APPENDICES.

APPENDIX A.

Wellington, 19th August, 1876.

Re Accident at Grey Gorge Bridge.

Memorandum for Royal Commissioners.

The breaking of the anchor-plates occurred at 4 a.m. on the morning of the 28th ultimo.

The anchor-plates which gave way were those at the south (Westland) end of the bridge.

At the time of the accident the trusses were completed throughout, and notched into the cross-bearers, which were hung to cables, with clips, complete. The horizontal cross-bracing at bottom of trusses was also completed; the cross-ties on top were fixed, but not the braces, and the joists over two-thirds of the length of the bridge were laid. The only portions of the superstructure remaining unfixed were therefore the top bracing, one-third of the joists, and the planking; but against this there was a large quantity of tackle and machinery (crab winch, derrick, chains, ropes, &c.) at about the centre of the bridge, and a great part of the planking strewed along it in the shape of scaffolding, so that it is probable that the strain on the cables was as nearly as possible the same as would result from the bridge completed.

On the 24th of the month (three days before the accident), there was a heavy gale blowing down the Gorge, which caused the bridge to sway to the extent of about six inches from side to side, but no sign of its being in any way damaged was apparent. The fact that the cross-braces were not fixed on top would no doubt account for the swaying, which they were calculated to counteract completely, supposing wind blowing with a force not exceeding 50 lbs. per square foot. On the night preceding the accident, there was a very sharp frost, followed towards morning by a rapid thaw.

Neither of the tunnels show any disturbance of the stratum or masonry; the only things except the anchor-plates which were disturbed being two out of the four cast-iron girders on which they rested—namely, the one most remote from centre line of bridge in each tunnel, which were shoved aside by the anchor-plates when they parted, and of the two so shoved aside one was broken laterally by the force of this side pressure.

The tracing attached shows the exact dimensions and relative positions of the anchor-plates as they would be seen looking from the Westland side of the river towards the Nelson side by a person standing behind them.

The immediate result of the accident was that the ropes ran rapidly over the piers for a length of about 80 feet, carrying the long ends of the anchor-plates with them up to the surface of the ground, and leaving the short ends remaining in the tunnels. By this time the cables had reached the bottom of the river, so ceased to run out before the ends came up to the pier. They remained therefore hanging over in about same position as when erected, except that the saddles, which were on rollers, were pulled off by the ropes as they ran out.

It was stated by one man, who was awakened, and looked out at the first shock when the anchor-plates gave way, that there were two distinct reports, indicating that one of the plates went a second or two before the other, and he says that the timber work of the bridge stood sustaining its own weight for a few seconds after that, but he could form no idea which side went first. The flaw observable on the west plate would seem to indicate that it should have gone first; but as against that there is the fact that the western cable lay on top of the wood work in the river, while the eastern cable lay under everything. It is difficult therefore to connect the flaw with the accident, unless by conceiving that the second cable which broke would jump further than the first one, on account of having the whole instead of half the weight acting upon it at the time it broke.

C. Y. O'Connor, C.E.

APPENDIX B.

Ultimate strength of bridge—		
10 large wires at 44 tons ($5\frac{5}{8}$ circumference)		440
4 large wires at 36 tons ($4\frac{1}{2}$ circumference)		144
12 telegraph wires at 34 tons (1 area)		408
		992
Load—		
Weight of bridge, 96 tons.		
Strain, $\frac{48 \times 75}{25}$	144 tons	
Factor of safety	$3\frac{1}{2}$	
	504—504	
Rolling load, 30 tons, distributed by truss over 80 feet $\frac{15 \times 130}{25}$	78	
Factor of safety	5	
	390—390	
		894
Add for increased weight at towers		40
		934