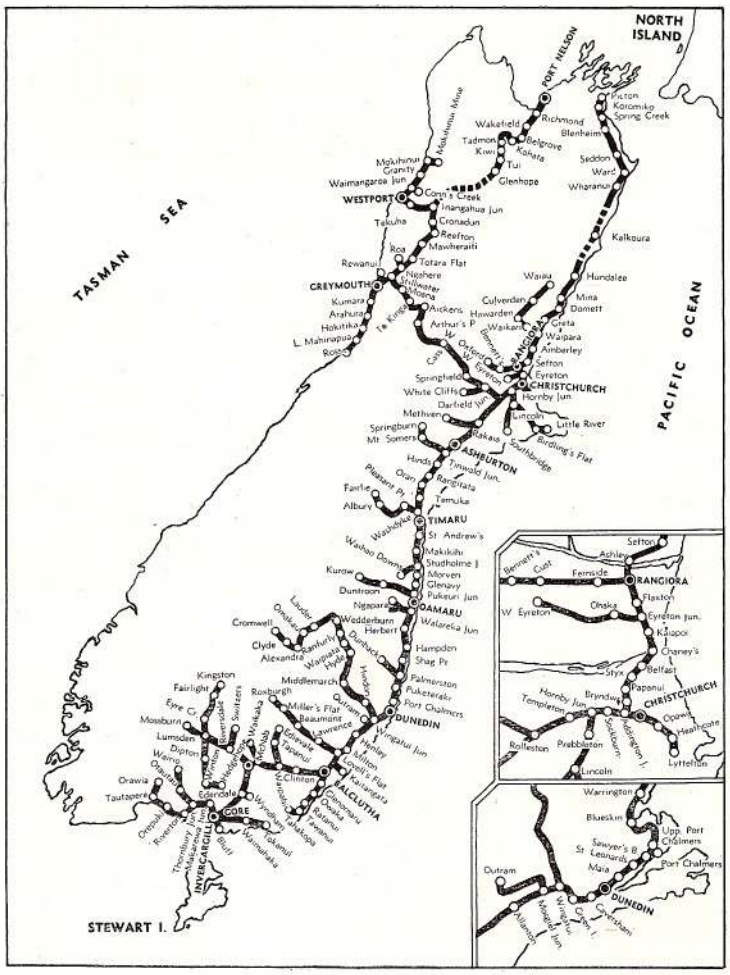
250-275 B.H.P. DIESEL MECHANICAL RAIL COACHES. NEW ZEALAND GOVERNMENT RAILWAYS.

3 ft. 6 in. Gauge.

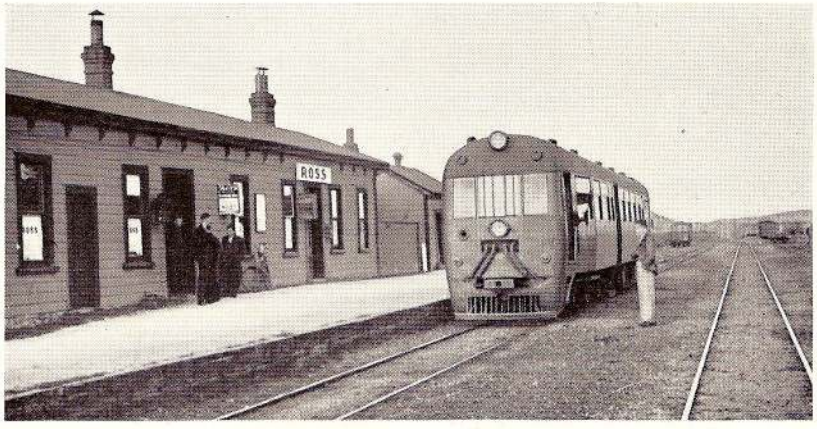
250-275 B.H.P. Diesel Mechanical Rail Coach, New Zealand Government Railways.

TEN Diesel Mechanical Rail Coaches of 250-275 B.H.P. with bodies supplied by English Electric Co., and with a seating capacity for 52 passengers, were designed and built by the Vulcan Foundry, and nine of these were put into service between 1940 and 1942 on the New Zealand Government Railways, whose gauge is 3 ft. 6 in. (1067 mm.). The tenth car was lost due to enemy action in transit.

Although maximum speeds of 76 m.p.h. (122 k.p.h.) have been attained by these Coaches when on trial, speeds for Railcars are normally limited to 55 m.p.h. (88.5 k.p.h.) in New Zealand. All the Coaches are employed in the South Island on the Christchurch-Timaru, and Christchurch-Greymouth-Hokitika-Westport routes, and in actual fact the fastest start to stop run in the Dominion is performed in daily service by these vehicles between Rakaia and Ashburton, a distance of 16.7 miles (26.9 Kms.), which is covered in 21 minutes at an average speed of 47.7 m.p.h. (76.8 k.p.h.).



Railway Map of S. Island, New Zealand.



Coach No. R.M. 52 at Ross Station, New Zealand Government Railways.

On the Christchuch-Greymouth route the Southern Alp mountains have to be negotiated and the line rises to a height of 2,400 ft. (731 Ms.) at the entrance to the Otira Tunnel, in which there is a six mile (9.6 kms.) gradient of 1 in 33. The Railcars ascend this gradient at 20 m.p.h. (32 k.p.h.).

The following is a brief description of these cars :—

LEADING DIMENSIONS :

Diesel Engine : " Vulcan-Frichs " 6185 C.A. 4-stroke. 250-275 B.H.P. at 1,000 R.P.M.

Transmission : Hydraulic Coupling, " Vulcan - Sinclair " Traction type.

Gearbox : Wilson Epicyclic with five ratios and reverse.

Speeds : 14, 20, 35, 51 and 75 m.p.h. (22.5, 32.2, 56.3, 82.1 and 120.7 k.p.h.) at maximum engine r.p.m.

Diam. of Wheels : 2 ft. 9 in. (838 mm.).

Total Wheelbase : 53 ft. 6 in. (16,306 mm.).

Overall Length : 66 ft. 3 in. (20,193 mm.).

Seating Capacity : 52 passengers.

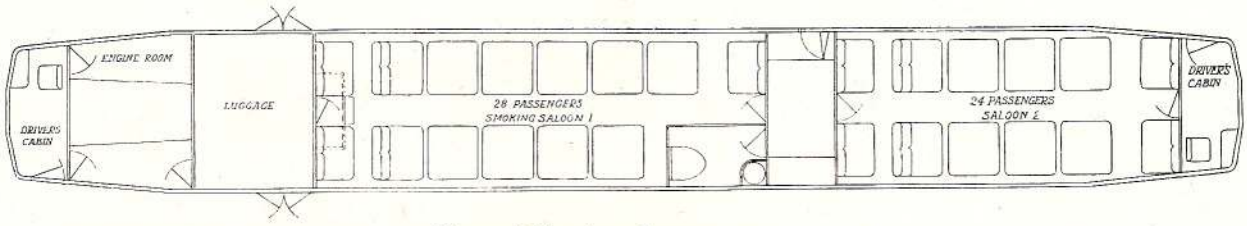
Baggage : 1 ton.

Fuel : 140 gallons (636 litres).

Maximum Axle Load : 8.5 tons.

Weight fully laden : 40.5 tons.

THE VEHICLE : Body and underframe are an integral welded structure, the roof being built separately. The solebars are each a single member running the full length of the car and form the underframe, which carries the fuel and water tanks, batteries, and air receivers. To this underframe is secured an auxiliary subframe, referred to later.



Plan of Seating Arrangement.

Side and roof panelling is in 18 s.w.g. steel, spot-welded to the framing. The exterior finish is devoid of mouldings. Seats are provided for 52 passengers in two compartments separated by an entrance vestibule. Folding steps are available for use where there are no platforms, and these are interlocked with air-operated jack-knife type doors. A baggage compartment is placed next to the engine-room.

Body weight is transferred to the two bogies by side-bearers and laminated springs. These bogies are of welded steel construction, and the carrying bogie has two axles with a wheelbase of 10 ft. (3,047 mm.).

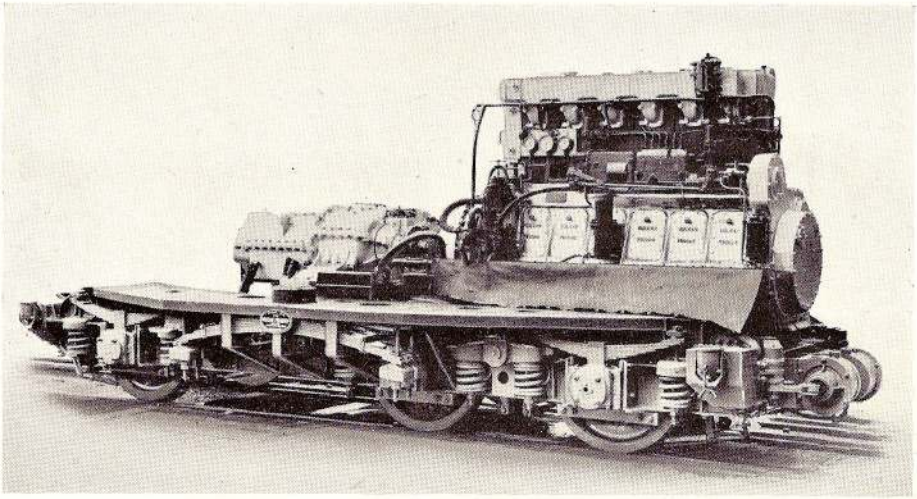
Interior of one of the Saloons.

Three axles are used in the power bogie, which has a wheelbase of 12 ft. (3,657 mm.), but the centre one is fixed and has flangeless wheels revolving on S.K.F. spherical roller bearings; the other axles are fitted with the normal type of S.K.F. roller bearing axleboxes.

ENGINE : When these Rail Coaches were built, the Vulcan Foundry were manufacturing Diesel Engines in association with Messrs. Frichs of Aarhus, Denmark, and the Vulcan-Frichs 6185 CA 4-stroke power units provided were all built at Newton-le-Willows. This engine, supported on three anti-vibration rubber mountings, has six cylinders of $7\frac{9}{32}$ in. (185 mm.) bore and $10\frac{1}{4}$ in. (260 mm.) stroke and has a normal rating of 250 B.H.P. at 1,000 r.p.m. or a maximum of 275 B.H.P. for one hour at the same speed.

Seven bearings in the crankcase carry the solid-forged crankshaft, on the forward end of which is a friction type vibration damper as well as the distribution drive. The camshaft is in the crankcase, with push-rod and rocker operation for the valves.

Big-end bearings consist of white-metal lined bronze shells and the small-end bearings are fully floating with aluminium end pads for the gudgeon pins. Pistons are aluminium alloy, working in "wet" cast-iron liners pressed into the cylinder block. The cylinder heads are six detachable castings.



Engine in position on one of the Power Bogies.

Lubricating oil is circulated by a gear type pump. A cooler, which may be by-passed if desired, is mounted at the inner end of the power bogie. In addition to oil pressure warning lamps in the driving cabins, there is an automatic safety shut down device which is operated by the lubricating oil pressure in the governor. If the pressure falls appreciably, the governor shuts off the fuel and stops the engine.

This governor is of the centrifugal type, mounted in tandem with the C.A.V. fuel injection pump. It acts upon the fuel pump rack rod and controls deliveries at full load and idling position only ; normal working load fuel quantities are set solely by the air operated piston under the driver's control. To obtain overload power, the driver's engine speed control lever is moved beyond the full load position. This actuates an electrical solenoid which raises the wedge limiting the travel of the extended rack rod of the fuel pump. In this way the normal fuel delivery can be exceeded so long as the driver-controlled wedge is kept in the raised position.

FUEL, HEATING AND COOLING SYSTEMS : Fuel is carried in two underframe tanks of sufficient capacity for 800 miles (1,288 kms.) travel ; an air pressure of 6 lb. per sq. in. (0.42 Kgs./Cm^2) delivers the oil through duplex filters to the ball-cock controlled service tank in the roof of the engine room. A cloth cartridge filter is placed between this service tank and the fuel feed pump, driven off the injection pump shaft, whilst a third C.A.V. filter is arranged between the supply pump and the injection pump.

On each side of the car is a filler for the main water tank, which supplies the cooling and heating systems, and a semi-rotary pump is installed for effecting this replenishment if an external pressure supply is not available. V-section belts from the hydraulic coupling drive the centrifugal pump on the engine bedplate, which serves the cooling system.

Two Coventry radiators are placed under the car facing outwards, so as to be unaffected by the direction of travel, and air passage through the elements is controlled by fans. Pivoted vanes can be set to scoop in the air in either direction, and baffles in the radiator headers direct the flow, which is horizontal.

These radiators are carried by an auxiliary subframe, suspended from the main underframe. Power for the various drives is taken from an auxiliary shaft which has Hardy-Spicer joints and is driven from the gearbox in the power bogie.

The auxiliary shaft also serves a Stone's 24-volt ventilated dynamo and a Westinghouse twin 26 cu. ft. min. (0.73 M3/min) compressor mounted on the sub-frame.

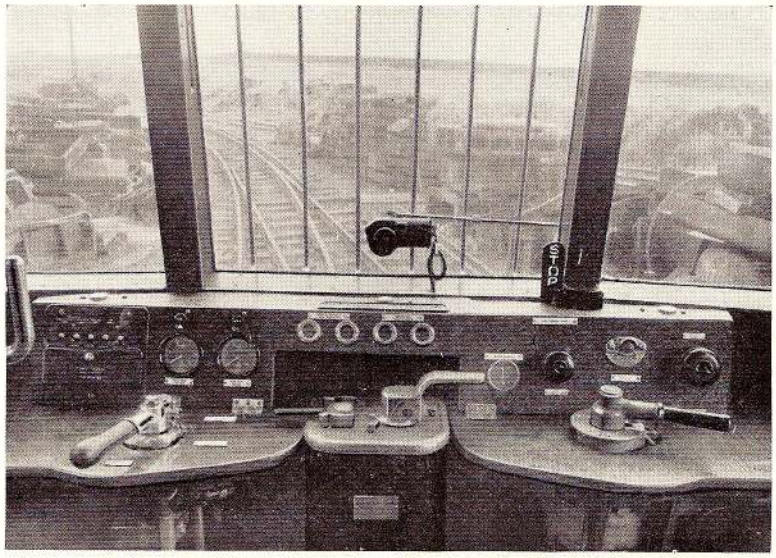
As the cars work in a dusty atmosphere special care was taken with the positioning of the air inlets, engine combustion air passing through a filter mounted in the top of the baggage compartment.

Heating of the cars is affected by Clayton-Dewandre units, employing engine cooling water, some being placed under the seats and one in each driving compartment. The hot air streams are directed by fans, and a thermostat controls the temperature of the water delivered to the heater. An air thermostat in each saloon cuts out the heaters if a predetermined temperature is exceeded. In hot weather the water is shut off and the fans in the heaters are used for air circulation.

TRANSMISSION : Behind the engine is a Vulcan-Sinclair traction type hydraulic coupling, which transfers the drive to a Wilson five-speed pre-selective epicyclic gearbox of the self-adjusting type. It is threepoint mounted in the bogie subframe. Between the hydraulic coupling and the gearbox is a Standage flexible coupling to deal with relative movement between the engine and gearbox.

The reverse mechanism is incorporated with the Wilson set. Layrub jointed shafts connect the gearbox and the spiral-bevel final drive boxes on the first and third axles of the power bogie. At 1,000 engine r.p.m. and allowing for coupling slip, the rail speeds are 14, 20, 35, 51 and 75 m.p.h. (22.5, 32.2, 56.3, 82.1 and 120.7 k.p.h.).

CONTROLS AND ACCESSORIES : The disposition of the controls as arranged for multiple unit operation, is shown in the illustration below, the engine speed control being pneumatic. In the case of the gearbox and reverse box, electro-pneumatic valves on the box casings operated by a controller in each cab admit air to the various cylinders. Thus, simple electrical circuits obviate lengthy flexible air hoses.



View of one of the Driver's Cabins.

A self-lapping valve controls Westinghouse straight air brakes and the control layout includes an automatic emergency feature. Should there be a loss of air from the emergency pipe, due to a breakaway, emergency application, or release of the "deadman's" pedal, the brakes on the coach are applied, bringing the engine to idling speed and putting the gearbox into neutral. Air for braking is derived from the compressor previously mentioned, and it also serves the gearbox controls, water and fuel raising systems, door operation and engine control.

All electrical circuits for the controls may be isolated by a removable key on the gearbox master controller, and this can be inserted or withdrawn only in the "off" position. It makes one or other driving desk "dead" and free from interference. When the master key has been inserted the engine can be started and air pressure built up.

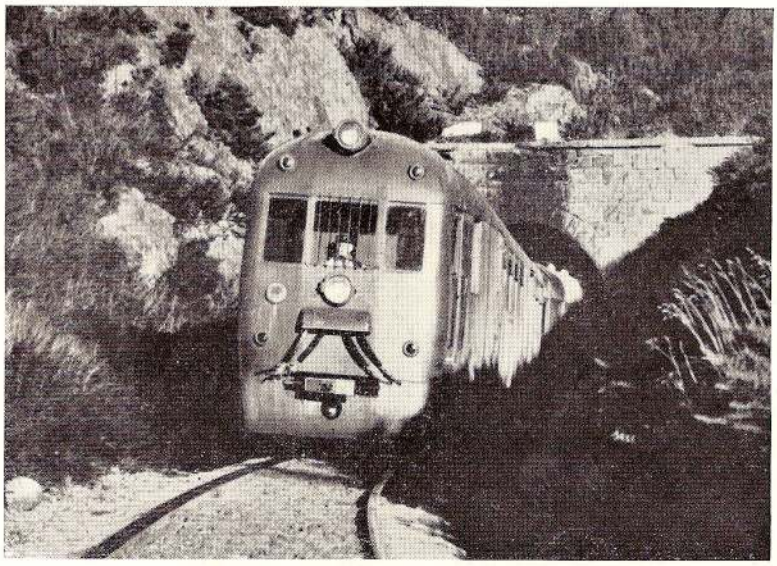
The gear lever has a mechanical interlock, so that it cannot be moved to the first-gear position unless the direction lever is in forward or reverse.

Starting is by a C.A.V. motor. Each car has a control for setting in motion the motor of an attached car if running in pairs, and in each engine room is a local starting point, primarily for the convenience of maintenance men.

When working in pairs the engine and transmission of either vehicle can be cut out by disconnection of a multi-point plug in the engine room which disconnects the control from these units.

The dynamo charges an Exide 24-volt battery, the charge and voltage of which are controlled by a Stone's carbon-pile regulator in the engine room control cabinet.

OPERATING DETAILS : These nine railcars have given consistently good service on the arduous routes on which they are employed and up to March 14th, 1947, they had completed 1,952,409 miles (3,143,350 Kms.) running, an average of 216,935 miles (349,250 Kms.) each.



Passing through the Southern Alp Mountains,
New Zealand Government Railways.

Some details of their performance during 1946 have been kindly supplied by the New Zealand Government Railways, and are as follows :—

Cost of Maintenance (Wages and Material).....	8.64d./mile (5.4d./km.).
Cost of Fuel	2.05d./mile (1.28d./km.).
Cost of Running and Cleaning Stores	0.74d./mile (0.46d./km.).
Total Cost of Operating.....	30.96d./mile (19.35d./km.).
Percentage of Available Working Days in Traffic...	83.21.
Fuel Consumption : Miles per gallon	6.35 (2.25 kms./litre).
Gallons per mile	0.157 (0.44 litres/km.).

N.B.—The balance of 19.53d./mile of the 30.96 comprises Drivers', Guards' and Cleaners' Wages, Depreciation and Interest.