

**Comprehensive  
Truck Size and  
Weight Limits  
Study**

November, 2013

**Compliance Comparative  
Analysis**

**Final Draft Project  
Plan/Schedule**



U.S. Department  
of Transportation

**Federal Highway  
Administration**

**General Approach for this Task:**

This document provides the detailed project plan for *Compliance Comparative Analysis for the USDOT Comprehensive Truck Size and Weight (CTSW) Limits Study*. The document is divided into five main sections:

1. Detailed Project Plan for **Part 1 (Desk Scan)**
2. General Approach for **Part 3 (Estimation of Cost of Enforcement) and Part 4 (Effectiveness of Enforcement)**
3. Detailed Project Plan for **Estimation of Cost of Enforcement**
4. Detailed Project Plan for **Effectiveness of Enforcement**
5. Proposed **Schedule for Completion**

This part of the Study will focus on the identification of difference in methods and approaches, effectiveness of methods and approaches and costs associated with inspecting and conducting compliance assessments on trucks operating at or below current federal truck size and weight limits as compared to conducting the same on trucks operating above those limits. Two steps will be completed under this Task: making comparative assessments on the current fleet of trucks operating in the US and making similar comparative assessments on the “alternative configurations that will be included in this Study.

As part of carrying out the responsibilities of included under this Task, it is important to note that success in completing the proposed work hinges on the need to gather the necessary data supporting the technical analysis and assessments to be addressed under this part of the Study.

It is envisioned that the following data sources will be used to conduct the required work:

- State Over-size/Over-weight Permitting Data: In consultation with AASHTO’s Sub Committee on Highway Transport, state permit data will be accessed and examined in order to identify trucks operating at or below current federal size and weight limits and trucks that operate above those limits.
- State Enforcement Plans: These plans provide state-specific data concerning resources (*e.g.*, budget, personnel, facilities, equipment) directed at truck size and weight enforcement and information about the environment within which these resources are expended (*e.g.*, extent of network, truck miles traveled).
- Annual Certifications of Truck Size and Weight Enforcement database: This database contains state-specific information on the enforcement of commercial motor vehicle weight (by type of weighing method), violations (by type of violation), load shifting and off-loading requirements, and permit issuance activities.

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- Weigh-in-Motion data: WIM data from selected locations (subject to the criteria listed in **Section 4.2**) will provide a means to assess truck weight compliance by axle group and for the whole vehicle. The WIM data enable the calculation of the proposed performance measures (see **Section 4.2**).
- Experiential data and intelligence: The Task relies on extensive consultation with industry stakeholders. In particular, state representatives will be asked to provide experiential data to support our analysis. Case studies will be selected to investigate specific issues concerning compliance of alternative vehicle configurations in states where detailed data and/or substantial experience exist.

## **PART 1 - DETAILED PROJECT PLAN FOR DESK SCAN**

### **1.1 Literature Review**

A comprehensive search of literature published in the last decade worldwide that will be helpful to this Comprehensive Truck Size & Weight Limits Study (CTS&WLS) will be completed with a special focus on compliance and enforcement program costs and the effectiveness of enforcement. The principal objective of the search is to gain a thorough understanding of the current state of research and practice concerning truck weight enforcement and compliance. The literature search will include a variety of information sources: (1) engineering and scientific periodicals and journals; (2) conference proceedings; and (3) readily-available government and industry reports. The starting point for this activity will be the final reports from NCHRP 20-07 Tasks 254 and 303. The American Association of State Highway and Transportation Officials (AASHTO) Subcommittee on Highway Transport (SCOHT) undertook Task 254 to summarize the activities associated with the international scan in 2006, and completed Task 303 in 2011 principally to respond to federal truck size and weight study questions.

Beyond these initial resources, the search includes the resources shown below.

#### **Library Catalogues and Conference Proceedings**

- Transportation Research International Documentation (TRID)
- American Society for Civil Engineers
- University of Michigan Transportation Research Institute Library
- University of Manitoba Transport Information Group Library
- ScienceDirect
- NRC Research Press
- Transportation Association of Canada

#### **Heavy Vehicle Transport Technology Proceedings Government and Industry Agencies**

- Federal Highway Administration (FHWA)
- Federal Motor Carrier Safety Administration (FMCSA)
- The Transportation Research Board (TRB)
- The Transportation Association of Canada
- American Transportation Research Institute
- National Transport Commission (Australia)
- Australian Road Research Board
- Organization for Economic and Community Development” (OECD)
- International Transport Forum (ITF)

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The search will supplement the following list of key historical material:

- *Comprehensive Truck Size and Weight Study* by the U.S. Department of Transportation, 2000 (2000 CTSW Study)
- Relevant special reports by the Transportation Research Board, namely *Special Report 267 Regulation of Weights, Lengths, and Widths of Commercial Motor Vehicles* and *Special Report 225 Truck Weight Limits: Issues and Options*
- Recent truck size and weight reports conducted in Maine, Vermont, Wisconsin, and Minnesota
- *Moving Freight With Better Trucks* by the International Transport Forum
- NCHRP Web Document 13 entitled *Developing Measures of Effectiveness for Truck Weight Enforcement Activities*
- *National Heavy Vehicle Enforcement Strategy Proposal* by the National Transport Commission (Australia)

The literature will be summarized according to the following main topics:

- Enforcement needs and approaches (including impacts of changes)
- Enforcement costs
- Enforcement benefits
- Effectiveness of enforcement
- Application and performance of enforcement technologies
- Alternative approaches for achieving compliance

### **1.2 Information from Outside Organizations**

To supplement the findings of the literature search, consultation will be conducted with industry stakeholders representing enforcement and permitting programs from selected states, relevant committees within the Commercial Vehicle Safety Alliance (CVSA), AASHTO, and Transportation Research Board (TRB), and international experts from Canada, Europe, and Australia to gather information needed to support work activities to be completed in this area of the Study. The Appendix contains a preliminary listing of the information associated with each of the organizations that would contribute to the Study. The organizations that consultation will be conducted with

#### **State Officials**

Information relevant to preparing the work products in this area of the Study is available at the state level. State partners have information on a more detailed level regarding their truck enforcement program activities and their effectiveness. A preliminary list of states that may have such information is provided below. Contacts within these states are noted, where applicable. The states that are listed have been selected because they: (1) are considered to be enforcement programming leaders in the nation; (2) have experience in enforcing vehicles

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subject to grandfather provisions (*e.g.*, Longer Combination Vehicles-LCV); and/or (3) have recently undertaken research and development projects related to truck size and weight enforcement.

- Colorado (Mark Savage)
- Florida (Keith Westphal)
- Georgia (Gene Davis)
- Idaho
- Indiana (John Hill)
- Maine (Rob Elder)
- Michigan
- Minnesota (Ted Coulianos, Tim Rogotzke, Bill Gardner, or Ward Briggs)
- New Mexico
- New York
- Ohio (Jeff Honefanger)
- Oregon
- Utah
- Vermont
- Washington
- Wisconsin (Peter Lynch or John Corbin)

**Representatives from CVSA Committees**

Information on enforcement effectiveness is also available from CVSA. The CVSA committees and contacts are:

- Stephen Keppler, Executive Director
- Size and Weight Committee: Jay Thompson, Chair (Arkansas Highway Police), Tim Levi, Vice Chair (Oklahoma Highway Patrol), and Allen Hook, Secretary (North Carolina State Highway Patrol)
- Driver-Traffic Enforcement Committee: Thomas Fitzgerald, Chair (Massachusetts State Police)
- Information Systems Committee: William Elovirta, Chair (Vermont Department of Motor Vehicles)
- Vehicle Committee: Kerri Wirachowsky, Chair (Ontario Ministry of Transportation)

**Representatives from AASHTO's Subcommittee on Highway Transport (SCOHT)**

Information gathered from state over-size and over-weight permitting offices is essential to the success of the work activities in this area of the Study. AASHTO's SCOHT is a forum that brings representatives from the various state agencies responsible for overseeing truck permitting activities together. The following is a listing of SCOHT members and their state agencies:

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- Mark Gottlieb, Chair (Wisconsin)
- Jeff Honefenger, Vice Chair (Ohio)
- Dan Breeden (Alaska)
- Jay Thompson (Arkansas)
- Alan Frew and Reymundo Rodriguez (Idaho)
- Tommy Thames (Mississippi)
- Jan Skouby (Missouri)
- Gregg Dal Ponte (Oregon)
- Glenn Rowe (Pennsylvania)
- Carol Davis (Texas)
- Anne Ford (Washington)

**Representatives from TRB Committees**

Consultation with relevant TRB Committees will be conducted. Issues on enforcement activities have been investigated through these various Committees; consultation with the Committees will produce information useful to this area of the Study. The Committees and Chairs of these Committees of interest are:

- Truck Size and Weight Committee (AT055), John Woodrooffe, Chair
- Trucking Industry Research Committee (AT060), David Miller, Chair
- Truck and Bus Safety (ANB70), Brenda Lantz, Chair

**Representatives from Trucking Industry**

Information from the private sector trucking organizations and, in some cases, companies may be beneficial to this area of the Study. Discussions on truck enforcement program effectiveness from the private sector perspective will be helpful in completing the work in this area of the Study. Representatives and their organizations that consultation will be conducted with include:

- Trucking associations: American Trucking Associations (Darrin Roth), selected State Motor Truck Associations
- Carriers: Landstar, Wal-Mart Transportation, FedEx Corp, ABF Freight Systems, Con-Way
- Manufacturers: Volvo (Skip Yeakel)

**International Experts**

Truck enforcement activities are conducted in many nations across the globe. Several countries have completed research into truck enforcement issues. Tapping into the knowledge and experience of international truck enforcement representatives may prove beneficial especially with regard to understanding the impacts that the alternative configurations may have on

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enforcement program activities. Information from discussions with such international experts will be conducted with:

- Anthony Germanchev, Australian Road Research Board
- Jose Arrendondo, National Transport Commission (Australia)
- Bob Pearson, PTRC (Australia)
- John de Pont, TERNZ Transport Research (New Zealand)
- Hans van Loo, Kalibra (Netherlands)
- Loes Aarts, Ministry of Transport (Netherlands)
- Bernard Jacob, IFSTTAR (France)
- Paul Nordengen, Council for Scientific and Industrial Research (South Africa)
- John Pearson, Council of Deputy Ministers of Transportation and Highway Safety, Ottawa, ON
- David Bradley, Canadian Trucking Alliance
- Rob Tardif, Ontario Ministry of Transportation
- Darren Christle, Manitoba Infrastructure and Transportation, former CVSA President, and current Chair of the Standing Committee of Compliance and Regulatory Affairs of the Canadian Council of Motor Transport Administrators

It is envisioned that a summary of the findings from measurable information and data gathered from the stakeholders according to the same topics listed above for the literature review will be produced under this part of the Study. Findings from the data gathered will be clearly differentiated from literature findings, and will be attributed to the type of stakeholder (*e.g.*, state official, researcher, international expert) generating the findings as possible. The results of the data gathering activities will be summarized in the Technical report being prepared in this area of the Study. The information provides a valuable assessment (in addition to the literature) of the current state-of-the-practice.

**PART 2 - GENERAL APPROACH FOR PARTS 3 (ENFORCEMENT PROGRAM COSTS) AND 4 (EFFECTIVENESS OF ENFORCEMENT PROGRAMS)**

A performance-based approach to estimate the costs of truck size and weight enforcement and analyze enforcement effectiveness will be applied. This approach considers enforcement program performance (or effectiveness) in terms of outputs (which reflect the way resources are used and what they are focused on: *i.e.*, Axle, Tandem Axle, Gross Vehicle Weight and Bridge Formula violations, when conducting enforcement activities) and outcomes (which reflect the degree of success of the enforcement program in achieving compliance), as a function of resource inputs (for example, program costs). The distinction between outputs and outcomes, while subtle, is important because measuring outputs may encourage efforts to increase the quantity of inspections conducted or violations observed and reported, which ideally should decrease in situations where enforcement achieves better compliance. In contrast, outcome-



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oriented measures may describe the frequency or rate of compliant events (which may suggest successful enforcement) or the severity of over-weight observations (which may suggest a lack of enforcement success). **Exhibit 1** provides example measures within this approach.

**Exhibit 1: Example Measures within the Performance-Based Approach**

Type of measure	Example measure(s)
Input	<ul style="list-style-type: none"> <li>• Enforcement program cost</li> <li>• Number of enforcement personnel</li> </ul>
Output	<ul style="list-style-type: none"> <li>• Inspections</li> <li>• Violations</li> <li>• Violation rate as a function of enforcement intensity</li> </ul>
Outcome	<ul style="list-style-type: none"> <li>• Compliant events</li> <li>• Severity of over-weight axles</li> </ul>

Application of this approach will provide the supporting framework for a multifaceted analysis designed to reveal insights about the costs and effectiveness of enforcement programs. It is acknowledged that a comprehensive, representative understanding of enforcement costs and effectiveness will be limited by the availability of reliable data. To accommodate these limitations and leverage existing datasets and institutional knowledge, a three-tiered approach will be pursued in completing the analysis for this part of the Study as described below:

- *Tier 1:* At the broadest level, relevant performance measures concerning enforcement costs (*i.e.*, inputs) and activities (*i.e.*, outputs) will be gathered at the state level using readily-available data sources, supplemented through data gathered from industry stakeholders. The selection of states will be made considering general differences in trucking operations and varying geographic and climatic factors.
- *Tier 2:* The assessment of compliance (*i.e.*, an outcome) will analyze relevant performance measures at specific locations where representative data are available (principally, weigh-in-motion (WIM) data). This assessment enables a more detailed quantitative analysis of certain compliance outcomes (such as the proportion of compliant events or the severity of over-weight observations for specific truck configurations at that location), but constrains the ability to ascertain the effects of enforcement activities on these outcomes. Efforts will be concentrated on examining differences between trucks operating in excess of federal limits and those operating below federal limits. This *Tier 2* deserves a little more explanation since it is the most complex. The level of compliance will be used as a way to measure enforcement effectiveness. Compliance will be measured by the degree of extremely over-weight trucks, measuring severity of over-weight axles and axle sets, and the proportion of compliant events, such as compliant

axles and axle sets. The severity measure will be calculated as the average weight of all the over-weight observations and then how much this average exceeds the limit. This determination will be based on the configuration of trucks, which has weight implication and the weight limit based on classification. Using FHWA's vehicle classification scheme classes, as defined in the Traffic monitoring Guide, the Class 9 (five-axle tractor-semitrailers) will be used as the foundation truck but will also gather information on other classes 10-13 (six-axle tractor semitrailers and multiple trailer trucks), which include other configurations being considered for study. This information will be captured for those legally loaded and operating trucks and those extra-legal trucks in order to determine the proportion of compliant trucks within certain classifications at a specific WIM location. The extent to which this information is aggregated along a corridor/in a region/in a state will be investigated as the study progresses. The determination of a specific enforcement activity related to these over-weight trucks will not be performed but will be useful in making observations toward trucks that are operating in over-weight conditions on these travel-ways. Special focus will be applied to Class 9 trucks and on specific, commonly-observed "extra-legal" trucks operating under a "grandfathered provision" (for example, under a state issued permit or a specific federal size and weight statutory exemption). For example, Longer Combination Vehicles (LCVs) allowed are allowed to operate, under the ISTEA-Freeze, in certain states at locations where they are known to be operating. Case study data will be examined from certain states where LCVs are allowed to legally operate and will be used to develop the adjustment factor for permits, and to help understand the compliance experience associated with trucks operating under a "grandfathered right".

- *Tier 3*: The third tier uses case studies to qualitatively investigate enforcement issues concerning alternative truck configurations that are too complex to handle at a larger scale. These case studies will be designed to support the quantitative assessment of compliance conducted in *Tier 2*.

The analysis approach described for **Part 3 (Estimation of Cost of Enforcement)** and **Part 4 (Effectiveness of Enforcement)** will also examine the integration of the alternative truck configuration and scenarios that are being developed for the CTSW Study as a whole. A more thorough framework for completing this integration will take shape as these scenarios are defined and clarified.

### **PART 3 – ESTIMATION OF COST OF ENFORCEMENT**

**Part 3** determines and describes the inputs or resources required to manage and operate a state truck size and weight enforcement program (*i.e.*, a *Tier 1* analysis). Based on the findings from **Part 2**, inspection steps and procedures for the principal truck size and weight enforcement methods used in North America will be summarized, namely: (1) fixed (inspections occurring at

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static weigh scales, with or without a mainline pre-screening device); (2) roving (mobile officers conducting inspections using portable or semi-portable weighing devices); (3) virtual (inspections occurring using a combination of WIM and video/imaging technologies); and (4) compliance demonstration (where selected carriers are deemed responsible for compliance with all relevant matters, including weight, and are subject to auditing to assure compliance). This task focuses on the enforcement of truck size and weight limits; however, distinguishing enforcement resources directed at truck size and weight from those resources directed at safety or credentials regulations is not always easily performed. The program areas will be distinguished as far as practicable.

Truck size and weight enforcement program inputs will be gathered from selected state officials conducted as part of work to be addressed as described under **Part 2** and summarized in a tabular format. Program inputs include:

- Annual monetary cost (or budget) of the enforcement program;
- Incremental costs of enforcement, weight measurements and other actions by configuration type of truck;
- Number of enforcement personnel, the time spent conducting various enforcement activities, and the number of inspections (or vehicle and axle weight measurements) by truck configuration performed by enforcement method;
- Quantity of fixed and mobile enforcement equipment (*e.g.*, scales or patrol cars); and
- Quantity and type of automated enforcement technologies.

The data gathered will reveal information about the relative proportion of available resources directed at specific aspects of the enforcement program. Program aspects to be distinguished include routes and/or networks; industries and/or commodities; truck configurations (specifically those operating within federal limits and those operating beyond federal limits); and non-permitted versus permitted trucks. It is expected that some states may be unable to provide detailed breakdowns concerning some of these aspects; the level of detail available will dictate the specificity of subsequent analyses in **Part 4 (Effectiveness of Enforcement)**.

Program cost figures for all states will be calculated from baseline information obtained from the annual certifications provided to FHWA, using staffing figures as a guide to the size of the program and adding the cost information, in proportion to staffing, obtained from selected states. This will help to normalize the data across states. Issues related to accuracy of proportional cost information will be reviewed with CVSA for quality control purposes. Additional normalization of the data will be accomplished through metrics such as highway network distance and truck miles of travel. Program costs will focus on any incremental costs (or cost savings) associated with enforcing regulations governing the alternative truck configurations currently operating in excess of federal limits in certain states.

Key findings and trends will be summarized and used to assess the enforcement community's ability to sustain viable enforcement programs in the context of potentially expanded use of the alternative truck configurations on specified networks. For example, trends showing budget reductions over time, extra costs and/or time associated with certain methods of enforcement (for certain truck configurations or networks), or investments in new technologies will help assess program viability. This particular component of the analysis will be shaped by further characterization of the scenarios being developed in the other task areas. In order to avoid highlighting states that may overstate their program capabilities and, on the other hand, may be in need of implementing improvements in their enforcement programs, findings will be consolidated on a national, regional or, in some cases, corridor basis.

To support the foregoing analysis, an investigation will be conducted into the costs and performance of existing and near-term enforcement technologies through gathering of experiential data from key technology users and vendors. Special attention will be given to the Smart Roadside Program that both FHWA and FMCSA have been promoting. This program is expected to be a key feature for improving enforcement effectiveness and future productivity. The virtual weigh station (VWS) initiative and wireless roadside inspection (WRI) technologies, two components of Smart Roadside, are already operating in several states across the nation. Although WRI is focused primarily on safety, any cost implications associated with truck size and weight will be captured in this cost analysis. Findings related to safety will also be considered and integrated into the work being completed in the Highway Safety/Truck Crash Analysis work are of this Project, as applicable.

#### **PART 4 – EFFECTIVENESS OF ENFORCEMENT**

Work to be completed under **Part 4** will determine and describe the outputs and outcomes of enforcement programs and evaluates effectiveness by developing relationships between resource inputs and program outputs and assessing compliance outcomes. The proposed approach to meet the requirements of this area of the Project involves: (1) compiling and analyzing program outputs at the state level (*i.e.*, a *Tier 1* analysis); (2) assessing compliance outcomes using Weigh-in-Motion (WIM) data collected at representative locations (*i.e.*, a *Tier 2* analysis); and (3) conducting targeted case studies to identify enforcement issues associated with the alternative truck configurations (*i.e.*, a *Tier 3* analysis). In addition, statutes and regulations pertaining to federal truck size and weight limits that would be impacted by regulatory changes will be identified..

Another important area of investigation included under this Part will be to determine the impact that the introduction of the “alternative configurations” included in this Study will have on the cost of enforcement programs and the impact on resource requirements needed to operate

effective truck size and weight enforcement programs. Outputs generated under the Modal Shift work area of this project will be used to define the boundaries for this assessment.

#### **4.1 Analysis of Program Outputs**

This component analyzes (at a *Tier 1* level) weight enforcement program outputs, including:

- Violations by type (*i.e.*, axle weight, GVW, bridge formula);
- Number of load shifting and offloading vehicles;
- Over-weight permits issued by type (*i.e.*, divisible vs. non-divisible, trip vs. annual); and
- Violation rates, calculated as violations per number of inspections and number of vehicles weighed or by enforcement method.

The output analysis will be conducted on a state-by-state basis using the Annual Certifications of Truck Size and Weight Enforcement Activities dataset. Output measures such as overloads identified and avoided (*e.g.*, through load shifting and/or offloading) are considered direct benefits of an enforcement program. Violations will be interpreted as observed incidents of non-compliance with all applicable size and weight laws and regulations.

An examination into the two relationships to further understand the effectiveness or performance of enforcement using these outputs and the inputs acquired in **Part 3 (Estimation of Cost of Enforcement)**. The relationship between violation rate and *inspection intensity* (*i.e.*, the number of inspections conducted per unit of time devoted to inspections), and between violation rate and *enforcement intensity* (*i.e.*, the number of inspections conducted per unit of truck travel in a geographic region) will be established as part of this work. Previous research conducted in Canada reveals that higher inspection and enforcement intensities (related to traditional on-road activities) lead to lower violation rates, but produce an ever-diminishing return. Essentially, at some point, increases in intensity cause no further decrease in the violation rate. In addition, relevant states will be selected to gain more detailed analysis of these relationships. Specifically, information will be disaggregated by enforcement method (*e.g.*, fixed vs. roving) and vehicle configuration to contribute to a more precise understanding of these relationships. The selection of states will be completed based on data availability (ascertained during the data gathering process) and directed at developing meaningful insights.

#### **4.2 Assessment of Compliance Outcomes**

Enforcement program effectiveness will also be evaluated based on its ability to meet its main objective: compliance. For this component, compliance is treated as an outcome within the performance-based approach. The compliance assessment occurs in the context of a *Tier 2* analysis, as described earlier. Since directly measuring compliance is difficult, the approach to assessing compliance will be supported by using WIM data to provide an indication of compliance rates and the intensity of over-weight observations (level of over-weight) at selected locations.

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The selection of WIM locations to include in the compliance assessment requires consideration of:

- The WIM data requirements of other Tasks, such as the pavement and bridge assessments included in the Project, so that quality control and pre-screening efforts can be minimized and standardized;
- The calibration record of WIM equipment;
- The quality and expected accuracy of WIM measurements, which varies by the type of WIM equipment;
- The proximity of a WIM station to a weigh scale;
- The availability of a full year of data to avoid seasonal bias;
- The need to include WIM data representative of various truck operating, geographic, and climatic conditions;
- The need to include WIM data representative of conditions on various highway networks (*e.g.*, Interstate System, national network, etc.);
- The ability to document the enforcement activities undertaken by the state in which the WIM is located (this will be assessed based on findings from **Part 3 (Estimation of Cost of Enforcement)**); and
- The ability to identify truck configurations from the WIM database that routinely operate under grandfather provisions, with the aim to isolate these from trucks that may operate under state issued over-size or over-weight permit.

At the selected WIM locations, specific configurations will be identified from the WIM dataset (using standard axle-based classification algorithms) and then analyze the weight data using the following performance measures:

- *Gross vehicle weight compliant, proportion*: the fraction (or percentage) of the total observed truck sample which complies with the legal (static) gross vehicle weight limit.
- *Gross vehicle over-weight, severity*: the extent to which average measured gross vehicle weights for the observed sub-sample of over-weight trucks exceeds the legal (static) gross vehicle weight limit.
- *Steering-axle compliant, proportion*: the fraction (or percentage) of the total observed truck sample for which the steering-axle weight complies with the legal (static) steering-axle weight limit.
- *Steering-axle over-weight, severity*: the extent to which average measured steering-axle weights for the observed sub-sample of trucks with an over-weight steering axle exceeds the legal (static) steering-axle weight limit.
- *Single-axle compliant, proportion*: the fraction (or percentage) of the total observed truck sample for which all single-axle weight observations comply with the legal (static) single-axle weight limit.



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- *Single-axle over-weight, severity*: the extent to which average measured single-axle weights for the observed sub-sample of trucks with over-weight single axles exceeds the legal (static) single-axle weight limit.
- *Tandem-axle compliant, proportion*: the fraction (or percentage) of the total observed truck sample for which all tandem-axle weight observations comply with the legal (static) tandem-axle weight limit.
- *Tandem-axle over-weight, severity*: the extent to which average measured tandem-axle weights for the observed sub-sample of trucks with over-weight tandem axles exceeds the legal (static) tandem-axle weight limit.
- *Federal Bridge Formula-B compliant, proportion*: the fraction or percentage of the total observed truck samples determined to comply with the Federal Bridge Formula.
- *Federal Bridge Formula-B violation severity*: the extent to which the average estimated bridge formula violations exceed the calculated value for each observed configuration that would deem it compliant.
- *Tridem-axle compliant, proportion* (if applicable): the fraction (or percentage) of the total observed truck sample for which all tridem-axle weight observations comply with the legal (static) tridem-axle weight limit.
- *Tridem-axle over-weight, severity* (if applicable): the extent to which average measured tridem-axle weights for the observed sub-sample of trucks with over-weight tridem axles exceeds the legal (static) tridem-axle weight limit.

To simplify the analysis, Class 9 trucks (standard five-axle tractor semitrailers) will be used as the base analysis vehicle for all locations. In addition, at certain locations, the truck configurations will be identified from the WIM database that routinely operate under grandfather provisions. Candidate truck configurations will be identified through consultation with state enforcement officials. Scoping the analysis to include only specific vehicle configurations minimizes the potential inclusion of permitted loads, which cannot be identified from the WIM data but which could be measured as over-weight despite being in compliance with permit conditions.

Performance measures listed previously will be used in order to define above as the basis for revealing insights about the compliance experience at the selected WIM locations. These insights will be shaped by knowledge gained about the enforcement practices and intensity in the state where the WIM is located. Specific findings concerning the effects of enforcement on compliance outcomes will be limited by the expected inability to attribute the intensity and type of enforcement activities to the specific WIM location. This issue, in addition to other uncontrolled variables, will also impact the ability to make direct comparisons of the compliance outcomes between WIM locations. Nevertheless, pragmatic insights will be drawn from the compliance assessment, and will select a sufficient number of WIM locations to generate and support these insights, subject to the selection considerations listed above.

When assessing truck weight compliance using WIM data, it is important to note two issues that arise because of the nature of the WIM measurements. First, WIM devices measure axle weights while trucks are in-motion and are therefore subject to the dynamic interactions between the vehicle and the road. As such, an over-weight observation by a WIM may not result in an over-weight observation if the same axle (or truck) is weighed on a static scale. Because of this, our analysis differentiates between an over-weight observation as recorded by a WIM and a violation, which normally arises from a static weighing with reference to a legal (static) load limit.

Second, because most WIM scales are not selective about the trucks they weigh (*i.e.*, it does not target a vehicle for weighing based on the likelihood that it is over-weight), the proportion and severity of over-weight observations is representative of all trucks passing over the scale during the observation period. In contrast, the proportion and severity of over-weight observations at a static weigh scale could reflect targeting of trucks likely to be over-weight. By extension, it is incorrect to assume that the proportion of compliant vehicles observed at a WIM is the same as that observed at a weigh scale.

#### **4.3 Case Studies of Alternative Truck Configurations**

The case studies (*Tier 3*) investigate and document the enforcement and compliance experience associated with the alternative truck configurations not currently allowed nationwide but which are already in common use (under grandfather provisions or on state roads) in certain states. The investigation supports the quantitative compliance assessment of vehicles operating under grandfather provisions undertaken as part of this subtask by providing qualitative information obtained through in-depth data gathering. Specifically, a review of experiences with the 88,000 lb. five-axle tractor semitrailer (a candidate state for this project is Florida), the 97,000 lb. six-axle tractor semitrailer (this case study may focus on an industry sector, for example hauling of forestry or agricultural products), and LCVs operating in a number of western states or international jurisdictions (for example, states located west of the Mississippi and/or Canadian provinces) will be completed as part of this work. Each case study (up to three in total) will attempt to document any specialized or targeted enforcement activities or technologies directed at the alternative vehicle configurations and the results of these efforts within a specific operating context (e.g., in a state as a whole or within a specific industry sector).

#### **4.4 Identification of Statutes and Regulations**

In this work area, all statutes and regulations pertaining to federal truck size and weight limits that would be impacted in the event of changes to these limits will be identified. The review will focus on relevant language contained in US Code Title 23: Highways and US Code Title 49: Transportation, as well as the corresponding regulations in the Code of Federal Regulations, Title 23, Part 658 and Code of Federal Regulations, Title 49 that pertain to federal truck compliance program activities. Consultation with state enforcement personnel responsible for



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the delivery of truck enforcement program activities will be conducted to ensure the appropriate federal statutory and regulatory references are identified.

**PART 5 - PROPOSED SCHEDULE FOR COMPLETION**

The project work plan will be completed in accordance with the following schedule:

*Part 2: Desk Scan*

- Literature review July-August, 2013
- Structured information gathering initiated July, 2013
- Draft and Final Report
  - Preliminary Draft September, 2014
  - Final Draft November, 2014

*Part 3: Estimation of cost of enforcement*

- Structured data gathering (part) September, 2013
- Data normalization, findings, trends October, 2013
- Inspection steps and procedures November, 2013
- Evaluate costs of technologies November, 2013
- Draft and Final Report
  - Preliminary Draft December, 2013
  - Final Draft Report January, 2014

*Part 4: Effectiveness of enforcement*

- Analysis of outputs and benefits December, 2013
- Assessment of compliance January, 2014
- Case studies of alternative configurations February, 2014
- Identification of relevant statutes/regulations February, 2014
- Draft and Final Technical Report
  - Preliminary Draft Report early-March, 2014
  - Final Draft Report end- of-March, 2014

*Technical Report:*

- Preliminary Draft Report early-April, 2014
- Final Draft Report end-of-April, 2014

## **APPENDIX: PROPOSED DATA GATHERING TOOLS**

As discussed in the body of the Project Plan, coordination with the four AASHTO regions (Western Association of State Highway and Transportation Officials [WASHTO], Southern Association of State Highway and Transportation Officials [SASHTO], Mid-American Association State Transportation Officials [MAASTO] and the Northeast Association of State Transportation Officials [NASTO]) and in consultation with CVSA Advisory Group comprised of no more than of nine states related to data gathering. Questions and requests for data will be coordinated through these organizations.

### **Questions to Guide Data Gathering with State and Industry Stakeholders and Data Experts**

Note: Regarding the question on differentiating between federal and non-federal states on weights, no differentiate by state will be performed; a category by state of trucks 80,000 pounds and under and then have another category of 80,000 pounds and over. Representative cost information for each of those two categories will be collected from several states. A factor will be developed to be applied to the remaining states. Information developed during the conduct of the desk scan should be helpful in identifying which states have the most reliable and current data available to complete this part of the work.

### **State Officials**

General comment: While conducting the data gathering activities needed to complete this part of the Study, states will be identified in which more detailed analysis, especially by vehicle configuration and enforcement methods that are routinely applied, may be most feasible and practical. In addition, this effort will help determine where there are opportunities for relevant vehicle-specific case studies that can be conducted. To identify the states where detailed analysis and case studies may be most appropriate, the following information would be helpful:

- Approaches to and methods employed in truck enforcement program activities –
  - Fixed, stationary scales (weigh-bridges);
  - Mobile enforcement using portable or semi-portable scales;
  - Roadside screening technologies used to identify trucks needing closer compliance checks and measurements.
- Areas of specific enforcement interest –
  - Specific routes and roadway networks;
  - Specific truck configurations or types;
  - Specific commodities being hauled.
- Impacts that a change in truck size and weight limits will have on enforcement program resources, costs and manpower needs.

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- Resources that support enforcement programs:
  - Annual budget (*i.e.*, program costs)
  - Number of on-road officers and FTEs (specify if seasonal employment occurs)
  - Number of vehicles weighed by fixed and mobile
  - Approximate number of hours conducting inspections (fixed and mobile)
  - Quantity of fixed equipment (*i.e.*, weigh scales)
  - Quantity of mobile equipment (*e.g.*, portable scales, patrol cars)
  - Percentage of resources (in terms of budget, personnel, or FTEs) devoted to safety, weights & dimensions, driver/vehicle credentials.
  - If available, any information on percentage of resources allocated to specific types of truck configurations or highway networks.
- Data used to conduct truck enforcement program activities –
  - WIM for pre-screening mainline truck traffic;
  - Ramp WIM for sorting at weigh station locations;
  - WIM as part of a mainline pre-clearance program;
  - Real-time, roving network connection WIM;
  - Digital photo identification of vehicle;
  - Automatic vehicle identification (AVI);
  - Automated counting at scale;
  - Virtual weigh stations;
  - Wireless roadside inspections technologies;
  - Others
- Scope of enforcement program responsibilities –
  - Number of centerline miles by roadway type and jurisdiction;
  - Number of centerline miles monitored;
  - Truck vehicle miles of travel.
- Benefits, quantified or monetized, identified with truck enforcement program.
- Identification specific enforcement strategies seen to be very effective.
- Alternative compliance techniques being used.
- Methods used to measure enforcement program effectiveness.
- Factors used to evaluate program effectiveness and monitor program performance
- Long term trends in resources availability and program performance.
- Recent studies or reports completed on truck enforcement program performance or program effectiveness.
- Truck size and weight enforcement cost analysis information or data.

### **Representatives from CVSA Committees**

Several of the previously identified data elements are relevant for data collection from state enforcement program personnel. A number of additional data elements are also needed:

- Program cost information associated with state enforcement agencies.in conducting truck enforcement program activities.
- Over-size and over-weight (os/ow) permit data and information.
- Oversight responsibilities for permit compliance and enforcement.

### **Representatives from AASHTO SCOHT (State Regulatory Personnel)**

Note: These are primarily the motor carrier safety program and regulatory personnel within state Departments of Transportation but, in some states, are assigned to Public Safety Agencies, Departments of Motor Vehicles and Department of Revenue agencies across the country. They generally differ from state law enforcement people.

- Availability of os/ow permit data.
- Locations and regions or sub-regions of the state where permits are most frequently used.
- Breakdown of permits by type (radial, annual, single trip, etc.).
- Vehicle weights that are most frequently issued permits.
- Enforcement personnel's access to permit information.
- Divisible load permits associated with vehicle weight (number of permits and weight that can be permitted).
- Availability to permitting program requirements and allowances.
- Intensity of permit usage by type of commodity.
- Permit compliance monitoring and enforcement activities.

### **Representatives from TRB Committees**

Representatives of the various TRB Committees referenced previously are seen as sources of more specific information on truck enforcement practices and research and in providing insights into enforcement program activities internationally. Consultation with Committee members will be conducted as needed.

### **Representatives from the Trucking Industry**

Consultation with trucking industry representatives will be completed to ascertain enforcement program and technique effectiveness from their perspective. It is not envisioned that specific data elements will be pursued from these stakeholders.

### **International Experts**

Practices and techniques in truck size and weight enforcement have the potential of contributing to understanding the additional cost to enforcement in resources and manpower for overseeing the operation of the alternative configurations included in the Study. The following data elements were felt to be beneficial if attained from truck size and weight personnel from other countries –

1. Size and weight (dimension and mass) limits for commercial motor vehicles.
2. Impacts that changes in truck size and weight regulations have had on enforcement program effectiveness.
3. Benefits, quantified or monetized, of truck weight enforcement.
4. Technologies used for truck weight enforcement.
5. Enforcement strategies effectiveness.
6. Alternative compliance techniques and their effectiveness.
7. Measures used for enforcement effectiveness.
8. Methods used to monitor or evaluate enforcement program activities.
9. Recent studies or reports completed in the area of truck size and weight enforcement.