Request for Design Exception No. 1

This form is to be completed and submitted for approval when minimum values of controlling criteria identified in the TxDOT Roadway Design Manual (RDM) cannot be met. Requests for Design Exceptions (DXs) on the NHS, on the Interstate, and /or identified in the FHWA Projects of Division Interest (PoDI) must be submitted through Design Division's Project Development Support Section (DES-PDSS) for review. DXs on the Interstate require FHWA approval. DXs on the PoDI may require FHWA review and/or approval as identified by a PoDI project's individual plan (PoDI Plan). DXs involving structural capacity, bridge rails and/or bridge width shall be sent to the Bridge Division for review and approval. All other DXs shall be approved by the responsible TxDOT District Office. Complete this form for the Controlling CSJ and list all CSJs associated with this Request. The DX Number must be unique for each CSJ listed on the request and must correspond to the DX number listed on Form 1002. (Complete all blanks; state N/A if necessary. Suggested/informational text on this form is shaded in **gray** and should be removed and replaced with applicable text in final submittal.)

Date: 06/16/2023 District: Austin County: Travis Letting Date: 09/2024

Highway: I-35 Limits: US 290E to US 290W/SH 71

CCSJ: 0015-13-388 Subordinate CSJs Associated with DX: N/A

Proposed Work: Remove the existing I-35 decks, lower the highway, add two NB and two SB non-tolled high occupancy vehicle managed lanes, and reconstruct east-west cross-street bridges. Improve corridor drainage

1. Design Criteria / Type of Design Exception:

☒ **4R** ☐ **3R** ☐ **2R**

☐ **Off-System Bridge Project (Current ADT <400)** ☐ **Off-System Historically Significant Bridge Project**

Table 1.1 - Design Exception Element(s)

Check boxes for all DX elements that are dependent upon one another and/or have the same justification for the need for the design exception and will be analyzed together in this design exception request. Use a separate Request for Design Exception form for each independent DX.

☐ Design Speed	☐ Vertical Alignment[(2)]
☒ Lane Width	☐ Bridge Width[(2)]
☒ Shoulder Width	☐ Lateral Offset to Obstructions[(2)]
☐ Horizontal Curve Radius	☐ Deficient Bridge Rails[(3)]
☐ Superelevation Rate	☐ New Bicycle / Vehicle Shared Lane, Width
☐ Stopping Sight Distance (SSD)[(1)]	☐ New Bicycle Lane, Width
☐ Maximum Grade	☐ Roadway Width[(4)]
☐ Cross Slope	☐ Load Carrying Capacity (Operating Rating)[(4)]
☐ Vertical Clearance	
☐ Design Loading Structural Capacity	

(1) SSD applies to horizontal alignments, and crest vertical curves for the purposes of a Design Exception. SSD for crest vertical curves is a direct correlation with the K-Value. If the minimum K-Value is satisfied for a crest vertical curve (Fig. 2-5), then the vertical SSD is satisfied under usual conditions.

(2) This element will no longer be controlling criteria for projects letting in January 2021 and beyond.

(3) 3R, high volume roadways only.

(4) Off-System Historically Significant Bridge Projects only.

Table 1.2 - Design Exception Element Location and Values

List in the table, the information for each design exception location, the minimum design values of the applicable design criteria from the RDM, the [Bridge Project Development Manual], and/or the AASHTO Guide for the Development of Bicycle Facilities, and reference the applicable design criteria page(s), chapter(s), section(s), table(s) and/or figure(s). List one design exception location per row. Each direction of travel is considered a unique design exception location and should be listed separately. Add additional lines as needed.

Facility Type	Design Exception Element	Location(s) (MP and Station)		Minimum Design Value	Proposed Value	Existing Value	Design Value Reference(s)
		Begin MP, Sta.	End MP, Sta.				
NB I-35 General Purpose Lanes	Lane Width	Sta. 3020+80	Sta. 3305+82	12 ft.	11 ft.	11-12 ft.	RDM CH. 3, Sec 6, Tbl 3-18
NB I-35 Managed Lanes	Lane Width	Sta. 3020+80	Sta. 3305+70	12 ft.	11 ft.	N/A	RDM CH. 3, Sec 6, Tbl 3-18
SB I-35 General Purpose Lanes	Lane Width	Sta. 3029+98	Sta. 3305+47	12 ft.	11 ft.	11-12 ft.	RDM CH. 3, Sec 6, Tbl 3-18
SB I-35 Managed Lanes	Lane Width	Sta. 3029+98	Sta. 3305+58	12 ft.	11 ft.	N/A	RDM CH. 3, Sec 6, Tbl 3-18
NB I-35 Managed Lanes	Inside Shoulder Width	Sta. 3020+80	Sta. 3113+87	10 ft.	4ft.	4-10 ft.	RDM CH. 3, Sec 6, Tbl 3-18
SB I-35 Managed Lanes	Inside Shoulder Width	Sta. 3029+98	Sta. 3113+87	10 ft.	4 ft.	4-10 ft.	RDM CH. 3, Sec 6, Tbl 3-18
NB I-35 General Purpose Lanes	Inside Shoulder Width	Sta. 3113+87	Sta. 3192+36	10 ft.	4 ft.	1-2 ft. (Lower Deck) 4 ft. (Upper Deck)	RDM CH. 3, Sec 6, Tbl 3-18
SB I-35 General Purpose Lanes	Inside Shoulder Width	Sta. 3113+87	Sta. 3195+50	10 ft.	4 ft.	1-2 ft. (Lower Deck) 4 ft. (Upper Deck)	RDM CH. 3, Sec 6, Tbl 3-18
NB I-35 Managed Lanes	Outside Shoulder Width	Sta. 3169+48	Sta. 3176+11	6 ft.	4-10 ft.	N/A	RDM CH. 3, Sec 6, Tbl 3-18
NB I-35 Managed Lanes	Inside Shoulder Width	Sta. 3192+36	Sta. 3219+25	10 ft.	4 ft.	1-2 ft. (Lower Deck) 4 ft. (Upper Deck)	RDM CH. 3, Sec 6, Tbl 3-18
SB I-35 Managed Lanes	Inside Shoulder Width	Sta. 3195+50	Sta. 3220+08	10 ft.	4 ft.	1-2 ft. (Lower Deck) 4 ft. (Upper Deck)	RDM CH. 3, Sec 6, Tbl 3-18
NB I-35 General Purpose Lanes	Inside Shoulder Width	Sta. 3219+25	Sta. 3247+69	10 ft.	4 ft.	1-5 ft.	RDM CH. 3, Sec 6, Tbl 3-18
SB I-35 General Purpose Lanes	Inside Shoulder Width	Sta. 3220+08	Sta. 3248+85	10 ft.	4 ft.	1-5 ft.	RDM CH. 3, Sec 6, Tbl 3-18
NB I-35 Managed Lanes	Inside Shoulder Width	Sta. 3247+69	Sta. 3305+66	10 ft.	4-8 ft.	2-5 ft.	RDM CH. 3, Sec 6, Tbl 3-18
SB I-35 Managed Lanes	Inside Shoulder Width	Sta. 3248+85	Sta. 3305+62	10 ft.	4-8 ft.	2-5 ft.	RDM CH. 3, Sec 6, Tbl 3-18

2. Brief Description of Project: *Include a brief project description with any applicable project information to assist the reader in becoming familiar with the project and its purpose, and include a regional vicinity map and a project location map clearly identifying the project limits and design exception locations (using milepost **and** station). Provide existing and proposed typical sections and plan views for ALL locations shown in Table 1.2, with stations and design exception locations labeled. If the request includes cross section and/or profile modifications, include existing and proposed cross section(s) and profile(s).*

The I-35 Capital Express (I-35 CapEx) Program is composed of three stand-alone projects – North, Central, and South. A project location map depicting the limits of the project is included in Appendix A. This design exception request is within the limits of the I-35 CapEx-Central Project. The limits of the I-35 CapEx-Central Project are from US 290E to US 290W/SH 71. The adjacent I-35 CapEx-North Project (CSJ 0015-10-062/0015-13-389) is from SH 45N to US 290E and the adjacent I-35 CapEx-South Project (CSJ 0015-13-077/0016-01-113) is from US 290W/SH 71 to SH 45SE.

The overall goals of the I-35 CapEx Program are to reduce congestion and improve mobility and connectivity along the I-35 corridor through the Austin area, while minimizing controversial and expensive right-of-way (ROW) acquisitions that negatively impact the community. The existing section of I-35 CapEx-Central Project from US 290E to US 290W/SH 71 was originally constructed over 50 years ago and was designed to interstate design standards of the time and for traffic volumes far less than today. The proposed project will improve operational efficiency and upgrade the system to modern standards.

The I-35 CapEx-Central Project includes adding one northbound and one southbound non-tolled managed lane (ML) between the northern project limits and Airport Boulevard, and two northbound (NB) and two southbound (SB) non-tolled managed lanes from Airport Boulevard to the southern project limit, as well as reconstructing the Ladybird Lake Bridge to accommodate the additional lanes. The project includes significant drainage improvements, reconstruction of ramps, frontage road improvements, cross-street bridges to maintain local access, and the introduction of bypass lanes to improve operations along the corridor.

Generally, both the managed lanes and general purpose lanes (GP) are proposed to be lowered one level below frontage roads and cross streets along the corridor. The ML are raised intermittently to be level with the frontage roads, allowing for direct access and egress ramps without requiring additional ROW impacts and without needing to weave across the GP lanes. The four locations with ML direct access and egress ramps are North of Airport Boulevard, at 32nd Street, at MLK Jr. Boulevard, and at Woodland Avenue.

All GP access and egress ramps throughout the project are being redesigned to accommodate the new configuration. To help with lane balancing and traffic merging, all GP entrance ramps will provide auxiliary lanes which continue until the next exit. All existing cross-street bridges and underpasses will be replaced where feasible with overhead bridge crossings, except for E 51st Street and Oltorf Street, which will remain in place, and the E 8th Street connection, which will be severed. Airport Boulevard and Riverside Drive crossings are being reconfigured as single point urban interchanges (SPUI) to improve traffic operations while limiting right of way (ROW) impacts.

New collector-distributors (CD) are also proposed, which provide grade separated through movements at several signalized intersections up and down the corridor including under 51st Street, Airport Boulevard, 41st St/Wilshire Boulevard, MLK Jr. Boulevard, Cesar Chavez and Holly Streets, and Riverside Drive.

Pedestrian elements such as shared-use-paths (SUPs) and pedestrian ramps are being included throughout the project. Proposed cross-street bridges will also be widened to provide safer, more pedestrian friendly routes, and new pedestrian bridges are proposed at several high-volume pedestrian routes. Pedestrian bridges will be located north of E 53rd ½ Street, near the Cap Metro Red Line crossing south of Airport Boulevard, MLK Jr. Boulevard, 15th Street, 4th Street, 3rd Street, and Woodland Avenue.

Starting at Dean Keeton Street, the southbound and northbound frontage roads will be brought together along the east side of I-35 in a proposed boulevard cross section. This boulevard will extend to 15th Street before crossing over the freeway and continuing through downtown on the west side of I-35 until it approaches Cesar Chavez where it once again splits into individual frontage roads on the respective northbound and southbound outsides of the freeway. This shift is in response to community outreach and coordination between the City of Austin, TXDOT, and local community leaders and will serve to reconnect the east and west sides of the highway through downtown Austin and improve pedestrian access and safety, as well as the overall downtown aesthetic. Further coordination with the City of Austin has identified several locations along the project for potential deck caps over the highway which, if constructed, will be designed and funded by the City.

In addition to the proposed roadway improvements, the project significantly improves drainage along the corridor with a proposed drainage tunnel below the proposed mainlanes and extending from north of Airport Boulevard through downtown, before turning along Cesar Chavez Street from I-35 to the Colorado River downstream of Longhorn Dam.

The cumulative effect of the improvements proposed by this project is an overall improvement in operations along the corridor with a 57 percent decrease in mainlane travel time (See Appendix F), improved emergency response times for EMS, police, fire, and hospitals with managed lane access, and reconnection of the divided downtown Austin area. The proposed design meets the goals of the I-35 CapEx Program by both reducing congestion and increasing mobility.

This design exception request is for the inside shoulder widths along the ML and GP lanes and lane widths along both the ML and GP. Typical sections depicting these widths are included in Appendix C**.**

3. Explanation of Why Minimum Design Values in Table 1.2 Cannot Be Met:

Reduced I-35 lane and inside shoulder widths have been introduced project-wide due to significant right of way constraints and to balance community impacts, freeway safety, and traffic volumes while still meeting project goals. The project has several major chokepoints along the corridor which, when taken together drive the need for lane and inside shoulder width reduction. These chokepoints are in such near proximity that temporary or intermittent lane and inside shoulder width reductions would be unfeasible without introducing potential safety concerns and increasing driver discomfort as lanes and shoulders transitioned back and forth in width.

Starting at the northern end of the project, the cross section provides the greatest possible lane and shoulder widths that will not require reconstruction of the US 290E direct connects (DC). Widening mainlane shoulder and lane widths would push the footprint into existing retaining walls, columns, and abutments, forcing full reconstruction of those bridges.

At E 51st Street, mainlane lane and inside shoulder widths must be reduced to avoid impacting the existing E 51st Street interchange. This interchange was recently constructed and opened to traffic in 2018. The proposed I-35 design ties into the interchange while maintaining the existing bridge, retaining walls, abutments, and turnarounds. The proposed design improves upon this design with an added northbound to southbound turnaround south of the existing bridge.

Just south of E 51st Street, between Airport Boulevard and Dean Keeton Street, the proposed ROW along the east side of the project follows the parcel limits of the first row of single-family homes through the Cherrywood neighborhood, with the wider portions of ROW between Edgewood Avenue and E 31st Street intended as potential construction staging and access areas for the project. Along the west side of the highway, the ROW is bounded by several existing and new multifamily housing units, businesses, and a hospital. In order to maximize the available right of way through this area, the proposed southbound frontage road cantilevers over the proposed southbound GP lanes, and the GP and ML lanes and inside shoulders are reduced.

Further south, between Dean Keeton Street and Manor Road / Clyde Littlefield Drive, the proposed ROW is once again highly restricted by the Mt. Calvary Cemetery to the east and the University of Texas Austin Campus to the west. Through this area, lane widths and ML inside shoulders are reduced to minimize impacts to university property and existing structures and to avoid encroaching on the cemetery. To further narrow the corridor footprint through this pinch point, the southbound and northbound frontage roads have been brought together on structure in a boulevard configuration over the northbound GP and ML lanes.

The downtown section of the project continues the heavy ROW limitations as the highway is surrounded on both sides by existing multistory buildings, including newer housing complexes, businesses, and Section 4(f) and 6(f) parkland: Palm Park along the west side of the highway, Edward Rendon Sr. Metro Park at Festival Beach, and Waller Beach at Town Lake Metro Park. Lane and shoulder widths are reduced to balance the limited ROW while still providing space for the many cross-street bridge substructures, retaining walls, and downtown entrance and exit ramps.

At the Ladybird Lake bridge, inside shoulders are widened to 8 ft. before reducing back to 4 ft. south of Riverside Drive. The bridge is bounded by Section 4(f) and 6(f): Ann and Roy Butler Hike and Bike Easement to the east and Norwood Tract at Town Lake Metro Park in the west . The extra inside shoulder width was added to balance safety across the proposed bridge with minimal parkland impacts. Inside shoulders taper down to 4 ft. south of Riverside Drive in order to allow space for at-grade ML northbound ingress from the GP and southbound egress to the GP.

Taken together, the significant number of constraints bounding the project ROW, as well as the highly sensitive nature of ROW impacts to the downtown Austin area, drove the need for efficient usage of the roadway cross section to meet project goals.

See Appendix B for plan views of the project and highlighted design exception locations.

4. **Future Projects that Would Bring the Design Values up to Standard:** *Describe any future projects programmed in the STIP and/or any projects not programmed in the STIP that are planned to remove the design exception condition(s) described in this request and bring the design up to standard. In either case, describe any commitment(s) made that those projects will be completed in the next few years, and describe the length of time this design exception is anticpated to be in place.*

   There are no future projects planned or in the STIP along I-35 within the limits of the design exception, so the design exception condition would be anticipated to remain in place for at least 10 years following completion of construction.

5. **Compatibility of Proposed Design with the Adjacent Sections of Roadway:** *Describe adjacent roadway sections and the corridor and whether or not they are compatible/consistent with the proposed design exception condition. Describe how the corridor and proposed design exception condition relate to driver expectancy. If adjacent roadway sections are not compatible/consistent with the corridor and the proposed design exception condition, mitigation measures at a minimum should be taken and described in Section 9.*

   The roadway section north of the project limits is a six-lane freeway with 11’ lanes, 5’ inside shoulders, and 10’ outside shoulders. The roadway section to the south of the project limits is a six-lane freeway with 12’ lanes and 10’ inside and outside shoulder widths and elevated managed lanes with two 12’ lanes in each direction, 4’ inside shoulders, and 8’ outside shoulders.

   The proposed design exception closely matches the lane and shoulder configuration of the roadway section north of the project limits with a short transition for the 5’ inside shoulder to align with the proposed 4’ inside shoulder. The southern portion of the project consists mainly of restriping the existing pavement section to align with the roadway south of the project. This allows for the required transition lengths in both the northbound and southbound directions to develop driver expectancy for reduced inside shoulders and lanes throughout the project.

6. **Crash History and Anticipated Changes to Crashes with the Proposed Design Exception:** *Summarize the crash history at the design exception location and the anticipated changes to crashes with the proposed design exception condition, and provide an analysis for each. Complete at a minimum the three tables below for at least the three most recent years of available data and provide discussion. In instances where the crash history does not adequately address the issue (e.g. new alignment, existing meets or is close to minimum criteria but substantial changes are made, etc.) discuss <u>Crash Modification Factors</u> (CMFs) and, if necessary, utilize predictive models to show the anticipated change in crashes due to the proposed design. If the design exception element is vertical clearance, information on bridge strikes from the applicable district office and information on other bridge vertical clearances along the corridor and alternative routes may be included in lieu of the three crash history tables, as appropriate, for a more meaningful analysis. In the tables below, the limits of analysis must encompass the limits specified in Table 1.2, and “N” values should be replaced with specific years of analysis. Identical limits and years of analysis for project data and statewide averages must be used. <u>Crash history</u> and <u>Statewide Crash Rates</u> are available through the Traffic Safety Division.*

Table 6.1 summarizes the number of crashes by severity along I-35 between 0.5 miles north of US 183 and 0.5 miles south of E Stassney Lane. These limits encompass the area of influence (AOI) established, in coordination with FHWA, for the traffic and safety analysis documented in the Interstate Access Justification Report. Crash data was provided by TxDOT and included crashes from 2017 to 2021 to align with the information shown in the IAJR. Appendix D provides the full historic crash analysis report.

Table 6.1 – Crashes by Severity

Year	Fatal (K)	Severe (Suspected Serious) (A)	Moderate (Suspected Minor) (B)	Minor (Possible Injury) (C)	No Fatality or Injury (O)	Unknown Crash Severity	Total
2017	5	47	373	411	1,152	27	2,015
2018	13	52	360	416	1,092	34	1,967
2019	12	43	407	447	1,026	26	1,961
2020	4	38	339	289	815	38	1,523
2021	23	48	306	390	836	51	1,654
Average	11	46	357	391	984	35	1,824
Total	57	228	1,785	1,953	4,921	176	9,120
% of Total	0.6%	2.5%	19.6%	21.4%	54.0%	1.9%	100%

As shown in Table 6.1, during this study period there were 57 fatal crashes, which accounted for 0.6 percent of all crashes. Higher severity crashes ("K" and "A") accounted for approximately 3.1 percent of all crashes. Year 2021 experienced a significantly higher number (23) of fatal crashes compared to other years. Over half (54 percent) of the crashes were PDO crashes.

Crash rates for the study area during the study period and a comparison with the statewide crash rates for similar facilities are presented in Figure 6.1 and Table 6.2. Statewide crash rates for similar facilities (Interstate urban roadways) were obtained from TxDOT Motor Vehicle Crash Statistics Website[1].

Figure 6.1. Crash Rate Comparison

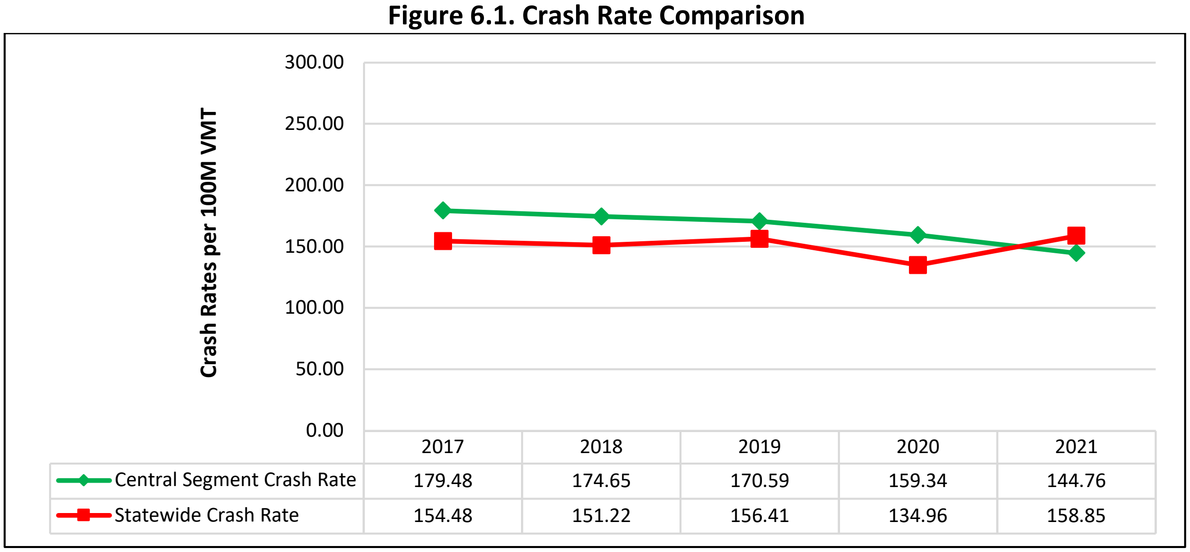


Table 6.2 – Crash Rate

Hwy / Limits: I-35 from US 183 to E Stassney Lane

1 https://www.txdot.gov/inside-txdot/forms-publications/drivers-vehicles/publications/annual-summary.html

Year	2017	2018	2019	2020	2021	Average
Total Crashes	1,585	1,547	1,500	1,207	1,284	1,425
Average Daily Traffic Volume[2]	210,385	211,018	209,478	180,463	211,310	204,531
Central Segment Crash Rate	179.48	174.65	170.59	159.34	144.76	165.77
Statewide Crash Rate[3]	154.48	151.22	156.41	134.96	158.85	151.18
Segment Safety Ratio	1.16	1.15	1.09	1.18	0.91	1.10

In the above table and figure, crash rates for road segments are determined using the following formula:

$$R = 10^8 \times C / (365 \times N \times V \times L)$$

Where,

R = Crash rate for the road segment expressed as crashes per 100 million vehicle-miles of travel (HMVMT).
C = Total number of crashes in the study period.
N = Number of years of data.
V = Number of vehicles per day (both directions).
L = Length of roadway segment in miles.

It is to be noted that for this comparison, crash rates were calculated excluding the crashes along the crossroad AOI for a fair comparison. I-35 Central Segment (mainlanes, frontage roads, and interchanges), including AOI to the north and south, experienced 7,123 crashes during the study period. This segment's average crash rate for the five-year period was 165.77 crashes per 100 million VMT, which was higher than the statewide average (151.18). However, the crash rates in the study area show a consistent decreasing pattern. In 2021, the study segment crash rate was lower than that of the statewide average, which was not the case for the other 4 years. Table 6.2 shows a comparative analysis of crash rate for the segment by year. Traffic volume was much lower in 2020 than the average due to the COVID-19 pandemic. The segment safety ratio, which is the ratio of the crash rate of the study area to that of Urban Interstate facilities in Texas, shows that I-35 Central Segment, on average, experienced 10 percent more crashes than the average for Urban Interstate facilities in Texas over the study period.

Historical crash data by major type of collision is listed in Table 6.3. The types of collisions include but are not limited to:

- Single Vehicle (Fixed Object / Overturn / Turning)
  - Manner of collision is “one motor vehicle” crash
  - First harmful event is not “pedestrian” or “pedalcyclist” (collision type excludes those involving pedestrians and cyclists)

- Single Vehicle (Pedestrian / Bicycle)
  - Manner of collision is “one motor vehicle”
  - First harmful event includes “pedestrian” or “pedalcyclist”

- 2+ Same Direction (Sideswipe)
  - Manner of collision is “same direction – sideswipe”

[2] TxDOT Transportation Data Management System, Location IDs 227H14, 227H119, 227H118, 227H117, 227SP132, 227H92, 227H94, 227H94A, 227H14NBSR, 227H119NBSR, 227H118NBSR, 227H117NBSR, 227SP132NBSR, 227H92NBSR, 227H94NBSR, 227H94ANBSR, 227H14SBSR, 227H119SBSR, 227H118SBSR, 227H117SBSR, 227SP132SBSR, 227H92SBSR, 227H94SBSR, 227H94ASBSR.

[3] TxDOT Statewide Traffic Crash Rates 2017, 2018, 2019, 2020, and 2021

  - Collision between side of one vehicle and side of another vehicle, with both vehicles travelling in the same direction
  - On freeways, these types of crashes are often related to congestion. Since this project is intended to relieve congestion, there would be an expected reduction in these types of crashes.

- 2+ Same Direction (Rear End)
  - Manner of collision is "same direction – rear-end"
  - Collision between front end of one vehicle and rear end of another vehicle, with both vehicles travelling in the same direction
  - On freeways, these types of crashes are often related to congestion. Since this project is intended to relieve congestion, there would be an expected reduction in these types of crashes.
- 2+ Opposite Direction (Head-on)
  - Manner of collision is "opposite direction"
  - Collision in which both vehicles are travelling in the opposite direction of each other

- 2+ Angle / Other
  - Manner of collision is "angle"

- Other
  - Manner of collision is "other"

As shown in Table 6.3, over 51 percent of all crashes were rear-end crashes, and single vehicle crashes (including bike and ped crashes) accounted for 17 percent of the crashes. The single vehicle crashes accounted for 43 percent (122 crashes) of all fatal and serious injury crashes, as compared to 17 percent of all crashes. Single vehicle crashes include crashes while turning, overturning, or hitting fixed objects like trees, traffic barriers, guardrails, and retaining walls. For this analysis, it was assumed that rear-end crashes include those in which a following vehicle hits a leading vehicle irrespective of whether it was in motion, stopped or going straight or turning left/right.

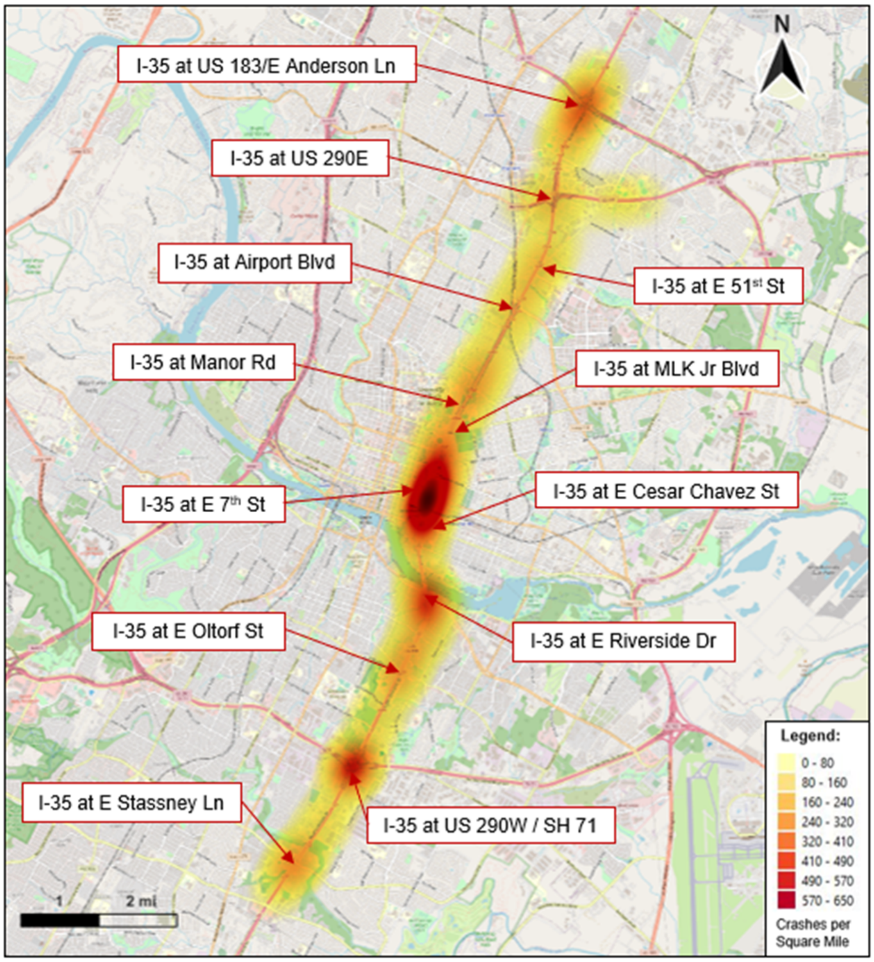
Table 6.3 - Crashes by Major Collision Types

Year	Single Vehicle (Fixed Object/ Overturn/Turning)	Single Vehicle (Pedestrian/ Bicycle)	2+ Same Direction (Sideswipe)	2+ Same Direction (Rear End)	2+ Opposite Direction (Head On)	2+ Angle Collision	Other	Total
2017	244	38	210	1110	79	332	2	2015
2018	297	44	209	1069	72	270	6	1967
2019	227	76	214	1053	71	315	5	1961
2020	247	32	194	727	44	268	11	1523
2021	304	50	204	744	52	283	17	1654
Average	263.8	48	206.2	940.6	63.6	293.6	8.2	1824
Total	1319	240	1031	4703	318	1468	41	9120
% of Total	14%	3%	11%	52%	3%	16%	0%	100%

A hot spot analysis was used to determine if there is a correlation between the design exception locations and areas with higher-than-average numbers of crashes along the corridor.

Figure 6.2 shows the historical crash heat map for all crashes from 2017 through 2021 along the I-35 corridor from US 183 to Stassney Lane.

Figure 6.2 – Central Segment Crash Density Heat Map



The primary crash hotspot location within the Central Segment is the section of I-35 between Martin Luther King Jr. Boulevard and Cesar Chavez Street, as illustrated in Table 6.2. Most notably, of the 238 crashes involving a pedestrian or cyclist within the Central study area, 98 (42 percent) of them occurred at this crash hotspot location.

Safety impacts for the requested design exceptions were quantified using Crash Modification Factors (CMFs) presented in the Highway Safety Manual (HSM)[4]. The following equations from HSM were used to calculate the CMFs for lane width change and inside shoulder width change on freeways.

CMF_{fl}= exp(-0.0376*[W_l-12]) : If W_l<13ft ……………………………………………………………………(HSM Equation 18-25)
CMF_{is} = exp(-0.0172*[W_{is} - 6]) ………………………………………………………………………………….(HSM Equation 18-26)

Where,
CMF_{fl} = crash modification factor for lane width in a freeway segment (base condition is 12-foot lane width)
CMF_{is} = crash modification factor for inside shoulder in a freeway segment (base condition: 6-foot shoulder width)
W_l = lane width (ft)
W_{is} = inside shoulder width (ft)

Table 6.4 shows calculated CMFs for the proposed lane and inside shoulder width changes. In the table, the CMF for the lane width change indicates there will be a 3.8% increase in crashes. Based on existing shoulder widths

[4] Highway Safety Manual, 1st Edition, 2010

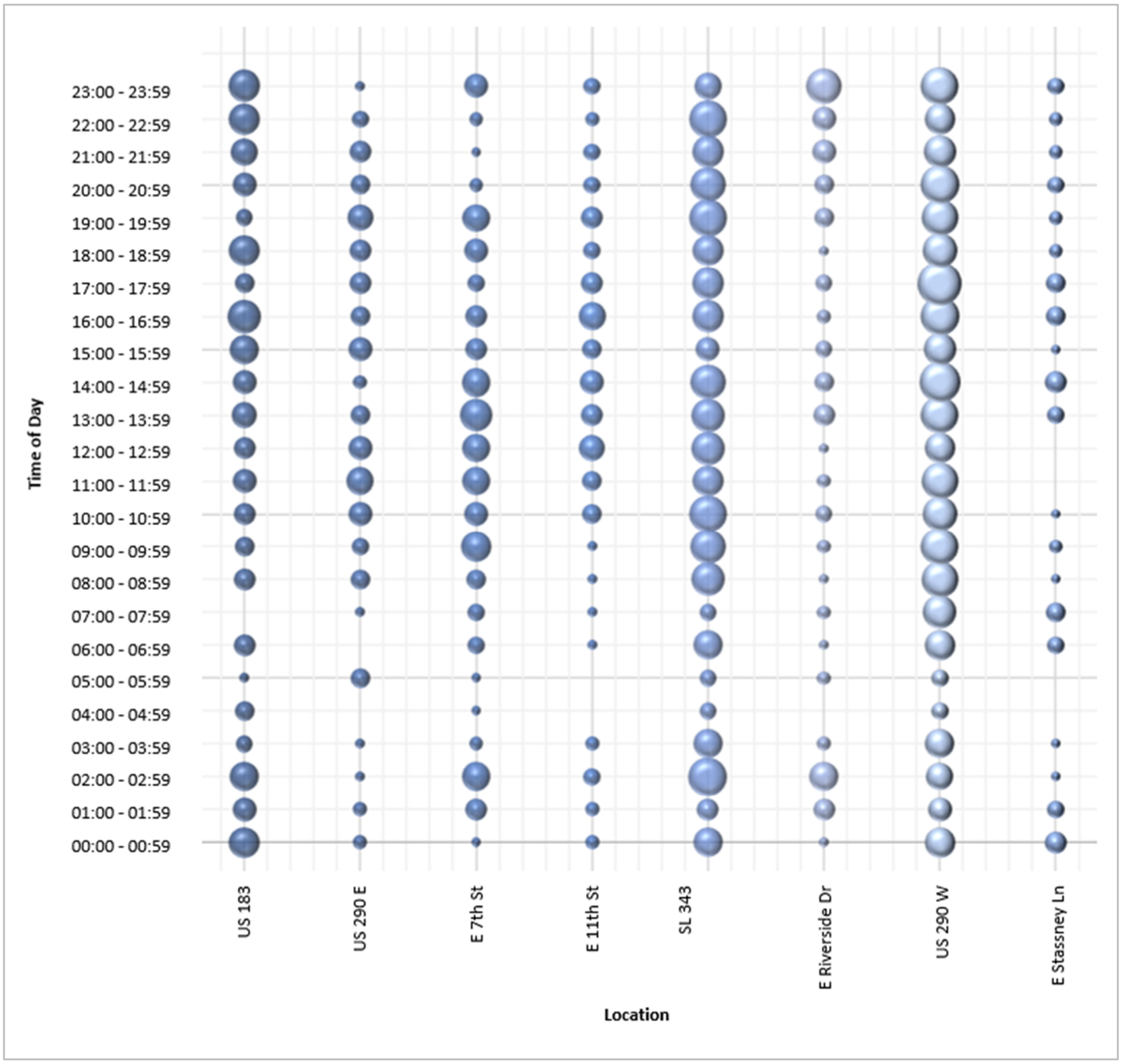
ranging between 1 feet to 10 feet and the proposed width of 4 feet, crashes would decrease by 5 percent in certain areas and increase by 10 percent in others. These numbers support the idea that crashes are expected to increase with narrower lanes and shoulders.

Table 6.4 – CMF for Lane Width and Inside Shoulder Width Change

Modification	Crash Type	Crash Severity	CMF
Convert 12-ft lanes to 11-ft lanes	All	KABC	1.038
Convert 1 ft -10 ft inside shoulders to 4 ft shoulders	All	All	0.949 - 1.108

However, these CMF equations do not represent the exact roadway environment for the proposed project. For example, adding the managed lanes would likely reduce crash frequency. The improvements proposed as part of I-35 CapEx-Central Project are expected to increase throughput and alleviate congestion that coincides with the heightened crash frequencies, as shown in Figure 6.3 (larger bubble radii represent greater relative crash frequencies). The figure shows that higher mainlane crash frequencies coincide with heavier congestion. The larger bubbles are generally located between 6:00 a.m. and 7:00 p.m., with some locations (e.g., US 290W, SL 343/Cesar Chavez Street) experiencing significant relative crash frequencies overnight. Even though the reduction of lane and shoulder widths would increase crashes in some areas, when other improvements are considered altogether, it would likely not degrade the overall safety within the project area.

Figure 6.3 – 2018 – 2021 Mainlane Crash Frequencies by Time of Day and Location



7. **Design Alternatives Considered:** *Describe the design alternatives considered (preferably in a table) showing which variables change from base conditions and costs associated with each alternative. Explain why the proposed design was preferred over each alternative. If the explanation as to why the preferred design is chosen over each alternative is not supported by data, a benefit/cost study should be developed and included with discussion.*

One design alternative was considered in addition to the proposed design for this design exception. Alternative A consisted of providing wider inside shoulders to meet 10-foot shoulder width criteria and increased lane widths to meet the 12-foot criteria. Full lane and shoulder widths were evaluated at each location of this design exception. The existing condition, proposed condition, and Alternative A are summarized in Table 7.1 and discussed in further detail below.

Table 7.1 - Design Alternatives

Element of Comparison	Existing Conditions	Design Exception Condition	Alternative A Widen to Meet Criteria
NB GP lane width	12 ft.	11 ft.	12 ft.
SB GP lane width	12 ft.	11 ft.	12 ft.
NB ML lane width	N/A	11 ft.	12 ft.
SB ML lane width	N/A	11 ft.	12 ft.
NB GP Inside shoulder width	1 ft. to 10 ft.	4 ft.	10 ft.
SB GP Inside Shoulder Width	1 ft. to 10 ft.	4 ft.	10 ft.
NB ML inside shoulder width	N/A	4 ft.	10 ft.
SB ML inside shoulder width	N/A	4 ft.	10 ft.
Design Alternative Cost		$4.50 Billion	$4.63 Billion

Existing Condition:
Inside shoulder widths for the existing general-purpose lanes vary from 1 ft. to 10 ft. Existing general-purpose lane widths are 12 ft. There are no managed lanes in the existing condition.

Design Exception Condition:
The design exception condition includes lane and shoulder width reductions to optimize project footprint, ROW, community impacts, construction schedule, cost, and operations. Lane and shoulder width reduction criteria hierarchy set forth for ML sections for the I-35 CapEx Central Project, developed in coordination with TxDOT Design Division and FHWA, was considered and implemented (see Appendix E).

Alternative A:
Exception Alternative A includes the full required mainlane shoulder and lane widths throughout the length of the project. This alternative would require additional reconstruction of the US 290E direct connectors (DC), E 51st Street interchange, which do not currently have sufficient space between retaining walls, abutments, and columns to fit the widened sections required by this alternative. Further, all proposed cross-street bridges along the project would have to be lengthened from the design exception condition to accommodate the section. Frontage roads through downtown between 15th Street and Holly Street would have to be cantilevered over the roadway to avoid impacts to existing buildings along the ROW, further reducing available space an already tight utility corridor.

These elements add significant construction costs as well as increase the overall duration of project construction. Additionally, ROW would need to be acquired at several locations along the project, the impacts of which are discussed in the following section.

The increase in construction cost for this alternative is estimated at $126,695,304. This estimate was derived as shown below:

- +$35M to reconstruct US 290E Direct Connectors
- +$35M to reconstruct E 51st Street interchange
- +$5M for increased cross-street bridge widths
- +$1M for increased frontage road cantilevered sections
- +$20M for additional mainlane widening and ramp reconstruction
- +$9,579,420 for 957,942 sf additional ROW at $10/sf
- +20% contingency

8. **Additional Discussion on the Proposed Design's Impact to Project:** *Provide additional justification for the proposed design's impact as it relates to such factors as project schedule, operations, right-of-way, the community, environmental, cost, usability by*

*all modes of transportation, and/or other considerations. Describe factors not yet discussed that will justify this design exception or eliminated the other design alternatives discussed in Section 7***.**

Project Delay:
The project would be delayed 18 - 24 months to incorporate the alternative that meets design criteria. The primary schedule impacts would be the extended time for ROW acquisition due to the large amount of additional ROW required and the additional time required to reconstruct the US 290E direct connectors and E 51st Street. Additional sources of delay include the expanded reconstruction area needed to widen the mainlanes and relocate the frontage roads, and the additional number of ramp and lane closures that would be required to reconstruct across a larger footprint. This larger footprint would also increase cross street bridge spans project-wide increasing construction complexity.

Operations:
Operational impacts for Alternative A include additional temporary lane closures, ramp closures, and possible detours that would not be required for the proposed condition. Per the *Highway Capacity Manual*, many types of common median barriers, including concrete barriers, do not affect driver behavior if they are no closer than 2 ft from the edge of the travel lane. Pairing this with the proposed 10 ft. outside shoulder widths results in no free flow speed (FFS) reduction for a six-lane highway. Even in locations where the median barrier assumption is invalid, there is a minimal impact to FFS, with a maximum reduction of 0.4 miles per hour for a six-lane highway.

Potential ROW:
Incorporation of the alternative that meets design criteria would require between 10 ft. to 20 ft. of new ROW along both sides of the roadway from US 290E through Dean Keeton. Restrictions imposed by the cemetery between Dean Keeton and Manor Road would require 25 ft. of additional ROW along University of Texas Austin campus, which would result in significant community disapproval. The increased Alternative A footprint would also result in 7 ft. of additional ROW along Section 4(f) and 6(f) parks, including Edward Rendon Sr. Metro Park at Festival Beach, Ann and Roy Butler Hike and Bike Easement, and Norwood Tract at Town Lake Metro Park.

Additional ROW is estimated as the sum of the length of each design exception area multiplied by the additional width required to meet 10 ft. shoulder width and 12 ft. lane width criteria for that area.

Approximate square feet of additional ROW: 957,942 sf

Social/Environmental Impacts:
There have been extensive public involvement efforts for this project, including scoping meetings in November 2020 and March 2021, a public meeting in August 2021 and Volunteer Opportunities in Community Engagement (VOICE) meeting in January 2022. If the design exception was not approved, the additional ROW needed would require additional coordination efforts and would likely be controversial for members of the community. 79 parcels would have increased ROW impacts including existing campus buildings on the University of Texas Austin property. One major public concern was the potential for impacts to homes in the Cherrywood Neighborhood, and Alternative A would result in impacts of up to 25 first-row homes through the area. These additional ROW needs would also need to be reevaluated for air quality, archeological resources, historic resources, biology, community impacts, protected parkland, hazardous materials, traffic noise, induced growth, cumulative impacts, and water resources

If this design exception is not approved, portions of the recently completed E 51st Street interchange will have to be reconstructed. This would build negative public perception given the recent completion of the project. The widened footprint would also increase construction duration due to the increased complexity and phasing complications brought about by the cantilevered downtown frontage road, further worsening public perception.

Cost:

Proposed project cost: $4,500,000,000

% Difference (Alternative A compared to current proposed, includes ROW and construction costs): +2.82%
Total Dollar Difference (Alternative A compared to current proposed, includes ROW and construction costs): +$126,695,304

Calculations:
% Difference = (($4,626,695,304 / $4,500,000,000) – 1) x 100% = 2.82%
Total Dollar Difference = (($4,626,695,304 - $4,500,000,000) = $126,695,304

Conclusion:
In considering the multiple project impacts to the project presented by the Alternative A option, the design exception condition provides the greatest benefits to users and the Austin community at large. The extensive additional ROW, neighborhood impacts, and reconstruction required to accommodate the Alternative A footprint would be both controversial and expensive, adding over $210 million to project costs, and increase the social and environmental impacts to the project. With the proposed condition, the public receives a project which can be built quicker, with less disruptions to existing property, all while still providing a 57 percent decrease in mainlane travel time, improved emergency response times for EMS, police, fire, and hospitals with managed lane access, and a reconnected downtown Austin area. These factors meet the goals of the I-35 CapEx Program by reducing congestion, increasing mobility, improving safety, and providing bicycle and pedestrian improvements projectwide.

9. Discussion on Practical Mitigation Measures / Cost: *Discuss practical mitigation measures (e.g. delineation, milled rumble strips, signing, lighting, etc.) along with associated costs. Describe measures taken to mitigate the design exception condition and the costs associated with each. (Reference Mitigation Strategies for Design Exceptions (July 2007) or other mitigation guidance.) Provide crash reduction factors (CRFs)/ crash modification factors (CMFs) such as those found in the Crash Modification Factors Clearinghouse or other reference material, if available, for any of the proposed mitigation measures, and discuss how the proposed mitigation measures are anticipated to reduce crashes. If no mitigations measures are to be implemented, provide justification.*

This project will incorporate practical mitigation measures along the corridor including enhanced pavement marking, raised profile markers, rumble strips, delineators and object markers, overhead lighting, and dynamic messaging signs. Mitigation measures will serve to increase driver visibility and awareness at night and encourage vehicles to stay within pavement markings, reducing the number of collisions with roadside barriers. The mitigation measures listed have been included within the construction cost estimates for ITS, lighting, and signing and striping. While these measures are generally included in the existing condition, the project will replace these with new elements which should perform better than the existing measures. For example, new signs and pavements markings would have higher levels of reflectivity, which would increase visibility in low lighting conditions. The estimated sum of these measures for the project is $25 million and are to be implemented project wide.

As a further mitigation, the Highway Emergency Response Operator (HERO) program is also operating along the I-35 corridor in the project area. This program helps mitigate secondary crashes through the removal of disabled vehicles and debris from the main lanes.

Table 9.1 shows available CMFs from the CMF Clearinghouse website that are most applicable to the mitigation measures previously listed.

Table 9.1 – Crash Modification Factors Applicable to Mitigation Measures

Mitigation Measure	CMF	CMF ID[1]	Description
Overhead Lighting	0.800	5160	Provide highway lighting
Enhanced Pavement Markings	0.887	8101	Upgrade existing markings to wet-reflective pavement markings
Rumble Strips	0.840	115	Install continuous milled-in shoulder rumble strips

[1] CMFs on the CMF Clearinghouse website (http://www.cmfclearinghouse.org/index.cfm) are given a searchable CMF ID.

The archived FHWA publication *Mitigation Strategies for Design Exceptions* lists measures to mitigate inadequate shoulder widths and lane widths. Of these measures, enhanced pavement markings, lighting, delineators, wide pavement markings, raised pavement markings, and rumble strips are applicable and included in the project and are expected to improve the ability to stay within the travel lanes. Paved shoulders are anticipated to improve the ability to recover if drivers leave the lanes. Clear recovery area, traversable slopes, breakaway safety hardware, and barriers where appropriate are anticipated to reduce the crash severity if the driver leaves the roadway. Though these mitigation measures are generally in place in the existing condition, including them in the proposed project will continue to benefit safety along the corridor. Additionally, the lane and shoulder widths are being optimized within the limited cross-sectional width as discussed with FHWA and documented in Appendix E for at-grade ML sections.

Attachments:

Appendix A – Regional Setting Map, Project Location Map, Area of Influence

Appendix B – Plan Views

Appendix C – Existing and Proposed Typical Sections

Appendix D – Historical Crash Analysis Memo

Appendix E – CapEx Central Reduction Criteria Hierarchy

Appendix F – CapEx Central Traffic Modeling Results Memo

Appendix G – Design Exception # 3 Profile

Appendix H – Design Exception and Design Waiver Project Graph