COMMERCIAL MOTOR VEHICLE Weight Enforcement



Overweight commercial motor vehicle (CMV) travel results in premature deterioration of the pavement infrastructure and associated increases in roadway maintenance costs. When increased maintenance funds are unavailable, deteriorated roadway conditions lead to compromised safety levels for the motoring public. Added annual costs attributable to overweight CMV travel have been estimated by several states to range from $8 to $144 million. On a national level, these costs are estimated to range from $265 million to $1.11 billion annually.

Transportation and law enforcement agencies in the U.S. are challenged to effectively and efficiently enforce CMV weight. U.S. enforcement officials are largely reliant on a network of fixed weigh station facilities that are inflexible in responding to changing industry travel, loading, and routing patterns. Fixed weigh stations, with sometimes restricted and often predictable hours of operation and vehicle capacity limitations, are often successfully bypassed by overweight CMVs. As such, significant enforcement effort is expended on compliant carriers; estimated overweight violation capture rates (i.e., overweight citations issued/total CMVs inspected) at continuously operated weigh stations on the U.S. Interstate System approximate 1%.

During the 2006 Commercial Motor Vehicle Size and Weight Enforcement Scanning Study - sponsored by the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the National Cooperation Highway Research Program - a team of U.S transportation experts observed notable technology-based European enforcement policies and procedures leading to enhanced efficiency and effectiveness in weight enforcement operations.

This informational brief describes these policies and procedures and considers the potential for U.S. application, including the necessary supporting technologies and opportunities for incremental implementation. Anticipated benefits and associated cost savings related to operational enhancements, infrastructure preservation, increased safety, and reduced congestion and harmful emissions are also described.

Although CMV weight and size enforcement activities are often performed concurrently by enforcement officials, opportunities to improve CMV weight enforcement are exclusively addressed here. Opportunities to improve CMV size enforcement are described in a companion publication, *Commercial Motor Vehicle Size Enforcement*, available at http://www.trb.org.

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Notable Policies and Procedures

With unique motivations related to pre-selection for manual enforcement, enforcement resource scheduling, preventative contacts for habitually non-compliant carriers, direct enforcement, and bypass prevention, transportation and law enforcement officials in Europe have developed various technology-based systems and supporting policies and procedures to enhance the efficiency and effectiveness of CMV weight enforcement.

Pre-selection

In the U.S., WIM systems are often used with fixed-scale facilities for real-time pre-selection (pre-screening) of non-compliant CMVs. Relying predominantly on mobile rather than fixed operations, several European countries utilize a combination of WIM and vehicle identification systems (WIM+VID) for the same purpose. Enforcement personnel receive weight data and vehicle silhouette/license plate images from an upstream WIM+VID site using dedicated short-range communications (DSRC). On-road colleagues intercept suspect vehicles and escort them to a downstream mobile or fixed site. On site, the vehicle is weighed using portable or permanent static scales. If a vehicle is confirmed to be overweight, the driver is issued a citation and/or required to offload the vehicle before proceeding.

Resource Scheduling

With continued focus on enforcement efficiency, France, Slovenia, and The Netherlands use archived WIM+VID data to schedule mobile enforcement resources. In The Netherlands, reports containing the number of overloaded vehicles by hour of day and day of week are automatically generated for each of the WIM+VID sites. From these reports, enforcement administrators can readily determine the most productive scheduling and dispatch of resources. Quality Assurance Statements - that include the number of axles measured, period of measure, and inaccuracy (compared to static weights) – accompany each report. In the U.S., the Montana Department of Transportation utilizes the Measurement of Enforcement Activity Reporting Software (MEARS) to help identify the time of day, day of week, and location of overweight CMV activity, as well as the predominant types of non-compliant vehicles.

Preventative Contacts

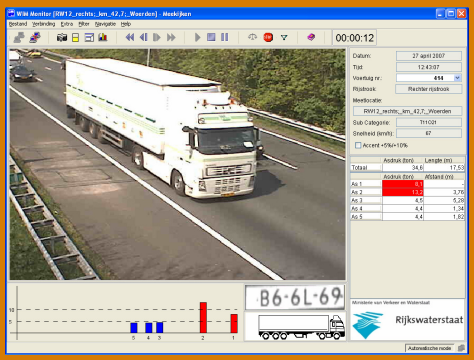
Archived WIM+VID data is also used to direct preventive contacts. In France and The Netherlands, carriers with the highest historic overloading offenses are sent an initial advisory notice (no citation is issued), meet with enforcement officials at their place of business, and begin a monitoring period. If loading behavior sufficiently improves, the carrier is reclassified as compliant. If it does not, roadside enforcement personnel begin stopping all carrier vehicles for inspection, regardless of load status. In The Netherlands, a decrease in overload offenses of at least 75% is required to re-categorize a carrier from “Code Red” to “Code Yellow” indicating continued but less intense monitoring. If behavior remains positive, the carrier is returned to “Code Green” with all other compliant carriers. Preventative visits are viewed as more efficient than roadside inspections; a single contact can reach company-wide rather than reaching a single driver or vehicle. In addition, use of WIM+VID systems allows for 100% capture and review of overloads (i.e., 24 hours a day, 7 days a week); roadside inspections are only effective when enforcement personnel are present.

Direct Enforcement

Building upon the aforementioned capabilities of the WIM+VID systems, the supplemental ability to issue citations based solely on WIM system data (i.e., without a secondary static measurement) could support direct, fully-automated CMV weight enforcement. At mainline speeds, direct enforcement could increase the proportion of CMVs monitored, overloaded CMVs detected, and non-compliant CMVs cited to effectively 100%. Off-route, at low speeds, French enforcement officials estimate a tenfold increase in the number of CMVs processed. Primary implementation challenges for direct CMV weight enforcement include: (1) attaining sufficient accuracy levels from WIM systems, (2) gaining metrological certification, and (3) modifying existing laws that require static weight measurements. The National Metrology Institute in France - historically unwilling to recognize dynamically captured measurements as “true” measurements - recently certified low-speed WIM systems for direct enforcement. Direct enforcement using high-speed WIM is estimated to be 5 to 20 years in the future.

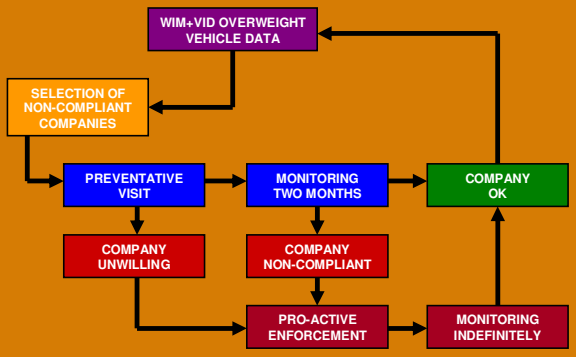
Bypass Prevention

The use of mobile enforcement procedures and low-cost technologies better positions European enforcement officials to address bypass challenges. France and The Netherlands have integrated bypass considerations into their WIM system site selection process, locating WIM systems to discourage obvious or convenient bypass. The Netherlands has also integrated bypass considerations into site-level system plans. On multilane facilities, WIM sensors are installed in the right two lanes; remaining lanes are equipped with electronic loops and overhead cameras to detect bypassing vehicles. CMVs are directed, via roadside signs, to travel in the right two lanes when approaching the WIM+VID site. As designed, overall system costs are reduced without significantly altering the effectiveness of enforcement.









Unique Partnerships

An overarching factor contributing to the success of many of the European policies and procedures for CMV size and weight enforcement is the high level of collaboration between similar agencies of different jurisdictional levels (e.g., national and regional law enforcement agencies) and between different agencies (e.g., transportation and law enforcement agencies).

In The Netherlands, for example, primary responsibility for CMV size and weight enforcement rests with the Ministry of Transport and National Police Agency. To ensure that CMV size and weight enforcement is a continued and consistent priority among the two agencies, the Ministry of Transport funds approximately 100 additional limited capacity police officers (trained in 80% of full police officer duties) who focus their time on weight enforcement and congestion/incident management activities. In addition, these two agencies work closely with the Transport Inspectorate, who monitors and enforces regulations on vehicle insurance, fleet maintenance, vehicle safety, and environmental conditions and Public Prosecution Service, who ensures that confirmed CMV size and weight regulation offenders are called to account with the law. Transportation and law enforcement agencies in the U.S., responsible for CMV size and weight enforcement, often do not share the same level of collaboration.

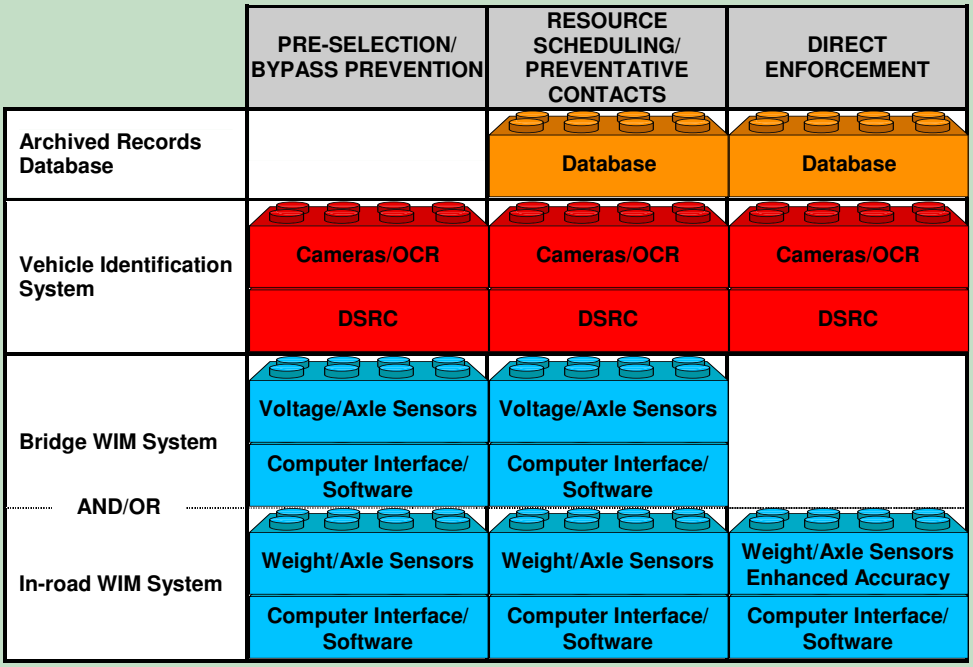
Supporting Technologies

In-road WIM System • Weight/Axle Sensors • Computer Interface/ PC Software	**Functions** • Measures and records axles and gross vehicle weight using piezoquartz, piezoceramic, fiber optic, or other sensor technology. **Considerations** • Provides 24/7 monitoring. • May be less accurate than traditional WIM systems (e.g., bending plate or load cell). • Lower cost supports wider implementation, greater geographic coverage. **Estimated Costs** • $9,000 - $32,500 per lane (for low-cost systems, traditional system costs are higher). • Varies based on weight sensor type, on-site communication requirements. • Requires additional, ongoing maintenance with associated costs.
Bridge WIM System • Weight (Voltage)/ Axle Sensors • Computer Interface/ PC Software	**Functions** • Measures and records vehicle weight using existing roadway structures instrumented with strain transducers or gauges. Bridge deflections are converted to weight measurements. • Measures and records axles using traditional in-road sensors or through Nothing-on-the-Road/Free-of-Axle Detector (NORFAD) systems. **Considerations** • NORFAD systems offer improved durability and easier installation with no traffic delays. • Requires suitable bridge in a location where WIM data is warranted. • Proven most successful on short, stiff bridge structures. • Structural assessments using strain data may require transducer calibration. • Calibration may require a high expertise level. **Estimated Costs** • $100,000 - $130,000 per bridge/system. • Varies based on weight sensor type, on-site communication requirements.
Vehicle Identification System • Camera/ OCR Software • DSRC/ Portable Computer	**Functions** • Captures both vehicle silhouette and license plate images using cameras. • Converts license plate image to numeric data using OCR software. • Transmits images/data via DSRC to portable computer used by enforcement officials. **Considerations** • Conversion of some license plate images to numeric data may result in errors. **Estimated Costs** • $52,000 - $80,000 per system. • Varies based on camera type, on-site communication requirements.
Archived Records Database	**Functions** • Supports data-driven scheduling of enforcement resources. • Supports data-driven preventative carrier contacts. • Supports continuous calibration and enhanced data quality. • Encourages long-term performance monitoring. **Considerations** • Requires procedures for quality control. **Estimated Costs** • $225,000 - $300,000

Perceived and Reported Benefits

Operational benefits attributable to the observed technology-based CMV weight enforcement policies and procedures focus on increased enforcement efficiency. Following implementation of technology-based pre-selection and resource scheduling programs, Slovenian enforcement officials reported overweight violation capture rates of 56% (compared to 0.5% using traditional enforcement methods); in The Netherlands, capture rates approach 80%. Industry is reacting positively to better self-monitor loading behavior. Hence, a reduction over time in the amount and frequency of weight overages suggests effectiveness.

Incremental Implementation Steps



Efforts to enhance enforcement efficiency in the U.S. could concurrently address broader benefits related to increased safety, reduced congestion, and harmful emissions. Increased use of technology-based pre-selection procedures could significantly reduce vehicle demand through fixed weigh station facilities; when vehicle demand exceeds facility capacity, vehicles queue on the mainline resulting in safety hazards and congestion. Direct enforcement using low-speed WIM systems could dramatically reduce harmful emissions attributable to the current drive pattern associated with the static scale weighing process.

Most significant however, is the potential impact of enhanced enforcement efficiency on infrastructure damage. Using technology to support enforcement resource scheduling, the Montana Department of Transportation reported a statistically significant 22% and 16% statewide reduction of overweight vehicles and overweight amount per vehicle, respectively. These reductions, expressed in terms of reduced pavement damage, had an associated cost savings of $700,000.

Interface with Other Functional Areas

SUPPORTING TECHNOLOGIES	ENFORCEMENT: SIZE: Infrastructure Preservation	ENFORCEMENT: SIZE: Pre-selection	ENFORCEMENT: SIZE: Direct Enforcement	ENFORCEMENT: WEIGHT: Pre-selection	ENFORCEMENT: WEIGHT: Resource Scheduling	ENFORCEMENT: WEIGHT: Preventative Carrier Contacts	ENFORCEMENT: WEIGHT: Direct Enforcement	ENFORCEMENT: WEIGHT: Bypass Prevention	WIM SYSTEM CALIBRATION: Continuous Calibration	WIM SYSTEM CALIBRATION: Quality Assurance	WIM SYSTEM CALIBRATION: Dynamic Calibration	OS/OW PERMITTING: Self Permitting/Routing	OS/OW PERMITTING: Bridge Safety Assessment	OS/OW PERMITTING: Remote Field Verification	BRIDGE PRESERVATION: Structural Assessment	BRIDGE PRESERVATION: Safety Assessment	BRIDGE PRESERVATION: Load Testing
Overheight Vehicle Detection System	✓	✓															
Vehicle Profiler System			✓														
In-road WIM System				✓	✓	✓	✓	✓	✓	✓	✓			✓			
Bridge WIM System				✓	✓	✓		✓	✓	✓			✓	✓	✓	✓	✓
Dynamic Calibration Vehicle											✓						
Vehicle Identification System	✓	✓		✓		✓	✓	✓	✓	✓				✓			
Advanced Routing/Permitting System												✓					
Archived Records Database					✓	✓			✓	✓			✓		✓	✓	

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