Review of Mexican Experience with the Regulation of Large Commercial Motor Vehicles

DETAILS

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REVIEW OF MEXICAN EXPERIENCE WITH THE REGULATION OF LARGE COMMERCIAL MOTOR VEHICLES

This digest presents the results of a follow-on study to NCHRP Project 08-63, "Review of Canadian Experience with Large Commercial Motor Vehicles." The study was conducted by the University of Michigan Transportation Research Institute (UMTRI) with the Texas Transportation Institute (TTI) as subcontractor. John Woodrooffe of UMTRI and Dan Middleton of TTI were co-Principal Investigators. Other authors are Juan Villa of TTI and Manuel Solari Terra, private consultant.

SUMMARY

The objective of this research was to review and summarize the most current information on the Mexican experience with changes in truck size and weight limits and to evaluate the potential applicability to size and weight limits in the United States. The major activities involved in this research were to investigate truck size and weight limits in Mexico, determine the concerns of U.S. border states, develop options to address those concerns, and conduct Mexico/U.S. analysis to determine what the United States can learn from the Mexican truck size/weight experience.

CONTENTS

Truck Size and Weight Limits

Mexico has been regulating large commercial vehicles since 1980, and since then significant changes have occurred to the maximum allowed size and weight. Many of those changes have been induced by economic or technical reasons, but many others are the consequence of pressure from various groups that benefit from larger and heavier trucks. Current Mexican maximum weight and size limits vary depending on highway classification and vehicle and axle configuration. Mexican truck size and weight regulations also include exceptions and special permits based on highway connectivity or access to specific industrial or distribution centers.

The Mexico Bridge Formula is the following:

$$GVW_{MX} = 870\left[\frac{L * N}{N-1} + 3.66 * N + 11\right]$$

where

GVW_{MX} = maximum gross vehicle weight (kg),
L = distance between extreme axles (m), and
N = number of axles

U.S. Federal Bridge Formula B is the following:

$$GVW_{US} = 500\left[\frac{L * N}{N-1} + 12 * N + 36\right]$$

where

GVW_{US} = maximum overall gross weight of the group (lb),
L = distance between extreme axles of the group (ft), and
N = number of axles in the group

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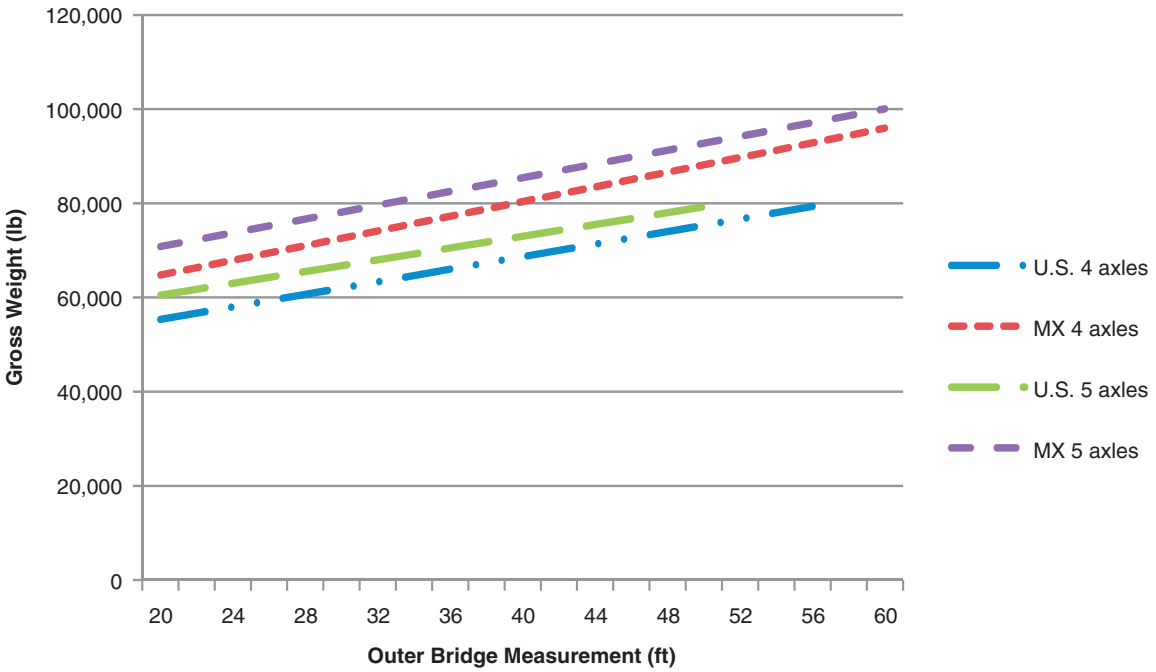

Figure 1 Comparison of U.S. Federal Bridge Formula B and the Mexico Bridge Formula.

Figure 1 shows that the bridge formula used in the United States is more restrictive than the bridge formula used in Mexico to establish maximum GVW limits.

Concerns of U.S. Border States

The states that border Mexico do not have substantial concerns about Mexican truck size and weight limits exceeding U.S. limits simply because of the extensive inspection process conducted by both the states and the federal government at border inspection facilities. However, there are concerns about the long queues of northbound trucks waiting to be inspected. Air quality and noise concerns arise because of trucks idling or creeping slowly and unproductive driver time waiting for the inspection.

Texas and Arizona are either planning or have implemented three initiatives that can mitigate the effects of Mexican truck size and weight limits that are being felt along the U.S./Mexico border. The three initiatives allow trucks to exceed the allowable weights and dimensions under special permitting as described below.

The overweight corridor program operating between the Port of Brownsville, Texas, and the Veteran's International Bridge—Los Tomates allows trucks to haul break bulk steel and other cargoes loaded to Mexican truck weights. The gross weight of cargo and equipment is not allowed to exceed the allowable permitted axle load, the Mexican legal weight limit, or 125,000 lb, whichever is the lowest weight. The dimensions of the load and vehicle cannot exceed 12 ft wide, 15 ft 6 in. high, or 110 ft long.

To reduce the number of crossings at the U.S./Mexico border, Texas and Arizona are proposing initiatives to allow one of the Mexican long combination vehicles (LCVs) (T3-S2-R4) with two 40-ft trailers to cross into the United States. The proposed initiative would allow trucks to cross the border, go through the Customs and Border Protection (CBP) and state safety inspections as a combination vehicle with two trailers, and then travel to a staging yard where the trailers would be decoupled. From there, two power units would pull the two single trailers to their destinations on U.S. roadways. The main benefit of this proposal is the reduction in the number of trips at international border crossings where current operations are congested.

The Arizona Department of Transportation (ADOT) has implemented a single trip overweight permit, which allows a motor carrier transporting fresh produce within the Mexico/Arizona commercial zone to lawfully operate a vehicle with an overall gross vehicle weight of up to 90,800 lb on a five-axle

tractor-semitrailer. The program began on May 17, 2010, and will allow ADOT to evaluate the effectiveness of allowing overweight trucks from Mexico and to determine whether to continue and possibly expand the service to other Mexico/Arizona commercial zones. Among other requirements, the carrier must utilize a sealed container originating in Mexico, must meet Arizona axle load limits, and must follow specific routes designated on the permit.

Mexico/U.S. Analysis

Keeping roadways safe and protecting infrastructure from premature decline are key issues in the debate over truck size and weight in the United States. A review of the Mexican experience with larger, heavier trucks may provide important insights that can be factored into the decision process in the United States.

A major contributor to the adoption of heavier trucks in Mexico is the Mexican Bridge Formula. However, it is difficult to evaluate this formula in comparison to U.S. Federal Bridge Formula B because there is little or no documentation on compliance with Mexico's bridge construction standards, monitoring of bridge construction, or bridge maintenance.

The United States is more conservative than Mexico and Canada in permissible GVW. Nonetheless, one element of the Mexican experience that may have relevance for the United States involves designating specific routes for heavier vehicles. However, if heavier truck limits were permitted, there could be increases in administrative and enforcement costs on these designated routes. These costs could be offset by a reduced number of trucks resulting from greater efficiencies.

BACKGROUND

Providing background information on the characteristics of Mexican truck movement will help lay the foundation for later discussion of size and weight issues. The emphasis placed on the types of trucks crossing the U.S./Mexico border is significant because Mexican trucks have been crossing the border into the U.S. commercial zone for many years, and the expectation is that Mexican trucks could someday travel far beyond the commercial zone on a more widespread basis.

U.S./Mexico Trade by Truck

U.S./Mexico trade by truck grew by a factor of almost three between 1995 and 2008, from $80 billion in 1995 to $234 billion in 2008. This increase is equivalent to an average annual growth rate of 8.75 percent (*1*). The number of trucks that crossed the border from Mexico into the United States grew from 2.9 million in 1995 to 4.9 million in 2008 (see Figure 2).

Land trade between Mexico and the United States is concentrated heavily at a limited number of ports of entry (POEs). Texas POEs near Laredo, El Paso, and Hidalgo (Pharr/McAllen); California POEs at Otay Mesa and Calexico-East; and the Arizona POE at Nogales handled 90 percent of the total trade by truck between the two countries. The Laredo POE is

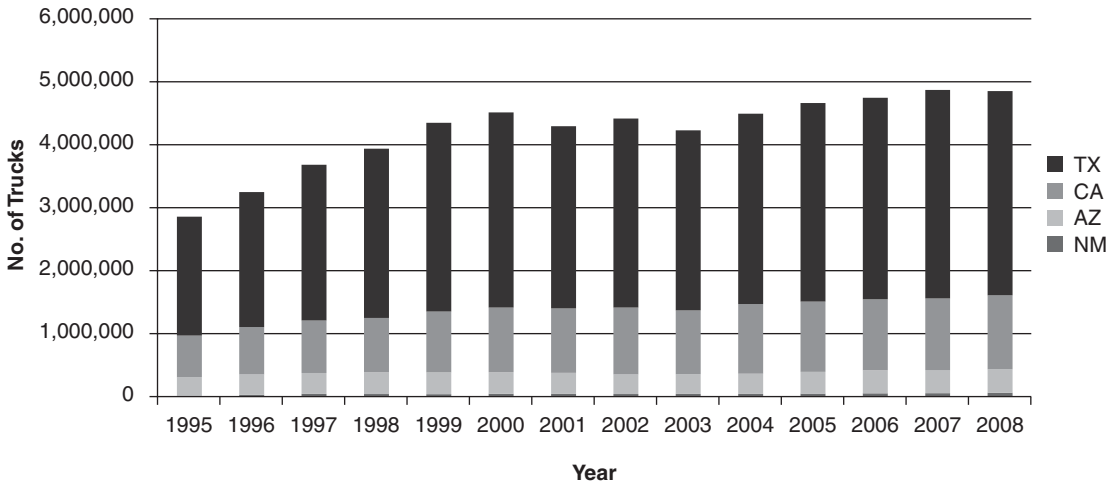

Figure 2 Trucks entering the United States from Mexico.

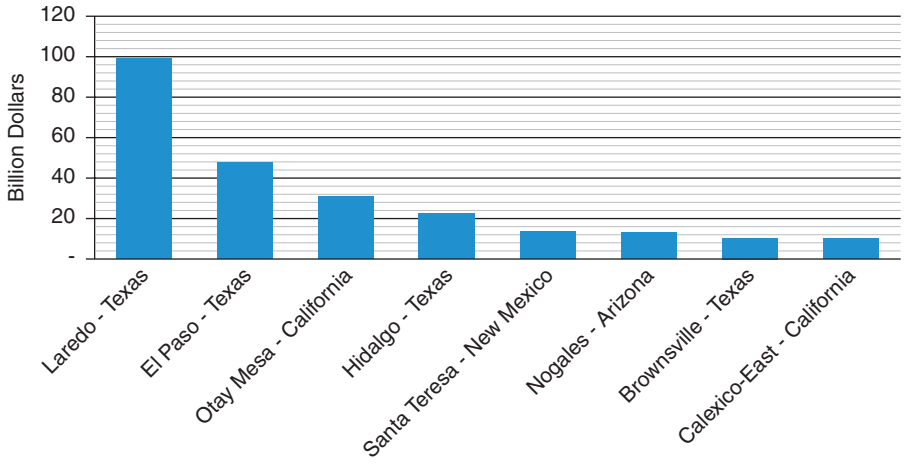

Figure 3 Value of U.S./Mexico truck trade by port of entry—2010.

by far the largest, with 38 percent of the total trade in 2010, and Laredo and El Paso combined handled 56 percent of the total 2010 truck trade (see Figure 3). Truck trade between Mexico and the United States is expected to continue growing. Freight transportation in Mexico is dominated by trucks. More than 80 percent of the total tonnage transported in Mexico by land modes is moved by truck.

Vehicle Size and Weight Regulations

Several rules and regulations define the operation of commercial vehicles in Mexico. Laws, or "reglamentos," establish in general terms the subject matter regulations, and the standards, or "normas," define the detail. The regulations have one or more Norma Oficial Mexicana (NOM) (Official Standard). The Mexican Official Standards provide greater detail pertaining to the content of the regulations.

In Mexico, the federal government—through the Secretaría de Comunicaciones y Transportes (SCT) (Ministry of Communications and Transport)—establishes truck size and weight regulations for operation on the federal highway system. The states do not have the authority to establish different standards from the ones established by the federal government, specifically the SCT. The Comité Consultivo Nacional de Normalización de Transporte Terrestre (CCNN-TT) (National Consultation Committee of Standard in Land Transportation) develops the Mexican NOMs in the transportation sector. Ley Federal sobre Metrología y Normalización (the Rule and Regulation Federal Law) defines the committee operation rules. The CCNN-TT is chaired by the SCT's transportation undersecretary and includes four groups of members:

- Federal agencies of the government
  - Economy
  - Security
  - Treasury
  - Environment
  - Foreign Relations
  - Health
  - National Defense
  - State Department
  - Tourism
  - Labor
  - Agriculture, Fishing, and Natural Resources
  - PEMEX (the state oil company)
- Industry and trade organizations, including those involved in transportation such as Camara Nacional del Autotransporte de Carga (CANACAR), a trade association representing individual carriers within the Mexican trucking industry; Asociación Nacional de Productores de Autobuses, Camiones y Tractocamiones (ANPACT), an association of bus and truck manufacturers; and Asociación Nacional de Transporte Privado (ANTP), an association of private transporters among others.
- Education and academic institutions, including the Instituto Mexicano del Transporte (IMT), the Mexican Transportation Institute, which is the research arm of the SCT, and the National Autonomous University (Universidad Nacional Autónoma de México) among others.
- The Procuraduría Federal del Consumidor (Federal Consumer Commission)

The CCNN-TT's main functions regarding truck size and weight regulations include the following:

- Contributing to the National Standard Program by developing proposals for new standards
- Requesting that the SCT publish a particular NOM
- Reviewing and modifying the NOMs if needed
- Coordinating with other groups as needed
- Analyzing the Manifestación de Impacto Regulatorio (MIR), a regulatory impact statement.

The CCNN-TT meets at least every 3 months and also has subcommittees that analyze the NOMs with more detail. Before any regulation or NOM is published in Diario Oficial de la Federación (the Mexican Federal Register), it has to go through a process of approval by la Comisión Federal de Mejora Regulatoria (COFEMER) (the Federal Regulatory Improvement Commission). The COFEMER requires that all federal agencies present a Regulatory Impact Statement (MIR) with the draft NOM. The MIR is open to the public for comments, and if it is approved and the cost-benefit analysis results are positive, the COFEMER approves the MIR, and the NOM is published.

The year associated with each NOM is the year it was first initiated, in this case by the SCT, and the NOM usually keeps the same "year" name if minor updates or delays cause its subsequent implementation to occur in a different year. Major changes might cause the year to be modified (e.g., NOM-012-SCT-2-1995 was initially published in 1995 and was modified several times until it was finally replaced by NOM-012-SCT-2-2008, which was approved in 2008).

The first regulation that established general standards for commercial vehicles was the Capitulo XI del Reglamento del Capítulo de Explotación de Caminos de la Ley de Vías Generales de Comunicación que Trata del Peso y otras Características de los Vehículos (the Regulation Concerning Weights and Other Vehicle Characteristics). The publication of this regulation in 1980 was the first time that the federal government had published rules for large commercial vehicles.

Other related regulations that led to the current standards include the following:

- Ley de Caminos, Puentes y Autotransporte Federal (LCPAF) (Law of Roads, Bridges, and Federal Motor Transportation) from October 2004. The objective of this law is to regulate the building, operation, conservation, and maintenance of roads and bridges, as well as the motor carrier services that operate on them and their ancillary services.
- Reglamento sobre el Peso, Dimensiones y Capacidad de los vehículos de Autotransporte que transitan en los Caminos y Puentes de jurisdicción Federal (RPD) (Regulation Concerning Weights, Dimensions, and Capacity of Commercial Vehicles that Travel on the Highways and Bridges of Federal Jurisdiction) from November 2006. This regulation aims to regulate weight, size, and capacity of commercial vehicles, and includes maximum truck weight and size limits.
- Reglamento de Autotransporte Federal y Servicios Auxiliares (RAFSA) (Regulation of Federal Motor Transportation and Auxiliary Services). The latest update was in November of 2000. The objective of this statute is to regulate the motor carrier passenger, tourism, and cargo services as well as their ancillary services. The SCT is responsible for its enforcement.
- Reglamento del Servicio de Medicina Preventiva en el Transporte (RSMPT) (Regulation of Preventive Medicine Services for Transportation), with the latest update in 2004. The objective of this regulation is to establish and regulate preventive medicine services in transportation, through the practice of comprehensive psychophysical tests and medical and toxicological exams, in order to have a personal record for Mexican or foreign commercial vehicle drivers.
- Reglamento de Tránsito en Carreteras Federales (RTCF) (Regulation of Circulation on Federal Highways) dated April 2004. The objective is to regulate the circulation of all types of vehicles.

The main standard that establishes commercial vehicle specifications is Norma Oficial Mexicana NOM-012-SCT-2-1994 sobre el Peso y Dimensiones Máximas con los que Pueden Circular los Vehículos de Autotransporte que Transitan en los Caminos y Puentes de Jurisdicción Federal, the Maximum Weight and Dimensions of Motor Transport Vehicles Traveling on Federal Jurisdiction Roads and Bridges (NOM-012). The first version was published in 1994 and was NOM-012-SCT-2-1994.

This regulation has been the subject of numerous changes and has encountered major opposition from the private transportation sector. The private

sector, represented by the National Association of Private Transporters, ANTP, claimed that the new regulation, which would reduce the gross vehicle weight (GVW) limits of some truck configurations, would compromise Mexican competitiveness.

After several revisions of the 1995 version (NOM-012-SCT-2-1995) and negotiations with the private sector, the SCT developed the latest revision (NOM-012-SCT-2-2008), which is the one currently in use.

Table 1 presents the commercial vehicle configurations with one or more trailers allowed in Mexico according to the latest NOM-012. Figure 4 shows a typical T3-S2 Mexican five-axle combination vehicle operating along the commercial zone along the U.S. side of the border. This truck is similar in dimensions to U.S. five-axle vehicles and is required to meet the weight limits allowed in the United States. Since Mexico allows higher axle and gross vehicle weights, many of the trailers have cargo offloaded before crossing the border to comply with U.S. laws.

Figure 4 T3-S2 vehicle used in Mexico and operating in Texas.

Table 1. Current commercial vehicle configurations allowed in Mexico.

Vehicle Type	No. of Axles	No. of Tires	Truck Configuration
T2-S1	3	10	
T2-S2	4	14	
T2-S3	5	18	
T3-S1	4	14	
T3-S2	5	18	
T3-S3	6	22	
T2-S1-R2	5	18	
T2-S2-R2	6	22	
T2-S1-R3	6	22	
T3-S1-R2	6	22	
T3-S1-R3	7	26	
T3-S2-R2	7	26	
T3-S2-R3	8	30	
T3-S2-R4	9	34	
T2-S2-S2	6	22	
T3-S2-S2	7	26	
T3-S3-S2	8	30	

SOURCE: NOM-012-SCT-2-2008.

Larger vehicles, often referred to as LCVs, also operate in Mexico, but under current rules they are generally not allowed to cross the border into the United States. The United States allows LCVs on certain routes, but under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), these routes are not allowed to expand beyond their limits at the time of the legislation. Figure 5 and Figure 6 are examples of LCVs currently operating in Mexico. The T3-S2-R4 in Figure 5 consists of two 40-ft trail-

Figure 5 T3-S2-R4 LCV used in Mexico.

Figure 6 T3-S3-S2 LCV used in Mexico.

ers. The T3-S3-S2 in Figure 6 operates under a special permit to haul steel between Monterrey, Mexico, and the Port of Brownsville, Texas. Since recent size and weight increases in Mexico have focused largely on LCVs, this digest will cover LCVs in some detail along with weight and dimensional changes, including when these changes occurred.

Mexican Highway Classification

Not all commercial vehicles can operate throughout the Mexican roadway network. The first version of the RPD included a definition of the Mexican roadway network. This regulation, which was developed by the SCT, established the following highway classifications: ET, A, B, C, and D. A description of each roadway classification follows:

- ET, or "transportation axis" highways, are the highest category of roadways in Mexico. ET highways are those that have geometric and structural characteristics that can accommodate the operation of vehicles with the maximum dimensions, capacity, and weight. Additionally, the SCT authorizes other general-interest vehicles to operate on ET highways. ET highways can be designated ET2 (two lanes) or ET4 (four lanes).
- Type A highways allow for the operation of all vehicles authorized with the maximum dimensions, capacity, and weight except those that by their dimensions and weight are only allowed on ET highways. Type A highways can be designated as A2 (two lanes) or A4 (four lanes).
- Type B highways have lower design standards than Type A highways, but they are included in the primary network. Due to their geometric and structural characteristics, they serve interstate transportation. Type B highways can be designated as B2 (two lanes) or B4 (four lanes).
- Type C highways form the secondary roadway network. Due to their design characteristics, they serve medium trip lengths within states, establishing connections and links with the primary network.
- Type D highways form the feeder network and serve traffic within municipalities. They serve relatively short trip lengths, establishing connections with the secondary network (Type C highways).

LCVs are allowed only on ET, A, and B highways, but single trailer combinations with 16.2-m (53-ft) semitrailers are only allowed on ET highways. Weight and size limits depend on the highway type and the vehicle characteristics.

ASSESSMENT OF MEXICO'S TRUCK SIZE AND WEIGHT REGULATIONS

Evolution of Current Size and Weight Limits

LCVs have been allowed to travel on Mexican federal highways since 1980, but significant changes have occurred since then. Many of those changes were induced by economic or technical reasons, but many others were the consequence of pressure from various groups, including the private-sector shipper association, ANTP, which benefits from larger and heavier trucks.

Vehicle weights and dimensions in Mexico are regulated based on highway classification, vehicle type, axle configuration, number of wheels per axle, and suspension type. NOM-012-SCT-2-2008 includes a list of highway segments that have some type of exemption. The exemption is usually an upgrade of the highway type to allow heavier or larger commercial vehicles. Exemptions are granted to facilitate highway connectivity or provide access to specific industrial or distribution centers.

There is also a mechanism to obtain a special permit to travel on highway segments with a vehicle that does not comply with the route's standards. These permits are granted for LCVs that need to serve distribution or production centers that are inaccessible

with a high-standard road. In these cases, a special authorization has to be requested from the SCT, and the request must be accompanied with evidence that there are no alternative routes or that there is no other vehicle configuration allowed that could economically travel that route segment. These permits are valid for 5 years and involve no fee.

Figure 7 presents a timeline showing when the most important rules and regulations pertaining to truck size and weight in Mexico became effective. Table 2 includes a brief description of the regulations shown in Figure 7. Since 1980, the maximum allowable GVW and dimensions have changed. Table 3 and Table 4 show some of the most important changes during the last 30 years for GVW and vehicle length, respectively.

Current Weight Limits

Mexican truck weight regulations specify that commercial vehicles using federal highways must comply simultaneously with requirements for maximum weight per axle and GVW, respectively.

The maximum GVW is limited by either of the following two factors—the sum of the maximum weight per axle or the bridge formula. The bridge formula is as follows:

$$MGW = 870\left(\frac{AD \times N}{N-1} + (3.66 \times N) + 11\right)$$

where

MGW = Maximum gross weight in kilograms
AD = Distance between the centers of the extreme axles
N = Number of axles

Vehicle type and roadway determine both the axle weight limit and the GVW limit. Table 5 and Table 6 present the maximum axle gross weight and the maximum GVW, respectively. These maximum weights could be even greater for trucks that travel on ET and A highways and comply with special characteristics.

Table 7 presents the required characteristics for increasing the allowable weight by 1.5 metric tons for every traction axle and by 1.0 metric ton for every other axle except the steering axle. This exception granted for vehicles with pneumatic suspension will reduce the pavement damage on roads and bridges by reducing the impact coefficient. This is one reason why the resulting GVW does not comply with the bridge formula. Additionally, in order to obtain the extra axle weight allowance, commercial vehicles must comply with the following operating condition requirements:

- Trucks must not exceed a speed of 80 km/h.
- Trucks must travel in the right-hand lane.
- Lights must be on during the entire trip.
- Trucks must be separated by a 100-m gap.

In order to be able to increase the maximum axle weight, the vehicle must meet the minimum requirements shown in Table 7 and drivers must have special training and licensing and maintain a trip log with hours of service. Drivers must also carry a private contract between the carrier and the shipment owner that specifies that they share responsibility for complying with the regulations. This contract specifies the truck route, the shipment description, and the vehicle gross weight.

Although NOM-012-SCT-2-2008 is the current regulation, the SCT is not enforcing its provisions at this time since some details are not final. For example, to verify that the vehicle complies with all the requirements included in Table 7, the SCT plans to release a new vehicle circulation card that will include all the necessary information. Due to several delays in the release of the new circulation cards, there is also a delay in enforcement of both the circulation cards and the special driver's license. Table 8 summarizes the maximum GVW allowed when the vehicle, driver, and carrier comply with all the exception requirements.

Current Size Limits

NOM-012-SCT-2-2008 also regulates the maximum vehicle dimensions. As shown in Table 9, the maximum length of 31 m (101.71 ft) has not changed significantly in the latest version of the standard. The maximum width for commercial vehicles is 2.60 m (8.5 ft), not including mirrors. The maximum height is 4.25 m (14 ft) for all types of combination vehicles and on all road classes.

The maximum length also varies with the type of road and type of combination vehicle. Additionally, NOM-012 establishes that trailer and semitrailer lengths should not exceed 13.70 m (45 ft) except on ET highways where it allows 16.2-m (53-ft) semitrailers (single semitrailers, not configured as LCVs).

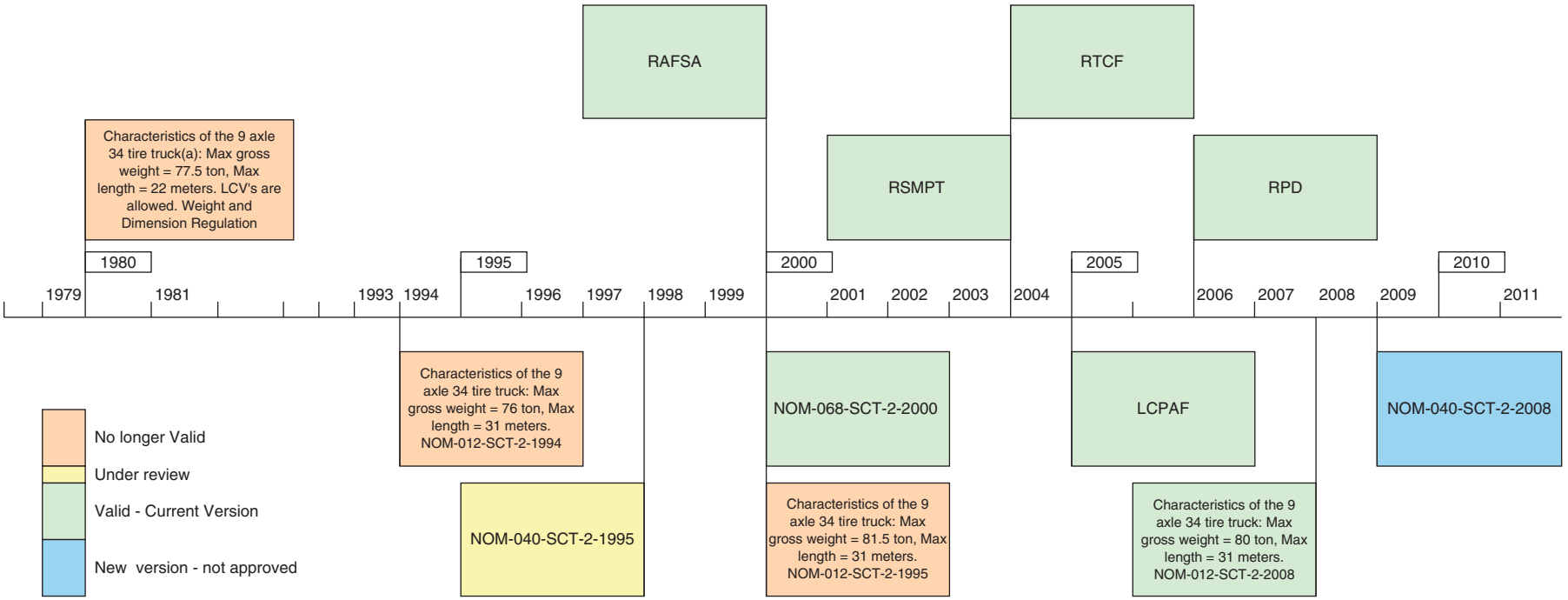

Figure 7 Mexican transportation regulations timeline.

Table 2 Mexican transportation regulations.

Abbreviation	Last Update	Title	Title in English
Reglamento de Peso y Dimensiones (no longer valid)	Oct. 1980	Reglamento de Peso y Dimensiones	Regulation Concerning Weights and Other Vehicle Characteristics
NOM-012-SCT-2-1994 (no longer valid)	Nov. 1994	Norma Oficial Mexicana NOM-012-SCT-2-1994, Sobre el peso y dimensiones máximas con los que pueden circular los vehículos de autotransporte que transitan en los caminos y puentes de jurisdicción federal.	Official Mexican Standard NOM-012-SCT-2-1994, On the Maximum Weight and Dimensions of Motor Transport Vehicles Traveling on Federal Jurisdiction Roads and Bridges
NOM-040-SCT-2-1995	March 1998	Norma Oficial Mexicana NOM-040-SCT-2-1995, Para el transporte de objetos indivisibles de gran peso y/o volumen, peso y dimensiones de las combinaciones vehiculares y de las grúas industriales y su tránsito por caminos y puentes de jurisdicción federal	Official Mexican Standard NOM-040-SCT-2-1995, The Transport of Single-Unit Objects of Great Weight and/or Volume, Weight, and Dimensions of Vehicular Combinations and of Industrial Cranes That Travel on Federal Jurisdiction Roads and Bridges
NOM-068-SCT-2-2000	July 2000	Norma Oficial Mexicana NOM-068-SCT-2-2000, Transporte terrestre-Servicio de autotransporte federal de pasaje, turismo, carga y transporte privado-Condiciones físico-mecánica y de seguridad para la operación en caminos y puentes de jurisdicción federal	Official Mexican Standard NOM-068-SCT-2-2000, Land Transportation-Passenger, Tourism and Freight Motor Transport-Physical, Mechanical and Safety Vehicle Condition for Operation on Federal Roads
NOM-012-SCT-2-1995 (no longer valid)	Oct. 2000	Norma Oficial Mexicana NOM-012-SCT-2-1995, Sobre el peso y dimensiones máximas con los que pueden circular los vehículos de autotransporte que transitan en los caminos y puentes de jurisdicción federal.	Official Mexican Standard NOM-012-SCT-2-1995, On the Maximum Weight and Dimensions of Motor Transportation Vehicles Circulating on Roads and Bridges of Federal Jurisdiction
RAFSA	Nov. 2000	Reglamento de Autotransporte Federal y Servicios Auxiliares	Regulation of Federal Motor Transportation and Auxiliary Services
RSMPT	April 2004	Reglamento del Servicio de Medicina Preventiva en el Transporte.	Regulation of Preventive Medicine Services for Transportation
RTCF	Oct. 2004	Reglamento de Tránsito en Carreteras Federales	Regulation of Travel on Federal Highways
LCPAF	Oct. 2005	Ley de Caminos, Puentes y Autotransporte Federal	Law of Roads, Bridges, and Federal Motor Transportation

Table 2 (Continued)

Abbreviation	Last Update	Title	Title in English
RPD	Nov. 2006	Reglamento sobre el Peso, Dimensiones y capacidad de los vehiculos de auto-transporte que transitan en los Caminos y puentes de jurisdiccion Federal	Regulation Concerning Weights, Dimensions, and Capacity of Commercial Vehicles That Travel on Federal Jurisdiction Highways and Bridges
NOM-012-SCT-2-2008	April 2008	Norma Oficial Mexicana NOM-012-SCT-2-2008, Sobre el peso y dimensiones máximas con los que pueden circular los vehículos de autotransporte que transitan en los caminos y puentes de jurisdicción federal.	Official Mexican Standard NOM-012-SCT-2-2008, On the Maximum Weight and Dimensions of Motor Transport Vehicles Traveling on Federal Jurisdiction Roads and Bridges
PROY NOM-040-SCT-2-2008	In process	Norma Oficial Mexicana NOM-040-SCT-2-2008, Para el transporte de objetos indivisibles de gran peso y/o volumen, peso y dimensiones de las combinaciones vehiculares y de las grúas industriales y su tránsito por caminos y puentes de jurisdicción federal	Official Mexican Standard NOM-040-SCT-2-2008, The Transport of Single-Unit Objects of Great Weight and/or Volume, Weight, and Dimensions of Vehicular Combinations and of Industrial Cranes Traveling on Federal Jurisdiction Roads and Bridges

Table 3 Evolution of the maximum allowable GVW (metric tons).*

Vehicle Type	1980 Regulation	NOM-012-SCT-2-1994	NOM-012-SCT-2-1995	NOM-012-SCT-2-2008
T3-S2	NA	44.0 + 5%	44.0 + 5.0	41.5 + 5.0
T2-S1-R2	45.5	47.5 + 5%	47.5 + 4.5	47.5 + 4.5
T2-S1-R3	—	—	—	54.5 + 5.5
T2-S2-R2	—	—	—	54.5 + 5.5
T3-S1-R2	53.5	56.0 + 5%	56.0 + 6.0	54.5 + 6.0
T3-S1-R3	—	—	—	60.5 + 7.0
T3-S2-R2	61.5	60.5 + 5%	60.5 + 7.0	60.5 + 7.0
T3-S2-R3	69.5	—	63.0 + 8.0	63.0 + 8.0 + 4.5**
T3-S2-R4	77.5	72.5 + 5%	66.5 + 9.0	66.5 + 9.0 + 4.5**
T3-S2-S2	—	—	—	58.5 + 7.0
T2-S2-S2	—	—	—	51.5 + 5.5
T3-S3-S2	—	—	60.0 + 8.0	60.0 + 8.0

*Maximum GVW on ET and A highways; extra weight is allowed for pneumatic suspension.
NA: data not available.
(—): not considered.
**These two vehicle combinations are allowed an extra 4.5 tons until 2013.

Table 4 Evolution of the maximum allowable length (m).*

Vehicle Type	1980 Regulation	NOM-012-SCT-2-1994	NOM-012-SCT-2-1995	NOM-012-SCT-2-2008
T3-S2	NA	20.8	20.8	23.0
T2-S1-R2	22.0	31.0	31.0	31.0
T2-S1-R3	—	—	—	31.0
T2-S2-R2	—	—	—	31.0
T3-S1-R2	22.0	31.0	31.0	31.0
T3-S1-R3	—	—	—	31.0
T3-S2-R2	22.0	31.0	31.0	31.0
T3-S2-R3	22.0	—	31.0	31.0
T3-S2-R4	22.0	31.0	31.0	31.0
T3-S2-S2	—	—	—	31.0
T2-S2-S2	—	—	—	31.0
T3-S3-S2	—	—	25.0	25.0

*Maximum allowable vehicle length for ET and A roadways.
NA: data not available.
(—): not considered.

Table 5 Maximum allowable axle and group weight (metric tons).

Axle Configuration		Road Type			
		ET & A	B	C	D
	Single (two tires)	6.50	6.00	5.50	5.00
	Single (four tires)	10.00	9.50	8.00	7.00
	Single power axle (four tires)	11.00	10.50	9.00	8.00
	Double power axle (six tires)	15.00	13.00	11.50	11.00
	Double (eight tires)	17.00	15.00	13.50	12.00
	Double power axle (eight tires)	18.00	17.00	14.50	13.50
	Triple (12 tires)	23.50	22.50	20.00	NA

NA: not authorized.
SOURCE: NOM-012-SCT-2-2008.

Table 6 Maximum allowable GVW.

LCV Configuration	Axles	Tires	Maximum Gross Weight (Metric Tons)			
			ET & A	B	C	D
T2-S1	3	10	27.5	26.0	22.5	NA
T2-S2	4	14	34.5	31.5	28.0	NA
T3-S2	5	18	41.5	38.0	33.5	NA
T3-S3	6	22	48.0	45.5	40.0	NA
T2-S3	5	18	41.0	39.0	34.5	NA
T3-S1	4	14	34.5	32.5	28.0	NA
T2-S1-R2	5	18	47.5	45.0	NA	NA
T2-S1-R3	6	22	54.5	50.5	NA	NA
T2-S2-R2	6	22	54.5	50.5	NA	NA
T3-S1-R2	6	22	54.5	51.5	NA	NA
T3-S1-R3	7	26	60.5	57.5	NA	NA
T3-S2-R2	7	26	60.5	57.5	NA	NA
T3-S2-R4	9	34	66.5	66.0	NA	NA
T3-S2-R3	8	30	63.0	62.5	NA	NA
T3-S3-S2	8	30	60.0	60.0	NA	NA
T2-S2-S2	6	22	51.5	46.5	NA	NA
T3-S2-S2	7	26	58.5	53.0	NA	NA

NA: not authorized.
SOURCE: NOM-012-SCT-2-2008.

For auto carriers, the rear overhang on the trailer or semitrailer can extend past the end of the trailer up to 1 m (3.28 ft). When the truck is transporting pipe, poles, or iron rods, the load can extend past the end of the semitrailer by as much as 2.50 m (8.2 ft) if the total length of the semitrailer is less than 14.63 m (48 ft) and the total length of the combination is less than the maximum allowed.

General Motor Carrier Operating Environment

As noted earlier, trucks and trailers used in Mexico are similar in many ways to trucks currently operating on U.S. highways. However, there are significant differences in size and weight limits between the two countries, so vehicles in Mexico are typically heavier than their counterparts in the United States. The largest—and in some cases heaviest—trucks in both countries are LCVs.

The most common type of combination vehicle used in Mexico (as in the United States) is the tractor-semitrailer (3-S2, or T3-S2 in Mexico). The most commonly used semitrailer length in the United States is 53 ft, and it is not surprising that vehicles of this length are widely used in Mexico on the highest classes of roadways (ET, A, and B).

Special Provisions for Non-Divisible Loads

In Mexico, NOM-040-SCT-2-1995 regulates non-divisible loads. Norma Oficial Mexicana NOM-040-SCT-2-1995, Para el transporte de objetos indivisibles de gran peso y/o volumen, peso y dimensiones de las combinaciones vehiculares y de las grúas industriales y su tránsito por caminos y puentes de jurisdicción federal (Transportation of Indivisible Objects of Great Weight and/or Volume, Weight, and Dimensions of Vehicular Combinations and of Industrial Cranes Traveling on Federal Jurisdiction Roads and Bridges) was published in March 1998. A new version of this standard is under development as a project (PROY NOM-040-SCT-2-2008), but it has to go through the approval process. Table 10 shows the current standard for maximum axle load for non-divisible load trips.

For special loads, the maximum GVW is the sum of the maximum axle weights. Cargo must be positioned in the truck so that the axle weight does not exceed the maximum allowed.

The maximum allowed speed on bridges is 30 km/hr (19 mph) for loads weighing less than 70 metric tons, 20 km/hr (12 mph) for loads weighing between 70 and 90 metric tons, and 10 km/hr

Table 7 Minimum requirements to increase maximum axle weight.

Truck Configuration	Low Emission and Physical-Mechanical Certification	Minimum Electronic Engine Power Requirements in Horse Power (HP)	Minimum Torque (lb-ft)	Minimum Capacity of Traction Axles (lb)	Auxiliary Brake System	Dolly Converter with Double Security Chains	Anti-lock Brake System (ABS)	Pneumatic Suspension
T2-S1	✓	260	660	—	✓	—	✓	✓
T2-S2	✓	300	800	—	✓	—	✓	✓
T3-S2	✓	350	1,050	—	✓	—	✓	✓
T3-S3	✓	350	1,050	—	✓	—	✓	✓
T2-S3	✓	350	1,050	—	✓	—	✓	✓
T3-S1	✓	300	800	—	✓	—	✓	✓
T2-S1-R2	✓	350	1,250	30,000	✓	✓	✓	✓
T2-S2-R2	✓	350	1,250	30,000	✓	✓	✓	✓
T2-S1-R3	✓	370	1,250	30,000	✓	✓	✓	✓
T3-S1-R2	✓	370	1,250	40,000	✓	✓	✓	✓
T3-S1-R3	✓	400	1,650	44,000	✓	✓	✓	✓
T3-S2-R2	✓	400	1,650	44,000	✓	✓	✓	✓
T3-S2-R4	✓	450	1,850	46,000	✓	✓	✓	✓
T3-S2-R3	✓	450	1,850	44,000	✓	✓	✓	✓
T3-S3-S2	✓	400	1,650	44,000	✓	—	✓	✓
T2-S2-S2	✓	370	1,250	30,000	✓	—	✓	✓
T3-S2-S2	✓	400	1,650	44,000	✓	—	✓	✓

(—): Not applicable for this vehicle.
SOURCE: NOM-012-SCT-2-2008.

Table 8 Maximum allowable GVW.

Truck Configuration	Maximum Gross Weight (Metric Tons) ET & A Highways
T2-S1	30.0
T2-S2	38.0
T3-S2	46.5
T3-S3	54.0
T2-S3	45.5
T3-S1	38.5
T2-S1-R2	52.0
T2-S1-R3	60.0
T2-S2-R2	60.0
T3-S1-R2	60.5
T3-S1-R3	67.5
T3-S2-R2	67.5
T3-S2-R4	80.0*
T3-S2-R3	75.5*
T3-S3-S2	68.0
T2-S2-S2	57.0
T3-S2-S2	65.5

*These figures include an additional 4.5 tons allowed by law until 2013.
SOURCE: NOM-012-SCT-2-2008.

Table 9 Maximum truck lengths in Mexico.

Truck Configuration	Maximum Length (m) by Road Type ET & A	B	C	D
T2-S1	23.0	20.8	18.5	NA
T2-S2	23.0	20.8	18.5	NA
T3-S2	23.0	20.8	18.5	NA
T3-S3	23.0	20.8	18.5	NA
T2-S3	23.0	20.0	18.0	NA
T3-S1	23.0	20.0	18.0	NA
T2-S1-R2	31.0	28.5	NA	NA
T2-S1-R3	31.0	28.5	NA	NA
T2-S2-R2	31.0	28.5	NA	NA
T3-S1-R2	31.0	28.5	NA	NA
T3-S1-R3	31.0	28.5	NA	NA
T3-S2-R2	31.0	28.5	NA	NA
T3-S2-R4	31.0	28.5	NA	NA
T3-S2-R3	31.0	28.5	NA	NA
T3-S3-S2	25.0	25.0	NA	NA
T2-S2-S2	31.0	28.5	NA	NA
T3-S2-S2	31.0	28.5	NA	NA

NA: not authorized.
SOURCE: NOM-012-SCT-2-2008.

(6 mph) for loads greater than 90 metric tons. The truck must also travel along the center of the bridge.

If the load capacity of the configuration does not exceed 90 metric tons, the maximum speed allowed varies between 20 km/hr and 70 km/hr (12 mph and 44 mph, respectively) depending on the vehicle configuration and road type. Pneumatic suspension is usually required. The carrier must prove that the load and axle configuration complies with the maximum allowed.

If the load capacity of the configuration exceeds 90 metric tons, the carrier must comply with a specific technical permission issued by the SCT. The carrier must inform the SCT and the Federal Highway Police

Table 10 Maximum axle load weight for non-divisible loads.

Axle Type or Group	Tires per Axle	Maximum Weight/Tire (Metric Tons)	Load/Axle Type (Metric Tons) Load per Axle	Load per Axle Group
Single	2	3.3	6.6	6.6
Single	4	2.75	11.0	11.0
Single	8	2.75	22.0	22.0
Double	8	2.75	11.0	22.0
Double	16	2.75	22.0	44.0
Triple	12	2.75	11.0	33.0
Triple	24	2.75	22.0	66.0
Quadruple	8 per axle	2.25	18.0	Variable
Quadruple	12 per axle	2.25	27.0	Variable

SOURCE: NOM-040-SCT-2-1995.

Table 11 Maximum axle load dimensions for non-divisible loads.

Configuration Type	Maximum Dimensions (m)		
	Length	Width	Height
1	20.8	2.6	4.25
2	20.8	Up to 3.1	Any
3	18.0	Up to 3.3	Any
4	30.0	Up to 3.6	Any
5	Over 30.0	Up to 3.6	Any
6	Any	Over 3.6	Any

SOURCE: NOM-040-SCT-2-1995.

of the route and schedule of the trip at least 24 hours in advance of the trip. Table 11 shows the maximum dimensions allowed by this standard.

Depending on the special vehicle configuration type, escort vehicles (or pilot cars) with warning lights are required to improve safety and facilitate transportation of the oversize vehicle. Oversize configuration Types 1 through 3 require no escort vehicles; Type 4 requires one escort vehicle; and Types 5 and 6 require two escort vehicles. These special vehicle configurations are not allowed to travel on federal highways between sunset and midnight.

Truck Size and Weight Enforcement Procedures

In Mexico, the SCT is responsible for the enforcement and regulation of commercial vehicles. First developed in the early 1990s, Mexico's commercial vehicle enforcement and inspection program includes roadside inspections and on-site compliance reviews. To achieve compliance with the standards regulating the use of highways at the federal level, Mexico uses various methods to check aspects of commercial vehicles.

The purpose of the inspections conducted by the SCT is to verify that carriers, drivers, equipment, installations, and operating service comply with all the requirements imposed by federal standards. SCT inspections are done with the cooperation of the Federal Highway Police, and, generally, they are performed during regular work days and hours, although they could be carried out at any day or time if necessary.

The SCT has built fixed-location facilities where trucks are inspected using techniques similar to those used in the United States. When the stations are in operation and lights are flashing to signal drivers to pull in, enforcement representatives direct drivers to cross a weigh-in-motion (WIM) system to estimate the weight. If the WIM detects that the truck is overweight, trucks have to be weighed on a static scale.

The SCT and the police also perform random checks at non-fixed locations of the roadway network utilizing portable equipment. These inspections are not very frequent because the federal police who perform the inspections have other duties assigned to them. Security issues along the roadway network have become more frequent in recent years, reducing the priority of vehicle safety inspections. During a roadside inspection at either fixed or portable locations, the SCT also requires drivers to undergo medical examinations. The purpose is to determine whether drivers are medically fit to operate large vehicles safely.

NOM-012-SCT-2-2008 empowers the SCT to limit the size and weight of commercial vehicles using size and weight enforcement stations (currently there are 7 fixed enforcement stations and more than 30 portable stations in Mexico) and an auto-regulation process whereby eligible shippers and carriers that have certified weighing scales and measuring systems can auto-regulate size and weight limits (this provision has not been enforced yet).

Norma Oficial Mexicana NOM-068-SCT-2-2000, Transporte terrestre-Servicio de autotransporte federal de pasaje, turismo, carga y transporte privado—Condiciones físico-mecánica y de seguridad para la operación en caminos y puentes de jurisdicción federal (NOM-068-SCT-2-2000) establishes the criteria and authority for roadside commercial vehicle inspections. This regulation also establishes the procedures used for inspecting commercial vehicles and placing them out of service and also a timeframe for inspecting these vehicles, ranging from 20 minutes for buses and commercial vehicles carrying hazardous materials to 30 minutes for commercial vehicles carrying general cargo. Table 12 shows current enforcement actions taken for various noncompliant equipment conditions under NOM-068-SCT-2-2000.

Vehicle Characteristics, Licensing, and Training Provisions

NOM-068-SCT-2-2000 defines the physical and mechanical requirements of vehicles on federal highways and inspection and verification procedures for determining whether vehicles comply with such specifications. This standard was published in 2000, but has not been enforced. However, now that the latest version of NOM-012 has been published, the

Table 12 Mexican roadside commercial vehicle noncompliant equipment conditions and enforcement actions.

NOM-068-SCT-2-2000		Noncompliant Equipment Conditions	Enforcement Actions
4.1	Lighting Systems	Missing fuses, bridged with wire, aluminum, or other Worn, exposed, twisted wires, missing insulation Missing or inoperable headlights (if needed) Missing or inoperable brake lights	A*
4.3	Windshield Wipers	No windshield wipers and spray jets	A
4.4	Windshield	Shattered or missing windshield	B†
4.5	Tires, Inner Tubes, Belts	Cut/damaged tire walls, exposed structural material, tread separation, abrasion from adjacent surfaces, exposed radial belts, wheel separation, not designed for highway use	B
4.6	Wheels, Rims	Bent, broken, or cracked wheel rims	B
4.7/4.8	Frames, Rails, Chassis	Cracked, loose, bent, or broken frame rails Twists, bends, weaknesses from cracked chassis	B
4.9	Fuel System	Missing gas cap, fuel spillage in filling pipe, leaking fuel lines	B
4.11	Exhaust System	Unsafe mounting of exhaust pipes Broken or damaged exhaust pipes	B
4.12	Steering System	Loose steering wheel, detached joints, missing steering column U-bolts Detached steering gear box from chassis mounting, ruptured gear box or mounting brackets	B
4.13	Suspension System	No springs on mechanical suspension Cracked suspension frame or loose U-bolts	B
4.14	Pneumatic Brake System	Curled, obstructed, or broken hoses or pipes Cracked brake drums Detached or loosely mounted brake chambers Out of adjustment (>20%) push rods	C‡
4.15	Hydraulic Brake System	Inoperative brake linings and/or oil contamination of drums Missing brake lining segments	B
4.16	Electric Brake System	Missing, ruptured, or defective brake on vehicle wheel	B

*A When these defects are evident, the driver is allowed to correct deficiencies immediately. Once the correction has been verified, he or she may continue his or her trip, exempt from corresponding sanctions.

†B For these defects, a sanction will be issued, but the driver/vehicle will be allowed to continue on to the destination with the aim of repairing the defects found. Once the defects are corrected and verified, the driver/vehicle will be allowed to resume normal operations. A written advisory will be issued that notes the defects discovered and allows a maximum of 20 calendar days to be corrected.

‡C For these defects, a sanction will be issued, and the driver/vehicle will be put out of service. The vehicle must be towed to a location determined by the owner for repair. Once the defects are repaired and inspected/verified, the driver/vehicle may resume normal operations. The driver must maintain the vehicle evaluation form in the vehicle.

SCT will begin enforcing verification that the LCVs that are allowed extra axle and gross weight actually have the requisite pneumatic suspensions.

Licensing Requirements

NOM-012-SCT-2-2008 specifies that LCV drivers must have a special driver's license and training when the truck is using the extra axle weight. As previously noted, this special license requirement is not being enforced since the license renewal mechanism has not been created. Nonetheless, it is important to review the basics of the current Mexican licensing, training, and testing processes.

According to the current legislation, all commercial vehicle drivers, including Mexican and foreign drivers, are required to have a valid driver's license.

To obtain a federal driver's license, drivers must file a written application with the SCT. Depending on the license category, the application must be accompanied with the following materials:

- In all cases, drivers must provide a medical (psychological and physical) fitness certificate, two identification cards with full-front color photos, proof of address, and a training certificate.
- For License Categories A (bus), B (tractor-trailer combination, excluding hazardous materials), C (two- or three-axle trucks, excluding hazardous materials), D (automobiles and small buses), and F (taxis to/from Mexican airports and seaports), drivers must also provide legal documentation that certifies their legal age and, in the case of Category D, a tourist guide credential.
- For Category E (any truck including hazardous materials), drivers must have a Category B or C federal driver's license or a hazardous materials and waste carrier certificate that indicates 2 years of experience operating vehicles that haul this type of product.

Drivers operating across international borders must also provide legal documentation that certifies their legal age as 21 years old or older and a certificate proving knowledge of the English language.

License Renewals

The effective term of a federal driver's license is 10 years with renewals every 2 years. License renewals require drivers to complete additional training and a physical exam. The following section presents the details of the physical exam and training requirements. When the driver is requesting a change in the license category, the applicant must file the appropriate training certificate and/or his/her current license with the SCT. The renewal term is currently under review by the SCT.

Training Requirements and Physical Exam

Prior to license issuance and renewal, drivers are required to obtain a training certificate. Training requirements for new drivers are 63 hours of roadway safety theory and defensive driving, vehicle operation and maintenance, customer service, security and hygiene, and human development and 57 hours of practical roadway safety and defensive driving, vehicle operations, and maintenance content. Training requirements for renewing drivers are 40 hours of roadway safety and defensive driving, vehicle operation and maintenance, and customer service; 28 hours of road safety, vehicle operation and maintenance, and customer attention and service; and 16 hours of technical update, service quality culture, family values, and integrity. Drivers can obtain the required training from the SCT's officially certified schools and educational or licensee training centers.

In addition to meeting training requirements, drivers must take a psychological and physical exam by a certified medical professional. A medical exam is required prior to license issuance and every 2 years thereafter. The exam considers each of the following physical features in the context of potential interference with the safe and efficient performance of driver activities:

- Eyes, nose, and throat
- Respiratory system
- Cardiovascular system
- Digestive system/abdominal wall
- Musculoskeletal system
- Plasma
- Organ transplants
- Nervous system
- Endocrinal system
- Hematopoietic system
- Genitourinary apparatus
- Skin
- Psychological
- Psychiatric

In the United States, individual states develop their own knowledge and skill tests that must meet the minimum federal standards provided for in Subpart G and H of 49 Code of Federal Regulations (CFR) Part 383 (*2*). The Federal Motor Carrier Safety Administration (FMCSA) has prepared and distributed model driver and examiner manuals and tests to the states to use if they wish. Some of the requirements associated with the tests include the following:

- Each basic knowledge test (i.e., the test covering the areas referred to in 49 CFR 383.111 for the applicable vehicle group) shall contain at least 30 items, exclusive of the number of items testing air brake knowledge.
- Applicants must correctly answer at least 80 percent of the questions to pass the knowledge tests (general and endorsement).

- Applicants must successfully perform all the required skills (listed in 49 CFR 383.113 through 49 CFR 383.123) to pass the skills test. The skills test must use a vehicle representative of the type of vehicle that the applicant operates or expects to operate. Depending on the type of passenger vehicle used in the skills test, the following restrictions must be added to the license: except Class A bus or except Class A and Class B bus.
- The driver/applicant must surrender his/her driver's license issued by another state if he/she has moved from another state.

FMCSA requires all commercial drivers to meet specific testing and licensing standards. Commercial Driver's License (CDL) driver training, however, is not a mandate unless the driver will be transporting hazardous materials (3).

Drug and Alcohol Testing

In order to detect the use of drugs or alcohol, a toxicological exam is required for all drivers in Mexico under the following circumstances:

- Every 3 months for 1 year after the physical exam
- Every 6 months thereafter
- As part of the psychophysical exam performed when a driver applies for a federal driver's license, any psychophysical event has transpired, an accident has occurred, or a carrier or driver asks for reevaluation
- During the 24 hours following a vehicular accident
- If there is evidence of substance abuse
- During any period determined by the Staff Security Monitoring Program
- When established by any international treaty or convention

For drivers who have successfully completed the drug and alcohol rehabilitation safety program, a toxicological exam is required every 3 months for 1 year after the physical exam and every 6 months thereafter.

Hours of Service

Commercial drivers must comply with the Federal Labor Law. The Mexican labor law limits daily hours of service for drivers to 8 hours for the day shift (6 a.m. to 8 p.m.), 7 hours for the night shift (8 p.m. to 6 a.m.), and 7.5 hours for a mixed shift. During a continuous work day, drivers must rest for at least 30 minutes. If the driver cannot leave the workplace for rest or meal breaks, he/she must count the corresponding time as hours of service. Drivers may accumulate daily overtime of up to 3 hours in three instances during a week (maximum 9 hours per week total). The carrier must pay drivers double their hourly rate for overtime. Drivers are required to report their work and break activities in a logbook and maintain records for a minimum of 60 days.

POTENTIAL IMPACTS ON U.S. BORDER STATES

Cross-Border Transportation

The FMCSA and the state departments of transportation inspect all commercial vehicles entering the United States from Mexico. In most land ports of entry, FMCSA inspectors operate within the federal compound; in other locations, FMCSA performs inspections at the state inspection facilities.

Under the North American Free Trade Agreement (NAFTA), the plan was to open the border for Mexican-domiciled trucks. The plan has not been implemented, and the majority of truck crossings from Mexico into the United States are drayage or transfer trucks. The original NAFTA provisions were designed to improve transportation efficiency by enabling more seamless cross-border trucking operations. However, Mexican truck operations are restricted to a narrow commercial zone extending 3 to 25 miles into the United States (up to 75 miles in Arizona).

Given that Mexican tractors are not allowed to travel beyond the commercial zone, northbound truck shipments into the United States must use a drayage or transfer tractor. These drayage tractors connect to a trailer on the Mexican side of the border and move the trailer into the U.S. commercial zone for coupling to a U.S. long-haul tractor to continue the trip to its destination.

In 2007, the U.S. and Mexican governments announced that they had reached a resolution on the cross-border trucking impasse. The agreement called for a 1-year pilot project involving up to 100 Mexican and 100 U.S. trucking firms that wished to engage in direct long-haul movements across the border and beyond the commercial zone. To qualify, Mexican

carriers had to undergo safety audits by U.S. inspectors in Mexico; meet all safety, environmental, insurance, homeland security, and other regulations imposed on U.S. trucking firms; and pay all applicable U.S., state, and federal taxes and registration fees. The pilot project was discontinued in March of 2009 when Congress eliminated funding for the demonstration program that had allowed Mexican trucks access to U.S. roads, citing safety concerns.

In July 2011, the FMCSA announced a new cross-border long-haul trucking pilot program to test and demonstrate the ability of Mexico-based motor carriers to operate safely in the United States beyond commercial zones. This pilot program would allow Mexico-domiciled motor carriers to operate throughout the United States for up to 3 years. Participating Mexican carriers and drivers would be required to comply with all applicable U.S. laws and regulations, including those concerned with motor carrier safety, customs, immigration, vehicle registration and taxation, and fuel taxation.

As with the previous pilot program, it is expected that very few Mexican carriers will participate. Point-to-point transportation (cabotage) is prohibited, and other commercial aspects and fees will prevent a large number of Mexican carriers from participating in the new program; therefore, drayage will continue to dominate cross-border trucking along the U.S./Mexico border.

Another common scenario for northbound trucks is to load a long-haul U.S. tractor-semitrailer combination at plants called *maquiladoras,* located near the border in Mexico. In this case, the U.S. tractor transports the trailer from the origin to its U.S. destination without being decoupled.

As noted earlier, truck weight limits in Mexico are higher than truck weight limits in the United States; therefore, northbound loads are usually adjusted to meet U.S. regulations before crossing into the United States. The drayage process is also used to consolidate loads so that they meet each country's truck size and weight regulations.

A considerable proportion of the freight that comes to the port of entry at Laredo, Texas, arrives by LCV, using the T3-S2-R4 configuration with two 40-ft trailers. This configuration is legal at the Mexico border city of Nuevo Laredo via the toll-road system. Once the shipment reaches the border, the driver disassembles the LCV into two separate tractor-semitrailer combinations. Drayage tractors cross each trailer separately in the United States, and the load is cross-docked into a 48- or 53-ft trailer or remains in the 40-ft trailer, depending on the destination. Southbound movements are usually unloaded or rearranged on the U.S. side of the border into a 40-ft trailer if the trip involves a T3-S2-R4 vehicle in Mexico for that shipment.

Given the extensive federal and state vehicle safety inspection process for every truck that enters the United States from Mexico and given that most of the existing commercial crossings have already built state inspection facilities, the U.S. border states have no concerns regarding Mexican trucks entering their territory with overweight or non-complying vehicles. However, safety and security inspections that take place at the border have a negative impact on border communities. These inspections create congestion at border crossings, and trucks waiting in long lines for inspection contribute excessively to greenhouse gases, unproductive driver time, and noise.

Some state agencies have developed strategies to reduce the impact of cross-border trucking. The following section describes two strategies that states are beginning to implement at the U.S./Mexico border to reduce congestion at the border.

Alternatives for U.S. Border States

Some of the states that border with Mexico are implementing or are in the process of analyzing various strategies to allow overweight or oversize vehicles to operate near the U.S./Mexico border. This section presents two projects that have been implemented and one that is being analyzed.

Port of Brownsville Overweight Corridor Program

The overweight corridor program allows trucks to transport overweight freight between the Port of Brownsville, Texas, and Monterrey, Mexico. This route between the port and the Veteran's International Bridge, SH 4 (International Boulevard), and SH 48 (Padre Island Highway) constitutes Brownsville's overweight truck corridor. The corridor allows trucks carrying primarily break bulk steel but also other cargoes to be loaded to Mexican truck weights. The gross weight of cargo and equipment is not allowed to exceed the allowable axle load, the Mexican legal weight limit, or 125,000 lb, whichever is less, and the dimensions of the load and vehicle shall not exceed 12 ft wide, 15 ft 6 in. high, or 110 ft long.

Overweight trucks must remain on the overweight corridor and pay a fee collected at the port to help cover damages caused by these loads. In 2009,

due to its success over a period of several years, Texas made this program permanent.

Arizona Overweight Permit Pilot Program

The Arizona Department of Transportation (ADOT) has implemented a Single Trip Overweight Permit, which allows a motor carrier transporting fresh produce within the Mexico/Arizona commercial zone to lawfully operate a vehicle with an overall GVW of up to 90,800 lb on a five-axle tractor-semitrailer. The program began on May 17, 2010, and will allow ADOT to evaluate the effectiveness of allowing overweight trucks from Mexico and thereby determine whether to continue or expand the service to other Mexico/Arizona commercial zones.

In order to qualify for this program, carriers must meet the following requirements:

- The cargo must arrive in a sealed container originating from Mexico.
- The vehicle configuration must have at least five axles.
- The axle group weight configuration cannot exceed the maximum weight allowed in the Arizona Administrative Code.
- Trucks can only follow specific routes designated on the permit by ADOT.

ADOT already issues overweight permits for shipments crossing the state from other states. The pilot program brings shipments crossing an international border into this permitting process and recognizes the importance of maintaining the security of shipments coming from Mexico, which allows for a higher GVW than the United States.

Currently, produce shipments from the Mexican states of Sinaloa and Sonora destined for the United States utilize staging areas across the border in Nogales Sonora to remove the portion of a shipment that is allowable in Mexico but that would be overweight in the United States. The overweight portions from several trucks are consolidated in a new truck, creating an additional shipment that must cross the border. Under the new program, growers will be able to ship produce at the allowed Arizona permitted weight of 90,800 lb without the need to break the cold chain and cross-dock produce to another truck.

Oversize Trucks Crossing into the United States

As noted previously, the T3-S2-R4 combination is popular in Mexico along the ET corridors, and most of these roadway types serve the U.S./Mexico border. The current scenario for those combination vehicles is to travel to the border and utilize staging areas on the Mexican side of the border where the tandem configuration is uncoupled. From that point, a drayage truck tows the load in two trips, usually a 40-ft trailer on each trip.

To reduce the number of crossings at the U.S./Mexico border, two states—Texas and Arizona—are proposing initiatives to allow tandem trucks to cross into the United States. The proposed operation would allow trucks to cross into the United States from Mexico, go through Customs and Border Protection and state safety inspections as a combination vehicle with two trailers, and then travel to a staging yard where trailers are decoupled. From there, two power units would pull the two single trailers to their destinations on U.S. roadways.

The main benefit of this proposal is the reduction in the number of drayage trips that are required to move the same number of trailers at international border crossings where current operations are congested. This scheme would allow for reducing the number of tractors crossing, thereby reducing emissions and congestion. This proposal would require a large plot of land next to the state inspection facility, and this close proximity would prevent tandem trucks (T3-S2-R4) from traveling on U.S. roadways.

North American Truck Size and Weight Limit Comparison

The following comparison concentrates on LCVs due to the emphasis on these vehicles in recent Mexican size and weight legislation. (Despite this emphasis on LCVs, it is important to note that most of the U.S./Mexico trade uses 53-ft semitrailers due to the ability to cross the border with these trailers.) Vehicle lengths are similar in both Mexico and the United States, but legal weights are quite different. The maximum GVW allowed in Mexico for the most common configuration (T3-S2) is 46.5 metric tons (102,515 lb); the maximum allowed in the United States is 80,000 lb (e.g., on Interstate highways). Trucks traveling to the United States from Mexico avoid going over the 80,000-lb limit established in the United States to avoid fines.

Table 13 presents some current U.S. state size and weight limits for common LCVs. FMCSA defines LCVs in the United States as a combination of a tractor and two or more trailers that operates on the

Table 13 General weight and dimension limits on U.S. LCVs.

State	Truck Tractor and Two Trailing Units Allowed		Truck Tractor and Three Trailing Units Allowed		
	Length (ft)[a]	Max. Gross Wt. (lb)	Length (ft)	Max. Gross Wt. (lb)	Other
Alaska	95	NA[f]	110	NA	83 ft
Arizona	95	129,000	95	129,000	[b]
Colorado	111	110,000	115.5	110,000	78 ft
Florida	106[c]	NA	NA	NA	NA
Hawaii	65[c]	NA	NA	NA	NA
Idaho	95	105,500	95	105,500	[b]
Indiana	106	127,400	104.5	127,400	58 ft
Iowa	100	129,000	100	129,000	78 ft
Kansas	109	120,000	109	120,000	NA
Massachusetts	104	127,400	NA	NA	NA
Michigan	58	164,000	NA	NA	NA
Missouri	110	120,000[e]	109	120,000	NA
Montana	93	137,800	100	131,060[c]	[b]
Nebraska	95	95,000	95	[c]	68 ft
Nevada	95	129,000	95	129,000	98 ft
New Mexico	NA	86,400[d]	NA	NA	NA
New York	102	143,000	NA	NA	NA
North Dakota	103	105,500	100	105,500	103 ft
Ohio	102	127,400	95	115,000	NA
Oklahoma	110	90,000	95	90,000	NA
Oregon	68	105,500	96	105,500	70.5 ft
South Dakota	100	129,000	100	129,000	[b]
Utah	95	129,000	95	129,000	[b]
Washington	68	105,500	NA	NA	68 ft
Wyoming	81	117,000	NA	NA	[b]

[a]Cargo-carrying length is measured from the front of the first cargo unit to the rear of the last cargo unit.
[b]State submission includes multiple vehicles in this category.
[c]No maximum weight is established because this vehicle combination is not considered an LCV per the ISTEA definition.
[d]No maximum cargo-carrying length is established for this combination.
[e]These dimensions do not apply to the same combinations. The 110-ft length is limited to vehicles entering from Oklahoma and is also limited to a 90,000-lb gross weight. The 120,000-lb gross weight is limited to vehicles entering from Kansas and also limited to a cargo-carrying length of 109 ft.
[f]NA: Not applicable.
SOURCE: *Longer Combination Vehicle (LCV) Regulations Training* (*4*).

Interstate Highway System at a gross weight greater than 80,000 lb. The FMCSA definition excludes the so-called "western double" from this group since its legal weight is capped at 80,000 lb. ISTEA prohibits any further expansion of LCV routes or increases in LCV sizes and weights where LCVs were allowed in 1991 when the law was passed.

The three common types of LCV on U.S. roadways are turnpike doubles (TPDs), Rocky Mountain doubles (RMDs), and triples. Descriptions of these types of LCV are the following:

- TPDs typically consist of a three-axle power unit pulling a tandem-axle semitrailer followed

by a second semitrailer converted to a trailer by an A-dolly. Each trailing unit is typically 13.7 to 14.6 m (45 to 48 ft) in length, and the total number of axles is nine. It is legal on at least some roads in 13 states (*4*).

- RMDs typically consist of a three-axle power unit, a tandem-axle semitrailer (typically 13.7 to 14.6 m [45 to 48 ft] in length), followed by an 8.5-m (28.5-ft) semitrailer converted to a trailer using a single-axle A-dolly, bringing the total number of axles to seven. RMDs are legal in 16 states.
- Triples typically consist of a two-axle tractor pulling three 8.5-m (28.5-ft) semitrailers, with the trailer and two semitrailers converted to trailers by using A-dollies. Triples can operate in 14 states, but in some cases only on designated turnpikes.

In Canada, LCVs usually operate on a special permit basis using vehicle configurations consisting of a tractor and two or three van trailers or containers. These vehicles exceed basic vehicle length limitations but operate within basic weight limits. Canadian provinces have the authority to regulate size and weight, so the limits under which commercial vehicles operate vary significantly among provinces. Canadian LCVs are not directly comparable with U.S. or Mexican LCVs due to differences in regulatory regimes and the operating environment. For example, the prairie region of Canada (Manitoba, Saskatchewan, and Alberta) requires trucks longer than 25 m (82 ft) to operate under a special permit. The three routinely permitted LCVs in this region are TPDs, RMDs, and triples. Even though the configurations have the same names as those allowed in the United States, they operate under different size and weight limits. Their configurations and size and weight limits are as follows:

- TPDs consist of a tractor with one 16.2-m (53-ft) van trailer and one 16.2-m (53-ft) van trailer converted from a semitrailer to a trailer by using an A- or C-dolly operating at maximum GVWs between 60.5 and 63.5 metric tons (133,000 and 140,000 lb).
- RMDs consist of a tractor with one 16.2-m (53-ft) van trailer and one 8.5-m (28-ft) van trailer converted from a semitrailer to a trailer by using an A- or C-dolly operating at maximum GVWs between 53.5 and 63.5 metric tons (117,700 and 140,000 lb).
- Triples consist of one 8.5-m (28.5-ft) van semitrailer followed by two 8.5-m (28.5-ft) van trailers converted from semitrailers to trailers by A- or C-dollies and operating at a maximum GVW of 53.5 metric tons (117,700 lb).

Table 14 compares LCVs allowed in Mexico with LCVs allowed in the United States and Canada and the corresponding weight and dimension limits in each country by vehicle type. This list includes the "western double" even though it is not considered an LCV in the United States according to the FMCSA's definition (GVW cap at 80,000 lb). Allowable GVWs for similar vehicles in Mexico and Canada are 114,000 lb and 92,200 lb, respectively. The other three comparable vehicles in the table are RMDs, TPDs, and B-trains. Differences among U.S. states and jurisdictions and between provincial limits in Canada create challenges for such comparisons, so this comparison simply uses some typical values in the United States and the maximums allowed by the Canadian memorandum of understanding (MOU).

Two of the vehicle types that do not have as much in common in the three countries are triples and B-trains. The United States and Canada allow triples, but they are not included in the table since their numbers are small. Carriers in the United States do not use B-trains extensively, but they are particularly well suited for high-density commodity movements. The GVW comparison for the remaining vehicles indicates that the U.S. GVW limits are typically lower than those of Mexico or Canada.

Both the United States and Mexico use bridge formulas to set GVW limits for the protection of bridges. The bridge formula used in the United States is more restrictive than the bridge formula shown below for Mexico.

The Mexico Bridge Formula is the following:

$$GVW_{MX} = 870\left[\frac{L * N}{N-1} + 3.66 * N + 11\right]$$

where

GVW_{MX} = maximum gross vehicle weight (kg),
L = distance between extreme axles (m), and
N = number of axles.

Table 14 Comparison of dimensional and weight limits for similar vehicles in the United States, Mexico, and Canada.

Vehicle	Limit	NOM-012-SCT-2-2008[a]	U.S. Comparable Vehicle	Canadian Comparable Vehicle[b]
T2-S1-R2	Weight T (lb)	52.0 (114,000)	36.4 (80,000)	41.9 (92,200)
	Length m (ft)	31.0 (102)	18.7 (61.5)	25.0 (82.0)
T2-S1-R3	Weight	60.0 (132,000)	NA[e]	NA
	Length	31.0 (102)	NA	NA
T2-S2-R2	Weight	60.0 (132,000)	NA	NA
	Length	31.0 (102)	NA	NA
T3-S1-R2	Weight	60.5 (133,100)	NA	NA
	Length	31.0 (102)	NA	NA
T3-S1-R3	Weight	67.5 (148,500)	NA	NA
	Length	31.0 (102)	NA	NA
T3-S2-R2	Weight	67.5 (148,500)	48.0 (105,500) [RMD]	53.5 (117,700) [RMD]
	Length	31.0 (102)	29.0 (95)	31.0 (101.7)
T3-S2-R3	Weight	75.5 (166,100)[c]	NA	NA
	Length	31.0 (102)	NA	NA
T3-S2-R4	Weight	80.0 (176,000)[c]	58.6 (129,000) [TPD]	53.5 (117,700) [TPD]
	Length	31.0 (102)	32.3 (106)	41.0 (134.5)
T3-S2-S2	Weight	65.5 (144,100)	NA	NA
	Length	31.0 (102)	NA	NA
T2-S2-S2	Weight	58.5 (128,700)	NA	NA
	Length	31.0 (102)	NA	NA
T3-S3-S2	Weight	68.0 (149,600)	56.8 (125,000) [B-train][d]	62.5 (137,500) [B-train]
	Length	25.0 (82)	33.5 (110)	25.0 (82.0)

[a]These Mexican GVW figures correspond to ET and A highway classification limits. The extra weight applies to trucks with pneumatic suspension.
[b]Limits according to MOE among provinces. Actual provincial limits vary.
[c]These two types of combinations are allowed an extra 4.5 tons gross weight until 2013.
[d]Usually operates under permit.
[e]NA: not applicable.

U.S. Federal Bridge Formula B is the following:

$$GVW_{US} = 500\left[\frac{L * N}{N-1} + 12 * N + 36\right]$$

where

GVW_{US} = maximum overall gross weight of the group (lb),
L = distance between extreme axles of the group (ft), and
N = number of axles in the group.

Figure 8 shows that the bridge formula used in the United States is more restrictive than the bridge formula used in Mexico to establish maximum GVW limits.

One of the reasons why the Mexican Bridge Formula is less restrictive than the U.S. formula is that the design live loads used in Mexico are larger than the U.S. live loads. The Normativa para la Infraestructura del Transporte (Transportation Infrastructure Regulation) published by the SCT regulates bridge design loads in Mexico. Section N-PRY-CAR-6-01-003/01 of this regulation establishes two live load configurations. The first one is applied to ET, A, B, and C highways, while the second one is applied to D highways. Figure 9 shows the corresponding live load configuration for bridges designed for ET, A, B, and C highway networks with a span length of less than 98 ft.

Canada, Mexico, and the United States also have different allowable axle weights. The six-axle tractor-semitrailer is a good choice of vehicle to illustrate the differences in axle weights and corresponding GVW because it contains both tandem and tridem axle groups. Table 15 shows that U.S. axle weights are

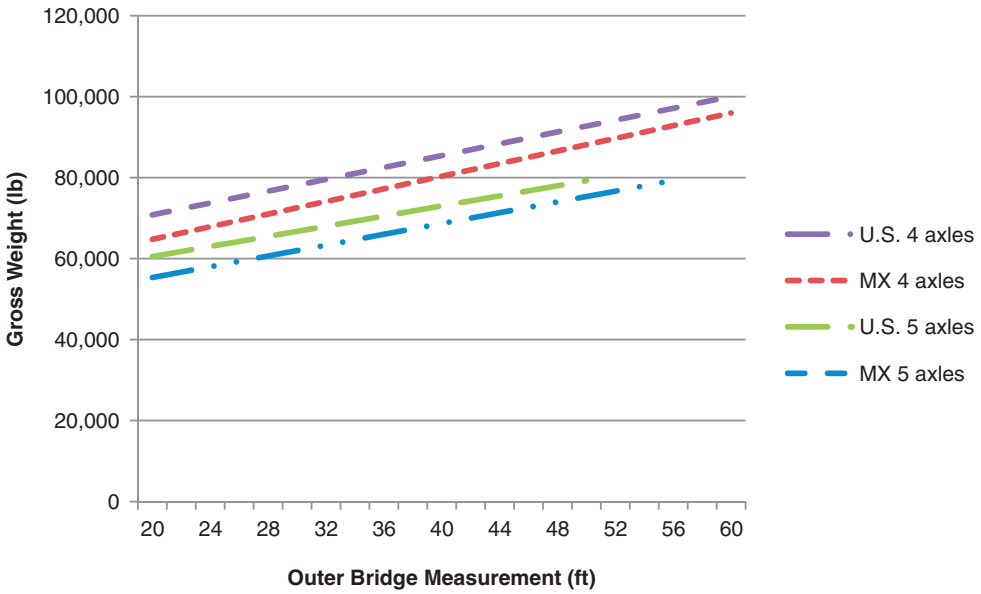

Figure 8 Comparison of U.S. Federal Bridge Formula B and the Mexico Bridge Formula.

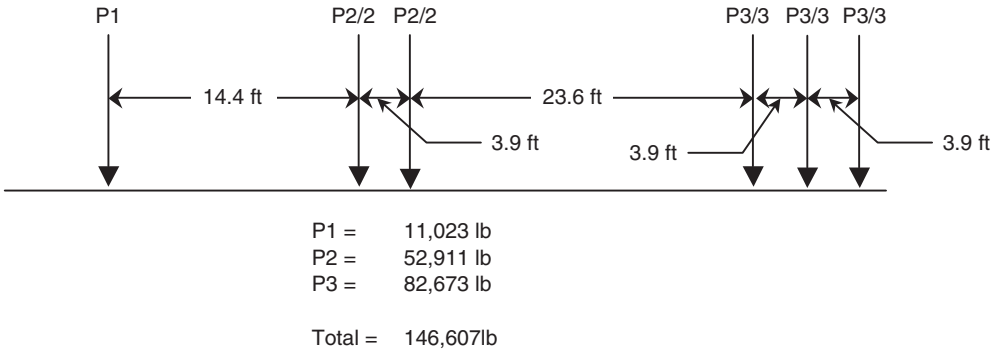

Figure 9 Mexican live load configuration.

consistently lower than those of Canada and Mexico, resulting in a GVW that is 16 percent lower than that of Canada and 21 percent lower than that of Mexico, assuming removal of the 80,000-lb cap. Basing the comparison on the current 80,000-lb cap indicates that the U.S. GVW is 28 percent lower than that of Canada and 33 percent lower than that of Mexico. Clearly the allowable tandem and tridem axle weights in the United States are substantially less than those in Canada and Mexico.

A recent Organisation for Economic Co-operation and Development (OECD) study on safety, productivity, infrastructure wear, fuel use, and emissions assessment of the international truck fleet found that U.S. axle weights were the lowest of all countries examined including Australia, Canada, the European Union, Mexico, and the United Kingdom (*5*). Coefficients within U.S. Federal Bridge Formula B are tied to current axle weights, so increasing these weights would require revising the bridge formula accordingly. Bridge formula revisions could create an environment of opportunity for vehicle designers to create more productive configurations.

Table 15 Comparison of allowable axle weights by country.

	Axle Weights and GVWs (lb)			
Country	**Steer**	**Drive**	**Tridem**	**GVW**
Canada	12,100	37,400	52,800	102,300
Mexico	14,300	42,900	49,500	106,700
U.S.	12,000	34,000	42,000	88,000

Table 16 Maximum allowable GVW for heaviest Mexican LCV (T3-S2-R4).

Axle Configuration	Maximum Allowable GVW (Metric Tons)
One single steering axle	6.5
One tandem power axle	18
Three tandem (non-powered) axles	17 × 3 = 51
Total	**75.5**

Implications of LCV Size and Weight Limits

Pavement and bridge damage caused by commercial vehicles has been discussed in Mexico for several years and was a major topic of discussion during the development of the last version of NOM-012. The effect of any particular vehicle on the infrastructure depends on the maximum allowable axle weight as well as the axle spatial distribution.

The maximum allowable GVW in Mexico depends on the lesser of two values: (1) the sum of the allowances for each axle or axle group or (2) the maximum weight according to the bridge formula. The lesser value should be the one that dictates the maximum GVW. Table 16 shows the limit based on the axle configuration for the heaviest LCV allowed in Mexico (T3-S2-R4).

The result of applying the bridge formula to this same vehicle configuration results in a maximum allowable gross weight of 66.5 metric tons.

According to the criteria for determining maximum allowable GVW in Mexico presented above, the maximum GVW for the T3-S2-R4 combination should have been 66.5 metric tons because this is the lesser value. However, during the development of the last version of NOM-012, pressure from certain shippers and carriers pushed the maximum GVW weight to be the higher value. On top of that, the SCT succumbed to similar pressure and allowed an additional 4.5 metric tons until 2013, for a total GVW of 80 metric tons. The SCT plans to rescind the additional 4.5 metric tons for T3-S2-R4 in 2013.

MEXICO/U.S. ANALYSIS

The elements of the Mexican experience that may have relevance for U.S. regulators are summarized herein. The discussion identifies areas where the Mexican truck size and weight limits have resulted in particular successes or problems, and it identifies constraints that might limit applicability of Mexican practices in the United States. It also examines the guidance of recent U.S. studies, such as TRB's *Special Report 227: New Trucks for Greater Productivity and Less Road Wear: An Evaluation of the Turner Proposal* (the Turner Study) and the Federal Highway Administration's (FHWA's) *Comprehensive Truck Size and Weight Study* (CTS&W Study), with respect to the objectives of this task (*6, 7*).

One of the obvious differences between Mexico and the United States that has been a major contributor to the adoption of heavier trucks in Mexico is the Mexican Bridge Formula. There has been much discussion in the United States over the past 30-plus years of adopting a more liberal bridge formula than U.S Federal Bridge Formula B, but all proposals have thus far been rejected. An example of a vehicle-specific increase that appears to have some momentum involves allowing a six-axle, 97,000-GVW combination vehicle (single semitrailer).

In Mexico, axle weight limits, gross vehicle weights, and overall length vary as a function of roadway type. LCVs in Mexico are restricted to specific roadway types and also are required to meet higher vehicle performance requirements (see Table 7). Driver requirements include a special driver's license and additional training. Other requirements include staying within maximum speed limits, keeping headlights on for the entire trip, and maintaining a minimum distance between trucks. These prerequisites are only required for vehicles (LCVs or others) that want to take advantage of the extra axle weight allowance. However, LCVs or "full trailers" gain the most from these benefits to increase the gross vehicle weight.

In Mexico, LCVs are restricted by roadway type, but in the United States, they are restricted to a designated network. However, the United States does not currently impose some of the other restrictions. The research team believes that the United States may benefit from investigating the merits of each stipulation for potential operation of larger/heavier trucks on an expanded LCV network in the United States.

Special permits could be considered for the operation of these vehicles and could include stringent driver qualifications and perhaps safety equipment beyond that required for current vehicles. Requiring a nominal fee for the permit would help offset the administrative costs. Even though tolls are unpopular among motor carriers, innovative scenarios could be investigated to make them more acceptable. For

example, there is technology available that could allow program administrators to determine the mileage of a particular operator on toll roads. This mileage would be treated differently than non-toll mileage by providing reductions in fuel or other taxes to carriers using toll roads. This reduction could serve to minimize the burden of "double taxation" that carriers object to (paying tolls plus fuel and other taxes).

Successes and Problems

This section considers the successes and problems associated with the Mexican truck size and weight limits. One of the benefits that comes with allowing heavier trucks is that one driver and one vehicle haul more freight per trip, reducing the number of trucks on the highways, assuming maximum load factors. This benefit can contribute to reducing congestion and fuel use, improving air quality, and reducing the safety risk incurred by exposure to other vehicles. Finally, larger payloads would reduce the unit cost of shipping, which influences international competitiveness and reduces the cost of goods/services to consumers.

On the subject of problems associated with heavier and longer trucks, a cost to the infrastructure is likely to be associated with heavier axle loads, but this may be partially offset by a reduction in truck travel. For longer vehicles, the impact on the infrastructure is often positive, given that the axle loads are distributed over a longer distance and the reduction in truck travel is usually greater with LCVs than with heavier vehicles. Pavement condition in Mexico for non-tolled facilities is generally worse than in the United States; however, this may be due to issues of maintenance or failure to control axle overloading. The same is not true of Mexican toll roads since they are newer and have not sustained the magnitude of heavy vehicle overloading that non-toll roads in Mexico have.

Longer trucks present an operational challenge with respect to infrastructure geometry, which limits the roads on which they can travel. The SCT requires minimum weight-to-horsepower values for trucks, so their acceleration characteristics in traffic are reasonable. Underpowered trucks would accelerate from intersections more slowly and impede other traffic on grades. Resulting speed differentials would be undesirable, raising the risk of rear-end crashes. Overtaking longer trucks on two-lane undivided roadways is also a potential problem due to increased exposure to opposing traffic during passing maneuvers.

Limitations in Comparing Mexico to the United States

The research team was unable to verify many of the factors that need to be considered to draw conclusions and to confidently transfer findings to a U.S. setting for comparative purposes. For example, accurate data on the number of trucks using the various highways in Mexico and their axle loads and wheelbases were not available. The cost and other information relevant to determining the wear rate of bridge components and pavements were not freely available. Information on enforcement activities targeting large trucks was not well documented; therefore, information regarding enforcement came entirely from SCT personnel during meetings with researchers.

Even though the SCT has installed WIM systems at a few locations, WIM data would be of limited use in determining the weight characteristics of the vehicles passing over these systems. Primarily on the basis of interview information, the research team believes that the WIM systems are not given the necessary attention to provide useful data. Other important factors that are critical to collecting accurate WIM data include smooth pavement upstream and downstream of the WIM and adequate maintenance of the WIM, including frequent calibration. WIM systems in remote areas are subject to vandalism. Enforcement personnel have other responsibilities besides enforcement relevant to commercial vehicles, so their presence on the roadways appears to be relatively sparse.

An argument against proliferation of LCVs in the United States has been that larger and more productive trucks might attract freight that is currently hauled by rail to the highway mode. If this were to happen, the net benefit of larger and heavier trucks might be diminished in certain areas. In Mexico, private railroad concessionaires provide rail intermodal service, which is more competitive than trucking for long-distance freight. Therefore, there is reason not to compare the United States to Mexico on the issue of freight diversion.

Comprehensive Truck Size and Weight Study

FHWA's *Comprehensive Truck Size and Weight Study* (CTS&W Study) (*7*) provides some pertinent information with regard to the issues discussed in this digest.

The CTS&W Study was similar in many ways to previous truck size and weight studies but unique in

its development of an analytical framework for future evaluations of new and different scenarios. It developed five scenarios to assess the impacts of changes in truck size and weight. The following describes the basics of each scenario (*7*):

- **Uniformity Scenario.** This scenario required all states to adopt federal weight limits on all National Network (NN) highways. States that exercised grandfather rights to allow heavier vehicles on the Interstate system would have to roll them back to the current federal limits. This would force LCVs to operate at an 80,000-lb GVW, making them impractical for all but the lightest loads.
- **North American Trade Scenario.** This scenario would allow a heavier GVW on certain configurations by increasing tridem-axle loads to make them more consistent with loads allowed for tridems in Canada and Mexico. Two alternatives were tested—the first at 44,000 lb and the second at 51,000 lb. At the higher limit, six-axle tractor-semitrailers would be allowed a GVW of 97,000 lb, which would allow transporting international containers loaded to the International Standards Organization (ISO) limit.
- **LCVs Nationwide Scenario.** LCVs were operating in 16 states west of the Mississippi River and on turnpikes in five states east of the Mississippi at the time the study was published. This scenario assumes that LCVs would operate on a nationwide network of highways. TPDs would consist of two 53-ft trailers weighing up to 148,000 lb; RMDs would consist of one 53-ft trailer followed by a 28.5-ft trailer with a GVW of up to 120,000 lb; and triple-trailer combinations would consist of three 28.5-ft trailers with GVWs of up to 132,000 lb. A fourth LCV would have two 33-ft trailers, a total of eight axles, and would weigh up to 124,000 lb.
- **HR 551 Scenario.** The Safe Highways and Infrastructure Preservation Act (HR 551) had three provisions related to truck size and weight limits. It would phase out trailers longer than 53 ft, freeze state grandfather rights, and freeze weight limits on non-Interstate portions of the National Highway System.
- **Triples Nationwide Scenario.** This scenario assumed the operation of triple-trailer combinations across the country at the same weights and dimensions as the LCVs Nationwide Scenario.

Table 17 provides an insightful comparison from the CTS&W Study indicating productivity by vehicle type by using load equivalency factors per weight of payload (*7*). The measure of pavement damage is

Table 17 Theoretical load equivalency factors per 100,000 lb of payload.

Configuration	GVW (lb)	Empty Wt. (lb)	Payload Wt. (lb)	No. of Vehicles per 100,000-lb Payload	Load Equivalency Factors[c]		
					Rigid Pavement Fatigue (10 in Thick)	Flexible Pavement (5-in Wearing Surface)	
						Fatigue	Rutting
5-Axle Semitrailer	80,000	30,500	49,500	2.02	5.7	9.3	10.3
6-Axle Semitrailer	90,000	31,500	58,500	1.71	3.8	7.5	9.6
	97,000	31,500	65,500	1.53	4.1	8.4	9.2
B-Train (8 Axles)	124,000	38,700	85,300	1.17	3.9	7.0	7.6
	131,000	38,700	92,300	1.08	4.1	7.7	7.5
RMD (9 Axles)	120,000	43,000	77,000	1.30	7.8	9.9	9.5
TPD (9 Axles)	148,000	46,700	101,300	0.99	5.0	7.7	7.2
Triple (7 Axles)	114,000[a]	44,500	69,500	1.44	8.6	9.8	9.6
	132,000[b]	44,500	87,500	1.14	11.6	11.8	9.0

[a]Less than truckload.
[b]Truckload.
[c]Based on 18,000-lb single axle with dual tires.
SOURCE: Adapted from *Comprehensive Truck Size and Weight Study* (*7*).

that caused by each vehicle at the maximum weight at which it can operate. As the values indicate, the pavement damage varies by type of pavement, specific vehicle type, and the weight at which trucks are allowed to operate. Comparing proposed vehicles against the five-axle tractor-semitrailer indicates gains or losses related to pavement damage for the assumed pavement types and thicknesses. The following vehicles result in less pavement wear than the baseline five-axle tractor-semitrailer (shaded row in Table 17): six-axle tractor-semitrailer, B-train, and TPD.

The CTS&W Study also evaluated bridges and the effects of allowing longer and heavier vehicles (*7*). The two most typical bridge designs are HS-20, which is common for higher-class roadways, and H-15, which is typical of bridges on lower-class roadways. The bridge formula is intended to maintain stress levels on bridges designed for HS-20 loadings to no more than 5 percent above the design stress. Similarly, the bridge formula should maintain stress levels on bridges designed with H-15 loadings to no more than 30 percent over the design stress. The CTS&W study assumed that when the proposed vehicles met or exceeded these stress levels, new bridges would be required. In reality, some of these bridges could be strengthened and forego replacement.

A significant cost with some of the LCVs was associated with road geometric improvements needed to accommodate these proposed vehicles. Geometric deficiencies were primarily interchanges and intersections that could not accommodate the longer vehicles with their increased off-tracking characteristics. The analysis assumed no encroachment on shoulders or adjacent lanes except for at-grade intersections where vehicles could encroach on one lane in the same direction of travel. The costs also included staging areas for certain LCVs at key points along the roadway. In reality, the number of staging areas needed would probably be significantly lower than that estimated by the analysis.

The safety of larger and heavier vehicles has been perhaps the most contentious issue due to the difficulties involved in conducting an analysis of the proposed vehicles. The safety analysis in the CTS&W Study included several caveats indicating the uncertainties in attempting to establish safety performance (*7*). Reasons for this difficulty are that the weights and dimensions of vehicles involved in crashes are usually not known, the vehicle miles traveled (VMTs) of specific vehicle types are not well documented, and crash rates for LCVs currently operating are not necessarily transferrable to other geographic areas or roadway types.

For these reasons, the U.S. Department of Transportation elected not to predict changes in crash rates in the CTS&W Study (*7*). The study did, however, recommend evaluation of the stability and control properties of different configurations, along with perceptions of drivers.

Special Report 227: New Trucks for Greater Productivity and Less Road Wear: An Evaluation of the Turner Proposal

Special Report 227: New Trucks for Greater Productivity and Less Road Wear: An Evaluation of the Turner Proposal (the Turner study) is another study that is relevant to the issues discussed herein (*6*).

In 1984, Francis Turner, a former FHWA administrator, made an address to the American Association of State Highway and Transportation Officials (AASHTO) in which he advocated a new approach to truck size and weight regulation. This approach, involving trucks with lower axle weights but higher gross weights than allowed for the current vehicles, came to be known as the "Turner Proposal." AASHTO requested that the Transportation Research Board (TRB) convene an oversight committee to undertake a comprehensive study of the approach and advise the states on the results.

Of the many new truck configurations that were possible to investigate, the Turner approach evaluation chose the following four prototypes (*6*):

- A seven-axle tractor-semitrailer combination with a GVW of 91,000 lb and length of 60 ft
- A nine-axle double trailer combination with two 33-ft trailers, a 114,000-lb GVW, and 81 ft overall length
- A nine-axle B-train double with similar dimensions as the preceding prototype but with different coupling between the trailers
- An 11-axle double trailer combination with a GVW of up to 141,000 lb

The axle and axle group weight limits for the Turner approach vehicles would be as follows: single-axle maximum 15,000 lb (compared to the current maximum of 20,000 lb) and tandem axle maximum of 25,000 lb (compared to 34,000 lb). These axle loads are extremely low by international standards and are impractical. The TRB oversight committee recommended some modifications including eliminating the 11-axle prototype.

Evaluation of the Turner trucks occurred in the following categories: safety and traffic, bridges, and pavements. On the safety issue, the evaluation suggested that adoption of Turner trucks would result in a modest reduction in truck crashes and a small reduction in truck interference with traffic flow. These reductions were the result of a decrease in total annual miles of combination truck travel with use of the Turner trucks. For bridges, the Turner trucks would require replacement of some 7,000 bridges on Interstate and primary highways (4 percent of the total). This finding represents the major cost to adopting the proposed vehicles. The cost of the bridge replacements at the time (1995) would have amounted to $2.8 billion. The additional cost to replace bridges on non-primary highways would have been $4.1 billion. Other bridge costs associated with this proposal were estimated at $138 million per year once the number of Turner trucks had ramped up to a steady state.

If the amount of freight currently hauled by trucks had been diverted in the expected proportions to Turner trucks, a reduction in pavement wear of 33 percent would have resulted. On a truck-mile basis, there would have been a 40-percent reduction in pavement wear. Considering the greater capacity of Turner trucks, the net effect would have been a 19-percent reduction in the rate of pavement wear. Savings to departments of transportation would have amounted to $729 million annually once the steady-state period for Turner trucks had been reached. Considering the pavement savings together with the bridge costs, adopting this proposal would have reduced annual highway agency costs by $326 million, again, once the Turner trucks reached full utilization.

The Turner study encouraged states to adopt its proposal in its entirety so that the states could realize the full benefits. Some of the restrictions recommended in order to ensure a high level of safety included minimum and maximum trailer lengths and kingpin-to-rear-axle dimensions, antilock brakes on power units, the ability to maintain speed on all grades, and use of the B-train configuration for tank trailers.

Some route restrictions were also included such as avoiding bridges deemed too weak for the expected loading. Requirements for drivers included a minimum of 5 years of employment experience in operating combination trucks and encouragement for drivers to complete an accredited training program for the specific truck to be operated.

Among other recommendations, adjustments to highway user fees were proposed to reflect the differences in highway maintenance caused by the vehicle type. Fees might be designed to provide incentives to choose the most efficient trucks considering both highway and truck operating costs. The Turner Study admitted that adjusting taxes by vehicle type would be difficult under the current taxing structure, but went on to suggest truck tax reform as well as changes in rates.

In the final analysis, while the Turner proposal had merit from the perspective of highway agencies, it did not offer sufficient incentives to carriers and shippers to make it attractive. Even though with the Turner proposal there would be increases in payload and perhaps increased profits due to operating larger and heavier vehicles, the increases in vehicle weight (due to more axles) were not sufficiently offset by the additional payload (*6*).

CONCLUSIONS

This research examined the Mexican truck size and weight experience with a view to assessing what may have application within the U.S. context. The research effort was impeded by a lack of accurate data on the number of trucks using the various highways in Mexico and on their axle loads and wheelbases. Actually, a similar situation exists in the United States when trying to rigorously document the effects of LCV use. Past efforts at comparing the effects of LCVs on safety and infrastructure damage have resulted in inconsistent findings. Furthermore, the costs and other information relevant to determining the replacement rate of bridge components and pavements in Mexico were not available. Information on enforcement activities targeting large trucks in Mexico was also not well documented, so information regarding enforcement came entirely from SCT personnel during meetings with researchers. This information indicates that enforcement presence on roadways is relatively sparse.

Even though the SCT has installed WIM systems at a few locations, WIM data would be of limited use in determining the weight characteristics of the vehicles passing over them. Based mostly on interview information, the authors believe that the WIM systems are not given the necessary attention to provide useful data. Critical factors to collecting accurate WIM data include smooth pavement, adequate maintenance of the WIM system, and frequent calibration.

Allowing larger and heavier trucks in Mexico has not caused significant diversion of freight from rail to truck. Rail intermodal service in Mexico is provided by private railroad concessionaires, and the

rail intermodal markets in Mexico are well defined for longer haul distances in which rail intermodal service is more competitive than trucking, even with the use of LCVs.

Mexico has been regulating large commercial vehicles since 1980 when general standards for commercial vehicles were first published. Since then, significant changes have occurred including maximum size and weight limits. Many of those changes are caused by economic or technical changes, but many others are the consequence of pressure from various groups that benefit from larger and heavier trucks. The following is a summary of the findings related to truck size and weight rules and regulations in Mexico:

- Current Mexican truck size and weight limits vary depending on highway classification, vehicle configuration, and axle configuration. Mexico only allows the longest and heaviest trucks on designated routes.
- Mexican size and weight regulations also include exceptions and special permits based on highway connectivity facilitation or access to specific industrial or distribution centers.
- Maximum gross weight can be increased by 1.5 metric tons for every traction axle and by 1.0 metric ton for every other axle except the steering axle if the vehicle, driver, and carrier comply with a number of requisites.
- There is a special regulation for non-divisible loads (NOM-040-SCT-2-1995). For these loads, the maximum GVW is set by the sum of the maximum axle weights. Depending on the GVW, the carrier might need to request a special permit to use federal highways.
- Axle weights and the bridge formula used in the United States are more restrictive than the ones used in Mexico. Mexico uses heavier live loads to design bridges than the United States.
- No data were found to indicate whether or not adherence to the Mexican bridge formula during construction was monitored or enforced.

The United States has a long history of research and debate pertaining to vehicle size and weight. This project reinvestigated two prominent research efforts dedicated to investigating this issue in years past. One such effort was the U.S. DOT *Comprehensive Truck Size and Weight Study* (CTS&W Study), a landmark research effort that thoroughly investigated various aspects of adopting proposed scenarios and developed an analytical framework that could be used for future analysis (*7*). Findings of the CTS&W indicated that longer, heavier vehicles would be more productive. According to the CTS&W Study, the following vehicles result in less pavement wear than the baseline five-axle tractor-semitrailer: six-axle tractor-semitrailers, B-trains, and TPDs. Triple trailer LCVs were found to be the least desirable from a pavement wear perspective.

The other research effort reinvestigated in this digest is *Special Report 227: New Trucks for Greater Productivity and Less Road Wear: An Evaluation of the Turner Proposal* (the Turner Study), which also predicted productivity gains from adopting the specific proposed vehicle changes, as well as a modest reduction in truck crashes and a small reduction in truck interference with traffic flow due to a reduction in total annual miles of combination truck travel (*6*). However, the Turner trucks utilize low axle weights, which means that more axles are required to carry a cargo of given mass than if the axle weights were higher. The Turner study recommended adjustments to highway user fees to reflect differences in highway maintenance caused by the vehicle type. Fees might be designed to provide incentives to use the most efficient trucks, considering both highway and truck operating costs. The report admitted that adjusting taxes by vehicle type would be difficult under the current taxing structure, but went on to suggest truck tax reform as well as changes in rates (*6*).

The idea of dedicating heavy-vehicle corridors in Mexico has parallels in the United States, but might require dedicated funding for improving pavements and bridges on key routes to accommodate LCVs on a limited nationwide network.

Representatives of U.S. border states expressed no significant concerns regarding Mexican trucks entering their territory with weight issues or non-complying vehicles mainly because they have installed vehicle safety inspection facilities at most of the border crossings. Some state agencies have already developed strategies to reduce the impact of congestion, air quality, and delay due to cross-border trucking. Some examples are the Port of Brownsville Overweight Corridor Program and the Arizona Overweight Permit Pilot Program. Currently, there is a proposal to allow tandem trucks (T3-S2-R4) to cross into the United States.

A major contributor to the adoption of heavier trucks in Mexico is the Mexican Bridge Formula. It is difficult to evaluate this formula in relation to U.S. Federal Bridge Formula B as there is little or no

documentation on compliance with Mexico's bridge construction standards, monitoring of bridge construction, or bridge maintenance. Nonetheless, international research shows that U.S. axle weights and corresponding GVWs are significantly lower than those of other countries.

On the subject of designating specific routes for heavier vehicles as is done in Mexico, the United States has begun the process in a limited way with LCVs. If the United States should decide to lift the moratorium on LCV route mileage, there would be increased administrative costs in terms of permitting, monitoring, and enforcement. These costs could be offset by permitting and other fees.

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