Virtual Weigh-In-Motion

A "WIM-win" for transportation agencies

VWI M 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

- Tons (millions)
- Year

- Tonnage: 0, 5000, 10000, 15000, 20000, 25000

The graph illustrates the growth in freight tonnage moved by truck from 1995 to 2035, showing an increasing trend.

Source: FHWA
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
Pavement Damage

\[ \text{ESAL} = \left( \frac{W_{\text{Single}}}{18000\text{lb}} \right)^4 \]
\[ \text{ESAL}_{\text{rigid}} = \left( \frac{W_{\text{Tandem}}}{29000\text{lb}} \right)^4 \]

<table>
<thead>
<tr>
<th>Class 9 GVW</th>
<th>80,000-lb</th>
<th>100,000-lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESAL</td>
<td>4.2</td>
<td>11.2</td>
</tr>
<tr>
<td>Equivalent Cars</td>
<td>26,000</td>
<td>70,500</td>
</tr>
</tbody>
</table>

Dr. Andrew P. Nichols data/graphic
VWI M 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

- **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**
**VWI M Detail**

<table>
<thead>
<tr>
<th>Vehicle sequence number:</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Width</strong></td>
<td>9.12 Feet</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>13.42 Feet</td>
</tr>
<tr>
<td><strong>Length</strong></td>
<td>86.15 Feet</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>24.26 MPH</td>
</tr>
</tbody>
</table>
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
VWI M 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 VWI M technology with LPR in highway speed mainline application
Prototype VWIM Station - Cordelia, CA

Cordelia, CA

Lane: WIM

All Vehicles — Classes 4–74 — Displaying Error Record Sorting by Sort Dec

Cordelia, CA – WIM

Record 38180

Fri Jun 09 11:50:18.39 2006

LENGTH: 68 ft  
SPEED: 58 mph  
18-K ESAL: 0.172  
MAX GVW: 80.0 kips

CLASS: 0  
GVW: 34.7 kips

<table>
<thead>
<tr>
<th>AXLE</th>
<th>SEPARATION</th>
<th>WEIGHT</th>
<th>ALLOWABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11.6</td>
<td>8.7</td>
<td>12.5</td>
</tr>
<tr>
<td>2</td>
<td>4.7</td>
<td>7.3</td>
<td>12.0</td>
</tr>
<tr>
<td>3</td>
<td>4.7</td>
<td>7.4</td>
<td>17.0</td>
</tr>
<tr>
<td>4</td>
<td>4.2</td>
<td>8.9</td>
<td>17.0</td>
</tr>
<tr>
<td>5</td>
<td>4.2</td>
<td>8.4</td>
<td>17.0</td>
</tr>
</tbody>
</table>

License: 9B33673 C:932
VWI M 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
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

Click here for video

ND DOT WIM site with Kistler sensors installed in asphalt

Buchanan
By Hour of Day (DOT)
VWIM in North Dakota
VWI M 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.
124,000-lb = 41.5 ESAL (261,000 pc)  
**Actual load distribution**

124,000-lb = 29.0 ESAL (182,000 pc)  
**Equal load distribution**

80,000-lb = 4.2 ESAL (26,000 pc)
Eastbound WIM Class 9 Volume GVW > 80k
January 16 – March 31, 2002
Virtual WIM: a “WIM-win” for Transportation Agencies, Industry & the Public

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

**VWI M 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 VWI M to screen for violators so non-violators can move on down the road.
VWIM Lead States Team Contacts

North Dakota DOT
• Tom Bold
  Chair, AASHTO TIG VWIM Lead States Team
  Materials & Research Division
  (701) 328-6921
  Tbold@nd.gov

• Terry Woehl
  Planning & Programming Division
  (701) 328-3531
  Twoehl@nd.gov

Indiana DOT
• Guy W. Boruff
  Traffic Management Business Unit
  (317) 899-8605
  Gboruff@indot.in.gov

California DOT (Caltrans)
• Randy Woolley, P.E.
  Division of Research & Innovation
  (949) 756-4930
  Randy.woolley@dot.ca.gov

Nevada DOT
• Tony Rivera
  Traffic Information Division
  (775) 888-7444
  Trivera@dot.state.nv.us

Florida DOT
• Craig Wilson
  Motor Carrier Compliance Office
  (850) 245-7932
  Craig.wilson@dot.state.fl.us

AASHTO Technology Implementation Group
http://aashtotig.org