

# **ASTM WIM SPECIFICATION E-1318**

—

**Revised for the  
New Millennium**

**by**

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# **ASTM Designation: E 1318-02**

## ***Standard Specification for Highway Weigh-In-Motion (WIM) Systems with User Requirements and Test Methods***

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- ***First Published 1990***
  - ***Revised Slightly 1994***
  - ***Extensively Revised 2000 & 2002***

**Available for Purchase: [www.astm.org](http://www.astm.org)**

# **FUNCTION OF A WIM STANDARD SPECIFICATION**

**To provide a comprehensive,  
authoritative reference document that  
aids the buyer (user) and the seller  
(vender) in procuring, installing,  
calibrating, testing, operating, and  
maintaining a satisfactory WIM system  
for use at a selected site.**

# ELEMENTS OF A WIM STANDARD SPECIFICATION

## 1) **TERMINOLOGY**

## 2) **TYPES / CLASSES**

According to Application / According to Accuracy Class

## 3) **PERFORMANCE REQUIREMENTS**

Features/Functions, Applications, **Tolerances**  
(estimated tyre loads, speed, axle spacing)

## 4) **USER REQUIREMENTS**

Road Geometry (Alignment, Cross-Section),  
**Surface Smoothness/Evenness**,  
Power Supply, Communications

## 5) **TEST METHODS (to be specified by user)**

- Reference tyre loads and axle spacings for static vehicles
- Calibration Procedure
- Type-approval Test
- On-site Acceptance/Verification Test

# **REVISIONS FOR ASTM E 1318-02**

## ***TERMINOLOGY:***

***gross-vehicle weight***—the local force of gravity acting vertically downwards on the total mass of a stationary vehicle; kg, Mg, or t.

***wheel/axle load***—the portion of the gross-vehicle weight imposed upon the tyres of a wheel or axle at the time of weighing; kg, Mg, or t.

## ***ADDED DEFINITIONS OF TERMS:***

***axle, dynamic vehicle tyre force, single-axle load, tandem-axle load, triple axle load.***

# **PERFORMANCE REQUIREMENTS:**

## ***TYPE I:***

For highest-quality statistical data acquisition –  
**no change.**

## ***TYPE II:***

For lesser-quality statistical data acquisition –  
**no change.**

## ***TYPE III:***

For screening suspected weight or load limit violators at an enforcement station—**speed range increased to between 16 and 130 km/h** (previously 10 to 80 km/h) **and required acceleration measurement eliminated for Type III systems with sensors installed in main traffic lanes.**

# **PERFORMANCE REQUIREMENTS:**

## **TYPE IV:**

Conceptual performance requirements for direct enforcement; WIM not yet approved for enforcement in U.S.A.–

- **Speeds between 3 and 16 km/h.**
- **Type IV systems with sensors that support full tyre contact area must indicate tyre loads of moving and stationary vehicles.**

# **PERFORMANCE REQUIREMENTS:**

## **VENDER SHALL SUPPLY:**

- 1) Evidence that the offered WIM system has previously performed satisfactorily (within specified tolerances) throughout the **user-specified ambient air temperature range** expected at the site.
- 2) A certificate showing that every offered tyre-force sensor for use with Type I, Type III, and Type IV systems has been tested under a simulated tyre load prior to installation and found to produce an **output signal** that was **linear** within 2% of the applied load up to 90 % of the sensor's rated load capacity **throughout the lateral extent** of the sensor.
- 3) A test report showing satisfactory performance (different criteria) of every offered sensor (usually piezo) for use with Type II systems.



# USER REQUIREMENTS:

## ***NEW EMPHASIS:***

*To consistently achieve E 1318-02 accuracy, the user is expected to **provide the specified pavement smoothness** (maximum deviation under a 6-m straightedge when measured with a 3-mm thick, 150-mm diameter metal gage plate for 60 m in advance of and 30 m beyond the WIM sensors) **or be willing to accept less-accurate performance from a Type-approved WIM system.***

# **USER REQUIREMENTS:**

## ***CALIBRATION:***

*A standard **Calibration Procedure** is required for the Type-approval Test and recommended for the On-site Acceptance Test.*

## ***RECALIBRATION:***

- 1) when a system is reinstalled,**
- 2) when site conditions or system components have changed significantly, and**
- 3) no less frequently than annually.**

# ***REVISED TEST METHODS***

## ***BASIC TEST-VEHICLE LOADING UNIT***

- Two loaded, **pre-weighed** and **pre-measured** test vehicles Each makes multiple passes over sensors in each lane at prescribed speeds and lateral positions
- 2-axle, single-unit (rigid) truck (lorry) with dual tyres on drive axle—provides a single-axle, dual-tyre test load
- 5-axle, tractor, semi-trailer truck with dual tyres on the tandem drive axle and semi-trailer axle
- Loaded to at least 90 % of registered gross-vehicle weight with a non-shifting, approximately-symmetric (side-to-side) load.
- Used for Calibration Procedure, Type-approval Test, and On-site Acceptance/Verification Test
- *51 additional vehicles from traffic stream used for Type-approval Test*

# ***REFERENCE LOADS AND WEIGHTS OF STATIC VEHICLES***

- **Type and quality of weighing apparatus specified**
- **Recent certification required**
- **Procedures for using apparatus specified**
- **Repeated measurements required**
- **Instructions for interpreting data to assure quality**

# ***CALIBRATION PROCEDURE***

- **To define factors for later application in WIM-system calculations that will help correlate observed vehicle speed and dynamic tyre force signals with corresponding estimated tyre-load and axle-spacing values for the static vehicle.**
- **Minimum of 3 runs of each test vehicle in each lane at 3 speeds and in 3 lateral positions of wheels in the lane**
- **Required for Type-approval Test and recalibration**
- **Recommended for On-site Acceptance/Verification Test**

# ***TYPE-APPROVAL TEST***

- **A rigorous test to demonstrate convincingly that the type and model of WIM system being tested is capable of meeting the E 1318-02 Performance Requirements when excellent (E 1318-02 or better) site conditions are provided.**
- **Requires multiple runs of 2 test vehicles and a single pass by at least 51 other vehicles selected in random order from the traffic stream and weighed on static scales near the site.**
- **Test needed only once**

# ***ON-SITE ACCEPTANCE TEST***

- **An abbreviated version of the Type-approval Test**
- **Requires only two loaded, pre-weighed and pre-measured test vehicles**
- **Demonstrates that the delivered and installed WIM system has performance capabilities similar those of the specimen system that passed the Type-approval Test**
- **Can be used on-site at any time to verify the performance of an operating WIM system**

# **COMPARISON OF APPROACHES TO WIM** **STANDARDS**

**(COST 323, 1999)** – COST 323 “Weigh-in-Motion of Road Vehicles,” Final Report, APPENDIX 1, *European WIM Specification*, Version 3.0, August 1999

**(ASTM, 2002)** – ASTM Designation: E 1318-02 *Standard Specification for Highway Weigh-In-Motion (WIM) Systems with User Requirements and Test Methods*

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## ***TERMINOLOGY:***

**Nearly verbatim, and consistent with OIML**



# **CLASSIFICATION:**

**(COST 323, 1999)** Systems designated by

- **7 Accuracy Classes:** A (5) through E, via performance requirements with associated calibration procedures and road conditions – **Elegant Tests**
- **3 Applications with suggested accuracy:**
  1. Statistics, 2. Infrastructure and Preselection, and 3. Legal Purposes
- **Road Geometry (similar to ASTM)**
- **3 Site Classes:** *I, excellent; II good; III, Acceptable— via Rutting, Deflection, Evenness (IRI, m/km, or APL)*

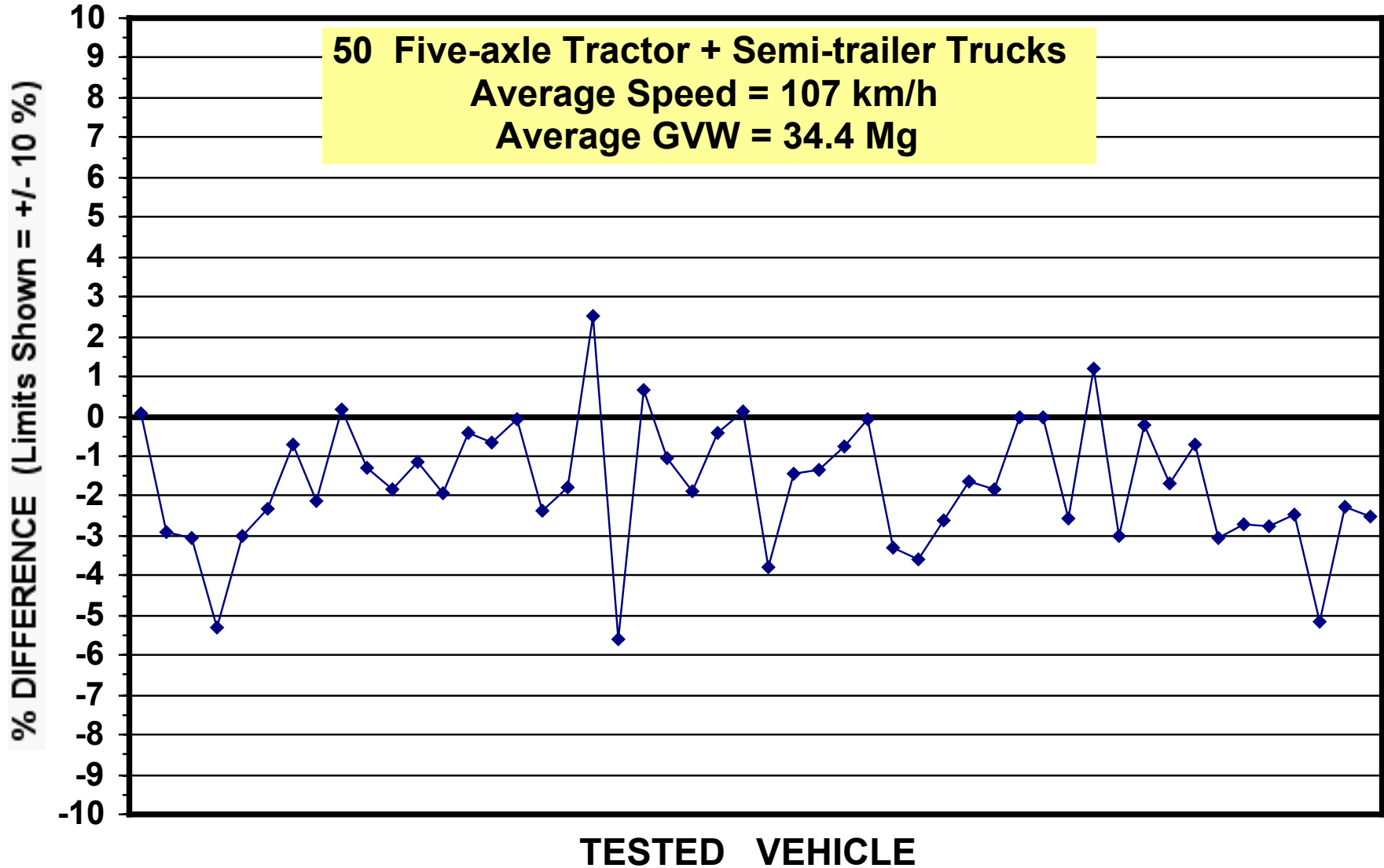
# **CLASSIFICATION:**

**(ASTM, 2002) Systems designated by**

- **Type according to Application:**  
Types I, II, III, and IV
- **Minimum Accuracy Level (95% conformity) required for each Type – Pass-or-Fail Tests**
- **Road Geometry (similar to COST 323)**
- **User responsible for providing smooth (even) road surface (6-m straight edge) 60 m in advance and 30 m beyond sensors or accepting less-accurate performance than specified for Type**
- **Wheel Load measurements required Type I**

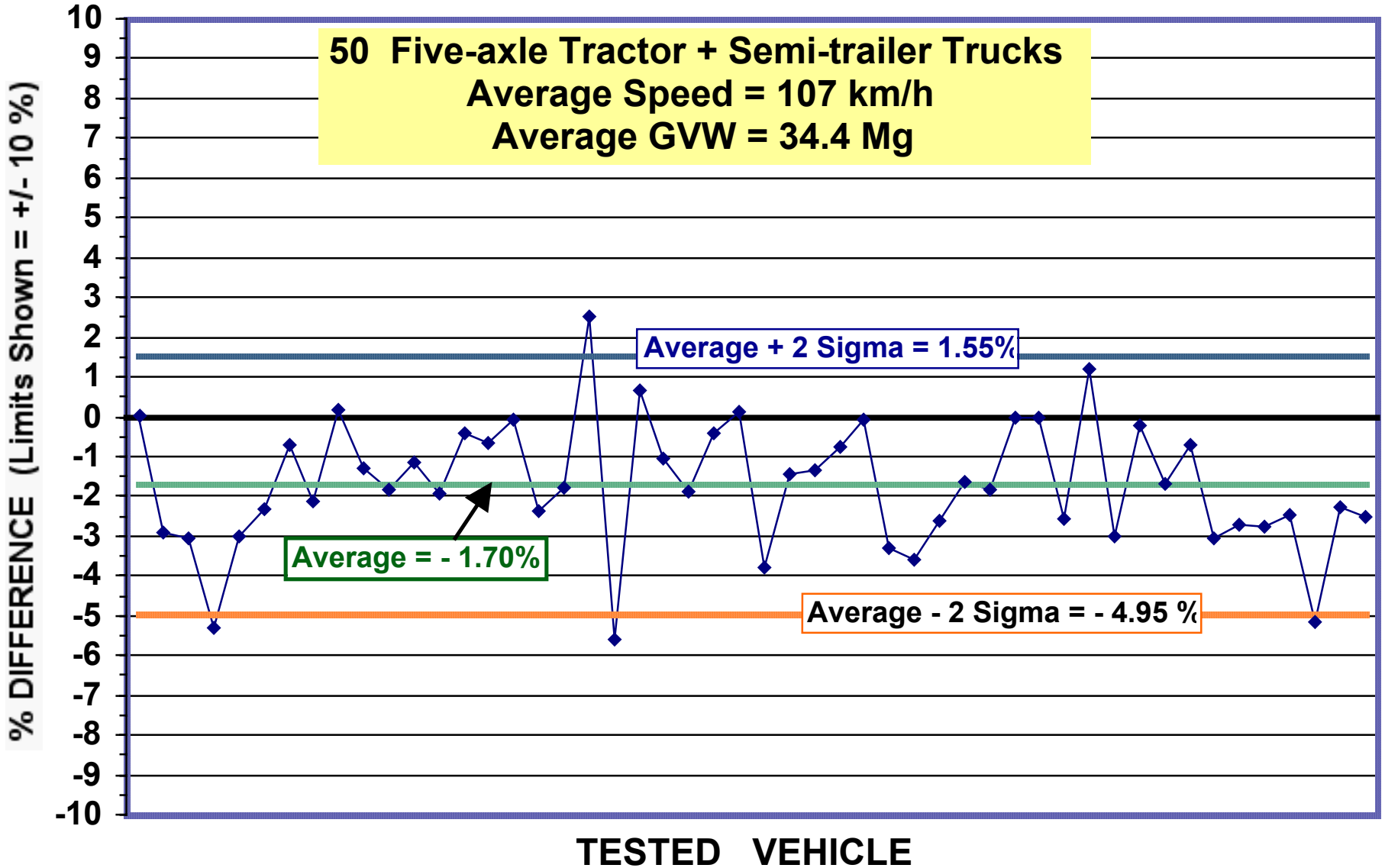
# **GROSS VEHICLE WEIGHT**

**50 Five-axle Tractor + Semi-trailer Trucks**  
**Average Speed = 107 km/h**  
**Average GVW = 34.4 Mg**



# GROSS VEHICLE WEIGHT

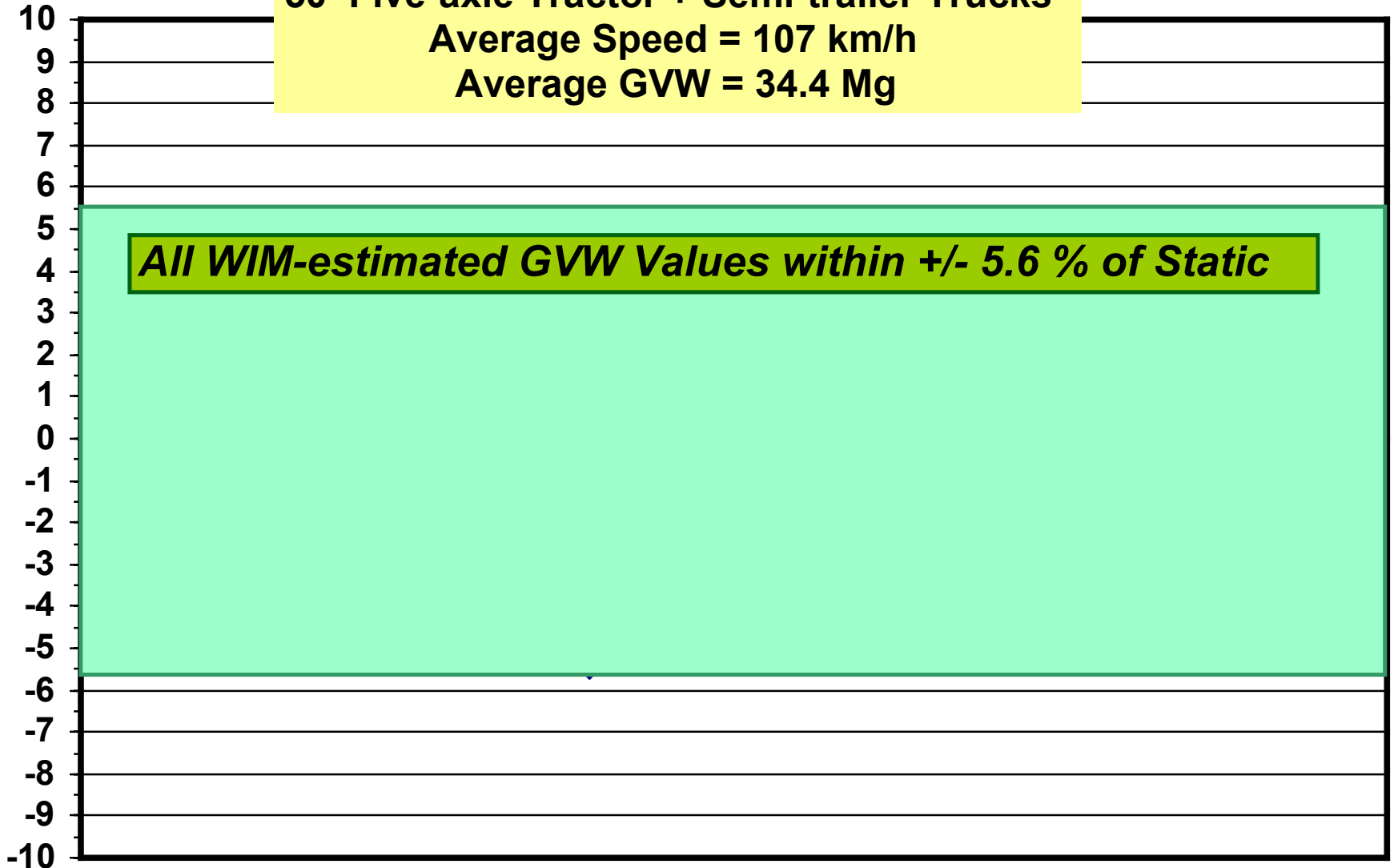
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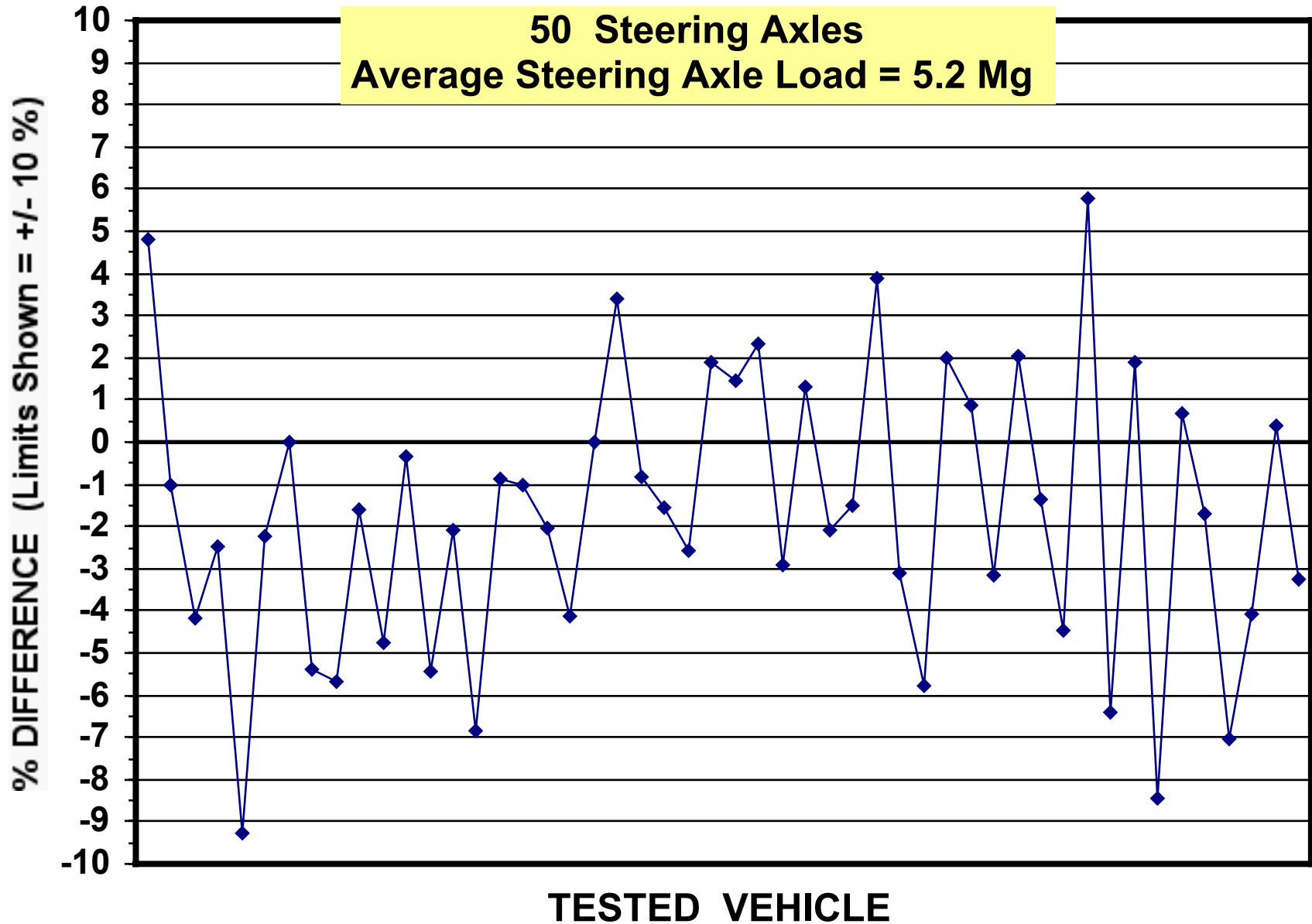
% DIFFERENCE (Limits Shown = +/- 10 %)



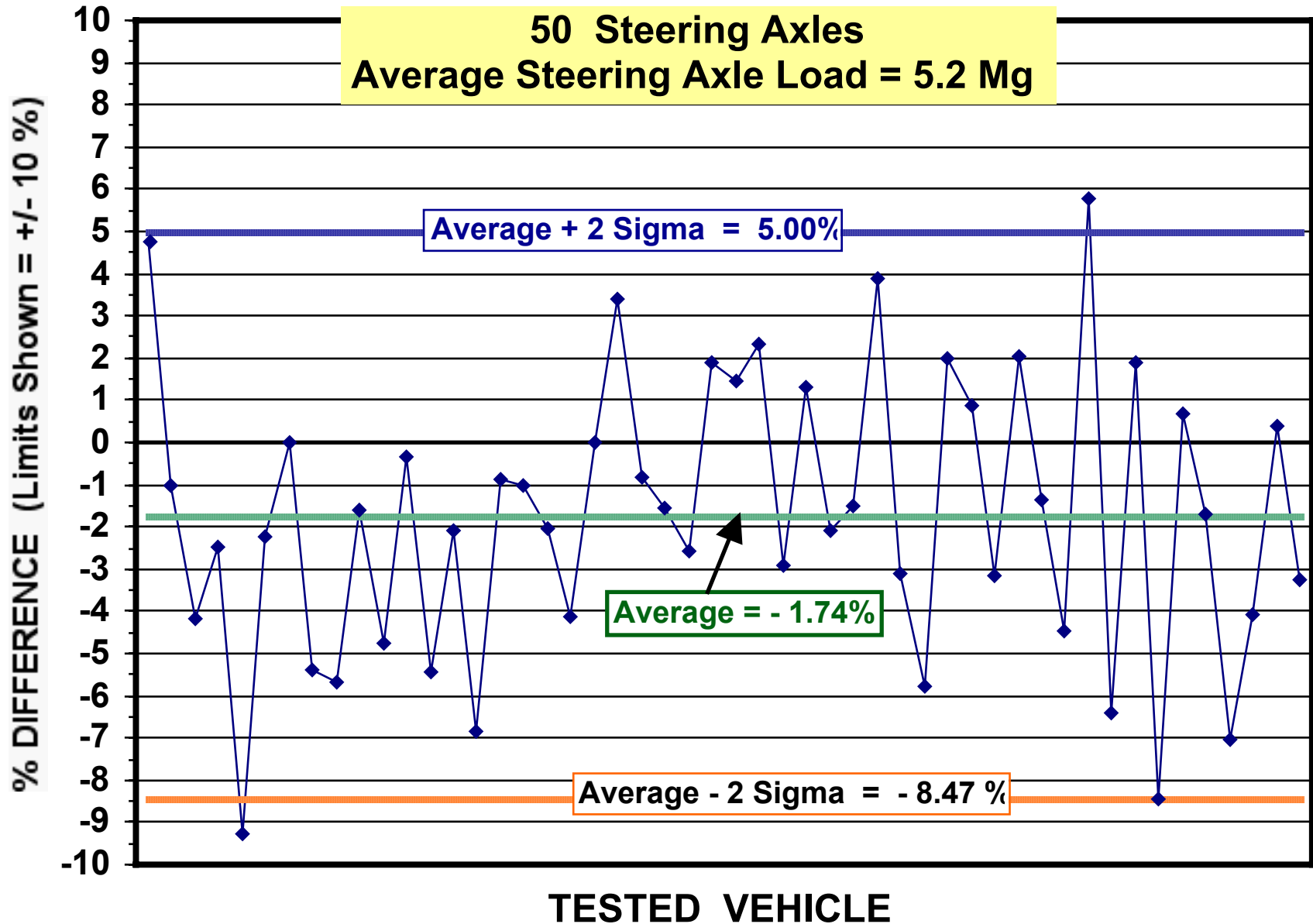
TESTED VEHICLE

# STEERING AXLE LOAD

50 Steering Axles  
Average Steering Axle Load = 5.2 Mg



# STEERING AXLE LOAD

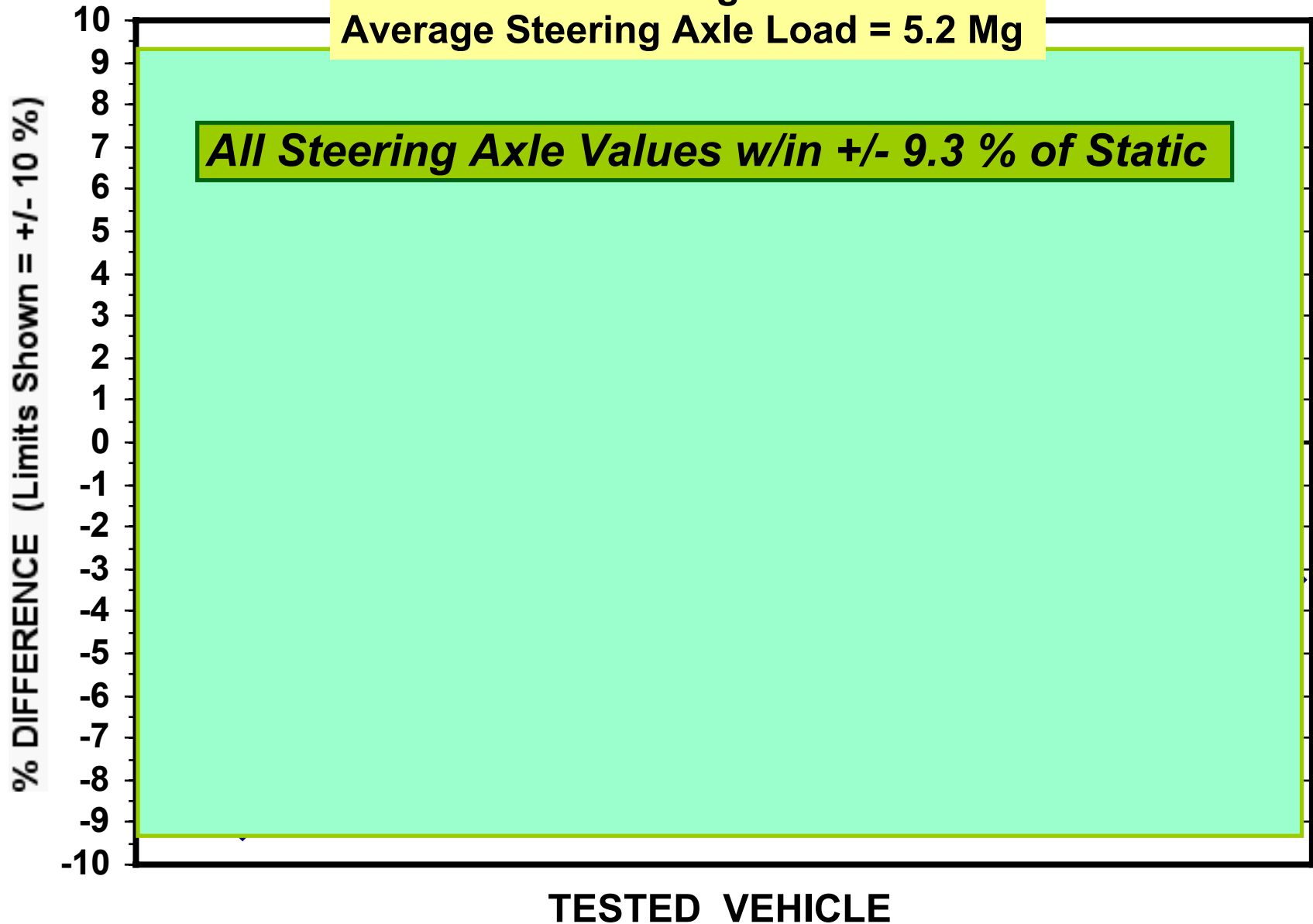


# STEERING AXLE LOAD

50 Steering Axles

Average Steering Axle Load = 5.2 Mg

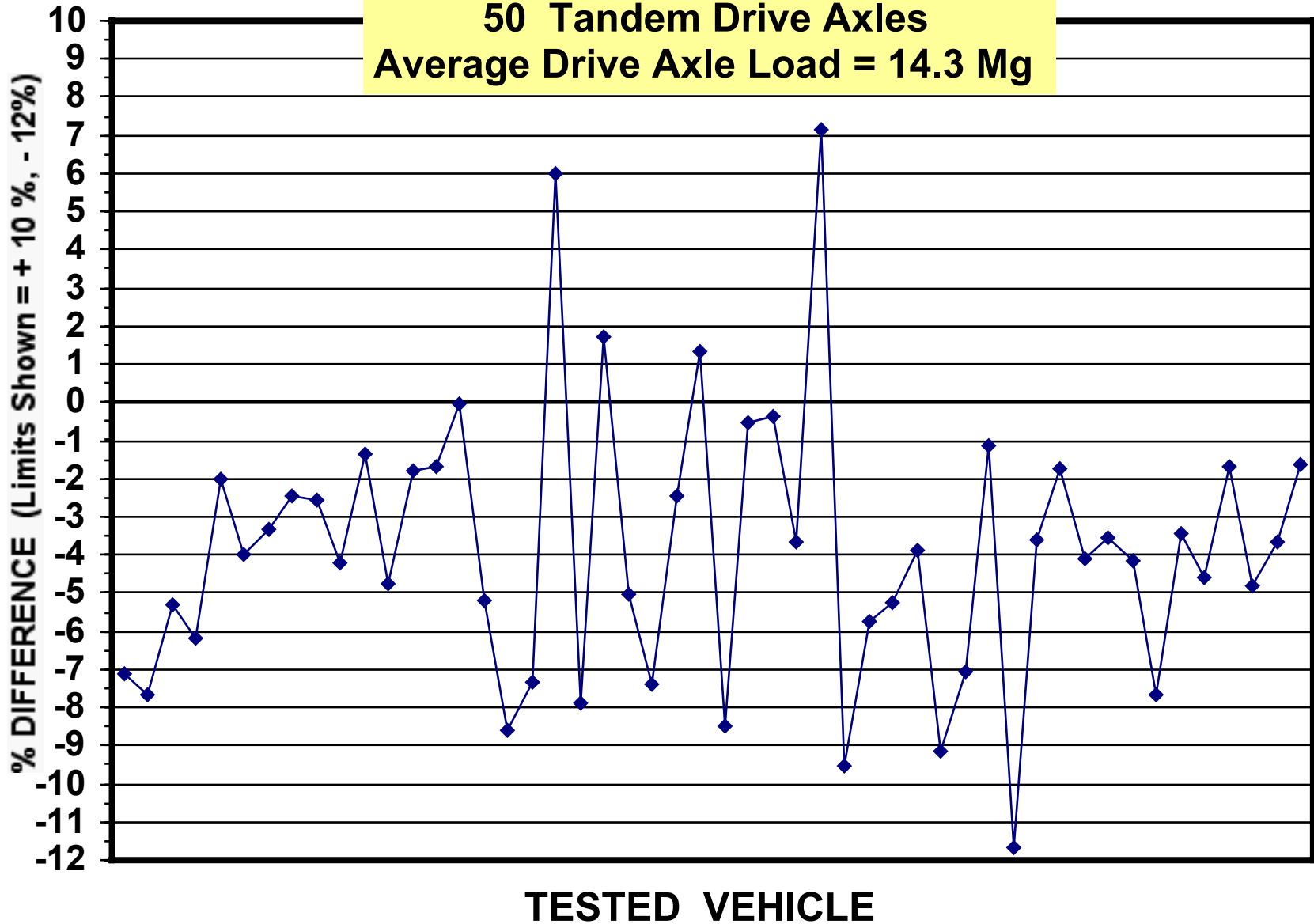
*All Steering Axle Values w/in +/- 9.3 % of Static*





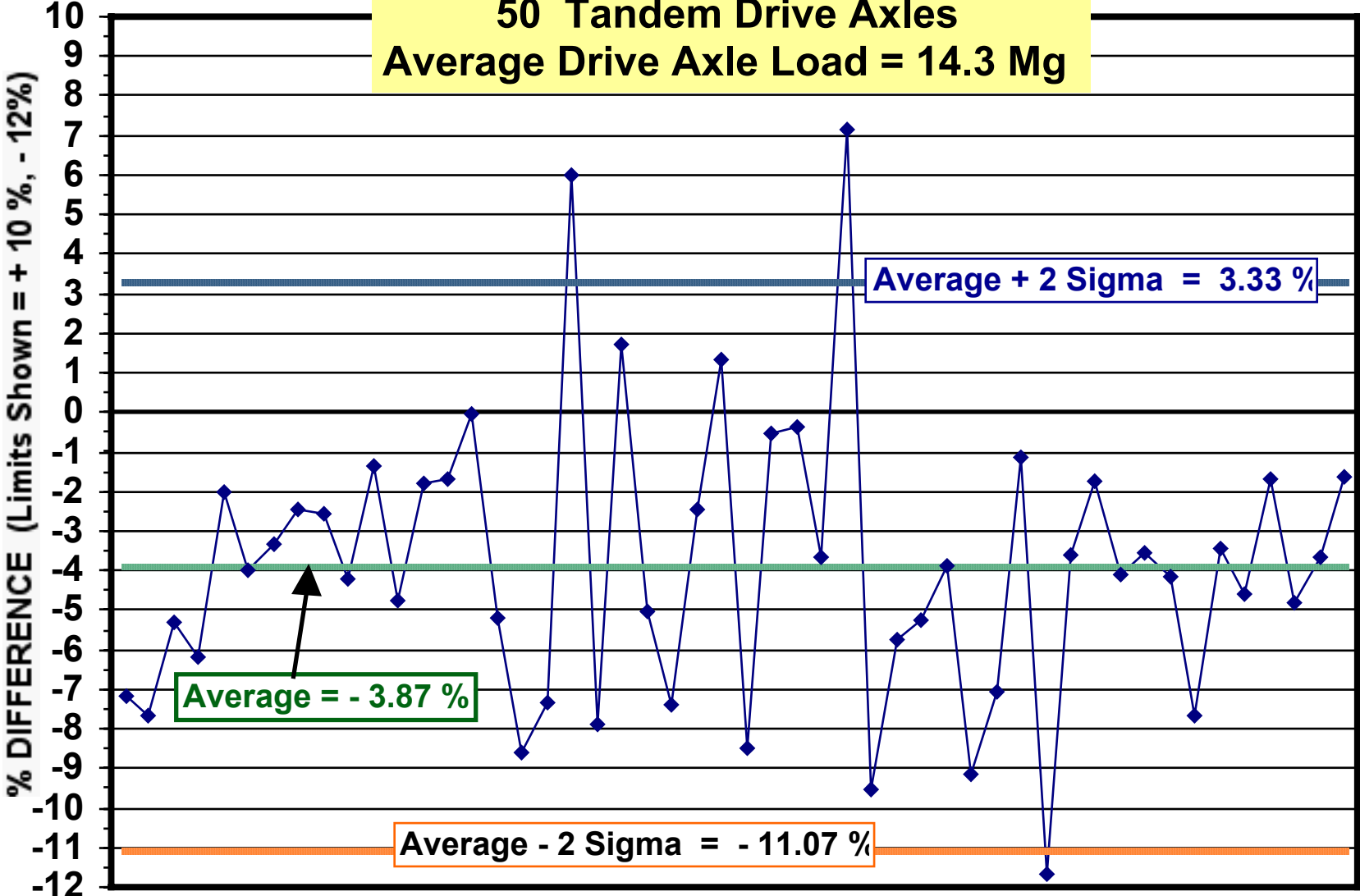
# DRIVE AXLE LOAD

50 Tandem Drive Axles  
Average Drive Axle Load = 14.3 Mg



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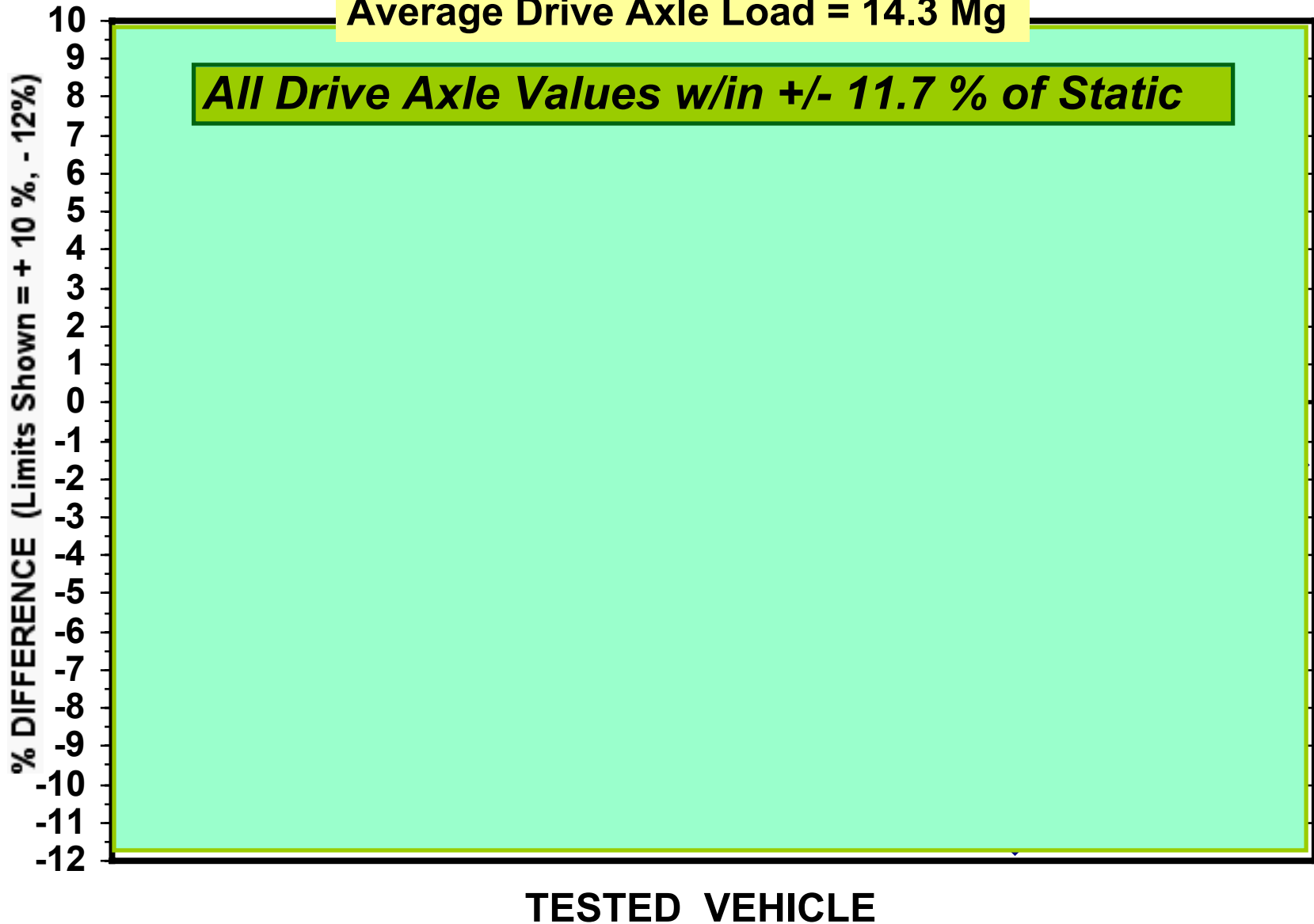


TESTED VEHICLE

# DRIVE AXLE LOAD

50 Tandem Drive Axles

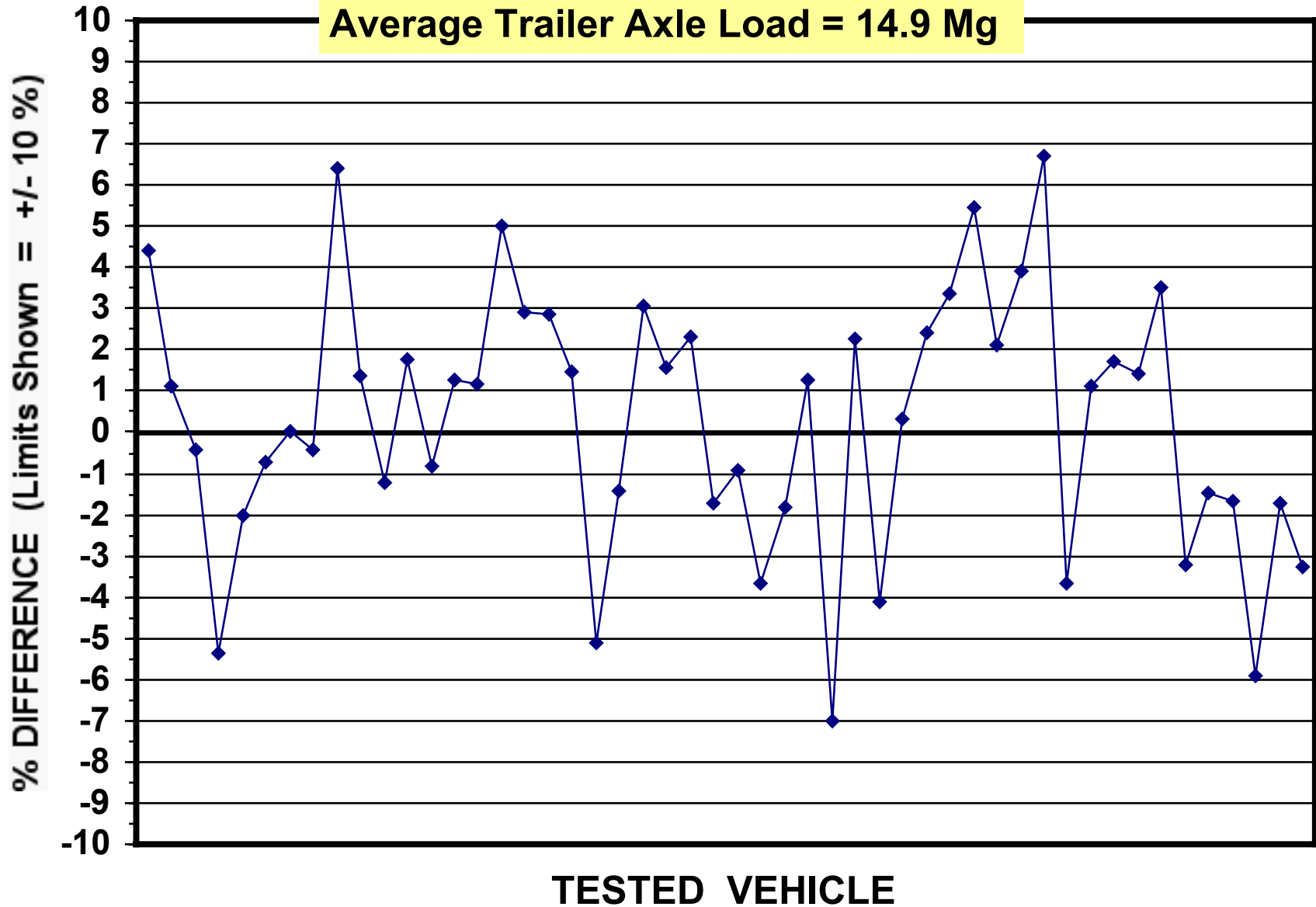
Average Drive Axle Load = 14.3 Mg



# TRAILER AXLE LOAD

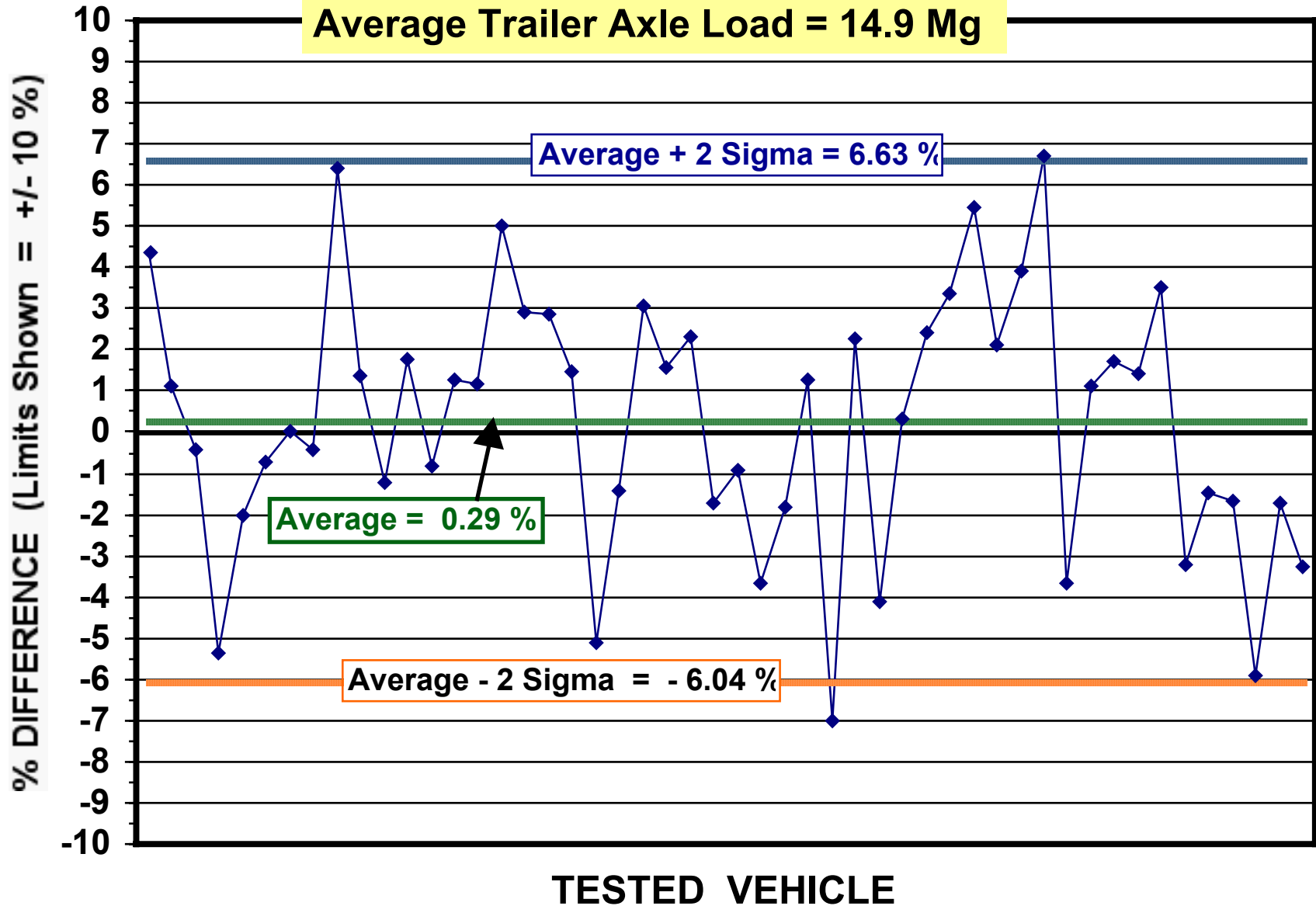
50 Tandem Trailer Axles

Average Trailer Axle Load = 14.9 Mg



# TRAILER AXLE LOAD

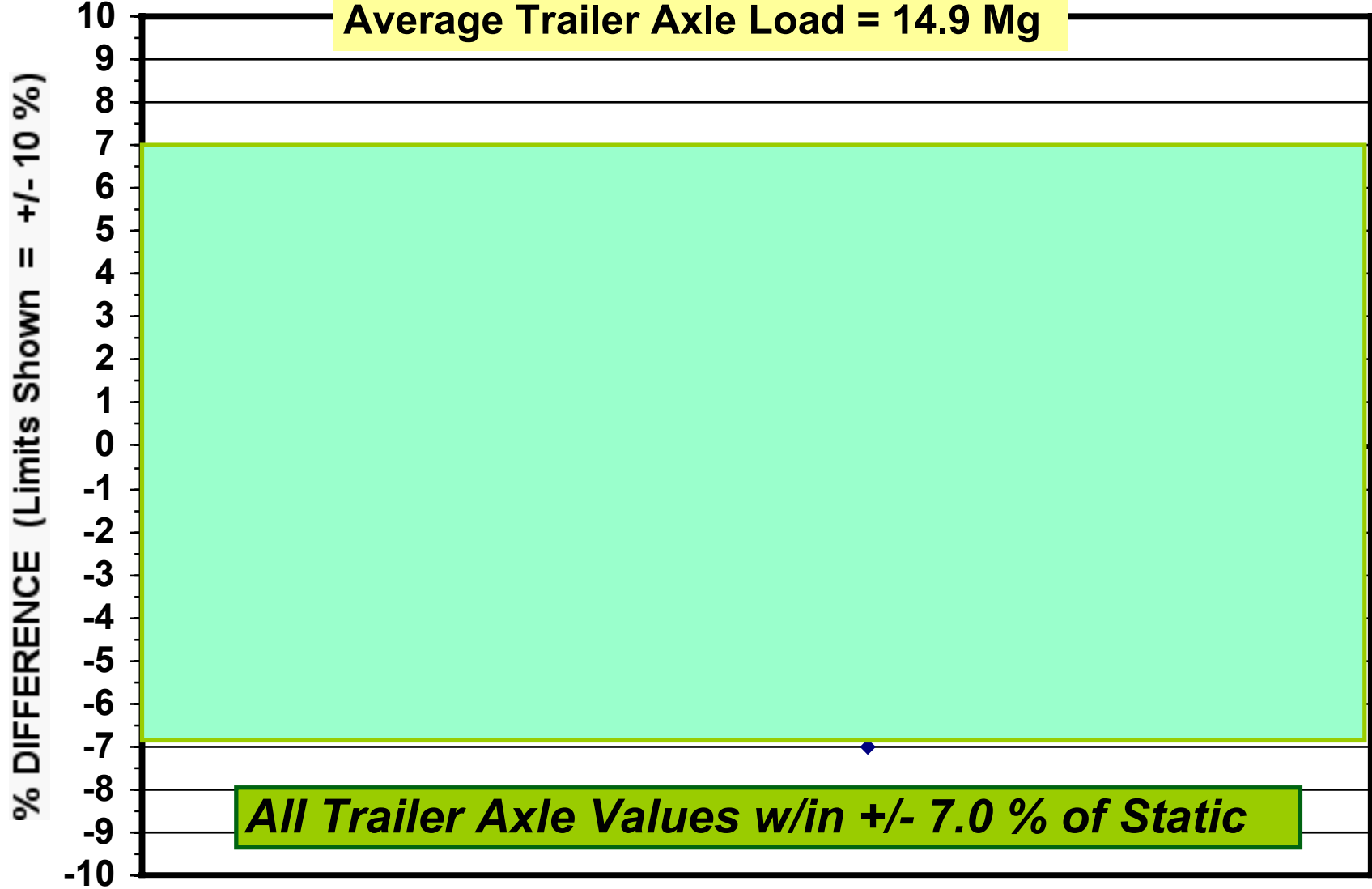
50 Tandem Trailer Axles  
Average Trailer Axle Load = 14.9 Mg



# TRAILER AXLE LOAD

50 Tandem Trailer Axles

Average Trailer Axle Load = 14.9 Mg



*All Trailer Axle Values w/in +/- 7.0 % of Static*

TESTED VEHICLE



**QUESTIONS**