

1903.  
NEW ZEALAND.

---

## ENGINE-TRIALS BETWEEN INVERCARGILL AND GORE (DETAILS OF).

---

*Presented to both Houses of the General Assembly by Command of His Excellency.*

---

MEMORANDUM for the Hon. the MINISTER for RAILWAYS.

Railway Department, Head Office,  
Wellington, 1st October, 1902.

*Trial of Locomotives.*

I HAVE the honour to submit herewith report on trials of various classes of locomotives which have recently been made between Invercargill and Gore.

T. RONAYNE, General Manager.

---

The CHIEF MECHANICAL ENGINEER, to the GENERAL MANAGER, New Zealand Railways.

Chief Mechanical Engineer's Office,  
Wellington, 30th September, 1902.

SIR,—

*Engine-trials.*

I have the honour to furnish for your information details of engine-trials recently made between Invercargill and Gore.

The tests would have been more exhaustive if made on a continuous ascending gradient where the engines would have been working at nearly their maximum tractive-power. Such a length of line not being available, the trials had to be run over a comparatively easy road, with, during a considerable portion of the time, the reversing-lever notched up close to centre, and steam wire-drawn by a nearly closed regulator.

The Glasgow and New Zealand built locomotives, having Walschaert valve-gear, giving an earlier cut-off, required for this very light work less wire-drawing of the steam than was necessary with the American locomotives having Stephenson link-motion, giving a later cut-off. But if all the engines had been exerting their maximum effort, the conditions would have been practically identical, and the comparisons more conclusive.

Of the larger locomotives, Class "Q," with large fire-grate area, gave the most efficient results.

I attach, for your consideration, tabulated statement showing details of trials.

Two series of tests were made—one with Brunner coal and the other with Nightcaps lignite. The tests were conducted under similar conditions, and every endeavour made to insure absolute impartiality. Weather was fairly uniform throughout, and, as the results of tests are based on the averages of six separate trials of the different types of locomotives, three with Brunner coal and three with Nightcaps lignite, the slightly varying weather was comparatively unimportant.

One notable feature was the very small quantity of ashes drawn through the tubes into the smoke-box of the Class "Q" locomotive, the tendency to throw sparks being, therefore, most materially reduced.

I have, &c.,

A. L. BEATTIE,  
Chief Mechanical Engineer.

The General Manager, New Zealand Railways.

TRIAL of LOCOMOTIVES between Invercargill and Gore with NIGHTCAPS COAL.

Particulars.	TYPE OF ENGINE.						
	Baldwin. Class Q.	Glasgow. Class U.C.	Glasgow. Class U.A.	Baldwin. Class U.B. First importation.	Baldwin. Class U.B. Second importation.	N.Z.R. Class W.A.	Baldwin. Class W.D.
Size of cylinders	16 by 22 sq.	16 by 22 sq.	16 by 20 sq.	16 by 20 sq.	16 by 20 sq.	14 by 20 sq.	14 by 20 sq.
Clearance of cylinders	..	..	..	..	..	..	..
Area of heating-surface	1,689	972	972	1,320	1,320	740	845
Area of grate-surface	40	16	16	16	16	12.5	17
Number of tubes	188	187	187	177	177	142	177
Outside diameter of tubes	2	1 1/2	1 1/2	2	2	1 1/2	1 1/2
Size of exhaust nozzle	4	4	4	4	4	3 1/2	3 1/2
Weight of engine in working-order	68.975	61.25	61.25	57.25	60.4	37.25	43.75
Number of vehicles	31	31	28	28	28	26	26
Length of route	..	..	..	..	..	..	..
Number of ton miles of train-load	24,880	24,880	22,472	22,472	22,472	20,564	20,564
Number of ton miles of total load	30,390	29,780	27,372	27,052	27,304	23,544	24,064
Weight of train in working-order, including engine, tender, and freight	850,920	833,840	766,416	757,456	764,512	659,232	673,792
Weight of train in working-order, excluding engine and tender	696,640	696,640	629,216	629,216	629,216	575,792	575,792
Locomotive Tests: General Results—							
Running of Train—							
Invercargill	a.m.	a.m.	a.m.	a.m.	a.m.	a.m.	a.m.
Woodlands	8.40	8.41	8.35	8.40	8.40	8.40	8.40
Morton Mains	9.17	9.17	9.13	9.17	9.18	9.18	9.18
Morton Mains	9.33	9.35	9.29	9.33	9.34	9.34	9.33
Edendale	9.43	9.45	9.38	9.46	9.47	9.46	9.43
Edendale	10.3	10.7	9.59	10.6	10.9	10.6	10.4
Edendale	10.9	10.12	10.5	10.11	10.14	10.12	10.9
Mataura	10.36	10.37	10.31	10.38	10.39	10.38	10.35
Gore ..	10.55	10.56	10.52	10.58	10.58	10.55	10.55
Gore ..	11.50	11.50	11.50	11.50	11.51	11.50	11.50
Mataura	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.
Mataura	12.14	12.13	12.13	12.14	12.14	12.13	12.13
Edendale	12.26	12.26	12.27	12.26	12.27	12.25	12.25
Edendale	12.55	12.55	12.55	12.56	12.56	12.55	12.55
Edendale	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Woodlands	1.42	1.41	1.40	1.41	1.44	1.42	1.40
Invercargill	2.15	2.15	2.15	2.15	2.17	2.15	2.15
Total quantity of water used	2,300	2,323.3	2,397.3	2,317.3	2,170	1,903.1	2,090
Waste of water at injectors	..	..	7.1	7.8	6.75	8	4.5
Water used, less waste at injectors	2,293.9	2,316.2	2,390.2	2,309.5	2,163.25	1,895.1	2,085.5
Water evaporated per pound of coal	4.97	4.91	4.82	4.71	4.95	5.18	4.73
Water used per ton of train per 100 miles	92.20	93.02	106.36	102.77	96.26	92.16	101.41
Water used per square foot of heating-surface per hour running-time	3.38	5.76	5.93	4.23	3.96	6.19	5.97

TRIAL of LOCOMOTIVES between Invercargill and Gore with NIGHTCAPS COAL--continued.

Particulars.	TYPE OF ENGINE.							
	Baldwin. Class Q.	Glasgow. Class U.C.	Glasgow. Class U.A.	Baldwin. Class U.B. First importation.	Baldwin. Class U.B. Second importation.	N.Z.R. Class W.A.	Baldwin. Class W.D.	Baldwin. Class W.D.
<i>Locomotive Tests: General Results--continued.</i>								
Water used per square foot of grate-surface per hour running-time	138.74	349.96	359.97	344.22	327.10	317.77	296.02	296.80
Equivalent evaporation per pound of coal from and at 212° F.	6.09	6.02	5.27	5.75	6.06	6.04	5.75	5.79
Weight of coal burned on journey ..	4,613.6	4,714.6	5,534	4,900	4,371.7	4,279.5	4,409	4,406
Actual weight of wood used in lighting-up ..	224	224	224	224	224	224	224	224
Actual weight of coal used in lighting-up ..	784	784	784	784	784	784	560	560
Total weight of coal and wood used ..	5,621.6	5,722.6	6,542	5,908	5,379.7	5,287.5	5,193	5,190
Coal consumed per ton mile of train-load ..	0.185	0.189	0.246	0.218	0.195	0.190	0.214	0.214
Coal used per ton of train per 100 miles ..	18.54	18.95	24.62	21.80	19.45	19.04	21.44	21.43
Weight of coal consumed per hour ..	1,116.1	1,140.6	1,332.1	1,185.4	1,057.6	1,081.2	1,066.7	1,066
Average weight of coal burned per square foot of grate-surface per hour running-time	27.90	71.29	83.34	74.09	66.10	64.45	62.75	62.70
Coal used per train mile ..	57.67	58.93	69.18	61.25	54.64	53.49	55.11	55.07
Calorimetric value of coal ..	8,663.8	8,663.8	8,663.8	8,663.8	8,663.8	8,663.8	8,663.8	8,663.8
Weight of ashes taken from ashpan ..	183	178	125	120	51	56	58	50
Weight of ashes taken from smoke-box ..	16	194	280	242	257	246	223	230
Weight of ashes, &c., taken out of firebox ..	66	39	98	57	78	95	69	50
Maximum boiler-pressure ..	200	200	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)
Minimum boiler-pressure ..	165	171	175	175	175	200	170	200
Mean boiler-pressure throughout journey ..	192.4	186.4	151.3	161.3	169.9	194.3	164.9	189.9
Mean temperature of feed-water ..	46.4	46.1	46.3	47.8	46	47.6	50.6	48.1
Mean temperature of atmosphere ..	50.9	45.5	47.4	54.5	49.1	52.2	55.2	51.8
Average speed in miles per hour ..	19.35	19.35	19.28	19.35	19.35	19.28	19.35	19.35
Actual time in motion ..	248	248	249	248	248	249	248	248
Time made up or lost ..	Nil	Nil	1 lost	Nil	Nil	1 lost	Nil	Nil
Number of stops ..	5	5	5	5	5	5	5	5
Aggregate intermediate stops ..	87	86	91	87	87	88	87	87
<i>Analysis of Nightcaps Coal--</i>								
Fixed carbon ..	Composition.							
Hydrocarbon ..	43.62							
Water ..	33.68							
Ash ..	18.33							
	4.37							

TRIAL of LOCOMOTIVES between Invercargill and Gore with BRUNNER COAL.

TYPE OF ENGINE.

Particulars.	Baldwin. Class Q.	Glasgow. Class Uc.	Glasgow. Class Ua.	Baldwin. Class Ub. First importation.	Baldwin. Class Ub. Second importation.	Baldwin. Class Wd. importation.	N.Z.R. Class Wa.	Baldwin. Class Wd.	Baldwin. Class Wd.
Size of cylinders	16 by 22	16 by 22	16 by 20	16 by 20	16 by 20	16 by 20	14 by 20	14 by 20	14 by 20
Clearance of cylinders	8	8	8	8	8	8	8	8	8
Area of heating-surface	1,689	972	972	1,320	1,320	1,320	740	845	845
Area of grate-surface	40	16	16	16	16	16	12.5	17	17
Number of tubes	188	187	187	177	177	177	142	177	177
Outside diameter of tubes	2	1½	1½	2	2	2	1½	1½	1½
Size of exhaust nozzle	4	4	4	4	4	4	3½	3½	3½
Weight of engine in working-order	68-875	61-25	61-25	57-25	60-4	60-4	37-25	43-75	43-75
Number of vehicles	31	31	28	28	28	28	26	26	26
Length of route	80	80	80	80	80	80	80	80	80
Number of ton miles of train-load	24,880	24,880	22,472	22,472	22,472	22,472	20,564	20,564	20,564
Number of ton miles of total load	30,390	29,780	27,372	27,052	27,304	27,304	23,544	24,064	24,064
Weight of train in working-order, including engine, tender, and freight	850,920	833,840	766,416	757,456	764,512	764,512	659,232	673,792	673,792
Weight of train in working-order, excluding engine and tender	696,640	696,640	629,216	629,216	629,216	629,216	575,792	575,792	575,792
Locomotive Tests: General Results—									
Running of Trains—									
Invercargill	dep.	a.m.	a.m.	a.m.	a.m.	a.m.	a.m.	a.m.	a.m.
Woodlands	dep.	8.40	8.36	8.36	8.35	8.40	8.40	8.40	8.40
Morton Mains	arr.	9.16	9.14	9.13	9.12	9.18	9.18	9.19	9.16
Morton Mains	dep.	9.32	9.34	9.30	9.30	9.33	9.33	9.34	9.33
Edendale	arr.	10.2	10.5	10.3	10.4	10.2	10.2	10.4	10.5
Edendale	dep.	10.7	10.9	10.8	10.7	10.8	10.8	10.9	10.11
Mataura	arr.	10.33	10.36	10.33	10.37	10.34	10.34	10.34	10.36
Gore	arr.	10.55	10.55	10.53	10.56	10.55	10.55	10.55	10.56
Gore	dep.	11.50	11.50	11.50	11.50	11.50	11.50	11.50	11.50
Mataura	arr.	12.14	12.14	12.13	12.14	12.13	12.13	12.13	12.13
Mataura	dep.	12.26	12.26	12.27	12.27	12.27	12.30	12.25	12.25
Edendale	arr.	12.54	12.54	12.54	12.55	12.58	12.59	12.57	12.58
Edendale	dep.	12.59	12.59	12.58	1.0	1.2	1.4	1.2	1.3
Woodlands	arr.	..	..	..	1.42	1.42	..	..	..
Woodlands	dep.	1.42	1.42	1.41	1.44	1.45	1.45	1.42	1.42
Invercargill	arr.	2.15	2.15	2.15	2.17	2.20	2.20	2.15	2.15
Total quantity of water used	..	2,204-3	2,230-7	2,394	2,242-5	2,188-2	1,897-66	2,253-5	2,253-5
Waste of water at injectors	..	6-17	6-2	7-8	5-4	6-13	7-58	4-8	4-8
Water used, less waste at injectors	..	2,174-8	2,224-5	2,386-2	2,338-6	2,182-37	1,890-08	2,248-7	2,248-7
Water evaporated per pound of coal	..	9-14	8-74	8-75	8-21	8-34	9-19	8-72	8-09
Water used per ton of train per 100 miles	..	87-41	98-99	100-62	104-07	99-52	91-91	106-12	109-35
Water used per square foot of heating-surface per hour running-time	..	3-12	5-46	4-37	4-28	4-10	6-18	6-25	6-44

TRIAL of LOCOMOTIVES between Invercargill and Gore with BRUNNER COAL—continued.

TYPE OF ENGINE.

Particulars.	Baldwin. Class Q.	Glasgow. Class Uc.	Glasgow. Class Ua.	Baldwin. Class Ur. First importation.	Baldwin. Class Ur. Second importation.	N.Z.R. Class Wa.	Baldwin. Class Wd.	Baldwin. Class Wd.
<i>Locomotive Tests: General Results—continued.</i>								
Water used per square foot of grate-surface per hour running-time	131.54	332.08	337.73	360.81	353.62	365.82	310.57	320.02
Equivalent evaporation per pound of coal from and at 212° F.	11.19	11.20	10.68	10.70	10.02	11.19	10.66	9.91
Weight of coal burned on journey	2,379.7	2,406.7	2,544	2,736	2,848.3	2,056	2,501.3	2,781
Actual weight of wood used in lighting-up	224	224	224	224	224	224	224	224
Actual weight of coal used in lighting-up	560	560	560	560	560	560	560	560
Total weight of wood and coal used	3,163.7	3,190.7	3,328	3,510	3,632.3	2,616	3,061.3	3,341
Coal consumed per ton mile of train-load	0.096	0.097	0.113	0.121	0.127	0.100	0.122	0.135
Coal used per ton of train per 100 miles	9.56	9.67	11.32	12.13	12.67	10	12.16	13.52
Weight of coal consumed per hour	575.7	582.2	617.1	659.5	688.2	497.4	605.1	672.8
Average weight of coal burned per sq. ft. of grate-surface per hour running-time	14.39	36.39	38.62	41.22	43.07	39.79	35.60	39.58
Coal used per train mile	29.75	30.08	31.8	34.08	35.6	25.7	31.26	34.76
Calorimetric value of coal	14,513.75	14,513.75	14,513.75	14,513.75	14,513.75	14,513.75	14,513.75	14,513.75
Weight of ashes taken from ashpan	83	91	97	66	41	45	53	42
Weight of ashes taken from smoke-box	7	96	76	178	110	104	129	180
Weight of ashes, &c., taken out of firebox	100	73	98	81	88	37	61	67
	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)	(all clinker and dirt)
Maximum boiler-pressure	200	200	175	175	175	170	170	200
Minimum boiler-pressure	178	161	125	131.7	133	126.3	136	153.5
Mean boiler-pressure throughout journey	193.9	190.3	160	160	162.6	157.7	162.9	190.4
Mean temperature of feed-water	48.3	45.2	46.2	44.7	47.9	49.3	46.9	47.1
Mean temperature of atmosphere	53.6	46.9	49.6	50.2	51	49.1	52.4	50.1
Average speed in miles per hour	19.35	19.35	19.38	19.35	19.33	19.35	19.35	19.35
Actual time in motion	248	248	247	248	248	248	248	248
Time made up or lost	Nil	Nil	Made up 1	Nil	Nil	Nil	Nil	Nil
Number of stops	5	5	5	5	5	5	5	5
Aggregate intermediate stops	87	87	92	89	91	92	87	87
<i>Analysis of Brunner Coal—</i>								
Fixed carbon	56.21	Composition.						
Hydrocarbon	37.73							
Water	1.50							
Ash	4.56							

Approximate Cost of Paper.—Preparation, not given; printing (1,200 copies), £6 3s. 6d.

By Authority: JOHN MACKAY, Government Printer, Wellington.—1903.

