



Wellington & Manawatu Railway Trust

Awakening a New Zealand Legend

Wellington & Manawatu Railway Company Research Notes

Research Note C9 - *Bogie Elliptical Springs*

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Introduction & Background

Each Wellington & Manawatu Railway Company (WMR) passenger bogie has two nests of elliptical springs. Each nest comprises of three elliptical springs. Each elliptical spring consists of two leaf springs each made up of four plates which are held together by a buckle in the centre of the span. The plates are spring steel, 3" wide (*Figure 9.1*). New Zealand Railways (NZR) passenger bogie springs of the period generally had 3 ½" wide leaves.

This research started in 2003 while preparing a request for the refurbishing and manufacture of elliptical springs for the restoration of WMR carriages #48 and #52.

This research note is an attempt to record our findings for posterity.

Passenger Bogie Types

Drawings are available for two passenger bogies (R22 and R111).

Bogie R 22 (actually from drawings R 22, R 23 and R 24)

These bogies were fitted to WMR carriages #1 to #35 (including Addington built cars #17 and #18), as well as some (probably most) passenger vans, dining car D3 (and presumably D1) and various roadsider vans. This bogie had a 4' 6" wheelbase.

WMR manufactured a number of the components for these bogies. It is assumed that the first 16 carriages were supplied complete with bogies and that all following cars were fitted with bogies assembled at the company workshops in Thorndon from locally made components, although wheels, springs and possibly some other components continued to be imported.

Bogie R 111/158

This bogie was fitted to the last 18 (50') carriages #36 to #52 and to dining car D2 (52' 4"). Drawing R 111 and associated component drawings were drawn in 1904 and show a 5' 3" wheelbase bogie. Almost all these drawings are entitled "Passenger cars Nos. 42 to 47" and many endorsed "42 to 53". However assembly drawing R111 (but not the associated component drawings) was cancelled, and replaced by drawing R158. No surviving copy of drawing R158 has been found.

Again it is believed these bogies were all built in Thorndon using imported wheels and springs.

Bogie R 149

Reference to this bogie can be found on the NZR rolling stock diagrams for the six class Pv bogie goods vans built in 1905 and 1906 (#117/x25614), and for the final two passenger guards vans built in 1906 and 1907 (#21/x25623).

Bogie R149 has a 5' 0" wheelbase and is essentially a shortened version of the R111/158 bogie. The drawing for this bogie has not been found. It is assumed that the WMR had decided not to build any further R22 bogies and produced the R149 bogie where shorter wheelbase "passenger" bogies were required (i.e. under 43' 4" underframes). The R22 bogie was probably considered an obsolete design as it had a number of wooden frame components, whereas the R111/158 and R149 bogies use timber only in the bolster.

Surviving WMR “Passenger” Bogies

It is believed that just eight WMR “passenger” bogies survive. For the purpose of this article they will be referred to as bogies B1 to B8.

B1 to B7 have 5' 3" wheelbase and appear to be R111/158 bogies. B8 has a 5' 0" wheelbase. The only WMR bogie with a 5' 0" wheelbase is the R149 bogie.

B1 and B2 are under WMR #42 at the Bust Tramway Club, Pukemiro. They are complete. The elliptical springs have a 30" span.

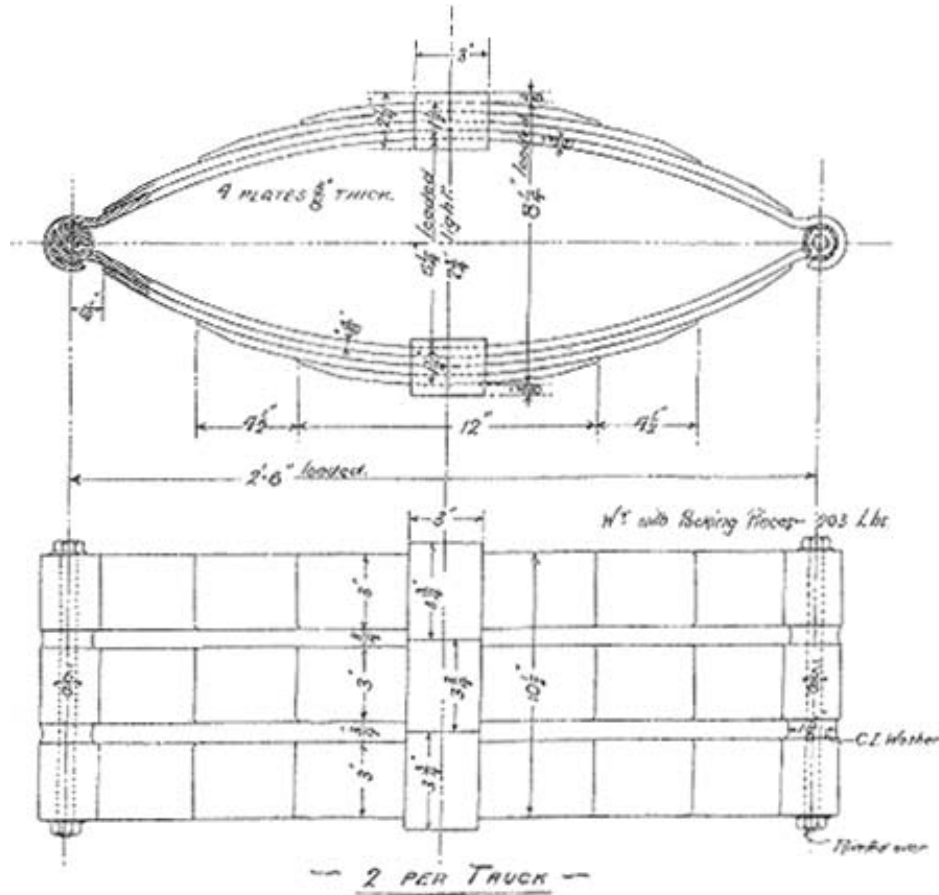
B3 and B4 came with WMR #48. They were complete and are currently located at the New Zealand Railway & Locomotive Society (NZRLS) North End shed, Silverstream along with #48. The horn castings are dated 1906, while the axle box lid castings are dated 1901 (x2) and 1906 (x1). The span of the elliptical springs varies from 33" to 34".

B5 and B6 were recovered from Mamaku in 1976 where they had been in use as log jiggers. They were recovered by members of Silver Stream Railway (SSR) for use under WMR #52. Only one elliptical spring (30" span) came with these bogies. They are also currently located at the NZRLS North End shed along with #52. The horn castings are dated 1906. A third bogie was recovered by SSR but to date this has not been located and is presumed lost.

B7 is presumed to have been recovered from Mamaku. It too has been converted to a log jigger. Bolster, elliptical springs and most of the brake gear is missing and a number of additional components are welded to the frame. It is currently located at Goldfields Railway, Waihi. The horn castings are dated 1906.

B8 has a 5' 0" wheelbase. It was saved from under a wooden underframe at Otahuhu workshops in the late 1970's or early 1980's, to become an exhibit at the Museum of Transport & Technology (MOTAT). It is essentially complete however the elliptical springs have corroded to the point where they have disintegrated; this made it almost impossible to measure the span. A measurement was able to be taken from the centre of the buckle shoe to the last remaining remnant of a tie bolt (spring curl) and the span (30") estimated

from this. There are no casting dates on the horn castings. I believe it is the only surviving R149 bogie.



*Marchbank
Jan 1904*

TRUCK SPRINGS &C.

PASSENGER CARS NOS 42 TO 77
S.O. Carriage Roll No. 154

R.100.

Figure 9.1 – Part of WMR drawing R100.

Drawings

References to WMR car and wagon drawings (classified with the 'R' prefix by the WMR) numbered R1 to R192 have been found in NZR drawing OP972, unfortunately many of these 'R' drawings appear to be missing. Above R135, only R181 still exists in official collections (Toll, NANZ, etc.).

The early cars (numbers 1 to 35) were fitted with the R22 bogie which is shown with 30" span elliptical springs. Bogie drawing R111 for the later cars also shows a 30" span, as does component drawing R100. Drawings R42 and R43 (drawn in 1899 and 1896 respectively) both show an elliptical spring with a 30" span, drawing 43 was cancelled in 1899.

The NZR Chief Mechanical Engineer (CME) card index for WMR car and wagon drawings refers to drawing R141 "Springs Elliptic for Cars". This drawing has not been found.

WMR drawing R128 'Alterations to Spring Links' shows an alteration to the R111 bogie.

Problem

The span of the elliptical springs fitted to the two bogies under WMR carriage #48 (B5 and B6 above) was found to be between 33" and 34". This contrasts with the known drawings which all show a span of 30" over the tie bolts.

The WMR cars were known to ride particularly smoothly. E.J. (Jack) McClare commented that in his experience (on the Otahuhu workshops train) the WMR cars were the smoothest riding cars around. A.N. Palmer in "*Steel Roads of New Zealand*" (p45) wrote "Later I was to travel to and from college in the high-roofed Manawatu cars, learning that 1127 (formerly WMR No.49) was easily the smoothest-riding passenger coach to be found."

Certainly a 33" span elliptical spring would give a softer ride than one of 30" span.

Hypothesis

WMR carriage #42 is fitted with 30" span elliptical springs. It might be assumed then that these are the size that is standard for this carriage. WMR #42 was the first carriage in the second batch of carriages equipped with the R111/158 bogie.

WMR carriage #48 is fitted with elliptical springs with a span of 33" to 34". It might also be assumed then, that these are the size that is standard for this carriage. WMR #48 was the first carriage in the third batch of carriages equipped with the R111/158 bogie.

The origin of these springs is open to speculation. They may have been rebuilt at some date unknown by NZR, or they may have been part of the difference between drawings R111 and R158.

So possibly the third and final batch of these bogies were fitted with softer springs (i.e. with longer span elliptical springs). In support of this theory is that the carriage mentioned in A.N. Palmer's article, WMR #49, was also a member of this last batch. In contradiction to the theory is the single spring nest found in bogie B3 and B4.

However, it is believed the elliptical springs and bolsters were not used during the bogies' roll as log jiggers. The spring trays were removed (the hangers have been cut through) and there were no bolsters in these bogies. The one spring may well have been recovered separately and placed in the bogie for ease of transport. The bolsters were separate. They may have been recovered from around the Mamaku workshop from among discarded springs and bolsters from batch 1, 2 and 3 bogies.

WMR drawings R128 and R141 may be modifications to the R111 bogie that necessitated it's redraw as R 158, with R141 possibly showing a 33" span spring.

A summary of the properties of the various WMR spring arrangements is shown below (*Figure 9.2*).

Conclusion

Without access to drawing R158 or R141, it is not possible to be sure of the size of elliptical springs fitted to the latter WMR carriages. I feel it is not unreasonable to conclude that elliptical springs with a span of 33 to 34" are correct for the six carriages fitted with the third and final batch of R111/158 bogies.

	R22	R42	R43	R100	R141
Drawn	?	1899	1896	1904	?
Spring Span	30"	30"	30"	30"	?
Free Height	?	11"	?	11 1/2"	?
Loaded Height	8 3/4"	?	9"	9"	?
No. of Leaves	4	4	4	4	?
Leaf Width	3"	3"	3"	3"	?
Leaf Thickness	11/32"	11/32"	3/8"	3/8"	?

Figure 9.2 – Comparisons of all known WMR elliptical spring drawings.



Acknowledgements

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Bibliography

- “Steel Roads of New Zealand” edited by Gordon Troupe
- NZR CME card index for WMR car and wagon drawings
- “NZR Passenger and Postal Cars” list of 1935

Drawings

- R22 ‘Details of Standard Passenger Truck’.
- R42 ‘Elliptical Springs’
- R43 ‘Elliptical Springs’.
- R100 ‘Truck Springs &c - for Passenger Cars Nos.42 – 47”
- R111 ‘Truck – Passenger Cars Nos.42 – 47”
- R128 ‘Alterations to Spring Links’
- x25614 ‘Car Diagrams’
- x25623 ‘Car Diagrams’