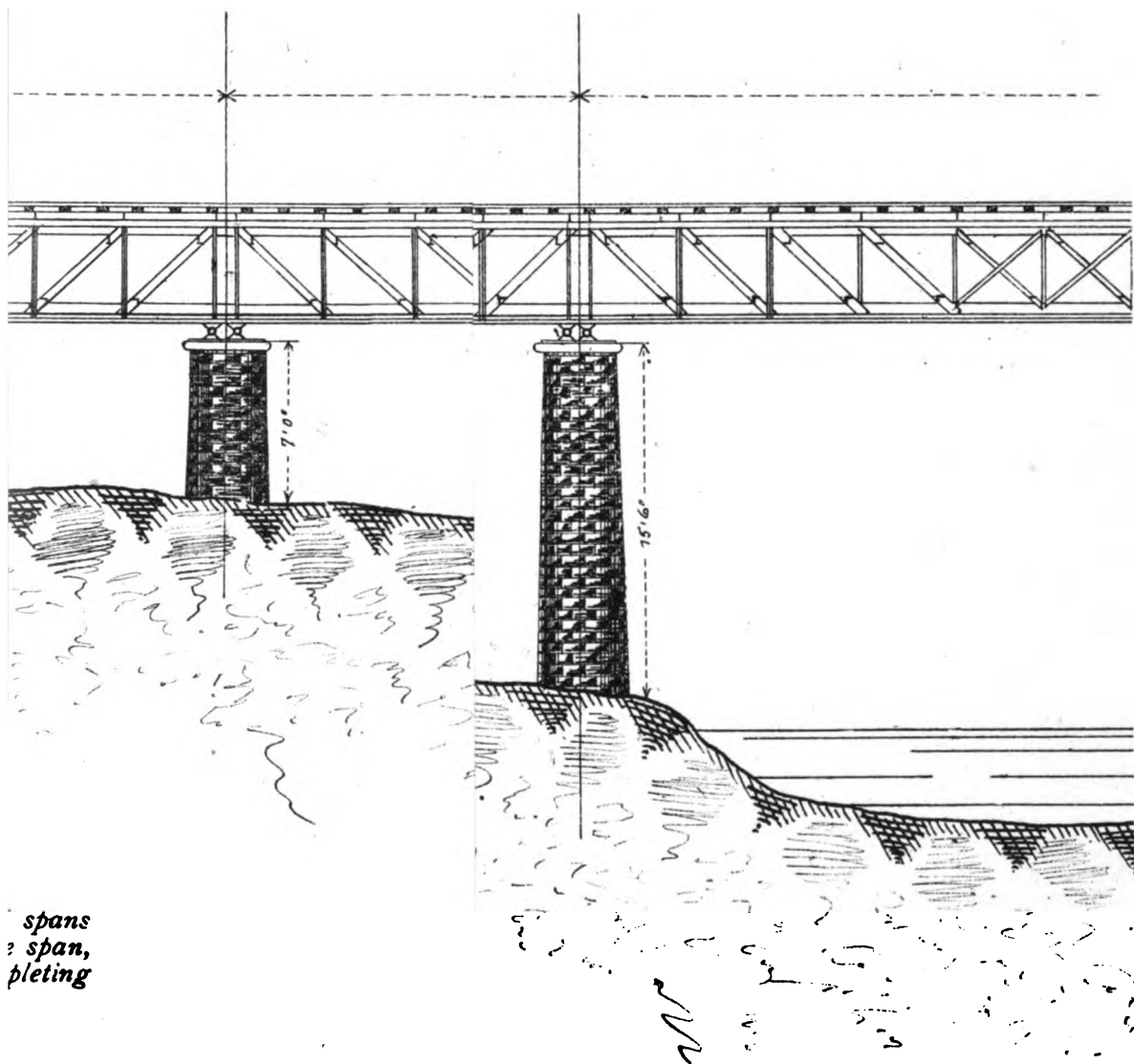
ENIGING.

IE.

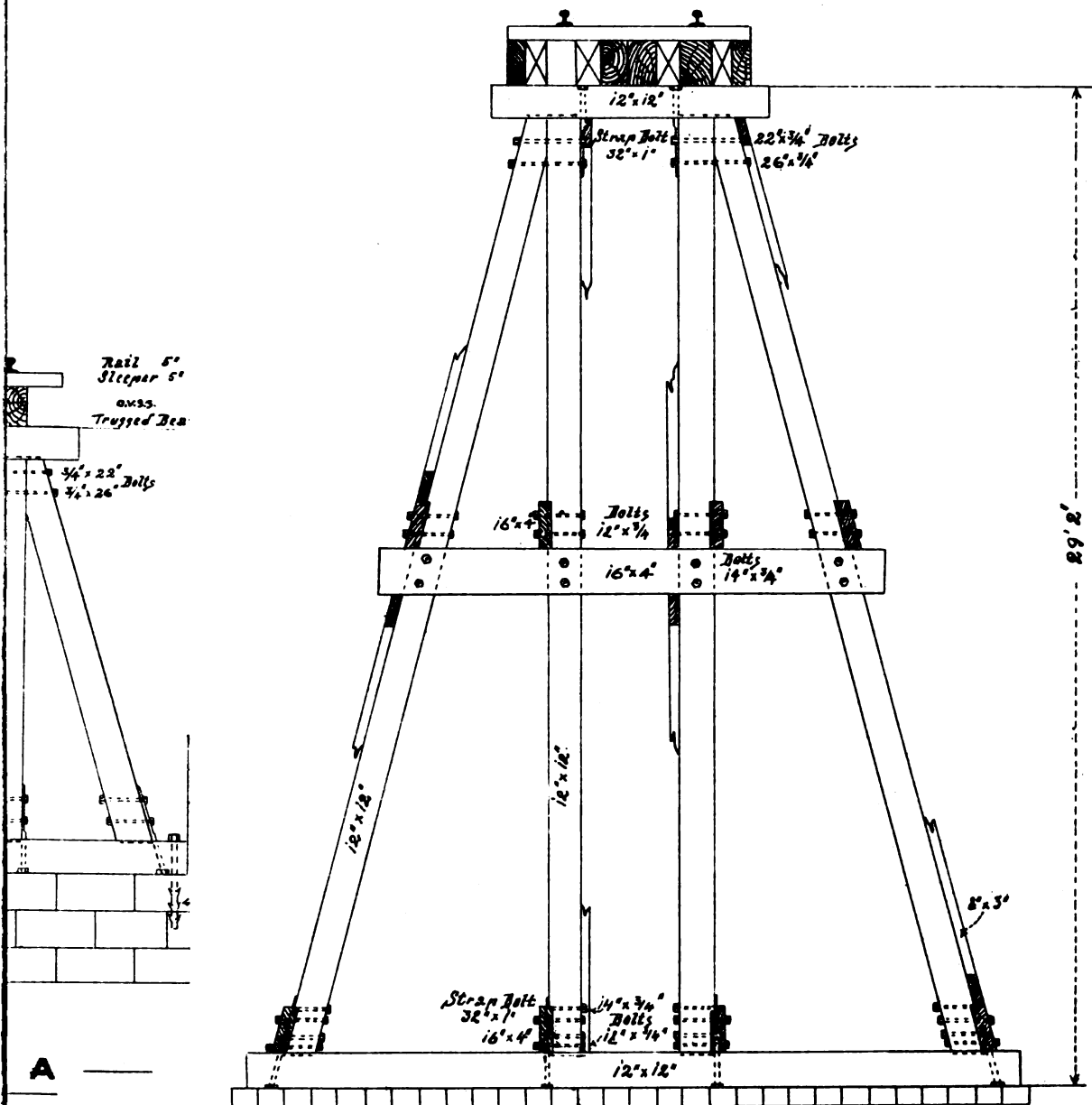
TH' END.

S.

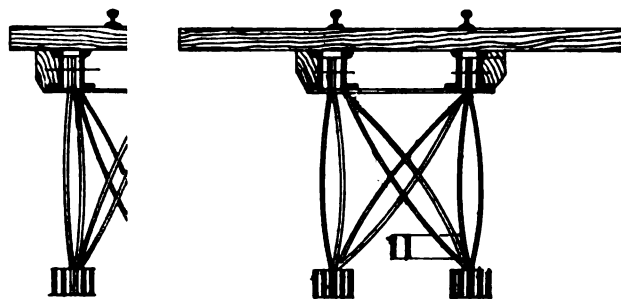
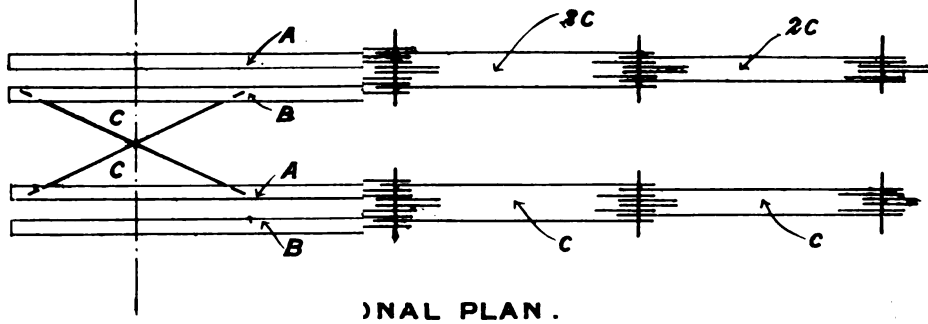
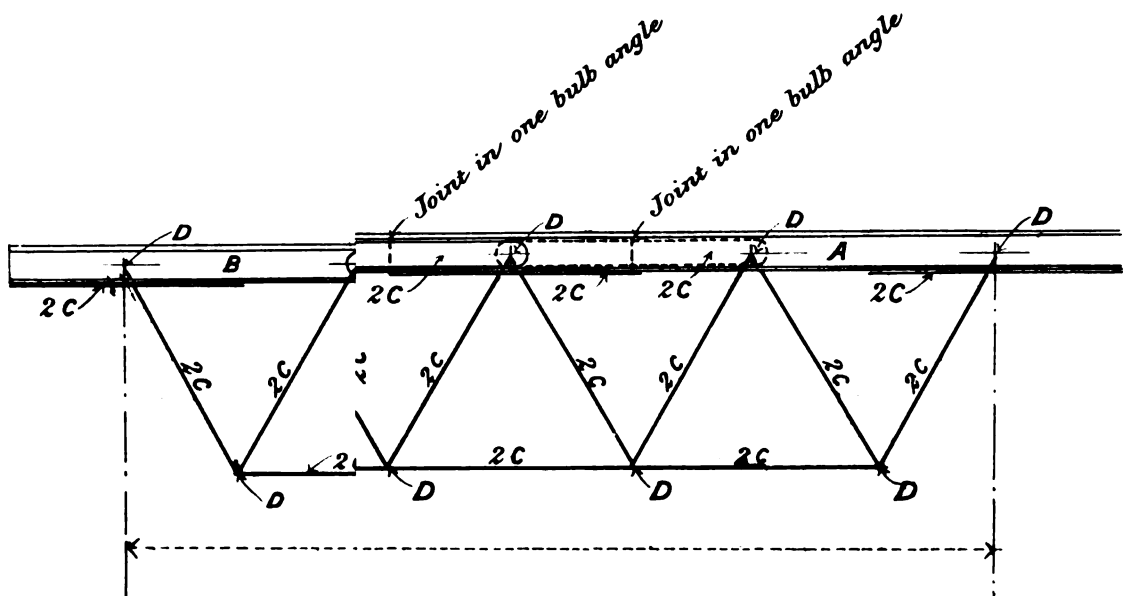
SPAN 4



VAAL RI
BL
DETAILS

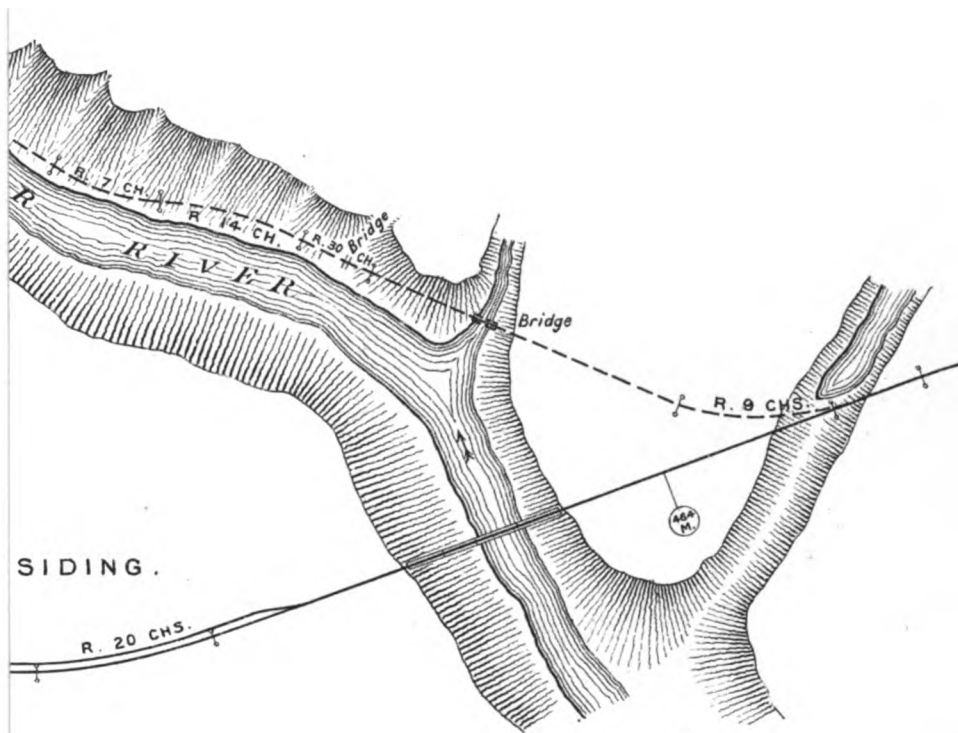


TRESTLE D



SECTION ADICTION ADAPTED FOR 2'6" GAUGE.

<i>Maximum</i>	<i>Maximum distributed dead load</i>	80 tons
<i>do. sing</i>	<i>do. single load as on one</i>	} 8 "
<i>and</i>	<i>axle and pair of wheels</i>	
<i>do. roll</i>	<i>do. rolling load at speed of</i>	} 53 "
15 n.	15 miles an hour.	

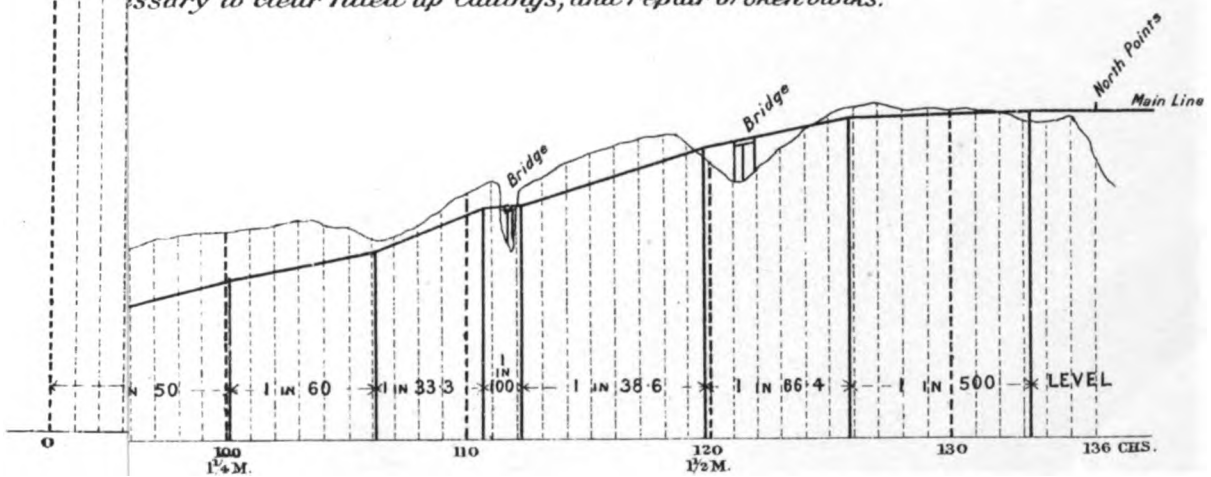


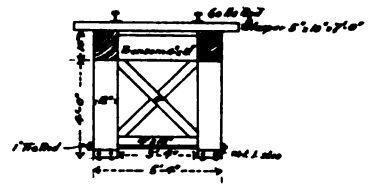
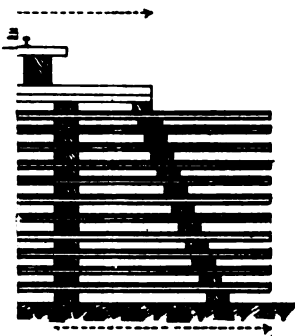
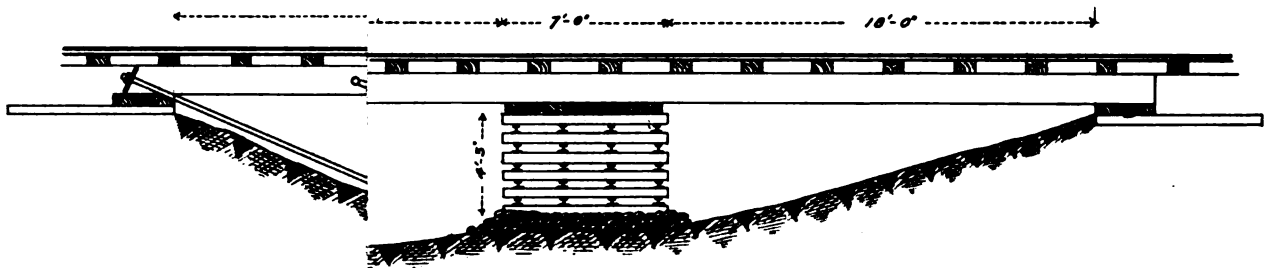
in Charge: Lieut. H.W. Buckle, R.E.
 ½ 7th (Field) Company, R.E.
 ½ 9th " " "
 Party for
 Deviation 100 Infantry.
 4 Civilian Carpenters.
 4 " Platelayers.
 60 Natives.

en to construct Bridges, and 1 Mile 56 Chains Deviation—17 Days
 cy, as Army was halted with Advance Force here.

Main Line
South Point

n Level existed previously, but considerable earthwork
 ssary to clear filled up cuttings, and repair broken banks.



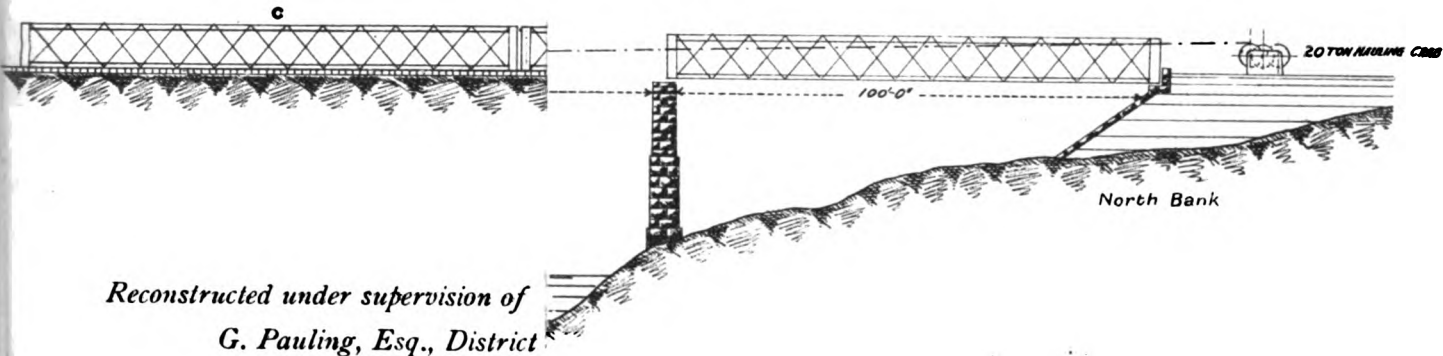
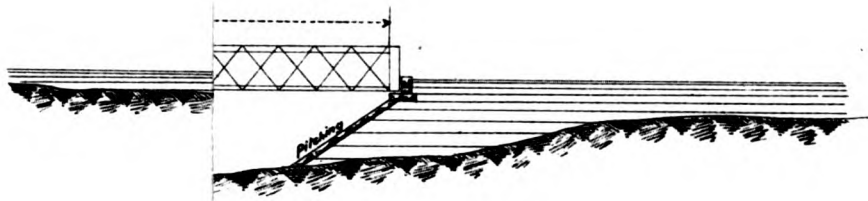


SECTION OF TRUSS AT A.B.

PIER

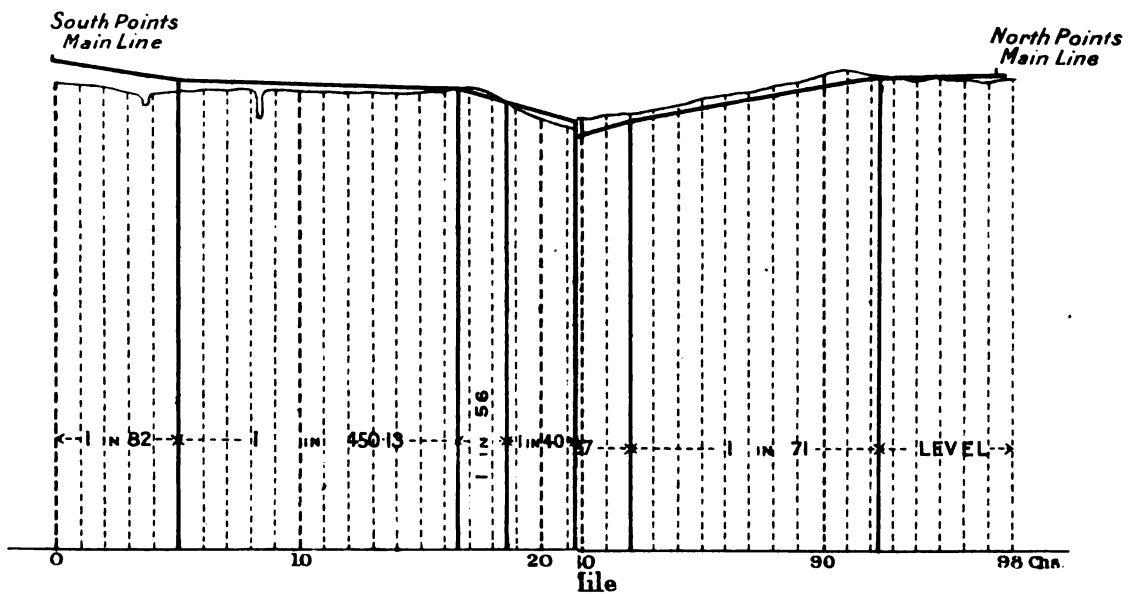
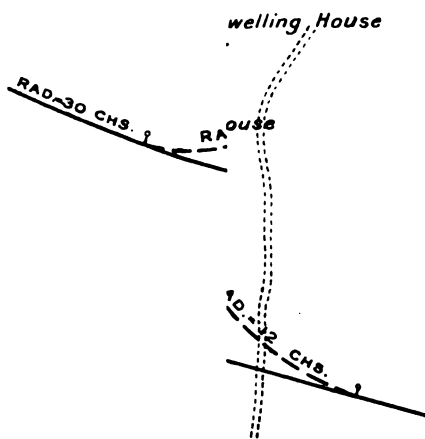
Officer in Charge: Lieut. H. W. Buckle, R.
 Working Party: $\frac{1}{2}$ 7th (Field) Company,
 $\frac{1}{2}$ 9th " " "
 100 Infantry.
 4 Civilian Carpenters and
 60 Natives.

Time taken to construct Bridges and 1 m
 Deviation—17 days. (Army was halted
 so no urgency).



L.A. Micklem, D.S.O. R.E.
with 40 Non-Commissioned Officers & Men 10th (Railway) Company R.E.
47 " " " " 42nd (Fortress) " "
from Troop R.E.
Officers
and Army platelayers.
in permanent way inspectors.
Engineers.
and Drivers.
and a Light Section Volunteer Engineers under Capt. F.L. Lloyd, R.E.
and a Working Party, averaging 400.
and 1000

Length of Deviation 1 Mile 18 Chains
Maximum Gradient 1 in 36.29
Minimum Curve 5 Chains Radius



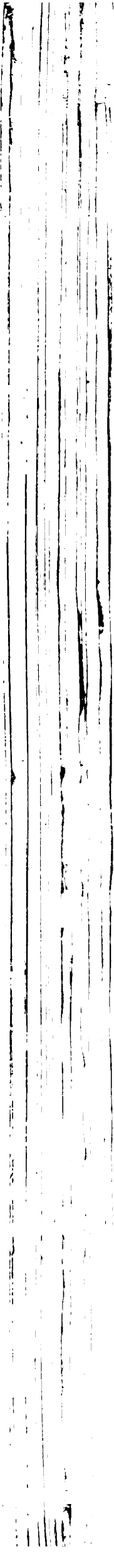


PLATE 46.

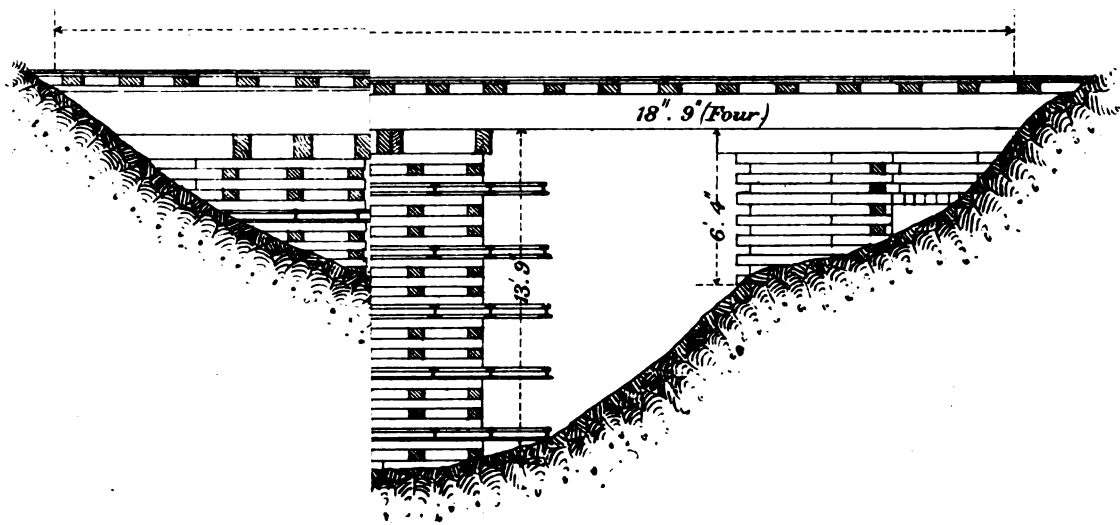
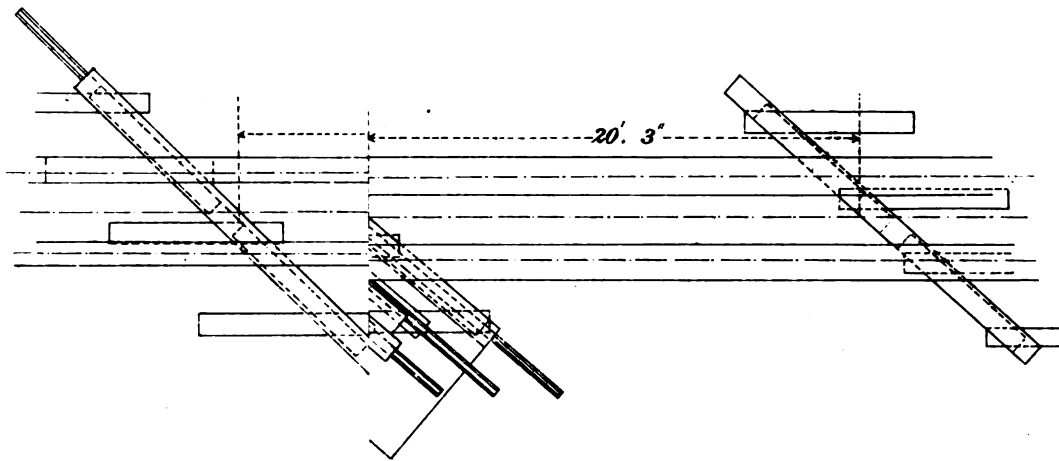
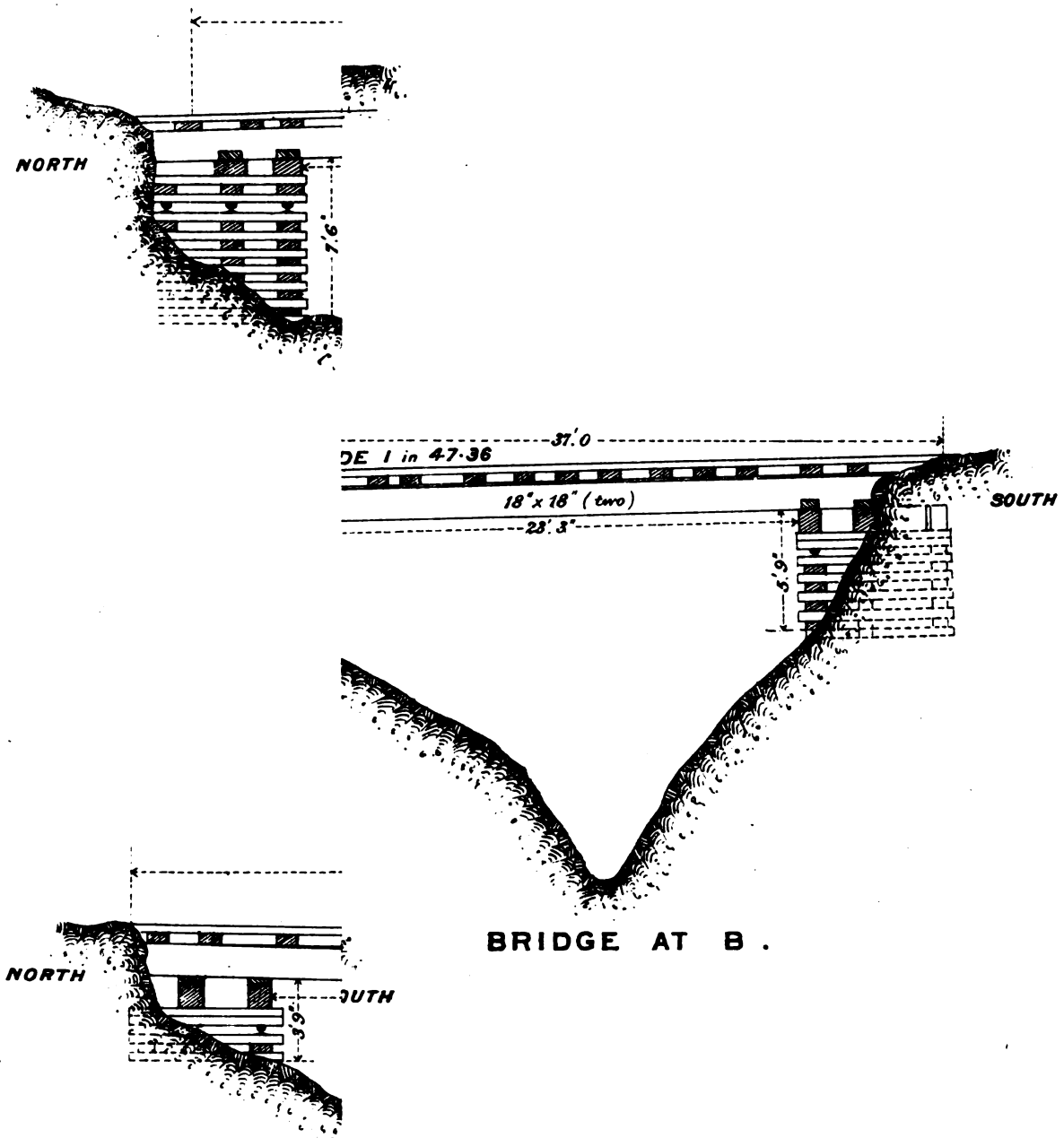
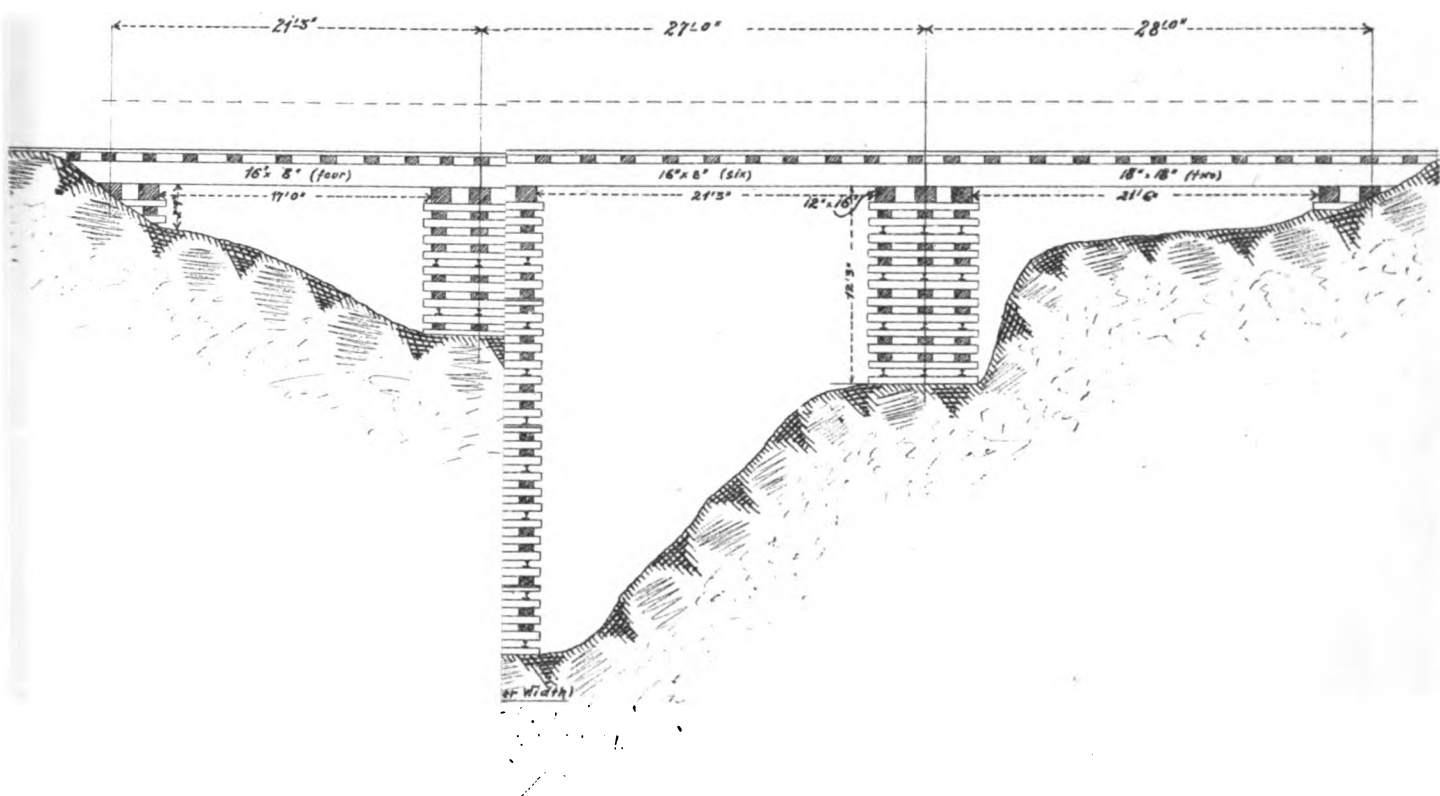


PLATE 47.







Officer in Charge : 1

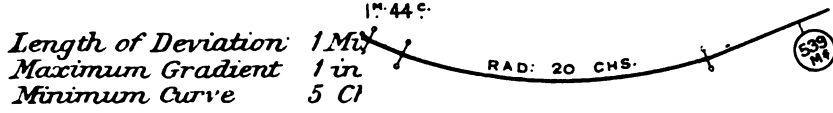
Working Party : 4

2

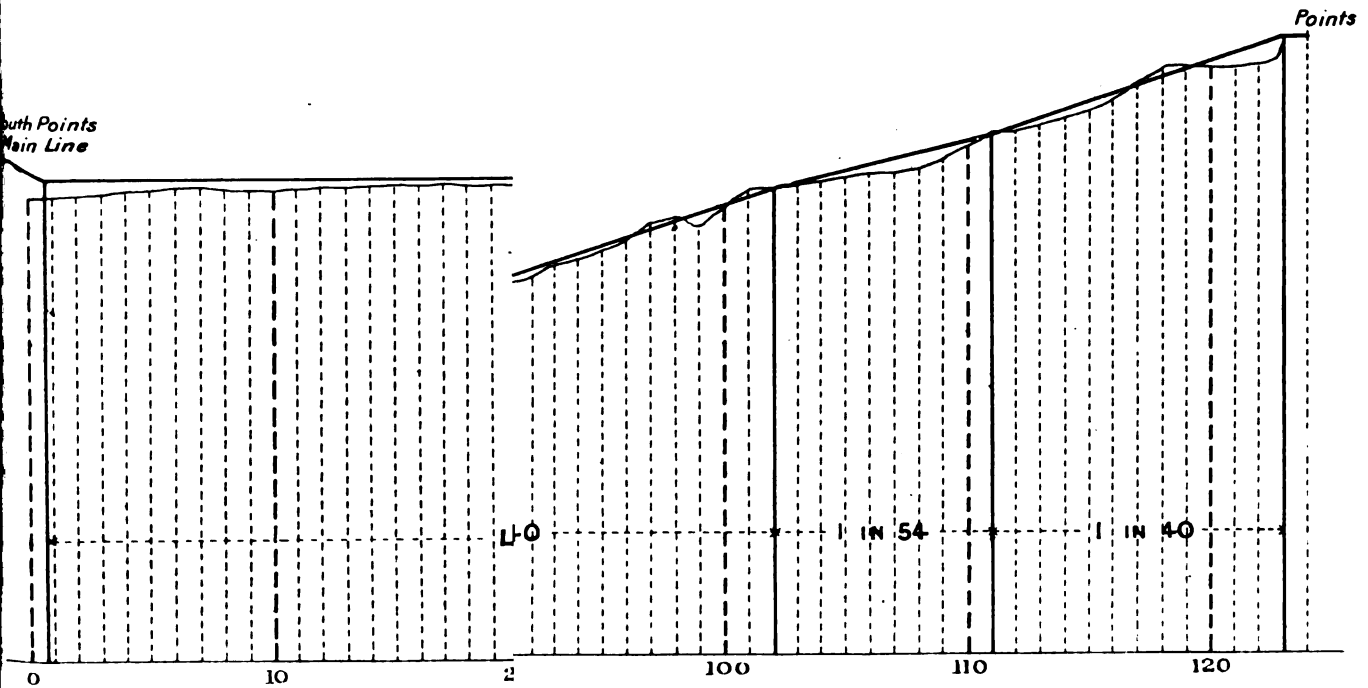
1

3

Time taken : 3

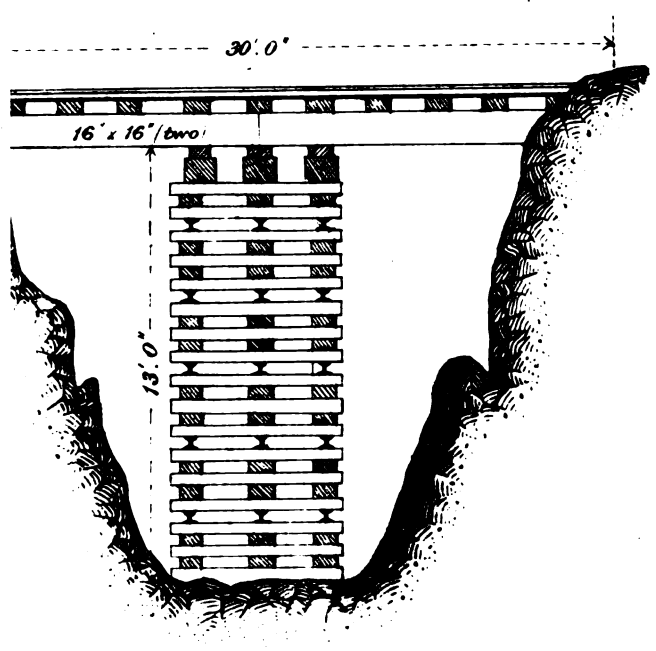
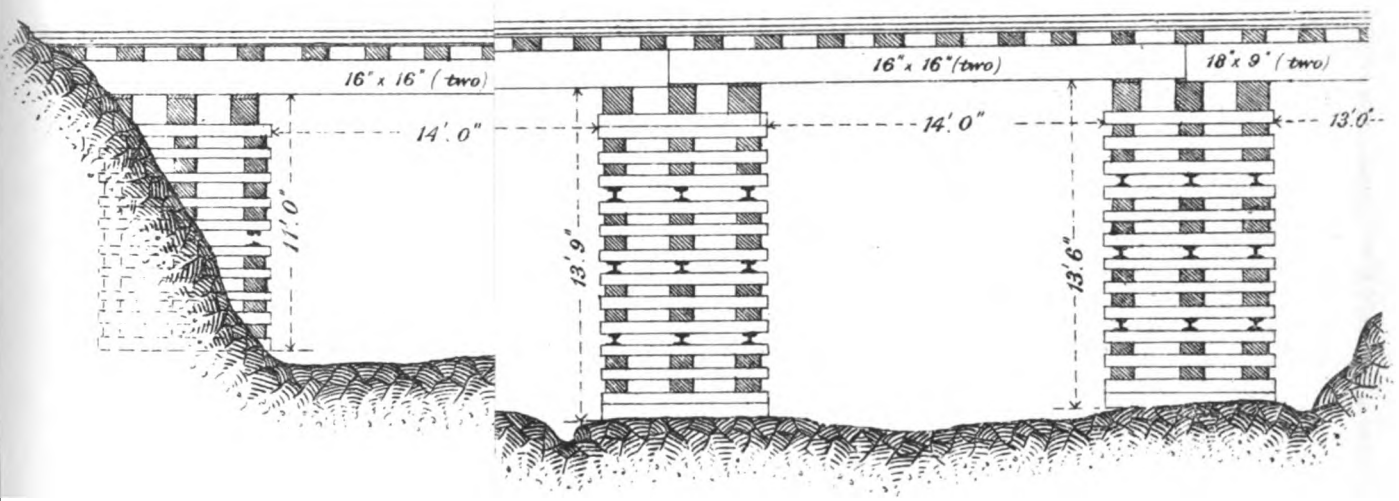


Lieut. H.A. Micklem. D.S.O., R.E.
Recr, 40 Non-Commissioned Officers & Men 10th (Railway) Company R.E.
icer, 47 " " " " 20th (Fortress) Company R.E.
E. Officers. " " " " 42nd (Fortress) Company R.E.
Infantry details.
Natives.
Civilian Gangers and 2 Permanent Way Inspectors.
Electric Light Section Volunteer Engineers under Capt. F.L. Lloyd R.E.
Infantry, averaging 300
erect temporary Bridges and 1 Mile 4+ Chains Deviation, 5 days 10 hours.



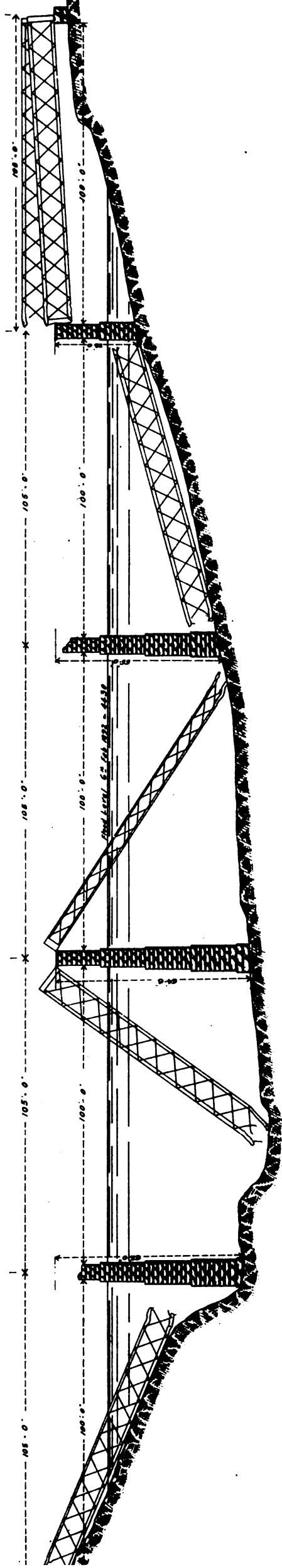


Officer in Charge: *Lieut. H.A. Mick*
 Working Party: *1 Officer, 40 N.C.*
1 " 47 "
20 N.C.O's & Men
Electric Light Se
4 R.E. Officers
33 Infantry deta
2 Civilian perman
30 " ganger
750 Natives
Infantry party, a
Time taken for bridges and 1 mile
See also Plates 34, 35, 36



VALSCH R. BRIDGE.
BLOEMFONTEIN—PRETORIA LINE.
ELEVATION OF DAMAGED BRIDGE.

Scale—40 Feet=1 Inch.





ONSTAD.

A LINE.

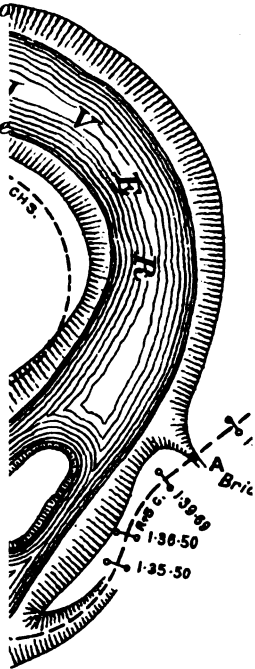
.TION.

1 Inch.
Inch.

Officers in C/

Working Part
for Bridge
and Derivation

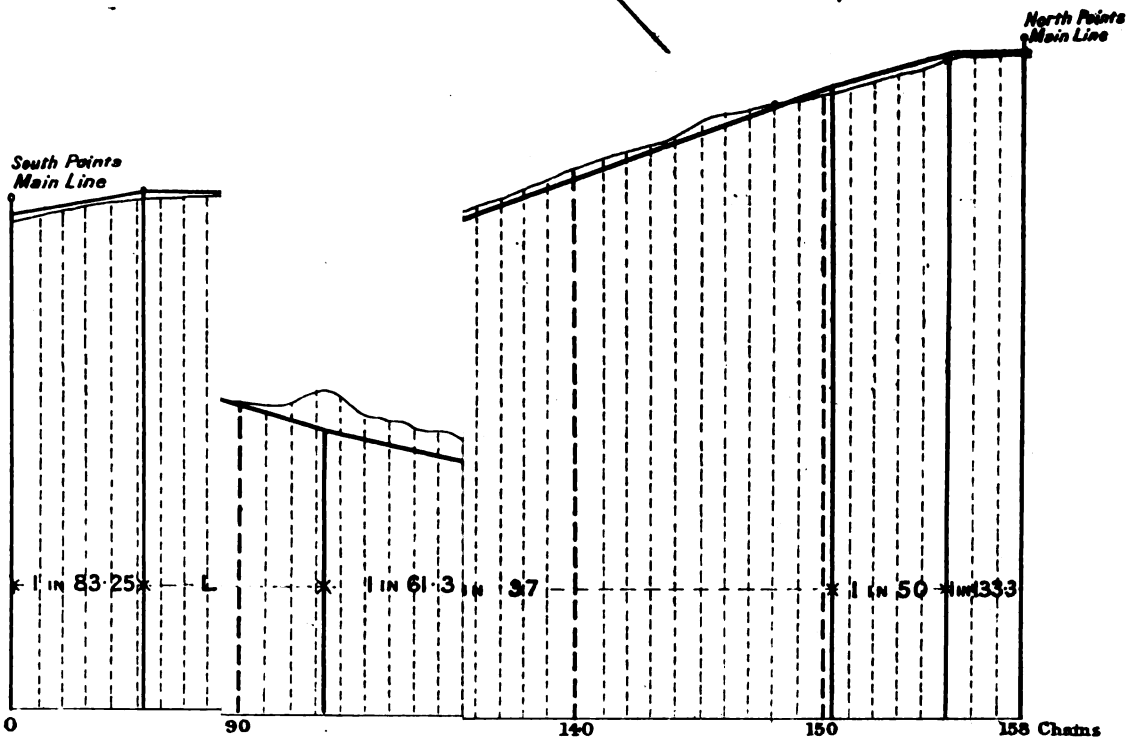
Time taken



KROONSTAD STATION

GROUND

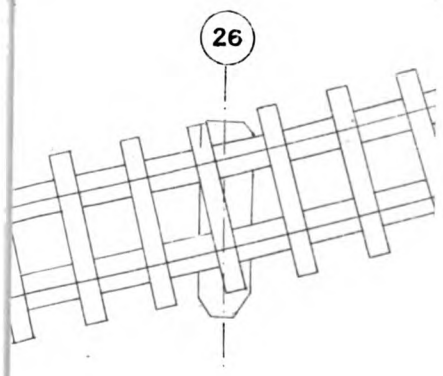
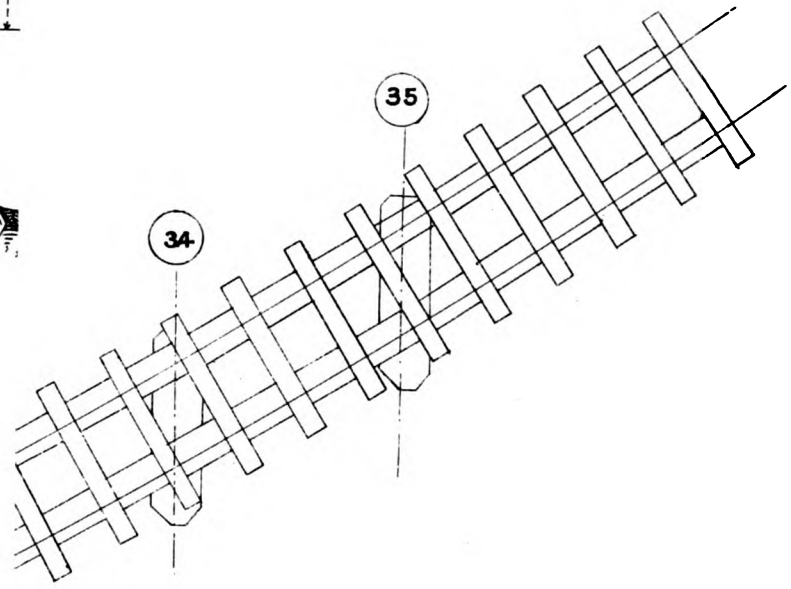
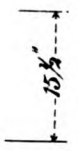
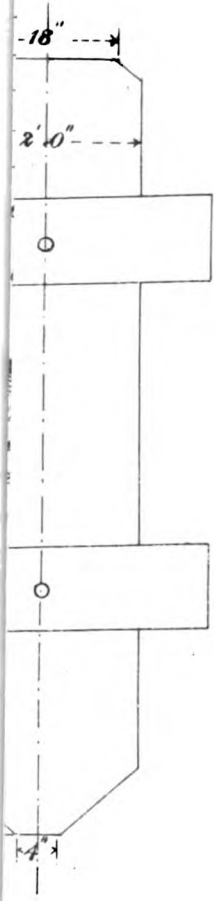
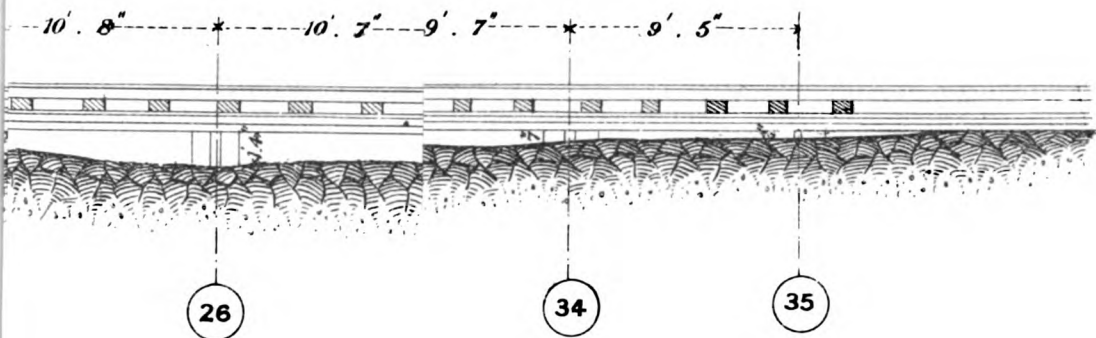
Length of Dev
Maximum G
Minimum Cu

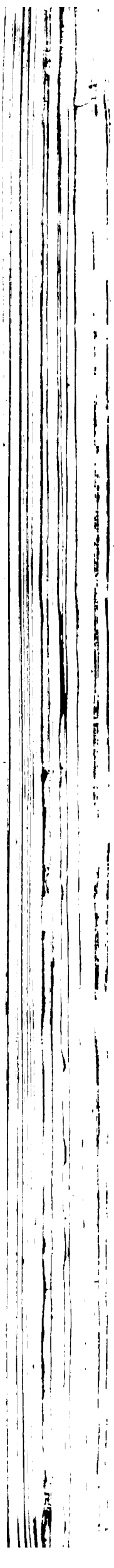




ONAGE

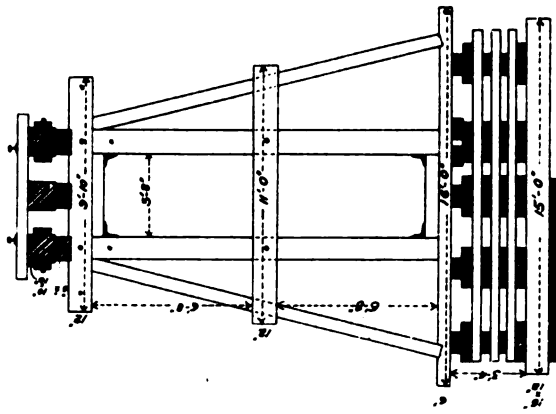
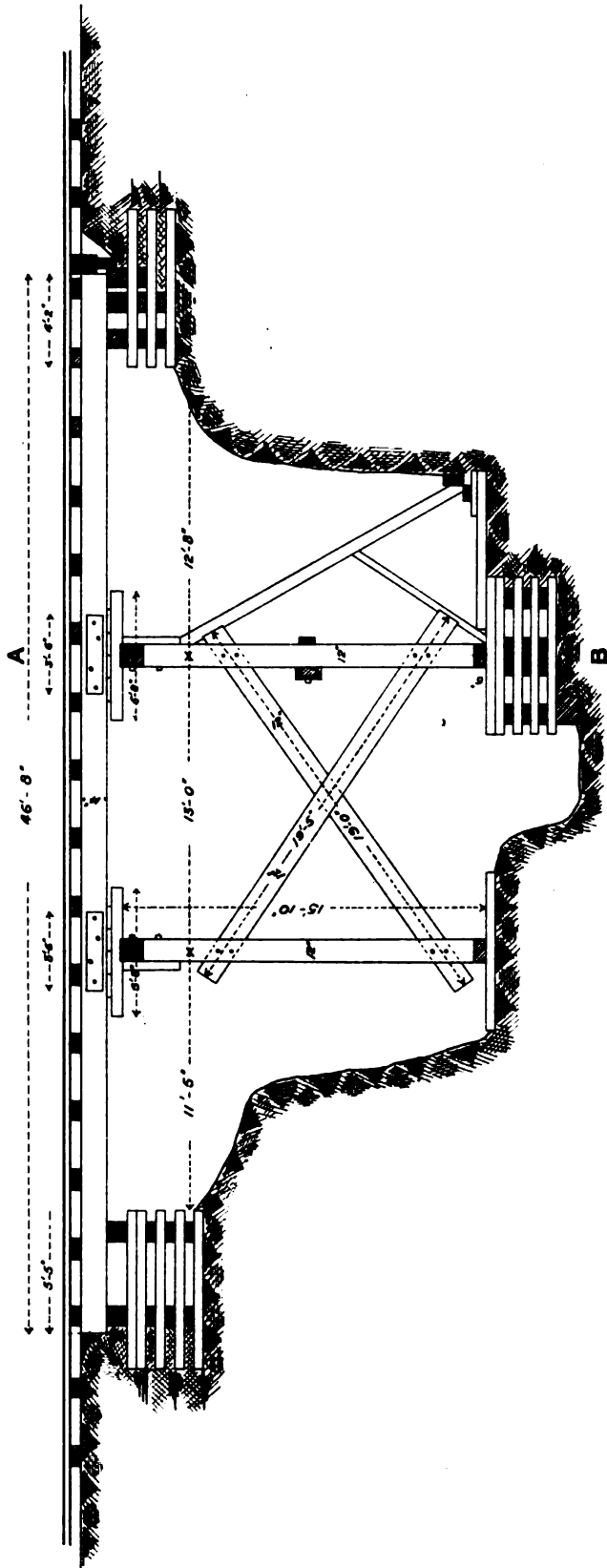
PLATE 53.





VALSCH R. BRIDGE.
 BLOEMFONTEIN—PRETORIA LINE.
 TRESTLE BRIDGE AT A ON DEVIATION.

Scale—8 Feet = 1 Inch.



— SIDE ELEVATION OF BENT AB. —

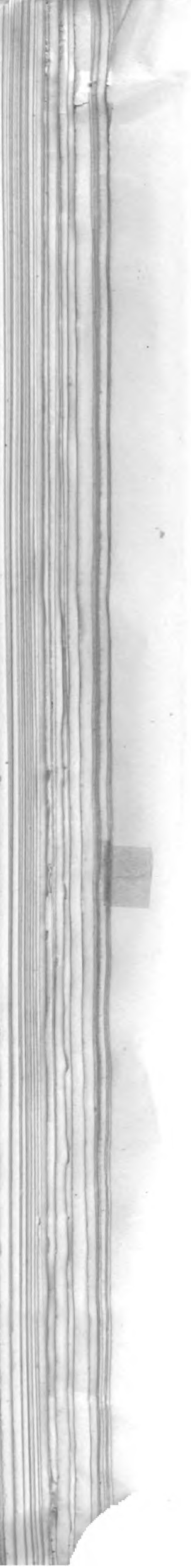
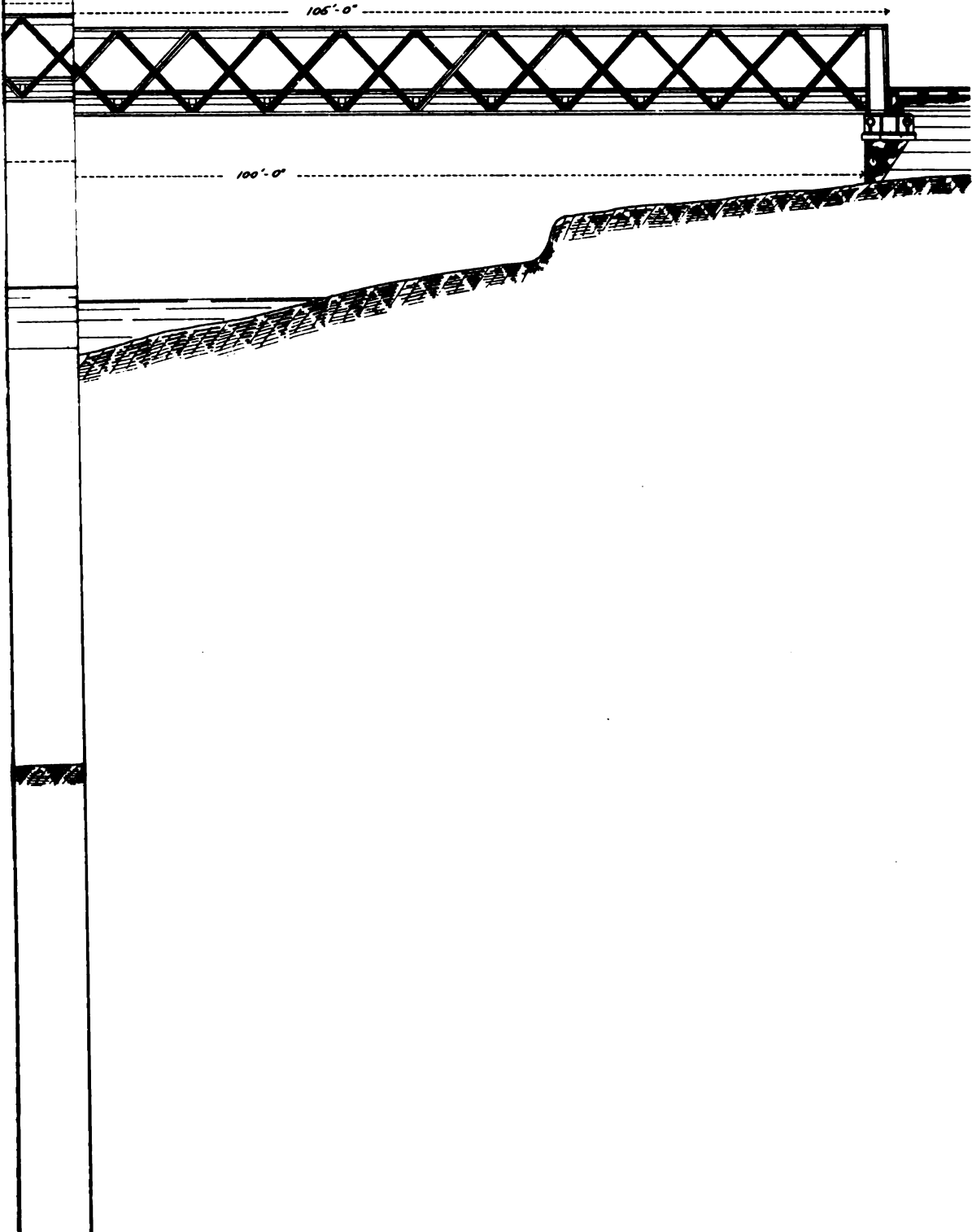
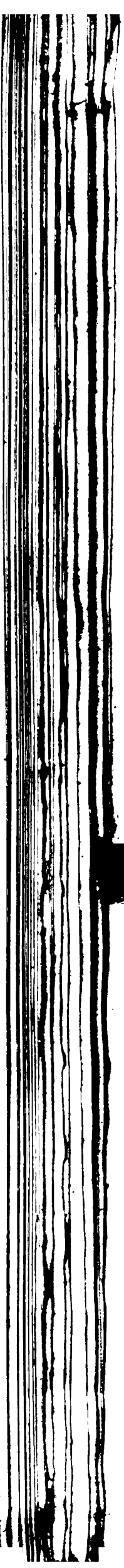


PLATE 55.

RECC





VALSCH R. BRIDGE.

BLOEMFONTEIN-PRETORIA LINE.

DETAILS OF SEMI-PERMANENT TRESTLE WORK.

Scale—8 Feet=1 Inch.

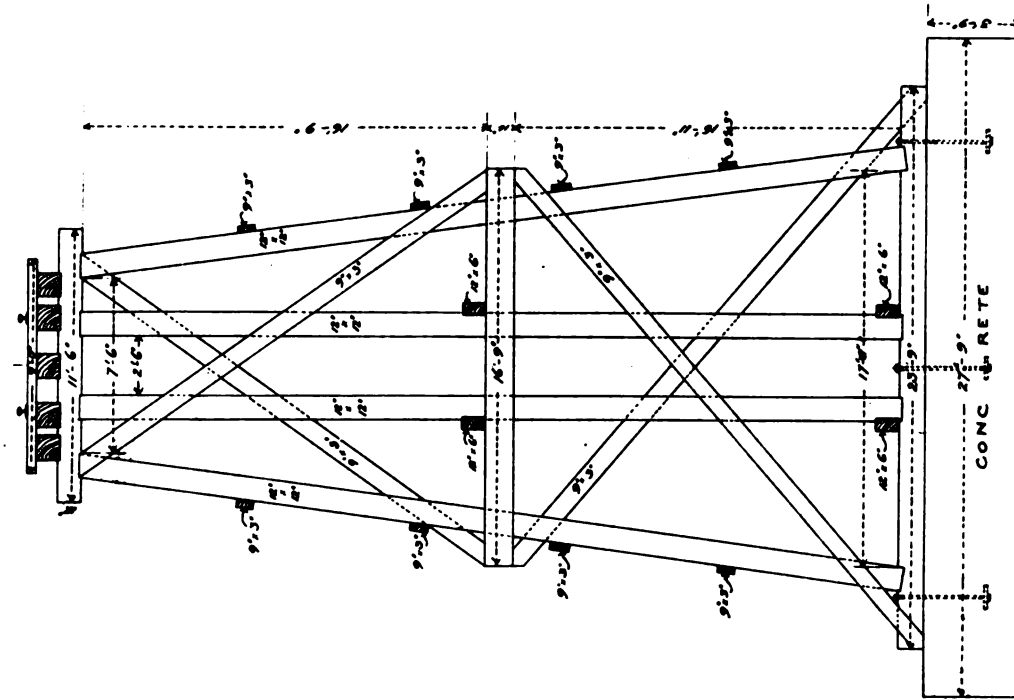
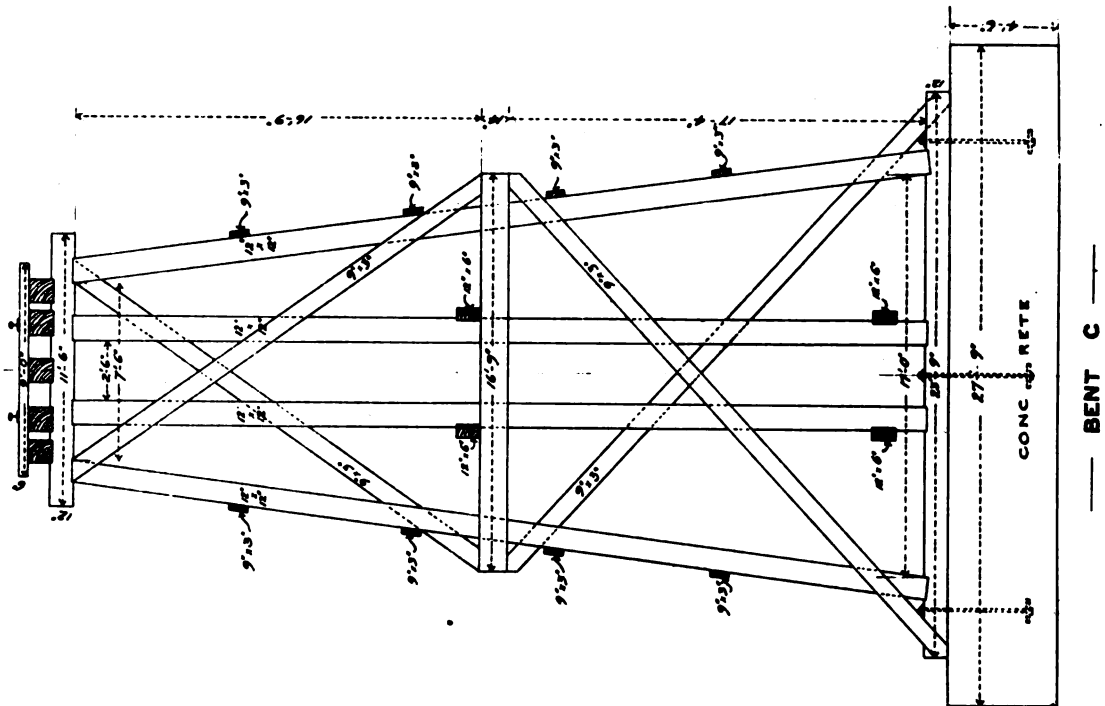
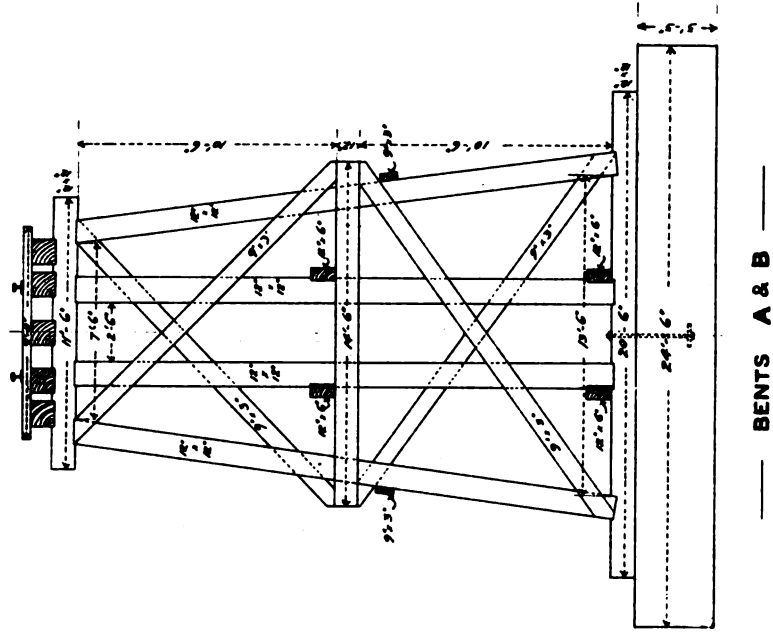


PLATE 56.

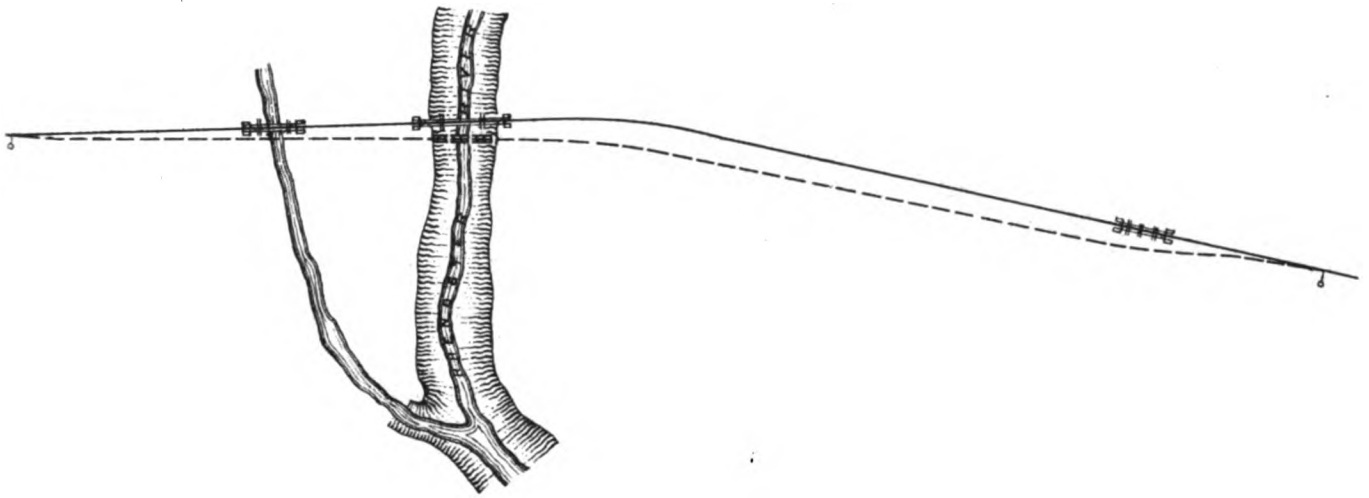


RHENOSTER R. BRIDGE BLOEMFONTEIN-PRETORIA LINE

PLAN & SECTION OF DEVIATION.

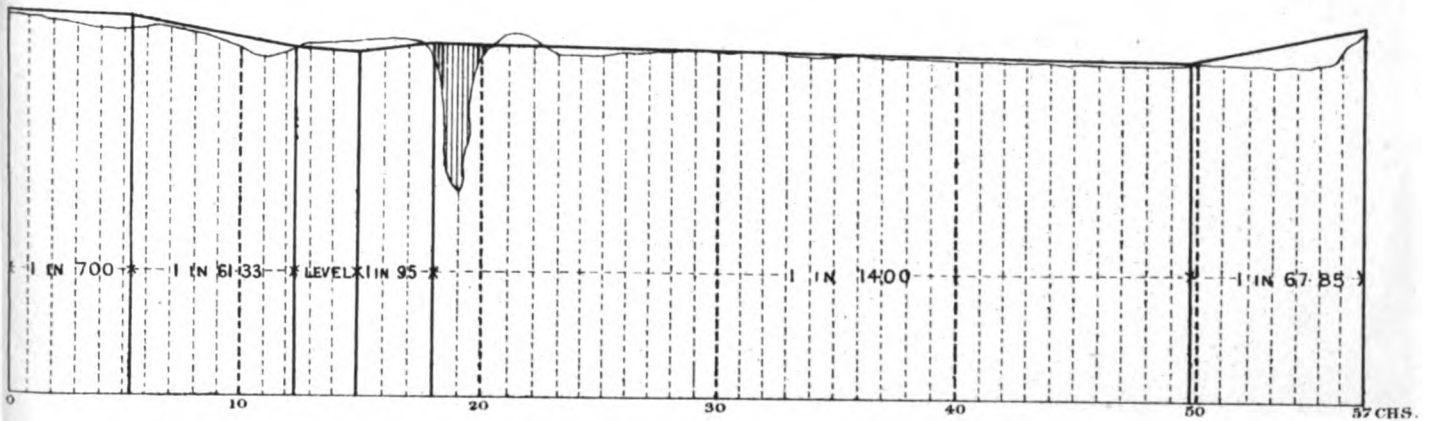
Horizontal Scale — 8 Chains = 1 Inch

Vertical Scale — 40 Feet = 1 Inch



*Length of Deviation — 57 Chains.
Maximum Gradient — 1 in 61.33.*

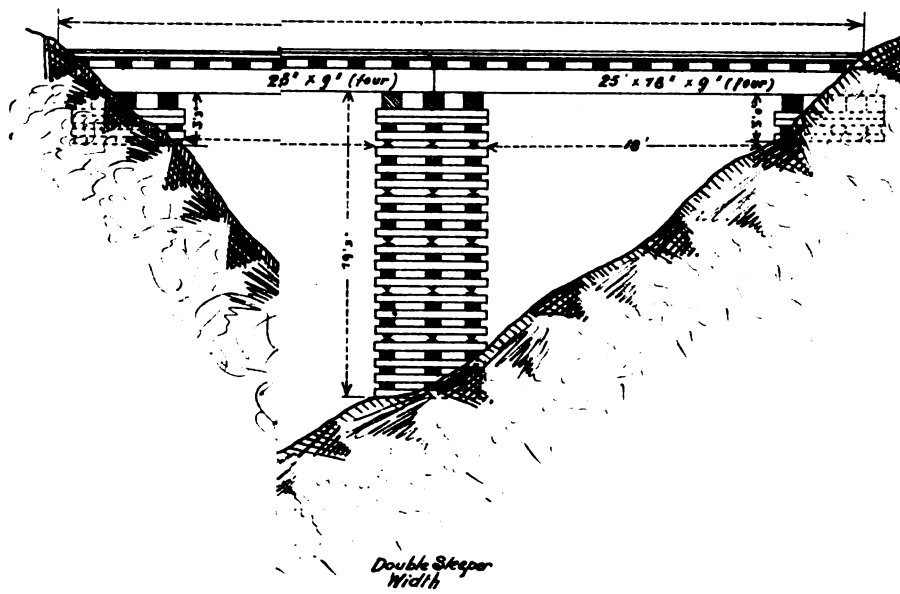
Officer in Charge *Lieut. H.A. Micklem, D.S.O. R.E.*
Working Party. *5 Officers 150 Non-Commissioned Officers & Men, R.E.*
55 Infantry details.
600 Natives.
Time taken for Bridge & Deviation 5 days 12½ hours





Officer in Charge : Lieut. H. L.
Working Party : 5 Officers,
55 Infantry,
600 Native.
Time taken for Bridge and De

This Bridge was destroyed by
by a Trestle Bridge.



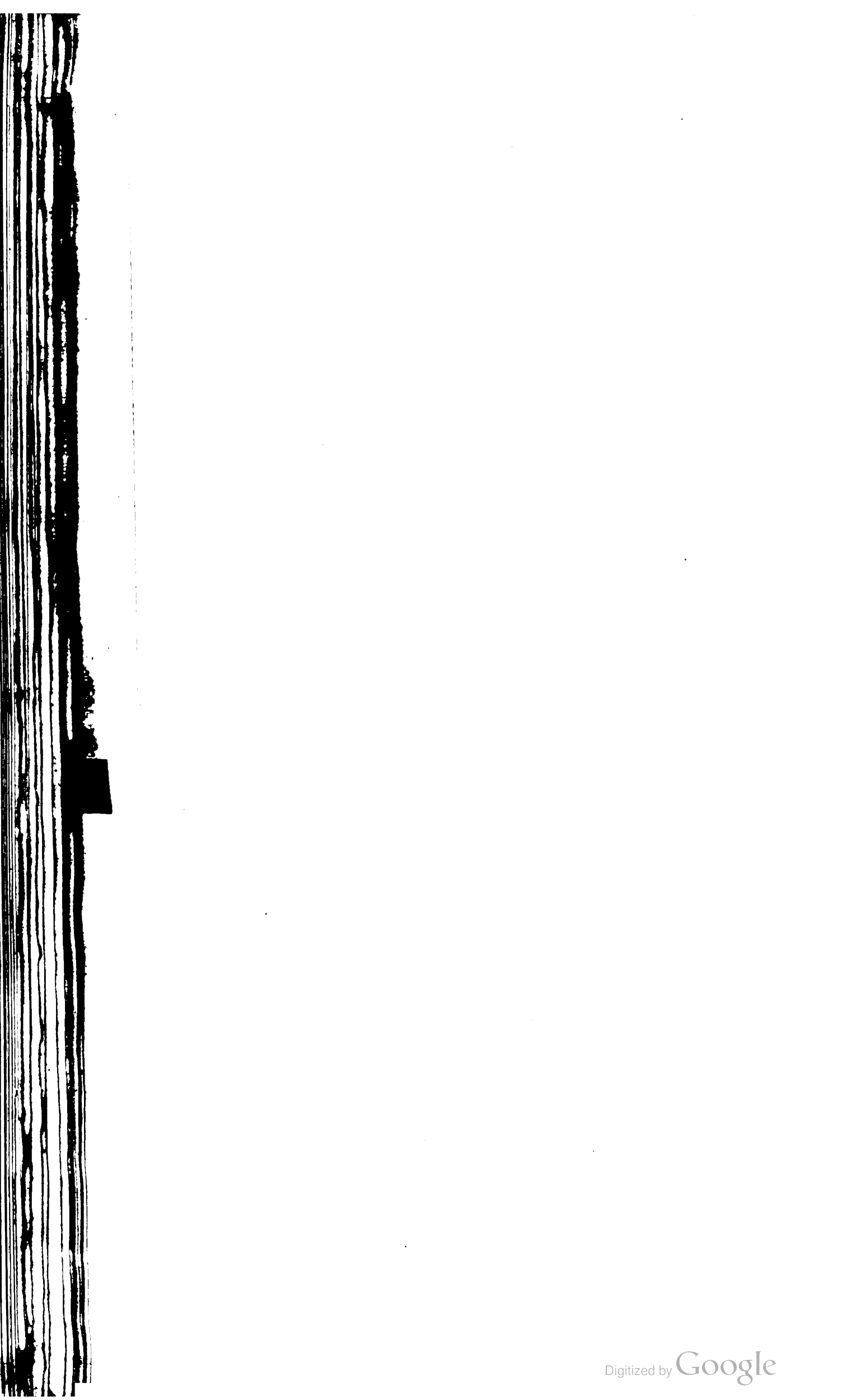
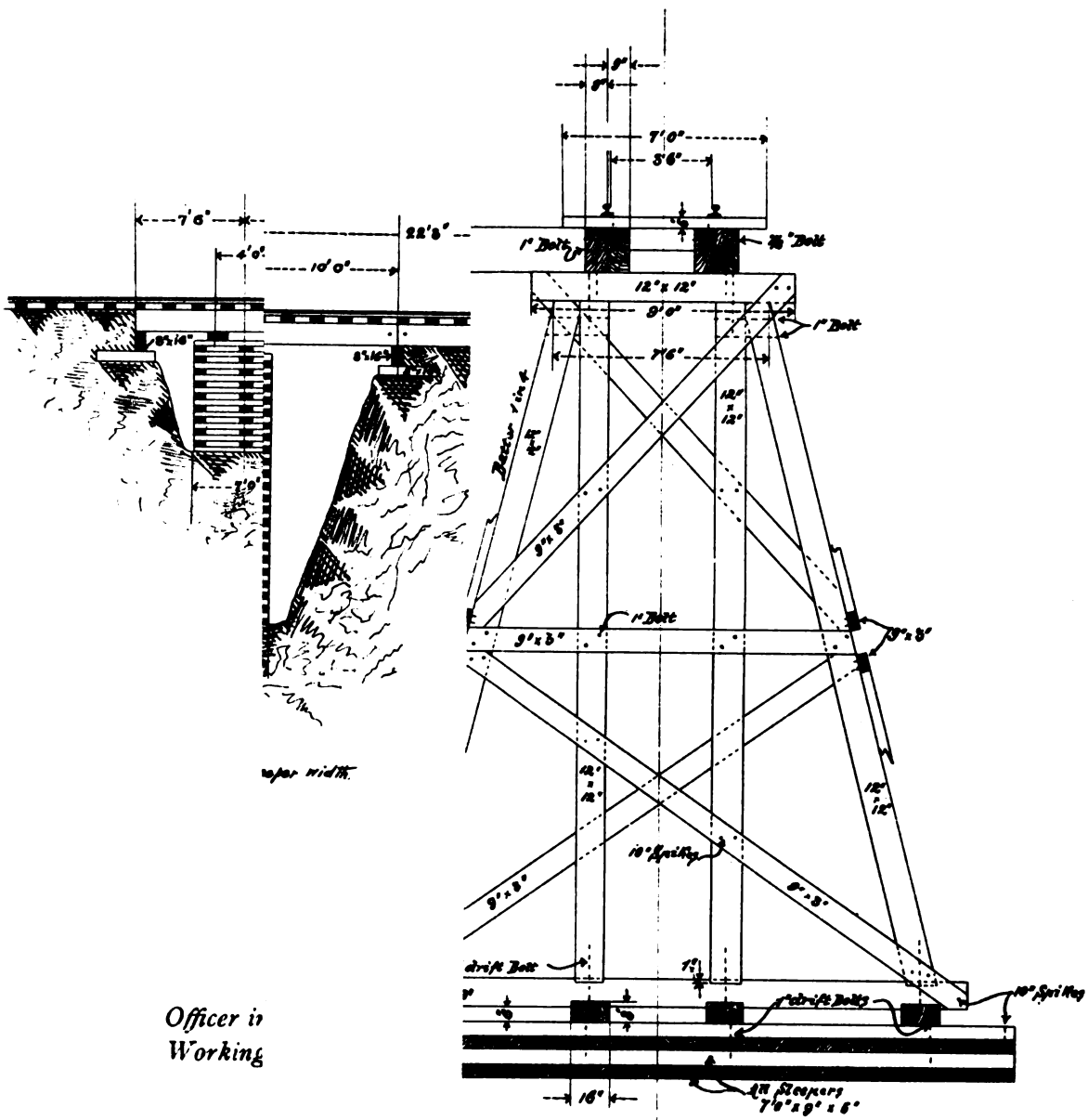


PLATE 59.

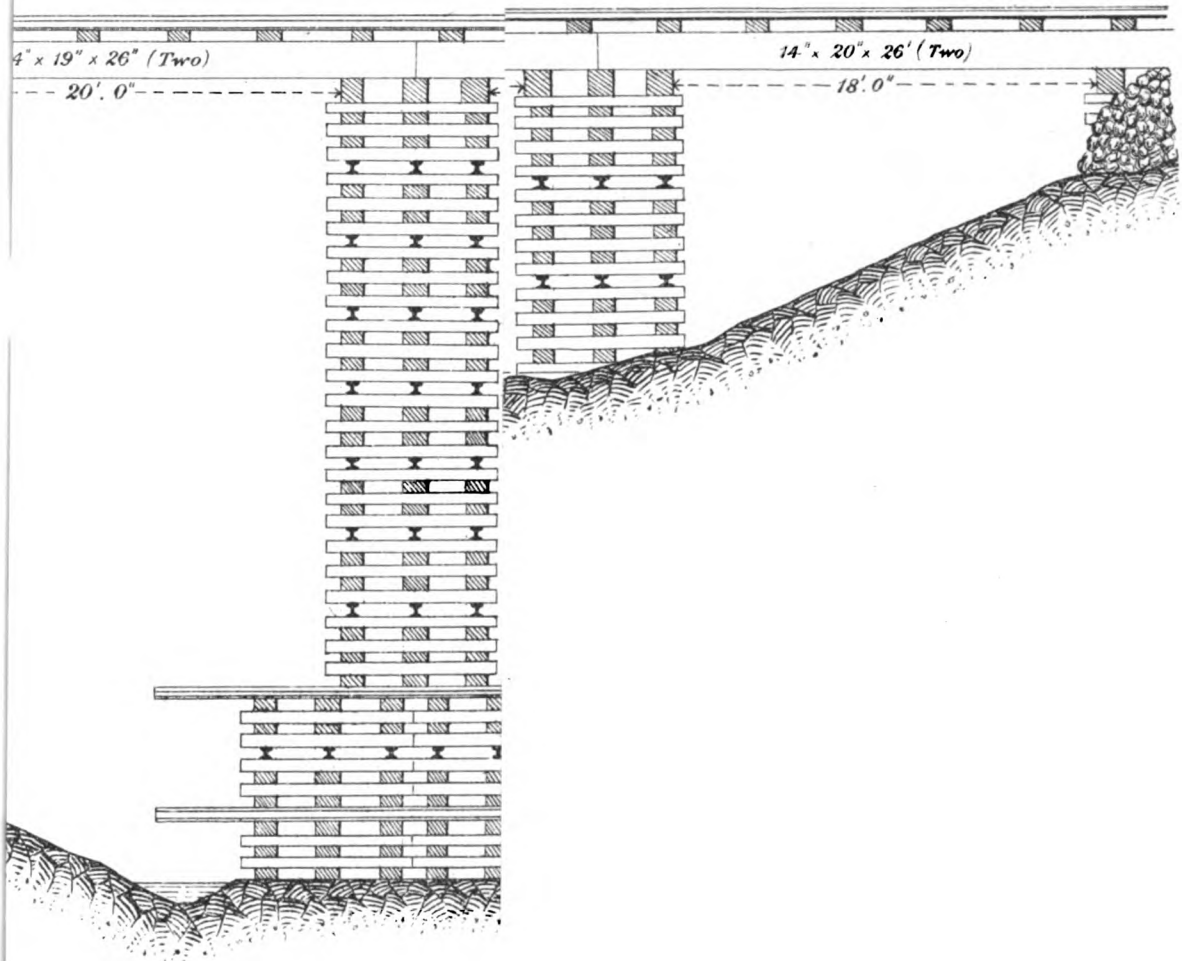




RIDGE.

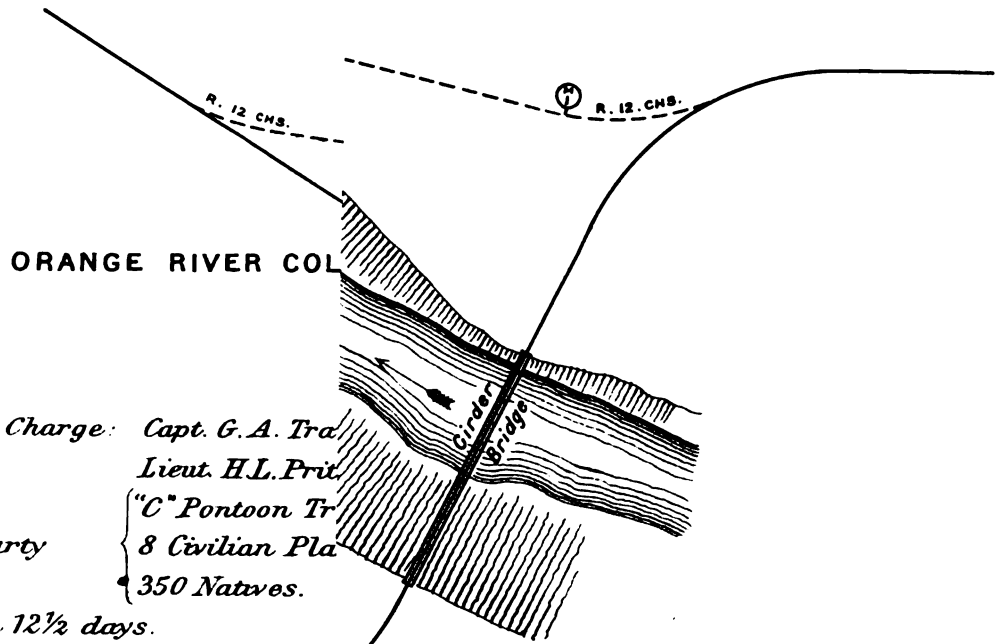
LINE.

TION.



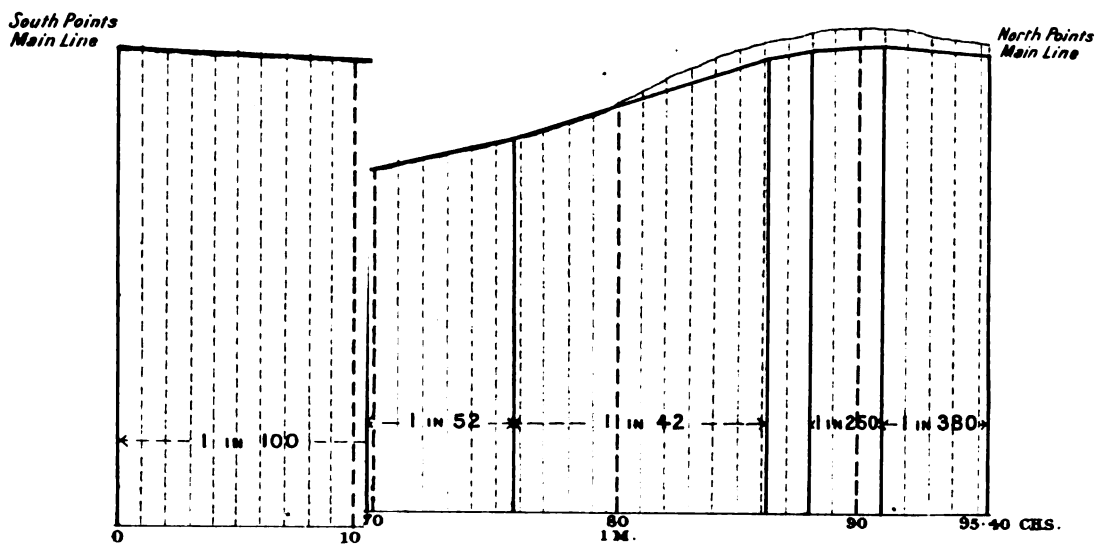


TRANSVAAL.

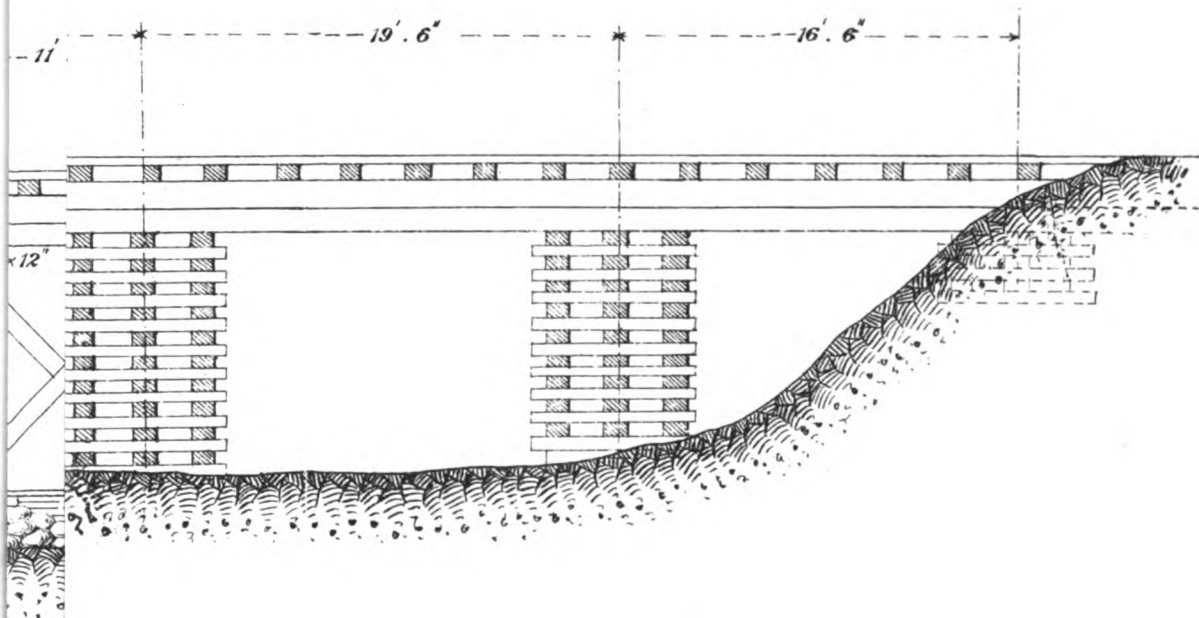
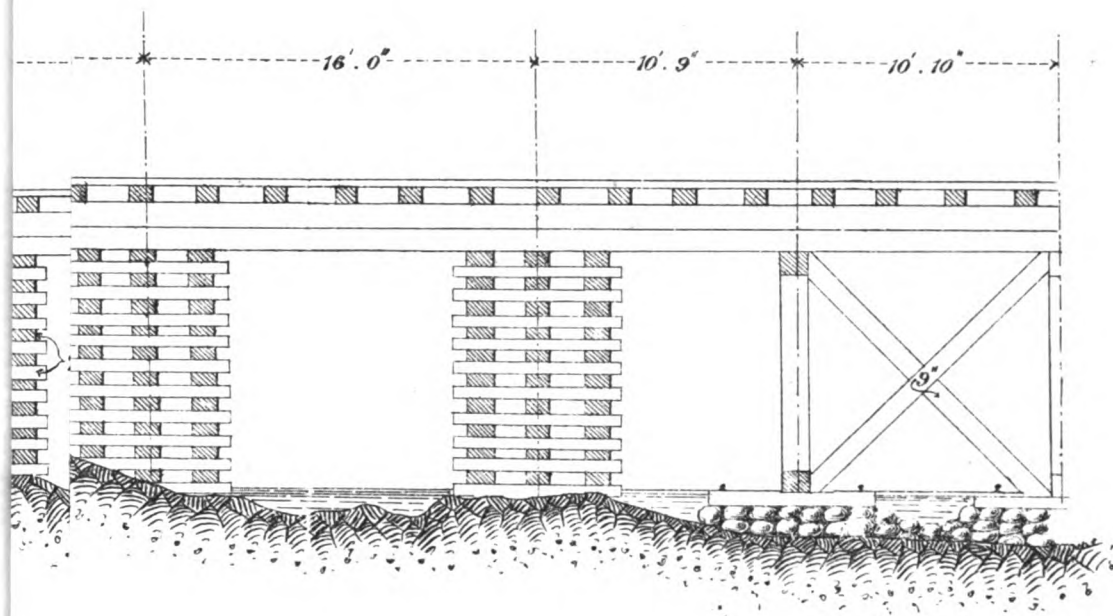


Officers in Charge: Capt. G. A. Tra
 Lieut. H. L. Prit
 Working Party { "C" Pontoon Tr
 8 Civilian Pla
 350 Natives.

Time taken 12½ days.
 All material found in neighbourhood
 and transported by wagon & trolle



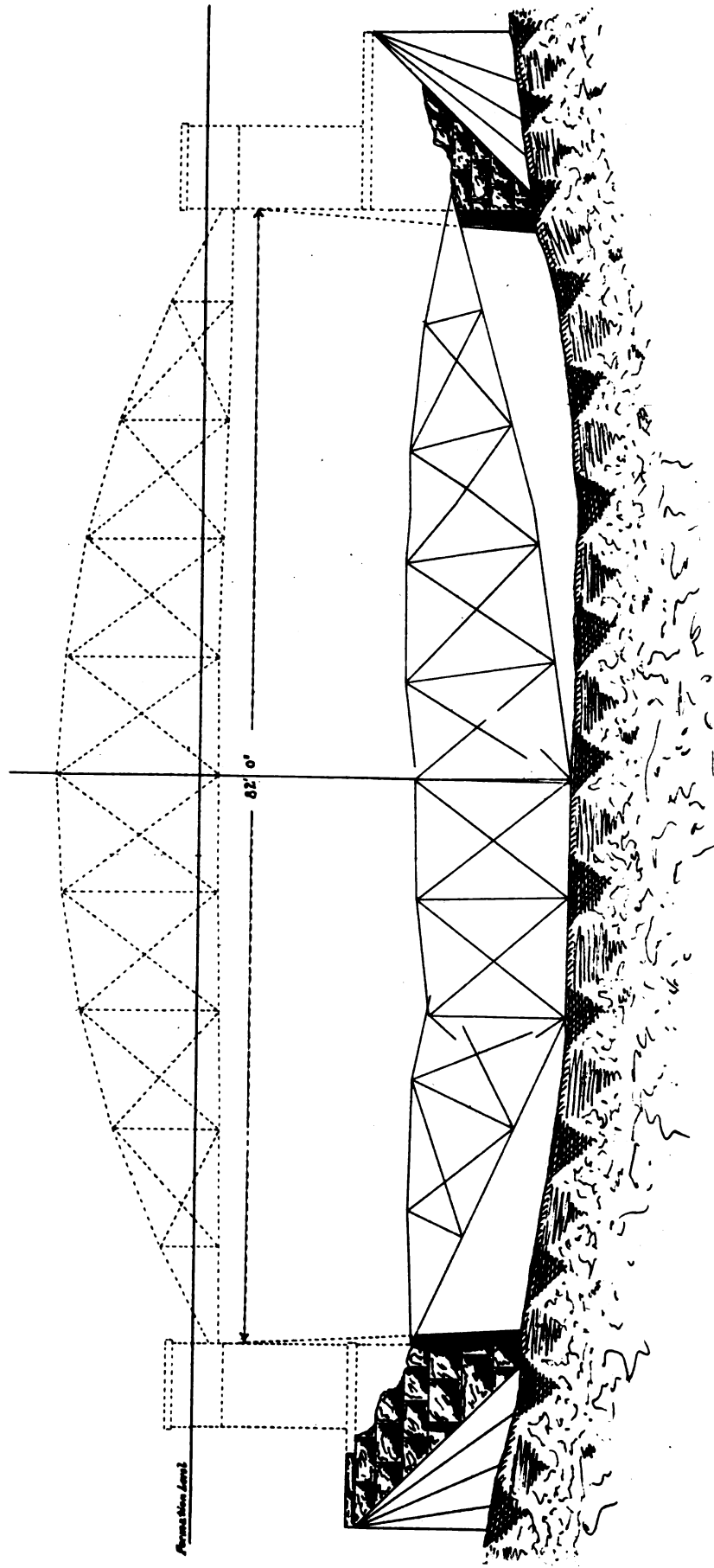






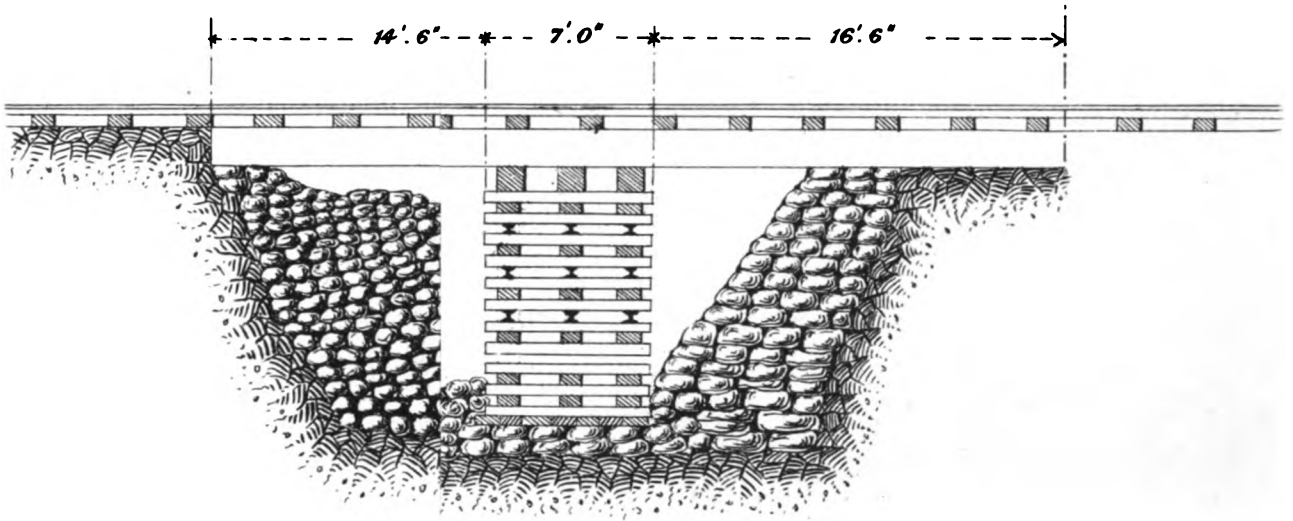
HENNOPS R. BRIDGE, IRENE.
BLOEMFONTEIN—PRETORIA LINE.

Scale—12 Feet=1 Inch.



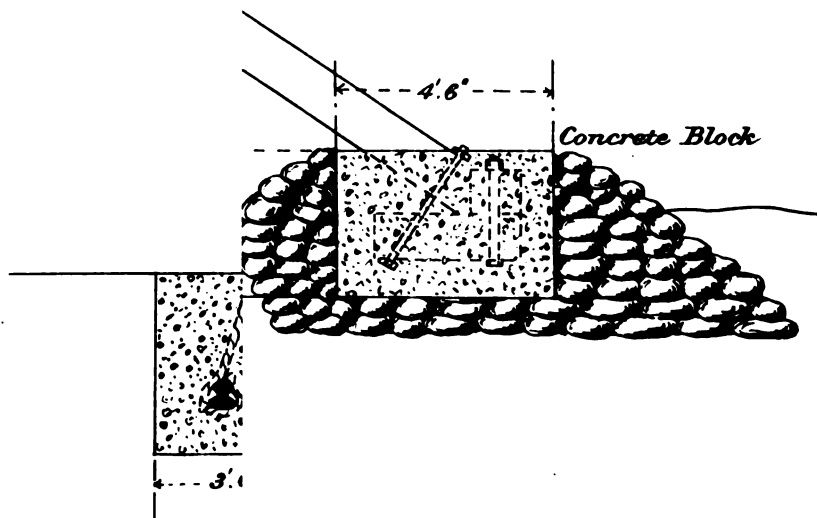
— BRIDGE AS LEFT BY THE ENEMY —
— DOTTED PORTION SHOWS ORIGINAL CONDITION —





*Officer
Workin.*

*ut to downstream
trestle.*





250

107

1118

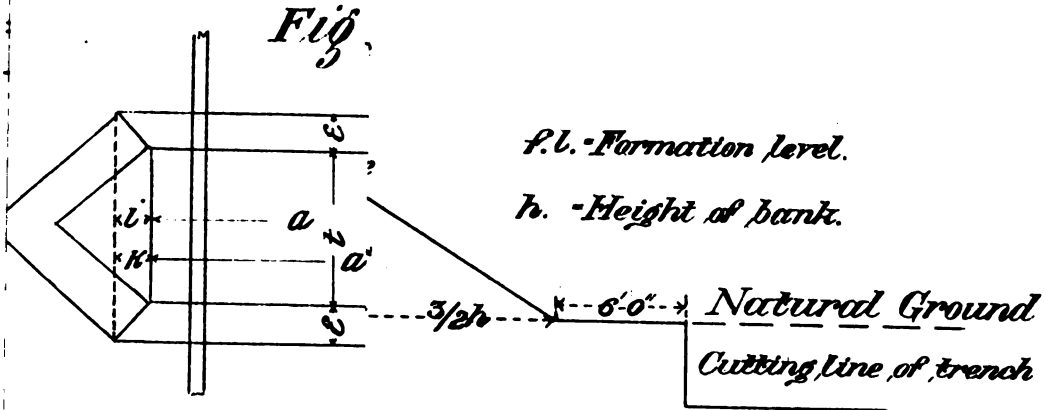
109

110

DRIA LINE

idge repairs.

RTHWORK IN BANK



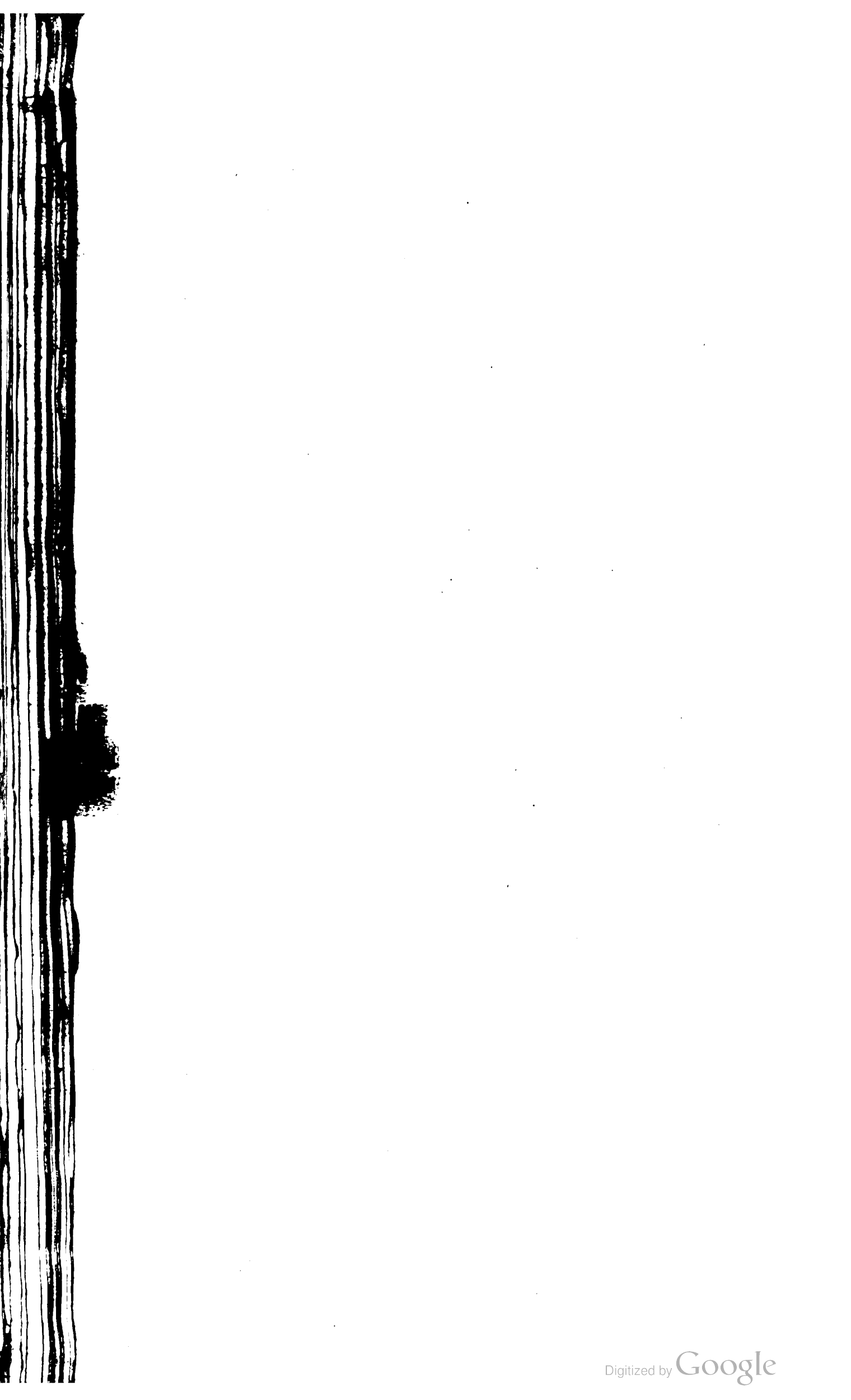
DI SLEEPER CRIB PIERS

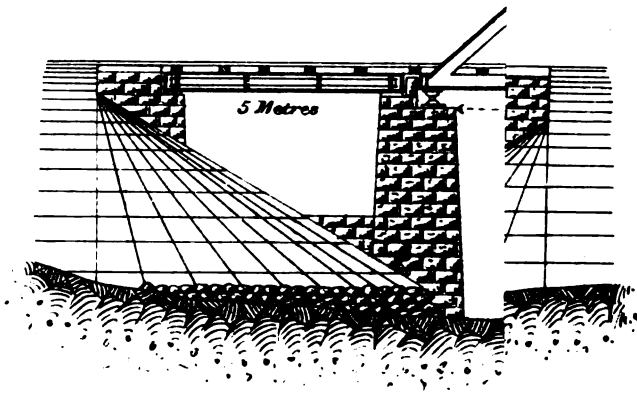
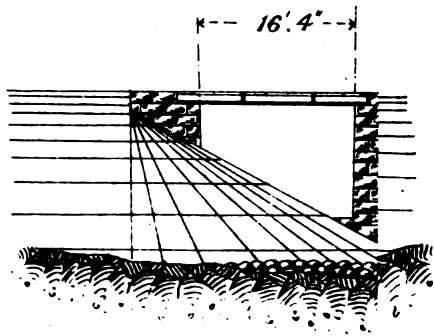
S	L	t
9'	30	3.0
20'	45	3.3
30'	65	4.3
50'	115	5.3
75'	180	5.6

up to 8'-0" width of pier - single crib.
 8'-0" - 18'-0" " " - double "
 18'-0" - 30'-0" " " - treble "
 maximum permissible height, 50'-0"

SPAN IN CLEAR	NR OF BAULKS
15'-0"	4 of 16x8 or 2 of 14x14 or 2 of 18x9
18'-0"	4 of 18x9
20'-0"	4 of 18x9 or 6 of 16x8
22'-0"	2 of 18x18
25'-0"	6 of 18x9

- S - Clear Span in
- L - Maximum loc
- t - Thickness of t
- E - Offset in thick
- points 5, 10, 20
- a - Length of top
- i - Offset at eac
- respectively b
- K - do do
- a' - Length of pie



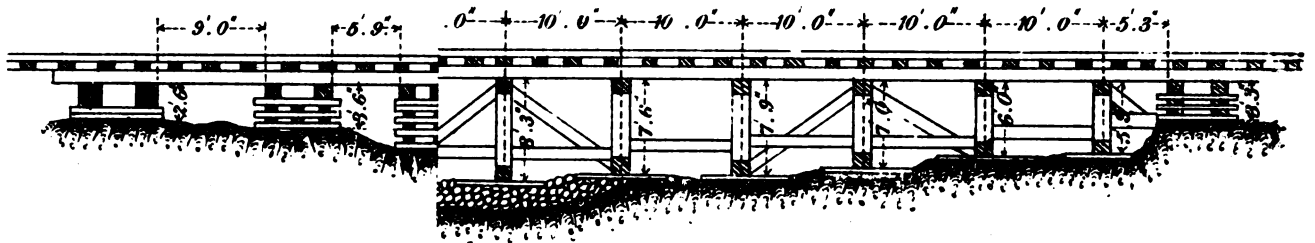


RI

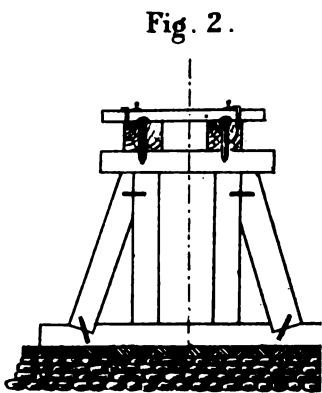
Officer in Charge: Lieut. G. R. Frith, R.E.
Working Party: 8th (Railway) Company
Civilian masons and
Time taken 51 days.

BRITISH

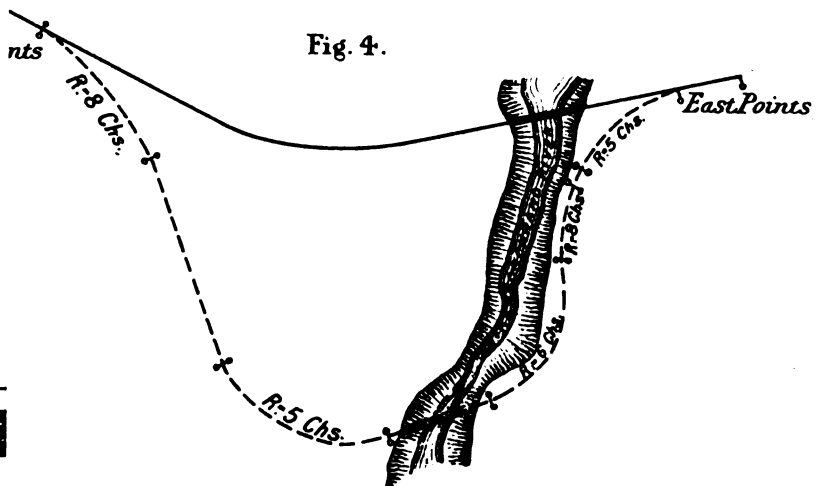
LIBRARY



*Length of Dev
Maximum Gra
Minimum Cur*



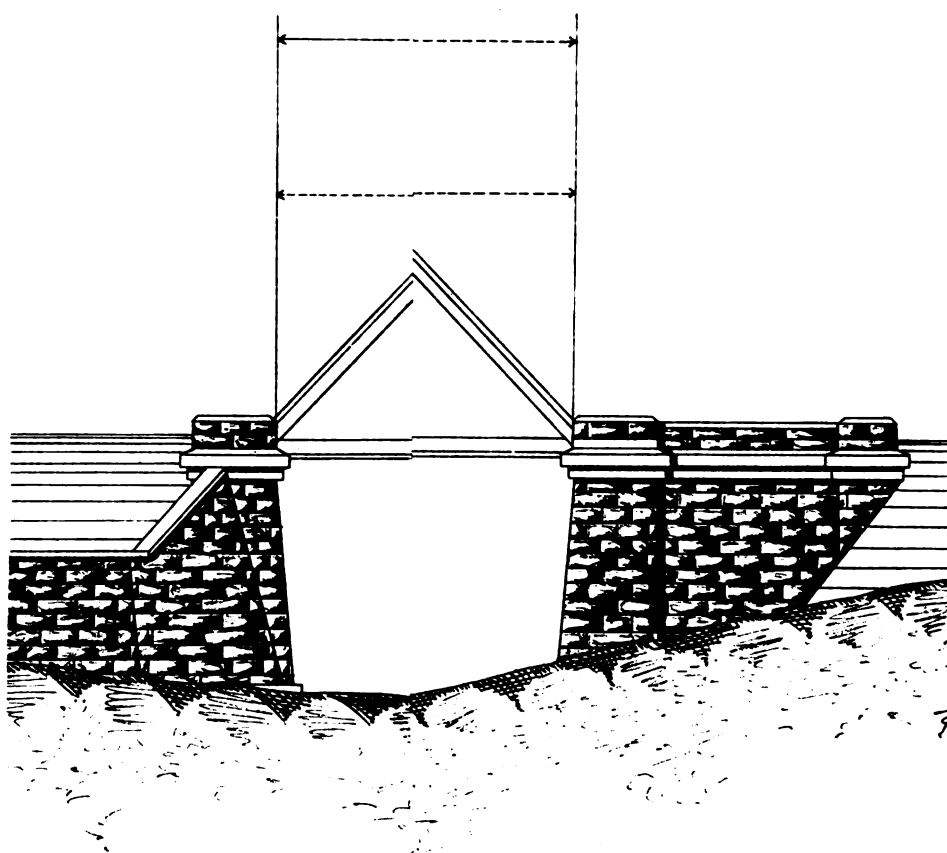
ELEVATION OF TRUSS
Scale 8 Feet - 1 In



PLAN OF DEVIATION.
Scale 8 Chains-1 Inch.



REVEREND
AND
WORTHY
FATHER
OF THE
CATHOLIC
CHURCH



Officer in Charge : Lieut. G. R.

*Working Party : 8th (Railway
Civilian Mas*

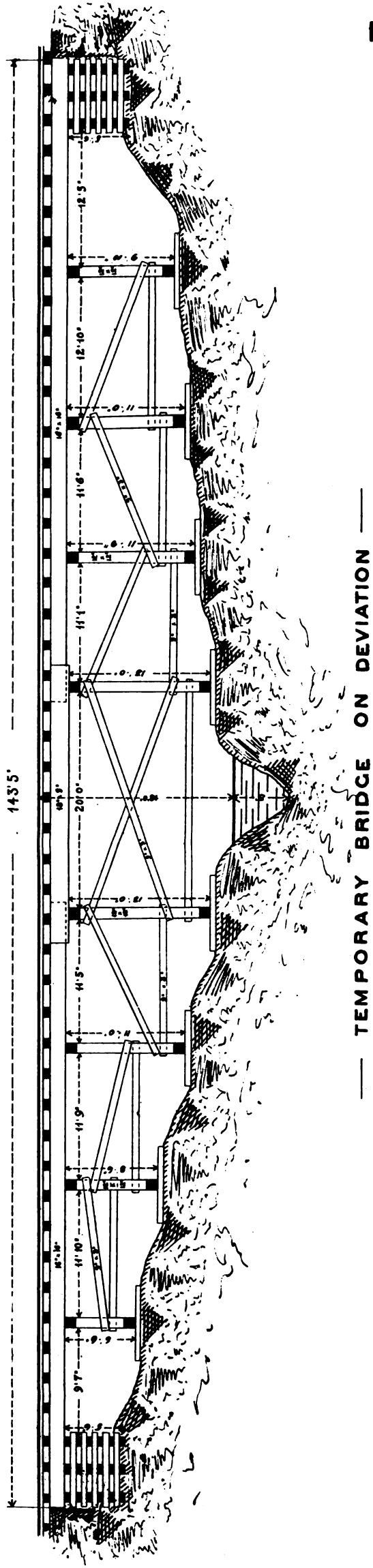
Time taken : 4 months.



Faint, illegible text or markings are visible in the upper left quadrant of the page, appearing as ghostly impressions or bleed-through from the reverse side. The rest of the page is blank.

**BRONKHORST SPRUIT BRIDGE.
ELANDSFONTEIN—NATAL LINE.**

Scale—1/2 Feet = 1 Inch.



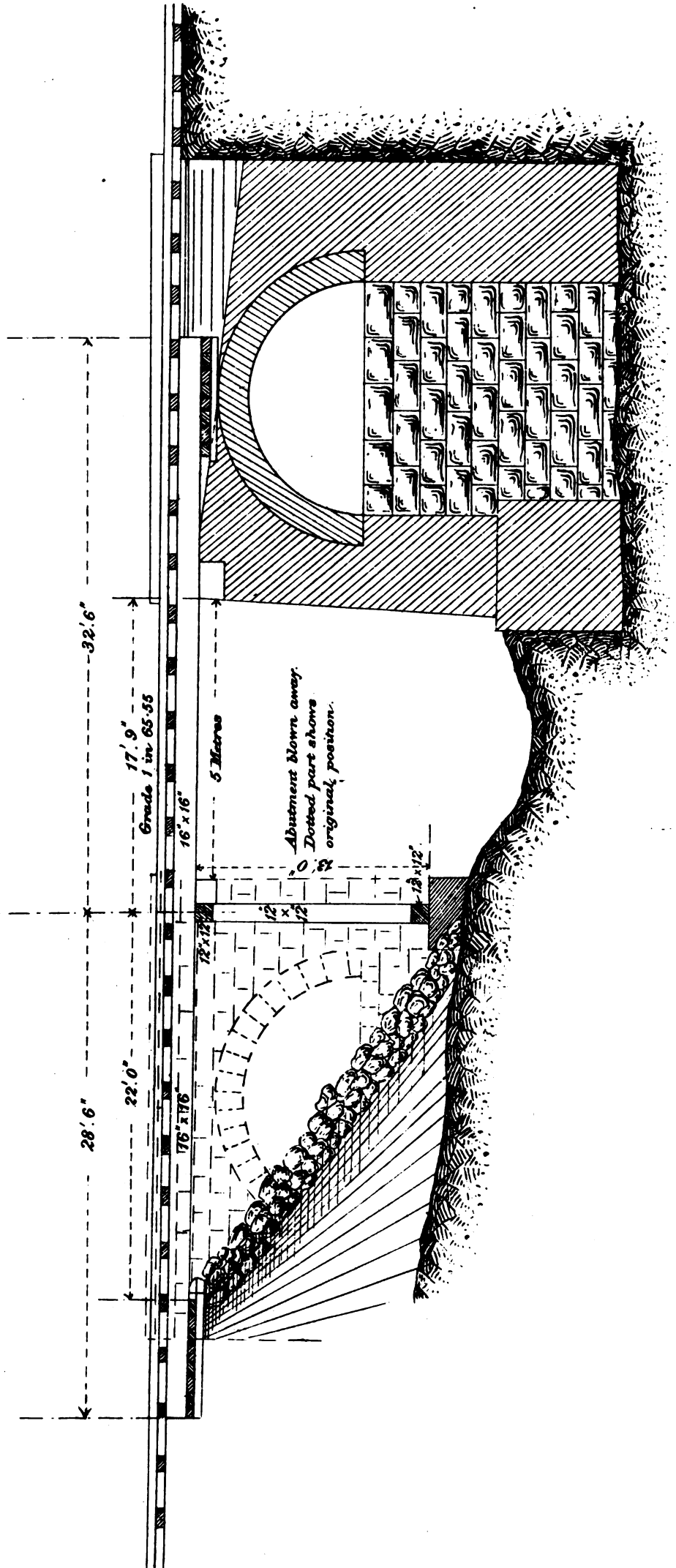
*Officer in Charge: Capt. F. G. Fuller, R.E.
Working Party: 5 Officers, 140 N.C.O.'s and Men R.E.
20 Infantry Platelayers.
500 Natives.
Time taken: 3 days, 18 hours.*



5 METRE CULVERT, KILOMETRE 401.
PRETORIA-DELAGOA BAY LINE.

TEMPORARY REPAIR.

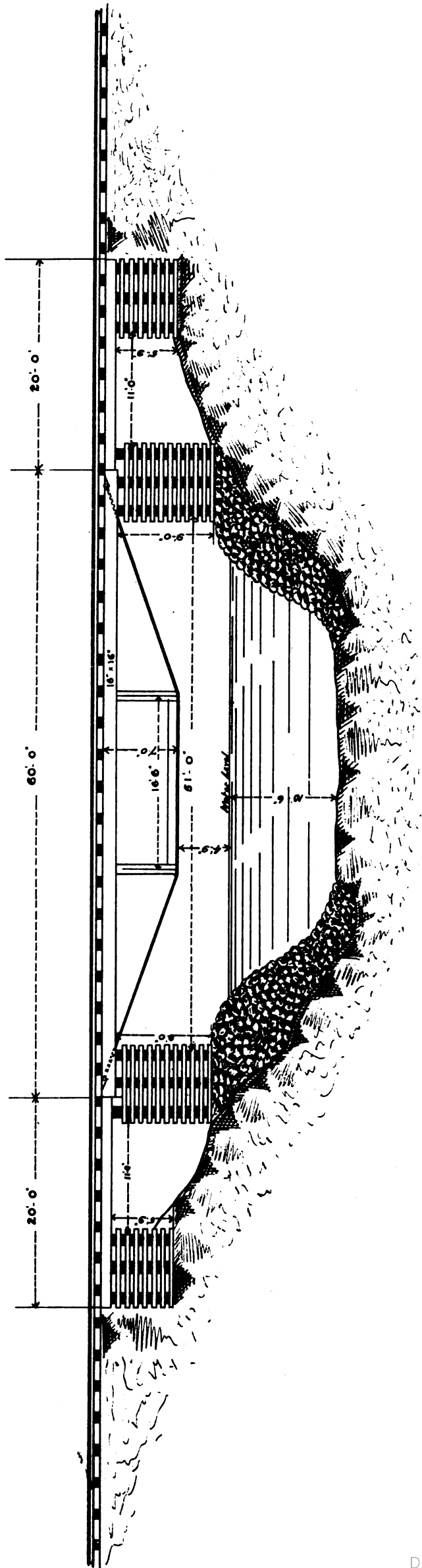
Scale . 8 Feet = 1 Inch.





WILGE R. BRIDGE.
 PRETORIA-DELAGOA BAY LINE.
 BRIDGE, WITH SPAN OF FOUR TRUSSED BEAMS, ON DEVIATION.

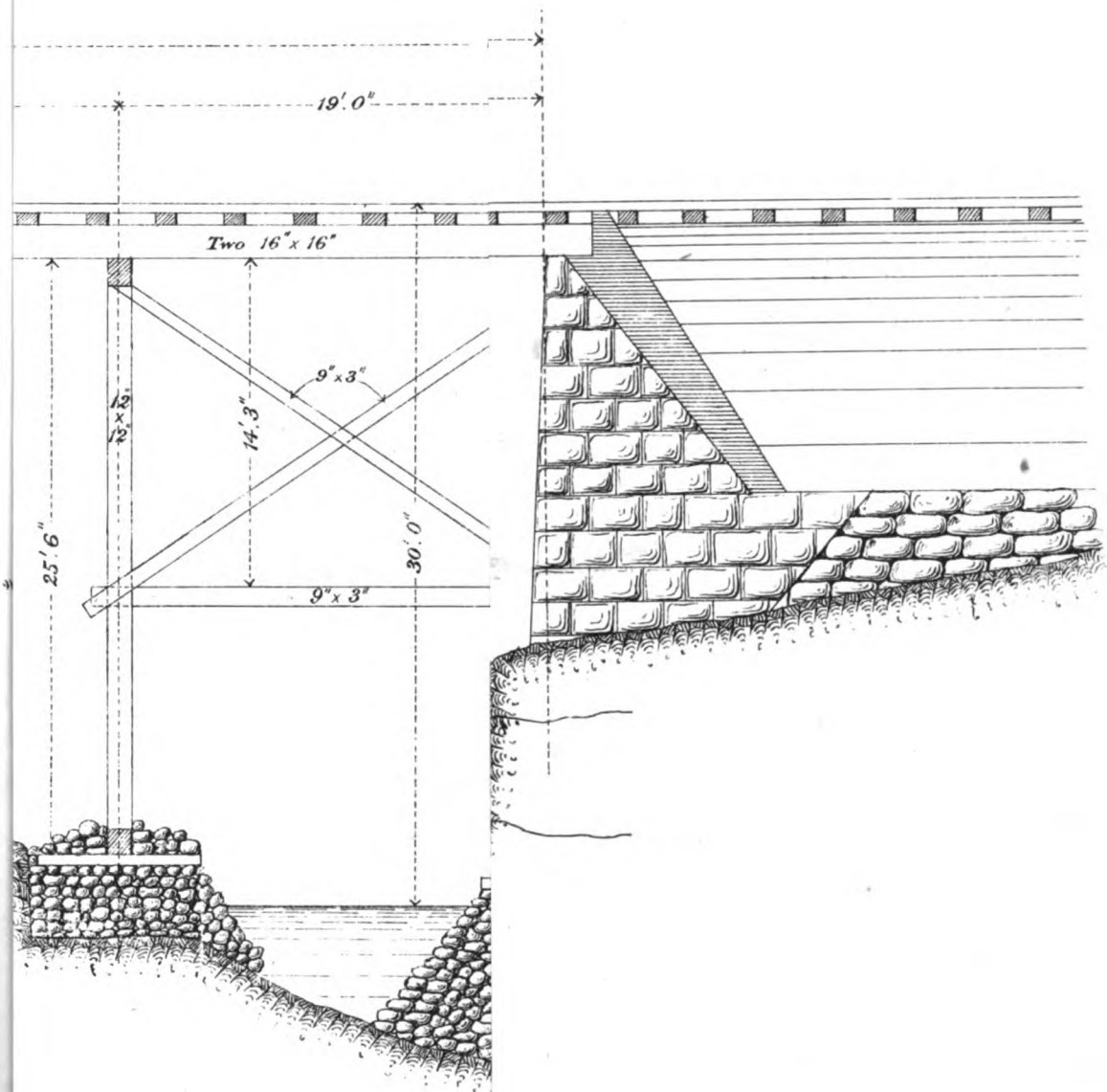
Scale—12 Feet=1 Inch.



Officer in Charge : Capt. F. G. Fuller, R.E.
 Working Party : 5 Officers, 140 N.C.O.'s and Men R.E.
 20 Infantry Platelayers.
 500 Natives.
 Time taken : 4 days, 17½ hours.

LINE .

Considerable Work was necessary



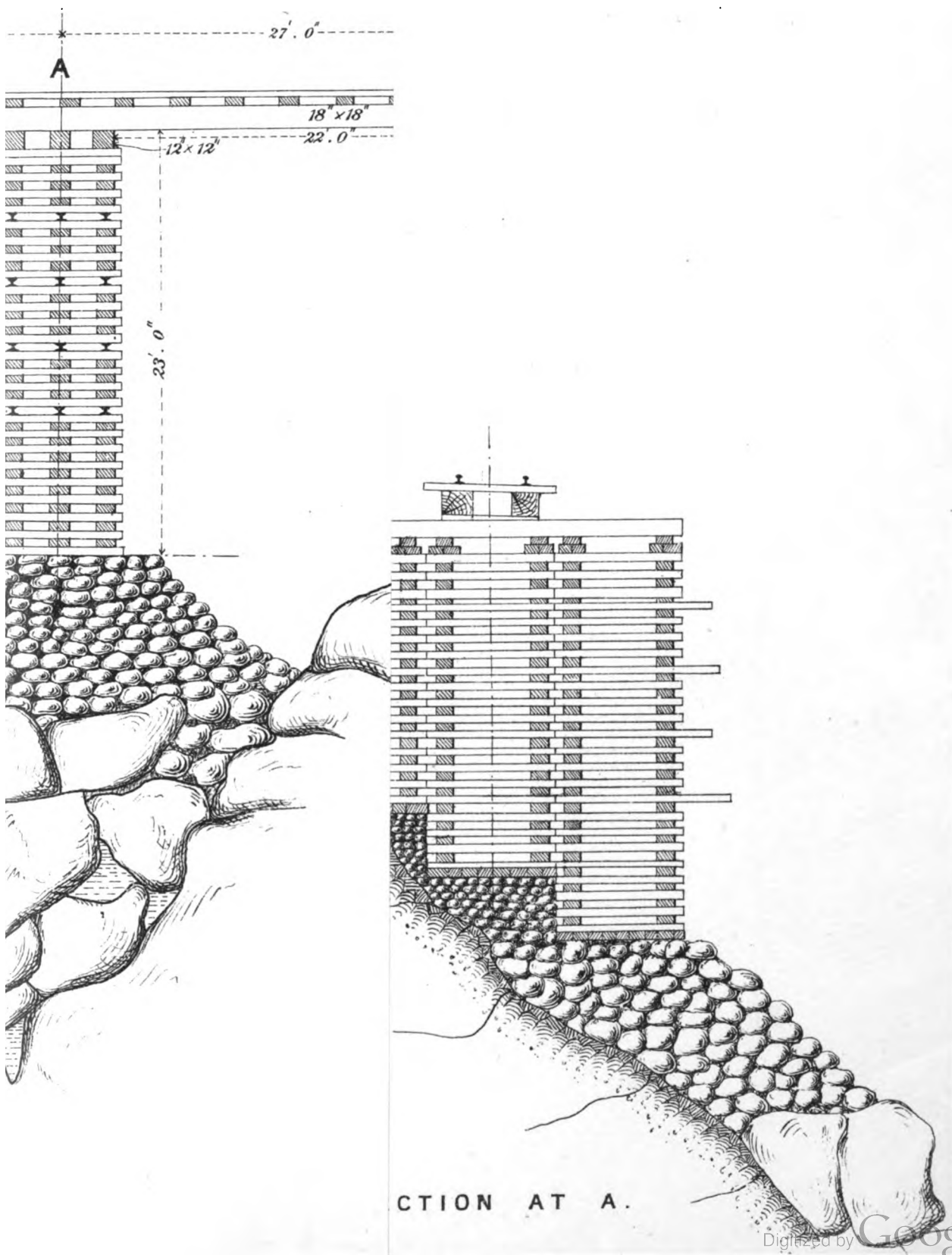
Foundations of Trestle

RT BRIDGE.

DA BAY LINE.

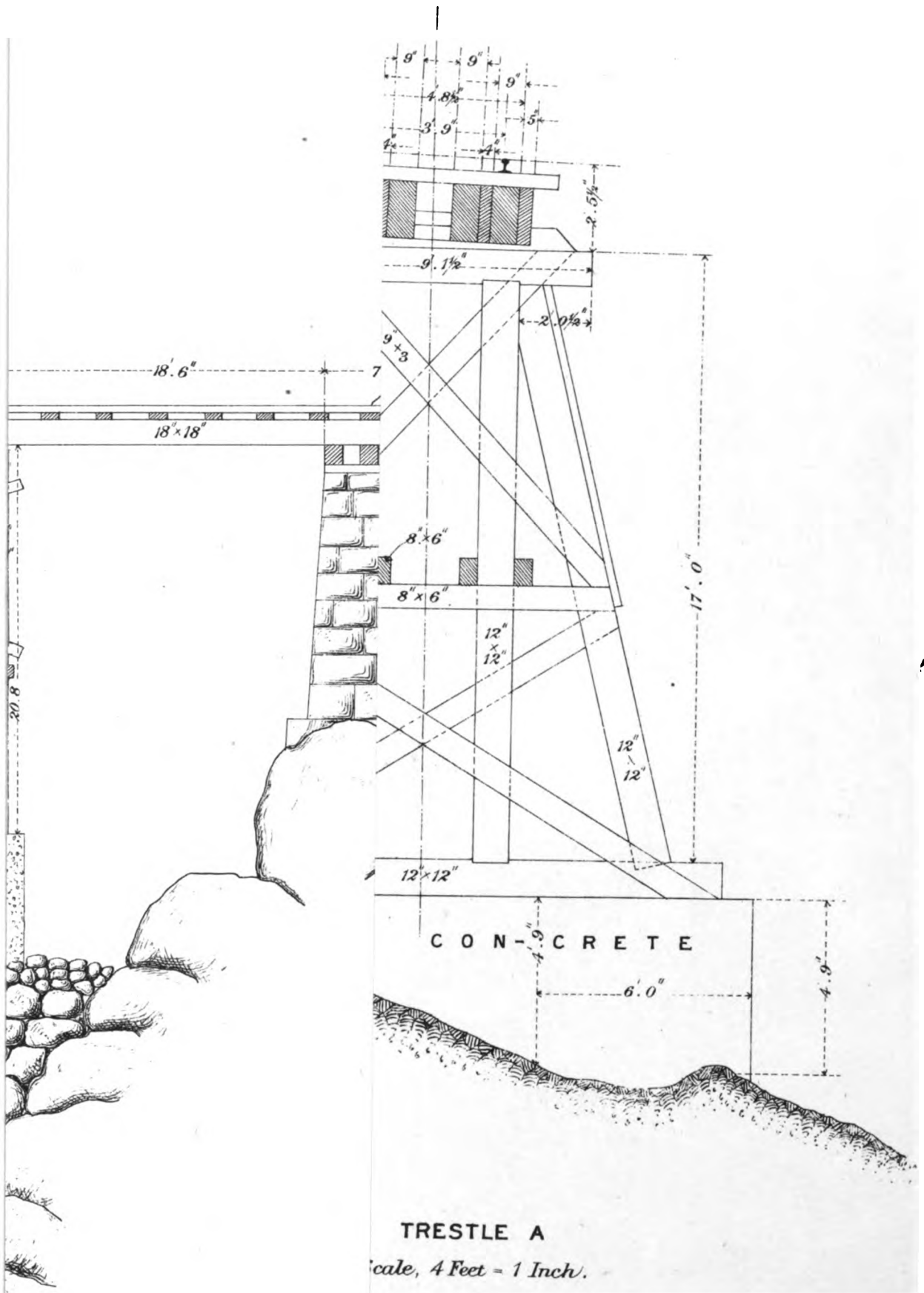
BRIDGE.

=1 Inch



E.

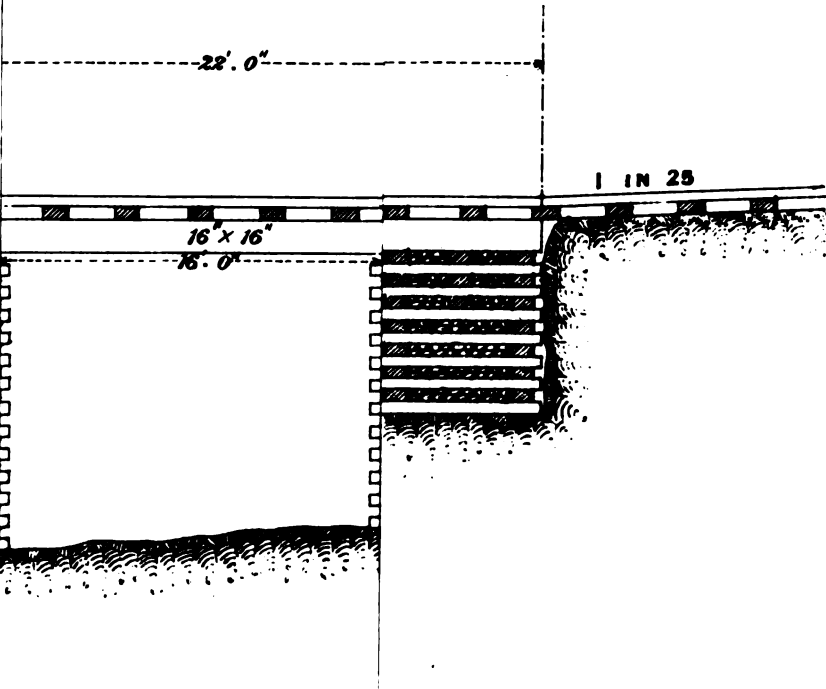
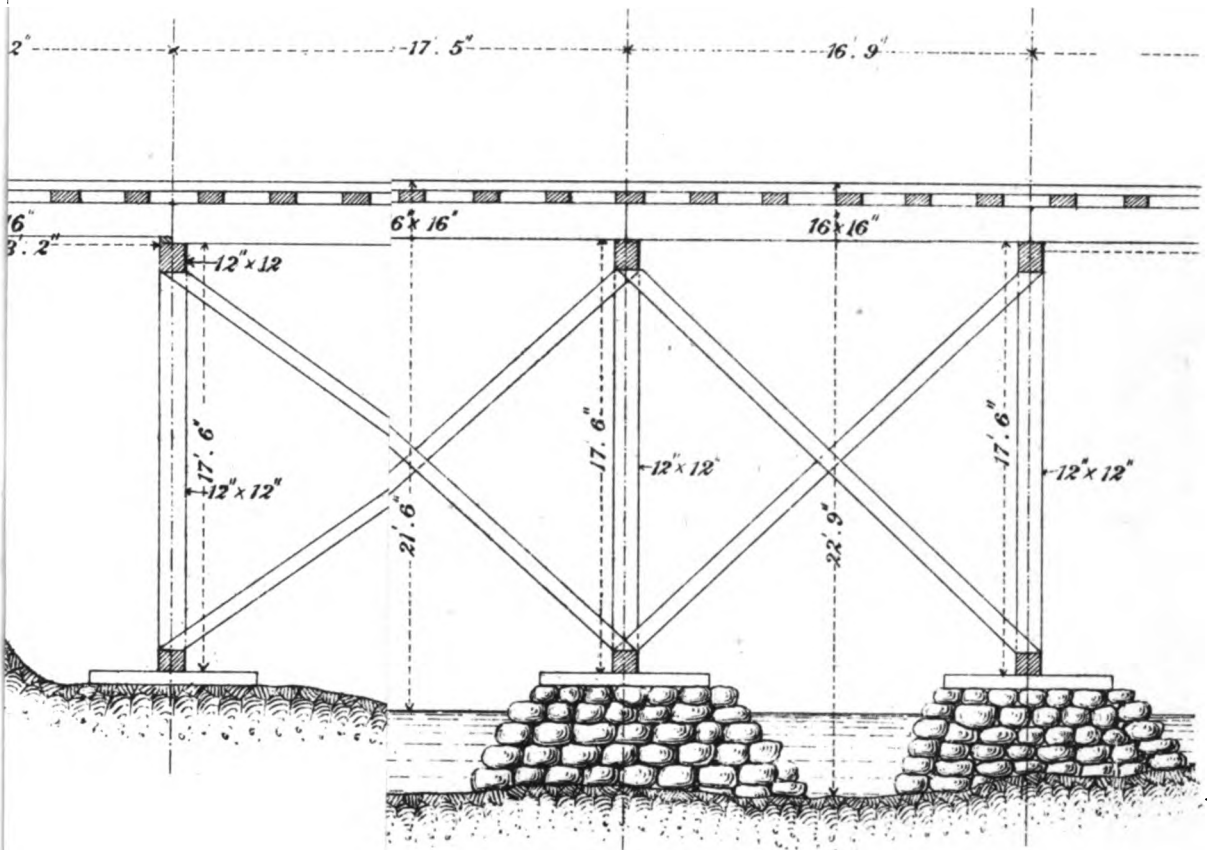
E.



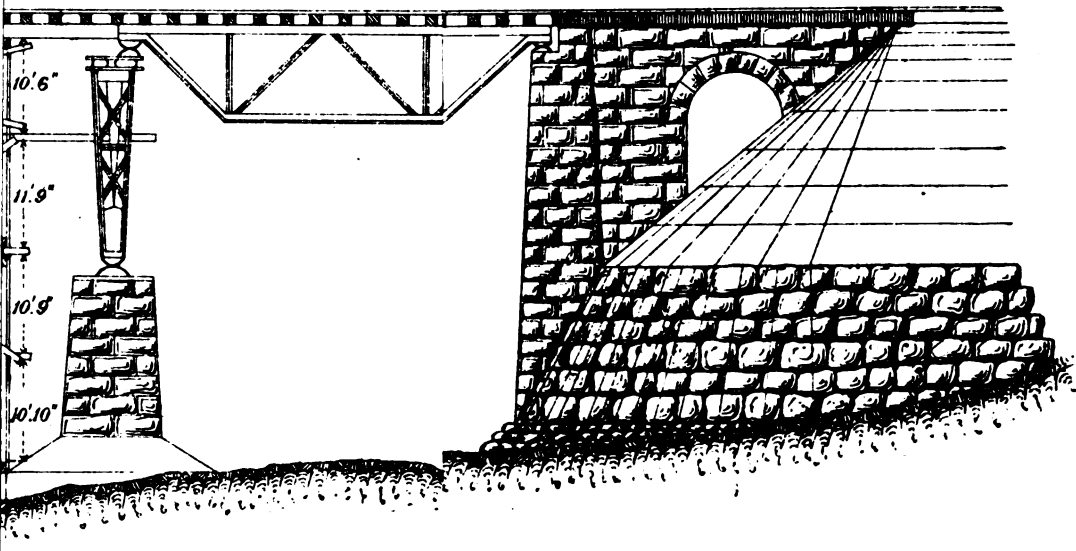
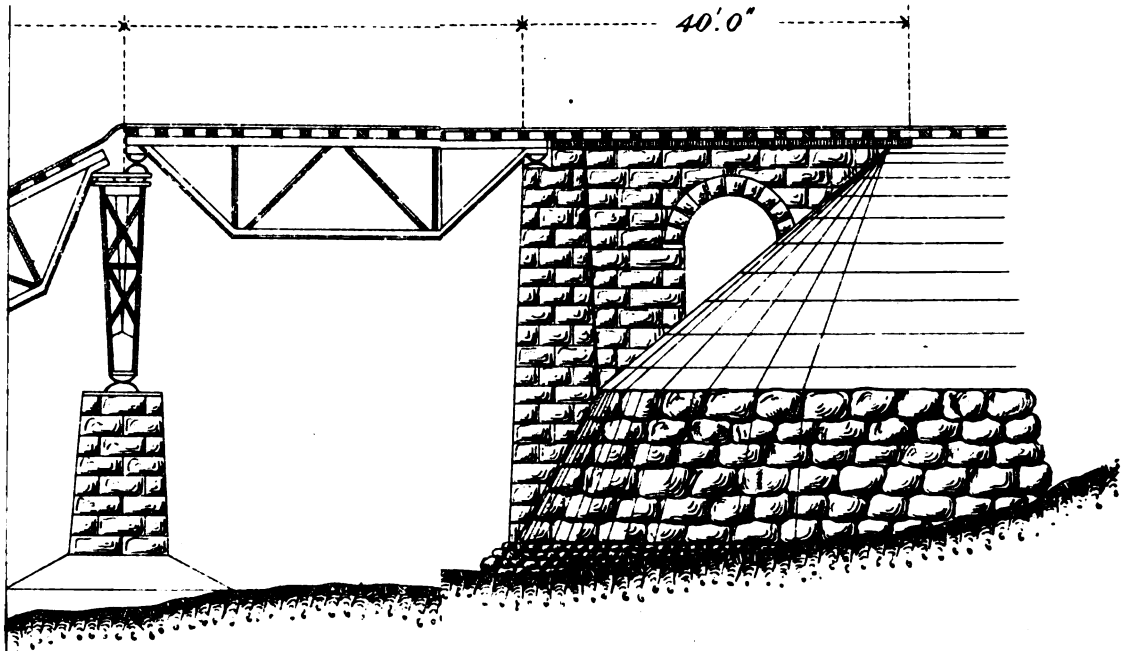
BAY LINE.

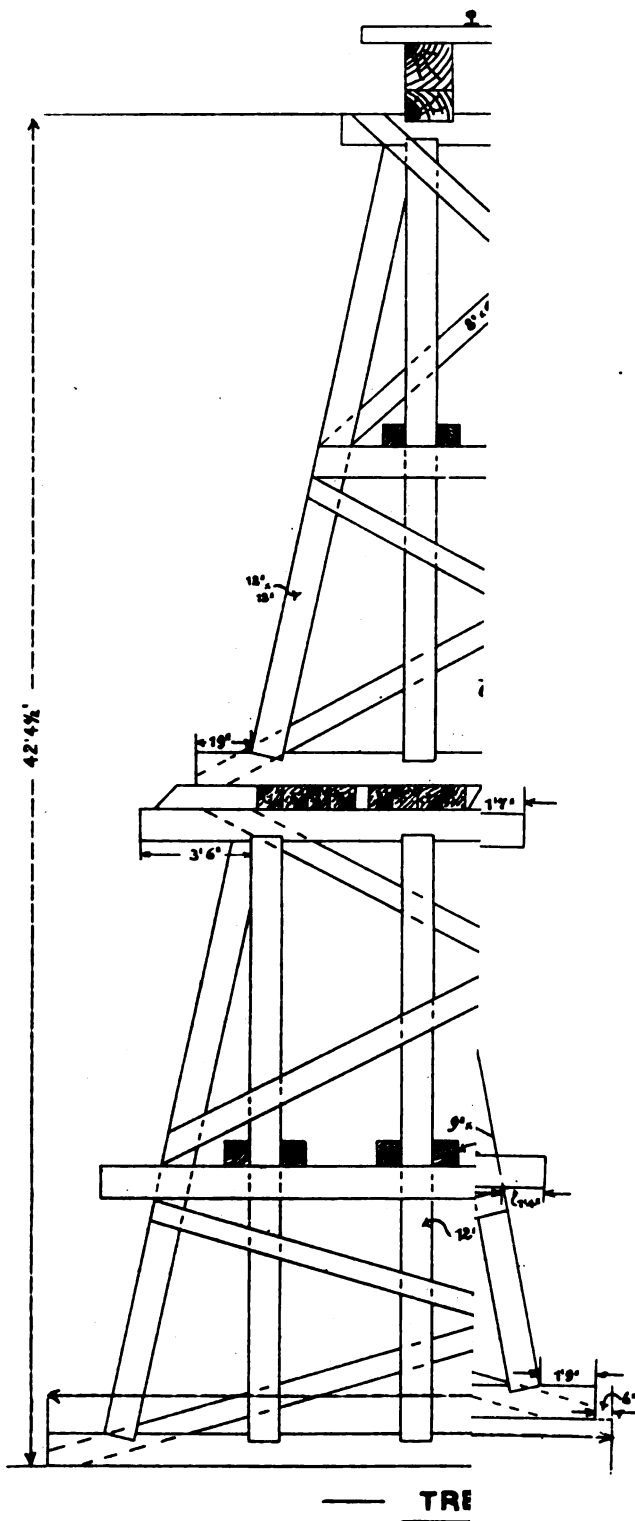
VIATION.

inch.



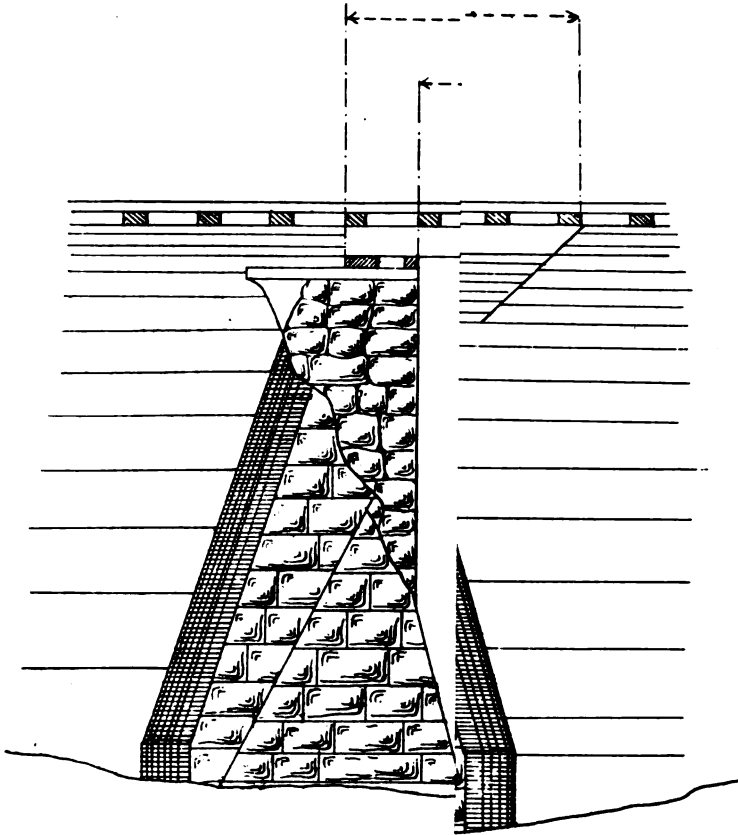
R .



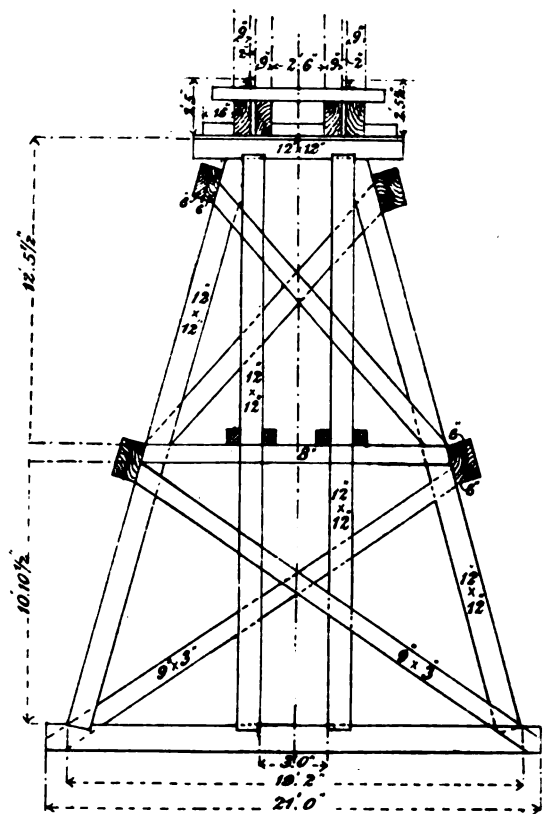
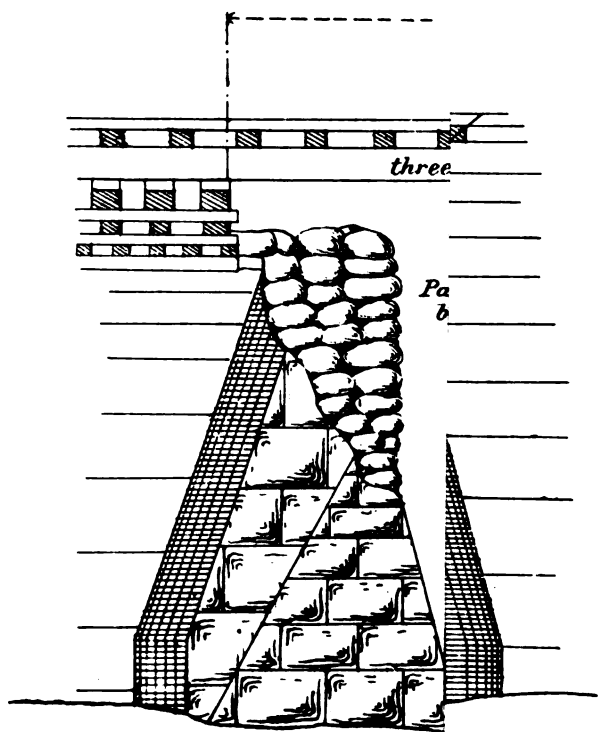


Officer in Charge: Lieut. C.N. Nort
 Working Party: Portions of 10th
 12nd (Fortress)

PLATE 78.



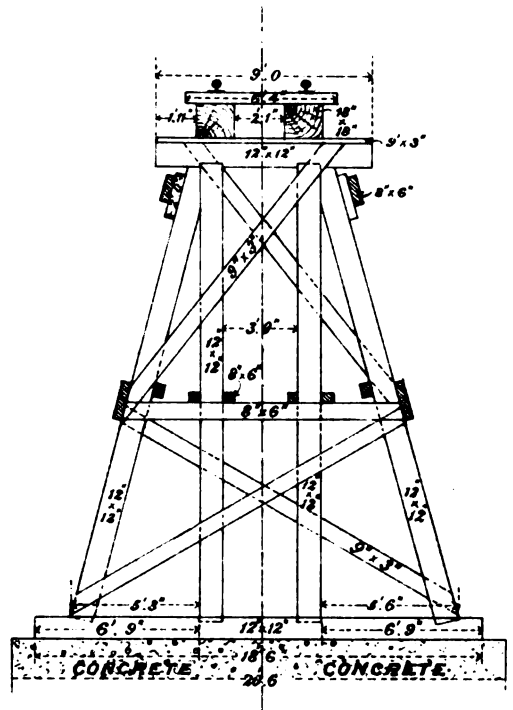
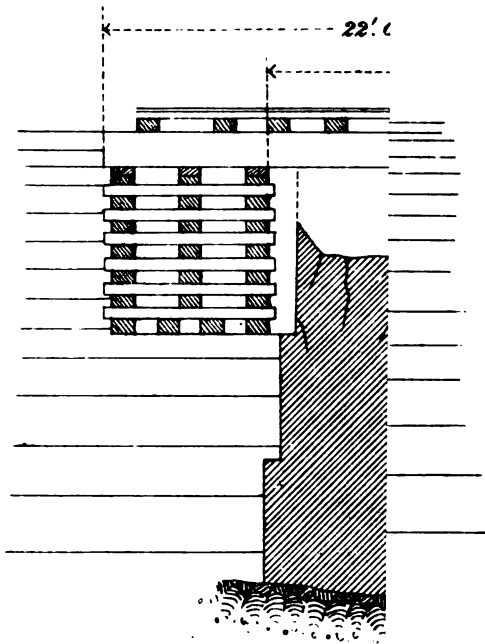
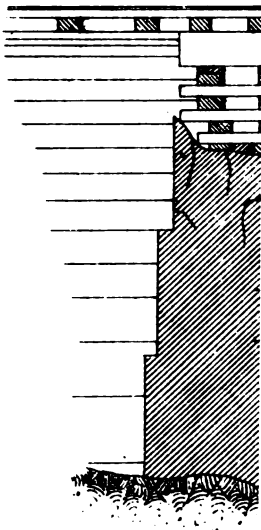
ING TO SINGLE CRIB AT TOP.



TRESTLE.

Temporary bridge

Semi-permanent

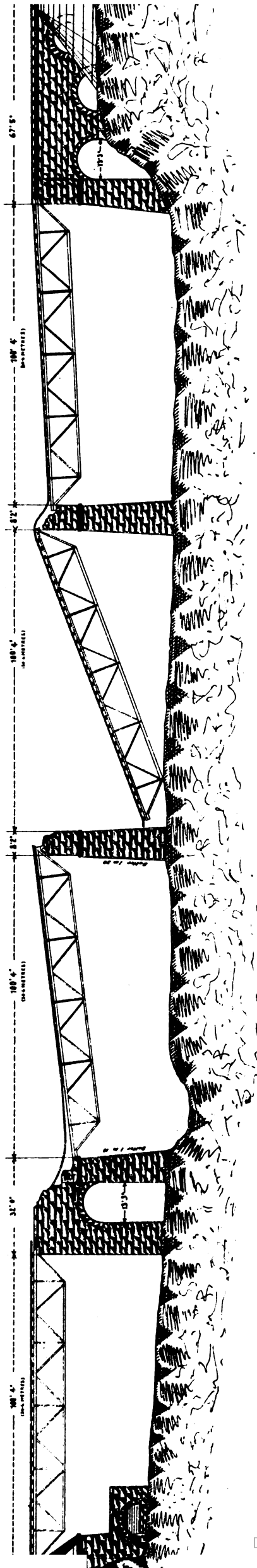


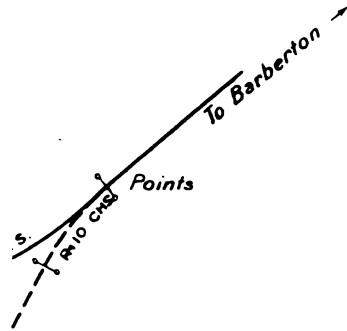
TRESTLE.

KAAP R. BRIDGE, AVOCA.
PRETORIA—DELAGOA BAY LINE.

DAMAGED BRIDGE.

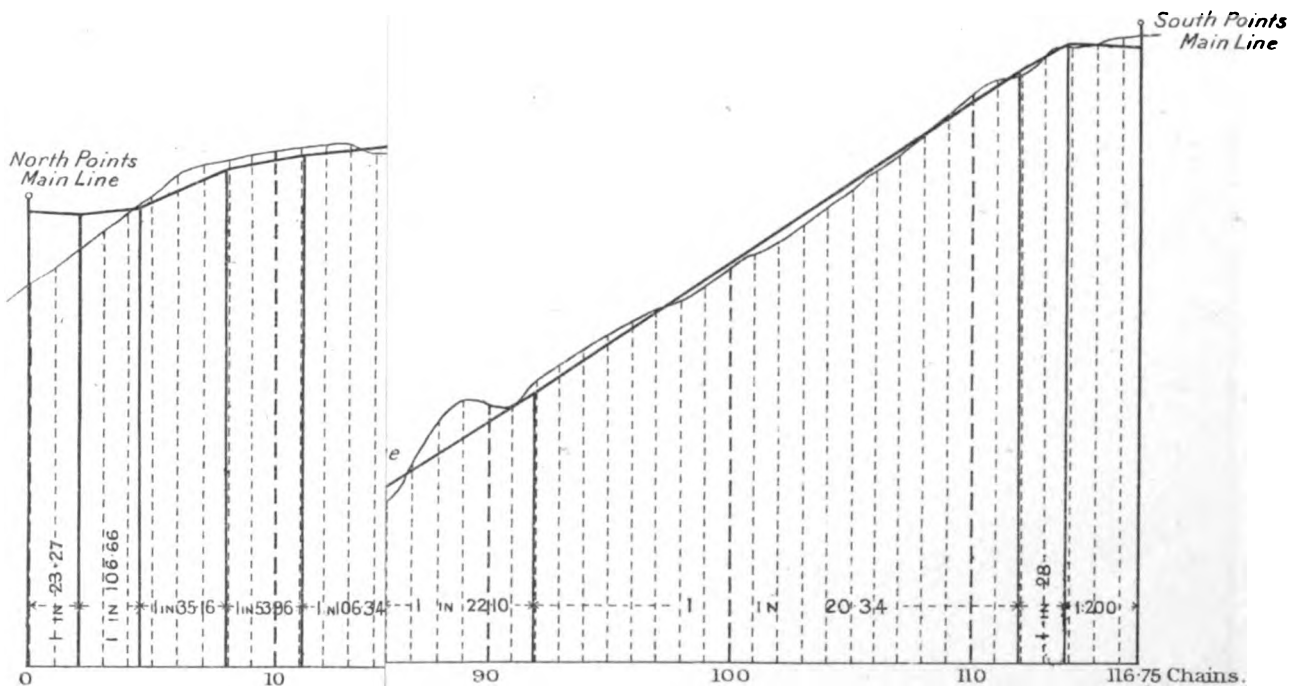
Scale—40 Feet=1 Inch.



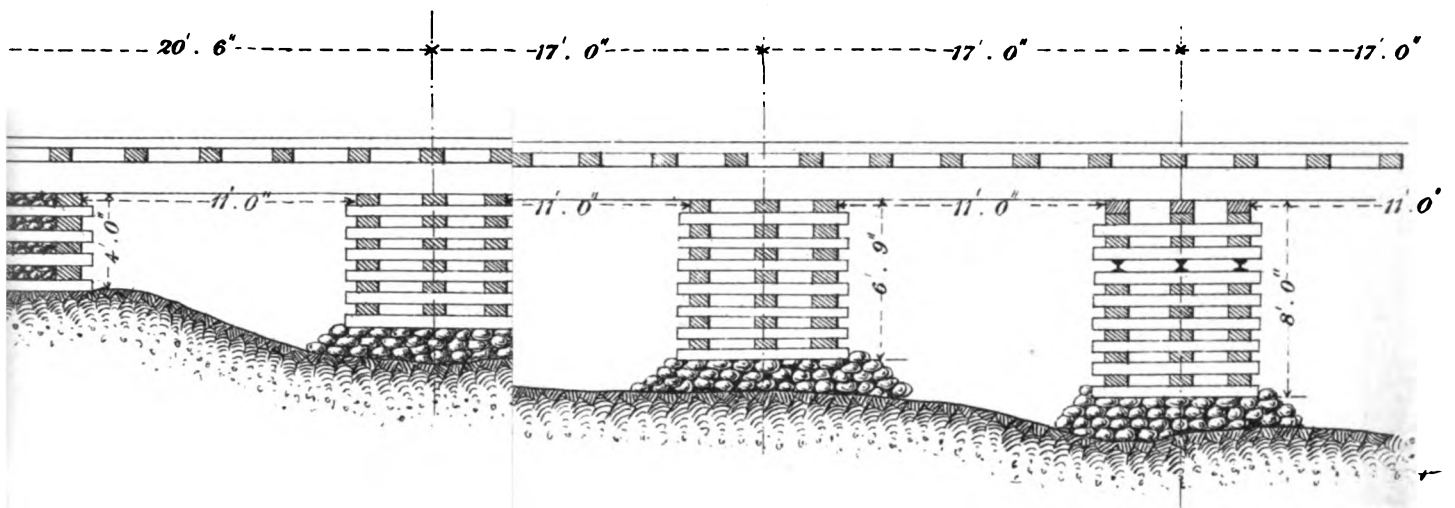


Length of Deviation
Maximum Gradient
Minimum Curve

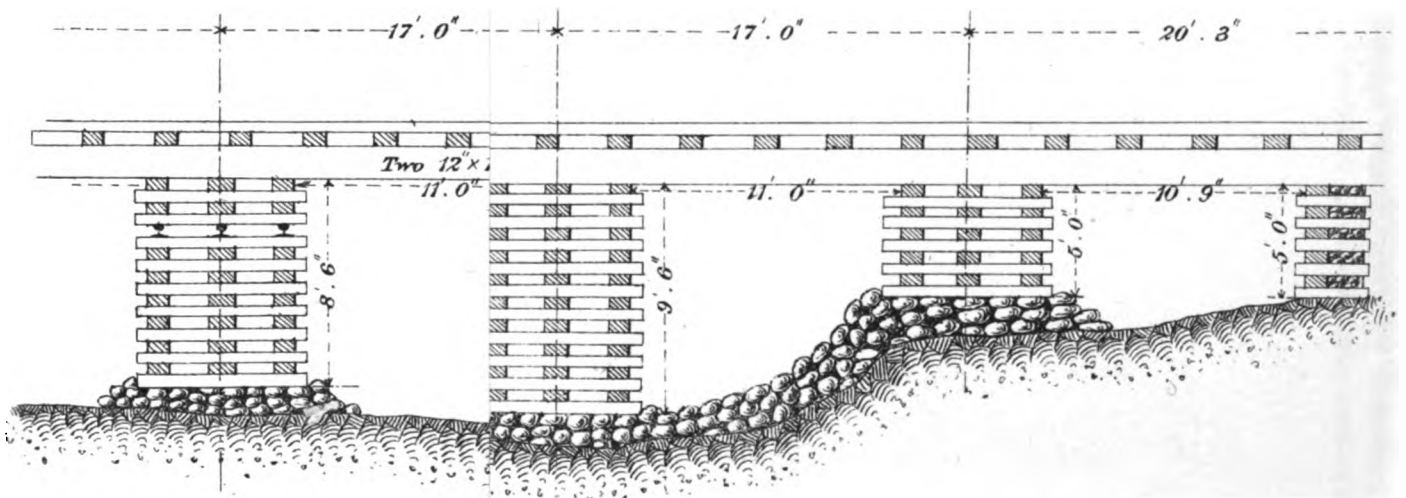
by Mr. A. G. Hunter Weston, R.E. did most of earthwork of deviation with—
1st Field Troop R.E. and Infantry
and Mr. H. A. Micklem, D.S.O. R.E. completed with—
3 Officers, 87 Non-commissioned officers and Men R.E.
30 Infantry Platelayers
300 Natives



Major A. G. Hurder-Weston
 . carried out by
Lieut. H. A. Micklem D.S.
 with 3 Officers, 87
 30 Infantry platelay
 300 natives.

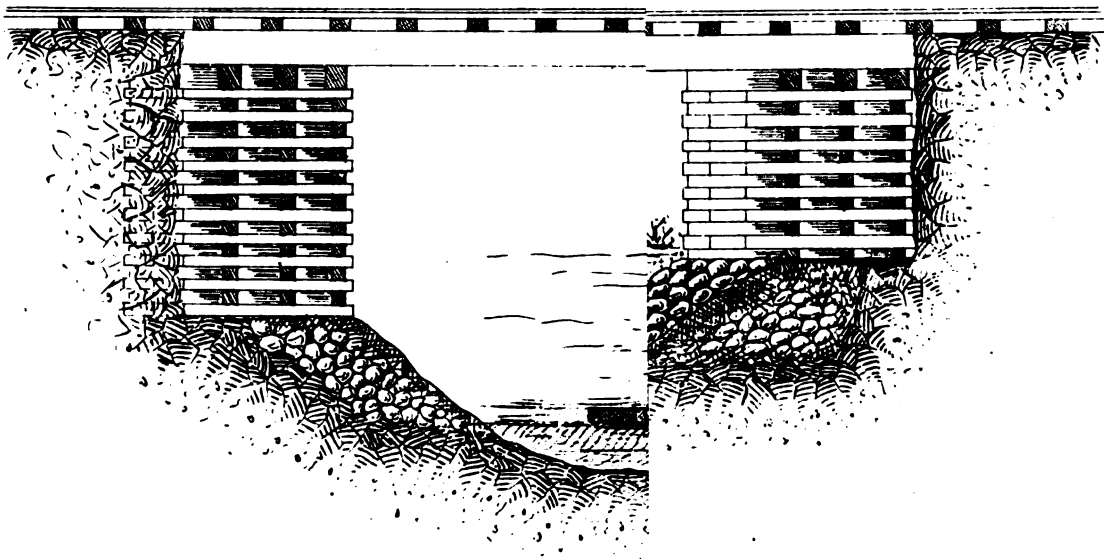
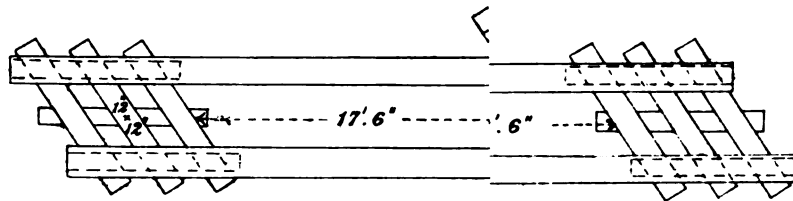


S.



SINGLE WIDTH CRIBS.

PLATE 83.



Officer in Charge: Capt. F. G. Fuller, R.E.

Working Party: 60 R.E.

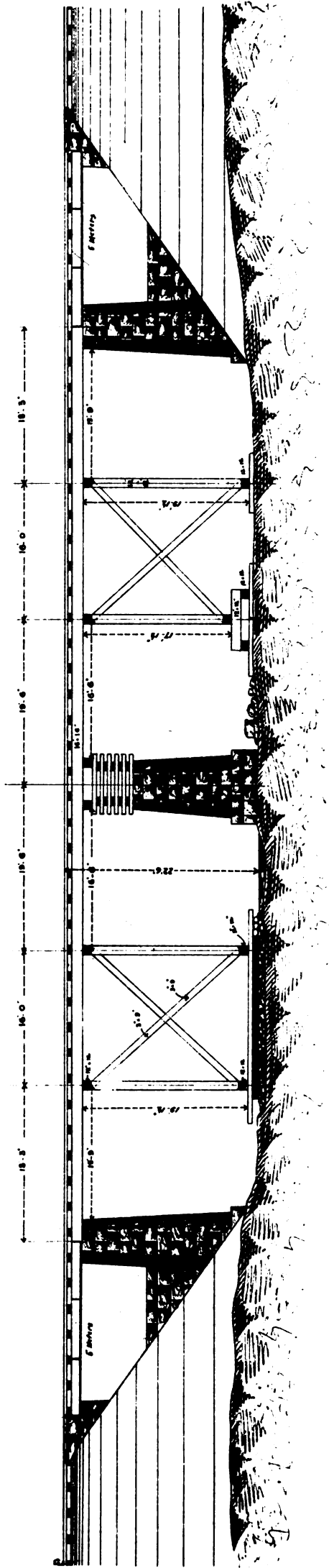
30 Infantry details.

300 Natives.

Time taken for bridge and 1 mile of deviat

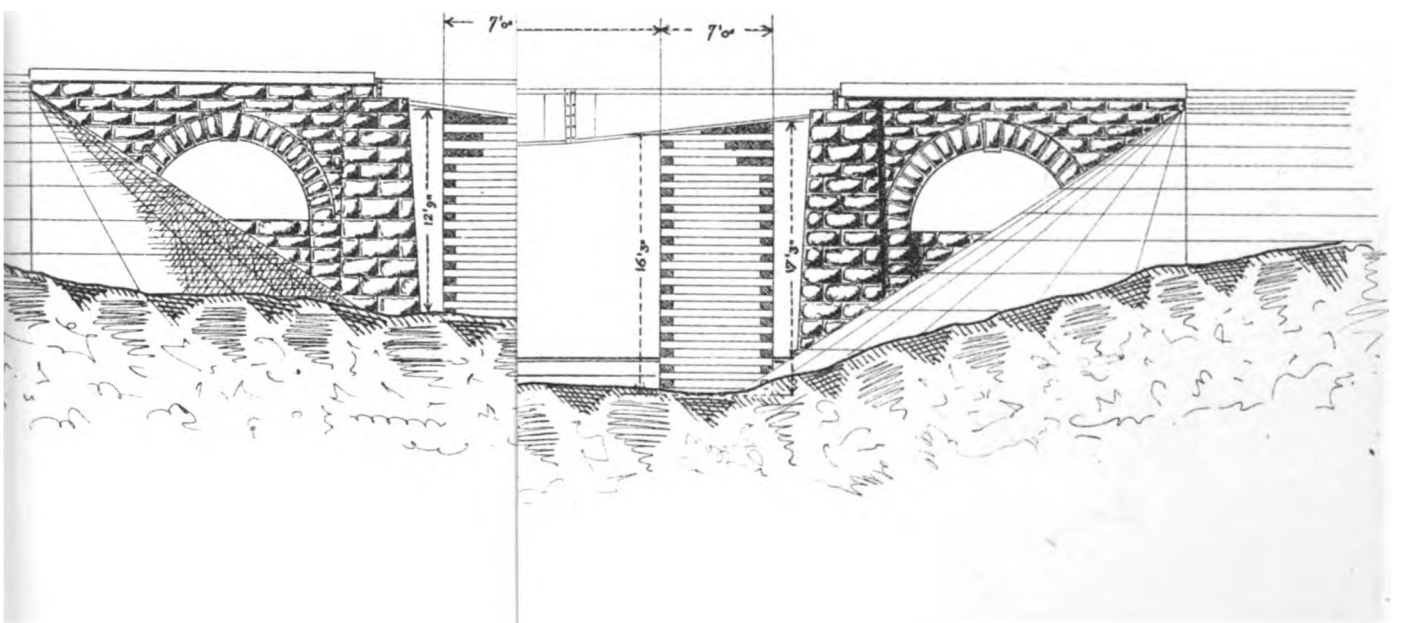
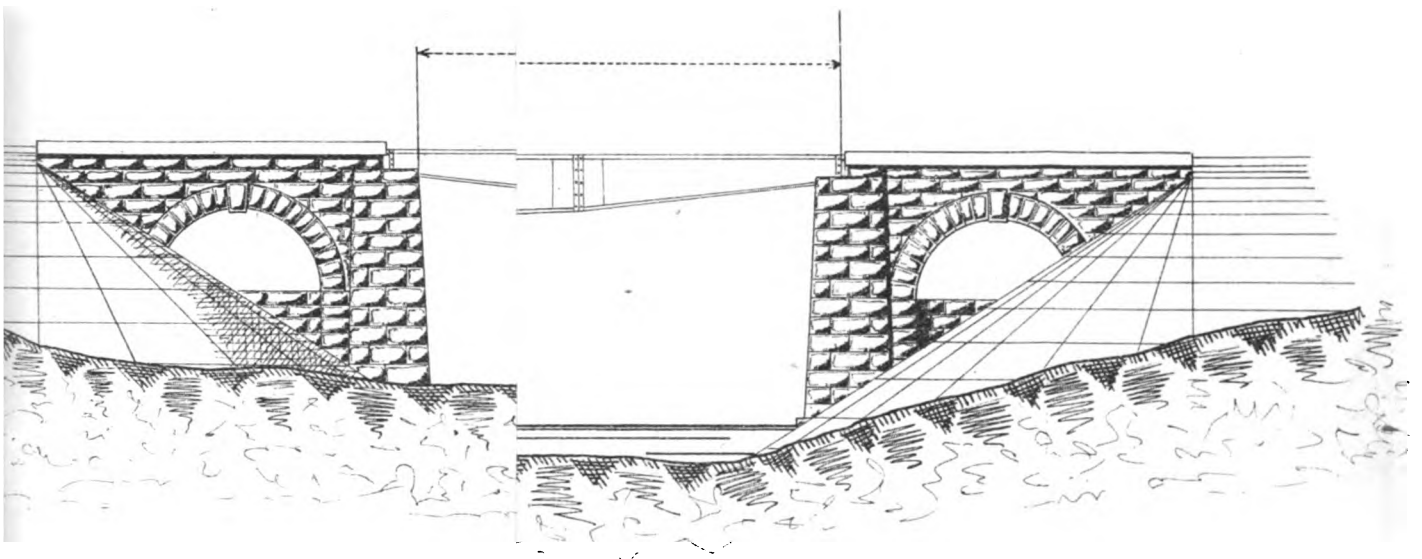
BANK BRIDGE.
ELANDSFONTEIN - KLERKSDORP LINE.
SEMI-PERMANENT BRIDGE.

Scale—16 Feet=1 Inch.



Officer in Charge : Lieut. A. G. T. Cousins, R.E.
Working Party : 17 R.E.
74 Natives.
Time taken : 6 days.

Officer in Charge : Lieut. Vercoe,
Working Party : 11 Men R.P./
130 Natives.
Time taken : 6 days.

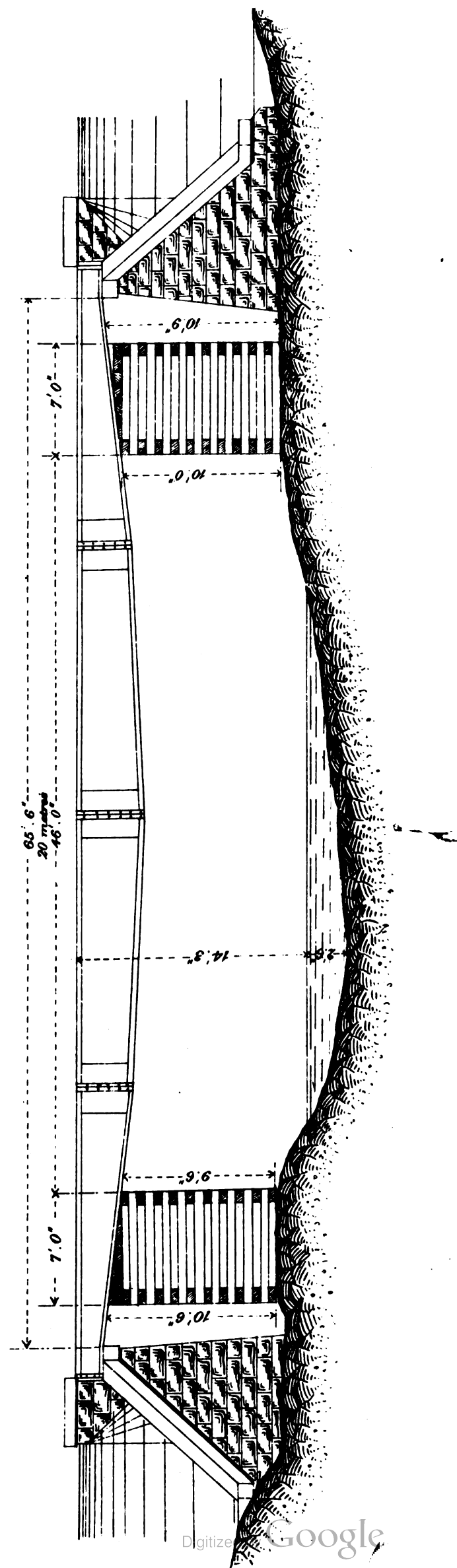


BRIDGE AT KILOMETRE 204½
ELANDSFONTEIN-KLERKSDORP LINE.
SEMI-PERMANENT BRIDGE.

Officer in charge : Lieut. Vercoe, R.P.R.
Working Party : 11 Men R.P.R.
25 Natives.
Time taken : 1 day.

Scale 8 Feet = 1 Inch.

A SIMILAR BRIDGE AT K.M. 209 HAS BEEN REPAIRED IN THE SAME MANNER.



FREDERIKSSTAD BRIDGE.

ELANDSFONTEIN—KLERKSDORP LINE.

SEMI PERMANENT BRIDGE.

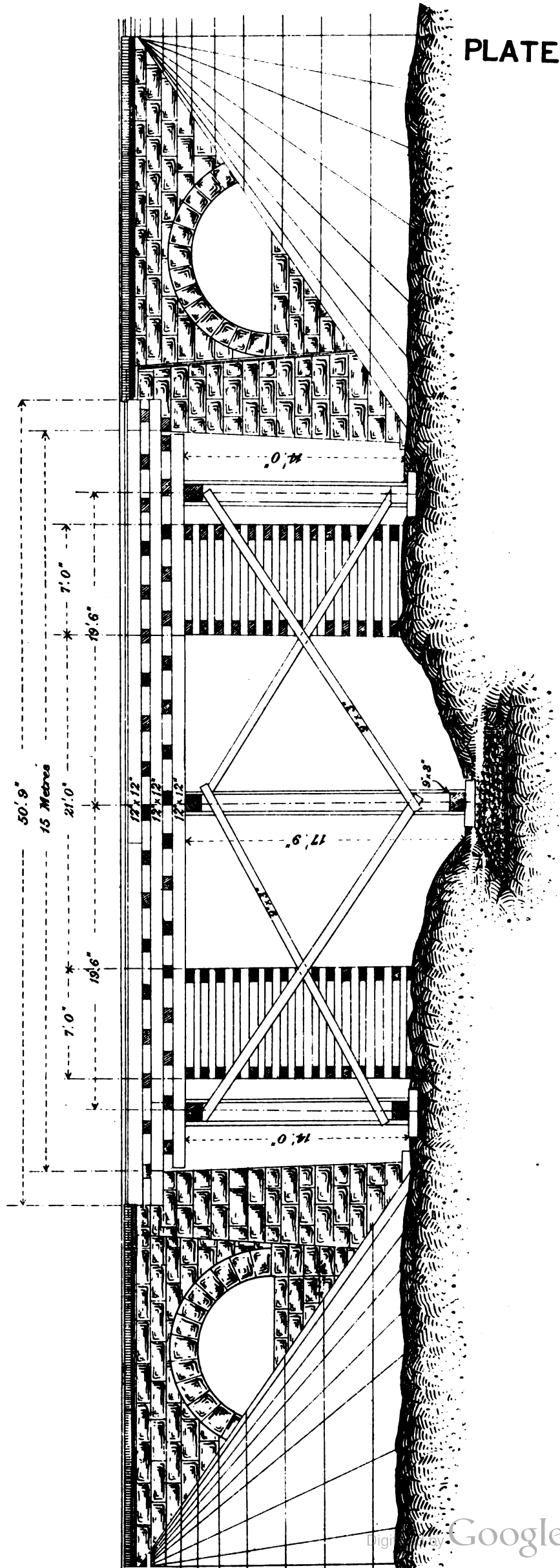
Officer in Charge : *Lieut. Vercoe, R.P.R.*

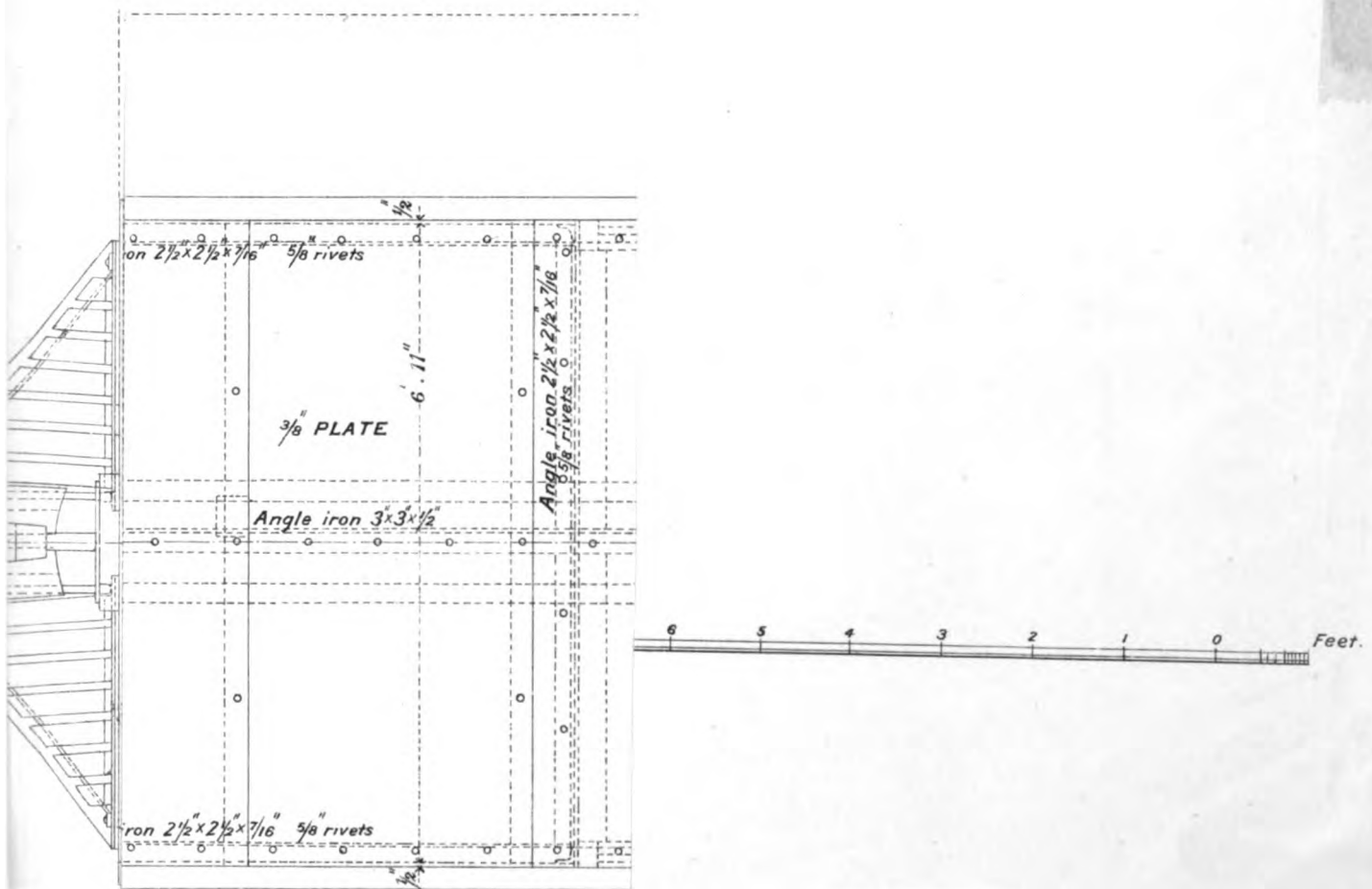
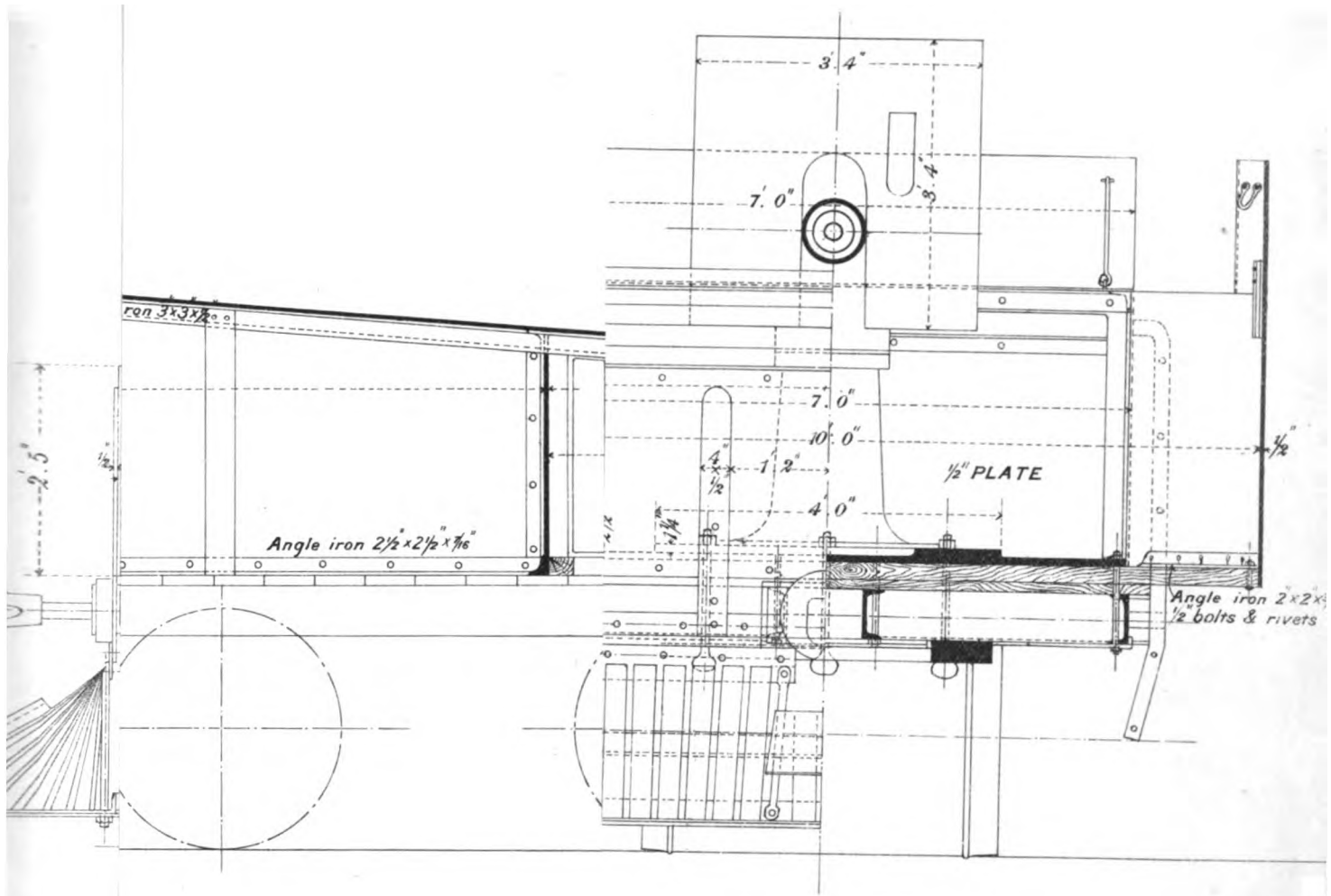
Working Party : *11 Men R.P.R.*

54 Natives.

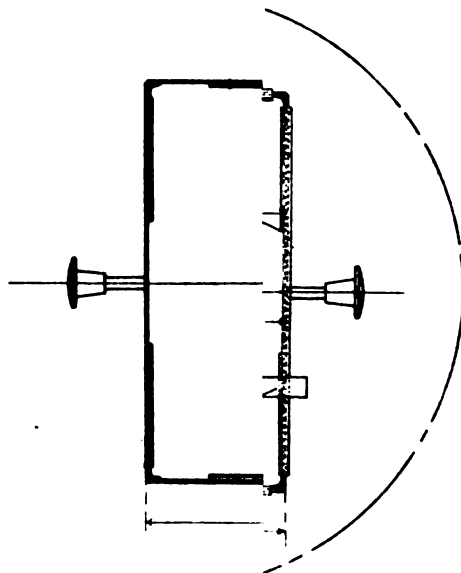
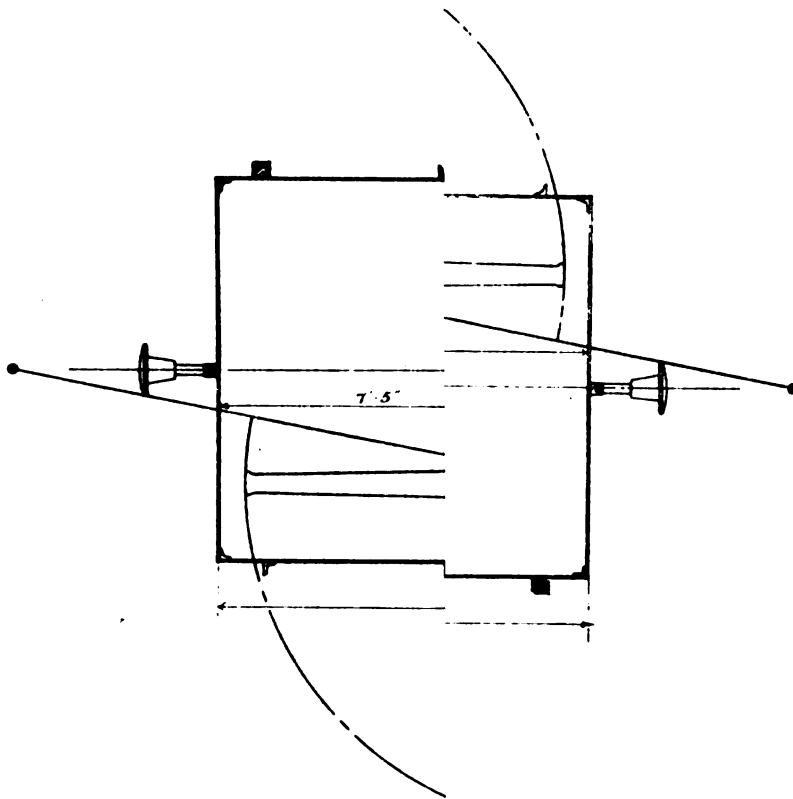
Time taken : *5½ days.*

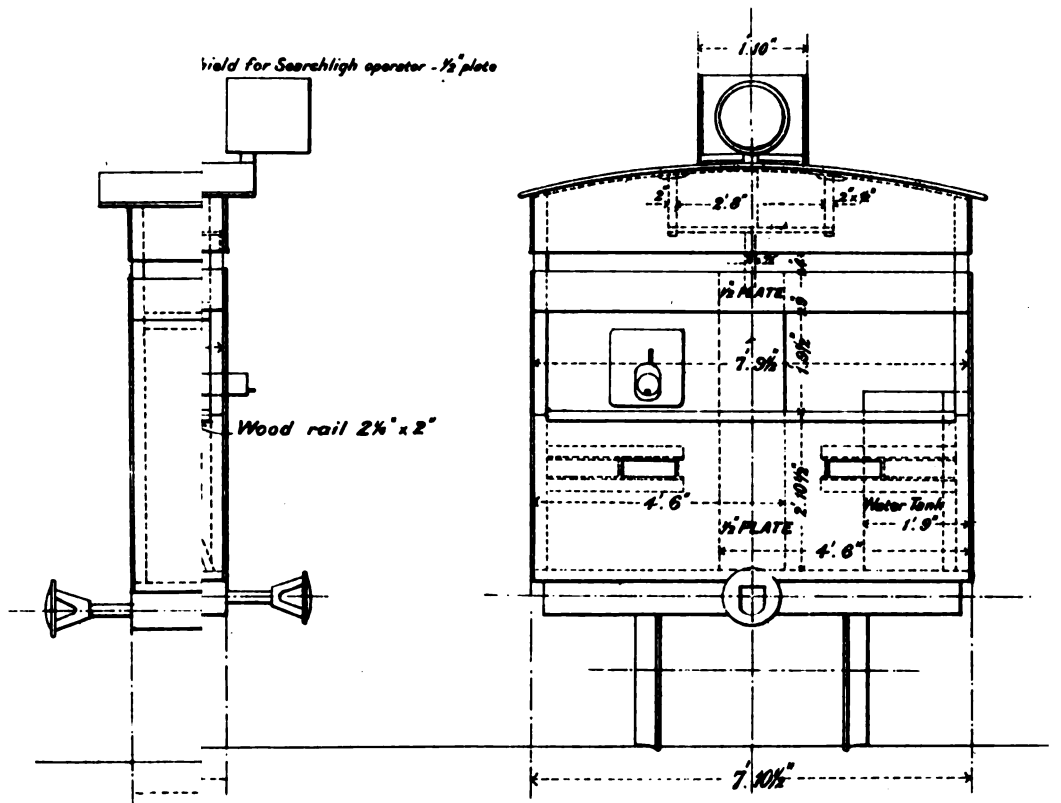
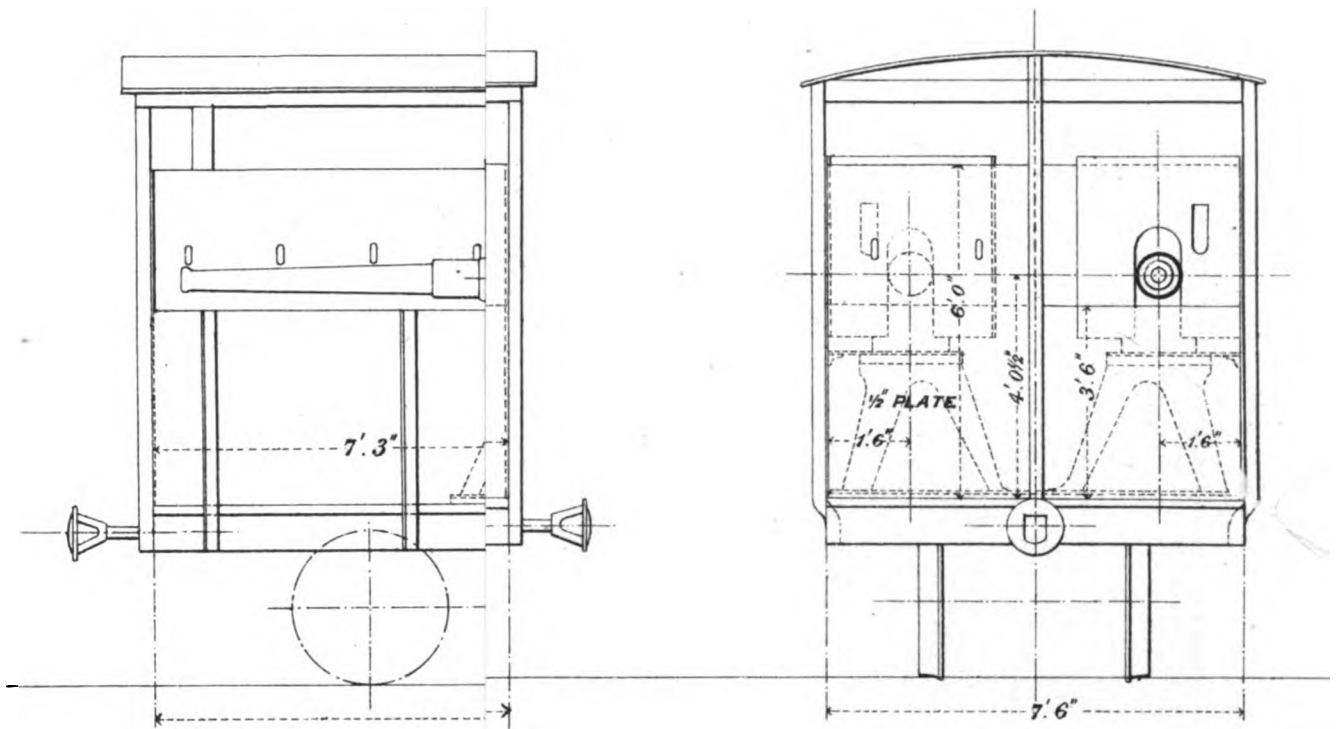
Scale 8 Feet = 1 Inch.



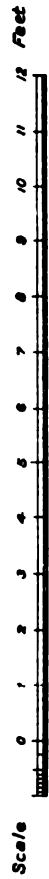
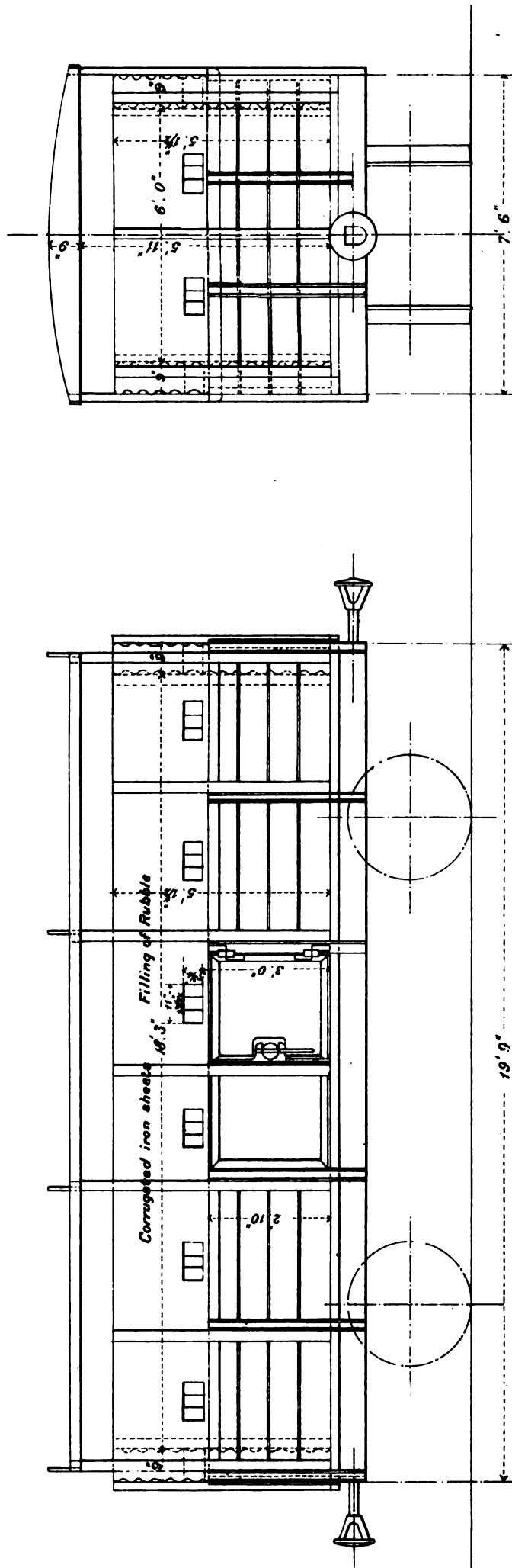


12





ESCORT TRUCK



— PROVIDING FLANK FIRE —

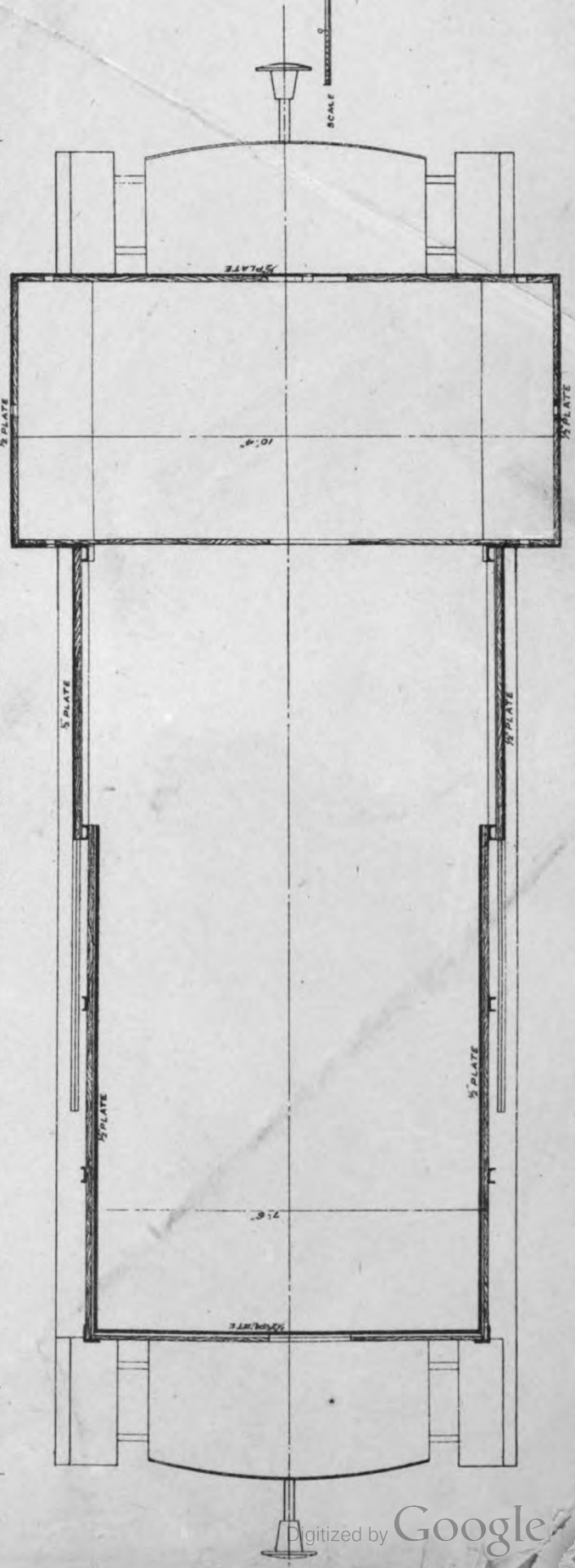
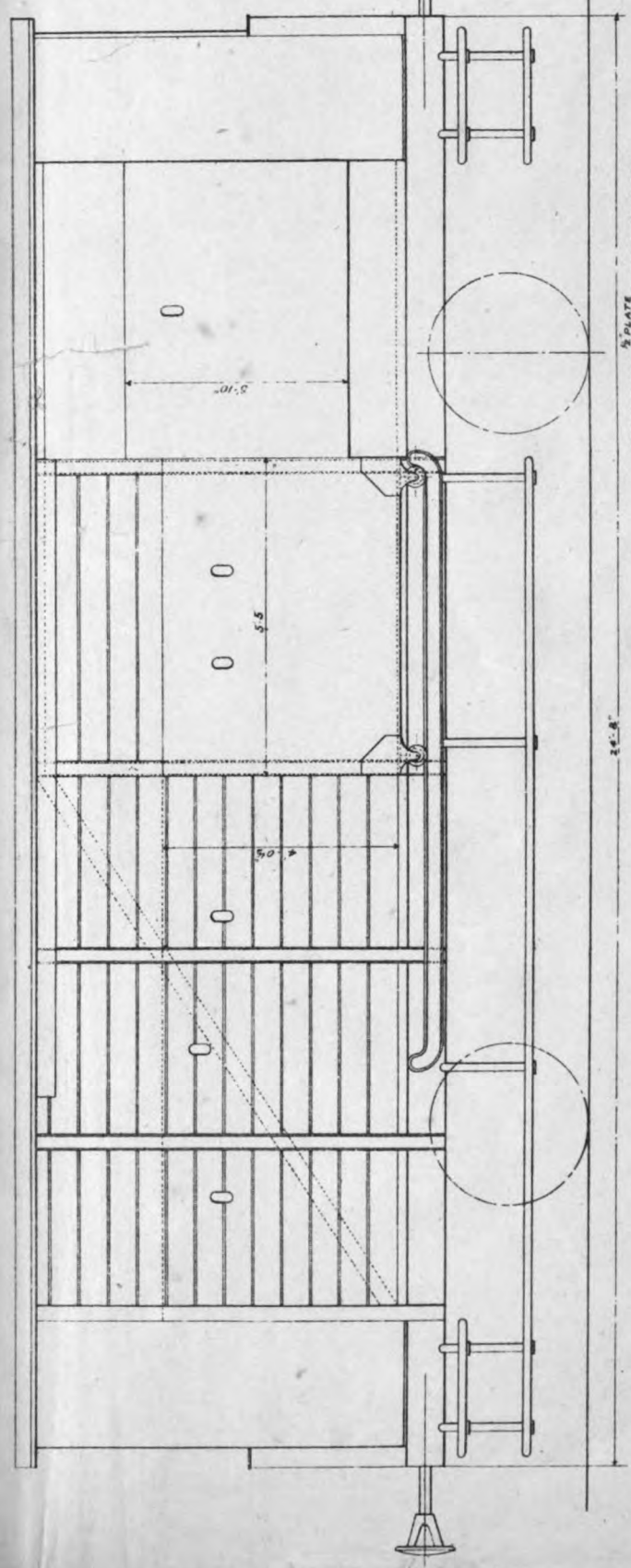
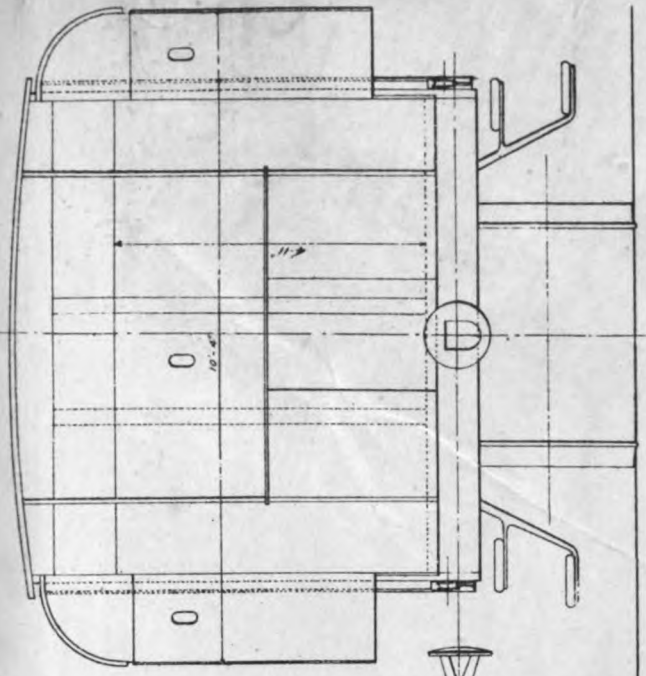


PLATE 93.



11/10/1911
11/10/1911

fd

