THE UNIVERSITY OF TEXAS AT AUSTIN
CENTER FOR TRANSPORTATION RESEARCH

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Process for Evaluating Overweight Truck Corridors Serving Coastal Port Regions and Border Ports of Entry

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16. Abstract
Coastal and inland ports, regional mobility authorities, cities, and counties located near or along the Texas Gulf Coast, and along the border with Mexico, have been granted authority by the state legislature to establish permitted overweight truck corridors. Though legislation grants the authority to establish a corridor and set the maximum permissible permit fee and administrative fee, the details of the corridor (including the specific routes, route lengths, and other details) are established between the Texas Department of Transportation and the local agency through a contract. A portion of the permit fee is kept by the local authority to pay for administration of the permitting process and the remaining fee accrues to a fund managed by TxDOT to maintain the corridor pavements and bridges. The purpose of this study is to develop a two-stage process for analyzing these corridors. Stage 1 providing network-level expedient analysis results that can be used to determine the fiscal impacts of a proposed new corridor or changes to an existing corridor. Stage 2 will be a more detailed process that uses more detailed information about each corridor route segment to help identify the existing conditions and propose treatment plans to maintain safe operating conditions and to preserve infrastructure conditions.

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- USDOT: Genevieve Bales, Georgi Jaenovec

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AADT	average annual daily traffic
ACP	asphalt concrete pavements
ADT	annual daily traffic
BRINSAP	Bridge Inspection and Appraisal Program
CRCP	continuously reinforced concrete pavement
ECF	Equivalent Consumption Factor
ESAL	equivalent single axle load
GVW	gross vehicle weight
IRI	International Roughness Index
JCP	jointed concrete pavement
LCV	longer combination vehicle
MOANSTR	Moment Analysis of Structures
NDT	non-destructive test
OS/OW	oversize/overweight
PMC	Project Monitoring Committee
PMIS	Pavement Management Information System
PoB	Port of Brownsville
POE	port of entry
RMA	regional mobility authority
SCI	Structural Condition Index
SN	structural numbers
STAA	Surface Transportation Assistance Act ()
TxDOT	Texas Department of Transportation
VMT	vehicle miles traveled

Executive Summary

The first year of project 0-6820 involved the completion of the first six tasks pertaining to Stage 1 of the project. The research team conducted a literature review; worked with TxDOT subject matter experts and PMC members on a Stage 1 framework for the analysis; developed a prototype version of the Stage 1 tool; held a workshop to demonstrate the Stage 1 tool and receive feedback; and finalized and submitted the operational version of the Stage 1 tool, the Stage 1 tool User's Manual, and the First Year Report. This section will include a brief summary of each completed task during the first year, and will also present recommendations for moving forward.

Task 1: Literature Review

The research team provided a literature review on overweight truck routing. In its review, the research team reviewed past TxDOT research on OW corridors, legislation, and policy at the federal and state level, as well as those of NAFTA partners. Also, OS/OW efforts in other states were studied and documented in the review.

In its review of previous TxDOT work on OW corridors, the research team studied work that CTR has done on the topic, and in particular, the projects listed below:

- 0-6095: Long Combination Vehicle
- 0-6736: Rider 36 study
- 0-6513: Impacts of Energy Development on the Transportation System
- 0-5496: Texas Cartographic Information System

In addition to the above, the research team also reviewed other TxDOT research projects regarding OS/OW routing. The legislation reviewed in Texas included port legislation at the following ports:

- Port of Brownsville
- Port of Freeport
- Hidalgo County
- Corpus Christi
- Chambers County
- Victoria County
- City of Laredo

While reviewing OS/OW legislation and policy, the research team revisited the Rider 36 study, and updated legislation on OS/OW routes and weight and dimensions limits at the federal, state, and Canada. Moreover, the research team reviewed other industrial and academic research and initiatives conducted by other states in the US, and by NAFTA partners Canada and Mexico. The other states that have been included in the review include California, Delaware, Florida, Illinois, Indiana, Maine, Maryland, Minnesota, New Jersey, New York, Oregon, Pennsylvania, South Carolina, Washington, and Wisconsin. Furthermore, research in Canada was concentrated on the bordering provinces, including Alberta, British Columbia, Manitoba, Ontario, and Saskatchewan. In addition, an overview of safety literature related to overweight trucks and truck traffic was also studied and documented.

Task 2: Develop the Stage 1 Expedient Analysis Framework

As part of Task 2, the research team developed a framework for the Stage 1 Expedient Analysis Method, by designing the models and methods that were used to process inputs and provide outputs when using the tool.

The research team provided a detailed description of the Expedient Analysis Method and provided its framework, which included the User Input Module, the tool's Data Library, Project Information module, Cost Analysis module, revenue analysis and permit fee recommendations, and reporting methods. The Team set up the preliminary framework, and held a workshop with TxDOT subject matter experts and the TxDOT Project Monitoring Committee in February in which details of the framework's components were discussed. The workshop provided the Team with information on refining the details of the framework.

Task 3: Develop the Stage 1 Expedient Analysis Tool Prototype

A prototype of the Stage 1 Expedient Analysis Tool was provided to TxDOT based on the agreed-upon framework created in Task 2. The prototype provided TxDOT with a means to assess the functionality of the tool and provide comments to the research team to enhance its features ahead of finalizing the tool.

The prototype incorporated the essential functions that would be included in the Stage 1 Tool, which included the calculation of pavement and bridge consumption, safety and pavement rehabilitation costs, truck distribution, and cost parameters. The prototype was provided to TxDOT members and the research team received the necessary feedback. The prototype provided a basic tool for the TxDOT subject matter experts and PMC members to decide on what functions to include, and how to make the tool clearer and easier to use. After submitting the prototype and receiving feedback, the research team proceeded to update the Tool.

Task 4: Select Case Studies and Conduct Analyses

After completing the prototype, the research team conducted a case study on the Port of Brownsville. The case study involved using relevant data to come up with total overweight and permit costs for the corridor at the Port of Brownsville.

Task 5: Refine the Expedient Analysis Tool, Provide a User's Manual, and Conduct a Training Workshop

After several meetings with TxDOT subject matter experts, the research team then set out to complete the first version of the Stage 1 Expedient Analysis Tool. The research team incorporated several features into the Tool based on comments and suggestions from TxDOT and from the research team meetings. The Tool was presented to TxDOT subject matter experts and PMC members on Tuesday, September 15, 2015, and received relevant feedback. The team enhanced features of the Tool, and created a User's Manual.

Task 6: Develop a Preliminary Stage 2 Detailed Analysis Framework

As part of Task 6, the research team set up a framework for the Stage 2 analysis of this project. The framework would enable the user to conduct a project level analysis, in addition to the network level analysis that is enabled as part of Stage 1. In addition, the framework would consider incorporating a detailed structural analysis and provide a more detailed description on how to estimate the distribution of overweight trucks on route segments of corridors that have not yet been legislated.

Chapter 1. Literature Review

1.1 History of OS/OW Regulation in the US

The United States has a long history of evolving truck size and weight regulations. There have been several changes to oversize and overweight (OS/OW) regulations for decades at the federal and state level, mainly since 1956. The first of such regulations was enacted in the Federal-Aid Highway Act of 1956, which established weight and size limits for trucks traveling on the Interstate System. The Act was amended in 1974, and the weight limits for trucks traveling on the Interstate System were increased, but the Act did not mandate state adoption of the amended weights. This resulted in some states refusing such increases, referred to as "barrier states," and the Surface Transportation Assistance Act (STAA) of 1982 expanded federal regulation over those states, and established minimum and maximum standards for weight and width, as well as minimum standards for length on the Interstate System and many Federal-Aid highways. The STAA also directed the Secretary of Transportation to designate a network of highways that would accommodate vehicles having size and weight standards that were established by the STAA, commonly referred to as the National Network. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 froze both the weight and length of combination vehicles. ISTEA froze the maximum weight of longer combination vehicles (LCVs), which were defined then as "any combination of a truck tractor and two or more trailers or semitrailers which operate on the National System of Interstate and Defense Highways with a GVW greater than 80,000 pounds." In addition, ISTEA included a freeze on the overall length of the multiple trailer units, when the cargo carrying units of the combination vehicles with two or more such units where one or both exceed 28.5 feet in length, on the National Network. The ISTEA freeze on both the weight and length of the combination vehicles are based on the weights in legal operation in a State on June 1, 1991. Moreover, the routes in effect on June 1, 1991, were also frozen for vehicle combinations subject to the freeze.

Table 1.1 summarizes the changes made by the aforementioned regulations regarding the size and weight of trucks.

In some cases, the new limits do not apply to certain states in which they are granted grandfather rights, whereby any existing regulations would still be applicable, despite the introduction of new truck size and weight limits. Three different grandfather rights provisions influence truck weight limits at the state level. The first was enacted in 1956 and deals with axle weights, gross weights, and permit practices. The second was adopted in 1975 and applies to bridge formula and axle spacing tables, while the third, which was enacted in 1991, ratified state practices with existing laws regarding LCVs, but froze further expansion of LCV operations in other US states.

It should be further noted that the Federal Highway Administration has provided additional guidance regarding permits for OS/OW vehicles that transport cargo considered to be a non-divisible load. In cases that sub-dividing OW cargo would damage the value of the cargo or require more than eight hours to dismantle a piece of machinery or equipment, a permit can be purchased to move the OS/OW load on the IH or National Highway System. Further, the FHWA has defined a sealed ocean container as a non-divisible load if the container is being transported in the course of international import/export trade. There is no national policy regarding permits for sealed ocean containers; rather, the FHWA indicates that each state may develop laws and rules regarding permits for sealed OW ocean containers based on that state's specific circumstances. Though forty-one states, counties, cities, and ports currently permit OW, sealed ocean containers for movement on the IH or National Highway System, Texas has no such legislation. HB3061, which was introduced during the 84^{th} Legislative Session, proposed new permit laws and establishment of OW container corridors in Texas; however, this Bill was not passed into law.

Table 1.1: History of Federal Truck Size and Weight Limits since 1956

	Federal-Aid Highway Act of 1956	**Federal-Aid Highway Act Amendments of 1974**	**STTA of 1982**	**ISTEA of 1991**
Maximum Width Limit	Not more or less than 96 inches	Not more or less than 96 inches	Not more or less than 102 inches (on 12-foot lanes)	
Maximum Length Limits			• On a semitrailer operating in any **truck tractor-semitrailer combination**: *not less than 48 feet* • On a semitrailer or trailer operating in a **truck tractor-semitrailer-trailer combination**: *not less than 28 feet*	Froze the weight and length of LCVs
Single-Axle Weight Limit	18,000 pounds	20,000 pounds	Mandated maximum limits on Interstates	
Tandem-Axle Weight Limit	32,000 pounds	34,000 pounds		
Gross Vehicle Weight (GVW)	72,280 pounds	80,000 pounds		

1.2 Current Federal Policy

Currently, the federally mandated maximum weights for the National System of Interstate and Defense Highways are as follows (23 CFR Part 658.17):

1. 80,000 pounds GVW
2. 20,000 pound single axle weight

3. 34,000 pound tandem axle weight

Federal weight compliance also includes considering axle spacing. The number and spacing of axles of the vehicle and the combined weight of the vehicle and load must be calculated when evaluating federal weight compliance in order to protect bridges. Therefore, a bridge weight formula is applied to commercial vehicles to determine their compliance with federal weight limits. The formula provides a means for determining if the weight on two or more consecutive axle-groups exceeds the limitations of the formula, except that two consecutive sets of tandem axles may carry a gross load of 34,000 pounds each if the overall distance between the first and last axle is 36 feet or more(FHWA, 2014). The bridge weight formula is:

$$W=500(LN/N-1 + 12N + 36)$$

Where:

- *W*=overall gross weight on any group of two or more consecutive axles to the nearest - 500 pounds.
- *L*=distance in feet between the extreme of any group of two or more consecutive axles, and
- *N*=number of axles in the group under consideration

The Federal government does not issue permits for OS/OW vehicles; the authority for that lies with the states. Each state has individual permitting programs for OS/OW vehicles that exceed the aforementioned federal and state size and/or weight limits. Significant variations exist among states in terms of policies and fees charged for vehicles that are above established size and weight limits. Permits may be issued by the states without regard to the axle, gross, or federal bridge formula requirements for non-divisible vehicles or loads(FHWA, 2015). For divisible loads, designated permits may be issued by the state based on the aforementioned grandfather rights, or congressional authorization for a state-specific commodity or route movement at a greater size or weight. States may also issue permits for single trips, multiple trips, or on an annual basis, and permits also authorize OS/OW vehicles to operate on specific routes on designated highways.

1.3 History of OS/OW Regulation in Texas

Truck size and weight, as well as OS/OW trucks, have been regulated in the state of Texas since 1929. Table 1.2 lists the major regulatory milestones. House Bill No. 583 was passed, amended articles 833 and 834 of the 1925 Texas Penal Code, and was later also later amended, authorizing the State Highway Commission to forbid the use of roads and bridges under certain circumstances. The statute allowed the state to set the maximum load permitted on highways and the times when their use would be prohibited.

Senate Bills No. 10 and 11 regulated the size, weight, and dimensions of vehicles using the public highways. The permitting system for the operation of OS/OW vehicles with GVW or size limits exceeding State Highway Department legal limits carrying non-divisible loads. On the other hand, SB 11 set the tolerances for weight and axles spacing for vehicles to operate on the public highways. HB 6, which was passed in 1929, set up within the General Laws of Texas the appropriation of funds for the construction, maintenance, regulation, and supervision of public highways through the distribution of vehicle license fees to the state and county highway funds for these activities.

Up until 1931, regulations mostly remained the same, with one amendment passed that year. Another amendment passed in 1949, followed by an amendment in 1951 that increased allowable GVW from 48,000 lbs to 58,240 lbs. Until 1971, regulations remained unchanged. Since 1971, the size and weight laws have been modified multiple times to include further regulations of OS/OW trucks, as well as the exemption of certain classes of vehicles, the introduction of the 2060 permit in 1989 and the 1547 permit in 1995, and changes regarding fees and payment for the Texas Permitting and Routing Optimization System (TxPROS) routing system. The majority of these cases have been linked to the maintenance and rehabilitation of the highway network, in addition to providing revenues for the issuance of permits and the inspection of loads by the Department of Public Safety and other law enforcement jurisdictions(CTR, 2012).

Table 1.2: History of OS/OW Regulation in Texas (CTR, 2012)

Bill No	Year	Major Components
HB 336	1931	Authorized Department of Highways to issue permits limited to periods of ninety days or less for transportation of OS/OW or overlength commodities that could not be reasonably dismantled and transport of super-heavy or oversized equipment. Authorized Department to designated county judges along with its designated agencies who were granted authority to issue such permits. Also authorized Commissioners Courts through the County Judges to issue permits for movement over the highways of their respective counties. Authorized Commissioner's courts to require a bond in amount sufficient to guarantee payment of any damages to road/bridge.
HB 465	1949	Applicant permit fee was augmented permit fee $5, single trip permit $5, $10 for permits not exceeding 30 days, $15 for permits not exceeding 60 days and $20 for permits not exceeding 90 days. This was to be deposited to State highway Fund.
SB 57	1951	Set the allowable GVW load limit to 58,420 lbs. based on the 1946 AASHO bridge formula. The GVW load limit was increased from 48,000 lbs. to encourage truckers to add an additional axle, thus reducing the number of OW axles. It was anticipated that the users would, as a result, use combination vehicles of four or more axles, and adding to the payload as a consequence, which would eliminate any OW axles.
HB 182	1971	Gave County Judges and Commissioner's Courts separate independent authority to issue permits. Gives authority to incorporated municipalities to regulate movement and operation of OS/OW or overlength commodities which cannot be reasonably dismantled.

Bill No	Year	Major Components
SB 351	1971	Authorized short-term movement of seasonal agricultural products to markets/point of sale that are of larger tonnage for one year. Permit fee was set as percentage of difference between regular annual registration and annual fee for heavier tonnage based on number of months requested.
SB 142	1973	Gave department authority to issue an annual permit with $50 fee for movement of unladen lift equipment motor vehicles that exceed maximum weight and width limitations.
HB 81	1977	Registration and width requirements for vehicles used to transport/spread fertilizer which includes agricultural limestone. Annual licenses fee for vehicle used exclusively for this purpose set at $50. Width requirements do not apply to vehicle registered that was 136 inches or less at its widest part.
HB 1121	1977	Authorized vehicles used exclusively to transport milk to use highways if distance between front wheel and forward tandem axle and rear wheel of rear tandem axle was at least 28 feet and maximum load carried on any group of axles does not exceed 68,000 pounds.
HB 638	1979	Authorized vehicles used to exclusively transport seed cotton modules to exceed limitation for length but may not exceed 48 feet, and to exceed limitations on weight provided load on any one axle cannot exceed 20,000 pounds and 44,000 pounds on a tandem axle. Required overall GVW to not exceed 64,000 pounds. Owner of vehicle with tandem axle weight greater than 34,000 ponds shall compensate state for all damages to highway caused by weight of tandem axle load.
HB 931	1981	---
SB 869	1981	Allows vehicle that does not exceed 100,000 pounds and is transporting grain to cross width of highway from private property to another private property. Requires agreement with Department to indemnify for cost of maintenance/repair for damage caused by vehicles crossing that portion of highway.
HB 691	1983	Further prohibits commercial vehicles of excessive weight from utilizing state-maintained highways inside incorporated city limits of cities over 1.5million in population.
HB 860	1983	Sets height limit for vehicles transporting cotton seed at fourteen feet six inches
HB 1114	1983	Extends the standard weight limits to state highways located in incorporated cities. Adds enforcement by municipal police offices from cities with a population greater than 1.5 million. Sets a stricter fine. Exempts loading of agricultural of forestry commodities prior to first processing of commodity.
HB 1601	1983	Amended definitions for truck-tractors to conform with federal states and amended various statutes to eliminate the prescribed limits for truck-tractor combinations and establish limits for lengths of trailers and semi-trailers.
HB 1602	1983	Amended VTCS Articles 6701d-11 and 6701d-11a to raise width limits and set lower limits on specially designated highways. Amended related statutes to confirm with federal laws.

Bill No	Year	Major Components
SB 1438	1983	Amended VTCS 6701-1/2 A by adding new language that prohibits manufactured housing from being moved over roads except in accordance with permits issued by Department. Local subdivisions were authorized to designate routes to be used within their boundaries but could not require additional fee or license.
HB 797	1985	Created system for OS/OW permits to be acquired by phone. Exempts oilfield equipment transportation vehicles from truck length limits. LBB estimated revenues losses from the highway fund of $5,860,000 each year for the five years post bill passage.
HB 1344	1985	Amends regulation to allow municipal police officers in cities with populations of 100,000 to enforce weight laws.
SB 1114	1985	Allowed dealers moving OS implements or husbandry to secure annual permits for $90. Authorized county Judge to issue annual permit.
HB14	1986	Amended Article 6701a to allow telephone permits for OS/OW vehicles.
HB 9	1987	Repealed Article 6701d-15 VTCS which set length of oil well service units that could be operated over state highways at 40 feet, so that these vehicles could now operate at limits of 45 feet.
HB 647	1987	Allowed courts to set a lesser fine than previously stipulated for violations of axle load if the gross weight limit is not exceeded.
HB 1646	1987	Amended Article 6701a by adding a new section on penalty provisions for offenses of provisions contained in the Act. Violations of the Act are misdemeanors.
HB 361	1989	Amended Article 6701d-11 to allow module haulers to transport cotton and equipment used in transport and processing of cotton. Deleted all axle load eight limits and required owner of vehicle with GVW over 59,400 pounds to compensate political subdivision for damages to roads and bridges caused by weight of load.
HB 1892	1989	Amends Article 6701d-11 to bring Texas length limits into compliance with federal statute that established a length limit of 59 feet for semi-trailers.
HB 2060	1989	
HB 490	1991	Amends 6701d-11 and 6675a-1 to change width requirements for vehicles transporting cotton or cotton related equipment. Provides for issuance of special license plates for these vehicles.
SB 944	1991	Amends 6701d-11 for vehicles loaded with timber, pulp. Wood chips, cotton, or agricultural product to have a defense to prosecution as long as they were not on a federal highway.
HB 1896	1993	Authorizes the Transportation Commission to enter into agreements with other states to issue permits (either for state or on behalf of other states) authorizing transportation of vehicles that exceed legal size/weight limitations.
HB 1345	1997	Authorizes TxDOT to issue an annual permit for movement of certain OS/OW vehicles. The bill sets out a set of load characteristics for safe travel on state highway system. Sets out how permits fees will be distributed to general revenue fund and to Fund 6.

Bill No	Year	Major Components
SB 1631	1997	Allows TxDOT to contract with 3rd party to act's as its agency for processing permit application and distribution. Allowed TxDOT to adopt rules prescribing payment method including use of electronic funds/credit cards. Requires that for a single trip the permit must state highways to be utilized but removed requirement for distance. Requires region/area over which equipment is operated to be stated on permit for multiple trips.
SB 1276	1997	Added new subchapter K to Chapter 623 Transportation Code for new optional procedure for permit issuance by port authorities in counties contiguous to Gulf of Mexico or a bay/inlet and bordering Mexico (i.e., Port of Brownsville). Stipulates elements required to be stated in the permit.
HB 1147	1999	Changes to lighting and flag requirements for vehicles with extended loads.
HB 1538	1999	Amended Transportation Code to allow motor carriers to acquire an annual permit to operate a super heavy or OS vehicle if it is properly registered. Eliminated department's reporting requirement on cumulative effects of permits issued on state highway system.
SB 844	1999	Authorizes cities with population of 50,000 or enforce to enforce weight standards in city limits.
SB 934	1999	Requires statement on cargo being transported over SH 48 and 4 between Port of Brownsville and International Bridge
HB 3467	1999	Amended the disposition of proceeds of fines if they occurred within 20 miles of an international border – providing that entire amount shall be deposited for purpose of road maintenance in municipal treasury if fine imposed by municipal court and county treasury if by justice court.
HB 1679	2001	Provides that tow truck operators are not required to obtain a permit to exceed vehicle weight limitations if town truck provides services necessary to remove disabled, abandoned or accident damaged vehicle, and is towing to nearest authorized place of repair, termini, or storage.
SB 545	2001	Requires that holder of 2060 permits can operate a vehicle on country road or bridge of a county designated in permit application only with approval of county judge or their appointee. Increased fees associated with this permit.
SB 886	2001	Major updates to various provisions of size and weight restrictions that had some provisions dating back to 1930s to reflect current practices.
SB 889	2001	Amended some provisions concerning bonds for carriers who are exempt from the 2060 permit requirement but are required to have a $15,000 bond (concrete, solid waste and recyclable material haulers). It requires that copy of bond be carried in vehicle when it is on a public highway and must be presented to an officer authorized to enforce these provisions.
SB 20	2003	Provides for operational procedure for permit issuance by Victoria County Navigation District for movement of OS/OW loads on state highways located in the county using FM 1432 to and from Victoria Barge Canal up to but not past intersection with SH185

Bill No	Year	Major Components
SB 1748	2003	Amended date for continuation of law authorizing issuance of OS/OW vehicle permits by certain port authorities to June 1, 2007.
HB 1044	2005	Provides operational procedure for permit issuance by Chambers County for movement of OS/.OW vehicles in the county. Permit issued under this chapter can only be used on FM1405, frontage road of SH99 located in a specific business park for movement of cargo weighing less than 100,000 pounds. County can collect fee – not to exceed $80
SB 737	2005	Amended jurisdictional authority relating to prosecution of offenses.
SB 1641	2005	Continuation of law relating to issuance of permits by port authorities for 2 more years till 2009.
HB 2093	2007	Authorizes TxDOT to revoke motor carrier registration for violating certain provisions of statute regarding OW, or for not paying penalties imposed. Set out new hearing process and eliminated different hearing processes based on type of violation. Provides for penalties and revocations for OW/OS permit violations. Authorized TxDOT to investigate and impose sanctions on shippers who provide false information.
HB 4594	2009	Amendment to Transportation Code to movement of OS/OW cargo in Chambers County. Added FM 565 from intersection with FM1405 for approximately 6200 linear feet, added FM2354 from intersection with FM1405 for approximately 300 linear feet.
SB 1571	2009	Authorized port of Corpus Christi to issue permit for OS/OW vehicles on roadway owned by port.
SB 1373	2009	Amendment to Transportation Code for fees collected under the subsection – these less administrative costs can be used for maintenance and improvement of the state highways listed within the chapter, and the administrative costs, which may not exceed 15% of fees collected may be retained by the port authority.
SB 274	2013	Amendment to Transportation Code to add more routes to Chambers County OS/OW routes
HB 474	2013	Established multiple routes that the Hidalgo RMA is authorized to establish OS/OW permits for vehicles not exceeding 125,000 pounds. The fees cannot exceed $80, with a maximum of 15% of the revenue made available for administrative costs, and the rest for the maintenance of the designated roadways.
HB 3125	**2013**	For a permit issued by a port authority in a county that borders the United Mexican States, the commission, with the consent of the port authority, shall designate the most direct route along specified roadways.
SB 1059	**2015**	Amends the Transportation Code to provide an optional procedure for the issuance of permits for the movement of OS/OW vehicles carrying cargo on certain roads in San Patricio and Nueces Counties.
HB 2861	**2015**	Allows the City of Laredo in Webb County to issue OS permits to trucks carrying cargo in the City not exceeding 125,000 lbs on specific roads. The city cannot charge more than $200 for a permit and the permit fee can be adjusted each year using the CPI index from the previous year. Administrative costs cannot exceed 15% of the collected fees.

Source: Adapted from Walton et al., 2012

1.4 Current Policy in Texas

Texas issues more OS/OW permits than any other state. In the past few years the majority of permits have been issued for the oil and gas industry. Figure 1.1 illustrates the industry trends for permits for the 2013 Fiscal Year.

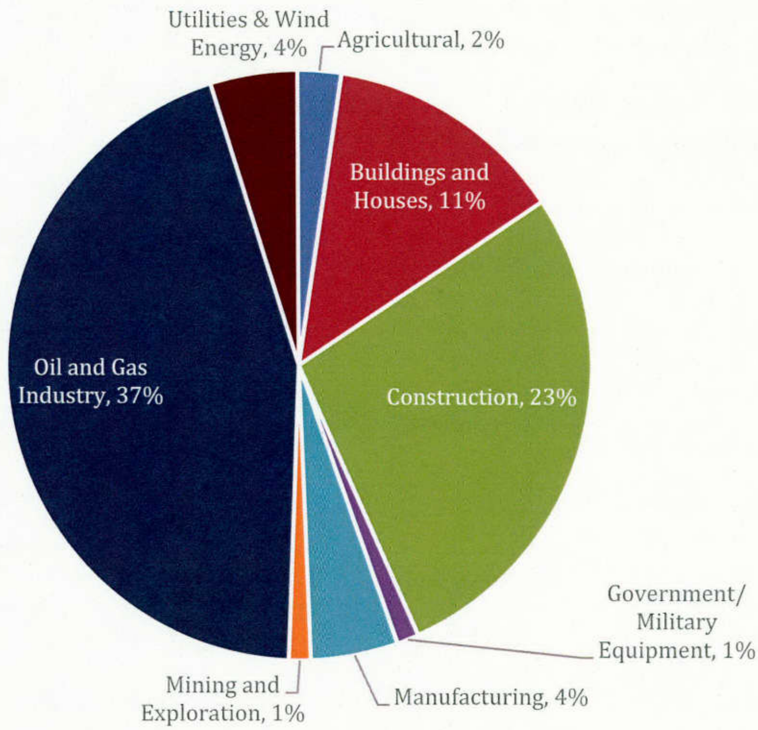


Figure 1.1: Permit Issuance Industry Trends FY 2013

Currently, the maximum vehicle weight, length and width dimensions that vehicles are authorized to operate on Texas's highways without OS/OW permits are detailed in the following subsections.

1.4.1 Width

Current width limits for Texas can be seen in Table 1.3. Width is measured from the outside points of the widest extremities, excluding safety devices.

Table 1.3: Legal Width Limits for Operation on Texas Highways (CTR, 2012)

Explanation	Measurement
Legal width limit	8', 6" (102")
Maximum width permitted on holidays	14', except for manufactured housing
Maximum width permitted on controlled access highways* (Interstate Highway System)	16', except for manufactured housing
Maximum width permitted without route and traffic studies and certification by applicant on file	20'
Maximum width permitted for new houses	34'
Maximum width permitted for existing houses	40'
Maximum width permitted for new tanks	34'
Maximum width permitted for existing tanks	40'
Maximum width permitted for portable buildings	No limit
Maximum width permitted for manufactured housing	No limit

Note* *Controlled access highways are those highways that must be entered from an access road, not from a stop sign. Traffic can cross the highway only by way of an overpass or underpass. Controlled access highways are usually considered to be the Interstate Highway System.*

- One escort is required for all loads exceeding 14' up to 16' wide. Two escorts are required for all loads exceeding 16' wide. The escort must precede the load on a two-lane highway to warn oncoming traffic of the approaching overwidth load. The escort must follow the load on a roadway of four or more lanes to warn approaching traffic of the overwidth load ahead.
- Loads exceeding 20' in width must physically inspect a proposed route and certify to the Motor Carrier Division by letter of facsimile that the overwidth load can safely negotiate the route.
- There are special requirements for manufactured housing.

1.4.2 Height

Height limits that are currently allowed on roads in Texas are included in Table 1.4.

Table 1.4: Legal Height Limits for Operation on Texas Highways (CTR, 2012)

Explanation	Measurement
Legal height limit	14'
Maximum height permitted on holidays	16'
Maximum height permitted without a route and traffic study and route certification by applicant on file	less than 19'
• One escort is required for loads exceeding 17' in height. The escort must be equipped with a height pole to accurately measure overhead obstructions. • Front and rear escorts are required for loads exceeding 18' in height. • Loads 19' or higher must physically inspect a proposed route and certify to the Motor Carrier Division by letter or facsimile that the overheight load can safely negotiate all power, communication, and cable television lines, and all other low vertical obstructions.	

1.4.3 Length

As previously mentioned, there are no federal regulations for the maximum lengths of vehicles allowed on roadways. States establish such limits, and those legally allowed on Texas's roadways are summarized in Table 1.5.

Table 1.5: Legal Length Limits for Operation on Texas Highways (CTR, 2012)

Vehicle Type	Legal	Maximum
Truck or single vehicle	45'	75'
Truck and trailer combination	65'	
Commercial truck and stinger-steered semi-trailer combination transporting automobiles or boats	75'	
Combinations such as truck, travel trailer & boat or motor home, boat and towing a car	65'	
Truck-tractor	unlimited	unlimited
Truck-tractor combination	overall unlimited, trailer limited to 59'	
Semitrailer		
Single unit	59'	
2 trailers	28', 6"	
Front overhang	3'	25'
Rear overhang	4'	30'
Maximum overall length		unlimited
Maximum length permitted without route and traffic study and route certification by applicant on file	125'	125'

One escort is required for loads exceeding:

- 110', but not exceeding 125' long
- 20' front or rear overhang

Front and rear escorts are required for loads exceeding 125' in length.

NOTE: The overall length indicated on the permit includes any overhang, but the amount of the overhang must be noted on the permit.

1.4.4 Weight

The weight limits of vehicles that are allowed to operate on roadways in Texas are in line with federal regulations and are summarized below.

- GVW: 80,000 pounds
- Single axle: 20,000 pounds

- Tandem axle group: 34,000 pounds
- Triple axle group: 42,000 pounds
- Quad axle group: 50,000 pounds

Each of the 25 TxDOT multi-county districts, however, has specific restrictions on the length, width, and weight of vehicles. These restrictions determine which loads are allowed to pass on certain routes within each district in Texas.

1.5 OS/OW Permits in Texas

Vehicles that exceed the size and weight limits detailed above must apply for an OS/OW permit. The current 27 different OS/OW permits authorized in Texas include the following:

- General Single Trip
- Crane and Well Servicing Unit Mileage
- Manufactured Housing – Single Day
- Portable Buildings
- Super-heavy
- Multi-State (WASHTO)
- House Move
- Self-Propelled Off Road Equipment
- Temporary Registration
- 30/60/90 Day Width or Length
- Company Specific Envelope
- Vehicle Specific Envelope
- Fracking Trailer
- Hay
- Quarterly Hubometer
- Implements of Husbandry
- Manufactured Housing – Annual
- Mobile Crane – Annual
- Well Servicing Unit – Annual
- Over Axle / Over Gross Weight Tolerance

- Rig-Up Truck
- Utility Pole
- Water Well Drilling Machinery & Equipment
- Annual Timber Permit
- Ready-Mixed Concrete Trucks
- Annual Length Permit
- Emergency Relief Permit

Since 1989, Texas has issued an annual over-axle/over-GVW tolerance permit as authorized by HB 2060 and later amended by HB1547 to restrict 84,000 lbs tractor-semi trailers from operating on load zoned bridges. The over-axle/over-GVW tolerance permit is an annual permit that allows an additional 5% gross weight and 10% axle weight above the maximum allowable weights that would otherwise apply to the vehicle. For these vehicles, the permit allows a gross weight of 84,000 lbs. (5% above 80,000 lbs.). The 2060/1547 permits are for divisible loads such as gravel, petroleum waste, sand, etc., which cannot legally be operated on the Interstate Highway system. Under the statute(s), the vehicle operator must pay a base fee of $90, and an administrative fee of $5, as well as a fee based on the number of counties in which the vehicle will operate in addition to posting a $15,000 bond. Box 1 provides the current fees for the different counties.

Box 1: Current Fees

Number of Counties	Fee
1-5	$175
6-20	$250
21-40	$450
41-60	$625
61-80	$800
81-100	$900
101-254	$1,000

In addition, current Specialty Permits issued include the following:

- 30/60/90 day permits
- Company specific envelope
- Fracking trailer
- Hay
- Quarterly hubometer
- Implements of husbandry
- Manufactured housing
- Mobile crane (unladen lift equipment)
- Oil well servicing unit

- Over-axle/over gross weight tolerance (2060/1547 permit)
- Rig-up truck
- Utility pole(s)
- Vehicle specific envelopes
- Water well and drilling machinery and equipment

Texas has also been challenged with routing OS/OW loads on its highway network to ensure the safety of the traveling public as well as the protection of the infrastructure. Development of the Eagle Ford Shale Play of South Texas meant that many inadequate roads would have to sustain the heavy loads of trucks transporting oil and gas related material. As a result, highways that were built decades ago, without shoulders, fell apart and crash rates increased significantly(Maj. Chris Nordloh, 2014).

In Texas, the Motor Carrier Division will designate the most practical route available to the permitted vehicles. This is done by taking into consideration the size and weight of the loads, highway geometric characteristics, and traffic levels. As mentioned previously, House Bills 3125 and 474 established OW corridors within Brownsville and Hidalgo County, respectively.

A report prepared by C&M Dannenbaum in 2013 included an analysis of the choice of routes by shippers across Hidalgo County RMA's point of entry bridges. The study was aimed at forecasting future traffic growth, and their distribution, across the three bridges within Hidalgo County RMA's area. Establishing origin destination pairs for current truck movement, and estimating that future traffic would be distributed according to the routes that would have the shortest travel time, was the method adopted for forecasting the distribution of the excess vehicles across the three bridges.

In a presentation prepared by the South Texas Manufacturers Association (STMA) for the City of Pharr in 2013, certain routes were identified, including OW routes, for the transport of vehicles to and from Mexico. Pharr International Bridge is one of busiest commercial ports of entry (POEs) in the United States, with a considerable number of OS/OW vehicles traveling across it. Specific routes were proposed within Hidalgo County, for vehicles traveling from the Pharr International Bridge, and an OW corridor was also proposed by the STMA(STMA, 2013). In addition, the report mentioned that when a major storm blocked passage along the international bridge between Laredo and Mexico, traffic was diverted onto the Pharr International Bridge, indicating a need for considering OS/OW corridors in terms of alternate routes for OS/OW vehicles.

1.6 Ports Legislation

1.6.1 Port of Brownsville (PoB)

Legislation

In Texas, several coastal and POE corridors have been permitted by legislation to allow the movement of OS/OW vehicles. Senate Bill 1276 provides procedures for the issuance of OS/OW permits by port authorities. The Bill authorizes port authorities to issue permits for the operation of OS/OW vehicles on state highways in counties adjacent to the Gulf of Mexico and bordering Mexico. In addition, the Bill includes specifications for permits issued by the Port of Brownsville (PoB), and it specifies that the cargo should be transported over the most direct route from the Gateway International Bridge to the entrance of the PoB using State Highway 48/State Highway 4. This route is highlighted in the image shown in Figure 1.2.

Figure 1.2: PoB Corridor

House Bill 3125 was enacted in order to address the need of an additional OS/OW route to the entrance of the PoB. The Bill specified the most direct route between the Free Trade International Bridge to the entrance of the PoB, traversing on portions of FM 509, US Highways 77, and 83, FM 511, State Highway 550, and State Highway 32. These routes require permits for the movement of OS/OW vehicles. Figure 1.3 shows the current existing permissible routes in addition to the suggested routes by HB 3125.

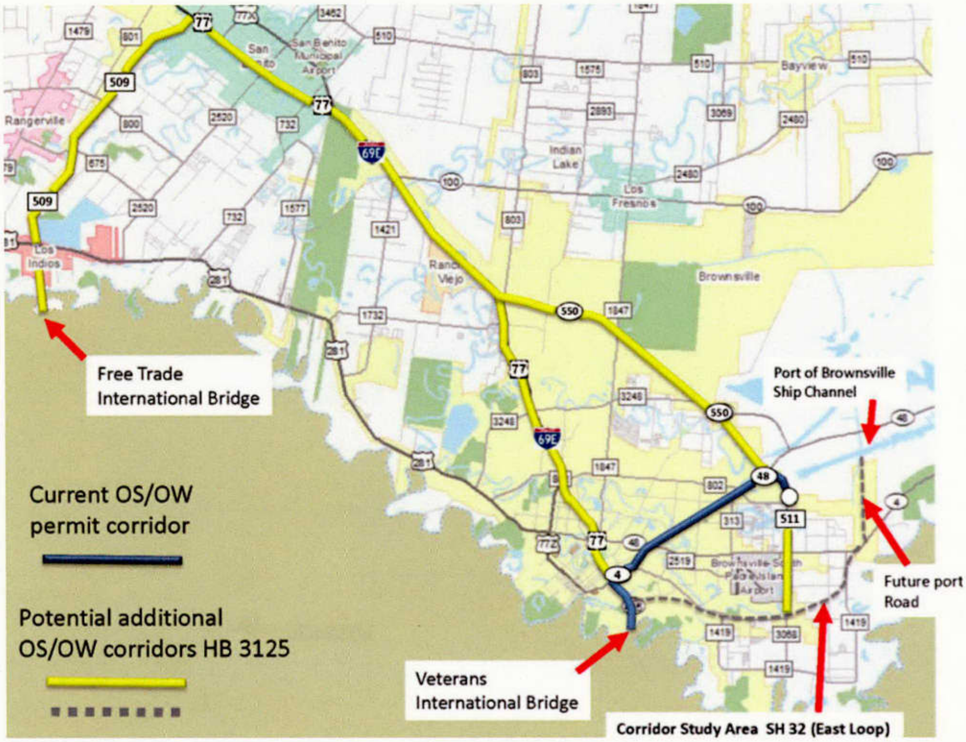


Figure 1.3: Additional OW Corridor in Brownsville

Allowable Truck Size and Weight

The Transportation Code, Chapter 623, states that the PoB may issue permits to vehicles that adhere to the maximum permit weight limits. To be eligible for a permit, first, an axle group must have a minimum spacing of four feet between each axle in the group, measured from center to center, to achieve the maximum permit weight for the group. Second, two or more consecutive axle groups must have an axle spacing of 12 feet or greater, measured from the center of the last axle in the preceding group to the center of the first axle of the following group, for each group to be eligible to be permitted for maximum permit weight. Third, the maximum permit weight for an axle or axle group is either 650 pounds per inch of tire width or the axle or axle group weights listed in Table 1.6, whichever is the lesser amount.

Table 1.6: Weights on Axle Configurations Allowable in Brownsville Corridors

Axle Configuration	Maximum Permit Weight
Single Axle	25,000 pounds
Two Axle Group	46,000 pounds
Three Axle Group	60,000 pounds
Four Axle Group	70,000 pounds
Five Axle Group	81,400 pounds
Trunnion Axles	60,000 pounds*

*If:

- The trunnion configuration has two axles
- There are a total of 16 tires for a trunnion configuration
- The trunnion axle is 10 feet in width

Permits

The PoB has authorized around 30,000 permits each year since 1997, at a cost of $30 per permit. The revenue generated from the permits sold go to funding highway maintenance (85%) as well as covering administrative processing fees (15%). Since 2007, the PoB has issued around 242,000 permits, generating an estimated $7.3 million in revenue, of which around $1.1 million were used to cover administration fees, while the remaining $6.2 million were transferred to TxDOT's Fund 6 to cover roadway maintenance costs.

Based on a sample of 742 permits sold between 2011 and 2012, the most common cargo category carried by PoB permitted trucks is petroleum products, representing around 44% of total permits sold. Around 20% of permits were sold to trucks carrying steel and building materials, while around 13% of permits were sold to trucks transporting aggregate, sand, and ore, with a similar percentage issued to trucks hauling oilfield equipment.

In general, along the PoB OW corridors, and based on a review of about 1,000 permits, about 90% of trucks operating along the SH 4 / SH 48 corridor have shorter inner and outer bridge lengths than the Federal legal limits (51' outer bridge and 36' inner bridge). This means that the researchers expect higher bridge consumption rates for the same axle and GVWs than would have occurred if the trucks were configured with legal inner and outer bridge spacing. Among the vehicles transported along the PoB corridors, the majority are Class 9/5-axle trucks, and Class 10/6-axle trucks, with the Class 9 trucks being more common.

1.6.2 Port of Freeport

Legislation

House Bill 1305 also addresses OS/OW routes that could be traversed by vehicles that obtain permits from counties adjacent to one or two counties having a population of at least 550,000. The routes lead to the entrance of the Port of Freeport, and oblige the vehicles to travel on the most direct routes. The specified routes include sections of the following roadways: FM Roads 523 and 1495 and State Highways 288 and 332. Figure 1.4 illustrates the permissible routes according to HB 1305.

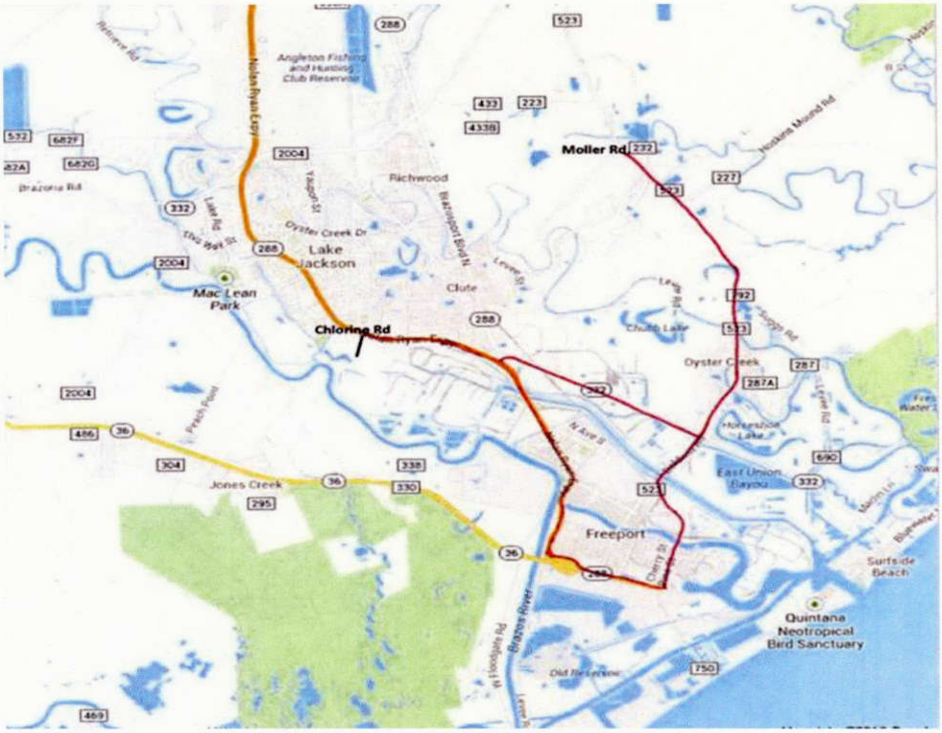


Figure 1.4: Port of Freeport OW Corridors

Allowable Truck Size and Weight

The vehicles that will be permitted by the Port of Freeport are allowed to travel no certain designated routes, as indicated in the above figure. The vehicles must not exceed the lesser value between the Mexican Legal Weight Limit and 125,000. The dimensions of the permitted vehicles and loads must not exceed 12' wide, 15'6" high, or 110' long. The maximum permit weight for an axle or group is the weight computed by multiplying 650 pounds times the total number of inches of the width of tires on the axle or group, or the values in Table 1.7, whichever is less.

Table 1.7: Weights on Axle Configurations Allowable in Freeport

Axle Configuration	Maximum Permit Weight
Single Axle	25,000 pounds
Two Axle Group	46,000 pounds
Three Axle Group	60,000 pounds
Four Axle Group	70,000 pounds
Five Axle Group	81,400 pounds
Trunnion Axles	60,000 pounds*

*If:

- The trunnion configuration has two axles
- There are a total of 16 tires for a trunnion configuration
- The trunnion axle is 10 feet in width

Permits

As mentioned earlier, the Port of Freeport has the authority to issue permits for the travel of OW vehicles along specific roadways. The Port sells permits for $30, of which it is allowed to retain 15% to cover administrative processing costs. The Port has sold only 15 permits in total, however, and is therefore considered an inactive port in terms of issuing permits for OW vehicles.

1.6.3 Hidalgo County

Legislation

House Bill 474 specifies OS/OW routes in Hidalgo County (Figure 1.5). The permitted routes include sections of the following roadways: US Highway 281; State Highway 336; FM Roads 396, 1016, and 2061; Trinity Road; Spur 29; and Doffin Canal Road. The maximum allowed vehicle weight along the specified routes cannot exceed 125,000 pounds, according to HB 474. The Bill also specifies that the maximum fee allowed to be charged is $80, with a maximum of 15% of that fee allotted for administrative fees.

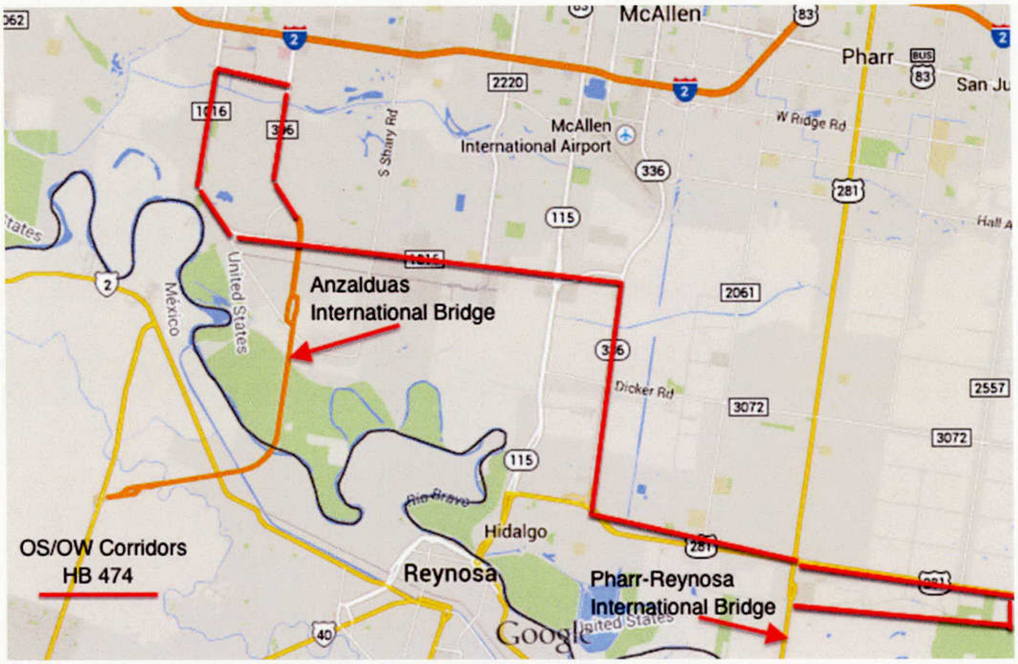


Figure 1.5: Hidalgo OW Corridors

Allowable Truck Size and Weight

Similar to the PoB and Port of Freeport, the Hidalgo County Regional Mobility Authority (RMA) is authorized to issue permits for vehicles that are allowed to travel on certain designated routes, as indicated in the above figure. The vehicles must not exceed the lesser value between the Mexican Legal Weight Limit and 125,000. The dimensions of the permitted vehicles and loads must not exceed 12' wide, 15'6'' high, or 110' long. The maximum permit weight for an axle or group is the weight computed by multiplying 650 pounds times the total number of inches of the width of tires on the axle or group, or the values in Table 1.8, whichever is less.

Table 1.8: Weights on Axle Configurations Allowable in Hidalgo County

Axle Configuration	Maximum Permit Weight
Single Axle	25,000 pounds
Two Axle Group	46,000 pounds
Three Axle Group	60,000 pounds
Four Axle Group	70,000 pounds
Five Axle Group	81,400 pounds
Trunnion Axles	60,000 pounds*

*If:

- The trunnion configuration has two axles
- There are a total of 16 tires for a trunnion configuration
- The trunnion axle is 10 feet in width

Permits

The Hidalgo County RMA was recently established as an active OW permitting authority. Hidalgo County RMA has currently sold around 270 OW permits a year, priced at $80 each. The total revenue generated through the issuance of permits is estimated to be around $21,600, with 15% of that value retained to cover administration processing costs, and the remainder paid to TxDOT to cover the maintenance of the roadways. Currently, all permits issued are for produce, fruit, and juice.

Reasons for Establishing the Corridor

Currently, the Pharr Bridge, located in Hidalgo County, is seventh busiest bridge in the country, and the fourth on the southern border with Mexico. In a study conducted by C&M Dannenbaum in 2013, the border crossing trends in Hidalgo County, to and from Mexico, were detailed. It was indicated that, overall, South Texas is transforming into the primary entry point for Mexican produce into the US, accounting for around 40% of all Mexican produce imports in the first quarter of 2012. In addition, both Hidalgo and Cameron counties have seen an increase as high as 40% over the past five years in imported produce from Mexico, showing their importance as POEs to Mexican produce.

The import of fresh fruits and vegetables from Mexico into the US accounted for almost 30% of all imported fruits and vegetables during the first quarter of 2013. The POEs of Nogales, Pharr, and Laredo have received the majority of the agriculture imports. The growth rate in monetary value of imported agriculture products at the Pharr POE, situated in Hidalgo County, has increased significantly over the past decade, increasing the importance of agriculture products for the Pharr POE. The share of agriculture products at Pharr was estimated at 53% by weight in 2012, a noticeable increase from the 35% share estimated in 2007.

The construction of the Durango-Mazaltan highway in Mexico will provide a direct route between Mexico's western regions and South Texas, which will encourage Mexican producers to export more produce through South Texas, rather than Nogales, Arizona, due to the shorter route to the Northeast of the US. Therefore, an increase in the number of Mexican vehicles crossing into Texas is expected. Currently, in Mexico trucks are allowed to operate with weights reaching 125,000 lbs. GVW, significantly greater than the 80,000 lbs. allowed in the US. For this reason, Mexican shippers usually stop at the Mexico-Texas border, unload cargo to reduce the weight to allowable levels, and then continue into the US. This routine has proven to be costly to shippers, due mainly to the reduction in quality of the produce, especially on hot days. Therefore, especially with the increased number of trucks expected to cross through POEs in South Texas, among them are those in Hidalgo County, a need was established to determine an OW corridor in Hidalgo County that would allow vehicles carrying over 80,000 lbs. in weight to travel in Texas. HB 474 addresses that concern, and the recent establishment of the OW routes in Hidalgo County will aim to decrease the burden on produce shippers who have previously had to stop in Mexico, before reaching the US border, to unload OW cargo.

1.6.4 Corpus Christi

Legislation

HB 2604 authorizes the Port of Corpus Christi Authority to issue permits for the movement of OS/OW vehicles on state highway special freight corridors in San Patricio County, and therefore amends the Transportation Code to provide this optional issuance of a roadway permit. SB 1059, passed during the 84th Legislative session, further amends the Transportation Code to provide an optional procedure for the issuance of permits as follows: the Port of Corpus Christi Authority may issue permits for the movement of OS/OW vehicles carrying cargo on certain roads in San Patricio and Nueces Counties. The permits may be issued on the following roadways: US 181 between its intersection with Burleson Street in the City of Corpus Christi and its intersection with County Road 3567 in San Patricio County; SH 35 between its intersection with Burleson Street in the City of Corpus Christi and its intersection with FM 3512; SH 361 between its intersection with SH 35 and its intersection with FM1069 in the City of Ingleside; and proposed SH 200 between its intersection with SH 361 and its intersection with FM 1069 in the City of Ingleside (provided that SH 200 is constructed).

1.6.5 Chambers County

Legislation

HB 1044 in the 79th Legislature amended Subchapter M of Chapter 623 of the Transportation Code to authorize Chambers County to issue OS/OW permits for vehicles with GVWs of up to 100,000 pounds along certain roadways. SB 274 in 2013 defines the permissible routes in Chambers County, and they include sections of the following roadways: FM Roads

1405, 565, and 2354, and a section the frontage road of State Highway 99. Chambers County, however, has opted not to use its existing authority to issue OS/OW permits. Therefore, Chambers County is currently inactive in terms of issuing OW permits.

Allowable Truck Size and Weight

Chambers County has similar truck and weight size regulations as that of the PoB, detailed earlier. To be eligible for a permit, first, an axle group must have a minimum spacing of four feet between each axle in the group, measured from center to center, to achieve the maximum permit weight for the group. Second, two or more consecutive axle groups must have an axle spacing of 12 feet or greater, measured from the center of the last axle in the preceding group to the center of the first axle of the following group, for each group to be eligible to be permitted for maximum permit weight. Third, the maximum permit weight for an axle or axle group is either 650 pounds per inch of tire width or the axle or axle group weights listed in Table 1.9, whichever is the lesser amount.

Table 1.9: Weights on Axle Configurations Allowable in Chambers County

Axle Configuration	Maximum Permit Weight
Single Axle	25,000 pounds
Two Axle Group	46,000 pounds
Three Axle Group	60,000 pounds
Four Axle Group	70,000 pounds
Five Axle Group	81,400 pounds
Trunnion Axles	60,000 pounds*

*If:

- The trunnion configuration has two axles
- There are a total of 16 tires for a trunnion configuration
- The trunnion axle is 10 feet in width

1.6.6 Victoria County

Legislation

SB 20 authorizes the Victoria County Navigation District to issue permits for the travel of OS/OW vehicles on state highways in Victoria County. The Bill states that the OS/OW vehicles may only travel to and from the Victoria Bridge Canal using FM 1432, and may not be transported over State Highway 185. Currently, the Victoria County Navigation District is inactive in terms of issuing OW permits.

1.6.7 City of Laredo

Legislation

HB 2861 was passed during the 84th Legislative session to allow the City of Laredo, in Webb County, to issue OS/OW permits to trucks carrying cargo in the City, not exceeding 125,000 pounds. The City may issue permits to vehicles to operate on the following roads in Webb County: FM 1472 between its intersection with State Highway Loop 20 and the northeast of its intersections with the World Trade Center Loop; FM 1472 between the northernmost of its intersections with World Trade Center Loop and its intersection with Hachar Loop (provided that the Hachar Loop project is constructed); Hachar Loop between its intersection with FM 1472 and its intersection with IH 35 (provided that the Hachar Loop project is constructed; and Beltway Parkway between its intersection with Hachar Loop and its intersection with IH 35 (provided that the Hachar Loop project is constructed).

The Bill states that the City may charge a fee that should not exceed $200 for a permit issued to an OS/OW vehicle. Furthermore, the City can adjust the maximum fee on September 1 of each year to reflect the change in percentage of the Consumer Price Index for all Urban Consumers (CPI-U), US City Average, in the previous year. The permit fee can be used only for the operation and maintenance of the aforementioned roadways, and to cover the administrative costs of the City of Laredo, which may not exceed 15% of the collected fees.

1.7 Vehicle Weight and Size Limits

In 43 Texas Administrative Code, Chapter 28 specifies rules and regulations of OS/OW permits. The Code indicates that the fee for a single trip permit, not exceeding 80,000 pounds, is $60. In addition, highway maintenance fees are required to be paid, according to the structure in Table 1.10.

Table 1.10: Texas Weight Permit Fees

Gross Weight in Pounds	Highway Maintenance Fee
80,001-120,000	$150
120,001-160,000	$225
160,001-200,000	$300
200,001-above	$375

To be eligible for a permit, first, an axle group must have a minimum spacing of four feet between each axle in the group, measured from center to center, to achieve the maximum permit weight for the group. The maximum permit weight for an axle group with spacing of 5 or more feet between each axle will be based on an engineering study conducted by the Motor Carrier District (MCD).

Furthermore, two or more consecutive axle groups must have an axle spacing of 12 feet or greater, measured from the center of the last axle in the preceding group to the center of the first axle of the following group, otherwise a reduction of 2.5% will be made on each foot less than 12 feet. Additionally, an over-dimensional load may not exceed the manufacturers' rated tire carrying capacity.

Finally, the maximum permit weight for an axle or axle group is either 650 pounds per inch of tire width or the axle or axle group weights listed in Table 1.11, whichever is the lesser amount.

Table 1.11: Weights on Axle Configurations Allowable in Texas

Axle Configuration	Maximum Permit Weight
Single Axle	25,000 pounds
Two Axle Group	46,000 pounds
Three Axle Group	60,000 pounds
Four Axle Group	70,000 pounds
Five Axle Group	81,400 pounds
Six or more Axle Group	Determined by the MCD based on an engineering study of the equipment, which will include the type of steering system used, the type of axle suspension, the spacing distance between each axle, the number of tires per axle, and the tire size on each axle
Trunnion Axles	60,000 pounds*

***If:**

- **The trunnion configuration has two axles**
- **There are a total of 16 tires for a trunnion configuration**
- **The trunnion axle is 10 feet in width**

The MCD may permit axle weights greater than those specified above, for a specific permit request, based on an engineering study of the routes and hauling equipment.

1.8 Other Literature

The establishment of OS/OW corridors in several states has been a priority to state DOTs. The Wisconsin Department of Transportation (WisDOT) initiated a process in 2012 to establish the Multimodal Freight Network (MFN), a network of transportation facilities important to freight movement in Wisconsin. The establishment of the network began by identifying tonnage, value, and regional significance profiles of commodities and identifying the freight routes they will traverse, such as highways and railroads. Moreover, WisDOT was able to identify the location of the state's largest shippers and receivers, enabling them to create industry specific maps showing the routes used to ship their commodities. These processes have enabled WisDOT to set the first steps in establishing the Multimodal Freight Network.

The New Jersey Department of Transportation (NJDOT) initiated the Portway Phase I study in 1996 to establish a dedicated road network to accommodate OS/OW trucks. A corridor, the Portway Phase I Corridor, was established to serve the Newark/Elizabeth Seaport complex and major rail and trucking distribution facilities throughout the region. In 2003, NJDOT initiated another study, called the Portway Extensions Concept Development Study, which expanded the study area to encompass five counties in New Jersey. The main purpose of this study was to identify goods movement issues and recommend extensions that facilitate the movement of goods from the state's ports to their destinations. The study aimed at identifying the existing and future container movements to, from, and through the study area, in order to relieve the congestion along the existing Portway corridor and in order to meet growing future demand.

In 2009, Oregon explored the option of establishing truck-only toll (TOT) lanes that would allow LCVs to travel across highways safely, reducing congestion, and attempting to minimize the impact of truck impacts on the built environment. In addition, the lanes would enable trucks to reach their destinations faster, enhancing their productivity. The lanes would be built up to specific standards that would allow heavy vehicles to operate, while toll revenues would cover their operations, maintenance, and capital costs(ODOT, 2009).

In a study conducted by the Center for Urban Transportation Research (CUTR) at the University of South Florida in 2005, a process for designating specific highway sections for truck only usage was detailed. The method for identifying highway corridors for truck movement between cities took included the weighted average of the percentage of trucks of total traffic, segments that have high volume of trucks and truck crashes, level of service, and percent of trucks. Another method for the designation of corridors for travel within cities was also established, and took into consideration the level of service, truck volume, percent of trucks, truck crash rates, distance to truck terminals and transfer facilities, airports, and seaports. The study concluded that most of Florida's Interstate System was suitable for the creation of exclusive truck facilities, with the construction of new lanes being a preferred option to "taking" lanes from existing users.

1.9 Review of Safety Literature related to OW Trucks

While increasing limits on truck weight and size provides opportunity to improve productivity, past studies have shown concerns on the potential adverse impacts, including safety as one of the biggest concerns. Generally, OW trucks require more braking capacity, and their braking performance and stopping distance differs from regular vehicles, especially for down-hill slopes. Heavier truck may have a higher center of gravity and thus increasing the risk of rollover. Heavier and larger trucks can cause greater interference with other traffic because of their different operational characteristics. Additionally, heavy truck involved crashes, especially those involving other vehicles, are more likely to result in serious injury and fatality as the kinetic energy of a heavier truck is higher at any given speed (Desk scan, NCFRP 500). According to the National Highway Traffic Safety Administration, large trucks make up just 4% of all registered vehicles in the US and 7% of all vehicle miles traveled (VMT), but are involved in 11% of all crash fatalities (BND, 2012).

A number of efforts have been made to investigate the safety impacts of truck weight and size in the US. There are three recent reviews of research on truck size and weight issues, including safety. The Directory of Significant Truck Size and Weight Research (2011) provided a summary of significant research related to large truck size and weight to support decision-makers. This report reviewed a broad range of topic areas not only on safety of heavy trucks, but also infrastructure, pavement, highway geometrics, enforcement and related issues.

AASHTO (2009) studied the relationship between vehicle safety and crash causation factors for OS/OW commercial vehicles. The analyses was conducted based on a review of over 100 research reports and journal articles, and over 50 interviews with heavy truck agency, industry and enforcement officials. The major findings includes 1) generally, crash rates decrease but crash severity increases as the size and weight of a commercial vehicle increase, 2) among the reviewed research, there is inconsistency regarding either a positive or negative relationship between larger/heavier vehicles and safety, suggesting that additional research is needed, 3) the existing truck crash data sets are not sufficient to conduct scientific analysis of the contributions of size and weight to crash causation or severity.

The MAP-21 Truck Size and Weight Safety Desk Scan (2013) provides a comprehensive review of current state of the art regarding this subject. This report focuses on reviewing data and methodologies that have been employed to analyze truck size and weight related safety issues. The following are highlights from the findings of the desk scan.

In general, two main approaches have been used to investigate the relationship between road safety and truck size and weight. The first approach assesses the safety impact by examining how increases in truck size and weight would affect critical performance characteristics. Performance parameters of heavier and longer trucks, such as rollover threshold, rearward amplification, braking, steering sensitivity, low-speed offtracking, and high-speed offtracking, stability, were estimated and then compared with threshold values to pass fail criteria. In FHWA's 2000 Comprehensive Truck Size and Weight Study (CTS&W), the safety analysis was conducted based on engineering tests of vehicle performance characteristics. Simulation tools were developed to evaluate stability and control properties of different vehicle configurations at different weights and dimensions. The study concluded that generally GVW, weight distribution, and the height of the gravity center had negative effects on vehicle stability, braking, and offtracking (2000 CTS&W Study). The 2004 Western Uniformity Scenario Analysis applied the methodologies and tools used in the safety analysis of 2000 CTS&W Study to an analysis of the effects of lifting the LCV freeze and allowing harmonized LCV weights, dimensions, and routes among 13 Western States (i.e., Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and

Wyoming) that currently allow LCVs. The scenario study assumed that weights would be only limited by federal axle load limits and the federal bridge formula, resulting in a maximum GVW of 129,000 pounds (Uniformity Scenario Analysis 2004).

Major findings of the desk scan regarding safety issues related to OW truck include the following:

- The results from previous studies regarding the safety effect of larger and heavier trucks on the total system crash rate or the total truck crash rate were inconclusive.
- Insufficient or lacking of crash and exposure data of OW trucks is a main challenge to support policy decisions.
- Studies in Alberta, Canada, of LCVs—operating within a permit regime that regulated driver qualifications and vehicle equipment and provided operating restrictions on road types, road condition, urban areas, and time—showed good relative safety performance. A study of similar LCVs operating in states of the Western US, which are less strictly regulated, showed higher crash rates for LCVs in comparison with tractor-semitrailers.

1.10 Other States

Across the US some states and local jurisdictions have implemented legislation to address the movement of OW trucks in coastal, and coastal to terminal routes. In many instances this has been achieved through the use of a sealed containerized load permit. Table 1.12 shows the types of permits that have been developed across the states, with a specific focus on coastal and port areas within specific states.

Table 1.12: Types of Coastal/Port OW Permits Used within the US

State	Permits
Alabama	No coastal corridor items, but has a sealed OW ocean container permit option.
Alaska	None
Arkansas	None
Arizona	State law allows ADOT to share with counties and border cities fee revenues collected from OW trucks crossing from Mexico into Arizona – between 80-90,800 pounds. Single use permit is $75 and it is split ADOT 50%, Yuma County 25% and Yuma and San Luis 25%
California	Port of LA Heavy Container Corridor
Colorado	
Delaware	Sealed OW ocean container permit Ship Permit – for OS/OW vehicles engaged in ship offloading operations at Port of Wilmington to designated locations within 2 miles of the property limits of the port

State	Permits
Florida	Sealed OW containerized load permit
Georgia	Sealed OW containerized load permit
Hawaii	None
Idaho	None
Illinois	State law allows ILDOT to issue sealed OW containerized load permit. In addition there is a quarterly or annual permit. Will county and Wheatland Township also offer sealed OW containerized load permits.
Indiana	Sealed Ocean Container Permit
Kansas	Sealed Ocean Container Permit
Kentucky	None
Louisiana	Sealed Container Permit
Maine	Sealed Ocean Container Permit
Maryland	Containerized Cargo Permit to move from Port of Baltimore for 1 year http://www.roads.maryland.gov/Index.aspx?PageId=497 http://www.mdot.maryland.gov/Office%20of%20Maryland%20Motor%20Carrier%20Program/Index.html
Massachusetts	State law allows a sealed ocean container permit
Michigan	
Minnesota	State law allows a sealed ocean container permit
Mississippi	State law allows a sealed ocean container permit
Missouri	State law allows a sealed ocean container permit
Montana	None
Nebraska	State law allows a sealed ocean container permit
Nevada	None
New Hampshire	None
New Jersey	State law allows a sealed ocean container permit
New Mexico	None
New York	Sealed Container Permit
North Carolina	State law allows a sealed ocean container permit. There is a single and annual trip permit.
North Dakota	None

State	Permits
Ohio	State law allows a sealed ocean container permit There are 2 permit types, 45 and 90 day one way permits
Oklahoma	None
Oregon	None
Pennsylvania	State law allows a sealed ocean container permit. There are two programs, containerized cargo Type 56A–56E and another permit for Philadelphia and surrounding counties for containerized meat.
Rhode Island	None
South Carolina	Container Permit – for 90,000 on 5 or more axles 940,000 per tandem) overall height at 13'6, maximum width 14' on all permits except for sealed ocean containers. These are broken into intermodal container permit for bulk agricultural products (single and annual trip) and intermodal container permit (single and annual trip)
South Dakota	None
Tennessee	State law allows a sealed ocean container permit – these are issued for single or annual trips.
Utah	None
Virginia	State law allows a sealed ocean container permit.
Washington	Tacoma Heavy Haul Corridor is authorized by state law Permit to authorize movement of Canadian OW trucks
West Virginia	State law allows a sealed ocean container permit - this is a blanket annual permit
Wisconsin	State law allows a sealed ocean container permit; there is a single trip permit, consecutive trip permit, and annual permit.
Wyoming	None

The next section highlights the types of permits in use in port/coastal areas on the Western and Eastern seaboards and the Great Lakes.

1.10.1 California

San Pedro Bay Ports of Los Angeles and Long Beach

A heavy container corridor was developed to allow OW 40' or larger ocean going containers to operate on specifically designated city streets around the Port of Los Angeles. The measure, developed by the City of Los Angeles, City of Long Beach, and the State of California, allows the GVW of the truck, chassis, container, and contents to be at 95,000 pounds/43,130 kilograms (with proper equipment). The application is placed within the jurisdiction of the highway being utilized. If a truck is traveling through multi-city jurisdictions a permit is required from each jurisdiction. Table 1.13 shows the weight guidelines.

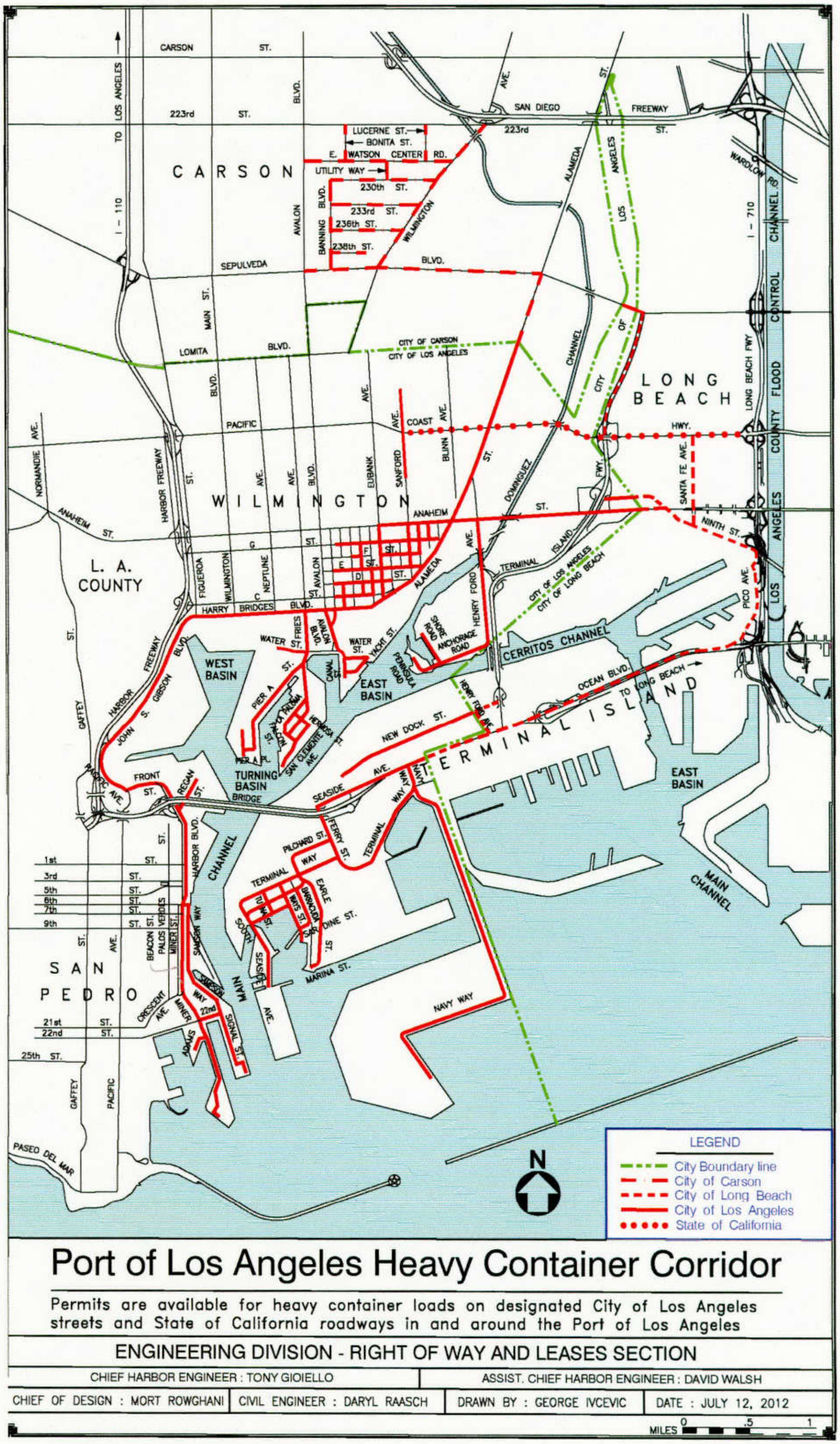
Table 1.13: San Pedro Bay Ports Cargo Weight Guidelines

CARGO WEIGHT GUIDELINES		
Container Size	**Chassis Type**	**Estimated Cargo Weight Guidelines***
20'	Standard steamship chassis	0 – 37,500 pounds
20'	Tri-axle slider chassis	37,501 – 44,000 pounds
20'	Tri-axle slider chassis with 4-axle tractor (on the OW corridor, with permits)	44,001 - 56,000 pounds
40' x 8'6"	Standard steamship chassis	0 - 46,500 pounds
40' x 8'6"	Tri-axle slider chassis with 4-axle tractor (on the OW corridor, with permits)	46,501 – 56,000 pounds
*Cargo weight may not exceed maximum container capacity weight		

Source: http://www.portoflosangeles.org/pdf/heavy_container%20_corridor.pdf

In addition, when applying for the permit, applicants must provide proof of auto liability insurance for $1 million; the CHP 407F Vehicle inspection Report is also required to operate the vehicle and trailer.

Single trip, 30-day, and annual permits are issued by City of Los Angeles ($14; $14 for first day and $9 for any other day within 30-day period; and $84.97). Annual and single trip permits are issued by City of Long Beach at $16 and $90 respectively (in addition the City of Long Beach issues permits for April–December $67.50, July–December $45, and October–December $22.50). Annual and single permits are issued by the County of Los Angeles for $90 annual or $16 each. Single trips permits are issued by Caltrans; these cost $90 and $16 respectively. Figure 1.6 shows the heavy container corridor map.



Source: http://www.portoflosangeles.org/pdf/heavy_container%20_corridor.pdf

Figure 1.6: Port of Los Angeles Heavy Container Corridor

1.10.2 Delaware

The State of Delaware introduced a sealed ocean container permit where the authorized total weight of the truck can be up to GVW of 100,000 pounds for a non-divisible load moving between a port and facility. The cost for a single trip is $10 plus a weight fee for each 8,000 pounds or portion thereof over legal weight. The permit lasts for five days and covers the 24-hour period (§3.2.1.5).

In addition, Delaware within its Transportation Code at §3.2.1.6 allows for a vehicle with a load less than 85 ft overall length and with a rear overhang not to exceed 1/3 length of load, 12 ft in width and gross weight up to 120,000 lb. on 5 or more axles irrespective of number of pieces being hauled from the port of Wilmington on state maintained roads within 2 miles of the Port of Wilmington (excluding I495). The Permit is not truck/trailer specific. The permit is multi-trip, lasts for five days, costs $900, and covers the 24-hour period.

1.10.3 Florida

Florida introduced permits to move sealed containerized loads in FC Chapter 14-26.013. A sealed containerized load is a freight container as defined by the International Standards Organization, Series 1, Freight Containers - Classification, dimensions and ratings, ISO668-1988 [E], which may or may not have wheels. The Florida DOT is required to treat a sealed containerized load being moved via a truck or trucks and rail in conjunction with a maritime shipment as a "nondivisible" load when:

(a) The sealed container does not transport hazardous waste, or hazardous materials, as defined in subsection (1)(a). Exceptions for materials packaged as provided in 49 C.F.R., Part 172.101 Hazardous Material Table are allowed. Hazardous materials meeting these packaging exceptions will be eligible for OW permits; and
(b) The sealed container is being moved by a vehicle qualified to do so under the provisions of this rule:
   1. From a maritime port to the destination point; or
   2. From a maritime port to a railroad facility for movement to the destination point; or
   3. From the point of origin to a maritime port; or
   4. From the point of origin to a railroad facility for movement to a maritime port.

The permit also requires a reasonable description of the contents of the sealed containerized load to be moved under the requested trip permit; a statement that movements under the requested trip permit will not contain any hazardous material as defined in (1)(a) of this rule; and statement that the sealed containerized loads to be moved under the requested trip permit will involve domestic maritime movements, international maritime movements or both.

Single trip and multi trip permits can be purchased. For multi-trip permits, applicants are required to provide the following on the proposed move:

(a) The maximum GVW of the vehicle and load to be transported under the requested multi-trip permit; and
(b) The axle spacing from center to center of each axle of vehicles to be utilized under the requested blanket permit.
(c) An affidavit providing:
1. A reasonable description of the probable cargo uses to be made of the sealed containers to be moved under the requested blanket permit;

2. A statement that movements under the requested permit will not contain any hazardous material as defined in (1)(a) of this rule; and

3. A statement that the sealed containerized loads to be moved under the requested multi-trip permit will involve domestic maritime movements, international maritime movements or both.

In February 2013 FDOT made rule changes increasing the GVW for a sealed container unit and axle grouping weights. Under FAC 14-26.01311(6) the maximum GVW was increased from 95,000 pounds to 100,000 pounds. There was also an increase to axle grouping weights from 44,000 pounds up to 50,000 pounds (FDOT, 2013). The new vehicle configuration requirements became:

- Maximum 5 axles required
- Minimum 51 feet wheelbase (outerbridge) required
- Minimum 10 feet required between groupings
- Maximum 100,000 GVW allowed
- Maximum 25,000 pounds on any single axle
- Maximum 50,000 pounds on any tandem axle grouping
- Maximum 60,000 pounds on any tri or quad axle grouping.

1.10.4 Georgia

The State of Georgia, under Georgia Codes Chapter 672-2 governing permits or loads of excess weights or dimensions, allows the movement of a sealed international container under permit. The movement must be with an original or a destination of a port used for international trading. A 40' box container is allowed a GVW of 100,000 pounds on a five axle tractor/trailer combination. A 20' box container is allowed 80,000 pounds with a tandem weight of 44,000 pounds. A 20' box container transported on a 40' center mount or center mount triaxle trailer is allowed a vehicle gross weight of 100,000 pounds on a five or more axle tractor/trailer. Fees for a standard annual movement are $150, and $500 for a National Highway System annual permit. Single trips permits are $30 for a standard single permit, $125 for a superload single permit between 150,001 to 180,000 pounds, and a superload plus at $500 for a weight over 180,000. The superload plus permit requires bridge analysis.

1.10.5 Illinois

Illinois Vehicle Code 625 ILCS 5/15 – 301 authorizes the Illinois DOT to issue permits for OW loads. Illinois does not have a specific sealed container permit provision within statutes, but it allows the movement of vehicles up to 120,000 pounds and applies a sliding scale of permit fee rates based upon mileage. Table 1.14 outlines the permit structure.

Table 1.14: Illinois Permit Structure

Axle and Weight Combinations → **Miles Travelled↓**	**3-axle truck tractor with a tandem axle composed of 2 consecutive axles drawing a semitrailer, or other vehicle, equipped with a tandem axle composed of 3 consecutive axles, weighing over 80,000 lbs but not more than 88,000 lbs GVW**	**For such combinations weighing over 88,000 lbs but not more than 100,000 lbs GVW**	**For such combination weighing over 100,000 lbs but not more than 110,000 lbs GVW**	**For such combinations weighing over 110,000 lbs but not more than 120,000 lbs GVW**
First 45 miles	$10	$15	$20	$30
45 to 90 miles	$12.50	$25	$32.50	$55
90-135 miles	$15	$35	$45	$80
135-180 miles	$17.50	$45	$57.50	$105
180-225 miles	$20	$55	$70	$130
For each additional 45 miles	$2.50	$10	$12.50	$25

Source: Illinois Code Section 625 5/15-307

The statute also allows cities and counties with permission to also set permit fee rates within their jurisdiction. As an example, Will County and Wheatland Township have set up OW permit fees.

Will County allows an overheight or OW permit to be issued for objects that cannot be reasonably dismantled or disassembled. In addition Will County also issues a permit for the movement of international shipping containers. The permit allows a maximum tandem weight on a trailer having only one tow axle tandem at 48,000 pounds with the tandem not exceeding 25,000 pounds. For a trailer with three or more axle tandems the weight limit is 60,000 pounds, with no axle in the tandem exceeding 21,000 pounds. The maximum eight for a vehicle having one tandem and one single axle as the last axle on the rig is 40,000 pounds. Maximum axle weight on the steer axle cannot be more than 20.000 ponds. Spacing between the steer axle and the first axle may not be less than 8'1" and spacing between the last axle on the tractor and the first axle on the trailer must be at least 18'6". The sum of all axle spacing must be at least 42'6". (Will County Permit Site, 2015). The permit is $50 for a daily permit, $250 weekly, and $500 monthly. In addition Will County also has a containerized grain permit. The permit allows a maximum GVW of 80,000 on five axles, is valid for 20 days of continuous operation and costs $9 per axle. For bulk grain produced outside of Will County that is not transported from a farm the permit, is valid for a 1 day single trip, at same weights, and costs $20.

1.10.6 Indiana

Indiana under IC 9-20-5-4 authorizes the movement of divisible loads with a total gross weight up to 134,000 pounds on extra heavy-duty highways. In addition, under IC 9-20-6-2 the movement of sealed container that is being transported from or to a distribution facility is also authorized. A permit that is issued for a sealed ocean container is valid for one year and costs $800. The following provisions are required to be followed:

- The container is sealed at the place of origin and has not been opened except by an agent of the federal government that may inspect the contents; and
- Being transported to and from a distribution facility.
- Ocean containers cannot exceed 53 feet (trailer and load length) in length with a tractor-trailer hook-up, 60 feet overall in length with a truck-trailer hook up, 8 feet 6 inches wide and 13 feet 6 inches overall height and 95,000 pounds.

1.10.7 Maine

Maine under 29-A MRSA section 2382 (1992, as amended) authorizes OW oceangoing container (OGC) permits. OGCs are defined as freight carrying containers designed to travel on a two or more axle semi-trailer chassis. For purposes of this rule, OGC's are deemed to be non-divisible. The term applies to both exported and imported OGCs that meet the following conditions:

A. Exported OGCs

(1) are loaded and sealed at a shipping point within the State of Maine for shipment outside of the United States;

(2) are accompanied by the appropriate permit carried in the vehicle (see Section 9);

(3) remain sealed throughout the route of travel to the oceangoing vessel; and

(4) are removed from the vehicle chassis only at either

(a) a dock facility for direct loading on board a ship; or

(b) a railhead for rail shipment directly to the dock facility of the oceangoing vessel.

B. Imported OGCs

(1) originate outside the United States;

(2) are delivered to a manufacturing facility within the State of Maine;

(3) contain only raw materials or components to be used to produce final products in the State of Maine at least 60% of which are exported outside the United States;

(4) are accompanied by the appropriate permit carried in the vehicle (see Section 9); and,

(5) remain sealed during the entire route of travel from the point of unloading at the vessel to the final destination in the State of Maine.

Carriers transporting sealed OGCs on roads or bridges maintained by the Maine Department of Transportation may, under certain predefined conditions, be issued OGC Permits authorizing operation at weights in excess of the legal weight allowed for the transporting vehicle configuration. OGC Permits are vehicle and route specific; issued for a predetermined number of trips; and expire one year from the date of issue. An annual administrative fee is charged along with a highway system impact fee based on the road mile distance within the State of Maine between the container's POE/exit or railhead removal point and its destination or origin point. This rule does not preclude the necessity to obtain additional permits for the use of other roads, including the Maine Turnpike, as many municipalities also have their own restrictions in place.

Applications for the multi-trip OGC permit must include the route(s) to be taken; the road miles within the State of Maine from the container's POE/exit or railhead removal point to the point of origin or destination; the number of trips to be taken on each proposed route; the combination type, GVW, axle weights and axle distances of the vehicle(s) to be permitted. The permit is granted only for travel on roads or bridges maintained by the Maine Department of Transportation. It is the responsibility of the motor carrier to obtain any necessary permits or permissions for the use of other roads from the appropriate jurisdiction. A separate permit must be obtained for OW movements on the Maine Turnpike. Municipalities also may have their own restrictions and permit systems in place.

1. OGCs may be carried only on a combination of vehicles consisting of a three axle tractor towing a tandem axle or tri-axle chassis semitrailer under the following conditions:

A. Five Axle Vehicle Combination

(1) The maximum GVW of the combination is 93,000 pounds;

(2) The maximum tandem axle weight is 46,000 pounds;

(3) The power unit must be registered for at least 80,000 pounds;

(4) The vehicle combination and load is not oversize.

B. Six Axle Vehicle Combination

(1) The maximum GVW of the combination is 100,000 pounds;

(2) The maximum tandem axle weight is 46,000 pounds;

(3) The maximum tri-axle weight is 54,000 pounds;

(4) The power unit must be registered for 100,000 pounds;

(5) The distance between the extreme axles of the vehicle combination, excluding the steering axle, must be at least 32 feet;

(6) The vehicle combination and load is not oversize.

2. Posted highway and bridge regulations must be observed at all times.

The permit costs include a $15.00 annual administrative charge along with a per trip highway system impact fee for each permit issued. The impact fee shall be based upon the shortest road mile distance within the State of Maine between the container's POE/exit or railhead removal point and its destination or origin point, as appropriate. The distance used for the purpose of the impact fee determination shall not include miles traveled on the Maine Turnpike or on roads under local jurisdiction. The impact fees are as provided in Table 1.15.

Table 1.15: Maine's OW Impact Fees

Shortest Road Mile Distance	Impact Fee
Greater than 0 miles up to 100 miles	$ 5.00
Greater than 100 miles up to 200 miles	$ 7.50
Greater than 200 miles	$10.00

Payment of the permit fees will be due at the beginning of the permit year and reconciliation will take place after the permit expiration date.

1.10.8 Maryland

The state of Maryland issues a containerized cargo permit that is a yearly blanket permit. The cargo must be coming from or going to a port in Maryland and the route travel is specific. The vehicle cannot exceed these maximum GVW:

(1) 22,400 pounds on a single axle;

(2) 44,000 pounds on 2 consecutive axles at least 4 feet apart; or

(3) 90,000 pounds GVW; and

The maximum allowable gross weight limit is 80,000 pounds for a 20-foot container loaded on a 20-foot intermodal chassis, 90,000 pounds for a 20-foot container loaded on a 40-foot or longer intermodal chassis, and 90,000 pounds for a 40-foot container. The unit must also have a minimum of 5 axles. There is no fee for these permits and no limit on how many can be applied for.

The permit is valid for travel on all interstate highways in Maryland and specific routes within the City of Baltimore.

1.10.9 Minnesota

In 2008 Minnesota changed their regulations to allow trucks moving internationally to carry heavier weights if they are carrying agricultural products in a sealed ocean container. The permit allows the movement of sealed intermodal containers carrying agricultural products that are in *international movement* up to 90,000 pounds GVW. The permit is $300 and allows travel on *interstate highways*. In addition Minnesota and Wisconsin have a website for joint permitting process across their jurisdictions.

1.10.10 New Jersey

In New Jersey, under title 13 Law and Public Chapter 18 Subchapter 1, the maximum allowable GVW of any tractor semitrailer combination, including load or content conveying sealed containers, is 90,000 pounds. The tractor semitrailer combination per-axle combined weight shall not exceed 38,000 pounds for any one tandem axle unit in any tractor semitrailer combination. For a tri-axle trailer configuration, it shall not exceed 56,400 pounds.

The base permit fee is detailed as follows:

- Either an OS or OW vehicle, single trip: $10
- An OS/OW vehicle, single trip: $20
- Annual ocean borne containerized cargo, multi-trip: $100

In addition to the base permit fees, there are fees accrued due to exceeding the OS/OW limits. These fees are shown in Table 1.16.

Table 1.16: New Jersey Permit Fee for Ocean Borne Containerized Cargo Multi Trip

For each foot or fractional portion thereof that the dimensions of any vehicle or combination of vehicles as that term is defined in N.J.S.A. 39:3-84a, including load or contents or of any part or portion thereof, exceed 14 feet in width	$1.00
For each foot or fractional portion thereof that the dimensions of any combination of vehicles as that term is defined in N.J.S.A. 39:3-84a, including load or contents or of any part or portion thereof, exceed 63 feet in length.	$1.00
For each foot or fractional portion thereof that the dimensions of any house-type trailer and its towing vehicle or any house-type semitrailer and its towing vehicle exceed 70 feet in length.	$1.00
For each 2,000 pounds or fractional portion thereof that the weight of the vehicle, including load, exceeds either the axle or gross weight limits--whichever is greater--set forth in Title 39 of the Revised Statutes	$5.00
For each permit transaction. Single-trip permits issued for vehicles that are both oversize and overweight shall be charged this fee as one transaction	$12.00 plus a service charge of five percent of the total permit fee
For a permit issued to a vehicle owned or operated by the United States, the State or any government or local government subdivision, agency or instrumentality thereof.	No fee, other than the transaction fee of $12.00 plus a service charge of five percent of the total permit fee
For a single-trip permit issued to a combination of vehicles utilizing a trailer with a Code 23 registration, as issued by the Commission.	No fee, other than the transaction fee of $12.00 plus a service charge of five percent of the total permit fee

1.10.11 New York

In the State of New York, the maximum allowable gross weight on all axles of a single vehicle or combination of vehicles having 3 axles or more is 80,000 pounds. The State offers three main types of permit fees for sealed ocean containers:

- Single trip: $40
- Monthly: $250
- Annual: $750

The New York State Thruway Authority's Department of Maintenance and Operations issues sealed container permits. The permit fee changes according to the date the application is submitted. All the Sealed Container Permits expire on December 31 of the year they were issued. The varying fees are shown in Table 1.17.

Table 1.17: New York Fees for Sealed Container Permits

Application Date	Fee
January 1 through March 31	$1250.00
April 1 through June 30	$937.50
July 1 through September 30	$625.00
October 1 through December 30	$312.50

1.10.12 South Carolina

South Carolina allows the use of OW sealed intermodal containers that are in the immediate vicinity of the Charleston Ports (SC Code of Law Section 56-5-4010 through 56-5-4230 and 57-3-130 through 5-7-190). These can also be used for bulk agricultural products for a single or annual trip permit, and regular intermodal containers for a single or annual trip.

The permit cost for an intermodal container with agricultural products is $30 for a single trip and $100 for a multiple trip. The maximum weights are:

- 20,000 pounds for a single axle,
- 48,000 pounds for a tandem axle,
- 55,000 pounds for a tridem axle with;
- GVW not to exceed 100,000 pounds over 5 or more axles
- A minimum trailer length of 40' is required and maximum overall height cannot exceed 13'6" and maximum overall width cannot exceed 8'6"

The permit cost for containerized international cargo container is $30 for a single trip on a designated route noting the commodity being hauled, and for multiple trips $100 per year but it has to be on one designated route only. The maximum weights are the same as for the intermodal container with agricultural products.

South Carolina also has approved truck routes for OW trucks with these permits. It can be found at http://www.scdot.org/doing/doingPDFs/permits/TruckRouteMap.pdf. These are for authorized interstates and approved US and SC Routes. Port access roads that are specifically allowed are Wando Welch, Veterans, North Charleston, Columbus, & Union Pier Terminal; Long Point Rd., McMillian Ave., Virginia Ave., Remount Rd., North Rhett, Mt. Pleasant St., Morrison St., and East Bay St.

1.10.13 Pennsylvania

According to Chapter 49 Subchapter C of the Pennsylvania Code, the maximum allowable GVW is 80,000 pounds. Furthermore, the gross allowable vehicle weight for an OW containerized cargo is 90,000 pounds. Several permits exist for OW vehicles: single trip, seasonal, and annual, with the seasonal and annual permits being commodity specific only.

The permit fees for a single trip OW vehicle and for containerized cargo are listed in Table 1.18.

Table 1.18: Pennsylvania Fees for Containerized Cargo

Permit Type	Permit Fee
Single Trip	\$35 if less than 14' wide + \$0.04 ton/mile \$71 if greater than 14' wide + \$0.04 ton/mile
Containerized Cargo – Annual	\$155 (1-15 permits) \$233 (16-50 permits) \$388 (51-100 permits) \$544 (101-150 permits) \$622 (151-200 permits)

1.10.14 Washington

Washington authorizes permits for handling Canadian weight trucks, as well as allowing sealed container OW corridors if the department of transportation, with respect to state highways maintained within port district property, may, at the request of a port commission, make and enter into agreements with port districts and adjacent jurisdictions or agencies of the districts, for the purpose of identifying, managing, and maintaining short heavy haul industrial corridors within port district property for the movement of OW sealed containers used in international trade. Table 1.19 shows the various types of permits for these types of trade movements.

Table 1.19: WSDOT OS/OW Permits Types

Application Types	Permit Types
Axle Spacing Report for Canadian Weights	**Canadian Axle** spacing report to allow Canadian weights on either SR 9 or US 97
Axle Spacing Report for Overweight Permits	**Axle Spacing Report** to calculate your legal and permit weight maximums
Canadian Weights	**State Route 9 -** This permit allows drivers to haul reducible loads with Canadian Weights from the Canadian border to Sumas, Washington on SR 9. $14.00 annual **US Highway 97 -** This permit allows drivers to haul reducible loads with Canadian Weights from the Canadian border to milepost 331.12 (Oroville Rail Yard). $100.00 per month / $1000.00 annual
Oversize/Overweight Permit	**Single Trip OSOW** - A single trip oversize and/or overweight permit that is route specific. This permit is for non-divisible loads only. Dimensional permits are $10.00 weight permit prices vary.
Regional Permit	**Western Regional -** A single permit for a non-divisible load to travel through multiple participating states. Limited to 160,000 lbs. gross weight, 14 ft. high, 14 ft. wide, and 110 ft. long. Permit duration is 5 days. Prices vary depending on states traveled.
Sealed Container	**State Route 509 -** This permit allows for sealed shipping containers to travel on a portion of SR 509 in the Port of Tacoma. $100.00 per month / $1,000.00 per year

In June 2008 the legislature created a heavy haul industrial corridor in US 97 in both directions from the Canadian border to milepost 331.22 in the City of Oroville. The legislation authorizes vehicle weight limits to reflect Canadian weight limits for divisible loads. Depending on the type of vehicle being used, these weights allow for a gross weight limit up to 137,788 lbs. (see "Weight Limits" section). This is considerably higher than the Washington State gross weight limit of 105,500 lbs. The fee is for the heavier limits are $100 per month or $1000 for annual permits.

The permit request must include a Canadian axle spacing report number. Vehicle types eligible for corridor permits include those listed in Table 1.20.

Table 1.20: WSDOT Container Permit Axles Spacing

Single Vehicles	2 to 3 axles
Truck and Pup	Appreciable weight of trailer on pintle hitch. (3 to 6 axles)
Truck and Full Trailer	Appreciable weight of trailer not on pintle hitch. (4 to 7 axles)
Tractor and Semi-Trailer	3 to 6 axles
Double trailer vehicles definition for this section:	A-Train: Double trailers coupled by a single drawbar. (5 to 8 axles) B-Train: Two semi-trailers coupled by a fifth wheel mounted to rear of first trailer. C-Train: Double trailers coupled by double drawbars with self-steering dolly axle(s).

Source: WSDOT Heavy Haul Permit Manual

Weight limits for the corridor are:

A. Primary steering axle - 600 lbs. per inch of width of tire.* with a
B. maximum limit of 12,100 lbs.
C. Other axles - 500 lbs. per inch of width of tire.*.
D. Single axles - 20,000 lbs. maximum.
E. Tandem axles - 37,500 lbs. maximum.
F. Width of tire is determined by tire side-wall nomenclature.
G. Tridem axles

The axle spread must be within the parameters provided in Table 1.21; Table 1.22 addresses the container permit maximums.

Table 1.21: WSDOT Container Permit Axle Spacing

Axle Spread	Pounds
94" to < 118"	46,300
118" to < 141"	50,700
141" to < 146"	52,900

Source: WSDOT Heavy Haul Permit Manual

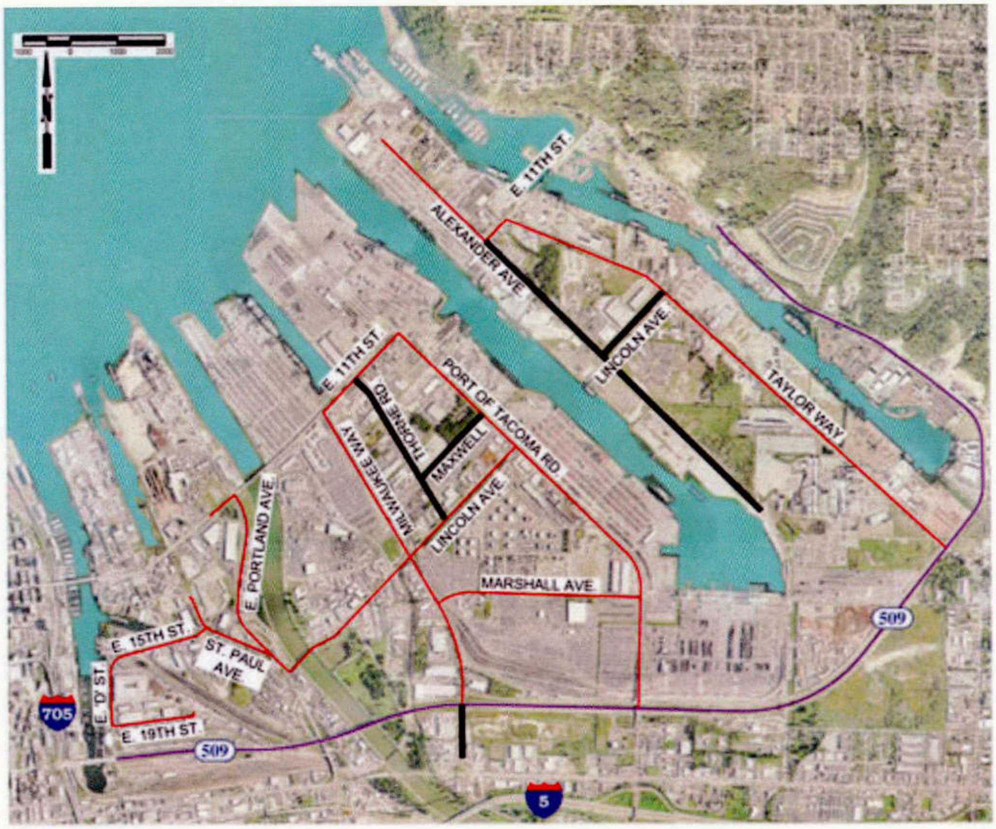
Table 1.22: WSDOT Container Permit Maximum Gross Weights (Pounds)

Number of Axles	2	3	4	5	6	7	8
Truck	36,000	53,000					
Truck and Full Trailer			74,000	91,000	106,500	118,000	
Truck and Pup		56,200	74,000	91,000	99,800		
Tractor and Semi		52,300	69,700	87,100	95,900 *		
A Train *				92,500	109,800	118,000	118,000
B Train *				90,000	107,200	124,600	137,800
C Train *				92,500	109,800	120,500	130,000
Semi trailer - tridem axle spacing and weight limits: *94" to < 118" spread - 95,900 lbs.* *118" to < 141" spread - 100,310 lbs.* *141" to < 146" spread - 102,500 lbs.*							

Source: WSDOT, Heavy Haul Permit Manual

Tacoma Heavy Haul Corridor

On May 9, 2005, Washington implemented legislation (HB 1181) that allowed a heavy haul industrial corridor within the Port of Tacoma (Fleet Owner, 2005). Figure 1.7 shows the configuration of this corridor. This was developed to address an OW load issue that was faced by companies moving cargo from rail boxcars into sealed ocean going containers which are drayed to the marine terminals over an approximate distance of two miles. The transloading movement often meant that trucks exceed the legal axle weight limit restrictions. The passage of the legislation allows the legal movement of this cargo for export into the port area. The Port of Tacoma is a center for break bulk, break and project heavy and other lift cargos, so the ability to facilitate the movement of these types of commodities was critical for its economic development and trade opportunities. House Bill 1181 completed an existing Corridor with the addition of State Route 509, which connects several segments of City of Tacoma roadways, already a part of the Corridor. RWC46.44.0915 Heavy haul industrial corridors — Overweight sealed containers and vehicles Section (1)(a) allows the department of transportation, with respect to state highways maintained within port district property, may, at the request of a port commission, make and enter into agreements with port districts and adjacent jurisdictions or agencies of the districts, for the purpose of identifying, managing, and maintaining short heavy haul industrial corridors within port district property for the movement of OW sealed containers used in international trade



LEGEND

HEAVY HAUL CORRIDOR ROUTES

SR 509 (A STATE PERMIT IS REQUIRED FOR SR 509)

PROPOSED HEAVY HAUL CORRIDOR EXTENSION

Figure 1.7: Port of Tacoma Heavy Haul Corridor

The Port of Tacoma Heavy Haul Industrial Corridor now encompasses:

- SR 509, from Taylor Way to East "D" Street
- Taylor Way and a portion of Alexander Avenue, from TOTE Terminal to SR 509
- Port of Tacoma Road
- Marshall Avenue
- Lincoln Avenue
- Milwaukee Way
- East 11th Street, from Port of Tacoma Road to Milwaukee Way
- Portland Avenue, from Lincoln Avenue to East 11th Street
- Portions of East "D" Street and East 15th Street

According to the Port of Tacoma, a coalition of stakeholders, including local transloading, warehousing and trucking companies, the Washington State Patrol, Washington Department of Transportation, City of Tacoma and Port of Tacoma, worked together over a three year period to establish this Heavy Haul Industrial Corridor. The legislation also completed a corridor group by adding to an existing corridor with State Route 509, which connects several segments of City of Tacoma roadways that were already a part of the Heavy-Haul Corridor.

The permit can be obtained from the Washington State Department of Transportation (www.portoftacoma.com.). The Permit authorizes non-divisible weight limits up to 105,500 lbs. to sealed ocean going containers on the SR 509 Heavy Haul at the Port of Tacoma. The special permit allows vehicles to operate in the heavy haul industrial corridor at the Port of Tacoma to carry weight in excess of weight established in RCW 46.44.041 (Chapter 46.44.091 RCW and Chapter 46.44.0915 RCW). However, the excess weight on a single axle (22,000), tandem axle (43,000), or any axle group must not exceed that allowed by RCW 46.44.091 (1) and (2), weight per tire must not exceed 600 pounds per inch weight of tire, and GVW must not exceed 105,500 pounds. The Heavy Haul Corridor extends on SR 509 between milepost .25 in the vicinity of East "D" Street and milepost 5.7 in the vicinity of Norpoint Way NE. The Permit Costs $100.00 Monthly or $1,000.00 Annual and is valid for a monthly (30 days) period or for one calendar year. The permit is issued on the same day if received before 3 pm. A permit can also be self-issued (http://www.wsdot.wa.gov/commercialvehicle/permitting).

Seattle's Proposed Heavy Haul Corridor

Seattle's Department of Transportation (SOT) has recently conducted a study to evaluate a proposed heavy haul corridor (Figure 1.8) that has been a discussion point since early 2013. In March 2014 the City Council placed a statement of legislative intent for its notebook and budget action (http://clerk.seattle.gov/public/meetingrecords/2014/budget/101-2-a-1-2014.pdf). SDOT is required to report to City Council before July 31, 2015, on its analysis. Council has requested SDOT analyze and evaluate the proposed heavy haul corridor within the City of Seattle as well as other approaches for transporting OW containers such as the use of special chassis and rigging. The analysis of the heavy haul corridor should include potential on-going or systemic costs related to maintenance and enforcement of the proposed route, potential alternatives to developing a heavy haul corridor, and what role the heavy haul corridor plays in the SDOT's Freight Master Plan. The concept behind the corridor is to implement upgrades for a heavy haul corridor to facilitate OS container loads between the container terminal and the Union Pacific and Burlington Northern Santa Fe rail yard facilities. The Port of Seattle maintains that Seattle port operations are at a competitive disadvantage because City of Seattle truck weight regulations create a burden on shippers. In order to remain a competitive point of entry for discretionary international cargo, the Port would like to increase truck weight limits along designated city streets. Allowing heavier vehicles along the route would lower logistical costs and provide a time savings; potential shippers would find the Port of Seattle a more attractive entry point for international cargo (City Clerk, 2015 Budget).

Source: Fleet Owner, 2015

Figure 1.8: City of Seattle Proposed Heavy Haul Corridor

1.10.15 Wisconsin

Wisconsin as noted has a cross-border permit with Minnesota for OW permitting processes. In addition Wisconsin also issues a Michigan Border permit for transportation of commodities and goods in Wisconsin within 11 miles of the Wisconsin-Michigan border. Under Wisconsin Statute 348.27(9), Chapter Trans 251, and Chapter Trans 253 WisDOT can issue annual or consecutive month permits, for the transportation of loads on a vehicle or combination of vehicles exceeding statutory length or weight limitations and for the unladen operation of such vehicles returning from the delivery of a load or operating to or from a point of fueling, servicing, or purchase or sale of the vehicle, that authorize all of the following:

Permit valid on State and US highways within 11 air miles from the Michigan/Wisconsin state line for transport of any load, or unladen for return trip, fueling, repair, or sale of vehicle. If transporting raw forest products, lumber or forestry biomass this permit is also valid on the following State and US highways:

- USH 2 anywhere in Iron, Florence, and Ashland counties
- USH 2 in Bayfield County from the Ashland County line through Hart Lake Road.
- USH 8, from the Wisconsin-Michigan border in Marinette County to USH 45 in Oneida County.
- USH 45, from the Wisconsin-Michigan border to Sunnyside Road south of the city of Antigo, in Vilas, Oneida, and Langlade counties.
- USH 51, from the USH 2/51 interchange north of the city of Hurley to Maple Ridge Road in the town of Mercer in Iron County.
- STH 77, from 2nd Avenue in the city of Hurley to Olson Road in the city of Mellen, in Iron and Ashland counties.
- STH 139, from the Wisconsin-Michigan border to USH 8, in Florence and Forest counties.

Wisconsin statue Chapter 348 governs vehicle size and weight. Under Section 348.26 permits for the transportation of sealed loads in international trade is authorized. This can be an annual or consecutive month permit under §348.27 (17), subject to the same requirements and limitations for annual and consecutive month permits described in §348.27 (17). A permit under this subsection may be issued only by the department, regardless of the highways to be used. A person issued a permit under this subsection shall use the automated routing system specified in §348.25 (11). The permit fee is $30 for s single trip. For multiple trips the fee is calculated from the day of application and permits may be issued for 3 to 12 months. The fee schedule can be seen in Table 1.23.

Table 1.23: Fees for Multiple Trips for Sealed Ocean Container in Wisconsin

Months	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**
	$300	$290	$265	$240	$215	$190	$165	$140	$115	$90

Source: WisDOT http://wisconsindot.gov/Documents/dmv/shared/info-cm.pdf

In addition, under 348.27 4, Wisconsin allows WisDOT to issue industrial interplant permits. These are to be issued to industries and to their agent motor carriers owning and operating OS vehicles in connection with interplant, and from plant to state line, operations in this state, annual or consecutive month permits for the operation of such vehicles over designated routes, provided that such permit shall not be issued under this section to agent motor carriers or, except for that portion of USH 51 between Wausau and STH 78 and that portion of STH 78 between USH 51 and the I 90/94 interchange near Portage upon their federal designation as I 39, from plant to state line for vehicles or loads of width exceeding 102 inches upon routes of the national system of interstate and defense highways. If the routes to be used involve city or village streets or county or town highways, the application shall be accompanied by a written statement of route approval by the officer in charge of maintenance of the highway in question.

Section 348.27 4m also allows for the transportation of loads on state highway 31 between and among manufacturing plants, distribution centers and warehouses. This can be an annual or consecutive month permits for the transportation of loads in vehicle combinations that exceed the maximum gross weight limitations under §348.15 (3) (c) by not more than 18,000 pounds if the vehicle combination has 6 or more axles and the gross weight imposed on the highway by the wheels of any one axle of the vehicle combination does not exceed 18,000 pounds, except that the gross weight imposed on the highway by the wheels of any steering axle on the power unit may not exceed the greater of 13,000 pounds or the manufacturer's rated capacity, but not to exceed 18,000 pounds. Notwithstanding §348.15 (8), any axle of a vehicle combination that does not impose on the highway at least 8% of the gross weight of the vehicle combination may not be counted as an axle for the purposes of this paragraph. Permits issued under this subsection do not authorize the operation of any vehicle combination at a maximum gross weight in excess of 98,000 pounds.

The permit under this subsection is valid only for the transportation of loads between or among any of the following:

1. A manufacturing plant located in Racine County.
2. A distribution center located in Kenosha County.
3. A warehouse located in Kenosha County.
4. A warehouse located in Racine County.

Permits issued under this subsection are only valid for State Highway 31 or local highways designated within the permit. Currently the Permit Website does not show them issuing these types of permits.

1.11 Canada Review

Canada's jurisdiction over motor carriers is shared between the federal government and the country's provinces. The federal role is mostly coordination and facilitation, and the federal legislation Motor Vehicle Transport Act (MVTA) allows the provinces to set their own rules subject to MVTA conditions. In 1988, the Task Force on Vehicle Weights and Dimensions Policy was created to pursue greater national and/or regional uniformity of policies, regulations, and enforcement practices for heavy vehicle weight and dimensions. The task force has met six times since its inception.

At the provincial level, the various provinces have laws and programs in place to regulate movement of heavy vehicles and heavy haul and extraordinary loads. In many instances, Canadian provinces have seasonal load restrictions due to winter weather impacts on highways. A selection of provinces bordering the US was reviewed for this research project.

1.11.1 British Columbia (B.C.)

The Transportation Act 2004 (as amended) British Columbia (B.C.) Law authorizes the minister of transport to set terms and conditions considered appropriate for use of provincial public highways. This includes authorization of a period for use of highway to limit or prohibit access or entry of "Extraordinary Traffic," which, within Section 66 (1), can include quantity of goods carried, mode or time of use, and speeds that can alter or increase burdens imposed on the highway by proper use by ordinary traffic or cause damage and expense to the provincial highway beyond what is reasonable or ordinary. The Commercial Transport Act (as amended) and its implementing regulations set forth specifications for vehicles and loads and when permits are required. Exemptions exist for vehicles driven by B.C. Hydro/Power Authority employees, highway maintenance contractors, and specially authorized vehicles such as Indian war canoes, parade floats, vehicles used for exhibition purposes, and other vehicles that may be authorized by the ministry, although permits are required. No fees are charged for vehicles owned or leased and operated by:

- The governments of Canada its providences and territories
- The governments of the US and any state or county in the US
- Municipalities and school districts outside of B.C.

Within its Commercial Transport Procedures Manual, B.C. sets forth heavy haul and extraordinary load guidelines, as well as general permit guidelines and information. Route maps for 16- and 24-wheeler tridems and tandem tridems are also in place. These lists specify load-posted routes, along with bridge tolerances. Permits are available via telephone request from the provincial permit center for

- Non-resident permits
- Term OS/OW permits
- Single-trip OS/OW permits
- Motive fuel user permits
- Extra-provincial temporary operating permits
- Temporary operating permits (emergency situations only)
- Highway crossing permits

Since 2008, permits available through the Permitting System Online Service include

- Term OS permit
- Non-resident single-trip permit
- Motive fuel user permit
- OW permits (single-trip)
- OS/OW permits
- FR application permits

The legal dimensions for extraordinary loads that exceed general policy limits and heavy haul size and overall dimensions are as shown in Figure 1.9.

Dimensions	
OAH	No limit - dependent on route and commodity requested • (CVSE1052 required to be completed if over 4.88 m, 5 m in East Kootenay Area (route specific – see 6.4.2 below) or 5.3 m in the Peace River Area)
OAL	• No limit – dependent on route and commodity requested – offtracking analysis may be required
OAW	• No limit – dependent on route and commodity requested (CVSE1052 required to be completed if over 6 m or up to 8 m in East Kootenay Area (route specific – see 6.4.2 below)) • Axle width of trailer must be at least half of the width of the load
Weights	
• Governed by vehicle configuration, route requested and structures crossed	
Travel Conditions	
• 0001 – 0500 hrs transport times (Monday to Friday excluding General Holidays) • 3 – 5 pilot cars depending on overall weights, dimensions, and routing • Other conditions, such as lights and signs, will be as per closest applicable T-Form	
Note: CVSE has the right to impose more pilot cars or restrict hours further than those listed if needed.	
"OAH" – overall height measured from the ground to the top of the vehicle and/or load. "OAL" – overall length measured from the front of the vehicle and/or load to the end of the vehicle and/or load. "OAW" – overall width measured from the widest point on the left side of the vehicle and/or load to the widest point on the right side of the vehicle and/or load.	

Source: Chapter 6 British Columbia Commercial Transport Procedures Manual

Figure 1.9: Legal Dimensions for Extraordinary Loads in British Columbia

The bridge formula is calculated in B.C. by

30 x wheelbase in centimeters (cm) + 18000 kilograms (kg) = maximum weight allowed by permit.

B.C. also allows a term axle OW permit (TRAX). This is for empty heavy haul configurations and allows empty, non-PME heavy haul configurations to exceed the legal weight limit of 6,000 kg (13,227 lb), up to 7,300 kg. (16,093 lb) on the steering axle only. This permit costs C$100 per month for a term of up to one year.

The first step in applying for extraordinary load approval is the request form, which is either emailed or faxed to the permit center. Turnaround time for approval of OS loads is usually 48 hours. Identical overload approval usually takes one to three business days. Bridge overload approval can take as little as 11 calendar days. However, on average, 95% of approvals are granted within 19 calendar days. Loads that require applicants to undertake their own bridge engineering fall into another category. These usually fall in the seven-business-day time frame. For identical overloads, approval can be expedited if data includes:

- Same truck configuration, including axle groups and spacing, and all axle weights are the same or lighter than the previous approval
- Same roads are travelled in the same direction, with the same start and end locations
- Previous Bridge Engineer approval (overload) number
- Previous approval within the last five years

Single-trip OS/OW Permits

These permits are issued for up to seven days. However, in some instances, the permit may be valid for up to 30 days. Conditions of travel are listed in the permit and are based on sizes/weights of commodity and vehicle. If the vehicle leaves B.C. from its initial destination, the return trip can be purchased on this permit if the sizes/weights are commensurate. The permit fee doubles for the return trip. The permit is issued to the power unit. An OS single-trip permit fee is C$15 per trip. The fee for an OW single-trip permit is calculated by overload in kilograms and kilometers of travel. Table 1.24 shows the fee schedule for each 10 km (6 miles) of operation. Figure 1.10 shows how the overload fee is calculated. The minimum fee is C$25.

Table 1.24: Fee Schedule per 10km of Operations in British Columbia

Kilometers travelled	C$	Kilometers travelled	C$
0 – 2,000 (0-1242 miles)	0.95	**15,001 – 16,000 (9321 – 9941 miles)**	7.25
2,001 – 3,000 (1243 – 1864 miles)	1.15	**16,001 – 17,000 (9942 – 10,563 miles)**	8.25
3,001 – 4,000 (1864 – 2485 miles)	1.40	**17,001 – 18,000 (10,563 – 11,184 miles)**	9.15
4,001 – 5,000 (2486 – 3106 miles)	1.60	**18,001 – 19,000 (11,185 – 11,806 miles)**	10.10
5,001 – 6,000 (3107 – 3728 miles)	1.85	**19001 – 20,000 (11,806 – 12,427 miles)**	10.90
6,001 – 7,000 (3729 – 4349 miles)	2.15	**20,001 – 21,000 (12,428 – 13,048 miles)**	11.85
7,001 – 8,000 (4350 – 4970 miles)	2.45	**21,001 – 22,000 (13,049 – 13,670 miles)**	12.70
8,001 – 9,000 (4971 – 5592 miles)	2.95	**22,001 – 23,000 (13,671 – 14,291 miles)**	13.95
9,001 – 10,000 (5592 – 6213 miles)	3.35	**23,001 – 24,000 (14,292 – 14,912 miles)**	14.95
10,001 – 11,000 (6214 – 6835 miles)	3.75	**24,001 – 25,000 (14,913 – 15,534 miles)**	16.10
11,001 – 12,000 (6835 – 7456 miles)	4.25	**25,001 – 26,000 (15,535 – 16,155 miles)**	17.85
12,001 – 13,000 (7457 – 8077 miles)	4.95	**26,001 – 27,000 (16,156 – 16,777 miles)**	19.85
13,001 – 14,000 (8078 – 8699 miles)	5.60	**27,001 – 28,000 (16,777 – 17,398miles)**	21.40
14,001 – 15,000 (8699 – 9320 miles)	6.25		

Source: Chapter 3 B.C. Commercial Transport Procedures Manual

There is also an option for companies to purchase OW permits to temporarily increase a vehicle's GVW:

a) any positive weight difference between.

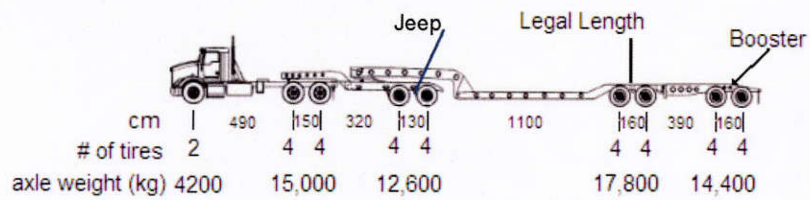
i) the axle weight and the maximum axle unit weight or the maximum gross weight for a group of axles allowed under these regulations

ii) the gross vehicle weight and the gross vehicle weight allowed for the particular vehicle or vehicle combination under these regulations, or

iii) the gross vehicle weight and the licensed gross vehicle weight, or

b) the total weight of any axle unit or group of axles, beyond 27.5 m overall length, of an empty (noload) vehicle combination.

iii) When calculating gross vehicle weight (GVW) allowable on overload permits, the lesser of the actual weight or legal allowable must be used for all axles or axle groups. When actual weights are known from weighing of a vehicle/load this may cause the GVW allowable to be lesser than the legal allowable as shown in example below.



Actual GVW = 64 000 kg

Licensed GVW = 63 500 kg

Tire Size - 27.9 cm x 55.9 cm

Legal Allowable: (5 500 + 28 000 + 31 000) kg = 64 500 kg (Table 1)

GVW Allowable (6 Weight Section of MV 4000

(4 200 + 15 000 + 12 600 + 31 000)kg = 62 800 kg

Overload = 1200 kg (actual - GVW allowable)

Source: Chapter 3, B.C. Commercial Transport Procedures Manual

Figure 1.10: Options to Purchase OW Permits to Temporarily Increase GVW in British Columbia

Term OS/OW Permits

OS/OW permits can be issued for one-month period increments or for a term of up to 12 months for loads, vehicles, or combinations thereof. Applicants can request a permit for a single commodity. They can also request that additional commodities be added to the permit. The permit price does not change if additional commodities are added to the term permit. The cost for an OS term permit is C$15 for a single-trip permit and C$30 for one month, while the cost for an OW term permit is C$100 per month. There is no OS/OW term permit; rather, two separate permits are issued. As part of the general term permits for OS vehicles, these basic conditions are required:

- 16 meters (m) (52’5”) in overall length for a single vehicle
- 27.5 m (90’2”) in overall length for heavy haul operations
- 31.5 m (103’4”) in overall length for mobile homes, modular buildings, etc.

- 31 m (101'8") in overall length for vehicle combinations
- 3.8 m (12'5") in overall width
- 4.3 m (14'1") in overall height (5.33 m (17'5") in the Peace River Area)
- 3 m (9'10") front projection beyond the kingpin or forward of the front bumper
- 6.5 m (21'3") rear projection beyond the turn center
- Conditions as per the Commercial Transport Procedures Manual and forms: CVSE 1000, CVSE 1000S, CVSE 1000L

There are multiple T-forms—29 total—designed to be attached to and form part of OS/OW permits. For OW term permits, bridge formula or policy maximums cannot be exceeded. These are not available for loads hauled on trailers, e.g., heavy haul, expandos, and steering trailers, or for fixed equipment on its own axles which functions as a semi-trailer.

B.C. also has seasonal load restrictions to protect the roadway through the Seasonal Strength Loss Program for heavy vehicles on the network. Load restrictions are removed only when the road has been determined to be structurally sound. Section 66 of the Transport Act (as amended) imposes specific weight restrictions, usually during spring. The restrictions are deliberately intended to refer only to axle weights and are generally shown as:

- 100% of legal axle loading
- 70% of legal axle loading
- 50% of legal axle loading

Under the Commercial Transport Act (1991) and Commercial Transportation Fees Regulation 2009 (B.C. Reg. 351/2008), commercial vehicle registration fees in B.C. are based on GVW on a sliding scale that ranges from C$42 (for a GVW not exceeding 500 kg (1,102 lb)) up to C$3,905 for a GVW up to 63,500 kg (140,000 lb).

1.11.2 Alberta

Alberta also has established maximum vehicle weight and dimension limits to preserve infrastructure and ensure safety. Some OS/OW permits can be obtained through a web-based system called TRAVIS, and some permits must be obtained through a central permit office. Web-based permits for over OW and over-dimensional vehicles include:

- Single-trip OW
- Drilling rig OW
- Multi-trip OW
- Single-trip over dimension

- Multi-trip over dimension
- Public entertainment vehicles
- Tridems on local roads
- Single-trip licensing
- 30/60/90 day licensing
- Winter log haul and seasonal log haul dimensional
- Salvage log haul dimensional
- Fleet tridrive exemption permit

The Commercial Vehicle Dimension and Weight Regulation Act (CVDWRA) 2002 (AR 315/2002) governs OS/OW vehicles. A single-trip permit fee for an over-dimensional vehicle is C$15. A multi-trip over-dimensional permit is C$60. An extended length permit is C$300. A high load corridor permit for over-dimensional vehicles is based on a fee-per-kilometer x-height of the vehicle:

- For a vehicle with height more than 6m (19'8") but less than 8.96m (29'4"), is the permit costs C$1, plus C$0.20 cents for every 10 centimeters (cms) (3 $^{15}/_{16}$ inch) over 6m (19'8") in height.
- For a vehicle with height over 8.9m (29'2"), the permit costs C$6.80.
- For a single-trip OW permit or single-trip OW and over-dimensional permit, the fee for each vehicle to which the permit pertains is the total of amounts:
- C$0.024 per ton per kilometer over the lesser of:
- Registered weight, and sum of allowable axle weights (being gross weight for steering axle and base weight for all other axles)
- Steering axle weight fee calculated using another schedule (Schedule 8)
- Axle group weight fee calculated using another schedule (Schedule 9)

Alberta Transport raised the permit fee for single trip OW permits by 10% on April 1, 2015. The increase in permit fee is a result of the increase in maintenance cost due to the operations of OW axles and vehicles on the roadway system. These fees have remained unchanged since 1998, apart from a minor per kilometer rate change in 2014. But, during that period, the maintenance costs have witnessed a significant increase, meaning the revenues have lagged significantly behind the infrastructure expenditures.

For a multi-trip OW permit or multi-trip OW and over-dimensional permit, the fee is the total of the following amounts:

- C$60
- Steering axle weight using Schedule 10
- Axle group weight fee using Schedule 11

Schedules 8, 9, 10, and 11 can be seen in Tables 1.25 through 1.28.

Table 1.25: Single-Trip Steering Axle Fee Table—Schedule 8

Permitted weight above legal weight Tons	Fee per KM C$
0 to 1 ton	0.06
Greater than 1 to 2 tons	0.15
Greater than 2 tons to 3 tons	0.22
Greater than 3 tons to 4 tons	0.35
Greater than 4 tons to 5 tons	0.50
Greater than 5 tons to 6 tons	0.67
Greater than 6 tons to 7 tons	0.87
Greater than 7 tons to 8 tons	1.08
Greater than 8 tons	1.40

Table 1.26: Single-Trip Axle Group Weight Fee Table—Schedule 9

	Fee per KM C$			
Permitted Weight Range Per Axle Group over Base Weight	A Single, Tandem and Tridem Axle Groups	B 16 wheel tandem	C Wide 16 wheel tandem	D 24 wheel tandem
0 ton to 1 ton	0.04	0.04	0.04	0.04
> than 1 to 2 ton	0.09	0.08	0.08	0.08
> than 2 to 3 ton	0.15	0.14	0.13	0.13
> than 3 to 4 ton	0.23	0.21	0.18	0.17
> than 4 to 5 ton	0.33	0.28	0.24	0.23
> than 5 to 6 ton	0.45	0.36	0.31	0.30
> than 6 to 7 ton	0.58	0.46	0.40	0.36
> than 7 to 8 ton	0.72	0.57	0.48	0.43
> than 8 to 9 ton		0.67	0.57	0.51

Permitted Weight Range Per Axle Group over Base Weight	Fee per KM C$			
	A	B	C	D
	Single, Tandem and Tridem Axle Groups	16 wheel tandem	Wide 16 wheel tandem	24 wheel tandem
> than 9 to 10 ton		0.80	0.67	0.59
> than 10 to 11 ton		0.94	0.76	0.67
> than 11 to 12 ton		1.08	0.88	0.77
> than 12 to 13 ton			1.00	0.87
> than 13 to 14 ton			1.12	0.90
> than 14 to 15 ton			1.25	1.08
> than 15 to 16 ton			1.39	1.20
> than 16 to 17 ton			1.53	1.31
> than 17 to 18 ton				1.42
> than 18 to 19 ton				1.57
> than 19 to 20 ton				1.70
> than 20 to 21 ton				1.84
> than 21 ton				1.98

Base Weights

Single Axle Group 9100kg (200,620 lb)

Tandem Axle group 17,000 kg (38,000 lb)

Tridem Axle Group

- **If axle spread is 3.6m (11' 9") or more but not more than 3.7m (12' 1") 24,000kgs (52,190 lbs)**
- **If axle spread is 3m (9'10") or more but not more than 3.6m (11'9") 23,000kgs (50,706 lbs)**
- **If axle spread is 2.4m (7' 10") or more but not more than 3m (9'10") 21,000kgs (46,297 lbs)**

16 wheel tandem 25,000kgs (55,115 lbs)

Wide 16 wheel tandem 32,000kgs (70,547 lbs)

24 wheel tandem 39,000kgs (85,980 lbs)

Table 1.27: Multi-Trip Steering Axle Fee Table—Schedule 10

Permitted weight above legal weight Tons	Fee per KM C$
0 to 1 ton	2.00
Greater than 1 to 2 tons	10.00
Greater than 2 tons to 3 tons	17.00
Greater than 3 tons to 4 tons	30.00
Greater than 4 tons to 5 tons	45.00
Greater than 5 tons to 6 tons	60.00
Greater than 6 tons to 7 tons	85.00
Greater than 7 tons to 8 tons	105.00
Greater than 8 tons	140.00

Table 1.28: Multi-Trip Steering Axle Fee Table—Schedule 11

Permitted weight above legal weight Tons	Fee per Month C$
0 to 1 ton	1.75
Greater than 1 to 2 tons	7.00
Greater than 2 tons to 3 tons	12.00
Greater than 3 tons to 4 tons	21.00
Greater than 4 tons to 5 tons	32.00
Greater than 5 tons to 6 tons	44.00
Greater than 6 tons to 7 tons	60.00
Greater than 7	75.00

The feel for an overload self-recording permit is C$15; the single-trip OW permit fee is also payable. For vehicles hauling logs, another set of criteria is applied:

a) C$200 per log haul season (the Director of Transport sets the term of the log haul season), and

b) C$20 per route map, where it is a condition of the OW permit that a route map must be attached to the permit for its validity.

No fee is payable for an OW or over-dimensional permit issued to the Government of Canada, Government of Alberta or another province, a foreign government, or municipality or board defined by the School Act. No fee is payable for an OW or over-dimensional permit issued for a point-to-point move within the corporate limits of a city or town. In a municipality other than a city or town, no fee is payable for an OW or over-dimensional permit issued for a point-to-point move within an industrial park, or if a municipality has passed a by-law to that effect. The CVDWRA specifies that any fee payable under its provisions be rounded off to the nearest dollar.

In Alberta, an exemption for farm equipment movements is also in place. Farm vehicles are not subject to width restrictions, but vehicle height is limited to minimize issues with utilities and other overhead structures. There is no permit fee for farmers. A fee for an over-dimensional permit for commercial operators is $60 per year for the whole company.

1.11.3 Saskatchewan

The Vehicle Weight and Dimension Regulations (Chapter H-3-01, Reg 8) effective November 12, 2010 and amended by Saskatchewan Regulations 46/2011, 12/2014, an Errata Notice published in Part II of the Gazette on May 2, 2014, and an Errata Notice published in Part II of the Gazette on April 24, 2015 set forth permit fees for OS/OW vehicles in the province in Part VI, Permit Fees, Sections 21–23. No permit fee is required under Section 21 if issued for:

a) moving a grain bin of any dimension;
b) operating a vehicle of any dimension that is transporting a load of hay or straw;
c) towing, operating, or transporting farm equipment of any dimension, including the load or contents of any description; or
d) towing, operating, or transporting a vehicle or machinery of any dimension, including the load or contents of any description, on a provincial highway for a distance of not more than 10 kilometers (6 miles).

Single-trip Permit

Under Section 22, if a permit is issued for a single-trip providing for any axle unit to carry a weight exceeding the maximum allowable gross weight, the fee is C$42 plus C$0.05 for each kilometer traveled. If a permit is issued for a single-trip providing for any group of axles that is not an axle unit, the fee is C$42 plus C$0.05 for each kilometer traveled.

If a permit is issued for a vehicle to transport a divisible load where the GVW exceeds the maximum allowable GVW limits and the permit is issued subject to an agreement entered into by the minister pursuant to clause 4(1)(g) or (h) of the Act, no fee is payable.

If a permit for a single-trip of road construction and maintenance equipment is issued, the fee payable is C$20 plus C$0.20 for each kilometer traveled over 10 kilometers.

Multi-trip Permit

For a multi-trip permit, the fee is C$66 per ton, or part of a ton, in excess of the allowable gross weight, per year. This fee is calculated based on gross weight carried by the axle unit that most exceeds the weight set forth in the regulations. If a multi-trip permit is issued for less than one year, the fee shall be prorated at the rate of one-twelfth for each month or part of a month for which the permit is issued, but the minimum fee payable is C$10.

Over-Width and Over-Length vehicles

Table 1.29 lists the permit costs for an over-width vehicle or load for a single-trip.

Table 1.29: Single-trip Over-Width Vehicle or Load

Width	Fee C$
Vehicle or load is more than 2.6m (8'6")wide but not more than 3.1m (10'2") wide	0
vehicle or load is more than 3.1m (10'2") wide but not more than 3.7m (12'1") wide	17
vehicle or load is more than 3.7m (12'1) wide but not more than 4.3m (14'1") wide	36
vehicle or load is more than 4.3m (14'1") wide	72

The permit cost for an over-width vehicle or load for multiple-trips (annual permit) is shown in Table 1.30.

Table 1.30: Annual Multiple-trip Permit Over-Width Vehicle or Load

Width	Fee C$
vehicle or load that is more than 2.6m (8'6") wide but not more than 3.1m (10'2") wide	15
vehicle or load that is more than 3.1m (10'2") wide but not more than 3.7m (12'1")wide	100
vehicle or load that is more than 3.7m (12'1")wide but not more than 4.3m (14'1")wide	144
vehicle or load that is more than 4.3m wide (14'1")	144

Permits are also issued for over-width buildings. For an over-width building that is more than 2.6m (8'6") wide but not more than 3.05m (10') wide, the permit costs nothing. For a building that is more than 3.05m (1-') wide but not more than 6.m (19'8") wide, a permit fee is C$36. A permit fee for a building that is more than 6.0m (19'8") wide costs C$72.

Permits are also issued for over-length vehicles. The fee schedule for a single-trip permit is as follows:

i. vehicle that is more than 12.5m (41') long but not more than 23m (75'5") long, and for a mobile home, nil;
ii. vehicle that is more than 23m (75'5") long but not more than 29m (95'1") long, C$10; and

iii. in the case of a vehicle that is more than 29m (95'1") long, C$15.

The fee schedule for a multiple-trip permit for one year for an over-length vehicle is as follows:

i. vehicle that is more than 12.5m (41') long but not more than 23m (75'5") long, C$10;
ii. vehicle that is more than 23m (75'5") long but not more than 29m (95'1") long, C$60; and
iii. vehicle that is more than 29m (95'1") long, C$120; and
iv. fee for a multiple vehicle, multiple-trip permit for one year issued to a permit holder operating under an EEMV agreement or a LCV permit is C$300.
    a) An EEMV agreement means an Energy Efficient Motor Vehicle Transportation Partnership Agreement entered into between the minister and a permit holder for the purpose of allowing the permit holder to operate an energy efficient motor vehicle.

Over-Height Vehicles and High-Load Corridor Routes

Under Section 23.1, high-load corridor routes are laid out for over-height or OW vehicles, namely:

- Provincial Highway No. 4, from the junction of Provincial Highway No. 15 to the junction of Provincial Highway No. 7;
- Provincial Highway No. 7, from Saskatoon to the Alberta Boundary; or
- Provincial Highway No. 15, from Melville to Provincial Highway No. 4, including those portions of Provincial Highway No. 6 and Provincial Highway No. 20 required to connect north and south junctions of Provincial Highway No. 15.

For permits issued for an over-height vehicle or load for travel in a high-load corridor route, the fee is:

- C$1 plus C$0.20 for every 10cms (3 $^{15}/_{16}$ inch) over 6m (19'8") in height for each kilometer traveled for a vehicle having a height that is more than 6m (19'8") but less than 8.9m (29'2"); or
- C$6.80 for each kilometer traveled for a vehicle having a height of 8.9m (29'2") or greater.

Over-Dimensional Vehicle Partnership Agreements

If vehicles exceed a regulated dimension with a single piece of cargo, they can be issued single-trip permits through the SGI permit office. This permit allows the vehicle to carry additional cargo as long as it does not exceed any other legal dimension in addition to the dimension it is permitted for, in which case it would require a TPA (Govt of Saskatchewan, not dated (c)). The over-dimensional haul agreement principles allow movement of vehicles that are overly long or overly wide and/or loads on the provincial highway system subject to:

- Carrier must follow routes designated in the agreement.
- An administration fee of C$1000 is charged annually.
- Vehicle permits issued are pursuant to agreements. Permits will show permitted dimensions.

Additional conditions of over-dimensional haul agreements include:

- Dynamic stability characteristics must be within safe limits.
- Speed is restricted (speed recording devices are required) for vehicles or loads exceeding 26m (85'3") in length and/or over legal width and for all configurations where reduced speeds would bring dynamic stability within TAC standards.
- Operation is not allowed where inclement weather or other conditions impair visibility (rain/snow), traction (ice), or handling (winds).
- Drivers are subject to special qualifications and performance criteria where length exceeds 26m (85'3").
- Vehicles exceeding specific dimensions must be properly flagged and/or lit and accompanied by escort vehicle(s).
- Hours of operation are restricted where required in accordance with The Vehicle Weight and Dimension Regulations, 1999.

Canada New West Partnership

In 2010, Canada's New West Partnership was created between B.C., Alberta and Saskatchewan to strengthen economies in Western Canada (Partnership). The Partnership focuses on four areas: trade, international cooperation, innovation, and procurement. In July 2011, B.C., Alberta, and Saskatchewan implemented a schedule to harmonize the provinces' vehicle weight and dimension laws. For divisible load OS permits, B.C. and Saskatchewan are redeveloping their divisible load policies using Alberta's permit conditions as a model. The partnership also provides for an increased maximum allowable weight on truck tractors for steering axles. For tridem drive truck tractors, the partners will defer to Alberta's dimension laws. The three provinces also agreed to harmonize overall lengths of double trailer combinations.

Areas that were set for negotiation by July 2012 include reviewing weight limits for vehicles used to haul very heavy equipment, along with turnpike doubles, rocky mountain doubles, and tandem axle weight limits. For divisible OS load permits, the partnership is reviewing policies to determine opportunities for reconciliation in the various approaches. For

OS/OW corridors, they are reviewing current routes to determine if more interprovincial connections can be constructed. They are also reviewing how provinces could provide road and construction information, including highway geometry and clearance, to plan multi-state permitted moves.

1.11.4 Manitoba

The Motor Carrier Permits and Development (MCPD) division administers and issues OS/OW permits and collects permit fees in the province of Manitoba. The MCPD also develops and implements the Spring Road Restrictions Program and maintains the automated routing and permitting system (ARPS). On February 11, 2011, Manitoba and Saskatchewan signed a memorandum of understanding on the harmonization of regulations and cooperation on transportation issues. Furthermore, the Motor Carrier Division published a guide on July 6, 2015 detailing the vehicle weight and dimension limits in Manitoba.

OW Permits

The Highway Traffic Act and Highway Traffic Act Regulations 197/2006 set forth permit fee costs for OS/OW permits. The cost of a non-annual OW permit is the greater of C$0.036 per km from point of departure multiplied by each increment of 1,000kg (2,204 lb) or part of such increment or C$6.

An annual OW permit is C$75 for each increment of 1,000kg (2,204 lb) part of such increment. This permit allows a vehicle to be over the allowable axle weights for its axle units. If an annual OW permit covers two or more highways, the lightest of the allowable axle weights for each axle unit is used to determine by how many kilograms the permit allows the axle to exceed its allowable axle weight.

Over-Width Permits

Over-width permits are issued for non-divisible loads that result in a vehicle with a width of more than 2.6m (8'6"). D signs and "wide load" signs are required for vehicles with a width exceeding 3.05m (10'); an escort is required for a vehicle wider than 4.6m (15'1"). Permits for vehicles with a width of 9m (26'6") or more must be requested at least two business days prior to the move date. Restrictions typically prohibit over-width vehicles from traveling on the highways during spring because they can damage vulnerable shoulders. Vehicles with widths in excess of 4.6m (15'1") are also not allowed on PTHs 100 and 101 from 7 to 9 a.m. and from 3.30 pm to 5.30 p.m. They are also not allowed on commuter routes or truck routes outside of Winnipeg during these times unless a permit is specifically approved. Table 1.31 lists over-dimensional permit costs for single-trip and annual permits.

Table 1.31: Over-Dimensional Permit Costs—Single-Trip and Annual

C$ Single	C$ Annual	Width
6	20	Authorizes width of 2.61m (8'6") to 3.05m (10')
15	45	Authorizes width of 3.06m (10') to 3.70m (12'1")
36	95	Authorizes width of 3.71(12'2")m to 4.30m (14'1")
72	195	Authorizes width of 4.31m (14'1") or more
6	20	Authorizes projection of any length from front of vehicle
6	20	Authorizes length of 20.1m (65'11") to 23m (75'5")
8	80	Authorizes length of 23.1m (75'9") to 30m (98'5")
12	160	Authorizes length of 30.1m (98'9")or more

Manitoba Trucking Productivity Improvement Fund

Section 34.1(1) of the Highways and Transportation Act establishes the Manitoba Trucking Productivity Improvement Fund (TPIF) for (a) funding or supplementing the funding of highway rehabilitation to remedy accelerated deterioration attributed to OW or over-dimensional vehicle traffic, (b) improvements in the load carrying capacity, productivity and safety of highways, and (c) other projects prescribed in the regulations that benefit Manitobans and the trucking industry. Permit fees paid for OS/OW vehicles are deposited into this fund according to the guidelines set out in the Act, along with any monetary penalties payable to the fund that are prescribed by regulation.

The TPIF is a voluntary user-pay program that allows increased loading on lower class highways. A trucking company completes an application form that details in great specificity a route and vehicle information and the commodity being transported. The application must be accompanied by an insurance certificate with a minimum of C$5,000,000 coverage per occurrence, as well as general liability insurance coverage for non-owned vehicles with a minimum limit of C$5,000,000.

A letter of permission is required from a municipality if the route includes a municipal road. The route is then analyzed and evaluated, a cost is determined accordingly, and a TPIF contribution for each route is applied. There is also a $20 administrative fee for each permit issued.

1.11.5 Ontario

Ontario's Highway Traffic Act 1990 (as amended) and Regulations establish laws governing OS/OW vehicles. The maximum width of a vehicle load is set at 2.6m (8'6"). Some exceptions include:

- Raw forest products (en route) – 2.8m (8'6").
- Road service vehicles traveling to and from a maintenance site or repair center – no specified limit.
- Loose fodder (including rectangular and round bales of hay) – no specified limit.

The maximum length of a single vehicle including load is 12.5m (41') with exceptions for:

- A fire apparatus
- A semi-trailer
- An articulated bus

The maximum length of a semi-trailer and its load is 14.65m (48'). This does not include any extension in length caused by auxiliary equipment or machinery not designed for carrying a load.

The maximum length of a combination of vehicles and their load is 23m (75'5"). The maximum height of a vehicle and it load is 4.15m (13'7").

Maximum weight allowances are determined using axle configurations and spacings. A permit is required if the axle and/or GVW exceeds the limits set out in the Act. Implements of husbandry are subject to an over-dimensional permit. These include over-dimensional farm machinery, farm tractors, and self-propelled implements of husbandry (SPIH) carried on a plated motor vehicle or plated trailer drawn by a motor vehicle.

Permits are issued for indivisible vehicles and/or loads when, if separated into smaller loads or vehicles, separation would

- Compromise the intended use of the vehicle or load
- Destroy the value of the load or vehicle
- Require more than 8 work hours to dismantle

The permit application process requires application forms be submitted by fax, e-mail, mail, or in person at an Ontario Ministry of Transportation Permit issuing office. Ontario allows some municipalities to set OW permits. These must be obtained from the individual municipalities. The permit issuer can consider multiple factors before granting an OS/OW permit which include:

- Complete and accurate application.
- Effect of the move on the safety and convenience of other highway users.
- Physical characteristics of the proposed route(s) including bridge restrictions, likely traffic conditions, any special events occurring.
- Time of year and potential weather conditions, and distance to be traveled, time to complete a move and where move takes place.
- Can the move be reasonably carried out using an alternative means of transportation?
- Can the load be reduced in size or weight?

- Can travel on roads other than province highways be conducted in accordance with the rules of the jurisdiction/municipality?
- Is there a traffic management plan in place for exceptional moves?

The permit issuer may limit the time and particular highway(s) that can be used and can also include certain special conditions or provisions in the permit considered necessary to protect the safety and integrity of the highways and other road users. Before issuing the permit, the ministry may also require a bond or other security sufficient to cover the cost of repairing possible damage to the highway be posted. The permit grants movement of OW loads on highways under provincial jurisdiction. Municipalities may accept ministry permits, or they can issue their own permits for highways under their jurisdiction. The carrier must contact the appropriate municipality(ies) to ensure compliance with local by-laws.

The ministry issues four types of permits:

- Annual
- Project
- Single-trip
- Special Vehicle Configuration

Permit Fees

The permit fee structure is as shown in Table 1.32:

Table 1.32: Permit Fees

Permit Type	**Cost C$**
Annual Permit	400
Project Permit	260
Single-trip Permit	
Oversize	65
Overweight: weight up to 120,000 kg (264,554 lb) travel on provincial highways	
Up to 100km (62m)	125
From 101km (62m) to 500 km (310 m)	200
Over 500km (310m)	260
Overweight over 120,000 kg (264,554 lb) regardless of distance	700
Oversize and overweight	Prices as for overweight above
Special vehicle configuration	Refer to Highway Traffic Act S110.1 (10)
Payment can be made by credit card or certified personal check unless payment is sent by mail. Cash for walk-in clients only.	

Source: Ontario Ministry of Transportation Guide to OS/OW Vehicles and Loads

Annual Permits

Annual permits are usually processed in 10 to 15 business days. Dimensions for an annual permit are set out in Table 1.33.

Table 1.33: Maximum Dimensions Permitted on Annual Permit

Single	Combination	Width	Height
12.5m (41') length including a max rear overhang of 4.65m (15'3")	25m (82') length with max rear overhang of 4.65m (15'3")	3.7m (12'1") on two-lane highways and 3.85m (12'7") on multi-lane (same for single/combination vehicles)	4.26m (13'11") (same for single/combination vehicles)
Weight is per the Act	Overweight requires contact with permit office, allowed up to 63,500 kg (140,000 lb)		

Project Permits

A project permit can be issued to allow contractors to move similar loads, objects, and structures over the same specified route for a period of up to, and including, six months. A copy of the project contract is required in the application. The letter of contract must be written on company letterhead and include the following information:

- Name and address of the carrier
- Contract number (if available)
- Duration of the contract
- Description of the product being transported
- Origin of load and destination with complete route specified including municipal roads

The permit office will assess traffic and construction issues before approving and issuing the permit. The weights and dimensions in the application must be load-specific. The maximum dimensions allowed on a project permit are as follows in Table 1.34:

Table 1.34: Maximum Dimensions on Project Permit

Single	Combination	Width
12.5m (41') length including a max rear overhang of 4.65m (15'3") Height up to 4.26m (13'11")	36.75m (120'6")length with max rear overhang of 4.65m (15'3") No height limit if load is on float type trailer. Height greater than 4.3m (14'1") require route clearance	Up to 4.30m (14'1")(same for single and combination) Escort vehicles may be required.
Weight is per the Act	Weight up to 70,000kg (154,323 lb)	

Single-Trip Permits

A single-trip permit may be issued for an OW move for a one-way trip along a specified route for a limited time period. These must be applied for 24 hours before the proposed move date, but two to three business days is recommended. Table 1.35 depicts the dimensions allowed for single-trip permits:

Table 1.35: Dimensions for Single-Trip Permit

	Length	Width	Height	Weight
Combination Vehicle	23m (75'5") – 45.75m (150'1") Over 45.75m (150'1") must be submitted to SCT permit office	2.61 (8'6") to 5m (16'4") Over 5.0m (16'4")must be submitted to STC	4.16m (13'7") or greater Max height on flatbed trailer is 4.26m (13'11")	120,000kg (264,554 lb) subject to weight & load engineers approval
Single Vehicle	12.5m (41') including overhang up to 4.65m (15'3")	2.61 (8'6") to 5m (16'4") (any permit office) Over 5.0m (16'4")must be submitted to STC	Max 4.26m (13'11")	

For exceptional dimensions permits for more than 5m (16'4") in width, and/or 45.75m (150'1") or more in length, and/or over 120,000 kg (264,554 lb), applicants must send their application to a specialized permit office five days before the proposed move date. The approval process minimum turnaround time is 72 hours but can take up to 14 days to process.

Superloads

Loads in excess of 120,000kg (264,554 lb) GVW, and/or 5m (16'4") in width, and/or 45.75m (150'1") in length that intend to use a two-lane highway route or 7m (22'11") width multi-lane highways are considered "superloads." These superloads are not considered to be routine applications and require additional processing time. Applications require supplementary documentation and are reviewed by the Ministry of Transportation's weight and load engineer and other ministry personnel. The application also requires a project justification for the intended move which normally includes:

- Documentation outlining why alternate means of transportation (e.g., rail, water, or possibly air) are not being pursued;
- Detailed description of the load, including an engineering drawing when applicable illustrating the item's construction and why it cannot be reduced in size or weight; and
- Detailed description of the project the item is intended for, including: construction schedule, consequences of late delivery, and the economic benefits associated with the project.

After reviewing the project justification documents, the ministry will consider the necessity of permitting the move. If the move is satisfactorily justified and considered to be absolutely necessary, the applicant is required to:

- Hire a designated consultant engineer to evaluate the bridges on route and submit the evaluation for approval.
- Submit a detailed traffic management plan describing all aspects of the intended move, including:
- Detailed escort requirement and procedures identifying the responsibility of all units involved (OPP and private);
- Detailed route survey indicating all appropriate locations for road closures, pull-over areas, emergency parking, fuel stops, significant turning movements, and any anticipated roadside related activities such as restricting roadside parking;
- Contingency plans for breakdowns; and
- Municipalities requiring separate permits.

Special Vehicle Configuration

Special Vehicle Configuration permits are issued for vehicles that vary from the requirements of the HTA and regulations. The purpose of Special Vehicle Configuration permits is to harmonize configurations, weights, and dimensions applicable to a class of vehicles with those in any other jurisdiction; to allow for a trial of a vehicle; or to allow for a variance from a limit within a specific geographical area.

Night Moves

Night moves are allowed for all permit types with certain restrictions provided that all conspicuity requirements are met. Two criteria are applied here for different vehicle dimensions.

Criteria 1: for over length and/or over width allows night moves for vehicles (and loads) up to and including 3.05m (10') wide and 25m (82') long. These are restricted to multi-lane controlled access highways with a median. The lane width on these types of highways is 3.75 m (12'3").

Criteria 2: for overheight and/or overweight allows night moves for vehicles and loads up to and including 4.26m (13'11") high and 63,500 kg (140,000 lb). These can travel on all the "King's highways."

If both criteria are in-play the conditions for both criteria are "Conspicuity requirements" must be met during a night move. These consist of the extremities being marked with a solid amber lamp(s) visible in the front and rear, conforming to SAE Code P2 or P3 with markings to appear on the lamp(s), and a retro-reflective "D" sign must be present. The night moves are restricted when inclement weather conditions prevail.

Public Holiday Moves

OW moves are allowed for all permit types on public holidays (New Year's Day, Family Day, Good Friday [Easter], Victoria Day, Canada Day, August Civic Holiday, Labor Day, Thanksgiving, Christmas Day, and Boxing Day) and the preceding day of a public holiday, subject to the following restrictions.

OW moves are allowed between half hour before sunrise and noon on a public holiday for dimensions that do not exceed:

- width of 3.70m (12'1") on two lane highways and 3.85m (12'7") on multi-lane highways
- length no greater than 25m (82') for combination vehicles and 12.50m (41') for single vehicles
- height maximum of 4.26m (13'11")
- weight no greater than 63,500kg (140,000 lbs).

The movement of vehicles and/or loads in excess of the dimensions listed above, is not permitted to travel on a public holiday but can travel on the preceding day subject to:

Preceding day means the day before a statutory holiday restriction. If the statutory holiday is a Saturday, Sunday or Monday, the preceding day is the Friday. If the statutory holiday is on any other day of the week, the preceding day is the day before the holiday.

OW moves are allowed all day on the preceding day of a statutory holiday for dimensions that do not exceed the following dimensions:

- width of 3.70m (12'1")on two lane highways and 3.85m (12'7") on multi-lane highways
- length no greater than 25m (82') for combination vehicles and 12.50m (41') for single vehicles

- height maximum 4.26m (13'11")
- weight no greater than 63,500kg (140,000 lbs).

Vehicles and/or loads in excess of the dimensions listed above are only allowed to travel between half hour before sunrise and noon on the preceding day of a public holiday. Weekend moves are allowed for all permit types with certain restrictions on dimensions. Weekend moves also have restrictions during summer months. OW moves are allowed all day Saturday and Sunday for dimensions that do not exceed the following dimensions:

- width of 3.70m (12'1") on two lane highways and 3.85m (12'7") on multi-lane highways
- length no greater than 25m (82') for combination vehicles and 12.5m (41') for single vehicles
- height maximum 4.26m (13'11")
- weight no greater than 63,500kg (140,000 lbs).

Sunday travel is not permitted between noon and midnight during the restricted summer months of June, July, August (Southern Ontario) and July and August (Northern Ontario) for any OW vehicles and/or loads.

Friday restrictions in summer months prohibit travel between 3:00 pm and midnight during the restricted summers months of June, July, August (Southern Ontario) and July and August (Northern Ontario) for any OW vehicles and/or loads. The exception for this is that for vehicles and/or loads with heights up to, and including, 4.26 m (13'11")and overall weight not exceeding 63,500 kg (140,000 lbs) travel between 3:00 pm and midnight on Fridays during summer may be permitted.

Long Wheelbase Tractors

While under Ontario Regulation 413/05 the province prefers to restrict the wheelbase of tractor units to the 6.20m (20'4") national standard it is aware that many carriers that specialize in the movement of OW indivisible loads often operate such over length tractors to accommodate the additional axles, heavier duty suspensions, and/or sliding fifth wheel assemblies for weight distribution. Ontario's Ministry of Transport will routinely authorize carriers to operate such fleets of specialized vehicles for routine "permitted" transportation of lighter O/O loads. The Ministry notes that this accommodation "however, is not intended to inadvertently authorize operation of overlength tractors equipped with large sleeper berths or living quarters, frequently utilized in other jurisdictions."

Permit issuing staff are required to verify tractor wheelbase dimensions and they can to ask for clarification and/or support documentation defining the requirements for the overlength tractor.

The Greater Toronto Area Restrictions

Within the Greater Toronto Area (GTA) vehicles and/or loads travelling under a single-trip or project permit are often subject to a congested traffic condition (Condition). The Condition applies to all single-trip and project permits with dimensions that exceed the following dimensions:

- width of 3.70m (12'1") on single highways, 3.85m (12'7") on multi-lane highways
- length exceeding 25m (82')
- height exceeding 4.26, m (13'11")
- weight in excess of 63,500kg (140,000 lbs).

Under the Condition permits are not valid for vehicles travelling in the specified area directions entering the GTA between the hours of 7:00am to 9:30am and vehicles travelling in the area directions exiting the GTA between the hours of 3:30pm to 6:30pm.

Bonds and Securities

The Ministry may require a bond, or other security, sufficient to cover the cost of repairing possible damage to the highway, is posted before issuing a permit. The following sets of circumstances may be sufficient to warrant a bond being posted:

- where loading on tires must exceed 11 kg (24 lb) per millimeter width,
- where loading on axle must exceed 10,000kg (22,046 lb) during reduced load period,
- where total GVW exceeds 120,000kg (264,554 lb) subject to engineering analysis of bridge structures and geotechnical assessment of roadway structure,
- where OW vehicles must be routed over substandard bridge structures subject to engineering analysis of bridge structures, or
- deemed to be warranted by the Director of the Carrier Safety and Enforcement Branch.

The value of the bond will be determined by the ministry. A carrier may be required to pay for the services of ministry approved geotechnical and/or structural consultants to assess conditions and evaluate any damages caused by the move.

Escort Vehicles

A permit may be issued on the condition that the permit holder provides escort vehicle(s) either preceding or following the OW vehicle or load. No escort is required:

- for widths from 2.61 m (8'6") to 3.99 m (13'1")
- for lengths from 23.01 m (75'5") to 36.75 m (120'6")

- for heights from 4.16 m (13’7”) to 4.86 m (15’11”)

A private escort warning vehicle is required for widths:

1. from 4 m (13’1”) to 4.99 m (16’4”) - 1 escort vehicle required on multi-lane highways
2. from 4 m (13’1”0 to 4.59 m (15’) - 1 escort vehicle required on two lane highways
3. from 4.6 m (15’1”) to 4.99 m (16’4”) - 2 escort vehicles required on two lane highways

A private escort warning vehicle is also required for over length vehicles:

- from 36.76 m (120’7”) to 45.74 m (150’) - 1 escort vehicle required
- rear overhang greater than 4.65 m (15’3”) - 1 escort vehicle required at the rear of load

An exception exists for mobile/modular homes: for a height greater than 4.87m (15’11”) one escort vehicle (pole car) is required. Mobile and/ or modular homes greater than 29.25m (95’11”) in length are not permitted to travel in convoy and require two private escort warning vehicles to accompany each load. Annual and project permit holders must provide a private escort warning vehicle on the certain stipulated highways when the load measurement meets or exceeds the listed widths:

Reduced Load Period

Annual and project permits for moving heavy vehicles, loads, objects or structures that exceed legal weight limits are not valid on any King's highway during the months of March and April (Southern Ontario) and March, April and May (Northern Ontario). Weights in excess of legal limits are only allowed when specifically authorized to do so under permit conditions.

Single-trip permits may be issued for movements on highways subject to reduced loading restrictions. However, the Weight and Load Engineer must approve these moves. Annual permits with special weight condition for specific axle weight configurations have an additional condition for reduced load periods.

Corridor Moves

OS/OW permits may be issued to Canadian or US carriers for movements within or through the province of Ontario under the following conditions:

- move originates and terminates in Ontario;
- move originates in Ontario and terminates in another province or territory;
- move originates in another Canadian province/territory, or one of the states of the United States of America, and terminates in Ontario;

- move originates in another Canadian province or territory and terminates in another/same Canadian province and/or territory, or one of the states of the United States of America, where Ontario is to be used as a corridor.
- move originates in one of the states of the United States of America and terminates in another Canadian province or territory, where Ontario is to be used as a corridor.
- move is a mobile home that originates and terminates in the United States of America, Ontario may be used as a corridor.

It should be noted that convoy moves are not permitted. Loads must be separated by at least 45 minutes. When on route, a minimum spacing of 10km (6m) is required. Annual and project permit holders may encounter construction zones where the horizontal clearance has been reduced to less than 3.70m (12'1") or vertical clearance has been reduced to less than 4.26m (13'11"). Before traveling through any construction zone, the permit holder is responsible for verifying clearances.

Metric Conversion:

Ontario measurement standards are in metric. To convert imperial measurement to metric:

- Convert measurement to inches and multiply by 0.0254, e.g.,
  9'6" = (9' x 12) + 6"
  = 108" + 6" = 114"
  114" x 0.0254 = 2.89 meters

- Convert weight from pounds to kilograms, divide pounds by 2.205,e.g., 154,000 lbs ÷ 2.205 = 69,841 kgs

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Chapter 2. Development of the Stage 1 Expedient Analysis Framework

This chapter describes the development of the Stage 1 Expedient Analysis Framework. The results include the decisions made during two simulation presentation meetings with TxDOT Maintenance Division personnel and the researchers, which included decisions about the priority of features and information to be included in the Stage 1 Expedient Analysis Tool. Also included is information obtained during a workshop held on February 11, 2015, at CTR with the TxDOT Project Monitoring Committee (PMC), TxDOT subject matter experts, and the researchers.

2.1 Introduction

2.1.1 Background

According to US Customs and Border Protection, there are 328 official POEs currently in the US, which include land border crossings (international bridges), seaports, and airports. Twenty-nine POEs are located in Texas, more than any other state. Of the 29 POEs, the southern border crossings and seaports play a key role in processing international freight from Mexico due to its geographic proximity. Figure 2.1 depicts these commercial and noncommercial international POEs located along the Mexican border with Texas. Previous studies have shown that problems have arisen from the fact that Mexico allows heavier and longer trucks on its road system than does Texas or much of the United States. This has resulted in significant economic loss due to the high cost associated with time delays and potential product damage (Batheja, 2013). For example, the heavier trucks hauling produce from Western Mexico to Southern Texas, specifically through Hidalgo County, have to stop in the city of Reynosa to redistribute their loads to adhere to the Texas regulations. This has caused drivers to make long stops, leading to a reduction in the quality of produce they are carrying, especially during hot days. As a result, local jurisdictions including ports, RMAs, and the State Legislature has recognized that economic benefits can be gained by establishing permitted OW truck corridors that serve ports and border POEs. While these OW truck corridors require a permit for the operation of an OW truck on the corridor, they allow heavier trucks to cross the Texas-Mexico border. Figure 2.2 shows the ports and POEs that have already been established as well as regulated OW truck corridors, such as the PoB, Port of Freeport, and Hidalgo County RMA. In addition, jurisdictions are shown that have been given authority, through a Legislative Bill, to negotiate with the Texas Transportation Commission and the Texas Department of Transportation (TxDOT) to establish such corridors.

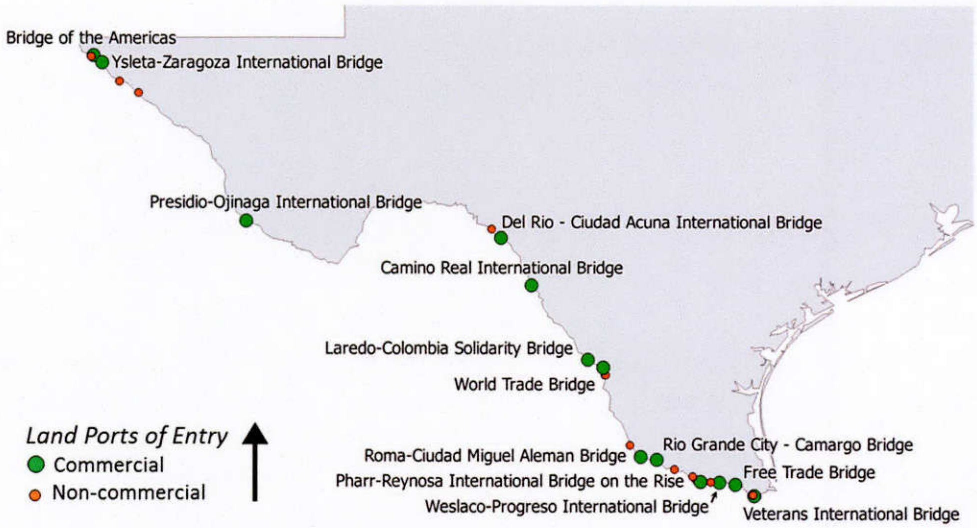


Figure 2.1: Border POEs in Texas

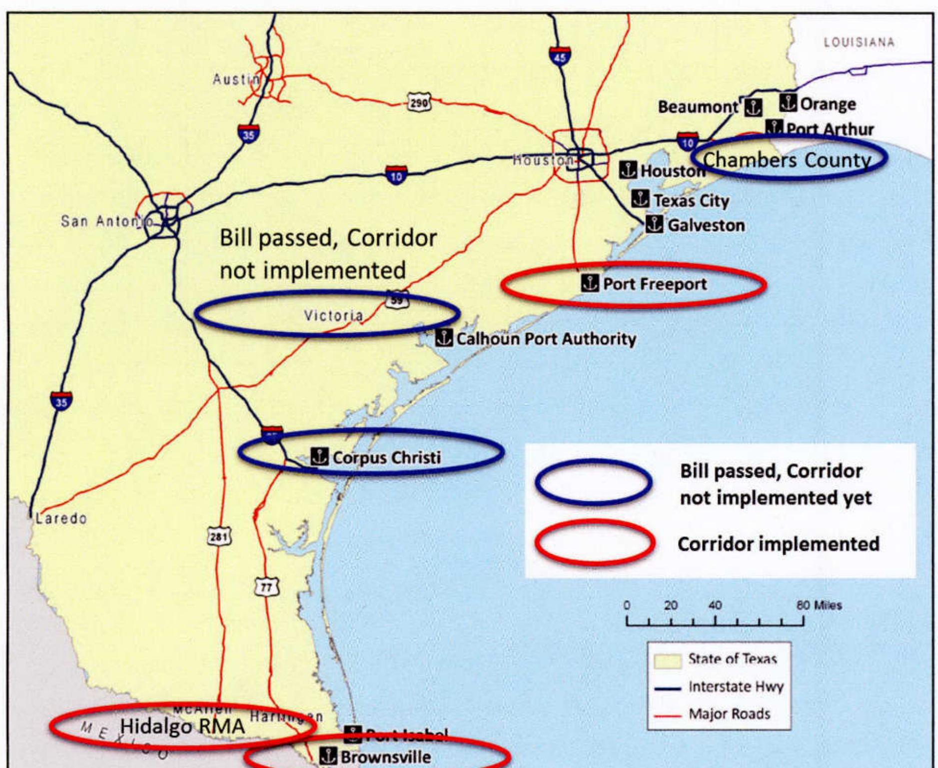


Figure 2.2: Texas Deep Water Ports and Location of Three Established Permitted OW Truck Corridors

During legislative sessions, discussions between members of the legislature, TxDOT, and representatives of jurisdictions seeking a corridor often result in questions about managing a corridor. These questions may relate to the cost to upgrade existing state roadways and bridges, the long-term infrastructure consumptions rates due to OW trucks, and the resulting maintenance expenditures. These questions often result in requests for information from TxDOT that typically need to be processed in a short period time. The information provided must be based on rational engineering and cost estimating processes and reported with appropriate and detailed information, including cost estimation results for the proposed corridors.

To address the need for a rational but fast method to determine costs and a proposed permit fee, the research team developed the Stage 1 Expedient Analysis Method. The method was used to evaluate potential OS/OW freight corridors that will serve Texas coastal port regions and border POEs during Stage 1 of this project. Once the methods were set up, an Excel-based Expedient Analysis Tool was created subsequently based on the methods developed.

2.2 Stage 1 Expedient Analysis Tool

2.2.1 Purpose of the Stage 1 Expedient Analysis Tool

TxDOT personnel need a tool to be able to promptly evaluate the impacts of freight traffic in a limited amount of time whenever that information is requested, noticeably from the legislature and administrative figures. Due to the short time frames involved, network-level or default values are required to provide reasonably accurate cost estimations. More detailed project-level information will likely not be available under these circumstances and in any case would require some complicated steps demanding considerable time to evaluate.

In this sense, the Stage 1 Expedient Analysis Tool pwas developed to aid TxDOT in estimating costs and a suggested permit fee that would provide for cost recovery for an existing, or proposed, OW truck corridor within the required time constraints. To achieve this goal, the tool generalizes and simplifies the cost estimation process by providing tables of default values based on sound analytical assumptions using information currently available about operational OW truck corridors. The Stage 2 Detailed Analysis Tool, to be developed in Stage 2 of this study, will provide more accurate and detailed cost estimations based on detailed, project-level data and information. The Stage 2 analysis will not be constrained by the same time limitations associated with the Stage 1 analysis process and will therefore incorporate additional analytical processes.

The Stage 1 Expedient Tool provides users with a process and a means to:

1. Describe a permitted OW corridor using route links.
2. Estimate numbers of permitted trucks, truck configurations, and weights.
3. Estimate the initial costs to upgrade the corridor.
4. Estimate the pavement and bridge consumption costs.
5. Calculate estimated the total costs for managing the studied corridor and a recommended permit fee.

6. Prepare a report documenting inputs, outputs, assumptions, and results.

The Stage 1 Expedient Analysis Tool was designed based on five assumptions as follows.

- **Assumption 1:** The total gross vehicle weight (GVW), including truck tare weight and cargo weight, and axle configurations based on the different truck characteristics were used to develop pavement and bridge consumption rates and to compute consumption costs for each truck classification.
- **Assumption 2:** The Stage 1 Analysis Method was applicable for ports, POEs, and RMAs serving coastal port regions and border POEs.
- **Assumption 3:** The existing, authorized route links at the PoB, Hidalgo County RMA, and Freeport OW corridors are assumed to be 'fixed' and not accessible to the Stage 1 tool user for adding to/removing from the corridor.
- **Assumption 4:** If a new port or RMA proposes an OW corridor, the types of cargo that are expected to be transported through the port or within the border region are used to select truck configurations and associated axle/GVW loads based on the configuration library developed from existing corridors.
- **Assumption 5:** The Stage 1 analysis process is fixed at 20 years.

These fundamental features and assumptions guided the development of the Stage 1 Expedient Analysis Tool Framework. The following section describes the framework and the five associated elements.

2.2.2 Stage 1 Expedient Analysis Tool Framework

The Stage 1 Expedient Analysis Tool framework is composed of the following five elements, as shown in Figure 2.3:

1. User Input module,
2. Data Library module,
3. Project Information module,
4. Cost Analysis module,
5. Permit Fee Recommendations/Reporting module

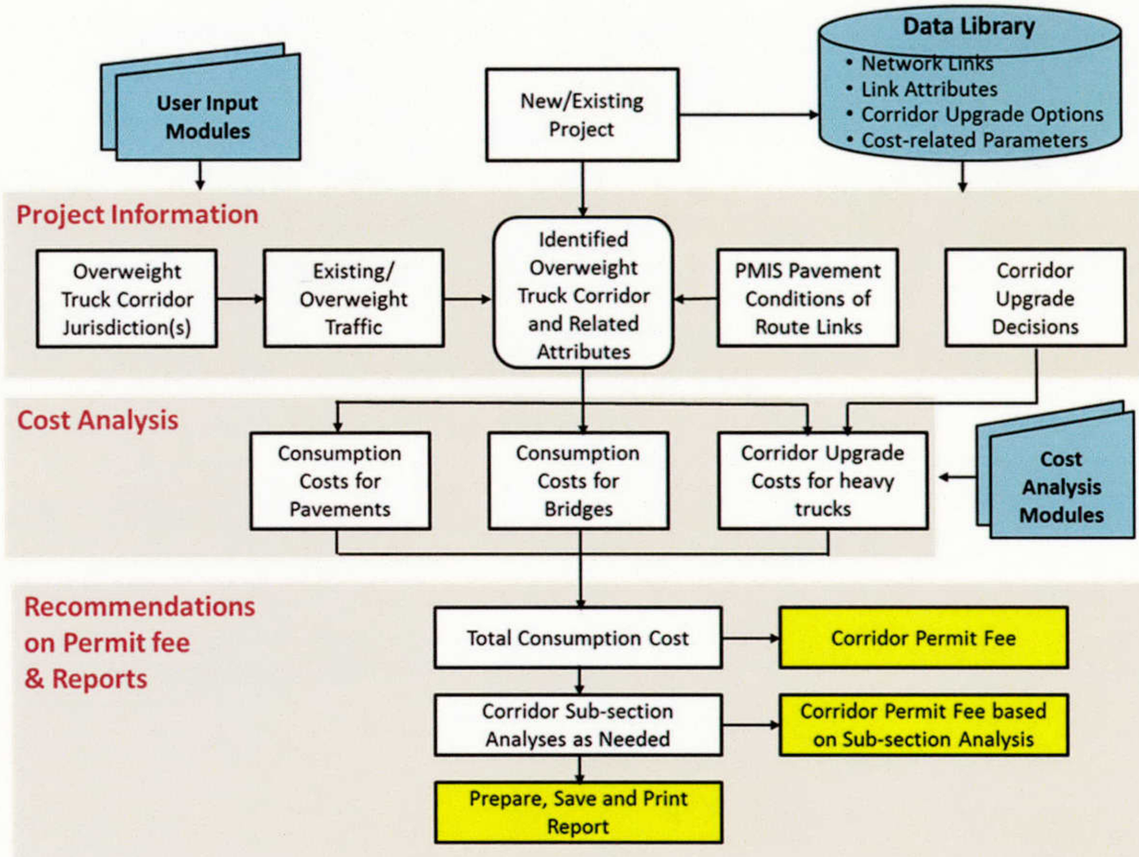


Figure 2.3: Stage 1 Expedient Analysis Tool Framework

<u>User Input Module:</u> The User Input Module will provide the user with options to describe the OW truck corridor and to provide inputs not previously stored in the data libraries. The user will be guided to provide needed information for the analysis, which will then link to data stored in the data library modules. Retrieving store data for the analysis will significantly reduce the time that would have been required for the user to obtain and input this information and potentially improve the analysis results. The tool will accommodate different jurisdiction configurations based on the user inputs and also guide users to provide more appropriate values for the inputs by offering additional information.

<u>Data Library:</u> The Data Library is a series of data tables containing information that will be developed from various available sources, such as import/export data for ports, default OW truck configurations based on existing permit information, TxDOT pavement and bridge treatment costs based on project plan information, and tables of pavement and bridge consumption rates based on the types of roadways along the Texas southern border. Once the user has provided inputs describing the corridor and other inputs that cannot be pre-determined, this information will be combined with the Library's information to provide all of the information required to conduct the cost estimation analysis.

Cost Analysis: After the user input is provided and the data library information has been extracted for the specific jurisdictions, the cost estimations analysis will be performed. The cost analysis will perform the following functions:

1. Calculate the cost to upgrade each corridor link based on the five basic Pavement Management Information System (PMIS) treatment levels: Do Nothing, Preventive Maintenance, Light Rehabilitation, Medium Rehabilitation, and Heavy Rehabilitation. The decision to apply a treatment or not will be made by the user. Project treatment costs per lane-mile, for each route type (FM, SH, US, and IH frontage roads), will be stored in a data library and combined with user inputs such as the route link length in miles and the number of lanes. This information will be used to compute the total project cost.
2. Additional treatments to upgrade safety and/or traffic operations may be required based on the user's judgment. Safety feature types and costs will be contained in a Library and may include the following:
    a. Install a left turn lane with storage
    b. Widen lane widths
    c. Add paved shoulders
    d. Widen structures
    e. Install guard fence and safety end treatments

    Examples of possible traffic operations upgrades include:
    a. Realign and improve intersection geometric design
    b. Install traffic signals
    c. Install railroad crossing signals and cross bucks
    d. Add new lanes

    Examples of possible bridge upgrades include the following options:
    a. Upgrade functionally obsolete bridges:
        i. Upgrade bridge rails
        ii. Widen bridge to match approach roadway width
        iii. Safety treat bridge rail end sections
    b. Upgrade structurally deficient bridges:
        i. Strengthen bridge structure components
        ii. Remove and replace bridge

    The researchers understand that, historically, the costs to upgrade the existing corridor roadways might not have been considered when calculating the corridor management costs or permit fee. However, to safely and efficiently accommodate both local traffic and large numbers of permitted OW trucks, the researchers think that options to include these costs should be available for consideration to the user of the Stage 1 tool.

3. Pavement Consumption Costs: The Stage 1 tool will use the same pavement consumption models, including failure modes and failure criteria that were used for Project 6736, "The Rider 36 Study." These models can be used to analyze any truck axle and load configuration on any pavement structure selected by the research team. Due to the time-consuming task of calculating consumption rates for each truck configuration for three failure modes, tables of pavement consumption rates will be developed that provide sufficiently accurate values for the Stage 1 analysis.
4. Bridge Consumption Costs: The Stage 1 tool will use the same bridge consumption analysis methods used for the Rider 36 study. A Monte Carlo simulation method will be employed to determine bridge consumption costs that will be used to create a Library Table of bridge consumption costs for specific truck configurations and associated route/bridge types.

Permit Fee Recommendations/Reporting: The final results obtained from the steps above will be synthesized and documented in the form of a report created by the tool. The report will document the corridor link components, numbers of OW trucks expected to use the corridor, truck configurations and cargo types, and the results of corridor cost and permit fee estimation.

2.2.3 Discussions of Each Component of the Framework

User Input Module

To conduct the cost estimation analysis, users must provide some information that cannot be abstracted from existing database. For this process, the User Input Module will play an important role to not only take inputs from users but also assist them to make better decisions by providing guidance.

First, users need to identify the local ports, RMAs, counties, or other jurisdiction(s) associated with the proposed OW truck corridor. This process will link to stored data and attributes of the various jurisdictions, such as port cargo types, annual tonnage, and percentage of each cargo type imported/exported to the corridor links of the freight corridor. Other types of information could include US Customs POE truck crossings, the types of cargoes associated within a region serviced by the corridor, and other factors that can vary among the jurisdictions. The tool will extract data associated with the jurisdictions associated with the corridor and will provide the user with initial information pertinent to the corridor being analyzed. Figure 2.4 presents an example of one input screen of the tool.

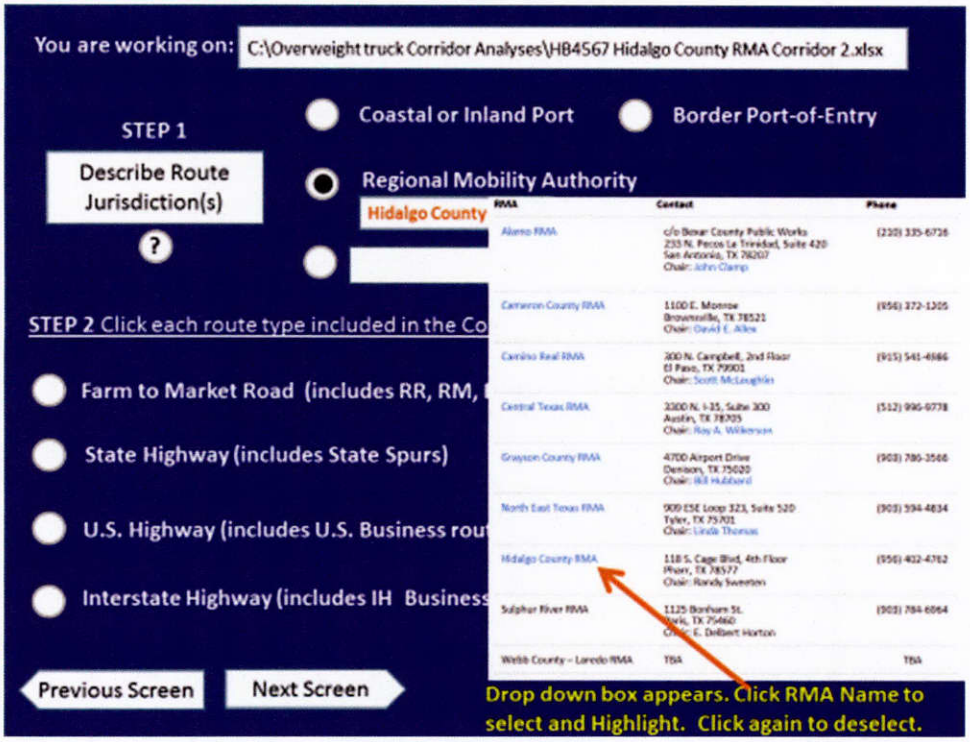


Figure 2.4: Example of User Input Screen for Corridor Description

After an OW truck corridor is specified, a user must specify certain factors that cannot be directly deduced from existing information. However, to accommodate the user input process, the tool will provide assistance for these inputs by suggesting default values, which are based on knowledge, facts, and insights that are available from existing information. This information will primarily be provided by historical permit information from the PoB and Hidalgo County RMA. Additional information will be stored relating to port operations and RMAs such as import/export products, tonnage, and percentages, as well as other local economic information and information from previous research. At present, it is expected that the user would provide the following input information with assistance from the tool where possible:

- Annual number of permitted OW trucks
- Growth factor
- OW truck configuration(s) and cargo
- Allocation of truck traffic to different route links
- Additional information used on the analysis that should be documented in the final report, such as user records, engineering judgment, and newly published resources and insights.

Users will provide the expected annual number of permitted OW trucks, which is a significant factor affecting both pavement and bridge structure consumption rates. The tool may be able to suggest a default number based on the historic data. However, the final decision should be made by the user to incorporate engineering judgment considering other external factors.

The permitted truck growth factor, for the assumed 20-year analysis period, will also be a user input. The estimated growth factor values will be provided based on values obtained from permit sales data for other corridors to guide input. The user will have the option to override the suggested growth factor based on expert opinion or relevant information not available at the time the tool was developed.

The user will be required to input the types of cargo expected to be transported along the corridor. Again, assistance will be provided from default tables when available. The cargo types will be used to determine the OW truck configurations selected from a table of default configurations based on the types of cargo transported. The default truck configurations will be based on those operating on the PoB and Hidalgo County RMA corridors since they are the only jurisdictions that are currently selling OW permits, which include information on the truck configurations.

The truck configurations will include GVW, axle group weights, and axle spacing used in determining the associated pavement or bridge consumption rate defaults. Thus, the tool will provide users with a list of the truck configurations from the Data Library based on cargo types and or known port, POE, or RMA operations and users can select the truck configuration from the list.

The allocation of the truck traffic along the OW corridor can be a challenging process. The research team used the allocation methods described below in order to attempt to allocate truck traffic on specific links on the OW corridors.

1. Interview Hidalgo RMA about corridor operations

   The research team has identified that contacting the Hidalgo County RMA directly would be beneficial to the project, since the officials' expertise and knowledge should be consulted when addressing freight operations in their jurisdiction. The purpose of contacting the RMA would be to obtain information on the operations of the POE, and on the activity of the OW routes. The team will aim at obtaining information regarding the types of industries located in the region, and the activity of the OW trucks corresponding to the industries. Also, the team aims to obtain information on the most traveled routes in the region, in an attempt to predict the volume of traffic along each designated route.

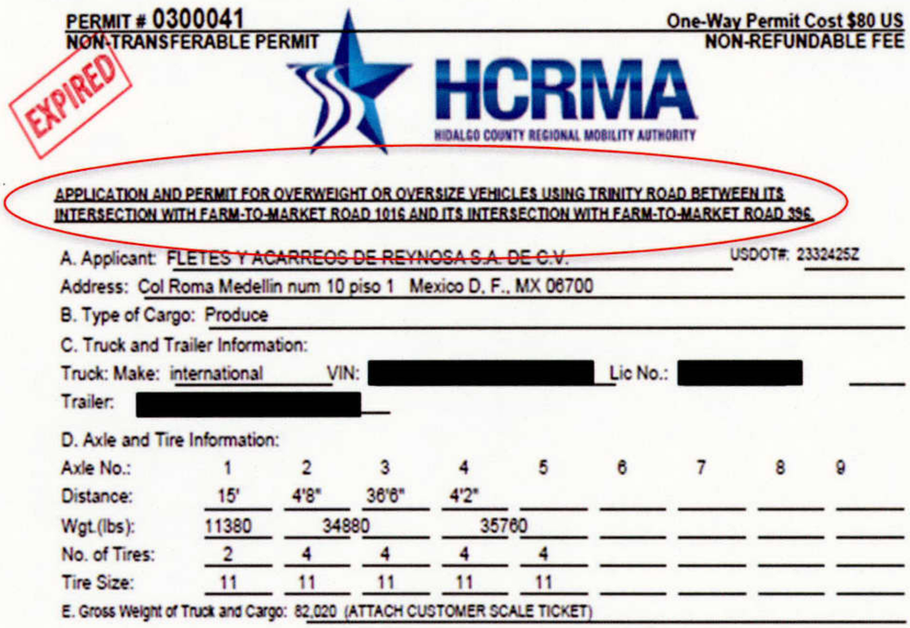
2. Obtain information about commercial / industrial / port operations including origin and destinations
   - Visual estimation of plant size (square foot areas)
   - Type of processing plant (fruit juice, produce, tomatoes, papayas, etc.).
   - Number of employees / plant based on county business data

   Obtaining such information will be possible through the examination of the different industries in the area. This could be done by visually estimating the plant size in square feet, determining the type of processing plants that are located in the area, and obtaining the number of employees in each plant based on county business data. In order to gather such information, a visit to the specific regions may be necessary.

3. Use of existing commodity flow databases to develop a base model to estimate the freight flows at the corridor level.
   The research team has identified databases that could assist in the estimation of the truck flow at the corridor level. The databases include the Freight Analysis Framework (FAF), IHS Global Insight Transearch, Commodity Flow Survey (CFS), North American Transborder Freight Database, Vehicle Inventory and Use Survey (VIUS), American Transportation Research Institute (ATRI) Truck GPS data, Safety and Fitness Electronic Records (SAFER) System, County Business Patterns. These national datasets will be augmented with state level data sets such as TxDOT's PMIS and the Texas Vehicle Classification data.

   A base model will be set up by the research team, using the aforementioned databases, and will be refined when new datasets become available. The benefits of using such a model are twofold. First, the above databases draw on the strength of the multiple data sources in order to minimize the number of assumptions. Second, the proposed methodology allows for seamless incorporation of future updates to the datasets.

As noted in the permit shown in Figure 2.5, although the user is required to input one of nine route links that make up the Hidalgo RMA corridor, the individual route links traveled to reach the link specified are not specified. If the permit required the user to specify each link to be traveled during the delivery process, a more accurate estimate of the pavement and bridge consumption costs could be determined. It is noted that the PoB permits specify whether the permitted truck will be loaded traveling north from Mexico to the port or loaded travelling south from the Port to the POE. Both the Hidalgo County RMA and PoB corridors may be expanded in the future based on recently passed legislation and expansion plans discussed on the Hidalgo and Cameron County RMA websites.


PERMIT # 0300041 One-Way Permit Cost $80 US
NON-TRANSFERABLE PERMIT NON-REFUNDABLE FEE

EXPIRED

HCRMA
HIDALGO COUNTY REGIONAL MOBILITY AUTHORITY

APPLICATION AND PERMIT FOR OVERWEIGHT OR OVERSIZE VEHICLES USING TRINITY ROAD BETWEEN ITS INTERSECTION WITH FARM-TO-MARKET ROAD 1016 AND ITS INTERSECTION WITH FARM-TO-MARKET ROAD 396.

A. Applicant: ~~FLETES Y ACARREOS DE REYNOSA S.A. DE C.V.~~ USDOT#: 2332425Z
Address: Col Roma Medellin num 10 piso 1 Mexico D. F., MX 06700
B. Type of Cargo: Produce
C. Truck and Trailer Information:
Truck: Make: international VIN: [redacted] Lic No.: [redacted]
Trailer: [redacted]

D. Axle and Tire Information:

Axle No.:	1	2	3	4	5	6	7	8	9
Distance:	15'	4'8"	36'6"	4'2"					
Wgt.(lbs):	11380	34880		35760					
No. of Tires:	2	4	4	4	4				
Tire Size:	11	11	11	11	11				

E. Gross Weight of Truck and Cargo: 82,020 (ATTACH CUSTOMER SCALE TICKET)

Figure 2.5: Example of an OW Permit with Route Information

Options to identify corridor link upgrade costs to improve pavement and bridge structural capacity and additional costs for safety and operation treatments will be provided. The tool will provide default values for maintenance and upgrade costs based on PMIS pavement condition scores, and other inputs. However, the users will be provided with options to override the recommendations and to make the final decision. Then the tool will analyze the associated costs by using cost-related parameters already stored in the Data Library. Figure 2.6 shows a sample of the user interface where corridor upgrade options may be selected, while Table 2.1 summarizes the user inputs.

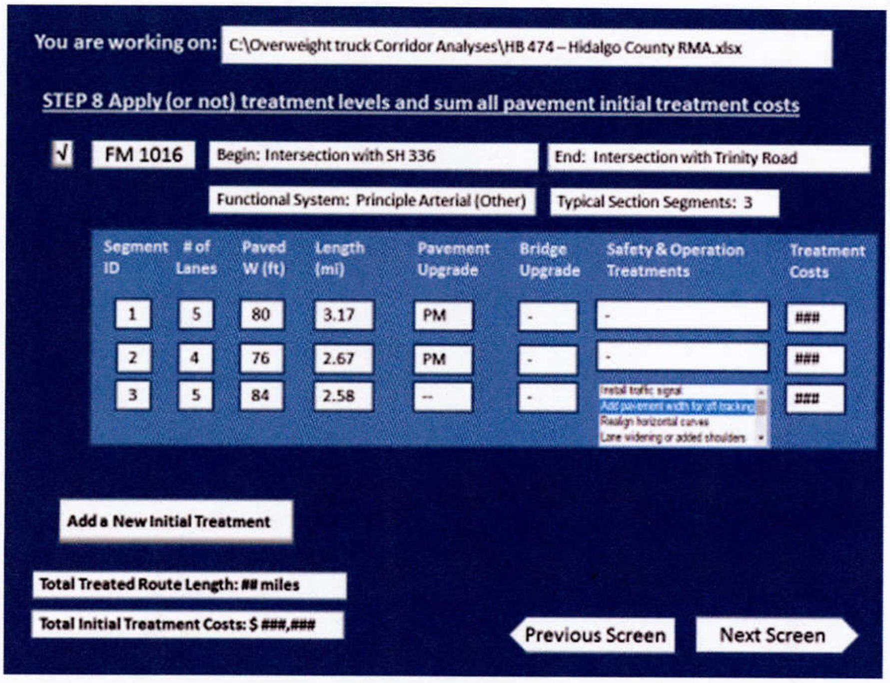


Figure 2.6: Example of User Input Module for Corridor Upgrade

Table 2.1: Summary of User Inputs

Category	User Inputs
Jurisdiction Description (Freight Corridor)	Name of the jurisdiction Route class in the freight corridor
Inputs for Estimation of Pavement and Bridge Consumption Costs	Annual number of the permitted OW trucks Growth factor OW truck configuration OW truck traffic allocation method Additional user-provided information
Inputs for Estimation of Corridor Upgrade Costs	Types of pavement upgrade to be implemented Types of bridge upgrade to be implemented Types of safety & operation treatment to be implemented

Data Library

The data library of the Stage 1 Expedient Analysis Tool will provide default information about corridor route links, link attributes, corridor upgrade options, and cost-related parameters. The data sources for these library data elements vary and may be obtained from existing TxDOT databases, summaries of information provided from the existing corridor permits, published information about port operations, international bridge traffic from US Customs Records, and other information. The data in the libraries will first be input based on the existing routes. For future routes, the team will use the predicted volumes that will be determined as described earlier. Once permit data will start being available on certain routes, the predicted data will be refined and will thus be updated in the libraries. The following sections provided additional detail about what will be fed into the different data libraries of the tool.

Corridor Link Library

Purpose

The purpose of the corridor link library is to store information including the route type (FM, US, SH, and IH frontage roads), route length, number of lanes, and other information relevant to the analysis.

Design

The corridor links library will constitute of basic information on the OW links across the different ports or POEs. When analyzing a certain corridor, the user will be able to either use the Corridor links stored in the data library or manually input the data for new routes, as shown in Figure 2.7.

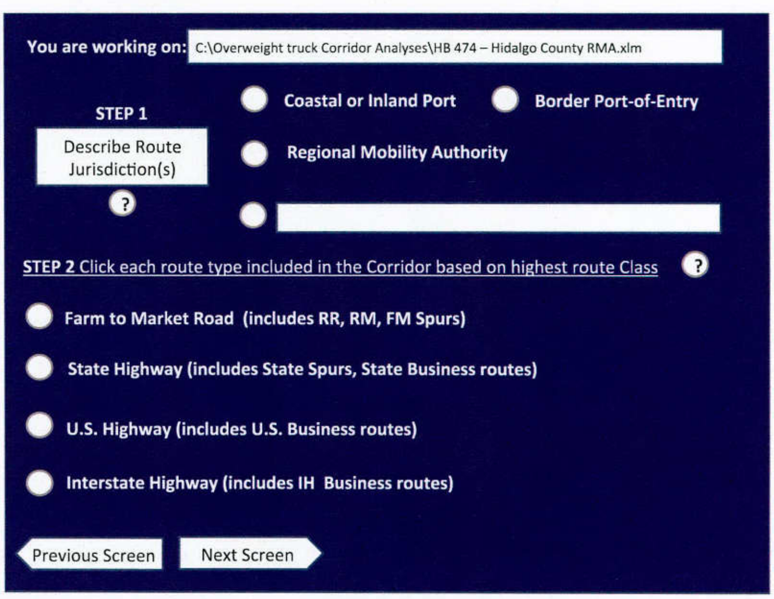


Figure 2.7: A Sample of the Tool's Interface for Corridor Links Description

Figure 2.7 shows an example of the tool's interface that would include a description of the corridor links. The user will make the selection of which port, POE, or RMA will be evaluated, and will be able to select the different links that constitute the Corridor. When the user makes the choice of a certain port, POE or RMA, the tool will automatically access the corridor links that are associated with the user's selection. In order to be able to properly identify the links on the selected corridor and store them in the tool, several data sources will be needed.

For an existing corridor, when the user selects the port or POE that will be analyzed, the data library will load information on the number and types of vehicles that travel on that corridor. The primary source of this information will be permits issued by authorized jurisdiction. However, permit information is not available for all ports or POEs since not all are authorized to issue OW permits. When analyzing a proposed new corridor, default information from existing corridors will be used when possible to provide default values.

Data Sources

The draft Legislative Bill that describes the route links will be used to designate proposed corridors. As shown in Figure 2.8, information about existing corridors and route links can be obtained from permitted OW truck permit website operated by a port or RMA.

Figure 2.8: PoB Permit Routes

As mentioned above, permits will be used to gain knowledge on the operations of OW trucks at existing corridors and can be used to help determine the types of truck configurations that could operate at a new corridor. The permits also provide data on the type of cargo being hauled, and on the direction of travel of the load (i.e., if the truck was loaded in the northbound direction and unloaded in the southbound direction).

The specific libraries that will be included within the Network Links library are described below.

Libraries of Port, POE, and RMA Information

Separate libraries of information for each ports, POEs, and RMA are necessary to the analysis that will be conducted by the tool. Information will be gathered from various sources and uploaded into the library. The library will ultimately include information about the operations at each port, POE, and RMA, which will include the imports/export tonnage and type of cargo hauled at each location using the data sources described in the previous section.

Library of Permit Information

The Permit Information library will include summary information extracted from permits including numbers of permits issued over different periods of time; tons of cargo transported, percentage of cargo transported by permitted trucks in relation to the same type of cargo processed by the port and other information.

Library of Truck Configuration Information

Information on the truck configurations is essential to be able to determine the pavement consumption and bridge costs. Information on the trucks configurations and weights, axle spacing, and cargo type will be obtained from the permits.

Library of Counties Bordering Mexico and the Gulf Intra Coastal Waterway

A separate library that includes the counties bordering Mexico and one that includes the counties bordering the Gulf Coast Waterway will be created. The library will include import and export data of each county, which will help in the identification of the number and configurations of vehicles traveling across the county's routes. In addition, economic and industry data will be added to the library to be able to determine the type of cargo that is hauled, as well as the specific routes that the trucks would traverse by highlighting the possible origins and/or destinations of the trucks.

Relationships with Other Libraries and Modules

Further libraries will use the information entered into the Network Links data library of the tool, specifically when describing the attributes if the route links. After entering information specifying the network links into the tool, further description of each link can be made. In addition, the data sources from the Network Links library will also be shared with the Route Links library, along with other sources that will be described in the following section.

<u>Corridor Link Attributes Library</u>

Purpose

An essential element in the analysis of the cost of construction and maintenance of the OW routes is the description of the roadways that will be analyzed. The attributes of the links on existing corridors need to be included within the data library to provide insights for future roadways that could be identified for inclusion in an existing corridor or as part of proposed corridor.

Design

The Link Attributes library will include an attribute table that shows the different condition, distress, and/or ride scores of each route. The attribute table will be developed for existing OW truck routes, and will be updated whenever a treatment is applied. In order to be able to set up this table, information on the route links needs to be provided, either by the user for new routes, or selected from the data library for existing routes. The information on the link attributes that will be included in the library, or set by the user, includes:

- Route type (FM, SH, US, and IH frontage roads)
- Roadbed information (divided or undivided)
- Physical beginning and ending description
- Center line length in miles
- Number of lanes for each route segment
- Condition score, distress score, and/or ride score data on each route
- Other factors to be determined

<u>Library of Corridor Upgrade Options</u>

Purpose

In addition to the data sources provided in the previous sections, there are many others that will be used in order to provide a comprehensive analysis on the overall cost of maintaining a roadway section. Such information will depend on the cost of maintenance, which is why a library of corridor upgrade options is necessary, as it will provide a basis for calculating the specific upgrade strategies that will be performed. The main corridor upgrade options that will be considered in this tool are safety and operations treatments, pavement upgrade, and bridge upgrade.

Design

The aforementioned corridor upgrade options that will be available to the user will be located in a separate library, which will also include attribute tables for the different safety and operations treatment types, along with their costs for each route type. Also, attribute tables will be included for the pavement and bridge upgrades, along with their costs for each route type. Figure 2.9 shows the suggested user interface for entering information on the corridor upgrade options.

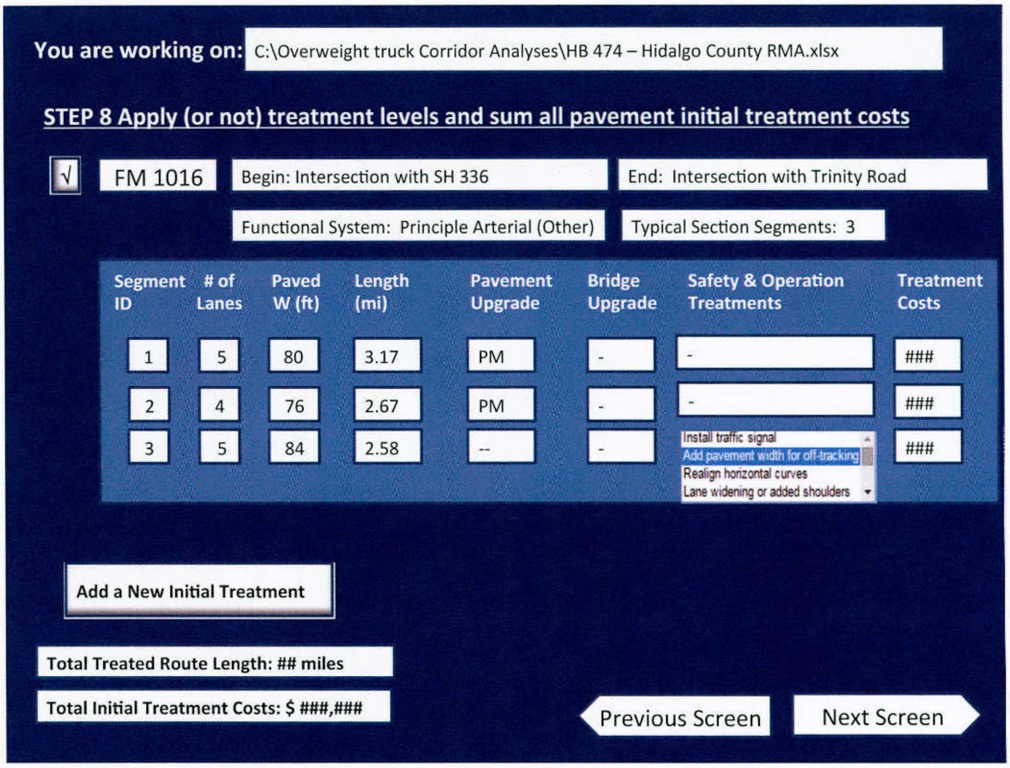


Figure 2.9: A Sample of Selecting Initial Treatment and Maintenance Options

The different corridor upgrade options will be available to the user to select from, as they will be stored in the data library. Initial treatment and cost modules will be set up in the tool in order to perform the analysis. Within the data library, information on the different pavement and bridge upgrade options, as well as the safety and operations treatment options will be included, and are summarized in Table 2.2.

Table 2.2: Different Initial Safety and Operations Treatments

Pavement Upgrades	Bridge Upgrades	Safety and Operations Treatment
Do nothing	Functional	Signing and Signals
Preventive Maintenance	Structural	Roadside Obstacles and Barriers
Light Rehabilitation		Resurfacing and Roadway Lighting
Medium Rehabilitation		Pavement Markings
Heavy Rehabilitation		Roadway Work
Reconstruction		

The user will also be able to get into a greater level of detail within the safety and operations treatment alternatives. Within each alternative, several detailed options will be available to select from and to analyze, such as:

Signing and Signals

- Install traffic signals
- Add railroad signals
- Add striping or signing

Roadside Obstacles and Barriers

- Add guardrail and safety end treatments

Resurfacing and Roadway Lighting

- High friction surface treatment

Roadway Work

- Add pavement width for heavy truck off-tracking
- Realign horizontal curves
- Lane widening or added shoulders
- Reconstruction of intersections to improve sight distance and flow
- Turn bays at intersections

Data Sources

The attribute table for each route type that is part of the Links Attributes library will be a main source of information for the corridor upgrade options. The decision to apply safety treatments will be primarily based on user judgments; some assistance may be available based on total existing average daily traffic, percentage or number of heavy trucks, and proposed additional OW trucks operating along the permit corridor. The researchers will investigate the possibility of incorporating guidance based on past crash histories using Crash Record Information System (CRIS) data; however, since numbers of crashes vary over time, the relevance of this data might decline with passage of time. Other methods for evaluating the corridor link risk levels will be considered based on work performed by research team members knowledgeable on this subject.

Library of Cost Parameters

Purpose

The Library of Cost parameters will provide default values for pavement and bridge upgrade treatment costs; safety and traffic operations upgrades; pavement and bridge consumption rates in units of dollars per VMT; and other associated costs necessary to provide the corridor cost analysis.

Design

For the pavement consumption costs, the data library will include information on the consumption rates, in dollars per VMT, for different permitted OW truck configurations, route types, and conditions. The consumption rates can be calculated for a given axle group (single, tandem, tridem, quad, etc.) and weight for a given pavement structure. This would justify the need to create an attribute table for truck configurations, which will include the GVW, axle group weights, axle spacing, and cargo types. Consumption rates can, therefore, be determined to create attribute tables for pavement and bridge consumption. The vehicle consumption is obtained by linearly aggregating the individual axle consumption rates. The unit cost per VMT is calculated based on the Equivalent Consumption Factor (ECF) of a given vehicle configuration for a given pavement structure. A structural number will be assumed for each facility type in order to create a library of consumption rates for each route type.

Data Sources

In order to be able to create the attribute tables mentioned above, information on the truck configurations will be needed, and can be obtained from permits, specifically from the PoB and Hidalgo County RMA. In addition, the library will also include the ECF for each axle configuration.

The data sources that will be needed to conduct the analysis for bridges include Bridge Inspection and Appraisal Program (BRINSAP), road segments GIS files, road segments and BRINSAP combined with ArcMap, and data cleansing using SAS. The use of these data sources will enable the determination of bridge upgrade costs to be used, ultimately, for the determination of the overall costs and permit fee required for an existing or proposed new OW corridor.

Bridge consumption rates will be determined for different route types (FM, SH, US, and IH frontage roads) based on a simulation of a specific truck configuration operating on the route for a specified number of load repetitions. The relationship between the bridge rating vehicle and the permitted OW truck configuration will be used to determine the default consumption rates. Based on the Rider 36 report, it was found that there are fewer bridges per mile of pavement in West Texas than East Texas—thus, the library of bridge consumption rates may require values for route types in western border regions such as El Paso, central regions such as Hidalgo County and Freeport, and eastern regions such as Houston and Beaumont.

Cost Analysis

The Expedient Analysis Tool will provide the user with options to calculate the cost of maintaining the roadway and the permit fee necessary to provide revenue for corridor management. Combining user-input data with data previously entered into the tool, as well as pre-stored data in the library, the tool will calculate bridge and pavement consumption costs as well as safety and operations costs.

<u>Initial Corridor Upgrade Factors and Costs</u>

Initial treatment and cost modules will be set up in the tool, with the objective of bringing the current corridor up to required conditions to carry heavy permitted trucks, in addition to loads applied by local traffic. The analysis will be conducted by route link, with default suggestions based on PMIS pavement conditions scores and CRIS data, as previously mentioned, with results given in US dollars per mile. The cost-related parameters will be stored in the data library, allowing for the ability to conduct scenario studies. The different initial corridor upgrade options are listed in Table 2.2 above.

<u>Pavement Consumption Costs</u>

Highways cater to a heterogeneous mix of truck configurations with different characteristics, such as number of trailers, GVWs, number of axles, and axle loads. The effect of each axle, either a single axle or a group of axles (i.e., tandem, tridem, or quad), on a pavement structure is usually considered independent of the effect of the previous axle; in other words, pavements feel axles but not vehicles. Therefore, simply counting the number of truck passes will not provide a correct measure of pavement consumption. Pavement consumption of a vehicle configuration is estimated as the cumulative pavement consumption caused by all the individual axle group loadings. The pavement consumption is measured in relative sense with respect to the single axle carrying 18 kip load. The concept of ECF is utilized to quantify the consumption of any axle group carrying any axle load. ECF is defined as the ratio of the pavement consumption caused by a given axle group/load to that of a single axle carrying 18-kip load (or ESAL [equivalent single axle load]).

The number of passes of a vehicle configuration (per day) $(n_{rut}, n_{crack}, and\ n_{IRI})$ necessary to reach the terminal threshold at the end of design life (20 years) is estimated corresponding to rutting, cracking and the International Roughness Index (IRI). As previously mentioned, pavement consumption rates will be calculated for a given vehicle configuration and a given pavement structure. For a given pavement and truck configuration, the ESALs to failure will be calculated based on the average ESALs to failure for the three failure modes: roughness, rutting, and fatigue cracking. This will enable the determination of the reduction in original pavement life, as shown in Figure 2.10.

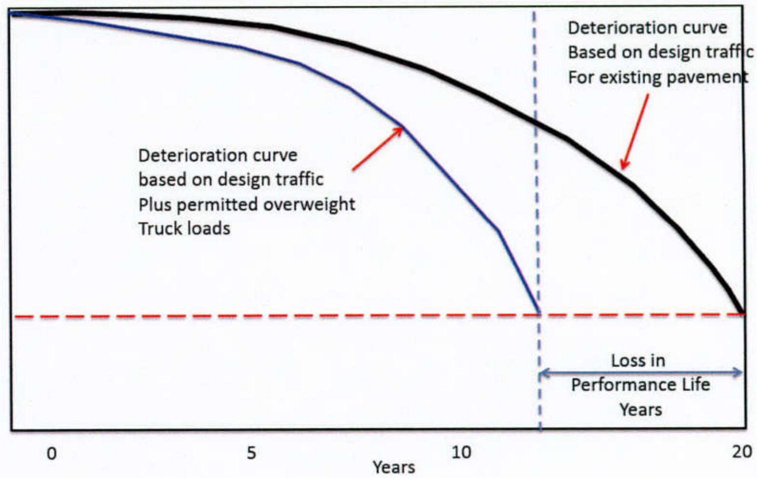


Figure 2.10: Pavement Consumption Determination

The thickness of additional structure needed to accommodate the OW traffic while lasting until the end of design period will be estimated using mechanistic-empirical analysis; this is demonstrated in Figure 2.11. The cost of the additional layer will be calculated based on unit material prices and fixed overlay project costs.

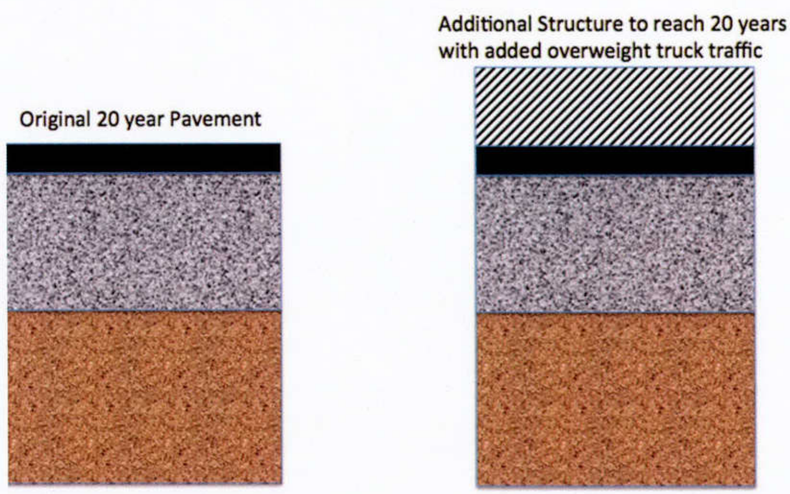


Figure 2.11: Additional Structure Needed for OW Truck Traffic

<u>Bridge Consumption Costs</u>

The bridge consumption costs will be calculated similar to the Rider 36 study, in which the use of GIS files marked with the permit routes, BRINSAP, the method of moments, and bridge fatigue concepts will lead to the determination of the cost per bridge on each segment, and the cost per mile for each permit. In summary, the methodology of calculating the bridge costs will include the definition of routes as stated in permits on GIS files, and BRINSAP, which will include data on each of the route segments. In addition, the methodology will also involve using information on the number of bridges per route segment. The characterization of permit loads, in terms of axle weights and spacing, computerized bending moment and fatigue analysis will be conducted.

Administrative Costs

Legislative bills authorizing ports or RMAs to issue OW truck permits specify that no more than 15% of the total permit fee can be used to cover administrative costs. Therefore, this cost needs to be incorporated into the overall permit fee in order to be able to generate enough revenue to be able to finance the administrative costs, as well as the roadway maintenance, safety, traffic operations, and maintenance costs due to consumption.

Recommendations and Reporting Features

The report created by the Stage 1 tool will summarize information used in the analysis and present the results in an easy to read format. In this sense, only the key elements should be shown on the report concisely and the structure of the report should be also straight forward. Figures and tables that may help understanding will be also provided if necessary. The followings are considered as key components of the report.

- Project location and description information
- Permitted truck and other traffic information
- Permitted traffic configurations, loads, numbers
- Proposed treatment costs
- Permit fee
- Permit revenue

The role of the first three components is providing basic information about the existing or proposed OW truck corridor. The project location information will summarize the general location of the corridor the jurisdictions associated with the corridor, each route link including route type, length, and number of lane miles and a summary of total center line and lane miles for the corridor. Similar summary information will be provided for bridges. The assumptions or default values used to estimate the number of permitted OW trucks and truck allocations to each corridor link will be provided.

Finally, the report will present the estimated maintenance costs that summarizing the proposed treatments to upgrade the corridor, and address safety and traffic operations. The results of the pavement and bridge consumption analysis will be provided to support the required revenue to manage the corridor over the 20-year analysis period. This information along with the estimated numbers of permitted trucks will be used to determine a proposed permit fee.

2.3 Workshop Findings – Summary

The workshop for the Stage 1 Expedient Analysis Tool development was held on February 11, 2015, between 1:00 PM to 4:00 PM at the Center for Transportation Research to explain the process, steps, functions, features, and data sources used in the tool and take note of guidance and comments from the subject matter experts in attendance. The workshop consisted of two parts. In Part I, project scope, objectives, deliverables, and planned use of the Stage 1 tool were briefly discussed and summarized to deliver the overall concept to the audience. In Part II, more detailed information on the Stage 1 Tool was provided, including pavement and bridge consumption analysis methods.

During the workshop, every attendee was given a chance to delineate their opinions freely. The key findings from workshops are summarized below.

- The PoB
  - The PoB plans to request an increase in the permit fee (currently $30 per trip) of $5 each year over the next 3 years.
  - The IH 69 corridor was included as a potential OW corridor route for the PoB (HB 3125) in order to provide an optional route to access the port from the Free Trade International Bridge in the event that there was a discontinuity of service across the Veterans International Bridge.
  - At the PoB, the new SH 32/East Loop route is scheduled for letting in 2015 and will take from 24 to 30 months to construct.
  - Currently, there are three auto manufacturing plants in Mexico south of the PoB location. Plans are to increase the number of auto manufacturing plants to 10 (7 additional).
- The Inland Port of Harlingen
  - The Inland Port of Harlingen plans to request legislation to create a permitted OW truck corridor that includes a portion of FM 509 linked to FM 106.
- Hidalgo County RMA
  - The Hidalgo County RMA plans to implement a new tolled corridor SH 356 and issue a combined permit + toll. They also plan to require permitted OW trucks to use SH 356.
  - Sections 1 and 2 of SH 356 are planned for a September 2016 letting. Section 3 is scheduled to open to traffic in December 2015.
  - TTI has conducted a weigh-in-motion data collection and analysis study that showed that a significant percentage of trucks entering Hidalgo County from the south are above the legal load limit.

    - Current OW permits for the Hidalgo RMA allow OW trucks to travel on the shortest path between origin and destination, which can be any part of the permitted network.
- Pharr District
    - It is anticipated that several new roadway projects planned and constructed in Mexico could result in significant increases in truck traffic flowing into the Pharr District.
    - During the last 30 years, there has been a significant increase in population growth in the border regions along the Pharr District border.

The attendees provided the research team with valuable information that cannot be easily obtained from reviewing existing literature. In particular, the future plans on the permitted OW truck corridors were important building blocks for the development of the Stage 1 tool prototype, since these plans are critical for estimating the maintenance costs for the corridors. Even though some of the future plans mentioned on the corridor may not be able to be fully addressed in the Stage 1 tool due to lack of detailed information, the tool should eventually include those plans as much as possible.

2.4 Summary

This chapter summarizes the initial findings and presents the results of two information presentations to TxDOT Maintenance Division personnel of the proposed analysis method. In addition, the chapter outlines the results of a workshop that was conducted by the research team to present the proposed Stage 1 tool framework, analysis modules, and information sources to the PMC and additional TxDOT subject matter experts.

Chapter 3. The Stage 1 Expedient Analysis Tool Prototype

3.1 Introduction

This chapter describes the development of a prototype of the Stage 1 Expedient Analysis Tool, based on the agreed-upon framework. The prototype enables the user to analyze the OW truck network at the PoB to determine the optimal permit fee that should be charged to OW vehicles traveling at the PoB. In addition, the research team developed the data library tables that populate the tool with information on pavement and bridge upgrade and consumption costs, as well as safety and traffic operations costs that are specific to the PoB.

3.1.1 Scope of Work and Assumptions

The prototype developed was based on several assumptions, outlined here.

- **Assumption 1:** The prototype tool will not enable the user to change the existing corridor links. That is, the user cannot edit the links that will be used from the PoB; such editing features will be provided in future versions of the tool. In addition, a fundamental consideration is that the default values stored in tables for truck configurations, consumption rates, and related items depend on data obtained from the existing PoB corridor. Thus, changing the existing aspects of the existing corridor might invalidate the default values. However, this consideration should not be confused with future capabilities, such as adding new route links to the existing corridor or changing the combination of new route links to study different scenarios. The ability to add and analyze new links depends on the defaults based on the existing corridor.
- **Assumption 2:** The current permit data on the PoB's OW corridor will be used to identify truck configurations in that region for use in the pavement and bridge consumption analysis.
- **Assumption 3:** The analysis process will be fixed at 20 years.

3.1.2 OW Corridor Permit Processing and Analysis

Port of Brownsville

PoB is one of the few POEs that currently sell permits for the operation of OW vehicles on the state highway network. The permitting process operated by PoB is independent from the Texas Department of Motor Vehicles – Motor Carrier Division – Texas Permitting and Routing Optimization System (TxPROS) system and funds collected through PoB permit sales are administered through different procedures. The Texas State Legislature House Bill 3125, passed in 1997, established the possible links that drivers of OW vehicles can operate on at the PoB, provided that they fill out a permit and pay a fee. Figure 3.1 provides a map showing the legal OW road segments that the trucks can travel on.

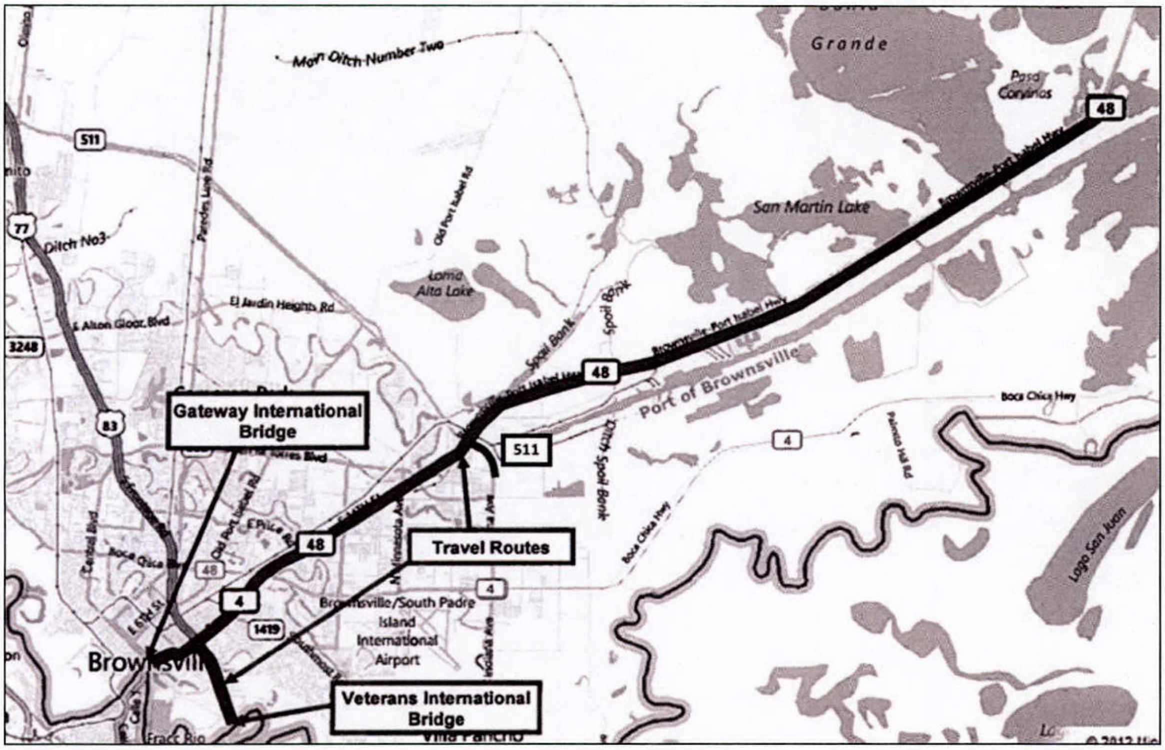


Figure 3.1: Map of the Route Segments that Carry OW Vehicles at the PoB

The PoB has been selling around 30,000 permits each year, greater than any other port issuing permits, making it the largest port or port-of-entry permit database that currently exists in Texas. The Hidalgo County RMA began issuing OW truck permits in July 2014; however, only a few thousand permits have been sold thus far.

The information on the PoB OW truck permit includes the following:

- The axle and GVW of the vehicle,
- Axle spacings, which can be used to compute the inner and outer bridge lengths,
- Truck's origin and destination,
- Type of cargo hauled,
- Other information pertaining to the company that owns the vehicle, the driver, USDOT number, and other commercial motor vehicle operating authority and related information.

Such information was extracted from a sample of around 9,000 permits issued by the PoB. Using this information, the research team was able to determine two common truck configurations that travel across the route for pavement and bridge analysis. By using information such as the inner and outer bridge length, which can be deduced from the axle spacing information provided in the permits, as well as the GVW and axle loading, the bridge and pavement consumption rates can be calculated using models originally developed during the Rider 36 study. These models are currently being enhanced through Project 0-6817 and will be evaluated for use in the Stage 2 tool developed in the second stage of this study.

Summary of Truck Configurations and Weights

The prototype will include the truck configurations and weights that can be found traveling on the OW corridor at the PoB. The truck configurations that will be accounted for in the prototype are the class 9 and class 10 vehicles, according to the FHWA classification, and are shown in Figures 3.2 and 3.3.

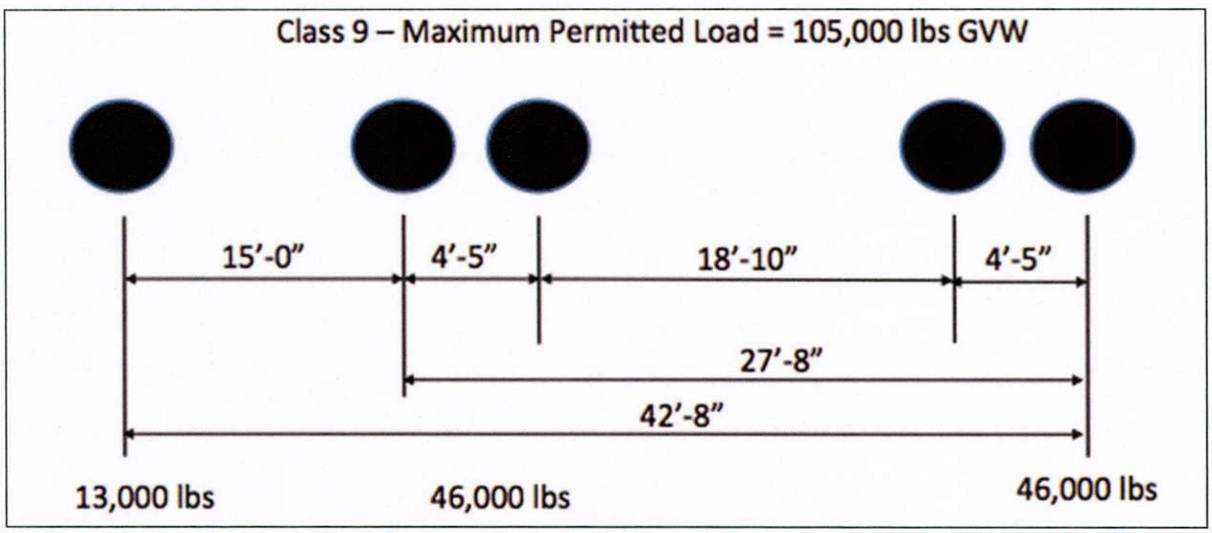


Figure 3.2: Class 9 Vehicle with 105,000 lbs.

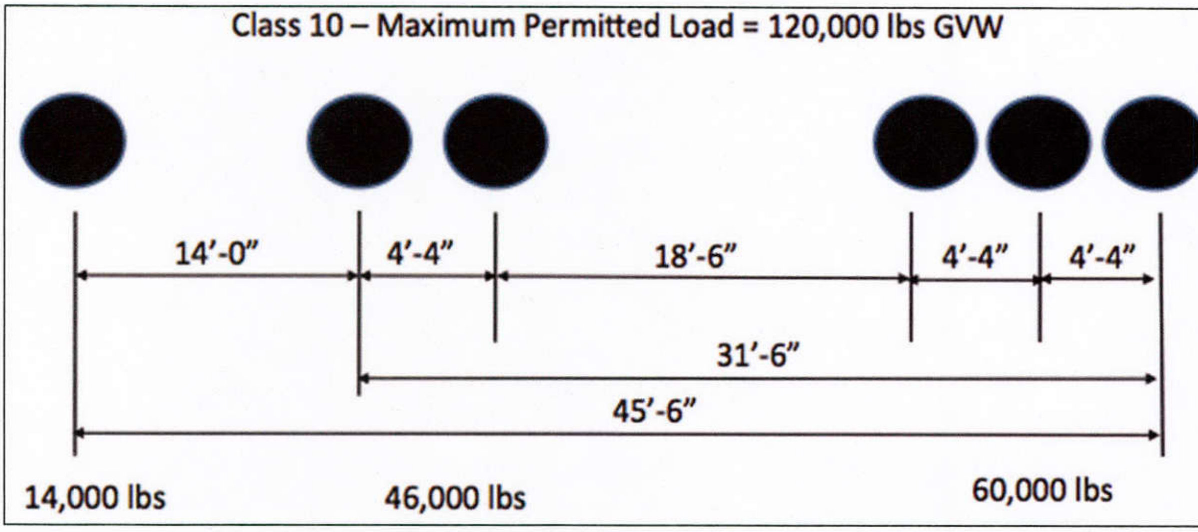


Figure 3.3: Class 10 Vehicle with 120,000 lbs.

The above truck configurations will be used for the calculation of the pavement and bridge consumption costs. The research team will develop consumption costs for each of the truck configurations, and will store them in the data library for use in the analysis.

3.2 Stage 1 Expedient Analysis Tool Prototype

3.2.1 Purpose of the Stage 1 Expedient Analysis Tool Prototype

The Stage 1 Expedient Analysis Tool will allow the user to conduct a quick analysis of the expected costs of an OW route in response to legislative requests or questions posed by the Texas Transportation Commission, TxDOT Administration, and others. The tool will allow the user to input different options for analysis, supported by data libraries containing default values that the program will access depending on user inputs. The default values will minimize the required input by the user and allow for quick access to data that otherwise might not be available at short notice, thus saving time. Moreover, the default value tables can be updated as soon as additional data become available and as soon as costs and cost factors change. In addition, the tool also provides the user the ability to document information sources, or assumptions made during the analysis, which might result in changes to the default values. In addition, a reporting feature is provided to document these data sources or assumptions. It is important to capture these additional considerations to help understand the final analysis results, which will be documented in analysis report(s) that can be formatted based on the inputs and required outputs.

The Stage 1 Expedient Analysis Tool Prototype is aimed at providing TxDOT with a means to evaluate the functionality and features of the tool. The prototype will include a sample analysis to estimate the permit fee cost for the PoB corridor. The analysis will include accounting for the pavement and bridge consumption and upgrade costs, as well as safety and operations upgrade costs. Based upon the Department representative's experiences with the tool, feedback will be provided to the research team in order to optimize its features accordingly.

3.2.2 Overview of the Prototype Interface

The prototype consists of six sequential stages through which the user is guided to evaluate the corridor in order to document needed maintenance treatments, safety and traffic operations upgrades, and the consumption costs that will be used to obtain an estimated permit fee. Throughout the different stages the user will make selections or input information that will allow for the proper analysis and calculation of a permit fee for an OW corridor. The different stages of the prototype are shown and detailed in this section.

Initial Interface of the 0-6820 Prototype Tool

Figure 3.4 shows the initial interface of the prototype analysis tool, where a user chooses to either begin a new analysis or open an existing analysis.

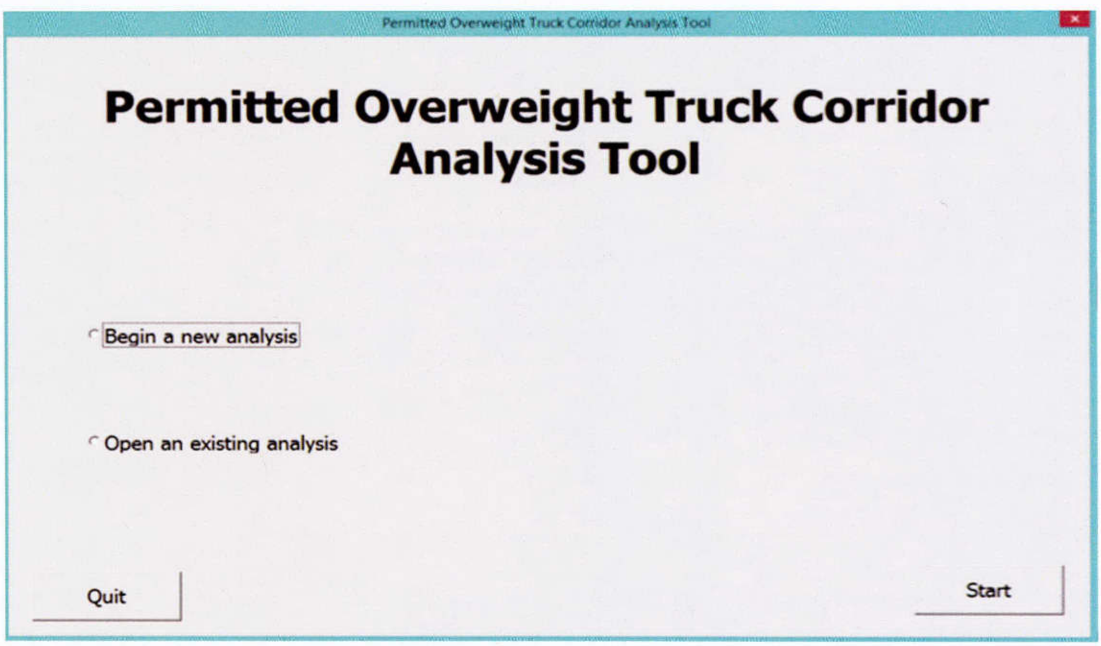


Figure 3.4: Initial Interface Encountered

In the prototype, the user will only be able to select "Begin a new analysis," and will select a folder in which to save the analysis. After beginning a new analysis, and naming and saving it, the user can now proceed to Step 1.

Step 1: Identifying Port Type

The interface of the first step of the prototype analysis tool is shown in Figure 3.5.

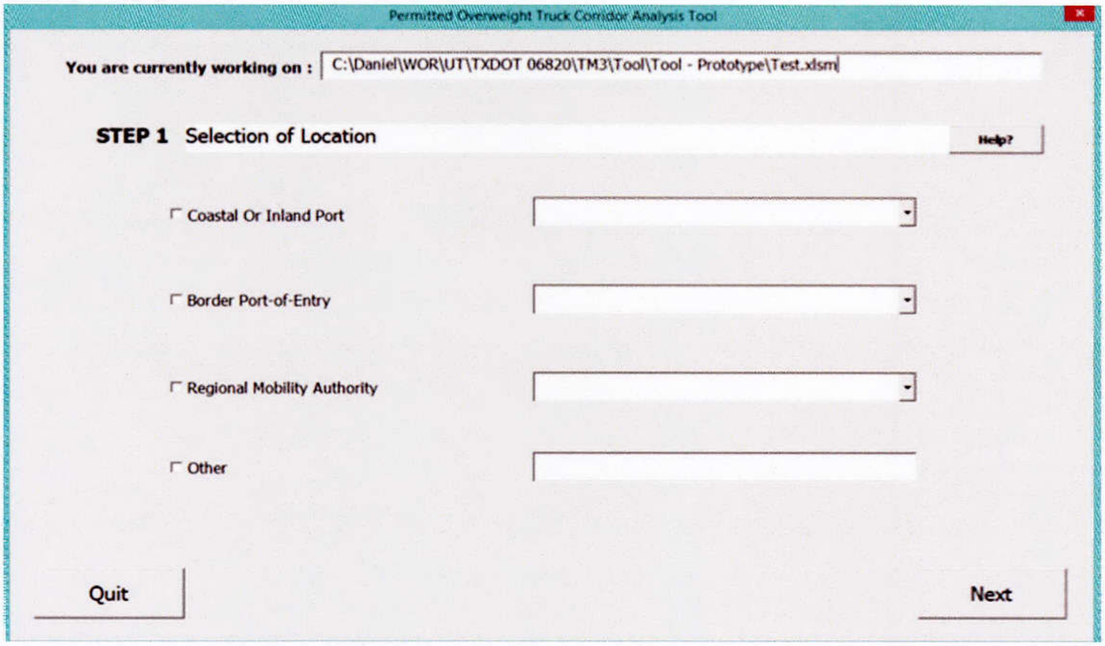


Figure 3.5: Interface of Step 1 of the Prototype Analysis Tool

The above image shows the first input screen, in which the user identifies the combination of authorities associated with an OW truck corridor that are selected for analysis. The options include one or more coastal or inland port(s), a border POE between Texas and Mexico, or an RMA. The selection of the authority type links to the relevant data in the default library tables used for the analysis. In the prototype, the user will only be able to select the PoB as the Coastal or Inland Port. After making the selection, the user may click the Next button and move on to the next step of the analysis.

Step 2: Selecting the Corridor Routes

Figure 3.6 shows the interface for the second step of the prototype, which involves selecting the different routes of the corridor and identifying their type.

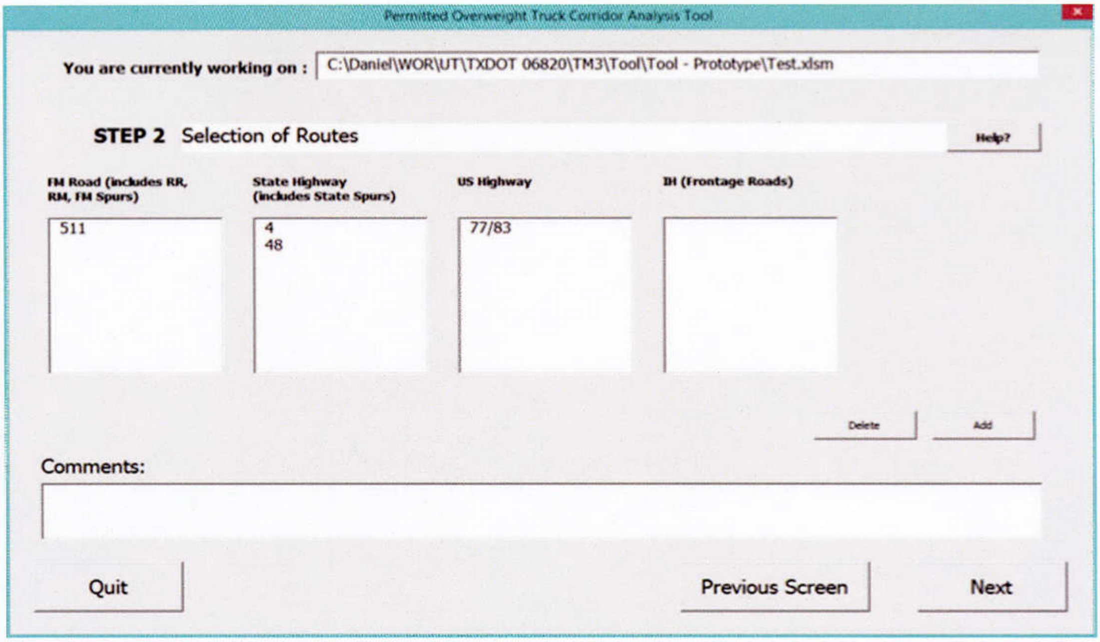


Figure 3.6: Interface of Step 2 of the Prototype Analysis Tool

The above image shows the second step of the prototype analysis, which includes showing the specific route segments types. The route segments of existing OW corridors are identified by specific House Bills, including their type and start and end points. The research team will include the list of routes and their segments at the PoB. The routes that will be included are US 77/US83, SH 4, SH 48, and FM 511. The route segments will be divided according to their pavement type (asphalt concrete pavement, jointed concrete pavement, or continuously reinforced concrete pavement) and tier group, in coordination with how the treatment cost section of the data library will be organized. Moreover, since the route segments will be pre-selected by the research team, the TRM limits will be established, which allows linking to the PMIS database stored in Cameron County's PMIS database. Linking to the PMIS database will provide information such as annual daily traffic (ADT), percent of trucks traveling on the segments, distress conditions and types, as well as other relevant information. In the prototype version of the tool, the user will not be able to add or delete route segments. After selecting the different route segments and their types, the relevant data from the library will be loaded, and the user can click the Next button to move to the third step of the analysis.

Step 3: Route Segments Attributes

Figure 3.7 shows the third step of the prototype analysis.

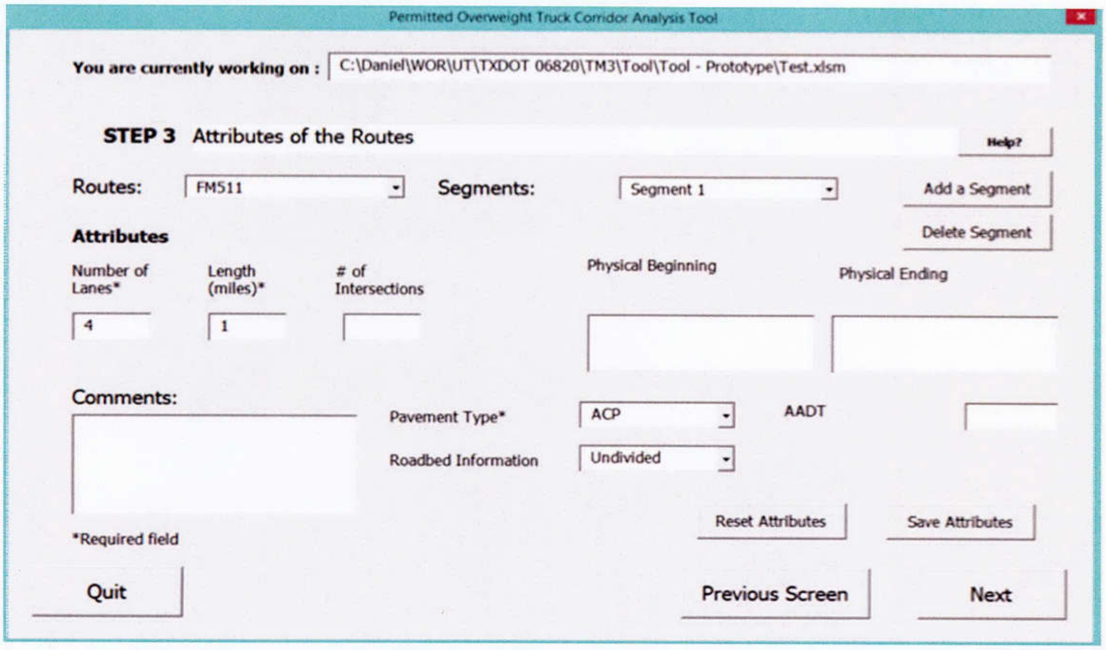


Figure 3.7: Interface of Step 3 of the Prototype Analysis Tool

The above image shows the different attributes that will be used for each route segment, using FM 511 as an example. For the corridor at the PoB, as previously mentioned, the route segments will already be established, and the attributes will be automatically filled out for each segment the user selects (using values already included in the data library); the user will not have the option of adjusting the values. For new segments, either at the PoB or at routes that will be identified in the future, the research team will further explore how the user will establish the links and input the different attributes.

The following attributes were chosen to help with the analysis and determination of the permit fee: the number of segments, the number of lanes, the paved width, the length, the number of bridges, the number of intersections, the roadbed information, and the pavement type. This information will be important to determine the total pavement and bridge consumption costs as well as the safety and traffic operations costs.

Step 4: Input Truck Details

The fourth step of the prototype analysis is shown in Figure 3.8.

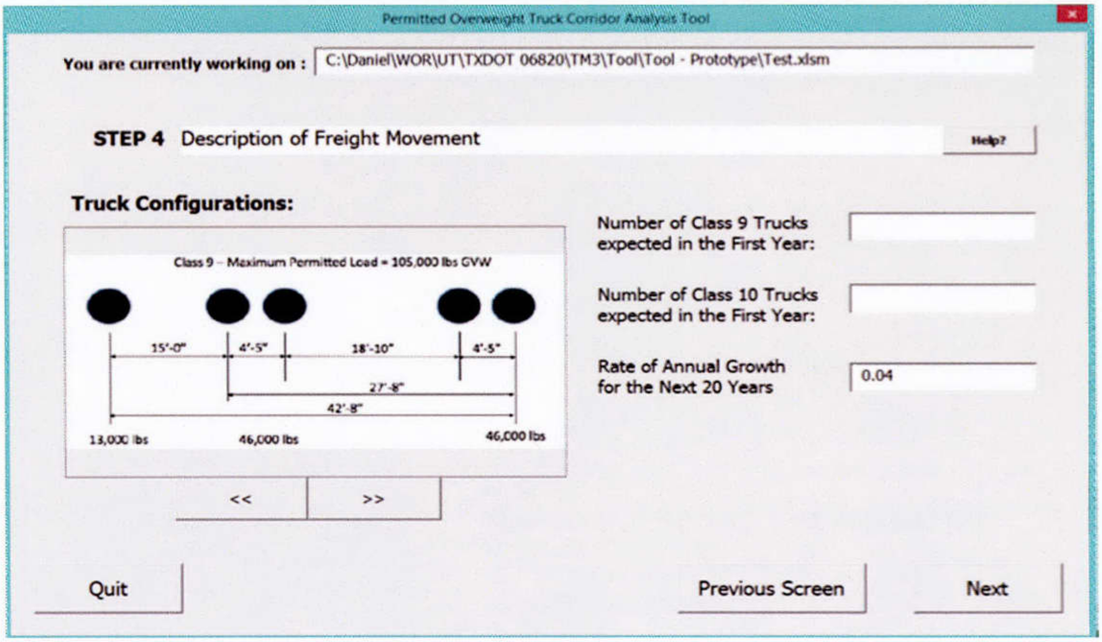


Figure 3.8: Interface of Step 4 of the Prototype Analysis Tool

The above image shows the interface where the user can input the truck configuration, number of trucks in the first year of analysis, and the growth rate for the 20-year analysis period. For the permitted routes—such as those at the PoB and at Hidalgo County RMA—default truck configurations, number of trucks, and a growth rate will be directly inserted into the tool from the data library. The user has the ability to choose from the different truck configurations that are stored in the data library, and will be able to specify the number of trucks in the first year of the analysis period, as well as a 20-year growth rate. The choice of the truck configurations will link directly to the bridge and pavement consumption costs stored in the data library, and coupled with the number of trucks assigned for the first year of analysis, as well as the information input in Step 3, the pavement and bridge consumption costs are calculated. After inputting data into all the fields, the user may now click on the Next button and move on to step five of the analysis, which will enable the calculation of the safety and traffic operations costs.

Step 5: Safety and Traffic Operations Treatments

Figure 3.9 shows the interface of the fifth step of the prototype analysis tool.

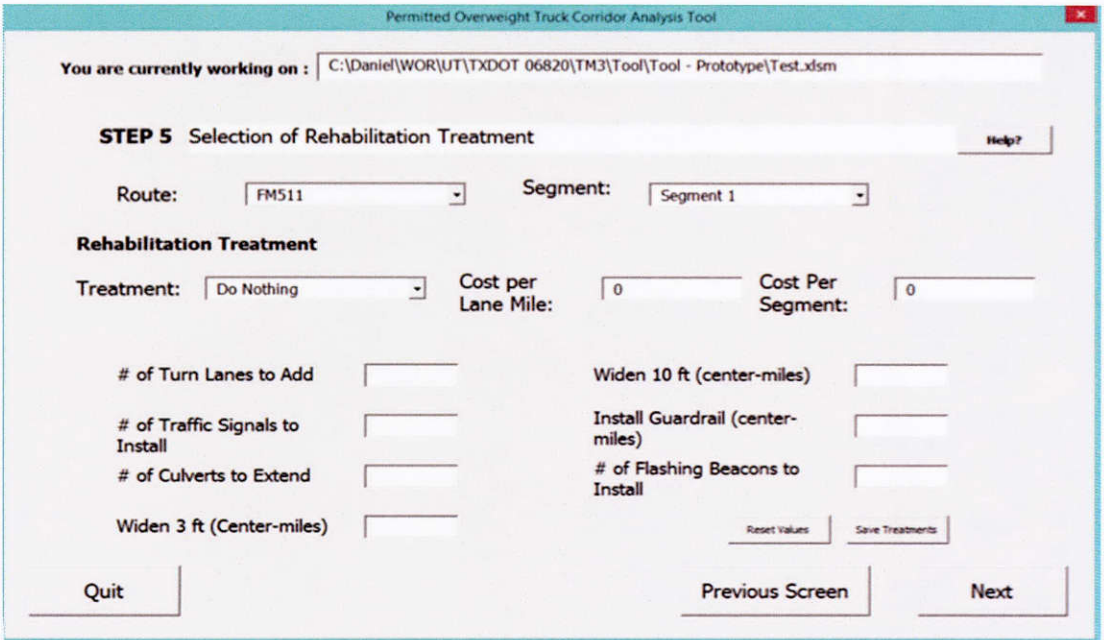


Figure 3.9: Interface of Step 5 of the Prototype Analysis Tool

The above image shows step five of the analysis, in which the user chooses the different safety and traffic operations treatments for each road segment. The treatments available to choose from in the prototype tool include these options:

- Number of turn lanes to add
- Number of signals to install
- Number of culverts to extend
- Widening the roadway, with two options: narrow widening of 3' and full widening by adding a 10' shoulder
- Mileage of guardrail to install
- Number of flashing beacons to install

After choosing the treatment option, the costs stored in the data library will enable the user to view the total cost to help the user with the analysis. For example, if the user chooses to add four turn lanes, the default cost for the four turn lanes will be summed and shown in the summary. On the other hand, when choosing to widen a roadway, the user will need to select whether a narrow or full widening is selected for a given segment. The tool will automatically calculate the total cost based on the number of centerline miles and the cost per mile. When all the treatment options are chosen, the user may then click the Next button to move onto the next step of the analysis.

At this stage of the analysis, the pavement and bridge consumption costs, as well as the safety and traffic operations costs, are now obtained, and the results can be viewed in the next, and final, stage of the analysis.

Step 6: Bridge Consumption Analysis

Figure 3.10 shows the sixth step of the analysis.

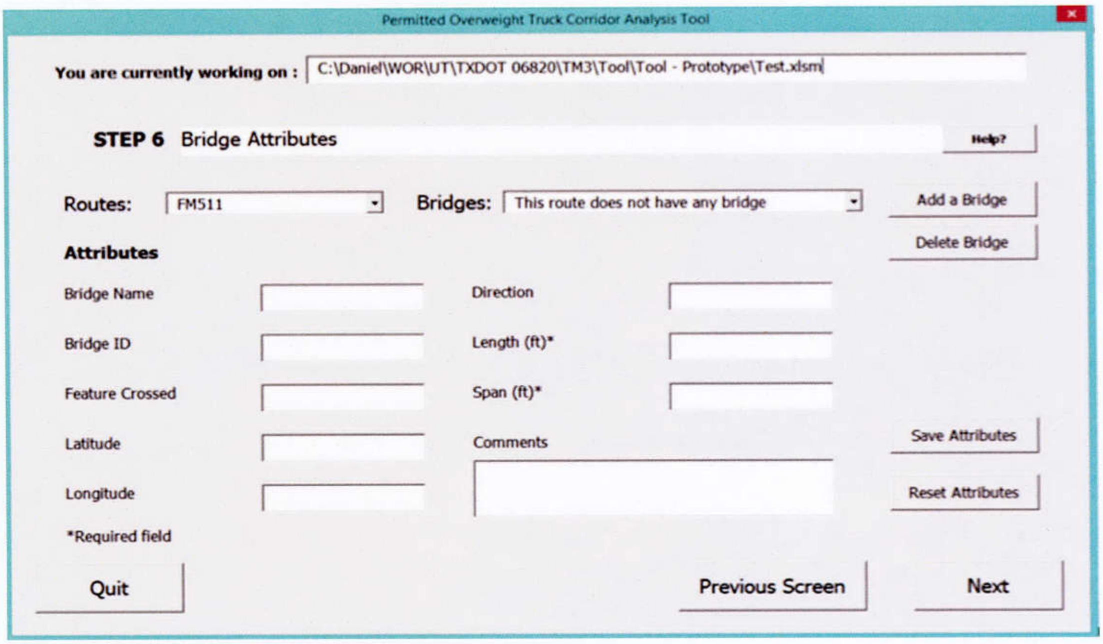


Figure 3.10: Interface of Step 6 of the Prototype Analysis Tool

In step six of the analysis, the user will be able to analyze the bridge consumption costs. The prototype version of the tool will include the bridge attributes automatically loaded into step six, and the user will not be able to modify the values. The values used are based on the bridges located at the OW route at the PoB. The detailed calculations on how these attributes are used to estimate the bridge consumption rates are shown later on in the document.

Step 7: Results

Figure 3.11 shows the final stage of the prototype tool analysis.

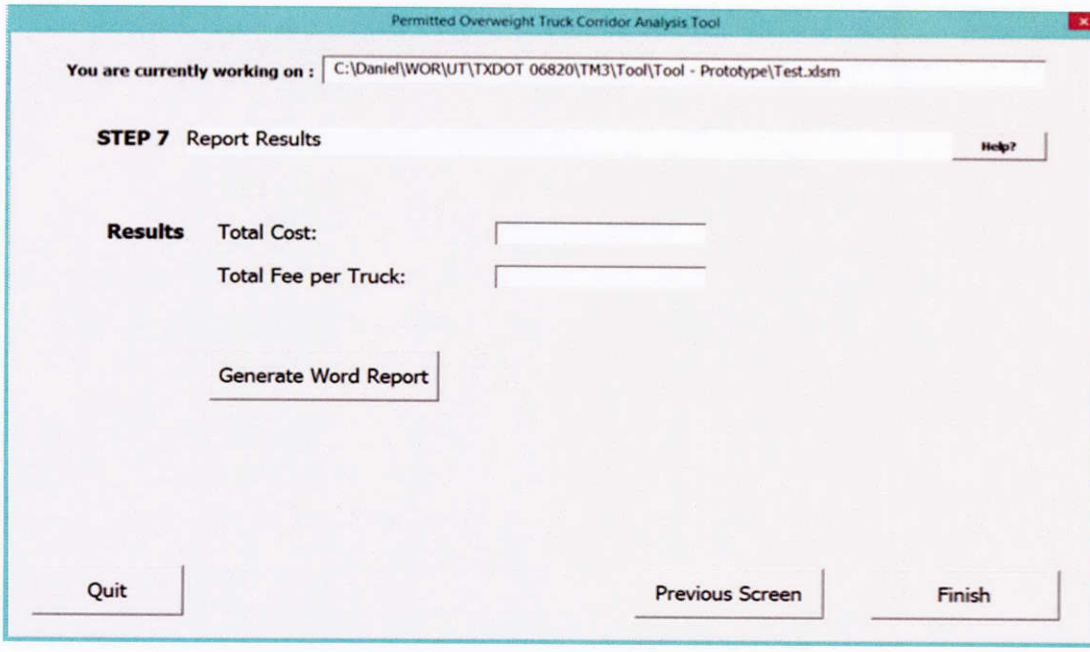


Figure 3.11: Interface of Step 7 of the Prototype Analysis Tool

Step seven, which is the final step of the prototype tool analysis, enables the user to view the results of the analysis, and obtain the total permit fee required per OW truck traveling on the select corridor. In addition, the user can generate a report in Microsoft Word format to view the results of the analysis in detail, as well as any comments included during the different analysis stages.

3.3 Discussion of Key Components

3.3.1 User Input Module

As shown in the previous section, the user will need to input data into the tool in order to be able to conduct the analysis and obtain a permit fee. The data that the user will need to input include:

- The total number of permitted trucks, based on the permits sold per year. For an existing corridor, such as the PoB, the default value will be known and included in the tool, and will be based on the number of permits issued annually.
- Number of trucks assumed for each configuration, based on the analysis of permit data. For an existing corridor, such as the PoB, the default number of trucks for each configuration will be based on an assessment of the permits. Using this information, distributions for other, new corridors could be estimated.

- Percentage of trucks traveling across each corridor link using the ADT and percentage of trucks values from the PMIS data to distribute the permitted trucks if the permits do not provide sufficient routing information.
- Assumed permit growth factor, based on actual growth in permits for existing corridors.
- Safety and traffic operations treatment options.
- Pavement and bridge upgrades. The tool will only include routine maintenance, preventive maintenance, and light rehabilitation in the analysis, since they do not change the structural capacity of the pavement used in the analysis to determine the consumption costs.

For the case of the PoB and Hidalgo County RMA, the total number of permitted trucks, the number of trucks assumed for each configuration, the percentage of trucks traveling on each corridor link, and the assumed permit growth factor will all be pre-set in the tool when conducting the analysis. Therefore, the user does not have to input any values for these data points; however, he/she will have the option to override some values, which are specified in the description of each step of the analysis in Section 2.2.

3.3.2 Data Library

The data library of the Stage 1 Expedient Analysis Tool includes libraries of data sources, corridor link attributes, corridor upgrade options, and cost parameters. The prototype includes the data in the library; however, it focuses only on the PoB to provide a first step in assessing how the tool should function based on TxDOT PMC and subject matter expert input.

Libraries of Data Sources

Data from permits issued by the PoB are included in the prototype's libraries of data sources, and serve as the main source of data for truck configuration, GVW, axle weights, cargo being hauled, and the direction of haul. This data will be sufficient for existing OW routes that exist at the PoB.

Corridor Link Attributes

The corridor link attributes library include:

- Route type (FM, SH, US, and IH frontage roads)
- Roadbed information (divided or undivided)
- Physical beginning and ending description
- Centerline length in miles
- Number of lanes for each route segment

- Other factors to be determined

The prototype will include the above information, which is necessary to be able to conduct the cost analysis. As mentioned before, the route type and the physical beginning and end of a route will be obtained from permit information for existing corridors or from the descriptions in passed legislative bills for corridors that have not yet been approved by the Commission. The OW corridor links for the PoB will be based on the existing corridor as described at the PoB permit sales website and an approved amendment to the original legislation. The centerline length in miles will be calculated based on the available information. The roadbed information and the number of lanes will be determined based on visual analysis of the route. The condition of the route will be obtained through further analysis of the roadway conditions using PMIS data and potentially other sources. It should be noted that though the PoB corridor only includes on-system roadways (and thus can be characterized using PMIS data), the Hidalgo County RMA corridor includes off-system routes such as Trinity Road. In addition, the routes authorized during the 84th Legislature for the Port of Corpus Christi and City of Laredo/Webb County include off-system routes. The amount of revenue from permit sales will be distributed, in part, to the local agencies that administer these routes. Thus, questions will arise about how much revenue will be available to TxDOT for on-system routes after funding for these local routes is subtracted. Since these routes are not administered by TxDOT, it is not within the scope of this project to address consumption rates or treatment costs for off-system routes. In addition, data necessary to perform analysis for these routes is generally not available.

Corridor Upgrade Options

The corridor upgrades section of the data library will include pavement and bridge upgrades, as well as safety and operations treatments. The different corridor upgrade options will be available in the data library for the user to choose from. The information that will be included in the data library is shown in Table 3.1.

Table 3.1: Different Initial Safety and Operations Treatments

Pavement Upgrades	Bridge Upgrades	Safety and Operations Treatment
Do nothing	Functional	Add Turn Lanes
Routine Maintenance	Structural	Install Traffic Signals
Preventive Maintenance		Extend Culverts
Light Rehabilitation		Install Guardrail
		Install Flashing Beacon

The pavement upgrade options included in Table 3.1 were chosen because they do not have any impact on the structural configuration of the pavement, and would not affect the pavement consumption calculations. The costs for the safety and operations treatment options included in the table were estimated based on TxDOT's project information database.

Cost Parameters

Tables of cost parameters will include default values for non-structural pavement and bridge upgrade treatment costs; safety and traffic operations upgrades; and pavement and bridge consumption rates in units of dollars per vehicles miles traveled. In order to obtain these default values, information on truck configurations from the aforementioned permit data is needed, as well as the establishment of an ECF for each axle configuration.

3.3.3 Cost Analysis

The overall objective of the Stage 1 Expedient Analysis Tool is to assist decision-makers in evaluating the various cost components associated with an existing or new OW truck corridor and to estimate the permit fee for OW trucks. The fee will be based on cost recovery to provide revenue for maintaining the roadway, maintaining safety and traffic operations, and administration fees. The combination of values entered by the user and the default values included in the data library tables will provide the basis for the cost analysis. In addition, the analysis will summarize each cost category so that the analyst can understand how each category contributes to the overall permit fee cost. In addition, this information will be helpful in planning short- and long-term route improvements and pavement/bridge treatments.

Initial Corridor Upgrade Factors and Costs

Initial treatment and cost modules will be set up in the tool, with the objective of bringing the current corridor up to required conditions to carry heavy permitted trucks, in addition to loads applied by local traffic. However, the cost factors determined by the tool will only be based on enhancements and consumption related to OW trucks permitted by the port or RMA. The analysis will be conducted by route link, with default suggestions based on PMIS pavement conditions scores and CRIS data, as previously mentioned, with results given in US dollars per mile. The cost-related parameters will be stored in the data library, allowing for the ability to conduct scenario studies.

3.4 Discussion of Pavement Consumption Analysis

It is important to understand that there is a fundamental difference between determining the consumption rate/VMT for a truck operating on the entire TxDOT pavement network and the cost of that same truck operating on a fixed OW truck corridor. This is due to several reasons:

1. The specific routes, route lengths, and segments including pavement surface types are fixed and known for the OW corridor analysis. Thus, for a given truck configuration the consumption rates are determined for the OW corridor pavements of a fixed length for an estimated number of truck repetitions based on the number of permits associated with than truck configuration. Since there is no information provided on the permit to specify the exact route a permitted truck will take, the researchers are currently allocating the number of permits, or truck repetitions for a given configuration in relation to the fraction of total trucks (both legally loaded and OW) that operate on the network based on the Transportation Planning and Programming Division traffic data.

   The number of loaded VMT is based on the estimated route length in one direction since permitted trucks can only carry cargo to or from a destination based on purchase of a single permit. If cargo is carried in both directions, then a permit would need to be purchased for both trips. In any case the loaded mileage would be the route distance estimate for the specific corridor route resulting in multiple applications of loads along the fixed corridor routes.

   The cost for this analysis is based on the typical treatment costs for medium and heavy rehabilitation projects for asphalt concrete pavements (ACP), continuously reinforced concrete pavement (CRCP), or jointed concrete pavement (JCP) sections depending on the specific corridor and routes. For this study, the typical costs used were assumed to be \$200,000 to \$400,000 per mile for a medium rehabilitation and from \$400,000 to \$1 million per mile for a heavy rehabilitation / reconstruction.

2. When considering a statewide, network-level analysis of the amount of consumption for the same truck configuration from item 1, the analysis is performed considering the typical total VMT traveled per year for a truck of a given configuration. Thus an over the road truck transporting freight of all kinds typically travels 120,000 VMT or more; a gravel hauler travels about 100,000 VMT and other types of trucks exhibit typical annual mileages in relation to the specific business operations they support. A statewide network level analysis would therefore involve knowing the type of truck and cargo being transported, the estimated total and loaded VMT per year and a determination of the types of routes a given type of truck might travel.

   Thus during the Rider 36 study a gravel truck was estimated to travel 100,00 VMT per year based on interviews with major gravel transport company representatives and analysis of the Federal Motor Carrier Safety Administration (FMCSA) SAFERSYS database. An assumption was also made that the truck would travel 50% of the VMT loaded and would be empty otherwise; therefore the loaded VMT = 50,000 miles. The next step is to determine the percentage of different route types the gravel truck would travel which could include load-zoned FM roads with a posted maximum load limit of 58,420 lbs GVW, as well as FMs, SHs, US routes, and IH frontage roads, which can carry the legal maximum load limit of 80,000 lbs GVW. Thus a distribution of the truck VMT for each route functional class was determined and a consumption cost for each route type determined for a given truck configuration. The total cost could then be calculated and an average cost / VMT determined.

The cost figures needed to arrive at the consumption rate / VMT were based on analysis of many different pavements representing the different route functional classes. Actual pavement design thickness and material types were obtained along with the design ESALs for the 20-year design life of that pavement. A specific OW truck configuration would then be applied for a given number of repetitions in relation to the typical loaded annual VMT to determine the remaining life for rutting, fatigue cracking, and roughness (IRI). It is understood that superimposing the additional ESALs for the OW truck for a specific number of repetitions will shorten the design life of the pavement. The researchers then determined the additional pavement thickness that would have been required to arrive at a pavement design that would carry both the original design ESALs and the superimposed ESALs due to the OW truck and achieve a 20-year design life. The consumption rate/VMT was then calculated based only on the additional pavement structure cost due to the OW trucks.

The reader can therefore understand that the methods for calculating consumption cost / VMT will yield different rates for a truck operating on a fixed corridor or if operating statewide on a mixed network of routes.

3.4.1 OW Corridor Analysis Process

The researchers used the consumption analysis method developed in the Rider 36 Study for the Stage 1 tool; however, the costs that were used to arrive at the total rate / VMT are different as described in items 1 and 2. The costs used are network-level project cost estimates provided by TxDOT and are representative for the corridor pavement types being analyzed.

The analysis was conducted for two truck configurations that represent the 'value of the permit' or the maximum load for a 5-axle or 6-axle truck operating at the PoB or Hidalgo County RMA corridors. The analysis was based on data from these two corridors since permit data sufficient for the analysis in terms of actual permitted truck configuration, including truck axle spacing and weights, only exists for these corridors. During the past 12 months approximately 30,000 permits were sold at PoB and approximately 10,500 for Hidalgo County RMA. The researchers evaluated a sample of over 9,000 permits from these two sources to identify the two truck configurations for the analysis.

The truck configurations and axle loads included:

	Steer	Drive Tandem	Trailer Tandem	Trailer Tridem
5-axle tractor semi-trailer	13,000 lbs	46,000 lbs	46,000 lbs	
6-axle tractor semi-trailer	14,000 lbs	46,000 lbs		60,000 lbs

The researchers evaluated these two configurations using the AASHTOWare DarWin ME pavement analysis software to determine the ECFs for rutting, fatigue, and IRI for each configuration. These values were determined to be:

	Rutting	Fatigue	IRI	Average ECF
5-axle tractor semi-trailer	23.8	8.50	4.40	12.23
6-axle tractor semi-trailer	24.1	7.30	4.20	11.87

The cost analysis based on the treatment cost ranges and the design ESALs for route types representative of the OW truck corridors at PoB and Hidalgo County RMA resulted in an average cost per VMT of $0.13. This estimate is a ball park figure at present for use in the Stage 1 tool and will be examined in greater detail as the pavement consumption models for project 0-6817 are refined.

Thus the cost / VMT for the 5-axle tractor semi-trailer is:

12.23 x $0.13 / VMT = $1.96 / VMT

Thus the cost / VMT for the 6-axle tractor semi-trailer is:

11.87 x $0.13 / VMT = $1.90 / VMT

These figures were coded in the Stage 1 tool and are average values for a network level analysis of the corridor regardless of the pavement surface type. The Stage 2 tool will provide more detailed consumption rates for each truck configuration and pavement type.

3.5 Discussion of Bridge Consumption Costs

3.5.1 Analysis Objective and Results Description

The objective of this analysis is to provide an estimate of the bridge consumption costs for 24 truck configurations, by county, urban/rural area, and highway classification. One of the 24 configurations is the standard 18-wheeler (interstate semi-trailer at 80K GVW), which provides a baseline case for incremental cost calculations. The estimated costs are per one-way trip and per mile.

Urban/rural information comes from RHiNo 2013, data item "functional system." The highway classifications had to be grouped in similar classes, in order to ensure a representative number of bridges in each county, urban/rural area, and highway class.

Table 3.2 shows the aggregated classifications used in this analysis, with an explanation and the RHiNo classification comprised.

Table 3.2: Highway Classes Used in the Bridge Analysis

Bridge Analysis Classification	*Comprises*	
	Description	RHiNo 2013 Classification
FM/RM/PR	FM-RM-RR-PR-Rec. Roads and their spurs	FM,FS,PR,RE,RM,RR,RS
IH	IH main lanes and frontage road segments with bridges	IH
SH	State highways	SH
SL/SS/BR/OSA	State loops, State spurs, all business roads and all on-system arterials.	BF,BI,BS,BU,PA,SL,SS
US	US highways, alternatives, and spurs	US,UP,UA

The bridge consumption results were delivered as one Excel workbook per vehicle configuration. All workbooks have two sheets. The sheet titled "lookup by county" contains the following:

- The first two columns of Table 3.2,
- A sketch of the truck configuration,
- The percent of bridges statewide exceeding the operating rating for that configuration, and
- A summary (pivot) table where the user can select a county and retrieve the configuration's bridge consumption cost per mile per (one-way) trip.

Figure 3.12 illustrates a screen capture of the summary table for Bexar County. It is very important to note that this pivot table gives correct results ONLY for each county. Choosing "all" in the table DOES NOT give correct statewide results, given the way Excel automatically adds pivot tables. If results need to be aggregated by TxDOT District or even statewide, the user has to use the results in the sheet discussed next.

Select county	BEXAR	
Cost/mile/trip	**Area**	
Classification	**RURAL**	**URBAN**
FM/RM/PR	$ 0.02	$ 0.03
IH	$ 0.07	$ 0.74
SH	$ 0.06	$ 0.29
SL/SS/BR/OSA	$ 0.03	$ 0.15
US	$ 0.03	$ 0.49

Figure 3.12: Screen Capture of the Data Summary by County

The other sheet in each workbook is titled after the configuration number. It contains a table with 1187 data rows and a sketch of the vehicle configuration. Figure 3.13 shows a partial screen capture of the data with a detailed explanation of the data columns.

Cost of one trip over the mileage.

Centerline mileage of all roads included in the classification, by county and area.

Average number of bridges/mile in the road mileage described above.

Estimated cost of an one-way, one-mile-long trip on a road included in classification, located in (rural/urban) area of the county.

County	UR	Classification	cost	mileage	Density	Cost/mi/trip
ANDERSON	RURAL	FM/RM/PR	$ 1.22	249.744	0.7888	$ 0.00
ANDERSON	RURAL	SH	$ 0.73	68.484	2.2487	$ 0.01
ANDERSON	RURAL	US	$ 3.53	80.59	1.824	$ 0.04
ANDERSON	URBAN	SL/SS/BR/OSA	$ 1.07	12.13	2.9678	$ 0.09
ANDERSON	URBAN	US	$ 0.05	17.162	4.7197	$ 0.00
ANDREWS	RURAL	SH	$ 0.12	108.08	0.3238	$ 0.00
ANGELINA	RURAL	FM/RM/PR	$ 0.96	182.979	1.093	$ 0.01
ANGELINA	RURAL	SH	$ 1.65	61.8	1.9417	$ 0.03
ANGELINA	RURAL	US	$ 2.18	52.63	2.1471	$ 0.04
ANGELINA	URBAN	FM/RM/PR	$ 0.48	24.012	4.6227	$ 0.02
ANGELINA	URBAN	SL/SS/BR/OSA	$ 3.89	20.715	6.2756	$ 0.19
ANGELINA	URBAN	US	$ 5.69	16.875	7.1111	$ 0.34
ARANSAS	RURAL	FM/RM/PR	$ 0.01	18.312	1.7475	$ 0.00
ARANSAS	RURAL	SH	$ 3.62	33.27	1.0219	$ 0.11
ARANSAS	URBAN	SH	$ 0.28	5.04	3.5714	$ 0.05

Figure 3.13: Sample of the Excel Sheet with 1187 Data Rows

The cost of any specific one-way route can be estimated by multiplying the unit cost by the route mileage, taking care to match highway class, and urban/rural area. For round trip, double the cost. If a route contains a segment with multiple highway classifications, the highest classification should be utilized. When estimating a route cost, is important to assign each route segment to its proper urban or rural area. The average costs generally are considerably different due to the higher bridge density in urban areas.

3.5.2 Bridge Consumption Methodology

The data available in the NBI/BRINSAP database allows for the application of simplified methodologies to estimate bridge consumption for load configurations at the policy level. Applying Equation 1 twice, once for the Inventory rating load and again for the OS/OW permit load and then subtracting one result from the other, one obtains Equation 2.

At the policy level, it is not feasible to calculate actual stress ranges for bridge details. Digital descriptions of bridge cross sections and other characteristics are not available; even if they were, computational demands would make this task unfeasible within this project's time frame. An acceptable method successfully used in previous OS/OW studies involves using live load bending moments as surrogates for the stress range (Imbsen et al., 1987; Weissmann & Harrison, 1992; and Weissmann, et al., 2002). This approach substitutes the stress ranges in Equation 2 with bending moments, defining the bridge consumption ratio as depicted in Equation 3. Simply put, Equation 3 states that the bridge consumption ratio induced by a bending moment of an inventory rating load passage on a given bridge is equal to 1. Loads inducing bending moments twice as large as the inventory rating bending moment lead to a bridge consumption ratio of two to the power "m", where "m" is a function of the bridge material. Altry et al., 2003 and Overman et al., 1984, recommend "m" values that can be matched to the corresponding BRINSAP structure type codes.

$$\log N = C - m \log S \tag{1}$$

Where:

N – Number of cycles or load applications

S – Stress range

m – Constant: material dependent

C – Constant

$$\frac{N_{Inventory}}{N_{OSOW}} = \frac{S_{OSOW}^{m}}{S_{Inventory}^{m}} \tag{2}$$

Where:

$N_{inventory}$ – Number of load applications for the inventory rating load

N_{OSOW} – Number of load applications for the OS/OW load

$S_{inventory}$ – Stress range for the inventory load

S_{OSOW} – Stress range for the OS/OW load

m – Constant: material dependent

$$ConsumptionRatio = \left(\frac{M_{OSOW}}{M_{Inventory}} \right)^m \tag{3}$$

Where:

$M_{inventory}$ – Live load bending moment for the inventory rating load

M_{OSOW} – Live load bending moment for the OS/OW load

m – Constant: material dependent

The bridge consumption in dollars due to the passage of a given load is estimated by using Equation 3 combined with a consumable asset value for the bridge. The recently completed Federal Truck Size and Weight study recommends that the current asset value of a bridge is $235 per square foot of deck area. Previous highway cost allocation studies established that the asset value of a bridge should be allocated according to Table 3.3, with 11 percent of the bridge asset value attributable to loads that are over HS20-44 (FHWA, 2000). HS20-44 is a standardized bridge design load, and current bridge inventory ratings are usually represented as multiples of the HS20 design load when recorded in NBI/BRINSAP.

Table 3.3: Bridge Asset Value Percentages for GVW Categories

Vehicle Class	Percent Allocation
Passenger Vehicles	65.02%
Trucks	
Single Unit	7.67%
Combinations	
under 50 kips	2.68%
50 - 70 kips	5.15%
70 - 75 kips	8.41%
Over HS20-44 Loading	11.08%
TOTAL =	100.00%

With the help of computerized routines, Equation 4 is applied on a bridge-by-bridge basis to all bridges in each county, urban/rural area, and highway classification used in this analysis. Bridge asset consumption results for each bridge are summarized and aggregated to determine an overall cost for a given mileage of a given highway class in a given area of a given county. This is divided by the mileage to get a cost-per-mile for bridge consumption.

$$Consumption_{osow} = [(Area)(235)(0.11)\left(\frac{M_{OSOW}}{M_{Inventory}}\right)^{m}] \div (2{,}000{,}000) \qquad (4)$$

Where:

$M_{Inventory}$ – Live load bending moment for the inventory rating load for each bridge in the permit dataset

M_{OSOW} – Live load bending moment for the OS/OW load for each bridge in the permit dataset

m – Constant: material dependent

235 – Asset value for a bridge in dollars per bridge deck square foot

0.11 – The bridge asset value responsibility for heavy trucks (see Table 3.3).

2,000,000 – Number of allowable load cycles that define bridge design life according to AASHTO.

The computer program Moment Analysis of Structures (MOANSTR) is used to calculate live load moment ratios required by Equation 4. The MOANSTR program's core is a finite differences routine that calculates live load moment envelopes generated by OS/OW configurations and NBI/BRINSAP rating loads. The MOANSTR routine, developed by members of the UTSA research team, incorporates previous research by Matlock (Matlock et al., 1968) and others (Weissmann & Harrison, 1992 and Weismann et al., 2002). MOANSTR calculates moment envelopes and identifies the maximum live load bending moments (positive and negative) induced by the OS/OW configuration and the inventory rating load.

Data Preparation

The steps listed below summarize the data preparation that was necessary to obtain mileages, assign a consistent highway classification as well as urban/rural area to each bridge, and arrive at the cost results previously discussed.

Step 1: Assign a consistent urban/rural classification to each bridge.

First, urban/rural classifications were retrieved from both RHiNo and BRINSAP, using their functional system variables. Urban/rural classification using the "functional_system" RHiNo variable does always not match the urban/rural classification using BRINSAP's equivalent variable, which is item 26/26A of the coding guide. It was necessary to resolve all inconsistencies.

Step 2: Develop a highway classification system that is consistent between RHiNo and BRINSAP.

First, it was necessary to assign a RHiNo classification to each bridge. As depicted in Table 3.4, highway classifications in RHiNo do not always match those used in BRINSAP (items 5.2 or 5.2A, depending on whether the bridge is located on the inventory route or passes under it). Every time the two classifications did not match, GIS was used to assign to the bridge the same classification as the RHiNo segment where each it is located.

Table 3.4: RHiNo and BRINSAP On-System Highway Classifications

RHiNo Variable	Highway	BRINSAP Variable Value	Highway
Value	Classification	(Items 5.2 or 5.2A)	Classification
BF	Business FM	25	Business IH
BI	Business IH	27	Business SH
BS	Business SH	26	Business US
BU	Business US	41	Federal Lands Road
FM	FM	15	FM/RM
FS	FM Spur	11	IH
IH	IH	24	NASA1
PA	Principal Arterial	19/99	Other
PR	Park Road	16	Park Road
RE	Recreational Road	17	Recreational Road/Spur
RM	RM	13	SH
RR	Ranch Road	14	SL or Spur
RS	RM Spur	51	State Lands Road
SH	SH	20	Toll Road
SL	SL	12	US Spur
SS	State Spur		
UA	US Alt.		
UP	US Spur		
US	US		

Once each bridge had a RHiNo classification, the following was done:

1. Using RHiNo, determine the total centerline mileage within each county and urban/rural area for each highway classification.
2. Using BRINSAP and the RHiNo highway classification of each bridge, determine the number of bridges in each county, urban/rural area, and each RHiNo highway classification.
3. Not every area in each county actually had bridges in each RHiNo classification; thus, it was necessary to aggregate some classifications to ensure meaningful results (see Table 3.4).

Step 3: Identify and eliminate from the analysis parallel bridges, culverts, and tunnels.

BRINSAP has variables identifying these situations. Culverts and tunnels are straightforward, and so is travel direction. However, an additional data treatment was necessary to eliminate parallel bridges in the same traffic direction, which are sometimes present. BRINSAP item 101 was used but several cases had to be visually checked in online maps and pictures using the geographical coordinates of the bridge. The data treatment to eliminate all parallel bridges was necessary due to the nature of the RHiNo data format that reports centerline mileage. Considering more than one parallel bridge in the same location to calculate the consumption due to one truck pass would artificially increase the cost.

Step 4: Calculate the bridge consumption of all on-system bridges.

The previous steps resulted in an analysis database with all pertinent BRINSAP variables, the aggregated highway classification developed as described in Step 2, an urban/rural area consistent with RHiNo, and no parallel structures or structures other than on-system bridges. This database was used to calculate the moment ratio and costs for each bridge, which were then added up by highway classification, area, and county, to obtain the final results reported in the spreadsheets previously discussed (see Figure 3.12 and Figure 3.13).

3.6 Conclusions

The product of this analysis is a network-level bridge consumption cost per VMT by county, urban/rural area, and the aggregated highway class depicted in Table 3.4. It provides a useful tool to estimate the bridge consumption costs of 24 different configurations for any given route in any county. Nevertheless, such estimates are less accurate than a project-level analysis of specific routes or corridors, basically for two reasons:

1. A corridor or route analysis calculates each specific bridge consumption cost rather than use average costs by factorial cells, and

2. The network-level analysis presented here depends on averages by highway class, area, and county, which in turn required resolving some inconsistencies among RHiNo and BRINSAP based on network-level type of reasoning and/or judgment, as previously discussed. This does not occur in a route-specific analysis where each individual bridge is considered.

Chapter 4. A Case Study Analysis Using the Prototype Tool

This chapter provides an example of a corridor study using Version 1.0 of the Tool. The case study will involve the cost analysis of the OW corridor at the PoB in order to come up with a permit fee that the OW vehicles should pay to operate at the Port, as well as the cost implications to TxDOT as a result of these operations. The analysis will consider the pavement and bridge consumption costs as well as safety and traffic operations upgrade costs.

This chapter will describe the process of calculating cost metrics showing the impact of OW truck operations at the Hidalgo County RMA, based on pavement and bridge consumption, and safety and traffic operations costs.

4.1 Assumptions

Several base assumptions needed to be made in order to decide on specific analysis decisions. These assumptions were agreed upon between the TxDOT subject matter experts, PMC members, and the research team at a workshop in February, followed by a number of subsequent meetings. The assumptions that were agreed upon are listed below:

- **Assumption 1:** The total GVW, including truck tare weight and cargo weight, will be used to develop pavement and bridge consumption rates and to compute consumption costs.
- **Assumption 2:** The Stage 1 Analysis Method will be applicable for ports, POEs, and RMAs serving coastal port regions and border POEs.
- **Assumption 3:** The existing, authorized route links at the PoB, Hidalgo County RMA, and Freeport OW corridors are assumed to be 'fixed' and not accessible to the Stage 1 tool User for adding/removing from the corridor. These corridors, which were in place and active during the Stage 1 tool development, will serve as 'Archived' corridor configurations on which default truck configurations and consumption rates will be based. In any case, the user can create a new Scenario by copying the Archived Scenario and changing route links, numbers of permits and other attributes associated with the analysis.
- **Assumption 4:** If a new port or RMA proposes an OW corridor, the types of cargo that are expected to be transported through the port or within the border region will be used to select truck configurations and associated axle/GVW loads based on the configuration library developed using information from an analysis of permits from existing corridors.
- **Assumption 5:** The Stage 1 analysis process will be fixed at 20 years.

4.2 Case Study: Hidalgo County RMA OW Corridor

The Stage 1 Expedient Analysis Tool involves a seven-step procedure by which the user identifies the desired route to analyze and, through calculating pavement and bridge consumption costs as well as safety enhancements, the Tool arrives at a cost breakdown of OW vehicles operating the corridor. The different stages of the analysis will be explained in greater detail in the following section, along with all the underlying calculations and links to the Tool's data library.

4.2.1 Start: Beginning a New Analysis/Continuing an Existing Analysis

The user will have the chance to being a new analysis by selecting the Tool's original excel file, or continuing an existing analysis by choosing a previously saved file. Figure 4.1 shows the Tool's interface after selecting the Tool's original file.

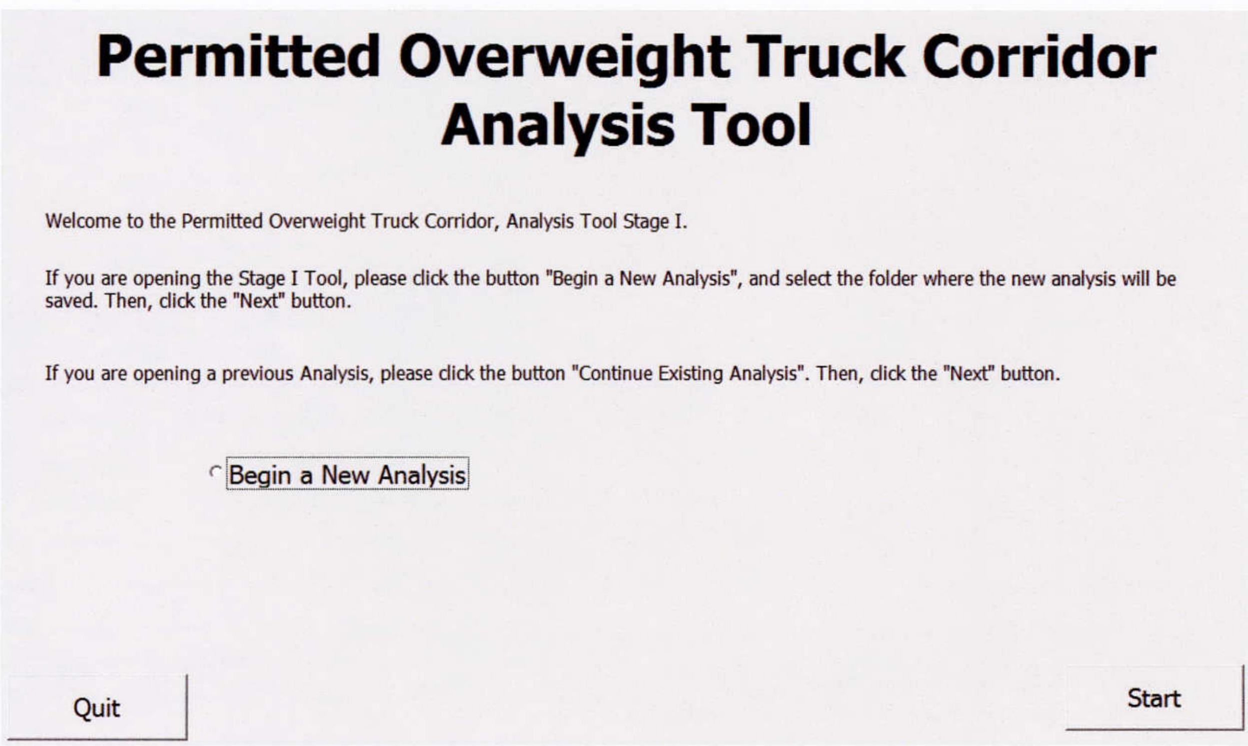


Figure 4.1: Interface of the Opening Window of the Tool

The user will choose to begin a new analysis, and will be prompted into selecting the name of the file and its location. Afterwards, the user can move forward to the first step of the analysis procedure.

4.2.2 Step 1: Selection of Location

The choice of which coastal or inland port, border POE, or RMA will be made during the first step of the analysis. Figure 4.2 shows the interface of Step 1 of the Tool.

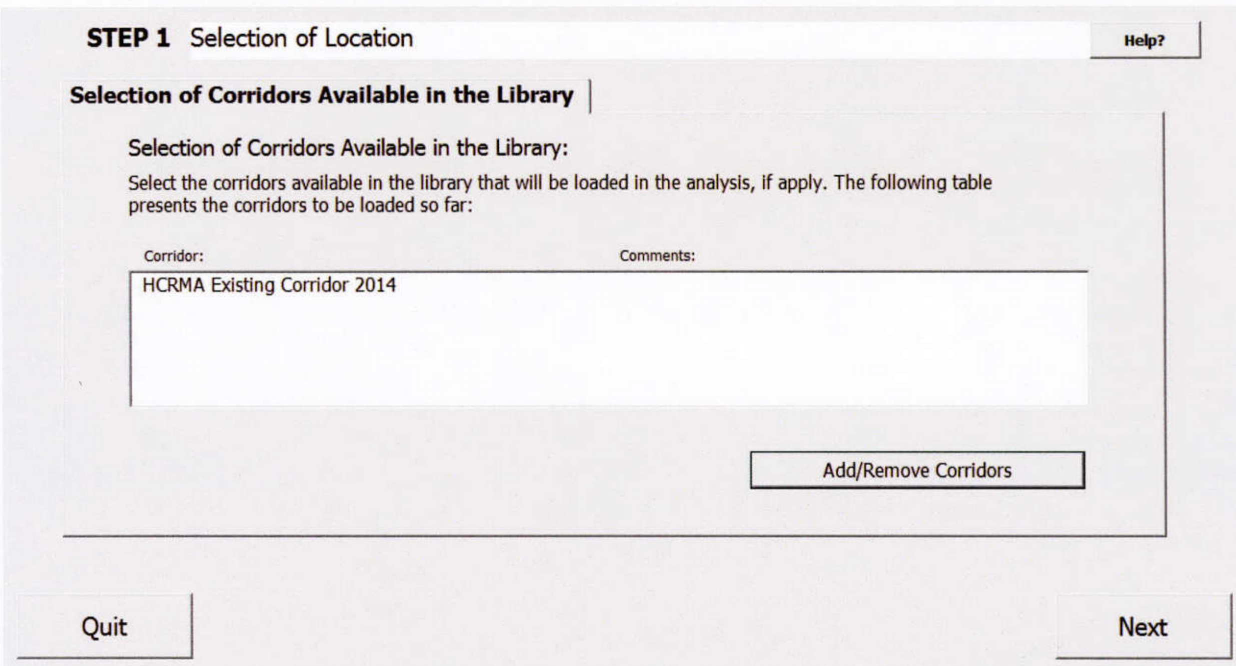


Figure 4.2: Interface of Step 1 of the Tool

The user has the option to choose the route for analysis. The options available to the user as part of the Stage 1 Expedient Analysis Tool's data library are the corridors at:

1. PoB
2. Port of Freeport
3. Hidalgo County RMA
4. Laredo
5. Port of Corpus Christi

The choices available to the user will be expanded as part of Stage 2 of the project. The selection of a corridor from this list will load all of its data that will be used for future steps of the analysis. The corridor's data that is included in the data library includes its specific routes and segments and, as part of Stage 2, additional information such as the cargo types that are being transported will be also included. Moreover, the user also has the ability to add more than one corridor to be analyzed at the same time. Also, the user can choose to conduct the analysis on a corridor that is not stored in the data library; therefore, no action is required in this step.

For the purpose of this case study, the corridor at Hidalgo County is selected. After making the selection, the user will be prompted to name the analysis to keep track of the progress. The user will now be able to move forward to Step 2 of the analysis.

4.2.3 Step 2: Selection of Routes

After selecting the location and corridors for analysis in the previous step, the user will now have the ability to choose the specific routes along the chosen corridors. Figure 4.3 shows the interface for Step 2 of the Tool.

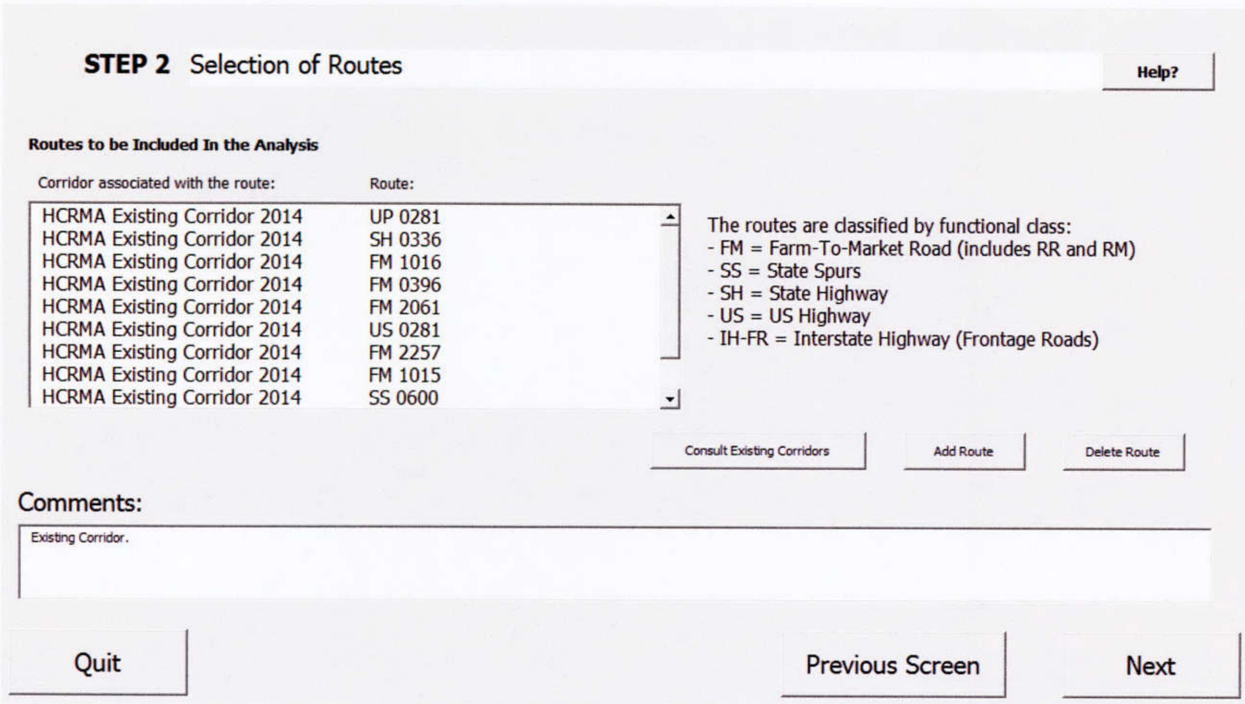


Figure 4.3: Interface of Step 2 of the Tool with the Hidalgo County RMA Routes Automatically Loaded

The Tool will automatically load the routes for existing, operational corridors that are stored in the data library. The user will have the ability to add routes to the corridor for analysis. Also, the user will be able to check images showing the corridor's routes within the Tool itself, to assist in making a decision. As part of this case study, the routes at Hidalgo County RMA were maintained, without adding any routes. After making the selection of the routes to be analyzed, the user is able to move to the next step of the analysis.

By choosing the routes for analysis, information pertaining to those routes will be loaded from the data library and will be used for subsequent steps. Such data includes the number of lanes, its length, the pavement types, and roadbed information, among others that are shown in Step 3.

4.2.4 Step 3: Selection of Route Attributes

After making the route selection in the previous step, Step 3 allows the user to view and edit the specific route information. Figure 4.4 shows the interface of the third step of the Tool.

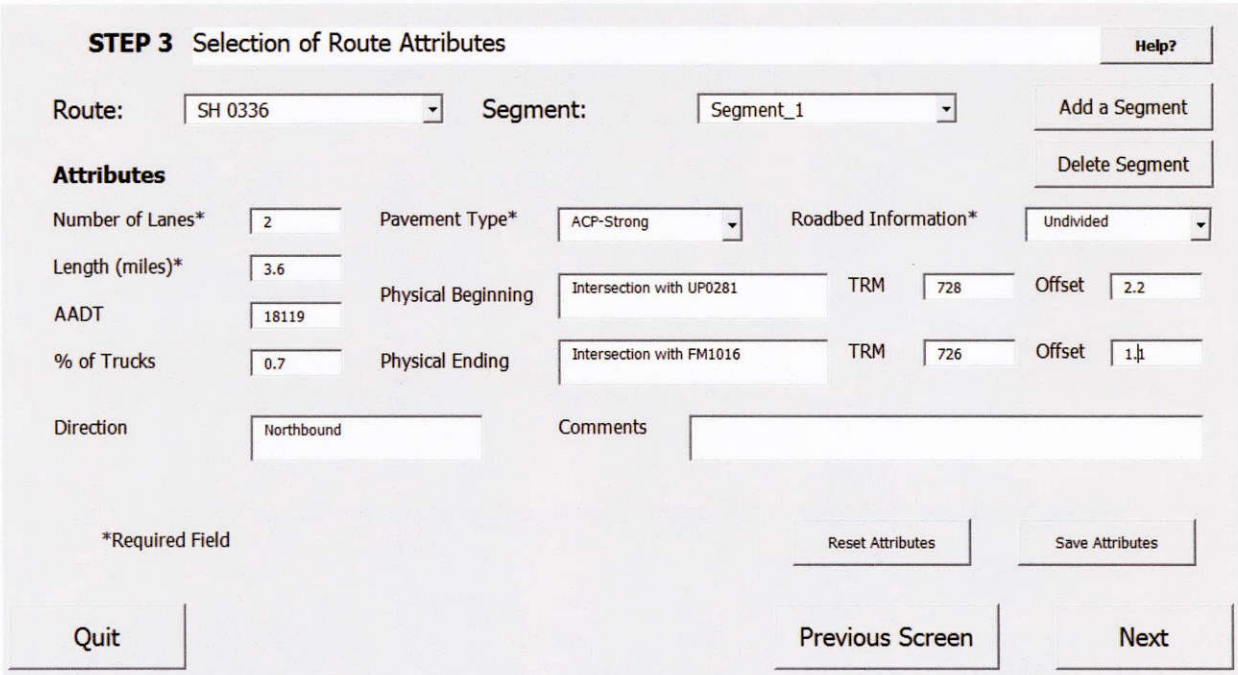


Figure 4.4: Interface of Step 3 of the Tool with the Values Automatically Loaded for the Selected Route and Segment

Since existing routes were chosen in the previous step, their basic information were automatically loaded into their respective fields. It can be noticed from the above that the segment field is already filled out. The current version of the Tool will have only one segment for each route; however, for future versions of the Tool each route will be segmented according to varying attributes. As can be seen in the above figure, all the attributes were automatically loaded, since this is an already existing corridor with existing routes. These values are stored in the data library, but the user has the ability to change them. If a route that is not currently legislated to carry OW vehicles is to be added, then the user will have to input its attributes. The number of lanes, length, pavement type, and roadbed information are required to conduct the analysis. Other information that the user could add, but that is not required for the analysis, include the average annual daily traffic (AADT), the percentage of trucks that travel on that segment, the physical beginning and end of the segment, and their TRM and offset values. This information will be used for the calculation of the pavement and bridge consumption that will contribute to the overall corridor costs.

As previously mentioned, existing routes on existing OW corridors are already segmented automatically by the Tool and stored in the data library. This version of the Tool will present each route as having one segment only; however, future versions of the Tool will have each route segmented according to varying attributes. The data that is stored in the data library for the Hidalgo County RMA OW corridor routes were not manipulated as part of this case study.

4.2.5 Step 4: Description of Freight Movement

After selecting the route segments and their specific information, the user can now describe the movement of freight along the corridor, and across each segment. Figure 4.5 shows the interface of Step four of the Tool.

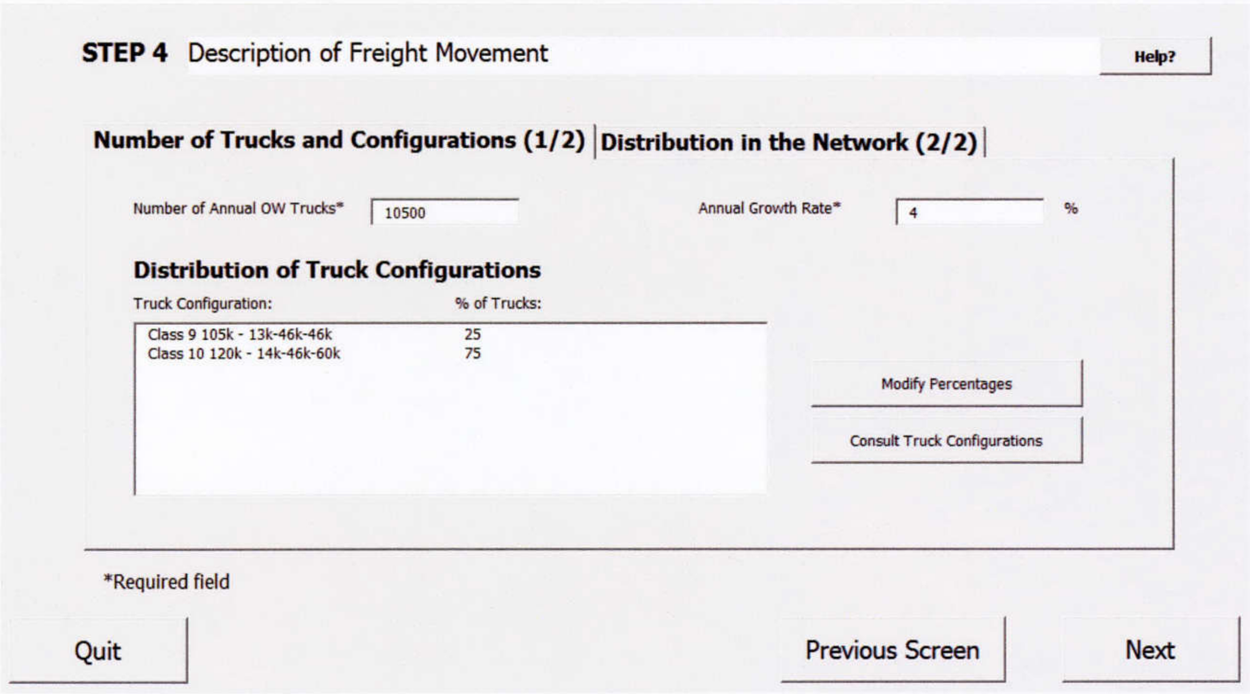


Figure 4.5: Interface of Step 4 of the Tool with the Percentage of OW Vehicles Automatically Set

The Tool will automatically load the number of OW permitted trucks, the annual growth rate, and the truck configurations that operate at the corridor of choice along with the each one's percentage of the total number of permitted OW vehicles. The user will not have the ability to change these percentage values, but will be able to do so for new routes by clicking the Modify Percentages button. Also, the user is able to view images showing the detailed truck configurations stored in the Tool, by clicking the Consult Truck Configurations button.

Furthermore, the Tool will automatically distribute the trucks along each segment in the corridor, and the breakdown can be seen when the user clicks on the "Distribution in the Network" tab, as shown in Figure 4.6.

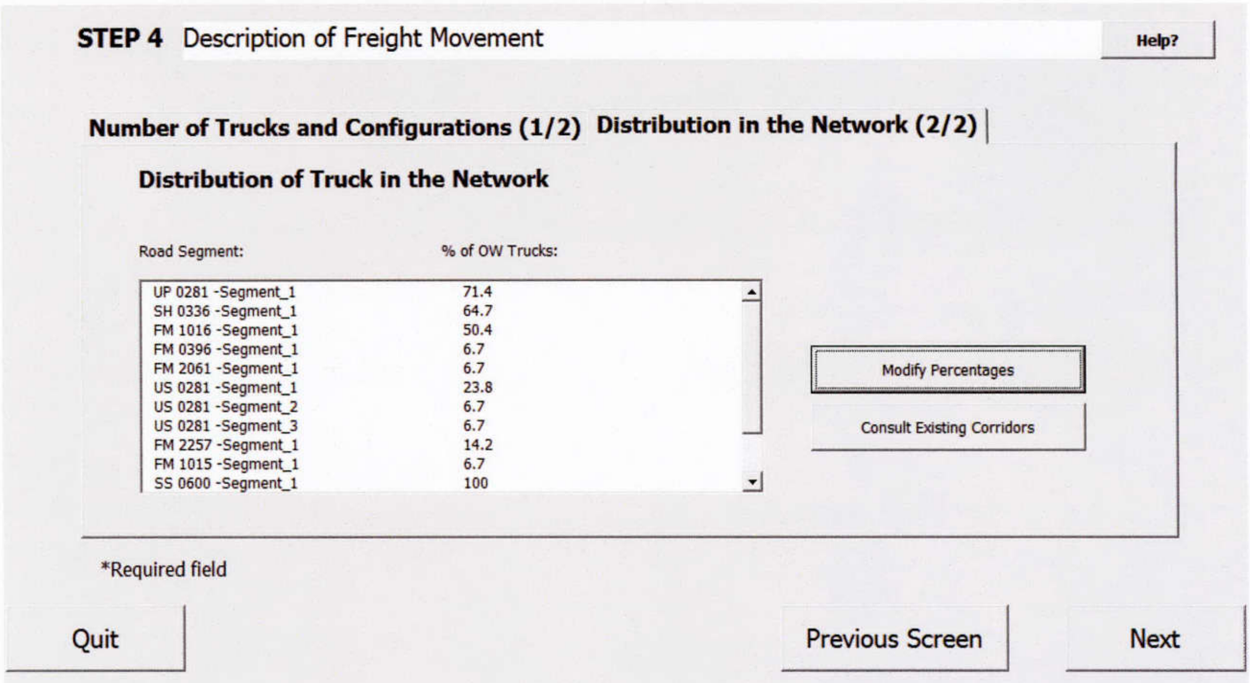


Figure 4.6: Interface of Step 4 of the Tool with the Distribution of the OW Trucks across Routes and Route Segments Automatically Set

The Tool will automatically distribute the trucks for the corridor at the Hidalgo County RMA in Stage 1, but the research team will be adding enhancing this feature for other corridors. If a new route was added to the corridor at a previous stage in the analysis, it will appear to have a value of 100% in the % of OW trucks column, which refers to the total OW traffic that operates on the corridor, but the user will have the ability to change these values.

As part of this case study, the percentage values were left unchanged. The OW trucks operational at the corridor were broken down according to the values indicated in the above figure.

The total number of OW trucks, the proportion of each configuration, and their distribution in the network will be used to calculate the pavement and bridge consumption costs. After describing the freight movement in this step, the user will be able to move to the next step of the analysis.

4.2.6 Step 5: Selection of Rehabilitation Treatment

Based on the routes and their segments described in earlier stages of the analysis, the user will be able to select the treatment to be made at each segment, along with the cost of each. Figure 4.7 shows the interface for Step 5 of the Tool.

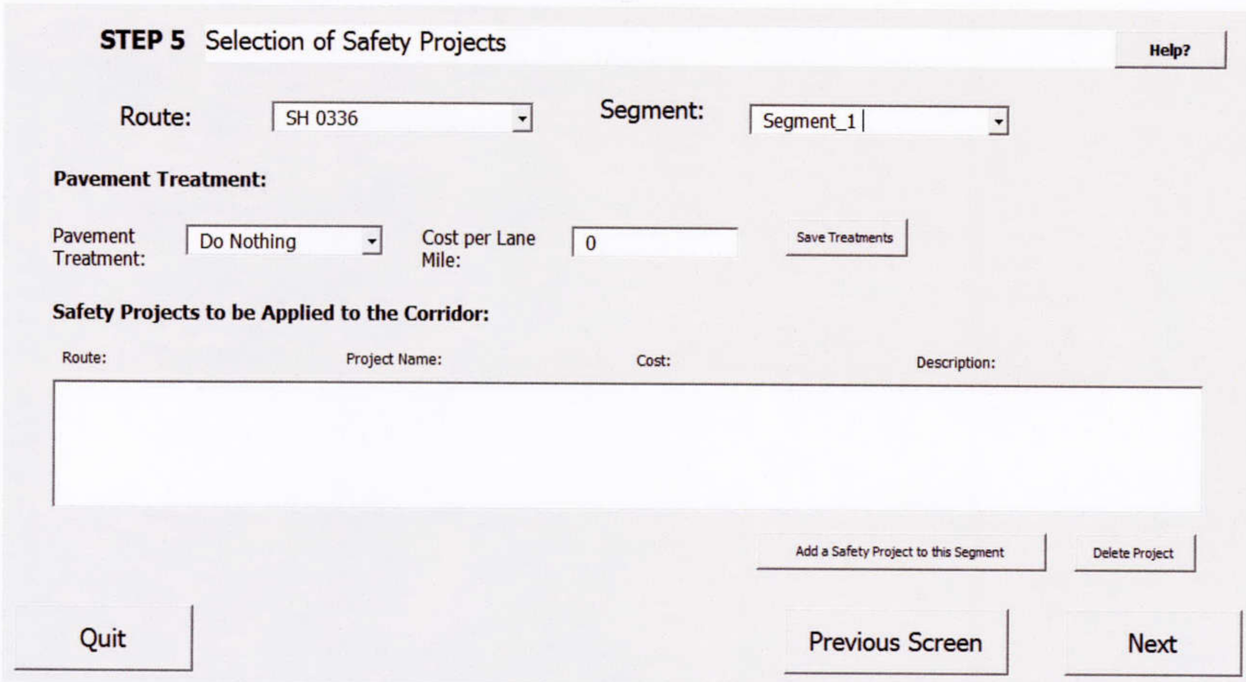


Figure 4.7: Interface of Step 5 of the Tool Showing that No Safety or Pavement Treatment Options Were Selected

In this step, the user can add pavement and safety treatments to be applied to each segment of the corridor. The pavement treatment options available to the user are light and medium rehabilitation only, due to the fact that they do not affect the structural capacity of the pavement. The structural capacity of the pavement will be captured in the pavement consumption calculation; therefore, selecting light or medium rehabilitation will help avoid any double counting of costs. In this case study no pavement treatment was chosen.

Also, the user can select safety treatment options for each segment. The Tool will not automatically load any value from the data library, but it provides the user to add projects and their costs that are stored in the data library by clicking the "Add a Safety Project to This Segment." The user may or may not choose one of the projects from the list, but will have to input the cost of each safety treatment option if a new one is selected. In this case study, no safety project was added.

Both treatment costs will be added to the total corridor costs, from which the permit fee and other cost components will be derived, as described in Step 7. The user may also opt to not include any pavement or safety treatment option, and can proceed to the next stage of the analysis once the desired selection is made.

4.2.7 Step 6: Selection of Bridge Information

In this step, the user can conduct a bridge analysis. At this stage, the user will be able to select the bridge density by county, urban-rural classification, and functional class. The interface of Step 6 is shown in Figure 4.8.

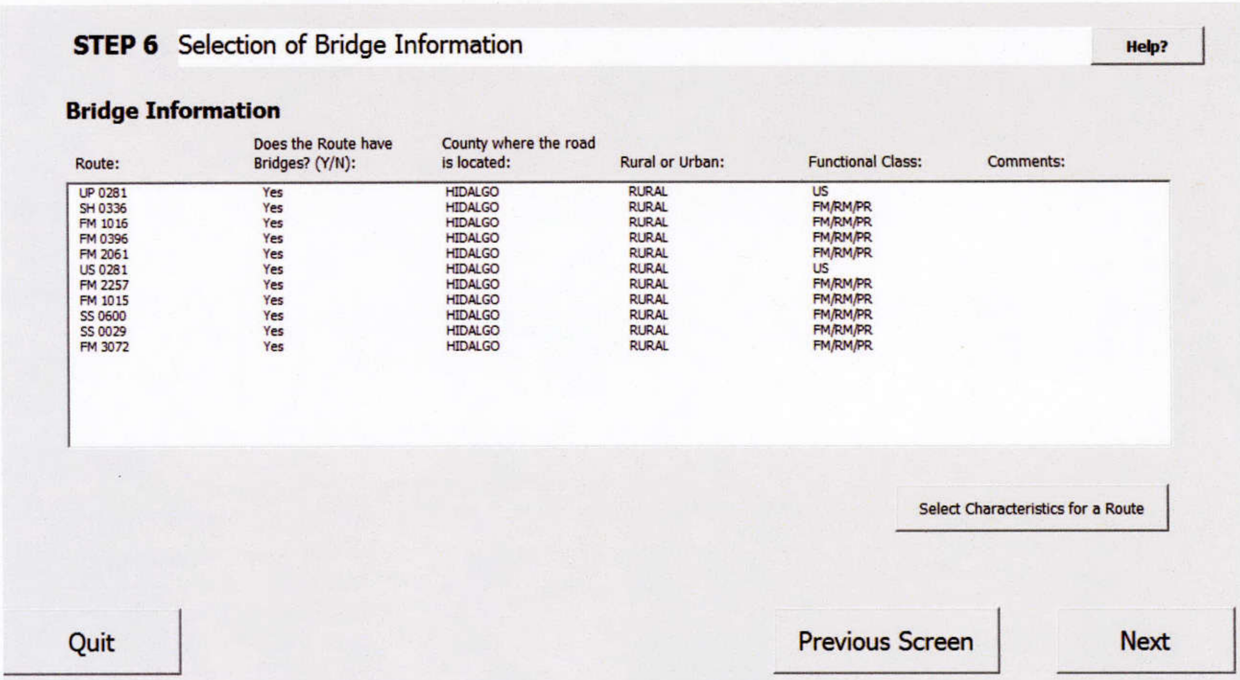


Figure 4.8: Interface of Step 6 of the Tool with the Bridge Density Is Chosen for Each Route based on County, Rural-Urban Classification, and Functional Class

Since existing routes were chosen, the Tool automatically filled in the values all the columns that can be seen in the above figure. If an additional route was added to this corridor, default values would be entered automatically by the Tool and the user will have the ability to adjust the values by clicking the Select Characteristics for a Route button. In this case study, no changes were made to the Tool's automatic inputs.

4.2.8 Step 7: Report Results

After adding all the information in the previous steps of the Tool, the analysis results will be shown in the seventh step. Figure 4.9 shows the interface for Step 7 of the Tool.

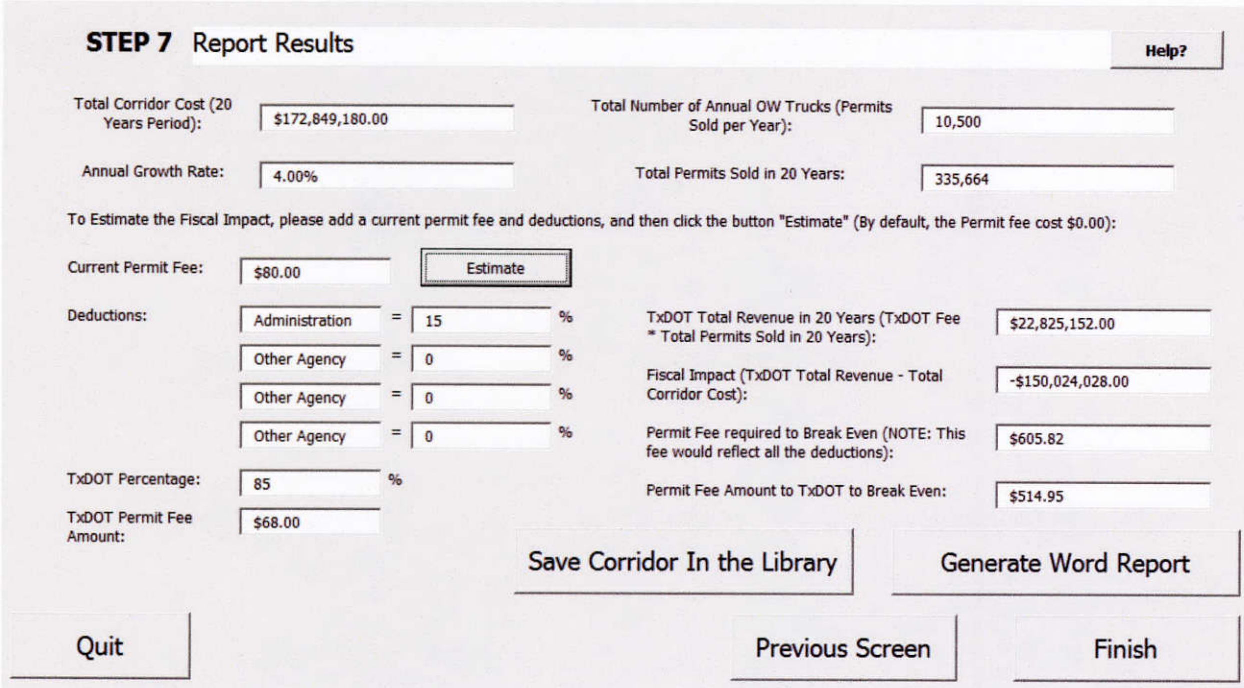


Figure 4.9: Interface of Step 7 of the Tool Showing the Results of the Analysis

Following are brief descriptions of each component in Figure 4.9.

- Total Corridor Cost: This shows the total cost on the corridor taking into account the pavement, bridge and pavement and safety treatment decisions made throughout the analysis. This value is expressed in 2014 dollar amounts.
- Total Number of Annual OW Trucks (Permits Sold per Year): Indicates the number of permits sold in the first year of the analysis period. A decision on this value is made in Step 4 of the Tool.
- Annual Growth Rate: Describes the percentage growth in number of permits sold each year. A decision on this value is made in Step 4 of the Tool.
- Total Permits Sold in 20 Years: The number of permits that will be sold in 20 years
- Current Permit Fee: This is a user input. The user will have to insert a value corresponding to the current permit fee at existing corridors. The user can change this value to check how the following cost parameters will change accordingly.
- Deductions: This section refers to other obligations that share a portion of the permit fee.
- TxDOT Percentage: Refers to the portion of the permit fee that TxDOT receives.
- TxDOT Permit Fee Amount: Shows the amount that TxDOT is entitled in dollar value.

- TxDOT Revenue in 20 Years: Calculates the dollar amount that TxDOT will receive in 20 years.
- Fiscal Impact: Describes the fiscal impact to TxDOT by subtracting TxDOT's total revenue and the total corridor costs.
- Permit Fee Required to Break Even: Shows the price that the permit should have for total corridor revenues (after deductions) to be equal to total corridor costs. It is calculated by dividing the Total Corridor Cost in 20 years by the Total Permits Sold in 20 Years.
- Permit Fee Amount to TxDOT to Break Even: Reflects the dollar amount that TxDOT will require to break even. It is calculated by multiplying the Permit Fee Required to Break Even by the TxDOT Percentage value.

After going through all steps of the analysis, the user can generate a Microsoft Word report showing all decisions made throughout the analysis procedure, as well as any comments that were included.

As part of this case study, considering all the inputs entered and the decisions made, the cost components are shown in the above figure. A permit fee of $30 was input, which is the current value of an OW permit at the PoB.

4.3 Conclusion

This document is intended to provide users with a brief guide on how to use the Tool, and to detail the Tool's different functions. A case study on the Hidalgo County RMA OW corridor was conducted, and the results of the analysis are shown. The results show that the fiscal impact to TxDOT if 10,500 permits are sold in 2014, at a 4% growth rate for 20 years, is a loss of around $150 million. The permit fee that would be required to break even is around $605 as opposed to the current $80 fee.

Throughout the analysis, the user is able to select the route for analysis, add or remove any routes to the existing Hidalgo County RMA corridor, modify the route segment attributes, change the truck configuration distribution, change the OW truck traffic distribution across the corridor's routes, and modifying the bridge information. The Tool automatically uploaded these values from the data library, but provided the user the ability to modify them.

The values that are used for bridge and pavement consumption, as well as the pavement and safety treatment costs, are stored in the Tool's data library, and the details of how they are calculated are included in Chapter 3.

Chapter 5. Workshop Outcome for the Stage 1 Tool

This chapter describes the comments made by the PMC panel members and other subject matter experts in attendance at the workshop and the subsequent tool refinements.

5.1 Refinements to the Stage 1 Tool

The Stage 1 Tool was upgraded to include additional features that would provide a better analysis of the desired routes. These adjustments were made to increase the input variables that the user can add into the Tool:

- Updating the data library to include additional corridors for analysis, pavement and bridge consumption values that can be used for the analysis of additional corridors. These corridors are the ones located at PoB, Hidalgo County, Port of Corpus Christi, Port of Freeport, and Laredo.
- The selection of specific routes for analysis, and combining routes to include a larger network in the analysis.
- The ability to view static maps of existing corridors that are currently operational and issue permits.
- The ability to add route segments to the analysis of a corridor.
- The ability to segment routes into the desired number of segments. The segmentation is based on the knowledge of the user of the attributes of the routes such as pavement type, number of lanes, etc.
- Enhancing the freight description procedure whereby the user can edit the number of OW trucks operational at a corridor, change the percentage breakdown among the different configurations, checking images of the existing configurations included in the data library, and specifying their distribution across the different route segments of a corridor.
- Providing the user with the freedom to add the required safety treatment options and their costs, without being restricted by options provided by the research team.
- Enhancing the bridge analysis procedure by providing consumption values broken down to the county, area type (rural vs. urban), and the roadway system classification (US vs. FM vs. SH vs. IH-FR) levels.
- Calculating additional cost values after completion of the analysis, as well as the fiscal impact of the OW operations to TxDOT. These values are: total permits sold in 20 years, current permit fee, TxDOT's revenues in 20 years, fiscal impact, and the permit fee required to break even

The incorporation of these features into the Stage 1 Tool enables the user to conduct a more detailed and accurate analysis of the costs associated with OW trucks operating on a certain corridor. The research team presented the Tool with these additional features to TxDOT subject matter experts and PMC members at the aforementioned workshop. The research team then received comments on the Tool.

5.2 Conclusions and Recommendations

The research team received extensive and valuable feedback from the PMC members, which was incorporated in the modified version of the Stage 1 analysis tool. In addition, recommendations were provided that will benefit the Stage 2 tool development.

Chapter 6. Stage 2 Tool Preliminary Framework

6.1 Introduction and Overview of Stage 2

The Stage 2 Detailed Analysis Tool will incorporate additional functionality and library information to enhance the user's ability to perform safety and financial impact analyses of existing or proposed new OW truck corridors serving coastal ports or border POEs.

The following summary outlines the main objectives of each Stage 2 task with regard to development of the Stage 2 analysis tool.

a) In Task 7, additional information about potential numbers, weights, and distributions of trucks operating on existing and new OW corridors.

b) In Task 8, the proposed Stage 2 analysis framework plan will be updated based on the information gained during Stage 1 and Task 7.

c) In Task 9, a more detailed pavement/bridge consumption analysis will be performed to expand the amount and flexibility of information available in the OW truck lookup tables initially developed for the Stage 1 tool. In addition, an expanded Safety Analysis will be performed to capture additional cost factors related to ensuring safe operation of OW truck corridors.

d) In Task 10, the prototype version of Stage 2 tool will be developed and will incorporate new information, and functions necessary to perform a detailed corridor analysis.

e) In Task 11, two case studies will be performed based on coordination with the PMC. The researchers will obtain non-destructive test (NDT) data and other information representative of data that is available to TxDOT analysts under typical conditions.

f) In Task 12, a workshop will be held with TxDOT and the ports, RMAs, cities, and other authorities that operate OW truck corridors to present the Stage 2 tool and obtain feedback.

g) In Task 13, the Stage 2 tool will be refined as necessary based on Task 12; a user's manual will be prepared and a training workshop will be conducted with TxDOT PMC members and other subject matter experts.

The following section summarizes guidance obtained from PMC members and other TxDOT subject matter experts over the course of the Stage 1 tool development. In addition, the Analysis Assumptions that were agreed to during the Stage 1 Workshop are summarized since they will continue to guide plans for the Stage 2 analysis process framework.

6.2 Stage 2 Analysis Framework

6.2.1 Enhancements to the OW Corridor Analysis

The Stage 1 Expedient Tool developed in the first year of project 0-6820 provides the following functionality.

1. Describe a permitted OW corridor using route links.
2. Estimate the number of permitted trucks, and truck configurations, for existing corridors.
3. Assign the trucks in the local network when TP&P information is available. Otherwise, additional information will need to be obtained from meetings with port, RMA, city, and county authorities. The research team will also be exploring other options in case no information can be provided from these sources.
4. Estimate the initial costs to upgrade the network (preventive maintenance or light rehabilitation).
5. Estimate the pavement and bridge consumption costs.
6. Calculate estimated total corridor costs and a permit fee.
7. Determine the financial impact of the corridor.
8. Prepare a report documenting inputs, outputs, assumptions, and results.

6.2.2 Stage 1 Expedient Analysis Tool Framework

The Stage 1 Expedient Analysis Tool framework is composed of five elements: User Input Modules, Data Library, Project Information, Cost Analysis, and Recommendations on Permit Fee/Reports, as shown in Figure 6.1.

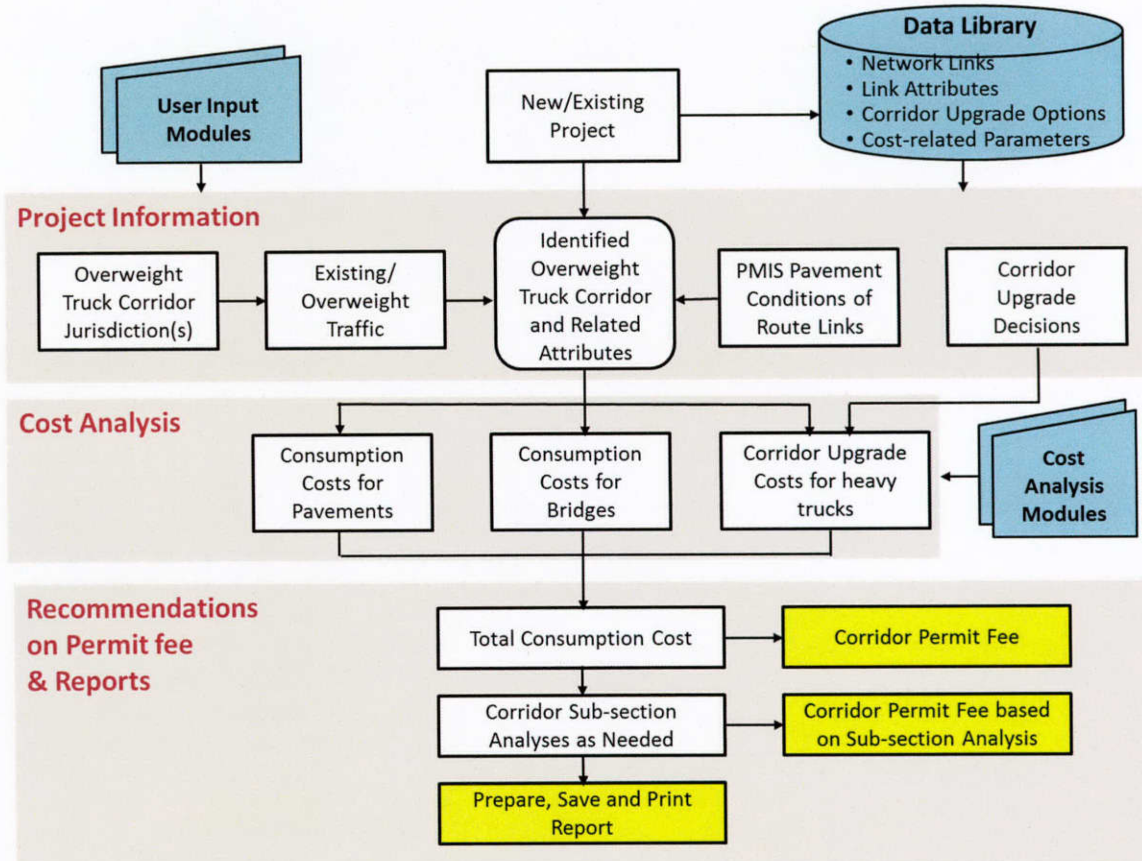


Figure 6.1: Stage 1 Expedient Analysis Tool Framework

Again, the goal of the Stage 1 Expedient Analysis Tool is to provide the cost estimation results with acceptable level for quick responses to information requests. To achieve this, the Stage 1 tool incorporates simplifying assumptions and the use of data libraries and lookup tables to expedite the calculations.

6.2.3 Stage 2 Tool Framework and Discussion

The Stage 2 analysis will incorporate the basic functions of the Stage 1 tool but will incorporate additional information in existing truck configuration, pavement and bridge consumption, and corridor upgrade option libraries.

In addition, the data and guidance available to the user will be enhanced for estimating the number and distribution of OW trucks on a new corridor. This information will be obtained during the Task 7 interviews with ports, RMAs, cities, and counties; truck fleet operators; and freight customers. In addition, the Stage 2 tool will potentially incorporate the SCI algorithm for estimating the structural condition of a route link using NDT data. Figure 6.2 shows the Stage 2 Framework based on the Stage 1 Workshop and input from PMC members described in previous sections.

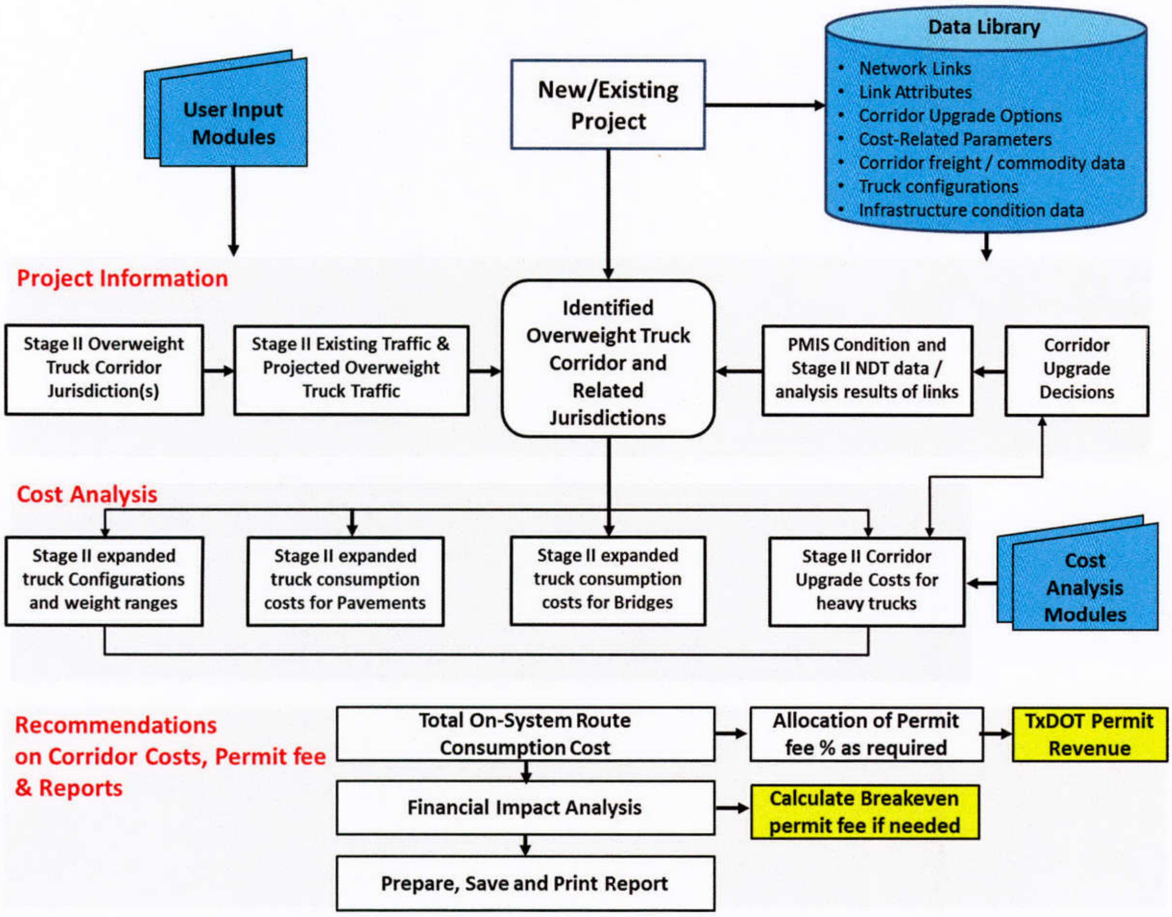


Figure 6.2: Stage 2 Tool Framework

User Input Module

As in the Stage 1 tool, the user will designate whether the analysis is based on an existing, stored analysis or is a new analysis. The new file will be saved by the user using the preferred naming convention.

The user will determine which corridor entities will be involved in the analysis and will link the entities using the interactive screen in Step 1. The Step 1 screen includes drop-down boxes listing each coastal port, inland port, or border POE that comprise the scope of this study.

As the user selects a corridor entity (for example, the PoB), the Data Libraries associated with the PoB will be accessed. These libraries will include information such as:

a) Truck configurations, GVW, axle weights, and groups that operate at PoB, Hidalgo County RMA, or Port of Freeport.

b) Cargo types associated with each truck configuration. This information will be beneficial in determining what types of truck configurations might operate at a new OW corridor based on the types of cargo or commodities that will be transported at the new corridor. Table 6.1 provides an example:

Table 6.1: Hypothetical Example of Matching PoB and Hidalgo County RMA Cargoes to a New Corridor

Corridor	PoB	Truck		Hidalgo County RMA	Truck	New Laredo Corridor	Tons
Number of Annual Permits	Cargo/ Commodity	Confg	Number of Annual Permits	Cargo/ Commodity	Confg	Cargo/ Commodity based on Literature	
6,000	Petroleum Oil	1	450	Produce	7	Petroleum Oil	250k
2,000	Mineral Oil	1	150	Cucumbers	7	Mineral Oil	100k
3,000	Wax	1	300	Persian Limes	7	Wax	50k
400	Petroleum Coke	2	50	Cotton Bales	8	Plastic Resin	25k
500	Polyethylene	3	125	Tomatoes	7	Asphalt	25k
100	Plastic Resin	3	75	Bananas	9	Sand	75k
150	Asphalt	1	75	Oranges	9	Gravel	199k
120	Synthetic Rubber	1	60	Papaya	7	Barium Sulfate	75k
400	Sand	2	125	Fruit	7	Olivine Sand	25k
1000	Gravel	2	90	Fruit Juice	10	Sand	100k
250	Bauxite Ore	2				Gravel	159k
150	Manganese	2				Sucker Rod	200k
50	Barium Sulfate	2				Tool Joints	250k
50	Ferro chromate	2				Oil Field Equipment	75k
75	Olivine Sand	2				Construction Equipment	75k
1500	Steel Coils	4				Auto Parts	30k
1400	Steel Plates	4				Limes	20k
800	Steel Beam	4				Fruit Juice	20k
400	Aluminum ingots	4				Produce	30k
250	Pig Iron	4					
500	Sucker Rod	4					
750	Tool Joints	4					
100	Brick	2					
300	Lumber	3					

Corridor	PoB	Truck		Hidalgo County RMA	Truck	New Laredo Corridor	Tons
Number of Annual Permits	Cargo/ Commodity	Confg	Number of Annual Permits	Cargo/ Commodity	Confg	Cargo/ Commodity based on Literature	
50	Cement	2					
150	Mosaic Tile	2					
100	Oil field equipment	5					
100	Auto Parts	6					
800	Steel Scrap	2					
125	Construction Equipment	5					

Based on this example, the truck configurations and cargo types at PoB or Hidalgo County RMA could be matched to the cargo types and tonnage expected to be transported at the City of Laredo Corridor. The PoB and Hidalgo County RMA truck configuration/tonnage would be used to compute the expected number of trucks for an estimated tonnage of freight to be moved by OW truck in each commodity category at the City of Laredo. This would provide the total number of trucks of each weight class for use in computing the pavement and bridge consumption rates and the total number of estimated permits that will be sold. This information would be helpful in computing the estimated corridor costs and permit revenue.

The number of permits, truck configuration, and cargo types for established corridors will be stored in lookup tables. In this way, as additional permit data is obtained from each corridor, the information in the lookup tables can be improved through addition of new commodities, related truck configurations, cargo, and GVW weight per truck and related information.

The different corridor options in Step 1 could be linked to create extended corridors such as might develop over time. Thus, the Hidalgo County RMA corridor could be linked to the PoB corridor along US 281, which would include the following entities:

- Hidalgo County RMA
- Anzualdus POE
- Hidalgo McAllen POE
- Pharr-Reynosa POE
- PoB
- Veterans International Bridge

- Gateway International Bridge

Future analysis functions could be developed to model changes to the number of truck trips along a given route or the number of trucks crossing at a particular POE as more is learned about how these corridors operate.

Route Links

In Step 2 and Step 3, the user will describe the corridor route links. Existing corridors at PoB and Hidalgo County RMA include existing operational links and proposed new links that might or might not be added in the future. The Stage 2 tool will include information on each existing corridor including the proposed routes that have not yet been added to the active corridor.

In addition, the user will be able to add new links that have not yet been identified as new information is made available. This feature will be necessary in any case in order to model a completely new corridor that does not yet exist.

As previously stated, when feasible the researchers will include information about existing or proposed new corridors that will help provide default values or information to help guide user inputs. The decision to add new corridors or routes will be made by TxDOT PMC members and the research team. The decision will be based on the availability of information for the corridors and routes and the ease of access to it. The decision will also be affected by the value off adding a corridor to the analysis that is currently inactive, which does not have any truck information associated with it. In the case of a completely new corridor, the route links will be identified by the user by route type and number, (e.g., FM 100 or US 281), the physical beginning and end points, TRMs limits, number of lanes and related information.

The research team will explore methods to enhance the bridge consumption lookup tables by providing more options for classifying routes by bridge density, or by creating route/bridge density lookup tables that are region specific.

As with the Stage 1 tool, the user will be able to add safety or traffic operations features and the associated costs for each route link under consideration. Routes can be subdivided into homogeneous segments to apply treatments and to determine treatment costs based on information from PMIS and NDT testing regarding route conditions.

- **Non-Destructive Testing of Route Links.** The falling weight deflectometer (FWD) and ground penetrating radar (GPR) are used by TxDOT pavement engineers and technicians to determine the structural condition of pavements. GPR data is used to screen a pavement route and provides data that can provide layer thickness information in addition to identifying locations where sub-surface damage due to moisture and stripping have occurred. GPR layer thickness data is a valuable input for FWD deflection data analysis. The FWD deflection and total pavement thicknesses can be used along with traffic load data expressed in ESALs, to evaluate the structural condition of the pavement using the SCI analysis process.

In addition, GPR and FWD data can be used to perform a more detailed mechanistic analysis of the pavement using back calculated moduli and fatigue and rutting equations. Pavement structures that have been evaluated using mechanistic models should also be checked using the Texas Triaxial Design Procedure, especially for thin pavements that may be subject to subgrade compression or lateral shear failure from high tire loads. The Flexible Pavement Design System (FPS-19) provides the ability to check a proposed pavement design using both the Texas Triaxial Design Method and the Asphalt Institute's rutting and fatigue equations. It is noted that FPS designs that meet the 20-year design life criteria might still fail either the TTD or AI mechanistic design checks. For this reason, additional care must be taken when evaluating the structural capacity of thin pavements (typically surface treated or thin ACP surface pavements with less than 2.5" thick surface placed on a base layer that is less than 10" thick. Further evaluation of these conditions is necessary in areas with weak subgrade soils. This is because flexible base stiffness is related to the subgrade stiffness; thus, lower flexible base moduli values are associated with weaker subgrades. The rule of thumb for base to subgrade stiffness ratios is 4:1, though the presence of a lime or cement treated or stabilized subgrade layer can improve the stiffness of the base layer. Further evaluation of the NDT data processes will be undertaken to help ensure that pavement routes that are candidates for preventive maintenance or light rehabilitation have adequate structural capacity to ensure the full design life of these treatments.

Figure 6.3 shows an example SCI plot for FM 141.

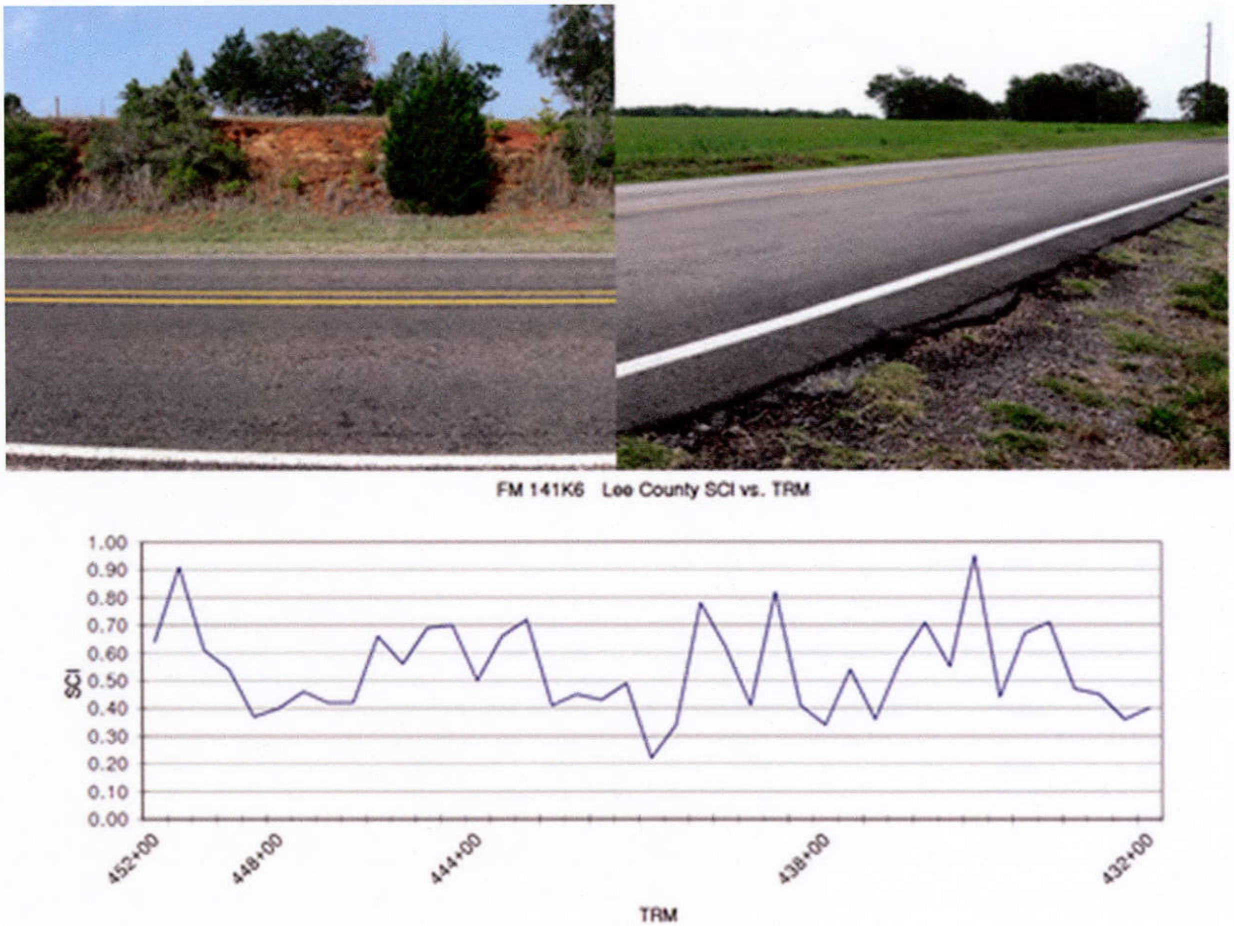


Figure 6.3: SCI Plot for FM 141B – Austin District – Lee County

The SCI values are interpreted based on the results of research project 0-4322 shown in Figure 6.4, which is based on the analysis of over 150 pavement sections by a group of pavement experts from different regions of the state.

SCI values above .90 indicate a pavement that is in good condition and is not a candidate for a structural treatment or preventative maintenance treatment associated with preserving pavement structural condition. An SCI value between 0.8 and 0.89 may be a candidate for a preventative maintenance treatment; a pavement with an SCI between .65 and .79 may be a candidate for a Light Rehabilitation; pavements with an SCI between 0.5 and 0.64 a medium rehabilitation treatment and pavements with an SCI less than 0.49 are candidates for a Heavy Rehabilitation. As Figure 6.4 indicates, the SCI value will vary along the pavement due to changes in layer thickness, stiffness, moisture intrusion, visible distress or sub-surface damage, and other factors. The SCI analysis is not intended to guide selection of a treatment without further investigation, but rather provides the analyst with a valuable screening tool to segment a project for further investigation.

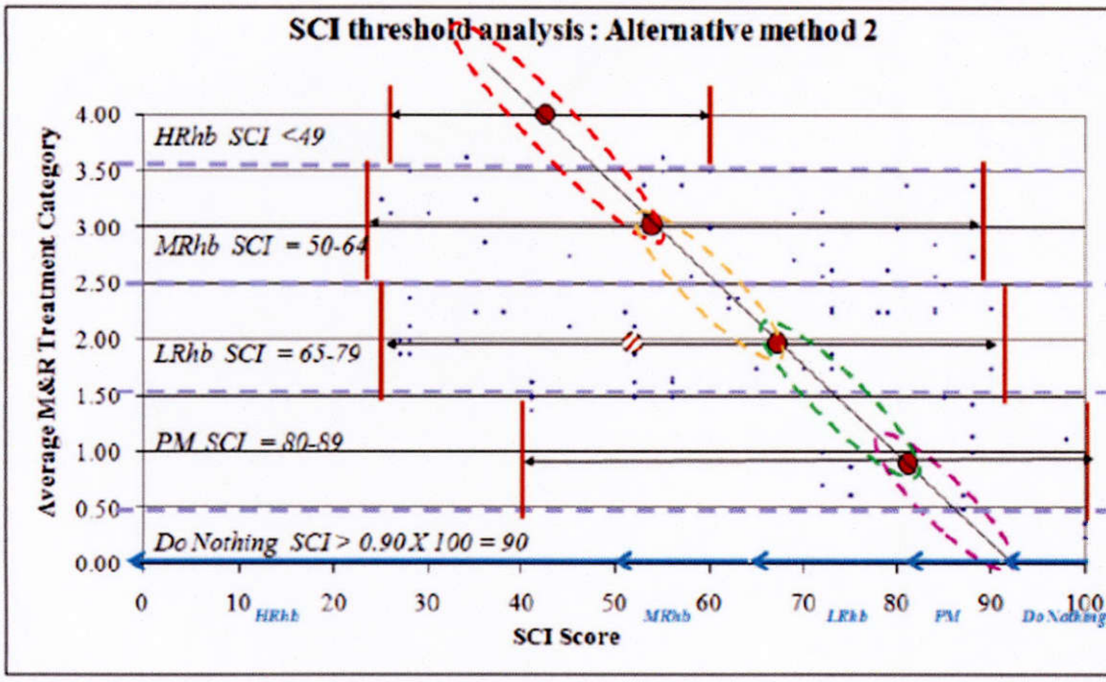


Figure 6.4: SCI Threshold Values Denoting Different Treatment Level Categories

Truck Configurations and Cargoes/Commodities

In Step 4, the user will select the OW truck configurations and will assign the number of permits that are anticipated to be sold for each configuration selected. This information will be based on historical permit data for existing corridors. For new corridors, the cargo/commodity types will be matched to identify the most likely truck configurations that will operate on the new corridor.

The cargo types being transported on an existing corridor will be obtained from the following sources:

a) OW permit data.

b) Information provided by the port or RMA through their websites or published consultant reports.

c) Information obtained during interviews with port, RMA, city, and county officials during Task 7.

d) Analysis of the Transearch and FAF databases to determine types of commodities, commodity tonnage, origins and destinations and routes.

e) Information provided by other entities such as trucking companies and freight customers during the Task 7 Workshop and in follow up meetings.

The research team has obtained detailed information on the Harris and Galveston Area Council (H-GAC) commodity flows through a detailed study conducted by Cambridge

Systematics. Studies of this type will be studied in depth and relevant data extracted to populate data libraries in the Stage 2 tool.

Cost Analysis

In Step 5, the cost analysis will combine each of the cost categories to arrive at the total corridor cost. These costs will include:

i. **Route link pavement treatment costs** (pavement preventive maintenance or light rehabilitation only; costs that increase the structural capacity of the pavement must be paid through permit revenue). Bridge treatments will also be addressed; however, the researchers think it is less likely that a route with a functionally obsolete or structurally deficient bridge would be included in an OW corridor.

ii. **Safety and/or traffic operations project costs.** These costs might include upgrading an intersection, adding traffic signals, a right- or left-turn bay, or other treatment that improves safety and traffic operations while considering OW trucks operating in mixed traffic.

iii. **Pavement consumption costs.**

iv. **Bridge consumption costs**

As part of the cost analysis, the research team will investigate the feasibility and costs/benefits of a permit fee structure that relates the permit cost to the pavement and bridge consumption rates of certain OW truck categories.

There are potential benefits to this approach considering that if an OW truck operator is willing to implement a truck configuration that has a lower consumption rate (such as replacing a 5-axle truck with a 6-axle truck within a given weight range increase), the lower consumption rate could potentially be recognized through a reduced permit fee cost. There are certain policy and operational considerations regarding this approach that will be studied by the research team, including:

1. Requiring that the weight scale ticket is attached to the permit and stored in the corridor permit database.
2. Requiring that the permit includes the origin, each route link that is to be traveled and the destination for each trip made.

The research team will study the feasibility a staged permit fee structure that is relatively simple to implement and administer. The goal will be to reduce the rate of corridor link consumption by introducing more infrastructure friendly truck configurations.

Corridor Permit Revenue Analysis

The revenue available to TxDOT for maintaining the OW truck corridor due to consumption by OW trucks is exclusively from the OW truck permits. Thus, the revenue is calculated based on the applicable permit fee, deductions from the fee due to administration and allocations made to other entities, and changes to permit fees that may be enacted within the analysis period by the state legislature.

The PoB currently charges a permit fee of $30 per loaded trip, one-way. A phased increase of the permit fee has been authorized by state legislation which will increase the permit fee in $5 increments over the next 3 years to a maximum fee of $45 per loaded trip, one-way.

Thus the Stage 1 and Stage 2 tools will need to consider that that the permit fee amount might change within the analysis period with associated adjustments to the permit fee revenue. As an example, the permit revenue for the PoB calculated over a 20-year period beginning in Calendar Year 2016 would be:

Analysis period 1

January 2016 – August 2016 estimated permits sold 24,000 x $ 30 = $720,000

September 2016 – December 2016 estimated permits sold 6,000 x $ 35 = $210,000

Total Revenue in 2016 = $930,000 x .85 = $ 790,500.

Analysis period 2

January 2017 – August 2017 estimated permits sold 25,000 x $35 = $875,000

September 2017 – December 2017 estimated permits sold 6,300 x $40 = $250,200

Total Revenue in 2017 = $ 1,125,200 x .85 = $956,250

Analysis period 3

January 2018 – August 2018 estimated permits sold 26,000 x $40 = $1,040,000

September 2018 – December 2018 estimated permits sold 6,600 x $45 = $292,500

Total Revenue in 2017 = $ 1,332,500 x .85 = $1,132,625.

Since there is no information regarding permit fee increases beyond 2017, the amount of revenue collected in 2018 through 2036 will be based on an estimated percent increase in permit sales which is currently calculated to be 4% based on historical trends. The total amount of permit fee revenue will be calculated using this method.

The revenue analysis will be somewhat more complicated if a stepped permit fee structure is adopted. In this case, the number of permits for each truck category with a different permit fee would be required in order to compute the total amount of available revenue. As stated previously, it is feasible that if the consumption cost of a specific truck configuration is identified, it could be beneficial to apply a permit fee that provides cost recovery while encouraging a more infrastructure friendly truck configuration.

Calculation of Financial Impact to the State

The net financial impact to the state is equal to the cost of maintaining the OW truck corridor minus the total revenue accrued to the state through permit fee sales. If the cost of maintaining the corridor exceeds revenue, a negative financial impact occurs. In this case, the permit fee necessary to break even is calculated to provide the user with information about the necessary increase in permit fees.

This analysis process can also be used to examine the benefits or costs associated with a permit fee structure in relation to different truck configuration categories. In this regard, the revenue assessment would necessarily need to be based on the estimated number of permits in each permit fee category and consider both pavement and bridge consumption rates reductions to arrive at total corridor costs and total accrued revenue.

Final Report

The final report will summarize each of the inputs, assumptions, and selections made by the user during the analysis. The report will be formatted to make review and presentation of this information easy to understand with sufficient detail to ensure the calculation methods can be followed. In this regard, the research team will ensure that the Stage 2 tool contains sufficient documentation, and a user's manual to help the user understand the analysis processes.

6.3 Year 1 Report Summary and Conclusions

The research team developed the Stage 1 expedient analysis tool that can be used to evaluate existing corridors established through legislation, providing the user with the ability to create new scenarios or copies of the existing corridors so that alternative analyses can be performed without losing the archived versions of the original corridors or the data associated with these corridors. This concept is important since the tool uses historical information about existing corridors that have sold permits to obtain the following information:

1. Truck configurations, including axle groups and spacings, GVWs, and axle loads. This information is essential to performing pavement and bridge consumption analyses.
2. Truck configurations and GVW in association with particular cargoes. This information is essential for determining expected truck configurations for specific commodities at a proposed or new OW truck corridor which has not yet issued permits.
3. Existing corridor-route links and traffic volumes. This provides historical information about the configuration of an OW corridor as originally archived in the tool. Though changes to the corridor may occur over time, it will be helpful for the user to be able to reference the original and subsequent versions of the corridor to understand changes in permitted truck trips, routing, and other factors.

4. Permit fee rates. The permit fee for the PoB has remained $30 since 1997. However, legislation has been enacted that will increase the permit fee by increments of $5 over the next three years to a maximum of $45 in 2018. It is important to capture the permit fee structure and change in structure over time to determine if there is an impact on the number of OW truck permits that are sold. This may directly affect the amount of revenue available to TxDOT for managing the corridor. In addition, the initial permit fee rate is different for different corridors; thus PoB and Port of Freeport are currently $30 per permit, while Hidalgo County RMA is $70 per permit. The research team will investigate how the original permit fee is set by the local authority. In addition, since the percentage allocated to administration of the permitting process is fixed at 15%, the amount allocated to administration will vary from corridor to corridor thought the sales and permit management processes are the same and in fact often administered by the same private company.

5. Proposed future corridor links. Though the user will be able to add new links to an existing corridor to evaluate the impacts, this information must be saved as a new Corridor Analysis to maintain the integrity of the archived, original corridor and associated data.

   Once the user has established the new Corridor Scenario, the user can elect to set the number of permitted trucks operating along existing corridor links to zero and assign these permitted trucks to other routes. Calculation of pavement and bridge consumption rates for new corridor links will be associated with the route type in the case of pavements and the county and location (urban/rural) for bridges. Additional features will be incorporated in the Stage 2 tool including additional truck configurations and more detailed options for route conditions.

6. The PMC requested options for designating different pavement types over specific segments of a corridor considering whether the route was a single or divided roadbed and whether permitted truck operations were on the main lanes, frontage roads, or both.

   The research team will work to include roadbed designations consistent with the PMIS procedures, which currently number single roadbed lanes as K1 – K6, divided roadbeds as L1…Lx and R1…Rx for left and right lanes and the lane positions. The frontage roads are labeled A or X with the lane numbering methodology as indicated for main lanes.

   Thus, a route may be sub-divided into three segments as described below:

Segment No.	Roadbed and Lanes	Pavement Type	Begin and End Points
Segment 1	R1, R2 , L1, L2	ACP	TRMs, GPS or physical limits
Segment 2	R1, R2, L1, L2	CRCP	TRMs, GPS or physical limits
Segment 3	R1, R2, L1, L2	JCP	TRMs, GPS, or physical limits

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