

ISWIM
International Society for Weigh in Motion



Strategies for Implementing Weigh-In-Motion (WIM) Systems for Direct Enforcement

Brendan Ezeanowi

Manager, International Sales, Quarterhill

SATC – ISWIM Workshop

10 July 2025

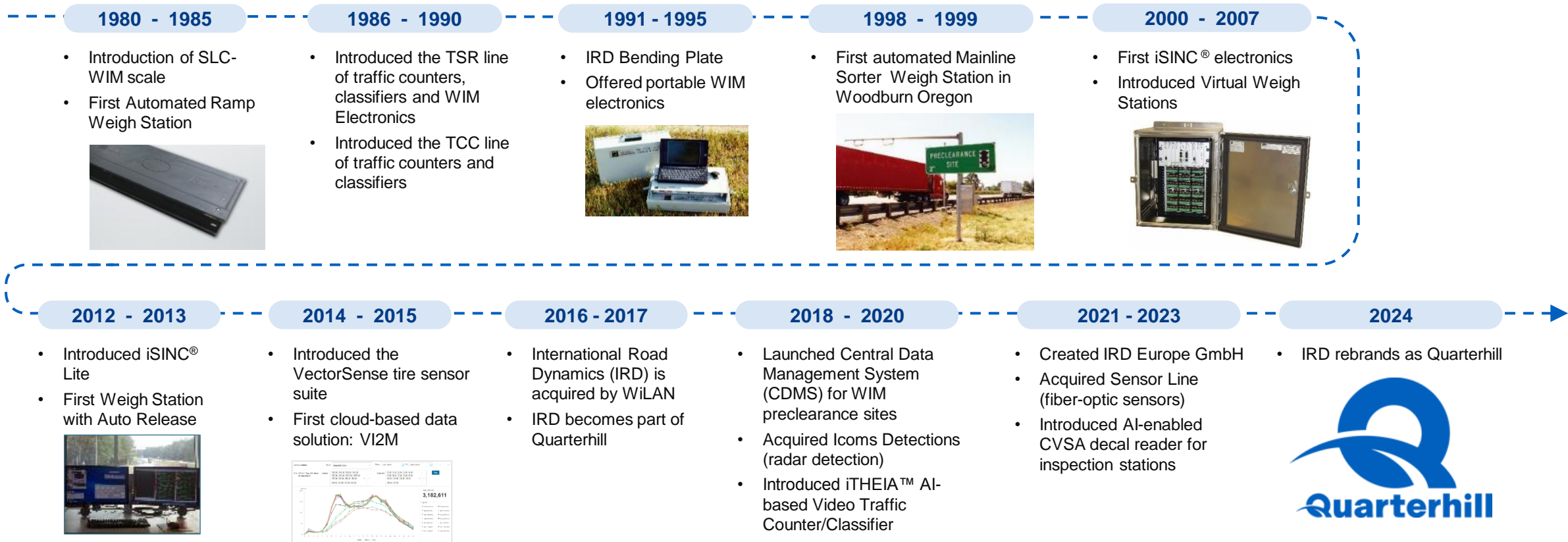


Strategies for Implementing Weigh-In-Motion for Automated Enforcement

- IRD/Quarterhill Experience
- WIM Data Collection
- Validating Enforcement
- Setting Thresholds for Enforcement
- Implementation
- Measurement Confidence
- Regulatory Environment
- Life-cycle Management



IRD/Quarterhill – 45 years in WIM



IRD/Quarterhill's Experience

- Modular systems help meet Enforcement objectives
- Our strategic and structured approach helps mitigate risks, manage costs, and ensure the system meets current and future demands
- Ensures WIM systems are reliable, sustainable, and adaptable



Managing Overloaded Vehicles at Weigh Stations

Key Challenges...

- Limited hours of operation/staffing challenges
- Inability to build weigh stations, which often include inspection bays and parking, in desired locations
- A limited subset of vehicles is selected for compliance checks

...Lead to a need for alternative solutions



Data Collection: Foundation for Implementation

Importance of comprehensive data collection:

- Understanding actual overloading trends through data
- Using data to establish enforcement baseline
- Assess enforcement program success, and justify investment

Site Summary												
Site C7L H-1 Fwy 200' West of Kaonohi St.										Class 0 to 15		Date 2021-Apr-01 to 2021-Apr-30
Lanes E1, E2, E3, E4, E5, E6, E7, W1, W1Z, W2, W2Z, W3, W4, W5, W6, W7												
Class	Vehicle Count	Vehicle Count %	PVR Count	No Weights	Weighted	Warning Count	Warning Count %	Valid Weights	Total GVW (kips)	Average GVW (lbs)	Overweigh t	Overweigh t %
0	0	0.00%	0	0	0	0	0.00%	0	0	0	0	0.00%
1	8,951	0.13%	8,951	2,638	6,313	809	12.81%	5,504	13,639	2,478	0	0.00%
2	4,636,653	67.38%	4,636,653	751,486	3,885,167	42,220	1.09%	3,842,947	16,042,560	4,175	0	0.00%
3	1,826,841	26.55%	1,826,841	186,906	1,639,935	18,507	1.13%	1,621,428	9,419,859	5,810	0	0.00%
4	19,783	0.29%	19,783	0	19,783	600	3.03%	19,183	561,142	29,252	4,890	25.49%
5	170,885	2.48%	170,885	0	170,885	3,401	1.99%	167,484	1,877,857	11,212	3,021	1.80%
6	28,404	0.41%	28,404	0	28,404	327	1.15%	28,077	943,205	33,594	3,266	11.63%
7	6,918	0.10%	6,918	0	6,918	58	0.84%	6,860	479,136	69,845	5,101	74.36%
8	11,376	0.17%	11,376	0	11,376	341	3.00%	11,035	273,004	24,740	1,157	10.48%
9	35,169	0.51%	35,169	0	35,169	345	0.98%	34,824	1,767,374	50,752	5,615	16.12%
10	1,921	0.03%	1,921	0	1,921	25	1.30%	1,896	119,532	63,044	540	28.48%
11	336	0.00%	336	0	336	12	3.57%	324	18,256	56,347	163	50.31%
12	175	0.00%	175	0	175	8	4.57%	167	13,817	82,736	140	83.83%
13	506	0.01%	506	0	506	6	1.19%	500	42,768	85,536	346	69.20%
14	27,117	0.39%	27,117	25,289	1,828	703	38.46%	1,125	18,026	16,023	0	0.00%
15	105,928	1.54%	105,928	105,928	0	0	0.00%	0	0	0	0	0.00%
Total	6,880,961	100.00%	6,880,961	1,072,245	5,808,716	67,362	1.16%	5,741,354	31,590,175	5,502	24,239	0.42%

WIM Report – VI²M™ Enterprise Reporting System

Designing for the Regulatory Environment

- Addressing legal nuances in different regions
- Ensuring legal defensibility of overweight citations
- Establishing a suitable WIM standard for certification of direct enforcement systems



Evolution of Existing Sites

- Planning enforcement architecture to **work with the existing WIM** system infrastructure
- **Build on the functionality** already in Virtual, Slow-Speed, and Preclearance systems
 - Dynamic weight measurement
 - Data collection, including e-screening
 - Variable Message Signs
 - Bypass system integration
- **Improve systems with:**
 - Software upgrades
 - Added sensors
 - AI: vehicle class and driver behaviour



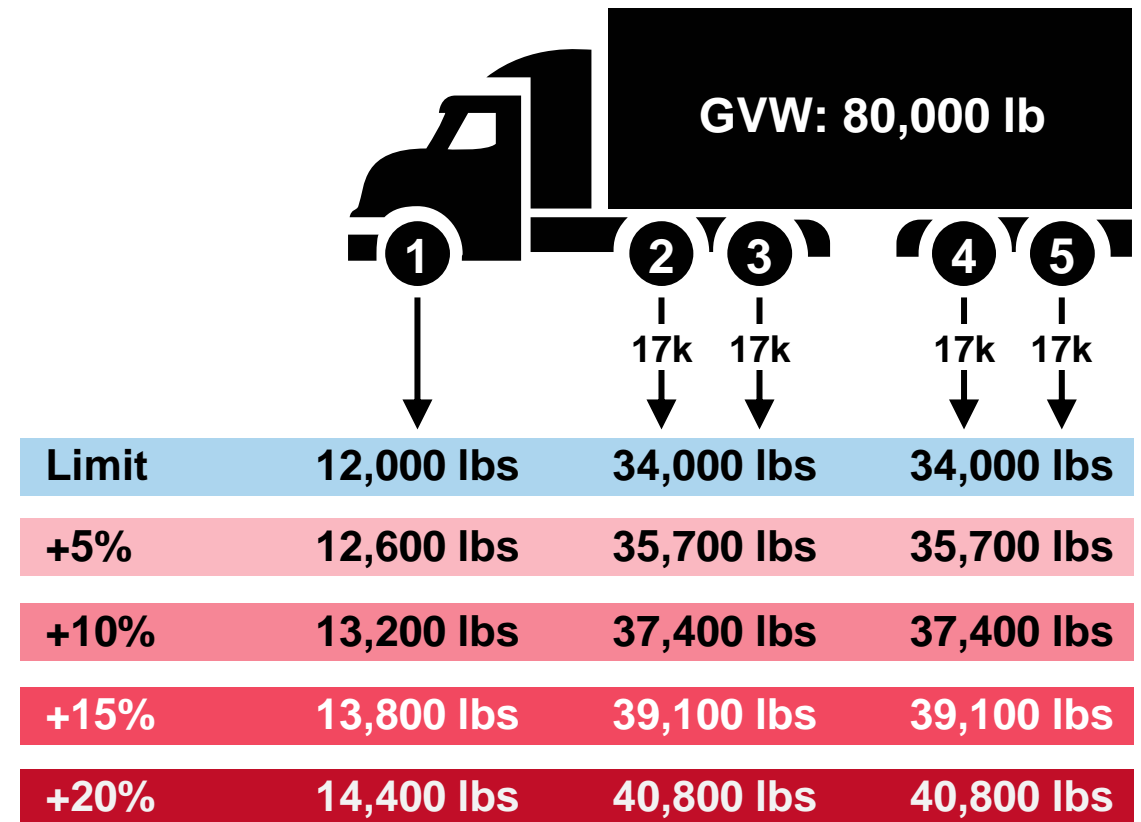
Critical Factors for System Implementation

- **Road quality:** flatness, stability, and structural integrity
- The smoother the roadway, the less effect dynamics have on vehicles passing over the system, the better the weighing accuracy
- Road quality is critical to maintaining measurement confidence over time
- **Experienced, qualified installation team**



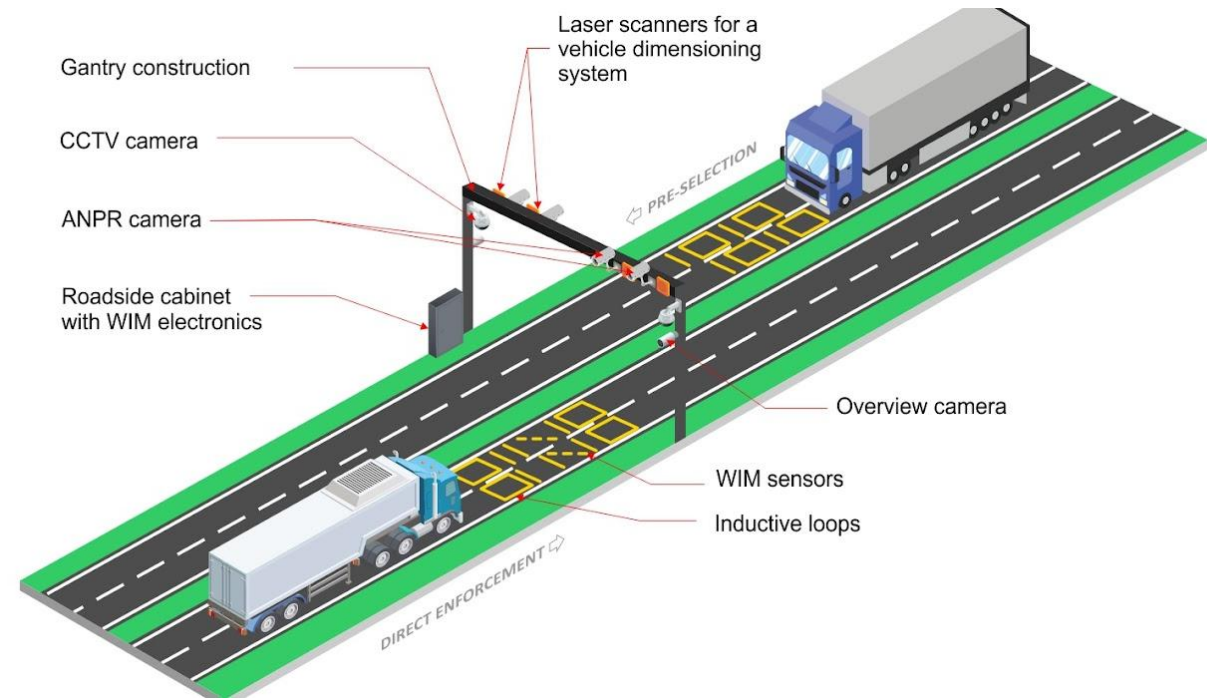
Setting Parameters Based on Agency Needs

- Aligning enforcement thresholds to address real issues
- Avoiding arbitrary benchmarks
- Customizing WIM systems for local needs:
 - Regulations
 - Calibration complexities
 - Type of load
 - Vehicle classification
 - Tire width (*wider single tires can carry more weight*)



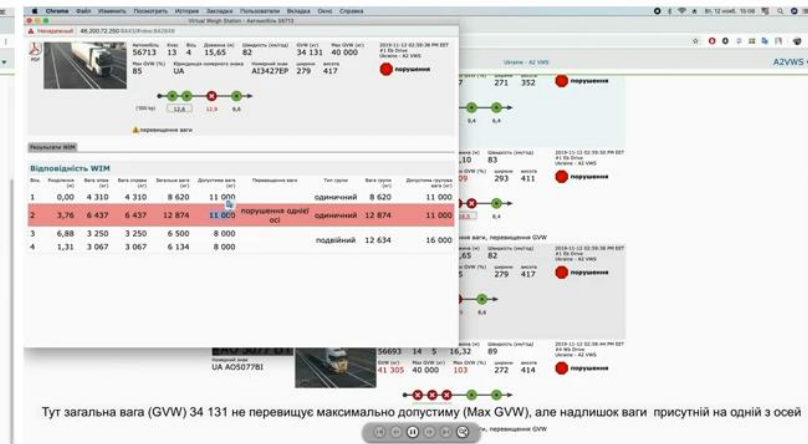
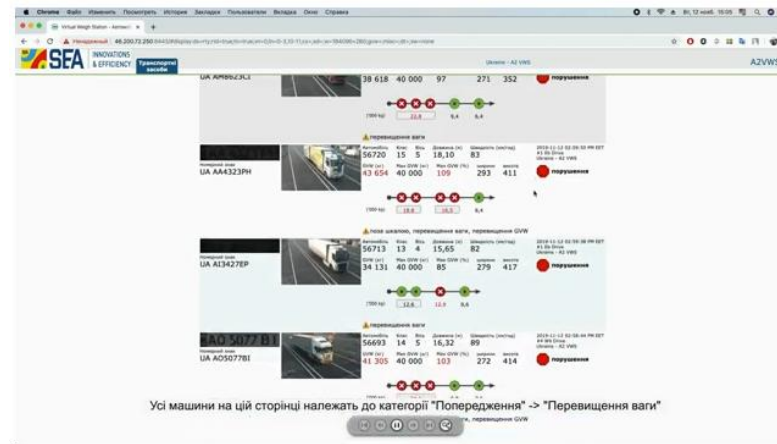
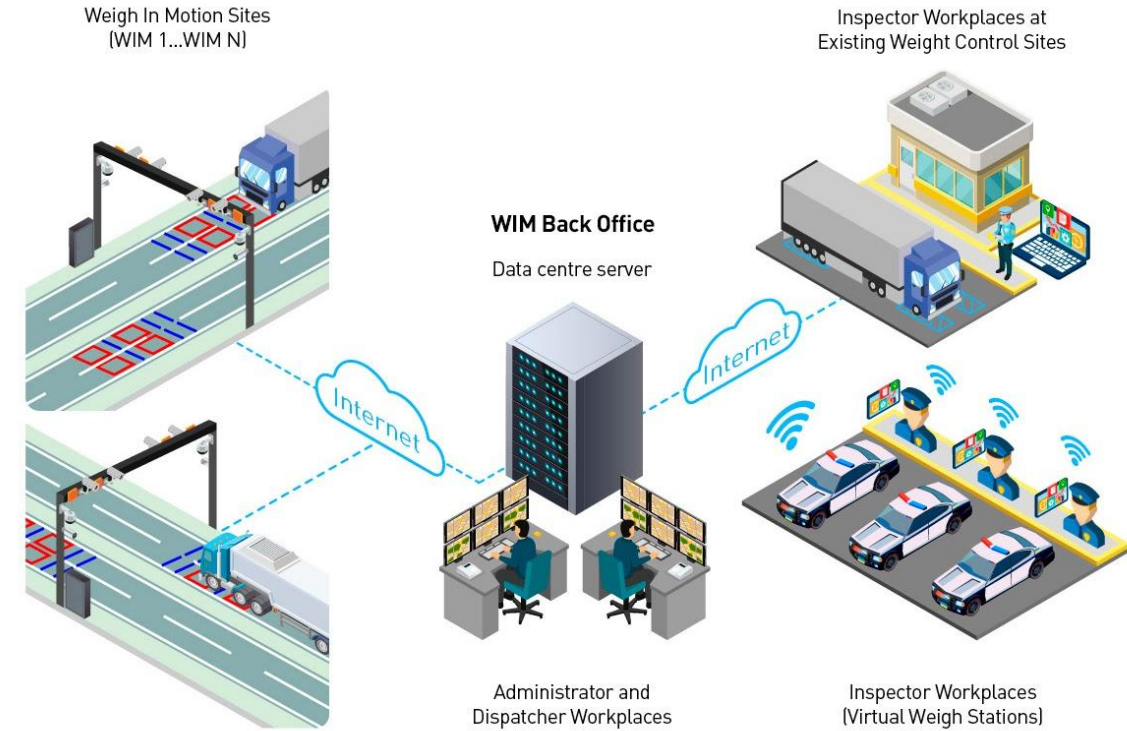
Example: Ukrainian Direct Enforcement Sites

- HS-WIM for direct enforcement
- Gross vehicle weight: $\pm 5\%$
- Accuracy (COST 323): Class A(5)
- Local type approval based on OIML standards
- Technology:
 - Quarterhill Virtual Weigh Station Software
 - iSINC Electronics
 - Intercomp Strip Sensors and Kistler Lineas[®] Quartz WIM Sensors
 - Automatic Number Plate Recognition (ANPR)



Ukraine: Direct Enforcement Back Office

- Connects data from multiple sites:
 - Central Server
 - Enforcement Package
 - Enforcement Personnel Review



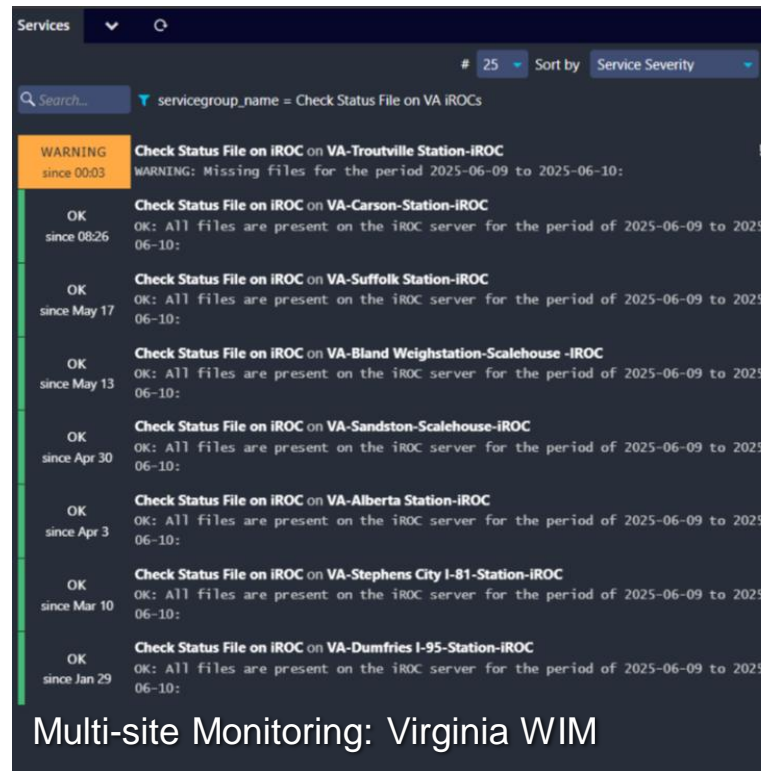
Vehicle Exclusions

- Load Types
- Permitting
- Environmental conditions
- Driver behaviour
- Lane position



Verification and Calibration

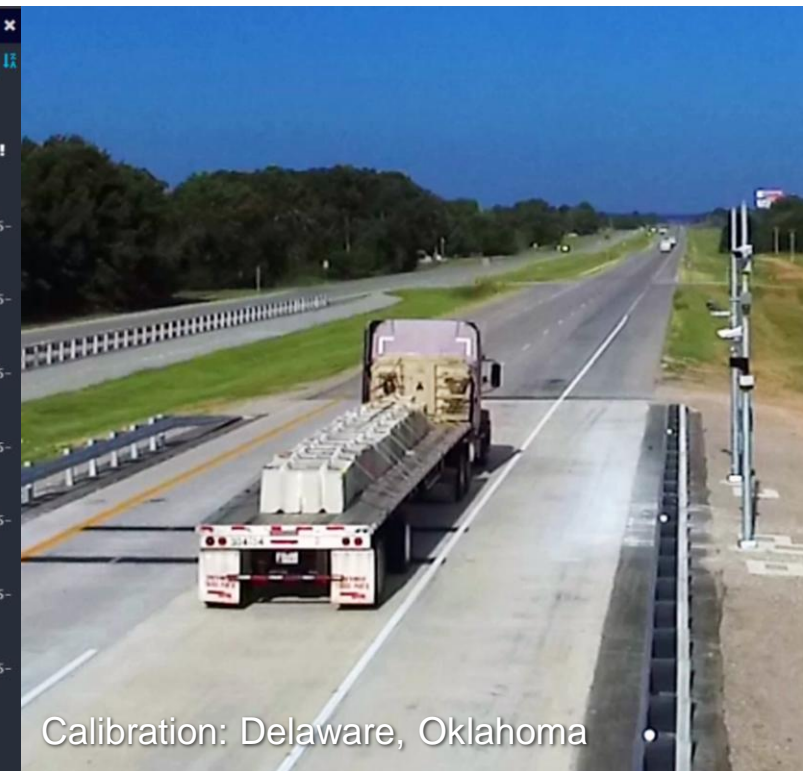
- Calibration plan
- Data monitoring
- Health monitoring



The screenshot shows a 'Services' window with a search bar and a filter for 'servicegroup_name = Check Status File on VA iROCs'. It displays a list of monitoring entries for various stations in Virginia:

Status	Station Name	Message
WARNING	Check Status File on iROC on VA-Troutville Station-iROC	WARNING: Missing files for the period 2025-06-09 to 2025-06-10:
OK	Check Status File on iROC on VA-Carson-Station-iROC	OK: All files are present on the iROC server for the period of 2025-06-09 to 2025-06-10:
OK	Check Status File on iROC on VA-Suffolk Station-iROC	OK: All files are present on the iROC server for the period of 2025-06-09 to 2025-06-10:
OK	Check Status File on iROC on VA-Bland Weighstation-Scalehouse -iROC	OK: All files are present on the iROC server for the period of 2025-06-09 to 2025-06-10:
OK	Check Status File on iROC on VA-Sandston-Scalehouse-iROC	OK: All files are present on the iROC server for the period of 2025-06-09 to 2025-06-10:
OK	Check Status File on iROC on VA-Alberta Station-iROC	OK: All files are present on the iROC server for the period of 2025-06-09 to 2025-06-10:
OK	Check Status File on iROC on VA-Stephens City I-81-Station-iROC	OK: All files are present on the iROC server for the period of 2025-06-09 to 2025-06-10:
OK	Check Status File on iROC on VA-Dumfries I-95-Station-iROC	OK: All files are present on the iROC server for the period of 2025-06-09 to 2025-06-10:

Multi-site Monitoring: Virginia WIM



Post-Implementation: Measuring Effectiveness

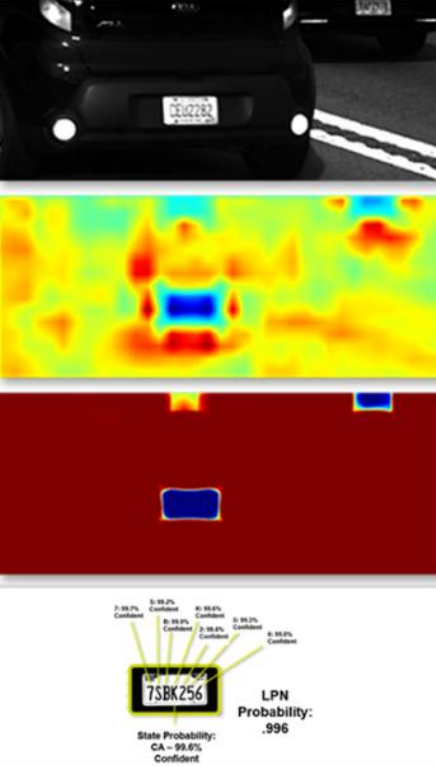
- Tracking trends in overloading before/after implementation
- Assessing enforcement **impact on compliance**
- **Continuous improvement** through data analysis
- **Life-Cycle Management of WIM Systems**
 - Regular updates to maintain system reliability, measurement accuracy, and confidence
 - Proactive maintenance strategies
 - Planning for future scalability



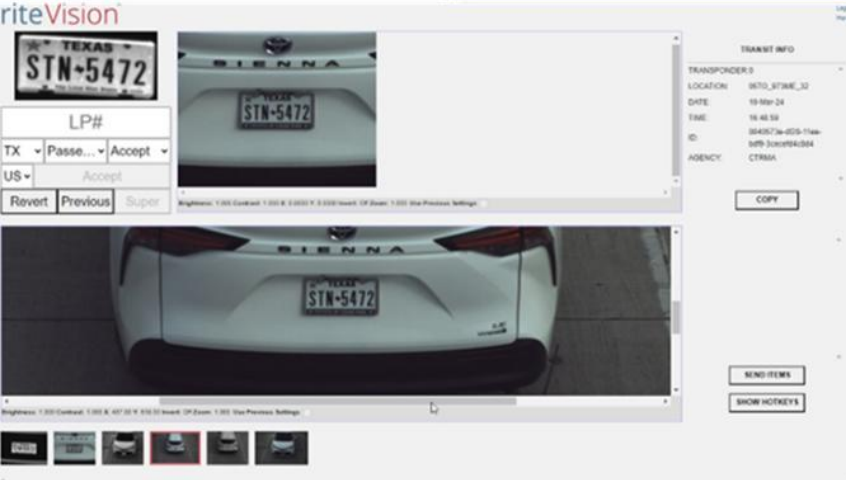
Future Trends in WIM Enforcement

Broader AI Implementation

- Enhancing data accuracy and validation
- Predictive maintenance for system reliability
- Real-time traffic & load optimization
- Advanced vehicle profiling and classification
- Enhanced license plate reader systems
- Improved enforcement accuracy with automated generation of citations



- 1 Raw image is inputted in the system.
- 2 Each pixel is evaluated for the probability that the pixel is a plate.
- 3 A SoftMax regression algorithm is applied to essentially "filter noise."
- 4 The final plates are extracted based on the input.



riteVision

TX TEXAS STN-5472

LP#

TX | Pass... | Accept

US | Accept

Revert | Previous | Super

TRANSPORTER'S INFO

LOCATION: 9870_STWME_32

DATE: 19 Sep 24

TIME: 16:42:59

ID: 2848726-025-1166

SUP: 3000994/004

AGENCY: CTBMA

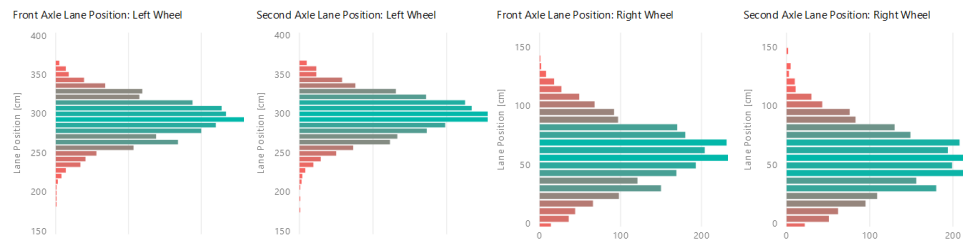
COPY

SEND ITEMS

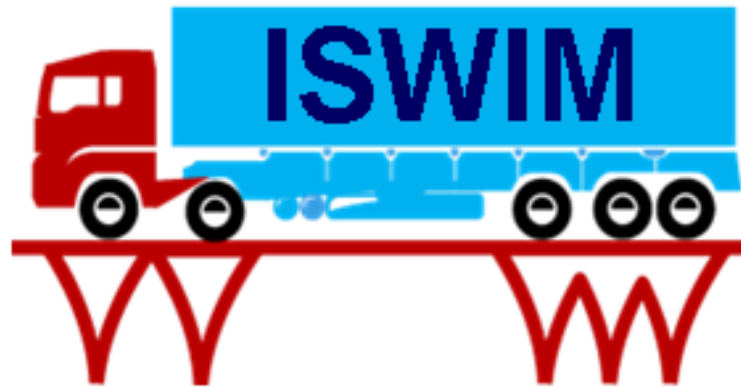
SHOW HOTKEYS

Tire Safety Screening

- **TACS – Tire Anomaly and Classification System** identifies vehicles with unsafe tires
- The system also augments WIM with tire width and position data
- VectorSense[®] sensors measure lane position to within 2 cm



Questions?



Brendan Ezeanowi
bezeanowi@quarterhill.com

www.quarterhill.com