Texas A&M Transportation Institute

Improvement of Locomotive and Rail Yard Activity Data Sourcing and Accuracy Project

Final Report

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EXECUTIVE SUMMARY

The Texas Commission on Environmental Quality (TCEQ) is required to submit periodic emissions inventories (EI) for all 254 Texas counties under the Air Emissions Reporting Requirements (AERR) to support the Environmental Protection Agency's (EPA's) comprehensive three-year cycle National Emissions Inventory (NEI), as well as supporting state implementation plan (SIP) development and air quality planning. This includes routine development of statewide EI for all locomotive and rail yard source categories in Texas.

The objective of this project was to:

- Streamline and improve the development of locomotive and rail yard source EIs by exploring and assessing various open-source data sets, such as freight analysis framework (FAF) data, to provide additional potential resources for obtaining activity data such as fuel usage and fleet-mix data.
- Develop an updated Texas-specific fleet-mix by Class I, Class III, Class I yard, Class III yard, commuter, and passenger operators and an improved EI of switching yard sources, including those located in critical nonattainment areas, through various comprehensive data mining efforts.

The Texas A&M Transportation Institute (TTI) conducted extensive literature and data source reviews to identify the most suitable datasets for obtaining line-haul activity and improving the railyard location inventory. These datasets included: (i) the FAF data, Transportation Routing Analysis Geographic System (TRAGIS), and Statewide Analysis Model (SAM) for use in distributing statewide Class I fuel consumption to different Texas counties, (ii) Class III fuel usage factor from American Short Line and Regional Railroad Association (ASLRRA) along with track ownership and track rights data contained within North American Rail Lines (NARL) for use in estimating the statewide fuel consumption and distribution for Class III operators, (iii) fuel consumption data for Amtrak from the Bureau of Transportation Statistics (BTS) and other commuter rail fuel consumption data directly from individual commuter rail operators, and (iv) recent fleet mix data for Class I and Class III operators from the Association of American Railroads (AAR) and Railinc for use in emissions calculations.

Accurate rail yard fuel consumption estimates need detailed studies. TTI conflated the previously developed Eastern Research Group (ERG), Eastern Regional Technical Advisory Committee (ERTAC), and NARL yard location inventories to develop a unified list of rail yard locations. TTI identified 541 rail yards for Texas, 324 of which were present in the 366 yards identified by ERTAC in 2017. There were 42 yards included in the ERTAC inventory that either did not have nearby tracks on the NARL shapefile or had a duplicate yard nearby. Thus, these yards were excluded from this study. TTI also identified 217 additional yards based on the satellite view of the area near the NARL yard and minor industrial lead lines not included in the 2017 ERTAC study. Since these 217 yards were absent in previous NEIs, they do not have an associated Emission Inventory System (EIS) ID. These yards need to be added to the EPA's EIS and assigned corresponding unique emission unit identifiers and unit emission process identifiers for these yards to be incorporated into the next NEI submittal.

In addition to identifying yards, TTI conducted a sensitivity analysis for four scenarios: a base case that is the same as the 2020 Texas Locomotive and Rail Yard AERR EI study and three alternative scenarios where either the fleet mix, fuel distribution, or both were altered.

TTI also performed the sensitivity analysis for ozone non-attainment areas, which shows a slight increase in emissions for San Antonio (SAN) and Dallas-Fort Worth (DFW) areas, and a slight decrease in Houston-Galveston-Brazoria (HGB) and El Paso (ELP) area emissions, if only the activity distribution is updated. When both activity and fleet mix were updated, SAN and DFW areas saw a noticeable increase in net emissions, the HGB area saw a minor increase in net emissions, and the ELP area saw a decrease in nitrogen oxides (NOx). For the ELP PM10 non-attainment area, updating just the activity distribution yields a decrease in emissions, whereas updating both fleet mix and activity instead yields an increase.

1 INTRODUCTION

1.1 Background

The TCEQ is responsible for developing the EI of locomotive and rail yard sources to support SIP development, meet federal EPA EI requirements, such as the AERR, and for emissions trend analyses.

The emissions sources for these EIs include six source classification codes (SCC): four for line-haul locomotive source categories and two for switching yard locomotive source categories. The line-haul locomotive SCCs are all reported under the nonpoint data category. Depending on the applicable reporting requirement, yard locomotives may be reported using either the SCC nonpoint or point data category, as shown in Table 1 below.

Table 1. Mobile – Locomotives Sector Emissions Sources by SCC and Data Category.

SCC[1]	SCC Description (Levels 1 through 4)	Data Category
2285002006	Mobile Sources; Railroad Equipment; Diesel; Line-Haul Locomotives: Class I Operations	Nonpoint
2285002007	Mobile Sources; Railroad Equipment; Diesel; Line-Haul Locomotives: Class II / III Operations	Nonpoint
2285002008	Mobile Sources; Railroad Equipment; Diesel; Line-Haul Locomotives: Passenger Trains (Amtrak)	Nonpoint
2285002009	Mobile Sources; Railroad Equipment; Diesel; Line-Haul Locomotives: Commuter Lines	Nonpoint
2285002010	Mobile Sources; Railroad Equipment; Diesel; Yard Locomotives	Nonpoint
28500201	Internal Combustion Engines; Railroad Equipment; Diesel; Yard Locomotives	Point

[1] These are the active SCCs for reporting locomotive and rail yard emissions (United States Environmental Protection Agency, 2016)

Locomotive activity in the form of fuel consumption is requested for EI development from various railroad operators for all counties and yards in Texas. Acquiring the data needed for estimating locomotive activity and activity distributions for inventory development is resource intensive.

In 2020, TTI contacted all passenger, commuter, and Class I locomotive operators and 49 of the 55 Class III operators to collect Texas railroad activity data. However, the responses received were limited, as shown in Table 2. Therefore, surrogate activity measures were required for developing updated EIs. These included national or state-level fuel consumption, fuel consumption rates, track mileage, and tonnage density.

Table 2: Summary of Railroad Data Collection Results.

Railroad Class	Number Operating in Texas	Facilities Contacted	Percent Contacted	Responses Received	Percent Responded
Class I	3	3	100%	1	33%
Class III	55	49	90%	10	20%
Regional Transit Rail	2	2	100%	2	100%
Total	**60**	**54**	**90%**	**13**	**24%**

Additionally, the counts of rail yards were different in two of the previously developed Texas locomotive EIs, one completed by the ERG and another by the ERTAC. This discrepancy in the number of yards led to inconsistent estimation and assignment of point source emissions.

This study by TTI aims to improve the locomotive and rail yard emissions estimates for TCEQ by:

1. finding alternate activity data sources,
2. reconciling the differences in identified rail yards (and their locations) between different sources.

1.2 Scope

This report was developed as part of Task 6 of the study and documents all parts of the *Improvement of Locomotive and Rail Yard Activity Data Sourcing and Accuracy Project*. The project can be broadly categorized into four parts:

1. Literature Review and Locomotive and Rail Yard Activity Data Gathering (Task 3), including:
    a. Brief descriptions of the approaches used to estimate activity in prior Texas locomotive EIs and California's approach.
    b. Discussion of the different data sources reviewed for this task.
2. Data Processing, Analysis, and Development of Pre-processing Procedures (Task 4), including:
    a. Revisions to the line-haul activity source and estimation methodology.

   b. Changes to the yard inventory and activity distribution.
3. Assessment of Emissions Impact (Task 5), and
4. Draft and Final Reports (Task 6).

1.3 Organization

This report is organized into six main sections. Chapter 2 discusses previous studies on activity estimation for locomotive EI development, which includes different studies from Texas and California. Chapter 3 covers the different data sources the TTI study team reviewed. Chapter 4 describes the revised methodology for assigning ERTAC yards from the 2017 NEI to the NARL shapefile and identifies the new yards that need to be added to the EPA's EIS. Chapter 4 also documents the activity estimation, which discusses the revisions to the line-haul and rail yard activity estimation procedures used in the most recent 2020 Texas Locomotive and Rail Yard AERR EI. The study team documented the EI sensitivity analysis results for four scenarios in Chapter 5. Finally, a summary of the findings and conclusions is listed and discussed in Chapter 6.

2 PREVIOUS STUDIES ON ACTIVITY ESTIMATION

This chapter reviews and describes approaches used to estimate activity in previous locomotive EIs.

A main focus in the previous studies on locomotive EI development was quantifying activity by different locomotive sources (defined by SCCs) needed to estimate locomotive emissions. Activity data can have various forms and components, such as fuel usage at different spatiotemporal levels, fleet mix of the locomotive engines, idling durations for yard switchers, etc. The following section focuses on previous studies' fuel consumption estimation and distribution methodology. The geographical focus is on previous "Texas" EIs only, as they can provide helpful information particular to the Texas region. The California EI approach has some different aspects compared to the Texas approach; thus, for an outside perspective, a review of California's EI development methods was also included in this chapter.

2.1 CLASS I ACTIVITY ESTIMATION

Class I locomotives are the most significant source of locomotive emissions. Previous studies have used different methodologies to predict county or line segment fuel consumption for line-haul locomotives, depending on the availability of activity data. For line-haul activity datasets such as tonnage density on different tracks, track density can distribute statewide or nationwide emissions to a smaller spatial scope (such as line segments or counties). The Federal Railroad Administration's (FRA) Millions of Gross Tons (MGT) per route mile data is one of the best sources of line-haul activity data. It is available at the link-level resolution. However, it is not easy to acquire as it is confidential, and the data release needs various stakeholders' approval. Therefore, in the absence of FRA MGT data, many previous studies have tried to estimate line-haul activity using previous inventories or surrogate data sources that are readily available.

The Class I activity estimation approaches used for 2020, 2017, and 2014 Texas locomotive EIs (developed to meet the AERR) are highlighted below, followed by some basics of the California Class I locomotive EI development approach.

2.1.1 Texas

For the 2020 Locomotive and Rail Yard AERR EI, TTI (Venugopal et al., 2021, 2020) collected Class I nationwide fuel data from Burlington Northern Santa Fe (BNSF), Kansas

City Southern (KCS), and Union Pacific (UP) through the R-1 reports[1] provided by the Surface Transportation Board (STB). The TTI study team then computed the percent of freight flow in Texas compared to nationwide from rail freight flow statistics available from the Bureau of Transportation Statistics (BTS) (USDOT BTS, 2019) to estimate the fuel consumption portion for Texas. Freight flow was considered a good surrogate for fuel consumption. It thus was used for estimating Texas's fuel consumption from national-level data. The study team subsequently used the 2017 ERTAC study to estimate the distribution of fuel consumption within each county with respect to statewide fuel consumption. The underlying data for the ERTAC study was FRA's MGT traffic density data (Harrell and Janssen, 2019). TTI used EPA's large line-haul emission factors by year that account for the changes in the locomotive fleet (EPA, 2009). Thus, the fleet mix used is the default mix provided by EPA.

To develop the 2017 locomotive NEI, ERTAC (Harrell and Janssen, 2019) was permitted to use Class 1 railroad inventory data, including the 2016 line-haul activity GIS shapefile from FRA. For the 2017 inventory, the fuel consumption index was adjusted to address discrepancies between FRA and R-1 report data. Fleet mix information was obtained from the Association of American Railroads (AAR). A link-level EI was created using these data sources and the methodology recommended by Sierra Research (Sierra Research, Inc. and Caretto, 2008).

For the development of the 2014 Texas Locomotive and Rail Yard AERR EI, ERG (Perez, 2015) obtained activity data from 2013, as this represented the latest available data at that time. ERG collected activity data for 2013, including receiving line-haul and yard data directly from UP and KCS. BNSF did not provide data for 2013 but responded to a previous data request for the 2011 inventory effort. This 2011 county-level fuel usage was extrapolated to 2013. Class I line-haul emissions were allocated based on the MGT activity data. The segment-specific railroad traffic data (ton-miles) was obtained from the Department of Transportation (BTS, 2009). The spatial inventory was developed from confidential MGT data from FRA. ERG used EPA's large line-haul emission factors by year that account for the changes in the locomotive fleet (EPA, 2009). Thus, the fleet mix used was the default mix provided by EPA.

[1] Class I railroads are required to file an Annual Report of Finances and Operations, known as the R-1, that contains information about their finances and operating statistics.

2.1.2 California

The activity data used to develop the California statewide locomotive EIs (California Air Resources Board, 2021) was collected under a 1998 memorandum of understanding (MOU) for the accelerated adoption of cleaner locomotives in the South Coast region. BNSF and UP provided the activity data in megawatts-hrs (MWh) by engine tier for the South Coast Air Basin (SCAB - Los Angeles, San Bernardino, Riverside, and Orange counties). The California 2020 Locomotive EI study increased power usage from 2018 to 2020. It also utilized the MWh data by engine tier in estimating the fleet-mix information. The MWh data and the proportion of different engine tiers were used to estimate emissions. The data is primarily for the SCAB region and thus needed to be extrapolated for all of California. Note that the California inventory uses power usage as the basis of emission estimation instead of the fuel consumption-based methodology used by ERTAC, ERG, and TTI. California had access to detailed activity data for Class I operators due to their MOU with the Class I operators in the state.

2.2 Class II and III Activity Estimation

Class II and III have much lower regulatory requirements for activity data reporting than Class I operators. Thus, very limited activity data is available for Class II and III operators. This section discusses the approaches and surrogate datasets for estimating Class II and III activity.

2.2.1 Texas

For the 2020 Texas Locomotive AERR EI, TTI (Venugopal et al., 2021, 2020) used statewide fuel consumption data reported by ten Class III railroad operators and the statewide carrier track miles based on NARL (USDOT BTS, 2022). Note that there are currently no Class II operators in Texas. The average fuel consumption rate of 2,420.38 gal/mile from the ten Class III operators was used to estimate the fuel use of the remaining 45 Class III railroad operators that did not report their data. The county mileage of each Class III carrier was multiplied by the fuel consumption rate (Venugopal et al., 2020). TTI used EPA's small railroad emission factors by year that account for the changes in the locomotive fleet (EPA, 2009). Thus, the fleet mix used is the default mix provided by EPA.

For the 2017 locomotive NEI, ERTAC (Harrell and Janssen, 2019) used the following data for Class II and Class III line-haul emissions:

- The nationwide Class II and III fuel use data reported by American Short Line and Regional Railroad Association (ASLRRA),
- The spatial location from the NARL data,
- The national fleet mix by AAR for 2016, and
- Age-based emission factors from the EPA.

A national fuel use factor of 2,941.5 gallons per mile, which was derived from Delaware, Maryland, Michigan, New Jersey, and the Indiana Harbor Belt Railroad, was applied by the number of route miles operated in the United States to calculate the link-level fuel use of each Class II and III operators. The emissions were estimated by multiplying fuel usage and age-based emission factors.

Similarly, for the 2014 Texas Locomotive and Rail Yard AERR EI, ERG (Perez, 2015) allocated statewide fuel consumption based on rail segment length and fuel consumption rate. ERG used a fuel consumption rate of 2,797.74 gallons per mile. The fuel consumption rate was obtained from ASLRRA. ERG used EPA's small railroad emission factors by year that account for the changes in the locomotive fleet (EPA, 2009). Thus, the fleet mix used is the default mix provided by EPA.

2.2.2 California

To develop the California statewide locomotive EIs for Class II and III operators, California used the Class II and III locomotive model year, tier, horsepower data, and 2015 fuel consumption data (Air Quality Planning & Science Division, 2020). The fuel consumption estimation approach is similar to Texas's locomotive fuel consumption estimation approach.

2.3 Switching Yard Activity Estimation

Since switching yards have different types of activity compared to line-haul, switching emissions are expected to be estimated differently than line-haul emissions. Each switching yard has several switchers, and the emissions are estimated for each. The number of switchers and the estimated emissions per switcher is the primary data source for estimating emissions in the switching yard. In absence of detailed data, EIs use fuel consumption rates or previous EIs with detailed data to estimate the switching yard activity or use fuel usage per yard mile to estimate the total yard fuel usage.

2.3.1 Texas

For the 2020 Texas Locomotive and Rail Yard AERR EI, TTI (Venugopal et al., 2021) obtained the fuel use data for individual Class I yards from the R-1 report. The average fuel consumption of 5,160.4 gal/mile based on the data provided by ten Class III operators was used for the Class III carrier-operated yards that did not provide fuel consumption details. The statewide fuel consumption was distributed across the different yards in Texas based on the 2017 ERTAC fuel consumption distribution across yards. TTI used EPA's large switcher-engine emission factors by year that account for the changes in the locomotive fleet (EPA, 2009). Thus, the fleet mix used is the default mix provided by EPA.

For the 2017 locomotive NEI, ERTAC (Harrell and Janssen, 2019) estimated the average fuel usage per switcher using 2017 fuel usage and switcher count data from the 14 largest railyards operated by BNSF, UP, KCS, and Chessie and Seaboard Consolidated (CSX). The average fuel use per switcher value was calculated by dividing the total fuel use by the number of switchers. Yard switcher counts were made through Google Earth. For Class I yards, fuel consumption by railroad was from R-1 data. The fuel usage rate per switcher for different Class I railroads was then used to allocate the total fuel use from R-1 to each yard based on the number of switchers at each location. Non-Class I yard fuel consumption was grown from 2014. Fleet mix information was from the AAR.

For the 2014 Texas Locomotive and Rail Yard AERR EI, ERG (Perez, 2015) used a mixture of approaches depending on the data availability. For Class I operated yards, ERG primarily used the fuel usage data reported by the operators. For Class I yards that did not report fuel usage, fuel consumption data from the 2011 inventory was grown to obtain the fuel consumption for the 2014 inventory. Watco's (a Class III railroad operator in Texas) fuel consumption rate of 10.05 gallons per hour was used along with the yearly hours of operations and the fraction of switching operations out of all yard operations to obtain its fuel consumption. For 230 small Class III yards that did not report any data, ERG took the statewide Class III fuel consumption (calculated based on Class III track mileage and fuel usage factor) and, based on the Class I data that indicated 5.39% of a railroad's total fuel consumption was for yard switches, developed the statewide fuel consumption for Class III yards. This fuel consumption was then divided equally to the 230 yards, equal to a couple of hours a week of operations at each switching yard. ERG used EPA's large switcher-engine emission factors by year that account for the changes in the locomotive fleet (EPA, 2009). Thus, the fleet mix used is the default mix provided by EPA.

2.3.2 California

For the California statewide locomotive EIs, California (Air Quality Planning & Science Division, 2020) obtained the number of full-time equivalent (FTE) engines per railyard.

$$FTE = \frac{Number\ of\ Engines\ \times activity\ \frac{hour}{year}}{24\frac{hour}{day}\ \times 365\ day/year}$$

California calculated the total fuel consumption at each yard based on the EPA's estimate of 82,490 gallons per year of fuel consumption per yard switcher and the FTE value.

2.4 Passenger Train and Commuter Rail Activity Estimation

2.4.1 Texas

For the 2020 Texas Locomotive and Rail Yard AERR EI, TTI (Venugopal et al., 2021) extracted all United States rail network links owned or operated by track rights for Amtrak from NARL data. The mile mix for each Amtrak-operated rail network link was calculated by dividing each link's miles by the sum of all Amtrak link miles. The fuel consumption for each link was estimated by multiplying the 2019 national Amtrak fuel usage obtained from BTS by the estimated mile mix. The county-level fuel consumption was obtained by summing the fuel consumption across all the links in the county. Denton County Transportation Authority (DCTA) and Trinity Railway Express (TRE) provided fuel consumption data for commuter rail. The commuter rail fuel usage estimation method was the same as that for passenger trains. TTI used EPA's passenger-commuter emission factors by year that account for the changes in the locomotive fleet (EPA, 2009). Thus, the fleet mix used is the default mix provided by EPA.

For the 2017 locomotive NEI, ERTAC (Harrell and Janssen, 2019) distributed the fuel consumption based on NARL's diesel-powered Amtrak route miles since activity data for each link was unavailable. The average fuel use of 2.2 gallons per passenger train mile from a 2016 Amtrak report was used. Amtrak also provided fleet mix information. For commuter rail, the estimation method was similar to Class III. The fuel use estimates for commuter rail were based on the Federal Transit Administration's (FTA) data.

For the 2014 Locomotive and Rail Yard AERR EI, ERG's (Perez, 2015) report does not mention developing emissions for Amtrak or commuter rail sources.

2.4.2 California

For the California statewide locomotive EIs, California (Air Quality Planning & Science Division, 2020) obtained the fuel consumption data from the rail companies.

2.5 Summary

Based on the above review, the following insights can be drawn for activity estimation and distribution.

1. If FRA tonnage density data is available for Class I line-haul activity estimations, this dataset should be considered the best choice for activity estimation and distribution. Each link of FRA data has county information; thus, estimating emissions by county is easy and accurate. Moreover, EPA allows states options for developing EIs using ERTAC data or using the state's local data. Therefore, EPA's [ERTAC] inventory, which uses FRA data, can also be used as a surrogate for activity when developing local inventories. And since the Class I operators are required to report fuel usage in the R-1 report, statewide fuel consumption for Class I operators is easy to acquire. Thus there are several ways in which reasonable county-level fuel consumption can be estimated.

2. FRA tonnage density might not provide accurate activity estimates for Class II and III operators because underlying data is heavily influenced by Class I railroad tonnage. Thus, direct fuel usage data from Class II and III operators is desirable. Without detailed data, fuel consumption rates by mile and the track mileage from NARL can be used to estimate county-level Class II and III fuel consumption.

3. For most previous studies, the calculation for switching yards is based on the average fuel consumption per switcher. For yard data, ERTAC's collection of switchers developed through Google earth provides a surrogate way to estimate yard activity. However, future studies are needed to develop more refined methodologies for quantifying yard fuel consumption. A 2010 rail yard emissions study (Douglass et al., 2010) pointed out some problems with the current general method. The authors (Douglass et al., 2010) collected rail yard data from nine (9) yard facilities - eight (8) from California and one (1) from Michigan. In the study, all yards were classified by activity types. According to the study, the emissions estimates varied across rail yard facilities. Therefore, current estimation methods for yards, such as extrapolation or generalization from one yard to another, provide very coarse estimates.

4. Data from passenger and commuter railroads such as Amtrak, DCTA, and TRE was used for passenger and commuter rail. The emissions by county are calculated based on the link miles by county because the data is provided in aggregate.

5. ERTAC collected the activity by model year or fleet mix data for different types of operators for 2016. Apart from this dataset, EPA's emission factors by carrier type and year have the fleet mix information built-in (EPA, 2009). Both datasets have several limitations, including both being at the national level and both studies being conducted in the past. However, in absence of more recent and Texas-specific data, EPA or ERTAC's fleet mix are reasonable choices for the development of EIs.

3 DATA SOURCES REVIEWED

Based on the information and findings from the literature review in Chapter 2, the TTI study team reviewed different data sources for this project. The following sub-sections describe various sources reviewed and their potential usefulness for obtaining activity data for line-haul and data for improving the railyard location inventory.

3.1 STATEWIDE ANALYSIS MODEL (SAM)

The SAM includes expanded coverage of Texas's travel demand modeling to a statewide model that includes different passenger and freight modes and the interaction among those modes. SAM Version 4 (SAM-V4) has 2015 as a base year and 2050 as a horizon year (Transportation Planning and Programming, 2021). SAM can be used to obtain the estimated rail tonnage capacity (Janie Temple, 2014). Figure 1 shows the freight flow assignment on the Texas rail network using SAM. Freight flow assignment in SAM is possible due to the Texas-North American Freight Flow Model (TX-NAFF model) integration within SAM. The TX-NAFF comprises a roadway network, rail network, and zone structure covering North America (HNTB, 2011). The assignment is based on STB's Waybill data ("Carload Waybill Sample," 2018).

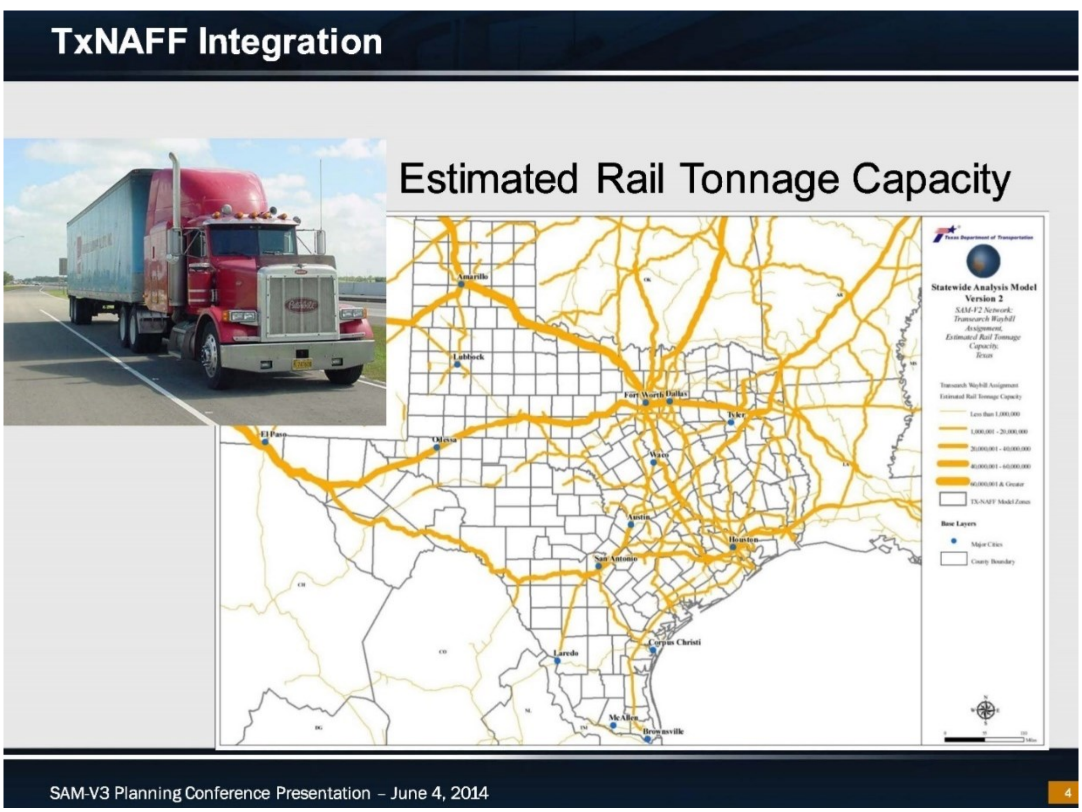


Figure 1: Rail Freight Flow Assignment in SAM (Janie Temple, 2014).

The output from SAM can be used to obtain the line-haul activity distribution within different districts. Assigned tonnage can subsequently be used to distribute Texas statewide fuel usage to different Texas counties. The TTI study team coordinated with the Texas Department of Transportation (TxDOT) to obtain the latest SAM model rail assignment output.

Figure 2 shows a sample output from the latest SAM model. The line segments are weighted by the field "DENSITYTON." This is the tonnage density on a link. The study team investigated the various fields of SAM output to identify this field that appropriately captures the tonnage flow over the links (discussed in more detail in Chapter 4).

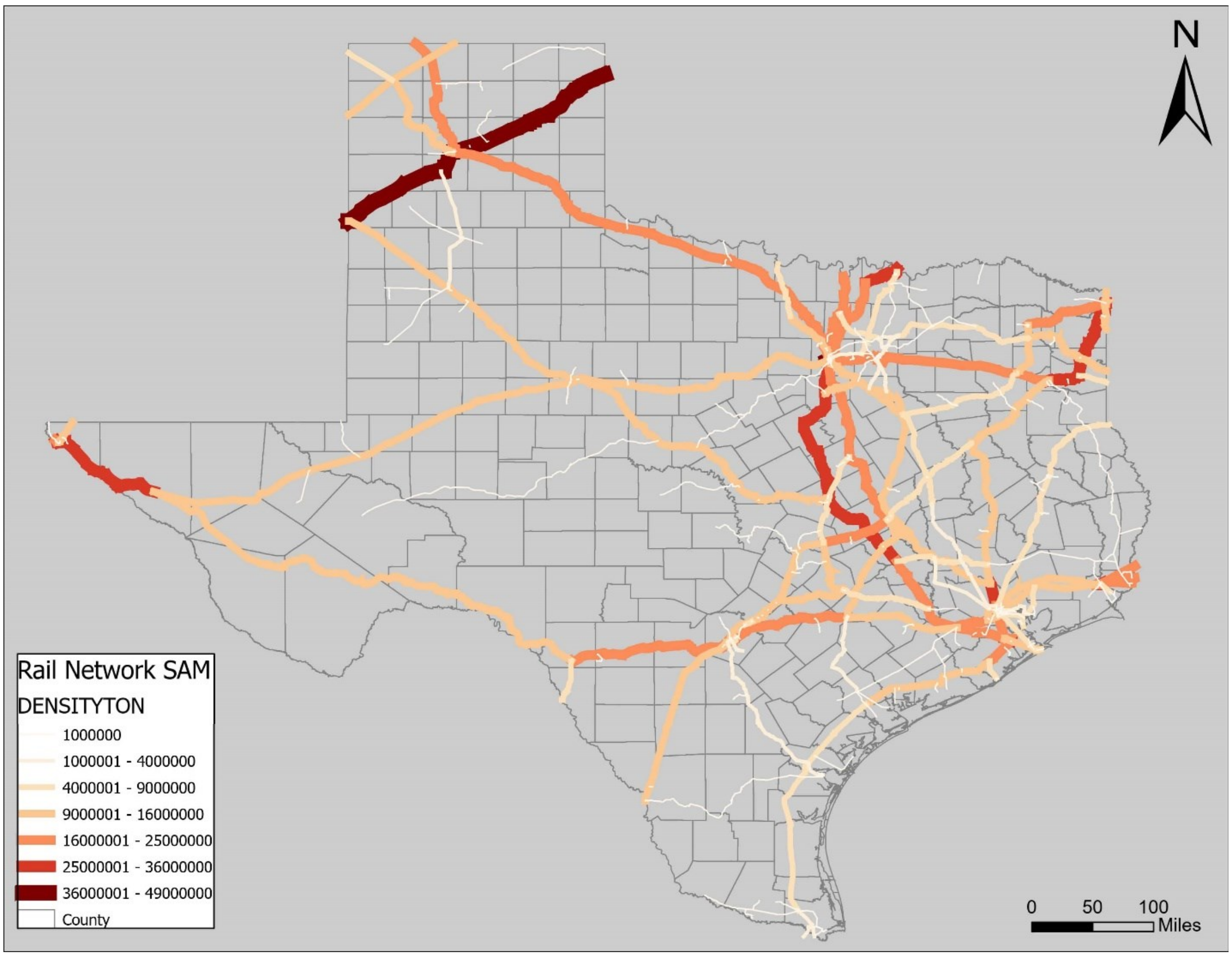


Figure 2: SAM Rail Freight Line Segments Weighted by "DENSITYTON" Field.

3.2 TxDOT 2019 Texas Rail Plan

TxDOT prepared the 2019 Texas Rail Plan report to document the state's vision for rail operations, including reviewing the existing Texas rail system and identifying potential passenger rail and freight rail improvements and investments, and opportunities for future rail service and investment programs (Texas Department of Transportation, 2019). The study report lists three Class I railroads, 55 Class III railroads, three Amtrak intercity passenger routes, four commuter rail services, six light rail/streetcar transit operations, and six tourist or heritage railroads operating in Texas. As of 2015, the AAR classification listing does not include any Class II regional railroad in Texas. The largest operators in Texas, UP, and Fort Worth-based BNSF, operate track over almost 11,400 miles, or 78 percent of the total track in Texas. KCS operates 820 miles. Short-line railroads operate almost 2,300 miles of rail line operated in the state. Class III railroads have 2,550 miles of track.

The study report lists rail mileage by railroad and non-operating railroad owners. It consists of miles owned, owned and operated, leased/operated under contract, miles operated under trackage rights, and miles operated by the railroad. In addition, Class I miles, tonnage density, daily traffic, speeds, and other operational information are provided by subdivision for individual Class I operators. The activity data by subdivision and Class I operators is shown in Appendix A. The study collected the data in 2017 through coordination with Texas' railroads and via analysis of TxDOT data, including rail maps generated by TxDOT, Class I Railroad Annual Report R-1s (submitted by the state's Class I railroads to the federal STB annually), railroad timetables, and other publicly available data.

Information about Class III railroads includes miles of track and annual carloads. However, the given data is not appropriate for estimating emissions from Class III operators as this information is not provided for all Class III railroads.

Yards are classified according to the operation: yard/terminal, intermodal facility, transloading facility, freight car repair facility, and locomotive repair and servicing facility. The major Class 1 railroads have all or some of these types of yards. Class 1 railroads provide information on intermodal terminals and some information about automotive terminals. Table 3 provides information on the intermodal terminal for different Class I operators.

Table 3: Intermodal Terminals of Class I Railroads (BNSF, 2022; Kansas City Southern, 2022; Union Pacific, 2022).

Railroad	Yard location	Hours	Flip hours	FIRMS Code	Track Capacity (ft)	Lift Capacity	Type of Cargo
BNSF	Alliance, TX	24H/7D	24H/7D	T926			
BNSF	El Paso, TX	M-F 8AM-6PM / Sat 8AM-4PM	M-F 8AM-4PM / Sat 8AM-4PM	S390			
BNSF	Houston, TX	24H/7D	24H/7D	S639			
KCS	Kendleton (Houston)	M-F 7 AM-5 PM	M-F 8 AM-3 PM	S855	10,000	152,400	COFC / TOFC[1] / Automotive
KCS	IFG (Kansas City, MO)	M-Sun 7 AM-7 PM	M-F 8AM-5PM / Sat&Sun 8AM-Noon	KJ166	96,000	8,000	COFC / TOFC / Automotive
KCS	Jackson, MS	M-F 8AM-6PM / Sat 8AM-2PM	M-Sat 8 AM-3 PM	S187	31,728	2,870	COFC / TOFC
KCS	Laredo, TX	M-F 8AM-6PM / Sa 8AM-2PM	M-F 8AM-5PM / SS 8AM-Noon	S187	118,332	4,500	COFC / TOFC
KCS	Wylie, TX	24H/7D	24H/7D	U178	342,000	9,400	COFC / TOFC
UP	Rio Valley, TX	M-F 8AM-6PM / Sat 8AM-Noon	-	-			COFC
UP	San Antonio, TX	M-F 5 AM-Midnight / Sat 7 AM-11 PM / Sun 7 AM-4 PM	M-F 8 AM-5 PM				COFC
UP	Houston, TX	M-F 8AM-10PM / Sat 8AM-6PM / Sun 10AM-2PM	M-F 5AM-11PM / Sat&Sun 7AM-23PM				COFC / TOFC
UP	Laredo, TX	M-F 8AM-10PM / Sat 8AM-6PM / Sun 10AM-2PM	M-F 8 AM-5 PM				COFC / TOFC
UP	Dallas (Mesquite), TX	24H/7D	M-F 8 AM-5 PM				
UP	DIT, TX	24H/7D	M-F 8 AM-5 PM				

1 TOFC: Trailer on Flatcar. COFC: Container on Flatcar.

3.3 BTS: Freight Analysis Framework 4 (FAF 4)

The FAF, produced through a partnership between BTS and Federal Highway Administration (FHWA), integrates data from various sources to create a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation. Starting with data from the 2017 Commodity Flow Survey (CFS) and international trade data from the Census Bureau, FAF version 5 (FAF5) incorporates data from agriculture, extraction, utility, construction, service, and other sectors. The FAF5 estimates tonnage values by regions of origin and destination, commodity type, and mode for the base year 2017 and a 30-year forecast. FAF5 forecasts provide a range of future freight demands at five-year increments representing three different economic growth scenarios, through 2050, by various modes of transportation (Oak Ridge National Laboratory, n.d.). Figure 3 shows the commodity flow from one of the Texas FAF zones to other parts of the USA. Table 4 shows the FAF zones for Texas. FAF data can provide the flow to and from the eight Texas FAF zones, which can be used with a rail freight assignment model to develop a line-haul tonnage density estimate in Texas.

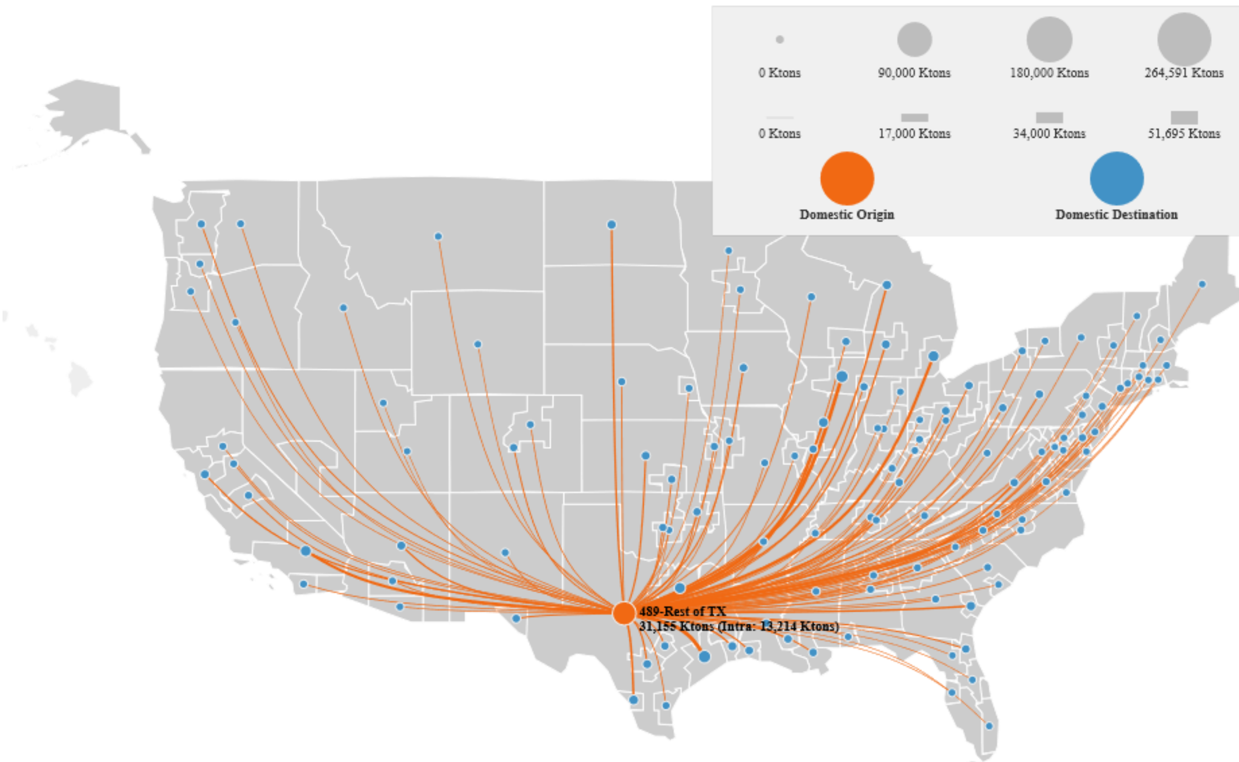


Figure 3: Sample Commodity Flow via Rail from "489-Rest of TX" FAF Zone to other FAF Zones.

Table 4: FAF5 Zones in Texas.

Code	FAF Region	Type of Region*
82	Beaumont-Port Arthur, TX CFS Area TX	M
483	Corpus Christi-Kingsville-Alice, TX CFS Area TX	C
484	Dallas-Fort Worth, TX-OK CFS Area (TX Part) TX	C
485	El Paso-Las Cruces, TX-NM CFS Area (TX Part) TX NM	C
486	Houston-The Woodlands, TX CFS Area TX	C
487	Laredo, TX CFS Area TX	M
488	San Antonio-New Braunfels, TX CFS Area TX	M
489	The remainder of Texas, TX	R

*Type of Region codes:

C: Combined Statistical Area (CSA)
M: Metropolitan Statistical Area (MSA)
R: The rest of State-everything in a state that is not included in a CSA or MSA (RoS)

3.4 Transportation Routing Analysis Geographic System (TRAGIS)

"The Web-Based Transportation Routing Analysis Geographic Information System (WebTRAGIS) is a user-friendly, geographic information system (GIS)–based transportation routing and analysis computer model. Funding for the development of WebTRAGIS has been provided by the Department of Energy (DOE) Office of Environmental Management (EM). WebTRAGIS is a browser-based application, and the user interface is accessed through a web browser via a personal computer or other web-capable devices. The WebTRAGIS routing engine and its large data files reside on a server maintained by Oak Ridge National Laboratory (ORNL)" (Peterson, 2018).

"The WebTRAGIS routing model calculates rail routes that simulate the routing practices of the railroad companies in the United States. The basic concept of determining rail routes is to calculate the shortest path based on travel distance biased by traffic density in terms of gross ton-miles (GTM). With highway routing, time and distance are primary factors. The highest-speed roads are limited access, and highway routes generally follow such roads. With rail routing, traffic stays on the main lines which have the highest traffic density, the highest class of track, and the most sophisticated signaling systems. Another difference between highway and rail routing is ownership. Trucking companies can operate over any highway within the national highway network. For railroads, the national rail network is an interconnected series of smaller networks owned and maintained by separate, mostly private, companies. These individual railroad companies can only move freight over lines they own or have permission to operate over. Further details regarding the operational characteristics of the US rail network and the WebTRAGIS rail network can be found in Sections 3.3.1 and 3.3.2, respectively" of the WebTRAGIS user manual (Peterson, 2018).

TRAGIS can be used to route the origin-destination freight data[2]. The study team obtained permission to use the 2019 and 2020 carload waybill data from the STB. Then,

[2] An account can be requested on the following website: https://webtragis.ornl.gov/login.

Steven Peterson from Oak Ridge National Laboratory, author of the WebTRAGIS manual, shared the freight assignment data for 2019 and 2020 with TTI[3].

3.5 Association of American Railroads (AAR) and Railinc

"The AAR compiles and distributes information on North American freight railroads, including finances, operations, performance, input cost indexes, traffic, and more" (AAR, n.d.). AAR provided the national fleet mix information for Class I line-haul and switching yards to ERTAC in 2017.

Railinc started as an information technology department of the AAR. It eventually branched off, and it is a wholly-owned subsidiary of the AAR. It provides business intelligence to railroad companies ("Home | Railinc," n.d.). Railinc provided ERTAC Class III fleet mix information in 2017.

The study team contacted AAR and Railinc to understand the procedure for obtaining Texas's fleet mix and other activity data. AAR and Railinc have Texas-specific fleet mix data. However, they could not share it with TTI as the data is confidential.

3.6 American Short Line and Regional Railroad Association (ASLRRA)

ASLRRA represents shortline owners and operators and regional railroads in North America. Based on the literature, Class III (shortline) information is generally hard to get from the operators. Thus associations like ASLRRA are promising avenues for obtaining Class III and other shortline railroad activity data.

ASLRRA provided the fuel usage and mileage data to ERTAC in 2017. ERTAC used this data to compute Fuel Use Factors (FUF) for all Class II and III operators. With this information, ERTAC calculated a FUF of 2,945.5 gal/mile.

The study team contacted ASLRRA in June 2022 for recent fuel and activity data; however, ASLRRA was unresponsive, and the study team could not receive updated Texas-specific fleet data.

[3] The study team reached out to Steven Peterson to access the assignment model or its results because none of the study team members working on this project were U.S. Citizens and thus could not get access to the data directly through the website through conventional means.

3.7 Federal Railroad Administration (FRA): North American Rail Network Lines (NARL) Database

NARL is a comprehensive BTS rail network database of North America's railway system as of May 04, 2022. The data set covers all 50 States plus the District of Columbia. It includes link-level information such as railroad owner, track rights, miles, link type (e.g., freight, yard, industrial), yard names, etc. The study team used this data in the 2020 Locomotive and Rail Yard AERR EI development. This dataset is publicly available and thus can be used in the future.

3.8 Surface Transportation Board (STB) R-1 Report

R-1 reports fuel usage (R-1 Report Schedule 750) and Gross Ton-Miles (R-1 Report Schedule 755) by railroad operators (Surface Transportation Board, n.d.). The study team had previously obtained the nationwide fuel usage and Gross-Ton-miles (Millions) data from the R-1 report. The team then used freight flow by the state to obtain the fuel consumption for Class I operators (USDOT BTS, 2019). A similar approach can be used to obtain updated fuel consumption by Class I operators for Texas in the future.

3.9 FRA Traffic Density

A link-level line-haul activity dataset managed by FRA containing gross tons hauled for each Class I railroad can be used to allocate fuel usage. Traffic density in terms of MGT hauled on each link is shown in Figure 4. ERTAC used this data for the 2017 locomotive NEI.

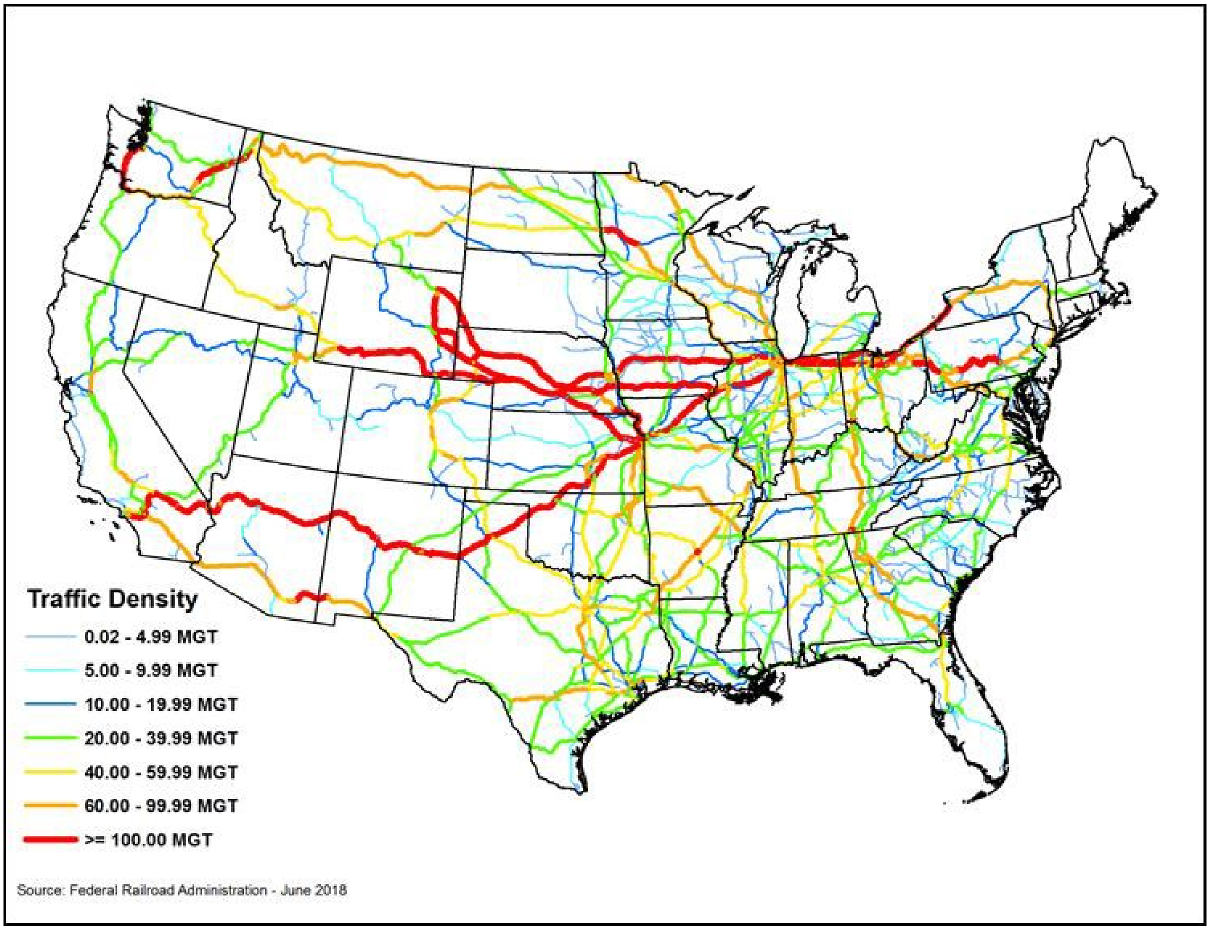


Figure 4: Class I Railroad Traffic Density Map (Harrell and Janssen, 2019).

3.10 ERG 2014 Texas Locomotive Inventory Yard Locations

ERG (Perez, 2015) reviewed yard location data from a previous inventory and NARL. It used satellite imagery to identify yards to delete or add. ERG identified new yards based on tracks that were located off of the main tracks. ERG also researched potential future yards online via websites from transportation departments, trade associations, railroad company websites, and industry trends sites (Perez, 2015). ERG identified 337 yards in Texas. Appendix B shows the updated list of yards in the ERG inventory, and Figure 5 shows the 337-yard locations. The ERG yard inventory provides one source of yard location data.

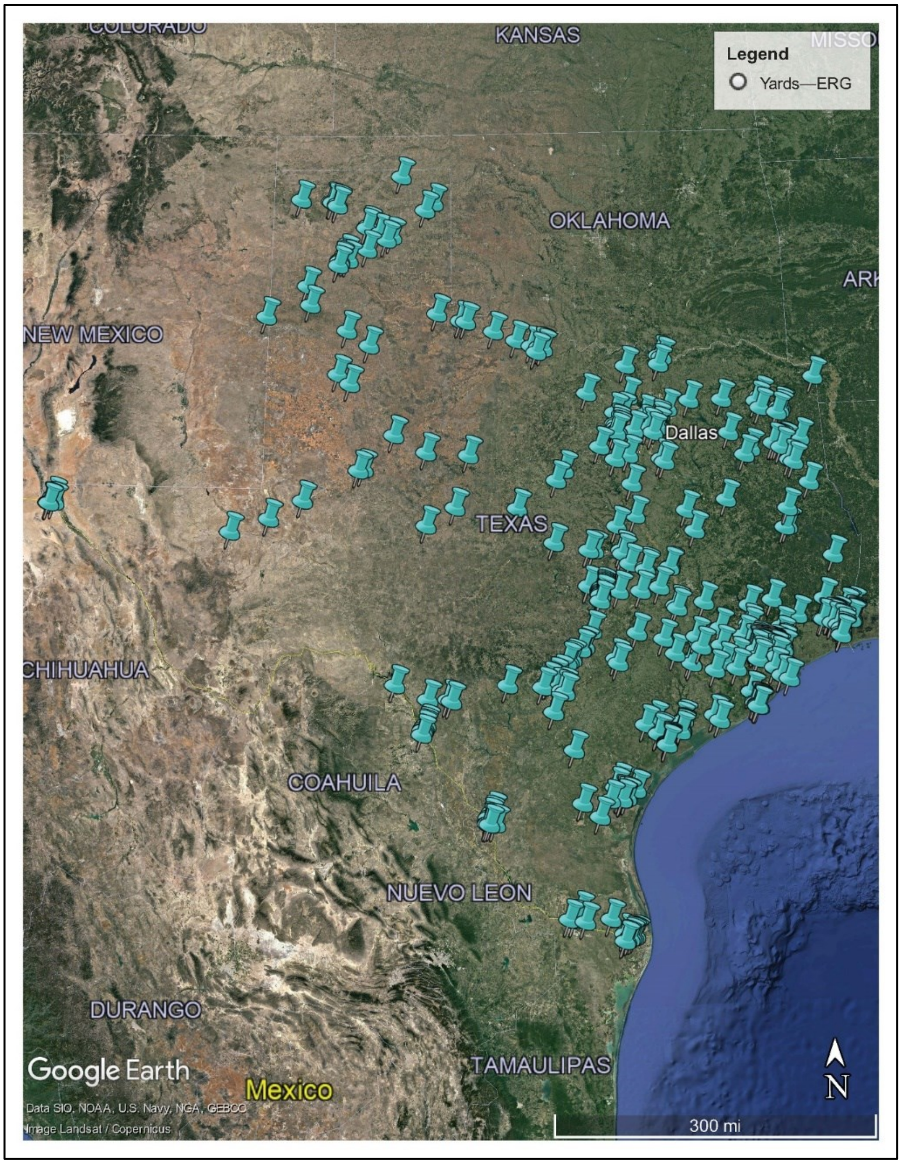


Figure 5: ERG Switching Yard Locations.

3.11 ERTAC 2017 Texas Locomotive Inventory

ERTAC (Harrell and Janssen, 2019) developed an inventory of railyards across the USA and potential switcher counts based on information from Google Earth. Appendix C and Figure 6 show the 366 railyard locations identified in Texas. This is another source of yard location data.

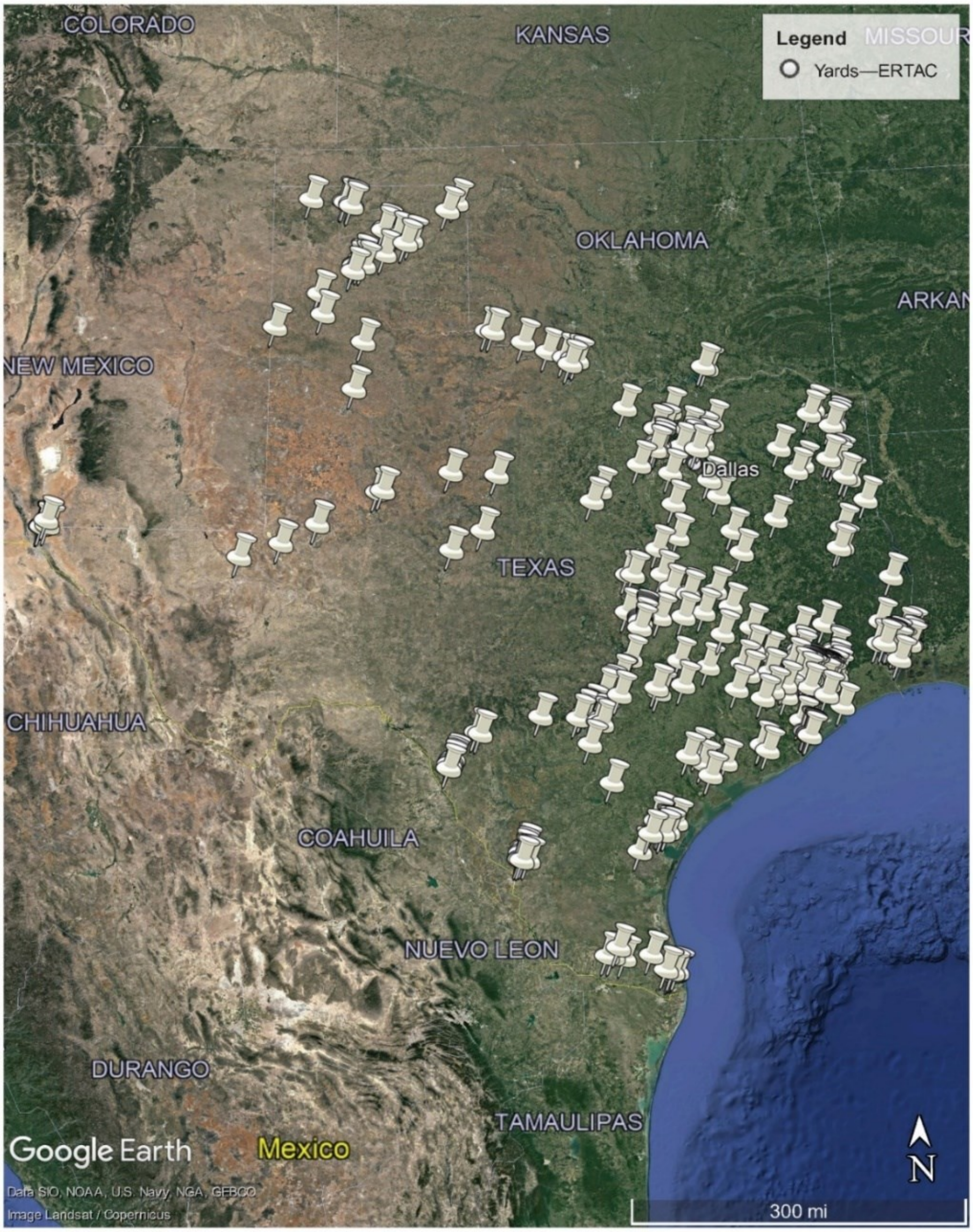


Figure 6: ERTAC Switching Yard Locations.

3.12 NARL Yard and Industrial Leads

In addition to the ERG and ERTAC yard (and industrial lead) location inventories, NARL also identifies yard and industrial lead locations and names. Figure 7 shows the NARL yard and industrial lead locations. NARL data, along with ERG and ERTAC yard inventories, can be used to develop a unified inventory of yard locations.

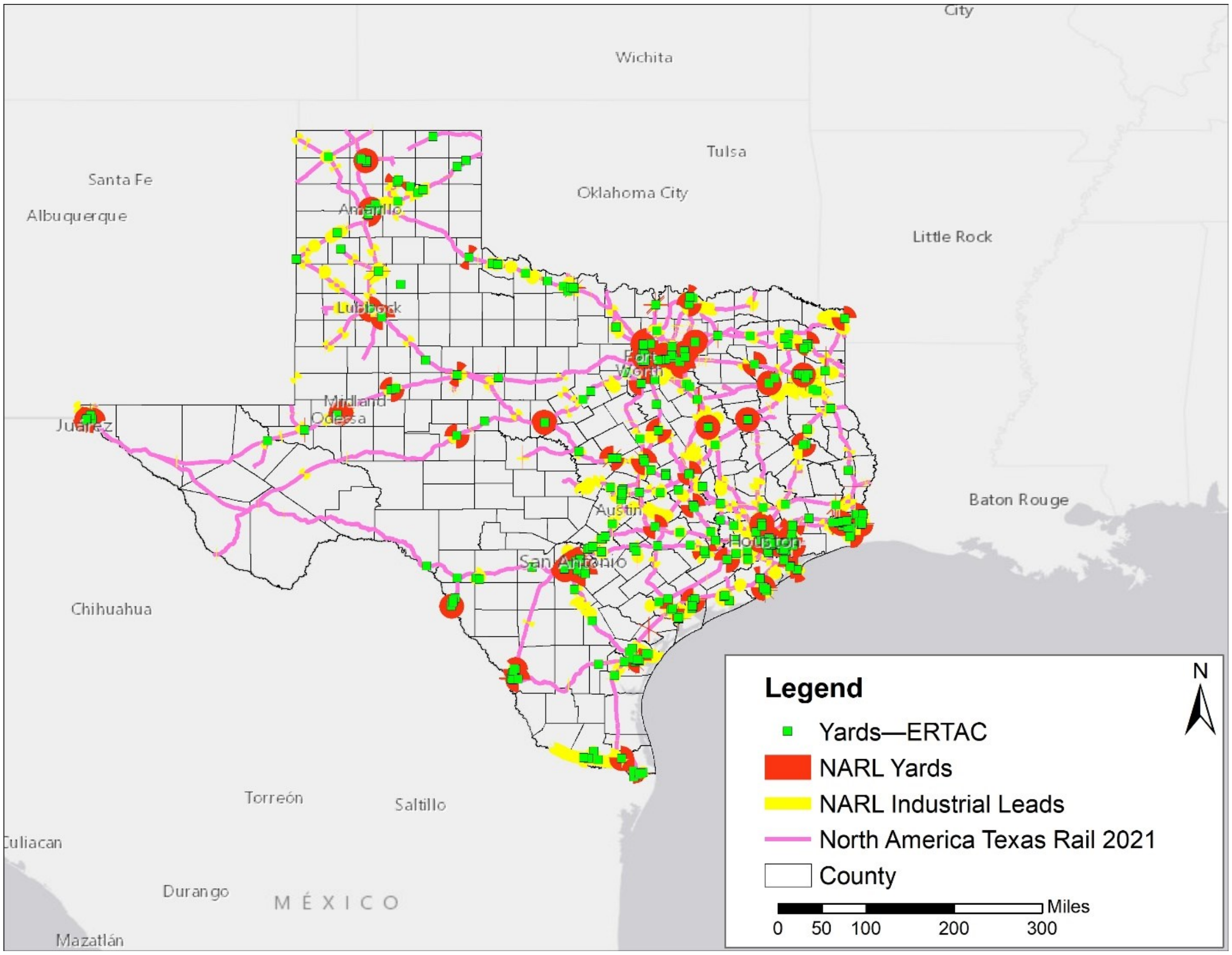


Figure 7: NARL Yard and Industrial Lead Locations.

3.13 Summary

The study team identified the following data sources for obtaining the Class I activity distribution data:

1. SAM: SAM can provide the tonnage assignment using the Carload Waybill data. TxDOT has provided this aggregated output data to the TTI study team. Thus, it can be used to develop future locomotive EIs.
2. TxDOT 2019 Rail Plan: This report provides estimates of the tonnage density in various BNSF, UP, and KCS subdivisions. While SAM provides details at the link level, TxDOT 2019 rail plan density details are at the subdivision level. Since SAM has a finer spatial resolution, it should be preferred over the TxDOT rail plan data.

3. FAF 4: FAF-4 provides origin-destination tonnage. It can be used to generate freight tonnage over Texas rail links. But, FAF-4 only has eight zones in Texas. In contrast, the SAM network has 348 zones.
4. TRAGIS: TRAGIS allows the assignment of rail freight. Access to TRAGIS requires a security clearance and thus is not easily accessible. TTI is a state agency and thus was able to access the confidential data for Texas.

The SAM and TRAGIS model output are most promising as they provide the tonnage assignment by links that can be used in distributing statewide Class I fuel consumption from STB's R-1 report to different Texas counties.

For Class III, a feasible approach for estimating the statewide fuel consumption and distribution for Class III operators consist of using the track ownership and rights data contained within NARL along with fuel usage factors. Fuel usage factors can be obtained from the following sources:

- based on the ten Class III railroad operator's data TTI collected for the 2020 Locomotive and Rail Yard AERR EI, or
- the fuel usage factor provided by ASLRRA

The study team procured fuel consumption data for Amtrak from BTS and other commuter rail fuel consumption data directly from individual commuter rail operators. Future EI developers should also be able to directly obtain the updated fuel consumption data or grow the older data based on the growth in the sector.

Due to confidentiality issues, recent fleet mixes for Class I and III operators cannot be secured from AAR and Railinc. Fleet mix from previous NEIs or EPA would need to be used instead.

Accurate yard fuel consumption estimates need detailed studies. However, some improvements can be made with the existing resources. ERG, ERTAC, and NARL yard location inventories can be conflated and reviewed to reconcile differences between the three to develop a unified, improved list of rail yard locations.

4 ACTIVITY ESTIMATION

This chapter evaluates the activity data sets identified and collected, as summarized in Chapter 3. The methodology used to assess the reliability and feasibility of processing the raw data and formatting it for use in developing the locomotive line and rail yard EIs is elucidated.

Table 5 provides the overall context for this work by briefly comparing the locomotive and railyard EI components between the 2020 Texas Locomotive and Rail Yard AERR EI and this work, highlighting components that will change by using new data sources and/or methods versus components that will be unchanged.

Table 5: Data Elements Used in 2020 Texas Locomotive and Rail Yard AERR EI and the Current Study.

Data Element	Source–2020 Texas Locomotive and Rail Yard AERR EI	Source–Current Study	Comments
Line-Haul Statewide Fuel Usage	Collected based on the STB's R-1 report and the Bureau of Transportation Statistics (USDOT BTS, 2019) freight flow by state, Amtrak reports, and ten Class III operators, TRE, and DCTA.	no change	The current study aims to identify inputs that will improve future locomotive EIs. Changing the fuel consumption values will not provide much insight, as statewide fuel consumption will be a given for future locomotive EI development.
Yard Statewide Fuel Usage	Obtained from STB R-1 report for Class I operators. Estimates are based on a fuel usage rate and operator's yard miles for non-Class I operators.	Updates the yard location inventory	The updated yard location inventory may change the yard miles.
Line-Haul and Yard Fleet Mix	Uses EPA's default fleet mix from EPA's "Emission Factor for Locomotive" technical highlights. (EPA, 2009)	Uses the national value from ERTAC's 2017 locomotive NEI (Harrell and Janssen, 2019).	This is primarily a sensitivity test to understand the impact of fleet mix on emissions. Both fleet mixes are national defaults, so using one over the other is a subjective choice.

Data Element	Source–2020 Texas Locomotive and Rail Yard AERR EI	Source–Current Study	Comments
Class I Line-Haul Activity Distribution by Counties	Based on EPA's 2017 locomotive NEI which uses densities[4] from FRA.	SAM or TRAGIS assignment.	The density ranges used in the previous study are broad. Freight assignments may provide better activity estimates.
Non-Class I Line-Haul Activity Distribution by Counties	Based on track miles.	no change	It is difficult to allocate activity to an individual operator on a given rail line segment as it can be used by many operators and is likely dominated by Class I operators.
Yard Location Inventory	Based on EPA's 2017 locomotive NEI prepared by ERTAC.	Based on the 2014 Texas Locomotive and Rail Yard AERR EI prepared by ERG (Perez, 2015), 2017 EI prepared by ERTAC, and NARL.	The current study aims to reconcile differences in yard locations and names between ERG, ERTAC, and NARL studies. This study creates a unified yard location inventory with EIS ID (when available).
Yard Activity Distribution	Based on EPA's 2017 locomotive NEI prepared by ERTAC.	Based on yard miles by operators extracted from NARL.	The current study estimates each yard's fuel consumption based on operators' yard miles. The previous 2017 NEI uses switcher counts at a yard and older NEI datasets to estimate fuel usage.

[4] There are seven density categories: 0.02 to 4.99, 5 to 9.99, 10 to 19.99, 20 to 39.99, 40 to 59.99, 60 to 99.99, and greater than 100 million gross tons (MGT).

The following sub-section details the revisions to the estimation of line-haul activity. The subsequent sub-section details the changes to the yard inventory and activity distribution.

4.1 Line Haul

This section discusses the revisions to the line-haul activity estimation procedures used in the 2020 Texas Locomotive and Rail Yard AERR EI.

Line-haul activity estimates are needed to estimate line-haul emissions. The U.S. EPA provides locomotive emission factors in grams per gallon that can be used to convert the annual fuel consumption rate to an emissions quantity. The fuel consumption rate in the 2020 Texas locomotive EI was estimated based on statewide fuel consumption, the distribution of line-haul activity across various counties, and the engine tier distribution.

Line-haul EIs are developed on a per-county basis; thus, activity estimates such as the ratio of the county to statewide ton-miles and track mileage are used to distribute statewide fuel consumption to individual counties. Engine tier levels affect the emission rates. Aggregated emission factors across engine tiers are combined with fuel usage to estimate the locomotive emissions.

Estimation methods and data sources for statewide fuel consumption, activity factors for fuel consumption distribution, and fleet mix were investigated by the study team for refinement.

The estimated statewide fuel consumption value and its estimation methodology used in this analysis are the same as in the 2020 Texas locomotive EI. The fuel consumption distribution factors were the main focus and were significantly updated, as detailed later. For the fleet mix data, the TTI study team contacted Railinc Corporation but did not get a response. In the absence of new fleet mix data, the study team used the fleet mix from the 2017 locomotive NEI developed by ERTAC (shown in Table 6).

Table 6: 2017 NEI Fleet Mix.

Tier Level	Class I (AAR)	Yard Switcher (AAR)	Class III (Railinc)	Amtrak (Amtrak)
Uncontrolled (pre-1973)	0.035628	0.2601	0.484296	0.0709
Tier 0 (1973-2001)	0.170656	0.2361	0.432286	0.8543
Tier 0+ (Tier 0 rebuilds)	0.151779	0.2599	0	0.0748
Tier 1 (2002-2004)	0.018282	0	0.002364	0
Tier 1+ (Tier 1 rebuilds)	0.243995	0.0476	0	0
Tier 2 (2005-2011)	0.112198	0.0233	0.034786	0
Tier 2+ (Tier 2 rebuilds)	0.098125	0.0464	0	0
Tier 3 (2012-2014)	0.123549	0.1018	0.039514	0
Tier 4 (2015 and later)	0.045789	0.0247	0.006754	0
Total	1	0.9999	1	1

The following data sources were used in developing the 2017 fleet mix data:

- The AAR provided the ERTAC Rail subcommittee with updated locomotive fleet mix information for 2017.
- The AAR provided ERTAC Rail with national tier fleet mix profiles representing the Class I yard switching locomotive fleet. The 2017 data had discrepancies (Harrell and Janssen, 2019), so 2016 data were used instead for the 2017 NEI.
- Railinc provided ERTAC Rail with a national line-haul Tier fleet mix profile for 2016 for developing the 2017 NEI.
- Amtrak also submitted company-specific fleet mix information and company-specific weighted emission factors.

The following subsections describe the improvements in the spatial allocation of the activity—specifically, the updates in the data sources, pre-processing, and quality assurance (QA) procedures.

4.1.1 Activity Distribution

The following data sources were identified in task three of this study for obtaining the Class I activity distribution data:

1. SAM: SAM can provide the tonnage assignment using the carload waybill data. TxDOT has provided this aggregated output data to TTI.
2. TxDOT 2019 Rail Plan: This report provides estimates of the tonnage density in various BNSF, UP, and KCS subdivisions. While SAM provides details at the link level, TxDOT 2019 rail plan density details are at the subdivision level.
3. TRAGIS: TRAGIS allows the assignment of rail freight using the carload waybill data. Steve Peterson from ORNL provided TTI with the rail network and freight assignment data for 2019 and 2020.

This study focused on SAM and TRAGIS assignment data as these two sources have finer spatial resolution than the TxDOT rail plan data. Class III, passenger, and commuter railroad modeling are unchanged from the 2020 Locomotive and Rail Yard AERR EI analysis. In summary, for Class III, passenger, and commuter railroad, the fuel consumption on individual NARL links is estimated based on the fuel usage factor used in the 2020 Locomotive and Rail Yard AERR EI analysis (Venugopal et al., 2021), along with track ownership and track rights data contained within NARL. For further details on the activity distribution for operators in these categories, please refer to the 2020 locomotive EI study report.

The following section describes the procedure for obtaining the dataset, the data format, and the timeframe for obtaining the SAM and TRAGIS datasets.

4.1.1.1 SAM Rail Assignment

SAM includes expanded coverage of Texas's travel demand model to a statewide model that includes different passenger and freight modes and the interaction among those modes. SAM Version 4 (SAM-V4) has 2015 as a base year and 2050 as a horizon year.

The study team contacted TxDOT's Transportation Planning and Programming (TPP) division to obtain the SAM. TTI signed a "Terms of Use Agreement" for using the results from the SAM. The SAM output for 2015 was shared in a TransCAD and a plain text file. The SAM network consisted of modes such as roadway, rail, and waterways. The study team filtered the modes to keep only rail freight links. Freight rail links have mode code 31, and freight link connectors have mode code 51 in the SAM network. It took around a month to obtain and review the SAM model. Figure 8 shows the assignment output for rail freight from the SAM network.

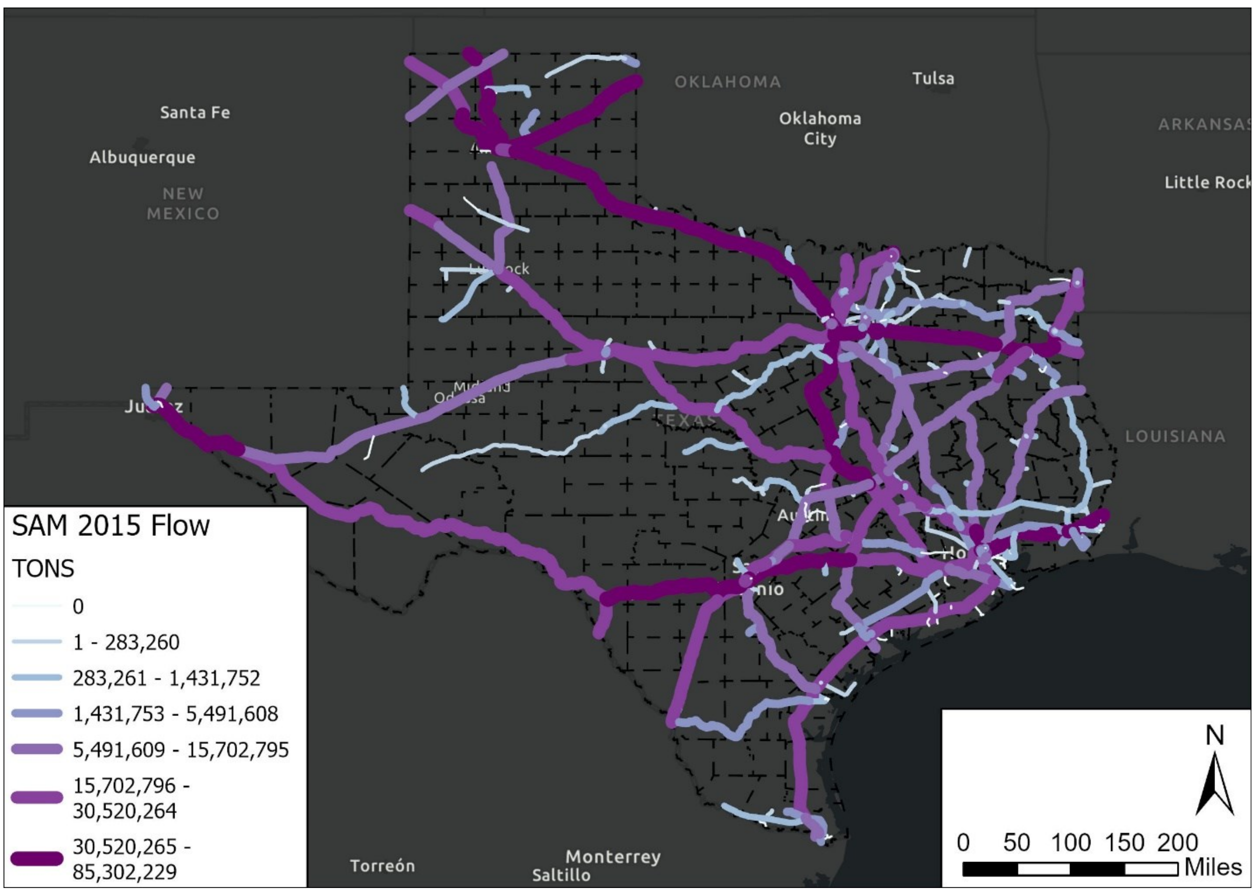
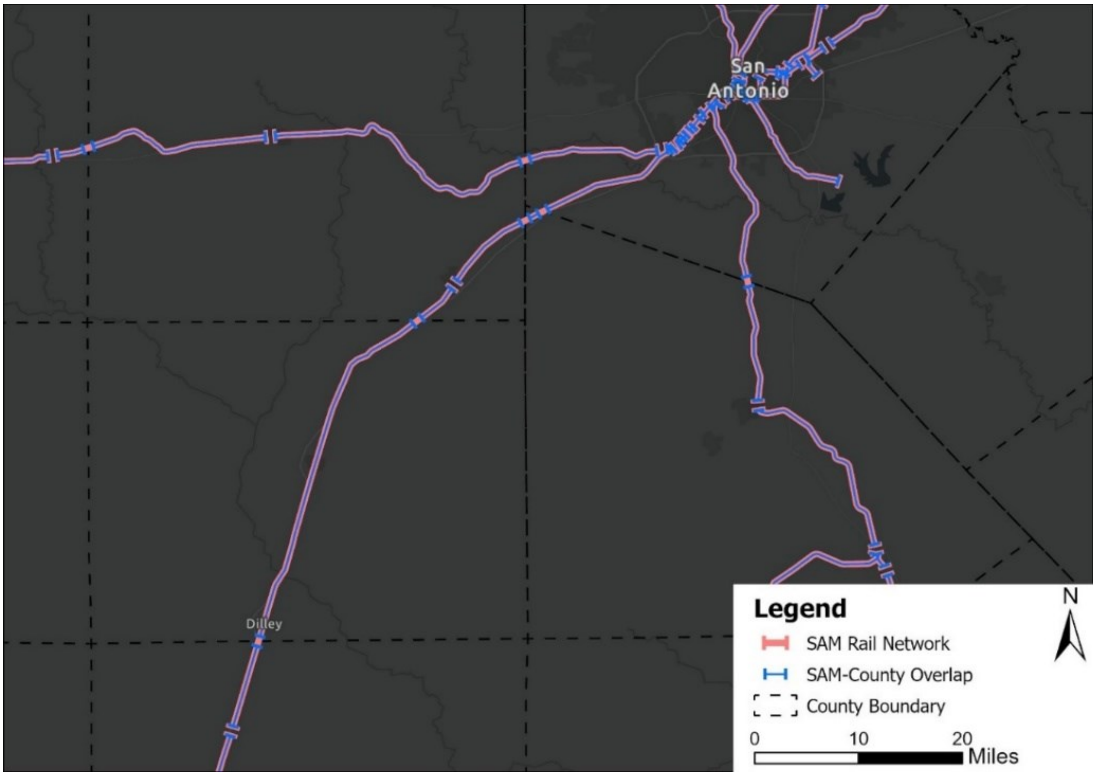


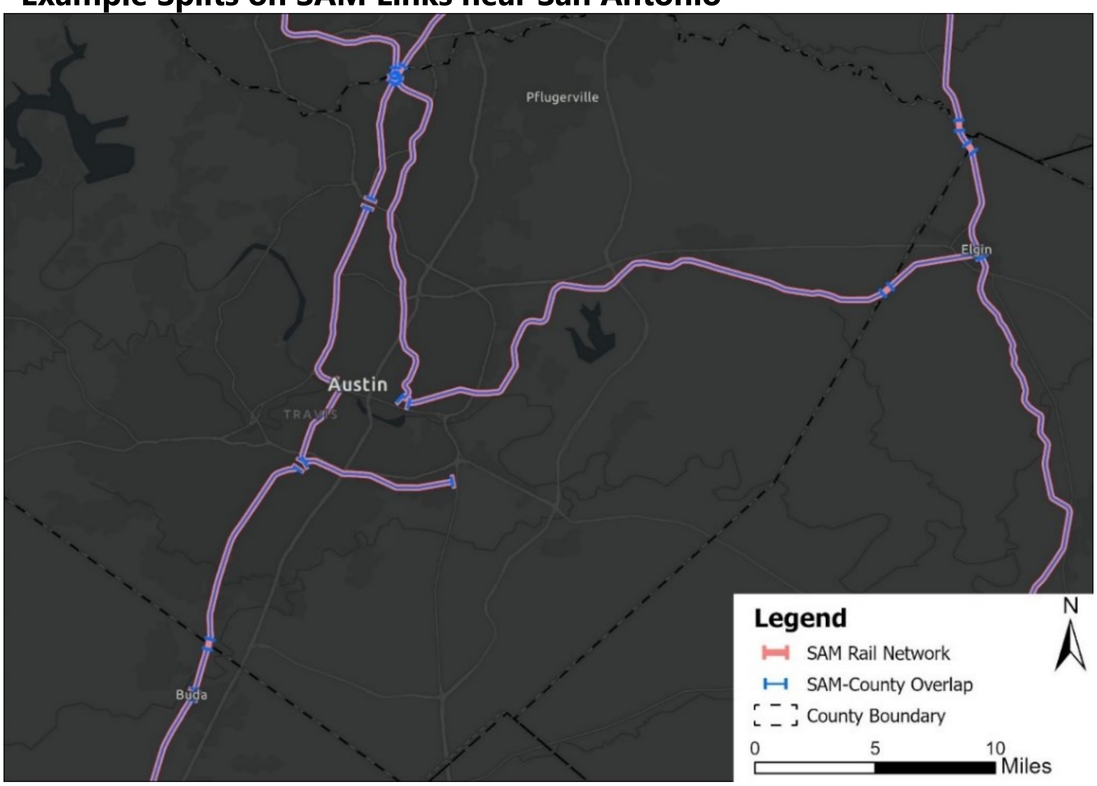
Figure 8: Rail Freight Assignment from the SAM Model.

The study team reviewed the SAM network to ensure that the data assignment output could be used for estimating ton-miles by counties. A visual inspection and spatial analysis were conducted to check if the rail links did not cover multiple county boundaries. Based on the checks, the study team found cases where the rail links crossed multiple county boundaries. The study team then overlaid the SAM network onto the TxDOT county boundaries layer and split the line segments at the county boundaries. Figure 9 shows the original SAM network links in wider red lines and the split-out SAM network links in thinner blue lines. As the blue links split at the county boundaries, they have more breaks, whereas the original SAM network links (in red) do not.

Apart from visual checks, the SAM network was compared with the most recent NARL dataset and the ERTAC data from the 2017 locomotive NEI. Figure 10 compares the link mileage by Texas county in the NARL versus the SAM network. It can be observed that county mileage between the two datasets is quite close. In addition to the mileage, the study team compared the percentage of the county ton-mile out of the statewide ton-mile between SAM and ERTAC. Figure 11 shows the comparison. The correlation between SAM and ERTAC data is 0.8965472 with a 95th percentile two-sided confidence interval of (0.8627531, 0.9223669). The confidence interval is statistically significant. Thus, SAM and ERTAC datasets are highly correlated.



a) Example Splits on SAM Links near San Antonio



b) Example Splits on SAM Links near Austin

Figure 9: Example Splits on SAM Links.

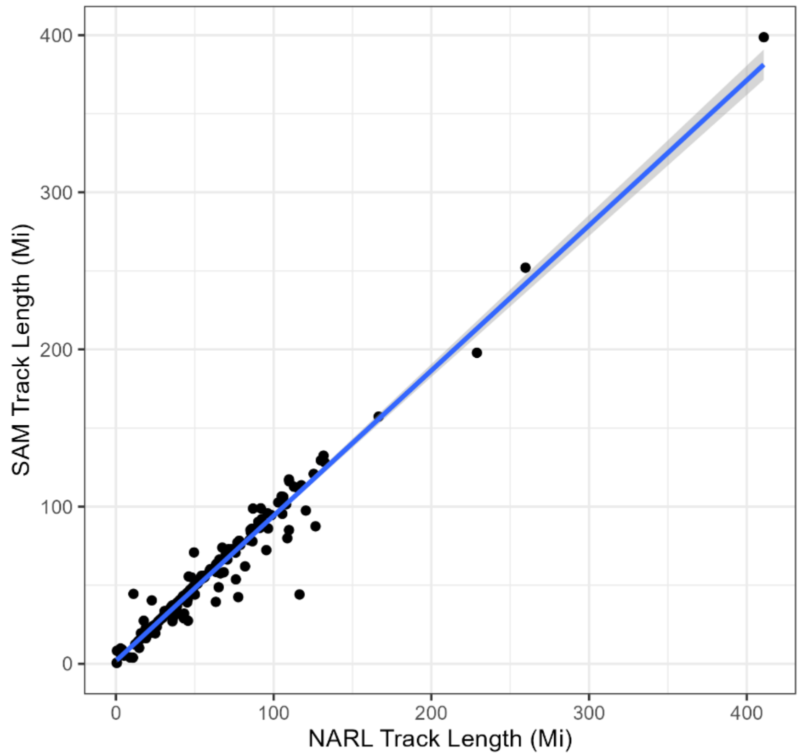


Figure 10: SAM vs. NARL Track Length for Texas Counties.

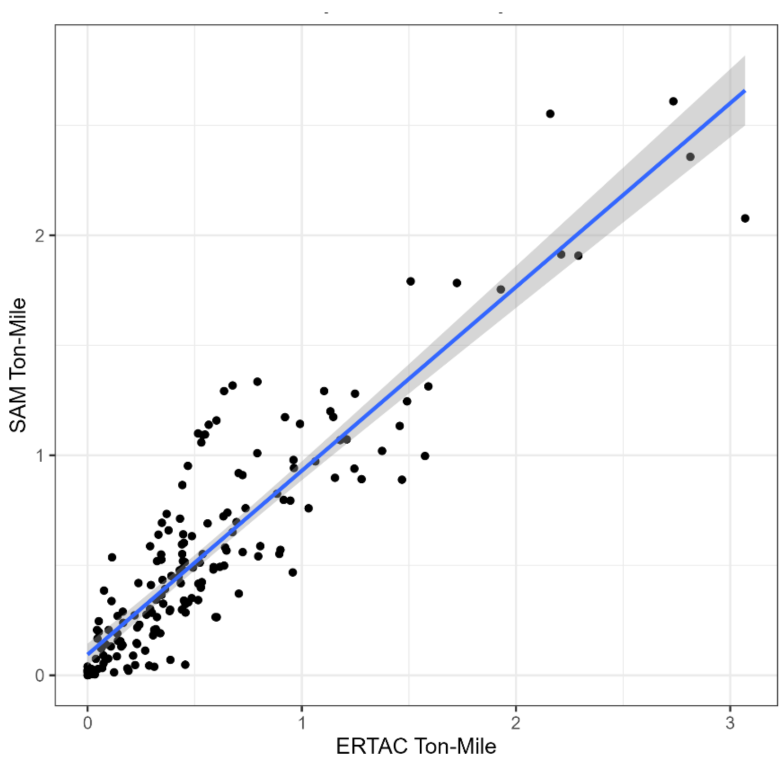


Figure 11: SAM vs. ERTAC Ton-Mile Distribution for Texas Counties.

4.1.1.2 TRAGIS Rail Assignment

The study team coordinated with Steven Peterson from ORNL, author of the WebTRAGIS manual, to explore ways to access the assignment model or its results. Based on the discussions, the study team had to first obtain permission from the STB to use the carload waybill data used in the TRAGIS. After TTI obtained permission to use the 2019 and 2020 carload waybill data, Steven Peterson shared the freight assignment data for 2019 and 2020. The data was in shapefile, plain text, and access database formats. Figure 12 shows the freight assignment for 2020 from TRAGIS. Note that SAM assignment data is for 2015, while TRAGIS assignment data is for 2019 and 2020. The entire process of obtaining the data took around two months. Figure 12 shows the 2020 freight assignment from TRAGIS.

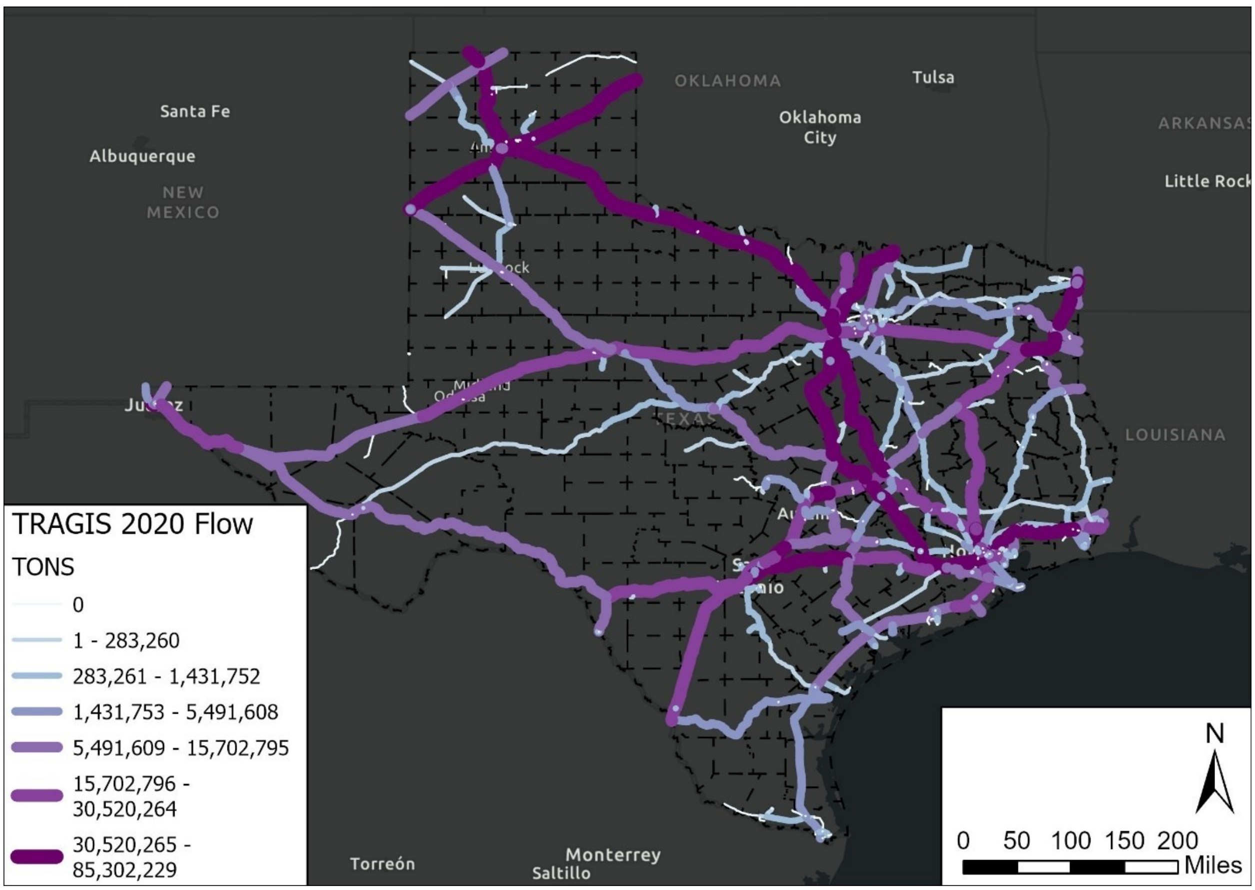


Figure 12: Rail Freight Assignment from the TRAGIS Model.

Similar to the SAM network review, the study team reviewed the TRAGIS network to ensure that the data assignment output could be used for estimating ton-miles by county. The study team conducted a visual inspection and spatial analysis to check if the rail links did not cover multiple county boundaries. Based on the checks, we found that line segments were already broken up at county boundaries, so no spatial pre-processing was necessary.

Besides visual checks, the TRAGIS network was compared with SAM and ERTAC data from the 2017 locomotive NEI. Figure 13 and Figure 14 show the ton-mile and the ton-mile distribution within different Texas counties between TRAGIS and SAM. Figure 15 shows the ton-mile comparison between the TRAGIS and ERTAC datasets. The correlation between TRAGIS and ERTAC data is 0.912254 with a 95th percentile two-sided confidence interval of 0.8833717 and 0.9342335. The correlation between TRAGIS and SAM data is 0.8912528 with a 95th percentile two-sided confidence interval of 0.8558608 and 0.9183371. Both confidence intervals are statistically significant. TRAGIS, SAM, and ERTAC data are highly correlated, with TRAGIS and ERTAC being more correlated than the TRAGIS and the SAM data. A higher correlation between TRAGIS and ERTAC data is reasonable as the underlying datasets, such as the network and origin-destination matrix for TRAGIS and ERTAC, are from the same source.

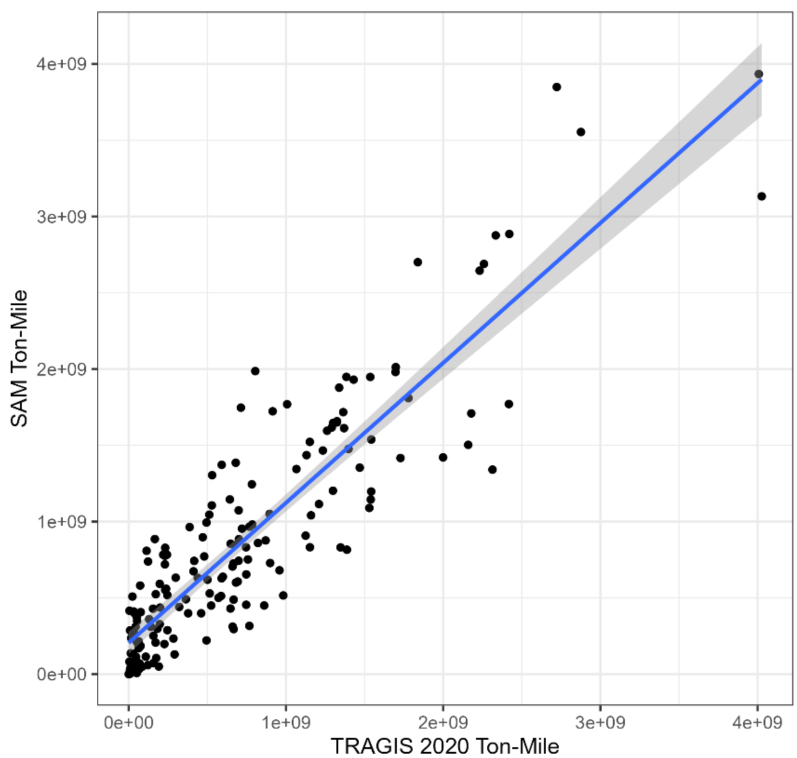


Figure 13: SAM vs. TRAGIS Ton-Miles by Texas Counties.

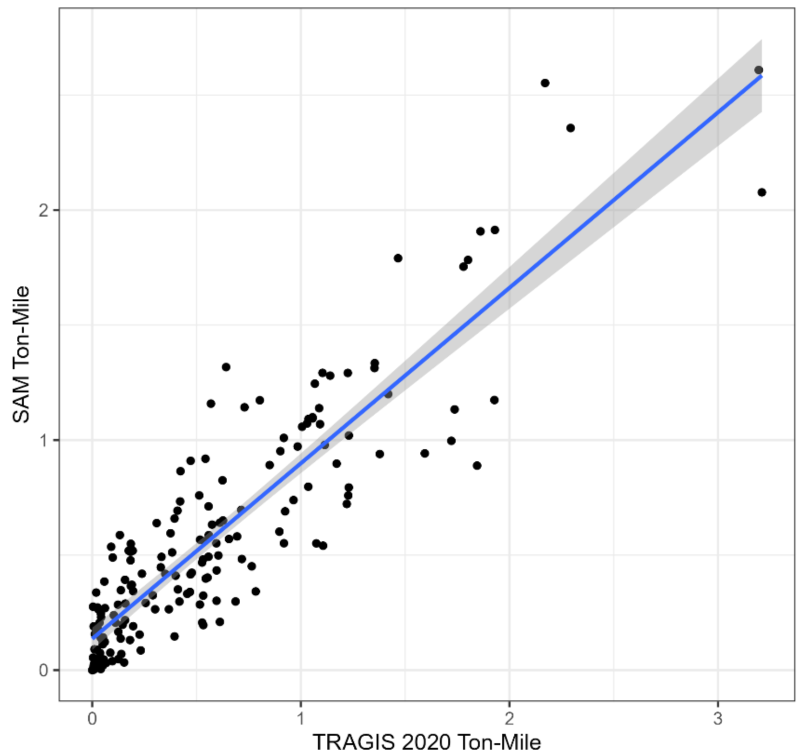


Figure 14: SAM vs. TRAGIS Ton-Mile Distribution by Texas Counties.

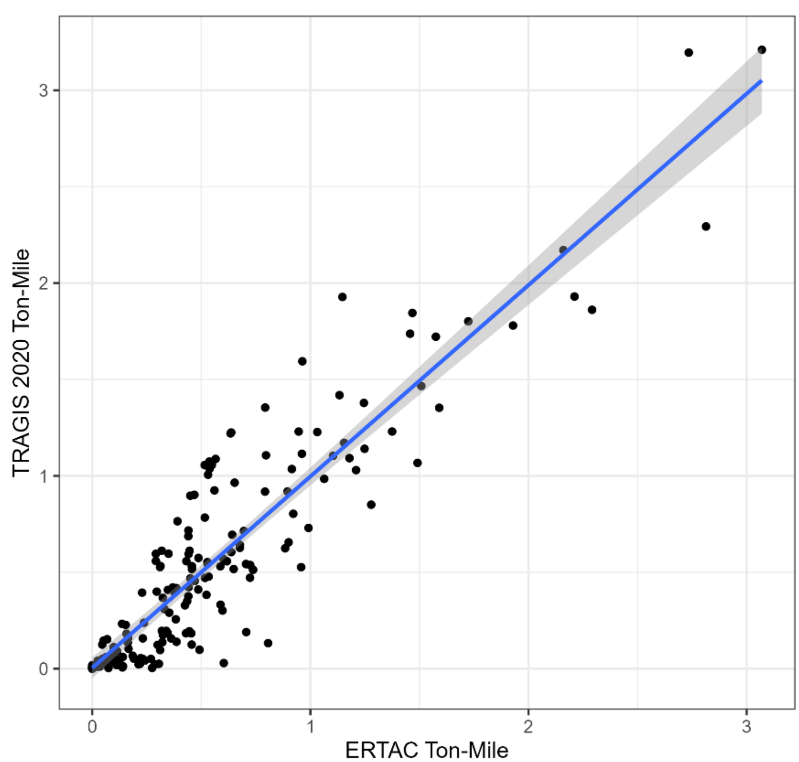


Figure 15: TRAGIS vs. ERTAC Ton-Mile Distribution by Texas Counties.

4.1.2 Summary

2015 SAM and 2020 TRAGIS assignment data were compared with the NARL, 2017 ERTAC NEI data and each other. It was observed that these data are highly correlated, which indicates that SAM or TRAGIS are good candidates to replace the existing 2017 ERTAC data. Since TRAGIS data is for 2020, the study team plans to use it for estimating county-level emissions instead of 2015 SAM data. Appendix D shows the ton-mile distribution by county from the above data sources.

More information on the QA procedures that the study team performed is available in Appendix F.

4.2 Yard

The TTI study team compared the yard locations across ERG, ERTAC, and NARL data to reconcile the discrepancies between the three sources. This section describes the methodology for assigning ERTAC yards from the 2017 locomotive NEI to the NARL shapefile and identifying new yards that need to be added to the EPA's EIS.

4.2.1 Yard Conflation

Initially, the TTI study team tried an approach that relied heavily on the spatial analysis toolset available on the ArcGIS software to identify yards on the NARL shapefile. However, there were discrepancies in the number of miles of industrial leads compared to the previous TTI activity data collection study and some incorrect assignments of NARL links to yards. This led the study team to use a different methodology. The revised methodology focused on manually reviewing and assigning yards on the NARL shapefile. This process was tedious but more accurate and took the team over a month to complete.

The TTI study team used the latitude and longitude of the yards from the ERTAC 2017 study (for 2017 NEI) to create a shapefile of the ERTAC yard location. The study team used this shapefile to find corresponding rail links on the NARL shapefile. This mapping was used to estimate the fuel consumption based on the fuel consumption rate per mile for the yard links. ERTAC had identified 366 yards for the 2017 NEI. 292 of these yards had non-zero emissions; these 292 yards were included in TTI's FY21 (Fiscal Year 2021) study to develop the 2020 Texas Locomotive and Rai Yard AERR EI. Also, ERG identified 337 yards in developing the 2014 Locomotive and Rail Yard AERR EI. These yards are a subset of the 366 yards identified by ERTAC in 2017; thus, they are not discussed here.

Figure 16 shows the 541 yards that the TTI study team identified. 324 were present in the 366 yards identified by ERTAC in 2017. There were 42 yards included in the ERTAC study that either did not have corresponding tracks on the NARL shapefile or had a duplicate yard nearby. Thus, these yards were excluded from this study. TTI also identified 217 additional yards based on the satellite view of the area near the NARL yard and minor industrial lead lines, which were not included in the 2017 ERTAC study. The additional yards based on the satellite view of the area near the NARL yard and minor industrial lead lines were not included in the 2017 ERTAC study.

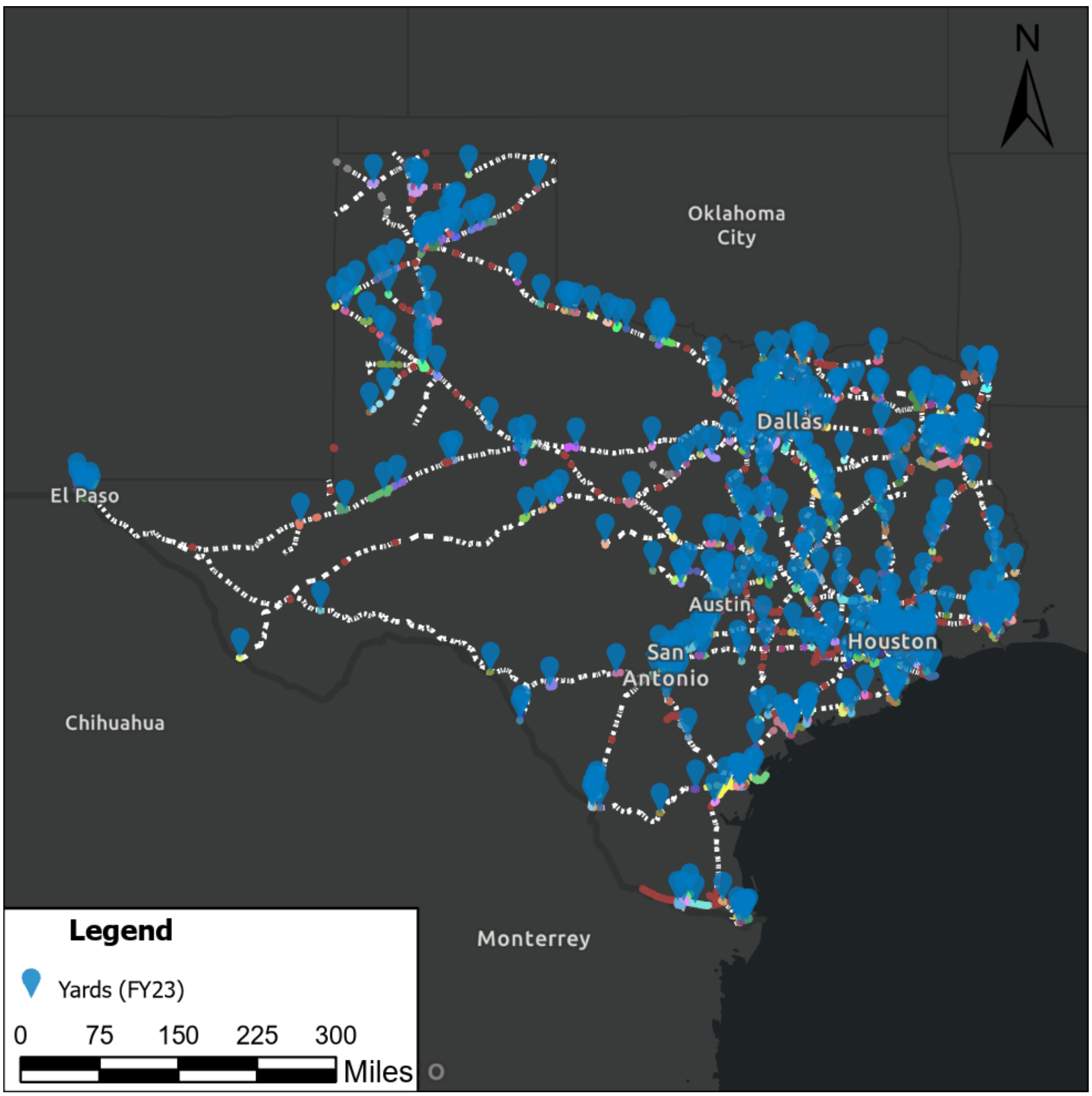


Figure 16: 541 Yards Identified in the Current Study.

Table 7 summarizes the counts of these yards by different counties. Thirty-one (31) of these yards span two or three counties; these yards were assigned to a single county where most of their track miles are concentrated. It can be observed from Figure 7 that most of the yards are concentrated in Harris County. This aligns with the result from the 2020 Locomotive and Rail Yard AERR EI, where TTI observed Harris County yards to have 1,022 short tons of nitrogen oxide (NO_x) emissions in 2020, the highest among all Texas counties.

Table 7: Yard Count by County*.

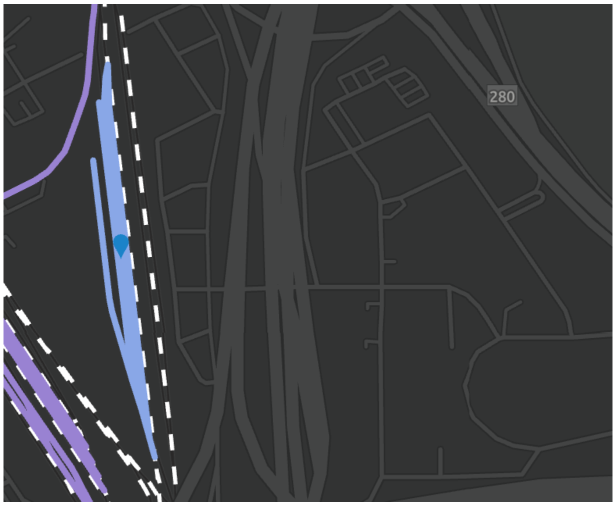
County	FIPS	Facility Count	County	FIPS	Facility Count
Harris	48201	71	Fayette	48149	2
Jefferson	48245	23	Freestone	48161	2
Dallas	48113	21	Maverick	48323	2
Tarrant	48439	19	Gonzales	48177	2
Bexar	48029	13	Gray	48179	2
Brazoria	48039	13	Wise	48497	2
Nueces	48355	12	Howard	48227	2
Harrison	48203	10	Polk	48373	2
Orange	48361	10	Grimes	48185	2
El Paso	48141	9	Randall	48381	2
Williamson	48491	9	Guadalupe	48187	2
Cameron	48061	9	Austin	48015	2
Calhoun	48057	9	Hill	48217	2
Bowie	48037	8	Shelby	48419	1
Wichita	48485	8	Rockwall	48397	1
Webb	48479	8	Scurry	48415	1
Gregg	48183	8	Swisher	48437	1
Denton	48121	7	Refugio	48391	1
Potter	48375	7	Camp	48063	1
Grayson	48181	6	Caldwell	48055	1
Fort Bend	48157	6	Sabine	48403	1
McLennan	48309	5	Hardin	48199	1
Bell	48027	5	Taylor	48441	1
Titus	48449	5	Terry	48445	1
Carson	48065	5	Brown	48049	1
Jasper	48241	4	Tom Green	48451	1
Johnson	48251	4	Presidio	48377	1
Galveston	48167	4	Uvalde	48463	1
Ellis	48139	4	Val Verde	48465	1
Liberty	48291	4	Brazos	48041	1
Hunt	48231	4	Walker	48471	1

County	FIPS	Facility Count	County	FIPS	Facility Count
Hidalgo	48215	4	Waller	48473	1
Hutchinson	48233	4	Washington	48477	1
Parmer	48369	4	Bosque	48035	1
Colorado	48089	4	Bastrop	48021	1
Smith	48423	4	Atascosa	48013	1
Robertson	48395	4	Wilson	48493	1
Chambers	48071	4	Brewster	48043	1
Morris	48343	4	Nacogdoches	48347	1
Hardeman	48197	4	Castro	48069	1
Lamb	48279	3	Panola	48365	1
Runnels	48399	3	Hall	48191	1
Wilbarger	48487	3	Hemphill	48211	1
Hays	48209	3	Henderson	48213	1
Victoria	48469	3	Hockley	48219	1
Hopkins	48223	3	Hood	48221	1
Travis	48453	3	Houston	48225	1
Lubbock	48303	3	Goliad	48175	1
Angelina	48005	3	Gaines	48165	1
Kaufman	48257	3	Jim Wells	48249	1
Jackson	48239	3	Fannin	48147	1
Moore	48341	3	Lampasas	48281	1
Montgomery	48339	3	Leon	48289	1
Nolan	48353	3	Ector	48135	1
Navarro	48349	3	Limestone	48293	1
Matagorda	48321	3	Live Oak	48297	1
Anderson	48001	3	Llano	48299	1
Deaf Smith	48117	3	Eastland	48133	1
Hale	48189	3	McCulloch	48307	1
Burnet	48053	3	Duval	48131	1
Comal	48091	3	Medina	48325	1
Erath	48143	3	Midland	48329	1
Collin	48085	3	Montague	48337	1
Cass	48067	2	Dallam	48111	1
Ward	48475	2	Coryell	48099	1
Marion	48315	2	Cooke	48097	1
Burleson	48051	2	Hansford	48195	1
Milam	48331	2	Newton	48351	1
San Patricio	48409	2	Childress	48075	1
Rusk	48401	2	Cherokee	48073	1
Lamar	48277	2	Wood	48499	1

* The above count sums to 535. DART, TRE, and RJCD operate the remaining six yards. Four of these: Cadiz, DFW-2, Lewisville Industrial Track, and Oldham, are owned by DART and within Dallas County. Since DART used electric

engines within Dallas County, these four were excluded. Trex Station, operated by TRE, is also excluded as TRE is a commuter, and all emissions from TRE are allocated to line haul. Diboll yard operated by RJCD is excluded as RJCD is not part of the 55 Class III operators considered in TCEQ's 2020 Locomotive and Rail Yard AERR EI.

Figure 17 shows two of the yards added in this study that were not included in the ERTAC study. The 9th Street yard is a typical yard with likely one or more switchers. In contrast, the Alleyton yard consists of a single link. This is one type of yard that was commonly observed. These are observed around small towns and likely do not have yard switchers but would have more idling compared to line haul and thus are included in the revised list of yards. ERTAC have several similar yards in their 2017 study.

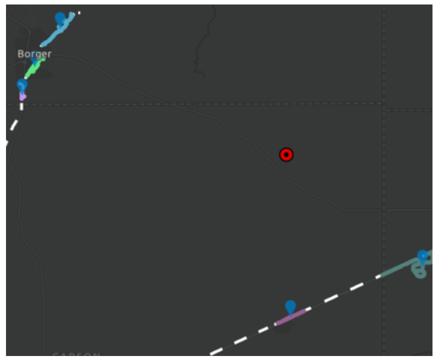


(a) 9th Street Yard

(b) Alleyton

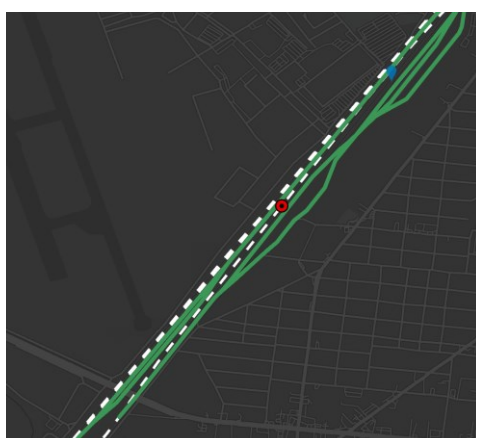
Figure 17: The "9th Street Yard" and "Alleyton" Yards (Shown by Blue Pins) that were added to the Yard Inventory.

Figure 18 shows Skellytown 1, Pearland, and South San Antonio yards from ERTAC's 2017 NEI. These yards were removed as the first two had no associated NARL lines, while the SOUTH SAN ANTONIO yard was removed as the nearby "San Antonio2" yard captured the NARL lines associated with SOUTH SAN ANTONIO.



(a) Skellytown 1

(b) Pearland



(c) South San Antonio

Figure 18: The "Skellytown 1", "Pearland", and "South San Antonio" Yards (shown by Red Circles) that were removed from the Yard Inventory.

4.2.2 Activity Distribution

The activity between the different yards and operators would be distributed based on the mileage of each yard for the different operators. Appendix E shows the miles by yard and operators.

4.2.3 Summary

This study identified 541 yards. 324 of these 541 yards are the same as the 366 yards identified in ERTAC's 2017 locomotive NEI. Forty-two (42) yards included in the ERTAC study either did not have corresponding tracks on the NARL shapefile or had a duplicate yard nearby. TTI also identified 217 additional yards based on the satellite view of the area near the NARL yard and minor industrial lead lines not included in the 2017 ERTAC study. Since these 217 yards were absent in the 2017 locomotive NEI, EPA does not have an associated EIS ID. These yards need to be added to the EPA's EIS and assigned corresponding unique *emission unit identifiers* and *unit emission process identifiers* for these yards to be incorporated into the subsequent NEI submittal. Appendix E provides the table of these 541 yards and their latitude, longitude, and EIS IDs when available. It also provides a table of NARL links associated with each yard.

More information on the QA procedures that the study team performed is available in Appendix F.

5 EMISSION INVENTORY SENSITIVITY ANALYSIS

This section presents the sensitivity analysis results for four different scenarios. The scenarios are based on different combinations of emission rates[4] and activity datasets. Specifically, the following four scenarios were evaluated:

Table 8: Sensitivity Analysis Scenarios.

Scenario	Class I Line-Haul Activity	Yard Activity	Class III Activity	Fleet Mix	Comments
Base Case	ERTAC's 2017 study/ NEI 2017 Class I activity distribution based on FRA tonnage density.	Activity distribution based on switcher counts ERTAC 2017 study.	Activity distribution based on carrier miles.	EPA defaults.	The base case is the same as the TTI 2020 Locomotive and Rail Yard AERR locomotive EI study results (Venugopal et al., 2021, 2020).
Scenario 1	Same as the base case.	Same as the base case.	Same as the base case.	ERTAC 2017 study's national fleet mix.	Same activity as the base case but with a different fleet mix. This scenario test's the impact of change in the fleet mix on emissions without considering changes in activity.
Scenario 2	Class I activity distribution based on the TRAGIS assignment output for 2020.	NARL yard track mileage for the distribution of yard fuel.	Class III line-haul and yard miles were updated, thus changing the total fuel consumption and activity distribution.	Same as the base case	Scenario 2 used the same fleet mix as the base case but different activity distribution. This scenario test's the impact of changes in activity without considering changes in the fleet mix.

[4] The basic emission rates by engine tier are the same for all scenarios compared. They are EPA default emission factors (EPA, 2009). The differences in rates are due to the fleet mix changes between different sources, which results in different composite emission rates.

Scenario	Class I Line-Haul Activity	Yard Activity	Class III Activity	Fleet Mix	Comments
Scenario 3	Class I activity distribution based on the TRAGIS assignment output for 2020.	NARL yard track mileage for the distribution of yard fuel.	Class III line-haul and yard miles were updated, thus changing the total fuel consumption and activity distribution.	ERTAC 2017 study's national fleet mix.	This scenario tests the impact of activity changes and fleet mix changes together.

Scenario 1 only changed the EPA emission factors with ERTAC fleet-based emission factors. Thus, this change scaled the emissions up or down uniformly across a source (represented by SCC in EPA's NEI) depending on the age distribution of the fleet represented in EPA versus ERTAC emission rates.

Scenario 2 changed the Class I line-haul activity distribution. However, the total statewide fuel was not changed as that value was obtained from the R-1 report. Class I yard fuel consumption was also obtained from the R-1 report. Scenario two used the yard track miles to estimate and distribute Class III fuel. The yard track miles were based on the results from Section 2. It used the same emission factors as the base case. Hence, the differences between Scenario 2 and the base case were due to changes in activity distribution between counties and yards. This scenario primarily impacted Class I and III SCCs, not passenger and commuter SCCs. The other SCC's (passenger; Amtrak, and commuter) fuel and emissions changed slightly; the only difference was an increase in fuel consumption for passenger and commuter SCCs, as the current study allocated the yard miles for these two SCCs towards the line-haul fuel consumption. The yard fuel for commuters and Amtrak were not incorporated in the previous study, thus, increasing the statewide fuel consumption for these two SCCs.

Scenario 3 is the same as Scenario 2, except it used the ERTAC fleet-based emission factors with the Scenario 2 activity.

5.1 Analysis of the Different Scenarios

Table 9 presents the statewide 2019 and 2020 fuel consumption for the 2020 Locomotive and Rail Yard AERR EI and the current study. It can be observed that the Class I line haul and yard fuel consumption did not change between the various scenarios analyzed in this study. Class III line-haul fuel consumption decreased (by 780,000 gallons), while Class III yard fuel consumption increased (by 1,860,000 gallons).

This is due to the changes in the NARL track assignment. Based on the abovementioned changes, commuter and Amtrak fuel consumption increased slightly.

Table 9: Fuel Consumption from 2020 Texas Locomotive and Rail Yard AERR EI (FY21) and Current Study (FY23)

Year	Class	Reporting Group	Fuel (Mil Gal) FY21	Fuel (Mil Gal) FY23	Difference (Mil Gal)
2019	Class I	Line-Haul	303.49	303.49	0.00
2019	Class I	Yard	17.87	17.87	0.00
2019	Class III	Line-Haul	6.51	5.74	-0.78
2019	Class III	Yard	3.09	4.95	1.86
2019	Commuter	Line-Haul	1.23	1.32	0.09
2019	Passenger	Line-Haul	4.49	4.49	0.00
2020	Class I	Line-Haul	255.48	255.48	0.00
2020	Class I	Yard	15.04	15.04	0.00
2020	Class III	Line-Haul	5.48	4.83	-0.65
2020	Class III	Yard	2.60	4.17	1.57
2020	Commuter	Line-Haul	0.77	0.82	0.05
2020	Passenger	Line-Haul	2.79	2.80	0.00

Table 10 presents the statewide emissions for CAPs across scenarios and the percent difference with the base case. It can be observed that when using the ERTAC fleet mix (Scenario 1), the emissions increase. Changes in the activity distribution (Scenario 2) have minimal impact on the overall emissions. The Scenario 3 difference is quite close to the Scenario 1 difference, indicating that the primary emissions differences are from the changes in emission rates and not activity.

Table 10: Statewide Annual CAP Emissions (Short Tons) across Scenarios.

Pollutant	Base Case	Scenario 1	Scenario 2	Scenario 3	Scenario 1 (% Diff)	Scenario 2 (% Diff)	Scenario 3 (% Diff)
CO	8285.49	8285.49	8316.75	8316.75	0.00	0.38	0.38
NH_3	25.82	25.82	25.91	25.91	0.00	0.35	0.35
NO_X	32093.69	41942.31	32239.12	42082.07	30.69	0.45	31.12
PM_{10}-PRI	767.95	1265.25	771.11	1268.88	64.76	0.41	65.23
$PM_{2.5}$-PRI	744.92	1227.30	747.97	1230.81	64.76	0.41	65.23
SO2	29.01	29.01	29.11	29.11	0.00	0.34	0.34
VOC	1370.46	2077.72	1380.24	2090.61	51.61	0.71	52.55

Table 11 shows the split across SCCs. Class I statewide emissions have no change for all pollutants except NO_x between Scenario 2 and the base case. The fuel consumption is the same between the base case and Scenario 2. The NO_x statewide emissions changes slightly due to changes in county activity distribution combined with the fact that only 110 out of 254 Texas counties have the TxLED factor active. In Scenario 2, which uses the revised activity, the contribution of activity from non-TxLED counties increased, thus increasing statewide NO_x emissions.

In Scenarios 2 and 3, Class III line-haul statewide emissions decline, but the Class III yard emissions increase. Amtrak and Commuter emissions are a small fraction of the total and, in terms of absolute difference, affect little change compared to other categories.

Table 11: Statewide Annual CAP Emissions (Short Tons) across Scenarios by SCC.

Pollutant	SCC	Base Case	Scenario 1	Scenario 2	Scenario 3	Scenario 1 (% Diff)	Scenario 2 (% Diff)	Scenario 3 (% Diff)
CO	Amtrak	82.01	82.01	82.05	82.05	0.00	0.05	0.05
CO	Class I	7497.68	7497.68	7497.68	7497.68	0.00	0.00	0.00
CO	Class III	140.83	140.83	124.04	124.04	0.00	-11.92	-11.92
CO	Commuter	22.49	22.49	24.05	24.05	0.00	6.94	6.94
CO	Yard	542.48	542.48	588.93	588.93	0.00	8.56	8.56
NH_3	Amtrak	0.26	0.26	0.26	0.26	0.00	0.00	0.00
NH_3	Class I	23.38	23.38	23.38	23.38	0.00	0.00	0.00
NH_3	Class III	0.50	0.50	0.44	0.44	0.00	-12.00	-12.00
NH_3	Commuter	0.07	0.07	0.07	0.07	0.00	0.00	0.00
NH_3	Yard	1.62	1.62	1.76	1.76	0.00	8.64	8.64
NO_X	Amtrak	275.24	542.16	275.38	542.43	96.98	0.05	97.08
NO_X	Class I	26938.66	36671.94	26918.20	36644.09	36.13	-0.08	36.03
NO_X	Class III	1345.44	1260.41	1189.38	1114.21	-6.32	-11.60	-17.19
NO_X	Commuter	73.69	171.48	78.79	183.34	132.70	6.92	148.80
NO_X	Yard	3460.67	3296.32	3777.38	3597.99	-4.75	9.15	3.97
PM_{10}-PRI	Amtrak	6.47	19.93	6.47	19.94	208.04	0.00	208.19
PM_{10}-PRI	Class I	647.71	1110.78	647.71	1110.78	71.49	0.00	71.49
PM_{10}-PRI	Class III	32.04	38.17	28.22	33.62	19.13	-11.92	4.93
PM_{10}-PRI	Commuter	1.77	5.33	1.90	5.70	201.13	7.34	222.03
PM_{10}-PRI	Yard	79.96	91.04	86.81	98.83	13.86	8.57	23.60
$PM_{2.5}$-PRI	Amtrak	6.27	19.33	6.28	19.34	208.29	0.16	208.45
$PM_{2.5}$-PRI	Class I	628.28	1077.46	628.28	1077.46	71.49	0.00	71.49
$PM_{2.5}$-PRI	Class III	31.08	37.03	27.37	32.61	19.14	-11.94	4.92
$PM_{2.5}$-PRI	Commuter	1.72	5.17	1.84	5.53	200.58	6.98	221.51
$PM_{2.5}$-PRI	Yard	77.56	88.30	84.20	95.87	13.85	8.56	23.61
SO_2	Amtrak	0.29	0.29	0.29	0.29	0.00	0.00	0.00
SO_2	Class I	26.26	26.26	26.26	26.26	0.00	0.00	0.00
SO_2	Class III	0.56	0.56	0.50	0.50	0.00	-10.71	-10.71
SO_2	Commuter	0.08	0.08	0.08	0.08	0.00	0.00	0.00

Pollutant	SCC	Base Case	Scenario 1	Scenario 2	Scenario 3	Scenario 1 (% Diff)	Scenario 2 (% Diff)	Scenario 3 (% Diff)
SO_2	Yard	1.82	1.82	1.97	1.97	0.00	8.24	8.24
VOC	Amtrak	10.06	31.48	10.06	31.49	212.92	0.00	213.02
VOC	Class I	1067.54	1750.00	1067.54	1750.00	63.93	0.00	63.93
VOC	Class III	74.48	60.31	65.60	53.12	-19.03	-11.92	-28.68
VOC	Commuter	2.76	8.43	2.95	9.01	205.43	6.88	226.45
VOC	Yard	215.63	227.50	234.09	246.98	5.50	8.56	14.54

Figure 19, Figure 20, and Figure 21 show the emissions values for NO_x, PM_{10}, and CO, respectively, from Table 11 as bar graphs. The key takeaways are that changing the fleet mix significantly impacted the NO_x and PM_{10} emissions compared to just changing the activity. CO emission factors do not depend on the fleet. Thus, CO emissions are the same between the EPA and ERTAC fleet mix.

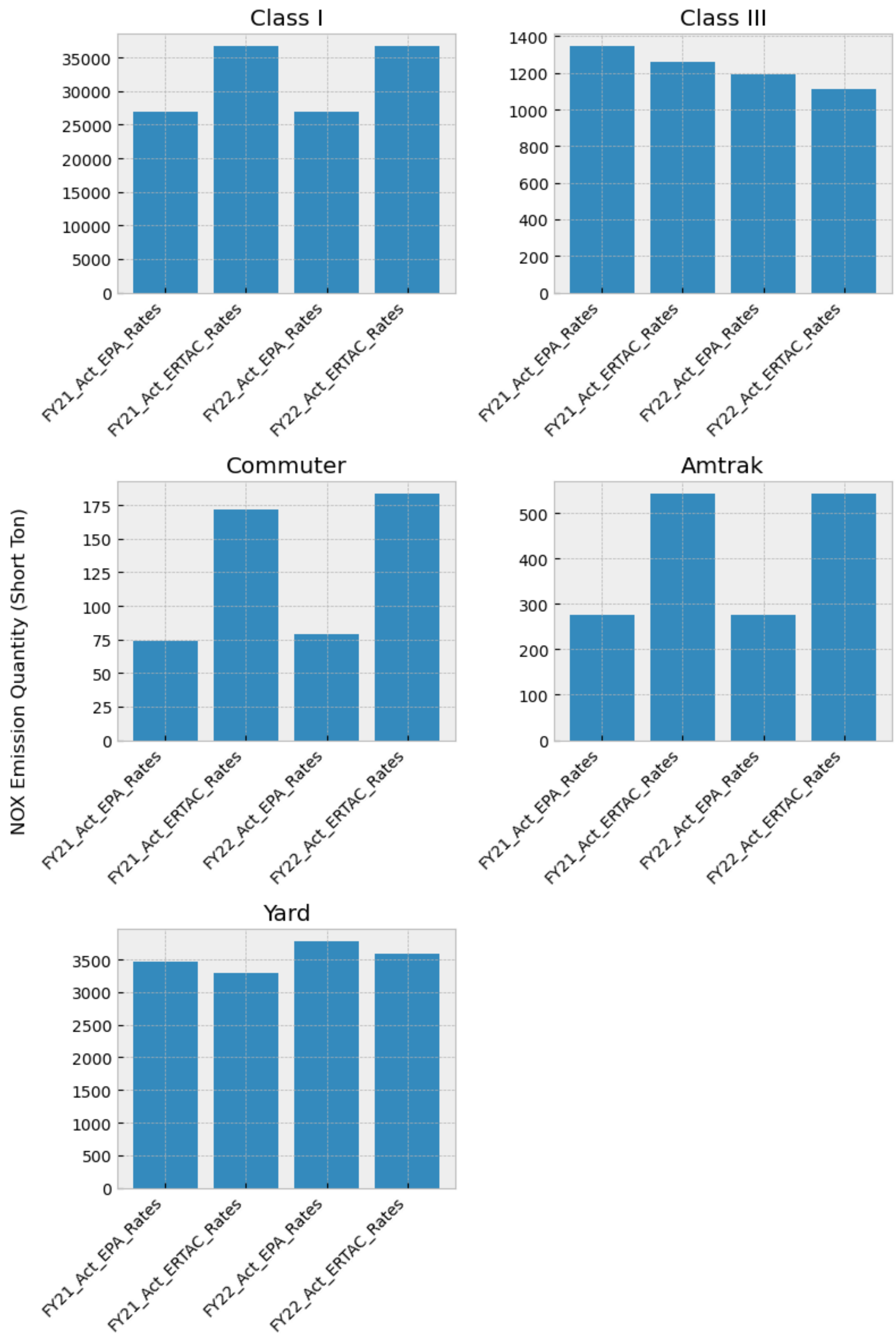


Figure 19: Statewide NO_x Emission Quantity (Short-Ton) for Different SCCs and Scenarios*.

*FY21_Act_EPA_Rates is the base case; FY21_Act_ERTAC_Rates is scenario 1, FY22_Act_EPA_Rates is scenario 2, and FY22_Act_ERTAC_Rates is is scenario 3.

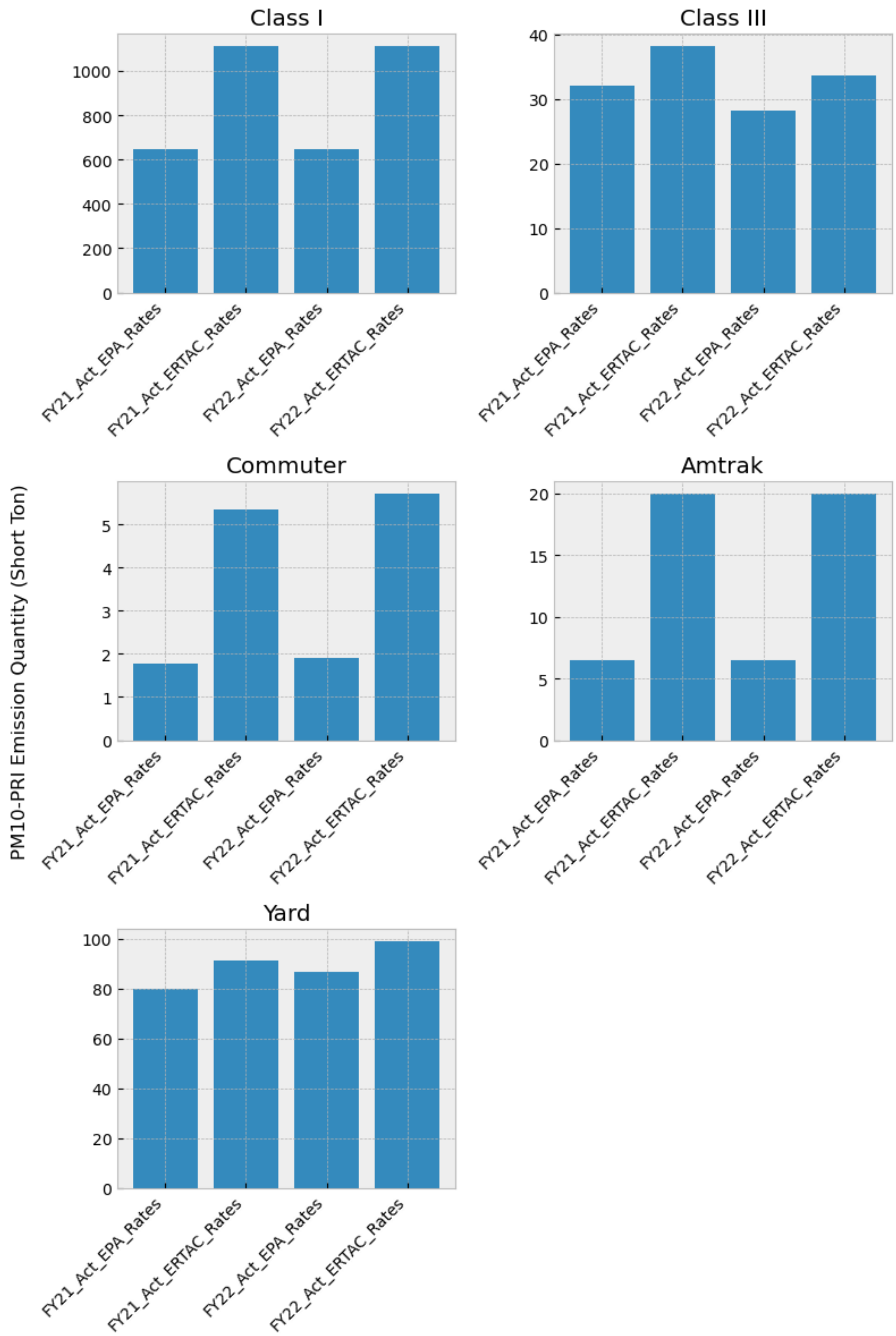


Figure 20: Statewide PM10 Emission Quantity (Short-Ton) for Different SCCs and Scenarios*.

*FY21_Act_EPA_Rates is the base case; FY21_Act_ERTAC_Rates is scenario 1, FY22_Act_EPA_Rates is scenario 2, and FY22_Act_ERTAC_Rates is is scenario 3.

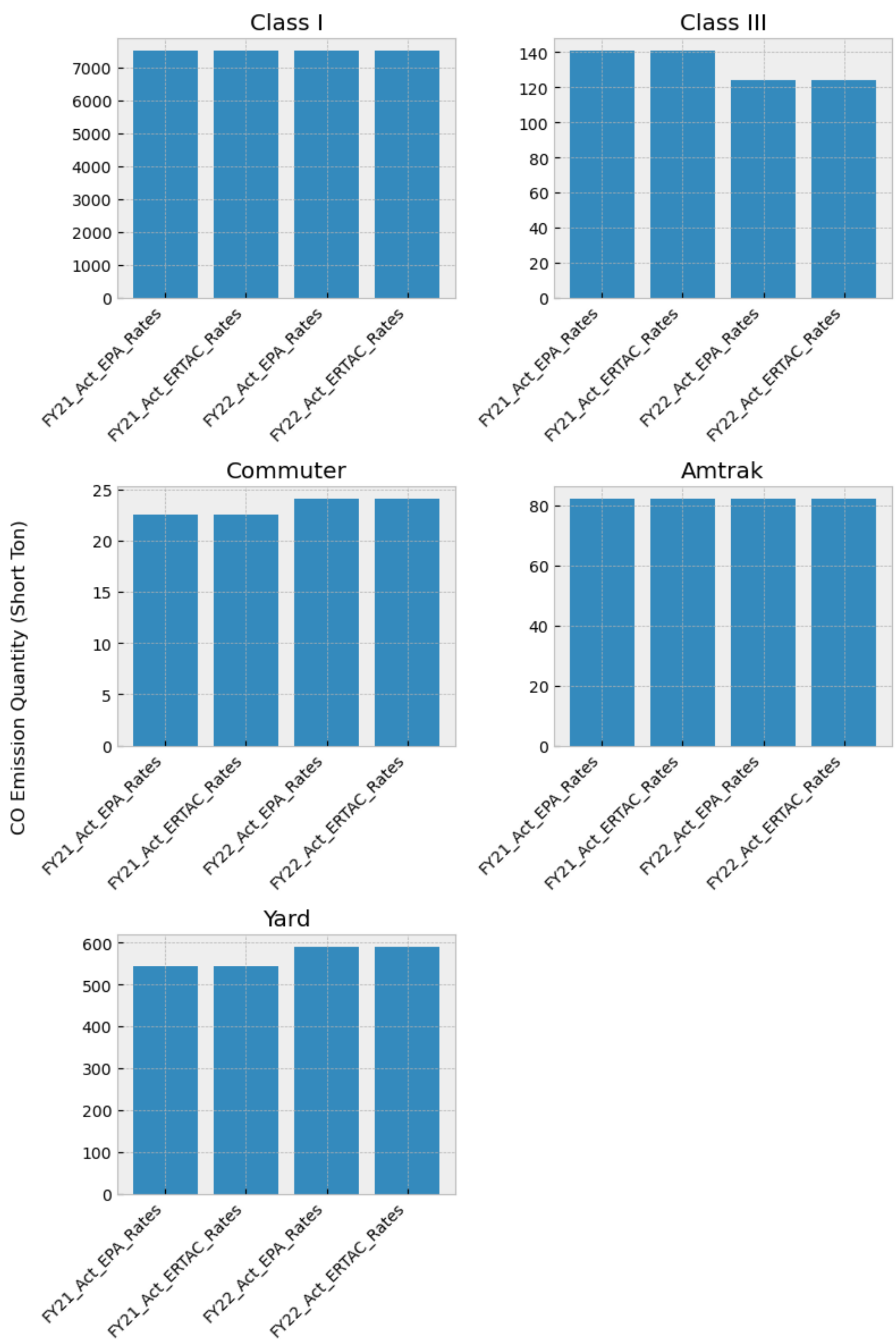


Figure 21: Statewide CO Emission Quantity (Short-Ton) for Different SCCs and Scenarios*.

*FY21_Act_EPA_Rates is the base case; FY21_Act_ERTAC_Rates is scenario 1, FY22_Act_EPA_Rates is scenario 2, and FY22_Act_ERTAC_Rates is is scenario 3.

Figure 22, Figure 23, and Figure 24 show the percent change in Class I NO_x countywide emissions for scenarios 1, 2, and 3, respectively, compared to the base case. For scenario 1, changing the fleet mix from EPA to ERTAC produces uniform increases or decreases in the county emissions (the same rates were applied to all counties). Figure 23 and Figure 24 show significant changes in the Class I emissions for individual counties even though statewide emission changes were minimal.

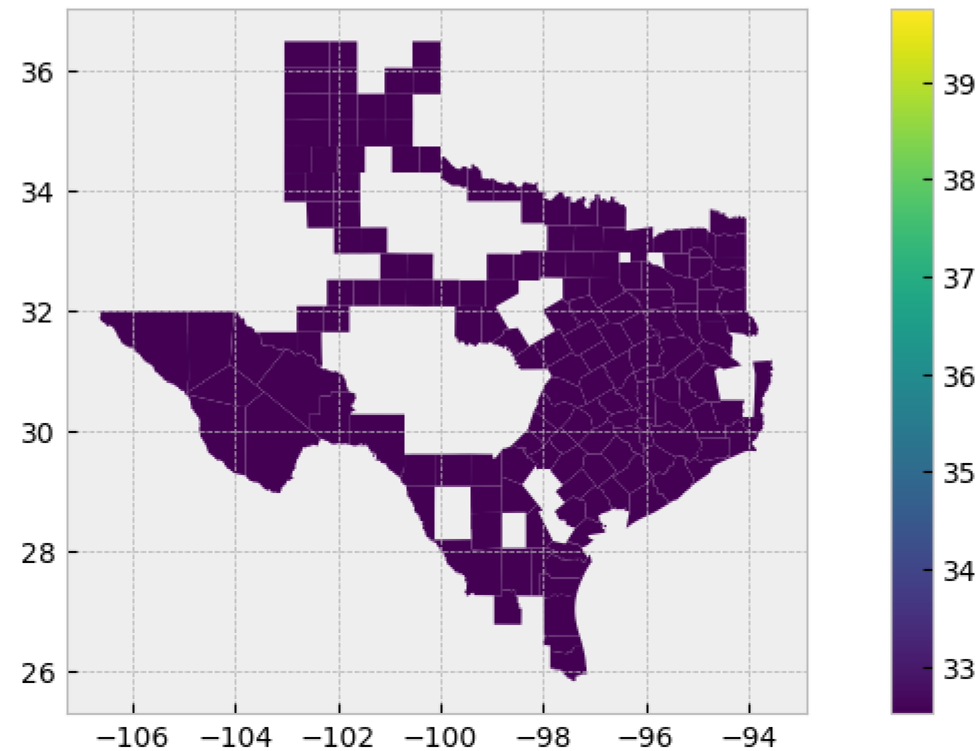


Figure 22: Class I Scenario 1 versus the Base Case Percent Change in Countywide NO_x Emissions.

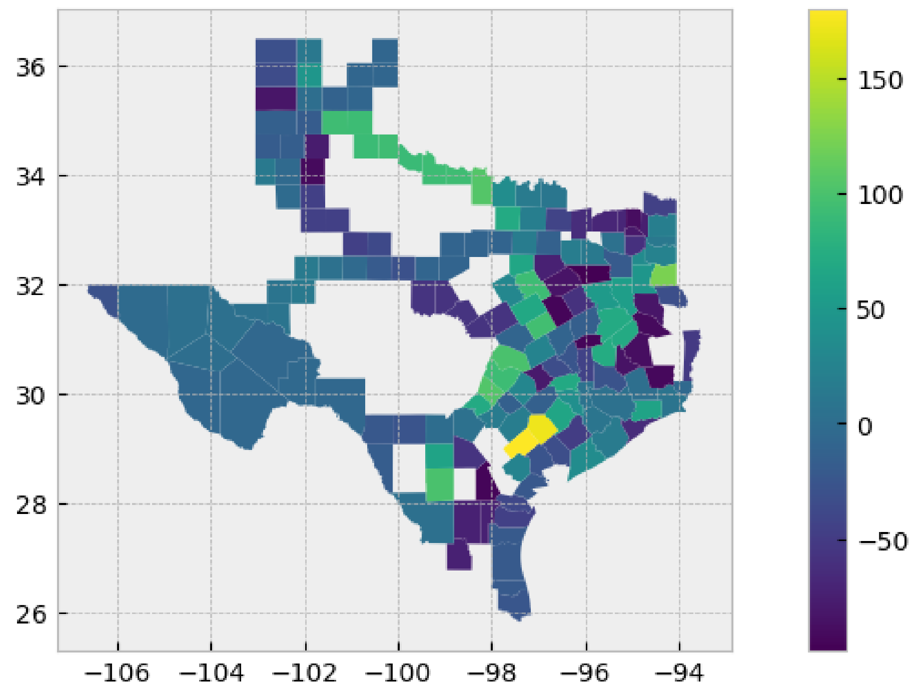


Figure 23: Class I Scenario 2 versus the Base Case Percent Change in Countywide NO_x Emissions.

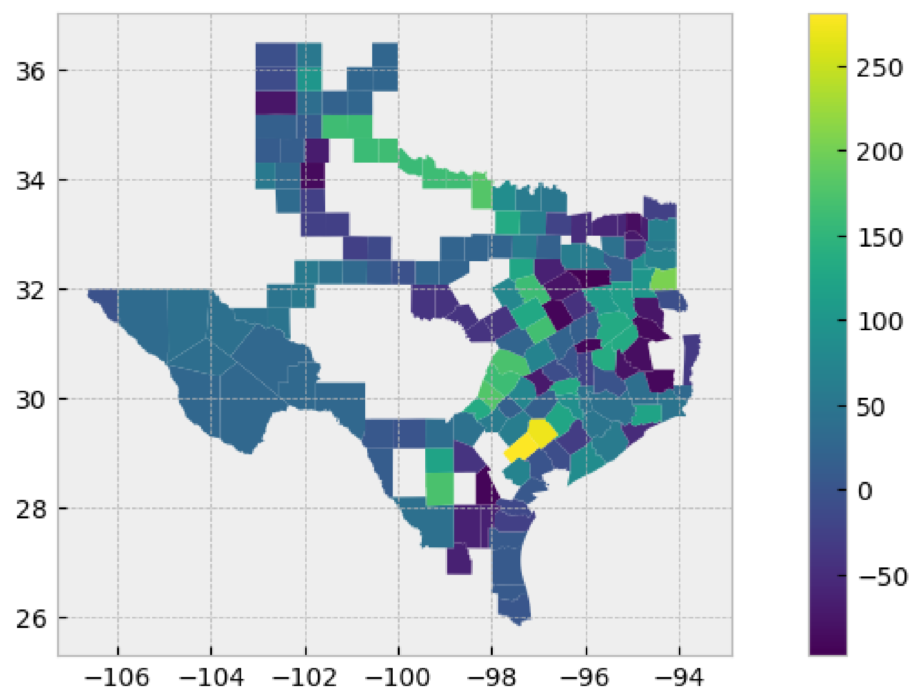


Figure 24: Class I Scenario 3 versus the Base Case Percent Change in Countywide NO_x Emissions.

Figure 25 and Figure 26 show a scatter plot comparison of the countywide NO_x emissions for Scenario 2 and 3, respectively. It can be observed that, generally, the distribution of fuel between Scenarios 2 and 3 closely tracks the fuel consumption seen in the base case. These figures also show that the yard emissions for scenarios 2 and 3 do not follow the trends from the base case. This is because the base case used the ERTAC 2017 study yard activity distribution, computed using the fuel consumption rate per switcher and the number of switchers present in a given yard. In contrast, the current study and scenarios 2 and 3 used the yard mileage to distribute the fuel.

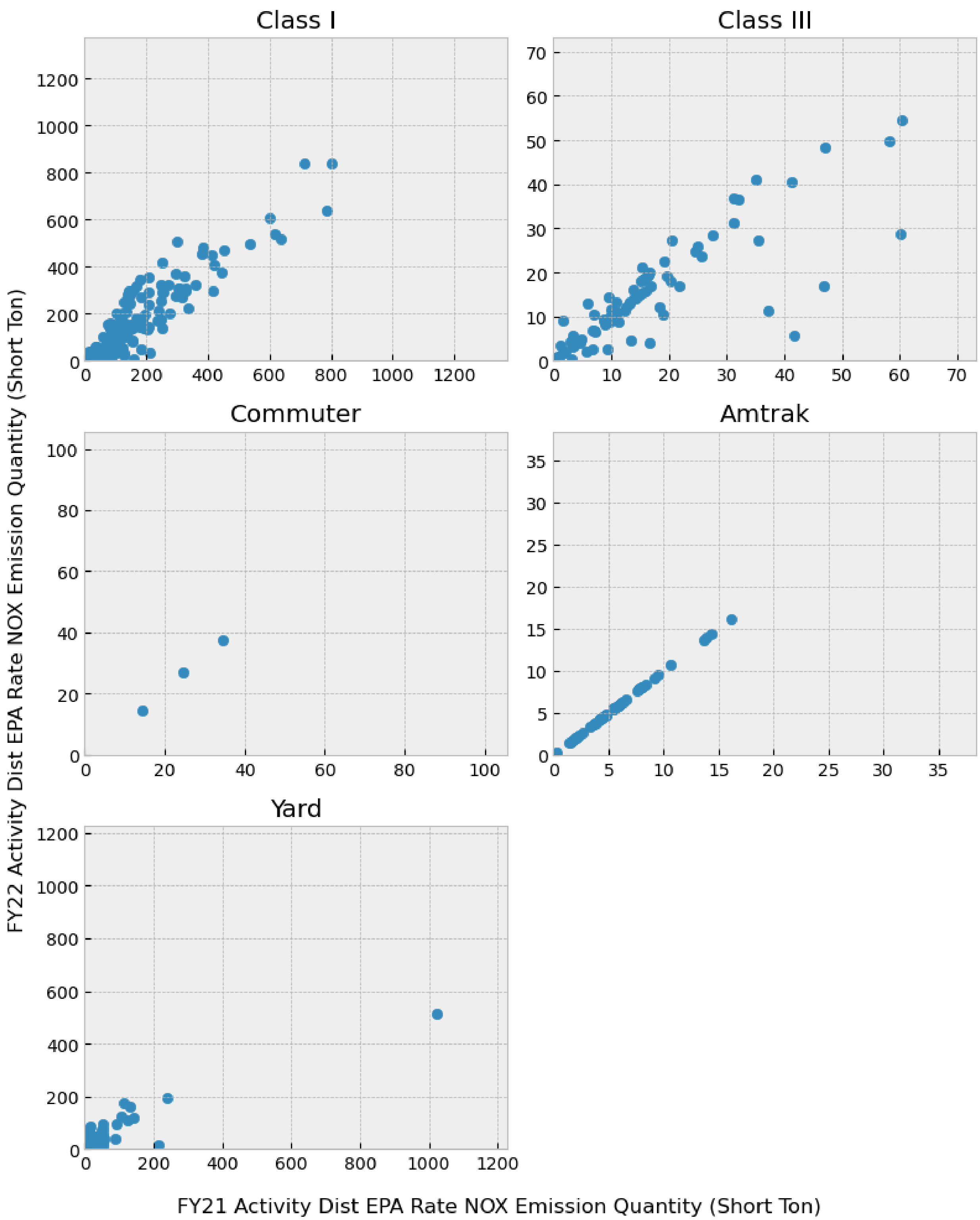


Figure 25: Scenario 2 (y) versus the Base Case (x) Countywide NO_x Emissions.

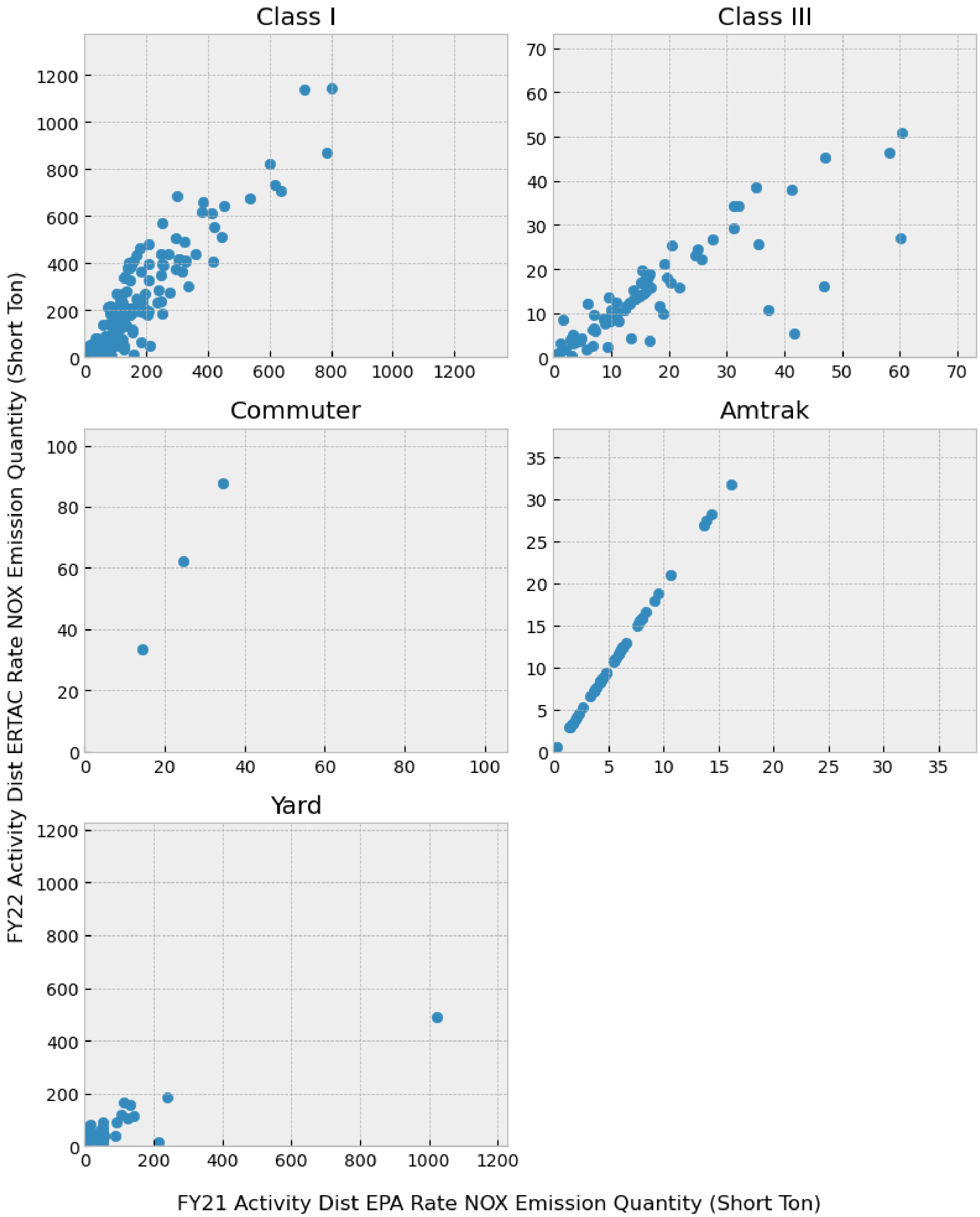


Figure 26: Scenario 3 (y) versus the Base Case (x) Countywide NO_x Emissions.

Table 12 presents the NO_x emission changes between different scenarios for ozone non-attainment areas. If emission factors were developed using the ERTAC 2017 study fleet mix (Scenario 1), NO_x emissions would increase across all four ozone non-attainment areas. If the fleet mix was kept the same (EPA's fleet mix) while activity distributions were updated (Scenario 2), San Antonio (SAN) and Dallas Forth Worth (DFW) emissions would slightly increase, whereas Houston-Galveston-Brazoria (HGB) and El Paso (ELP) emissions would decrease. When using revised activity and fleet mix (Scenario 3), SAN and DFW had a noticeable increase in net emissions, HGB had a minor increase in emissions, and ELP had a decrease in NO_x.

Table 12: Ozone Non-Attainment Area Annual NO_x Emissions Quantity (Short-Ton) for Different Scenarios and Percent Change Relative to Base Case*.

COG	Base Case	Scenario 1	Scenario 2	Scenario 3	Scenario 1 (% Diff)	Scenario 2 (% Diff)	Scenario 3 (% Diff)
SAN	577.37	748.05	616.36	793.47	29.56	6.75	37.43
HGB	3606.67	4321.98	2941.45	3687.48	19.83	-18.44	2.24
DFW	3061.44	3991.08	3398.52	4443.52	30.37	11.01	45.14
ELP	574.18	726.08	425.53	536.22	26.45	-25.89	-6.61

* SAN: San Antonio; HGB: Houston-Galveston-Brazoria; DFW: Dallas-Fort Worth; ELP: El Paso

ELP is the only county in Texas currently in non-attainment for PM_{10}. Table 13 presents the changes in ELP PM_{10} emissions between different scenarios. ELP's non-attainment area would have a 26 percent decrease in emissions if the fleet mix is kept the same as the base case and the activity distribution is updated (Scenario 2). However, if emission factors were developed using the ERTAC 2017 study fleet mix (Scenario 1), PM_{10} emissions would increase by 59.31 short-tons. It would have a 17.63 short-ton increase in emissions due to combined changes in fleet mix and activity (Scenario 3).

Table 13: El Paso Non-Attainment Area Annual PM_{10} Emissions Quantity (Short-Ton) for Different Scenarios and Percent Change relative to Base Case.

SCC	Base Case	Scenario 1	Scenario 2	Scenario 3	Scenario 1 (% Diff)	Scenario 2 (% Diff)	Scenario 3 (% Diff)
Amtrak	0.21	0.63	0.21	0.63	208.06	0.05	208.22
Class I	9.66	16.57	6.91	11.86	71.49	-28.43	22.73
Class II/III	0.13	0.15	0.05	0.05	19.14	-64.99	-58.28
Yard	3.15	3.59	2.56	2.92	13.85	-18.64	-7.37
Total	**13.14**	**20.94**	**9.73**	**15.46**	**59.31**	**-26.00**	**17.63**

5.2 Summary

This chapter details the sensitivity analysis for four scenarios: Base Case, Scenario 1, Scenario 2, and Scenario 3. The following is a quick overview of the four scenarios:

- The base case is the same as the 2020 Locomotive and Rail Yard AERR EI study.
- Scenario 1 uses the same activity distribution for Class I and yards as the base case. However, ERTAC 2017 study fleet mix was used for developing emission factors.
- Scenario 2 uses the Class I activity distribution based on the TRAGIS assignment output for 2020 and NARL yard track mileage for the distribution of yard fuel. In contrast, the base case and scenario 1 use the ERTAC 2017 fuel distribution across counties and yards to distribute the statewide fuel. Scenario 2 used the same fleet mix as the base case.
- Scenario 3 uses the same activity distribution as scenario 2 but uses ERTAC 2017 study fleet mix for developing emission factors.

The following were the key takeaways for statewide fuel consumption and emissions from the sensitivity analysis:

1. Between scenarios (Scenario 2 and Scenario 3) with updated activity, Class I line haul and yard fuel consumption did not change. Class III line-haul fuel consumption decreased (by 780,000 gallons), while Class III yard fuel consumption increased (by 1,860,000 gallons). This is due to the Class III line-haul and yard label changes for the NARL tracks.
2. In general, the emissions increase for scenarios using the ERTAC fleet mix (Scenarios 1 and 3).
3. Changes in the activity distribution (Scenario 2) have minimal impact on the overall emissions. The primary emissions differences are from the changes in composite emission rates due to the different underlying fleet mixes.

The following were the key takeaways for countywide emissions from the sensitivity analysis:

1. Noticeable changes in the Class I emissions for individual counties, even though there are only relatively minor changes in the statewide emissions. The differences in emissions might not impact SIP and conformity processes when considering the absolute emissions differences for a day.

2. Class I line-haul distribution of fuel and emissions for scenarios (scenario 2 and scenario 3) with updated activity closely tracks the fuel consumption in the base case.
3. The yard emissions for scenarios (Scenario 2 and Scenario 3) with updated activity do not follow the trends from the base case. This is because the base case uses the ERTAC 2017 study yard activity distribution, computed using the fuel consumption rate per switcher and the number of switchers present in each yard, while the current study's (scenarios 2 and 3) activity distribution uses the yard mileage to distribute the fuel.

The following were the key takeaways for ozone and PM_{10} non-attainment areas from the sensitivity analysis:

1. Ozone Non-Attainment Areas: SAN and DFW non-attainment areas will have a slight increase in NO_x emissions if just the activity distribution is updated. HGB and ELP areas would have a decrease in NO_x emissions if just the activity were updated and the fleet mix was kept the same (EPA's fleet mix). SAN and DFW areas will have a noticeable increase in emissions when using revised activity and fleet mix. In contrast, the HGB area would have a minor increase in emissions, and ELP would have a decrease in NO_x.
2. PM_{10} non-attainment area (ELP): ELP non-attainment area would have a 26 percent decrease in PM_{10} emissions if the fleet mix is kept the same as the base case and the activity distribution is updated. It would have a 17.63 percent increase in PM_{10} emissions due to combined fleet mix and activity changes.

The TTI study team identified that, in general, the emissions increase for scenarios using the ERTAC fleet-mix (Scenarios 1 and 3). In contrast, changes in the activity distribution (Scenario 2) have minimal impact on the emissions. When emissions were compared for the ozone and PM_{10} non-attainment areas, Scenarios 1 and 3 consistently generated higher NO_x and PM_{10} emissions than the base case (as shown in Table 12 and Table 13), whereas Scenario 1 emissions were significantly higher than Scenario 3 emissions.

The TTI study team suggests using the conservative scenario with the most recent activity data identified in this study (Scenario 3) to develop updated locomotive and rail yard EIs. A conservative scenario here refers to a modeling approach that, by design, tends to overestimate emissions. This approach leads to higher emissions than might otherwise be expected in actuality. If an exceedance in the National Ambient Air Quality Standards (NAAQS) did not occur, correlated in time to these conservative inputs and assumptions, then an exceedance under “real-world” conditions would be extremely unlikely to occur. This is standard practice in transportation air quality modeling.

6 CONCLUSION

This study examined the previous 2020 locomotive EI developed by TTI and explored alternate data sources for improving the emissions estimates of line-haul and railyard sources. Specifically, this study aimed at

- adding, deleting, and updating railyards based on NARL and previous EIs by ERTAC and ERG.
- updating the Class I activity distribution across Texas counties.
- updating the fleet mix with the most recent available data.

Additionally, this study conducted a sensitivity analysis to understand how emissions would be impacted due to the above changes, in isolation and combined.

Based on the literature review and coordination with several agencies and associations, TTI was able to obtain some updated activity data for Class I operators as part of this study. ORNL and TxDOT both provided the freight assignment data. Moreover, TTI can reach out to these agencies in the future to obtain the most recent activity data. The approximate time for coordination and obtaining the activity data should be around two months. Unfortunately, TTI was unable to get the most recent fleet mix information for Texas. Based on communication with AAR and Railinc, this information is available, but due to confidentiality reasons cannot be shared with TTI.

Apart from the line-haul activity for Class I operators, this study identified an exhaustive list of possible yards for Texas. It identified 541 yards, 324 of which were present in the 366 yards identified in ERTAC's 2017 study. Forty-two (42) yards included in the ERTAC study either did not have corresponding tracks on the NARL shapefile or had a duplicate yard nearby. Thus, they were excluded from the current study. Two hundred seventeen (217) additional yards identified in this study were not included in the 2017 ERTAC study. Thus, they do not have an associated EIS ID. These yards need to be added to the EPA's EIS and assigned corresponding unique *emission unit identifiers* and *unit emission process identifiers* for these yards to be incorporated into the next NEI submittal. TTI will investigate the most recent 2020 locomotive and rail yard NEI developed by the EPA to identify any changes in the yard information and coordinate with the EPA to consolidate the number and location of yards.

After identifying alternate sources of activity and fleet mix data and updating the railyard inventory, TTI conducted a sensitivity analysis for four scenarios: a Base Case that is the same as the 2020 Locomotive and Rail Yard AERR EI study and three alternative scenarios where either the fleet mix, fuel distribution, or both were altered. Through the sensitivity analysis, TTI identified that, in general, the emissions increase from the base case for scenarios using the ERTAC fleet mix. Changes in the activity distribution have minimal impact on the overall emissions. The primary emissions differences are from the changes in composite emission rates due to changes in the underlying fleet mix (proportions) of the basic emissions rates by age. Countywide emissions sensitivity analysis showed noticeable changes in the Class I emissions for individual counties, even though there is only a relatively minor change in the statewide emissions.

The TTI study team suggests using the conservative scenario with the most recent activity data identified in this study (Scenario 3) to develop updated locomotive and rail yard EIs. A conservative scenario here refers to a modeling approach that, by design, tends to overestimate emissions. This approach leads to higher estimates than might otherwise be expected in actuality. If an exceedance in the NAAQS did not occur, correlating in time under these conservative inputs and assumptions, then an exceedance under "real-world" conditions would be extremely unlikely to occur. This is standard practice in transportation air quality modeling.

6.1 Next Steps

EPA will release its most recent 2020 locomotive NEI sometime in spring 2023. TTI can compare the methodology and results from this study with EPA values to identify any areas of improvement or discrepancies. If directed by TCEQ, TTI can coordinate with the EPA to consider adding to EPA's EIS the two hundred seventeen (217) additional yards identified in this study, which were previously absent in the EPA's EIS. To incorporate these yards in the subsequent NEI submittal, these newly identified yards need to be assigned corresponding unique *emission unit identifiers* and *unit emission process identifiers*.

To ensure conservative emission values are generated, the conservative scenario, generated using the ERTAC fleet mix, as identified in this study through Scenarios 1 and 3 of the sensitivity analysis, should be incorporated into the development of updated locomotive and rail yard EIs.

The following are the areas of future work that can significantly improve the methodology:

- an in-depth study of the railyards in Texas to identify different types of yards, types of operations occurring at the different types of yards, switcher characteristics (number, age, and operating hours), and good predictors of fuel usage at the yards. This study would need coordination with the railroad operators in Texas. The current methods of using only the number of switchers at a yard or the number of track miles at a yard do not consider the range of operations that may occur at a yard.
- obtaining the Texas-specific fleet mix. The emission factors used to estimate emissions are sensitive to the model year of an engine. Using national defaults to estimate Texas-specific emissions are likely less accurate.
- understanding the Class III fuel usage. The current methodology of using track miles to estimate Class III fuel usage has been used for over a decade. This is warranted due to the lack of data available from Class III operators. There is a need to survey the Class III operators to understand their activity and fleet.

A caveat on the above is that the datasets needed to conduct these studies are mostly available only through rail operators, who are often unwilling (mainly due to corporate policy) to share the data for EI development. There is a need to have a memorandum of understanding (MOU) with rail operators, similar to what California has, to be able to obtain the detailed data needed to make fundamental changes to the locomotive EI.

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APPENDIX A: TXDOT RAIL PLAN TONNAGE BY CLASS I SUBDIVISIONS

2017 Annual Gross Tons per Mile for Class I Carrier Subdivisions.

Division	Subdivision	Owner	Operator	Subdivision Route / Mileage	Current Line Density (2017) in Annual Gross Tons per Mile (in Millions)
Kansas	Boise City	BNSF Railway	BNSF Railway	Total 256.8 miles; approximately 100 miles in Texas	51
Kansas	Dalhart	BNSF Railway	BNSF Railway	Total 119.3 miles total; approximately 118 miles in Texas	16
Kansas	Hereford	BNSF Railway	BNSF Railway	Total 105.2 miles; approximately 95 miles in Texas	202
Kansas	Panhandle	BNSF Railway	BNSF Railway	Total 312.5 miles; approximately 123 miles in Texas	175
Red River	Bay City	BNSF Railway	BNSF Railway	Total 17.5 miles	2
Red River	BBRX	BNSF Railway	BNSF Railway	Total 14.7 miles	Unknown
Red River	Chickasaw	BNSF Railway	BNSF Railway	Total 54.5 miles; approximately	Unknown
Red River	Conroe	BNSF Railway	BNSF Railway	Total 152.2 miles	10
Red River	DFW	BNSF Railway	BNSF Railway	Total 94.0 miles	25
Red River	Fort Worth	BNSF Railway	BNSF Railway	Total 193.3 miles	66 to 73
Red River	Galveston	BNSF Railway	BNSF Railway	Total 217.8 miles	32 to 73
Red River	Houston	BNSF Railway	BNSF Railway	Total 148.2 miles	17
Red River	Lampasas	BNSF Railway	BNSF Railway	Total 241.5 miles	27
Red River	Longview	BNSF Railway	BNSF Railway	Total 186.6 miles	9
Red River	Madill	BNSF Railway	BNSF Railway	Total 108.4 miles; approximately 80 miles in Texas	31
Red River	Mykawa	BNSF Railway	BNSF Railway	Total 19.3 miles	46
Red River	Plainview	BNSF Railway	BNSF Railway	Total 102.7 miles	20
Red River	Red River Valley	BNSF Railway	BNSF Railway	Total 220.6 miles	50
Red River	Silsbee	BNSF Railway	BNSF Railway	Total 19.7 miles	9
Red River	Slaton	BNSF Railway	BNSF Railway	Total 208.7 miles	24

Division	Subdivision	Owner	Operator	Subdivision Route / Mileage	Current Line Density (2017) in Annual Gross Tons per Mile (in Millions)
Red River	Venus	BNSF Railway	BNSF Railway	Total 18.0 miles	2 to 4
Red River	Wichita Falls	BNSF Railway	BNSF Railway	Total 109.3 miles	48
Midwest	Alliance Subdivision	KCS	KCS	Total 49.4 miles	Unknown
Midwest	Dallas Subdivision	KCS	KCS	Total 18.1 miles	Unknown
Midwest	White Rock Branch	KCS	KCS	Total 10.9 miles	Unknown
Midwest	Greenville Subdivision	KCS	KCS	Total 183.6 miles; 173.7 miles in Texas	Unknown
Southwest	Beaumont Subdivision	KCS	KCS	Total 209.1 miles; 51.2 miles in Texas	Unknown
Southwest	Rosenburg Subdivision	KCS	KCS	Total 84.6 miles	Unknown
Southwest	Laredo Subdivision	KCS	KCS	Total 159.5 miles	Unknown
Fort Worth	Athens	Union Pacific Railroad	Union Pacific Railroad	Total 13.6 miles	Unknown
Fort Worth	Baird	Union Pacific Railroad	Union Pacific Railroad	Total 196.0 miles	55-60
Fort Worth	Choctaw	Union Pacific Railroad	Union Pacific Railroad	Total 190.6 miles; approximately 99 miles in Texas	60-75
Fort Worth	Corsicana	Union Pacific Railroad	Union Pacific Railroad	Total 96.2 miles	24-28
Fort Worth	Dallas	Union Pacific Railroad	Union Pacific Railroad	Total 49.6 miles	45-70
Fort Worth	DFW	Union Pacific Railroad	Union Pacific Railroad	Total 32.2 miles	Under 1
Fort Worth	Duncan	Union Pacific Railroad	Union Pacific Railroad	Total 176.6 miles; approximately 94 miles in Texas	15-20
Fort Worth	Ennis	Union Pacific Railroad	Union Pacific Railroad	Total 140.5 miles	35-65
Fort Worth	Fort Worth	Union Pacific Railroad	Union Pacific Railroad	Total 150.0 miles	32-48

Division	Subdivision	Owner	Operator	Subdivision Route / Mileage	Current Line Density (2017) in Annual Gross Tons per Mile (in Millions)
Fort Worth	Hearne	Union Pacific Railroad	Union Pacific Railroad	Total 88.5 miles	28-30
Fort Worth	Midlothian	Union Pacific Railroad	Union Pacific Railroad	Total 50.2 miles	35-40
Fort Worth	Mineola	Union Pacific Railroad	Union Pacific Railroad	Total 123.3 miles	44-48
Fort Worth	Smithville	Union Pacific Railroad	Union Pacific Railroad	Total 65.8 miles	10-12
Fort Worth	Waco	Union Pacific Railroad	Union Pacific Railroad	Total 127.3 miles	7-10
Houston	Angleton	Union Pacific Railroad	Union Pacific Railroad	Total 122.1 miles	15-35
Houston	Baytown	Union Pacific Railroad	Union Pacific Railroad	Total 48.7 miles	5-7
Houston	Beaumont	Union Pacific Railroad	Union Pacific Railroad	Total 243.7 miles	15-20
Houston	Brownsville	Union Pacific Railroad	Union Pacific Railroad	221.0	6-10 MGT (UP only)
Houston	Bryan	Union Pacific Railroad	Union Pacific Railroad	Total 21.3 miles	Unknown
Houston	Coleto Creek	Union Pacific Railroad	Union Pacific Railroad	Total 15.0 miles	2-3
Houston	Cuero	Union Pacific Railroad	Union Pacific Railroad	Total 108.0 miles	5-6
Houston	Eureka	Union Pacific Railroad	Union Pacific Railroad	Total 65.2 miles	1-2
Houston	Galveston	Union Pacific Railroad	Union Pacific Railroad	Total 46.4 miles	3-5
Houston	Giddings	Union Pacific Railroad	Union Pacific Railroad	Total 77.1 miles	38-40
Houston	Glidden	Union Pacific Railroad	Union Pacific Railroad	Total 187.8 miles	40-55
Houston	Harlingen	Union Pacific Railroad	Union Pacific Railroad	Total 24.0 miles	1-2

Division	Subdivision	Owner	Operator	Subdivision Route / Mileage	Current Line Density (2017) in Annual Gross Tons per Mile (in Millions)
Houston	Harrisburg	Union Pacific Railroad	Union Pacific Railroad	Total 12.4 miles	12-14
Houston	Houston	Union Pacific Railroad	Union Pacific Railroad	Total 94.5 miles	25-30
Houston	Houston East Belt	Union Pacific Railroad	Union Pacific Railroad	Total 11.3 miles	35-40
Houston	Houston West Belt	Union Pacific Railroad	Union Pacific Railroad	Total 9.2 miles	30-35
Houston	Navasota	Union Pacific Railroad	Union Pacific Railroad	Total 100.9 miles	40-45
Houston	Palestine	Union Pacific Railroad	Union Pacific Railroad	Total 228.9 miles	20-22
Houston	Rosenburg	Union Pacific Railroad	Union Pacific Railroad	Total 2.6 miles	Unknown
Houston	Strang	Union Pacific Railroad	Union Pacific Railroad	Total 21.1 miles	6-8
Livonia	Lafayette	Union Pacific Railroad	Union Pacific Railroad	Total 76.8 miles; approximately 32 miles in Texas	20-25
Livonia	Lufkin	Union Pacific Railroad	Union Pacific Railroad	Total 228.7 miles; approximately 188 miles in Texas	12-15
Heartland	Pratt	Union Pacific Railroad	Union Pacific Railroad	Total 242.6 miles; approximately 49 miles in Texas	30-35
San Antonio	Austin	Union Pacific Railroad	Union Pacific Railroad	Total 170.5 miles	38-42
San Antonio	Corpus Christi	Union Pacific Railroad	Union Pacific Railroad	Total 145.9 miles	6-8
San Antonio	Del Rio	Union Pacific Railroad	Union Pacific Railroad	Total 178.0 miles	25-55
San Antonio	Eagle Pass	Union Pacific Railroad	Union Pacific Railroad	Total 34.6 miles	24-26
San Antonio	Kerrville	Union Pacific Railroad	Union Pacific Railroad	Total 15.0 miles	1
San Antonio	Laredo	Union Pacific Railroad	Union Pacific Railroad	Total 152.1 miles	30-45

Division	Subdivision	Owner	Operator	Subdivision Route / Mileage	Current Line Density (2017) in Annual Gross Tons per Mile (in Millions)
San Antonio	Lockhart	Union Pacific Railroad	Union Pacific Railroad	Total 51.9 miles	18-22
San Antonio	Rockport	Union Pacific Railroad	Union Pacific Railroad	Total 16.1 miles	8-10
San Antonio	Sanderson	Union Pacific Railroad	Union Pacific Railroad	Total 222.4 miles	24-26
Sunset	Carrizozo	Union Pacific Railroad	Union Pacific Railroad	Total 229.0 miles; approximately 18 miles are located in Texas	38-42
Sunset	Toyah	Union Pacific Railroad	Union Pacific Railroad	Total 320.9 miles	40-60
Sunset	Tucumcari	Union Pacific Railroad	Union Pacific Railroad	Total 195.6 miles; approximately 43 miles in Texas	30-35
Sunset	Valentine	Union Pacific Railroad	Union Pacific Railroad	Total 212.3 miles	20-60
North Little Rock	Reisor	Union Pacific Railroad	Union Pacific Railroad	Total 155.7 miles; approximately 135 miles in Texas	24-26

APPENDIX B: YARDS— ERG LOCATION

Yard Location Based on ERG's 2014 EI.

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48001	Anderson	Palestine	RY739	14461911	31.757692	-95.635833
48005	Angelina	Herty	RY1025	16912511	31.355473	-94.678973
48005	Angelina	Lufkin	RY1171	16923311	31.344356	-94.728319
48013	Atascosa	Pleasanton	RY1191	16924611	28.97427	-98.481283
48015	Austin	Bellville	RY1053	16914411	29.922351	-96.240637
48015	Austin	Sealy1	RY1108	16918211	29.781802	-96.16711
48021	Bastrop	Smithville	RY1104	16917811	30.003586	-97.157494
48027	Bell	Corpus Christi3 (Agnes St Yard)	RY953	15528711	27.785797	-97.477569
48027	Bell	Fort Hood	RY988	16933211	31.125511	-97.78053
48027	Bell	Rogers	RY1102	16917611	30.931574	-97.225284
48027	Bell	Temple 1	RY740	14462111	31.11474	-97.348822
48027	Bell	Temple 2	RY982	16929111	31.068564	-97.329459
48029	Bexar	Calaveras Lake	RY1057	16914711	29.29981	-98.322104
48029	Bexar	East 3	RY741	14462211	29.434091	-98.467212
48029	Bexar	Kirby	RY963	16927511	29.471846	-98.38799
48029	Bexar	Mitchell Lake	RY1163	16922611	29.308866	-98.640641
48029	Bexar	San Antonio Central	RY975	16928511	29.37842	-98.541273
48029	Bexar	San Antonio2	RY1109	16918311	29.376954	-98.556942
48029	Bexar	So San Antonio	RY974	16928411	29.295394	-98.432169
48037	Bowie	Texarkana	RY743	14462311	33.399495	-94.05799
48039	Brazoria	Angleton 1	RY744	14462411	29.157184	-95.433799
48039	Brazoria	Angleton 2	RY1300	16930111	29.152062	-95.433486
48039	Brazoria	Brazosport	RY1047	16913911	28.949548	-95.321535
48039	Brazoria	Clute1	RY1092	16916911	29.010993	-95.387195

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48039	Brazoria	Clute2	RY1091	16931511	28.996955	-95.375762
48039	Brazoria	Clute3	RY1090	16916811	28.998359	-95.359885
48039	Brazoria	Freeport1	RY1028	16912811	28.964256	-95.348806
48039	Brazoria	Freeport2	RY1041	16933311	28.952796	-95.338393
48039	Brazoria	Oyster Creek1	RY1173	16934211	28.98326	-95.34286
48039	Brazoria	Oyster Creek2	RY1158	16922211	28.972508	-95.340582
48039	Brazoria	Pearland	RY1197	16925111	29.577526	-95.291657
48049	Brown	Brownwood	RY745	14462511	31.712634	-98.966355
48051	Burleson	Chriesman	RY1093	16917011	30.606182	-96.775294
48051	Burleson	Somerville	RY977	16928711	30.35103	-96.531718
48057	Calhoun	Long Mott1	RY1177	16933411	28.49311	-96.767357
48057	Calhoun	Long Mott2	RY1176	16933811	28.500873	-96.772772
48057	Calhoun	Long Mott3	RY1160	16922411	28.512421	-96.771912
48057	Calhoun	Long Mott4	RY1174	16933511	28.521817	-96.769775
48057	Calhoun	Long Mott5	RY1188	16933911	28.534027	-96.764061
48057	Calhoun	Point Comfort1	RY1146	16921011	28.661036	-96.553703
48057	Calhoun	Point Comfort2	RY1103	16917711	28.687419	-96.543028
48057	Calhoun	Point Comfort3	RY1161	16934611	28.697426	-96.534372
48061	Cameron	Alamo Junction	RY1311	16926311	29.261258	-98.346338
48061	Cameron	Brownsville	RY747	14462611	25.912592	-97.489694
48061	Cameron	Cameron Park1	RY1059	16914911	25.941462	-97.439003
48061	Cameron	Harlingen	RY748	14462711	26.204216	-97.706849
48061	Cameron	Olmito 0	RY749	14462811	25.90313	-97.50719
48061	Cameron	Olmito 1	RY1201	16934011	25.999663	-97.507797
48061	Cameron	Reid Hope King1	RY1124	16934911	25.953804	-97.41116
48061	Cameron	Reid Hope King2	RY1123	16934511	25.958507	-97.386164
48061	Cameron	Reid Hope King3	RY1122	16935011	25.954362	-97.381916
48061	Cameron	Reid Hope King4	RY1121	16919211	25.975434	-97.352218
48061	Cameron	Reid Hope King5	RY1120	16919111	25.969089	-97.417659

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48063	Camp	Pittsburg	RY1194	16924811	32.99762	-94.978054
48065	Carson	Panhandle	RY1200	16925311	35.34161	-101.37594
48065	Carson	Skellytown 1	RY1106	16918011	35.580678	-101.17095
48067	Cass	Hughes Springs	RY954	15528811	32.998464	-94.634842
48069	Castro	Dimmitt	RY1307	16926011	34.556851	-102.31117
48071	Chambers	Baytown2	RY1061	16915011	29.758596	-94.89949
48071	Chambers	Baytown3	RY1060	16930611	29.772596	-94.894913
48071	Chambers	Beach City	RY1044	16913711	29.696948	-94.89278
48071	Chambers	Mont Belvieu	RY1067	16915611	29.871641	-94.909055
48075	Childress	Childress	RY752	14463011	34.422742	-100.21081
48085	Collin	Wylie	RY955	15528911	33.032174	-96.499084
48089	Colorado	Eagle Lake1	RY1002	16910311	29.563454	-96.328963
48089	Colorado	Eagle Lake2	RY986	16932911	29.601906	-96.347254
48089	Colorado	Glidden	RY753	14463111	29.703364	-96.580978
48091	Comal	Garden Ridge	RY1001	16910211	29.636199	-98.258133
48091	Comal	Hunter	RY1020	16912011	29.803357	-98.036609
48091	Comal	Jama1	RY754	14463211	29.806695	-98.02403
48091	Comal	New Braunfels3	RY1147	16921111	29.678635	-98.181673
48091	Comal	Northcliff	RY1131	16919911	29.653876	-98.227899
48097	Cooke	Gainesville	RY755	14463311	33.641692	-97.145132
48099	Coryell	Copperas Cove	RY1089	16916711	31.127656	-97.860036
48111	Dallam	Dalhart	RY1305	16925811	36.070668	-102.5148
48113	Dallas	Cadiaz	RY756	14463411	32.776399	-96.827491
48113	Dallas	Carrollton 2	RY1096	16917211	32.959155	-96.878801
48113	Dallas	Dallas	RY956	15529011	32.8577	-96.674332
48113	Dallas	Garland 2	RY1042	16913611	32.888027	-96.673711
48113	Dallas	Irving	RY959	16927111	32.81345	-96.881208
48113	Dallas	Mesquite	RY964	16927611	32.78078	-96.670368
48113	Dallas	Miller Yard	RY962	16927411	32.710739	-96.74846

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48117	Deaf Smith	Hereford 2	RY1316	16926611	34.825079	-102.36994
48121	Denton	Denton	RY1006	16910711	33.21336	-97.12698
48121	Denton	Justin	RY1017	16911711	32.996909	-97.354136
48121	Denton	Roanoke	RY1119	16919011	33.00007	-97.230422
48135	Ector	Odessa	RY757	14488911	31.841812	-102.37186
48141	El Paso	Alfalfa	RY759	14463611	31.764201	-106.39349
48141	El Paso	Dallas Street	RY760	14487811	31.758912	-106.47871
48141	El Paso	El Paso 0	RY965	16935211	31.74995	-106.47871
48141	El Paso	El Paso 1	RY1308	16926111	31.753308	-106.49313
48141	El Paso	El Paso 2	RY1309	16930911	31.765651	-106.47961
48141	El Paso	Fort Bliss	RY989	16929411	31.836356	-106.41454
48139	Ellis	Ennis	RY1312	16926411	32.300988	-96.589346
48139	Ellis	Garrett	RY758	14463511	32.343809	-96.636944
48143	Erath	Dublin	RY1003	16910411	32.087055	-98.337189
48143	Erath	Stephenville	RY1156	16922011	32.223114	-98.209424
48149	Fayette	Halsted	RY1029	16912911	29.90784	-96.749174
48153	Floyd	Floydada	RY990	16929511	33.980715	-101.32867
48157	Fort Bend	Kendleton_Intermodal	RY967	16927811	29.463533	-95.974282
48157	Fort Bend	Rosenberg	RY1130	16919811	29.560409	-95.828585
48157	Fort Bend	Sugar Land	RY1155	16921911	29.620307	-95.640544
48157	Fort Bend	Thompsons	RY1145	16920911	29.472938	-95.634893
48161	Freestone	Teague	RY981	16929011	31.63	-96.287795
48167	Galveston	Dickinson	RY1005	16910611	29.459966	-95.044592
48167	Galveston	East 2	RY761	14488011	29.3489	-94.941395
48167	Galveston	Galveston	RY762	14463711	29.30052	-94.823747
48167	Galveston	Texas City	RY763	14463811	29.35393	-94.934279
48177	Gonzales	Harwood1	RY1027	16912711	29.605124	-97.468063
48177	Gonzales	Harwood2	RY1026	16912611	29.666476	-97.501541
48179	Gray	Pampa 1	RY1054	16914511	35.482466	-101.05536

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48179	Gray	Pampa 2	RY968	16927911	35.529388	-100.96277
48181	Grayson	Denison 1	RY1007	16910811	33.7537	-96.534072
48181	Grayson	Ray Yard	RY1306	16925911	33.771553	-96.584119
48181	Grayson	Sherman	RY764	14463911	33.654137	-96.599046
48183	Gregg	Greggton 1	RY1314	16926511	32.503945	-94.811731
48183	Gregg	Greggton 2	RY1034	16933611	32.501706	-94.788586
48183	Gregg	Greggton 3	RY1033	16913111	32.496285	-94.770163
48183	Gregg	Longview	RY765	14464011	32.493149	-94.727315
48185	Grimes	Navasot	RY1151	16921511	30.381244	-96.086452
48189	Hale	Plainview	RY971	16928111	34.192689	-101.69697
48197	Hardeman	Goodlett 2	RY1037	16913311	34.317627	-99.824209
48197	Hardeman	Quanah	RY972	16928211	34.30422	-99.738047
48199	Hardin	Silsbee	RY766	14464111	30.358535	-94.189046
48201	Harris	Basin	RY767	14464211	29.767723	-95.293528
48201	Harris	Bayport North Industrial Park	RY1062	16915111	29.639855	-95.089988
48201	Harris	Booth	RY769	14464311	29.735778	-95.281514
48201	Harris	Coady	RY770	14464511	29.751592	-95.020386
48201	Harris	Congress	RY771	14487711	29.765943	-95.355992
48201	Harris	Deer Park1	RY1079	16931811	29.725726	-95.153921
48201	Harris	Deer Park10	RY1078	16932011	29.704988	-95.085304
48201	Harris	Deer Park11	RY1077	16932111	29.705392	-95.062476
48201	Harris	Deer Park12	RY1076	16932211	29.699268	-95.062862
48201	Harris	Deer Park2	RY1075	16932411	29.724306	-95.143419
48201	Harris	Deer Park3	RY1074	16932311	29.720538	-95.124579
48201	Harris	Deer Park4	RY1030	16932511	29.721127	-95.099948
48201	Harris	Deer Park5	RY987	16932611	29.73898	-95.093049
48201	Harris	Deer Park6	RY1045	16932711	29.733578	-95.080292
48201	Harris	Deer Park7	RY1012	16911211	29.727554	-95.084177
48201	Harris	Deer Park8	RY1011	16932811	29.715635	-95.082191

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48201	Harris	Deer Park9	RY1010	16911111	29.713203	-95.111229
48201	Harris	East 1	RY772	14487911	29.797557	-95.292164
48201	Harris	Englewood	RY773	14464611	29.787702	-95.315257
48201	Harris	Erinwilde	RY993	16929811	30.010395	-95.40042
48201	Harris	Eureka	RY774	14488111	29.782728	-95.421667
48201	Harris	Galena Park	RY1313	16935811	29.748052	-95.218042
48201	Harris	Greens Port	RY1036	16913211	29.75234	-95.196799
48201	Harris	Hardy Street	RY775	14488311	29.771328	-95.356215
48201	Harris	Hockley	RY1023	16912311	30.023641	-95.863606
48201	Harris	Houston1	RY1318	16926811	29.744724	-95.276491
48201	Harris	Houston2	RY1319	16926911	29.715129	-95.262293
48201	Harris	Houston3	RY1021	16912111	29.70115	-95.252357
48201	Harris	La Porte1	RY1187	16924411	29.67599	-95.012984
48201	Harris	La Porte2	RY1186	16924311	29.624278	-95.056247
48201	Harris	Market Street	RY777	14488511	29.717766	-95.286374
48201	Harris	Mykawa	RY778	14464711	29.614838	-95.302751
48201	Harris	New South	RY779	14488611	29.70433	-95.329046
48201	Harris	North Yard	RY780	14488811	29.754853	-95.290042
48201	Harris	Old South	RY781	14464811	29.721474	-95.335379
48201	Harris	Pasadena1	RY969	16931011	29.722678	-95.199411
48201	Harris	Pasadena2	RY1199	16925211	29.727417	-95.174135
48201	Harris	Settegast	RY783	14489111	29.82028	-95.289579
48201	Harris	South	RY784	14489211	29.750607	-95.345575
48201	Harris	Spring	RY1157	16922111	30.05954	-95.409357
48201	Harris	Strang	RY785	14464911	29.680663	-95.039661
48201	Harris	Taylor Lake Village	RY1150	16921411	29.60348	-95.0108
48201	Harris	Woodgate	RY1132	16920011	29.913467	-95.502106
48203	Harrison	Ferguson Creek Reservoir	RY991	16929611	32.440928	-94.68728
48203	Harrison	Longview Heights	RY1172	16923411	32.503887	-94.639639

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48203	Harrison	Marshall	RY786	14465011	32.55855	-94.367461
48209	Hays	Jama2	RY787	14488411	29.844798	-97.975179
48209	Hays	Mountain City	RY1175	16923511	30.050715	-97.860152
48211	Hemphill	Canadian	RY1098	16917411	35.906492	-100.4007
48211	Hemphill	Glazier	RY1039	16913411	36.011836	-100.2578
48215	Hidalgo	Alamo	RY1071	16915911	26.177803	-98.088345
48215	Hidalgo	Edinburg1	RY1000	16910111	26.318662	-98.163969
48215	Hidalgo	Kane	RY1129	16919711	26.207663	-98.247463
48215	Hidalgo	Mission	RY1165	16922811	26.214564	-98.329242
48217	Hill	Hillsboro	RY1024	16912411	32.009497	-97.133451
48221	Hood	Cresson	RY1082	16916311	32.535098	-97.621812
48223	Hopkins	Sulphur Springs	RY957	15529111	33.1339	-95.599774
48227	Howard	Big Spring	RY789	14465111	32.25336	-101.48547
48227	Howard	Ziler	RY973	16928311	32.272861	-101.40899
48231	Hunt	Greenville	RY790	14465211	33.137239	-96.133632
48233	Hutchinson	Borger 1	RY1048	16914011	35.656805	-101.39016
48233	Hutchinson	Phillips	RY1195	16924911	35.689992	-101.36805
48239	Jackson	La Ward1	RY1185	16924211	28.816099	-96.504261
48239	Jackson	Point Comfort4	RY1190	16934711	28.709149	-96.543012
48239	Jackson	Redfish Lake	RY1125	16919311	28.78962	-96.548613
48241	Jasper	Jasper	RY960	16927211	30.925756	-93.984383
48245	Jefferson	Amelia	RY791	14465311	30.06967	-94.222215
48245	Jefferson	Beaumont0	RY792	14465411	30.084803	-94.112368
48245	Jefferson	Beaumont1	RY1072	16930711	30.068821	-94.07643
48245	Jefferson	Beaumont2	RY1056	16914611	30.075981	-94.090309
48245	Jefferson	Beaumont3	RY1055	16930811	30.083773	-94.095049
48245	Jefferson	Central Gardens1	RY1095	16931411	29.986176	-93.991318
48245	Jefferson	Central Gardens2	RY1094	16917111	29.999693	-93.983808
48245	Jefferson	Chaison	RY793	14465511	30.054845	-94.074835

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48245	Jefferson	Guffy	RY794	14465611	30.019666	-94.082543
48245	Jefferson	Jefferson County1	RY961	16927311	30.078028	-94.242501
48245	Jefferson	Port Neches	RY1128	16919611	29.984083	-93.946568
48245	Jefferson	Port_Neches	RY966	16927711	29.937528	-93.945796
48245	Jefferson	Port Arthur	RY795	14465711	29.879483	-93.952974
48245	Jefferson	Smith Island	RY1105	16917911	30.061217	-94.042518
48245	Jefferson	Sunnyside	RY796	14465811	30.079539	-94.128833
48245	Jefferson	West Port Arthur1	RY1137	16935411	29.842258	-93.957541
48245	Jefferson	West Port Arthur2	RY1136	16920311	29.853767	-93.948576
48249	Jim Wells	Alice	RY1183	16924011	27.74792	-98.081037
48251	Johnson	Alvarado	RY1069	16915711	32.410154	-97.162628
48251	Johnson	Cleburne	RY797	14465911	32.3539	-97.383291
48271	Kinney	Spofford	RY799	14466011	29.168379	-100.4024
48281	Lampasas	Lometa	RY800	14466311	31.235143	-98.403714
48289	Leon	Newby	RY1144	16920811	31.349208	-96.169407
48291	Liberty	Hightower	RY1317	16926711	30.372323	-95.016209
48291	Liberty	Hull	RY958	16927011	30.141691	-94.631271
48291	Liberty	Stilson	RY978	16928811	30.005911	-94.904853
48297	Live Oak	Three Rivers	RY1159	16922311	28.460253	-98.186677
48303	Lubbock	Lubbock	RY801	14466411	33.580156	-101.83688
48303	Lubbock	Slaton	RY802	14466511	33.444147	-101.64069
48321	Matagorda	Matagorda County1	RY1170	16934111	28.871153	-96.00391
48321	Matagorda	Matagorda County2	RY1169	16923211	28.862906	-96.023213
48321	Matagorda	Wadsworth	RY1140	16920511	28.789652	-95.941567
48323	Maverick	Eagle Pass	RY803	14466611	28.702588	-100.49848
48323	Maverick	Elm Creek1	RY1018	16911811	28.835211	-100.4351
48323	Maverick	Elm Creek2	RY1035	16933011	28.799258	-100.46372
48323	Maverick	Elm Creek3	RY1038	16933111	28.772273	-100.47349
48323	Maverick	Elm Creek4	RY1009	16911011	28.75816	-100.48703

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48309	McLennan	Bellmead	RY1302	16925611	31.58012	-97.101521
48309	McLennan	Mcgregor	RY1168	16923111	31.442749	-97.405413
48325	Medina	Hondo	RY1022	16912211	29.344583	-99.176201
48331	Milam	Alcoa Lake	RY1070	16915811	30.561095	-97.070274
48331	Milam	Cameron1	RY1100	16931311	30.846703	-96.981575
48331	Milam	Cameron2	RY1099	16917511	30.874457	-96.978211
48339	Montgomery	Beach2	RY1058	16914811	30.315312	-95.384943
48341	Moore	Cactus 1	RY1046	16913811	36.041154	-101.9948
48341	Moore	Cactus 2	RY1086	16931211	36.028971	-101.97537
48341	Moore	Sunray 1	RY979	16931111	36.007858	-101.8911
48341	Moore	Sunray 2	RY1152	16921611	35.982023	-101.89081
48343	Morris	Daingerfield	RY1080	16916111	32.995427	-94.659246
48343	Morris	Lone Star	RY1178	16923611	32.95318	-94.663554
48343	Morris	Tn	RY1310	16926211	32.924907	-94.712187
48347	Nacogdoches	Nacogdoches	RY1153	16921711	31.60338	-94.659177
48353	Nolan	Sweetwater	RY980	16928911	32.494157	-100.4041
48355	Nueces	Agnesstreetyard	RY804	14487511	27.78563	-97.4848
48355	Nueces	Bishop1	RY1051	16914211	27.566487	-97.8229
48355	Nueces	Corpus Christi1	RY1304	16934811	27.823998	-97.451767
48355	Nueces	Corpus Christi2	RY1073	16916011	27.808592	-97.414636
48355	Nueces	Corpus Christi4	RY1087	16916511	27.821131	-97.426548
48355	Nueces	Corpus Christi6	RY1101	16931611	27.818226	-97.46178
48355	Nueces	Corpus Christi7	RY1085	16931711	27.817454	-97.480121
48355	Nueces	Corpus Christi8	RY1084	16931911	27.830165	-97.504066
48355	Nueces	Corpus Christi9	RY1083	16916411	27.841698	-97.522759
48355	Nueces	Nueces River Rail Yard/Proposed	RY1198	16934311	27.84218	-97.510594
48355	Nueces	Robstown	RY1118	16918911	27.785912	-97.663499
48357	Ochiltree	Perryton Yard	RY1196	16925011	36.401251	-100.80165
48361	Orange	Lemonville	RY1181	16923811	30.20868	-93.843601

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48361	Orange	Mauriceville	RY805	14466711	30.201928	-93.868283
48361	Orange	Mule Island	RY1154	16921811	30.045574	-93.779374
48361	Orange	Orange	RY806	14489011	30.088921	-93.766165
48361	Orange	Orangefield	RY1179	16935711	30.093865	-93.808438
48361	Orange	Owens-Illinois Reservoir	RY1189	16924511	30.214838	-93.748731
48361	Orange	Plant Reservoir1	RY1193	16934411	30.049283	-93.758592
48361	Orange	Plant Reservoir2	RY1192	16924711	30.056401	-93.762297
48361	Orange	Rose City	RY1116	16918711	30.084554	-94.07519
48361	Orange	Vidor	RY1141	16930211	30.099047	-94.005519
48361	Orange	West Orange	RY1138	16930411	30.068852	-93.768584
48365	Panola	Beckville	RY1301	16925511	32.231131	-94.50244
48369	Parmer	Farwell	RY992	16929711	34.390702	-103.03883
48371	Pecos	Pecos	RY970	16928011	31.409243	-103.51915
48375	Potter	Amarillo 1	RY1068	16930511	35.286018	-101.74415
48375	Potter	Amarillo 2	RY808	14466811	35.192681	-101.83187
48375	Potter	Amarillo 3	RY1066	16915511	35.217033	-101.79963
48375	Potter	Amarillo 4	RY1065	16915411	35.204283	-101.746
48375	Potter	Amarillo 5	RY1064	16915311	35.197775	-101.69289
48381	Randall	Amarillo 0	RY809	14487611	35.175463	-101.83828
48381	Randall	Canyon	RY1097	16917311	35.121278	-101.85741
48395	Robertson	Hearne 1	RY810	14466911	30.874762	-96.589704
48395	Robertson	Hearne 2	RY1315	16930311	30.864016	-96.603899
48399	Runnels	Ballinger	RY1063	16915211	31.738243	-99.950347
48401	Rusk	Dirgin	RY1004	16910511	32.260767	-94.566016
48409	San Patricio	Del Sol-Loma Linda	RY1008	16910911	28.010168	-97.529368
48409	San Patricio	Gregory1	RY1032	16933711	27.925216	-97.296283
48409	San Patricio	Gregory2	RY1031	16913011	27.910357	-97.267706
48409	San Patricio	Odem	RY1107	16918111	27.952409	-97.579317
48415	Scurry	Snyder	RY811	14467011	32.734416	-100.92016

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48419	Shelby	Tenaha 2	RY983	16929211	31.940529	-94.278078
48423	Smith	Tyler	RY812	14489411	32.360122	-95.288832
48423	Smith	Winona	RY1133	16920111	32.441579	-95.187055
48439	Tarrant	Berkeley Place	RY1052	16914311	32.718943	-97.344553
48439	Tarrant	Centennial	RY813	14467111	32.725212	-97.376769
48439	Tarrant	Ft Worth	RY814	14467211	32.745423	-97.322403
48439	Tarrant	Great Southwest	RY815	14488211	32.742351	-97.062948
48439	Tarrant	Hodge	RY816	14467311	32.826229	-97.332881
48439	Tarrant	North	RY817	14488711	32.783278	-97.335054
48439	Tarrant	Saginaw	RY818	14467411	32.842821	-97.358468
48439	Tarrant	Tower 55	RY819	14489311	32.743856	-97.323574
48441	Taylor	Abilene	RY1016	16911611	32.448959	-99.728013
48449	Titus	Lake Monticello	RY1184	16924111	33.091947	-95.033686
48449	Titus	Mount Pleasant	RY820	14467611	33.159441	-94.966074
48451	Tom Green	San Angelo 2	RY1110	16918411	31.496793	-100.41152
48453	Travis	Northtech Business Center	RY1117	16918811	30.444777	-97.711953
48463	Uvalde	Dabney	RY1081	16916211	29.163283	-100.09063
48463	Uvalde	Mine	RY1166	16922911	29.14162	-100.03964
48465	Val Verde	Del Rio	RY821	14467711	29.362357	-100.90551
48469	Victoria	Bloomington1	RY822	14467811	28.644604	-96.89578
48469	Victoria	Bloomington2	RY1049	16914111	28.661921	-96.871432
48469	Victoria	Raisin	RY1126	16919411	28.771198	-97.090286
48469	Victoria	Victoria2	RY1142	16920611	28.821866	-96.946411
48473	Waller	Katy	RY1013	16911311	29.792335	-95.856356
48475	Ward	Monahans	RY1162	16922511	31.591845	-102.90593
48477	Washington	Quarry	RY1127	16919511	30.315691	-96.511282
48479	Webb	El Cuatro	RY1014	16911411	27.506138	-99.516703
48479	Webb	Laredo	RY823	14467911	27.522694	-99.516579
48479	Webb	Laredo_Yard	RY1202	16925411	27.501126	-99.402717

FIPS Code	County Name	Facility Name	Alternative ID	EIS ID	Latitude	Longitude
48479	Webb	Lax	RY1182	16923911	27.498554	-99.490273
48479	Webb	Milo Distribution Center	RY1167	16923011	27.613699	-99.484956
48479	Webb	Missouri Pacific Railyards	RY1164	16922711	27.666101	-99.445618
48479	Webb	Tejas Industrial Park	RY1149	16921311	27.587831	-99.502833
48479	Webb	Tex-Mex Industrial Park	RY1148	16921211	27.511634	-99.452059
48485	Wichita	Electra	RY1015	16911511	34.029564	-98.921597
48485	Wichita	Iowa Park	RY1019	16911911	33.949852	-98.663938
48485	Wichita	Kay-Bub	RY1088	16916611	33.862578	-98.590921
48485	Wichita	Wichita Falls 1	RY1135	16935611	33.929796	-98.502339
48485	Wichita	Wichita Falls 2	RY984	16929311	33.908664	-98.483341
48485	Wichita	Wichita Falls 3	RY1134	16920211	33.931061	-98.541143
48487	Wilbarger	Vernon	RY1143	16920711	34.161473	-99.283779
48491	Williamson	Georgetown	RY1040	16913511	30.620467	-97.680647
48491	Williamson	Liberty Hill	RY1180	16923711	30.64779	-97.885799
48491	Williamson	Round Rock1	RY1114	16935311	30.523004	-97.696295
48491	Williamson	Round Rock2	RY1113	16935111	30.53806	-97.699185
48491	Williamson	Round Rock3	RY1112	16935511	30.554088	-97.698567
48491	Williamson	Round Rock4	RY1111	16918511	30.570614	-97.698318
48491	Williamson	Soil Conservation Service Site 10A	RY1115	16918611	30.588143	-97.696639
48491	Williamson	Taylor	RY826	14468011	30.567394	-97.414481
48493	Wilson	Mission Rail Elmendorf	RY976	16928611	29.232801	-98.302306
48497	Wise	Chico	RY1303	16925711	33.274931	-97.795768
48499	Wood	West Mineola	RY1139	16920411	32.669933	-95.522961

APPENDIX C: YARDS— ERTAC LOCATION

Yard Location Based on ERTAC's 2017 EI.

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
14461911	48001	Anderson	UP	PALESTINE	Unknown	0	31.75769	-95.6358
16912511	48005	Angelina	UNKNOWN	Herty	Lufkin	75901	31.35547	-94.679
16923311	48005	Angelina	UP	Lufkin	Lufkin	75904	31.34436	-94.7283
16924611	48013	Atascosa	UNKNOWN	Pleasanton	Pleasanton	78064	28.97427	-98.4813
16914411	48015	Austin	UNKNOWN	Bellville	Bellville	77418	29.92235	-96.2406
16918211	48015	Austin	UNKNOWN	Sealy1	Sealy	77474	29.7818	-96.1671
16917811	48021	Bastrop	UP	Smithville	Smithville	78957	30.00359	-97.1575
14462111	48027	Bell	BNSF	TEMPLE	Unknown	0	31.11474	-97.3488
16917611	48027	Bell	UNKNOWN	Rogers	Rogers	76569	30.93157	-97.2253
16929111	48027	Bell	BNSF	KNOWD	Temple	76501	31.06856	-97.3295
16933211	48027	Bell	UNKNOWN	Fort Hood	Fort Hood	76544	31.12551	-97.7805
14462211	48029	Bexar	UP	SAN ANTONIO EAST YARD	Unknown	0	29.43578	-98.4579
16914711	48029	Bexar	UNKNOWN	Calaveras Lake	Elmendorf	78263	29.29981	-98.3221
16918311	48029	Bexar	UNKNOWN	San Antonio2	San Antonio	78211	29.37695	-98.5569
16922611	48029	Bexar	UNKNOWN	Mitchell Lake	San Antonio	78073	29.30887	-98.6406
16926311	48029	Bexar	UNKNOWN	ALAMO Junction	Elmendorf	78112	29.26126	-98.3463
16927511	48029	Bexar	BNSF	KIRBY	San Antonio	78218	29.47185	-98.388
16928411	48029	Bexar	UP	SOUTHTON RAIL TERMINAL	San Antonio	78223	29.29539	-98.4322
16928511	48029	Bexar	UNKNOWN	San Antonio Central	San Antonio	78226	29.37842	-98.5413
17872311	48029	Bexar	UP	SOUTH SAN ANTONIO	Unknown	0	29.37035	-98.5628
14462311	48037	Bowie	UP	TEXARKANA	Unknown	0	33.41725	-94.0466
14462411	48039	Brazoria	UP	Angleton 1	Unknown	0	29.15718	-95.4338
16912811	48039	Brazoria	UP	Freeport1	Freeport	77541	28.96426	-95.3488
16913911	48039	Brazoria	UNKNOWN	Brazosport	Freeport	77541	28.94955	-95.3215
16916811	48039	Brazoria	UNKNOWN	Clute3	Freeport	77541	28.99836	-95.3599

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16916911	48039	Brazoria	UP	Clute1	Clute	77531	29.01099	-95.3872
16922211	48039	Brazoria	UNKNOWN	Oyster Creek2	Freeport	77541	28.97251	-95.3406
16925111	48039	Brazoria	UNKNOWN	Pearland	Pearland	77581	29.57753	-95.2917
16930111	48039	Brazoria	UNKNOWN	Angleton 2	Angleton	77515	29.15206	-95.4335
16931511	48039	Brazoria	UNKNOWN	Clute2	Freeport	77541	28.99696	-95.3758
16933311	48039	Brazoria	UP	Freeport2	Freeport	77541	28.9528	-95.3384
16934211	48039	Brazoria	UNKNOWN	Oyster Creek1	Freeport	77541	28.98326	-95.3429
17861911	48041	Brazos	UP	BRYAN	Unknown	0	30.66182	-96.3743
14462511	48049	Brown	BNSF	BROWNWOOD	Unknown	0	31.71263	-98.9664
16917011	48051	Burleson	UNKNOWN	Chriesman	Caldwell	77836	30.60618	-96.7753
16928711	48051	Burleson	BNSF	Somerville	Somerville	77879	30.35103	-96.5317
16917711	48057	Calhoun	UP	Point Comfort2	Point Comfort	77971	28.68742	-96.543
16921011	48057	Calhoun	PCN	Point Comfort1	Point Comfort	77979	28.66104	-96.5537
16922411	48057	Calhoun	UP	Long Mott3	Seadrift	77979	28.51242	-96.7719
16933411	48057	Calhoun	UP	Long Mott1	Seadrift	77979	28.49311	-96.7674
16933511	48057	Calhoun	UP	Long Mott4	Seadrift	77979	28.52182	-96.7698
16933811	48057	Calhoun	UP	Long Mott2	Seadrift	77979	28.50087	-96.7728
16933911	48057	Calhoun	UP	Long Mott5	Seadrift	77979	28.53403	-96.7641
16934611	48057	Calhoun	UP	Point Comfort3	Point Comfort	77971	28.69743	-96.5344
17869511	48057	Calhoun	UP	NORTH SEADRIFT	Unknown	0	28.50735	-96.778
14462611	48061	Cameron	UP	BROWNSVILLE	Unknown	0	25.91259	-97.4897
14462711	48061	Cameron	RVSC	HARLINGEN	Unknown	0	26.20422	-97.7068
14462811	48061	Cameron	UP	Olmito 0	Unknown	0	25.90313	-97.5072
16914911	48061	Cameron	UNKNOWN	Cameron Park1	Brownsville	78521	25.94146	-97.439
16919111	48061	Cameron	UNKNOWN	Reid Hope King5	Brownsville	78526	25.96909	-97.4177
16919211	48061	Cameron	UNKNOWN	Reid Hope King4	Brownsville	78521	25.97543	-97.3522
16934011	48061	Cameron	UP	Olmito 1	Brownsville	78526	25.99966	-97.5078
16934511	48061	Cameron	UNKNOWN	Reid Hope King2	Brownsville	78521	25.95851	-97.3862
16934911	48061	Cameron	UNKNOWN	Reid Hope King1	Brownsville	78521	25.9538	-97.4112
16935011	48061	Cameron	UNKNOWN	Reid Hope King3	Brownsville	78526	25.95436	-97.3819

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16924811	48063	Camp	KCS	Pittsburg	Pittsburg	75686	32.99762	-94.9781
16918011	48065	Carson	UNKNOWN	Skellytown 1	Skellytown	79080	35.58068	-101.171
16925311	48065	Carson	UNKNOWN	Panhandle	Panhandle	79068	35.34161	-101.376
15528811	48067	Cass	KCS	HUGHES SPRINGS	Hughes Springs	75656	32.99944	-94.6389
16926011	48069	Castro	UNKNOWN	Dimmitt	Dimmitt	79027	34.55685	-102.311
16913711	48071	Chambers	UNKNOWN	Beach City	Baytown	77523	29.69695	-94.8928
16915011	48071	Chambers	UNKNOWN	Baytown2	Baytown	77523	29.7586	-94.8995
16915611	48071	Chambers	UP	Mont Belvieu	Mont Belvieu	77523	29.87164	-94.9091
16930611	48071	Chambers	UNKNOWN	Baytown3	Baytown	77523	29.7726	-94.8949
14463011	48075	Childress	BNSF	CHILDRESS	Unknown	0	34.42274	-100.211
15528911	48085	Collin	KCS	WYLIE	Wylie	75098	33.03164	-96.5017
14463111	48089	Colorado	UP	GLIDDEN	Unknown	0	29.70336	-96.581
16910311	48089	Colorado	UP	Eagle Lake1	Eagle Lake	77434	29.56345	-96.329
16932911	48089	Colorado	UP	Eagle Lake2	Eagle Lake	77434	29.60191	-96.3473
14463211	48091	Comal	UP	JAMA1	Unknown	0	29.8067	-98.024
16910211	48091	Comal	UNKNOWN	Garden Ridge	Garden Ridge	78132	29.6362	-98.2581
16912011	48091	Comal	UNKNOWN	Hunter	San Marcos	78132	29.80336	-98.0366
16919911	48091	Comal	UP	Northcliff	Schertz	78132	29.65388	-98.2279
16921111	48091	Comal	UNKNOWN	New Braunfels3	New Braunfels	78132	29.67864	-98.1817
14463311	48097	Cooke	BNSF	GAINESVILLE	Unknown	0	33.64169	-97.1451
16916711	48099	Coryell	UNKNOWN	Copperas Cove	Copperas Cove	76544	31.12766	-97.86
16925811	48111	Dallam	UP	Dalhart	Dalhart	79022	36.07067	-102.515
14463411	48113	Dallas	UP	BROWDER	Unknown	0	32.77498	-96.8566
15529011	48113	Dallas	KCS	DALLAS IMF	Dallas	75218	32.85787	-96.6703
16913611	48113	Dallas	DGNO	Garland 2	Garland	75041	32.88803	-96.6737
16917211	48113	Dallas	UNKNOWN	Carrollton 2	Carrollton	75006	32.95916	-96.8788
16927111	48113	Dallas	UNKNOWN	Irving	Dallas	75247	32.81345	-96.8812
16927411	48113	Dallas	UP	MILLER YARD	Dallas	75216	32.71074	-96.7485
16927611	48113	Dallas	UP	MESQUITE	Dallas	75227	32.78322	-96.6616
17865311	48113	Dallas	UP	GRAND PRAIRIE	Unknown	0	32.74551	-96.9872

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16926611	48117	Deaf Smith	UNKNOWN	Hereford 2	Hereford	79045	34.82508	-102.37
16910711	48121	Denton	UNKNOWN	Denton	Denton	76201	33.21336	-97.127
16911711	48121	Denton	UNKNOWN	Justin	Fort Worth	76052	32.99691	-97.3541
16919011	48121	Denton	UP	Roanoke	Roanoke	76262	33.00007	-97.2304
AIS_NEEDED_1401	48121	DENTON	BNSF	HASLET (ALLIANCE)	HASLET		32.99066	-97.3482
14488911	48135	Ector	UP	ODESSA	Unknown	0	31.84181	-102.372
14463611	48141	El Paso	UP	ALFALFA	Unknown	0	31.7642	-106.393
14487811	48141	El Paso	UP	DALLAS STREET	Unknown	0	31.75891	-106.479
16926111	48141	El Paso	UNKNOWN	El Paso 1	El Paso	79901	31.75331	-106.493
16929411	48141	El Paso	UNKNOWN	Fort Bliss	El Paso	79916	31.83636	-106.415
16930911	48141	El Paso	UP	El Paso 2	El Paso	79901	31.76565	-106.48
16935211	48141	El Paso	UP	EL PASO SOUTH/INTERNATIONAL	El Paso	79901	31.74995	-106.479
17864011	48141	El Paso	UNKNOWN	EL PASO DALLAS ST	Unknown	0	31.77042	-106.475
AIS_NEEDED_1412	48141	EL PASO	BNSF	EL PASO	EL PASO		31.7519	-106.489
14463511	48139	Ellis	CSXT	GARRETT	Unknown	0	32.34381	-96.6369
16926411	48139	Ellis	UP	ENNIS	Ennis	75119	32.30099	-96.5893
16910411	48143	Erath	UNKNOWN	Dublin	Dublin	76446	32.08706	-98.3372
16922011	48143	Erath	UNKNOWN	Stephenville	Stephenville	76401	32.22311	-98.2094
16912911	48149	Fayette	UNKNOWN	Halsted	Fayetteville	78945	29.90784	-96.7492
17864811	48149	Fayette	UP	FLATONIA	Unknown	0	29.68709	-97.1159
16929511	48153	Floyd	UNKNOWN	Floydada	Floydada	79235	33.98072	-101.329
16919811	48157	Fort Bend	UNKNOWN	Rosenberg	Rosenberg	77471	29.56041	-95.8286
16920911	48157	Fort Bend	UNKNOWN	Thompsons	Thompsons	77469	29.47294	-95.6349
16921911	48157	Fort Bend	UNKNOWN	Sugar Land	Sugar Land	77498	29.62031	-95.6405
16927811	48157	Fort Bend	UNKNOWN	Kendleton_Intermodal	Kendleton	77417	29.46353	-95.9743
16929011	48161	Freestone	UNKNOWN	Teague	Teague	75860	31.63	-96.2878
14463711	48167	Galveston	UP	GALVESTON	Unknown	0	29.30052	-94.8237
14463811	48167	Galveston	BNSF	TEXAS CITY	Unknown	0	29.35393	-94.9343
14488011	48167	Galveston	UNKNOWN	East 2	Unknown	0	29.3489	-94.9414
16910611	48167	Galveston	UNKNOWN	Dickinson	Dickinson	77539	29.45997	-95.0446

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16912611	48177	Gonzales	UNKNOWN	Harwood2	Luling	78632	29.66648	-97.5015
16912711	48177	Gonzales	UNKNOWN	Harwood1	Gonzales	78629	29.60512	-97.4681
16914511	48179	Gray	UNKNOWN	Pampa 1	Pampa	79065	35.48265	-101.052
16927911	48179	Gray	UNKNOWN	Pampa 2	Pampa	79065	35.52939	-100.963
14463911	48181	Grayson	BNSF	SHERMAN	Unknown	0	33.65414	-96.599
16910811	48181	Grayson	UNKNOWN	Denison 1	Denison	75021	33.7537	-96.5341
16925911	48181	Grayson	UP	RAY YARD	Denison	75020	33.77155	-96.5841
14464011	48183	Gregg	BNSF	LONGVIEW	Unknown	0	32.49315	-94.7273
16913111	48183	Gregg	UP	Greggton 3	Longview	75604	32.49629	-94.7702
16926511	48183	Gregg	UP	Greggton 1	Longview	75604	32.50395	-94.8117
16933611	48183	Gregg	UP	Greggton 2	Longview	75604	32.50171	-94.7886
17867911	48183	Gregg	UP	LONGVIEW_2	Unknown	0	32.49455	-94.7269
16921511	48185	Grimes	UNKNOWN	Navasota	Navasota	77868	30.38124	-96.0865
17869111	48187	Guadalupe	UP	NOLTE SPUR	Unknown	0	29.59392	-98.0341
16928111	48189	Hale	UNKNOWN	Plainview	Plainview	79072	34.19269	-101.697
16913311	48197	Hardeman	UNKNOWN	Goodlett 2	Quanah	79252	34.31763	-99.8242
16928211	48197	Hardeman	UNKNOWN	Quanah	Quanah	79252	34.30422	-99.738
14464111	48199	Hardin	BNSF	SILSBEE	Unknown	0	30.35854	-94.189
14464211	48201	Harris	UP	BASIN	Unknown	0	29.76772	-95.2935
14464311	48201	Harris	UP	BOOTH	Unknown	0	29.73578	-95.2815
14464511	48201	Harris	UP	COADY	Unknown	0	29.75159	-95.0204
14464611	48201	Harris	UP	ENGLEWOOD	Unknown	0	29.7877	-95.3153
14464711	48201	Harris	BNSF	MYKAWA	Unknown	0	29.61484	-95.3028
14464811	48201	Harris	UP	OLD SOUTH	Unknown	0	29.72147	-95.3354
14464911	48201	Harris	UP	STRANG	Unknown	0	29.68066	-95.0397
14487711	48201	Harris	UP	CONGRESS	Unknown	0	29.76594	-95.356
14487911	48201	Harris	UNKNOWN	East 1	Unknown	0	29.79756	-95.2922
14488111	48201	Harris	UP	EUREKA	Unknown	0	29.78273	-95.4217
14488311	48201	Harris	UP	HARDY STREET	Unknown	0	29.77133	-95.3562
14488511	48201	Harris	UP	MARKET STREET	Unknown	0	29.71777	-95.2864

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
14488611	48201	Harris	BNSF	NEW SOUTH	Unknown	0	29.70433	-95.329
14488811	48201	Harris	PTRA	NORTH YARD	Unknown	0	29.76418	-95.293
14489111	48201	Harris	UP	SETTEGAST	Unknown	0	29.82028	-95.2896
14489211	48201	Harris	UP	SOUTH	Unknown	0	29.75061	-95.3456
16911111	48201	Harris	PTRA	Deer Park9	Deer Park	77536	29.7132	-95.1112
16911211	48201	Harris	PTRA	Deer Park7	Deer Park	77571	29.72755	-95.0842
16912111	48201	Harris	UNKNOWN	Houston3	Houston	77017	29.70115	-95.2524
16912311	48201	Harris	UNKNOWN	Hockley	Houston	77447	30.02364	-95.8636
16913211	48201	Harris	PTRA	Greens Port	Houston	77015	29.75234	-95.1968
16915111	48201	Harris	UP	Bayport North Industrial Park	Pasadena	77507	29.63986	-95.09
16920011	48201	Harris	UNKNOWN	Woodgate	Houston	77086	29.91347	-95.5021
16921411	48201	Harris	UNKNOWN	Taylor Lake Village	Pasadena	77586	29.60348	-95.0108
16922111	48201	Harris	UNKNOWN	Spring	Spring	77373	30.05954	-95.4094
16924311	48201	Harris	UNKNOWN	La Porte2	Pasadena	77507	29.62428	-95.0562
16924411	48201	Harris	UNKNOWN	La Porte1	Morgan s Point	77571	29.67599	-95.013
16925211	48201	Harris	PTRA	CHEVRON PHILLIPS PASADENA	Pasadena	77506	29.72267	-95.1811
16926811	48201	Harris	PTRA	STORAGE YARD	Houston	77029	29.74472	-95.2765
16926911	48201	Harris	UNKNOWN	Houston2	Houston	77012	29.71513	-95.2623
16929811	48201	Harris	UNKNOWN	Erinwilde	Spring	77073	30.0104	-95.4004
16931011	48201	Harris	PTRA	Pasadena1	Pasadena	77506	29.72268	-95.1994
16931811	48201	Harris	PTRA	Deer Park1	Pasadena	77503	29.72573	-95.1539
16932011	48201	Harris	PTRA	Deer Park10	La Porte	77571	29.70499	-95.0853
16932111	48201	Harris	PTRA	Deer Park11	La Porte	77571	29.70539	-95.0625
16932211	48201	Harris	PTRA	Deer Park12	La Porte	77571	29.69927	-95.0629
16932311	48201	Harris	PTRA	Deer Park3	Deer Park	77536	29.72054	-95.1246
16932411	48201	Harris	PTRA	Deer Park2	Pasadena	77536	29.72431	-95.1434
16932511	48201	Harris	PTRA	Deer Park4	Deer Park	77536	29.72113	-95.0999
16932611	48201	Harris	PTRA	Deer Park5	Deer Park	77536	29.73898	-95.093
16932711	48201	Harris	PTRA	Deer Park6	Deer Park	77571	29.73358	-95.0803
16932811	48201	Harris	PTRA	Deer Park8	La Porte	77571	29.71564	-95.0822

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16935811	48201	Harris	UP	GALENA PARK	Galena Park	77015	29.74805	-95.218
17860911	48201	Harris	UP	Baytown 2	Unknown	0	29.73514	-94.967
17864111	48201	Harris	UP	ELDON	Unknown	0	29.81315	-94.9196
17865111	48201	Harris	UP	GLASS YARD	Unknown	0	29.79134	-95.2885
17872111	48201	Harris	UP	SINCO	Unknown	0	29.70922	-95.252
17874611	48201	Harris	UP	WEST BAYPORT	Unknown	0	29.64678	-95.0387
17876311	48201	Harris	UP	TOWER 87	Unknown	0	29.79939	-95.2886
AIS_NEEDED_1396	48201	HARRIS	BNSF	HOUSTON SOUTH	HOUSTON		29.71396	-95.3328
AIS_NEEDED_1432	48201	Harris	UP	MARKET STREET (UP)	Unknown	0	29.76828	-95.2601
AIS_NEEDED_1441	48201	Harris	UP	BAYPORT	Unknown	0	29.63832	-95.0383
AIS_NEEDED_1445	48201	Harris	UP	GALENA PARK (UP)	Unknown	0	29.73014	-95.2224
14465011	48203	Harrison	BNSF	MARSHALL	Unknown	0	32.55855	-94.3675
16923411	48203	Harrison	UP	Longview Heights	Longview	75602	32.50389	-94.6396
16929611	48203	Harrison	UNKNOWN	Ferguson Creek Reservoir	Longview	75602	32.44093	-94.6873
14488411	48209	Hays	UP	JAMA2	Unknown	0	29.8448	-97.9752
16923511	48209	Hays	UNKNOWN	Mountain City	Buda	78610	30.05072	-97.8602
16913411	48211	Hemphill	UNKNOWN	Glazier	Canadian	79014	36.01184	-100.258
16917411	48211	Hemphill	UNKNOWN	Canadian	Canadian	79014	35.90649	-100.401
16910111	48215	Hidalgo	UNKNOWN	Edinburg1	Edinburg	78541	26.31866	-98.164
16915911	48215	Hidalgo	UNKNOWN	Alamo	Alamo	78537	26.1778	-98.0883
16919711	48215	Hidalgo	UNKNOWN	Kane	McAllen	78501	26.20766	-98.2475
16922811	48215	Hidalgo	UNKNOWN	Mission	Mission	78572	26.21456	-98.3292
16912411	48217	Hill	UNKNOWN	Hillsboro	Hillsboro	76645	32.0095	-97.1335
16916311	48221	Hood	UNKNOWN	Cresson	Godley	76035	32.5351	-97.6218
15529111	48223	Hopkins	KCS	SULPHUR SPRINGS	Sulphur Springs	75482	33.1339	-95.5998
14465111	48227	Howard	UP	BIG SPRING	Unknown	0	32.25336	-101.485
16928311	48227	Howard	UP	ZILER	Big Spring	79720	32.27286	-101.409
14465211	48231	Hunt	KCS	GREENVILLE	Unknown	0	33.1366	-96.1279
16914011	48233	Hutchinson	UNKNOWN	Borger 1	Borger	79007	35.65681	-101.39
16924911	48233	Hutchinson	UNKNOWN	Phillips	Borger	79007	35.68999	-101.368

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16919311	48239	Jackson	UP	Redfish Lake	Lolita	77971	28.78962	-96.5486
16924211	48239	Jackson	UP	La Ward1	Lolita	77971	28.8161	-96.5043
16934711	48239	Jackson	UP	Point Comfort4	Point Comfort	77971	28.70915	-96.543
16927211	48241	Jasper	UNKNOWN	Jasper	Jasper	75951	30.92576	-93.9844
14465311	48245	Jefferson	UP	AMELIA	Unknown	0	30.06967	-94.2222
14465411	48245	Jefferson	UP	Beaumont0	Unknown	0	30.0848	-94.1124
14465511	48245	Jefferson	KCS	CHAISON	Unknown	0	30.05485	-94.0748
14465611	48245	Jefferson	UP	GUFFY	Unknown	0	30.01967	-94.0825
14465711	48245	Jefferson	KCS	PORT ARTHUR	Unknown	0	29.87948	-93.953
14465811	48245	Jefferson	BNSF	SUNNYSIDE	Unknown	0	30.07954	-94.1288
16914611	48245	Jefferson	UNKNOWN	Beaumont2	Beaumont	77701	30.07598	-94.0903
16917111	48245	Jefferson	UNKNOWN	Central Gardens2	Nederland	77627	29.99969	-93.9838
16917911	48245	Jefferson	UNKNOWN	Smith Island	Beaumont	77705	30.06122	-94.0425
16919611	48245	Jefferson	UNKNOWN	Port Neches	Port Neches	77651	29.98408	-93.9466
16920311	48245	Jefferson	KCS	PORT ARTHUR	Port Arthur	77640	29.85377	-93.9486
16927311	48245	Jefferson	UNKNOWN	Jefferson County1	Beaumont	77713	30.07803	-94.2425
16927711	48245	Jefferson	UNKNOWN	Port_Neches	Port Arthur	77642	29.93753	-93.9458
16930711	48245	Jefferson	UNKNOWN	Beaumont1	Beaumont	77701	30.06882	-94.0764
16930811	48245	Jefferson	UNKNOWN	Beaumont3	Beaumont	77701	30.08377	-94.095
16931411	48245	Jefferson	UNKNOWN	Central Gardens1	Nederland	77627	29.98618	-93.9913
16935411	48245	Jefferson	UP	West Port Arthur1	Port Arthur	77640	29.84226	-93.9575
17861011	48245	Jefferson	UP	Beaumont 0	Unknown	0	30.07332	-94.1493
16924011	48249	Jim Wells	UNKNOWN	Alice	Alice	78332	27.74792	-98.081
14465911	48251	Johnson	BNSF	CLEBURNE	Unknown	0	32.3539	-97.3833
16915711	48251	Johnson	UNKNOWN	Alvarado	Venus	76009	32.41015	-97.1626
14466011	48271	Kinney	UP	SPOFFORD	Unknown	0	29.16838	-100.402
14466311	48281	Lampasas	BNSF	LOMETA	Unknown	0	31.23514	-98.4037
16920811	48289	Leon	UNKNOWN	Newby	Jewett	75846	31.34921	-96.1694
16926711	48291	Liberty	UTLX	Hightower	Cleveland	77327	30.37232	-95.0162
16927011	48291	Liberty	UP	Hull	Daisetta	77564	30.14169	-94.6313

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
17863211	48291	Liberty	UP	DAYTON	Unknown	0	30.03904	-94.8995
16928811	48291	LIBERTY	BNSF	DAYTON(BNSF)	DAYTON		30.01501	-94.9034
16922311	48297	Live Oak	UNKNOWN	Three Rivers	Three Rivers	78071	28.46025	-98.1867
14466411	48303	Lubbock	BNSF	LUBBOCK	Unknown	0	33.58016	-101.837
14466511	48303	Lubbock	BNSF	SLATON	Unknown	0	33.44415	-101.641
16920511	48321	Matagorda	UNKNOWN	Wadsworth	Bay City	77414	28.78965	-95.9416
16923211	48321	Matagorda	UNKNOWN	Matagorda County2	Markham	77414	28.86291	-96.0232
16934111	48321	Matagorda	UNKNOWN	Matagorda County1	Bay City	77414	28.87115	-96.0039
14466611	48323	Maverick	UP	EAGLE PASS	Unknown	0	28.70259	-100.498
16911011	48323	Maverick	UNKNOWN	Elm Creek4	Elm Creek	78852	28.75816	-100.487
16911811	48323	Maverick	UNKNOWN	Elm Creek1	Radar Base	78877	28.83521	-100.435
16933011	48323	Maverick	UNKNOWN	Elm Creek2	Elm Creek	78877	28.79926	-100.464
16933111	48323	Maverick	UNKNOWN	Elm Creek3	Elm Creek	78877	28.77227	-100.473
16923111	48309	McLennan	UNKNOWN	McGregor	McGregor	76657	31.44275	-97.4054
16925611	48309	McLennan	UP	BELLMEAD	Bellmead	76705	31.58012	-97.1015
16912211	48325	Medina	UNKNOWN	Hondo	Hondo	78861	29.34458	-99.1762
16915811	48331	Milam	UNKNOWN	Alcoa Lake	Rockdale	76577	30.5611	-97.0703
16917511	48331	Milam	UNKNOWN	Cameron2	Cameron	76520	30.87446	-96.9782
16931311	48331	Milam	UNKNOWN	Cameron1	Cameron	76520	30.8467	-96.9816
16914811	48339	Montgomery	UNKNOWN	Beach2	Conroe	77306	30.31531	-95.3849
16913811	48341	Moore	UNKNOWN	Cactus 1	Cactus	79029	36.04115	-101.995
16921611	48341	Moore	UNKNOWN	Sunray 2	Sunray	79086	35.98202	-101.891
16931111	48341	Moore	UNKNOWN	Sunray 1	Sunray	79086	36.00786	-101.891
16931211	48341	Moore	UNKNOWN	Cactus 2	Cactus	79029	36.02897	-101.975
16916111	48343	Morris	TN	Daingerfield	Hughes Springs	75638	32.99543	-94.6592
16923611	48343	Morris	UNKNOWN	Lone Star	Hughes Springs	75668	32.95318	-94.6636
16926211	48343	Morris	UNKNOWN	TN	Lone Star	75668	32.92491	-94.7122
16921711	48347	Nacogdoches	UP	Nacogdoches	Nacogdoches	75961	31.60338	-94.6592
17862911	48349	Navarro	UP	CORSICANA	Unknown	0	32.09059	-96.4621
16928911	48353	Nolan	UNKNOWN	Sweetwater	Sweetwater	79556	32.49416	-100.404

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
14487511	48355	Nueces	KCS	AGNESSTREETYARD	Unknown	0	27.78563	-97.4848
15528711	48355	Nueces	KCS	Corpus Christi3 (Agnes St Yard)	Corpus Christi	78406	27.7858	-97.4776
16914211	48355	Nueces	UNKNOWN	Bishop1	Bishop	78343	27.56649	-97.8229
16916011	48355	Nueces	UP	Corpus Christi2	Corpus Christi	78407	27.80859	-97.4146
16916411	48355	Nueces	UNKNOWN	Corpus Christi9	Corpus Christi	78409	27.8417	-97.5228
16916511	48355	Nueces	UNKNOWN	Corpus Christi4	Corpus Christi	78402	27.82113	-97.4265
16918911	48355	Nueces	UNKNOWN	Robstown	Robstown	78380	27.78591	-97.6635
16931611	48355	Nueces	UNKNOWN	Corpus Christi6	Corpus Christi	78409	27.81823	-97.4618
16931711	48355	Nueces	UNKNOWN	Corpus Christi7	Corpus Christi	78409	27.81745	-97.4801
16931911	48355	Nueces	UNKNOWN	Corpus Christi8	Corpus Christi	78409	27.83017	-97.5041
16934311	48355	Nueces	UNKNOWN	Nueces River Rail Yard/Proposed	Corpus Christi	78409	27.84218	-97.5106
16934811	48355	Nueces	UNKNOWN	Corpus Christi1	Corpus Christi	78402	27.824	-97.4518
16925011	48357	Ochiltree	UNKNOWN	Perryton Yard	Perryton	79070	36.40125	-100.802
14466711	48361	Orange	KCS	MAURICEVILLE	Unknown	0	30.20193	-93.8683
16918711	48361	Orange	UNKNOWN	Rose City	Beaumont	77662	30.08455	-94.0752
16921811	48361	Orange	UNKNOWN	Mule Island	Bridge City	77630	30.04557	-93.7794
16923811	48361	Orange	UNKNOWN	Lemonville	Mauriceville	77632	30.20868	-93.8436
16924511	48361	Orange	UNKNOWN	Owens-Illinois Reservoir	Orange	77632	30.21484	-93.7487
16924711	48361	Orange	UNKNOWN	Plant Reservoir2	West Orange	77630	30.0564	-93.7623
16930211	48361	Orange	UNKNOWN	Vidor	Vidor	77662	30.09905	-94.0055
16930411	48361	Orange	UNKNOWN	West Orange	West Orange	77630	30.06885	-93.7686
16934411	48361	Orange	UNKNOWN	Plant Reservoir1	Bridge City	77630	30.04928	-93.7586
16935711	48361	Orange	UNKNOWN	Orangefield	Orange	77630	30.09387	-93.8084
14489011	48361	Orange	UP	ORANGE	Unknown	0	30.08892	-93.7662
16925511	48365	Panola	UNKNOWN	Beckville	Beckville	75631	32.23113	-94.5024
16929711	48369	Parmer	UNKNOWN	Farwell	Farwell	79325	34.3907	-103.039
14466811	48375	Potter	BNSF	SOUTH AMARILLO	Unknown	0	35.19268	-101.832
16915311	48375	Potter	UNKNOWN	Amarillo 5	Amarillo	79111	35.19778	-101.693
16915411	48375	Potter	UNKNOWN	Amarillo 4	Amarillo	79118	35.20428	-101.746
16915511	48375	Potter	UP	Amarillo 3	Amarillo	79107	35.21703	-101.8

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16930511	48375	Potter	UNKNOWN	Amarillo 1	Amarillo	79108	35.28602	-101.744
AIS_NEEDED_1436	48375	Potter	UP	AMARILLO (UP)	Unknown	0	35.21252	-101.829
14487611	48381	Randall	BNSF	SOUTH AMARILLO	Unknown	0	35.17546	-101.838
16917311	48381	Randall	UNKNOWN	Canyon	Amarillo	79118	35.12128	-101.857
16928011	48389	Reeves	UNKNOWN	Pecos	Pecos	79772	31.41264	-103.519
14466911	48395	Robertson	UP	HEARNE 1	Unknown	0	30.87476	-96.5897
16930311	48395	Robertson	UP	Hearne 2	Hearne	77859	30.86402	-96.6039
16915211	48399	Runnels	UNKNOWN	Ballinger	Ballinger	76821	31.73824	-99.9503
16910511	48401	Rusk	UNKNOWN	Dirgin	Tatum	75691	32.26077	-94.566
16910911	48409	San Patricio	UNKNOWN	Del Sol-Loma Linda	Del Sol-Loma Linda	78387	28.01017	-97.5294
16913011	48409	San Patricio	UP	Gregory2	Gregory	78374	27.91036	-97.2677
16918111	48409	San Patricio	UNKNOWN	Odem	Odem	78370	27.95241	-97.5793
16933711	48409	San Patricio	UP	Gregory1	Gregory	78374	27.92522	-97.2963
14467011	48415	Scurry	BNSF	SNYDER	Unknown	0	32.73442	-100.92
16929211	48419	Shelby	UNKNOWN	Tenaha 2	Tenaha	75974	31.94053	-94.2781
14489411	48423	Smith	UP	TYLER	Unknown	0	32.36012	-95.2888
16920111	48423	Smith	UP	Winona	Tyler	75708	32.44158	-95.1871
14467111	48439	Tarrant	UP	CENTENNIAL	Unknown	0	32.72521	-97.3768
14467211	48439	Tarrant	UP	FT WORTH	Unknown	0	32.74542	-97.3224
14467311	48439	Tarrant	FWWR	HODGE	Unknown	0	32.80999	-97.3157
14467411	48439	Tarrant	BNSF	SAGINAW	Unknown	0	32.84282	-97.3585
14488211	48439	Tarrant	UP	GREAT SOUTHWEST	Unknown	0	32.74235	-97.0629
14488711	48439	Tarrant	BNSF	NORTH	Unknown	0	32.8244	-97.332
14489311	48439	Tarrant	UP	TOWER 55	Unknown	0	32.74386	-97.3236
16914311	48439	Tarrant	UNKNOWN	Berkeley Place	Fort Worth	76110	32.71894	-97.3446
17860611	48439	Tarrant	UNKNOWN	ARLINGTON	Unknown	0	32.73731	-97.1076
17869011	48439	Tarrant	UP	NEY YARD	Unknown	0	32.72438	-97.3228
17876211	48439	Tarrant	UP	PEACH	Unknown	0	32.76725	-97.3234
16911611	48441	Taylor	UNKNOWN	Abilene	Abilene	79601	32.44896	-99.728
14467611	48449	Titus	UP	MOUNT PLEASANT	Unknown	0	33.15944	-94.9661

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
16924111	48449	Titus	UNKNOWN	Lake Monticello	Rocky Mound	75493	33.09195	-95.0337
16918411	48451	Tom Green	UNKNOWN	San Angelo 2	San Angelo	76903	31.49679	-100.412
16918811	48453	Travis	UNKNOWN	Northtech Business Center	Austin	78727	30.44478	-97.712
16916211	48463	Uvalde	UP	Dabney	Uvalde Estates	78801	29.16328	-100.091
16922911	48463	Uvalde	UNKNOWN	Mine	Uvalde Estates	78801	29.14162	-100.04
14467711	48465	Val Verde	UP	DEL RIO	Unknown	0	29.36236	-100.906
14467811	48469	Victoria	UP	Bloomington1	Unknown	0	28.6446	-96.8958
16914111	48469	Victoria	UP	Bloomington2	Bloomington	77905	28.66192	-96.8714
16919411	48469	Victoria	UNKNOWN	Raisin	Victoria	77905	28.7712	-97.0903
16920611	48469	Victoria	UNKNOWN	Victoria2	Victoria	77905	28.82187	-96.9464
16911311	48473	Waller	UNKNOWN	Katy	Katy	77493	29.79234	-95.8564
17865711	48473	Waller	UP	HEMPSTEAD	Unknown	0	30.10764	-96.082
16922511	48475	Ward	UP	Monahans	Monahans	79756	31.59185	-102.906
16919511	48477	Washington	UNKNOWN	Quarry	Somerville	77833	30.31569	-96.5113
14467911	48479	Webb	KCS	LAREDO	Unknown	0	27.52269	-99.5166
16911411	48479	Webb	UNKNOWN	El Cuatro	Laredo	78040	27.50614	-99.5167
16921211	48479	Webb	UNKNOWN	Tex-Mex Industrial Park	Laredo	78043	27.51163	-99.4521
16921311	48479	Webb	UNKNOWN	Tejas Industrial Park	Laredo	78045	27.58783	-99.5028
16922711	48479	Webb	UNKNOWN	Missouri Pacific Railyards	Laredo	78045	27.6661	-99.4456
16923011	48479	Webb	UNKNOWN	Milo Distribution Center	Laredo	78045	27.6137	-99.485
16923911	48479	Webb	UNKNOWN	LAX	Laredo	78040	27.49855	-99.4903
16925411	48479	Webb	UP	Laredo_Yard	Laredo	78043	27.50113	-99.4027
17870311	48479	Webb	UP	PORT LAREDO	Unknown	0	27.67127	-99.4686
16911511	48485	Wichita	UNKNOWN	Electra	Electra	76360	34.02956	-98.9216
16911911	48485	Wichita	UNKNOWN	Iowa Park	Iowa Park	76367	33.94985	-98.6639
16916611	48485	Wichita	UNKNOWN	Kay-Bub	Wichita Falls	76310	33.86258	-98.5909
16920211	48485	Wichita	UNKNOWN	Wichita Falls 3	Wichita Falls	76306	33.93106	-98.5411
16929311	48485	Wichita	UNKNOWN	Wichita Falls 2	Wichita Falls	76301	33.90866	-98.4833
16935611	48485	Wichita	UNKNOWN	Wichita Falls 1	Wichita Falls	76306	33.9298	-98.5023
16920711	48487	Wilbarger	UNKNOWN	Vernon	Vernon	76384	34.16147	-99.2838

EIS ID	FIPS	County	Owner	Yard Name	City	Zip	Lat	Long
14468011	48491	Williamson	UP	TAYLOR	Unknown	0	30.56739	-97.4145
16913511	48491	Williamson	UNKNOWN	Georgetown	Georgetown	78626	30.62047	-97.6806
16918511	48491	Williamson	UNKNOWN	Round Rock4	Round Rock	78681	30.57061	-97.6983
16918611	48491	Williamson	UNKNOWN	Soil Conservation Service Site 10a	Georgetown	78628	30.58814	-97.6966
16923711	48491	Williamson	UNKNOWN	Liberty Hill	Liberty Hill	78642	30.64779	-97.8858
16935111	48491	Williamson	UNKNOWN	Round Rock2	Round Rock	78681	30.53806	-97.6992
16935311	48491	Williamson	UNKNOWN	Round Rock1	Round Rock	78681	30.523	-97.6963
16935511	48491	Williamson	UNKNOWN	Round Rock3	Round Rock	78681	30.55409	-97.6986
16928611	48493	Wilson	UP	Mission Rail Elmendorf	Elmendorf	78112	29.2328	-98.3023
16925711	48497	Wise	UP	Chico	Chico	76426	33.27493	-97.7958
16920411	48499	Wood	UP	West Mineola	Mineola	75773	32.66993	-95.523

APPENDIX D: LINE-HAUL TON-MILE DISTRIBUTION BY TEXAS COUNTIES

Line-Haul Ton-Mile by Texas Counties.

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48201	Harris	3.0698	2.0772	3.1438	3.2102
48439	Tarrant	2.7346	2.6091	3.3506	3.1954
48369	Parmer	2.8137	2.3569	2.1360	2.2935
48375	Potter	2.1598	2.5525	2.1936	2.1709
48065	Carson	2.2108	1.9135	1.7554	1.9303
48309	McLennan	1.1470	1.1742	1.9943	1.9280
48381	Randall	2.2914	1.9075	1.7077	1.8613
48331	Milam	1.4677	0.8891	1.9884	1.8450
48029	Bexar	1.7241	1.7834	1.7112	1.8016
48211	Hemphill	1.9291	1.7541	1.6120	1.7798
48121	Denton	1.4572	1.1335	1.8004	1.7373
48157	Fort Bend	1.5752	0.9969	1.7269	1.7217
48251	Johnson	0.9632	0.9422	1.6469	1.5943
48229	Hudspeth	1.5084	1.7909	1.2998	1.4662
48203	Harrison	1.1335	1.2000	1.4272	1.4188
48181	Grayson	1.2454	0.9395	1.4378	1.3784
48497	Wise	0.7929	1.3346	1.4108	1.3544
48117	Deaf Smith	1.5908	1.3134	1.2434	1.3532
48395	Robertson	1.3747	1.0200	1.2680	1.2302
48035	Bosque	0.9465	0.7940	1.2899	1.2299
48067	Cass	1.0317	0.7592	1.2442	1.2275
48129	Donley	0.6371	1.2920	1.2986	1.2252
48217	Hill	0.6341	0.7224	1.2541	1.2204
48291	Liberty	1.1548	0.8977	1.2798	1.1717
48027	Bell	1.2484	1.2801	1.2622	1.1406

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48039	Brazoria	0.9611	0.9788	0.9788	1.1147
48015	Austin	0.7966	0.5408	1.2595	1.1067
48325	Medina	1.1041	1.2922	0.9721	1.1040
48179	Gray	1.1792	1.0694	0.9896	1.0922
48487	Wilbarger	0.5655	1.1389	1.1495	1.0878
48491	Williamson	0.5370	0.5510	1.0747	1.0744
48141	El Paso	1.4914	1.2454	0.9746	1.0674
48077	Clay	0.5155	1.0994	1.1165	1.0561
48485	Wichita	0.5481	1.0944	1.1160	1.0561
48011	Armstrong	0.5379	1.0921	1.0991	1.0369
48421	Sherman	0.9150	0.7974	1.1231	1.0356
48149	Fayette	1.2095	1.0724	0.9529	1.0300
48197	Hardeman	0.5311	1.0582	1.0659	1.0062
48393	Roberts	1.0635	0.9722	0.8918	0.9846
48341	Moore	0.6527	0.7392	1.0488	0.9650
48089	Colorado	0.5603	0.6903	0.7968	0.9247
48479	Webb	0.8952	0.5515	0.8275	0.9191
48187	Guadalupe	0.7922	1.0096	0.8432	0.9185
48075	Childress	0.4683	0.9519	0.9560	0.9020
48283	La Salle	0.4497	0.6021	0.8383	0.8973
48051	Burleson	1.2790	0.8915	0.9612	0.8506
48113	Dallas	0.9216	1.1733	0.7977	0.8035
48001	Anderson	0.5162	0.3420	0.7841	0.7839
48145	Falls	0.3909	0.4514	0.7617	0.7648
48463	Uvalde	0.9916	1.1428	0.6449	0.7300
48163	Frio	0.4411	0.4830	0.7008	0.7172
48109	Culberson	0.6952	0.6965	0.6436	0.7144
48245	Jefferson	0.6417	0.5812	0.7904	0.6945
48073	Cherokee	0.4405	0.2984	0.6924	0.6872

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48339	Montgomery	0.9003	0.5701	0.6106	0.6556
48465	Val Verde	0.6770	1.3175	0.5346	0.6418
48295	Lipscomb	0.6767	0.6505	0.5677	0.6268
48441	Taylor	0.8844	0.8252	0.7161	0.6246
48453	Travis	0.3187	0.2097	0.6215	0.6121
48337	Montague	0.4463	0.6408	0.6468	0.6118
48361	Orange	0.6374	0.4984	0.6761	0.6046
48091	Comal	0.3499	0.4335	0.6154	0.5963
48209	Hays	0.2918	0.3014	0.6097	0.5960
48183	Gregg	0.4418	0.5512	0.5978	0.5951
48177	Gonzales	0.4870	0.6325	0.5343	0.5745
48043	Brewster	0.6017	1.1584	0.4742	0.5690
48191	Hall	0.2919	0.5867	0.5921	0.5586
48021	Bastrop	0.4315	0.7120	0.5385	0.5577
48363	Palo Pinto	0.6174	0.4928	0.6010	0.5573
48475	Ward	0.5279	0.4023	0.5285	0.5529
48389	Reeves	0.5285	0.3981	0.5038	0.5440
48271	Kinney	0.7050	0.9189	0.4676	0.5428
48041	Brazos	0.7242	0.5600	0.5318	0.5375
48225	Houston	0.3131	0.1956	0.4872	0.5323
48097	Cooke	0.4566	0.3239	0.5282	0.5321
48367	Parker	0.5873	0.4809	0.5731	0.5311
48477	Washington	0.3108	0.2066	0.6034	0.5271
48037	Bowie	0.9578	0.4677	0.5330	0.5267
48353	Nolan	0.6484	0.5670	0.5703	0.5169
48315	Marion	0.4573	0.2851	0.5358	0.5161
48111	Dallam	0.7375	0.7595	0.5687	0.5129
48133	Eastland	0.5334	0.4234	0.5114	0.4775
48205	Hartley	0.7233	0.9100	0.5033	0.4717

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48059	Callahan	0.5173	0.4163	0.5029	0.4711
48227	Howard	0.4497	0.3397	0.4976	0.4684
48335	Mitchell	0.4700	0.3317	0.4846	0.4554
48443	Terrell	0.4423	0.8649	0.3525	0.4232
48467	Van Zandt	0.3691	0.7335	0.4269	0.4215
48135	Ector	0.3855	0.2981	0.4161	0.4182
48289	Leon	0.4860	0.3508	0.4728	0.4107
48257	Kaufman	0.3469	0.6932	0.4192	0.4087
48321	Matagorda	0.2958	0.4104	0.3458	0.3997
48499	Wood	0.3778	0.6590	0.3983	0.3946
48471	Walker	0.2287	0.1465	0.3579	0.3946
48469	Victoria	0.5238	0.5118	0.3755	0.3831
48055	Caldwell	0.4406	0.5950	0.3676	0.3755
48329	Midland	0.3237	0.2645	0.3858	0.3674
48423	Smith	0.4351	0.4185	0.3520	0.3500
48185	Grimes	0.5881	0.4922	0.3337	0.3321
48391	Refugio	0.4251	0.4470	0.2835	0.3287
48377	Presidio	0.3307	0.6392	0.2589	0.3090
48481	Wharton	0.5973	0.2645	0.2600	0.3016
48323	Maverick	0.3531	0.3254	0.2589	0.2904
48239	Jackson	0.3831	0.2920	0.2249	0.2563
48243	Jeff Davis	0.2374	0.4192	0.2040	0.2383
48455	Trinity	0.1368	0.0858	0.2128	0.2326
48401	Rusk	0.1538	0.1546	0.2283	0.2269
48085	Collin	0.3393	0.1911	0.2110	0.1963
48409	San Patricio	0.3192	0.3432	0.1638	0.1962
48281	Lampasas	0.4450	0.5191	0.2672	0.1941
48139	Ellis	0.7060	0.3711	0.2279	0.1898
48303	Lubbock	0.3447	0.5258	0.2246	0.1863

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48355	Nueces	0.3456	0.3657	0.1478	0.1852
48169	Garza	0.3433	0.5492	0.2226	0.1851
48083	Coleman	0.4299	0.4772	0.2497	0.1838
48459	Upshur	0.4541	0.5145	0.1841	0.1836
48317	Martin	0.1570	0.1308	0.1918	0.1811
48415	Scurry	0.3243	0.5190	0.2103	0.1749
48279	Lamb	0.1643	0.2892	0.1939	0.1590
48419	Shelby	0.2319	0.2172	0.1274	0.1575
48333	Mills	0.3617	0.3926	0.2163	0.1573
48365	Panola	0.0685	0.0332	0.1200	0.1529
48123	De Witt	0.0522	0.1973	0.1713	0.1458
48167	Galveston	0.3864	0.0701	0.1295	0.1396
48049	Brown	0.3216	0.3475	0.1931	0.1373
48069	Castro	0.1630	0.1372	0.1249	0.1363
48349	Navarro	0.8063	0.5872	0.1703	0.1325
48131	Duval	0.4559	0.0481	0.0954	0.1251
48285	Lavaca	0.0459	0.1667	0.1475	0.1250
48161	Freestone	0.3001	0.2844	0.1689	0.1235
48017	Bailey	0.0983	0.2060	0.1392	0.1116
48151	Fisher	0.1663	0.2385	0.1202	0.1036
48287	Lee	0.4918	0.4896	0.0976	0.0982
48223	Hopkins	0.3112	0.0389	0.1034	0.0968
48261	Kenedy	0.1141	0.5362	0.0774	0.0907
48429	Stephens	0.0961	0.0758	0.0935	0.0867
48231	Hunt	0.1854	0.0315	0.0720	0.0671
48013	Atascosa	0.1401	0.2696	0.0553	0.0610
48371	Pecos	0.0635	0.1225	0.0502	0.0602
48061	Cameron	0.0767	0.3851	0.0499	0.0581
48343	Morris	0.2219	0.0465	0.0645	0.0548

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48249	Jim Wells	0.1910	0.0207	0.0401	0.0522
48437	Swisher	0.2312	0.1425	0.0380	0.0513
48473	Waller	0.0477	0.0284	0.0448	0.0512
48063	Camp	0.2690	0.1123	0.0536	0.0507
48099	Coryell	0.1088	0.1311	0.0655	0.0476
48347	Nacogdoches	0.2417	0.2301	0.0324	0.0426
48273	Kleberg	0.0522	0.2460	0.0354	0.0415
48071	Chambers	0.0253	0.0047	0.0390	0.0411
48351	Newton	0.0839	0.1409	0.0455	0.0408
48219	Hockley	0.0386	0.0745	0.0457	0.0375
48489	Willacy	0.0440	0.2059	0.0299	0.0350
48247	Jim Hogg	0.1236	0.0133	0.0259	0.0340
48293	Limestone	0.6032	0.2642	0.0245	0.0293
48189	Hale	0.3058	0.1815	0.0222	0.0254
48373	Polk	0.2190	0.2724	0.0169	0.0254
48449	Titus	0.2126	0.0892	0.0228	0.0225
48199	Hardin	0.2874	0.0441	0.0229	0.0224
48103	Crane	0.0176	0.0139	0.0187	0.0190
48359	Oldham	0.1118	0.3373	0.0154	0.0190
48057	Calhoun	0.0000	0.0398	0.0161	0.0177
48005	Angelina	0.1413	0.1566	0.0086	0.0127
48407	San Jacinto	0.0735	0.0906	0.0069	0.0108
48159	Franklin	0.0340	0.0040	0.0114	0.0107
48305	Lynn	0.0180	0.0288	0.0117	0.0097
48221	Hood	0.0000	0.0235	0.0329	0.0084
48143	Erath	0.0000	0.0201	0.0223	0.0070
48297	Live Oak	0.1386	0.1901	0.0032	0.0069
48093	Comanche	0.0000	0.0133	0.0148	0.0064
48175	Goliad	0.0034	0.0005	0.0051	0.0043

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48213	Henderson	0.2747	0.2756	0.0037	0.0040
48313	Madison	0.0744	0.0541	0.0034	0.0037
48007	Aransas	0.0000	0.0000	0.0000	0.0000
48493	Wilson	0.0000	-	0.0000	0.0000
48053	Burnet	-	0.0097	-	-
48079	Cochran	-	0.0000	-	-
48105	Crockett	-	0.0000	-	-
48119	Delta	-	0.0000	-	-
48147	Fannin	-	0.0008	-	-
48153	Floyd	-	0.0006	-	-
48165	Gaines	-	0.0021	-	-
48195	Hansford	-	0.0002	-	-
48215	Hidalgo	-	0.0171	-	-
48233	Hutchinson	-	0.0113	-	-
48235	Irion	-	0.0020	-	-
48241	Jasper	-	0.0227	-	-
48253	Jones	-	0.0011	-	-
48277	Lamar	-	0.0001	-	-
48299	Llano	-	0.0007	-	-
48307	McCulloch	-	0.0085	-	-
48357	Ochiltree	-	0.0022	-	-
48383	Reagan	-	0.0002	-	-
48397	Rockwall	-	0.0013	-	-
48399	Runnels	-	0.0129	-	-
48403	Sabine	-	0.0060	-	-
48405	San Augustine	-	0.0058	-	-
48411	San Saba	-	0.0177	-	-
48427	Starr	-	0.0037	-	-
48445	Terry	-	0.0149	-	-

FIPS	County	ERTAC 2017 Ton-Mile Distribution	SAM 2015 Ton-Mile Distribution	TRAGIS 2019 Ton-Mile Distribution	TRAGIS 2020 Ton-Mile Distribution
48451	Tom Green	-	0.0085	-	-
48461	Upton	-	0.0002	-	-
48495	Winkler	-	0.0081	-	-
48	**Texas**	**100**	**100**	**100**	**100**

APPENDIX E: FY23 YARD LOCATION AND CORRESPONDING NARL LINKS

Available electronically in Microsoft Excel format.

APPENDIX F: QUALITY ASSURANCE PROCEDURES

The TTI study team used basic criteria to assure the acceptable quality of the project. We assured the acceptable quality of the deliverables by verifying the process as stated in the grant activity description (GAD) and quality assurance project plan (QAPP) of this project[5] (Task 1). We verified that:

- The deliverable meets the purpose of the activity development (i.e., needed for emissions analysis to support the state implementation plan (SIP) development and to meet federal EI reporting requirements).
- The full extent of the modeling domain was included (i.e., analysis year, geographic coverage, seasonal periods, days, sources, etc.).
- Agreed-upon methods, models, tools, and data were used, as specified in Section 3 of the QAPP document, and any change from this plan were made in consultation with and approval by the TCEQ project managers (PM).
- The required output data sets were produced in the appropriate formats in accordance with the GAD requirements.
- Any deficiencies found during development and end-product quality checks were corrected.
- Aggregate activity estimate results were comparable with available, similarly produced activity estimates.

The TTI study team quality assured (QA) the data and activity input developed using EPA's recommended systematic planning process to ascertain reasonableness and to identify potential outliers that could affect the accuracy of future EI development. We notified the TCEQ PMs and provided potential options to address the issues when any QA issues were identified (for example, we determined that the original methodology developed to conflate the ERTAC, ERG, and NARL yards was not producing satisfactory results compared to previous estimates; thus, we consulted with TCEQ PMs and provided an alternative method to conflate these years, which were discussed in Chapter 4.2 of this report).

The TTI study team ensured that data quality fulfilled the criteria of completeness, representativeness, and comparability (see table below). For each of these criteria, the study team spot-checked and QA'd a minimum of 10% of the dataset.

[5] Proposal for Grant Activities/PCR No. 582-22-32564-007. Improvement of Locomotive and Rail Yard Activity Data Sourcing and Accuracy Project. Tracking No. 2022-37. Grant Number: 582-21-10369.

Description of each Data Quality Criteria

Criteria	Description
Completeness	• The study team ensured that the data gathered and processed were checked to address completeness. • We verified that the data and activity inputs developed were within the required dimensions, all required activity inputs were produced, and all required fields were populated and properly coded or labeled. • For cases where necessary data was unavailable, we made reasonable efforts to find alternative ways to fill the gap. ○ For example, we indicated which counties and rail equipment categories, if any, may be missing activity data, and the necessary steps to take to estimate activity data using statistical methods. • The TTI project manager also spot-checked a sample of datasets.
Representativeness	• The study team ensured that the data gathered was checked to address representativeness. • We worked with the locomotive industry to ensure that rail-specific parameters were employed to represent local activity and conditions. • Where data was unavailable, we took steps to estimate representative railroad activity data. • The TTI project manager also spot-checked a sample of datasets.
Comparability	• The study team compared the activity data to the most recent work of prior studies and where applicable, to railroad-specific web-published data. • We analyzed any significant differences when the reason for the difference was not obvious. • The TTI project manager also spot-checked a sample of datasets.

Data Processing Requirements

The data sources for the project were provided by local railroad companies, and/or national or local agencies (accessed on their web resources), and in most cases had been QA'd by the providing agency. All data we acquired were used either as direct input or to produce inputs that were reviewed for suitability before use.

Data Validation

The quality of the data sources and the inputs developed from the data sources have a significant impact on the EIs. The study team performed checks on collected and processed activity data sets, as appropriate to the component, including:

- Input data checks:
  - Verified the basis of input data: Actual historical or latest available data, expected values versus reported, regulatory programs, surrogates, and professional judgment; checked aggregation levels.
  - Completeness: (discussed earlier).
  - Format: Verified that extracted and formatted data are within required specifications if any (e.g., field positions, data types and formats, and file formats).
  - Reasonability checks: (discussed earlier).
  - Ensured that any inputs provided from external sources were quality assured, as listed previously.
- Perform further checks for consistency, completeness, and reasonability of data collected and processed:
  - Verified that any distribution factors produced or used sum to 1.0, as appropriate.
  - Verified that the required data fields were present, populated, and properly coded or labeled; verified that data and file formats were within specifications.
  - Verified if the hierarchy is applied appropriately (i.e., local data provided by railroad companies were preferred and used versus other data sets).
  - Checked for consistency between data sets (e.g., compare detailed disaggregated activity estimates provided by railroad companies versus aggregate totals available from other sources).
  - Checked the final activity data for the outliers while assessing the reasonability of any relative and directional differences (e.g., qualify based on activity distributions by railroad class and fleet mix and control program coverage).
  - Checked for inconsistency between the newly developed inputs with those used in the previous locomotive and rail yard EIs. The checks focused on the fuel usage considered, fleet mix, number of yards, activity estimate and models used at rail yards, and emission reduction programs applied. Significant inconsistencies were investigated to identify potential causes.
  - Checked for inconsistency between the newly developed inputs with those used in the previous locomotive and rail yard EIs. The checks focused on the emission estimates. Significant inconsistencies were investigated to identify potential causes.

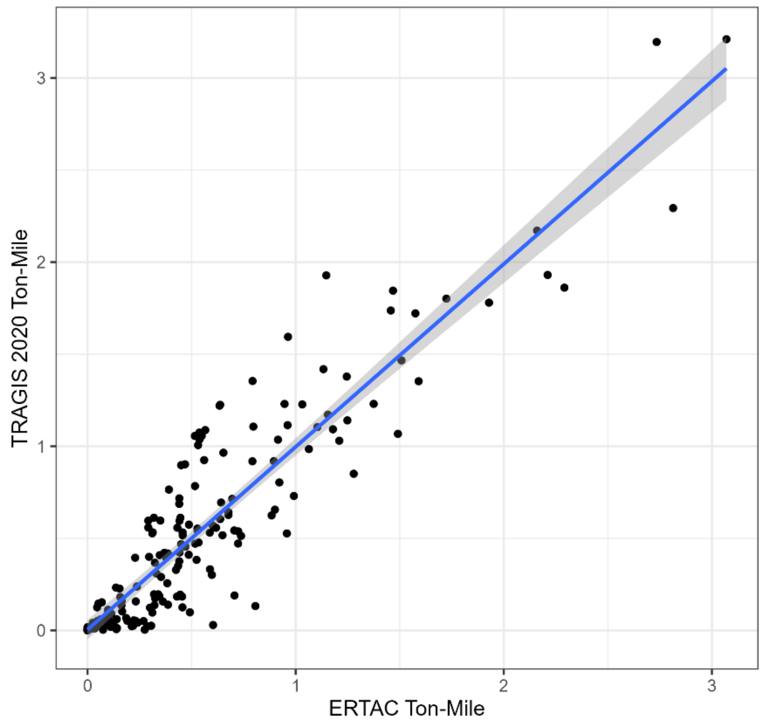
The study team ensured that any additional data products required were subjected to the appropriate QA checks previously listed. The study team reported any major problem to the TTI PI and communicated them to the TCEQ PMs as needed. We also communicated to the TTI PI and TCEQ PMs when the data elements in the process passed QA checks and were ready for further processing. Lastly, the TTI PI ensured that all QA checks performed were compiled and maintained in the project archives.

Data Summary and Analysis

The study team used basic descriptive statistics for the result summary and analysis. We developed tables and plots to display trends, summary statistics (e.g., minimum and maximum values), comparisons, and aggregated results (e.g., county-level emissions).

We used preliminary statistical methods/models (e.g., descriptive statistics and correlation test) to (i) develop surrogate or default values if data was not available at the required level, (ii) develop a unified rail yard inventory dataset, and (iii) evaluate and compare data sets and emission outputs. These were mainly used in Chapters 4 and 5 of this study, corresponding to Task 4 - Data Processing, Analysis, and Development of Pre-processing Procedures. An example of how the study team applied statistical methods to evaluate and compare data sets is shown in the figure below (previously shown in the report as Figure 15).

Lastly, the study team used well-established and commonly accepted statistical methods/models to check for reasonableness. We corrected any significant problems found during the checks and repeated the QA procedure until we were satisfied.



TRAGIS vs. ERTAC Ton-Mile Distribution by Texas Counties.