Scale Manufacturers Association

Standard

Vehicle Scale Characterization

(SMA VCS-1102)

First Edition

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Standard for Vehicle Scale Characterization

1. Scope

1.1 Purpose

This standard is intended to provide criteria for characterizing the service life of a vehicle scale based on the CLC rating of the platform. This knowledge can be used by potential scale owners and operators to select the proper scale for the application.

1.2 Applicability

These criteria cover all drive-on vehicle scales which have a CLC rating specified by the manufacturer. They apply to both mechanical and electronic devices. On-board vehicle scales are not included

2. Definitions

2.1 Concentrated load capacity (CLC)

A capacity rating of a vehicle, or axle-load scale, specified by the manufacturer, defining the maximum load applied by a group of two axles, with a centerline spaced 4 feet apart and an axle width of 8 feet, for which the weighbridge is designed. The concentrated load rating is for both test and use.

2.2 Vehicle Scale

A scale designed for weighing vehicles, loaded or unloaded, with axle configuration based on the Bridge Gross Weight Formula published by the U.S. Department of Transportation, Federal Highway Administration (See 2.6).

2.3 Vehicle Weighment

For the purpose of this standard, a vehicle weighment is the passage of a multi-axle vehicle over the scale platform, entering or exiting from either direction. The vehicle may or may not come to a stop on the platform in the process.

2.4 Load Cycle

For the purpose of this standard, a load cycle is the application and removal of a load from an axle or group of axles rolling over the scale weighbridge. A vehicle weighment consists of multiple load cycles, depending on vehicle axle configurations.

2.5 Single Axle

An individual axle, such as a steering axle

2.6 Group of Axles

A series of two or more axles with the loading configuration specified by the following formula, which is based on the Bridge Gross Weight Formula published by the US Department of Transportation, Federal Highway Administration.

$$W = 500 \times \left[\frac{L \times N}{(N - 1)} + (12 \times N) + 36 \right]$$

W' = the maximum weight in pounds that can be carried on any group of two or more consecutive axles.

L = the spacing in feet between the outer axles of any two or more consecutive axles in feet.

N = the number of axles being considered.

3. Characterization

3.1 Service Life Elements

The service life of a vehicle scale is dependent on the cumulative number of load cycles and the level of the load-induced stress developed during the load cycles.

The number of load cycles is determined by the number of weighments multiplied by the total of the single axles and groups of axles per vehicle.

For a single axle, the load cycle generated is simply the load on the axle.

For a group of axles to generate a load cycle at the combined load of the group, the spacing of the outer axles must be equal to or less than 1/2 the span of the weighbridge.

For spacing greater than this, the loading effect is diminished for the cycle.

Generally, with normal weighbridge spans, i.e. – 15' or greater, dual and triple tandem axles will generate a full combined load cycle.

To quantify the level of load-induced stresses in the scale system, the CLC rating is used as a baseline load for determining the expected service life of the device.

The CLC by definition determines the maximum allowable loading of the common dual tandem axle set with a 4' axle spacing.

Additionally, the determination of the maximum allowable loads can be extended to any group of two or more consecutive axles by employing the bridge formula in §2.6 above to develop a ratio of the CLC to the maximum load for a given axle configuration.

The baseline axle configuration for this is a dual tandem axle set with 4' spacing, where the ratio is 1.0. This is illustrated in Table UR.3.2.1 in NIST Handbook 44.

3.2 Service Life Recommendation

a.) Platform Span of 15' or Greater

Max. Load	Cycles	Weighments
Full CLC	1,100,000	500,000
80% of CLC	2,200,000	1,000,000
65% of CLC	3,300,000	1,500,000

*Weighment numbers are based on an average of 2.2 load cycles per weighment. This is roughly equivalent to weighing dual tandem axle semi-trailer rigs, i.e. – 2 groups of axles with an added 0.2 contribution of the steering axle to the tractor driver axle group.

b.) Platform Span of Less than 15'

Max. Load	Cycles	Weighments
Full CLC	1,100,000	367,000
80% of CLC	2,200,000	733,300
65% of CLC	3,300,000	1,000,000

*Weighment numbers are based on an average of 3 load cycles per weighment. This is equivalent to weighing dual tandem axle semi-trailer rigs, i.e.-a single axle and 2 groups of axles.

The tables above are based on a design fatigue life of scale structural members developed from nationally accepted engineering standards and specifications such as the American Institute of Steel Construction (AISC) "Manual of Steel Construction" or the American Association of State Highway and Transportation Officials (AASHTO) "Standard Specification for Highway Bridges."

Devices for which this standard is applicable will have been verified by a manufacturer to comply with these fatigue standards.

The Manufacturer should verify design compliance with the fatigue life criteria of these standards using full CLC load ratings.

Note:
The environment in which a scale is placed may also effect the service life of a vehicle scale. Special consideration must be given to scales placed in corrosive environments, such as where high salt or active chemicals are present.

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