

Railroad Car Weighing

A Qualifying Guide

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First Principles

Question 1: Accuracy required?

Does the scale need to be certified for Legal for Trade usage i.e. what will the scale weight be used for?

- If Legal for Trade, see **Certified Track Scales** below
- If not Legal for Trade, see **Non Certified Track Scales** on page 3

Certified Track Scales

If the answer to question 1 is “Yes” i.e. scales must be Legal for Trade, ask the following:

Question 2: Throughput?

How many cars to be weighed per day – less than 30 or more than 30?

- **If the answer to question 2 is less than 30 cars per day**, then static weighing is in most cases the most appropriate:

Static Weighing – for static Legal for Trade applications, cars should be weighed full draft but 2 drafts is permitted in some states. Each end of the car must be on the scale. This is usually done by having a 12” scale & a 26” scale with a dead space in-between.

Cars have to be positioned, stopped and then one or both ends uncoupled.

It is potentially the most accurate form of rail car weighing. However, it is very time consuming and sometimes prone to positioning & operator errors.

- **If the answer to question 2 is more than 30 cars per day**, then in-motion weighing is usually the most cost effective & efficient method.

Option 1:

Uncoupled in-motion – cars are uncoupled & “kicked” or free polled across the scales. Usually done two draft using a 12’6” or a 26” scale.

Almost as accurate as static, but still requires uncoupling the cars. Some means of “kicking” the cars across the scales, usually a locomotive, is required.

Option 2:

Coupled in-motion – cars are pulled coupled together across a two draft scale. A 12’6” scale is normally used.

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This is, by far, the quickest & most efficient method as no uncoupling or positioning is required.

However because the cars are coupled there will be errors due to the weight transfer through the couplers. With short trains, good site conditions & smooth trains handling, weight transfer errors can be kept quite low.

Accuracy over complete trains or groups of cars is, in most cases, as accurate as the first 2 methods.

All three basic methods require extensive foundations in addition to the scales themselves.

Accuracies

Accuracies are defined by NIST H44 and are expressed in scale increments. Railroads tracks scales are normally classified as Class III devices but for high accuracy applications Class III accuracies can be achieved.

Initial verification tolerance applied when the scales is initially installed. Maintenance tolerance applies for subsequent test.

The Following table equates the H44 increments to percentage errors.

Accuracy – Certified Scales.			
Type of scale	Accuracy Class	Initial Verification	Maintenance Tolerance
Static- full Draft	III	0.05%	0.1%
	IIIL	0.1%	0.2%
Un- coupled in-motion	IIIL	0.2%	0.2%
Coupled in-motion	IIIL	Individual cars: 65% < 0.2% 95% < 0.4% 100% < 0.6% Total train < 0.2%	Individual cars: 65% < 0.2% 95% < 0.4% 100% < 0.6% Total train < 0.2%

Types of scale construction for certified scales.

There are three basic types:

Mechanical lever system – this type has largely been displaced by load cells/ electronic scales. They normally require extensive foundation with a deep pit.

Deep pit load cell systems – may be full length, single or double (split) platform design with each platform supported by four or more load cells. Extensive foundations are required. Their main advantage is ease of maintenance. In some respects they're better suited to the "snow belt"

Low profile load cell system – invariably single or double (split) platform design, using a very shallow pit. Some designs are called "pit less" as there are no side walls. Less extensive foundations are required which tends to reduce installed cost.

All of the above require concrete approaches. These are 25' for static scales & 75' for in-motion.

Non- Certificated Track Scales

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Option 2:

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However because the cars are coupled there will be errors due to the weight transfer through the couplers. With short trains, good site conditions & smooth trains handling, weight transfer errors can be kept quite low.

Accuracy over complete trains or groups of cars is, in most cases, as accurate as the first 2 methods.

All three basic methods require extensive foundations in addition to the scales themselves.

Types of scale construction for Non-certified Scales

If the scale does not have to be certified, then a different solution can be offered at considerably less installation cost. The most cost savings derive from the elimination of or the reduction of the foundation requirements.

Low Profile load cell system – Essentially the same design as for certified scales but with reduced foundation & approach requirements.

Foundation – less designs substitute steel under frame for a concrete foundation.

Instrumented rail system “WEIGHLINE” – The rail itself is converted into the measuring elements. With this design the minimal disturbance to the existing track & the system can be installed in a few hours.

TYPICAL ACCURACY – NON CERTIFIED SCALES	
Type of Scale	Accuracy
Load Cell Full Draft- Static	0.2%
Load Cell Two Draft – Static	0.3%
Weighline Full Draft – static	+/- 0.25%
Weighline Two Draft- Static	+/- 0.4%
Weighline Uncoupled in-motion	+/- 0.5%
Weighline Coupled in-motion (up to 6mph/10km/h)	Individual cars +/-0.5% Total train +/-0.25%

Installed Cost & downtime

The following table gives approx cost for the various types of systems & the amount of time the rail track is typically out of service. It is important to note that foundation costs can vary considerably depending upon the soil conditions.

Type of Scale	Static or in-motion	Size	Typical Installed cost (US\$)	Typical Downtime
Mechanical	Static	60'	\$200,000	8 weeks
Loadcell deep pit:				
Full Draft	Static	60'	\$225,000	8 weeks
Full Draft	In-Motion	80'	\$280,000	10 weeks
Two Draft	In- Motion	20'	\$225,000	10 weeks
Loadcell low Profile:				
Full Draft	Static	12'6"+26'	\$160,000	8 weeks
Two Draft	In – Motion	12'6"	\$200,000	8 weeks
WEIGHLINE Profile:				
Full Draft	Static	*	\$45,000	8 hours
Two Draft	Static	*	\$30,000	6 hours
Two Draft	In – Motion	*	\$70,000	6 hours

- WEIGHLINE section positions are chosen to suit the particular application

It should be noted that the above chart is only intended as a very rough guide. Actual costs will vary depending upon features required, track and soil conditions.

Non-certified load cell scales would typically be \$20,000-£30,000 less than the numbers shown.

- **Summary**

Users should first evaluate their requirements & determine if the scale must be certified and number of cars per day they'll be weighing.

From these two answers the appropriate type of track scales can be selected. In some cases the type of scales may be determined by just the accuracy required i.e. if 0.1% maintenance tolerance is needed because the product is very expensive, then the full draft static scale should be used.

Downtime, installed cost & number of cars per day all have a major impact on what is best for the particular application.

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