

A Focus Technology of the American Association of State Highway and Transportation Officials (AASHTO) Technology Implementation Group (TIG)

Virtual Weigh-In-Motion *A "WIM-win" for transportation agencies*

VWIM Lead States Team

North Dakota (Chair)

California

Florida

Indiana

Nevada



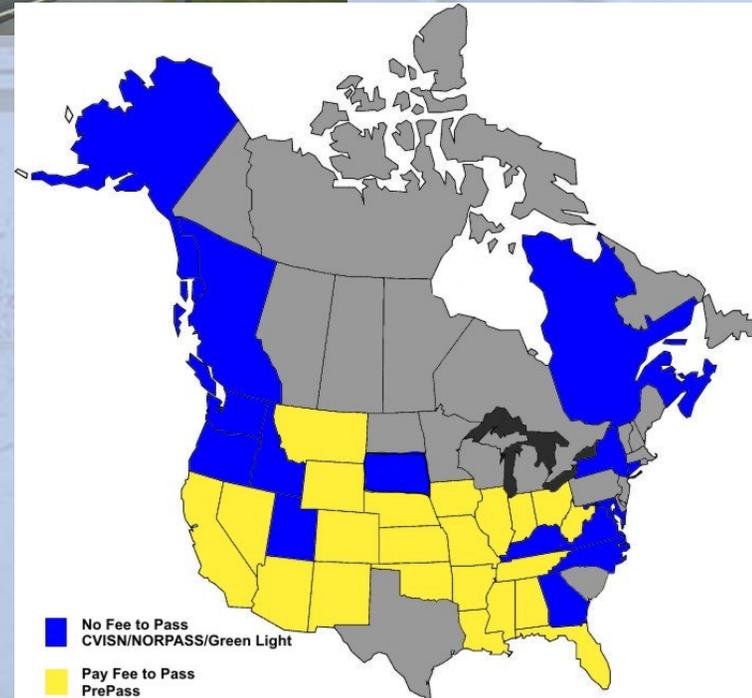
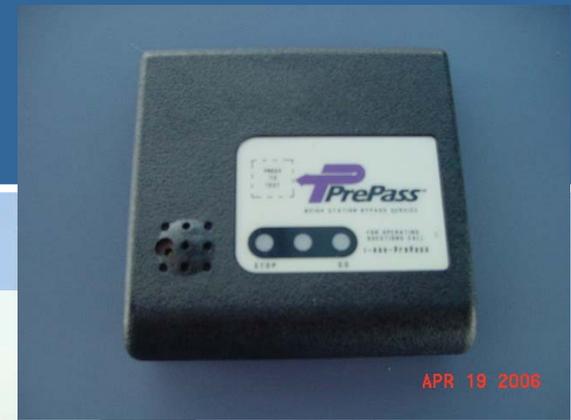
Virtual WIM: real time data from a distance

- Non-intrusive, unmanned, automated data collection
- System can include
 - Wireless communications
 - Remote cameras
 - Electronic transponders
 - Optical character recognition (OCR) cameras
 - License Plate Reader (LPR) technology
- Game changer for enforcement
- Eases traffic flow
- Selective, not random, inspections



Electronic Pre-clearance

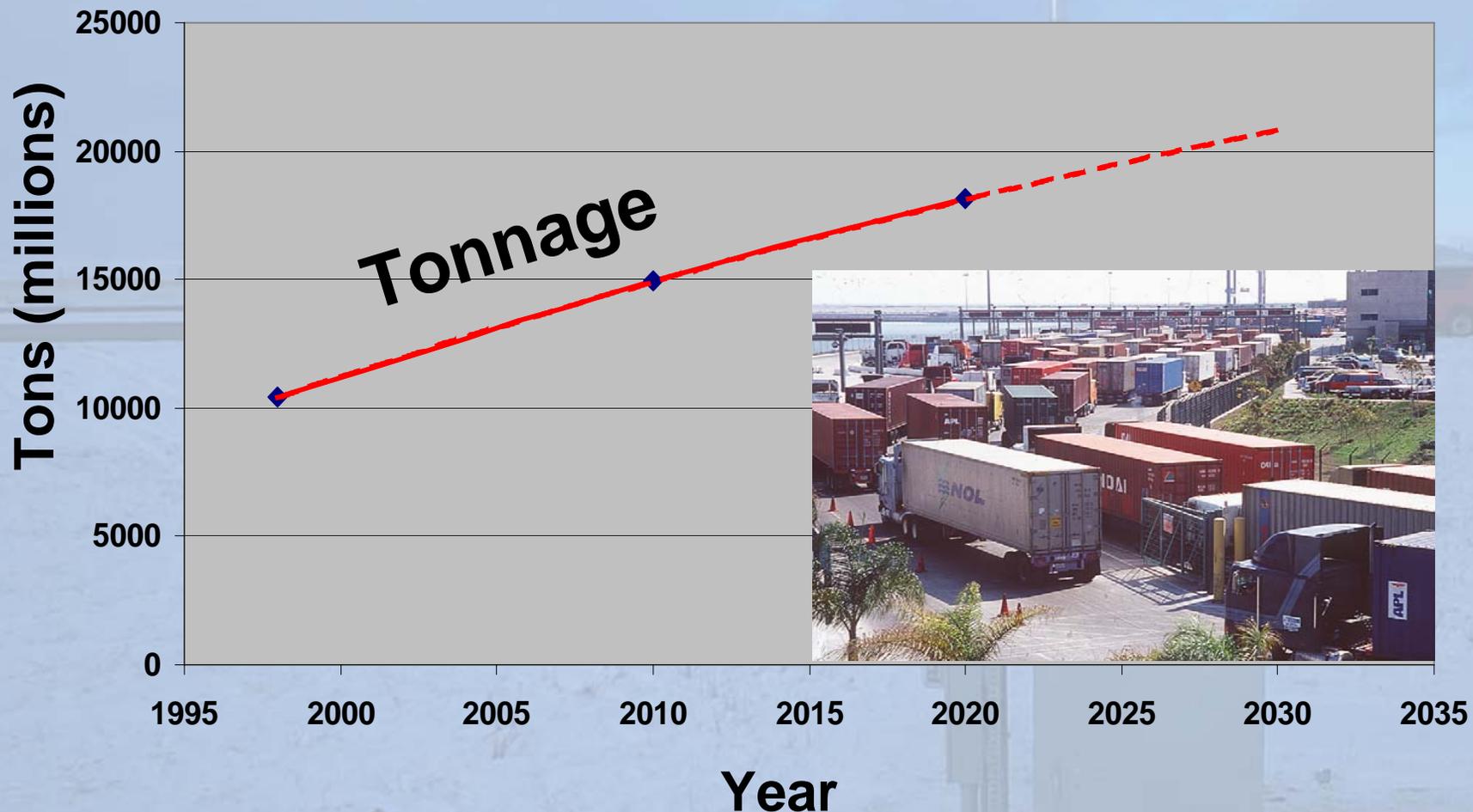
- In some States, linked to WIM
- Trucks often bypass weigh station
- Communicate via transponder for vehicle identity
 - Green for "bypass"
 - Red for "pull in"
- Credential check: State/National databases
- Nationwide
 - 40 jurisdictions use e-screening
 - 300 sites
 - 430,000 trucks with transponders
- Pre-clearance vendors
 - PrePass™
 - NorPass
 - GreenLight



Why VWIM, Why Now?

Freight Tonnage Moved by Truck

Source: FHWA



Why VWIM, Why Now? (cont'd)

- Enforcement
- Resource Management
- Budget realities
 - Cost of Right-of-Way
 - Cost to build
- Damage from overweight trucks
- Lessen volume at choke points
- Curb congestion (\$63B/year in U.S.)
- Expedite commerce
- Stem air pollution
- Sharpen predictions for design/maintenance



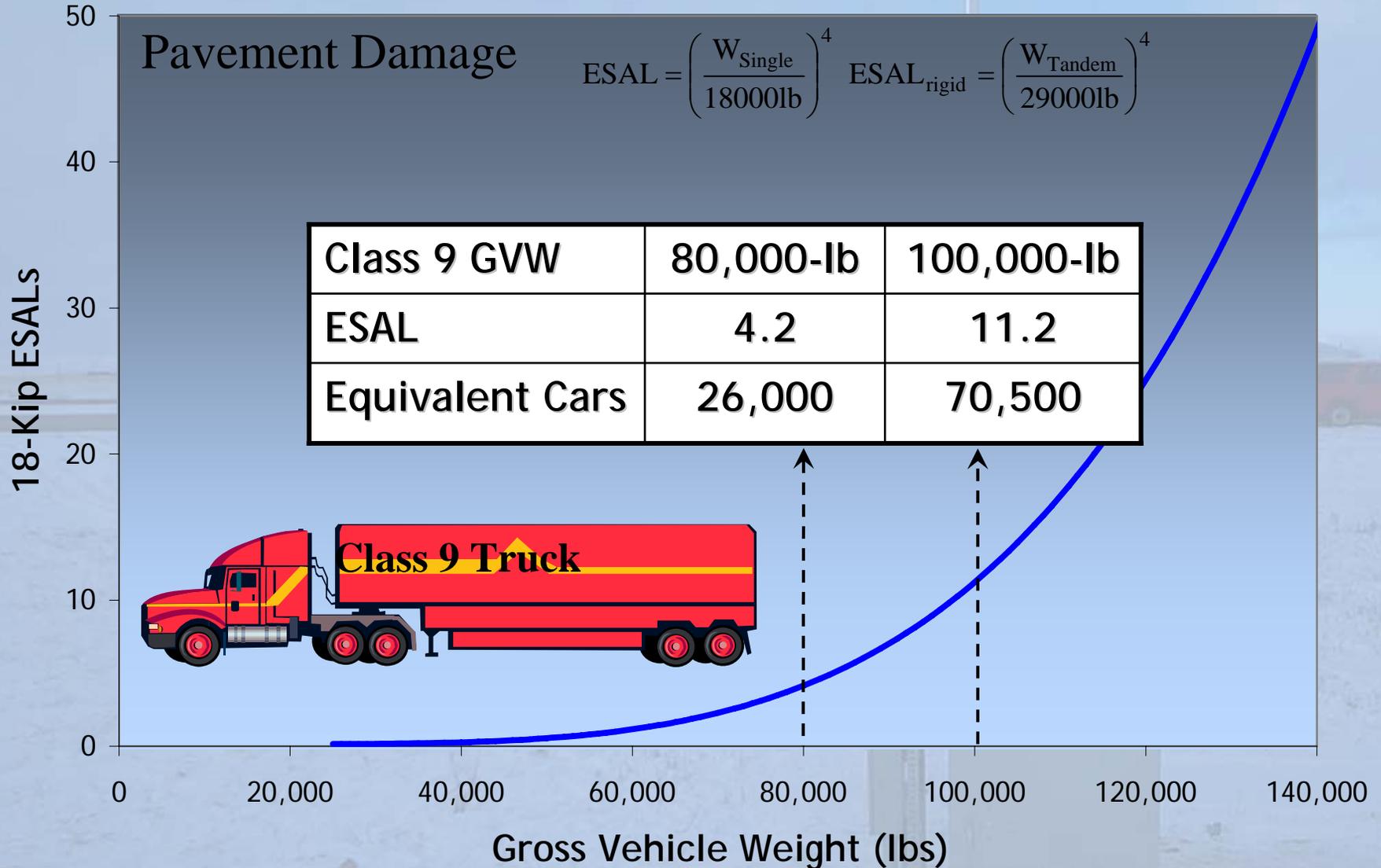
Backup at Indiana's Seymour Weigh Station
5/9/06

Over the next 20 years, truck tonnage is expected to increase at a rate more than five times that of population growth.

Texas Transportation Institute

Why VWIM, Why Now? (cont'd)

ESAL 101 (Equivalent Single Axle Loads)



VWIM Stakeholders

- **Driving public**
- **American Trucking Associations**
- **State Departments of Transportation**
- **Departments of revenue**
- **U.S. Department of Transportation**
- **Federal Highway Administration**
- **American Association of State Highway and Transportation Officials**
- **Federal Motor Carrier Safety Administration**
- **State highway patrols**
- **Motor carriers**
- **Commercial Vehicle Information Systems and Networks (CVISN)**



VWIM in Florida

New Cargoscan Laser Software for 3-Dimensioning Scanner at Flagler

The Vehicle System

The screenshot displays three rows of 3D point cloud models of vehicles, each with associated data. The data is presented in a table format for each vehicle.

Vehicle sequence number:	6
Width	2.78 Meter
Height	4.09 Meter
Length	26.26 Meter
Speed	39.05 Km/h
Time of record	Wed 20 Sep 12:40:01

Vehicle sequence number:	7
Width	2.68 Meter
Height	4.08 Meter
Length	28.88 Meter
Speed	53.52 Km/h
Time of record	Wed 20 Sep 12:40:32

Vehicle sequence number:	8
Width	3.62 Meter
Height	3.98 Meter
Length	29.31 Meter
Speed	42.49 Km/h
Time of record	Wed 20 Sep 12:40:40

Cargoscan a Mettler Toledo company

12-48 2006

- Pioneer of License Plate Reader systems
- Florida DOT/MCCO & University of Central Florida researching
 - 3-D scanning in mainline
 - Camera technology for USDOT Optical Character Recognition
 - Improved loop and sensor triggering devices
- All Interstate facilities equipped with
 - 45 mph ramp WIM lanes
 - 2 static scales
 - Comfort/inspection barns
 - Parking lots for 23 - 36 trucks
- Demonstration sites constructed to evaluate virtual technologies

VWIM Detail



Vehicle sequence number: 6

Width	9.12	Feet
Height	13.42	Feet
Length	86.15	Feet
Speed	24.26	MPH

LPR Lessons Learned

- **License Plate Readers**

Vendor: The Revenue Market Inc. (TRMI)

- **Night washout/weather**
- **Affordable precise triggering systems**
- **Wide lane coverage with single cameras**
- **Damaged/low contrast plates**
- **Infrared illumination=reduced optical character recognition (OCR) performance**
- **Illumination to minimize motorist concerns**

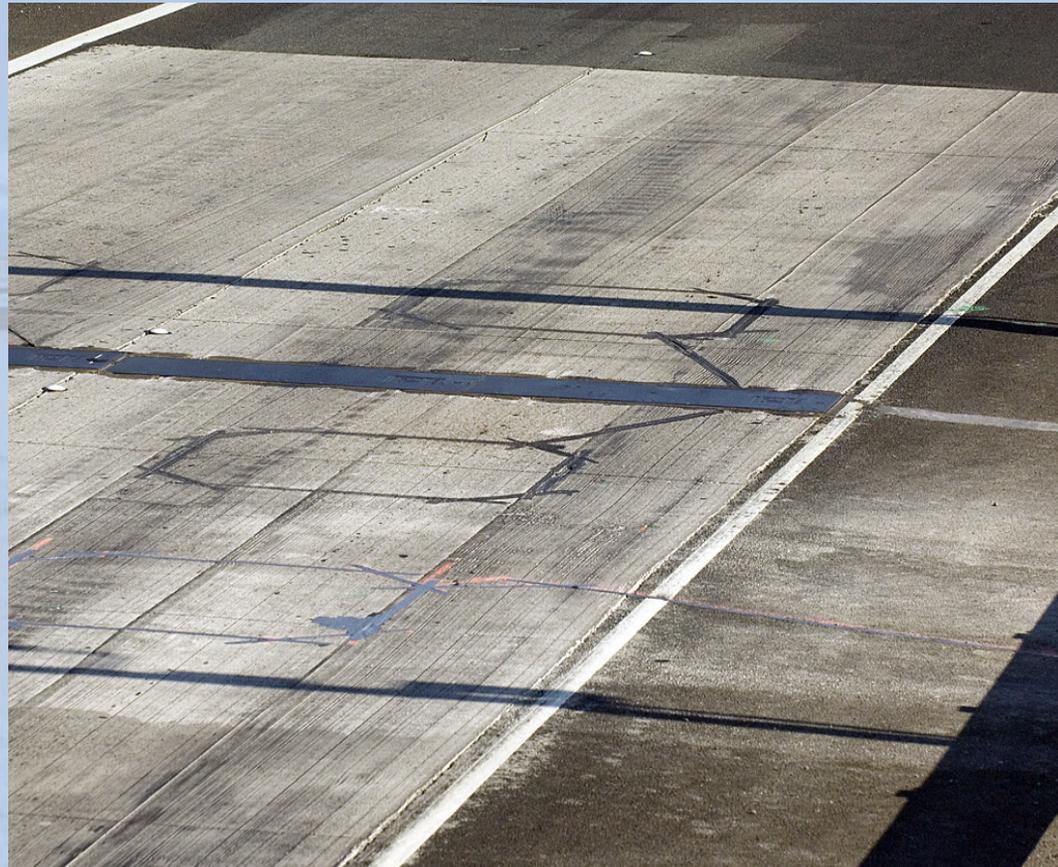
Video: Florida MCCO 1st Full Service WIM Station



VWIM in California

- 1/6 of WIM sites in the country
- Pacific Rim significant ports:
Freight bound for other
States/countries
- Virtual weigh
station prototype
- Evaluating VWIM technology
with LPR in highway speed
mainline application

Cordelia VWS in-ground equipment



Prototype VWIM Station - Cordelia, CA

Cordelia, CA

Lane: WIM All Vehicles — Classes 4–74 — Displaying Error Records **Sorting by Sort Dec**

Cordelia, CA – WIM

Record 38180 **Fri Jun 09 11:50:18.39 2006** LANE: WIM

CLASS: 9 LENGTH: 68 ft SPEED: 58 mph 18-K ESAL: 0.172
 GWW: 34.7 kips MAX GWW: 80.0 kips

|-----52.7ft----->|
 ° ° ° ° °
 5.4 5.9 7.4 7.3 8.7

AXLE	SEPARATION (ft)	WEIGHT (kips)	ALLOWABLE (kips)
1		8.7	12.5
2	11.6	7.3	17.0
3	4.7	7.4	17.0
4	32.2	5.9	17.0
5	4.2	5.4	17.0

License: **9B33673 C:932**

Internet

VWIM in Nevada

- **Permanent WIM for high volume systems**
 - Continuous data 97% of time
- **Portable WIM for lower order roads**
 - Short term counts
- **Remote Installations - viable alternatives**
- **General Packet Radio Service (GPRS) communications and solar power sources replace permanent utilities**



Nevada DOT installs WIM bending plate in PCC Portland Cement on I-80 near Verdi, NV



Permanent Kistler quartz WIM site on I-15 with sensors and scale

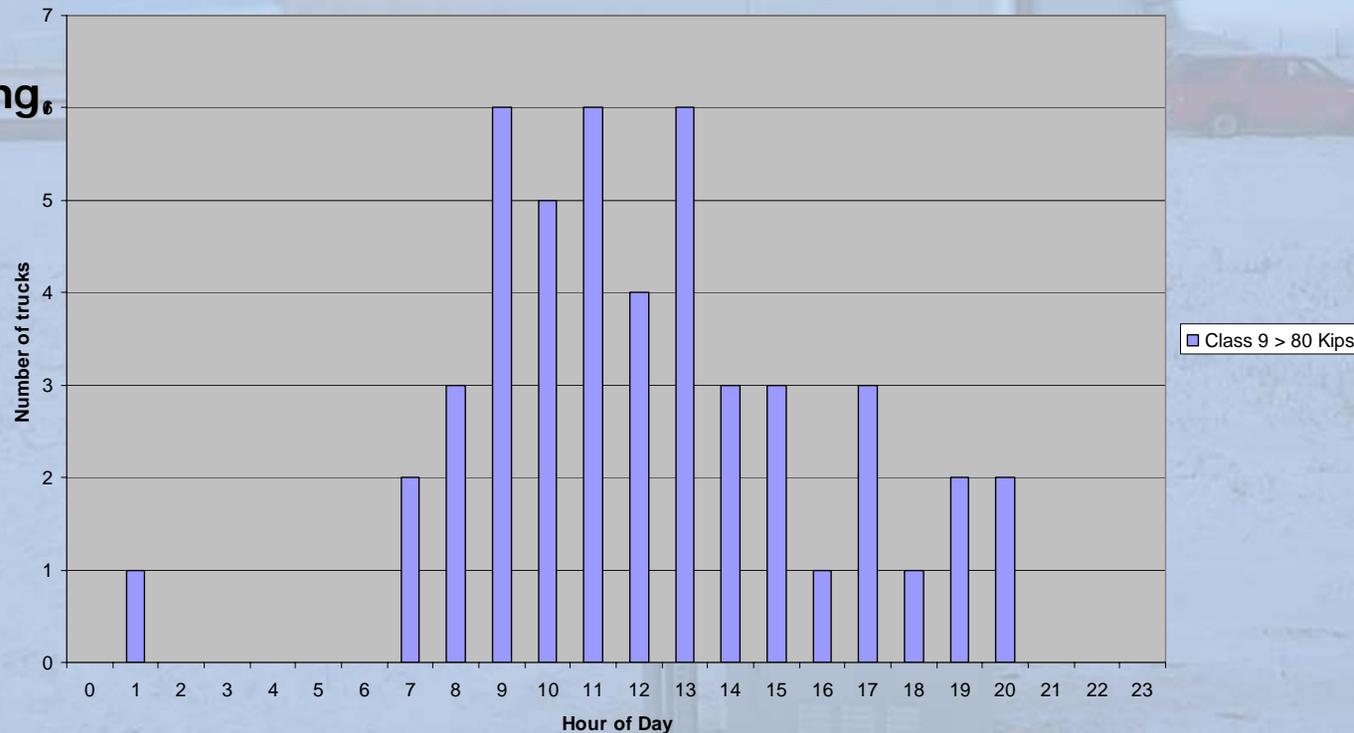
VWIM in North Dakota

- Increased emphasis on WIM sites vs. fixed scales
- Statewide implementation of WIM for increased data collection and mobile enforcement
- 12 mainline WIM sites – wirelessly communicating with enforcement vehicle
- Enforcement, screening, safety compliance
 - Target areas of known violations
 - Target worst violators by area & time of day/week
 - Historical Data
 - Real-time Data

ND DOT WIM site with Kistler sensors installed in asphalt



Buchanan
Overweight Trucks Wed 4/5/2006
By Hour of Day (DOT)



VWIM in North Dakota



Click
for next
slide

VWIM in Indiana

- Unique working relationship among DOT, State Police, DOR/MCS & Purdue
- Remote cameras, wireless communications for enforcement screening
- Data analysis for trend identification & targeting enforcement activities

Video: Overweight on Indiana's Borman Expressway - laptop screen seen by an officer



Click on video to play.

Road Runner

File Communications Clear Screen

Date: 04/11/02
 Time: 10:50:09
 Record: 24241
 Lane: 3
 Class: 0
 Axles: 0
 Length: 0
 Speed: 0
 GWV: 0

Axle Weights: 0, 0, 0, 0, 0, 0, 0

GVW Limit: 80
 Lane 1
 Lane 2
 Lane 3
 Lane 4
 Class 7
 Class 8
 Class 9
 All Classes

Violators

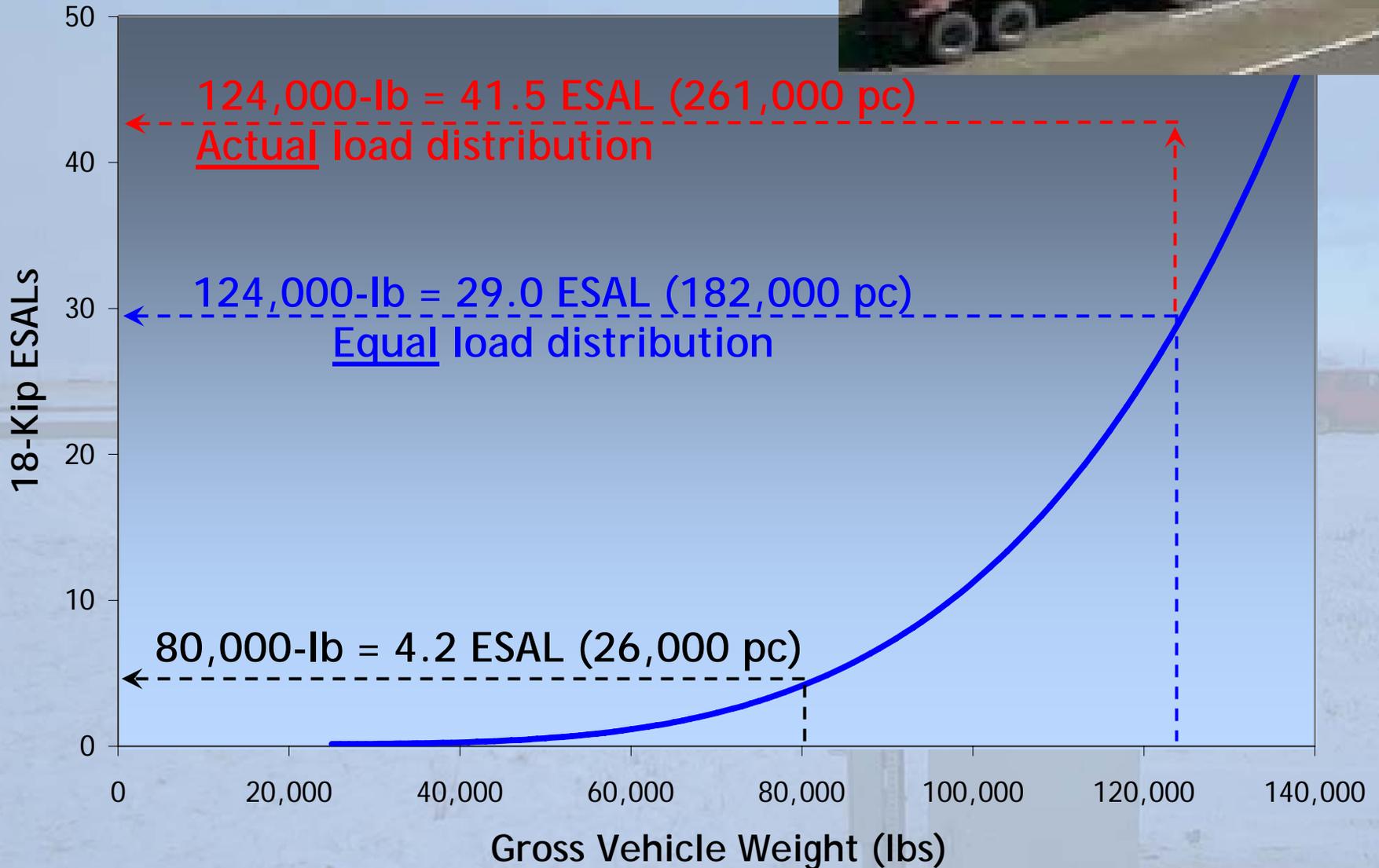
Record	Class	Lane	GVW
24195	9	3	81.6
24213	9	3	82.8
24224	9	3	81.2

Axle Weights

Time	Record	Class	Lane	GVW	1	2	3	4	5	6	7
10:49:53	24223	9	2	31.8	10.5	6.4	6.5	4	4.4	0	0
10:49:56	24224	9	3	81.2	12.4	16.6	16.3	17.8	18.2	0	0
10:50:02	24230	9	1	31.3	10.7	6.3	6.1	3.9	4.2	0	0
10:50:04	24233	9	3	26.3	9.4	5.4	5.8	2.9	2.8	0	0
10:50:05	24234	9	1	31.4	7.5	5.9	6.9	4.9	6.1	0	0
10:50:07	24235	9	2	23.1	8.3	4.1	4.6	3	3	0	0
10:50:07	24237	0	4	8.9	3.4	4.3	1.3	0	0	0	0
10:50:08	24238	0	3	0	0	0	0	0	0	0	0
10:50:09	24241	0	3	0	0	0	0	0	0	0	0

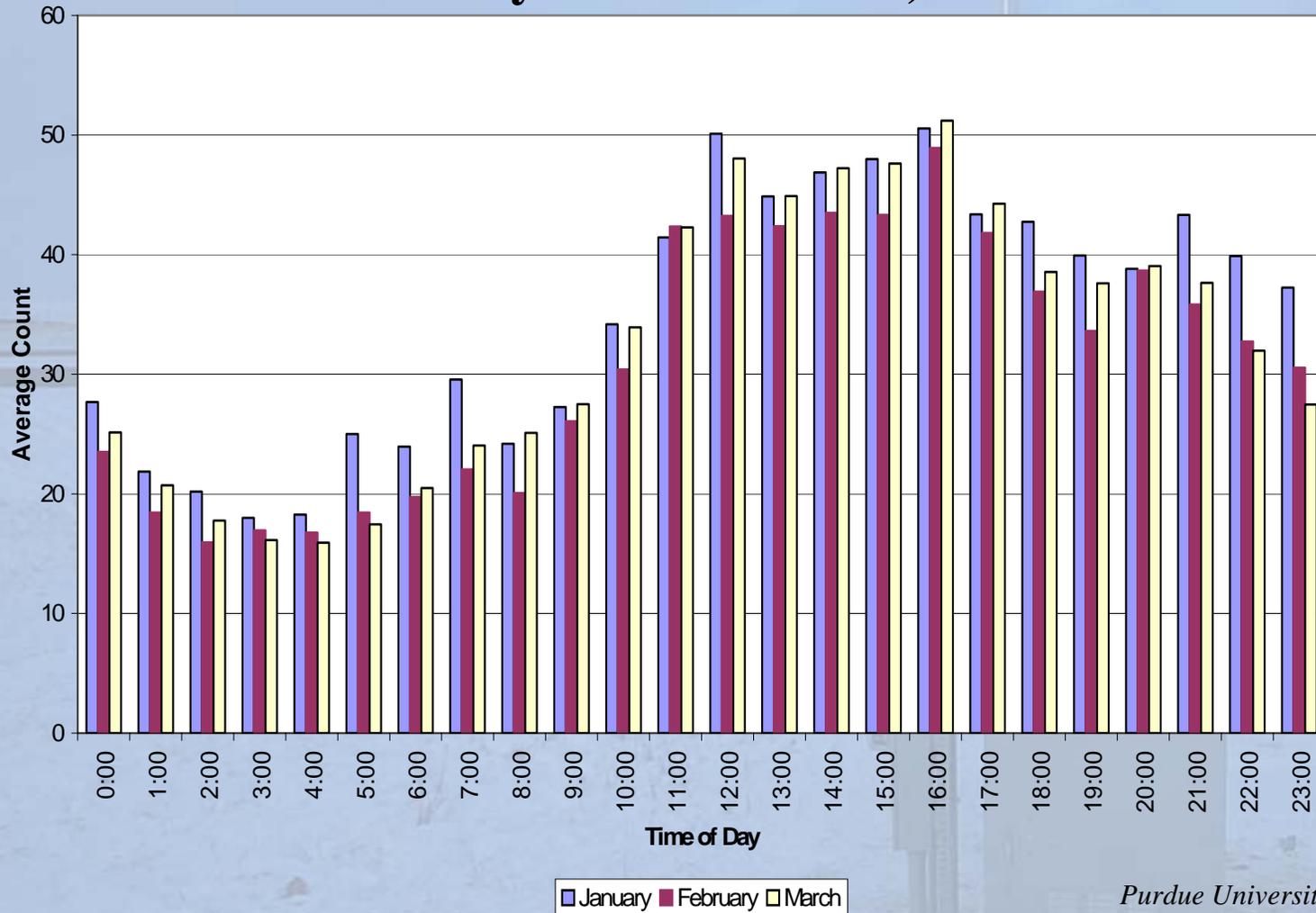


VWIM in Indiana



I-80/94 – Hour of Day

Eastbound WIM Class 9 Volume GVW > 80k January 16 – March 31, 2002



Virtual WIM: a “WIM-win” for Transportation Agencies, Industry & the Public

VWIM Increases

- Enforcement activity
- Personnel efficiency
- Data collection
- Design accuracy
- Freight movement
- Asset management
- Rewards to legal carriers
- Penalties to offenders
- Safety, security, mobility, commerce

VWIM Reduces

- Right-of-Way costs
- Infrastructure costs
- Construction costs
- Operating costs
- Labor costs
- Maintenance costs
- Delay & idle time
- Freight delivery times
- Fuel consumption, pollution, congestion

**Electronic credentialing helps,
but future growth demands VWIM to screen for violators
so non-violators can move on down the road.**

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AASHTO Technology Implementation Group

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