OVERSIZE/ OVERWEIGHT VEHICLES Permitting, Routing, and Monitoring

State departments of transportation are charged with regulating the movement of oversize and overweight (OS/OW) commercial motor vehicles (CMVs) on the state highway system, to ensure the safety of the traveling public and to preserve the transportation infrastructure though appropriate routing and mitigation measures. This responsibility is accomplished through the issuance of permits for vehicles and loads whose size or gross weight exceeds the limits allowed by law and that cannot be reasonably dismantled. Fees are charged for permits, which are issued on a single-trip, multiple-trip, consecutive month, or annual basis. Permits issued are subject to enforcement by appropriate officials.

Transportation and law enforcement agencies in the U.S. are challenged to effectively and efficiently permit, route, and monitor OS/OW CMVs. The review, approval, and issuance process for OS/OW vehicle permits is labor-intensive, time consuming, and prone to human error. The increasing demand for OS/OW permits further challenges this process. State-level transportation personnel report issuing from 800 to more than 1,800 permits per day, with an ever-increasing volume of permit requests from the motor carrier industry. Enforcement resources cannot keep pace in ensuring that intended legally permitted OS/OW vehicles are, in fact, legal, resulting in accelerated highway and bridge deterioration from overloaded vehicles that exceed overweight permit authorization.

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 OS/OW permitting, routing, and monitoring policies and procedures leading to enhanced efficiency and effectiveness in 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.

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Notable Policies and Procedures

Unique European procedures for addressing OS/OW permitting, routing, and monitoring are focused on the development and provision of websites allowing CMV drivers to self-route based on origin, destination, and route restrictions; the use of calibrated influence lines derived from bridge WIM to assess the safety of a bridge for OS/OW movements using the exact axle loadings and spacing; and remote field verification capabilities for OS/OW movements.

Self Permitting/ Routing

Motivated by a need to gain industry cooperation for safety measures implemented at tunnel approaches, limit the impacts of temporary closures resulting from incidents or adverse weather, and promote the national policy of shifting goods traffic from road to rail, Swiss transportation officials developed a comprehensive website, www.truckinfo.ch, that provides a description of tunnel traffic management measures, real-time road and rail traffic information, weather forecasts and related road conditions, and an interactive self-routing function that includes transalpine piggyback rail services as an alternative to roadway transport. The four main mountain pass roads and tunnels along the transalpine routes constitute a critical capacity constraint for CMV traffic, especially when temporary closures are caused by weather conditions or incidents. Hence, the web-based information system targets medium and long-range CMV goods transport through Switzerland. Commercial motor vehicle drivers can self-route based on origin, destination, and route restrictions.

Similar systems - that automate both permitting and routing functions - are currently commercially available and in use in several states in the U.S. Advanced routing and permitting systems enable CMVs to apply online for permits, pay for permits using secure Internet connections, and receive approved routes (based on road system constraints and the intended vehicle/load characteristics) by fax or email 24 hours a day, 7 days a week. In addition, permit applications can be automatically checked against the carrier's account balances, insurance coverage, permitting violations, registration, and other background information. Road, bridge, and map data is used to support determination of safe, consistent routes of travel appropriate for the specific vehicle dimensions and load. Temporary restrictions that may be imposed because of construction, maintenance, weather, or related conditions are also taken into account. En route, enforcement personnel can use electronic access to quickly review and confirm permitting activities.

Bridge Safety Assessment

Prior to issuance of an OS/OW permit, an evaluation of the bridges along the permitted vehicle's intended route may be required. Because bridges may be required to support the full load of the CMV, depending on the relation between vehicle and bridge lengths, their load carrying capacity often becomes the limiting factor in issuing a permit.

The traditional methods for calculating bridge load carrying capacity tend to be conservative to account for uncertainty levels in the live (i.e., traffic) loads applied to a structure and the structure's response to those loads. In many cases, these methods also neglect potential sources of reserve capacity (i.e., additional strength resulting from the composite action between slab and girders in bridges that were designed as non-composite, rigid or semi-rigid connections that were designed as flexible, etc.).

Bridge safety assessments, as part of the OS/OW permit review process, use the permit vehicle as the live load reference effectively eliminating any uncertainty related to loading. Improving upon theoretical assumptions about the structural behaviour of a bridge, bridge WIM systems provide direct response measurements that allow for more accurate determination of influence lines, the statistical load distribution, and impact factors from normal traffic. In particular, the shift from theoretical to measured influence lines can dramatically change the input parameters used in the bridge safety assessment model, resulting in different conclusions regarding the safety of an existing bridge under the intended vehicle loading. In France and Slovenia, calibrated influence lines derived from bridge WIM systems are routinely being used to calculate the safety of a particular bridge or bridges under OS/OW loading using the exact axle loading and axle spacing.

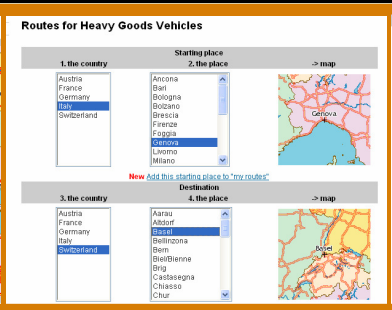
Remote Field Verification

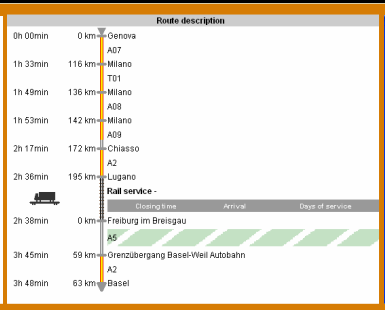
Ensuring that intended, legally-permitted OS/OW vehicles are in fact "legal" poses a challenge in Europe. During a special investigation, enforcement officials in Slovenia observed violation rates of more than 50% pre-trip and 70% en route for permitted OS/OW vehicles. Of the OS/OW vehicles intercepted pre-trip, 47% were found to be overweight. A similar investigation performed in The Netherlands observed 40% of OS/OW vehicles to be operating without proper credentials.

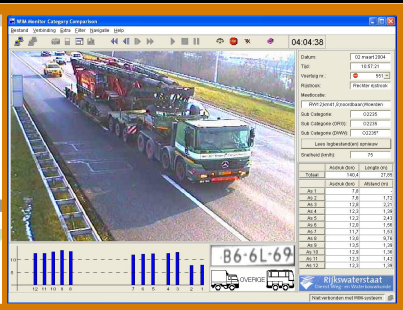
Prompted by the results of these studies, transportation and enforcement officials in Slovenia and The Netherlands are now utilizing in-road and bridge WIM systems, in conjunction with vehicle identification systems, to remotely verify and subsequently enforce non-compliant OS/OW movements. Commercial motor vehicle weight and configuration characteristics and unique vehicle identifiers (i.e., vehicle silhouette and license plate image) are captured in the field and compared in near real-time to details contained in the approved permit application. If the field measurements differ substantially from the details in the approved permit application or if no permit application is on file, mobile enforcement units may be alerted to intercept the vehicle and assess appropriate penalties.

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.
Advanced Routing/ Permitting System	**Functions** • Allows drivers to self-route based on origin, destination, and route restrictions. **Considerations** • Requires supporting highway and bridge characteristic information. • Different state-level permit fees, routing, and regulations make initial development costly. • Provides 24/7 access for industry. **Estimated Costs** • $2.0 – $8.3 million per statewide system.
Archived Records Database	**Functions** • Supports data-driven scheduling of enforcement resources and 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





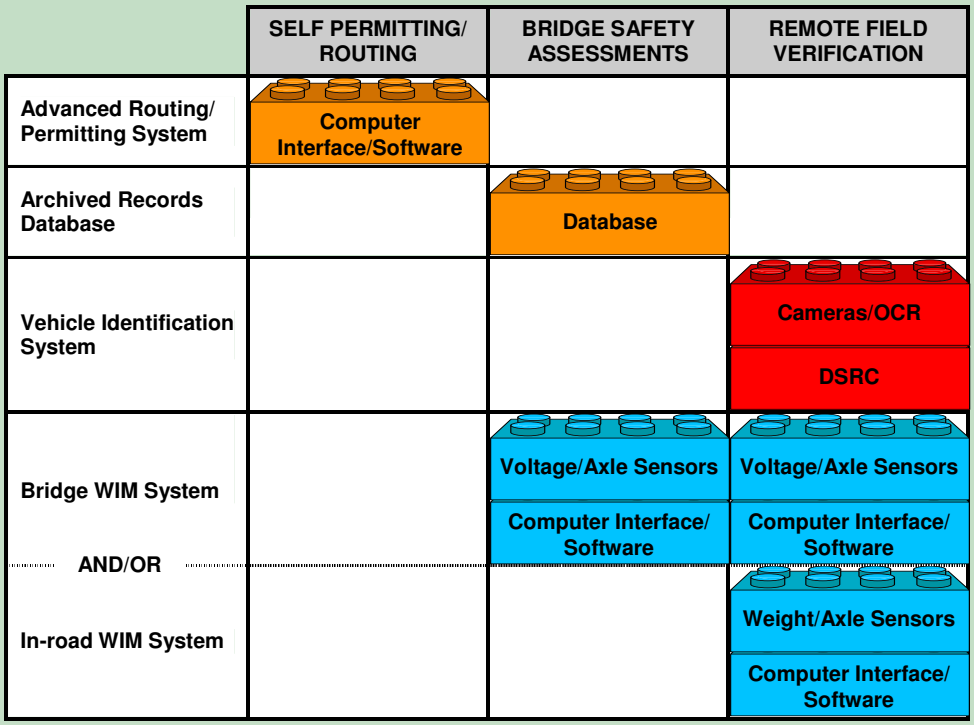


Perceived and Reported Benefits

Operational benefits attributable to the observed technology-based OS/OW permitting, routing, and monitoring policies and procedures are diverse and largely anecdotal. Advanced permitting and routing systems reportedly offer significant efficiency, productivity, and cost-effectiveness gains in the permitting and routing process while improving service to the motor carrier industry. Following implementation of an advanced permitting and routing system, the Georgia Department of Transportation reports the ability to issue permits within a target two-hour timeframe 99% of the time. The use of bridge WIM systems to support bridge safety assessments reportedly increases the accuracy in determining the safety of an existing bridge under intended vehicle loading, according to French and Slovenian transportation officials. With 40 to 70% observed OS/OW permit violation rates, transportation and enforcement officials in Slovenia and The Netherlands are anticipating significant violation reductions through the combined use of in-road or bridge WIM systems and vehicle identification systems to enhance enforcement capabilities.

Broader benefits related to infrastructure preservation, increased safety, and reduced congestion and harmful emissions are also not well-documented but could prove significant in the U.S. Efficient permitting, appropriate routing, and effective enforcement measures will better limit OS/OW movements to road and bridge infrastructure capable of withstanding increased loads and/or accommodating increased vehicle dimensions. In turn, unnecessary or premature rehabilitation and unnecessary incidents resulting from vehicle-infrastructure collisions may be avoided. Associated congestion and harmful emissions resulting from rehabilitation or incident management measures may also be avoided.

Incremental Implementation Steps



Interface with Other Functional Areas

SUPPORTING TECHNOLOGIES	Infrastructure Preservation	Pre-selection	Direct Enforcement	Pre-selection	Resource Scheduling	Preventative Carrier Contacts	Direct Enforcement	Bypass Prevention	Continuous Calibration	Quality Assurance	Dynamic Calibration	Self Permitting/Routing	Bridge Safety Assessment	Remote Field Verification	Structural Assessment	Safety Assessment	Load Testing
	ENFORCEMENT											WIM SYSTEM CALIBRATION	OS/OW PERMITTING				BRIDGE PRESERVATION
	SIZE			WEIGHT													
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					✓	✓			✓	✓			✓		✓	✓	