

CHAPTER 5: ESTIMATION OF VEHICLE ACTIVITY

5.1 Dallas-Fort Worth Travel Model for the Expanded Area Overview

The Dallas-Fort Worth Travel Model for the Expanded Area (DFX), validated in 2010, serves as the source for forecasting vehicle miles of travel (VMT) and other travel characteristics for the North Central Texas nonattainment area. The network-based DFX is executed in the TransCAD environment, which is a Geographic Information System-based commercial travel demand software package for transportation planning. The North Central Texas Council of Governments (NCTCOG) Transportation Department is responsible for executing the DFX and conducting various planning studies for the region. The department provides technical support and staff assistance to the Regional Transportation Council and its technical committees, which compose the Metropolitan Planning Organization policy-making body.

5.2 Multimodal Transportation Analysis Process

The forecasting technique of the DFX is based on a four-step sequential process designed to model travel behavior and predict the level of travel demand at regional, sub-area, or small area levels. These four steps are: Trip Generation, Trip Distribution, Mode Choice, and Roadway Assignment. A detailed explanation of DFX is included in Appendix 12.7.

The roadway networks developed for the analysis years contain over 30,000 unique segments constructed to replicate the transportation system of the coverage area. The transportation networks for this inventory were developed specifically for the years 2018, 2020, 2028, 2037 and 2045, as shown in Exhibit 5.2-1.

Exhibit 5.2-1: Transportation Network Development Methodology Summary

Network	Contents
2018	2010 roadway / 2011 transit DFX model validation year network
	All in-place regionally significant facilities, services, and activities operational in the 2018 ozone season
2020	2020 analysis year network
	Transportation system improvements from staging of the MTP operational in the 2020 ozone season
2028	2028 analysis year network
	Transportation system improvements from staging of the MTP operational in the 2028 ozone season
2037	2037 analysis year network
	Transportation system improvements from staging of the MTP operational in the 2037 ozone season
2045	2045 analysis year network
	Transportation system improvements from staging of the MTP operational in the 2045 ozone season

5.3 Model Adjustments

Several adjustment factors were applied to this conformity determination. A Highway Performance Monitoring System (HPMS) factor and a nonrecurring congestion factor were applied to the network-based travel model; and several time-of-day factors were developed to convert the network to August weekday. The HPMS and nonrecurring congestion factors are consistent with model adjustments applied to the 8-hour Attainment Demonstration State Implementation Plan (AD SIP) used to develop the motor vehicle emission budgets applicable to this transportation conformity analysis. The seasonal, daily, and hourly distribution factors used in the AD SIP are based on the Texas Department of Transportation's (TxDOT) Automatic Traffic Recorder (ATR) data averaged over a five-year period, 2012-2016. A detailed explanation of these adjustment factors is provided in Appendix 12.8.

5.3.1 Model VMT Adjustments (HPMS VS DFX)

Consistent with previous emission inventory practices, the DFW MPO used TxDOT's HPMS data to adjust modeled VMT to ensure consistent reporting across the state. This adjustment is based on the Environmental Protection Agency's guidance for emission inventory development. Exhibit 5.3.1-1 shows the calculation performed to develop the new HPMS adjustment factor, 0.9703, based on a comparison of 2010 VMT for HPMS and DFX.

Exhibit 5.3.1-1: 2010 DFW and HPMS VMT Analysis

Model VMT Adjustment Factor	
	2010 VMT
HPMS (ASWT ²¹)	165,292,084 ²²
DFX (ASWT)	170,346,118
HPMS/DFX Ratio	0.9703

Source: NCTCOG

The ATR data collected by TxDOT is used to calculate the necessary conversions for seasonal and daily adjustment factors and hourly distribution factors.

5.3.2 Seasonal and Daily Adjustments

ATR data averaged over five years (2012-2016) is organized into five day types: Sunday, Monday, Midweek (Tuesday, Wednesday, and Thursday), Friday, and Saturday. To adjust the representative average school season weekday traffic (ASWT) VMT from the DFX to the specified day types in the summer season, ratios are calculated. The summer portion of the ratio uses traffic volumes recorded for June, July, and August months. Seasonal and daily adjustments for DFX counties are listed in Exhibit 5.3.2-1.

²¹ Average School Season Weekday Traffic

²² Annual Average Daily Traffic to ASWT conversion factor applied.

Exhibit 5.3.2-1: Average 2012-2016 Seasonal Correction Factors

	County Type	Midweek
Midweek School to August	Core (Dallas/Tarrant)	1.014
	Rural (Collin/Denton)	1.009
	Perimeter (Ellis, Johnson, Kaufman, Rockwall, Parker, and Wise)	1.042

Source: TxDOT

5.3.3 Hourly Adjustments

Daily volumes recorded for midweek, described above, are aggregated by hour to determine the percent of daily traffic occurring during each hour, representing hourly vehicle activity estimates. The DFX county midweek is further detailed by utilizing a time period volume for aggregation. These time periods correspond to the time periods used in the DFX, where, AM Peak is 6:30 a.m. to 8:59 a.m., PM Peak is 3:00 p.m. to 6:29 p.m., and Off-Peak represents all other hours of the day (12:00 a.m. to 6:29 a.m., 9:00 a.m. to 2:59 p.m., and 6:30 p.m. to 11:59 p.m.) Periods split by mid-hour times use an equal division of traffic recorded during the hour. The hourly adjustments for DFX counties are shown in Exhibit 5.3.3-1.

Exhibit: 5.3.3-1 Average 2012-2016 Hourly Distribution Factors

Hours	County Groups		
	Core/Urban	Rural	Perimeter
12:00 a.m. – 12:59 a.m.	0.94%	0.68%	1.08%
1:00 a.m. – 1:59 a.m.	0.61%	0.44%	0.83%
2:00 a.m. – 2:59 a.m.	0.56%	0.36%	0.76%
3:00 a.m. – 3:59 a.m.	0.62%	0.35%	0.90%
4:00 a.m. – 4:59 a.m.	1.11%	0.61%	1.40%
5:00 a.m. – 5:59 a.m.	2.96%	1.73%	2.81%
6:00 a.m. – 6:29 a.m.	2.90%	2.21%	2.32%
6:30 a.m. – 6:59 a.m.	2.90%	2.21%	2.32%
7:00 a.m. – 7:59 a.m.	7.14%	6.38%	6.08%
8:00 a.m. – 8:59 a.m.	6.31%	6.42%	5.49%
9:00 a.m. – 9:59 a.m.	5.16%	5.32%	5.30%
10:00 a.m. – 10:59 a.m.	4.77%	4.89%	5.47%
11:00 a.m. – 11:59 a.m.	4.95%	5.24%	5.61%
12:00 p.m. – 12:59 p.m.	5.20%	5.65%	5.74%
1:00 p.m. – 1:59 p.m.	5.36%	5.76%	5.94%
2:00 p.m. – 2:59 p.m.	5.79%	5.91%	6.27%
3:00 p.m. – 3:59 p.m.	6.55%	6.45%	6.74%
4:00 p.m. – 4:59 p.m.	7.33%	7.38%	7.33%
5:00 p.m. – 5:59 p.m.	7.52%	8.34%	7.53%
6:00 p.m. – 6:29 p.m.	3.15%	3.80%	2.92%
6:30 p.m. – 6:59 p.m.	3.15%	3.80%	2.92%
7:00 p.m. – 7:59 p.m.	4.60%	5.52%	4.35%
8:00 p.m. – 8:59 p.m.	3.55%	4.08%	3.46%
9:00 p.m. – 9:59 p.m.	3.02%	3.16%	2.78%
10:00 p.m. – 10:59 p.m.	2.31%	2.08%	2.10%
11:00 p.m. – 11:59 p.m.	1.55%	1.21%	1.55%

Source: TxDOT

5.3.4 Non-Recurring Congestion

According to a paper published in the January 1987 Institute of Transportation Engineers’ journal by Jeffrey A. Lindley titled “Urban Freeway Congestion: Quantification of the Problem and Effectiveness of Potential Solutions”, congestion due to traffic incidents, or nonrecurring congestion, accounts for twice the amount of congestion when compared to bottleneck situations. Since nonrecurring congestion is not

accounted for in the DFX, a nonrecurring congestion factor (1.049) was developed to be applied to the freeway link-based travel times modeled by DFX. Applying this factor reduces speeds on freeway facilities, which translates into an increase in volatile organic compounds (VOC) and nitrogen oxides (NO_x). This is thought to be a conservative estimate of increased emissions due to nonrecurring congestion. Arterial street emissions are not significantly affected by incidents because alternate routes on the arterial system are generally available; therefore, this factor is not applied to non-freeway type facilities.

5.4 Transit Systems

The DFW region has three transportation authorities: Dallas Area Rapid Transit (DART) serving the eastern portion of the region, the Denton County Transit Authority (DCTA) serving Denton County, and the Fort Worth Transportation Authority (Trinity Metro) serving the western portion of the region.

Within DART's 700-square-mile service area are a broad range of transportation services, from modern bus and rail services to ridesharing programs, and corporate transportation demand management programs. DART constantly adds and upgrades transit facilities throughout the region by reviewing bus routes to maximize efficiency, especially with regard to the orientation of feeder bus routes to rail station destinations. Local feeder routes improve the potential for increased rail ridership by providing reliable connections from residential areas to rail stations. DART system planners evaluate current routes and design improved cross-town and radial routes to serve current and future rail stations and major destinations. Express routes improve commute time to major destinations by utilizing HOV lanes and major highways with limited stop time. Express routes serve both transit centers and park-and-ride lots. Improved rail service and ridership are high priorities in DART's attempt to serve the region.

The DCTA is a coordinated county transportation authority currently providing express bus service between the cities of Denton, Highland Village, and Lewisville. The service plan includes the A-train, connecting Denton County residents to DART, local fixed-route bus services serving the densest portions of the county, shuttle service for local colleges and universities, a demand response service to member cities for the elderly and disabled, and a commuter vanpool program.

Trinity Metro provides fixed-route bus service, express bus service, and Rider Request services throughout various cities in the western region. The state-of-the-art Intermodal Transportation Center provides easy access to the Trinity Railway Express (TRE) and Trinity Metro's fixed-route bus service. Trinity Metro operates the TRE jointly with DART to provide regional rail service between Fort Worth and Dallas.

The Rider Request routes offer the choice of having a bus arrive where requested, so long as travel is within the route's designated service area. Trinity Metro's Mobility Impaired Transportation Service (MITS) offers door-to-door transportation anywhere within the cities of Fort Worth, Richland Hills, and Blue Mound. MITS is a transportation service for persons with a verified disability preventing them from riding a fixed route bus service.

The transit agencies coordinate fare structures to provide riders seamless transfers between service providers and modes.

5.4.1 Transit VMT

Exhibit 5.4.1-1 lists the daily regional transit VMT used in DFX for the identified transit modes for analysis years 2018, 2020, 2028, 2037, and 2045. The slight fluctuation of transit service from year to year is a result of roadway project modifications, implementation of future rail lines and additional bus services identified to support the rail lines.

Exhibit 5.4.1-1: Transit Vehicle Miles of Travel

Transit Name	2018	2020	2028	2037	2045
DART Bus	72,834	77,289	87,556	87,578	98,935
Trinity Metro Bus	18,157	25,224	29,631	29,641	35,169
DCTA Bus	3,408	3,408	3,421	3,421	3,413
Rail	17,562	19,271	21,136	22,806	32,807
Total Daily VMT	111,961	125,192	141,744	143,446	170,324

5.5 Roadway VMT

Roadway VMT totals by county and analysis year are in Exhibit 5.5-1. Final VMT estimates are listed in Appendix 12.9.

Exhibit 5.5-1: Roadway Vehicle Miles of Travel

County	2018	2020	2028	2037	2045
Collin	27,048,364	28,612,040	35,065,013	42,085,656	47,415,485
Dallas	84,707,260	86,937,220	98,104,953	109,111,204	117,529,912
Denton	21,680,082	22,563,719	27,311,274	30,241,449	35,650,799
Ellis	8,177,337	8,675,032	10,987,196	13,716,405	15,743,483
Johnson	5,969,626	6,299,492	7,922,597	9,861,668	11,472,048
Kaufman	7,162,122	7,606,726	9,641,849	12,149,664	14,198,875
Parker	6,253,535	6,560,929	7,908,335	9,501,517	10,789,893
Rockwall	2,877,465	3,020,656	3,839,502	4,857,075	5,714,055
Tarrant	55,781,234	58,007,215	68,385,156	80,089,156	86,244,484
Wise	4,107,462	4,266,875	4,957,739	5,901,192	6,795,414
10-County Total Daily VMT	223,764,487	232,549,903	274,123,613	317,514,987	351,554,448

5.5.1 Average Loaded Speeds

Average Loaded Speeds are provided by county by functional class. Final average loaded speeds are listed in Appendix 12.10.

5.5.2 Centerline and Lane Miles

Centerline and Lane Miles are provided by county by functional class. Final mileage estimates are listed in Appendix 12.11.