West Texas Rail Feasibility Study

Phase 2 Report

technical

memorandum

prepared for

Texas Department of Transportation

prepared by

Cambridge Systematics, Inc.

with

HNTB

June 2011

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1.0 Introduction

The objective of the *West Texas Rail Feasibility Study* is to help the Texas Department of Transportation (TxDOT) determine the feasibility of developing a north-south rail linkage between Seagraves, Texas and the U.S.-Mexican border at Del Rio or Eagle Pass, Texas. Through analysis of rail corridor alternatives and improvement options a strategy will be developed to help guide TxDOT, the Ports-to-Plains (P2P) Alliance, and other partners toward corridor development, including the next steps of an environmental study, preliminary engineering, and financial partnership.

This *Phase 2 Report* for the *West Texas Rail Feasibility Study* is the second of two reports prepared for this project. The Phase 1 report outlined baseline conditions through review of previous research, stakeholder interviews and freight data analysis. It also presented potential rail corridor alignment options and calculates order of magnitude costs as a jumping off point for Phase 2 analysis.

This *Phase 2 Report* completes this projects analysis, and determines the feasibility of the West Texas Rail Corridor. This Phase 2 report is organized as follows:

- **Section 2 – Diversion Analysis** outlines the methodology and results of truck-to-rail and rail-to rail diversion analysis by commodity that could potentially use the new north-south corridor;
- **Section 3 – Benefit-Cost Analysis** explains the evaluation measures used to evaluate the benefits and costs of a variety of aspects of the new north-south corridor;
- **Section 4 – Revenue Analysis** describes the basis for calculating revenue that could be generated by the line;
- **Section 5 – Findings and Opportunities** provides a summary of the rail corridor analyses and outlines several options that could be considered as means to attract new rail traffic to the line.

2.0 Diversion Analysis

Demand for the West Texas rail corridor will be primarily driven by diversion of freight flows that currently use other road and rail networks to get goods-to-market, and will secondarily be driven by the introduction of "mega-shippers" that may be attracted to locate within the corridor because of the presence of the new rail line.

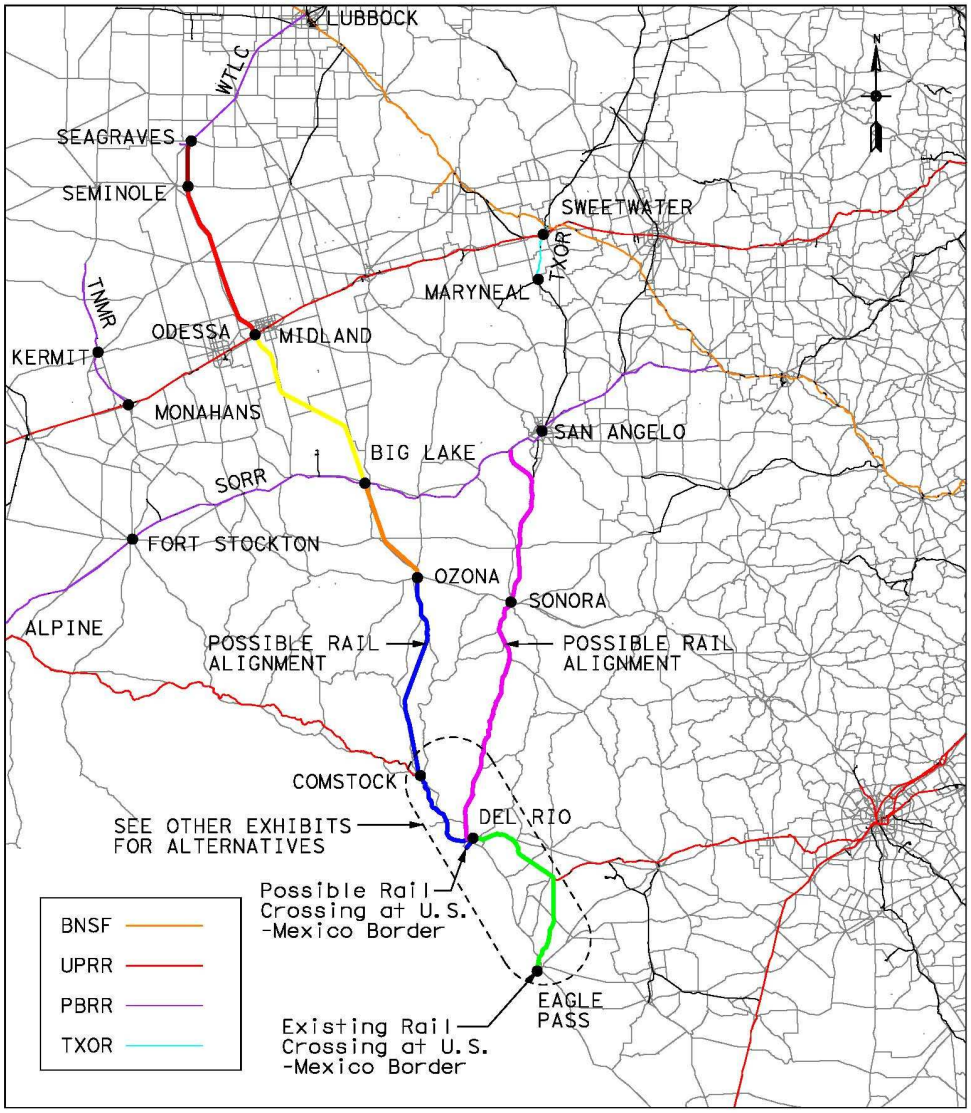
The objective of this diversion analysis was to quantify the primary source of traffic on the West Texas rail line; specifically truck-to-rail and rail-to-rail freight flow diversions that could[1] use a new north-south rail corridor. This analysis was done for two distinct corridor development approaches:

- **Full Development.** The full development alternatives evaluate the diversion to the West Texas Rail Corridor if constructed between Eagle Pass to Seagraves – one alternative connects through Big Lake and Midland -Odessa, and a second alternative connect to San Angelo, then Big Lake and Midland-Odessa. The economic and feasibility analysis presented in this report assumes full build of the corridor.
- **Phased Development.** The phased development alternative evaluates the diversion to the West Texas Rail Corridor if constructed between Midland-Odessa to Seagraves, only. This is done for two purposes: 1) to understand the demand should this segment be a starting point for corridor construction, and 2) to provide comparison between the Permian Basin Rail Study. The results of this analysis can be found in **Appendix A**.

The existing rail network in Texas along with the potential West Texas rail corridors is shown in Figure 2.1.

[1] Note that this analysis reflects the consultants' diversion estimates, only, and does not intend to imply actual use of the corridor. Use of this shortline operated rail corridor by diverting Class I railroads is unlikely due to the nature of existing Class I operations and the railcar classification process at existing rail yards.

Figure 2.1 Existing Texas Rail Network with Potential Rail Corridors



Source: HNTB Conceptual Alignment. Detailed alternate alignments found in Phase 1 report.

2.1 DATA AND METHODOLOGY

Data and Tools Used

Several modeling tools were used for this analysis.

- **Oak Ridge National Laboratory (ORNL) Rail Network.** This rail network developed by ORNL was used for routing of rail flows before and after the development of the full or phased development of West Texas rail line.

- **Freight Analysis Framework (FAF3) Highway Network.** This highway network provided by FHWA was used for routing of truck flows before and after the full or phased development of the West Texas rail line.
- **TxDOT Statewide and Freight Mode Choice Models.** The Statewide Analysis Model (SAM), Version 2 is the latest Texas model and uses a 2003 TRANSEARCH commodity flow database and forecasts. It consists of: 1) Texas Counties, other U.S. States and Mexico States as zones; 2) 15 consolidated commodity groups; and 3) 11 mode types, out of which only 3 mode types were of interest to this study, namely, rail carload, rail intermodal and truck. Flows with either an origin or a destination in Mexico States were considered international flows. This data provided the static demand between given origin-destination (OD) pairs.

  The 2003 TRANSEARCH database also forms the basis for a recently calibrated logit based SAM-V2 Freight Mode Choice Model. The mode choice model was used in this study to estimate modal shares, and as a consequence the modal demands. Mode choice equations and the estimated modal utility coefficients by commodity group can be found in a recent TxDOT SAM V2 documentation[2].

Methodology

Select link analyses on railway links were performed to determine the OD pairs that could switch to the potential rail corridor. This was done by first starting with the ORNL rail network, and adding railway links to the network based on the potential rail network. Next, a select rail link assignment on all of the West Texas rail links, new and existing was performed using rail distance as the impedance variable. The trip table for this process included 1's as the flow variable in each and every OD pair because the intent was only to identify those OD pairs which could potentially use the West Texas rail links (1's were assigned to possible flows that could be diverted, and 0's assigned to all others and then easily eliminated from further analysis). Only those OD pairs in the trip table were selected that had non-zero flows on the new rail links.

Base and Planning Case Analyses

The analysis assumed two cases:

- **Base Case**. Represents all freight flows by mode as they occur today.
- **Planning Case.** Represents potential freight flows by mode, as they could occur, after construction of a rail line in West Texas.

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[2] Alliance Transportation Group, Inc. and Cambridge Systematics, Inc. TxDOT Statewide Analysis Model (SAM) – Second Version (V2) – Freight Mode Choice, Task 8.4.3. Prepared for Texas Department of Transportation, November 2010.

Modal Diversions

For each of the identified OD pairs and the existing total freight demand, the modal shares by commodity group in the Base Case and Planning Case were estimated by applying the Texas SAM V2 Freight Mode Choice Model. In this analysis, it was assumed that the total freight demand remains static during the analysis year, i.e. no induced demand is anticipated.

One of the key factors affecting the mode choice equation for the rail mode is the travel distance. The West Texas rail connection is expected to shorten the distance over rail for the identified OD pairs, leading to a higher level-of-service or utility of the rail mode. This, by definition of the mode choice equation, will result in a gain in rail usage.

For a given commodity group, modal demand was obtained by multiplying total demand by its corresponding mode shares. Applying TRANSEARCH'S average payload factors by commodity group (i.e. the average number of tons per loaded unit), the annual carloads and twenty-foot equivalent units (TEU) added, and annual truck trips saved were also estimated. The results of this analysis were tabulated by commodity group, by trade type and totaled.

Route Diversions

Route assignment was performed once for the Base Case trip table and once for the Planning Case trip table, both considering only the divertible flows.

The ORNL network's route assignment of the diverted rail flows was carried out based on a shortest distance path algorithm, which translates to minimizing rail shipping costs. This assignment assumes that trains travel the corridor without classification at a rail yard.

The FAF highway network's route assignment of diverted truck flows was done based on shortest travel time computed using impedance functions of links on a route. The impedance function value for a link is computed using a number of factors, including number of lanes, urban bypass, traffic restriction, truck route designation, tolls, link reliability, and link capacity.

The difference between the Base Case and Planning Case flow values on the network links indicates the estimated route diversions. These are presented with the help of maps for the rail and truck networks.

Regional Ton-Mile Diversions

Ton-mile changes for divertible flows were summarized by three region definitions as follows, 1) statewide; 2) study area (all rail links and highway links within the study area boundary); and 3) study area network (potential rail alignment and study area highway network). Summing the product of the link flow and link length over each link within a region, the ton-miles were computed. The results were broken down by mode type and tabulated by trade type and totaled.

Ton-Miles Attracted by New Rail Segments

Ton-miles attracted to individual segments of the potential West Texas rail connection (as identified in Section 5 of the Phase 1 Report) are provided for the following segments: Lubbock to Seagraves, Seagraves to Seminole, Seminole to Midland/Odessa, Midland/Odessa to Big Lake, Big Lake to Ozona, Ozona to Del Rio, and Del Rio to Eagle Pass.

2.2 RESULTS OF FULL RAIL CORRIDOR DEVELOPMENT (EAGLE PASS, BIG LAKE, MIDLAND-ODESSA, LUBBOCK)

For the full development of a West Texas rail corridor from Eagle Pass to Lubbock, the OD pairs that could potentially use the full rail corridor were identified.

Base and Planning Case Analyses

Modal Diversions

Table 2.1 indicates the modal diversions summary for the full development of the corridor, articulating in both tons and units the Base and Planning Case volumes and diversion. The first column describes the various commodity groups found in the TxDOT SAM V2 TRANSEARCH database.

The total freight demand of divertible flows is about 19.4 million tons annually; the SAM V2 mode choice model was applied on this flow to estimate the Base and Planning Case modal demands. This resulted in an estimated 3.75 million annual tons of rail carload flows and an estimated 0.12 million annual tons of rail intermodal flows, together making about 19.6% of the total demand related to the identified OD pairs.

Analysis shows that with full development of the West Texas rail corridor, the demand for rail carload is expected to go up by about 147,000 tons annually and the demand for rail intermodal is expected to go up by about 26,500 tons annually. This would mean increases of about 1,800 carload trips annually and about 1,400 TEUs annually, while saving about 7,600 truck trips annually, which will no longer use the Texas roadways.

The top five commodity groups that show a sharp increase in rail share with the new West Texas rail connection are Food[3], Chemicals, Petroleum, Non-metallic

[3] Commodity is a consideration-factor in mode choice, i.e. some commodities are better suited for truck transport, while others are suited for rail, so diversion is calculated accordingly. The top diverting commodity in this analysis is shown to be Food. This

Footnote continued

minerals, and Primary Metal. Together, they account for 88% of rail carload diversions and 83% of rail intermodal diversions from trucks by annual tonnages.

may be a data anomaly as diverting food (like time-sensitive or refrigerated items) from truck to rail may not be feasible unless these are bulk items like grains.

Table 2.1 Modal Diversions for a West Texas Rail Connection by Commodity Group (Eagle Pass to Lubbock, TX)

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Truck*	Total Flows*	Rail Carload %	Rail Intermodal %	Truck %
	Base Case (tons)	107,899	40,290	1,925,726	2,073,915	5.20%	1.90%	92.90%
	Diversion (tons)	39,625	13,591	-53,216		1.90%	0.70%	-2.60%
	Planning Case (tons)	147,524	53,881	1,872,510	2,073,915	7.10%	2.60%	90.30%
5 (Food)	Payload Factor	83.22	19.81	24.07				
	Base Case (units)	1,297 Carloads	2,034 TEUs	80,005 Trucks				
	Diversion (units)	476 Carloads	686 TEUs	-2,211 Trucks				
	Planning Case (units)	1,773 Carloads	2,720 TEUs	77,794 Trucks				
	Base Case (tons)	106,805	9,085	2,159,234	2,275,125	4.70%	0.40%	94.90%
	Diversion (tons)	39,487	3,284	-42,771		1.70%	0.10%	-1.90%
	Planning Case (tons)	146,292	12,369	2,116,463	2,275,125	6.40%	0.50%	93.00%
11 (Chemicals)	Payload Factor	91.23	18.35	21.82				
	Base Case (units)	1,171 Carloads	495 TEUs	98,957 Trucks				
	Diversion (units)	433 Carloads	179 TEUs	-1,960 Trucks				
	Planning Case (units)	1,604 Carloads	674 TEUs	96,996 Trucks				
	Base Case (tons)	32,426	325	4,237,278	4,270,029	0.80%	0.00%	99.20%
	Diversion (tons)	25,437	251	-25,688		0.60%	0.00%	-0.60%
	Planning Case (tons)	57,863	576	4,211,590	4,270,029	1.40%	0.00%	98.60%
12 (Petroleum)	Payload Factor	82.04	18.62	25.42				
	Base Case (units)	395 Carloads	17 TEUs	166,691 Trucks				
	Diversion (units)	310 Carloads	13 TEUs	-1,011 Trucks				
	Planning Case (units)	705 Carloads	31 TEUs	165,680 Trucks				

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Truck*	Total Flows*	Rail Carload %	Rail Intermodal %	Truck %
4 (Nonmetallic Minerals)	Base Case (tons)	153,167	15,092	1,760,633	1,928,892	7.90%	0.80%	91.30%
	Diversion (tons)	14,641	2,290	-16,930		0.80%	0.10%	-0.90%
	Planning Case (tons)	167,807	17,382	1,743,703	1,928,892	8.70%	0.90%	90.40%
	Payload Factor	98.34	18.24	22.17				
	Base Case (units)	1,558 Carloads	827 TEUs	79,415 Trucks				
	Diversion (units)	149 Carloads	126 TEUs	-764 Trucks				
	Planning Case (units)	1,706 Carloads	953 TEUs	78,651 Trucks				
14 (Primary Metal)	Base Case (tons)	22,780	5,970	915,200	943,950	2.40%	0.60%	97.00%
	Diversion (tons)	10,609	2,570	-13,179		1.10%	0.30%	-1.40%
	Planning Case (tons)	33,389	8,540	902,021	943,950	3.50%	0.90%	95.60%
	Payload Factor	84.71	19.7	26.01				
	Base Case (units)	269 Carloads	303 TEUs	35,186 Trucks				
	Diversion (units)	125 Carloads	130 TEUs	-507 Trucks				
	Planning Case (units)	394 Carloads	434 TEUs	34,680 Trucks				
13 (Clay, Concrete, Glass)	Base Case (tons)	19,630	1,658	1,233,135	1,254,423	1.60%	0.10%	98.30%
	Diversion (tons)	5,338	459	-5,797		0.40%	0.10%	-0.50%
	Planning Case (tons)	24,968	2,116	1,227,339	1,254,423	2.00%	0.20%	97.80%
	Payload Factor	91.13	15.46	17.01				
	Base Case (units)	215 Carloads	107 TEUs	72,495 Trucks				
	Diversion (units)	59 Carloads	30 TEUs	-341 Trucks				
	Planning Case (units)	274 Carloads	137 TEUs	72,154 Trucks				
9 (Durable Manufacturing)	Base Case (tons)	10,524	1,609	835,178	847,310	1.20%	0.20%	98.60%
	Diversion (tons)	3,028	405	-3,433		0.40%	0.00%	-0.40%

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Truck*	Total Flows*	Rail Carload %	Rail Intermodal %	Truck %
	Planning Case (tons)	13,552	2,014	831,745	847,310	1.60%	0.20%	98.20%
	Payload Factor	22.47	12.02	16.46				
	Base Case (units)	468 Carloads	134 TEUs	50,740 Trucks				
	Diversion (units)	135 Carloads	34 TEUs	-209 Trucks				
	Planning Case (units)	603 Carloads	168 TEUs	50,531 Trucks				
10 (Paper)	Base Case (tons)	9,362	4,330	282,830	296,522	3.20%	1.50%	95.40%
	Diversion (tons)	3,006	1,411	-4,418		1.00%	0.40%	-1.50%
	Planning Case (tons)	12,368	5,741	278,412	296,522	4.20%	1.90%	93.90%
	Payload Factor	67.68	16.65	25.32				
	Base Case (units)	138 Carloads	260 TEUs	11,170 Trucks				
	Diversion (units)	44 Carloads	85 TEUs	-174 Trucks				
	Planning Case (units)	183 Carloads	345 TEUs	10,996 Trucks				
8 (Lumber)	Base Case (tons)	8,082	1,835	616,541	626,459	1.30%	0.30%	98.40%
	Diversion (tons)	2,935	649	-3,585		0.50%	0.10%	-0.60%
	Planning Case (tons)	11,018	2,484	612,957	626,459	1.80%	0.40%	97.80%
	Payload Factor	76.98	16.63	26.86				
	Base Case (units)	105 Carloads	110 TEUs	22,954 Trucks				
	Diversion (units)	38 Carloads	39 TEUs	-133 Trucks				
	Planning Case (units)	143 Carloads	149 TEUs	22,820 Trucks				
15 (Misc. Mix & Secondary)	Base Case (tons)	3,789	1,006	916,606	921,401	0.40%	0.10%	99.50%
	Diversion (tons)	2,177	539	-2,716		0.20%	0.10%	-0.30%
	Planning Case (tons)	5,966	1,545	913,890	921,401	0.60%	0.20%	99.20%
	Payload Factor	53.55	13.31	19.45				

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Truck*	Total Flows*	Rail Carload %	Rail Intermodal %	Truck %
	Base Case (units)	71 Carloads	76 TEUs	47,126 Trucks				
	Diversion (units)	41 Carloads	40 TEUs	-140 Trucks				
	Planning Case (units)	111 Carloads	116 TEUs	46,987 Trucks				
7 (Non-Durable Manufacturing)	Base Case (tons)	1,873	2,038	272,194	276,105	0.70%	0.70%	98.60%
	Diversion (tons)	905	941	-1,846		0.30%	0.40%	-0.70%
	Planning Case (tons)	2,778	2,978	270,349	276,105	1.00%	1.10%	97.90%
	Payload Factor	39.92	13.8	13.32				
	Base Case (units)	47 Carloads	148 TEUs	20,435 Trucks				
	Diversion (units)	23 Carloads	68 TEUs	-139 Trucks				
	Planning Case (units)	70 Carloads	216 TEUs	20,296 Trucks				
2 (Mining)	Base Case (tons)	7,372	86	20,404	27,862	26.50%	0.30%	73.20%
	Diversion (tons)	114	3	-117		0.40%	0.00%	-0.40%
	Planning Case (tons)	7,486	89	20,286	27,862	26.90%	0.30%	72.80%
	Payload Factor	89.29	NA	27.45				
	Base Case (units)	83 Carloads	NA	743 Trucks				
	Diversion (units)	1 Carloads	NA	-4 Trucks				
	Planning Case (units)	84 Carloads	NA	739 Trucks				
3 (Coal)	Base Case (tons)	742,253	0	30	742,283	100.00%	0.00%	0.00%
	Diversion (tons)	20	0	-20		0.00%	0.00%	0.00%
	Planning Case (tons)	742,273	0	10	742,283	100.00%	0.00%	0.00%
	Payload Factor	112.92	NA	26.49				
	Base Case (units)	6,573 Carloads	NA	1 Trucks				
	Diversion (units)	0 Carloads	NA	-1 Trucks				

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Truck*	Total Flows*	Rail Carload %	Rail Intermodal %	Truck %
	Planning Case (units)	6,573 Carloads	NA	0 Trucks				
6 (Consumer Manufacturing)	Base Case (tons)	29	318	88,835	89,182	0.00%	0.40%	99.60%
	Diversion (tons)	11	123	-134		0.00%	0.10%	-0.10%
	Planning Case (tons)	40	441	88,701	89,182	0.00%	0.50%	99.50%
	Payload Factor	15	14.96	19.25				
	Base Case (units)	2 Carloads	21 TEUs	4,615 Trucks				
	Diversion (units)	1 Carloads	8 TEUs	-7 Trucks				
	Planning Case (units)	3 Carloads	29 TEUs	4,608 Trucks				
1 (Agriculture)	Base Case (tons)	2,523,227	35,244	308,368	2,866,839	88.00%	1.20%	10.80%
	Diversion (tons)	0	0	0		0.00%	0.00%	0.00%
	Planning Case (tons)	2,523,227	35,244	308,368	2,866,839	88.00%	1.20%	10.80%
	Payload Factor	99.31	21.09	22.36				
	Base Case (units)	25,408 Carloads	1,671 TEUs	13,791 Trucks				
	Diversion (units)	0 Carloads	0 TEUs	0 Trucks				
	Planning Case (units)	25,408 Carloads	1,671 TEUs	13,791 Trucks				
Total	Base Case (tons)	3,749,216	118,886	15,572,195	19,440,297	19.30%	0.60%	80.10%
	Diversion (tons)	147,334	26,516	-173,851		0.70%	0.10%	-0.90%
	Planning Case (tons)	3,896,551	145,402	15,398,345	19,440,297	20.00%	0.70%	79.20%
	Base Case (units)	37,799 Carloads	6,204 TEUs	704,324 Trucks				
	Diversion (units)	1,835 Carloads	1,439 TEUs	-7,599 Trucks				
	Planning Case (units)	39,634 Carloads	7,642 TEUs	696,725 Trucks				

Source: TxDOT SAM V2 Freight Mode Choice Modeling, Cambridge Systematics, Inc. *The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide

Modal diversions were also summarized by trade type, shown in Table 2.2. The U.S.-Mexico North American Free Trade Agreement (NAFTA) flows include about 31,000 tons of rail carload and about 8,400 tons of rail intermodal annually, which make up about 21% and about 32% of all diversions of the corresponding modes.

Table 2.2 Modal Diversions for a West Texas Rail Connection by Trade Type (Eagle Pass to Lubbock, TX)

Trade Type	Scenario	Rail Carload*	%Change of Rail Total	Rail Intermodal *	%Change of Rail Total	Truck*
All Flows	Base Case (tons)	3,749,216		118,886		15,572,195
	Planning Case (tons)	3,896,551		145,402		15,398,345
	Diversion (tons)	147,334	85%	26,516	15%	-173,851
Domestic Flows	Base Case (tons)	1,157,472		61,574		13,602,555
	Planning Case (tons)	1,273,831		79,652		13,468,118
	Diversion (tons)	116,359	87%	18,078	13%	-134,437
	% Diversion of All Flows	79%		68%		77.3%
International Flows	Base Case (tons)	2,591,745		57,311		1,969,640
	Planning Case (tons)	2,622,720		65,750		1,930,227
	Diversion (tons)	30,975	79%	8,438	21%	-39,414
	% Diversion of All Flows	21%		32%		22.7%

Source: TxDOT SAM V2 Freight Mode Choice Modeling, Cambridge Systematics, Inc.

*The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals.

Route Diversions

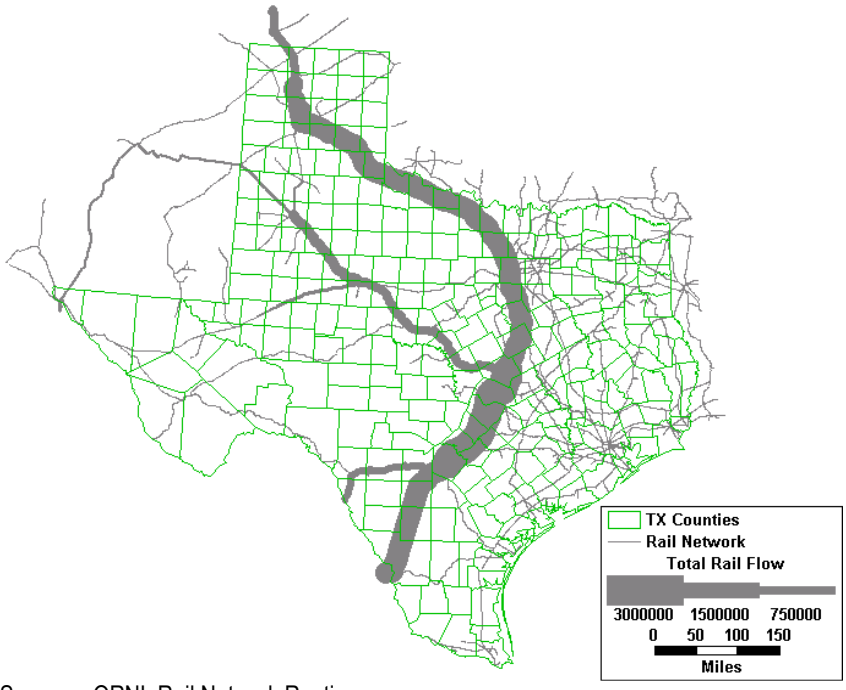
The Base Case rail freight flows are about 3.86 million annual tons (approx. 20% of total existing demand), and were routed on the existing rail network. These rail flows as shown in Figure 2.2 appear to be going through San Antonio, Austin and Dallas (along the I-35 corridor), and then into the Texas panhandle. This

clearly depicts the roundabout route most of these rail flows have to go through, which increases their travel times significantly. However, this routing is necessary due to the rail classification process at Class I yards along these corridors; breaking and re-classifying trains to direct them to their final destinations.

The change in flows over the rail network as a result of the full development of West Texas rail connection are shown in Figure 2.3. There are increases in flow on the new rail line, while there are reductions in flow in rest of Texas indicating diversions within the rail mode. The new rail line tries to eliminate some of the winding flows identified above. However, comparing the relative magnitudes of the change to the existing flow bandwidths, the flows diverted from other rail lines are quite small.

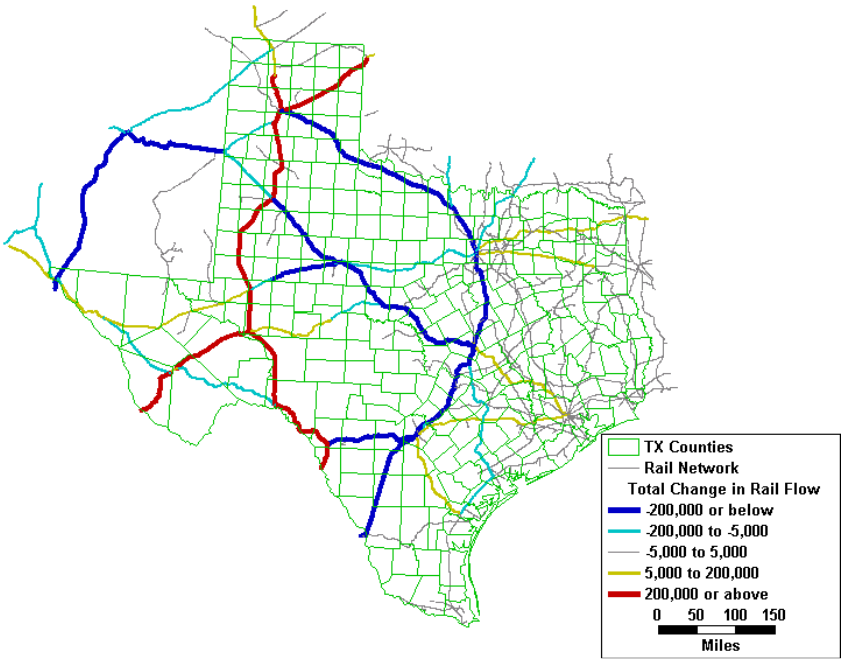
The routed highway freight flows of 15.57 million annual tons in the Base Case were found to have a flow pattern as shown in Figure 2.4. According to Figure 2.5, the change in truck flows as a result of the West Texas Rail Connection is minimal within the corridor, as only 7,600 trucks are expected to divert, annually.

Figure 2.2 Base Case Rail Flows on the Rail Network (Eagle Pass to Lubbock, TX)



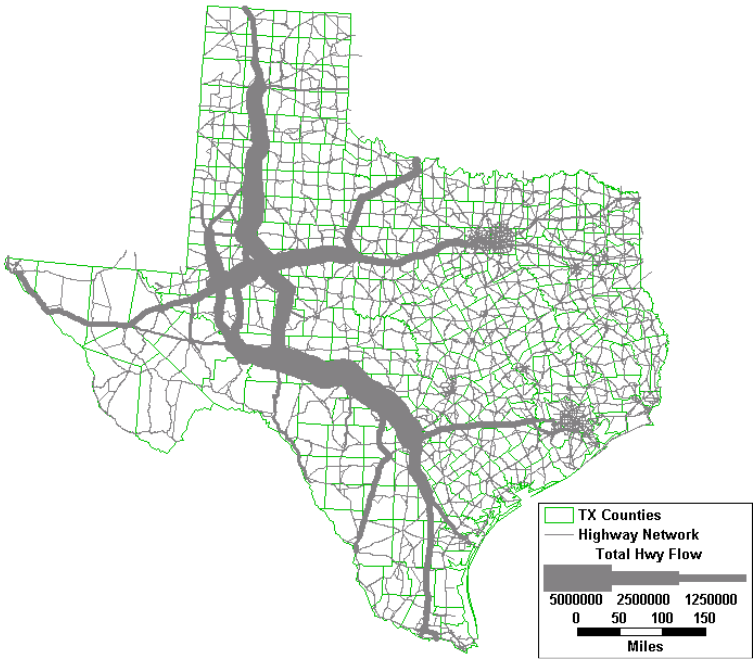
Source: ORNL Rail Network Routing

Figure 2.3 Route Diversions on Rail Network for the West Texas Rail Connection (Eagle Pass to Lubbock, TX)



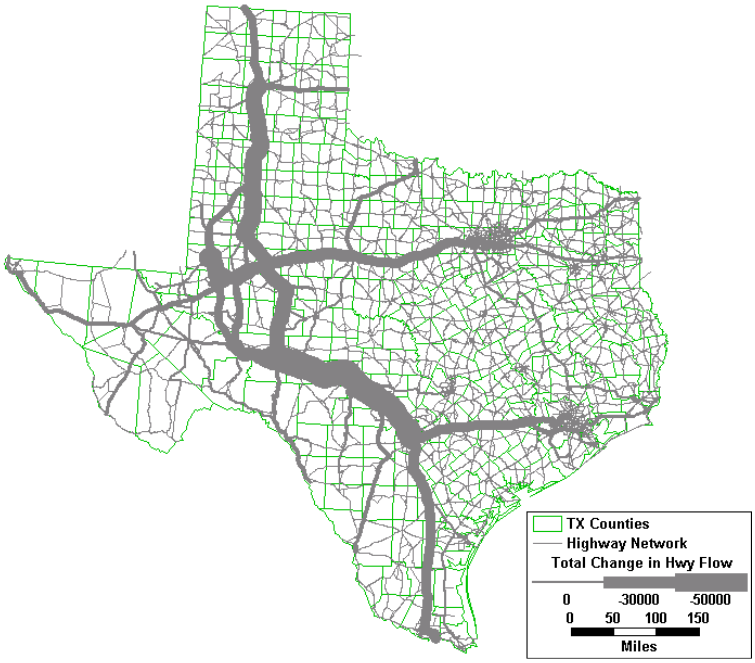
Source: ORNL Rail Network Routing

Figure 2.4 Base Case Truck Flows on the Highway Network (Eagle Pass to Lubbock, TX)



Source: FAF Highway Network Routing

Figure 2.5 Route Diversions on Highway Network for the West Texas Rail Connection (Eagle Pass to Lubbock, TX)



Source: FAF Highway Network Routing, Cambridge Systematics, Inc.

Regional Ton-Mile Diversions

To estimate the total travel impact of full development of West Texas rail corridor on the transportation system, rail ton-mile diversions were estimated for the divertible flows. Three regions where impacts may be felt are shown in Table 2.3.

The state of Texas as a whole has a significant reduction in rail ton-miles in spite of the increase in rail tons, which indicates there is travel distance savings for the selected OD pairs. This was previously confirmed by the rail route diversion maps. Due to a longer existing travel distance over the Texas roadways, the statewide ton-mile reductions for international flows is higher.

The study area zones, on the other hand, as expected, have an increase in flows due to addition of the new rail line. The increase in ton-miles on the potential West Texas rail line itself is about 1.42 billion ton-miles annually.

Table 2.3 Regional Rail Ton-Mile Diversions for the West Texas Rail Connection by Trade Type (Eagle Pass to Lubbock, TX)

Trade Type	Scenario	Texas*	Study Area Zones*	Study Area Network*
All Flows	Base Case (tons)	2,575,786,819	131,772,346	34,998,551
	Planning Case (tons)	2,176,653,648	1,644,058,875	1,453,694,808
	Diversion (ton-miles)	-399,133,171	1,512,286,529	1,418,696,257
Domestic Flows	Base Case (tons)	783,415,893	88,620,406	27,267,636
	Planning Case (tons)	708,614,971	429,021,032	366,352,870
	Diversion (ton-miles)	-74,800,922	340,400,626	339,085,235
	% Diversion of All Flows	19%	23%	24%
International Flows	Base Case (tons)	1,792,370,926	43,151,940	7,730,915
	Planning Case (tons)	1,468,038,677	1,215,037,843	1,087,341,938
	Diversion (ton-miles)	-324,332,249	1,171,885,903	1,079,611,023
	% Diversion of All Flows	81%	77%	76%

Source: Regional Ton-miles Estimation, Cambridge Systematics, Inc.

* The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Corridor, only. These are not statewide totals. Study Area Zones are study area identified counties in the Phase 1 Report and all the links lying within or touching the boundary of the study area are included. Study Area Network consists of West Texas rail connection and its parallel highway network as identified in the Phase 1 Report.

Similar results were generated for the truck ton-mile flows in the region and are summarized in Table 2.4 below. As expected, at all region levels, a decrease in ton-miles is observed.

Table 2.4 Regional Truck Ton-Mile Diversions for the West Texas Rail Connection by Trade Type (Eagle Pass to Lubbock, TX)

Trade Type	Scenario	Texas*	Study Area Zones*	Study Area Network*
All Flows	Base Case (tons)	8,215,584,723	1,489,743,118	1,113,731,086
	Planning Case (tons)	8,051,728,724	1,471,697,751	1,094,215,678
	Diversion (ton-miles)	-163,856,000	-18,045,368	-19,515,409
Domestic Flows	Base Case (tons)	6,584,411,065	1,420,894,049	1,067,222,191
	Planning Case (tons)	6,459,470,520	1,406,865,086	1,047,728,397
	Diversion (ton-miles)	-124,940,545	-14,028,963	-19,493,794
	% Diversion of All Flows	76%	78%	100%
International Flows	Base Case (tons)	1,631,173,659	68,849,069	46,508,895
	Planning Case (tons)	1,592,258,204	64,832,664	46,487,281
	Diversion (ton-miles)	-38,915,455	-4,016,405	-21,615
	% Diversion of All Flows	24%	22%	0%

Source: Regional Ton-miles Estimation, Cambridge Systematics, Inc.

* The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals. Study Area Zones are study area identified counties in the Phase 1 Report and all the links lying within or touching the boundary of the study area are included. Study Area Network consists of West Texas rail connection and its parallel highway network as identified in the Phase 1 Report.

Rail Ton-Miles and Average Rail Flow Attracted by New Rail Segments

Focusing on the potential rail corridor, segment-by-segment, the expected ton-miles and average rail flow captured are indicated in Table 2.5. The estimated rail flow appears to be uniform for all segments.

Table 2.5 Rail Ton-Miles and Average Rail Flow for the West Texas Rail Connection by New Rail Segment (Eagle Pass to Lubbock, TX)

Segment Start	Segment End	Rail Ton-Miles Added	Segment Length (miles)	Average Rail Flow (Tons)
Eagle Pass	Del Rio	201,632,498	73.4	2,746,288
Del Rio	Ozona	380,456,885	120.3	3,163,093
Ozona	Big Lake	153,386,591	48.0	3,197,552
Big Lake	Midland/Odessa	187,496,356	53.9	3,481,180
Midland/Odessa	Seminole	215,836,196	55.5	3,888,240
Seminole	Seagraves	80,411,381	21.2	3,791,201
Seagraves	Lubbock	199,476,350	54.4	3,664,824
Total		**1,418,696,257**	**426.7**	

Source: ORNL Rail Network Routing, Cambridge Systematics, Inc.

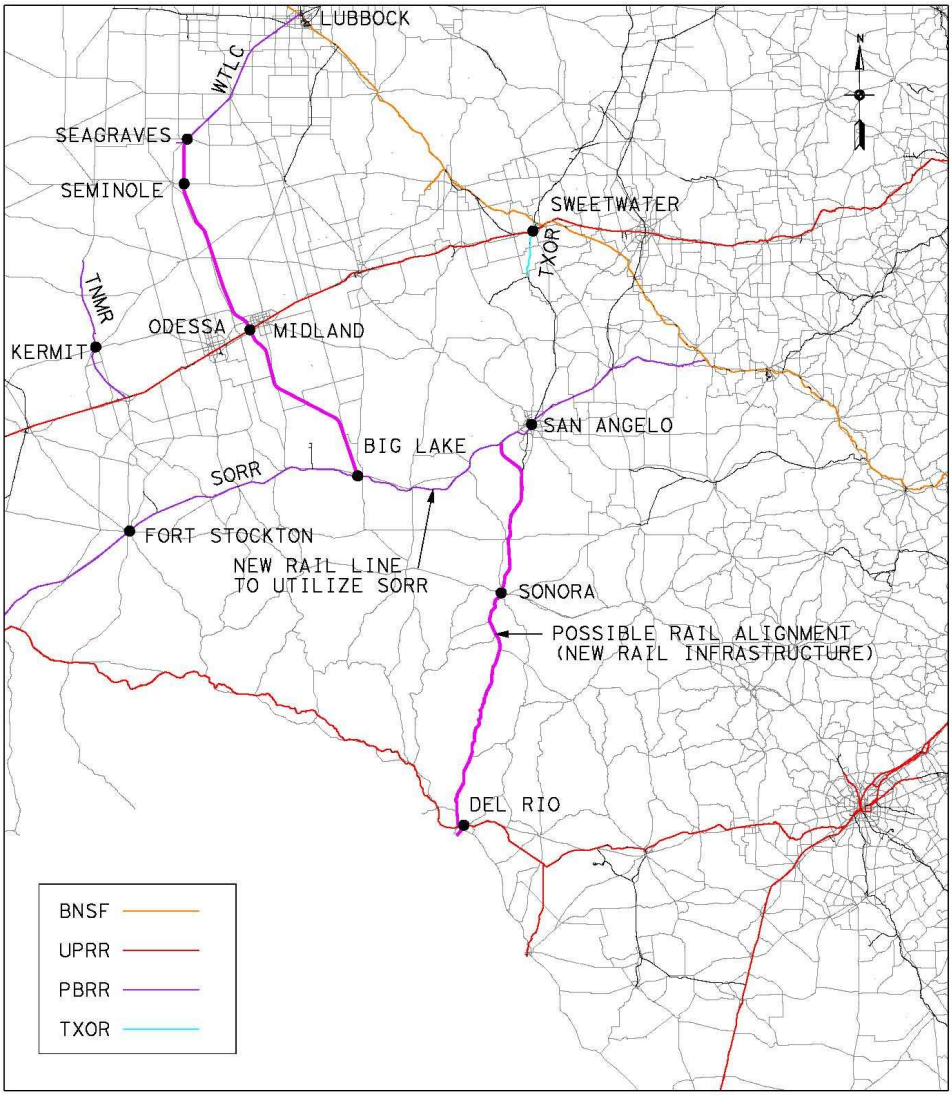
2.3 RESULTS OF FULL RAIL CORRIDOR DEVELOPMENT (EAGLE PASS, SAN ANGELO, BIG LAKE, MIDLAND-ODESSA, LUBBOCK)

About the Alignment

In an effort to comprehensively evaluate the West Texas rail connection, a slightly alternate alignment was suggested and studied as shown in Figure 2.6. Under this, apart from improving the existing rail line between Eagle Pass and Del Rio, a new rail alignment between Del Rio and Midland/Odessa via San Angelo was considered. The main reason for selecting this alignment is that San Angelo is located in Tom Green county, which was shown in the Phase 1 report to have substantial freight demand, and is likely to experience growth at an annualized rate of 1.5% by tons and 1.7% by value, between 2010 and 2035.

For the full development of a West Texas rail corridor from Eagle Pass to Lubbock – connecting through San Angelo - the OD pairs that could potentially use the full connectivity rail were identified.

Figure 2.6 Existing Texas Rail Network with Potential Rail Corridor Connection to San Angelo



Source: HNTB Conceptual Alignment.

Base and Planning Case Analyses

Modal Diversions

Table 2.6 indicates the modal diversions summary for this alternate rail alignment. The first column describes the various commodity groups used in the TxDOT SAM V2 TRANSEARCH database.

Table 2.6 Modal Diversions for a West Texas Rail Connection by Commodity Group (Eagle Pass, San Angelo, Lubbock, TX)

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Total Rail Flows*	Rail Carload %	Rail Intermodal %	Truck*
	Base Case (tons)	148,603	57,697	206,299	72.03%	27.97%	
	Diversions (tons)	22,582	7,671	30,253	74.64%	25.36%	30,253
5 (Food)	Planning Case (tons)	171,185	65,368	236,553	72.37%	27.63%	
	Payload Factor**	80.61	31.62				24.14
	Units Diverted	2,124 Carloads	2,067 TEUs				1,253 Trucks
	Base Case (tons)	132,770	11,345	144,115	92.13%	7.87%	
	Diversions (tons)	24,972	2,086	27,058	92.29%	7.71%	27,058
11 (Chemicals)	Planning Case (tons)	157,742	13,431	171,172	92.15%	7.85%	
	Payload Factor**	91.26	13.46				21.78
	Units Diverted	1,728 Carloads	998 TEUs				1,242 Trucks
	Base Case (tons)	39,381	392	39,773	99.01%	0.99%	
	Diversions (tons)	16,249	160	16,409	99.02%	0.98%	16,409
12 (Petroleum)	Planning Case (tons)	55,630	552	56,182	99.02%	0.98%	
	Payload Factor**	81.41	20.87				25.62
	Units Diverted	683 Carloads	26 TEUs				640 Trucks
	Base Case (tons)	44,691	11,766	56,457	79.16%	20.84%	
	Diversions (tons)	8,878	2,165	11,043	80.40%	19.60%	11,043
14 (Primary Metal)	Planning Case (tons)	53,569	13,930	67,500	79.36%	20.64%	
	Payload Factor**	85.17	17.08				26.01
	Units Diverted	629 Carloads	816 TEUs				425 Trucks
4 (Nonmetallic	Base Case (tons)	168,443	15,304	183,747	91.67%	8.33%	

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Total Rail Flows*	Rail Carload %	Rail Intermodal %	Truck*
Minerals)	Diversions (tons)	8,272	1,401	9,674	85.51%	14.49%	9,674
	Planning Case (tons)	176,716	16,706	193,421	91.36%	8.64%	
	Payload Factor**	99.07	NA				22.20
	Units Diverted	1,784 Carloads	0 TEUs				436 Trucks
13 (Clay, Concrete, Glass)	Base Case (tons)	33,181	2,759	35,940	92.32%	7.68%	
	Diversions (tons)	4,022	344	4,366	92.11%	7.89%	4,366
	Planning Case (tons)	37,202	3,104	40,306	92.30%	7.70%	
	Payload Factor**	93.75	44.90				17.06
	Units Diverted	397 Carloads	69 TEUs				256 Trucks
10 (Paper)	Base Case (tons)	28,595	13,441	42,036	68.02%	31.98%	
	Diversions (tons)	1,926	926	2,853	67.53%	32.47%	2,853
	Planning Case (tons)	30,521	14,368	44,889	67.99%	32.01%	
	Payload Factor**	72.25	21.92				25.32
	Units Diverted	422 Carloads	655 TEUs				113 Trucks
9 (Durable Manufacturing)	Base Case (tons)	31,255	4,884	36,139	86.49%	13.51%	
	Diversions (tons)	2,159	292	2,451	88.09%	11.91%	2,451
	Planning Case (tons)	33,414	5,175	38,590	86.59%	13.41%	
	Payload Factor**	23.76	15.85				16.43
	Units Diverted	1,406 Carloads	326 TEUs				149 Trucks
8 (Lumber)	Base Case (tons)	17,351	3,912	21,263	81.60%	18.40%	
	Diversions (tons)	1,808	399	2,207	81.92%	18.08%	2,207
	Planning Case (tons)	19,159	4,311	23,470	81.63%	18.37%	
	Payload Factor**	121.56	144.17				39.89

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Total Rail Flows*	Rail Carload %	Rail Intermodal %	Truck*
	Units Diverted	158 Carloads	30 TEUs				55 Trucks
15 (Misc. Mix & Secondary)	Base Case (tons)	3,933	1,108	5,041	78.01%	21.99%	
	Diversions (tons)	1,581	394	1,976	80.03%	19.97%	1,976
	Planning Case (tons)	5,514	1,503	7,017	78.58%	21.42%	
	Payload Factor**	51.88	22.00				19.56
	Units Diverted	106 Carloads	68 TEUs				101 Trucks
7 (Non-Durable Manufacturing)	Base Case (tons)	2,948	3,418	6,366	46.31%	53.69%	
	Diversions (tons)	593	656	1,249	47.45%	52.55%	1,249
	Planning Case (tons)	3,540	4,074	7,615	46.50%	53.50%	
	Payload Factor**	39.57	12.70				13.12
	Units Diverted	89 Carloads	321 TEUs				95 Trucks
2 (Mining)	Base Case (tons)	22,804	280	23,083	98.79%	1.21%	
	Diversions (tons)	64	2	66	97.41%	2.59%	66
	Planning Case (tons)	22,868	282	23,149	98.78%	1.22%	
	Payload Factor**	84.98	67.81				22.16
	Units Diverted	269 Carloads	4 TEUs				3 Trucks
3 (Coal)	Base Case (tons)	773,487	0	773,487	100.00%	0.00%	
	Diversions (tons)	0	0	0	100.00%	0.00%	0
	Planning Case (tons)	773,487	0	773,487	100.00%	0.00%	
	Payload Factor**	112.49	NA				26.10
	Units Diverted	6,876 Carloads	0 TEUs				0 Trucks
6 (Consumer Manufacturing)	Base Case (tons)	101	1,172	1,273	7.94%	92.06%	
	Diversions (tons)	5	52	57	8.35%	91.65%	57

Commodity Group	Source of Diversion	Rail Carload*	Rail Intermodal*	Total Rail Flows*	Rail Carload %	Rail Intermodal %	Truck*
	Planning Case (tons)	106	1,224	1,330	7.96%	92.04%	
	Payload Factor**	33.86	18.64				20.16
	Units Diverted	3 Carloads	66 TEUs				3 Trucks
1 (Agriculture)	Base Case (tons)	2,471,841	34,526	2,506,368	98.62%	1.38%	
	Diversions (tons)	0	0	0	0.00%	0.00%	0
	Planning Case (tons)	2,471,841	34,526	2,506,368	98.62%	1.38%	
	Payload Factor**	98.50	22.09				
	Units Diverted	25,094 Carloads	1,563 TEUs				0 Trucks
Total	Base Case (tons)	3,919,383	162,004	4,081,387	96.0%	4.0%	
	Diversions (tons)	93,112	16,549	109,661	84.9%	15.1%	109,661
	Planning Case (tons)	4,012,495	178,553	4,191,049	95.7%	4.3%	
	Units Diverted	41,770 Carloads	7,011 TEUs				4,771 Trucks

Source: TxDOT SAM V2 Freight Mode Choice Modeling, Cambridge Systematics, Inc. *The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals

The total freight demand of divertible flows is about 23.0 million tons annually, of which 4.1 million tons use the existing rail network. On the remaining 19.0 million tons of divertible flows using the highway mode, the SAM V2 mode choice model was applied to estimate the diversions to the rail mode. The truck-to-rail diversions were a mere 0.11 million tons annually. Overall, the West Texas rail connection can generate about 4.0 million annual tons of rail carload flows (or about 41,800 carloads) and about 0.18 million annual tons of rail intermodal flows (or about 7,000 TEUs), while eliminating about 4,800 truck trips annually. This is less than the 7,500 truck trips identified with the alignment that by-passes San Angelo.

The top five commodity groups that show the highest truck-to-rail diversion are: a) Food[4]; b) Chemicals; c) Petroleum; d) Primary Metal; and e) Non-metallic minerals. Together, they account for 87% of rail carload diversions and 81% of rail intermodal diversions from trucks by annual tonnages. The top five commodity groups that show the highest total diversion are: a) Agriculture, b) Coal, c) Food, d) Nonmetallic minerals, and e) Chemicals. These make up 93%of the total diverted rail tons.

Further, we summarize the modal diversions by trade type in Table 2.7. The U.S.-Mexico North American Free Trade Agreement (NAFTA) flows included about 2.7 million tons of rail carload and about 83,000 tons of rail intermodal annually, which make up about 67% and about 46% of all diversions of the corresponding modes.

[4] Commodity is a consideration-factor in mode choice, i.e. some commodities are better suited for truck transport, while others are suited for rail, so diversion is calculated accordingly. The top diverting commodity in this analysis is shown to be Food. This may be a data anomaly as diverting food (like time-sensitive or refrigerated items) from truck to rail may not be feasible unless these are bulk items like grains.

Table 2.7 Modal Diversions for a West Texas Rail Connection by Trade Type (Eagle Pass, San Angelo, Lubbock, TX)

Trade Type	Scenario	Rail Carload*	%Change of Rail Total	Rail Intermodal *	%Change of Rail Total	Truck*
All Flows	Potential Rail-to-Rail Diversion (Tons)	3,919,383	96.0%	162,004	4.0%	
	Potential Truck-to-Rail Diversion (Tons)	93,112	84.9%	16,549	15.1%	109,661
	Potential Total Diverted (Tons)	4,012,495	95.7%	178,553	4.3%	
Domestic Flows	Potential Rail-to-Rail Diversion (Tons)	1,240,563	93.8%	82,702	0.6%	
	Potential Truck-to-Rail Diversion (Tons)	80,441	85.9%	13,167	14.1%	93,608
	Potential Total Diverted (Tons)	1,321,003	93.2%	95,869	0.7%	
	% Change of All Flows	33%		54%		85%
International Flows	Potential Rail-to-Rail Diversion (Tons)	2,678,821	97.1%	79,302	1.8%	
	Potential Truck-to-Rail Diversion (Tons)	12,671	78.9%	3,382	21.1%	16,053
	Potential Total Diverted (Tons)	2,691,492	97.0%	82,684	1.9%	
	% Change of All Flows	67%		46%		15%

Source: TxDOT SAM V2 Freight Mode Choice Modeling, Cambridge Systematics, Inc.

*The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals.

Route Diversions

The rail freight flows of divertible OD pairs (about 4.1 million annual tons, or about 18% of total existing demand) were routed on the existing rail network. These rail flows as shown in Figure 2.7 seem to be going through San Antonio, Austin and Dallas (along the I-35 corridor), and then into the Texas panhandle.

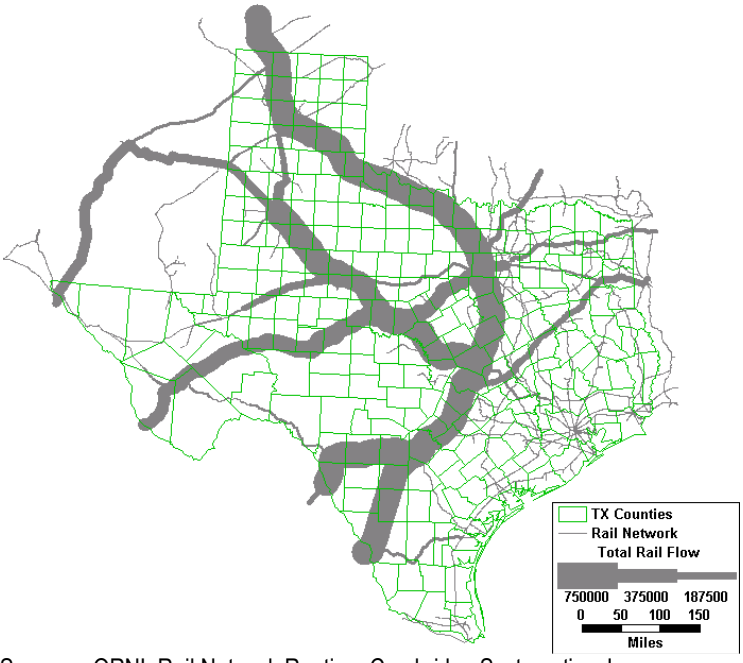
This clearly depicts the roundabout route most of these rail flows have to go through, which increases their travel times significantly.

The change in flows over the rail network as a result of the modified alignment alternative of West Texas rail connection are shown in Figure 2.8. There are increases in flow on the new rail line, while there are reductions in flow in rest of Texas indicating diversions within the rail mode. The new rail line tries to eliminate some of the winding flows identified above. Comparing to the original alternative, the modified alternative has a much wider system flow impacts.

The highway flows of divertible OD pairs (about 19.0 million annual tons, or about 82% of total existing demand) were routed on the highway network. The flows were found to have a pattern as shown in Figure 2.9. The key divertible highways flows are: (a) between El Paso area and Dallas metropolitan area, and (b) less prominent yet conceivably between Midland/Odessa and San Antonio. However, in terms of annual tonnages these are very small values compared to the divertible rail flows.

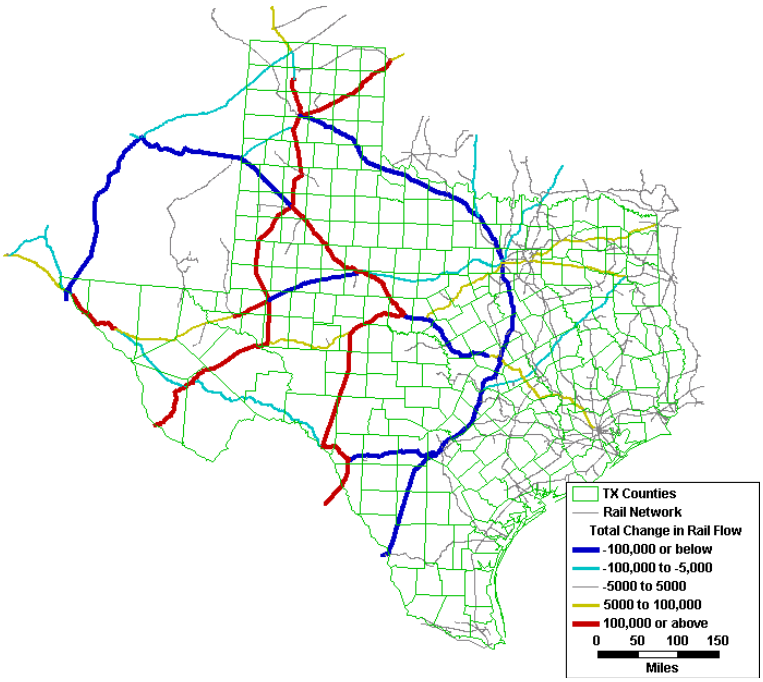
Figure 2.10 shows the change in truck flows as a result of the West Texas Rail Connection. The values have small effect in the central parts of Texas and the study area. Not many OD pairs that currently depend on trucking stand to gain by the new rail connection. The impact seems quite similar for both Dallas and San Antonio markets.

Figure 2.7 Base Case Rail Flows on the Rail Network (Eagle Pass to San Angelo to Lubbock, TX)



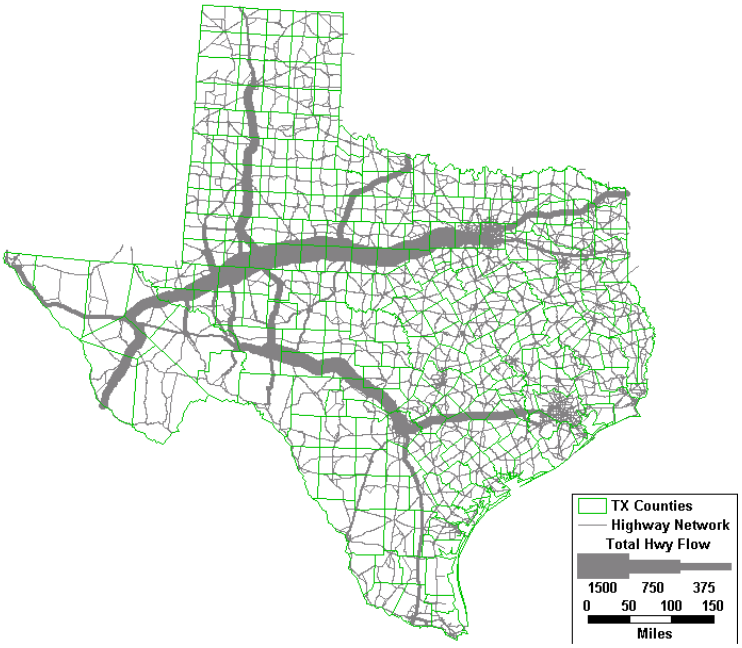
Source: ORNL Rail Network Routing, Cambridge Systematics, Inc.

Figure 2.8 Route Diversions on Rail Network for the West Texas Rail Connection (Eagle Pass to San Angelo to Lubbock, TX)



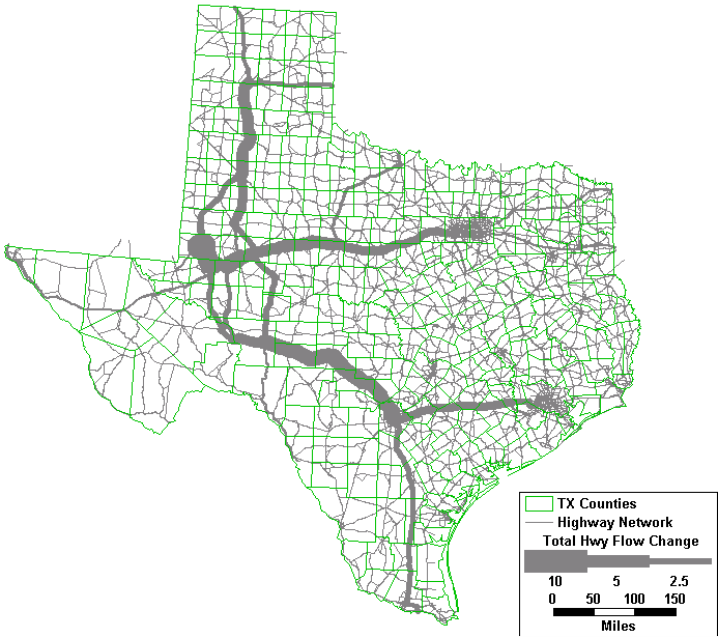
Source: ORNL Rail Network Routing, Cambridge Systematics, Inc.

Figure 2.9 Base Case Truck Flows on the Highway Network (Eagle Pass to San Angelo to Lubbock, TX)



Source: FAF Highway Network Routing

Figure 2.10 Route Diversions on Highway Network for the West Texas Rail Connection (Eagle Pass to San Angelo to Lubbock, TX)



Source: FAF Highway Network Routing, Cambridge Systematics, Inc.

Regional Ton-Mile Diversions

To estimate the total travel impact of the full development of West Texas rail connection on the transportation system, rail ton-mile diversions were estimated for the divertible flows. The summaries were made using the previously described regions as shown in Table 2.8 below.

The state of Texas as a whole has a significant reduction in rail ton-miles in spite of the increase in rail tons, which indicates there is travel distance savings for the selected OD pairs, which was also confirmed earlier by the rail route diversion maps. Due to a longer existing travel distance over the Texas roadways, the statewide ton-mile reductions for international flows is higher.

The study area zones, on the other hand, as expected have an increase in flows due to addition of the new rail line. The increase in ton-miles on West Texas rail connection itself is about 0.62 billion ton-miles annually.

Table 2.8 Regional Rail Ton-Mile Diversions for the West Texas Rail Connection by Trade Type (Eagle Pass to San Angelo to Lubbock, TX)

Trade Type	Scenario	Texas*	Study Area Zones*	Study Area Network*
All Flows	Before (ton-miles)	2,563,233,599	176,342,277	89,085,086
	After (ton-miles)	2,091,523,008	975,590,785	710,084,024
	Change (ton-miles)	-471,710,592	799,248,508	620,998,938
Domestic Flows	Before (ton-miles)	817,616,496	87,893,016	42,693,393
	After (ton-miles)	690,068,322	295,094,213	218,912,541
	Change (ton-miles)	-127,548,173	207,201,198	176,219,149
	% Change of All Flows	27%	26%	28%
International Flows	Before (ton-miles)	1,745,617,103	176,342,277	89,085,086
	After (ton-miles)	1,401,454,685	975,590,785	710,084,024
	Change (ton-miles)	-344,162,418	799,248,508	620,998,938
	% Change of All Flows	73%	74%	72%

Source: Regional Ton-miles Estimation, Cambridge Systematics, Inc.

* The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Corridor, only. These are not statewide totals. Study Area Zones are study area identified counties in the Phase 1 Report and all the links lying within or touching the boundary of the study area are included. Study Area Network consists of West Texas rail connection and its parallel highway network as identified in the Phase 1 Report.

Similar results were generated for the truck ton-mile flows in the region and are summarized in Table 2.9 below. As expected, at all regional levels, decrease in ton-miles is observed.

Table 2.9 Regional Truck Ton-Mile Diversions for the West Texas Rail Connection by Trade Type (Eagle Pass to San Angelo to Lubbock, TX)

Trade Type	Scenario	Texas*	Study Area Zones*	Study Area Network*
All Flows	Before (ton-miles)	1,655,847	438,053	439,676
	After (ton-miles)	1,646,683	435,032	436,636
	Change (ton-miles)	-9,163	-3,022	-3,039
Domestic Flows	Before (ton-miles)	1,115,875	321,507	327,016
	After (ton-miles)	1,108,848	319,152	324,664
	Change (ton-miles)	-7,027	-2,356	-2,352
	% Change of All Flows	77%	78%	77%
International Flows	Before (ton-miles)	539,972	116,546	112,659
	After (ton-miles)	537,835	115,880	111,972
	Change (ton-miles)	-2,136	-666	-687
	% Change of All Flows	23%	22%	23%

Source: Regional Ton-miles Estimation, Cambridge Systematics, Inc.

* The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals. Study Area Zones are study area identified counties in the Phase 1 Report and all the links lying within or touching the boundary of the study area are included. Study Area Network consists of West Texas rail connection and its parallel highway network as identified in the Phase 1 Report.

Rail Ton-Miles and Average Rail Flow Attracted by New Rail Segments

Focusing on the new rail segments as defined in the Phase 1 Report, the expected ton-miles and average flow tons captured by the full deployment of the West Texas rail connection are indicated in Table 2.10. The estimated rail flow is highest between Eagle Pass and San Angelo and beyond that it falls down, indicating that there is a benefit in providing a direct connectivity from San Angelo to the international border crossing with Mexico in the south.

The average rail flow by segment in the alignment through San Angelo is just over 950,000 tons. The average rail flow of the more direct route is over 3.3M. For this reason, the route through San Angelo will not be evaluated as part of the economic and financial feasibility analysis.

Table 2.10 Rail Ton-Miles and Average Rail Flow for the West Texas Rail Connection by New Rail Segment (Eagle Pass to San Angelo to Lubbock, TX)

Segment Start	Segment End	Rail Ton-Miles Added	Segment Length (miles)	Average Rail Flow (Tons)
Eagle Pass	Del Rio	136,105,333	73.4	1,847,500
Del Rio	San Angelo	267,272,305	144.9	1,845,039
San Angelo	Midland/Odessa	64,925,082	170.0	381,867
Midland/Odessa	Seminole	11,940,393	55.5	215,103
Seminole	Seagraves	4,555,897	21.2	214,799
Seagraves	Lubbock	12,330,494	57.4	214,742
Total		**497,129,502**	**522.7**	**951,080**

Source: ORNL Rail Network Routing, Cambridge Systematics, Inc.

3.0 Benefit-Cost Analysis

One of the objectives of this study is to determine the feasibility of developing the north-south rail linkage between Del Rio/Eagle Pass and Lubbock, Texas. To that end, key benefit factors have been evaluated to help assess a variety of aspects of the rail line, e.g. if the line will yield transportation benefits on Texas roadways (e.g. pavement or safety improvements), if there will be environmental benefits, and if the line will serve as a catalyst of economic growth in West Texas.

The methodology used is largely based on benefit-cost analysis processes developed by Cambridge Systematics for TIGER II Discretionary Grant applications and truck size and weight studies such as the Wisconsin Truck Size and Weight Study (2009) which includes rail diversion impact assessment.

In general, benefits are shaped by the following inputs:

- **Changing shipping patterns.** Development of new rail facilities provide shippers with additional goods movement options. Some will find shorter rail trips. Others will move goods from truck to rail to realize cost savings. Changing shipping patterns will have impacts on infrastructure maintenance, safety, emissions, and fuel consumption.
- **Construction spending.** New spending on rail infrastructure can inject the region with new permanent operations jobs and wages as well as temporary jobs and wages during the construction period.
- **Business attraction.** New infrastructure and access to better transportation resources can serve as a catalyst for new economic development and business attraction.

There are two areas of benefits that are traditionally considered in this type of benefit-costs analysis, however, that are not included in this evaluation:

- **Congestion Relief.** While congestion relief can be a secondary benefit of shifting truck traffic to railways, it is not considered a significant factor in this analysis because 1) the region does not face significant roadway congestion at present, 2) the region is not anticipated to face significant roadway congestion in the future, and 3) the amount of truck traffic anticipated to shift onto railways would likely have minimal impact, given the high available roadway capacity of the region.
- **Reliability Savings.** Some shippers may see changes in freight reliability as they shift from truck to rail freight movements. However, these factors are assumed to be accounted for in the estimation of truck diversion. It is assumed that shippers will generally pursue the lowest cost transportation option available for bulky, non-time sensitive commodities.

Note that this analysis reflects the consultants' diversion estimates, only, and does not intend to imply actual use of the corridor. Use of this shortline operated rail corridor by diverting Class I railroads is very unlikely due to the nature of existing Class I operations and the desire to minimize interchanges.

3.1 ASSUMPTIONS

The following categories of benefits and major assumptions used to estimate benefits of the West Texas rail project are shown in Table 3.1.

Table 3.1 Benefit Analysis Assumptions (Real 2010 Dollars)

Input Category	Input	Value
Present Value and Benefit Cost Ratio	Analysis timeframe	2010 to 2045
	Discount rate	2.8%
Timeline	Construction period	2012-2015
	Operating period	2015-2045
Residual Value of Capital	Lifespan for rail	50 years
Shipping Costs	Rail – carload (per ton-mile)	$0.036
	Rail – intermodal (per ton-mile)	$0.10
	Truck (per ton-mile)	$0.15
Safety	Savings for eliminating truck VMT	$0.13
State of Good Repair	Pavement impacts per truck VMT	$0.20
Environmental	"Monopsony" Savings (reduced pressure on world fuel prices) per gallon	$0.28
	"Price Shock" Savings (reduced exposure to economic loss risks) per gallon	$0.12
	Combined emissions cost (CO2, NOx and PM) per gallon by truck	$0.86
	Combined emissions cost (CO2, NOx and PM) per gallon by rail	$1.56
	Ton-miles per gallon (truck)	97.2
	Ton-miles per gallon (rail)	413
Regional Economy/Economic Analysis	Permanent jobs per $1M operations cost	11.9463
	Construction job per $1M capital cost	21.6992
	Operations-related wages per operations $	$0.5617
	Construction-related wages per construction $	$0.8266

The basis for the assumptions used to calculated benefits is outlined in Subsection 3.2.

Note, in addition to the assumptions outlined in the table, the results presented in Section 3.0 calculate the benefit-cost for truck-to-rail diversions, only. While significant rail-to-rail demand has been identified as part of the diversion analysis, that demand is primarily as a result of diverting Class I rail traffic to this potential shortline operated rail corridor. It is unrealistic to assume that this corridor will be an attractive option for those rail operators, given the presence of existing rail classification yards along Class I corridors and the additional switching and operational complexities that would be introduced if those movements were diverted. **Appendix B** provides comparative results that include rail-to-rail diversions, as well as truck-to-rail diversions, as information on how the benefit-cost of this corridor could fluctuate with the introduction of significantly more traffic.

3.2 BENEFITS DUE TO CHANGING SHIPPING PATTERNS

Transportation benefits are applied to estimated current and future transportation flows. The potential for induced demand (the possibility that shipping volumes may increase due to the presence of a rail option) is not considered as part of this analysis. This analysis has only been conducted for the alignment discussed in Section 2.2 – Eagle Pass to Lubbock, connecting through Big Lake and Midland-Odessa.

Shipper Cost Savings

While shipper cost savings are not a direct public benefit, they do, however, increase the competitiveness of rail as a transportation mode and increase the potential of the region to attract and retain businesses. For that reason they are generally included in benefit-cost analyses.

Additional transportation options allow for shipper cost savings in two areas. Some shippers that rely on rail transportation see reduced trip lengths due to new, more direct rail connections. As rail shippers typically pay on a per-mile basis, it is possible to anticipate reduced costs for shipping via rail based on reduced trip lengths[5]. Truck to rail diversion is another opportunity for shipper cost savings. Truck transportation is typically more expensive than the rail alternative. These benefits are summarized in Table 3.2.

[5] As previously noted, this analysis does not account for rail-to-rail diversions, due to the fact that this corridor would likely not be an attractive option for Class I rail operators. Appendix B does provide benefit-cost calculations that include rail-to-rail diversions.

The rates used for developing shipper cost units are: $0.036 per ton-mile for rail carload traffic and $0.15 per ton-mile for truck freight[6], and $0.10 for rail intermodal units[7].

The overall impact of the new rail line on shipper cost savings is significant. When provided with this new transportation option, local, domestic, and international shippers save just over an estimated $63M during the 30-year analysis period, making freight movements to, from, and through West Texas significantly more cost-effective and competitive. These benefits are summarized in Table 3.2.

Infrastructure Impacts and Maintenance Costs

Engineers design roads to accommodate projected vehicle loads, in particular, heavy vehicle axle loads. The life of a pavement is related to the magnitude and frequency of these heavy axle loads. For the West Texas rail project, diverting truck traffic to rail can reduce pavement impacts from heavy axle loads.

Over the 30-year analysis project, it is estimated that freight movements requiring about 0.84M truck vehicle-miles traveled (VMT) will be converted to rail. The FHWA Cost Allocation Study Addendum figure for marginal pavement costs for 80,000 pound, five-axle combination trucks on rural Interstate highways (converted to 2010$) is $0.20 per vehicle-mile. Applying this figure leads to an estimated savings on pavement impacts of about $4.4M over the 30-year analysis period. These benefits are summarized in Table 3.2.

Safety Impacts

With fewer trucks on the highways, the possibility of exposure to dangerous crashes is reduced. As part of the benefit-cost analysis, safety benefits were calculated as the number of fatalities, injuries, and crashes avoided based on a reduction of truck VMT.

Using Texas Motor Vehicle Crash Statistics from 2009 and National Safety Council estimates for the costs of crashes based on fatality and/or injury occurrence, it was assumed that eliminating one truck vehicle-mile can lead to about $0.13 in safety savings. Given the estimated 0.84M truck vehicle-mile reduction due to rail construction, safety savings are estimated to be about $2.8M over the 30-year period. The impacts of increased rail traffic on safety were estimated but found to have a negligible impact. These benefits are summarized in Table 3.2.

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[6] These were both developed as part of the study and documented in the West Texas Highway and Rail Transportation Revenue Memo.

[7] This is an industry standard proposed by Cambridge Systematics. It does not include truck drayage costs associated with intermodal transport.

Environmental Impacts

Moving goods via rail rather than truck can play a large role in reducing air pollutants generated by vehicular emissions, which are health hazards. Vehicular pollutants include five key pollutants: hydrocarbons (HC), carbon monoxides (CO), nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM). In presence of oxygen, CO oxidizes to carbon dioxide (CO2), the most prominent greenhouse gas (GHG), aside from water vapor. Rail freight movement emits less of these gases than truck freight movement due to efficiencies of scale, so moving goods from highway modes to rail yields social value through reduced air pollution and world-wide contributions to rapid climate change.

For this analysis, impacts on CO2, NOx, and PM were quantified. Based on estimated fuel consumption changes for both rail and truck, emission rates from MOBILE 6/Texas Transportation Institute sources, and savings estimates for emission reductions, each of these three pollutant areas generated about $2.6M in savings over the 30-year analysis. One significant assumption was that over the life of the project, non-GHG emission rates would cut in half for both modes, based in advances in technology. Fuel consumption was estimated using ton-miles with trucks moving approximately 97.2 ton-miles of freight per gallon and railroads moving 413 ton-miles per gallon.

Additional environmental benefits from reduced fuel consumption were considered. Monopsony[8] savings were calculated (reduced pressure on world fuel prices) with a savings of $0.28 per gallon applied (from National Highway Traffic Safety Administration (NHTSA) sources). Price shock savings were also calculated (reduced exposure to economic loss risks) with a savings of $0.12 per gallon applied (from NHTSA).

Monopsony and price shock savings added up to $1.2M and $0.5M respectively. This led to a total environmental savings (for both social and air quality elements) of about $4.3M for the project's analysis period. These benefits are summarized in Table 3.2.

3.3 BENEFITS DUE TO CONSTRUCTION SPENDING

Direct and Indirect Job and Wage Creation

New spending on rail infrastructure can inject the region with new permanent operations jobs and wages as well as temporary jobs and wages during the construction period. The Bureau of Economic Analysis (BEA) calculates estimates of how much a one-time or sustained increase in economic activity in a particular

[8] A market similar to a monopoly except that a large buyer not seller controls a large proportion of the market and drives the prices down. Sometimes referred to as the buyer's monopoly. Definition provided by www.investopedia.com

region will be supplied by industries located in the region, known as a regional input-output multiplier. In the example of a rail linkage, money spent on construction will create new jobs, be used to pay workers wages which they will spend a portion of locally, and be used for equipment and materials which may be purchased locally. Using Texas-specific BEA Regional Input-Output Modeling System (RIMS II) multipliers, total construction and on-going operations costs can be used to estimate the overall benefits in jobs and wages within the region.

During the construction period, it is estimated that about 21,000 to 31,000 full-time equivalent (FTE) jobs could be created. Approximately 7,000-10,333 individuals could be fully employed for a three-year construction period. It is estimated that these workers would earn between $815M and about 1.2B in wages, pumping a significant source of private spending and savings opportunity as well as tax revenue into the region.

Once the rail line is operation, jobs will be created for rail operators and maintenance workers. It is estimated that between about 1,700 and 2,400 FTE jobs will be created over the 30-year operational period. These workers will earn an estimated $78-112M in wages. It is important to note that a portion of these jobs will remain in West Texas for as long as the rail line is operating, whereas the construction jobs are a temporary economic benefit. These benefits are summarized in Table 3.3.

3.4 BENEFIT-COST SUMMARY – TRUCK-TO-RAIL DIVERSIONS

Benefit-cost analysis can be a very effective tool in informing decision-making, but it is essential to recognize that there are limitations and uncertainties involved in long-range estimation. Tables 3.2 and 3.3 provide a summary of each benefit as applied to the three alternatives under evaluation:

- **Alternative 1 (Seagraves to Del Rio)**
  - Travels through Midland/Odessa, Big Lake, Ozona, and Del Rio
  - Likely requires a rail overpass at Comstock for rail operations
  - Requires a new international rail crossing and track in Mexico
  - All new track
- **Alternative 2 (Seagraves to Eagle Pass)**
  - Travels through Midland/Odessa, Big Lake, Ozona, Del Rio, and Eagle Pass
  - Switches rail operations with Union Pacific Railroad at Comstock
  - Utilizes existing Union Pacific Railroad Del Rio and Eagle Pass Subdivisions and existing border crossing at Eagle Pass

- **Alternative 3 (Seagraves to Eagle Pass)**
  - Travels through Midland/Odessa, Big Lake, Ozona, Del Rio, and Eagle Pass
  - Likely requires a rail overpass at Union Pacific Railroad for rail operations
  - Utilizes existing border crossing at Eagle Pass
  - All new track

It is anticipated that about 175,000 truck tons would divert to the new rail line. This equates to close to 20M truck ton-miles that are removed from area Texas highways and transported instead as rail carload and rail intermodal units. Considering only truck-to-rail diversion, we see limited benefits. Costs remain the same, as do the employment and wage creation due to spending. Benefits are smaller as rail-to-rail diversions are not considered. See **Appendix B** for the full diversion summary, inclusive of rail-to-rail diversions.

Benefits are driven largely by the estimated $63M in transportation cost savings for local, domestic, and international shippers diverting from truck to rail movements. The benefit-cost ratio for all three alternatives is close to 0.41, indicating that significant additional truck diversion or increased rail traffic for economic benefit would be needed for the benefits to exceed the costs for this project. A 1.0 or better benefit-cost ratio is desired.

Table 3.2 Total Costs and Benefits (Millions of Real 2010 Dollars)

	Item	Alt 1	Alt 2	Alt 3
Costs	Construction	1,048	987	1,416
	Operations and Maintenance	143	140	200
	Total Costs	**1,191**	**1,127**	**1,616**
Benefits	Shipper Cost Savings	63	63	63
	State of Good Repair	4.4	4.4	4.4
	Safety	2.8	2.8	2.8
	Environmental	4.3	4.3	4.3
	Residual Value	419	395	566
	Total Benefits	**493.5**	**469.5**	**640.5**
	Benefit-Cost Ratio	**0.41**	**0.42**	**0.40**

Table 3.3 provides benefits as a result of construction. These are the same benefits regardless of what diversion alternative is considered, as the construction and operating costs of the line are constant values.

Table 3.3 Employment and Wage Benefits

Item	Alt 1	Alt 2	Alt 3
FTE Jobs Created by Construction *(2012-2015)**	22,700	21,400	30,700
Wages Created by Construction *(2012-2015)*	$866.5 M	$815.9 M	$1,170.5 M
FTE Jobs Created by Railroad Operations *(2015-2045)**	1,700	1,700	2,400
Wages Created by Railroad Operations *(2015-2045)*	$80.2 M	$78.5 M	$112.2 M

*Rounded to the nearest hundredth.

4.0 Rail Line Revenue Analysis

A rail line revenue analysis was conducted to understand the potential revenue that could be generated through operating a potential West Texas rail line. The objective of this analysis is to compare rail line revenue to operating expenses to determine whether or not operations can be self-sufficient. The overarching assumption for this financial analysis is that public funding will either not be available for this project or will form a small part of the total financing package. This assumption is based on the reality of the current transportation funding shortfall at both the state and national level and the number of projects already in the funding queue.

4.1 RAIL AND TRUCK SHIPPING RATES

A comparison of costs for competing modes of freight transportation service was made in order to assess the feasibility of constructing a new rail line in West Texas. Shipping costs, measured in cents per ton-mile, for truck and rail service were prepared so that the economics of these two modes could be compared to one another. This analysis principally assumes that the owner and financier of the new rail line is an entity separate from that of the rail service provider, which would be a shortline railroad company contracted to move rail freight between shippers in the West Texas region (i.e., truck-to-rail diversions) and a Class I railroad that completes the delivery of freight to its final destination, or continuous through-movement of Class I rail freight that begins using the new rail line in lieu of existing routes (i.e., rail-to-rail diversions).[9] A secondary analysis is made assuming that the shortline railroad is both owner and operator.

Historic Railroad Shipping Rate Data

Bureau of Transportation Statistics (BTS) revenue data for Class I railroads has been converted to 2010 dollars and plotted in Figure 4.1, indicating that average railroad rates have decreased over time and bottomed out at about 2.7 cents per ton-mile in 2003 before returning to approximately 3.4 cents per ton-mile in 2008. Table 4.1 includes Class I railroad revenues published under, Railroad Ten-Year Trends: 2000-2009, by the Policy and Economics Department of the Association of American Railroads (AAR) in 2011. This data shows that specific commodities, particularly those commodities considered as divertible to the new West Texas

[9] The U.S. Code of Federal Regulations defines a shortline railroad, or Class III railroad, as having operating revenue less than $20 million per year and operating less than 350 miles of track, and Class I railroad as having operating revenue in excess of $250 million per year (49 CFR 1201, Subpart A).

rail line, earn the railroads higher revenues than the 3.4 cents per ton-mile rate reported by the BTS, particularly for commodities such as food, chemicals, petroleum, non-metallic minerals, primary metals, and intermodal freight, ranging from 4.1 cents per ton-mile to 5.8 cents per ton-mile (2009 dollars) and averaging 5.0 cents per ton-mile.

Figure 4.1 Inflation-Adjusted Historic Class I Railroad Revenue Rates in 2010 Dollars

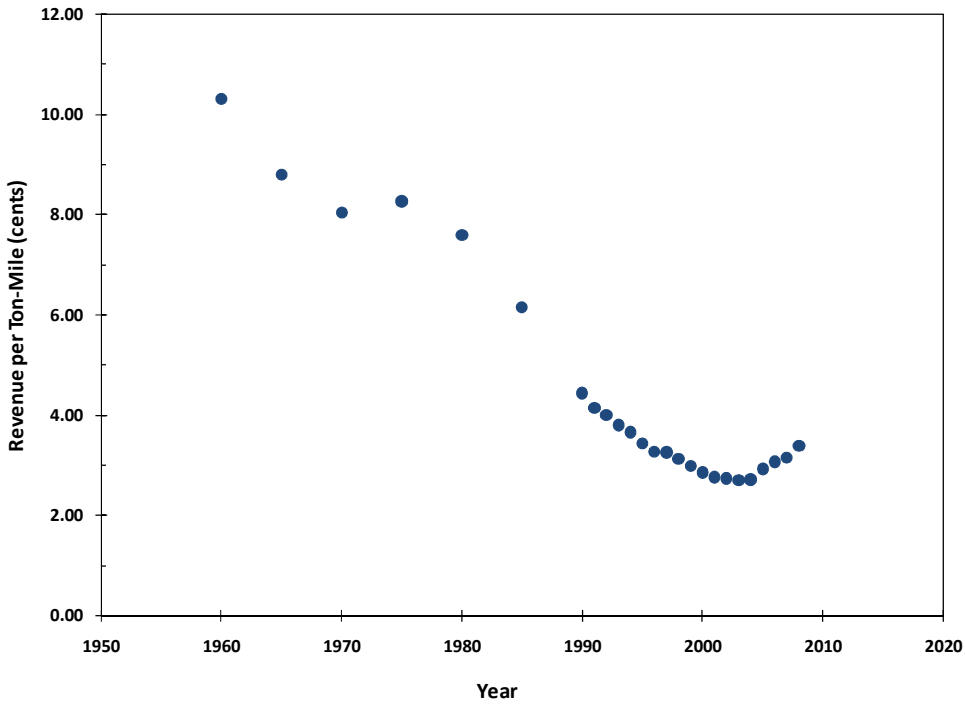


Table 4.1 Class I Railroad Revenues

	Constant 2009 Dollars (Cents per Ton-Mile)				
Commodity	**2005**	**2006**	**2007**	**2008**	**2009**
Farm Products	2.83	2.88	2.93	3.23	3.03
Metallic Ores	3.73	4.03	4.16	4.47	4.84
Coal	1.93	1.95	2.0	2.46	2.21
Nonmetallic Minerals	3.96	4.14	4.18	4.76	4.65
Food	3.8	4.01	4.03	4.42	4.09
Lumber & Wood Products	4.1	4.3	4.32	4.61	4.1
Paper & Allied Products	5.54	5.99	5.96	6.44	5.64
Chemicals	3.56	4.81	5.16	5.69	5.39
Petroleum & Coal Products	4.37	4.64	4.92	5.76	5.6
Stone, Clay & Glass Products	5.09	5.43	5.45	5.95	5.77
Metal Products	5.04	5.57	5.9	6.35	5.81
Transportation Equipment	12.15	12.79	12.21	14.27	14.98
Waste & Scrap Material	5.36	5.76	5.81	6.53	5.8
Intermodal (Mixed Shipments)	4.55	4.81	4.81	5.21	4.69

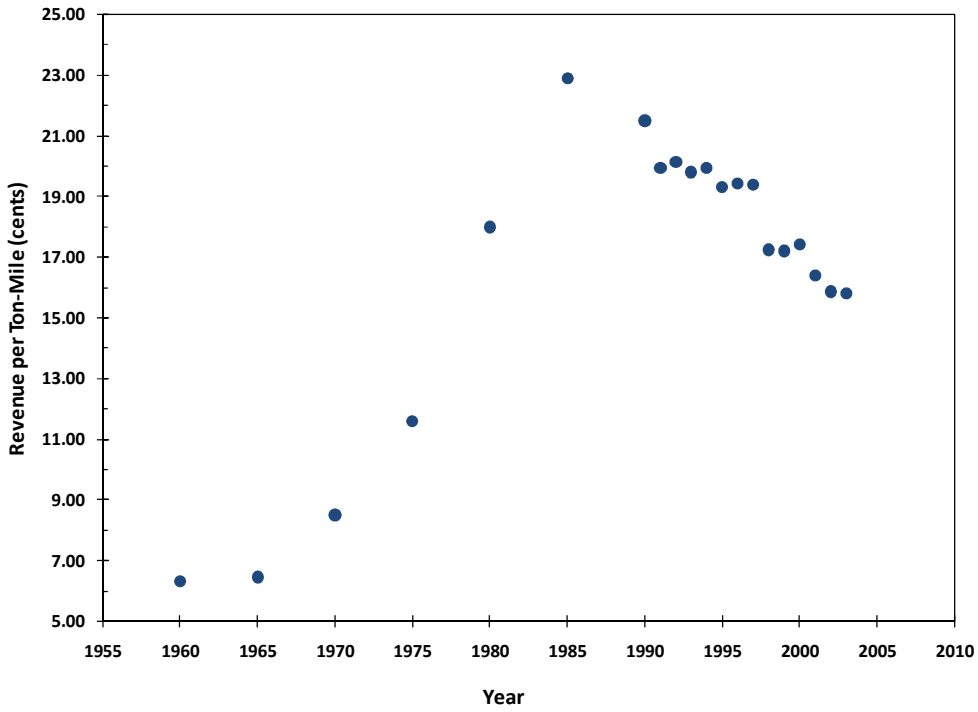
Source: Association of American Railroads, 2011

Historic Truck Shipping Rate Data

Figure 4.2 shows that truck revenue rates have also decreased over time, but no clear stabilization trend is evident from the plot of this data. Since the end of data collected for 2005, other reports indicate that truck revenues may be closer to 27.0 cents per ton-mile, a shipping cost five times higher than current Class I railroad rates of 5.0 cents per ton-mile.[10] Considering the unavailability of current (2010-2011) truck shipping rates, it may be reasonable to assume projected rates no less than 20.0 cents per ton-mile given forecasts for sustained higher energy costs into the future.

[10] Morrow, W.R., Griffin, W.M., and Matthews, H.S., Modeling Switchgrass Derived Cellulosic Ethanol Distribution in the United States, Environmental Science & Technology, Vol. 40, No. 9, 2006.

Figure 4.2 Inflation-Adjusted Historic Truck Revenue Rates in 2010 Dollars



4.2 SHORTLINE RAILROAD PRO FORMA ANALYSIS

Shortline railroads are often contracted by the owner of a rail line to provide rail services required under the infrastructure owner's common carrier obligation. In most instances, these shortline operators are one of many operators owned by a parent or holding company that specialize in providing transportation services (e.g., railroad switching, mechanical, and leasing services). For example, the Capital Metropolitan Transit Authority (Cap Metro) of Austin, Texas purchased from the City of Austin in 1998 a 162-mile rail line that was at one time owned by the Southern Pacific Railroad, and has provided continuous service to freight rail customers on the line through contracts with four different shortline operators since then. The current shortline operator, Austin & Western Railroad, is one of 23 railroads owned by Watco Companies that operates in 18 states.

The pro forma analysis used to forecast the shipping rate that a shortline railroad operator would need to charge shippers in West Texas assumes a typical scenario where the new rail line is owned by a separate entity and the shortline railroad company is contracted to provide freight rail service on the owner's behalf. The determination of a shipping rate for this scenario assumes that:

1. Shippers in West Texas that divert freight from truck to rail service pay the shortline railroad a tariff on a per railcar basis, and also pay to lease railcars from a Class I railroad or a railcar leasing company.

2. The shortline railroad bases the railcar tariff on the costs expected to be incurred in order to meet the demand for rail service (i.e., the tonnage expected to be diverted to rail) plus an acceptable rate of return on the expenditures made to meet this demand.
3. The shortline railroad is a newly established company rather than an expansion of service provided by other shortline or regional railroads that might exist within the region, even though existing railroads might in fact become interested in performing this service.
4. Railcars transported by the shortline interchange with a Class I railroad for delivery to their final destination.

Demand for Shortline Railroad Service

Truck-to-rail diversions have been forecasted to be almost 175,000 tons per year, with an average payload of approximately 70 tons per railcar (boxcar, gondola, hopper, etc.) and 17.5 tons per intermodal twenty-foot equivalent unit (TEU) container. Since intermodal flatbed railcars have a four-TEU capacity, these intermodal railcars are also assumed to have a total payload of 70 tons.[11]

Trains operated by the shortline railroad are assumed to consist of 25 railcars each with a maximum in-haul delivery time of four days, which leads to the need for approximately 100 trains per year (one train every 3 to 4 days). Since one train move is expected to occur about once every four days, and since the maximum in-haul delivery time is assumed to be four days, this analysis also assumes that only 25 railcars will be under lease by shippers at a cost of $15.00 per day en-route.[12]

Costs of Shortline Railroad Operations

Shortline railroad operations will incur costs associated with rolling stock, track maintenance, and labor expenses. After these expenses have been totaled, the cost is then inflated by an expected rate of return on investment to establish a tariff that the shortline railroad will charge per railcar to shippers in West Texas.

- **Rolling Stock:** This analysis assumes an average haul length of 150 miles, requiring two locomotives with an efficiency of 400 ton-miles per gallon to each be leased at a rate of $250 per day and consuming No. 2 Diesel at a cost of $3.00 per gallon. Since the cost of railcars will be incurred by shippers, the

[11] The AAR reports that average line haul freight payloads are actually about 61 tons per railcar in Class I Railroad Statistics, AAR – Policy & Economics Department, April 21, 2008.

[12] The inclusion of railcar lease costs actually has a negligible effect on shipping rates paid by shippers.

total cost of rolling stock to the shortline railroad is expected to be $698,125 per year.

- **Track Maintenance:** A maintenance-of-way cost of $2,000 per mile is assumed to maintain the condition of the new 286,000-pound capacity track in use by 100 trains per year comprised of 25 railcars each.[13] Leases for support vehicles, such as hi-rail or standard trucks, are assumed to cost $1,500 per month, and additional equipment expenses are assumed to cost $10,000 per year. The total cost of track maintenance is expected to be $548,000 per year.
- **Labor:** Labor costs are assumed to include one manager at a salary of $80,000 per year, four train crew members each at a salary of $50,000 per year, three track and signalmen each at a salary of $45,000 per year, and one support staff member at a salary of $35,000 per year. A multiplier of 2.5 times salary is applied to each employee to account for all overhead associated with the support of these personnel, giving a total expected labor cost of $1,125,000 per year.
- **Return on Investment:** The most recent Surface Transportation Board release on the cost of capital (cost of debt and shareholder equity) for Class I railroads indicates that the average (all Class I railroads) cost of capital is 10.75 percent. This analysis bases the necessary return on investment to equal the cost of capital, a minimum acceptable condition for sustainable business operations, and assumes that the shortline railroad's cost of capital (and consequently, the required return on investment) is 10.0 percent.

As shown in Table 4.2 the shortline railroad tariff must cover the following expenses on an annual basis.

Table 4.2 Annual Shortline Railroad Expenses

Item	Cost
Rolling Stock	$698,125
Track Maintenance	$548,000
Labor	$1,125,000
Total	**$2,371,125**
ROI at 10%	237,113
Total Required Revenue	**$2,608,238**

[13] Maintenance-of-way costs necessary to support through-movement of Class I rail freight (rail-to-rail diversions) must be collected from the Class I railroads in exchange for trackage rights granted by the rail line owner.

Shortline Railroad Tariff

The Table 4.2 indicates that a new shortline railroad will need to earn revenues equal to $2,608,238 per year in order to cover the cost of operations and earn a return on investment of 10 percent when moving 175,000 tons per year by moving approximately one train, each comprised of 25 railcars, every four days. The need for $2,608,238 in annual revenue translates to a tariff of $1,043 per railcar. On a ton-mile basis, this tariff equates to a shipping rate of 10.5 cents per ton-mile for shippers that chose to divert freight from truck to rail.

As a comparison, the tariff for moving rock approximately 41 miles by the Austin & Western Railroad on the Cap Metro line between Austin and Elgin is $650 per railcar. These railcars are likely to carry a payload closer to 100 tons per railcar rather than 70 tons (as assumed in the West Texas case), resulting in a shipping rate of approximately 16 cents per ton-mile. These findings indicate that shipping rates charged by shortline railroads can exceed the trends in shipping rates presented in Table 4.1.

Analysis of an Owner-Operator Business Model

The tariff analysis, above, assumes that the owner and financier of the new rail line is an entity separate from that of the rail service provider, with the rail service provider consisting of a shortline railroad company contracted by the owner to move freight between shippers in the West Texas region and a Class I railroad. Therefore, a second analysis has been prepared using an owner-operator business model, in which a single entity finances the new rail line through the obligation of revenues generated by rail service that it provides to shippers in West Texas.

The owner-operator business model assumes that the $1.0 billion capital cost of the new line is able to be financed at an interest rate of 3.0 percent over 30 years, resulting in an annual debt payment of approximately $51 million included in the list of cost items that need to be covered by operations. This scenario also assumes an increase in track maintenance and rolling stock costs (e.g., locomotive maintenance and fuel) required to accommodate the significant additions in tonnage needed to be handled by the shortline railroad in order to remain profitable. T

Table 4.3 lists the operating expenses necessary to support shortline railroad operations under the owner-operator business model, attributable to the need to handle volumes of freight great enough to offset the added expense of debt financing (i.e. the additional $51.02 million per year).

Table 4.3 Annual Shortline Railroad Expenses (Owner-Operator Model)

Item	Cost
Rolling Stock	$11,124,464
Track Maintenance	$1,060,000
Labor	$1,125,000
Debt Financing	$51,020,000
Total	**$64,329,464**
ROI at 10%	$6,432,946
Total Required Revenue	**$70,762,410**

Figure 4.3 compares the railcar tariff of approximately $1,040 required for a traffic volume of 175,000 tons per year in the original analysis to railcar tariffs necessary for the owner-operator to earn a return on investment of 10 percent at traffic volumes of 2.0, 3.0, 4.0, and 4.75 million tons per year. Figure 4.4 makes the same comparison of the shipping rates at these tonnages to the shipping rate of 10.5 cents per ton-mile in the original analysis.

The results of this owner-operator business model show that the tariff and shipping rate required for a 10 percent return on investment do not equal the $1,040 tariff and 10.5 cent shipping rate of the original analysis until traffic volumes reach 4.75 million tons per year. That is, the owner-operator business model does not become feasible unless the volume of freight can be increased from the original case by 4.575 million tons per year.

Figure 4.3 Effects of Tonnage Volume on Railcar Tariff for an Owner-Operator Business Model

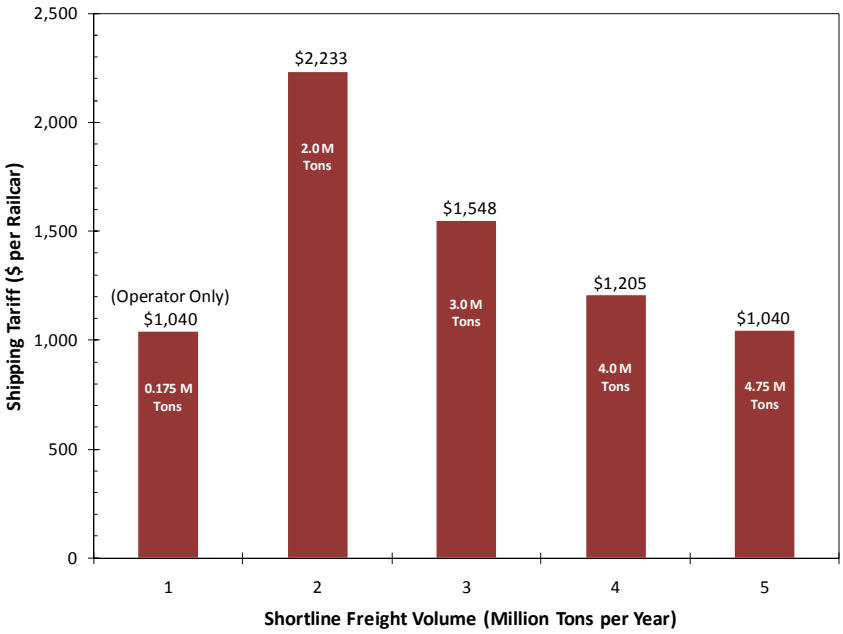
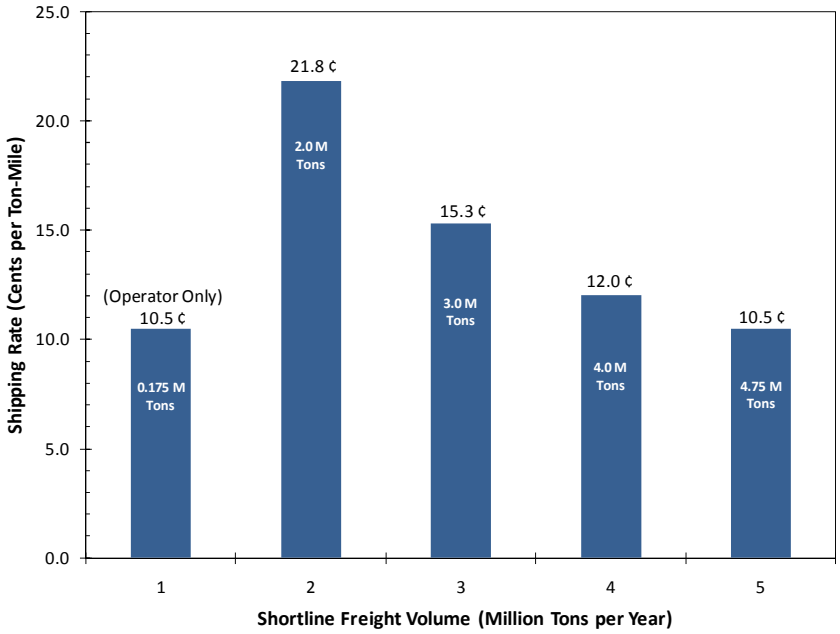


Figure 4.4 Effects of Tonnage Volume on Shipping Rate for an Owner-Operator Business Model



4.3 RAIL LINE REVENUE SUMMARY

The AAR data obtained from Class I railroads (Table 4.1) for commodities such as food, chemicals, petroleum, non-metallic minerals, primary metals, and intermodal freight range from 4.1 cents per ton-mile to 5.8 cents per ton-mile in 2009 dollars. The shipping rate of 10.5 cents per ton-mile determined to be necessary in this study for sustainable shortline railroad operations is comparable to rates for moving rock by shortline railroad service between Austin and Elgin. The basis of the 10.5 per ton-mile shipping rate is a tariff of approximately $1,040 per railcar to deliver 70-ton railcar payloads on average 150 miles by the shortline railroad, plus the cost of railcar leasing. This same movement of freight by truck is likely to cost shippers in excess of 20 cents per ton-mile.

The expectation for revenue from shortline railroad service to cover the $1.0 billion capital cost of the new rail line in addition to covering the railroad's operating costs (i.e., an owner-operator business model) increases annual expenses by more than $51 million. This significant increase in annual expenses has the effect of increasing the volume of traffic required to maintain a reasonable railcar tariff and shipping rate (i.e., a tariff of $1,040 and a shipping rate of 10.5 cents per ton-mile) by more than 4.5 million tons per year.

5.0 Findings and Future Opportunities

The results of the benefit-cost and rail revenue analyses for a potential West Texas Rail Corridor are sobering. As noted in Subsection 3.4, the maximum benefit-cost ratio is 0.42. A benefit-cost of 1.0, or better is desired to advance projects. Additionally, as noted in Subsection 4.4 of the rail line revenue analysis, in order to "break-even" from a self-supported financial perspective, 4.75 M tons need to be transported on the rail corridor, annually. These are daunting numbers and represent a significant shortfall in benefits to justify a $1B investment.

However, as a point of comparison, this study only calculated the benefit-cost ratio on truck-to-rail diversions. If rail-to-rail diversions are considered as input into the analysis, an addition 3.9M tons are input, and a maximum benefit-cost ratio of 1.34 is achieved. While this shows additional transportation system benefits can be achieved through rail diversions, the 3.9M tons are still short of the required 4.5M tons to make this rail line self-sufficient, and, as previously noted may be unrealistic to expect to divert.

Absent the guarantee of rail-to-rail diversions for this analysis, other local conditions should be considered as holding the potential to generate additional demand for the West Texas rail line. The ideas and opportunities presented in this section are a result of stakeholder interviews, and receipt of comments at each of the three steering committee meetings held during the course of study. The amount of traffic that could be generated by each development has not been quantified.

The following subsection provides ideas and opportunities that could generate additional traffic on the West Texas rail line.

5.1 BUSINESS ATTRACTION

As previously noted, the potential for induced demand (the possibility that shipping volumes may increase due to the presence of better rail options) was not considered as part of this analysis. However, it is valid to assume that this rail project could attract business and stimulate economic development and place additional demand on the rail line. Access to rail service is recognized as one of many critical conditions for business attraction potential. Investment in this rail linkage can spur development along the corridor. As part of stakeholder interviews, one interviewee was eager to see the development of a new rail line because they felt captive to a single Class I railroad. They believe that increased

competition would result in more favorable rail rates and service to shippers – which would also result in new business locating to the area.

5.2 EXPANSION DEMAND

Expansion demand is traffic generated from expansion of existing shippers located on the line or from new shippers that located or relocated to the area for its improved rail service. This is new demand resulting from expansion accruing in addition to the diversion. Few public studies describe the expansion demand potential of new rail facilities, especially in rural areas. Through the interviews conducted for this study, we identified several opportunities where the new alignment could provide service to "mega-shippers" - companies that have the potential to bring significant traffic to this corridor. These businesses include:

- **Wind turbine manufacturing.** Located in San Angelo, this facility is currently operational but does not have rail access. A spur is planned to connect to the South Orient Rail Line. The West Texas rail corridor could provide north-south connectivity for transporting wind turbine components.
- **Gasification facility.** A gasification plant is being constructed by Summit Energy in Penwell. As part of this development, the Union Pacific Railroad will provide service to the plant via a rail spur. Given the proximity of the West Texas rail corridor, there is potential for raw materials (sand, water) and processed gases to be transported to/from the facility on a north-south rail line.
- **Industrial park**. On the outskirts of Odessa, Flint Hill is an abandoned industrial park (1,100 acres) with an existing rail spur; the only rail spur still in existence in the area that presents the community some potential for generating new business/attracting companies. Flint Hill Petrochemical closed several years ago, but has capacity for 450 rail cars. There is also additional land for expansion and the Odessa Economic Development Corporation is working with local companies to re-establish the activity in park. The West Texas rail line could potentially serve this development.
- **Nuclear waste disposal.** This industry is very dependent on rail, with the vast majority of incoming waste from East Coast markets. It is expected that the facility will grow substantially in the next few years (over 3 million square yards of near-surface disposal has been planned for expansion by 2014 resulting in up to 700 rail carloads by that time). Currently the site is served by the Texas-New Mexico shortline railroad via a connection with Union Pacific Railroad (and to a certain extent by CSXT). If the supply chain shifts for this business in the future, (i.e. waste is transported to the facility from areas other than the East Coast) there could potentially be a role for a north-south rail corridor.

In addition to these site-specific industries, it was mentioned that a new rail line could support existing thriving businesses in the region, especially the cotton

and grain sorghum hybrid business along the corridor. Recognizing that the interview process for this study was limited, there are likely other shippers that could be attracted to the region by the new rail service, but an estimate would be nothing more than an educated guess.

5.3 BUILD ON EXISTING, ON-GOING INVESTMENTS IN THE REGION

Several interviewees mentioned that by constructing this rail line, they believe that shippers in the region would be able to eventually make use of Mexican ports instead of relying on Class I railroads to ship to congested U.S. West Coast ports of L.A. and Long Beach. This includes a connection to Mexican rail (which leads to Mexican Pacific Coast Ports) near Del Rio, as well as through the South Orient Rail Line to the Mexican port of Topolobampo through the border town of Presidio. While these proposals are ambitious, they may not be unrealistic considering several developments underway.

- **Presidio Bridge reopening.** There are plans underway for this bridge that had suffered fire damage to reopen, again in the next two years. While traffic on this line had been in decline (or absent) at the time of the closure (as a result of track class and slow speed limitations), a north-south rail line connecting to the South Orient Rail Line could provide the link needed to drive demand at that border crossing.
- **Border initiatives.** The TxDOT has contracted with the Center for Transportation Research to undertake the Border Master Planning study. As part of this effort current and planned future capacity of ports of entry, and the bi-national transportation infrastructure serving those points will be reviewed and improvement investments, prioritized. Of the concerns of this project, border crossings and their condition are critical to success. The Eagle Pass alternative is attractive because it is an existing crossing, however, the crossing would require significant coordination with Union Pacific to serve it.

  The Del Rio crossing is also a concern. No rail bridge currently crosses the Rio Grande and the potential bridge location has been compromised on the Mexican-side through the removal of previously-existing infrastructure and development on the old railroad line. This bi-national effort could prioritize the Del Rio rail crossing and provide this study a lower cost option to connect to Mexico. It is our understanding that there is a significant rail market on the border region that could be served by this rail line, as the trend of Mexican businesses is to open in the U.S. so they are able to sell their product as "Made in the U.S.A."
- **Intermodal expansions.** There are several rail expansions on-going in the region. In November the city of Levelland, Texas opened an $8.6 million industrial rail park. The park encompasses 240-acres and is located along a West Texas & Lubbock Railway line. City officials expect the park to create

1,000 jobs and generate $100 million in new capital investment during the next 10 years[14]. A north-south rail line connecting to the West Texas & Lubbock could not only increase the economic activity at the industrial park, but could also benefit from directly serving industry. Continued investment in establishing intermodal and transload facilities along the West Texas rail shed will enable system interconnectivity and increase the likelihood of traffic to choose use of the new rail corridor.

- **Track Improvements.** During stakeholder interviews, track improvements to the rail line east of San Angelo were mentioned several times as an example of how improved rail infrastructure can benefit businesses and the region. For one, these track improvements contributed to the region landing a new green energy production plant (i.e. wind turbines). In addition, several agricultural businesses are happy with how goods are moved more efficiently and effectively from the region to eastern destinations because of the track improvements. Continued investment in upgrading and maintaining existing infrastructure holds the potential to make using a West Texas rail line that connects to upgraded track more attractive.

[14] Progressive Railroading

A. Results of Phased Rail Corridor Development (Midland-Odessa to Lubbock)

The phased development alternative evaluates the diversion to the West Texas Rail Corridor if constructed between Midland-Odessa to Seagraves, only. This is done for two purposes: 1) to understand the demand should this segment be a starting point for corridor construction, and 2) to provide comparison between the Permian Basin Rail Study.

Base and Planning Case Analyses

Modal Diversions

Table A.1 indicates the modal diversions summary for the phased development scenario. The commodity groups are sorted by the decreasing order of total rail tons diverted.

The total freight demand of divertible flows in the first phase of the development is about 15.2 million tons annually, the SAM V2 mode choice model was applied on this flow to estimate the Base and Planning Case modal demands. This resulted in an estimated 3.63 million annual tons of rail carload flows and an estimated 0.11 million annual tons of rail intermodal flows, together they make about 24.6% of the total demand related to the identified OD pairs.

As a direct result of the first phase development of the West Texas rail connection, the demand for rail carload is expected to go up by about 71,600 tons annually and the demand for rail intermodal is expected to go up by about 11,500 tons annually. The value is almost half of what was obtained for the full development of the West Texas rail connection. This also means increases of about 880 carload trips annually and about 633 TEUs annually, while saving about 3,600 truck trips annually, which will no longer use the Texas roadways.

Table A.1 Modal Diversions for the West Texas Rail Connection by Commodity Group (Midland-Odessa to Lubbock, TX)

Commodity Group	Scenario	Rail Carload*	Rail Intermodal*	Truck*	TOTAL	Rail Carload %	Rail Intermodal %	Truck %
	Base Case (tons)	89,798	7,656	1,687,339	1,784,792	5.0%	0.4%	94.5%
	Planning Case (tons)	111,970	9,507	1,663,316	1,784,792	6.3%	0.5%	93.2%
11 (Chemicals)	Diversion (tons)	22,172	1,851	-24,023	0	6.3%	0.5%	93.2%
	Payload Factor	91.23	18.35	21.82				
	Diversion (units)	243	101	-1,101				
	Base Case (tons)	101,333	38,122	1,756,670	1,896,124	5.3%	2.0%	92.6%
	Planning Case (tons)	113,489	42,166	1,740,469	1,896,124	6.0%	2.2%	91.8%
5 (Food)	Diversion (tons)	12,157	4,043	-16,200	0	6.0%	2.2%	91.8%
	Payload Factor	83.22	19.81	24.07				
	Diversion (units)	146	204	-673				
	Base Case (tons)	25,455	256	2,755,637	2,781,348	0.9%	0.0%	99.1%
	Planning Case (tons)	38,732	387	2,742,229	2,781,348	1.4%	0.0%	98.6%
12 (Petroleum)	Diversion (tons)	13,277	130	-13,408	0	1.4%	0.0%	98.6%
	Payload Factor	82.04	18.62	25.42				
	Diversion (units)	162	7	-527				
	Base Case (tons)	21,293	5,610	824,956	851,859	2.5%	0.7%	96.8%
	Planning Case (tons)	28,665	7,412	815,783	851,859	3.4%	0.9%	95.8%
14 (Primary Metal)	Diversion (tons)	7,372	1,801	-9,173	0	3.4%	0.9%	95.8%
	Payload Factor	84.71	19.7	26.01				
	Diversion (units)	87	91	-353				
4 (Nonmetallic Minerals)	Base Case (tons)	118,053	10,999	1,017,723	1,146,776	10.3%	1.0%	88.7%

Commodity Group	Scenario	Rail Carload*	Rail Intermodal*	Truck*	TOTAL	Rail Carload %	Rail Intermodal %	Truck %
	Planning Case (tons)	125,000	12,140	1,009,636	1,146,776	10.9%	1.1%	88.0%
	Diversion (tons)	6,947	1,141	-8,087	0	10.9%	1.1%	88.0%
	Payload Factor	98.34	18.24	22.17				
	Diversion (units)	71	63	-365				
13 (Clay, Concrete, Glass)	Base Case (tons)	15,828	1,331	921,982	939,140	1.7%	0.1%	98.2%
	Planning Case (tons)	19,479	1,643	918,018	939,140	2.1%	0.2%	97.8%
	Diversion (tons)	3,651	312	-3,963	0	2.1%	0.2%	97.8%
	Payload Factor	91.13	15.46	17.01				
	Diversion (units)	40	20	-233				
10 (Paper)	Base Case (tons)	9,205	4,266	265,256	278,727	3.3%	1.5%	95.2%
	Planning Case (tons)	10,892	5,096	262,739	278,727	3.9%	1.8%	94.3%
	Diversion (tons)	1,687	830	-2,517	0	3.9%	1.8%	94.3%
	Payload Factor	67.68	16.65	25.32				
	Diversion (units)	25	50	-99				
15 (Misc. Mix & Secondary)	Base Case (tons)	2,322	627	539,227	542,176	0.4%	0.1%	99.5%
	Planning Case (tons)	3,699	969	537,508	542,176	0.7%	0.2%	99.1%
	Diversion (tons)	1,377	342	-1,720	0	0.7%	0.2%	99.1%
	Payload Factor	53.55	13.31	19.45				
	Diversion (units)	26	26	-88				
8 (Lumber)	Base Case (tons)	7,097	1,622	441,422	450,140	1.6%	0.4%	98.1%
	Planning Case (tons)	8,421	1,912	439,807	450,140	1.9%	0.4%	97.7%
	Diversion (tons)	1,325	290	-1,615	0	1.9%	0.4%	97.7%
	Payload Factor	76.98	16.63	26.86				

Commodity Group	Scenario	Rail Carload*	Rail Intermodal*	Truck*	TOTAL	Rail Carload %	Rail Intermodal %	Truck %
	Diversion (units)	17	17	-60				
9 (Durable Manufacturing)	Base Case (tons)	7,773	1,230	615,236	624,239	1.2%	0.2%	98.6%
	Planning Case (tons)	8,932	1,395	613,913	624,239	1.4%	0.2%	98.3%
	Diversion (tons)	1,158	164	-1,323	0	1.4%	0.2%	98.3%
	Payload Factor	22.47	12.02	16.46				
	Diversion (units)	52	14	-80				
7 (Non-Durable Manufacturing)	Base Case (tons)	1,752	1,927	251,860	255,540	0.7%	0.8%	98.6%
	Planning Case (tons)	2,240	2,464	250,835	255,540	0.9%	1.0%	98.2%
	Diversion (tons)	488	537	-1,025	0	0.9%	1.0%	98.2%
	Payload Factor	39.92	13.8	13.32				
	Diversion (units)	12	39	-77				
6 (Consumer Manufacturing)	Base Case (tons)	26	292	78,956	79,275	0.0%	0.4%	99.6%
	Planning Case (tons)	29	317	78,929	79,275	0.0%	0.4%	99.6%
	Diversion (tons)	2	25	-27	0	0.0%	0.4%	99.6%
	Payload Factor	15	14.96	19.25				
	Diversion (units)	0	2	-1				
3 (Coal)	Base Case (tons)	741,383	0	1	741,383	100.0%	0.0%	0.0%
	Planning Case (tons)	741,383	0	1	741,383	100.0%	0.0%	0.0%
	Diversion (tons)	0	0	0	0	100.0%	0.0%	0.0%
	Payload Factor	112.92	NA	26.49				
	Diversion (units)	0	NA	0				
1 (Agriculture)	Base Case (tons)	2,485,355	34,715	303,740	2,823,810	88.0%	1.2%	10.8%
	Planning Case (tons)	2,485,355	34,715	303,740	2,823,810	88.0%	1.2%	10.8%

Commodity Group	Scenario	Rail Carload*	Rail Intermodal*	Truck*	TOTAL	Rail Carload %	Rail Intermodal %	Truck %
	Diversion (tons)	0	0	0	0	88.0%	1.2%	10.8%
	Payload Factor	99.31	21.09	22.36				
	Diversion (units)	0	0	0				
2 (Mining)	Base Case (tons)	3,094	34	6,466	9,594	32.3%	0.4%	67.4%
	Planning Case (tons)	3,094	34	6,466	9,594	32.3%	0.4%	67.4%
	Diversion (tons)	0	0	0	0	32.3%	0.4%	67.4%
	Payload Factor	89.29	NA	27.45				
	Diversion (units)	0	NA	0				
Total	Base Case (tons)	3,629,765	108,688	11,466,469	15,204,923	23.9%	0.7%	75.4%
	Planning Case (tons)	3,701,379	120,156	11,383,388	15,204,923	24.3%	0.8%	74.9%
	Diversion (tons)	71,614	11,468	-83,081	0	24.3%	0.8%	74.9%
	Diversion (units)	880	633	-3,659				

Source: TxDOT SAM V2 Freight Mode Choice Modeling, Cambridge Systematics, Inc.

*The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals.

The top five commodity groups that show a sharp increase in rail share with the new West Texas rail connection are: a) Chemicals; b) Food[15]; c) Petroleum; d) Primary Metal; and e) Non-metallic minerals. Together, they account for 86% of rail carload diversions and 83% of rail intermodal diversions from trucks by annual tonnages.

Further, we summarize the modal diversions by trade type in Table A.2. Due to the location of the new rail links, the first phase of development has almost no effect on the U.S.-Mexico North American Free Trade Agreement (NAFTA) flows. Nearly all of the diversions are domestic in scope.

Table A.2 Modal Diversions for the West Texas Rail Connection by Trade Type (Midland-Odessa to Lubbock, TX)

Trade Type	Scenario	Rail Carload*	%Change of Rail Total	Rail Intermodal*	%Change of Rail Total	Truck*
All Flows	Base Case (tons)	3,629,765		108,688		11,466,469
	Planning Case (tons)	3,701,379		120,156		11,383,388
	Diversion (tons)	71,614	85%	11,468	15%	-83,081
Domestic Flows	Base Case (tons)	1,090,487		53,587		9,769,718
	Planning Case (tons)	1,161,556		64,904		9,687,331
	Diversion (tons)	71,069	87%	11,317	13%	-82,386
	% Diversion of All Flows	99%		99%		99%
International Flows	Base Case (tons)	2,539,279		55,101		1,696,752
	Planning Case (tons)	2,539,823		55,252		1,696,057
	Diversion (tons)	544	79%	151	21%	-695
	% Diversion of All Flows	1%		1%		1%

Source: TxDOT SAM V2 Freight Mode Choice Modeling, Cambridge Systematics, Inc.

*The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals.

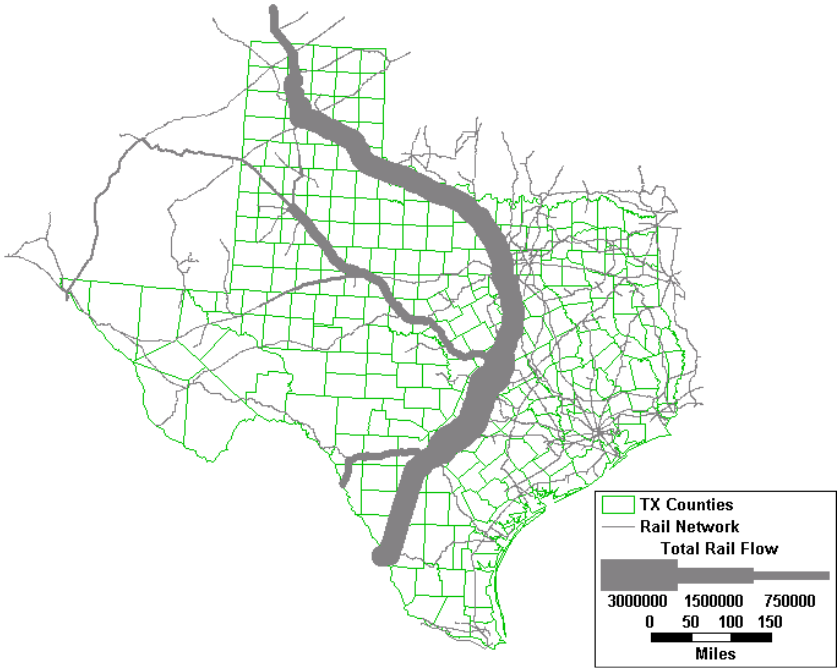
[15] Commodity is a consideration-factor in mode choice, i.e. some commodities are better suited for truck transport, while others are suited for rail, so diversion is calculated accordingly. The top diverting commodity in this analysis is shown to be Food. This may be a data anomaly as diverting food (like time-sensitive or refrigerated items) from truck to rail may not be feasible unless these are bulk items like grains.

Route Diversions

The Base Case rail freight flows of identified OD pairs is about 3.74 million annual tons (about 25% of total existing demand), these were routed on the existing rail network. Only due to slight differences in the OD pairs selected between full and first phase development of the West Texas rail connection, the rail flows in the Base Case (See Figure A.1) are having a similar pattern. Since the first phase of the development does not extend to the U.S.-Mexico border, and there is not much east-west rail demand that is likely to use the new rail links (as per the figure), diversions within rail may not be as important as truck-to-rail diversions.

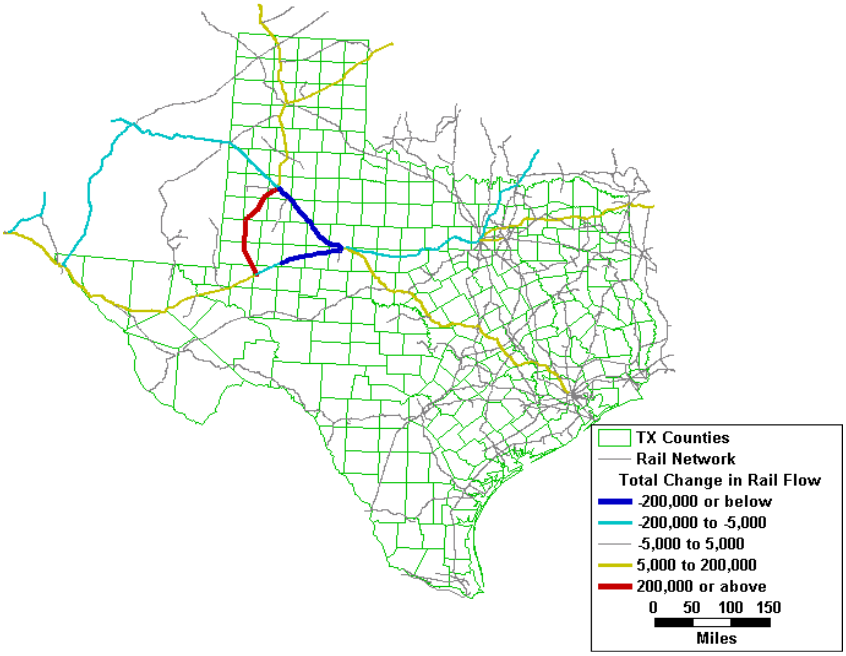
The change in flows over the rail network as a result of the first phase development of West Texas rail connection are shown in Figure A.2. As anticipated above, the rail-to-rail diversion is very minimal in the first phase. It does not affect the statewide flows significantly.

Figure A.1 Base Case Rail Flows on the Rail Network (Midland-Odessa to Lubbock, TX)



Source: ORNL Rail Network Routing, Cambridge Systematics, Inc.

Figure A.2 Route Diversions on Rail Network for the West Texas Rail Connection (Midland-Odessa to Lubbock, TX)



Source: ORNL Rail Network Routing, Cambridge Systematics, Inc.

Regional Ton-Mile Diversions

To estimate the total travel impact of the first phase development of West Texas rail connection on the transportation system, rail ton-mile diversions were estimated for the divertible flows. The summaries were made using defined regions and are shown in Table A.3 below.

Due to the limited rail-to-rail diversion potential of the first phase development, unlike the full development there is no reduction in rail ton-miles on a statewide basis. In contrary, there is an increase in rail ton-miles of 65.1 million ton-miles annually, which is small compared to the Base Case value. The new rail line is expected to have an increase in ton-miles of about 68 million ton-miles annually.

Table A.3 Regional Rail Ton-Mile Diversions for the West Texas Rail Connection by Trade Type (Midland-Odessa to Lubbock, TX)

Trade Type	Scenario	Texas*	Study Area Zones*	Study Area Network*
All Flows	Base Case (tons)	2,520,000,006	107,838,738	5,213,273
	Planning Case (tons)	2,585,104,447	180,378,123	74,132,067
	Diversion (ton-miles)	65,104,441	72,539,385	68,918,794
Domestic Flows	Base Case (tons)	747,242,817	74,360,015	5,181,053
	Planning Case (tons)	786,105,154	131,630,673	63,608,756
	Diversion (ton-miles)	38,862,336	57,270,659	58,427,703
	% Diversion of All Flows	60%	79%	85%
International Flows	Base Case (tons)	1,772,757,189	33,478,724	32,220
	Planning Case (tons)	1,798,999,293	48,747,450	10,523,311
	Diversion (ton-miles)	26,242,104	15,268,726	10,491,091
	% Diversion of All Flows	40%	21%	15%

Source: Regional Ton-miles Estimation, Cambridge Systematics, Inc.

* The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals. Study Area Zones are study area identified counties in the Phase 1 Report and all the links lying within or touching the boundary of the study area are included. Study Area Network consists of West Texas rail connection and its parallel highway network as identified in the Phase 1 Report.

Now taking a look at the truck ton-miles in Table A.4, there is an unexpected slight increase in statewide international truck ton-miles. Otherwise, the reduction in tons moved by trucks is resulting in a decrease in ton-miles.

Table A.4 Regional Truck Ton-Mile Diversions for the West Texas Rail Connection by Trade Type (Midland-Odessa to Lubbock, TX)

Trade Type	Scenario	Texas*	Study Area Zones*	Study Area Network*
All Flows	Base Case (tons)	6,242,992,050	1,056,425,606	806,923,931
	Planning Case (tons)	6,138,724,715	1,032,605,386	795,161,835
	Diversion (ton-miles)	-104,267,336	-23,820,220	-11,762,096
Domestic Flows	Base Case (tons)	4,765,692,549	1,021,866,647	782,333,611
	Planning Case (tons)	4,656,090,861	998,573,090	771,193,879
	Diversion (ton-miles)	-109,601,688	-23,293,557	-11,139,731
	% Diversion of All Flows	NA	98%	95%
International Flows	Base Case (tons)	1,477,299,502	34,558,959	24,590,321
	Planning Case (tons)	1,482,633,854	34,032,295	23,967,955
	Diversion (ton-miles)	5,334,352	-526,663	-622,365
	% Diversion of All Flows	NA	2%	5%

Source: Regional Ton-miles Estimation, Cambridge Systematics, Inc.

* The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only. These are not statewide totals. Study Area Zones are study area identified counties in the Phase 1 Report and all the links lying within or touching the boundary of the study area are included. Study Area Network consists of West Texas rail connection and its parallel highway network as identified in the Phase 1 Report.

Rail Ton-Miles and Average Rail Flow Attracted by New Rail Segments

Focusing on the new rail segments as defined in the Phase 1 Report that form part of the first phase of the West Texas rail connection, the expected ton-miles and average flow tons are indicated in Table A.5. To give a comparison, the value of rail average flow tons or ton-miles added for Midland/Odessa to Seminole in full development case is more than 6 times that found in the first phase development. Overall, it seems reasonable to say that the project cannot be stopped at the Phase 1, it needs to be expanded to the border, especially to capture the international flows.

Table A.5 Rail Ton-Miles and Average Rail Flow for the West Texas Rail Connection by New Rail Segment (Midland-Odessa to Lubbock, TX)

Segment Start	Segment End	Rail Ton-Miles Added	Segment Length (miles)	Average Rail Flow (Tons)
Midland/Odessa	Seminole	34,362,119	55.5	619,137
Seminole	Seagraves	11,120,745	21.2	524,563
Seagraves	Lubbock	23,257,306	54.4	427,524
Total		68,740,171	131.1	

Source: ORNL Rail Network Routing, Cambridge Systematics, Inc.

The values correspond to the annual total for OD pairs with flows divertible to the West Texas Rail Connection only.

B. Benefit-Cost Summary (All Diversions)

Section 3.0 of this report presents the benefit-cost summary of only those diversions from truck-to-rail. This Appendix quantifies benefit-costs from rail-to-rail diversions in addition to those from truck-to-rail. In this case, the benefit-cost result demonstrates that investment in the West Texas rail linkage will provide significant benefits in shipper cost savings, reduced pavement impacts, improved safety, and better air quality. Jobs and wages are created to fuel the region's economy. However, as stated in Section 2.0, including rail-to-rail diversions may not be realistic due to the classification operations that are in place for Class I railroads within the corridors this traffic may be diverted from.

Driven largely by the estimated $1.0B in transportation cost savings for local, domestic, and international shippers making freight movements to, from, and through West Texas, the benefit-cost ratio for all three alternatives is greater than one. This indicates that the project will generate benefits that exceed the cost over the analysis period.

Table B.1 Total Costs and Benefits (Millions of Real 2010 Dollars)

	Item	Alt 1	Alt 2	Alt 3
Costs	Construction	1,048	987	1,416
	Operations and Maintenance	143	140	200
	Total Costs	**1,191**	**1,127**	**1,616**
Benefits	Shipper Cost Savings	1,007	1,007	1,007
	State of Good Repair	41	41	41
	Safety	26	26	26
	Environmental	98	98	98
	Residual Value	419	395	566
	Total Benefits	**1,591**	**1,567**	**1,739**
	Benefit-Cost Ratio	**1.34**	**1.39**	**1.08**

Table B.2 Employment and Wage Benefits

Item	Alt 1	Alt 2	Alt 3
FTE Jobs Created by Construction *(2012-2015)**	22,700	21,400	30,700
Wages Created by Construction *(2012-2015)*	$866.5 M	$815.9 M	$1,170.5 M
FTE Jobs Created by Railroad Operations *(2015-2045)**	1,700	1,700	2,400
Wages Created by Railroad Operations *(2015-2045)*	$80.2 M	$78.5 M	$112.2 M

*Rounded to the nearest hundredth.