CVSA/ISWIM Workshop
Sunday September 21st, 2025

IMPLEMENTATION OF WIM SYSTEMS FOR DIRECT ENFORCEMENT OF LEGAL WEIGHT LIMITS ON THE BQE CONCRETE CANTILEVER STRUCTURES

TANVI PANDYA, P.E., DBIA (NYCDOT)

AGENDA

- Team Introduction
- BQE Project Background
- Direct Enforcement Implementation
- Standardizing Certification Requirements
- Concern Raised At NCWM
- Closing Remarks

TEAM INTRODUCTION

Tanvi Pandya, Executive Director, BQE, Design Build & Emergency Contracts

Dawn Harrison, Director, Design & Planning , BQE, Design-Build & Emergency Contracts

Shane Trotman, Civil Design Lead, BQE/, Design-Build & Emergency Contracts

Hani Nassif, Professor & Director of RIME Group and Associate Director of C2SMART

Kaan Ozbay, Professor and Director of C2SMART

Chaekuk Na, Senior Research Associate

Peng Lou, Research Associate, and Senior Str. Engineer

Infrastructure Kistler Instrument Corp.

Public agencies face an increasingly complex challenge:

Managing aging infrastructure under demands that far exceed original design expectations with **extensive (and often, uncertain) timelines** required to fund, design, and implement major rehabilitation or replacement projects.

BQE PROJECT PACKGROUND

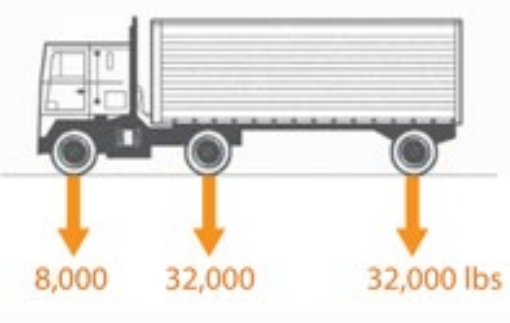
BQE PROJECT BACKGROUND

The BQE is one of the most heavily traveled roadways in New York City, and beyond, with an average daily volume of **130,000 vehicles**, including up to 13,000 trucks:

Key freight route: peak volume of up to 1,100 trucks per hour (500-600 per direction) during weekday mornings.

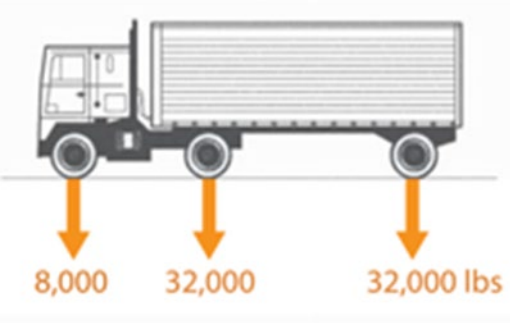
Comparison of Load Factors

- In Bridge design, the standard HL-93 truck load is typically used for analysis, amplified by a **load factor**: (a statistically-determined factor of safety).



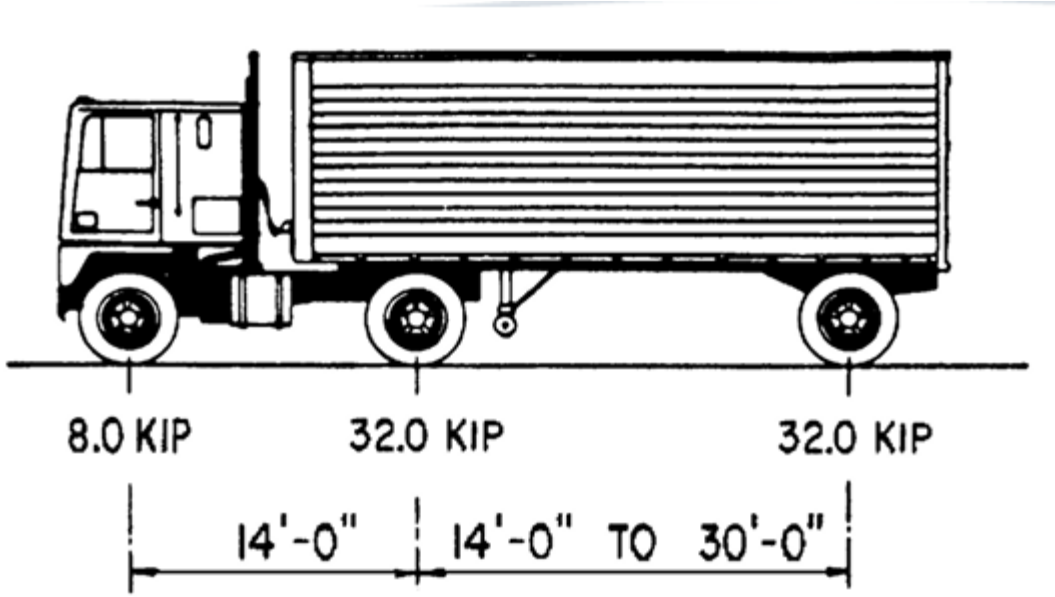
X Load Factor$_{standard}$

- When site-specific loads are calculated using WIM, the standard HL-93 truck load is amplified further to account for the new variation in loads.



X Load Factor$_{WIM}$

The Truth About Truck Loads



Standard HL-93 AASHTO Design Truck Load

Actual Site-Specific loads

Comparison of Load Factors

Comparing the **standard design load factors** with the **load factors calculated to account for site-specific loads** gives a quantitative measure of the effect of site-specific WIM loads on design

LRFD Rating	HL-93 (design standard)	Site-Specific (WIM)	% Increase
Staten-Island Bound	1.75	2.13	22%
Queens-bound	1.75	2.31	32%

DIRECT ENFORCEMENT - IMPLEMENTATION

NYS Legislation Overview

Amended in 2023:S6246/A6225

Dec 23, 2021	APPROVAL MEMO.151
Dec 22, 2021	SIGNED CHAP.773
Dec 10, 2021	DELIVERED TO GOVERNOR
Jun 08, 2021	Returned To Senate Passed Assembly Home Rule Request Ordered To Third Reading Rules Cal.536 Substituted For A2316a
Jun 03, 2021	Referred To Codes DELIVERED TO ASSEMBLY PASSED SENATE HOME RULE REQUEST
May 24, 2021	AMENDED ON THIRD READING 2740B
Apr 26, 2021	ADVANCED TO THIRD READING
Apr 21, 2021	2ND REPORT CAL.
Apr 20, 2021	1ST REPORT CAL.707
Apr 08, 2021	PRINT NUMBER 2740A
Apr 08, 2021	AMEND AND RECOMMIT TO TRANSPORTATION
Jan 25, 2021	REFERRED TO TRANSPORTATION

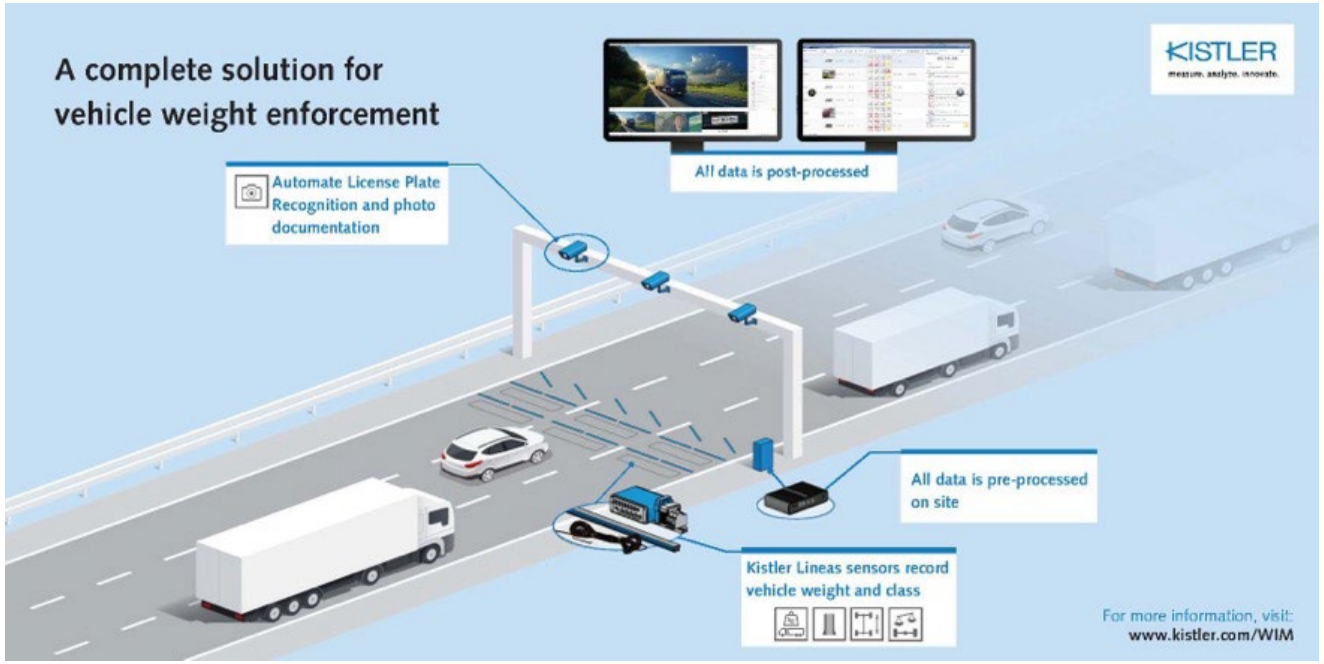
Approved.

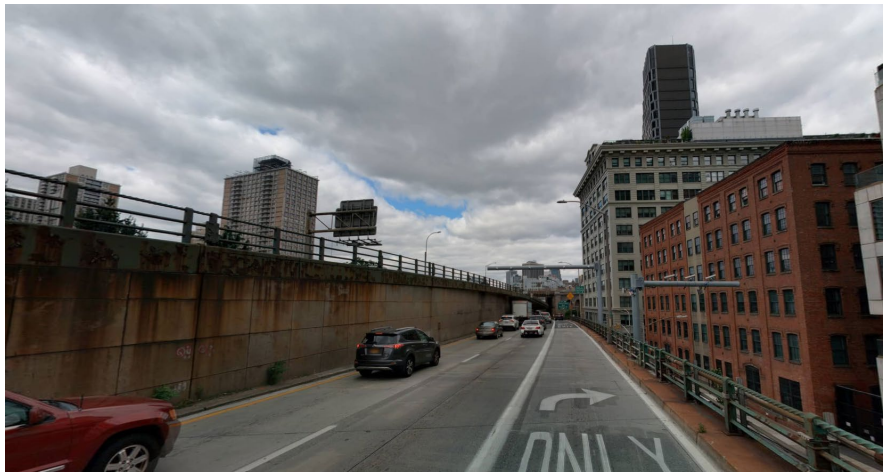
Introduced.

- Establishes a weigh-in-motion (WIM) demonstration program on I-278 in Kings County (Brooklyn, NY), imposing monetary liability for failure of an operator to comply with gross vehicle weight and/or axle weight restrictions; and
- The installation and operation of up to (16) sixteen weigh-in-motion violation monitoring systems within the vicinity of the Atlantic Ave. interchange to Sands St.
- Calibration & Certification of Calibration Required every 6 months
- **Violations**
  - GVW **10%** above gross vehicle weight restrictions
    - FHWA GVW Limit = 80 kips or Federal Bridge Formula
  - Axle/Tandem weights **20%** overweight restrictions
  - At least two independent weight measurements obtained by the WIM monitoring system

DIRECT ENFORCEMENT IMPLEMENTATION

QB WIM System Installation: November 2022
Calibration: December 2022
System Validation & Back Office Configuration
: January ~ July 2023





CERTIFICATION TESTING

Table N.1.6: Minimum Number of Test Runs per Test Vehicle	
Load Condition	Speed
Half Load (10 runs)	High Speed Vmax (5 runs)
	Low Speed Vmin (5 runs)
Full Load (20 runs)	High Speed Vmax (10 runs)
	Low Speed Vmin (10 runs)
Total 30 runs per Test Vehicle	

- Testing consisted of field visit, witnessing of reference scale weighment, measurement of axle spacing of each truck
- Test runs were viewed from multiple cameras along with direct feed from the data logger
- Test completed over 2 nights with assistance from NYCDOT attenuator trucks for traffic management
- Concurrent logging of data by inspectors into their verification tabulation

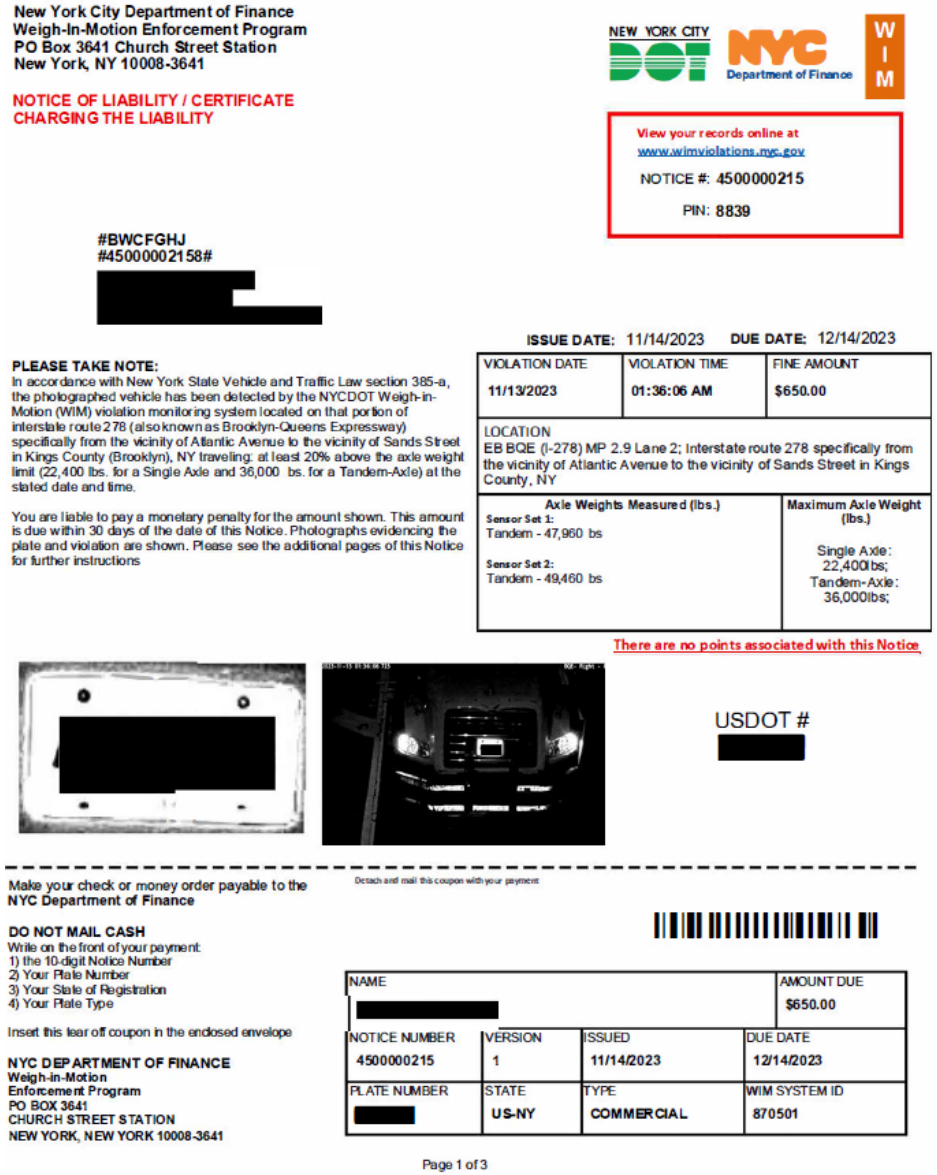
SYSTEM CERTIFIED

Certification by NYS Dept. of Ag.: QB roadway October 2023, April 2024, November 2024 & June 2025

SIB roadway June 2025

Table T.2.3: Maintenance Tolerances for Accuracy		Test Result
Load Description at **100%** Compliance	Tolerance	
Axle Load	± 20 %	✓
Axle Group Load (including bridge formula)	± 15 %	✓
Gross Vehicle Weight	± 10 %	✓

System calculates federal bridge formula based maximum GVW for truck configuration and differentiates between tandem and single axle



New York City Department of Finance
Weigh-In-Motion Enforcement Program
PO Box 3641 Church Street Station
New York, NY 10008-3641

NOTICE OF LIABILITY / CERTIFICATE CHARGING THE LIABILITY

NEW YORK CITY DOF NYC Department of Finance W I M

View your records online at www.wimviolations.nyc.gov
NOTICE #: 4500000215
PIN: 8839

#BWCFGHJ
#4500002158#
[redacted]

ISSUE DATE: 11/14/2023 DUE DATE: 12/14/2023

PLEASE TAKE NOTE:
In accordance with New York State Vehicle and Traffic Law section 385-a, the photographed vehicle has been detected by the NYCDOT Weigh-in-Motion (WIM) violation monitoring system located on that portion of interstate route 278 (also known as Brooklyn-Queens Expressway) specifically from the vicinity of Atlantic Avenue to the vicinity of Sands Street in Kings County (Brooklyn), NY traveling: at least 20% above the axle weight limit (22,400 lbs. for a Single Axle and 36,000 lbs. for a Tandem-Axle) at the stated date and time.

You are liable to pay a monetary penalty for the amount shown. This amount is due within 30 days of the date of this Notice. Photographs evidencing the plate and violation are shown. Please see the additional pages of this Notice for further instructions

VIOLATION DATE	VIOLATION TIME	FINE AMOUNT
11/13/2023	01:36:06 AM	$650.00

LOCATION
EB BQE (I-278) MP 2.9 Lane 2; Interstate route 278 specifically from the vicinity of Atlantic Avenue to the vicinity of Sands Street in Kings County, NY

Axle Weights Measured (lbs.)	Maximum Axle Weight (lbs.)
Sensor Set 1: Tandem - 47,960 lbs Sensor Set 2: Tandem - 49,460 lbs	Single Axle: 22,400lbs; Tandem-Axle: 36,000lbs;

There are no points associated with this Notice

USDOT # [redacted]

Make your check or money order payable to the NYC Department of Finance

DO NOT MAIL CASH
Write on the front of your payment:
1) the 10-digit Notice Number
2) Your Plate Number
3) Your State of Registration
4) Your Plate Type

Insert this tear off coupon in the enclosed envelope

NYC DEPARTMENT OF FINANCE
Weigh-in-Motion
Enforcement Program
PO BOX 3641
CHURCH STREET STATION
NEW YORK, NEW YORK 10008-3641

Detach and mail this coupon with your payment

NAME			AMOUNT DUE
[redacted]			$650.00
NOTICE NUMBER	VERSION	ISSUED	DUE DATE
4500000215	1	11/14/2023	12/14/2023
PLATE NUMBER	STATE	TYPE	WIM SYSTEM ID
[redacted]	US-NY	COMMERCIAL	870501

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Gross Vehicle Weight Violations

- Date and time of violation
- License plate photograph
- GW Measured per sensor set
- Allowable maximum Weight per bridge formula
- Link to website for view record online
- NOL issued to Owner / Responsible Party (Rental)

Each violation reviewed by NYCDOT personnel to ensure integrity of package

Axle Weight Violations

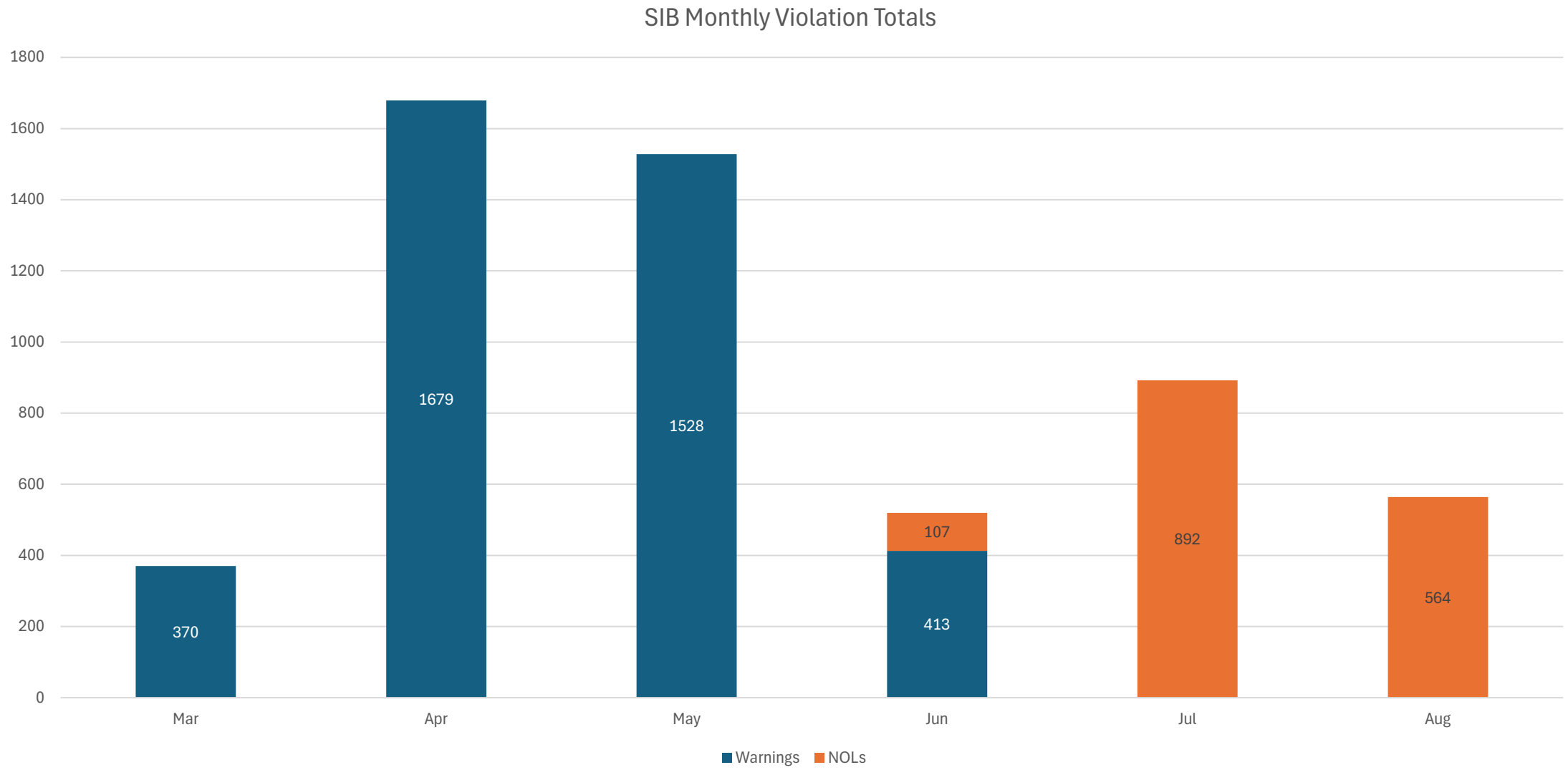
- Date and time of violation
- License plate photograph
- Each Axle Weight Measured per sensor set
- Allowable maximum for the axle in violation per bridge formula
- Additional tabulation of axle spacing and weights for identification of axle in question, e.g., tandem
- Link to website for view record online
- NOL issued to Owner / Responsible Party (Rental)

ENFORCEMENT DATA – QB

	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	Aug-25
NOL				241	547	524	440	351	154	204	163	210	249	309	273	27	172	242	183	153	88	30	114	165	140
Warnings	1167	1141	1075	587																					

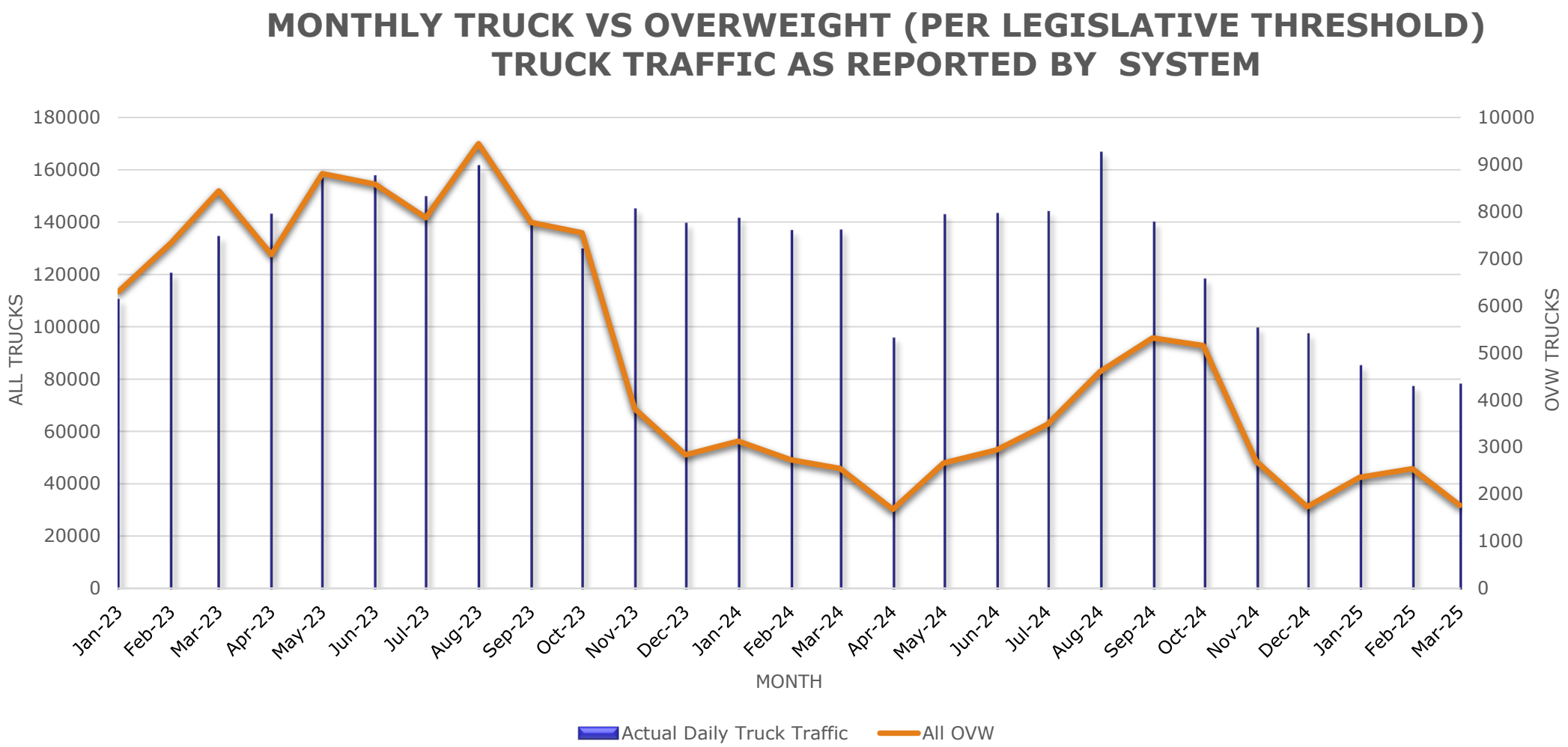
Totals: QB Warnings 3970; QB NOLs 4979 through August 2025

ENFORCEMENT DATA- SIB



Totals: SIB Warnings 3990; NOLs 1563

DATA TREND



Graph accounts for the 13978 Identified Overweight for the duration

Load Rating Evaluation

- Two distinct WIM datasets were analyzed to evaluate the preliminary effect of the ISHMa system's enforcement component:
  - **Pre-Enforcement Period: December 20, 2022 – September 20, 2023**
  - **Post-Enforcement Period: January 1, 2024 – July 29, 2024**

- **Site-specific live load factors calculated for each period:**

Rating Type	Pre-Enforcement LL Factor	Post-Enforcement LL Factor	HL-93 (standard)
Inventory	2.20	**1.75**	1.75
Operating	1.60	**1.27**	1.75

This indicates that the enforcement has reduced loads to match the standard design requirements!

Note: Post-enforcement time period documented is roughly 7 months. Longer time periods are needed to validate preliminary results.

STANDARDIZING CERTIFICATION REQUIREMENTS

Calibration/Certification Progress

State Department of Agriculture typically certifies all commercial as well as enforcement equipment using NIST Handbook 44 Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

- Existing NIST Handbook 44 currently has a tentative code for screening of vehicles

- NIST Handbook 44 update effort- Each state Dept of Ag Director gets a vote, voting occurs in person in July at annual meeting. 27 states must vote yes.

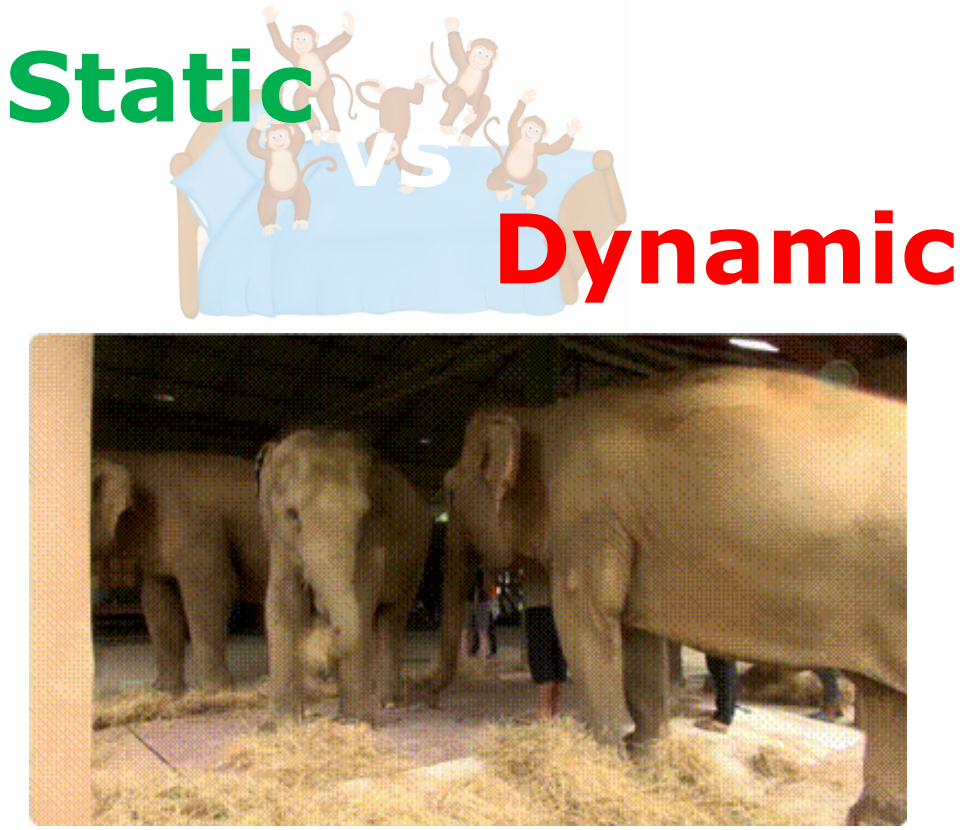
  - NCWM Interim Meeting in January 2025 formal designation as voting item
  - NCWM Annual Meeting in July 2025 Voting on the update failed.

OIML R134-1: A comprehensive existing standard available for reference Handbook 44

Aspect	Proposed Section 2.26	OIML R134-1
Accuracy	Class 10 (Similar to OIML F10) 10% GVW, 20% Single,15% Group Class 5 5% GVW, 10% Axle,8% Group	F10 10% GVW, 16% Single; 8% Group E5 5% GVW, 8% Axle/Group
Tolerance	Aligned with OIML	Interval 50-1000d @ d=200kg; min 50d
Influence Factor	Aligned with OIML	Temp range; voltage variation
Technical Requirement	Covering all aspects in Scale Code + Equivalent to OIML	Zero-setting, zero-tracking, operating speed, marking, vehicle recognition, etc.
Test Vehicle	3 vehicles Class 8-9/Class 6-7/Class 5 with full/partially full load per decision from Demo	3 vehicles Class 8-9/Class 6-7/Class 5 with full/empty load
Add'l vehicle	Aligned with OIML	If system is expected to weigh vehicle w/shifting weights, must include in tests
Speed Meas.	Aligned with OIML/Scale Code	Addressed
Position Test	Excluded per decision at Demo	Addressed

CONCERN RAISED AT NCWM

Scale and WIM are both used for enforcement. Why can't WIM match scale tolerance?



- Low speed WIM (static) can meet a tighter tolerance while high speed WIM (dynamic) yield a bit higher tolerance; however, that would not achieve the enforcement goal.
- The key difference is in **efficiency**, with direct

Tolerance in Legal Enforcement

How can we use such high tolerance for legal enforcement?

All enforcement systems must **address the system error** in determining appropriateness of issuing citation, e.g. portable scales have an allowance that is considered when issuing violation.

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Reduced by Max Error During Calibration (10%)

> Minimum GVW for Enforcement @ BQE

Other Concerns Previously Addressed

Too Wide Tolerance (10%) for Enforcement	Additional class of tolerance included similar to OIML R134-1
Tolerance Class Selection	Related clarifications for site selection and class selections added for user benefit
Excessive Test Procedure.	Potential for reduction in # of test runs for operational testing after initial acceptance testing incorporated
Calibration Test Logistically Challenging	Testing guidance provided as supporting document to assist in addressing previous testing logistics concerns
WIM System Requirements	Specific System specification requirements to match tolerance and metrology requirements per NIST input

Update of Handbook to include WIM for Direct Enforcement is continuing into 2026 session

What can you do to support?

Attend upcoming NCWM Events:

Regional meetings to match your location:

- 2025 SWMA Annual Meeting Registration October 26-29 Greenville, South Carolina
- 2025 CWMA Interim Meeting Registration September 29 - October 2 | Dubuque, IA
- 2025 NEWMA Interim Meeting October 20, 2025 - October 22, 2025 Norwich, CT

At a national level attend and make your voice heard at:
NCWM 2026 Interim Meeting January 11-14 Mobile, Alabama

Contact your state Department of Agriculture:

https://www.nist.gov/system/files/documents/2023/10/29/2024%20WMD-DIRECTORY.pdf

Calibration/Certification

- ASTM Code update is also currently in progress

  ASTM 1318:
  - Type IV system potentially for automated enforcement for speeds of 2 – 10 mph.
  - The Type 3 system is defined as a system to be used for screening for weight violations only

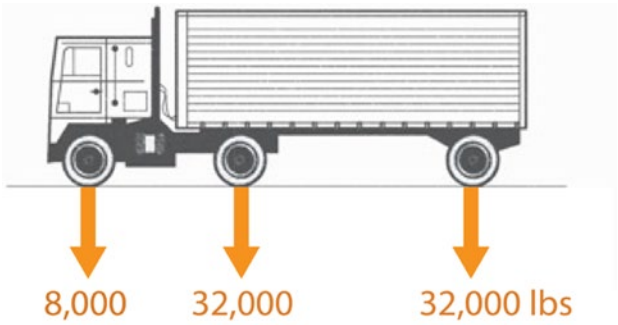
In the meantime:

- NYCDOT entered a MOA with NYS Dept of Agriculture to certify the system as a pilot.
- They have the authority to test/certify equipment outside of the handbook guidelines.
- Until the handbook is updated, they will use the most recent version of the proposed standard under consideration with national weights and measure for handbook update

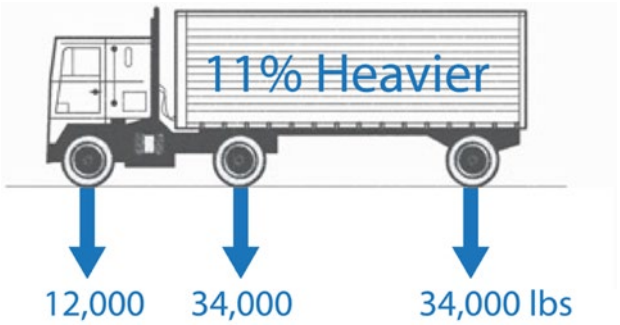
CLOSING REMARKS

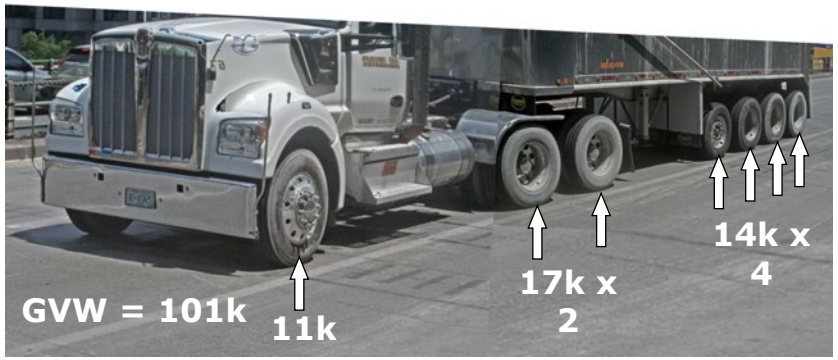
Legal load has been increased significantly, and the actual load is higher than structure's designed load.

Standard HL-93 AASHTO Design Truck Load



NYS Legal Load





What do we do about it?

Since NYCDOT's implementation WIM for direct enforcement:

Statewide Ripple Effects

In 2025, New York enacted Senate Bill S6383, expanding the authority to use WIM-based enforcement to other major infrastructure owners, including:

- Triborough Bridge and Tunnel Authority
- New York State Thruway Authority
- New York State Bridge Authority
- Port Authority of New York and New Jersey

- ***Signaling a broader policy shift toward integrating behavioral enforcement with infrastructure preservation.***
- Outreach with Freight partners to foster a culture of regulatory compliance and even the playing field

- NYCDOT is actively working with authorizing entities, including, FHWA, to educate and inform the industry on the WIM installation, calibration, and enforcement process.

CLOSING REMARKS

- Protecting our infrastructure and safer highways requires efficient means to enforce truck weight limits along with other related enforcement

- There is a gap in communications in achieving this goal
  - For instance –
    - DOT needs to protect bridges from overweight vehicles, may or may not be involved in weight enforcement must consider actual loads in their assessment
    - Highway Safety Personnel need to ensure vehicles are following safety standards but may not be aware of the infrastructure implications
    - Department of Agriculture reviews Handbook 44 which would set the standards for technology but are not involved in safety or infrastructure needs
    - Technology/Theoretical discussions don't always connect with decision makers

Who steps up to connect these seemingly disconnected aspects to achieve the goal?