Engineering Standard

Rolling Stock

CRN RS 012

RAIL VEHICLE WEIGHING REQUIREMENTS

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Summary of changes from previous version

Section	Summary of change

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Rail vehicle weighing requirements

1 Introduction

This standard describes the procedure recommended for weighing rail vehicles, and the method of assessing measured results, including allowable limits.

The weighing facility used shall be capable of measuring individual wheel loads.

2 Weighing test procedure

The weight of the complete vehicle, in working order, and the vertical load exerted by each wheel on the track shall be measured, with due regard to the accuracy of the measuring equipment.

Either mechanical or electronic/load cell weighing methods may be used.

Track at the weighing site shall be nominally tangent and be level in the horizontal plane within 1 mm for at least 20m either side of the site.

2.1 Vehicle inspection

Prior to weighing, the following items shall be checked:-

- All axle box clearances must be equal to or greater than the minimum allowable dimension. This may be checked using a long feeler gauge or by running the vehicle over an obstruction placed on the rail head, and observing free motion of the axle boxes relative to the horn guides.
- All equipment fitted to the bogies must be in the running condition, which includes the correct fitment of all dampers, traction rods, torsion bars and levelling valves where applicable.
- Vehicles with semi-permanent couplers shall remain coupled throughout the weighing operation.
- The car body of the vehicle must be located centrally in the lateral direction with respect to the bogie and track centre line.
- Vehicles fitted with an air spring secondary suspension shall have their spring heights set to the correct height as specified by the spring manufacturer. The vehicle must be on level track.

  Note: Prior to, and during the weighing process, air springs shall be kept fully inflated at the correct level by a suitable main reservoir air supply. Air spring isolation cocks shall be open and levelling valve arms shall be connected.
- Air sprung vehicle heights shall be measured from rail head to a reference point on the car body and must be within the allowable limits for the vehicle being weighed.

  Note: The vehicle height shall not be altered by adjustment of levelling valves unless the air spring height is incorrect.
- All brakes must be in the released position for the vehicle being weighed. Brakes shall not be applied on the vehicle being weighed or at any time during the weighing operation, including whilst shunting the vehicle on and off the weighbridge.

  Note: Particular attention shall be given to ensure that vehicles, fitted with spring parking brakes, have the brakes released either manually or by maintaining a main reservoir air supply on the vehicle.

2.2 Vehicle weighing procedure

For consistency in the method of weighing vehicles, it is recommended that the following procedure be followed.

- The vehicle shall be moved at low speed onto the weighbridge.
- Whilst the vehicle is on the weighbridge, no alteration or adjustment shall be made to the state of the vehicle (body or suspension) including artificial blows, shaking or other procedure unless the vehicle is run over a minimum distance of 200 metres after the above mentioned adjustment is carried out and immediately prior to reweighing the vehicle.

  Note: No personnel are to be permitted to climb on or enter the vehicle during the weighing process.

- The weighing procedure shall consist of four (4) independent weighings as follows:-
  - ~ Weigh (1) - direction A
  - ~ Weigh (2) - direction B
  - ~ Weigh (3) - direction A
  - ~ Weigh (4) - direction B

That is, the direction which the vehicle approaches the weighbridge shall alternate between successive weighings.

Also, where possible, the vehicle must be run over a minimum distance of 200 metres immediately before each weighing.

This will assist in shaking the vehicle suspension system to eliminate, as far as possible, errors resulting from friction in the suspension system.

2.3 Analysis of measured results - total vehicle weight

Following the weighings and the recording of the wheel load results, the weighing uncertainty, E shall be calculated as follows:

After calculating the total vehicle mass for each of the four (4) weighings, the weighing uncertainty shall be determined by taking the difference between the maximum total vehicle mass, M_{max}, and the minimum total vehicle mass, M_{min}, and dividing the result by 2.

That is,

$$E = \frac{(M_{max} - M_{min})}{2}$$

The average total vehicle mass, M_a, referred to in clauses 2.4.2 and 2.4.3 shall be calculated using the sum of the total vehicle masses, as determined above for each of the four (4) weighings, divided by 4.

That is,

$$M_a = \frac{1}{4}\left[(M1) + (M2) + (M3) + (M4)\right]$$

For both the tare and the fully loaded (crush) condition, the average total vehicle mass, M_a minus the weighing uncertainty E, shall not exceed the maximum specified mass for the tare and fully loaded vehicle, respectively.

$$M_a - E \leq \text{Maximum specified mass}$$

2.4 Analysis of measured results - individual wheel weights

2.4.1 Wheel load P

For each wheel, in turn, the average wheel load (Pa) shall be determined as follows, using that wheel's individual load from each of the four (4) weighings.

That is,

$$P_a = \frac{1}{4}\left[P(1) + P(2) + P(3) + P(4)\right] \quad \text{for each wheel}$$

2.4.2 Driving axles - axle to axle load

The following is recommended for vehicles with driving axles:

The sum of the two (2) average wheel loads P_a at each driving axle in turn, shall not deviate by more than ± 2% from the average axle load, (determined by dividing the 'average total vehicle mass', M_a by the number of axles), for driving axles intended to exert the same tractive effort.

In summary, for each driving axle in turn,

$$(P_a1 + P_a2)\ \text{max} = \frac{1.02}{A}\left[M_a + E\right]$$

$$(P_a1 + P_a2)\ \text{min} = \frac{0.98}{A}\left[M_a - E\right]$$

Where,

P_a1, P_a2 = Average wheel loads on the same driving axle.

A = Total number of axles on the vehicle being weighed.

M_a = Average total vehicle mass

E = Weighing uncertainty.

$(P_a1 + P_a2)$ max, shall not exceed the maximum specified axle load.

2.4.3 Non driving axles - axle to axle load

For vehicles with non driving axles:

The sum of the two (2) wheel loads P_a at each non-driving axle in turn, shall not deviate by more than ± 6% from the average axle load, (determined by dividing the 'average total vehicle mass', M_a by the number of axles).

In summary, for each non driving axle in turn,

$$(P_a3 + P_a4)\ \text{max} = \frac{1.06}{A}\left[M_a + E\right]$$

$$(P_a3 + P_a4)\ \text{min} = \frac{0.94}{A}\left[M_a - E\right]$$

Where,

P_a3, P_a4 = Individual measured average wheel loads on the same non driving axle.

A = Total number of axles on the vehicle being weighed.

M_a = Average total vehicle mass

E = Weighing uncertainty.

($P_a3 + P_a4$) max shall not exceed the maximum specified axle load.

2.4.4 Wheel load across an axle

For a given axle, the average measured wheel load P_a must not deviate by more than ± 4% from the average load per wheel of this axle.

In summary for each axle in turn:

$$Pmax = 0.52\left(P_a1 + P_a2 + \frac{E}{A} \right)$$

$$Pmin = 0.48\left(P_a1 + P_a2 - \frac{E}{A} \right)$$

Where,

Pmax, Pmin = Maximum and minimum allowable wheel loads P, respectively.

P_a1, P_a2 = The two (2) individual average wheel loads associated with each axle in turn.

E = Weighing uncertainty.

A = Total number of axles on vehicle being weighed.

2.4.5 Vehicle mass side to side

Notwithstanding Clause 2.4.4, the sum of the average measured wheel loads P_a along one side of the vehicle must not deviate by more than ± 2% from the average of the sum of all average wheel loads P_a on both sides of the vehicle.

In summary, for each vehicle side:

$$Rmax = Lmax = \frac{1.02}{2}\left(L + R + E \right)$$

$$Rmin = Lmin = \frac{0.98}{2}\left(L + R - E \right)$$

Where,

R max, L max = Maximum permissible sum of the average wheel loads P_a on right and left hand sides of the vehicle, respectively.

Rmin, Lmin = Minimum permissible sum of the average wheel loads P_a on right and left hand sides of the vehicle, respectively.

R, L = Sum of the average wheel loads P_a on right and left hand sides of the vehicle, respectively.

E = Weighing uncertainty.