

Archie-M Standard Loads

UK rail loads to NR/GN/CIV/025

1 Document History

- 2023-06-14 HH
 - New rail loads distributed with Archie-M 2.6.
 - Versions without symmetrical loads (for Archie-M 2.6) and with (for 2.5.1) generated.

2 Introduction

This document describes the Archie-M rail loads, how they are derived, and how they interact with the transverse distribution rules. We also look at the load factors set out in NR/GN/CIV/025.

Users of these load definitions should read both NR/GN/CIV/025 and this document carefully. We have interpreted the rules as written, but it is your responsibility to ensure that the loads used in assessment *both* satisfy the standard *and* reasonably represent the real situation of concern.

If you think there is an error in the loads, you disagree with the interpretation of the standards given here, or simply have questions, please email us at support@obvis.com.

317.5

3 Vehicle and available (formerly “bridge”) widths

As with the road assessment standards, the transverse distribution model from 025 is naive, and makes it impossible to deal sensibly with complex bridges or loads.

Standard rail gauge is 1435mm, sleeper distribution of 400mm each side of each wheel, and transverse distribution at 1:1 from the sleeper base, mean that distributed wheel loads will meet with cover between sleeper base and extrados of 300mm. However 025 requires that centrifugal forces are taken into account, which can shift load between the axles.

To do so, we are required to curtail transverse distribution at the middle of the four-foot (mid-point between the rails), and consider the more heavily loaded rail only. For this reason, the rail loads are provided as *wheel* loads, **and the available width must be set accordingly.**

The correct available width to use is the width of bridge that can be used by this load alone. For wheel loads, that is the distance from the middle of the four-foot to mid-point between the load and the near side of the next track if there is one, or the edge of the bridge. If longitudinal cracks or construction joints exist these should also be taken into account.

Notes:

1. It is at least possible that the more heavily loaded rail is not the critical rail, as the available width for each rail will be different, and the ratio of available widths could well be greater than that between rail loads.
2. Archie-M 2.6 asks for an *available* width where 2.5.1 and before referred to a *bridge* width. The latter term caused some confusion, we hope that the new one helps.

4 Factors of safety

025 specifies use of partial factors for live loads as follows (section 6.1.7):

$$\gamma_{fL} = 1.4$$

$$\gamma_{f3} = 1.35$$

$$\gamma_m = 1.0$$

Where γ_{fL} is the partial factor on load, γ_{f3} on load effect, and γ_m on material strength. The use of 1.0 on material strength presumably reflects the fact that masonry strength is highly uncertain and variable, and this is generally taken into account by the use of conservative values.

Note that $1.4 \times 1.35 = 1.9$, so the overall factor on live load is identical to that used in BD21 (but 5% higher than that used in the current CS454).

In addition:

A dynamic factor of 1.8 should be applied to a single axle load or to the critical axle of a train of loads.

This specific instruction seems to override section 4.3.2 on Dynamic Effects. Again, the value of 1.8 is identical to the standard impact factor used in road bridge assessment.

No mention is made of bogies or groups of axles, so this appears to apply to a single axle in any train of loads. For masonry bridge assessment, most often we will be considering short loads anyway.

There is no suggestion in 025 (as there is in BD21 and CS454) that the factors here are in some way intended to guard against progressive deterioration of masonry. The partial factors are given without comment.

5 Load Factors

5.1 Dynamic factor (Impact)

The dynamic factor is to be applied to “the critical axle” of a train of loads. In practice we simply apply the dynamic factor to each axle in turn, and find the worst result.

This is handled in Archie-M by providing load cases with impact applied to each axle in a load. Load files for Archie-M 2.5.1 must provide symmetrical load cases, as auto-run does not test loads in both directions. Archie-M 2.6 auto-run does run loads both ways, so loads supplied with Archie-M 2.6 filter symmetrical load cases.

6 Load models

6.1 The RA1 load model

The primary assessment load model is RA1. Figure 6.1, from NR/GN/CIV/025, gives the specifications for the full and “short lengths” loads. See the Obvis help site for discussion of what this represents; in short, nothing that we expect to see on a modern railway.

For masonry bridges, the “short lengths” model is most likely to be critical. The full RA1 load model produces a distributed load, which masonry bridges will generally tolerate well. Under a distributed load, the axial stress in the arch barrel will increase, but the eccentricity of that stress will be low. It is concentrated loads that cause problems, both in assessment and in reality.

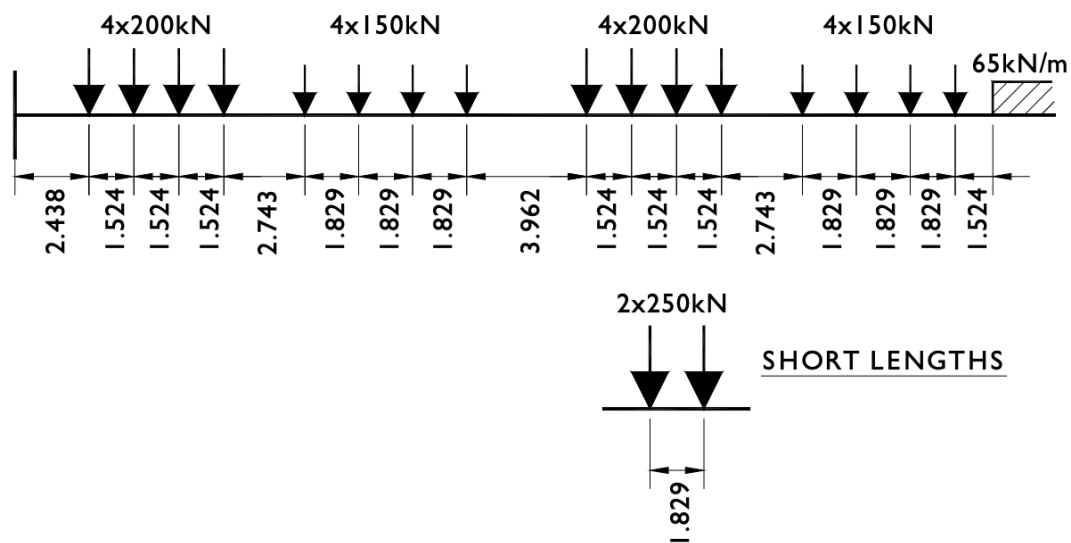


Figure 6.1: The RA1 load model (loads represent 20 units of RA1).

6.2 Assessment Load Wagon

Figure 6.2 shows the “Assessment Load Wagon”. This represents a bogie wagon, 11.696m over couplings. The bogies are identical to the RA1 short lengths load model.

6 Load models

For masonry bridges (at least), the *pair of bogies over a coupling* (not those from a single wagon as shown) might have a more adverse effect in some circumstances than the single bogie short lengths load.

It is certainly the case that this loading - 2 no. 50 tonne bogies with a minimum gap between - is causing serious damage to masonry viaducts across the network. This effect will vary depending on arch geometry relative to the wagon wheelbase.

025 does not specify how the Assessment Load Wagon fits into the RA rating scheme.

11.596

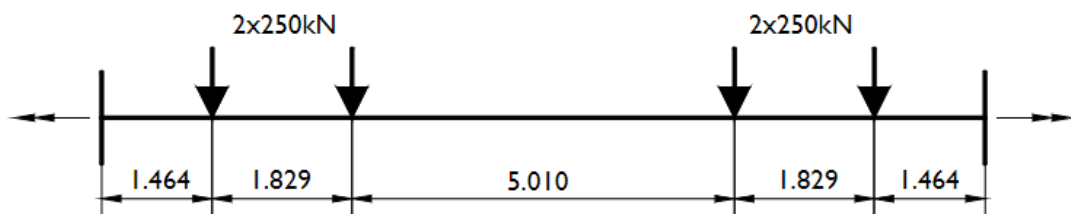


Figure 6.2: NR/GN/CIV/025 figure 4.2: Assessment Load Wagon

6.3 The D4 model

Archie-M 2.5.1 and before was shipped with a “D4 vehicle load”. Loads with 1, 2, 3 and 4 axles were given. These had the geometry of the current Assessment Load Wagon, for a pair of bogies over the coupling, but a 22.5tonne axle load.

The current UIC D4 model still has 22.5tonne axles, but metricated dimensions (1.8m axle spacing, and 1.5m from coupling to nearest axle). The D4 load model now shipped matches these UIC dimensions. The differences are small.

2.928

7 RA rating of bridges

A major area of difference of rail assessment from road bridges is the use of the RA rating. The idea is that if all bridges and all vehicles have an RA rating, then it is immediately clear whether a vehicle can cross a bridge.

The problem with this is that the RA system is geared towards beam type bridges, where bridge and load geometry do not have such controlling influences on the outcome. In that case, it is possible to rate vehicles and bridges separately, and simply compare the resulting ratings. Masonry bridge behaviour is strongly influenced by both.

Note that the numbers in Figure 6.1 represent *20 units* of RA1 loading. Even more confusing, an RA1 *rating* requires *11 units* of RA1 loading. The full rating system is given in Figure 7.1.

RA NUMBER	RANGE OF UNITS	RANGE OF SINGLE AXLE WEIGHTS
RA0	Up to 10.99 units	Under 13.96 tonnes
RA1	11.00 to 11.99 units	13.97 to 15.23 tonnes
RA2	12.00 to 12.99 units	15.24 to 16.50 tonnes
RA3	13.00 to 13.99 units	16.51 to 17.77 tonnes
RA4	14.00 to 14.99 units	17.78 to 19.04 tonnes
RA5	15.00 to 15.99 units	19.05 to 20.31 tonnes
RA6	16.00 to 16.99 units	20.32 to 21.58 tonnes
RA7	17.00 to 17.99 units	21.59 to 22.85 tonnes
RA8	18.00 to 18.99 units	22.86 to 24.12 tonnes
RA9	19.00 to 19.99 units	24.13 to 25.39 tonnes
RA10	20.00 to 20.99 units	25.40 to 26.66 tonnes
RA11	21.00 to 21.99 units	26.67 to 27.93 tonnes
RA12	22.00 to 22.99 units	27.94 to 29.20 tonnes
RA13	23.00 to 23.99 units	29.21 to 30.47 tonnes
RA14	24.00 to 24.99 units	30.48 to 31.74 tonnes
RA15	25.00 units and over	31.75 tonnes and over

Figure 7.1: NR/GN/CIV/025 table 4.3, Route Availability Classification for Bridges

Prior to Archie-M 2.6, only then RA10 load was provided. Assessment for different RA classifications was achieved by adjusting the load factors.

There are situations in which it would be convenient to run a full set of RA loads, and see where the failure happens. We have generated loads to allow this.

7 RA rating of bridges

This table based presentation is awkward to use in a semi-automated assessment context. The approach we have taken is to create loads for the bottom end of each RA band. No RA0 load is provided, as if a bridge fails for RA1, it is RA0. This approach handles the odd situation that an RA15 rating apparently allows any load over 25 units of RA1.

It isn't clear how the single axle weights values are derived. No normal value for g produces 25.40 tonnes from 250kN.

8 Load file

Archie-M load files organise loads into *families* and *groups*. There is no correct way to arrange things, but we try arrange things to make it easy to select relevant loads for autorun.

We group the RA1 full length loads as one family, and short lengths as another. Within each family, we group the loads for a particular RA rating. And within each group, there is a no impact, and a load with impact on each axle. Symmetrical loads are removed.

Because the RA1 full length load model is asymmetrical, there is no opportunity to cull symmetrical loads, so the full set here is large. We only consider impact on the heavy axles.

The third family is “other loads”, with groups for the Assessment Load Wagon and D4 loads. Only the full 25tonne or 22.5tonne axle loads are provided for these. Again, in impact and impact variants are given.

Because it is sometimes necessary to use wheel loads, but where not (e.g. where track is not curved) it can be simpler to use axle loads, we provide both. **It is vital that the appropriate available width is used in each case.**

The following shows a partial load file for the RA1 short and long loads. The number of variants for the long loads makes this rather verbose; the full load file is very long.

```
%FAMILY: Rail - wheel loads - RA short length

%GROUP: RA3 short length - wheel loads

RA3 short - wheel - no impact, 16.58, 2, 1, 8.29, 1.829, 8.29, 1, 0.800; 0.800
RA3 short - wheel - impact on 1, 23.21, 2, 1, 14.92, 1.829, 8.29, 1, 0.800; 0.800

%GROUP: RA4 short length - wheel loads

RA4 short - wheel - no impact, 17.86, 2, 1, 8.93, 1.829, 8.93, 1, 0.800; 0.800
RA4 short - wheel - impact on 1, 25.00, 2, 1, 16.07, 1.829, 8.93, 1, 0.800; 0.800

%GROUP: RA10 short length - wheel loads

RA10 short - wheel - no impact, 25.51, 2, 1, 12.76, 1.829, 12.76, 1, 0.800; 0.800
```

8 Load file

```
RA10 short - wheel - impact on 1, 35.71, 2, 1, 22.96, 1.829, 12.76, 1, 0.800; 0.800

%FAMILY: Rail - axle loads - RA short length

%GROUP: RA3 short length - axle loads

RA3 short - axle - no impact, 33.16, 2, 1, 16.58, 1.829, 16.58, 1, 2.235; 2.235
RA3 short - axle - impact on 1, 46.43, 2, 1, 29.85, 1.829, 16.58, 1, 2.235; 2.235

%GROUP: RA4 short length - axle loads

RA4 short - axle - no impact, 35.71, 2, 1, 17.86, 1.829, 17.86, 1, 2.235; 2.235
RA4 short - axle - impact on 1, 50.00, 2, 1, 32.14, 1.829, 17.86, 1, 2.235; 2.235

%GROUP: RA10 short length - axle loads

RA10 short - axle - no impact, 51.02, 2, 1, 25.51, 1.829, 25.51, 1, 2.235; 2.235
RA10 short - axle - impact on 1, 71.43, 2, 1, 45.92, 1.829, 25.51, 1, 2.235; 2.235

%FAMILY: Rail - wheel loads - RA full length (no UDL)

%GROUP: RA3 full length (no UDL) - wheel loads

RA3 long - wheel - no impact, 92.86, 16, 1, 6.63, 1.524, 6.63, 1.524, 6.63, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 6.63, 1.524,
↪ 6.63, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
RA3 long - wheel - impact on 1, 98.16, 16, 1, 11.94, 1.524, 6.63, 1.524, 6.63, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 6.63, 1.524,
↪ 6.63, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
RA3 long - wheel - impact on 2, 98.16, 16, 1, 6.63, 1.524, 11.94, 1.524, 6.63, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 6.63, 1.524,
↪ 6.63, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
RA3 long - wheel - impact on 3, 98.16, 16, 1, 6.63, 1.524, 6.63, 1.524, 11.94, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 6.63, 1.524,
↪ 6.63, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
RA3 long - wheel - impact on 4, 98.16, 16, 1, 6.63, 1.524, 6.63, 1.524, 6.63, 1.524, 11.94,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 6.63, 1.524,
↪ 6.63, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
RA3 long - wheel - impact on 9, 98.16, 16, 1, 6.63, 1.524, 6.63, 1.524, 6.63, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 11.94, 1.524, 6.63, 1.524,
↪ 6.63, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
```

8 Load file

```
RA3 long - wheel - impact on 10, 98.16, 16, 1, 6.63, 1.524, 6.63, 1.524, 6.63, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 11.94, 1.524,
↪ 6.63, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
RA3 long - wheel - impact on 11, 98.16, 16, 1, 6.63, 1.524, 6.63, 1.524, 6.63, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 6.63, 1.524,
↪ 11.94, 1.524, 6.63, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800
RA3 long - wheel - impact on 12, 98.16, 16, 1, 6.63, 1.524, 6.63, 1.524, 6.63, 1.524, 6.63,
↪ 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 3.962, 6.63, 1.524, 6.63, 1.524,
↪ 6.63, 1.524, 11.94, 2.743, 4.97, 1.829, 4.97, 1.829, 4.97, 1.829, 4.97, 1, 0.800; 0.800

%GROUP: RA4 full length (no UDL) - wheel loads

RA4 long - wheel - no impact, 100.00, 16, 1, 7.14, 1.524, 7.14, 1.524, 7.14, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 7.14, 1.524,
↪ 7.14, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 1, 105.71, 16, 1, 12.86, 1.524, 7.14, 1.524, 7.14, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 7.14, 1.524,
↪ 7.14, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 2, 105.71, 16, 1, 7.14, 1.524, 12.86, 1.524, 7.14, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 7.14, 1.524,
↪ 7.14, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 3, 105.71, 16, 1, 7.14, 1.524, 7.14, 1.524, 12.86, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 7.14, 1.524,
↪ 7.14, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 4, 105.71, 16, 1, 7.14, 1.524, 7.14, 1.524, 7.14, 1.524, 12.86,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 7.14, 1.524,
↪ 7.14, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 9, 105.71, 16, 1, 7.14, 1.524, 7.14, 1.524, 7.14, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 12.86, 1.524, 7.14, 1.524,
↪ 7.14, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 10, 105.71, 16, 1, 7.14, 1.524, 7.14, 1.524, 7.14, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 12.86, 1.524,
↪ 7.14, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 11, 105.71, 16, 1, 7.14, 1.524, 7.14, 1.524, 7.14, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 7.14, 1.524,
↪ 12.86, 1.524, 7.14, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800
RA4 long - wheel - impact on 12, 105.71, 16, 1, 7.14, 1.524, 7.14, 1.524, 7.14, 1.524, 7.14,
↪ 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 3.962, 7.14, 1.524, 7.14, 1.524,
↪ 7.14, 1.524, 12.86, 2.743, 5.36, 1.829, 5.36, 1.829, 5.36, 1.829, 5.36, 1, 0.800; 0.800

%GROUP: RA10 full length (no UDL) - wheel loads
```

8 Load file

```
RA10 long - wheel - no impact, 142.86, 16, 1, 10.20, 1.524, 10.20, 1.524, 10.20, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 10.20,
↪ 1.524, 10.20, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 1, 151.02, 16, 1, 18.37, 1.524, 10.20, 1.524, 10.20, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 10.20,
↪ 1.524, 10.20, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 2, 151.02, 16, 1, 10.20, 1.524, 18.37, 1.524, 10.20, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 10.20,
↪ 1.524, 10.20, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 3, 151.02, 16, 1, 10.20, 1.524, 10.20, 1.524, 18.37, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 10.20,
↪ 1.524, 10.20, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 4, 151.02, 16, 1, 10.20, 1.524, 10.20, 1.524, 10.20, 1.524,
↪ 18.37, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 10.20,
↪ 1.524, 10.20, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 9, 151.02, 16, 1, 10.20, 1.524, 10.20, 1.524, 10.20, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 18.37, 1.524, 10.20,
↪ 1.524, 10.20, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 10, 151.02, 16, 1, 10.20, 1.524, 10.20, 1.524, 10.20, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 18.37,
↪ 1.524, 10.20, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 11, 151.02, 16, 1, 10.20, 1.524, 10.20, 1.524, 10.20, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 10.20,
↪ 1.524, 18.37, 1.524, 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

RA10 long - wheel - impact on 12, 151.02, 16, 1, 10.20, 1.524, 10.20, 1.524, 10.20, 1.524,
↪ 10.20, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 3.962, 10.20, 1.524, 10.20,
↪ 1.524, 10.20, 1.524, 18.37, 2.743, 7.65, 1.829, 7.65, 1.829, 7.65, 1.829, 7.65, 1,
↪ 0.800; 0.800

%FAMILY: Rail - axle loads - RA full length (no UDL)

%GROUP: RA3 full length (no UDL) - axle loads
```

8 Load file

```
RA3 long - axle - no impact, 185.71, 16, 1, 13.27, 1.524, 13.27, 1.524, 13.27, 1.524, 13.27,
↳ 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 13.27, 1.524,
↳ 13.27, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1, 2.235; 2.235
RA3 long - axle - impact on 1, 196.33, 16, 1, 23.88, 1.524, 13.27, 1.524, 13.27, 1.524,
↳ 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 13.27,
↳ 1.524, 13.27, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235
RA3 long - axle - impact on 2, 196.33, 16, 1, 13.27, 1.524, 23.88, 1.524, 13.27, 1.524,
↳ 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 13.27,
↳ 1.524, 13.27, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235
RA3 long - axle - impact on 3, 196.33, 16, 1, 13.27, 1.524, 13.27, 1.524, 23.88, 1.524,
↳ 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 13.27,
↳ 1.524, 13.27, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235
RA3 long - axle - impact on 4, 196.33, 16, 1, 13.27, 1.524, 13.27, 1.524, 13.27, 1.524,
↳ 23.88, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 13.27,
↳ 1.524, 13.27, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235
RA3 long - axle - impact on 9, 196.33, 16, 1, 13.27, 1.524, 13.27, 1.524, 13.27, 1.524,
↳ 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 23.88, 1.524, 13.27,
↳ 1.524, 13.27, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235
RA3 long - axle - impact on 10, 196.33, 16, 1, 13.27, 1.524, 13.27, 1.524, 13.27, 1.524,
↳ 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 23.88,
↳ 1.524, 13.27, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235
RA3 long - axle - impact on 11, 196.33, 16, 1, 13.27, 1.524, 13.27, 1.524, 13.27, 1.524,
↳ 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 13.27,
↳ 1.524, 23.88, 1.524, 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235
RA3 long - axle - impact on 12, 196.33, 16, 1, 13.27, 1.524, 13.27, 1.524, 13.27, 1.524,
↳ 13.27, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 3.962, 13.27, 1.524, 13.27,
↳ 1.524, 13.27, 1.524, 23.88, 2.743, 9.95, 1.829, 9.95, 1.829, 9.95, 1.829, 9.95, 1,
↳ 2.235; 2.235

%GROUP: RA4 full length (no UDL) - axle loads

RA4 long - axle - no impact, 200.00, 16, 1, 14.29, 1.524, 14.29, 1.524, 14.29, 1.524,
↳ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,
↳ 14.29, 1.524, 14.29, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,
↳ 10.71, 1, 2.235; 2.235
```

8 Load file

```
RA4 long - axle - impact on 1, 211.43, 16, 1, 25.71, 1.524, 14.29, 1.524, 14.29, 1.524,  
  ⇨ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,  
  ⇨ 14.29, 1.524, 14.29, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
RA4 long - axle - impact on 2, 211.43, 16, 1, 14.29, 1.524, 25.71, 1.524, 14.29, 1.524,  
  ⇨ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,  
  ⇨ 14.29, 1.524, 14.29, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
RA4 long - axle - impact on 3, 211.43, 16, 1, 14.29, 1.524, 14.29, 1.524, 25.71, 1.524,  
  ⇨ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,  
  ⇨ 14.29, 1.524, 14.29, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
RA4 long - axle - impact on 4, 211.43, 16, 1, 14.29, 1.524, 14.29, 1.524, 14.29, 1.524,  
  ⇨ 25.71, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,  
  ⇨ 14.29, 1.524, 14.29, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
RA4 long - axle - impact on 9, 211.43, 16, 1, 14.29, 1.524, 14.29, 1.524, 14.29, 1.524,  
  ⇨ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 25.71, 1.524,  
  ⇨ 14.29, 1.524, 14.29, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
RA4 long - axle - impact on 10, 211.43, 16, 1, 14.29, 1.524, 14.29, 1.524, 14.29, 1.524,  
  ⇨ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,  
  ⇨ 25.71, 1.524, 14.29, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
RA4 long - axle - impact on 11, 211.43, 16, 1, 14.29, 1.524, 14.29, 1.524, 14.29, 1.524,  
  ⇨ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,  
  ⇨ 14.29, 1.524, 25.71, 1.524, 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
RA4 long - axle - impact on 12, 211.43, 16, 1, 14.29, 1.524, 14.29, 1.524, 14.29, 1.524,  
  ⇨ 14.29, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829, 10.71, 3.962, 14.29, 1.524,  
  ⇨ 14.29, 1.524, 14.29, 1.524, 25.71, 2.743, 10.71, 1.829, 10.71, 1.829, 10.71, 1.829,  
  ⇨ 10.71, 1, 2.235; 2.235  
  
%GROUP: RA10 full length (no UDL) - axle loads  
  
RA10 long - axle - no impact, 285.71, 16, 1, 20.41, 1.524, 20.41, 1.524, 20.41, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 20.41, 1.524, 20.41, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235  
RA10 long - axle - impact on 1, 302.04, 16, 1, 36.73, 1.524, 20.41, 1.524, 20.41, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 20.41, 1.524, 20.41, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235
```

8 Loadfile

```
RA10 long - axle - impact on 2, 302.04, 16, 1, 20.41, 1.524, 36.73, 1.524, 20.41, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 20.41, 1.524, 20.41, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235  
RA10 long - axle - impact on 3, 302.04, 16, 1, 20.41, 1.524, 20.41, 1.524, 36.73, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 20.41, 1.524, 20.41, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235  
RA10 long - axle - impact on 4, 302.04, 16, 1, 20.41, 1.524, 20.41, 1.524, 20.41, 1.524,  
  ⇨ 36.73, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 20.41, 1.524, 20.41, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235  
RA10 long - axle - impact on 9, 302.04, 16, 1, 20.41, 1.524, 20.41, 1.524, 20.41, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 36.73, 1.524,  
  ⇨ 20.41, 1.524, 20.41, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235  
RA10 long - axle - impact on 10, 302.04, 16, 1, 20.41, 1.524, 20.41, 1.524, 20.41, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 36.73, 1.524, 20.41, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235  
RA10 long - axle - impact on 11, 302.04, 16, 1, 20.41, 1.524, 20.41, 1.524, 20.41, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 20.41, 1.524, 36.73, 1.524, 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235  
RA10 long - axle - impact on 12, 302.04, 16, 1, 20.41, 1.524, 20.41, 1.524, 20.41, 1.524,  
  ⇨ 20.41, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829, 15.31, 3.962, 20.41, 1.524,  
  ⇨ 20.41, 1.524, 20.41, 1.524, 36.73, 2.743, 15.31, 1.829, 15.31, 1.829, 15.31, 1.829,  
  ⇨ 15.31, 1, 2.235; 2.235
```

```
%FAMILY: Rail - wheel loads - Other loads
```

```
%GROUP: Assessment Load Wagon - wheel loads
```

```
ALW over coupling - wheel - no impact, 51.02, 4, 1, 12.76, 1.829, 12.76, 2.928, 12.76,  
  ⇨ 1.829, 12.76, 1, 0.800; 0.800  
ALW over coupling - wheel - impact on 1, 61.22, 4, 1, 22.96, 1.829, 12.76, 2.928, 12.76,  
  ⇨ 1.829, 12.76, 1, 0.800; 0.800  
ALW over coupling - wheel - impact on 2, 61.22, 4, 1, 12.76, 1.829, 22.96, 2.928, 12.76,  
  ⇨ 1.829, 12.76, 1, 0.800; 0.800
```

8 Load file

```
%GROUP: D4 load - wheel loads

D4 over coupling - wheel - no impact, 45.00, 4, 1, 11.25, 1.800, 11.25, 3.000, 11.25,
↵ 1.800, 11.25, 1, 0.800; 0.800
D4 over coupling - wheel - impact on 1, 54.00, 4, 1, 20.25, 1.800, 11.25, 3.000, 11.25,
↵ 1.800, 11.25, 1, 0.800; 0.800
D4 over coupling - wheel - impact on 2, 54.00, 4, 1, 11.25, 1.800, 20.25, 3.000, 11.25,
↵ 1.800, 11.25, 1, 0.800; 0.800

%FAMILY: Rail - axle loads - Other loads

%GROUP: Assessment Load Wagon - axle loads

ALW over coupling - axle - no impact, 102.04, 4, 1, 25.51, 1.829, 25.51, 2.928, 25.51,
↵ 1.829, 25.51, 1, 2.235; 2.235
ALW over coupling - axle - impact on 1, 122.45, 4, 1, 45.92, 1.829, 25.51, 2.928, 25.51,
↵ 1.829, 25.51, 1, 2.235; 2.235
ALW over coupling - axle - impact on 2, 122.45, 4, 1, 25.51, 1.829, 45.92, 2.928, 25.51,
↵ 1.829, 25.51, 1, 2.235; 2.235

%GROUP: D4 load - axle loads

D4 over coupling - axle - no impact, 90.00, 4, 1, 22.50, 1.800, 22.50, 3.000, 22.50, 1.800,
↵ 22.50, 1, 2.235; 2.235
D4 over coupling - axle - impact on 1, 108.00, 4, 1, 40.50, 1.800, 22.50, 3.000, 22.50,
↵ 1.800, 22.50, 1, 2.235; 2.235
D4 over coupling - axle - impact on 2, 108.00, 4, 1, 22.50, 1.800, 40.50, 3.000, 22.50,
↵ 1.800, 22.50, 1, 2.235; 2.235
```

9 Load file

The complete set of loads is assembled in the file `Rail_loads.ldf`. This file is included in the Archie-M distribution, so the various families should appear in the standard load list.

A variant with all symmetrical load cases included for use with Archie-M 2.5.1 is provided in `Rail_loads_withsymmetrical.ldf`