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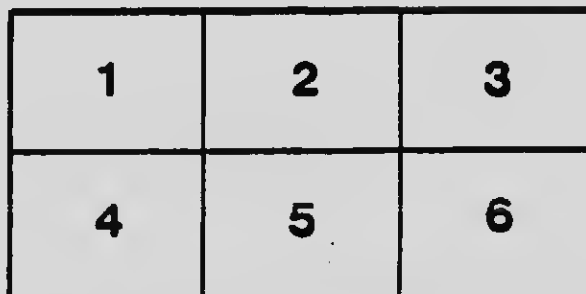
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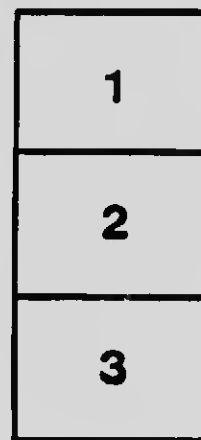
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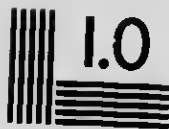
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**NATIONAL
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RAILWAY**

GENERAL SPECIFICATIONS

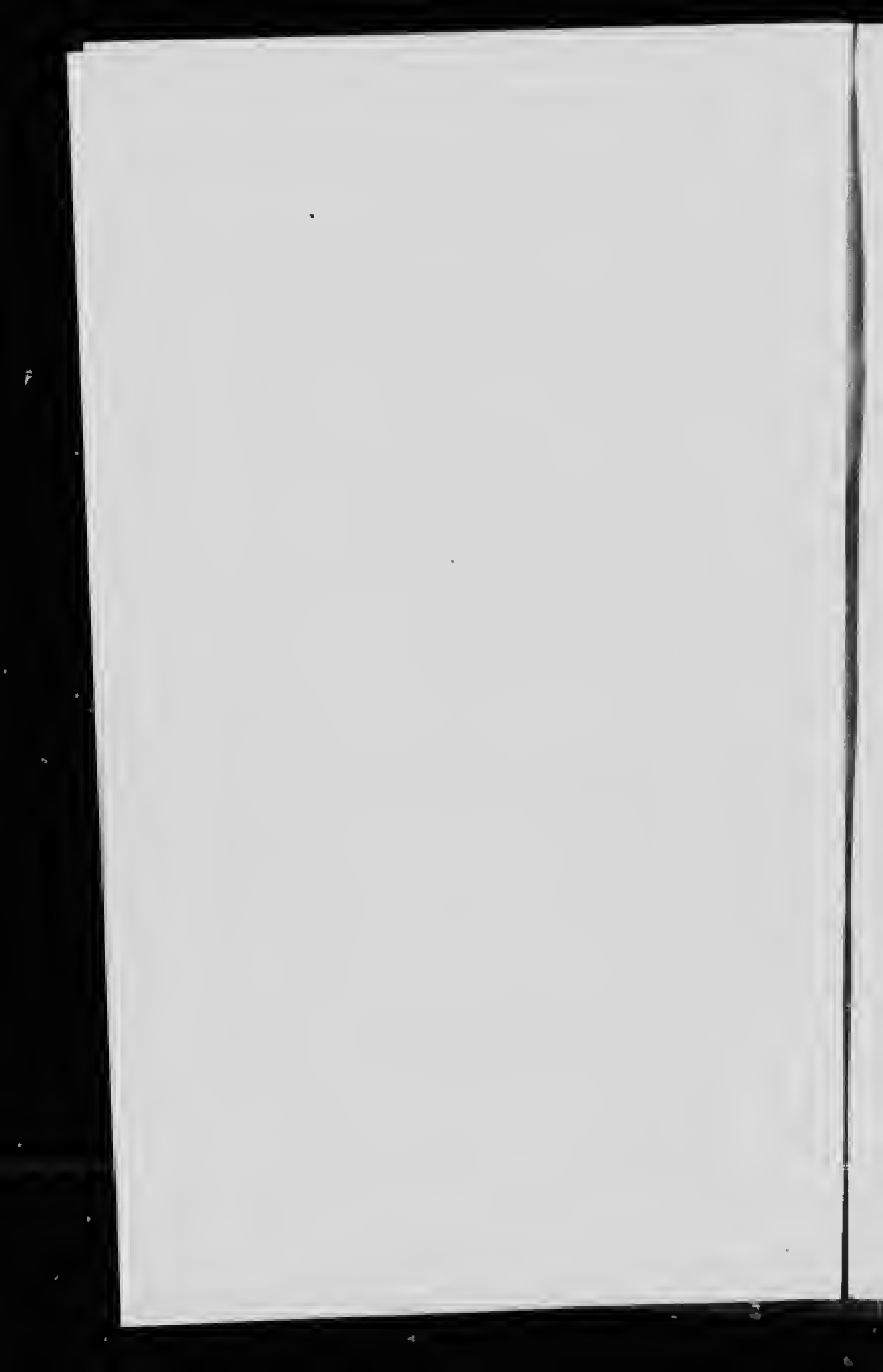
1
1
1
1
1
1
1
2
2
2
2
2

INDEX TO SUBJECTS

TO

GENERAL SPECIFICATIONS.

PAR.		PAGE
1 to 11	General	33 to 35
12 to 17	Grading	35 to 36
	Temporary Bridge or Haulway	36
18 to 27	Excavations and Embankments	36 to 38
28 to 32	Side Ditches, Borrow Pits, Etc.	38 to 39
33 to 39	Classification	39 to 40
40 to 47	Foundations	40 to 41
48 to 56	Tests	41 to 43
57	—Specifications for Sand, for Concrete and Masonry	43
58	—Specifications for Stone, for Concrete	43
59	—Specifications for Stone, for Masonry	43
60	—Concrete Culverts and Concrete Pipes	44
61 to 73	—Specifications for Concrete	44 to 46
74 to 83	Stone Masonry	46 to 49
84 to 88	General Description (Second-Class)	50 to 51
89 to 100	General Description (Third-Class)	51 to 53
101 to 108	Cast-Iron Culvert Pipe	53 to 54
109 to 112	Rip-Rapping	54 to 55
113 to 116	Paving	55 to 56
117 to 138	Tunnels	56 to 58
139 to 144	Timber Structures	59
145 to 154	Piling for Foundations	59 to 61
155 to 157	Sheet Piling	61
158 to 162	Frame Trestles	61 to 62
163 to 170	Crib-Work	62 to 63
171 to 174	Specifications for Ties	63 to 64
175 to 224	Track Laying	64 to 70
225 to 234	Ballasting	70 to 71
235 to 239	Specifications for Fences	72 to 73
240 to 243	Highway Crossings	73
244 to 249	General	73 to 74
	—Standard Specifications for Steel Rails	74 to 77
	—Standard Specifications for Steel Splice-Bars	77 to 80
	—Specifications for Telegraph Line	81 to 84 G
	—Turntables	84 H
	—Track Scales	84 H
	—Buildings	84 H
	—Water Stations	84 H
	—Steel Bridges	84 H



FORM OF TENDER.

To

THE COMMISSIONERS OF THE TRANSCONTINENTAL RAILWAY.
OTTAWA.

GENTLEMEN,—

(I or we) the undersigned do hereby offer to the Commissioners to furnish all and every kind of labour, tools, machinery, implements and other plant, services and materials whatsoever necessary for the due execution and completion of, and to fully execute and complete in the most thorough, workmanlike and substantial manner on or before the first day of _____ in accordance with the specifications hereto annexed and the plans, profiles and drawings prepared and to be prepared for the purposes of the work, and upon the terms and conditions set out in the printed form of contract furnished by the said Commissioners and also attached hereto, and in every respect to the satisfaction and approval of the Chief Engineer of the Commissioners, all the work of the different kinds hereinafter mentioned set out or referred to in the said specifications, so far as the same are applicable to the classes of work hereby tendered for, and required in the construction of the following section of the Transcontinental Railway, viz:—

that is to say, clearing, close cutting, grubbing, grading, cross logging, ditching, stream and road diversions, truss, pile and trestle bridging, masonry and concrete culverts, cast iron and other pipe culverts, drains of various kinds, piers, abutments, road crossings, bridge masonry, retaining walls, embankment protection, paving, rip rap, cattle guards, telegraph line, track laying, surfacing, ballasting, water service, turntable substructures, engine houses, section houses, fences, gates and all the works below sub-grade or formation level, in fact all work necessary when the bridge superstructures are in place to complete ready for operation a single track railway, with side tracks, switches, yards, terminal yards, depot grounds, spurs and other necessary and appurtenant tracks, at and for the prices set opposite the different items in the following schedule:—

Item	Description of work	Measure	Quantity	Rate	Amount
1	Clearing.....	acre		\$ cts.	\$ cts.
2	Trees cut down outside right of way.....	each			
3	Grubbing.....	acre			
4	Solid rock.....	c. yd.			
5	Loose rock and other materials, sec. 35.....	"			
6	Common excavation.....				
7	Excavation in foundations, no coffer dams.....	"			
8	Excavation of foundation, within coffer dams.....				
9	Overhaul all materials per c. yd. per 100 ft. over 500 ft. haul.....	"			
10	Piling delivered as per engineer's bill.....	lin. ft.		0 01	
11	Piling driven.....	"			
12	Sheet piling per M. ft. b.m.....				
13	Wakefield type.....				
14	Cross-logging, 1 ft. deep with 18-in. brushwork....	acre			
15	Pole drains.....	lin. ft.			
16	French stone drains.....	"			
17	Paving in culverts.....	c. yd.			

Item	Description of work	Measure	Quantity	Rate	Amount
				\$ cts.	\$ cts.
18	Crib filling with stone.	c. yd.			
19	Hand laid rip-rap.	"			
20	Pierre Perdu random rip-rap.	"			
21	Piling out reserved stone from rock cuttings.	"			
22	Round logs in cribs.	lin. ft.			
23	Cedar mud sills, per M, ft. b.m.				
24	Framed trestles per M. ft. b.m. except stringers.				
25	Caps, walings and braces for pile trestles, per M. ft. b.m.				
26	Sawn ties and guard rails for bridges per M. ft. b.m.				
27	Stringers per M. ft. b.m.				
28	Cedar timber in culverts, 8- in. x 12-in., 10 in. x 12-in. and 12-in. x 12-in., per M. ft. b.m.				
29	Plank in highway and pri- vate road crossings, per M. ft. b.m.				
30	Timber, best quality, for cul- verts, per M. ft. b.m.				
31	Vitrified pipe culverts. — 12-in. diameter.	lin. ft.			
32	14-in. diameter.	"			
33	15-in. diameter.	"			
34	18-in. diameter.	"			
35	Reinforced concrete pipe— 12-in. diameter.	"			
36	14-in. diameter.	"			
37	16-in. diameter.	"			
38	18-in. diameter.	"			
39	20-in. diameter.	"			
40	24-in. diameter.	"			
41	30-in. diameter.	"			
42	36-in. diameter.	"			
43	42-in. diameter.	"			
44	48-in. diameter.	"			

Item	Description of work	Measure	Quantity	Rate	Amount
45	54-in. diameter	lin. ft.		\$ cts.	\$
46	60-in. diameter	"			
47	4-in. agricultural under tile drains	"			
48	Cast iron pipe culverts—				
	16-in. diameter	"			
49	18-in. diameter	"			
50	20-in. diameter	"			
51	24-in. diameter	"			
52	30-in. diameter	"			
53	36-in. diameter	"			
54	42-in. diameter	"			
55	48-in. diameter	"			
56	54-in. diameter	"			
57	60-in. diameter	"			
58	Concrete facing mixture ($\frac{1}{2}$) 2½-in. thick.	c. yd.			
59	Concrete 1-2-4 coping course 6-in. thick.	"			
60	Concrete 1-3-5	"			
61	" 1-3-6	"			
62	" 1-3-5 in arch culverts, including curbing.	"			
63	Concrete 1-3-6 in arch culverts, including curbing.	"			
64	Concrete 1-3-6 in box culverts, including curbing.	"			
65	Concrete 1-4-8 ordinary foundations including curbing.	"			
66	Concrete 1-4-8 walls of building including curbing.	"			
67	First-class masonry.	"			
68	Second-class masonry.	"			
69	Third-class masonry.	"			
70	Dry masonry	"			
71	Masonry in arch ring, including centering.	"			

Rate	Amount					
\$ cts.	\$ cts.	Item	Description of work	Measure	Quantity	Rate \$ cts. \$ cts.
		72	Track-laying in main line with ordinary frogs, switches and sidings, including light surfacing 'A' ..	mile		
		73	Track-laying in yards at terminals	"		
		74	Train hauled surfacing 'B'	c. yd.		
		75	Ballasting.	"		
		76	Ties, first-class.	each		
		77	Ties second-class.	"		
		78	Ties for switches, sawn to dimensions per M. ft. b.m.			
		79	Public road signs.	each		
		80	Mile posts, whistle posts, and road signs	"		
		81	Semaphores at stations, complete.	"		
		82	Interlocking appliances, complete, eight levers ...	"		
		83	Each additional lever.	"		
		84	Fencing.	rod		
		85	Gates.	each		
		86	Tunnels, rock section (unlined).	lin. ft.		
		87	Tunnels, lined.	"		
		88	" concrete lining ...	c. yd.		
		89	" masonry lining. ...	"		
		90	Drainage tunnels, 4 c. yds. per ft.	lin. ft.		
		91	Telegraph line.	mile		
		92	Water tanks, 50,000 galls. ...	each		
		93	Turntables.	"		
		94	Track scales.	"		
		95	Tunnel shafts.	c. yd.		
		96	Iron in drift bolts.	lbs.†		
		97	Iron in screw bolts.	"		
		98	Forged or cut spikes.	"		

Item	Description of work	Measure	Quantity	Rate	Amount
99	Cast-iron washers and separators			\$ cts	\$ cts
100	Cattle-guards (3 sections) . .	lbs.			
101	Cast-iron pile shoes	each			
		"			

It shall be understood that the Commissioners are to furnish to the Contractor all the rails and fastenings, tie plates, track bolts, spikes, and ties, either on board cars at the nearest accessible point by rail or at steamboat landing, or at a point along the line of road to be constructed, as may be provided by the special contract. All other materials required for the said construction shall be supplied by the Contractor at the schedule price for same.

It shall also be understood that the construction of steel bridges, Depots, shops, warehouses, freight and fuel sheds does not form a part of this contract and is not included in the work tendered for.

The Contractor at his own cost provides all waggon roads to reach and carry on the work.

The Contractor will be required to handle all material at his own expense, including the unloading and loading of cars, and all material must be unloaded from cars within three days after its arrival, unless special authority to the contrary is given by the Engineer. Any violation of this rule will subject the Contractor to the usual demurrage.

Accompanying this tender is an accepted cheque on the Bank for the sum of dollars, as required by the advertisement annexed hereto.

And we do hereby declare and agree that in case of refusal or failure to execute the said contract with the Commissioners, and also to furnish the approved security required, to an amount not exceeding one third of the estimated total consideration of the contract, for the faithful performance of the said contract, within ten days after the acceptance of this tender, the said cheque shall be forfeited to the said Commissioners as liquidated damages for such refusal or failure, and that all contract rights acquired by the acceptance of this tender shall be forfeited.

The full names and residence of all persons interested in this tender as principals are as follows:—

Amount
\$ cts

The undersigned further agree to conform in all respects to the terms and conditions of this tender.

Dated at _____ the _____ day of 1906.

Witness	Actual Signature of Parties Tendering.		
	Occupation.	Residence.	

INDEX OF SUBJECTS

TO FORM OF CONTRACT.

PAR.		PAGE
	Parties.	12
	General Covenant.	12
1	Meaning of word "work"	12
2	"Engineer," "Chief Engineer" defined.	12
3	Construction of clauses as covenants.	13
4	Performance by Contractor.	13
	Date of completion.	13
	Description of work	14
5	Time of the essence of the contract.	14
6	Manner of performance.	14
7	Several clauses of contract to be read together.	14
8	Commencement and prosecution of the work	15
9	Agreement not to be assigned.	15
10	Control of the work by Engineer.	15
11	Changes and extra work	16
12	Clauses of contract to apply to changes and extra work	16
13	No claim for loss of profits.	16
14	Claims for extra work to be presented at end of month.	17
15	Engineer sole judge	17
16	Prices in schedule to include all things necessary for execution and completion of work.	17
17	Foreman	17
18	Material objected to must be removed.	18
19	Machinery and plant to be the property of Commissioners during construction.	18
20	Power to take work out of Contractor's hands	19
21	Abandonment of work by Contractor	19
22	Power to employ additional men, horses, plant, etc.	19
23	Works at the risk of Contractor until completion.	20
24	Damage generally.	20
25	Stoppage of work and reduction of force.	21
26	Extension of time in case of stoppage of work	21
27	Total suspension with consent of the Commissioners.	22
28	Delay beyond period fixed shall not avoid the contract.	22
29	Contract to make prompt payment for labour	22
30	Damage by fire and insurance.	23
31	No intoxicating liquors to be sold.	23

32	Removal of temporary structures and debris.	24
33	Commissioners covenants to pay	24
34	Method of payment.	28
35	Prices for extra work.	28
36	Estimation where work not readily measured.	28
37	Engineer's monthly certificates	29
38	Monthly presentation and renewal of claims.	29
39	Progress certificates not binding	29
40	Contractor's information.	30
41	No claim for delay	30
42	No action to be brought against Commissioners.	30
	Remedy against Crown by Petition of Right	30
43	Senators and Members excluded from Contract.	30
44	Contractors to protect stakes	30
45	Notices upon Contractor.	31
46	Machinery and Plant to be made in Canada.	31
47	Fair wages clause.	31
48	Regulations, by Department of Labor.	31
49	Compliance with regulations respecting health.	31
50	Contractor to pay Medical and Sanitary expenses.	31
51	Fire regulations.	32
52	No implied contract.	32

FORM OF CONTRACT.

(RAILWAY CONSTRUCTION.)

THIS AGREEMENT made (in triplicate) the
day of _____ 190

BETWEEN:

(hereinafter called the "Contractor") OF THE FIRST PART;
AND THE COMMISSIONERS OF THE TRANSCONTINENTAL RAILWAY
(hereinafter called "the Commissioners") OF THE SECOND PART;

WITNESSETH as follows:—

General Covenant.

In consideration of the covenants and agreements hereinafter contained and to be performed by the Commissioners and of the prices hereinafter mentioned, the Contractor hereby COVENANTS AND AGREES with the Commissioners as follows:—

Meaning of word "work."

1. In this agreement the word "work" or "works" shall, unless the context requires a different meaning, mean the whole of the work and materials, matters and things required to be done, furnished and performed by the Contractor under this Contract.

Engineer, Chief Engineer, defined.

2. The words "Engineer" or "Chief Engineer" when used in this agreement or in the specifications hereunto annexed, shall mean the Chief Engineer of the Commissioners, for the time being, acting as such either directly or through the Assistant Chief Engineer, District Engineer, Division Engineer, Resident Engineer or Inspector, having immediate charge of a portion of the works limited by the particular duties entrusted to him. All instructions and directions or certificates given, or decisions made, by anyone acting under the authority of the Chief Engineer shall be subject to his approval and may be cancelled, altered, modified and changed as he may see fit. In all cases where the Contractor is dissatisfied with the decision of the Engineer or Inspector in immediate charge of the work, an appeal to the Chief Engineer may be made.

Construction of clauses as covenants.

3. Whenever in this agreement it is stipulated that anything shall be done or performed by either of the parties hereto, it shall have the same effect and be construed as if the said party had entered into a covenant with the other party to do or perform the same, and as if any such covenant on the part of the Contractor had been expressly made not only on his own behalf, but also on behalf of his executors, administrators and assigns, and that any such covenant on the part of the Commissioners had been expressly made on behalf of themselves and their successors. Whenever this agreement is entered into by more than one party as parties of the first part, the word "Contractor" shall be read "Contractors" and all pronouns in this Contract or in the specifications hereunto annexed referring to the Contractor shall be read as plural, and whenever a corporation is the party of the First Part, the said pronouns shall be read accordingly.

Performance by Contractor.

4. The Contractor shall, at his own expense, furnish all and every kind of labour, tools, machinery, implements, and other plant, services and materials whatsoever necessary for the due execution and completion of, and shall fully construct, perform, execute and complete in the most thorough, workmanlike and substantial manner in every respect, to the satisfaction and approval of the Chief Engineer, in the manner and upon the terms and conditions herein specified, and according to the specifications annexed hereto, which, for the purposes of identification, have been signed by the Contractor and the Secretary of the Commissioners, and form part of this agreement, and to the plans, profiles and drawings in the office of the Chief Engineer, and to any further plans or drawings in addition thereto which the Chief Engineer may find necessary to provide from time to time for the full and complete performance of the work; and shall, on or before the first day of _____ finally complete and deliver to the Commissioners all the works of the different kinds herein-after mentioned, set out or referred to in the said specifications hereto annexed in so far as the same are applicable to the classes of work hereby contracted for and shown on the said plans, profiles and drawings prepared, and those to be prepared, for the purpose of the work required in the construction of that portion of the Transcontinental Railway between _____

and

a distance of more or less, that is to say, the clearing, close-cutting, grubbing, grading, cross-logging, ditching, stream and road diversions, truss trestle bridging, masonry and concrete culverts, cast iron and other pipe culverts, drains of various kinds, piers, abutments, road crossings, bridge masonry, retaining walls, embankment protection, paving, rip-rap, cattle guards, telegraph line, track-laying, surfacing, ballasting, water service, turntable sub-structures, engine houses, section houses, fences, gates, and all the works below sub-grade or formation level, in fact all work necessary, when the bridge superstructures are in place, to complete ready for operation a single track railway with side tracks, switches, yards, terminal yards, depot grounds, spurs, and other necessary and appurtenant tracks; but it shall be understood that the Commissioners are to furnish to the Contractor all the rails and fastenings, tie plates, track bolts, spikes and ties, either on board cars at the nearest accessible point by rail or at steamer landing, or at a point along the line of road to be constructed, as may be provided by the special contract; however, steel bridges, depots, shops, warehouses, freight and fuel sheds do not form part of the present contract.

Time of the essence of the Contract.

5. Time shall be of the essence of this Contract.

Manner of Performance.

6. All of the said works shall be constructed of the best materials of their several kinds, and finished in the best and most workmanlike manner, in the manner required by and in strict conformity with the said specifications and the drawings relating thereto, and the working or detail drawings which may, from time to time, be furnished (which said specifications and drawings and the working or detail drawings to be hereafter furnished are hereby declared to be part of this Contract), and to the complete satisfaction of the Chief Engineer.

Several clauses of contract to be read together.

7. The several parts of this Contract shall be taken together, to explain each other, and to make the whole consistent; and if it

be found that anything has been omitted or mis-stated, which is necessary for the proper performance and completion of any part of the work herein mentioned and described, the Contractor will, at his own expense, execute the same as though it had been inserted and properly described, and the correction of any such error or omission shall not be deemed to be an addition or deviation from the works hereby contracted for.

Commencement and prosecution of work.

8. The said work shall be commenced immediately after the execution of this agreement and shall be proceeded with continuously and diligently, and under the personal supervision of the Contractor, until completed. The work shall be carried on and prosecuted in all its several parts in such a manner and at such points and places as the Engineer shall, from time to time, direct and to his satisfaction, but always according to the provisions of this agreement, and, if no direction is given, then in a careful, prompt and workmanlike manner, according to this Agreement. The Contractor shall make and keep open for use in safe condition, all crossings and approaches wherever the line of railway traverses any public or private road, and shall alter and amend such roads, crossings and approaches whenever required by the Engineer in charge of the work, during the construction of the line.

Agreement not to be assigned.

9. This agreement shall not be assigned, nor shall the said work or any part thereof be subcontracted, without the written consent of the Chief Engineer to every such assignment or subcontract.

Control of the work by Engineer.

10. The Contractor shall in all things conform to and comply with the instructions of the Engineer. All work and material shall be subject to the approval of the Engineer, and any work or material which, in the opinion of the Engineer, is not of the character, quality, dimensions or design required by the plans or specifications, or which is in the judgement of the Engineer otherwise in any manner defective, imperfect or insufficient, shall be replaced or remedied when pointed out to the Contractor by the Engineer, and shall be made good and sufficient by the Contractor, at his own expense, and to the satisfaction of the Engineer, who shall have the power and whose duty it shall be, to have any defective work or material taken out and rebuilt, or replaced at the expense of the Contractor. Any omission by the Engineer to disapprove of or reject any insufficient or imperfect work at the time of any estimate shall not be deemed an acceptance of such work or material.

Changes and extra work.

11. The Engineer shall be at liberty at any time, either before the commencement or during the construction of the works or at any portion thereof, to order any extra work to be done, and to make any change or alteration which he may deem expedient in the alignment or grade of the railway, or in the dimensions, nature, location, or position of the works, or of any part or parts thereof, in any other thing connected with the works, whether or not, such changes increased or diminish the work to be done, or the cost of doing the same, and the Contractor shall immediately comply with all written requisitions of the Engineer in that behalf, but the Contractor shall not make any change in or addition to, or omission from the works, and shall not be entitled to any payment for any change, addition or deviation, or any extra work unless such changes, addition, omission, deviation, or extra work, shall have been first directed in writing by the Engineer, and notified to the Contractor in writing, nor unless the price to be paid for any change, addition, deviation or extra work shall have been previously fixed by the Engineer in writing, and the decision of the Engineer as to whether any such change or deviation increases or diminishes the cost of the work, and as to the amount to be paid or deducted as the case may be in respect thereof, shall be final, and the obtaining of his decision in writing as to such amount shall be a condition precedent to the right of the Contractor to be paid therefor. If any such change or alteration, in the opinion of the said Engineer, shall materially affect the cost of doing the work, he shall fix or determine the price to be paid either above or below the prices hereinbefore provided to be paid for such work, as the case may be, so as to do substantial justice to both parties, and his decision as to the amount to be fixed for the price of such work shall be final.

Clauses of contract to apply to changes and extra work.

12. All the clauses of this Contract shall apply to any changes, additions, omissions, deviations, or extra work, in like manner, and to the same extent as to the works contracted for, and no changes, additions, deviations, omissions, or extra work shall annul or invalidate this Contract.

No claim for loss of profits.

13. If any change or deviation in, or omission from the works be made by which the amount of work to be done shall be decreased, no compensation shall be claimable by the Contractor for any loss of anticipated profits in respect therefor.

Claims for extra work to be presented at end of month.

14. All claims for extra or additional payment must be presented to the Engineer for allowance at the end of the month in which the work or material in respect of which the same is claimed shall have been done or furnished, and shall, if allowed by the Engineer, be included in the estimate for that month, otherwise all claims therefor shall be deemed to be absolutely waived by the Contractor and the Commissioners shall not be required to make such or any payment for or in respect of such work or material, unless, in the judgment of the Commissioners under the circumstances of the case, it is reasonable and proper to do so.

Engineer sole judge.

15. The Engineer shall be the sole judge of work and material in respect of both quantity and quality, and his decision on all questions in dispute with regard to work or material, shall be final, and no work or extra or additional work or changes shall be deemed to have been executed, nor shall the Contractor be entitled to payment for the same, unless the same shall have been executed to the satisfaction of the Engineer, as evidenced by his certificate in writing, which certificate shall be a condition precedent to the right of the Contractor to be paid therefor.

Prices in schedule to include all things necessary for execution and completion of work.

16. The prices to be paid for the different kinds of work set out or referred to in the list or schedule of Prices are intended to and shall include not merely the particular kind of work or materials mentioned in the said list or Schedule, but also all and every kind of work, labour, tools and plant, materials, articles and things whatsoever necessary for the full execution and completion ready for use of the respective portions of the works, to the satisfaction of the Engineer. And in case of dispute as to what work, labour, tools and plant, materials, articles and things, are or are not so included, the decision of the Engineer shall be final and conclusive.

Foreman.

17. A competent foreman shall be kept on the ground by the Contractor during all the working hours, to receive the orders of

the Engineer, and, should the person so appointed be deemed by the Engineer incompetent, or conduct himself improperly, he may be discharged by the Engineer, and another shall be at once appointed in his stead; such foreman shall be considered as the lawful representative of the Contractor, and shall have full power to carry out all requisitions and instructions of the Engineer.

Material objected to must be removed.

18. In case any materials, or other things in the opinion of the Engineer, which are not in accordance with the several parts of this Contract or are not sufficiently sound or are otherwise unsuitable for the respective works, shall be used for or brought to the intended works, or any part thereof, or in case any work shall be improperly executed, the Engineer may require the Contractor to remove the same, and to provide proper material or other things, or to properly re-execute the work, as the case may be; and thereupon the Contractor shall and will immediately comply with the said requisition, and if twenty-four hours shall elapse and such requisition shall not have been complied with, the Engineer may cause such materials or other things, or such work, to be removed and, in any such case, the Contractor shall pay to the Commissioners all such damages and expense as shall be incurred in the removal of such materials, or other things, or of such work, or the Commissioners may, in their discretion, retain and deduct such damages and expenses from any amounts payable to the Contractor.

Machinery and plant to be property of Commissioners during construction.

19. All machinery and other plant, materials and things whatsoever provided by the Contractor for the works hereby contracted for, and not rejected under the provisions of the last preceding clause, shall, from the time of their being so provided, become, and, until the final completion of the said work, shall be the property of the Commissioners for the purpose of the said works, and the same shall on no account be taken away, or used or disposed of except for the purposes of the said works, without the consent in writing of the Engineer, and the Commissioners shall not be answerable for any loss or damage whatsoever which may happen to such machinery or other plant, materials or things, provided always that upon the completion of the works and upon payment by the Contractor of all such moneys, if any, as shall be due from him to the Commissioners, such of the said machinery and other plant, materials and things as shall not have been used

and converted in the works and shall remain undisposed of, shall upon demand, be delivered up to the Contractor.

Power to take work out of Contractor's hands.

20. In case the Contractor shall make default or delay in diligently continuing to execute or advance the works to the satisfaction of the Engineer, and such default or delay shall continue for six days after notice in writing shall have been given by the Engineer to the Contractor requiring him to put an end to such default or delay, or in case the Contractor shall become insolvent, or make an assignment for the benefit of creditors, or neglect either personally or by a skilful and competent agent to superintend the works, then any of such cases the Commissioners may take the work out of the hands of the Contractor and employ such means as they may see fit to complete the work, and the Contractor shall have no claim for any further payment in respect of the works performed, but shall nevertheless remain liable for all loss or damage which may be suffered by reason of the non-completion by him of the works; and all materials and things whatsoever, and all horses, machinery and other plant provided by him for the purposes of the works, shall remain and be considered as the property of the Commissioners for the purposes and according to the provisions and conditions contained in paragraph 22 hereof.

Abandonment of Work by Contractor.

21. If the work to be done under this Agreement shall be abandoned, or be assigned by the Contractor without the consent of the Commissioners, or if the Contractor shall lose control of the work for any cause, excepting the acts of God or of the public enemy, or if at any time the Chief Engineer shall be of the opinion and shall so certify in writing to the Commissioners that the Contractor is wilfully and persistently violating any of the conditions or covenants of this Contract, or is not executing said Contract in good faith, the Commissioners may take the work out of the hands of the Contractor and may employ such means as they may see fit to complete the work, and all the provisions of section 20 of the Agreement shall thereupon apply and the Commissioners shall have in regard to the said work all the powers therein provided.

Power to employ additional men, horses, etc, and plant.

22. If the Engineer shall at any time consider that the number of workmen, or horses, or the quantity of machinery, or other

plant, or the quantity of proper materials, respectively employed, provided or supplied by the Contractor on or for the said works, is insufficient for the advancement thereof towards completion within the limited time, or that the works are, or some part thereof is, not being carried on with due diligence, then and in every such case the Engineer may, by written notice to the Contractor, require him to employ or provide such additional workmen, horses, or machinery or such additional or other plant or materials as the Engineer may think necessary, and, in case the Contractor shall not thereupon within three days, or such other longer period as may be fixed by any such notice, in all respects comply with such requisition, then the Engineer may, either on behalf of the Commissioners, or, if he sees fit, may as the agent of and on account of the Contractor, but in either case at the expense of the Contractor, provide and employ such additional workmen, horses, or machinery or such additional or other plant, or materials or any portion thereof, respectively as he may think proper, and may pay such additional workmen such wages, and for such additional horses, machinery or such additional or other plant and materials respectively such prices as he may think proper, and all such wages and prices respectively shall thereupon at once be repaid by the Contractor, or the same may be retained and deducted out of any sum that may then or thereafter be or become due from the Commissioners to the Contractor, and the Commissioners may use in the execution or advancement of the said works not only the horses, machinery and other plant and other materials so in any case provided by anyone on their behalf, but also all such as may have been or may be provided by or on behalf of the said Contractor.

Works at the risk of Contractor until completion.

23. The Contractor shall be at the risk of, and shall bear, all loss or damage whatsoever, from whatsoever cause arising, which may occur to the works, or any of them, until the same shall be fully and finally completed and delivered up to and accepted by the Commissioners; and, if any such loss or damage shall occur before such final completion, delivery and acceptance, the Contractor shall immediately, at his own expense, repair, restore and re-execute the work so damaged.

Damage Generally.

24. The Contractor and his agents, labourers and all employed by him or under his control, shall use due care that no person or property is injured or any rights infringed in the pro-

secution of the said work, and the Contractor shall be responsible for all damages claimable by any person or corporation whatsoever in respect of any injury to persons or property or in respect of any infringement of any right whatsoever, including damage by fire occasioned in his carrying on of the said works, or by any neglect or misfeasance or nonfeasance on his part or on the part of his servants or employees, and shall and will, at his own expense, make such temporary provisions as may be necessary for the protection of persons, or of lands, buildings, animals or other property, or to prevent the interruption of the traffic on any public or private road, or for the uninterrupted enjoyment of all rights of persons or corporations in and during the performance of the said works.

Stoppage of Work and Reduction of Force.

25. The Commissioners shall have the right to suspend operations from time to time at any particular point or points or upon the whole of the works, or to direct that the force employed on the works shall be diminished, and the Contractor, upon being requested in writing so to do by the Commissioners, shall stop the work or reduce the force, as the case may be, in accordance with such written request, and the Contractor shall have no claim for damage by reason thereof. Such writing shall be signed by the Engineer and delivered to the Contractor, or to some person on the work representing the Contractor, at least ten days previous to such stoppage of work or reduction of force.

Extension of time in case of Stoppage of Work.

26. If there be any stoppage of the said work upon the written directions of the Commissioners or if its progress be materially delayed from want of location or staking of the line or work of securing of the right of way by reason of any act or neglect of any of the Engineers or agents or employees of the Commissioners, the time herein specified for completing the said work shall be extended for a period of time equal to the time of such stoppage or delay, and the Contractor shall have no further or other claim therefor, or for or in respect of anything arising therefrom or caused thereby. The right of the Contractor to such extension shall be deemed to have been waived unless a claim therefor, stating the occasion and nature thereof, shall be made by him in writing, delivered to the Commissioners at the time of such stoppage or delay. At any time after operations have been suspended either in whole or in part, such operations may be again resumed and again suspended and resumed as the Commissioners may deem proper, and the Contractor, upon receiving written notice on be-

half of the Commissioners that the suspended operations are to be resumed, shall at once resume the prosecution of the work under this Contract and diligently carry on the same.

Total suspension with the consent of the Commissioners.

27. In case of a total suspension of all work under this Agreement without any fault, default, collusion or procurement of the Contractor for a longer period than _____ days, unless such suspension shall have been caused by the winter season or protracted rigor of weather, it shall be the duty of the Engineer to make a final estimate of the work done according to the terms of this Agreement, and to make a return thereof to the Commissioners when the amount found by the Engineer to be then due for work done, together with all percentages retained up to that time, except as herein otherwise provided, shall be paid to the Contractor.

28. No delay within or beyond the period herein specified for completing the said work shall vitiate or void this Contract, or any part thereof, or the obligation hereby imposed upon the Contractor, or shall make void or in anywise impair or affect any current or other bond or security for the performance of this contract, and all the Covenants and Agreements in this Contract and in the said Specifications contained shall apply to this Contract until the said work is finally completed and accepted, notwithstanding the fact that such work is not completed within the time specified herein for such completion.

Contractors to pay for labour promptly.

29. The Contractor shall promptly pay for all labour, services and material in or about the construction of the work and all payments for such purpose shall be made by the Contractor at least as often as payments are made by the Commissioners to the Contractor, and in the event of failure by the Contractor at any time to do so, the Commissioners may retain from any moneys due or to become due to the Contractor such amount of money as the Chief Engineer may deem sufficient to make such payments. If the Engineer reports that there is reason to fear that any such payments will not be promptly made by the Contractor, the Commissioners may pay for any such labour, services and material from any date to any date and to any amount which may be payable and may charge the same to the Contractor, and the Contractor covenants with the Commissioners to repay at once all and every sum so paid. Before final settlement is made between the parties hereto for work done and materials furnished under this Contract, the Contractor shall and will produce and furnish evidence satis-

factory to the Commissioners that the said work and any other property of the Commissioners upon which said work may have been constructed and all structures, are free and clear from all liens for labour, workmanship, materials or otherwise and that no claim then exists in respect of which a lien upon the said work or property of the Commissioners could or might attach. And the Contractor shall protect and hold harmless the Commissioners and all their property from any and all kinds of liens accruing from labour and services performed and material furnished or otherwise and any of the same in or about the said work.

Damage by fire.

30. Special precautions must be taken by the Contractor at his own expense to prevent fire; and the labourers in his employ shall be subject to the direction of the Engineer in the event of their aid being required by the Engineer to extinguish forest fires occurring in proximity to the right-of-way.

The Contractor shall conform to the fire regulations adopted by the Commissioners and also to the laws and regulations respecting fires in the different Provinces wherein the work is being performed.

Any damage by fire that may occur to buildings or structures during construction, must be made good by the Contractor, who must keep such structures fully insured until the same have been completed and accepted by the Commissioners. The operation or occupation by the Commissioners of a portion of the work, before the completion of the whole, is not to be considered as an acceptance of the same by the Commissioners. The premiums for fire insurance shall be payable by the Contractor, and the policies are to be made payable to the Commissioners or in such form as they may direct, the loss being made payable as the interest of the Contractor and of the Commissioners respectively may appear and the policy or policies shall be deposited with the Chief Engineer of the Commissioners until the completion and acceptance of the work.

Intoxicating liquors.

31. The Contractor shall not bring nor permit to be brought anywhere on or near the said works any spirituous or intoxicating liquors, and if any foreman, labourer or other employee or Contractor in the opinion of the Engineer, be intemperate, disorderly, incompetent, wilfully negligent or dishonest in the performance of his duties, he shall, on the direction of the Engineer, be forthwith discharged and the Contractor shall not employ or permit to remain upon the work any person who shall have been discharged from the said work for any or all of the said causes.

32. Upon the completion of the work, the Contractor shall remove all temporary structures, fill up all holes and trenches, level all mounds or heaps of earth that may have been dug or built by him in the execution of the work or incident thereto and shall remove and clean away all surplus and waste materials or rubbish of whatever kind remaining on or about the works, and deposit such refuse material at such place as the Engineer may designate.

Commissioners covenant to pay.

33. In consideration of the faithful performance by the Contractor of all and singular the covenants and agreements herein contained, the Commissioners hereby covenant and agree with the Contractor that they will well and truly pay him on the full completion by him of all the work herein specified within the time specified and limited for the completion thereof to the satisfaction and subject to acceptance by their Chief Engineer and subject also as herein provided, the following sums and prices, namely:—

Item	Description of work	Measure	Quantity	Rate	Amount
1	Clearing.....	acre		\$ cts.	\$ cts.
2	Trees cut down outside right of way.....	each			
3	Grubbing ..	acre			
4	Solid rock.....	c. yd.			
5	Loose rock and other materials, sec. 35 (spec.).....	"			
6	Common excavation.....	"			
7	Excavation in foundations, no coffer dams.....	"			
8	Excavation of foundation, within coffer dams.....	"			
9	Overhaul all materials per c. yd. per 100 ft. over 500 ft. haul.....	"		0 01	
10	Piling delivered as per engineer's bill.....	lin. ft.			
11	Piling driven.....	"			
12	Sheet piling per M. ft. b.m.				
13	Wakefield type ..				
14	Cross-logging, 1 ft. deep with 18-in. brushwork...	acre			

Item	Description of work	Measure	Quantity	Rate	Amount
				\$ cts.	\$ cts.
15	Pole drains.	lin. ft.			
16	French stone drains	"			
17	Paving in culverts.	c. yd.			
18	Crib filling with stone.	"			
19	Hand laid rip-rap	"			
20	Pierre Perdu random rip-rap	"			
21	Piling out reserved stone from rock cuttings	"			
22	Round logs in cribs	lin. ft.			
23	Cedar mud sills, per M. ft. b.m.				
24	Framed trestles per M. ft. b.m. except stringers				
25	Caps, walings and braces for pile trestles, per M. ft. b.m.				
26	Sawn ties and guard rails for bridges per M. ft. b.m.				
27	Stringers per M. ft. b.m.				
28	Cedar timber in culverts, 8- in. x 12-in., 10 in. x 12-in. and 12-in. x 12-in., per M. ft. b.m.				
29	Plank in highway and pri- vate road crossings, per M. ft. b.m.				
30	Timber, best quality, for cul- verts, per M. ft. b.m.				
31	Vitrified pipe culverts. — 12-in. diameter	lin. ft.			
32	14-in. diameter	"			
33	15-in. diameter	"			
34	18-in. diameter	"			
35	Reinforced concrete pipe— 12-in. diameter	"			
36	14-in. diameter	"			
37	16-in. diameter	"			
38	18-in. diameter	"			
39	20-in. diameter	"			
40	24-in. diameter	"			
41	30-in. diameter	"			
42	36-in. diameter	"			

Item	Description of work	Measure	Quantity	Rate	Amount
43	42-in. diameter	lin. ft.		\$ cts.	\$ cts.
44	48-in. diameter	"			
45	54-in. diameter	"			
46	60-in. diameter	"			
47	4-in. agricultural under tile drains	"			
48	Cast iron pipe culverts—				
	16-in. diameter	"			
49	18-in. diameter	"			
50	20-in. diameter	"			
51	24-in. diameter	"			
52	30-in. diameter	"			
53	36-in. diameter	"			
54	42-in. diameter	"			
55	48-in. diameter	"			
56	54-in. diameter	"			
57	60-in. diameter	"			
58	Concrete facing mixture ($\frac{1}{2}$) 2 $\frac{1}{2}$ -in. thick.	c. yd.			
59	Concrete 1-2-4 coping course 6-in. thick.	"			
60	Concrete 1-3-5	"			
61	" 1-3-6	"			
62	" 1-3-5 in arch culverts, including curbing. .	"			
63	Concrete 1-3-6 in arch culverts, including curbing. .	"			
64	Concrete 1-3-6 in box culverts, including curbing. .	"			
65	Concrete 1-4-8 ordinary foundations including curbing.	"			
66	Concrete 1-4-8 walls of building including curbing. .	"			
67	First-class masonry.	"			
68	Second-class masonry.	"			
69	Third-class masonry.	"			
70	Dry masonry	"			
71	Masonry in arch ring, including centering.	"			

Item	Description of work	Measure	Quantity	Rate	Amount
				\$ cts.	\$ cts.
72	Track-laying in main line with ordinary frogs, switches and sidings, including light surfacing 'A' ..	mile			
73	Track-laying in yards at terminals	"			
74	Train hauled surfacing 'B'	c. yd.			
75	Ballasting	"			
76	Ties, first-class	each			
77	Ties second-class	"			
78	Ties for switches, sawn to dimensions per M. ft. b.m				
79	Public road signs	each			
80	Mile posts, whistle posts, and road signs	"			
81	Semaphores at stations, complete	"			
82	Interlocking appliances, complete, eight levers ...	"			
83	Each additional lever	"			
84	Fencing	rod			
85	Gates	each			
86	Tunnels, rock section (unlined)	lin. ft.			
87	Tunnels, lined	"			
88	" concrete lining ...	c. yd.			
89	" masonry lining. ...	"			
90	Drainage tunnels, 4 c. yds. per ft.	lin. ft.			
91	Telegraph line	mile			
92	Water tanks, 50,000 galls. ...	each			
93	Turntables	"			
94	Track scales	"			
95	Tunnel shafts	c. yd.			
96	Iron in drift bolts	lbs.			
97	Iron in screw bolts	"			
98	Forged or cut spikes	"			
99	Cast-iron washers and separators	"			
100	Cattle-guards (3 sections) ..	each			
101	Cast-iron pile shoes	"			

Amount

\$ cts.

34. Cash payments equal to about ninety per cent. of the value of the work done, approximately made up from returns of progress measurements and computed at the prices agreed upon or determined under the provisions of this Agreement, will be made to the Contractor monthly, on the written certificate of the Engineer that the work for, or on account of which, the certificate is granted has been duly executed to his satisfaction, and stating the value of such work computed as mentioned, and upon approval of such certificate by the Commissioners; and the said certificate and such approval thereof shall be a condition precedent to the right of the Contractor to be paid the said ninety per cent., or any part thereof. The remaining ten per cent. shall be retained until the final completion of the whole work to the satisfaction of the Chief Engineer for the time being having control over the work; and within two months after such completion the remaining ten per cent. will be paid; and the written certificate of the Engineer, certifying to the final completion of the said works to his satisfaction, shall be a condition precedent to the right of the Contractor to receive or to be paid the said remaining ten per cent., or any part thereof. The Commissioners shall be at liberty from time to time to take over as completed any portion of the work certified to by the Engineer as having been completed, and the Contractor shall, thereupon, be entitled to payment in full for the work so completed in like manner, and subject to the same conditions, as if the said completed portion comprised the whole work to be done. The Commissioners shall be entitled from time to time to the use of any portion of the line of railway not theretofore accepted as completed under the terms hereof for the transportation of all steel superstructures or other materials, and no such use of any part of the said railway shall be deemed to be any acceptance or taking possession thereof.

Price for Extra Work.

35. In addition to the foregoing contract price, the Commissioners will pay to the Contractor for extra work or for work done under written orders of the Engineer, not covered by this Agreement, but done in the proper execution of this Contract, and for which prices are not named herein, the actual cost of such work, with an additional ten per cent. on the cost of labour and material for the use of tools, Contractor's plant, superintendence and profit, but such actual cost shall not exceed the reasonable market value of such labour and material as the case may be.

36. Where, in the opinion of the Chief Engineer, the work done is not, having regard to the nature and character of the work

remaining to be performed, of sufficient value to justify computation at the prices agreed upon and determined under the provisions of this agreement, it shall be competent for the Chief Engineer, in certifying the value of the work done for the purpose of such payment, to disregard the prices so agreed upon or determined, and to compute and certify its relative and proportionate value having regard to the nature and character of the work remaining to be performed; in which case the Contractor shall only be entitled to receive ninety per cent. of the value of the work done as stated in such certificate, and he shall not be paid the difference between ninety per cent. of the value of the work done as so ascertained and certified, and ninety per cent. of the value of such work according to the prices stipulated therefor under the provisions of this agreement, until such time as the Chief Engineer, by reason of the performance of additional work of greater relative value, shall certify that the Contractor is entitled to receive the same.

37. It is intended that every allowance to which the Contractor is fairly entitled will be embraced in the Engineer's monthly certificates; but should the Contractor at any time have claims of any description which he considers are not included in the progress certificates, it will be necessary for him to make and repeat such claims in writing to the Engineer within thirty days after the date of the despatch to the Contractor of each and every certificate in which he alleges such claims to have been omitted.

38. The Contractor in presenting claims of the kind referred to in the last preceding paragraph must accompany them with satisfactory evidence of their accuracy, and the reason why he thinks they should be allowed. Unless such claims are thus made during the progress of the work, within thirty days, as in the preceding clause, and repeated, in writing, every month, until finally adjusted or rejected, the Contractor shall have no claim upon the Commissioners in respect thereof.

39. The progress measurements and progress certificates shall not in any respect be taken as hindering upon the Commissioners, or as final measurements or as fixing final amounts; they are to be subject to the revision of the Engineer in making up his final certificate, and they shall not in any respect be taken as an acceptance of the work or release of the Contractor from responsibility in respect thereof, but he shall at the conclusion of the works deliver over the same in good order, according to the true intent and meaning of this Agreement.

Contractor's Information.

40. This agreement is made and entered into by the Contractor for the consideration herein expressed, solely on his own knowledge, information and judgment of the character and topography of the country, its streams, water courses and rainfalls and subject to the same, and upon information derived from other sources than the Commissioners, its officers or agents, of and respecting the nature and formation of the property upon which the said work is to be done, or the character, quantities, or location of the material required to be removed or to be used in forming the roadbed for the said railway, and the Contractor does not rely upon any information given or statement or representation made to him in connection with the said contract by the Commissioners or any of its officers or agents. The Contractor further declares and agrees that the plans, maps and profiles of the said work, furnished by the Commissioners are given only for the purpose of general information.

41. The Contractor shall not have nor make any claim or demand against the Commissioners or file a petition of right for any damage which he may sustain by reason of any delay in the progress of the work, arising from the acts of any of the Commissioner's agents, and it is agreed that, in the event of any such delay, the Contractor shall have such further time for the completion of the works as may be fixed in that behalf by the Commissioners.

42. No action shall be brought against the Commissioners upon this Agreement, or for any breach of any covenants herein contained, or for any work done or claimed to be done or for damages arising out of or by reason of this Agreement, but the remedy of the Contractor shall only be by way of Petition of Right to His Majesty the King, and it is hereby agreed that all matters of difference arising between the parties hereto upon any matter connected with or arising out of this Agreement, the decision thereof is not hereby especially given to the Engineer, shall be referred to the Exchequer Court of Canada.

43. This Contract is hereby made subject to the express condition that no Member of the Senate or of the House of Commons of Canada shall be a party to or concerned or interested in any contract with the Commissioners for the construction of any part of the Eastern Division of the National Transcontinental Railway, or shall be a shareholder in any incorporated company having any such contract.

44. The Contractors will protect, and will not remove or destroy, or permit to be removed or destroyed, the stakes, buoys and other marks placed on or about the said works by the Engineers of the works, and shall furnish the necessary assistance to correct

or replace any stake or mark which through any cause may have been removed or destroyed.

45. Any notice or other communication mentioned in this Contract to be notified or given to the Contractor shall be deemed to be well and sufficiently notified or given if the same be left at the Contractor's office or mailed in any Post Office to the Contractor or Foreman, addressed to the address mentioned in this Contract, or to the Contractor's last known place of business.

46. The Contractor shall, in connection with the whole of the said work, as far as practicable, use only material, machinery, plant, supplies and rolling stock manufactured or produced in Canada, provided same can be obtained as cheaply and upon as good terms in Canada as elsewhere, having regard to quality and price.

47. All mechanics, labourers, or other persons who perform labour for the purposes of the construction of the works hereby contracted for shall be paid such wages as are generally accepted as current for competent workmen in the district in which the work is being performed, and, if there is no current rate in such district, then a fair and reasonable rate, and, in the event of a dispute arising as to what is the current or a fair and reasonable rate, it shall be determined by the Commissioners, whose decision shall be final.

48. This Agreement is subject to the regulations now in force or which may at any time hereafter be in force during the construction of the works hereby contracted for, made under the authority of the Department of Labour and which are or shall be applicable to such works.

49. All the works carried on under this Agreement shall be subject to the provisions of the Act respecting the Preservation of Health on Public Works and to all regulations made or to be hereafter made pursuant to the said Act, or by any other lawful authority, and applicable to such works, and to any regulations which may be adopted by the Commissioners in reference to sanitation or the preservation of health on public works.

50. The Contractor shall at his own expense make adequate arrangements for the medical and sanitary supervision of all his employees, and shall for that purpose employ the necessary duly qualified medical practitioners, furnish and provide all necessary medicines, surgical instruments, and hospital accommodation to the satisfaction of the Chief Engineer.

The duties of the medical staff shall include not only the attendance on sick or injured men, but the inspection of the sanitary arrangements of all camps, dwellings and works, at least once a month, or oftener if, in the opinion of the Engineer, it is necessary.

In order to compensate the Contractor for such supervision he shall deduct from the wages of every man in his employment in the district or districts in which this contract is situated the sum of c. per month, or a proportional rate for a less period.

It shall be optional on the part of the Commissioners should they see fit so to do to take over the medical and sanitary supervision of all men, camps, dwellings and works, and should they elect so to do the Contractor shall deduct from the wages of all employees as before stated the sum of c. per month, or a proportional rate for a less period, and shall furnish to the Commissioners at the end of each month a full and correct statement of all such deductions, and the Commissioners shall subtract the total amount of such deductions from the moneys due or to become due to the Contractor on account of estimates for that month.

51. The Contractor shall observe and comply with all regulations made by any lawful authority and with all regulations of the Commissioners and instructions from the Engineer of the said works, from time to time during the construction, made or given with reference to the prevention and extinguishing of fires, and shall pay all wages and other outlay occasioned by such regulations and instructions.

52. It is distinctly declared that no implied contract of any kind whatsoever, by or on behalf of the Commissioners, shall arise or be implied from anything in this contract contained, or from any position or situation of the parties at any time, it being clearly understood and agreed that the express contracts, covenants and agreements herein contained and made by the Commissioners, are and shall be the only contracts, covenants and agreements upon which any rights against them are to be founded.

IN WITNESS WHEREOF the parties hereto have herewith caused these presents to be signed and sealed on the day and year first above written.

SIGNED SEALED AND DELIVERED,
by the Contractor in the
presence of:

.....
Signature of Contractor.

SIGNED, SEALED AND DELIVERED
by the Commissioners in the
presence of:

.....
.....

GENERAL SPECIFICATIONS

FOR THE CONSTRUCTION OF THE

National Trans-Continental Railway.

EASTERN DIVISION.

GENERAL.

Alignment.

1. The centre of the roadbed shall conform in alignment to the centre stakes.

Sub-Grade.

2. The grade line of the profile denotes sub-grade, and this term indicates the top of embankments or the bottom of excavations ready to receive the ballast.

Cross Section.

3. The roadbed shall be formed to the section, slopes and dimensions shown upon the standard drawings, or to such modifications thereof as are required to meet special conditions, as may be from time to time directed.

Width of Roadbed.

4. When finished and properly settled the roadbed shall conform to the finishing stakes and shall be of the following dimensions at sub-grade, for single track, viz.:

On embankments less than sixteen feet in height, the width shall be sixteen feet. On all other heights, the width shall be eighteen feet.

Earth excavations, twenty-two feet at formation level.

Rock excavation, twenty feet wide at formation level.

Slopes.

5. The slopes of embankments and excavations shall be of the following inclinations, as expressed in the ratio of the horizontal distance to the vertical rise:

Embankments: Earth, one and one-half to one; rock, one to one.

Excavations: Earth, one and one-half to one; loose rock, one to one; solid rock, one quarter to one.

CLEARING AND GRUBBING.

Clearing.

6. The whole, or as much of the right-of-way as the Engineer may direct, shall be entirely cleared of all trees, logs, brush and other perishable matter; all of which shall be burnt or otherwise disposed of as the Engineer may direct, unless specially reserved to be made into ties, timber or cordwood. Unless directed in writing by the Engineer, trees and brush must not be thrown on adjacent lands, but must be disposed of on the right-of-way. Trees unavoidably falling outside right-of-way, must be cut up, removed to right-of-way and disposed of.

All trees, stumps, undergrowth and brush within such clearing must be cut so that the tops of same shall not be over eighteen inches above surface of ground.

No allowance will be made for the cutting and removal of grain, grass, weeds or other annual plants on the right-of-way, the contract price of grading being assumed and understood to cover all such items.

Dangerous Trees.

7. All trees outside the limit of the right-of-way considered unsafe by the Engineer shall be cut down and disposed of as "other clearing," but no trees shall be cut down unless marked for cutting by the Engineer.

How Paid For.

8. Clearing shall be paid for by the acre where actually performed and dangerous trees cut outside the right-of-way at the specified rate per single tree.

Close Cutting.

9. On ground to be covered by embankments more than two feet high, all trees and stumps shall be cut off even with the surface of the ground and removed; the price paid for clearing covers close cutting.

Grubbing.

10. In all excavations, including borrow pits, on all ground to be covered by embankments less than two feet high, and from all ditches, drains, new channels for water ways and other places when required, all stumps and large roots must be grubbed out and removed.

How Paid For.

11. Grubbing will be estimated and paid for by the acre, when actually performed in excavation less than four feet deep, under embankments less than two feet high, and on borrow pits, ditches, drains, and new channels for water within the clearing limits, but no grubbing will be allowed on the slopes of any cutting where the depth at a distance of eleven feet on either side of the centre line exceeds four feet.

GRADING.**Definition.**

12. Under this head will be included excavations and embankments for the formation of the roadbed; all diversions of roads and streams; all borrow pits and ditches, trestles, culverts, buildings and structures, and all similar work connected with and incident to the construction of the roadbed.

Large Blasts.

13. The use of powder or other explosives in large blasts is prohibited, unless on written authority of the Engineer. In the event of wasting of rock through any such blasting the Contractor shall, if the material is required in the vicinity for the making up of embankments, of which the Engineer shall be the judge, furnish at his own cost an equivalent amount of material for such embankment. One yard of rock in place being taken to equal $1\frac{1}{2}$ yards of earth.

Responsibility for Damage.

14. All damage occasioned by blasting of rocks in the progress of the work, to any person, or any injury done by the Contractor, or those in his employ, to tracks, rolling stock, crops, fences, buildings or any property of the Commissioners, or of the adjoining land owners or occupants, shall be paid by the Contractor, or may be paid by the Commissioners and charged to the Contractor.

Public or Private Roads.

15. Whenever the line is intersected by public or private roads, the Contractor must keep open, at his own expense, convenient passing places. All dangerous places must be suitably protected by the customary warning signals, and fences when necessary.

Removal of Ice and Snow.

16. The Contractor shall, at his own cost, remove snow and ice from any portion of the work, whenever deemed necessary by the Engineer.

Haul.

17. The limit of free haul will be 500 feet. For any haul exceeding 500 feet the Contractor shall be paid at one cent per cubic yard per 100 feet. The yardage overhauled will always be measured and estimated in excavation.

In all cases the work will be estimated so as to make the least cost; that is, if necessary, earth from excavations will be estimated as having been hauled regardless of the fact that the Contractor may have preferred to waste the material from the cuts and borrow the material for the fills, but such waste and borrow must be subject to the approval of the Engineer in writing.

TEMPORARY BRIDGE OR HAULWAY.

When the Engineer or the Commissioners so directs, material will be hauled over or beyond any bridge opening, and the Contractors shall construct such temporary bridge or haulway over or around such opening, and shall receive therefor actual cost of such bridge or haulway, including labor and material, plus ten (10%) per cent. This clause does not include the construction of roadways which are to be provided by the Contractor under section 244.

EXCAVATIONS AND EMBANKMENTS.

Finishing Slopes.

18. Slopes of all excavations shall be cut true and straight, and all loose or projecting stones on the slopes must be removed.

Excess and Deficiencies of Material.

19. Excess material in excavation shall be used to widen embankments within the limit of haul. No wasting will be permitted except on written authority of the Engineer. When the quantity of excavation is insufficient to make up embankments within the limit of haul, the deficiency shall be made up by widening the cuts as directed. No borrowing will be permitted until this manner of obtaining material has been exhausted.

Reservation of Material and Payment Therefor.

20. Whenever gravel suitable for ballasting is found in a cutting, the Contractor shall, if required by the Engineer, cut a

gullet through large enough to pass a train, the remainder of the material being reserved for top dressing or ballasting. The price stipulated in the schedule for common excavation shall cover the gulleting of gravel cuts, the remainder being treated as ballast. When stone suitable for special purposes is found in a cutting, it shall, if required by the Engineer, be reserved for such special purposes, and shall be piled near at hand so as to permit convenient loading on cars. The price paid for piling and reloading such reserved stone shall be the schedule price for same.

Catch Water Ditches.

21. Catch water ditches, as required, shall be made along the tops of excavations to prevent water flowing into the cut. The location and cross section of such ditches shall be designated by the Engineer, and, if required, shall be excavated before the cuts are opened.

Tile Drains.

22. When required, four (4) inch tile drains shall be used; their location shall be as directed by the Engineer. The trenches for these tile drains must be excavated below frost line and to a true grade. The tile shall be laid with ends butted, and shall be covered with brush, grass, hay or straw, over which shall be laid gravel or other suitable material approved by the Engineer.

Provision for Settlement.

23. Whenever it is necessary to provide for the future settlement of the embankments, the height and width of the roadbed shall be increased, as directed.

Precautions on Sidehill Ground.

24. When the embankment is to be placed on steep sidehill, the surface shall be deeply plowed, stepped or trenched. If built on wet or spongy ground likely to be affected by water, the Contractor shall remove all unsuitable material, and, if required, shall underdrain the same with tile, broken stone or pole drains, as directed.

Cross-Waying.

25. When required, in swamps or muskegs, cross-ways shall be put in. They shall be built of logs of such length as shall be directed by the Engineer, and not less than six (6) inches in diameter. The depth of the log portion of the cross-way shall not be less than one foot. Said cross-way to be thatched with full limbs and brush to a depth of at least eighteen (18) inches. Such cross-way shall be paid for at the schedule price per acre.

(If the cross-logging is two feet or more in depth, with the eighteen inches of brush on top, the price will be the schedule price for two or more acres, as the case may be.) No ditches shall be made on either side of cross-ways, except by direction of the Engineer.

Embankments Against Masonry.

26. Embankments over culverts of masonry or concrete, or iron or vitrified pipe, shall be built of the best obtainable material. The portion against the sides of the culvert or pipe shall be thoroughly tamped. The portion over the arch or crown shall be deposited as loosely as possible, using all necessary care to avoid injury to the structure or pipe. The price paid for common excavation will cover the cost of doing such work.

Slopes Where Riprap is Used.

27. When directed, embankments or slopes which are to be riprapped, shall be flattened to a slope of 2 to 1.

SIDE DITCHES, BORROW PITS, ETC.

Side Ditches on Prairie.

28. On prairie or level country, where embankments are much in excess of excavation, the material to form the embankments will usually be obtained from parallel side ditches; such ditches must be made continuous, of uniform cross section and constructed to a regular grade to facilitate drainage.

Location of Borrow Pits.

29. Borrow pits shall be located in such places as will be approved by the Engineer. They shall be regular in width, unless otherwise permitted by the Engineer, and, if required, shall be connected with ditches and drained to the nearest water course.

Berms.

30. Berms of the following widths must be left between the slope stakes and edge of borrow pits or ditches: For banks under 3 feet in height, berms 6 ft. wide; For banks 3 to 10 feet in height, berms 8 feet wide; For banks over 10 feet in height, berms 10 feet wide.

Slopes of Borrow Pits.

31. The side slopes of borrow pits on the right-of-way nearest the embankment, shall not be less than $1\frac{1}{2}$ to 1, and those nearest to the outside of the right-of-way, not less than $1\frac{1}{2}$ to 1,

always leaving sufficient berm to prevent the right-of-way fence from caving, but in no case less than four feet.

Borrowing at Stations.

32. Borrowing from the side will not be allowed on either side of the centre line within eight hundred (800) feet of a station building, or a proposed station site, except where otherwise directed by the Engineer.

CLASSIFICATION.

Classification.

33. Grading will be commonly classified under the following heads: "Solid Rock Excavation"; "Loose Rock" and "Common Excavation."

Solid Rock Excavation.

34. Solid rock excavation will include all rock found in ledges or masses of more than one cubic yard, which, in the judgment of the Engineer, may be best removed by blasting.

Loose Rock.

35. All large stones and boulders measuring more than one cubic foot and less than one cubic yard, and all loose rock whether in situ or otherwise, that may be removed by hand, pick or bar, all cemented gravel, indurated clay and other materials, that cannot, in the judgment of the Engineer, be ploughed with a 10-inch grading plow, behind a team of six good horses, properly handled; and without the necessity of blasting, although blasting may be occasionally resorted to, shall be classified as "Loose Rock."

Common Excavation.

36. Common excavation will include all earth, free gravel or other material of any character whatever not classified as solid or loose rock.

Slides.

37. Material in slips, slides and subsidences extending beyond slopes in cuttings will not be paid for, unless, in the opinion of the Engineer, such occurrences were beyond the control of the Contractor and not preventable by use of due care and diligence.

Classification of Slides.

38. The classification of material from slides shall be made by the Engineer, and will be in accordance with its condition at the time of the slide, regardless of prior condition.

Measurements—How Made.

39. Measurements will usually be made in excavation, and will only be made in embankments when borrow pits of great irregularity only can be had, and where it is not practicable to measure the material in excavation. In such cases the following percentages will be deducted from the bank measurement, viz.: When the bank is made up from side casting and shovel work, 10%; wagon and wheel scraper work, 7%; slush scraper work, 5%.

FOUNDATIONS.

Dimensions.

40. Foundation pits shall be of such dimensions and excavated to such depths as are shown on the plans, and, if required, shall be excavated to such further dimensions and depths as may be necessary to insure stability of the structure to be erected, according to the instructions of the Engineer, but in no case less than is shown on plans, except by the order in writing of the Engineer.

Material Where Deposited.

41. Material excavated from foundation pits shall be deposited in the embankment, unless otherwise directed. Excavations for foundation pits, including those excavated under water, but not requiring caissons, coffer dams or other special appliances, shall be paid for at the schedule price per cubic yard excavated, such excavation to be kept dry, and the schedule price shall include the necessary bailing or pumping.

Coffer Dams and Pumping.

Foundations requiring coffer dams and pumping—excavation shall be made in the dry, that is, ample pumping capacity shall be furnished by the Contractor to insure dry work, and the price per cubic yard of excavation shall include the cost of said pumping or bailing.

Built to Standard Plans.

42. Foundations must be built strictly according to the general or special plans. Material used in their construction must, in every respect, conform with the specifications of the Commissioners.

Tamping.

43. Great care must be used to thoroughly tamp and solidify the ground in the bottom of foundation trenches for bridges, trestles, culverts, buildings or other structures. Where mud sills are used they must be settled to a permanent bearing by ramming with heavy rammers.

SPECIFICATIONS FOR PORTLAND CEMENT.

Brand.

44. No cement will be allowed to be used, except established brands of high-grade Portland cement, which have been successfully used under similar climatic conditions, and approved by the Engineer.

Weight.

45. A sack of cement shall mean 87½ lbs., four sacks making a barrel of 350 lbs.

Package.

47. The package shall be plainly labelled with the name of the brand and of the manufacturer, and must be put up in good, sound, strong barrels, well lined with paper, or in case where bags can be advantageously used, in good stout cloth or canvas, tight sacks.

TESTS.

Tests.

48. Tests may be made from time to time of the fineness, specific gravity, soundness, time of setting, tensile strength and chemical composition.

Fineness.

49. Ninety-four per cent. of the cement must pass through a sieve made of No. 40 wire Stubbs gauge, having ten thousand (10,000) openings per square inch.

Specific Gravity.

50. The specific gravity of the cement, as determined from a sample, which has been carefully dried, shall be between 3.10 and 3.25.

Soundness.

51. To test the soundness of the cement, at least two pats of neat cement mixed for five minutes with 20 per cent. of water by weight shall be made on glass, each pat about (3) three inches in diameter and one-half (½) inch thick at the centre, tapering thence to a thin edge. To be well trowelled to work out air bubbles and surplus moisture. The pats are to be kept under a wet cloth until finally set, when one is to be placed in fresh water

for twenty-eight (28) days. The second pat will be placed on the rack in "Faija bot bath tank" over the vapour of water heated to 170° Fahr. and allowed to remain there from 3 to 4 hours, after which it will be placed in the hot water, temperature 170° Fahr. where it will remain for the balance of the twenty-four hours, and then be allowed to cool. In some cases it will be found desirable to raise the temperature of the water to the boiling point 212° Fahr. Neither sample should show distortion or cracks.

Time of Setting.

52. The cement shall not acquire its initial set in less than 45 minutes and must have acquired its final set in ten hours.

The cement is considered to have acquired its initial set when the pat will bear, without being appreciably indented, a wire one-twelfth of an inch in diameter loaded with one-fourth of a pound. The final set has been acquired when the pat will bear, without being appreciably indented, a wire one-twenty-fourth of an inch in diameter, loaded to weigh one pound.

Tensile Strength.

53. Briquettes made of neat cement, after being kept in air for twenty-four hours under a wet cloth, and the balance of the time in water, shall develop tensile strength per square inch, as follows:

After seven days, 450 pounds; after 28 days, 540 pounds. Briquettes made of one part cement and three parts clean sharp sand, by weight, shall develop tensile strength per square inch, as follows:

After seven days, 140 pounds; after 28 days, 220 pounds.

Governing Test.

54. The highest result from each set of five briquettes made at any one time, is to be considered the governing test. Any cement not showing an increase of strength in the 28 days over the seven days' test, will be rejected.

Making Briquettes.

55. When making briquettes, neat cement will be mixed with 20 per cent. of water by weight, and sand and cement with 12½ per cent. of water, by weight. After being thoroughly mixed and worked for five minutes, the cement or mortar will be placed in the briquette mould in five equal layers and each layer

rammed and compressed by 30 blows of a soft brass or copper rammer, three-quarters of an inch in diameter (or seven-tenths of an inch square, with rounded corners) weighing one pound. It is to be allowed to drop on the mixture from a height of about one-half inch. When the ramming is completed, the surplus cement shall be struck off and the final layer smoothed with a trowel held almost horizontal and drawn back with sufficient pressure to make its edge follow the surface of the mould. The briquettes will be kept in air under a wet cloth until set, when they will be placed in clean, fresh water where they will remain until broken.

Chemical Analysis.

56. Manufacturers shall furnish a chemical analysis which will give the average composition of the cement supplied by them.

SPECIFICATION FOR SAND, FOR CONCRETE AND MASONRY.

Sand.

57. Sand shall be clean, sharp, of variable size of grain, largely silica and must be free of loam, mica or other deleterious substances.

SPECIFICATION FOR STONE FOR CONCRETE.

Stone.

58. Stone for concrete shall consist of hard, strong stone, granite, gneiss and allied rocks, limestone or other approved solid stone, or suitable gravel approved by the Engineer. Under no circumstances will shale, slate or similar friable rocks be used.

SPECIFICATION FOR STONE FOR MASONRY.

For Masonry.

59. Stone used for masonry shall consist of the strongest, hardest and best description of rock that can be found. Sound, hard limestone, granite, sandstone (when equal to Wallace stone) or other approved rock. Particular care will be exercised to exclude rock with "drys," shaky stratification or weak cleavage planes. All stones shall be laid upon their quarry beds, and shall be well selected, sound stone. Particular care will be taken to exclude all rock shattered by blasting. No stone shall be used for masonry or concrete until it has been approved by the District Engineer.

CONCRETE CULVERTS AND CONCRETE PIPES.

Must be Built to Standard.

60. Concrete culverts must be built in strict accordance with the standard plans, and the concrete used in their construction must strictly conform to the standard specification.

SPECIFICATION FOR CONCRETE.

Concrete for Foundations, etc.

61. Concrete will be used whenever suitable stone for masonry is not to be had at reasonable cost, it will always be used in foundations, hearting of piers, backing of abutments, small culverts, and, generally where in the judgment of the Chief Engineer, a more satisfactory work can be had than by other methods. The proportions to be used in making concrete, will vary with the nature of the work as hereinafter described. Proportions are to be by measure, the barrel being the unit, being the volume of a 350 pound barrel.

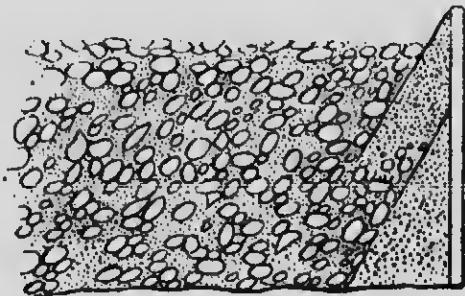
Face Concrete.

62. Face concrete will be used in all cases where the structure is exposed to the air or water, and when the body of the structure is made of concrete, it will consist of one part Portland cement, two parts sand, mixed together thoroughly while dry, when sufficient clean water will be added to bring the mortar to the consistency of rather stiff plasterer's mortar. (A ball of it taken in the hand will retain its form and the impress of the fingers.)

Machine Mixed Concrete.

63. Machine mixed concrete will be acceptable when a suitable batch mixer is used.

The face concrete will average $2\frac{1}{2}$ inches in thickness and will be placed as nearly as possible simultaneously with the mass concrete of the body of the pier or structure. An excellent plan to secure a homogeneous mass, is to deposit the face material against the form in a triangular piece, some two inches higher than the regular bed in the body of the pier, then ramming the entire mass together; see sketch:



Body Concrete for Piers, Abutments and Large Masses.

64. The concrete will consist of one part Portland cement, three parts sand, six parts broken stone, or screened gravel, the same shall vary in size, the largest pieces shall pass a 2½ inch ring, the smaller may be of the size of a lima bean.

Hand-Mixed.

The sand and cement shall be thoroughly mixed together, dry, when the stone will be added, the whole then to be well wet down and to be thoroughly mixed together with shovels.

Machine Mixed.

65. Machine mixed concrete shall be mixed in approved batch mixers and the whole of the material may be dumped into the mixers at once, providing the apportionment of material is properly made before being placed in the mixers. It is intended to secure wet concrete, the whole mass after being as above described, thoroughly mixed, will be deposited in place, in the dry. Only in exceptional cases will any concrete under any circumstances be permitted to be deposited through water, and only when the approval of the Chief Engineer has first been obtained, approving of the method to be used, and the proportions to be used. In all cases when large masses of concrete are being placed, subject to the approval of the Chief Engineer or Inspectors, large blocks of approved stone, spaced at least 12 inches apart in every direction and ten inches from the face—may be used—"plums in the pudding." In fixing the size of the stone to be so deposited, due regard will be had to the mass of the structure in general, the proper size will be found by looking at the drawing of the structure.

Depth of Layers.

66. As a general rule concrete shall not be deposited in layers of a greater depth than 12 inches, the whole layer to be well and thoroughly rammed with suitable rammers. Great care will be required to insure homogeneity in the mass, in depositing on a layer that has set or partially set, it must be thoroughly cleaned and wet down. No layer or surface will be rammed smooth. It is desirable to leave the surface as uneven and rugged as is consistent with proper compacting of the layer.

Concrete for Arch Culverts.

67. The concrete composing the arch ring will consist of one part cement, three parts sand, five parts broken stone, mixed and deposited in the manner heretofore described, except that the ring will be built up from both springing lines simultaneously.

Coping Course and Bridge Seats.

68. The concrete for same shall consist of one part cement, two parts sand, four parts finely crushed, hard selected stone, or screened gravel, the coarse particles not to exceed three-quarters of an inch and to vary in size down to that of pea size. This coping course to be at least six inches thick. Particular care shall be exacted to insure the thorough mixing and depositing of this layer, which must be placed before the mass beneath it has set. The whole surface to be floated off even and perfectly level, with a wooden float so as to insure a perfectly smooth, even surface.

Tank Foundations.

69. Concrete shall consist of the same quality as that provided for piers and abutments, except that no displacers shall be used in the walls.

Turntable Foundations.

70. Concrete shall consist of the same quality as that provided for piers and abutments.

Ordinary Building Foundations.

71. Concrete shall consist of one part cement, four parts sand, eight parts broken stone or gravel. The broken stone or gravel shall vary in size from two and one-half inches in diameter to pea size. The methods of mixing and depositing to be as heretofore described.

Filling.

72. Filling over and around culverts shall not, in any case, be done before the concrete has set. The minimum time allowed will be two weeks, but may be extended if required.

How Paid for.

73. Concrete culverts will be paid for at the specified rate per cubic yard, which will cover the cost of all labor and material incident to their construction; except the preparation of foundations, which will be paid for at the specified rate per cubic yard.

STONE MASONRY.

Pointing.

74. Joints below the ground line shall be thoroughly pointed up with a trowel as the work progresses, but need not be raked out.

Joints above the ground line shall be carefully raked to a depth of one (1) inch and pointed up with fresh mortar consisting of one part Portland cement and two parts of sand.

If the structure is subject to the action of running water, or is unusually exposed, the pointing mortar shall consist of one (1) part of Portland cement to one (1) part of sand; and the joints shall be raked out to a depth of one and one-half ($1\frac{1}{2}$) inches.

Before filling the joints be careful that they are well cleaned by brushing out all loose matter, and thoroughly wet. Apply the mortar with the trowel and calk the joints so that they will be completely filled.

If pointing is done in very hot weather great care should be taken by wetting the stones, not to allow the mortar to dry too rapidly. No pointing shall be done in freezing weather.

Laying.

75. All stone, whether face, coping or backing, shall be laid in full flush beds of mortar mixed fresh for the work in hand. In no case shall stone be allowed to touch stone; a good bed of mortar must intervene. Wedging up of stones with spalls or chips will not be allowed. No mortar shall be spread on any stone already laid until the latter has been swept off cleanly and then thoroughly wet. All stones must be free from scales, **THOROUGHLY CLEANED** by washing or otherwise, from sand and dirt, and thoroughly wet before laying. All rear joints shall be thoroughly filled with mortar and struck smooth as the wall is built up.

Quality of Stone.

76. Bridge seats, coping, arch sheeting, ring stones and ashlar or face stones, shall be sound and durable, of neat quality, free from any defects, and acceptable to the Engineer.

The backing shall consist of sound, durable, well shaped stones, free from defects that will impair their durability or strength, and shall consist of large stones that in general require handling with a derrick.

Coping and Bridge Seats.

77. The bridge seat course shall include the cut stone course upon which the superstructure rests. Each stone of the bridge seats shall be set to the exact proper height to receive the bridge, shall not be less than (20) twenty inches in thickness, two feet and six inches (2' 6") in length, and of sufficient width to extend twelve (12) inches into the back or parapet wall. Piers of seven (7) feet, or less, under bridge seat, shall have bridge seats extend across top of pier in one piece. They shall be finely bush-hammered on top to true planes, free from hollows or "winds," and

shall be laid to joints not exceeding one-half ($\frac{1}{2}$) inch in thickness. They shall be laid in full beds of mortar, as grouting will not be allowed.

Copings shall include the top course of retaining walls. They shall not be less than twelve (12) inches in thickness, three (3) feet long, and of sufficient width to extend across the entire width of the wall. Top surfaces shall be bush-hammered, with edges neatly pitched to straight lines. Joints of copings shall not exceed one-half ($\frac{1}{2}$) inch.

Arch Sheeting and Ring Stones.

78. Sheeting for arch-culverts shall consist of large sized stone, with radial beds and joints extending through the whole thickness of the arch, and hammer or point-dressed, so as to admit of one-half ($\frac{1}{2}$) inch joints. The sheeting shall be laid in continuous courses, care being taken to break joints not less than nine (9) inches, so that the arch will be thoroughly bonded. No stone shall be less than eight inches wide (8) on the intrados. Centres shall not be removed until so ordered by the Engineer.

Ring stones shall be dressed to the size and shape shown on the plans, or as directed by the Engineer, shall be laid with one-quarter inch joints, and shall bond thoroughly with the sheeting. The joints must be on truly radial lines. Faces shall be left rough and with one and one-half ($1\frac{1}{2}$) inch chiseled draft line on the curved margin.

The top of the third-class rubble masonry spandrel backing and arch shall have a coat at least one (1) inch thick of Portland cement mortar, one part of cement to four parts of sand, (1:4) on top of which apply a coating of about one-quarter ($\frac{1}{4}$) inch thick of straight run coal tar pitch. In case it is not practicable to secure the coal tar, then a richer mortar of one part cement to two parts sand (1:2) shall be used, the cost of which shall be included in the price for arch sheeting and ring stones.

First-Class Masonry.

79. **GENERAL DESCRIPTION**—First-class masonry shall be used where directed by the Engineer for abutments, piers and retaining walls, and shall consist of rock-faced ashlar work, with rough backing. Edges shall be pitched to straight lines, beds shall be parallel and joints rectangular.

The face stones shall be arranged on their natural beds as headers and stretchers in regular continuous courses, not less than sixteen (16) inches nor more than thirty-six (36) inches in thickness, and the thickness of any course shall not exceed that of the course below it.

Size of Stone.

80. Stretchers must not be less than two and one-half ($2\frac{1}{2}$) feet in length, and not less than one and one-half ($1\frac{1}{2}$) feet in width; nor in any case less in width than one and one-quarter ($1\frac{1}{4}$) times their depth. Headers must not be less than four feet long where the wall is of sufficient thickness, and at least two (2) feet longer than the width of the adjacent stretchers, not less than one and one-half ($1\frac{1}{2}$) feet in width, nor less in width than they are in depth of course. In walls of five feet or less in thickness, the headers shall extend entirely through the same.

Wing steps shall be of the full thickness of the course.

Cutting.

81. Every stone must be laid on its natural bed. All face stones must have beds well dressed, parallel and true to proper line and made to extend the full length and width of the stone. The beds and sides of the face stones must be cut before being placed in the work, so as to form joints not exceeding one-half ($\frac{1}{2}$) inch in width. No hammering on stone will be allowed after it is set; but if any inequalities occur, they must be pointed off. The vertical joints must not be less than ten (10) inches in from the face and as much more as the stone will admit. All corners and batter lines shall be run with a neat chisel draft one and one-half inches ($1\frac{1}{2}$) in width on each corner. The projections of the quarry face beyond the draft line shall not exceed four inches (4). The tops of wing steps shall be bush-hammered to a uniform surface.

Bond.

82. The masonry shall consist of headers and stretchers alternately arranged so as to thoroughly bond together the face stone and the backing; and every header shall be immediately over a stretcher of the underlying course. The stones of each course of face stones shall be so arranged so as to form a bond of at least one foot (1) with the stone of the underlying course. Particular care must be taken that the stones in the course below the coping course, coming directly under the bridge seats, are large and well bedded.

Backing.

83. The backing shall consist of large-sized, well shaped stones, laid so as to break joints and thoroughly bond the work in all directions, and leave no spaces between them more than six (6) inches in width, as nearly as possible, which space shall be filled with concrete. The courses may correspond with the face

stones, but two (2) courses shall fill up one (1) of the face, providing no stone less than six (6) inches thick be used. The broadest bed shall be laid undermost, and must have a good bearing on the stone below. Two-thirds ($\frac{2}{3}$) of the upper bed shall be of the full thickness of the course.

GENERAL DESCRIPTION.

Second-Class.

84. Second-class masonry shall consist of rock-faced ashlar work. It shall be used for such small arch-culverts, cattle passes, abutments, piers, and retaining walls as the Engineer may direct, and shall include the portion of the structure above the concrete footing courses.

Face Stones.

85. Face stones shall be of a superior quality, free from defects such as clay seams, dry-seams, weather cracks, etc., shall be rock-faced, with edges pitched to straight lines, with no projections exceeding four (4) inches; and shall have parallel beds and rectangular joints. The beds and end joints for six inches (6) back from the face line shall be point or hammer dressed to three-quarter ($\frac{3}{4}$) inch joints. No face stone shall be less than eight (8) inches in thickness, nor be in breadth less than twelve (12) inches, nor less in length than its breadth. The wing steps shall be of the full thickness of the course and the tops thereof shall be bush-hammered to a smooth surface. All corners or batter lines are to be run with a neat chisel draft of one and one-half ($1\frac{1}{2}$) inches on each corner.

Courses.

86. The stones need not be arranged in regular courses, but shall be laid level on their natural beds, arranged as headers and stretchers, with joints well broken.

Bond.

87. At least one-quarter ($\frac{1}{4}$) of the face stones shall be headers not less than three feet (3) six (6) inches long, except where the thickness of the wall is less, and extending through the wall, where the same is four feet (4) thick or less, and at least two (2) feet longer than the width of the adjacent stretcher and so distributed so as to make the best bond. The stone of each course of face stones shall be so arranged so as to form a bond of at least one (1) foot with the stone of the underlying course, except in the case of "fillers" in broken range work.

Backing.

88. The backing shall be well-shaped, sound, durable stone, not less than six (6) inches thick, at least one-half of which ($\frac{1}{2}$) shall measure three (3) cubic feet, to be laid close in full mortar beds and joints, well bonded with face stones, and with joints well broken. All spaces between backing and face stone are to be filled with concrete.

GENERAL DESCRIPTION.**Third Class.**

89. Rubble masonry shall be used for such small culverts, depot foundations and piers, pipe ends, spandrel backing for arches, and other structures as the Engineer may direct.

General Conditions.

90. All stones shall be sound and durable, with the face stones free from clay seams, dry seams, weather cracks, etc. They shall be laid on their natural beds, and shall be sufficiently large to make a good, well bonded, strong job; shall be laid in the most substantial manner, and with as much neatness as this description of work will admit.

Dimensions of Stone.

91. No stone shall be used in the face that has more height than breadth of bed. No spalls shall be permitted in the bed joints.

Bond.

92. The whole wall shall be bound together with headers occupying one-fifth ($\frac{1}{5}$) of the area of the face of the wall, front and rear, extending through walls three (3) feet or less in thickness.

Coursing.

93. The walls shall be levelled up and coursed longitudinally at least every four (4) feet in height.

Stone to be Roughly Squared.

94. Stone shall be roughly squared on joints, beds and faces laid so as to break joints, and in full mortar beds.

Vertical Spaces.

95. All inside vertical spaces shall be flushed with mortar and then packed full of spalls. No liquid grouting shall be allowed.

All rear joints shall be thoroughly filled and struck smooth as the wall is built up.

Angles.

96. Selected stone shall be used at all angles, and shall be neatly pitched to true lines, and laid on hammer-dressed beds.

Box Culverts.

97. All stone box culverts shall have a water way at least $2\frac{1}{2} \times 3$ feet. The side walls shall not be less than two (2) feet thick, and shall be built of sound, durable stones, not less than six (6) inches thick, laid in cement mortar (usually one part Portland cement to three parts sand.) The walls must be laid in true horizontal courses, but in case the thickness of the course is greater than twelve (12) inches, occasionally two (2) stones may be used to make up the thickness. The walls must be laid so as to be thoroughly bonded, and at least one-fourth ($\frac{1}{4}$) of the area of each course must be headers going entirely through the wall. The top course must have one-half ($\frac{1}{2}$) its area of through stones, and the remainder of this course must consist of stone going at least one-half of the way across the wall from the inside face. The face stones of each course must be dressed to a straight edge, and pitched off a true line. All of the coping stones of head walls must be throughs, and must have the upper surfaces hammer-dressed to a straight edge, and the face pitched off to a true line with margin draft.

Cover Stones.

Cover stones shall have a thickness of at least twelve (12) inches for opening of three feet, and at least fourteen inches for opening of four feet; and must be carefully selected, and must be of such length as to have a bearing of at least one (1) foot on either wall.

The beds and vertical joints of the face stones for a distance of six inches (6) from the face of the wall, shall be so dressed as to require a mortar joint not thicker than three-fourths of an inch ($\frac{3}{4}$). Joints between the covering stones must be not wider than three-fourths ($\frac{3}{4}$) of an inch, and the bearing surface of cover stones upon side walls must be so dressed as to require not more than one (1) inch mortar joint.

Paving Stones.

The paving shall consist of flat stones, set on edge, at right angles with the line of the culvert, not less than twelve (12) inches deep, and shall be laid in cement mortar.

Turntable Masonry.

98. Shall consist of second-class masonry as hereinbefore described.

Foundation and Walls for Water Tank Wells.

99. Shall consist of third-class masonry as hereinbefore described.

100. The circular walls to be parallel and true to line and to consist of third-class masonry as hereinbefore described.

CAST IRON CULVERT PIPE.**Quality Cast Iron Culverts.**

101. They shall be cast vertically in dry sand moulds and dried cores and shall be coated with Dr. Smith's solution, while hot, and shall be of the highest quality of metal in use for pipe founding purposes.

Dimensions.

102. The size, length, thickness and weight shall be as in the following table:

DIAMETER	LENGTH	THICKNESS	WEIGHT
16 inches	12	$1\frac{1}{8}$	1380
18 "	12	$\frac{7}{8}$	1800
20 "	12	$\frac{7}{8}$	2200
24 "	12	$\frac{7}{8}$	2400
30 "	12	$\frac{7}{8}$	2900
36 "	12	$\frac{7}{8}$	4100
36 "	6	$\frac{7}{8}$	1800
42 "	8	$\frac{7}{8}$	3200
48 "	6	1	3000
54 "	6	$1\frac{1}{8}$	3900
60 "	6	$1\frac{1}{8}$	4850

SALT GLAZED DOUBLE STRENGTH VITRIFIED PIPE.**Salt Glazed Pipe Culverts.**

12 inches	} Shall be of well burnt vitrified clay, with a smooth, salt, glazed surface, true to diameter, straight, in three feet (3) lengths, with bell and spiggott.
14 "	
15 "	
18 "	

Sub-Soil Drains.

103. Agricultural tile, four inches (4) in diameter, shall be straight, well burnt, true in diameter, and free from cracks or checks.

Reinforced Cement Pipe Culverts.

104. The concrete shall consist of one part cement, two parts sand, five parts one and one-half inch diameter broken stone or screened gravel of same dimensions. The reinforcing metal to be in accordance with the best modern practice, and both the mixing of the concrete, the method of reinforcing, the size of the pipe, length and all other matters in connection therewith, to be approved by the Engineer.

Masonry Ends.

105. All to have concrete or masonry ends for protection walls.

Foundations for Pipe.

106. Great care must be taken to get a firm and uniform bearing for pipe culverts, and material for bedding the pipe must be free from stone.

Joints.

107. The joints of all pipe, both iron and vitrified, shall be well and thoroughly packed, as shown on standard plans. Cast iron pipe of 30 inches diameter and over, shall be stayed and crowned by wedging in struts as shown on standard plans. The struts shall not be removed until sufficient settlement has taken place in the bank. In general, this will not be less than one year from the completion of the filling.

Foundations for Vitrified Pipe.

108. Where vitrified pipe is laid in hard ground the bottom of the trench in which the pipe is to lay should be rounded to fit the pipe as nearly as possible, so that the pipe may rest easily and solidly in its bed. If the ground is soft, a foundation satisfactory to the Engineer shall be made.

RIP-RAPPING.**Rip-Rap Stone to be Angular.**

109. When required by the special or general plans, as ordered by the Engineer as protection against the action of water, hand laid or "Pierre Perdu Random" of angular stones shall be laid or placed on embankments, or about foundations

or at the ends of culverts or masonry or other places, as directed. Boulders shall not be used unless ordered in writing by the Engineer.

Size.

The largest procurable stones shall be used, and they shall in no case measure less than one cubic foot. The largest stones shall be placed at the bottom and where the current is the greatest. They shall be laid as closely together as possible so as to avoid large openings.

Trenches.

110. When required, a trench shall be excavated at the base of the slope to such a depth as will insure a solid foundation, and all sand or ice or other perishable matter will be removed.

General Dimensions.

111. In general, the depth of the rip-rapping at the base shall measure three feet at right angles to the slope and shall gradually taper off to a depth of two feet; but shall, if ordered by the Engineer, be built of any required thickness.

How Paid For.

112. Rip-rapping shall be paid for at the specified rate per cubic yard in place, for each class.

PAVING.

Where Used.

113. When required by the general or special plans, as ordered by the Engineer, the ends of masonry or concrete culverts, vitrified or iron pipe, the bottom of wooden culverts, and other places, shall be protected by paving.

Description.

114. Paving will be made of flat stones set upon their edges, the longest dimensions at right angles to the waterway in such manner as to leave the least possible space between them, and of such size as to reach through the entire depth of the pavement.

Undermining.

115. Great care must be taken at the ends of any piece of paving to make it secure, so it cannot be undermined or cut by water flowing underneath it. The lower end must receive special care to prevent this undermining. A concrete apron shall be provided when required by the Engineer.

How Paid For.

116. Paving will be paid for at the specified rate per cubic yard in place.

TUNNELS.**How Built.**

117. All tunnels must be built in strict accordance with the general or special plans.

Lining.

118. Tunnels which do not require lining shall be excavated to the section and dimensions shown on the standard plans for "Tunnels, Rock Section."

Timber, Concrete or Masonry Lining.

119. Tunnels which require lining with timber, masonry or concrete, shall be excavated to the section and dimensions as shown on the standard plans for "Tunnels, Timbered Section."

Dangerous Rock.

120. The Contractor must take out at his own expense all loose or shattered rock which is loose or likely to become so.

Rock Tunnels.

121. Rock tunnels shall be excavated to one foot below profile grade and refilled to such grade with rock spalls or other approved material.

Explosives.

122. The Contractor must limit the use of explosives to avoid unnecessarily shattering the roof or sides of the tunnel, or damaging the lining, and the Engineer shall have the right to restrict the use of such explosives.

Situation of Lining.

123. Where lining is required, such lining must conform to the standard or special plans.

Lining.

124. Lining will be made with timber, concrete or masonry, as ordered.

Timber Lining.

125. Where timber is used, it shall be red or yellow fir, cedar, oak, tamarac, or white or yellow pine, as may be designated, and must be of the best description of the kind required. It must be hewed or sawed square and to proper dimensions. It must be

free from all loose, large or unsound knots, sap, sun cracks, shakes, wanes or other imperfections or defects that would lessen its durability.

Lagging.

126. The lagging shall be in pieces 4 inches thick and 6 inches wide.

How Paid For.

127. Timber used for lining shall be paid for at the specified rate per thousand feet B. M. of timber left in completed structure.

Timber Price Includes Iron Required.

The price paid per thousand feet will include the cost of the necessary iron and the total cost of all labor incidental to putting the timber and iron in place.

Use of Concrete or Masonry.

128. Where concrete or masonry is used for lining, such concrete or masonry must be built in strict accordance with the section and dimensions as shown on the standard plans or special plans, and must conform strictly with the specifications for concrete or masonry.

Protection of Lining from Blasting.

129. The Contractor will be required, at his own expense, to protect the lining when in place from the effects of blasting, by covering with slabs or otherwise, as most convenient. He will also be required to replace, at his own expense, any lining shattered or crushed in any stage of the work by blasting or other operations of his own.

Cavities Behind the Lining.

130. In lined tunnels the Contractor must, at his own expense, fill in any cavities behind the lining, resulting from any cause whatever, so that the roof and sides will in all cases have a firm bearing on the lagging or lining. In timbered tunnels this packing shall consist of timber or stones. When the lining is constructed of concrete or masonry the packing shall consist of stones closely packed together.

Portals.

131. Material in portals will be paid for at the same rate as lining in the tunnel.

Niches or Recesses.

132. Niches or recesses for the protection or convenience of railway employees shall be constructed when ordered.

Drainage.

133. Drainage shall be carefully executed as shown upon the standard or special plans or as directed, and all drains or sources of water shall be treated as directed, the cost of which shall be included in the price per lineal foot of excavation.

Shafts.

134. The number, location and dimensions of all shafts shall be shown as on the plans, or as directed, and the specified price per cubic yard for shaft excavation shall cover all material contained between the surfaces of the ground and the cross section of the tunnel, as shown on the standard or special plans, and the cost of all labor and material incidental to their construction.

Wells or Sumps.

135. All wells or sumps necessary for the completed tunnel shall be made as directed and shall be paid for at the same rate per cubic yard as shaft excavation.

Tunnel Excavation.

136. Tunnel excavation shall be paid for at the specified rate per lineal foot under cover for "Tunnels, Rock Section" and "Tunnels, Timber Section." The specified rate per lineal foot shall cover the whole cost of labor and material incidental to the excavation of the tunnel and the haul and deposit of the material in the embankments at the ends of the tunnel, as directed.

Net Section.

137. No allowance shall be made for material taken out beyond the theoretical section shown on the standard or special plans.

Dimensions.

138. The standard dimensions of the tunnel may be varied if found necessary, or desired. If the area of the section be not thereby increased no extra allowance shall be made to the Contractor on account of such change. If the area of the section be not thereby increased or diminished, the specified rate per lineal foot shall be increased or diminished in proportion.

TIMBER STRUCTURES.

To be Built to Plans.

139. All structures must be built in strict accordance with the general or special plans.

Quality.

140. All timber either sawed or hewed must be of the best description of the kind required. As directed by the Engineer, it must be sawn or hewn square and to proper dimensions. It must be free from all loose, large or unsound knots, sap, sun cracks, shakes, waness or other imperfections or defects which would impair its strength or durability.

Quality and Description.

141. The quality and description of timber used for each portion of the structure must be as specified. Stringers must be of long leaf yellow pine, douglas fir, white pine, or other timber approved by the Engineer.

Clearing Ground.

142. Before commencing work on any wooden structure, the ground must be entirely cleared of logs, brush and trees for the whole of the width of the right-of-way, and during the progress of the work all pile or timber ends, chips and brush, shall be cleared from around the structure and burnt, or otherwise disposed of as the Engineer may direct.

Framing.

143. No shimming will be permitted. Great care must be taken in framing all timber structures, to insure a perfect fit at all joints. At the completion of the work they must be left in perfect line and surface.

Erection of Bridges Ahead of Track.

144. Bridges must be erected ahead of the track in all cases, but the maximum distance beyond the end of track to which the Contractor shall be required to haul timber or other material without extra payment, shall not exceed four miles.

PILING FOR FOUNDATIONS.

Timber.

145. Piles may be of oak, rock elm, douglas fir, tamarac, cedar, hemlock, jack pine and spruce, to be straight, or reasonably straight-grained, sound, live timber, free from all bad knots, wind shakes or other defects. All diameters must be measured inside the bark, which shall be removed before delivery

Dimensions.

146. Standard dimensions for piling are as follows: Minimum lengths in feet 15, 20, 25, 30, 35, 40, 45, 50, over 50; Diameter in inches at small end, 10, 9, 9, 9, 9, 9, 8, 8, over $7\frac{1}{2}$. Butt diameter to be not less than 12 inches or more than 20 inches at five feet from butt.

Lengths.

147. Piles will only be accepted and paid for in lengths which are multiples of five.

How Driven.

148. Unless otherwise directed, all piles shall be sharpened and driven small end down, capped with a suitable iron ring, as the Engineer may direct, to prevent spreading or brooming while driving, and, if required, shall be shod with an iron shoe of approved design.

Driving.

149. Piles shall be driven until the fall of a hammer weighing 2,000 pounds, with a clear fall of 25 feet or an equivalent blow, causes a penetration not to exceed 10 inches under the last ten blows, or to such further limit as directed.

Broken Piles.

150. Should any piling be broken in the driving, another sound pile shall be driven alongside to replace it.

Batter Piles.

151. All piles must be driven vertically unless otherwise shown on the plan. Batter piles will be driven at the batter shown on the plans.

Extra Lengths—How Attained.

152. When necessary to drive to great depth and piles of adequate length cannot be obtained, one shall be spliced on top of another. The first pile having been driven as far as practicable, it shall be cut off square to receive the following pile, which also must be squared and set on top on the one already driven, using a dowel pin 1 inch diameter in the centre, extending 8 inches at least into each pile. The piles shall if required, be fastened together by an approved splice.

How Paid For.

153. Piling will be paid for under the heads of "Piling Delivered" and "Piling Driven."

Engineer's Bill of Lengths Only Will be Paid.

"Piling Delivered" will include piling furnished by the Contractor at bridge site, as ordered by the Engineer, and will be paid for by the lineal foot, but any lengths in excess of those ordered by the Engineer shall not be paid for.

"Piling Driven" will be paid for at the specified rate per lineal foot in the finished structure, which will include all work of any kind in connection therewith.

Rings and Shoes—How Paid For.

154. Rings shall not be paid for, but shoes will be paid for at the specified rate per shoe.

SHEET PILING.

Points.

155. Sheet piles shall be cut at the end, so as to form a point at one side and not in the middle, and when driven this point shall be kept next to toe pile previously driven to insure contact, and when required by the Engineer, the Wakefield type of piling shall be used.

Broken Joints.

156. Where there are two or more rows of sheet piles, they shall be driven with broken joints.

How Paid For.

157. Sheet piling will be paid for at the specified price per thousand feet B. M. left in the work.

FRAME TRESTLES.

Cedar for Mud Sills.

158. Mud sills not less than ten inches thick, must in all cases, be made of sound, live cedar, unless permitted in writing by the Engineer. The use of timber other than cedar for this purpose is objectionable, and will be permitted only in case of necessity.

Sills and Posts Not to be Buried.

159. Care must be taken not to bury with earth, any portion of the sills or posts. All pits for trestle foundations must have free drainage.

Adjustments.

160. All adjustments in height of structures, due to settlement or other causes, must be rectified by jacking up from the bottom to the proper elevation.

Timber Culverts.

161. Timber culverts will be made of sound, hewed or sawn timber, and in accordance with standard plans. They shall be of such dimensions as shall allow the insertion of cast iron or other approved pipe and in accordance with the direction of the Engineer. They will be estimated and paid for at the specified price per thousand feet B. M.

Paving.

162. The bottom of timber culverts will be paved to the top of the mud sills with angular rock, when it can be obtained from the adjacent cuttings, otherwise with large boulders if the Engineer so elects.

CRIB-WORK.**Timber Cribs.**

163. Timber cribs used in support of trusses shall be built of timber in quality similar to that used in trestles and according to plans furnished by the Engineer, and to his approval, both as to workmanship and material.

How Paid For.

They will be estimated and paid for by the thousand feet B. M., according to bills furnished by the Engineer. Iron contained in them will be paid for by the pound. They will be filled in with angular stones of a size and character satisfactory to the Engineer, which shall be placed in the cribs without damage to any portion of the structure, and as the Engineer may direct.

Round Timber Cribs for Protection Work.

164. Round timber cribs shall be built in accordance with general plans furnished by the Engineer, under his direction and to his entire satisfaction, both as to size of material, quality and workmanship.

Quality.

165. Timber must be good, sound, live red or yellow fir, cedar, pine or tamarac, or other wood approved by the Engineer, free from wind shakes, loose or rotten knots, and all other kinds of decay.

How Paid For.

166. Timber in cribs will be paid for by the lineal foot, all pieces being estimated only as to length, the varying thickness not being taken into consideration, but only the best available timber must be used as directed by the Engineer.

How Filled.

167. Timber crib-work required for sustaining or protecting embankment, or for deflecting or changing the channels of stream will, preferably, be filled with angular rock obtained from excavations adjacent, and care must be taken to work the largest stones to the face. If, however, no suitable material to fill them is found in the excavation, it will be obtained by horrowing.

Trenches.

168. When required, a trench shall be excavated at the base of the slope to such a depth as will insure a solid foundation, and all sand or ice or other perishable matter shall be removed.

Cribs to be Close-Fitting.

169. When cribs are built for protection against the action of the waves or the impinging of running streams, the Engineer may require the logs to be flattened on two sides, or he may resort to any other method of making the cribs tight and close-fitting, that in his judgment may be necessary.

Quality of Materials.

170. The materials for all timber structures must be such as are approved by the Engineer, and the workmanship must be of the best kind to secure the full bearing and strength of the materials, and must in all respects be satisfactory to the Engineer.

SPECIFICATIONS FOR TIES.**First-Class Ties.**

171. Ties shall be made of the best description of timber tributary to the line of the railway.

Quality and Description of Timber.

172. All timber shall be cut from live, sound trees, free from large or loose knots, wind shakes or other defects which would impair its durability or strength. The following kinds of timber will be accepted in the order named; oak, cedar, tamarac, douglas fir, pine, hemlock, (black spruce only to be used under the approval of the District Engineer.)

Size.

173. They shall be hewn or sawn with two parallel straight faces, reasonably straight, exactly eight feet long, full seven inches thick and seven inches face. Sawn square at the ends.

Second-Class Ties.

174. They shall be of the same quality and description of timber, but the size may be as follows: Length, exactly eight feet; thickness, full six inches; face, six inches. These shall not be used in main tracks.

TRACK LAYING**Track Laying.**

175. Track laying will include all work of loading, unloading and handling material; laying the main track, spurs, turnouts, wyes, and other permanent tracks, frogs, switches, rail braces, tie plates, crossings, etc.; laying and spiking plank of road crossings, setting all track markers or signs, and such necessary light curbing with material from the sides, cutting down or filling up the inequalities of the roadbed as will allow of the passage of trains, without damage to rail or rolling stock, until the proper ballasting is performed.

Second-Class Ties.

176. Second-class ties may be used in sidings and spurs if sound and otherwise fit for use.

Bark.

177. Bark must be removed from all ties before they are placed in the track.

Number of Ties.

178. Sixteen (16) ties will be used to each 30 foot rail length or eighteen (18) ties to a 33 foot rail on tangents and two additional ties on curves, as directed by the Engineer.

How Spaced.

179. Ties of full size and uniform standard should be used for joint and shoulder ties. Shoulder ties should be placed not more than 10 inches distant from joint ties; the remaining ties must be spaced evenly between shoulder ties. All ties must be laid at right angles to the track.

Lining.

180. The ends of cross ties in single track must be lined true on the south and east side of the track.

Adzing.

181. Cross ties must never be notched, but if necessary must be adzed, in order to maintain a true uniform bearing, for the tie plate or the base of the rail.

Tie Picks.

182. In moving ties with a pick, the point should be stuck into the side of the tie and not into the face.

Switch Ties.

183. Sawn ties must, except under written authority of the Engineer, be used for all permanent switch turnouts, cross-overs and railway crossings and acute angles; and placed, spaced and lined in exact conformance with the standard plans.

Bolting and Drilling.

184. All joints must be full bolted and rails drilled, when necessary. Nuts must be tightened as required until entirely satisfactory to the Engineer.

Compromise Splices.

185. When rails of different weights or sections join each other it must be done with compromise splice bars, made to fit the different rail sections and bolt holes.

Spiking and Slots.

186. A spike must be driven in each slot, inside and outside of rails and angle bars, except on bridges or trestles where spiking in slots, or against the ends of angle bars, or in any way anchoring the rails to the bridge, is prohibited.

Nuts.

187. The nuts of all track bolts shall be placed on the outside of the rails.

Broken Joints.

188. Track shall be laid with broken joints on the main lines and important branches where new steel is used; or minor branch lines where re-laying steel is used.

Variation of Joints.

189. When track is laid with broken joints, they must not vary more than eighteen (18) inches from the middle of the opposite rail.

Short Rails.

190. Short rails shall be used in inside line of rails on curves of large central angle, in order to maintain position of joints near centre of outer rail.

Cross Spiking.

191. Track must be fully spiked, using the system commonly known as "Cross Spiking," with the inside and outside spikes driven on opposite sides of the centre of the tie. They must be set as far apart as the face and character of the tie will permit.

Vertical Spiking.

192. Spikes must be set one-half of their own width from edge of rail and driven vertically to full bearing on base of rail, and they must be kept in this position. Driving sloping spikes or giving them a final lateral blow to close the spikes against the rail, is forbidden.

Use of Gauge.

193. The track gauge must always be used when spiking.

Boat Spikes.

194. Boat spikes 8 inches x $\frac{3}{8}$ -inch shall be used for spiking frog and switch blocking to ties.

Elevation.

195. The elevation of the outer rail will be as ordered and great care must be used to keep the elevation uniform. The grade line must be maintained along the inner rail and the elevation obtained by raising the outer rail. The full elevation of outer rail must not be continued beyond the end of the central curve, but shall decrease uniformly, as the Engineer directs, generally one-half inch in 30 feet, along the easement curve to the tangent point, where both rails should be level.

Elevation on Non-Spiral Curves.

196. For curves not having ends eased the full elevation should be extended to the end of the curve where it should run out gradually on a tangent to a level with the inner rail, by reducing the elevation of the outer rail one-half inch to 30 feet rail length, except in cases where tangents are too short to permit.

Level Rails.

197. On all tangents the tops of the rails must be level with each other, except the approaches to the curves that are not eased.

Track Level.

198. The track level must be used when surfacing either curves or tangents.

Gauge.

199. Gauge of track must be exactly and uniformly as prescribed.

Standard Gauge.

200. The standard gauge is 4 feet 8 $\frac{1}{2}$ inches. Extra width of gauge on account of curvature must be given, as follows:

On curves of 3 and 4 deg.	$\frac{1}{8}$ inch
" 5 and 6 deg.	$\frac{1}{4}$ inch

Extra Width of Gauge.

201. The extra width of gauge should be given by the inside rail and uniformly decreased on the easement curve, from point of central curve to point of tangent.

Handling Rails.

202. Rails must be handled carefully before being put in the track, and must be uniformly supported after being placed there. Skids will invariably be used whenever necessary to unload them into piles. In all cases the greatest care must be used to avoid injury to rails by dropping them on hard substances or uneven surfaces.

Drilling.

203. When necessary to make holes in rails for bolts they must be drilled with proper tools furnished for that purpose.

Brand.

204. The position of the brand on the rail is immaterial whether right or left, inside or outside, but its position must be uniform in the same line of rails. When new rails are being laid different brands must not be mixed.

Curving.

205. All rails for curves over 3 deg. must be separately curved by an approved rail bender before being placed in the track. The sledging or dropping of rails on ties to curve them, is forbidden.

Care in Curving.

206. Particular care must be given to insure uniform curvature of the rails throughout their length, in accordance with the following table:

For 2 deg. curve, 30 ft.....	$\frac{1}{2}$ in.	33 ft.....	$\frac{5}{8}$ in.
" 4 " "	$\frac{3}{4}$ "	"	$\frac{7}{8}$ "
" 5 " "	$1\frac{1}{4}$ "	"	$1\frac{3}{8}$ "
" 6 " "	$1\frac{1}{2}$ "	"	$1\frac{3}{4}$ "

Expansion.

207. Proper allowance must be made for expansion according to temperature of rail when being laid. When the average thermometer reading on 30 or 33 feet rails, is:

90 deg. Fah., give.....	0 in. expansion space
70 to 90 deg. Fah., give.....	$\frac{1}{16}$ "
50 to 70 " "	$\frac{1}{8}$ "
30 to 50 " "	$\frac{3}{16}$ "
10 to 30 " "	$\frac{1}{4}$ "
10 to 10 " "	$\frac{5}{16}$ "

208. Rails must not be bumped together when being laid.

Iron Shims.

209. Proper expansion must be secured by using iron shims, according to the above specifications, except where track is laid on a steep grade, when sawn wooden shims of proper thickness will be provided. They must be left in place until track is fully spiked, bolted and anchored, and then removed.

Tie Plates.

210. Where tie plates are ordered they must be placed in pairs one on each end of the tie. The end with the widest margin must be placed on the outside of the rail.

Spiking on Tie Plates.

211. On tangents only two spikes should be used in each plate; on curves use three or four as required. In general, on curves less than 6 degrees, three spikes should be used and on sharper curves, four spikes.

How put On.

212. Tie plates must be forced into the ties before trains are allowed to run over them.

Rail Braces.

213. Rail braces must be used on guard rails and switches as shown on the standard plans, and on curves where ordered.

Switches.

214. Switches must be put in track in accordance with the standard plans. No stub switches shall be allowed in main line or cross-overs.

Stub Switches.

215. At all stub switches, bridle rods must be confined between two ties, placed six inches apart.

Lead Rails.

216. Lead rails in all turnouts must be curved separately with the rail bender before being laid. The narrow places between rails at frogs, guard rails and switches, must be filled with standard wooden blocks.

Difference in Weight of Rails.

217. When rail of a heavier pattern is used in the main track than in the side track, the main track pattern must extend as far up the side track at least as far as the switch ties extend.

Derailing Switches.

218. A standard derailing switch, stop block or safety switch must be placed at the clearance point of all sidings when ordered.

Guard Rails.

219. Guard rails must be placed at frogs, switches, and when ordered, on sharp curves and bridges.

Track Markers.

220. All standard track markers and signs must be placed strictly in accordance with the standard plans.

Lengths Paid For.

221. Only such sidings, spurs, turnouts, wyes, and other track, and such lengths thereof as ordered, will be estimated and paid for.

Surfacing.

222. The track will be surfaced with material obtained from the side, or with train hauled material as directed by the Engineer, but in no case shall the bottom of the ties be raised more than 3 inches above sub-grade.

Surfacing from the Side.

223. "Surfacing 'A'" will include all work of procuring surfacing material from side ditches or other places where allowed, putting under the track, surfacing, lining and all other work incident to the preparation of the track for running work trains, where material for surfacing is obtained from the side.

Surfacing from Train Hauled Material.

224. "Surfacing 'B'" will include the cost of all train hauled material under the track, surfacing, lining and all other work incident to the preparation of the track for running work trains where surfacing is done with train hauled material other than ballast. The surfacing must be kept up with the track laying as far as possible. All new tracks must be brought to surface and tamped up before it is run over. Rails that are damaged by reason of neglect on the part of the Contractor will be replaced at his expense.

BALLASTING.

Ballasting.

225. Ballasting will include the loading, hauling, unloading alongside of track, and transportation of all material hauled by train for the purpose of ballasting the track, said material to be duly accepted as ballast by the Engineer. Ballast shall consist of broken stone, gravel, or coarse sand, approved by the Engineer.

Ditches.

226. All road and surface ditches will be left clear and free, so open and extended as to conduct water freely and quickly from the roadbed, and all side ditches must be left unobstructed.

Slopes.

227. The side slopes and ditches must be left neat and smooth, and free from all rubbish, materials and obstructions.

Material for ballasting must not be taken from the slopes of embankments.

Land.

228. The land for ballast pits and approaches thereto will be furnished by the Commissioners and approved by the Engineer. In selecting land for this purpose, a preference will always be given to those points where the best material can be procured within a reasonable distance as determined by the Engineer.

During the working of any pit, should the material be found unfit for ballasting, the Engineer shall compel the Contractor to close such pits and open others.

Distribution of Ballast for Embankment.

229. The surface of the ballast pits shall be stripped of soil where such exists, and no material whatever shall be placed on the roadbed but good, clean gravel. The maximum size of gravel must not be greater in diameter than three (3) inches.

First Lift.

230. Material sufficient for the first lift of six inches shall be delivered along the track, the track must then be raised so that there will be an average depth of six inches below the ties and the ballast must be well packed and tamped under and around them. As the raising proceeds, the end of the lift shall extend on not less than three rail lengths, and before trains are allowed to pass over the inclined portion of the track it must be made solid to prevent bending the rails or twisting the joints.

Second Lift.

231. Precisely the same method shall be followed in making the second lift, so as to secure a uniform thickness of twelve (12) inches under the ties. The ballast shall fill the space between the ties full and shall conform to the section shown in the standard drawing.

Tamping.

232. Three feet at each end of each tie shall be thoroughly tamped, the centre of the tie to be loosely tamped. After this lift, the track shall be centred, lined, topped, surfaced, and trimmed off to the proper form and width.

Ballasting to be Kept Up to Track Laying.

233. The ballasting must be kept up to the track laying in so far as is possible. All new track must be brought to surface and tamped up before it is run over. Rails that are damaged by reason of neglect on the part of the Contractor to comply with these requirements will be replaced at his expense.

Lining.

234. when the surfacing and ballasting is completed, the track must be in perfect line, surface and gauge, and must be so maintained by the Contractor until it is accepted by the Commissioners for operation. This contemplates a second adjustment of track to line and grade after it is settled under traffic.

SPECIFICATION FOR FENCES.

Fence.

235. The fence shall consist of an approved wire fencing at least 4 feet 6 inches high properly fastened to cedar posts as hereinafter specified, with suitable staples, stretched and built in a workmanlike manner in every respect, and to the satisfaction of the Engineer. The posts shall be of sound, live cedar, 5 inches in diameter at the top, 8 feet 6 inches long, reasonably straight, with limbs and knots dressed off smoothly, with the bark removed. Such posts shall be spaced sixteen and one-half feet centre to centre, placed three feet six inches depth in the ground, and thoroughly tamped. At all road crossings, farm crossings, jogs in the line of the fence and at intervals not exceeding 20 rods braced panels shall be built, having the posts spaced eight feet apart and a diagonal brace piece at least five inches in diameter at the top shall run from a point about one foot below the top of the end post to a short distance above the ground line of the adjacent post. The diagonal piece shall be notched into the post and be thoroughly nailed thereto with 6-inch wire nails. The posts for brace panels shall be carefully selected, not less than 8 inches diameter at the top and ten feet long. They shall be set four feet in the ground and firmly tamped. After the wire is strung the top of the post shall be cut true to a line and at an angle of 45 degrees for the purpose of shedding rain.

Posts in Shallow Soil.

236. When the depth of the soil will not admit of the post hole depth called for above, "1" or "A" frame posts as shown on the standard drawing will be required. The foot of such posts shall be loaded with stones to prevent overturning.

Fences at Highway Crossings.

237. At all highway crossings the fence shall be turned into the cattle guard and the posts shall be spaced equally apart to enable a sixteen foot 1 inch x 8 inch board to be nailed at the end and the centre, to the top of the posts. Such board being on edge and the line of boards to run from the fence to the cattle guard.

Gates.

238. Gates shall be made of an approved pattern of gas pipe frame and strung with wire, and to include suitable hinges and fastenings.

Cattle Guards.

239. Cattle guards shall be placed at all highway crossings. They shall be of an approved pattern, made in sections with provision for removal without injury to the guard. The form and section to be approved of by the Engineer.

HIGHWAY CROSSINGS.**How Graded.**

240. The approaches to the rail level shall be graded on a slope not more than five (5) per cent, with width of roadway, of not less than 20 feet.

Signals.

241. At each highway crossing at rail level, there shall be placed a sign-board with the words "Railway Crossing" on both sides of the board, (and in the Province of Quebec, in French also the words, ("Chemin de Fer")) in black letters on white ground, six inches in height. The board is to be framed into a cedar post firmly bedded at least four feet in the ground and at least 13 feet above the surface of the road.

Planking.

242. The highway at rail level shall be planked with three inch plank, packed up with 2 x 3 inch pieces resting on the ties. To have four planks 12 inches wide between the rails and two outside, one on either side level with the track. For single track crossing, to be 20 feet in length, at right angles to the direction of the highway.

Farm Crossings, How Graded.

243. The approaches shall be graded to insure a good roadway. When practicable, not to exceed a five (5) per cent. approach, the width of the finished road to be twelve feet. The crossing to be planked with four planks, two inside and two outside the rails. The interim space between the inner planks to be thoroughly packed with hard stones or gravel.

GENERAL.**Contractor to Provide Wagon Roads, Etc.**

244. The Contractor, at his own cost, must provide all wagon roads to reach and carry on the work; he must also provide all tools of every description and all supplies required for the prosecution of the work.

Prices for Buildings to Include Foundations.

245. The prices paid for buildings, water tanks, turntables, depots, section houses, and other standard structures, shall be as per schedule of prices.

Material to be Furnished by the Commissioners.

246. Unless otherwise provided, it shall be understood that the Commissioners are to furnish the Contractor all the rails, fastenings, tie plates, track bolts, spikes, ties and steel bridges, either on board cars at the nearest accessible point by rail or at steamer landing, or at points along the line of road to be constructed, as may be provided by the special contract.

Other Materials.

247. All other materials required for the construction of the Railway shall be supplied by the Contractor at the schedule price for same.

Contractor to Handle all Material.

248. The Contractor will be required to handle all material at his own expense, including unloading and loading in cars, and all material must be unloaded from cars within three days after its arrival, unless special authority to the contrary is given by the Engineer. Any violation of this rule will subject the Contractor to the usual demurrage.

Hauling.

249. Whenever cross-ties, piles, timber or other material is delivered along the line of the road, the Contractor must do the hauling to put in place, including the loading in cars when necessary.

STANDARD SPECIFICATIONS FOR STEEL RAILS.

How Made.

1. (a) Steel may be made by the Bessemer or open-hearth process.

(b) The entire process of manufacture and testing shall be in accordance with the best standard current practice, and special care shall be taken to conform to the following instructions:

(c) Ingots shall be kept in a vertical position in pit-heating furnaces.

(d) No bled ingots shall be used.

(e) Sufficient material shall be discarded from the top of the ingots to insure sound rails.

Chemical Properties.

2. Rails of the weight per yard specified below shall conform to the following limits in chemical composition, namely, 80 lb.

Rails.

Carbon.....	0.43-	0.53
Phosphorous shall not exceed.....	0.10	
Silicon shall not exceed.....	0.20	
Manganese.....	0.80	3

PHYSICAL PROPERTIES.**Physical Properties.**

3. One drop test shall be made on a piece of rail not more than 6 feet long, selected from every fifth blow of steel. The test piece shall be taken from the top of the ingot. The rail shall be placed head upwards on the supports and the sections shall be subjected to the following impact tests; eighty pound rails per yard, to have height of drop, eighteen feet. If any rail break when subjected to the drop test two additional tests will be made of other rails from the same blow of steel, and if either of these latter tests fail, all the rails of the blow which they represent will be rejected; but if both of these additional test pieces meet the requirements all the rails of the blow which they represent will be accepted. If the rails from the tested blow shall be rejected for failure to meet the requirements of the drop test, as above specified, two other rails will be subjected to the same tests, one from the blow next preceding, and one from the blow next succeeding the rejected blow. In case the first test taken from the preceding or succeeding blow shall fail, two additional tests shall be taken from the same blow of steel, the acceptance or rejection of which shall also be determined as specified above, and if the rails of the preceding or succeeding blows shall be rejected, similar tests may be taken from the previous or following blows, as the case may be, until the entire group of five blows is tested, if necessary. The acceptance or rejection of all rails from any blow will depend upon the results of the tests thereof.

Heat Treatment.

The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass, the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws of six inches for 85 and 6½ inches for 100-lb. rails, and no artificial means of cooling the rails shall be used between the finishing pass and the hot saws

Test Pieces and Methods of Testing.

4. The drop test machine shall have a tup of 2,000 lbs. weight, the striking face of which shall have a radius of not more than five inches, and the test rail shall be placed head upwards on solid supports 3 feet apart. The anvil block shall weigh at least 20,000 pounds and the support shall be a part of, or firmly secured to, the anvil.

Analysis.

5. The Manufacturer shall furnish the Inspector, daily, with carbon determination of each blow, and a complete chemical analysis every twenty-four hours, representing the average of the other elements contained in the steel. These analyses shall be made on drillings taken from a small test ingot.

Finish.

6. Unless otherwise specified the section of rail shall be the standard recommended by the American Society of Civil Engineers, and shall conform, as accurately as possible, to the template furnished by the Commissioners, consistent with paragraph No. 7, relative to the specified weight. A variation in height of $\frac{1}{64}$ -inch less and $\frac{1}{32}$ -inch greater than the specified height will be permitted. A perfect fit of the splice bars, however, shall be maintained at all times.

Weight.

7. The weight of the rails shall be maintained as nearly as possible, after complying with paragraph No. 6 to that specified in contract. A variation of one-half of one per cent. for an entire order will be allowed. Rails shall be accepted and paid for according to actual weights.

Lengths.

8. The standard length of rails shall be 33 feet. Ten per cent. of the entire order will be accepted in shorter lengths, varying by even feet, down to 27 feet. A variation of quarter inch in length from that specified will be allowed. The ends of rails shorter than 33 feet, are to be painted green.

Holes for Splice Bars.

9. Circular holes for splice bars shall be drilled in accordance with the specifications of the purchaser. The holes shall accurately conform to the drawing and dimensions furnished, in every respect, and must be free from burrs.

Straightening of Rails.

10. Rails shall be straightened while cold, smooth on head, sawed square at ends, and prior to shipment, shall have the burr, occasioned by the saw-cutting, removed, and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

Branding.

11. The name of the maker, the month and year of manufacture, shall be rolled in raised letters on the side of the web, and the number of the blow shall be stamped on each rail.

Inspection.

12. The Inspector representing the purchaser shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture, prior to shipment.

No. 2 Rails.

13. Rails that possess any injurious physical defects, or which for any other cause are not suitable for first quality or No. 1 rails, shall be considered as No. 2 rails, provided however, that rails which contain any physical defects which seriously impair their strength shall be rejected. The ends of all No. 2 rails shall be painted white in order to distinguish them. No. 2 rails shall not in any case be laid in the main line.

Guarantee.

14. The Manufacturer shall furnish the Commissioners with a five (5) year guarantee, of approved form.

STANDARD SPECIFICATIONS FOR STEEL SPLICE BARS.**How Made.**

1. Steel for splice bars may be made by the Bessemer or open-hearth process.
2. Steel for splice bars shall conform to the following limits in chemical composition:

Carbon shall not exceed.	0.15	per cent.
Phosphorous shall not exceed.	0.10	"
Manganese,	0.30 to 0.60	"

Physical Qualities.

3. Splice bar steel shall conform to the following physical qualities:

Tensile strength, pounds, per square inch 54,000 to 64,000.

Yield point, pounds, per square inch, 32,000.

Elongation, per cent. in eight inches shall not be less than 25.

Test Specimen.

4. (a) A test specimen cut from the head of the splice bar shall bend 180° flat on itself without fracture on the outside of the bent portion.

(b) If preferred the bending test may be made on an unpunched splice bar, which, if necessary, shall be first flattened and shall then be bent 180° flat on itself without fracture on the outside of the bent portion.

Physical Properties.

5. A test specimen of 8-inch gauged length, cut from the head of the splice bar, shall be used to determine the physical properties specified in paragraph No. 3.

Tensile Specimen.

6. One tensile specimen shall be taken from the rolled splice bars of each blow or melt, but in case this develops flaws, or breaks outside of the middle third of its gauged length, it may be discarded and another test specimen submitted therefor.

Bending Test.

7. One test specimen cut from the head of the splice bar shall be taken from a rolled bar of each blow or melt, or if preferred the bending test may be made on an unpunched splice bar, which, if necessary, shall be flattened before testing. The bending test shall be made by pressure or by blows.

Yield Point.

8. For the purpose of this specification, the yield point shall be determined by the careful observation of the drop in the beam or halt in the gauge of the testing machine

Analysis.

9. In order to determine if the material conforms to the chemical limitations prescribed in paragraph No. 2 herein, analysis shall be made of drillings taken from a small test ingot.

Rolling.

10. The angle bars must be rolled to shape in strict conformity with standard templets, which shall be made for each of the several sizes and sections of bars required from the dimensions shown on drawings or blue prints of same, which will be furnished by the Commissioners; particular attention will be required that the height of the bars, as determined by the finishing angles, is also at the proper distance from the centre line of the rail section, as shown by the standard drawings of same furnished by the Commissioners; as the proper fit of the bars to the rails depends on this feature, its strict observance will be insisted upon. The bars must be rolled with a smooth surface finish and be free from cracks or fins on the edges.

Before cutting up into splice bar lengths the hot bars must be run upon proper hot beds and be held in position to insure cooling as uniformly as possible.

Branding.

11. The name or initial of the maker, and date and year of rolling, also the designation of the particular rail section to which they apply, as per standard drawings, are to be rolled upon the bevel of each bar in such position as not to be under the heads or butts of bolts.

Shearing.

The knives of the shears must be well and properly shaped, and at all times kept sharp, and must shear clean, without tearing, cracking or leaving "fins" on the bar.

Punching.

In all bars, the entire number of holes must be punched at one operation, and so as not to cause "swelling" in the edges of either of the finishing angles, and must be punched clean and smooth, leaving no cracks or burrs. The punches must be set accurately in line and centre, spaced in strict conformity with the standard templets made from drawings furnished by the Commissioners. The punches and dies must at all times be kept sharp and in good order. Punching one hole at a time is strictly prohibited, and plates so punched will be rejected.

Notching.

All the spike "notches" in any one bar must be punched at one operation and must strictly conform, both in size and shape, with the dimensions shown on standard drawings of same.

Inspection.

All bars must be straight and free from kinks in any direction.

Tests and Inspections of Templets with Drawings.

12. The Inspector representing the Commissioners must compare all "cold templets" and gauges to see that they are in strict conformity with the dimensions given by the standard drawings for any section, and any templet or gauge not so conforming must be readjusted or replaced, and any heat of steel or splice bar found by him not to be in conformity with every requirement of this specification shall be rejected by said Inspector. All tests and inspections shall be made at the plant of the manufacturers, prior to shipment.

SPECIFICATIONS FOR STANDARD TELEGRAPH LINE.

Poles.

All poles shall be of live green cedar, sound, straight, cut square at both ends, all knots trimmed close, thoroughly peeled to within five feet of the butt, and must not be less than seven (7) inches in diameter at small end, inside the bark.

Pole-Line.

Shall be of twenty-five (25) foot poles for body of line and longer lengths at railway and highway crossings, through railway yards, and so proportioned to the contour of the country, that the wires may be strung without abrupt changes of level.

Poles shall be placed generally at six (6) feet inside of the right-of-way limit, except on such cuttings and embankments that the nature of the formation renders such position unsuitable, but no pole shall be set at a distance less than twelve (12) feet from the nearest rail. In wooded country, poles may be set thirty feet from the nearest rail.

Under no circumstances shall a pole or poles be set in a position that would interfere with a clear view of railway signals from station windows or engine cabs. In locating the line on straight sections, poles shall be placed at equal distances of one hundred and fifty (150) feet, and in curves at one hundred and thirty-five (135) feet.

Through station yards and at all railway and highway crossings poles not less than thirty (30) feet in length shall be set. All poles shall be set perpendicularly, except on curves or corners where they can be leaned *slightly* against the strain.

Holes shall be dug large enough to admit the poles without hewing, and shall be full size at the bottom, to permit of the use of iron tampers.

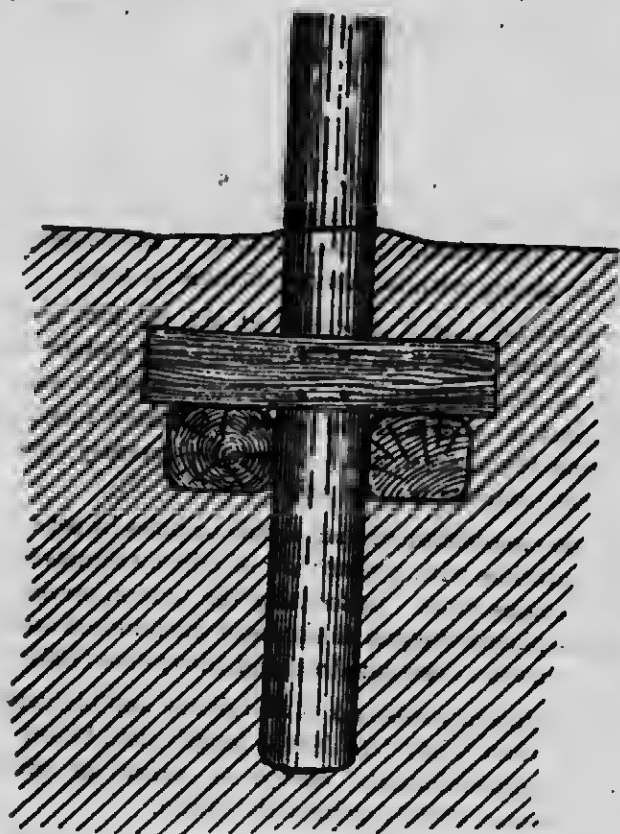
When the pole is placed in position, one shovel only shall be used in filling the hole, and two tampers used in packing the filling continuously until the hole is filled. The soil must be piled above the surface and firmly packed around the pole.

All poles shall be set beneath the surface of the ground as follows:—

25 and 30 foot lengths	5 feet
35 and 40 foot lengths	6 feet
45, 50 ft. and longer lengths	7 feet

Where solid rock is encountered, deduct one foot from the above scale of depths.

In wet or marshy locations, or where it is necessary to set poles on slopes, they should be set at a greater depth than previously indicated, to prevent the possibility of being blown over by wind or lifted by frost.



SIDE VIEW OF POLE WITH FOOT FOR VERY SOFT MARSH. CRIBBING MADE OF PIECES OF OLD POLES. LENGTHS AS REQUIRED.

In soft or marshy ground, weather braces shall be framed with a foot to hold the poles from being pushed in to the ground. The size of the foot shall be determined by the strain the brace is designed to hold.

Instead of the foot, it will be permitted, when the ground is so soft as to prevent proper tamping, to fill in with stone, and brace the pole in four directions.

Poles to be set in quicksand shall be tapered from a point eighteen (18) inches above the butt to the butt, by the use of an axe, as piling is pointed before being driven.

Flitting of Poles.

The top of the pole shall be roofed, and shall have not less than two (2) gains four and a quarter ($4\frac{1}{4}$) inches wide by three-quarters ($\frac{3}{4}$) of an inch deep, spaced twenty-two (22) inches on centres. The centre of the upper gain shall be ten (10) inches from the apex of the pole roof.

The direction of the apex of the "roof" shall be at right angles with the cross-arm, or parallel to the wires.

Braces.

All braces shall be of cedar and set at a uniform distance from the butt of the pole, at least six (6) feet wherever possible, the top of the pole brace shall be just below the bottom gain, and shall be fastened with lag bolts.

Line Props.

Line props shall be used on every fifteenth (15th) pole, placed parallel to the line in alternate positions. Props shall be of cedar and not less than fifteen (15) feet in length, set in the ground from two to three feet, not less than six (6) feet from the butt of line pole, and shall be fastened with lag bolts.

Anchors.

Through station yards, and for one thousand (1,000) feet each side and beyond stations, braces must not be used; anchors only shall be used.

All excavations for anchor logs shall be five (5) feet deep wherever practicable. If impracticable to obtain this depth on account of the nature of the ground, the excavation may be made not less than three and one-half ($3\frac{1}{2}$) feet deep. Anchor logs must be of cedar.

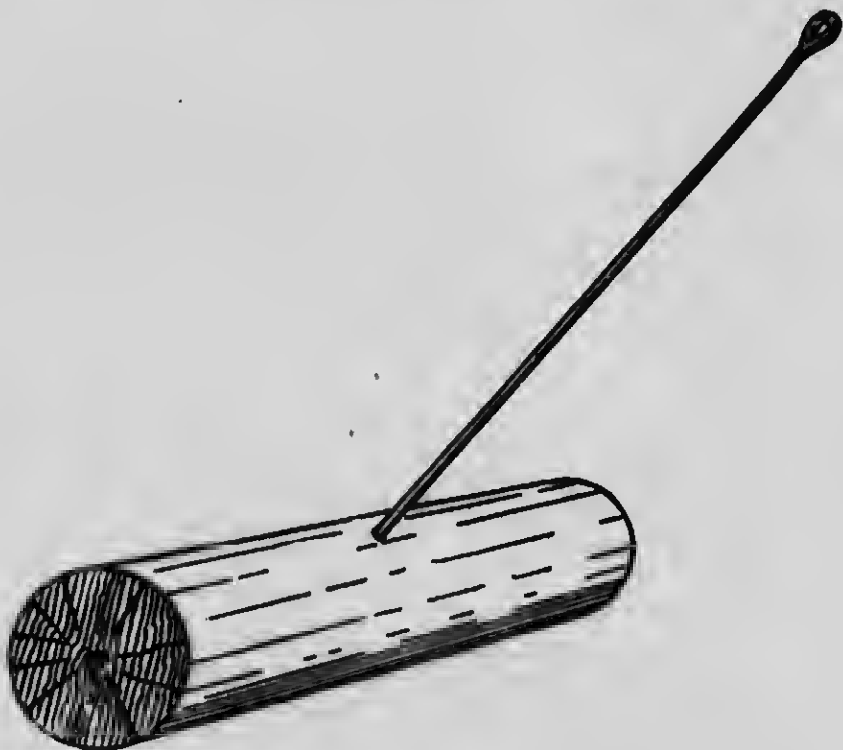
Curves.

All poles in curves shall be re-inforced by anchor guys or props.

Crossings.

At all crossings, the poles on each side shall be double armed

and of such height as to allow the arm in the bottom gain to carry the wires at least twenty-five (25) feet above the surface of the ground or rail level.



ANCHOR 5 FEET LONG, MADE OF CEDAR, DEPTH TO SUIT
REQUIREMENTS.

Capacity of Line.

The line shall have an ultimate capacity for two (2) six (6) pin cross-arms and twelve (12) wires.

Guy Wires.

Guy wires shall be of seven (7) strands No. thirteen (13) gauge steel rope. The ends of the guys shall be wrapped twice around the pole immediately under the lowest gain, and fastened to the guy rod. The ends of the wire shall be fastened by standard two bolt clamps. Under no circumstances shall guy wire be secured to the anchor beneath the surface of the ground.

In locating anchor guys, the distance from the butt of the pole shall not be less than one fifth ($\frac{1}{5}$ th) the length of the pole. In exposed places, guy wires must be protected by a guard of wood or iron pipe.

Mechanical Anchors.

An approved mechanical device may be substituted for the anchor log and iron guy rod.

Office Poles.

Office poles shall be securely guyed to keep the strain of the wires off the office fixtures and buildings.

Placing Cross-Arms.

When planting poles, the cross-arms must face each other on every alternate span between poles.

Cross arms must be secured by two (2) seven (7) inch lag bolts, and two (2) iron braces as required by standard specifications. Braces to be fastened to the back of the cross-arms.

Long Spans.

At all crossings with spans of two hundred (200) feet and over, poles on either side shall be equipped with double arms.

Lightning Arresters.

A lightning rod of number eight (8) iron wire shall be securely attached to every tenth (10th) pole, with one and one-half (1½) inch staples. The rod shall project three (3) inches above the top of the pole to within one (1) foot of the hutt, where four (4) spiral turns will be made around the pole, and a hand coil of about six (6) feet fastened to the bottom. All office and cable poles shall be equipped in the same manner, except that two (2) number eight (8) iron twisted wires shall be used.

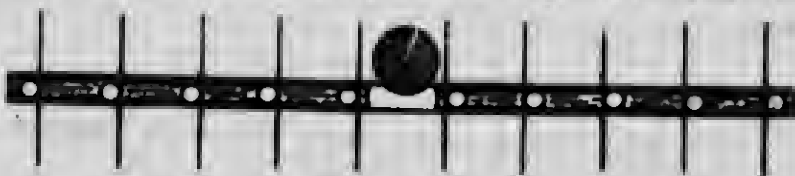
Wires.

The first wire erected shall be No. eight (8) gauge, iron, weight 400 pounds per mile. The second wire shall be No. 6 gauge, iron, weight 574 pounds per mile.

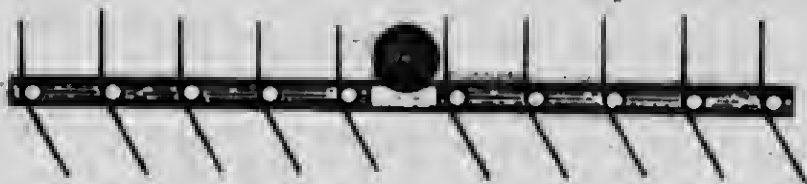
Erection of Wires.

String wires so as to avoid kinking and other damage, and remove all tags. Wires shall be tied on the side of the insulator nearest the pole, except on curves or corners where it is necessary to place it on the opposite side so that the strain will be against the insulator. (See sketch.)

The ties must have three (3) turns on each side of the insulator and the ends bent in and pointed toward the groove in the insulator.



STRAIGHT LINE LOCATION OF WIRES ON INSULATOR.



CURVE OR CORNER LOCATION OF WIRE ON INSULATOR.

Joints.

When connecting iron wires, first clean the wire, then use pliers and connectors, giving not less than five (5) turns on each side of the joint. All joints must be soldered.

Equipment.

The contractor shall furnish all the batteries, instruments, switchboards and all necessary equipment, in every particular, to secure a first-class installation, having due regard to the requirements of the service, the whole to be done in a workmanlike manner, fully guaranteed, and to the satisfaction of the Chief Engineer.

Copper Wires.

Extraordinary care must be taken to prevent kinking or other damage. When stringing copper wire, draw out by a rope over the cross-arm the full length of the coil, then pull up with approved grips. The wire shall then be tied throughout, the Grips being left on until the next coil is strung, the joint made, wire pulled up, and Grips attached in the same manner.

No mechanical device except approved Grips shall be used in pulling up copper wire.

Tying.

Copper wire shall be tied by hand. One side of the tie shall pass over the line wire, making five (5) complete turns, the other side shall pass under the line wire, also making five (5) complete turns.

Ties shall be of annealed copper wire, of the same gauge as line wire, not less than twenty (20) inches in length, and must be well stretched before being used. After making the full number of twists on the line wire, turn the ends back against the line wire toward the insulator. These ends shall not be cut.

Joints.

Copper wires shall be connected by approved sleeves. Each sleeve shall have three (3) complete twists. Two pairs of approved splicing clamps only shall be used in making the joints.

After the joint is made, the end of the wire shall be bent at right angles to the joint and cut close to the side of the sleeve.

String all wires so that the sag between poles shall be as given in the following table, making the allowance indicated for the temperature and length of span.

Sag in all line Wire.

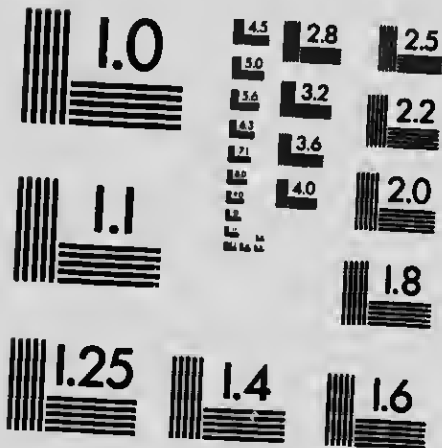
SAG EXPRESSED IN INCHES.

Temperature	Span		
	135 ft.	150 and 165 ft.	200 ft.
30 below.	3½	4½	8
10 "	3½	5	9
10 above.	4½	5½	10½
30 "	5½	6½	12
60 "	7	9	15½
80 "	8½	11½	18½
100 "	11	14	22½



MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc

1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

Specifications for Material.

Specifications for Galvanized Iron Telegraph Wire.

1. The wire to be soft and pliable, and capable of elongating 15 per cent. without breaking, after being galvanized.
2. Extreme tensile strength is not required, but the wire must not break under a less strain than two and one-half times its weight in pounds per mile. Tests for tensile strength will be made by direct application of weight, or by means of a lever, at the option of the inspecting Officer.
3. Tests for ductility will be made as follows:—The piece of wire will be gripped by two vises, six inches apart, and twisted. The full number of twists must be distinctly visible between the vises on the six inch piece. The number of twists in a piece of six inches in length must not be less than 15.
4. The weight per mile for different sizes of wire will be:—For No. 6 gauge, 574 lbs.; No. 8 gauge, 400 lbs.; No. 9 gauge, 330 lbs.; or, as near these figures as practicable. A variation of not more than two per cent. will be allowed.
5. The electrical resistance of the wire in Ohms per mile at a temperature of 68 degrees Fahrenheit, must not exceed the quotient arising from dividing the constant number 5000 by the weight of the wire in pounds per mile. Example:—The mileage resistance of a wire weighing 400 pounds per mile, should not exceed $5000 \div 400 = 12.50$ Ohms.
6. The wire must be cylindrical and free from scales, inequalities, flaws, sand splits and other imperfections and defects. Each coil must be warranted not to contain any weld, joint or splice whatever in the rod before drawn. All wire to be "killed" or stretched about two per cent. before delivery.
7. It is desired to obtain the wire in coils, all of one piece. If this cannot be undertaken, the contractor may tender for a supply of wire with two pieces only to the coil, joined by the ordinary twist joint and carefully soldered or electrically welded. It should be stated in the tender whether there will be one or two pieces in each coil. The length of the wire in each coil shall be as follows:—No. 8 B.W.G., or smaller, one-half mile; No. 6 B.W.G., one-third mile. A variation of not more than three per cent. from the above will be allowed. The grade of iron wire to be used is that known as "Extra Best Best."
8. The wire must be well galvanized, and capable of standing the following tests:—The wire will be immersed in a saturated

solution of sulphate of copper at 68 degrees Fahrenheit, and permitted to remain one minute, and then wiped clean. This process will be performed four times. If the wire appears black after the fourth immersion, it shows that the zinc has not all been removed and that the galvanizing is well done, but if it has a copper color, the iron is exposed, showing that the zinc is too thin.

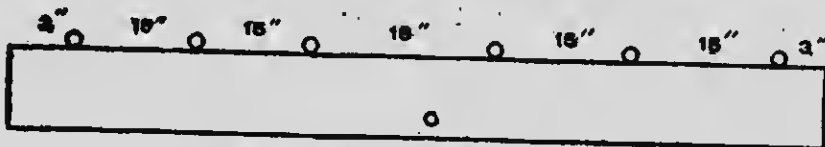
Specifications for Hard Drawn Copper Line Wire.

Each coil must be drawn in one continuous length without joints. The wire must be cylindrical and free from scales, flaws, inequalities and other imperfections. It must have a tensile strength to sustain three times its weight in pounds per mile; must withstand without breaking, thirty twists in six inches, and must be capable of elongation $1\frac{1}{2}$ per cent, before breaking; must permit of being wrapped a number of times about its own diameter, and unwrapped without showing signs of breaking.

Its electrical resistance per mile in international Ohms at 68 degrees Fahrenheit, must not exceed the quotient arising from dividing the constant 912 by its own weight in pounds per mile.

Cross-Arms.

The cross-arms to be perfectly sound, seasoned, straight grained, red pine or British Columbia, Douglas Fir, free from knots or other defects, surfaced on all sides, rounded off on top edge to produce the full size of seven (7) foot lengths, four and one-quarter ($4\frac{1}{4}$) inches by three and one-quarter ($3\frac{1}{4}$) inches, bored for six (6) one-half ($\frac{1}{2}$) inch holes to take standard steel pins, spaced as per sketch. Two (2) central lag screws holes nine-sixteenths ($\frac{9}{16}$) of an inch in diameter bored in each cross-arm, staggered vertically three (3) inches.



SIZE WHEN DRESSED $4\frac{1}{4}$ " x $3\frac{1}{4}$ ".

Pins.

To be of approved steel pattern.

Insulators.

Double petticoat design, weight twenty-five (25) ounce, to be manufactured of best glass used for the purpose, free from blow

holes and other defects. The threading shall be neatly and fully formed and the whole shape made uniformly true throughout.

The initial "G.T.P." shall be blown on the outside surface of the glass on the margin below the tie line groove, in block letters one-half an inch in height.

Cross-Arm Lag Screws.

These are to be of wrought iron or steel, one-half an inch in diameter, full seven inches long under head, with full three inches of thread, six (6) threads per inch, gimlet pointed, with standard square heads with flat circular top, surface of five-eighths ($\frac{5}{8}$) inch diameter with remaining surface and corner pressed to the standard rounding surface.

Washers: one and three-eighths ($1\frac{3}{8}$) inch by nine-sixteenths ($\frac{9}{16}$) inch. No. twelve (12) gauge.

Cross-Arm Braces.

To be of wrought iron or steel, one inch wide, twenty-eight (28) inches long, seven-thirty-second ($\frac{7}{32}$) inch thick, with a hole punched at each end seven-sixteenths ($\frac{7}{16}$) of an inch in diameter, the centre of which shall be three-quarters ($\frac{3}{4}$) of an inch from end of brace.

Brace Bolts.

To be: one-half ($\frac{1}{2}$) inch by three and one-quarter, ($3\frac{1}{4}$) inches. Three-eighths ($\frac{3}{8}$) by two and one-quarter, ($2\frac{1}{4}$) inches. Gimlet pointed, flat head, standard make.

Guy Rods.

To be of wrought iron or steel, five-eighths, ($\frac{5}{8}$) inch diameter, five foot (5) six inches (6) in length, threaded for four (4) inch plate and nut, top end welded to form a loop.

TURNTABLES

Shall be of medium steel, plate girder type, seventy-five feet long with a capacity of 200 tons.

TRACK SCALES

Shall be of 100 tons capacity, 64 feet long and shall be housed from the weather, and shall consist of the most approved pattern of railroad track scales, with concrete or masonry foundations, and all to the satisfaction of the Engineer.

BUILDINGS.

Tool houses, outbuildings, section houses, passenger or combination freight and passenger station buildings, freight sheds, engine houses, car and locomotive repair shops and such other buildings as may be required shall be built in accordance with the detailed plans and specifications which may be furnished from time to time by the Chief Engineer.

WATER STATIONS.

Water tanks shall be built frost proof. Minimum capacity of 50,000 gallons, resting on concrete or masonry foundations, in accordance with the detailed plans and specifications, and to the satisfaction of the chief Engineer.

STEEL BRIDGES

Shall be designed and built in accordance with the provisions of the general specifications for railway bridges, issued by the Department of Railways and Canals, 1905 edition. The class of loading to be used for all bridges is that designated HEAVY.

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TRANS-CONTINENTAL RAILWAY

(EASTERN DIVISION)

District.....Sec.

Contractor.

Estimate of work done and materials furnished for the
month of.....190....

Item	Description of Work	Measure	Quantity	Rate	Amount
1	Clearing.....	acre			
2	Trees cut down outside right-of-way.....	each			
3	Grubbing.....	acre			
4	Solid rock.....	c. y.			
5	Loose rock and other ma- terials (section 35 Spec.)	c. y.			
6	Common excavation.....	c. y.			
7	Excavation in foundations, no coffer dams.....	c. y.			
8	Excavation of foundations within coffer dams.....	c. y.			
9	Overhaul, all materials per cub yd. per 100 ft. over 500 ft. haul.....	c. y.		0 01	
10	Piling delivered as per En- gineer's bill.....	lin. ft.			
11	Piling driven.....	lin. ft.			
12	Sheet piling, per M. ft. B. M.....				
13	Wakefield type, per M. ft. B. M.....				
14	Cross-logging 1 ft. deep, with 18 inches brush- work.....	acre			
15	Pole drains.....	lin. ft.			
16	French stone drains.....	lin. ft.			
17	Paving in culverts.....	c. y.			
18	Crib filling with stone.....	c. y.			
19	Hand laid rip-rap.....	c. y.			
20	Pierre Perdu random rip- rap.....	c. y.			

Item	Description of Work	Measure	Quantity	Rate	Amount
21	Piling out reserved stone from rock cuttings.....	c. y.			
22	Round logs in cribs.....	lin. ft.			
23	Cedar mud sills, per thousand ft. B. M.....				
24	Framed trestles, per thousand ft. B. M., except stringers.....				
25	Caps, walings, and braces for pile trestles, per M. ft. B. M.....				
26	Sawn ties and guard rails for bridges, per M. ft. B. M.....				
27	Stringers, per M. ft. B. M.				
28	Cedar timber in culverts, 8 ins. x 12 ins., 10 ins. x 12 ins. and 12 ins. x 12 ins. per M. ft. B. M.....				
29	Plank in highway and private road crossings, per M. ft. B. M.....				
30	Timber, best quality, for culverts, per M. ft. B. M.				
31	Vitrified pipe culverts, 12 inches diam.....	lin. ft.			
32	14 inches diam.....	lin. ft.			
33	15 inches diam.....	lin. ft.			
34	18 inches diam.....	lin. ft.			
35	Reinforced concrete pipe, 12 inches diam.....	lin. ft.			
36	14 inches diam.....	lin. ft.			
37	16 inches diam.....	lin. ft.			
38	18 inches diam.....	lin. ft.			
39	20 inches diam.....	lin. ft.			
40	24 inches diam.....	lin. ft.			
41	30 inches diam.....	lin. ft.			
42	36 inches diam.....	lin. ft.			
43	42 inches diam.....	lin. ft.			
44	48 inches diam.....	lin. ft.			
45	54 inches diam.....	lin. ft.			
46	60 inches diam.....	lin. ft.			

Item	Description of Work	Measure	Quantity	Rate	Amount
47	4 inches Agricultural under tile drains.	lin. ft.			
	Cast iron pipe culverts,				
48	16 inches diam.	lin. ft.			
49	18 inches diam.	lin. ft.			
50	20 inches diam.	lin. ft.			
51	24 inches diam.	lin. ft.			
52	30 inches diam.	lin. ft.			
53	36 inches diam.	lin. ft.			
54	42 inches diam.	lin. ft.			
55	48 inches diam.	lin. ft.			
56	54 inches diam.	lin. ft.			
57	60 inches diam.	lin. ft.			
58	Concrete facing mixture (1-2) 2½ in. thick.	c. y.			
59	Concrete 1-2-4 coping, course 6 in. thick.	c. y.			
60	Concrete 1-3-3.	c. y.			
61	Concrete 1-3-6.	c. y.			
62	Concrete 1-3-5 in arch culverts, including curbing	c. y.			
63	Concrete 1-3-6 in arch culverts, including curbing	c. y.			
64	Concrete 1-3-6 in box culverts, including curbing	c. y.			
65	Concrete 1-4-8 ordinary foundations, including curbing.	c. y.			
66	Concrete 1-4-8 walls of building, including curb, ing.	c. y.			
67	First-class masonry.	c. y.			
68	Second-class masonry.	c. y.			
69	Third-class masonry.	c. y.			
70	Dry masonry.	c. y.			
71	Masonry in arch ring, including centreing.	c. y.			
72	Track-laying in main line, with ordinary frogs, switches and sidings, including light surfacing A	mile			
73	Track-laying in yards at terminals.	mile			

Item	Description of Work	Measure	Quantity	Rate	Amount
74	Train hauled surfacing B.	c. y.			
75	Ballasting.	c. y.			
76	Ties, first-class.	each			
77	Ties, second-class.	each			
78	Ties for switches, sawn to dimensions per M. ft. B. M.				
79	Public road signs.	each			
80	Mile posts, whistle posts, and road signs.	each			
81	Semaphores at stations, complete.	each			
82	Interlocking appliances, complete, eight levers..	each			
83	Each additional lever. ...	each			
84	Fencing.	rod			
85	Gates.	each			
86	Tunnels, rock section (un- lined).	lin. ft.			
87	Tunnels, lined.	lin. ft.			
88	Tunnels, concrete lining..	c. y.			
89	Tunnels, masonry lining..	c. y.			
90	Drainage tunnels, 4 c. yds. per foot.	lin. ft.			
91	Telegraph lines.	mile			
92	Water tanks, 50,000 gals..	each			
93	Turntables.	each			
94	Track scales.	each			
95	Tunnel shafts.	each			
96	Iron in drift bolts.	lbs.			
97	Iron in screw bolts.	lbs.			
98	Forged or cut spikes.	lbs.			
99	Cast iron washers and sep- arators.	lbs.			
100	Cattle guards (3 sections).	each			
101	Cast iron pile shoes.	each			

Approved,

Chief Engineer, Eastern Division, Trans-Continental
Railway.

Approved

Chief Engineer, Grand Trunk Pacific Railway.

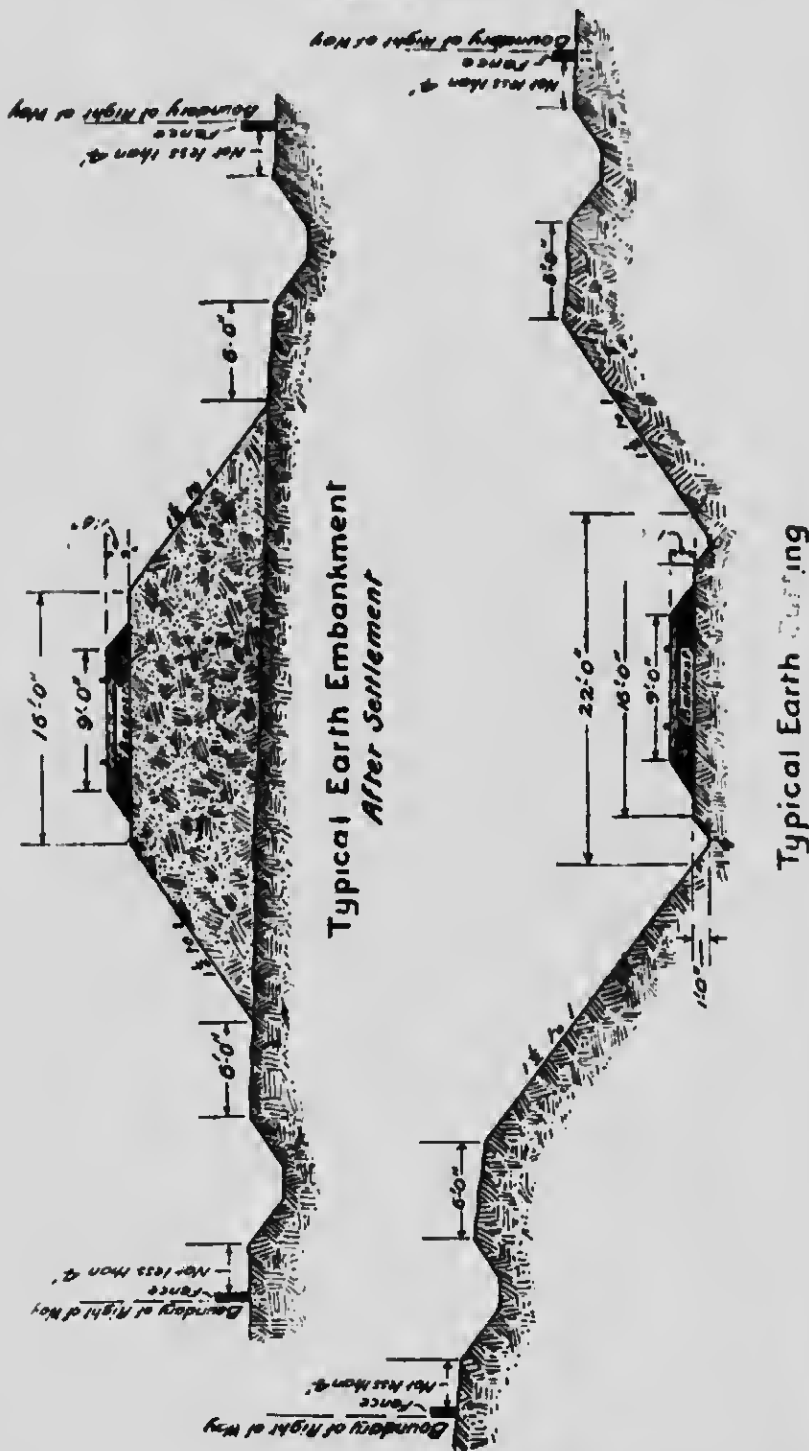
Approved,

Chief Engineer, Department of Railways and Canals,
of Canada.

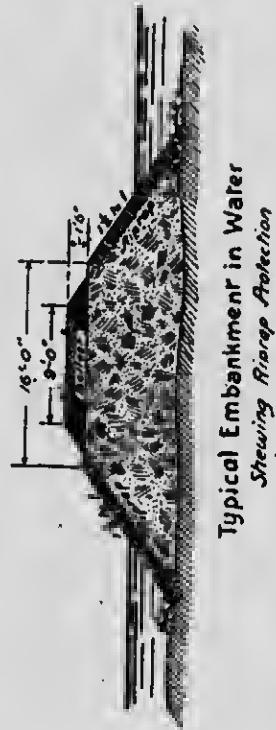
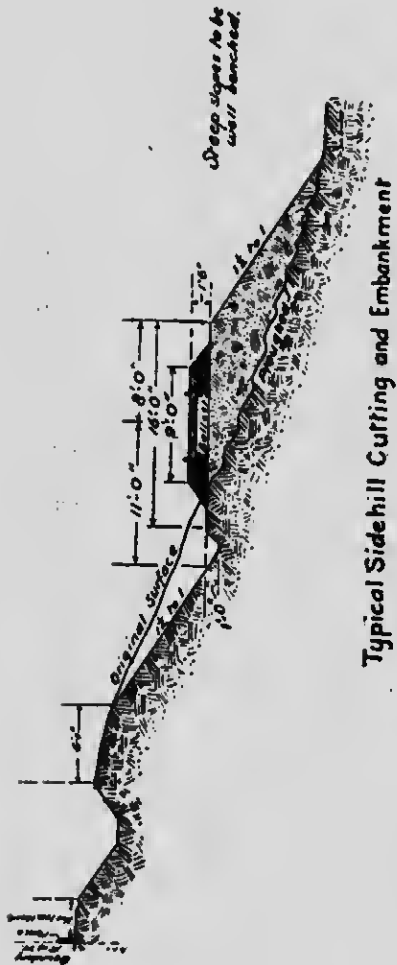
Ottawa,.....190.....

THE NATIONAL TRANS-CONTINENTAL RAILWAY. EASTERN DIVISION.

DRAWING No. 1.



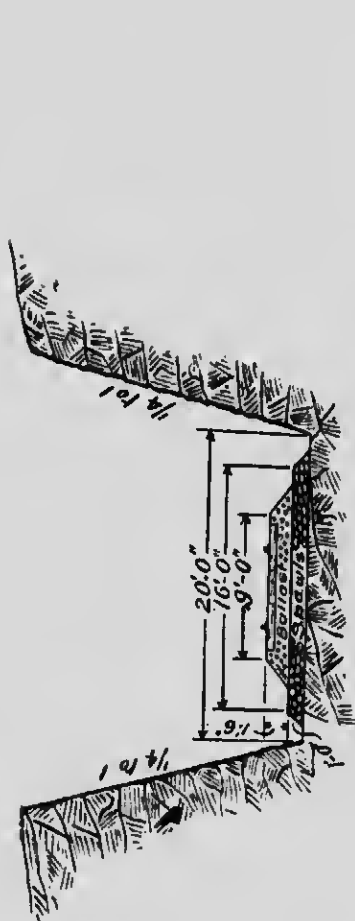
THE NATIONAL TRANS-CONTINENTAL RAILWAY.
EASTERN DIVISION.
DRAWING NO. 2.



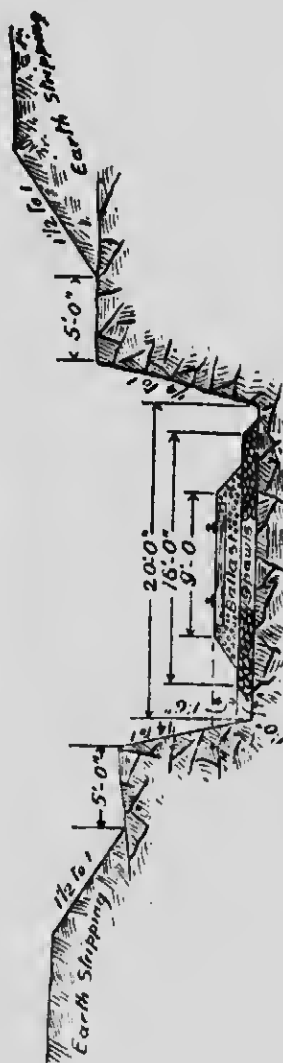
THE NATIONAL TRANSCONTINENTAL RAILWAY.

EASTERN DIVISION.

DRAWING NO. 3.



Typical Rock Cutting.



Typical Rock and Earth Cutting.

DRAWING NO. 4.

(Am. Soc. C. E. Pattern.)



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