CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

July 24, 2019
AGENDA ITEM #13

Approve new maximum and minimum speed limits for the MoPac Express Lanes and related amendments to Mobility Authority Policy Code Section 301.015

Strategic Plan Relevance:	Regional Mobility
Department:	Engineering
Contact:	Justin Word, P.E., Director of Engineering
Associated Costs:	Estimated at $80,000
Funding Source:	MoPac General Funds
Action Requested:	Consider and act on draft resolution

Project Description - The MoPac Express Lanes give drivers the option to bypass congestion on the 11-mile stretch of MoPac between Parmer Lane and Cesar Chavez Street. Express lanes are special buffer-separated lanes that use variable tolls to keep traffic moving even when the adjacent lanes are congested. The express lanes are located in the middle of the MoPac corridor, separated from the general purpose lanes by flexible plastic, vertical delineators. Drivers are able to access the MoPac Express Lanes northbound in the vicinity of Cesar Chavez Street and RM 2222 (Northland Drive); and southbound in the vicinity of Parmer Lane and RM 2222 (Northland Drive).

This resolution approves new maximum and minimum speed limits for the MoPac Express Lanes. The Texas Administrative Code (TAC) sets forth a procedure for establishing the maximum and minimum speed limits, which requires an engineering and traffic investigation (a "speed zone study") by a licensed transportation engineer that meets Texas Department of Transportation criteria, in Subchapter B (Procedures for Establishing Speed Zones), 43 TAC § 25.21 et seq.

Some of the potential benefits anticipated from establishing new maximum and minimum speed limits within the express lanes are to:

- encourage uniformity by discouraging wide variations in express lane travel speeds, which could also reduce the risk of crashes;
- potentially increase peak period throughput by discouraging slow speeds that can meter the number of vehicles that can traverse express lane segments; and

- more consistently meet driver expectations of experiencing a fast, reliable rate of travel.

Previous Actions/Brief History of the Project/Program – In November of 2017 the express lanes fully opened to traffic. Since that time, the express lanes have operated using the existing speed limit on the facility's general purpose lanes of 65 miles per hour. In December 2018, a speed study was conducted to review speed in the express lanes and consider if different speed requirements would benefit the system.

The results of the study support a minimum speed of 55 miles per hour and an increase in the maximum speed limit from 65 to 70 miles per hour for the entirety of the MoPac Express Lanes. Minimum speeds are justified when a study shows that slow moving vehicles impede the normal and reasonable flow of traffic, and they are regulated in the same manner as maximum speeds. The minimum speed will help ensure the Express Lanes operate as they are intended by prohibiting cars from driving exceedingly slow and impeding free flowing traffic. In the case of congested conditions, drivers will not be in violation of the minimum if traffic does not reasonably allow for a speed of 55 miles per hour. The required speed zone study for the MoPac Express Lanes is attached.

The requested funds will cover the purchase and the installation of the new speed signs along the corridor, including any necessary traffic control and construction oversight and inspection.

Financing – Transportation Code enables CTRMA to operate two or more transportation projects as one operational and financial enterprise, by creating a "system" made up of those transportation projects. CTRMA's system includes 183A, 290 East, 71 East, and 183 South. The MoPac Express Lanes are not currently part of our system, and thus functions as a standalone project with its own operating funds. Funding to be provided through those MoPac General Funds.

Action Requested – Staff recommends approval of this item to adopt the 70 mile per hour maximum speed limit and 55 mile per hour minimum speed limit for the MoPac express lanes. The new maximum and minimum speed limits will become effective upon installation of new maximum "70 MPH" speed limit and "55 MPH" minimum speed signs along MoPac/Loop 1.

Backup Provided: Draft Resolution
Draft Mobility Authority Policy Code revisions section § 301.015
MoPac Express Lane 2018 Speed Study

GENERAL MEETING OF THE BOARD OF DIRECTORS
OF THE
CENTRAL TEXAS REGIONAL MOBILITY AUTHORITY

RESOLUTION NO. 19-0XX

APPROVING MAXIMUM AND MINIMUM SPEED LIMITS FOR THE MOPAC EXPRESS LANES AND RELATED AMENDMENTS TO MOBILITY AUTHORITY POLICY CODE SECTION 301.015

WHEREAS, Chapter 370 of the Transportation Code and other applicable law authorizes the Board to establish speed limits on Mobility Authority roadways; and

WHEREAS, Section 301.014 of the Policy Code provides guidelines for establishing speed limits on Mobility Authority roadways; and

WHEREAS, Section 301.015 of the Mobility Authority Policy Code publishes the speed limits for certain Mobility Authority toll facilities; and

WHEREAS, the Board has reviewed and considered the "MoPac Express Lanes Speed Limit Study" dated December 26, 2018, prepared by WSP USA Inc. and on file in the Mobility Authority office (the "Speed Limit Study"); and

WHEREAS, based on the Speed Limit Study, the Board finds that a maximum speed limit of 70 miles per hour and a minimum speed of 55 miles per hour are safe and reasonable speeds for those who travel on the MoPac Express Lanes, and that it is in the best interest of the Mobility Authority and those who travel on the MoPac Express Lanes to establish a maximum speed limit of 70 miles per hour and a minimum speed of 55 miles per hour.

NOW THEREFORE, BE IT RESOLVED, that the Board accepts the Speed Limit Study and hereby approves the recommended maximum speed limit of 70 miles per hour and minimum speed of 55 miles per hour on the MoPac Express Lanes, as set forth in the Speed Limit Study; and

BE IT FURTHER RESOLVED, that the Board hereby amends Section 301.015 of the Mobility Authority Policy Code to promulgate maximum and minimum speed limits for the MoPac Express Lanes by adding a new Subsection 301.015(c) as set forth in Exhibit A hereto.

Adopted by the Board of Directors of the Central Texas Regional Mobility Authority on the 24th day of July 2019.

Submitted and reviewed by:

_____
Geoffrey Petrov, General Counsel

Approved:

_____
Nikelle Meade
Vice Chair, Board of Directors

Exhibit A

301.015 Speed Limits for Specific Roadways

(a) The maximum speed of a motor vehicle on the main tolled lanes of the 183A Turnpike is limited to 75 miles per hour except within construction, transitional, or reduced speed zones, or during any period of adverse atmospheric or weather conditions. Notwithstanding the foregoing, the maximum speed of a motor vehicle on a non-tolled frontage road of the 183A Turnpike is limited to 60 miles per hour.

(b) The maximum speed of a motor vehicle on the main toll lanes of the 290 Toll is limited to 75 miles per hour except within construction, transitional, or reduced speed zones, or during any period of adverse atmospheric or weather conditions. Notwithstanding the foregoing, a lesser transition maximum speed limit for a motor vehicle that is entering or exiting a main toll lane of the 290 Toll is established as identified on the strip map attached as Appendix C to the September 8, 2014, Speed Zone Study, on file in the Mobility Authority offices.

(c) The maximum speed of a motor vehicle on the MoPac Express Lanes is limited to 70 miles per hour except within construction, transitional, or reduced speed zones, or during any period of adverse atmospheric or weather conditions. The minimum speed of a motor vehicle on the MoPac Express Lanes is limited to 55 miles per hour except within construction, transitional, or reduced speed zones, or during any period of congested conditions or adverse atmospheric or weather conditions.

MOPAC EXPRESS LANES

SPEED LIMIT STUDY

CENTRAL TEXAS REGIONAL
MOBILITY AUTHORITY

December 26, 2018

STATE OF TEXAS
JESSICA KESSINGER
118217
LICENSED PROFESSIONAL ENGINEER

Jessica Kessinger 12/26/18

MoPac Express Lane Speed Study
Central Texas Regional Mobility Authority

December 26, 2018
Prepared by:
Jessica Kessinger PE, Michael Penic

EXECUTIVE SUMMARY

This memorandum describes results of speed limit study conducted along the express lanes of the MoPac Expressway. The study limits extended from Wells Branch Parkway to Barton Springs Road.

Key findings

- Radar speed data collected for this study justifies express lane speed limits of 65 or 70 mph.
- Though there are no guidelines for selection of a minimum speed limit, the 15th percentile speeds suggest a 50-mph minimum speed on the express lane, while the lower limit of the 10 mph pace[1] statistic suggests a 55-mph minimum speed on the express lane.
- Though crash history information is presented for the MoPac Expressway, the lack of history after express lane opening and the lack of data specificity regarding the location of the crashes (general purpose lanes versus express lanes) make it difficult to draw conclusions regarding crash effects. Overall, crash rates simply indicate that crashes are more prevalent near ramp junctions and within freeway weaving areas.

Recommended next step

- Express lane incident data collected by the RMA should be used for future evaluation of speed management issues in the corridor. This data is collected by the RMA's incident management team, and includes crash attributes that are more detailed than that of TxDOT's CRIS (Crash Record Information System) data.

[1] The "10 mile per hour pace" is the 10 mile per hour range of speeds in which the largest portion of vehicles were observed to travel. It is thus a measure of the most common range of speeds observed.

1. EXPRESS LANE SPEED MANAGEMENT CONCERNS

The MoPac Express Lanes between Parmer Lane and the Colorado River in Austin, Texas have generated several concerns regarding the management of operating speeds. The current speed limit governing the express lanes is the same as that of the general-purpose lanes; 65 miles per hour. Noted concerns include:

- Vehicles that travel well below the speed limit. This is a frustration to other drivers due to the lack of passing lanes on the single lane express toll facility.
- Inability to consistently meet driver expectation of experiencing a fast, reliable rate of travel that is faster than that of the adjacent general-purpose lanes in exchange for paying a toll.
- Complaints from drivers that would like to travel the express lanes at speeds higher than the general-purpose lanes during off peak periods, but are held back by those that choose to travel at a slower speed.

Issues regarding the reliability of travel times arise due to the extreme popularity of the express lanes. Thus far, the variable toll rate algorithms that attempt to maintain acceptable operations in the lanes have not always been able to prevent both travel speed fluctuations and – at some times of the day – congestion inside the express lanes, at end points and at ingress/egress areas. Even if these issues were addressed, the result might be extremely high toll rates that may generate public outcry. However, opportunities to change the maximum speed limit and to designate a minimum speed limit can be evaluated through a formal traffic analysis process called a speed study. These actions could produce meaningful benefits to concerned users when congestion is not present.

The purpose of this memorandum is to describe the speed study conducted for the MoPac Expressway corridor over the limits of the new express lanes, and present findings and recommendations regarding speed limit management practices for the express lane.

2. SPEED STUDY PROCESS

This section outlines data collection, analysis and documentation tasks required to solicit a request to modify the maximum speed limit and potentially establish a minimum speed limit on the MoPac North Express Lanes (SL 1) between FM 734 (Parmer Lane) on the north and Lady Bird Lake (south of Lake Austin Boulevard) on the south. The requirements generally follow the recommended practice from the TxDOT guideline document "Procedure for Establishing Speed Zones"[2], last revised in August 2015. This study process seeks to provide the same level of traffic data, analysis and documentation as a speed study conducted on any other state highway.

[2]"Procedure for Establishing Speed Zones", Texas Department of Transportation, Traffic Operations Division, August 2015.

On most state highways, speed limit determinations involve a collaborative effort between the TxDOT district, TxDOT Traffic Operations Division, and local jurisdictions that could include city or county agencies. Section 545.354 of the Texas Transportation states that Regional Mobility Authorities have independent authority to set speed limits on toll facilities under their jurisdiction: *The authority's power to alter prima facie speed limits is effective and exclusive on any part of a turnpike project constructed and maintained by the authority inside and outside the limits of a municipality, including a home-rule municipality.*[3].

Additionally, Section 545.363 of the Texas Transportation Code extends this authority to include posting minimum speeds: *When the Texas Transportation Commission, the Texas Turnpike Authority, the commissioners court of a county, or the governing body of a municipality, within the jurisdiction of each, as applicable, as specified in Sections 545.353 to 545.357, determines from the results of an engineering and traffic investigation that slow speeds on a part of a highway consistently impede the normal and reasonable movement of traffic, the commission, authority, county commissioners court, or governing body may determine and declare a minimum speed limit on the highway.*[4]

In addition to the Texas Transportation Code, the Project Development Agreement (PDA) for the MoPac Improvement Project grants authority to the Mobility Authority to operate, maintain, police, and regulate the MoPac express lane: *TxDOT grants to the Authority a license and right of entry on, over, and under such area and right-of-way owned by, subsequently acquired, and otherwise under TxDOT's control and as necessary to enable the authority to cause the express lanes to be operated, maintained, policed, and regulated*[5].

2.1 Traffic Data Collection

Generally, the recommended practice for conducting a spot speed study involves collection of at least 125 free flow speed observations during off peak periods on a typical weekday. Radar technology was used to collect the speed and passage time of each vehicle. The TxDOT guidelines note that the accuracy of radar speed measurements tends to be within 2 miles per hour of actual. The term "free flow speed" means that each of these observations must be made on vehicles whose speed is not obstructed by a leading vehicle. Thus, the measured speeds do not include data from vehicles whose speeds are constrained because they are closely following another vehicle. This is achieved by measuring the speed of a vehicle only if the lead gap to the previous vehicle is at least 15 seconds. Though not relevant to the express lanes, speed data can also be classified by vehicle type to investigate speed differentials of different vehicle classes such as trucks.

For freeway class facilities in an urban area, at least one speed study location between each interchange is recommended. For the MoPac express lane facility, there are 14 segments between interchanges, and one on each end of the corridor that could be considered, resulting

[3] Texas Transportation Code, Section 545.354
[4] Texas Transportation Code, Section 545.363
[5] Section 2. Use of Right-of-Way of the MoPac North Project Development Agreement

in 16 segments per direction. Seven additional general-purpose lane locations were included at express lane ingress and/or egress areas, thus resulting in a total of 39 locations.

2.2 Statistical Analysis

Traffic analysis normally includes development of a speed frequency distribution and computation of the 85th percentile speed for maximum speed limits, and 15th percentile speeds if minimum speed limits are being considered. The 85th percentile speed is the speed in which 15 percent of all vehicles surveyed travel faster. Similarly, the 15th percentile speed is the speed in which 15 percent of all vehicles surveyed travel slower. Other statistics include the "10 mile per hour pace"; which is defined as the 10 mile per hour range of speeds in which the largest portion of measured speeds occur. This measure includes the percentage of vehicles that fall within this 10-mile-per-hour range, which is a measure of the consistency of driver speed behavior.

2.3 CRASH Analysis

On existing roadways, an evaluation of crash experience is also required. However, the crash history of the MoPac Expressway was affected by construction activity and changes to the roadway cross section and ramp locations resulting from the construction of the express lanes. Thus, separate summaries of crash data have been developed for crashes that occurred before, during and after construction.

2.4 Development of a Speed Limit Evaluation Strip Map

A strip map is a combination of graphical and tabular depictions of key corridor features and data that affect speed limits. The map incorporates the historical patterns of crashes along the corridor to contribute to the evaluation process. Otherwise, the strip map summarizes all maximum and minimum speed threshold analysis results and speed frequency distributions, facilitates decisions regarding design consistency and continuity, establishes evidence for speed zone transitions where speed limits must change, and makes it easier to relate these to known geometric features along the corridor. For freeway facilities, relevant attributes include lane width, shoulder width, sight distance (horizontal and vertical curves), cross section transitions, ramps, weaving segments, and any local constraints such as narrow bridges, abrupt lateral lane shift transitions, or other areas with constrained cross sections, etc. Also, a summary of crash rates is summarized along the strip map to identify hot spots for potential further evaluation.

2.5 Speed Data Evaluation Process

The speed data evaluation process summarizes noted issues and considerations used to devise recommendations on posted speed limits and transition zones, including the governing reasons why the continuity of speed limits should be broken by establishing lower speed limit zones in specific areas, if applicable. Later sections of this memorandum present a summary of speed data analysis results, the strip map, and other supporting documentation to recommend a course of action.

2.6 Approval Process

The normal TxDOT process for evaluating the speed limit study includes an engineering review by TxDOT district traffic staff and the TxDOT Traffic Operations Division (TOD). However, for toll facilities operated entirely by and RMA, speed limits can be adopted by a minute order from either the RMA board or by similar actions by cities along the corridor.

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3. DATA COLLECTION FOR SPEED LIMIT STUDIES

Speed studies were conducted along MoPac Expressway from July 31 to August 7, 2018. The studies were conducted at 39 directional locations; which include 11 on the general-purpose lanes and 28 in the express lanes. There is generally one speed measurement location per direction between each major crossroad for the express lanes. General-purpose lane speed measurements were taken at the ends of the corridor and on segments where there are ingress and/or egress areas accessing the express lanes.

At each location, 125 speed measurements are taken during a weekday in the middle of the day to develop speed statistics. For this study, data was collected between 10:00 am and 11:00 am. Corridor traffic counts show that this is the time period in which MoPac Expressway traffic volumes tend to be the lowest of all mid-day hours between the peak periods. The speed measurements only represent vehicles that are not following another vehicle, thus the driver's choice of speed is not constrained by other vehicles. As previously noted, the passage of each valid vehicle for speed measurement must occur at least 15 seconds after the passage of the previous vehicle.

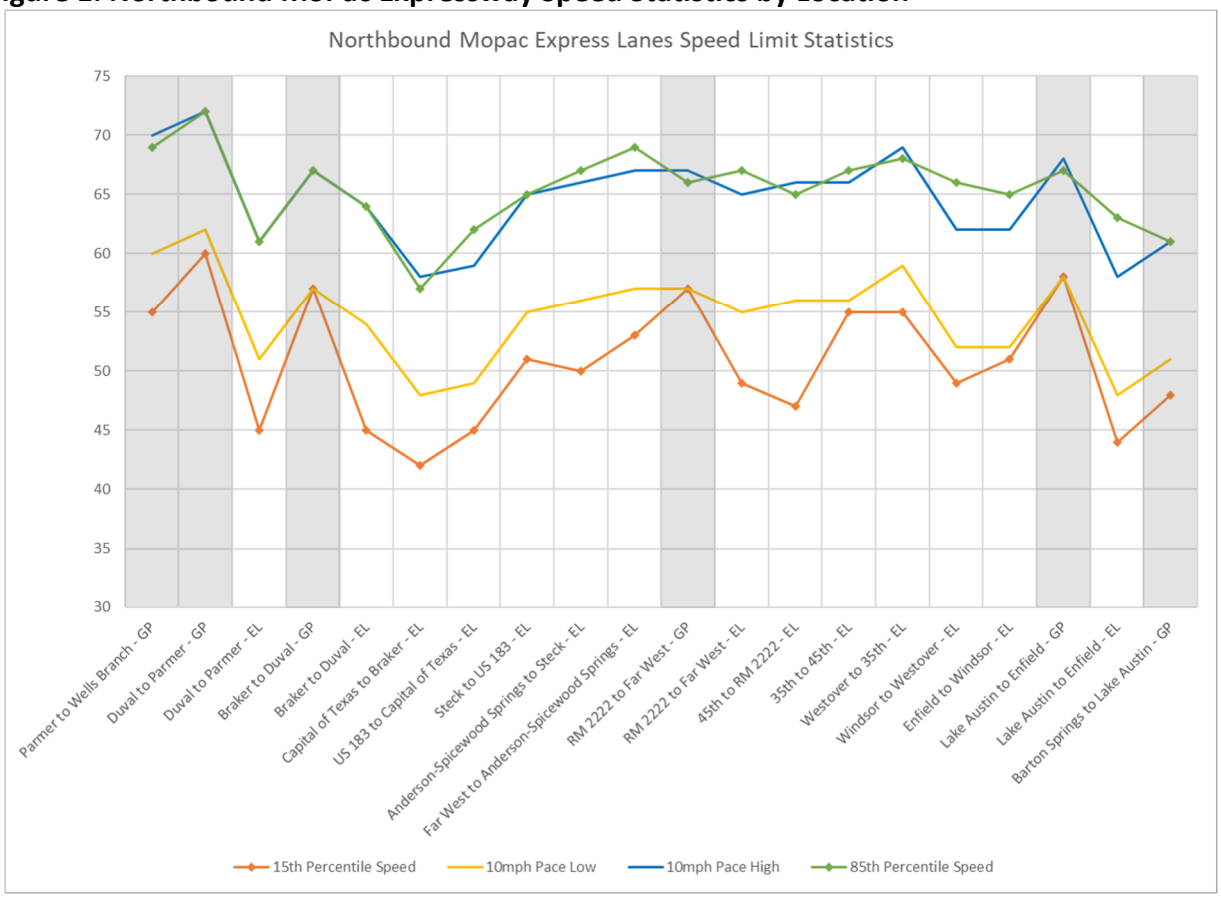
Figure 1 summarizes the 85th and 15th percentile speeds and the 10 mile per hour pace for the northbound general-purpose and express lane measurement segments. Figure 2 summarizes similar data for the southbound segments. Gray shading identifies segments representing general-purpose lane data (GP for "general-purpose" lanes) in each of these figures, while white background identifies express lane (EL) data.

A summary of speed violation rates was also conducted by segment. This consists of both the number and portion of speed measurements traveling faster than 60, 65, 70, 75 or 80 miles per hour. Table 1 summarizes the northbound data for express and general purpose lane segments. Table 2 summarizes similar information for the southbound lanes. Bar charts have been embedded in the data to help visualize the level of consistency among these measurements.

The following observations apply to northbound MoPac Expressway speed statistics shown in Figure 1:

- General-purpose lane 85th and 15th percentile speeds are higher from Wells Branch to Duval, most likely due to the posted speed limit of 75 mph on the Loop 1 toll road north of Parmer Lane. Speed statistics for the next three general-purpose lane sites are in the range of 66 to 67 mph for the 85th percentile speed, and 57 to 58 for the 15th percentile speed. The last measurement from Lake Austin Blvd to Barton Springs Road has an 85th percentile speed of 61 mph and a 15th percentile speed of 48 mph, most likely due to weaving turbulence from the large number of merging and diverging ramps in the area.
- Lower 85th and 15th percentile speeds occur on the express lane from Duval to US 183. The 85th percentile speed ranges from 57 to 64 mph, while the 15th percentile speed ranges from 42 to 45 mph.

Figure 1: Northbound MoPac Expressway Speed Statistics by Location

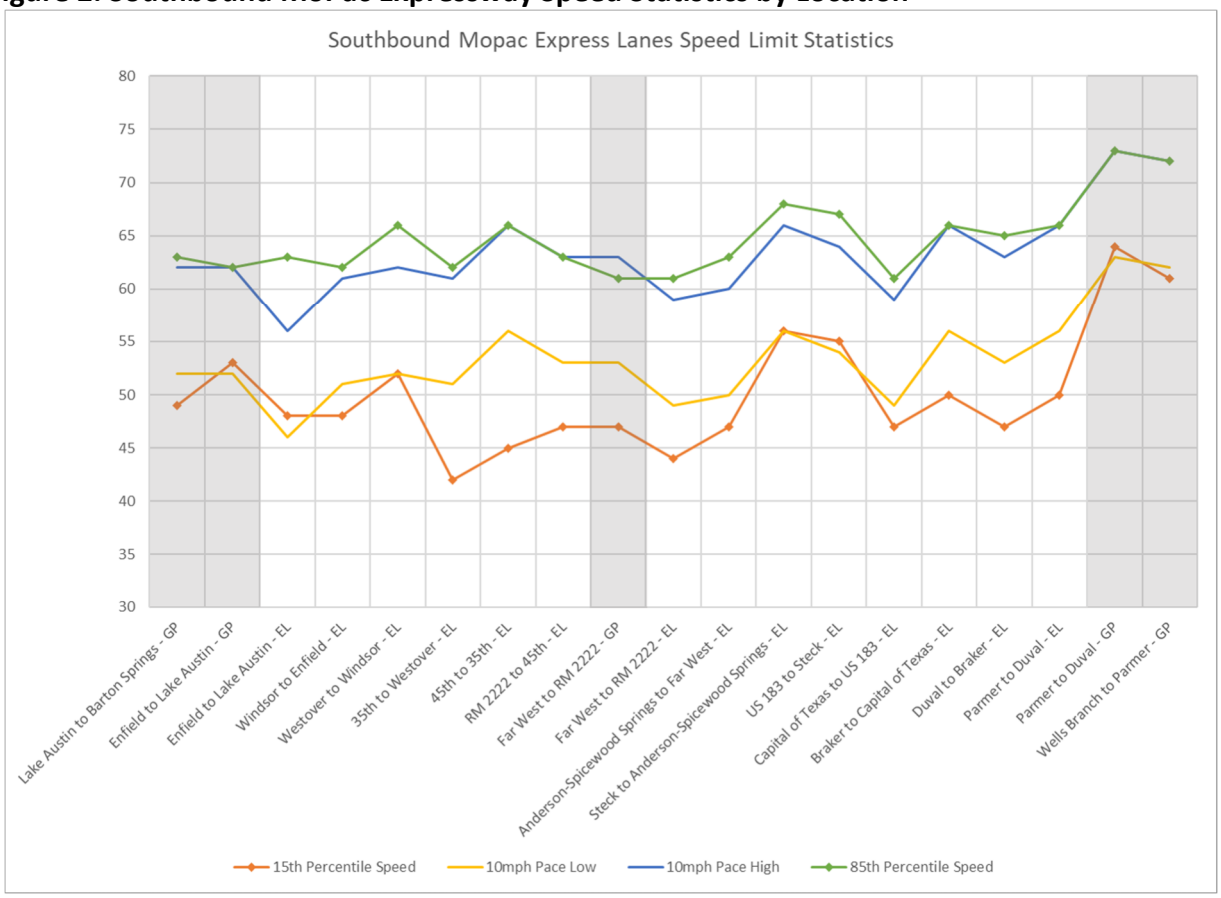


- Express lane speed statistics south of US 183 are generally higher. The 85th percentile speed ranges from 63 to 68 mph, while the 15th percentile speed ranges from 44 to 55 mph.
- It is interesting to note that the 10 mph pace upper limit tracks well with the 85th percentile speed, while the lower limit of the 10 mph pace is generally higher than the 15th percentile speed on the express lane segments. In other words, the largest portion of express lane drivers tend to travel at much higher speeds than those of the slowest 15 percent of drivers.

The following observations apply to southbound MoPac Expressway speed statistics shown in Figure 2:

- General-purpose lane 85th and 15th percentile speeds are higher from Duval to Wells Branch, most likely due to the posted speed limit of 75 mph on the Loop 1 toll road north of Parmer Lane. Speed statistics for the general-purpose lanes are in the range of 66 to 67 mph for the 85th percentile speed, and 57 to 58 for the 15th percentile speed.
- Express lane 85th percentile speeds range from 61 to 68 mph among all measured sites. The highest 85th percentile speeds occur from Anderson Lane/Spicewood Spring Road to US 183.

Figure 2: Southbound MoPac Expressway Speed Statistics by Location



- Express lane 15th percentiles speeds are around 50 mph south of Westover Road and north of US 183. The 15th percentile speeds are notably lower around 45 mph from Far West Blvd. to Westover Road, and higher around 55 mph from Capital of Texas Highway to Steck Avenue.
- Express lane speed statistics south of US 183 are generally higher. The 85th percentile speed ranges from 63 to 68 mph, while the 15th percentile speed ranges from 44 to 55 mph.
- Similar to the northbound data, the 10 mph pace upper limit tracks well with the 85th percentile speed, while the lower limit of the 10 mph pace is generally higher than the 15th percentile speed on the express lane segments. This may be additional evidence of the impact of slow drivers in the express lanes.

The following observations apply to northbound MoPac Expressway speed threshold statistics shown in Table 1:

- The portion of express lane traffic exceeding 70 mph ranges from 11 to 15 percent on only three of fourteen northbound segments. The portion of express lane traffic exceeding 75 mph reaches a maximum of four percent on two segments.

Table 1: Northbound MoPac Expressway – Number & Percent of Speeds Above 5 mph Thresholds

Northbound Express Lanes										
	Counts					% out of Total (total =125)				
Location	>=60	>=65	>=70	>=75	>=80	>=60	>=65	>=70	>=75	>=80
Duval to Parmer	32	8	1	0	0	25.6%	6.4%	0.8%	0.0%	0.0%
Braker to Duval	51	19	6	1	0	40.8%	15.2%	4.8%	0.8%	0.0%
Capital of Texas to Braker	12	5	1	0	0	9.6%	4.0%	0.8%	0.0%	0.0%
US 183 to Capital of Texas	33	8	3	0	0	26.4%	6.4%	2.4%	0.0%	0.0%
Steck to US 183	50	25	6	0	0	40.0%	20.0%	4.8%	0.0%	0.0%
Anderson-Spicewood Springs to Steck	68	34	14	2	0	54.4%	27.2%	11.2%	1.6%	0.0%
Far West to Anderson-Spicewood Springs	77	44	19	5	1	61.6%	35.2%	15.2%	4.0%	0.8%
RM 2222 to Far West	56	30	8	1	0	44.8%	24.0%	6.4%	0.8%	0.0%
45th to RM 2222	43	22	4	0	0	34.4%	17.6%	3.2%	0.0%	0.0%
35th to 45th	75	38	15	2	0	60.0%	30.4%	12.0%	1.6%	0.0%
Westover to 35th	80	41	9	5	0	64.0%	32.8%	7.2%	4.0%	0.0%
Windsor to Westover	48	21	7	2	0	38.4%	16.8%	5.6%	1.6%	0.0%
Enfield to Windsor	55	24	7	4	0	44.0%	19.2%	5.6%	3.2%	0.0%
Lake Austin to Enfield	31	16	7	2	0	24.8%	12.8%	5.6%	1.6%	0.0%

Northbound General Purpose Lanes										
Location	Counts					% out of Total (total =125)				
	>=60	>=65	>=70	>=75	>=80	>=60	>=65	>=70	>=75	>=80
Parmer to Wells Branch	90	55	18	0	0	72.0%	44.0%	14.4%	0.0%	0.0%
Duval to Parmer	107	75	32	5	0	85.6%	60.0%	25.6%	4.0%	0.0%
Braker to Duval	82	26	7	0	0	65.6%	20.8%	5.6%	0.0%	0.0%
RM 2222 to Far West	90	34	4	0	0	72.0%	27.2%	3.2%	0.0%	0.0%
Lake Austin to Enfield	95	33	4	0	0	76.0%	26.4%	3.2%	0.0%	0.0%
Barton Springs to Lake Austin	31	8	4	0	0	24.8%	6.4%	3.2%	0.0%	0.0%

- The portion of general-purpose lane traffic exceeding 70 mph is only large (approximately 14-26 percent) on the segment of northbound MoPac Expressway adjacent to the Loop 1 Toll Road where the posted speed limit transitions to 75 mph. Otherwise, three to six percent of general purpose lane traffic exceeds 70 mph on other segments.

The following observations apply to southbound MoPac Expressway speed threshold statistics shown in Table 2:

- The portion of express lane traffic exceeding 70 mph ranges from 10 to 11 percent on only two of fourteen southbound segments. The portion of express lane traffic exceeding 75 mph reaches a maximum of two percent on one segment.
- The portion of general-purpose lane traffic exceeding 70 mph is only large (approximately 38-48 percent) on the segment of southbound MoPac Expressway adjacent to the Loop 1 Toll Road where the posted speed limit transitions from 75 mph to 65 mph. Otherwise, up to two percent of general purpose lane traffic exceeds 70 mph on other segments.
- The portion of general-purpose lane traffic exceeding 70 mph is only large (approximately 14-26 percent) on the segment of northbound MoPac Expressway adjacent to the Loop 1 Toll Road where the posted speed limit transitions to 75 mph. Otherwise, three to six percent of general purpose lane traffic exceeds 70 mph on other segments.

Table 2: Southbound MoPac Expressway – Number & Percent of Speeds Above 5 mph Thresholds

Southbound Express Lanes										
Location	Counts					% out of Total (total =125)				
	>=60	>=65	>=70	>=75	>=80	>=60	>=65	>=70	>=75	>=80
Enfield to Lake Austin	30	16	10	1	1	24.0%	12.8%	8.0%	0.8%	0.8%
Windsor to Enfield	40	14	4	2	1	32.0%	11.2%	3.2%	1.6%	0.8%
Westover to Windsor	57	26	6	0	0	45.6%	20.8%	4.8%	0.0%	0.0%
35th to Westover	27	9	0	0	0	21.6%	7.2%	0.0%	0.0%	0.0%
45th to 35th	63	32	14	2	0	50.4%	25.6%	11.2%	1.6%	0.0%
RM 2222 to 45th	43	11	3	0	0	34.4%	8.8%	2.4%	0.0%	0.0%
Far West to RM 2222	26	7	0	0	0	20.8%	5.6%	0.0%	0.0%	0.0%
Anderson-Spicewood Springs to Far West	34	15	2	0	0	27.2%	12.0%	1.6%	0.0%	0.0%
Steck to Anderson-Spicewood Springs	86	41	13	1	0	68.8%	32.8%	10.4%	0.8%	0.0%
US 183 to Steck	80	31	11	3	0	64.0%	24.8%	8.8%	2.4%	0.0%
Capital of Texas to US 183	25	9	1	0	0	20.0%	7.2%	0.8%	0.0%	0.0%
Braker to Capital of Texas	65	30	11	0	0	52.0%	24.0%	8.8%	0.0%	0.0%
Duval to Braker	46	22	6	2	1	36.8%	17.6%	4.8%	1.6%	0.8%
Parmer to Duval	63	29	10	1	0	50.4%	23.2%	8.0%	0.8%	0.0%

Southbound General Purpose Lanes										
Location	Counts					% out of Total (total =125)				
	>=60	>=65	>=70	>=75	>=80	>=60	>=65	>=70	>=75	>=80
Lake Austin to Barton Springs	44	16	3	0	0	35.2%	12.8%	2.4%	0.0%	0.0%
Enfield to Lake Austin	48	8	1	0	0	38.4%	6.4%	0.8%	0.0%	0.0%
Far West to RM 2222	34	4	0	0	0	27.2%	3.2%	0.0%	0.0%	0.0%
Parmer to Duval	120	103	59	15	1	96.0%	82.4%	47.2%	12.0%	0.8%
Wells Branch to Parmer	114	82	48	9	1	91.2%	65.6%	38.4%	7.2%	0.8%

Figure 3 on the following page shows the speed frequency distribution of the general purpose and express lanes based on all 39 count locations (Eleven general purpose lane sites and twenty-eight express lane sites). Percentages near the bars show cumulative distributions. The general-purpose lanes have an average 15th percentile speed of 53 mph and an 85th percentile of 69 mph. The express lanes have an average 15th percentile speed of 48 mph and an 85th percentile speed of 65 mph. The frequency distributions also show that a larger portion of express lane users travel at all recorded speeds below 60 mph, and a larger portion of general-purpose lane users travel at all recorded speeds of 60 mph and higher.

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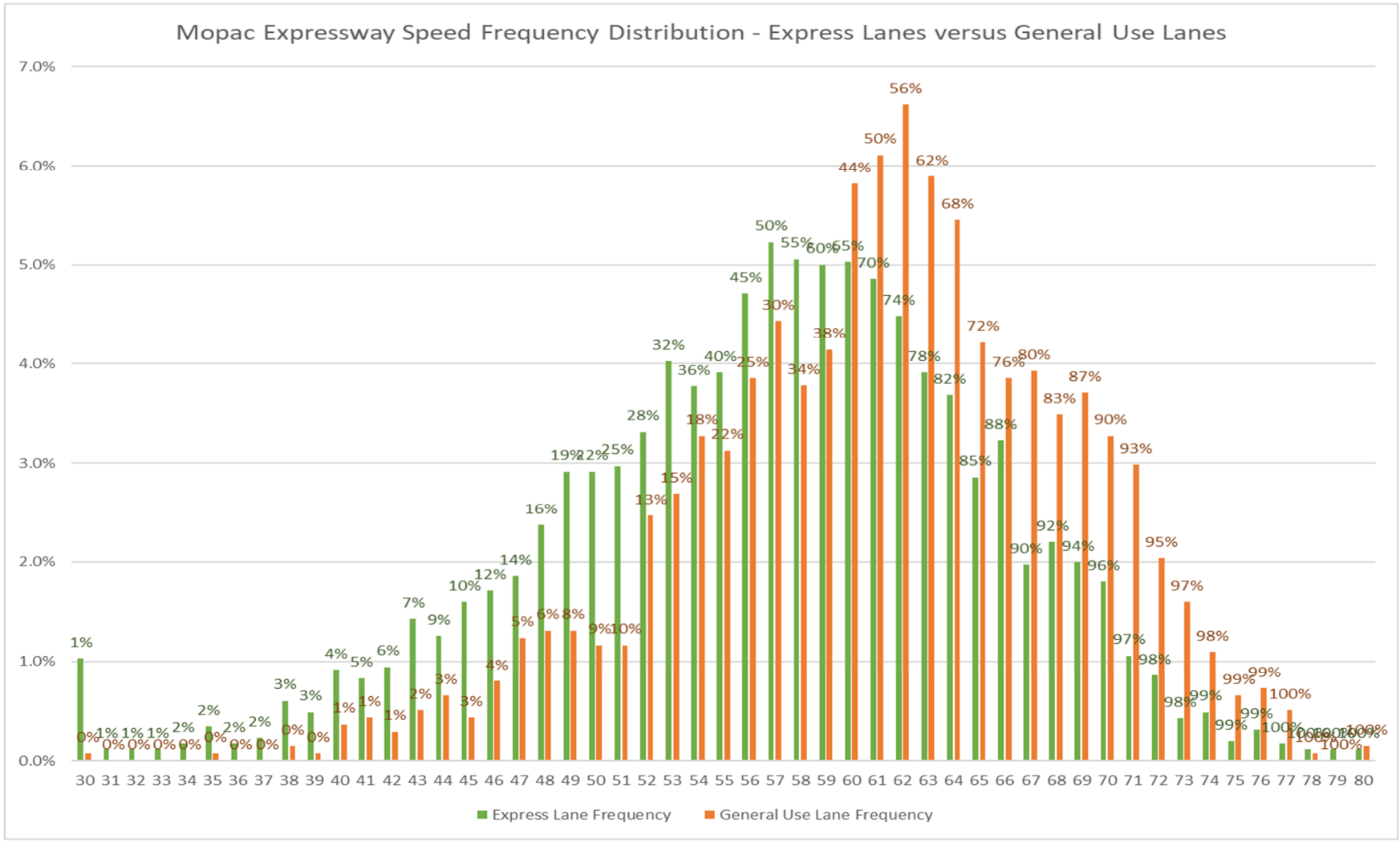
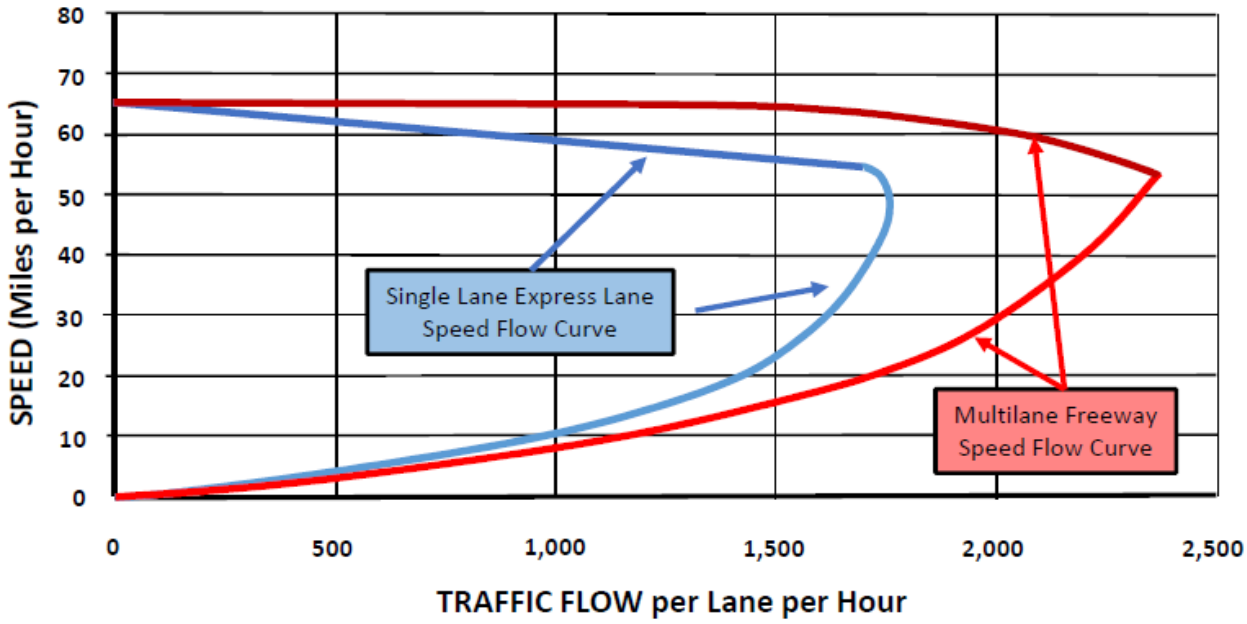
Figure 3: MoPac Expressway – General purpose versus Express Lane Speed Frequency Distribution



Differences between measured speeds between the general-purpose and express lanes follow theoretical relationships from traffic flow theory and highway capacity research. The general-purpose lanes function as a multilane freeway, whereas the single-lane express lanes function like a two-lane highway with no passing zones. Even though the roadway alignment characteristics are virtually the same, a multilane freeway with a free flow speed of 65 mph will operate at 65 mph over a range of traffic flows from zero to 1550 passenger cars per hour per lane (pcphpl), then decline in a curve that reaches 53 mph at a capacity of 2350 pcphpl. A two-lane highway operates at the same 65 mph free flow speed at very low volumes, but will lose speed in a linear fashion with increased traffic flow, reaching 55 mph at a much lower capacity of 1700 pcphpl. The difference between the speed-flow realms of the general-purpose freeway lanes and a single express lane are illustrated below in Figure 4. Thus, the impact of either higher maximum speed limits or higher minimum speeds may have the greatest effect at lower volumes.

Figure 4: Speed versus Traffic Flow Realm of Multilane Freeways versus Single Lane Express Lanes



4. EVALUATION OF SPEED DATA

The TxDOT Speed Limit Guidelines document references research from Michigan DOT ("Comparison of Speed Zoning Procedures and Their Effectiveness", Michigan DOT, September, 1992) indicating that speed data measured by radar units tends to underestimate the 85th percentile speed by approximately 3 miles per hour. The guidelines also note that TxDOT considers it reasonable and prudent to post a speed limit that is within 5 miles per hour of the 85th percentile speed to avoid unnecessary enforcement issues unless there is clear justification for a different speed (normally lower) based on crash experience or other factors.

Also, when evaluating 85th percentile speeds along a corridor, lone speed measurements are generally removed from computed averages for the corridor if they fall outside of 7 miles per hour higher or lower than the overall corridor average. In these cases, the readings from the removed location(s) may be in error or due to a unique situation that may require further evaluation. Legitimate reasons for an outlier speed measure may include vertical grades, sight distance constraints, horizontal curves, and operationally complex roadway configurations that naturally result in lower speed. In the case of MoPac Expressway, lower speed measurements between Lake Austin Boulevard and Bee Cave Road are known to result from freeway weaving turbulence due to the many ramps that merge and diverge in the area.

Figure 5 shows the effect of the 3 mph upward adjustment to the 85th percentile speed along the northbound express lane. The dashed line shows the average 85th percentile speed after the adjustment is made at 68 mph. There are two buffer thresholds above and below this line. The larger buffer of plus or minus 7 mph (61 to 75 mph) evaluates potential outlier speed measurements. One such outlier occurs between Capital of Texas Highway and Braker Lane. However, removal of this data point had no effect on the overall average. The smaller buffer of plus or minus 5 mph (63 to 73 mph) is the potential range of speed limits justified by the average 85th percentile speed. Since speed limits can only be posted in 5 mph increments, the adjusted data justifies speed limits of either 65 or 70 mph.

Figure 6 shows the effect of the 3 mph upward adjustment to the 85th percentile speed along the southbound express lane. The average 85th percentile speed for southbound is 67 mph. The 7 mph buffer thus extends from 60 to 74 mph. For southbound, there are no outlier segments outside the 7 mph buffer, but the same segment from Braker Lane to Capital of Texas Highway is close at 6 mph low, and the ingress-egress segment from Far West Blvd to RM 2222 is also at 6 mph low. The 5 mph buffer extends from 62 to 72 mph, and thus the speed data also justifies either 65 or 70 mph speed limits.

The TxDOT guidelines regarding minimum speed limits state that a minimum speed limit can be posted when there is evidence that slow-moving vehicles are causing operational and/or safety issues on a corridor. Note that there is no similar requirement that minimum speeds be based on some threshold from the radar speed studies. However, like the 85th percentile speed threshold for maximum speed limits, a minimum speed that varies significantly from the 15th percentile speed threshold will affect such a large portion of drivers that compliance may be an issue. If the 15th percentile speed is to be used to designate a minimum speed for the express lanes, a speed of 50 mph would roughly comply with the average of 15th percentile speeds observed. As previously discussed, the lower threshold of the 10 mph pace statistic from Figures 1 and 2 show a low limit that averages 55 mph. There may be justification to consider this speed for a minimum speed limit as well.

Figure 5: Northbound MoPac Expressway – Evaluation of 85th Percentile Speeds

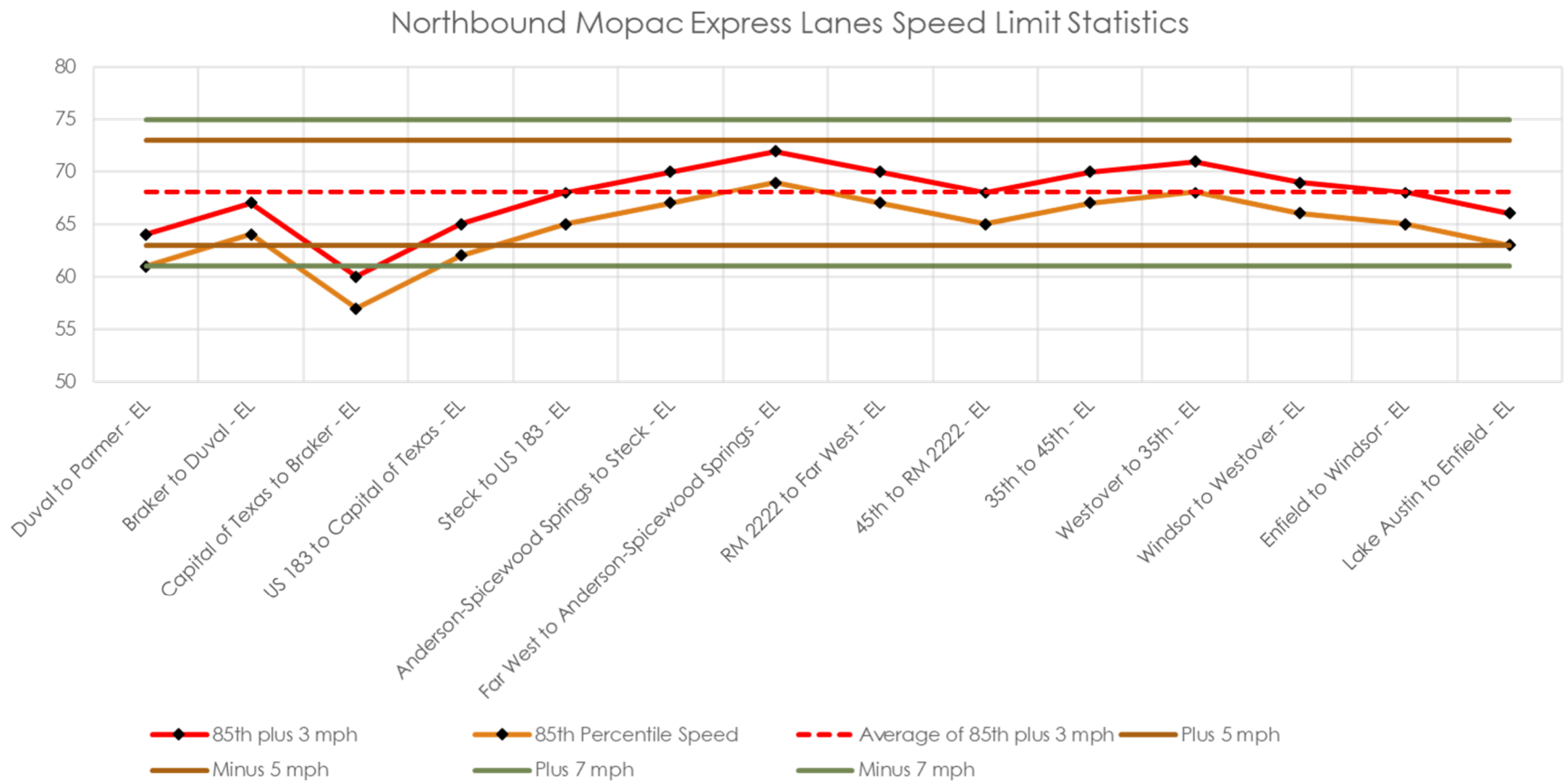
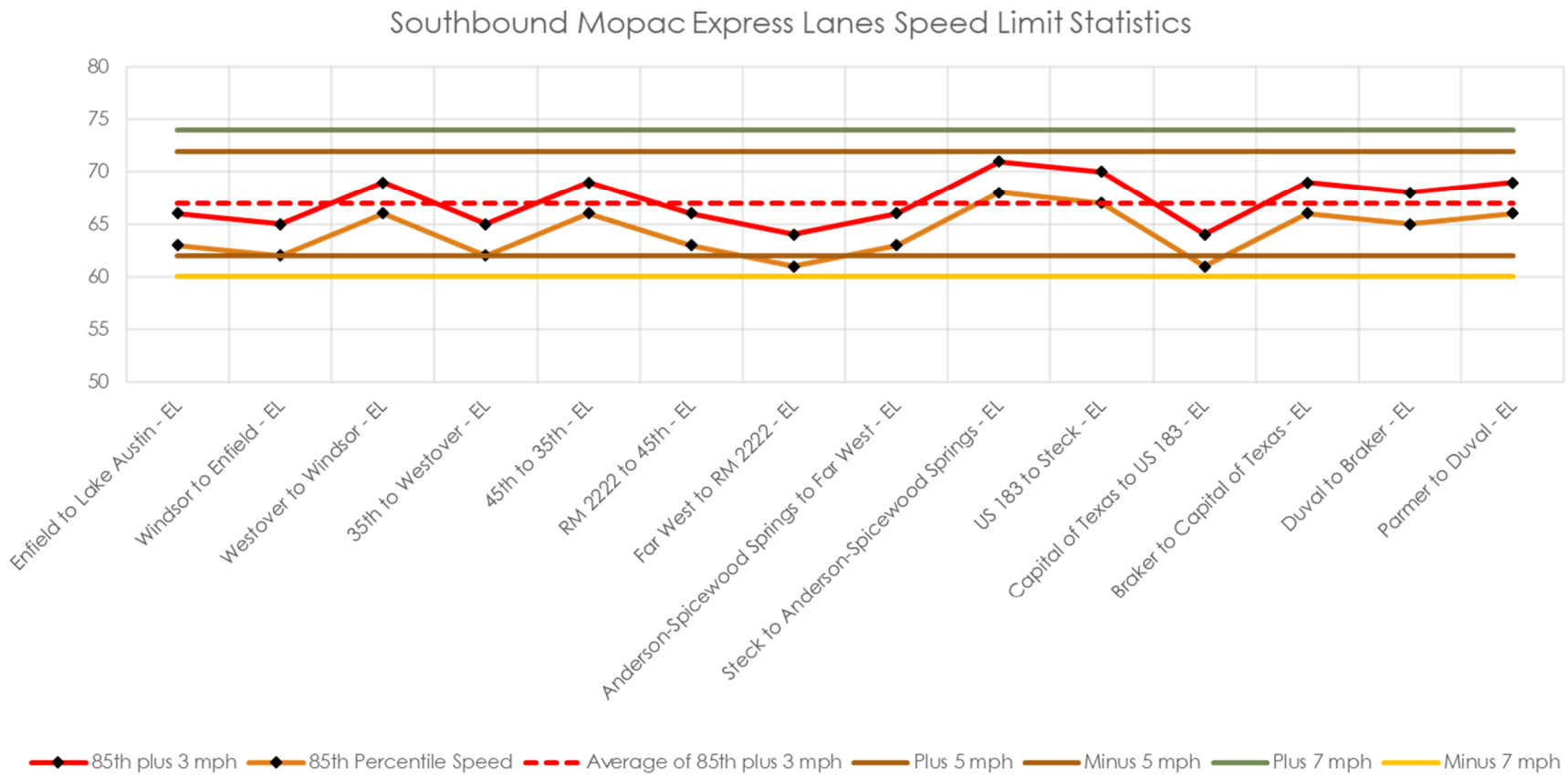


Figure 6: Southbound MoPac Expressway – Evaluation of 85th Percentile Speeds



5. CRASH DATA ANALYSIS

An analysis of crash data from TxDOT's Crash Record Information System (CRIS) was conducted to evaluate the potential interdependencies between crash occurrence and the need to modify speed limits of the MoPac Expressway corridor. The key objectives of the crash analysis were to:

- Compare MoPac Expressway general purpose lane crash experience prior to, during and after construction of the express lanes.
- Devise directional crash rates for short segments of MoPac Expressway to relate the crash patterns with the location of geometric and operational features for before, during and after construction conditions.
- Evaluate the portion of crashes related to speed and key contributing factors involved.

5.1 Data Collection

The crash data evaluation was complicated by the lack of consistent crash history due to express lane construction. Historical crash data was obtained from CRIS from January 1, 2010 to August 13, 2018 for the MoPac Expressway (State Loop 1) to capture crash patterns of pre-construction, construction, and post-opening of the express lanes using the following range of dates:

- Pre-construction (January 1, 2010 - December 31, 2013)
- Construction (January 1, 2014 – October 31, 2017)
- Operations (November 1, 2017 – August 13, 2018)

Crash data was extracted from both the open source and the standard interface of CRIS. This was necessary to obtain attributes required to process and quality control check the data. Overall, 6,645 crashes were verified for the MoPac Expressway corridor over the 7-year, 7.5-month period. This amounts to approximately 871 crashes per year.

5.2 Crash Data Analysis Methodology

Like most agencies, TxDOT defines average crash rates for corridor segments in units of annual number of crashes per 100 million vehicle miles traveled (Crashes/100 MVMT). For roadway segments, the mathematical equation for crash rates is shown below:

$$\boldsymbol{Average\ Crash\ Rate\ (ACR)} = \frac{\boldsymbol{Number\ of\ Crashes\ per\ year}}{(\boldsymbol{AADT} * \mathbf{365} * \boldsymbol{Segment\ length(miles)}} * \mathbf{100,000,000}$$

Since this study seeks to relate crash experience to geometric features along the corridor, a crash rate segment length of 0.1 miles (528 feet) was used and crash rates were calculated for each direction of travel using the "Vehicle Travel Direction" attribute. The relevant crashes were further filtered to only include crashes that occurred on main lanes and entrance/exit ramps. The crash rates were also calculated separately for the three periods to distinguish the crash patterns before, during and after construction of the express lanes. These detailed results are discussed in the next chapter.

5.3 Crash Analysis Results

The overall summary of crash experience revealed that among the 6,645 crashes over seven years and seven and one half months, 848 crashes involved speeding as one contributing factor (around 12%). This summary information is not normalized for counts and segment length, and it cannot provide local evidence for presence of speed-related hotspots. To introduce local spatial context, the crash rates were calculated by dividing the study corridor into 0.1-mile segments, and calculating crash rates for each segment using number of crashes and traffic count data available from the CRIS database.

Table 3 summarizes the number of speed related crashes by both the contributing factor to the crash, and by the combination of contributing factors if several were involved. A total of 617 of the 848 speed-related crashes are included from the nearly eight-year period to cover the top 12 ranked causal factors. As shown by totals and percentages on the right side of the table, "Failure to control speed" was cited as the sole factor in 46 percent of crashes, putting this contributing factor in the rank of first with three times the number of crashes as the number two ranking causal factor combination. When viewing the number and portion of crashes by individual factor (lower left of the table), "Failure to control speed" was cited as a contributing factor to 82 percent of all crashes. "Driver inattention" contributed to 28 percent of the crashes, while "Unsafe speed" and "Followed too closely" contributed to 18 and 16 percent of crashes, respectively.

Per the 839 speed-related crash records obtained from a CRIS query of top speed related crash factors, a total of 486 crashes occurred along the MoPac Expressway study corridor during the four-year pre-construction period, resulting in an average of 121.5 speed-related crashes per year. During the construction of the express lanes, 272 speed-related crashes occurred over a two-year and ten-month period resulting in an average of 96.1 crashes per year, or a 21 percent reduction. It is not clear whether this reduction was due to changes in driver attention during the construction process, or simply due to the difficulty in processing crash information at the crash site when shoulders are closed for construction. The post-construction data only extends for nine and one half months. A total of 81 speed-related crashes occurred, resulting in an average of 103.2 crashes per year, or a 15 percent reduction relative to pre-construction conditions. Again, it is not clear what factors contributed to the change in the number of recorded speed-related crashes.

5.4 Basis of Crash Rate Comparison

TxDOT provides annual updates to a table of statewide average crash rates that are commonly used to conduct planning and policy-level assessments of crash rates on the state highway system. The rates are provided in units of crashes per 100 million vehicle miles traveled are provided in two tables that contrast the following factors:

- Urban versus Rural
- Route Designation (Interstate, US Highway, State Highway and Farm-to-Market)
- Cross Section (Two Lane or Four-or-more Lane Undivided, Four-or-more Lane Divided)

Table 3: Summary of Factors Contributing to Speed-Related Crashes on MoPac Expressway

Factors Contributing to Crashes										
Failure to Control Speed	Unsafe Speed	Driver Inattention	Followed Too Closely	Faulty Evasive Action	Under Influence - Alcohol	Changed Lanes when Unsafe	Other	Rank	Number of Crashes by Contributing Factor Combination	Percent of All Speed-related Crashes
O								1	281	46%
O		O						2	94	15%
	O							3	66	11%
O			O					4	43	7%
O		O	O					5	41	7%
	O	O						6	23	4%
O				O				7	16	3%
	O	O	O					8	12	2%
O					O			9	11	2%
O							O	10	10	2%
O						O		11	10	2%
	O			O				12	10	2%
Number and Percent of Crashes by Individual Contributing Factor									Total Number of Unique Crashes in Eight Year Sample	
506	111	170	96	26	11	10	10		617	100%
82%	18%	28%	16%	4%	2%	2%	2%		100%	

In the TxDOT route designation hierarchy, Loop 1 is classified as a state highway. The latest (2017) TxDOT State-level average crash rates for an urban state highway is 277.20[6]. The average crash rate for a four-or-more lane divided urban roadway is 187.46. Crash evaluations are generally conducted by rating the actual roadway crash rates to multiples of the statewide rate. The more common range used includes thresholds such as 1.0, 1.5 and 2.0 times the statewide average. Table 4 summarizes these rates.

[6] TxDOT (2017), Statewide traffic crash rates, http://ftp.dot.state.tx.us/pub/txdot-info/trf/crash_statistics/2017/02.pdf

Table 4: 2017 TxDOT Statewide Crash Rate Thresholds for MoPac Expressway

Crash Rate Attributes	Average Crash Rate	1.5 times Average Rate	2.0 times Average Rate
Urban State Highway	277.20	415.80	554.40
Urban Four-or-more Lane Divided Highway	187.46	281.19	374.92

These statewide average crash rates are presented as a basis of comparison for evaluating crash rates presented on the MoPac Expressway corridor condition diagram (strip map) discussed in the next section of this document. It is suggested that the crash rates for Urban Four-or-more Lane Divided Highway be used for the evaluation since statewide crash rates for Urban State Highways can include a wide variety of urban streets that are less representative of urban freeways.

6. CORRIDOR CONDITION DIAGRAM (STRIP MAP)

A corridor condition diagram – referred to as a "strip map" in the TxDOT Speed Limit Study Guidelines - was developed to integrate data from different sources onto a schematic representation of the MoPac Expressway corridor that extends from north of Scofield Ridge Parkway to south of Bee Cave Road. Due to the length of the diagram, the graphic is provided separately at the end of this document as a large-scale plot. The diagram contains the following features:

- Functional Design Diagram – this is a scaled stick diagram of the corridor that locates ramp junctions and intersections on a scale to the nearest 100 feet and shows the number of lanes on mainline and ramp segments.
- Radar Speed Frequency Distribution and Speed Statistics – these graphs illustrate the pattern of measured speeds at 39 locations in which radar speed data was collected. The graphs also contain scaled icons illustrating the speed summary statistics including the 10 mile-per-hour pace range, the 85th percentile speed, and the 15th percentile speed. The graphs are color coded black for general purpose lane sites and green for express lane sites. Inside the functional design diagram, the 85th and 15th percentile speeds of each speed data collection site are also shown in large text for reference in black for general purpose lane segments and green for express lane segments.
- Express Lane Cross Section Feature Diagram – this is a scaled graphic identifying the location of express lane ingress and egress locations, and location where there is a change in express lane width, left shoulder width or express lane separation buffer width. This facilitates relating speed or crash rate data to express lane cross section constraints. The feature diagrams are provided above the functional design diagram for northbound lanes and below the diagram for southbound lanes. The feature diagram of the southbound lanes also includes the location of crossroad bridges and locations in which the mainline freeway alignment switches from a straight segment to a curve

segment and visa-versa. “SC” indicates a transition from straight to curved alignment, and “CS” indicates the opposite.

- TxDOT Annual Average Crash Rates – Copies of the 2017 TxDOT annual average crash rates are above the far-left end of the functional design diagram. Other legends are located above or below the far-left end of the functional design diagram.
- Annual Crash Rates by Era – Annual crash rates in crashes per 100 MVMT are depicted above the functional design diagram for northbound, and below for southbound for 0.1 segments of MoPac Expressway. The crash rates are presented separately for the pre, during and post construction era for comparison purposes. The crash rates have been color shade coded such that green represents the lowest rates, and higher rates transition from yellow to orange to red. Blank white entries indicate that no crashes were recorded in the subject tenth-of-a-mile segment during the given era. For reference, crash rates of 187, 281 and 375 crashes per 100 MVMT represent the three threshold rates for 1.0, 1.5 and 2.0 times the statewide average for a four-or-more lane divided urban highway. The crash rates were aggregated at 0.10 mile (528 foot) intervals. Thus, the crash rate tables were scaled to the functional design diagram, which is otherwise scaled to units of 500 feet, so that the roadway geometry and speed data can be related to the crash rates. The crash rate tables also show whether rates in specific locations have changed relative to the three construction eras.

7. SUMMARY OF SPEED STUDY FINDINGS

- Radar speed data collected for this study justifies express lane speed limits of 65 or 70 mph.
- Though there are no guidelines for selection of a minimum speed limit, the 15th percentile speeds suggest a 50-mph minimum speed on express lane, while the lower limit of the 10 mph pace statistic suggests a 55-mph minimum speed on the express lane.
- Though crash history information is presented for the MoPac Expressway, the lack of history after express lane opening and the lack of data specificity regarding the location of the crashes (general purpose lanes versus express lanes) make it difficult to draw conclusions regarding crash effects. Overall, crash rates simply indicate that crashes are more prevalent near ramp junctions and within freeway weaving areas.

8. RECOMMENDED NEXT STEP

- Express lane incident data collected by the RMA should be used for future evaluation of speed management issues in the corridor. This data is collected by the RMA’s incident management team, and includes crash attributes that are more detailed than that of TxDOT’s CRIS (Crash Record Information System) data.

MOPAC EXPRESSWAY CORRIDOR CONDITION DIAGRAM
ROADWAY CONFIGURATION, RADAR SPEED STUDY RESULTS, ANNUAL CRASHES PER 100 MVMT BY CONSTRUCTION ERA

CRASH RATE PER 100 MVMT — Northbound

Northbound	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
Pre-Construction (2010-2013)	35	35	301	18	53	18		44	14	113
Construction (2014-2017)		35	88	18	18	53		44	14	99
Post-Construction (2017+)					53	53	53	42	85	127

Northbound	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Pre-Construction (2010-2013)	85	42	53	10	30	30	20	80	20	20
Construction (2014-2017)	71	56	71	20	30	30	50	40		60
Post-Construction (2017+)	42	42			30		60	30		30

Northbound	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9
Pre-Construction (2010-2013)	30	190	108	78	20	29	78	10	10	10
Construction (2014-2017)	50	190	147	108	39	10	68	10	39	20
Post-Construction (2017+)	90	240	89		29		29			

Northbound	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
Pre-Construction (2010-2013)	59	20	10	20	49	228	46	35	46	46
Construction (2014-2017)	20	20	10	29	39	80	23	23	23	162
Post-Construction (2017+)	29		29	29	29	59	35			35

Northbound	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9
Pre-Construction (2010-2013)	35	12	35		23	23	46	58	23	35
Construction (2014-2017)		23	23		35	35	12	139	69	115
Post-Construction (2017+)			35		35		35	139	35	

Northbound	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
Pre-Construction (2010-2013)	23	22	15	30	22	178	30	30	30	30
Construction (2014-2017)		15	37	30	44	133	155	44	22	30
Post-Construction (2017+)				44	44	44	89	67	22	22

Northbound	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
Pre-Construction (2010-2013)	81		37	22	15	30	30	96	60	23
Construction (2014-2017)	44	30	37	22		52	15	59	75	38
Post-Construction (2017+)	89					22		22	91	23

Northbound	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9
Pre-Construction (2010-2013)	46		38	23	8	61	8	61	122	99
Construction (2014-2017)	30	15	84	23			61	38	69	91
Post-Construction (2017+)	114	23	23	46	23	69	23	23	137	114

Northbound	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
Pre-Construction (2010-2013)	14	43	14	21	36	7	21	21	43	86
Construction (2014-2017)	50	72	14	43	14		7		36	21
Post-Construction (2017+)									21	

Northbound	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9
Pre-Construction (2010-2013)	36	93	43	7		43	14	43	107	57
Construction (2014-2017)		7			7	7	7		21	14
Post-Construction (2017+)		21								

Northbound	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9
Pre-Construction (2010-2013)	23	31	8	38	62	38	31	23	46	215
Construction (2014-2017)	15	23	23	46	38	23	8	46	31	108
Post-Construction (2017+)		23		23	46		23	23		23

Northbound	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9
Pre-Construction (2010-2013)	23	31	31	23	154	100	46	46	62	69
Construction (2014-2017)	38	23	54	31	177	69	54	46	46	39
Post-Construction (2017+)	23		69		23			69		46

Northbound	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
Pre-Construction (2010-2013)	46	139	92	46	120	17	34	34	26	34
Construction (2014-2017)	46	69	62	54	86		51	26	17	77
Post-Construction (2017+)					103	26			51	51

Northbound	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9
Pre-Construction (2010-2013)	51	26	77	69	33	69	8	54	46	8
Construction (2014-2017)	26	17	111	26		15	8	38	46	
Post-Construction (2017+)			103					23		

Miles (DFO reference) 2.69 2.79 2.88 2.98 3.07 3.17 3.26 3.36 3.45 3.55 3.64 3.74 3.83 3.92 4.02 4.11 4.21 4.30 4.40 4.49 4.59 4.68 4.78 4.87 4.97 5.06 5.16 5.25 5.35 5.44 5.53 5.63 5.72 5.82 5.91 6.01 6.10 6.20 6.29 6.39 6.48 6.58 6.67 6.77 6.86 6.96 7.05 7.14 7.24 7.33 7.43 7.52 7.62 7.71 7.81 7.90 8.00 8.09 8.19 8.28 8.38 8.47 8.56 8.66 8.75 8.85 8.94 9.04 9.13 9.23 9.32 9.42 9.51 9.61 9.70 9.80 9.89 9.99 10.08 10.17 10.27 10.36 10.46 10.55 10.65 10.74 10.84 10.93 11.03 11.12 11.22 11.31 11.41 11.50 11.60 11.69 11.78 11.88 11.97 12.07 12.16 12.26 12.35 12.45 12.54 12.64 12.73 12.83 12.92 13.02 13.11 13.21 13.30 13.39 13.49 13.58 13.68 13.77 13.87 13.96 14.06 14.15 14.25 14.34 14.44 14.53 14.63 14.72 14.81 14.91 15.00 15.10 15.19 15.29 15.38 15.48 15.57 15.67 15.76 15.86 15.95 16.05 16.14 16.24 16.33 16.42 16.52 16.61 16.71 16.80 16.90 16.99 17.09

Texas Department of Transportation
STATEWIDE TRAFFIC CRASH RATES
2017

Highway System	Traffic Crashes per 100 million vehicle miles: Rural	Urban
Interstate	61.92	166.15
US Highway	73.24	204.54
State Highway	95.17	277.20
Farm-to-Market	131.37	295.61

Road Type	Traffic Crashes per 100 million vehicle miles: Rural	Urban
2 lane, 2 way	103.78	260.78
4 or more lanes, divided	64.77	187.46
4 or more lanes, undivided	110.33	366.97

CRASH RATE PER 100 MVMT — Southbound

Southbound	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9
Pre-Construction (2010-2013)	53	71	159	71	142	35	18	42	99	127
Construction (2014-2017)			88	18	88	35			71	197
Post-Construction (2017+)	53				53					127

Southbound	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Pre-Construction (2010-2013)	56		37		60	10		90	30	30
Construction (2014-2017)	14	14			20	10	20		30	40
Post-Construction (2017+)	169	42								

Southbound	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9
Pre-Construction (2010-2013)	20	160	30	39			20	10		10
Construction (2014-2017)	20	80	39	20			10	10		29
Post-Construction (2017+)	30	180	29	29						

Southbound	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
Pre-Construction (2010-2013)	39	10	10	29	10	157		12	23	58
Construction (2014-2017)	20	20	20	20	39	101	35	46	23	196
Post-Construction (2017+)		29	29		117	63				

Southbound	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9
Pre-Construction (2010-2013)	12	12	46	12	23	23		58	46	35
Construction (2014-2017)	23		35	12	69	58	104	104	35	46
Post-Construction (2017+)	35		35		69	35	35	173	35	104

Southbound	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
Pre-Construction (2010-2013)	20	37	59	52	37	185	44	15	52	37
Construction (2014-2017)	58	15	59	44	59	44	30	37	15	15
Post-Construction (2017+)	69		22		44	67	44		44	111

Southbound	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
Pre-Construction (2010-2013)	126	44	52	30		52	30	170	82	8
Construction (2014-2017)	81	22	30	22	44	59	30	67	52	30
Post-Construction (2017+)	67	22	67	44	22	67	22	22	68	

Southbound	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9
Pre-Construction (2010-2013)	46	15	38	53	8	30	76	23	107	69
Construction (2014-2017)	46		30	38		23	91	99	99	61
Post-Construction (2017+)	91	23		69	69	23	183	160	206	69

Southbound	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
Pre-Construction (2010-2013)	36	43	72	29	43	14	93	36	93	129
Construction (2014-2017)	21	57	21	36	7	7	72	29	21	57
Post-Construction (2017+)	64	21	21			21				21

Southbound	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9
Pre-Construction (2010-2013)	50	29	14		43	57	72	165	72	29
Construction (2014-2017)	21	7		7	29		7	36	21	14
Post-Construction (2017+)	21		21					43	21	21

Southbound	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9
Pre-Construction (2010-2013)	8	23	62	46	69	8	8	23	31	208
Construction (2014-2017)	15	23	77	62	85	46	15	46	15	138
Post-Construction (2017+)		23	92	69	23	46		92	46	185

Southbound	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9
Pre-Construction (2010-2013)	115	8	54	15	123	31	23	77	39	23
Construction (2014-2017)	38	23	46	23	62	39	46	54		31
Post-Construction (2017+)	115	69		23	46	92				46

Southbound	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9
Pre-Construction (2010-2013)	23	62	100	62	94	26	34	43	77	103
Construction (2014-2017)	8	46	54	24	60	60	43	51	26	103
Post-Construction (2017+)		46	23						26	51

Southbound	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9
Pre-Construction (2010-2013)	43	60	86	17	34	15	23	62	54	8
Construction (2014-2017)	17	34	94	26	26	8		46	15	
Post-Construction (2017+)	51	26	154			23	23	23		