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HB 2319 Study

Impact of Intermodal Containers on the Pavements and Bridges Located at the Border Between Texas and Arkansas

This Report was prepared in collaboration with the Texas Department of Transportation (TxDOT), the Texas Department of Motor Vehicles (TxDMV), The University of Texas at Austin (UT Austin), and The University of Texas at San Antonio (UTSA), in response to House Bill 2319 of the 85th Texas Legislative Session.

1 INTRODUCTION

The movement of freight through Texas ports, rail terminals, and distribution centers is a critical component of the state's economy. As international trade volumes continue to grow, efficient transportation of intermodal shipping containers has become increasingly important for maintaining supply chain performance and supporting economic development. To accommodate heavier loads, the Texas Legislature enacted provisions allowing the issuance of permits for specific overweight intermodal container movements. Although these permits enhance freight efficiency, they also raise concerns regarding the additional deterioration imposed on the state's roadway network and the corresponding costs associated with its maintenance and preservation.

This study evaluates the impacts of vehicles operating under the provision of the House Bill 2319 (HB 2319), enacted during the 85th Texas Legislative Session and codified in the 2023 Texas Transportation Code, Title 7 (Vehicles and Traffic), Subtitle E (Vehicle Size and Weight), Chapter 623 (Permits for Oversize or Overweight Vehicles), Subchapter B (General Permits), Section 623.0172 (Permit for Intermodal Shipping Container). The legislation authorizes permitted motor carriers to transport intermodal shipping containers with gross vehicle weights (GVW) exceeding the federal and state limit of 80,000 lbs. while operating on designated state roadways, provided that the vehicles comply with state axle-weight limits established for permitted operations.

For the purposes of HB 2319, an intermodal shipping container is defined as an enclosed, standardized, reusable container that: (i) is used to pack, ship, move, or transport cargo; (ii) is designed to be carried on a semitrailer and transferred to or from a ship or vessel engaged in international transportation or a rail system supporting international transportation; and (iii) when transported in combination with a vehicle, exceeds the gross vehicle weight or axle weight limits otherwise permitted by law. By allowing these heavier vehicle configurations under a permitting framework, the legislation seeks to improve freight movement while ensuring that their operation remains subject to regulatory oversight.

The objective of this report is to quantify the pavement and bridge structural consumption associated with these permitted vehicle movements and to provide a technical basis for evaluating whether the current permit fee adequately recovers the infrastructure costs imposed on the Texas transportation system. Under the current legislation, the Texas Department of Motor Vehicles (TxDMV) establishes an annual permit fee of \$1,000 for the North Texas Intermodal permit. The legislation further requires that this fee be reassessed every two years and adjusted, as appropriate, based on a reasonable estimate of the costs associated with maintaining and repairing the transportation infrastructure affected by these permitted operations. Accordingly, the findings presented in this report are intended to support policy decisions regarding permit fees and the long-term sustainability of freight operations authorized under HB 2319.

2 ROADWAY INVENTORY

Under the provisions of HB 2319, permitted motor carriers are authorized to operate only on routes that: (i) are located within a county with a population exceeding 90,000; (ii) are part of the state highway system; and (iii) lie within five miles of the Texas–Arkansas state border.

In practice, these statutory restrictions limit eligible operations to a single corridor located in Bowie County, consisting of approximately 2.5 miles of roadway extending from the junction of US 71 and IH 49 eastbound to the Texas–Arkansas state line, as illustrated in **Figure 1**.

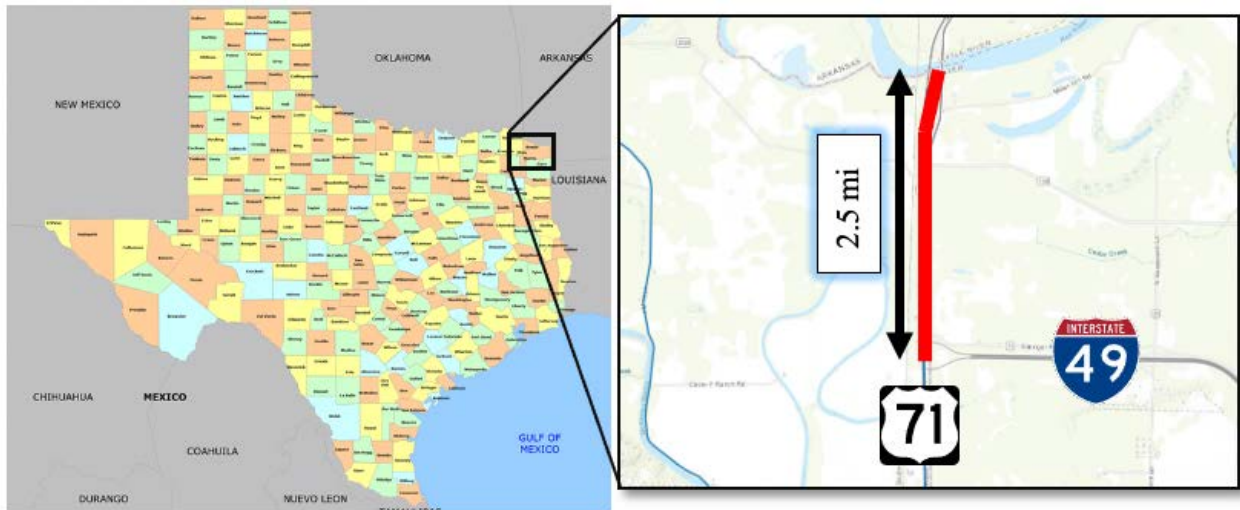


Figure 1: Roadway network under the provision of HB 2319.

3 TRAFFIC CHARACTERISTICS

HB 2319 authorizes the TxDMV to issue an annual North Texas Intermodal permit for the transportation of intermodal shipping containers using a truck-tractor and semitrailer combination with six total axles. Vehicles operating under this permit must comply with the axle-weight and axle-spacing requirements specified in **Table 1**, with the axle scheme illustrated in **Figure 2**.

Table 1: Vehicle configuration envelope under the provision of HB 2319.

Description	Restrictions
Max. GVW	93,000 lbs.
Max dist. between 1 st and last axle	647 in.
<i>Truck-tractor</i>	
Max. load for single axle	13,000 lbs.
Max. load for 2-axle group	37,000 lbs.
Max. load per axle	18,500 lbs.
Max. distance between axles ¹	51–52 in.
Max. load for 3-axle group	n/a
Max. load per axle	n/a
Max. distance between axles ¹	n/a
<i>Semi-trailer</i>	
Max. load for 3-axle group	49,195 lbs.
Max. load per axle	16,400 lbs.
Max. distance between axles ¹	60 in.

¹ Distance between axles of the same axle-group.

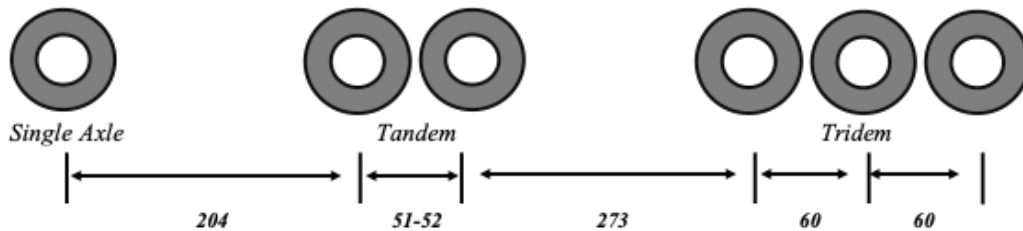


Figure 2: Axel-scheme for the North Texas Intermodal permit.

Notice that when each axle group is loaded to its maximum allowable axle weight, the resulting GVW exceeds the 93,000 lbs. limit established by HB 2319. Therefore, to conduct a comprehensive assessment of the structural demand on pavements and bridges, multiple loading scenarios were developed by distributing the allowable gross vehicle weight among the axle groups, as preset in **Table 2**. This approach ensures that the analysis captures the full range of possible loading conditions while accounting for the worst-case structural impact.

Table 2: Proposed loading scenarios for critical deteriorate rate assessment.

Loading Scenario	Axle group		
	Single	Tandem	Tridem
1	11,000	32,805	49,195
2	11,000	35,000	47,000
3	11,000	37,000	45,000
4	12,000	31,805	49,195
5	12,000	35,000	46,000
6	12,000	37,000	44,000
7	13,000	30,805	49,195
8	13,000	35,000	45,000
9	13,000	37,000	43,000

4 NORTH TEXAS INTERMODAL PERMIT DATA

The database for this study was provided by TxDMV through the so-called Texas Permitting & Routing Optimization System (TxPROS). TxPROS is a web-based integrated GIS-based mapping system with real time restriction management that provides automated routing for transportation Oversized and Overweight (OS/OW) loads on the TxDOT-maintained infrastructure network. The real-time restriction management provides a specific route based on vehicle information and infrastructure constraints, such as vertical clearance, lane width, load ratings, scheduled construction, and maintenance services. The database of the system is synchronized with reports from district officials, resulting in a reliable mapping of possible routes, reducing possible congestion or misleading paths.

The TxPROS routing algorithm enables the user to select the origin and destination, and by checking the respective vehicle configuration with the system infrastructure, returns a specified route in compliance with the state restrictions. In combination with size-weight-limits, TxPROS also uses a modified dual Dykstra routing algorithm on direct and reverse graphs, which is popular for finding shortest-path between two locations in transportation-based networks (1). In addition to mapping and managing restriction for OS/OW routes, TxPROS also generates an inventory of permits issued through 13 different reports regarding routes used by OS/OW vehicles, axle configuration, and administrative status of permitting processes. The available TxPROS database ranges from January, 2012 to December, 2025.

As part of the present Interagency Cooperation Contract, permit data from calendar years 2018 through 2025 were analyzed. Calendar years were used because fiscal year 2026 data were not yet available and to maintain consistency with previous studies (2, 3). Since the North Texas

Intermodal permit is issued on an annual basis, route information is not recorded in the TxPROS system. Consequently, vehicle miles traveled (VMT) cannot be directly estimated from the permit records. Over the entire analysis period, only 22 North Texas Intermodal permits were issued, as shown in **Figure 3**.

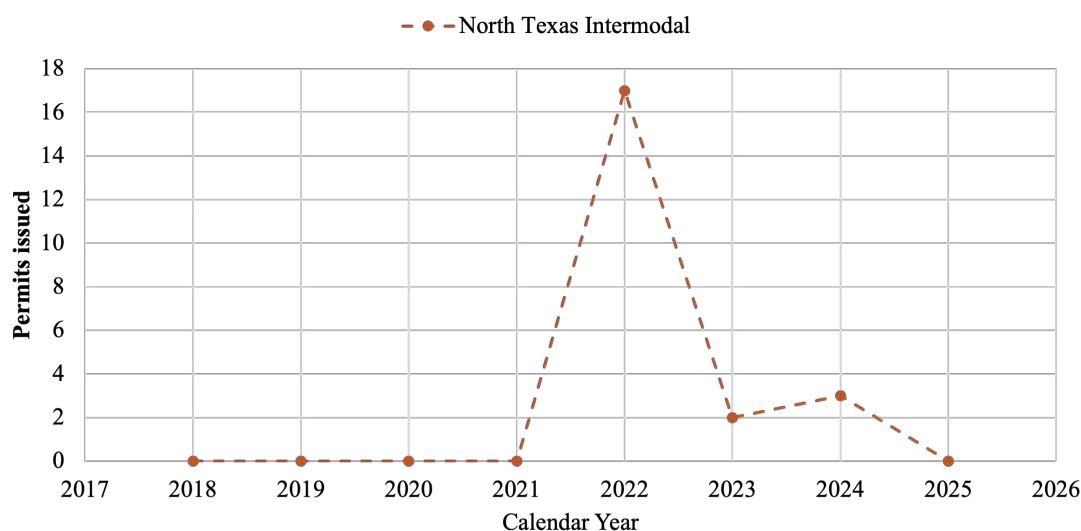


Figure 3: North Texas Intermodal permit issuance during the period of analysis.

5 PAVEMENT ANALYSIS

The pavement analysis was based on the structural consumption methodology developed in previous studies (4–6) to quantify the effects of overweight vehicles using the equivalent consumption factor (ECF). The ECF represents the relative amount of pavement life consumed by a given axle configuration as compared to the equivalent single axle load (ESAL), which consists of a single axle equipped with dual wheel and loaded with 18,000 lbs.

The approximately 2.5-mile corridor evaluated under HB 2319 consists entirely of asphalt concrete pavement (ACP). Accordingly, the analysis considered only ACP-related distresses and their performance criteria. Therefore, pavement failure was defined using the following thresholds: (i) a maximum rut depth of 0.5 in., (ii) a maximum fatigue cracking of 25 percent of the wheel path area, and (iii) a maximum pavement roughness of 172 in./mi, expressed in terms of the International Roughness Index (IRI). An initial IRI of 63 in./mi was assumed for the structural analyses.

Because pavement distresses develop through different deterioration mechanisms, the corresponding terminal thresholds are generally not reached simultaneously at the end of the 20-year design period. Consequently, an individual ECF was first calculated for each pavement distress. However, for practical applications, each axle configuration should be represented by a single

structural consumption factor. Therefore, the distress-specific ECFs were combined into a weighted average value, with the weights reflecting the relative importance of each distress mechanism for asphalt concrete pavements.

By definition, an axle configuration with an ECF less than 1.0 consumes pavement life at a slower rate than the standard 18,000-lb single axle and, therefore, would require more than the 20-year design period to reach the terminal failure criteria. Conversely, an ECF greater than 1.0 indicates accelerated pavement deterioration, resulting in the terminal condition being reached in less than the design period.

The inherent variability associated with each distress-specific ECF was also considered in the analysis. For example, the ECF derived from the rutting criterion exhibited lower uncertainty (i.e., a smaller standard error) than the ECFs based on fatigue cracking or pavement roughness, which showed greater variability. Consequently, distress measures with lower uncertainty were assigned relatively greater weight in the calculation of the overall ECF.

To provide a conservative estimate of pavement consumption along the routes authorized under this permit, the final ECF was calculated as the average of the three most critical loading scenarios, resulting in an overall ECF of 3.91. Based on this value, the average pavement consumption cost was estimated at 7.3 cents per ESAL-mile (December 2025 dollars). The analysis was expressed in December 2025 dollars to align with the period covered by the database and to avoid distortions associated with recent construction cost fluctuations. Accordingly, the average pavement consumption cost for the 6-axle vehicle was estimated at 28.5 cents per mile.

6 BRIDGE ANALYSIS

Bridge consumption may be understood as a fatigue process in which each load passage over a given bridge consumes a portion of the bridge design life (5). Under this framework, bridge deterioration is represented by fatigue curves that relate the stress range induced by a load to the number of load applications required to reach the end of the design life. In general, larger stress ranges produce fewer allowable load cycles, resulting in greater structural consumption per vehicle passage. Because the objective of this study was to evaluate the impacts of recurring permitted vehicles at a specific location, bridge consumption was quantified relative to that specific bridge inventory rating, which represents the load-carrying capacity for that same bridge under normal operating conditions. The proportional structural consumption was obtained using the moment ratio concept, which is extensively documented on similar and previous bridge consumption cost studies (7, 8).

The bridge consumption analysis is generally divided between state-managed bridges (on-system) and locally-managed bridges (off-system) due to the requirements of the analytical procedures and data availability. However, in the area of interest (**Figure 1**) there is only one

on-system bridge (spanning over the Red River) at the state border, identified by the unique ID: 190190021701007. The total bridge consumption cost was updated to \$4.82 or \$1.93/mile. The value for the bridge consumption analysis was updated using the same asset cost updating procedures used by the pavement analysis by using the same highway construction cost indices. In addition, the load rating value, a key input for the bridge consumption analysis, was checked using the most current version of the bridge inspection database and it was found to have not changed from the previous report.

7 TOTAL CONSUMPTION ANALYSIS

Following the pavement and bridge analyses, the total infrastructure consumption associated with the North Texas Intermodal permit was estimated at approximately \$2.21 per mile. Because this permit is valid for one year and does not require vehicle routing through the TxPROS system, information on VMT or on trips made is not available. Consequently, infrastructure costs cannot be directly estimated on a per-permit basis.

Beginning September 2022, and every even-numbered year thereafter, the TxDMV is required to establish the permit fee based on a reasonable estimate of the costs associated with operating vehicles under this permit, including the additional costs of maintaining and repairing the affected transportation infrastructure. Under the statute, 90 percent of the permit revenue is deposited into the State Highway Fund, 5 percent is allocated to TxDMV, and the remaining 5 percent is deposited into the appropriate county road and bridge fund. Therefore, although the annual permit fee is currently \$1,000, only \$900 is available to offset the costs associated with pavement and bridge maintenance and rehabilitation. It should be noted, however, that this route is entirely on the TxDOT-maintained system and no county roads are utilized.

Previous studies have evaluated the adequacy of permit fees by comparing infrastructure consumption costs with permit revenue through sensitivity analyses (2, 3). Following the same approach, this study estimated the number of trips (i.e., 2.5-mile-long trip) that would result in infrastructure consumption costs equal to the portion of the permit fee available for roadway preservation. The results are presented in **Table 3**. That is, the permit fee covers 163 trips.

Table 3: Sensitivity analysis on the total consumption cost to the number of trips.

Number of Trips	Pavement Cost	Bridge Cost	Total Cost
10	\$7	\$48	\$55
50	\$36	\$241	\$277
100	\$71	\$482	\$553
150	\$107	\$723	\$830
163	\$116	\$784	\$900
250	\$178	\$1,206	\$1,384
300	\$214	\$1,447	\$1,660
350	\$249	\$1,688	\$1,937

8 CRASH ANALYSIS

The crash data was obtained by the Texas Peace Officer’s Crash Reports processed by TxDOT. A reportable motor vehicle traffic crash is defined as: “...any crash involving a motor vehicle in transport that occurs or originates on a traffic way, results in injury to or death of any person, or damage to the property of any one person to the apparent extent of \$1,000...”

During the period of analysis (January, 2024 to December, 2025), four crashes were reported involving vehicles that have applied for a North Texas Intermodal permit, as presented in **Table 4**. No vehicle was reported flagged with an intermodal container permit.

Table 4: Motor vehicle traffic crashes involving North Texas Intermodal permits.

Year	Fatal	Serious Injury	Minor Injury	Possible Injury	Non-Injury	Unknown Injury	Total
2024	0	0	0	0	1	0	1
2025	0	0	0	0	3	0	3

9 CONCLUSIONS AND RECOMMENDATIONS

In preparing this report, the study team compiled and evaluated permit records provided by the Texas Department of Motor Vehicles (TxDMV) through the TxPROS system, together with pavement inventory data from Pavement Analyst, provided by TxDOT. These datasets were integrated to quantify the relative pavement and bridge consumption associated with vehicles operating under the provisions of HB 2319 and to estimate the corresponding infrastructure costs.

The sensitivity analysis indicated that the current annual permit fee is adequate to recover the estimated infrastructure consumption costs provided that a permitted six-axle vehicle, operating

at the maximum allowable gross vehicle weight of 93,000 lbs., makes no more than 163 fully loaded trips per year over the authorized route. If this number of annual trips is exceeded, the current permit fee would no longer be sufficient to offset the estimated pavement and bridge deterioration costs incurred along the corridor. It should be noted that this entire route is on the TxDOT-maintained system with no county roads in Texas are being utilized.

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