



# Feasibility Study Report

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US 277 Sonora Safety Route Study  
City of Sonora and Sutton County, Texas

November 2020

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## Acronyms

<u>Acronym</u>	<u>Definition</u>
AADT	Annual Average Daily Traffic
GIS	Geographic Information Systems
I	Interstate
LP	State Loop
MPH	Miles per hour
MVMT	Million Vehicle Miles Travelled
NEPA	National Environmental Policy Act
RM	Ranch-to-Market
SAM	Statewide Analysis Model
STIP	Statewide Transportation Implementation Program
TxDOT	Texas Department of Transportation
US	United States
UTP	Unified Transportation Program

# 1. Introduction

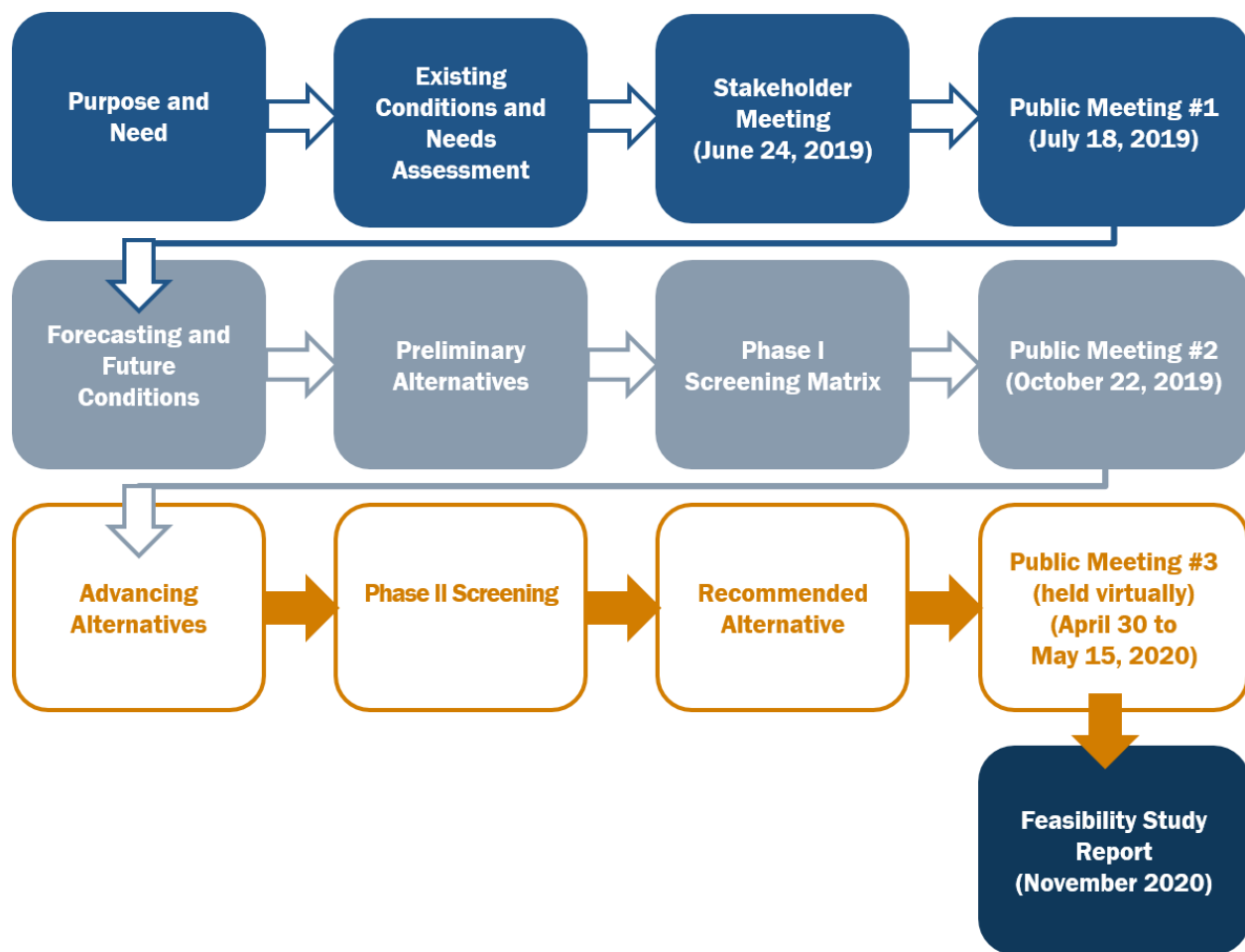
The Texas Department of Transportation (TxDOT) initiated a feasibility study of safety route alternatives to mitigate traffic safety-related issues for passenger and freight vehicles traversing Sonora via United States Highway 277 (US 277). The City of Sonora is located at the intersection of I-10 and US 277 in Sutton County. I-10 is a four-lane freeway and a major east-west route across Texas. I-10 includes three exits through the City of Sonora including Exit 399 to State Loop (LP) 467, Exit 400 to US 277, and Exit 404 to LP 467/Ranch-to-Market (RM) road 864. US 277 is the primary north-south highway in the region. US 277 traffic is currently routed through central Sonora on city streets, creating safety and mobility issues, especially associated with oversized trucks. This report presents the purpose, process, findings, and recommendations from the feasibility study.

## 1.1 *Purpose of the Feasibility Study*

This feasibility study was led by the TxDOT San Angelo District, in cooperation with the TxDOT Transportation Planning and Programming Division. TxDOT was supported by a team of consultants led by Garver and supported by WSP and HG Consults. The team of TxDOT and their consultants are referred to as “the TxDOT Team” in this report. The graphic on the next page shows the process the TxDOT Team used for the US 277 Sonora Safety Route Feasibility Study.

The purpose of this study is to evaluate the feasibility of safety route alternatives around the City of Sonora and identify a Recommended Alternative for further study. The Recommended Alternative would be the starting point for any future phases of project development. Alternatives analyzed in this study include seven route alternatives and a No Build alternative. This report:

- provides a summary of the project background and purpose and need
- presents the study area and environmental constraints considered in the development of alternatives
- describes the process the TxDOT Team used to develop and evaluate the preliminary alternatives
- summarizes the public involvement effort and feedback
- identifies a Recommended Alternative
- presents an implementation plan for development of the Recommended Alternative



## 1.2 Project Background

In March 2010, TxDOT conducted and published the “Sonora Relief Route Investigative Study,” which documented the planning process for a possible relief route for Sonora. TxDOT initiated the US 277 Sonora Safety Route Feasibility Study in the Spring of 2019 to build upon that previous investigative study and to identify a recommended safer alternative route to existing US 277 for the City of Sonora and sections of Sutton County. Diverting the through traffic around downtown is anticipated to ease traffic congestion, enhance mobility, and create safer driving conditions.

The section of US 277 considered in this study includes the City of Sonora and adjacent sections of Sutton County, is part of the Texas Highway Freight Network and the Ports-to-Plains Corridor (a Congressional-designated High Priority Corridor on the National Highway System), and is on the Texas Highway Trunk system of roadways. These designations collectively point to US 277’s strategic importance and viability as a major economic driver in the region. US 277 in the study area experiences a large volume of truck traffic that is routed through downtown Sonora, creating safety and mobility issues. Numerous traffic lights, driveways and right turns present potential conflicts for through traffic, particularly for freight traffic that is slowed by going through town and faces difficulties with local roadway elements such as turning angles.

## 2. Purpose and Need

Defining the purpose and need for a project is essential to developing, evaluating, and selecting an alternative for further study. The TxDOT Team developed a purpose and need statement (TxDOT, May 2020) for a safety relief route based on the transportation needs identified in the 2010 study, the existing conditions in the study area, and input from stakeholders and the public.

The project purpose and need is described below:

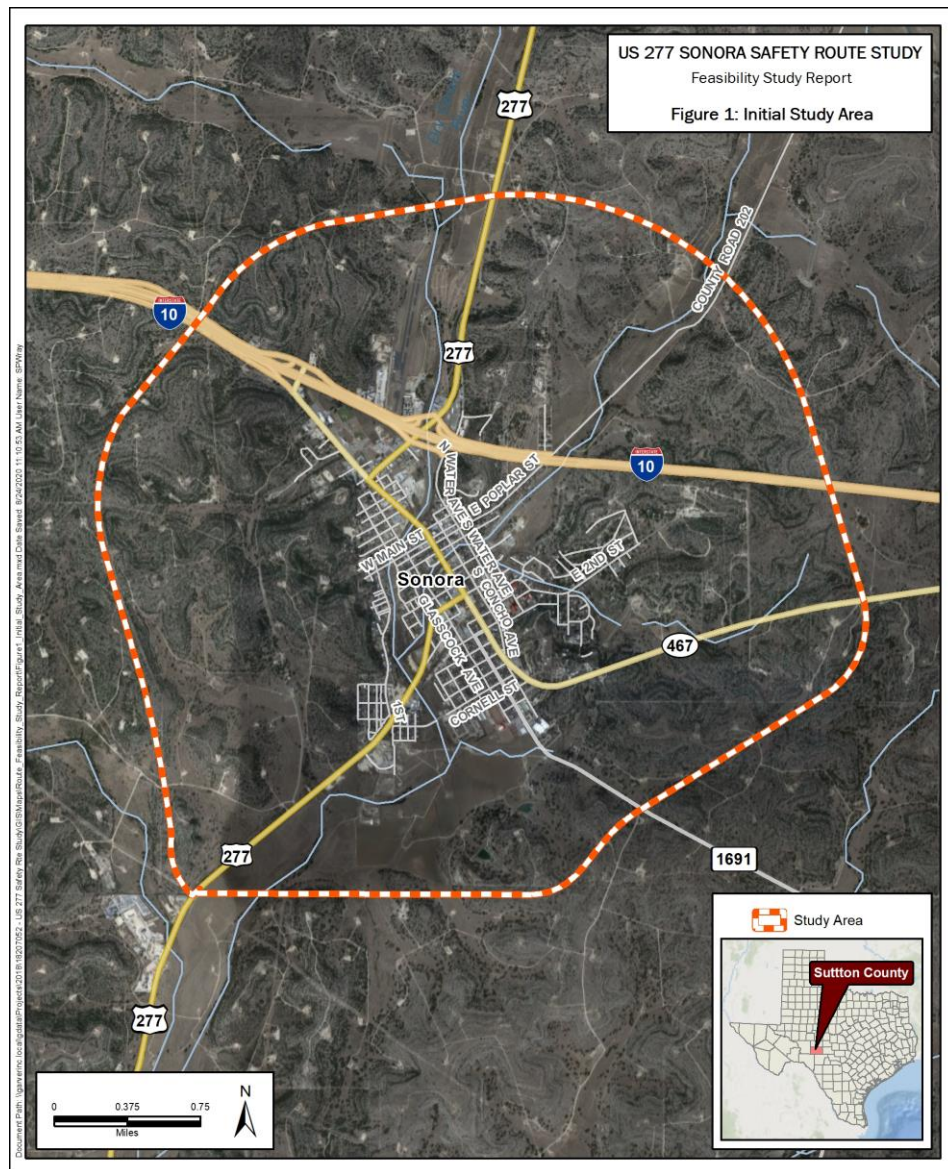
- |                         |   |
|-------------------------|---|
| <b>Project Need:</b>    | An alternative route to existing US 277 through the City of Sonora and Sutton County is needed because existing roadway conditions reduce opportunities for safety upgrades and future improvements. Additionally, there is a potential increase in hazardous and oversized cargo traveling by freight as traffic increases in the future, and there are current traffic conflicts with traffic lights, driveways and right turns through Sonora. |
| <b>Project Purpose:</b> | The purpose of an alternative route for US 277 through the City of Sonora and Sutton County is to provide a safer corridor alternative and to provide improved  |

mobility and reduced congestion through the construction of an alternative route to the existing US 277 corridor.

### 3. Study Area

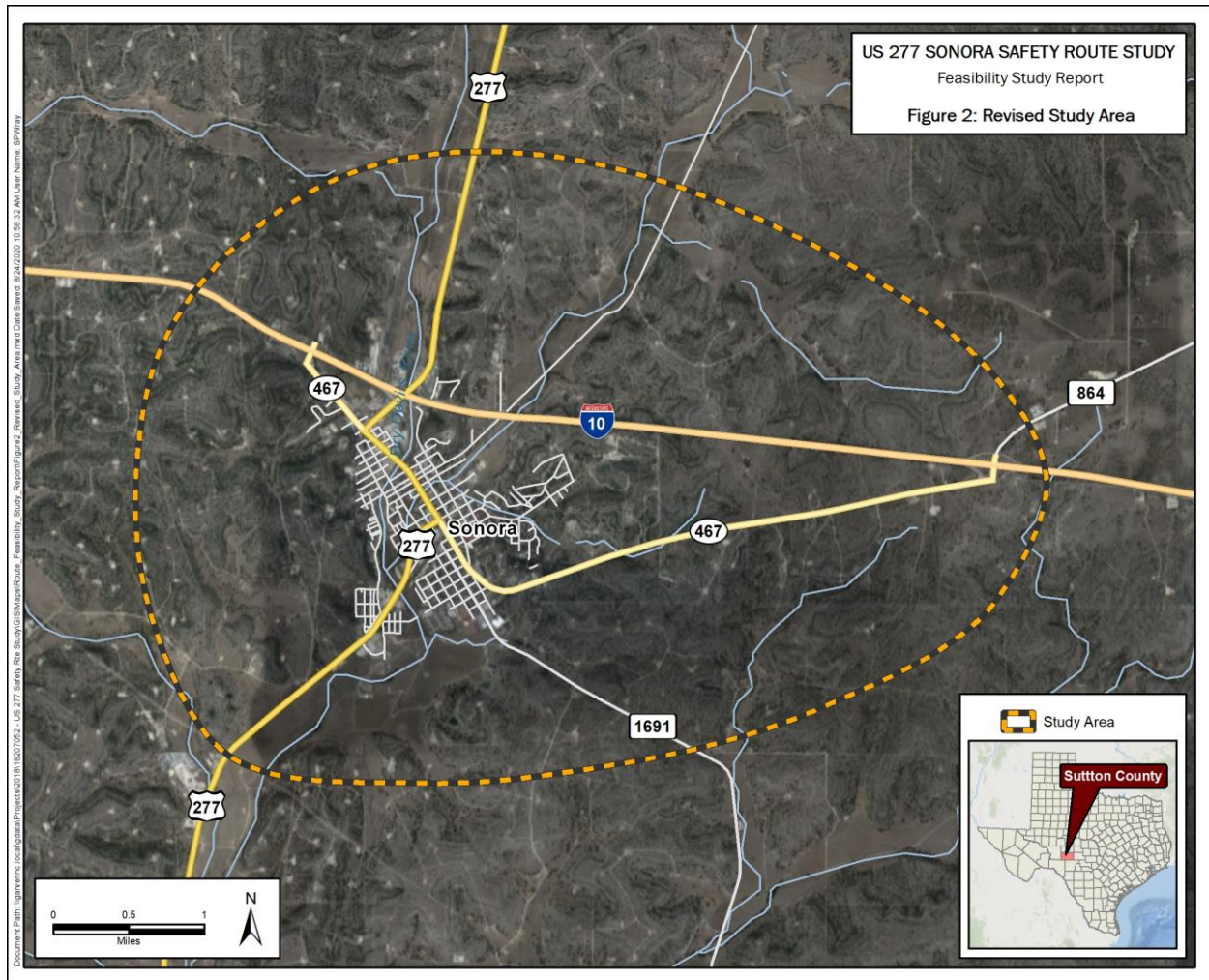
#### 3.1 Development of the Study Area

A site visit was conducted in the Spring of 2019 to view the topography and identify potential constraints to determine a study area for the US 277 Sonora Safety Route. Based on the information collected, the TxDOT Team developed an initial study area that encompassed the I-10/LP 467 intersection west of Sonora, and an area several miles north and south of the city limits along US 277.



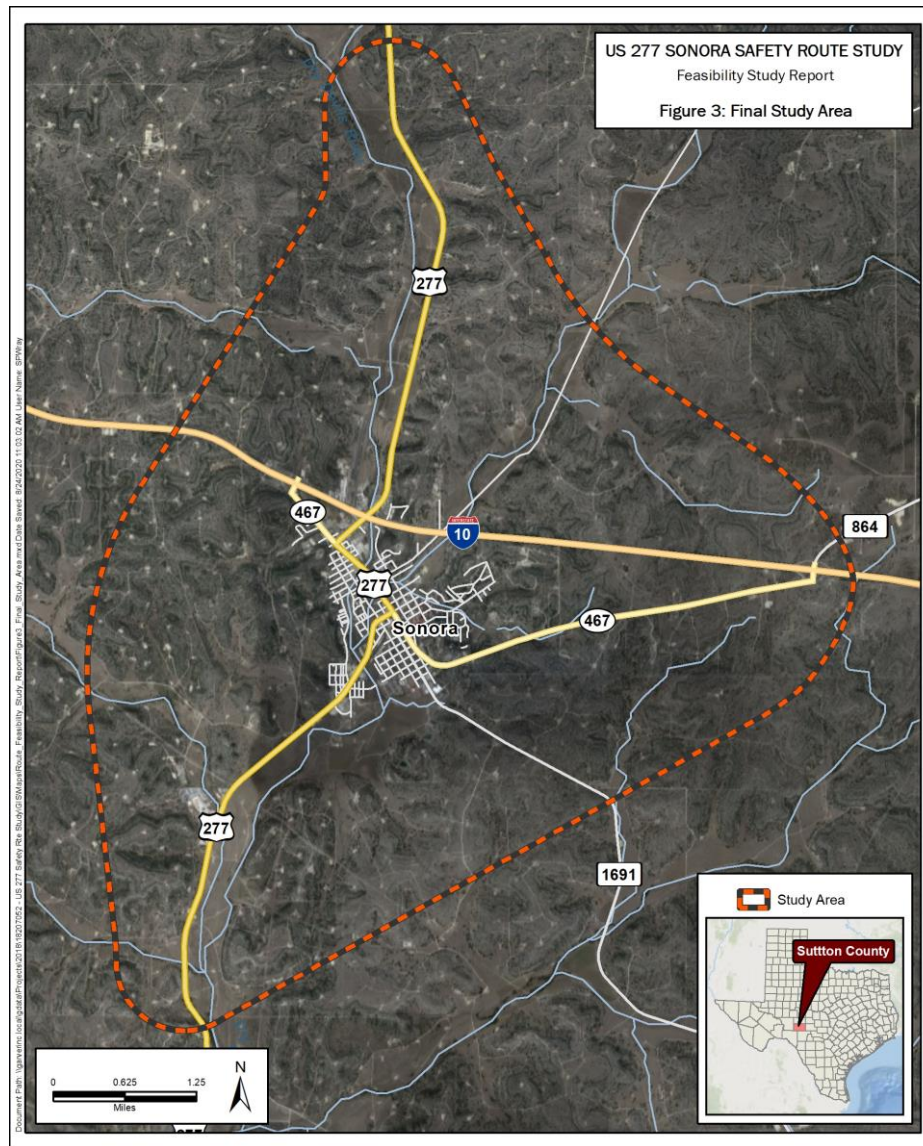


The TxDOT Team held an informational meeting with Sutton County Judge Stephen Smith and key stakeholders identified by Judge Smith on June 24, 2019 to provide them information about the project and gather their input on the study area and potential constraints. Based on comments received at the stakeholder meeting, TxDOT expanded the study area east to include the I-10 and LP 467 interchange. The study area was also expanded slightly to the west to include undeveloped swaths of land and avoid residences based on comments from the stakeholders. The revised study area is shown in **Figure 2**.



The revised study area was shown to the public at the first public meeting held on July 18, 019. The TxDOT Team asked the public for feedback on the study area. Comments were made about the natural gas pump station near US 277 to the south as well as the golf course.

After the public meeting, TxDOT expanded the study area to the north to provide an additional buffer around the airport and golf course and to the south to avoid the new natural gas pump station. A map showing the final study area is shown in **Figure 3**.

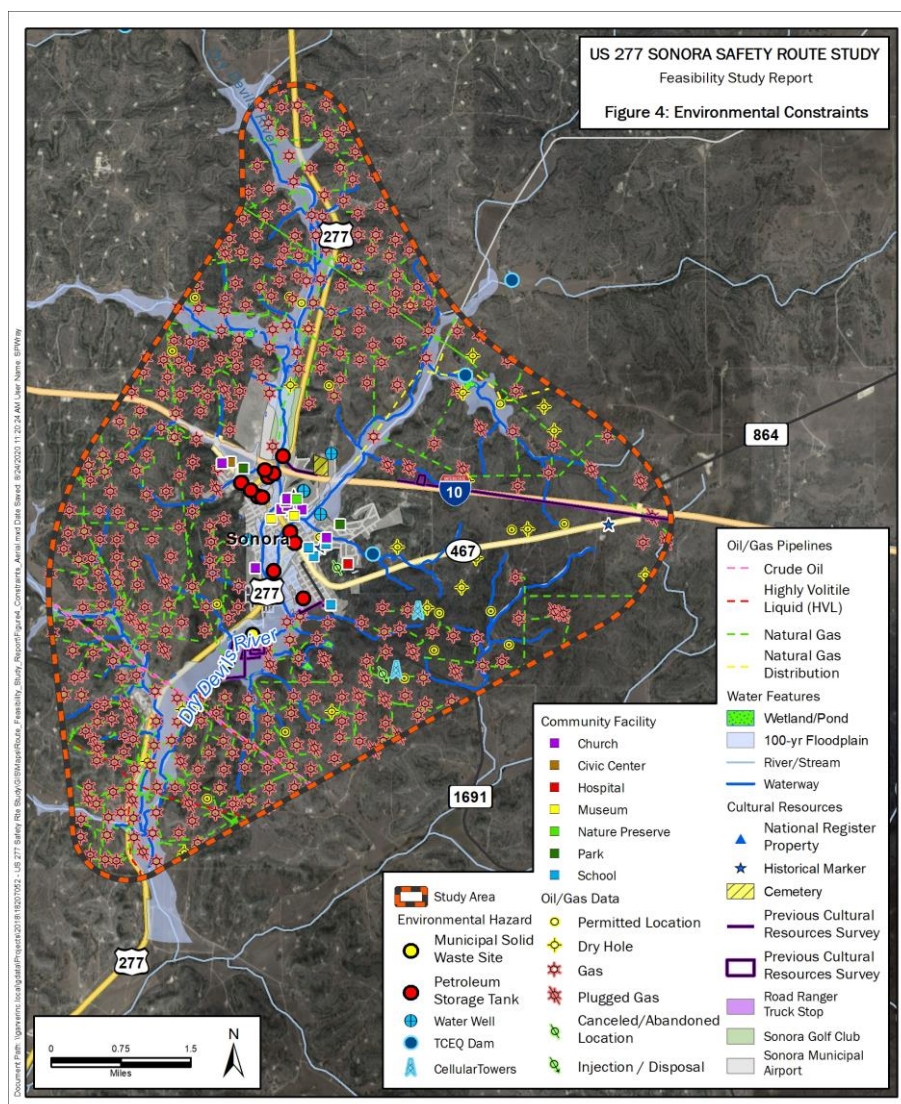




## 3.2 Environmental Constraints

Prior to developing alternatives, the TxDOT Team collected and mapped constraints for consideration in developing the preliminary alternatives. The TxDOT Team researched databases with information about floodplains, archaeological and historical sites, hazardous sites, streams and wetlands, dams, oil and gas wells, pipelines, environmental justice populations (minority and low-income as defined by the US Census Bureau, and public parks and recreation areas. The environmental constraints map and the TxDOT Team developed is shown in **Figure 4**. TxDOT presented the environmental constraints to Sutton County Judge Steve Smith and a group of stakeholders prior to the first public meeting for their review and feedback.

At the first public meeting on July 18, 2019, the TxDOT Team provided the environmental constraints map to the public for comments and feedback. The public confirmed some of the oil/gas well locations and told the TxDOT Team that the alternatives should attempt to avoid them. The environmental constraints identified were used to guide the TxDOT Team as alternatives were developed. They were also included in the Phase I and Phase II Screening Matrices, discussed later in this report, as the TxDOT Team evaluated alternatives.



## 4. Traffic Analysis

The TxDOT Team conducted a traffic analysis to identify existing traffic and safety issues and future traffic conditions in the study area. This section presents a summary of the results of the analysis.

### 4.1 Existing Traffic

Traffic engineers analyzed existing traffic conditions for US 277 and I-10 in the study area. Data for the study was collected from TxDOT historic average daily traffic counts (1999 to 2018), as well as vehicle classification counts, and automated traffic recorder station counts. Additionally, a traffic count program was conducted throughout the study area, and field visits were conducted to verify roadway conditions observed via Google Earth Pro and other aerial photography. A summary of the traffic analysis is presented below.

Traffic congestion in the study area currently exists in the following locations:

- US 277 from I-10 to LP 467 and along US 277 near LP 467/Crockett Avenue.
- I-10 Service Road approaching US 277



The congestion along US 277 is due to a lack of free flow traffic caused by several intersections and driveways and few left-turn lanes, while I-10 experiences congestion because of vehicles queueing as they turn onto US 277 to travel through Sonora. In addition to the congestion experienced at the locations noted above, the entirety of US 277 within the study area has travel times that are over two to three times higher than free flow speed travel times.

The study area is in a region known as the Permian Basin, which has vast numbers of crude oil and natural gas reserves. The use of hydraulic fracking technology after 2010 sharply increased oil and natural gas production. This increase has led to more traffic traveling through the City of Sonora and Sutton County. Based on historical traffic data provided by TxDOT, annual average daily traffic (AADT) in the study area has grown 200 to 250 vehicles per year along I-10 and 50 to 100 vehicles per year along US 277. Traffic, including freight traffic, is anticipated to increase along with the growth in oil and gas production in the region. **Table 1** provides current annual average daily traffic (AADT) taken from 2019 traffic counts and traffic projections anticipated by 2050 and includes the potential improvement of the Ports-to-Plains Corridor as an upgrade to an interstate.

*Table 1. 2019 and 2050 AADT for the Study Area*

Location	2019 Existing AADT (vehicles)	2050 Projected AADT (vehicles)
US 277 north of Sonora	2,600 to 3,100	4,150
US 277 south of Sonora	1,800 to 3,300	5,800
I-10 near Sonora	12,200 to 15,000	19,100 to 22,750
US 277/LP 467 within the city of Sonora	3,200 to 8,600	4,750 to 11,700

Source: Traffic Count Program conducted for this study in May 2019 and TxDOT Historic Count Trends and Texas Statewide Traffic Model (SAM)

More information from the existing traffic conditions analysis is provided in the “US 277 Sonora Safety Route Study Existing Traffic Conditions Report” document (TxDOT, July 2020).

## 4.2 Projected Traffic

The TxDOT Team’s traffic engineers analyzed future traffic conditions for the study area. Data sources for the traffic forecasting process included the 2019 traffic count program used for the existing traffic conditions analysis, growth trends from historic TxDOT counts, and TxDOT’s Statewide

Analysis Model (SAM), which is the travel demand forecasting model for Texas. The current SAM is Version 4, which provides a 2015 base year, and forecasts for 2025, 2035, 2045, and 2050. The base year for the study is 2019 based on the 2019 traffic count program. The horizon year for the model is 2050, which is consistent with the last year covered by the SAM model.

According to TxDOT 2017 vehicle classification counts, truck percentages along US 277 and I-10 were 13.3 and 41.5 percent, respectively with I-10 having the largest percentage of truck traffic within the study area. From 2013 to 2017, truck percentages along US 277 and I-10 increased by 76.4 and 15.1 percent, respectively. As oil and gas production along with overall traffic projections are anticipated to increase, freight traffic is also anticipated to increase. As freight traffic increases, congestion currently exhibited due to trucks traversing through Sonora and encountering passenger vehicles, traffic lights, and driveways are anticipated to also increase, leading to greater congestion challenges.

Forecasted traffic was also analyzed for each of the advancing alternatives. More information on the analysis can be found in the “US 277 Sonora Safety Route Study Future Traffic and Forecasted Conditions Report” document (TxDOT, August 2020).

### 4.3 Safety Analysis

The TxDOT Team’s transportation analysts reviewed crash data for a five-year period (2014 to 2018) to determine patterns or crash hot spots within the study area. **Table 2** provides the crash rates and severity for three major routes in the study area, I-10, US 277 and LP467.

*Table 2. Five-Year Crash History by Severity of US 277, I-10, and LP 467 from 2014 to 2018*

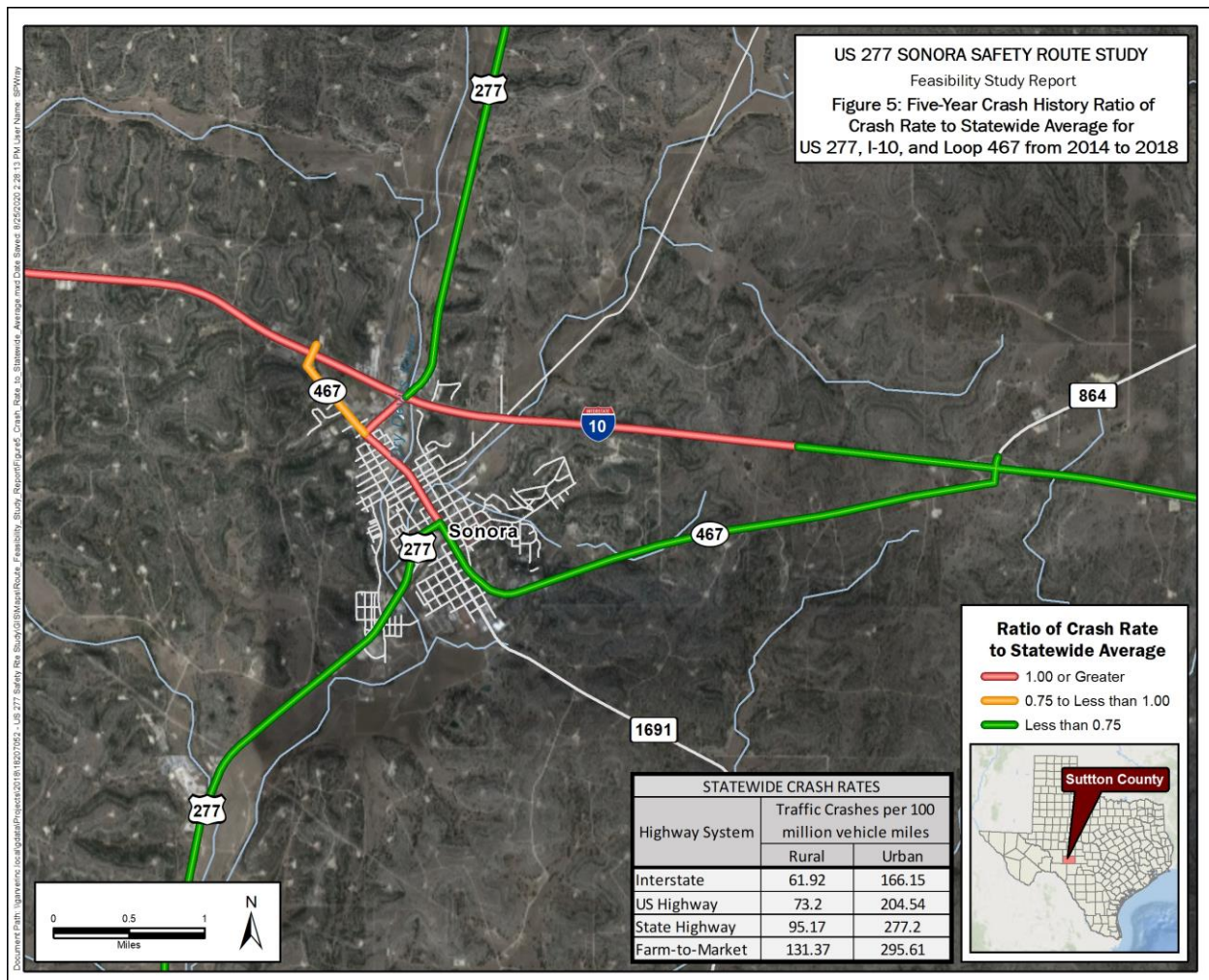
Year	Number of Crashes by Crash Severity Type					
	Property Damage Only	Non-Incapacitating Injury	Possible Injury	Suspected Serious Injury	Fatality	Total
2014	15	2	3	3	0	23
2015	16	2	3	1	1	23
2016	14	3	2	0	0	19
2017	6	2	3	0	1	12
2018	11	3	0	0	0	14
Total	62	12	11	4	2	91

Source: TxDOT Crash Records Information System



Of the 91 crashes that occurred within the five-year period, approximately 43 percent were along US 277. **Figure 5** provides a comparison of the crash rates within the study area to the statewide average crash rates in the five-year period and better illustrates the number of crashes along US 277 in comparison to the rest of the study area.

Average statewide rural crash rates for Interstate, US and state highways were 61.92, 73.24 and 95.17 crashes per 100 million vehicle miles travelled, respectively. TxDOT also categorizes crash rates by the type of roadway cross section. Average statewide rural crash rates for 2-lane undivided and 4 or more lanes divided highways are 103.78 and 64.77 crashes per 100 million vehicle miles travelled (MVMT), respectively. The rate for a four-lane undivided urban highway, similar to much of US 277 in Sonora, is 366.97 crashes per 100 MVMT. Road segments with crash rates less than 75 percent of the statewide average are considered normal and are shown in green. Segments near the statewide average (between 75 and 100 percent of the statewide average) are in yellow.



**Figure 5** shows that the crash rate on US 277 within Sonora is not only significantly higher than the statewide average, but it is also significantly higher than the northern and southern segments of US 277. Segments that exceed the statewide average are shown in red. The higher crash rates within Sonora are in part due to existing roadway conditions including many intersections and driveways with turning radii that are too tight for trucks and particularly oversize and overweight trucks. I-10, within and surrounding Sonora also exhibit high crash rates compared to the statewide average, which could be a result of congestion issues both on I-10 and from backups on ramps along US 277. Crashes and conflicts in the study area are worsened by freight and passenger vehicle mix. Trucks with oversized loads or carrying hazardous freight traversing US 277 start and stop at frequently spaced intersections and driveways. These travel movements increase the opportunity for conflict with passenger vehicles.

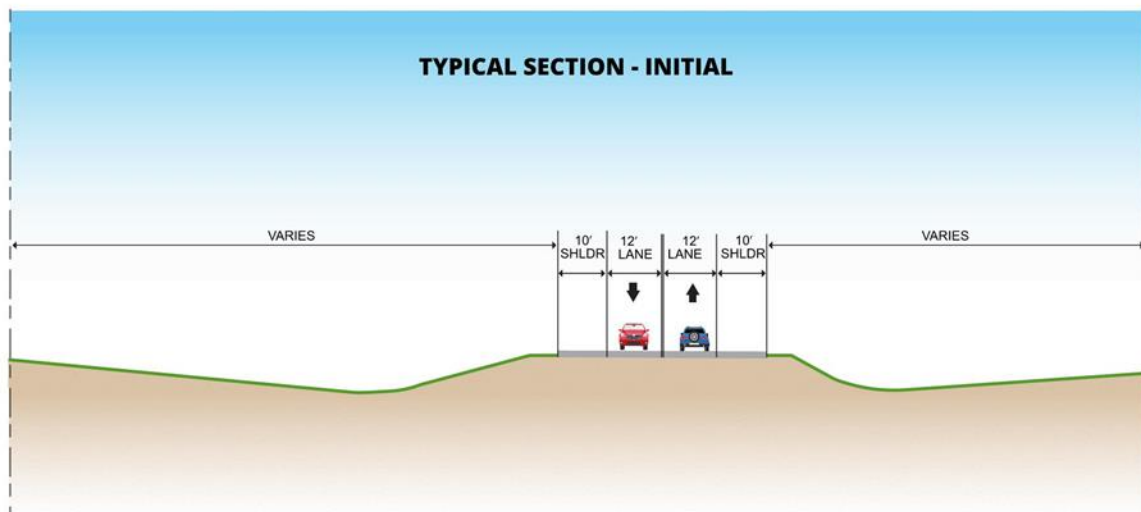
## 5. Design Criteria

The TxDOT Team's design engineers determined the design criteria for the US 277 Sonora Safety Route and prepared a Design Summary Report. The design engineers developed a roadway typical section to provide a baseline for right-of-way need and future more detailed design of the project. The typical section included a rural, four-lane divided highway that does not preclude upgrading to an interstate facility in the future. The design engineers also developed a two-lane rural typical section with 10-foot wide shoulders for the project to be implemented in phases with the initial project phase consisting of the construction of a two-lane rural roadway and the ultimate project phase including construction of a four-lane divided highway with frontage roads. **Figure 6** shows the initial typical section and **Figure 7** shows the ultimate typical section for the US 277 Sonora Safety Route Study.

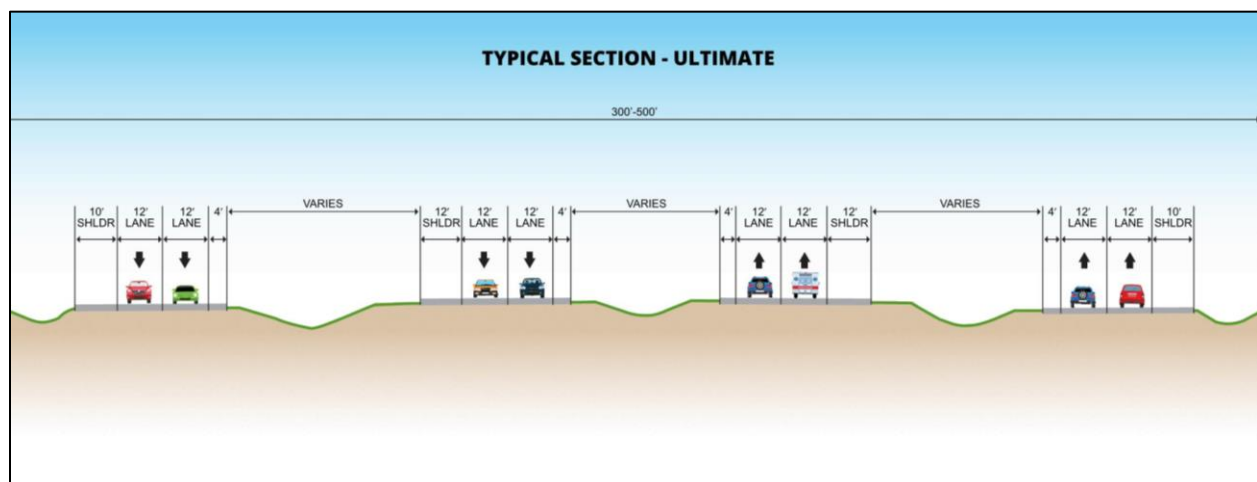
For purposes of identifying potential routes, it was assumed that the proposed safety route alternatives would tie-in to US 277 north and south of the City of Sonora. Other major design assumptions include:

- Two main lanes in each direction (ultimate),
- Frontage roads,
- Access controlled,
- 80 mile per hour (mph) main lane design speed,
- Overpass vertical clearance not less than 18'-6",
- Interchanges for access to US 277 and I-10, and
- Typical 350' right-of-way width.





*Figure 6. US 277 Sonora Safety Route Study Initial Two-Lane Rural Typical Section*



*Figure 7. US 277 Sonora Safety Route Study Ultimate Four-Lane Rural Typical Section*

## 6. No Build Alternative

A No Build Alternative was evaluated in this feasibility study for comparison purposes. The No Build Alternative assumes currently planned and programmed projects in the TxDOT Statewide Improvement Program (STIP) and Unified Transportation Program (UTP) are constructed. The No Build Alternative would not meet the purpose and need of the project of enhancing the mobility and improving safety on US 277 through the City of Sonora and Sutton County.

## 7. Alternatives Development and Screening

This feasibility study used a planning level, two-phased approach to develop and evaluate feasible route alternatives. Preliminary Alternatives were developed, followed by a Phase I Screening. From the Phase I Screening, Advancing Alternatives were selected to move forward into a Phase II Screening. This section describes the alternatives development and screening process the TxDOT Team used.

### 7.1 *Preliminary Alternatives*

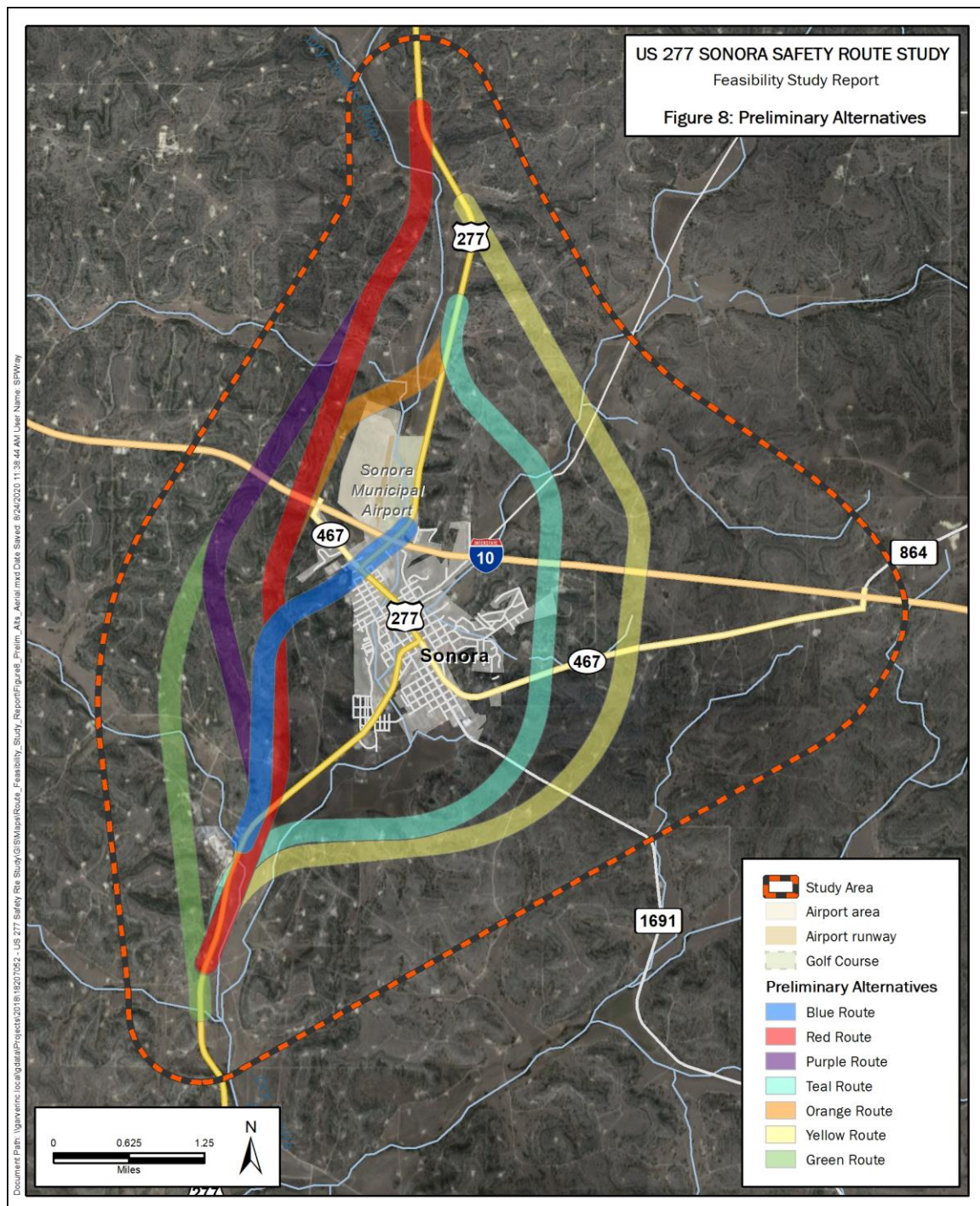
Following the July 18, 2019 public meeting, the TxDOT Team developed preliminary alternatives for the US 277 Sonora Safety Route Study. The TxDOT Team considered the project purpose and need, design criteria, and environmental constraints in developing and evaluating the build alternatives. Additionally, input provided from the stakeholder and public meetings was also considered such as:

- maintaining potential future interstate compatibility,
- avoiding oil and natural gas wells within the study area,
- preserving the gas station on the east side of Sonora and its economic impact, and
- considering corridor placement in relation to downtown Sonora.

The TxDOT Team performed location studies using topographic and geographic features data obtained from GIS, as well as terrain, or contour, data to help develop locations of the preliminary alternatives. These features were converted to Microstation v8i/Geopak and were relatively accurate up to two feet; terrain data was relatively less accurate at five-foot intervals. Right-of-way linework was also downloaded from the TxDOT website and used in the location studies. This level of accuracy is common for determining the feasibility in these types of rural areas and was sufficient for the development of alternatives.

The horizontal geometries for each of the alternatives were designed to meet 75 miles per hour (mph) for a four-lane divided highway with frontage roads. Due to the hilly terrain, conceptual level vertical geometry was developed to also meet 75 mph. Profile grades were visually developed to balance cut and fills, but additional design elements considerations and calculations will not occur until the schematic phase of design.

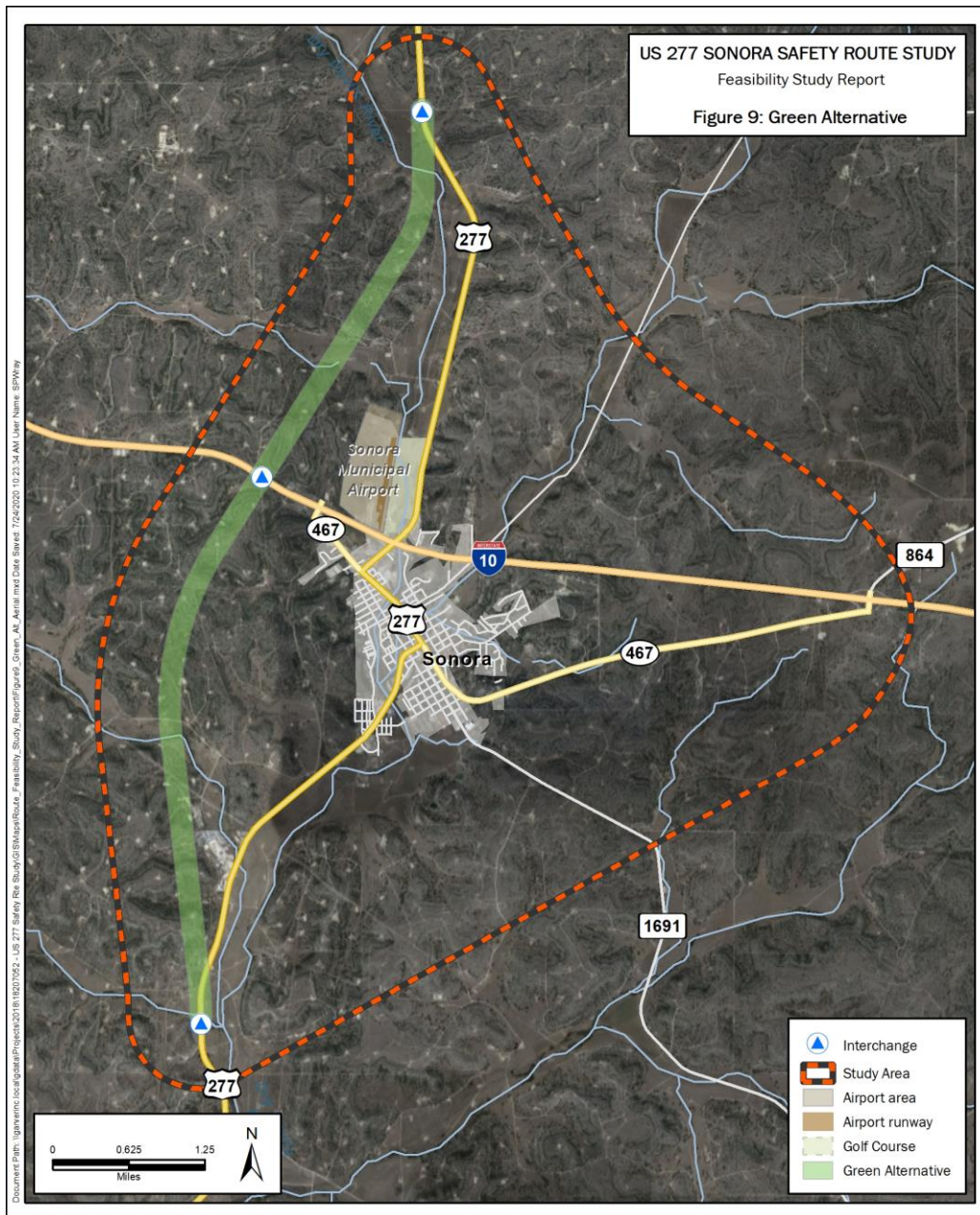
**Figure 8** includes a map showing the seven preliminary alternatives. Following the figure is a description and a map of each of the preliminary alternatives.





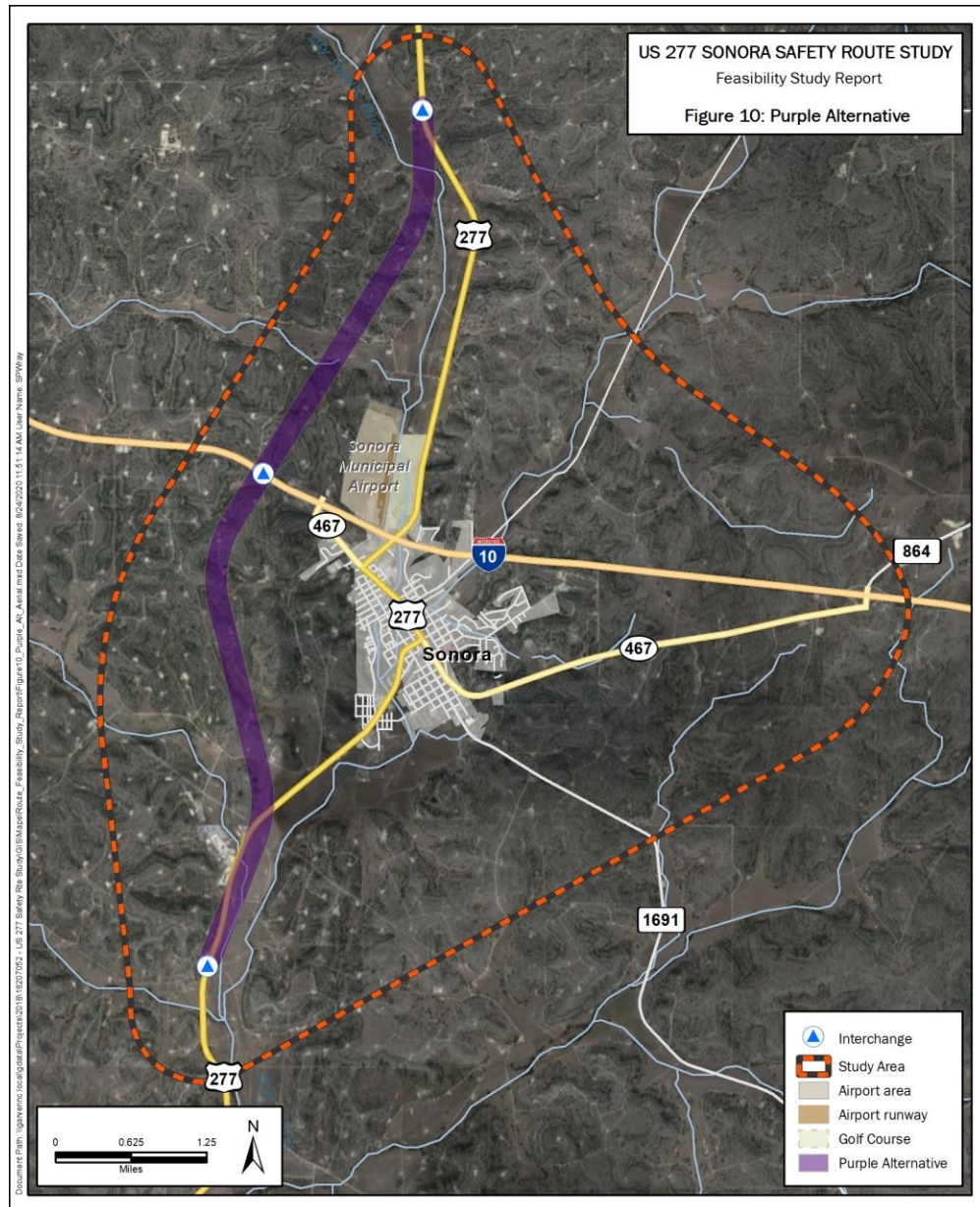
### 7.2.1 Green Alternative Description

The Green Alternative is approximately 8.1 miles long and starts the farthest south of all the alternatives. It begins at US 277 south of Sonora and travels north of the west side of Sonora and ends at US 277 north of Sonora. One new interchange would be required at I-10 (in the initial phase) and it would require two new interchanges, one at US 277 south of Sonora and one at US 277 north of Sonora (in the ultimate phase). **Figure 9** shows the Green Alternative.



### 7.2.2 Purple Alternative Description

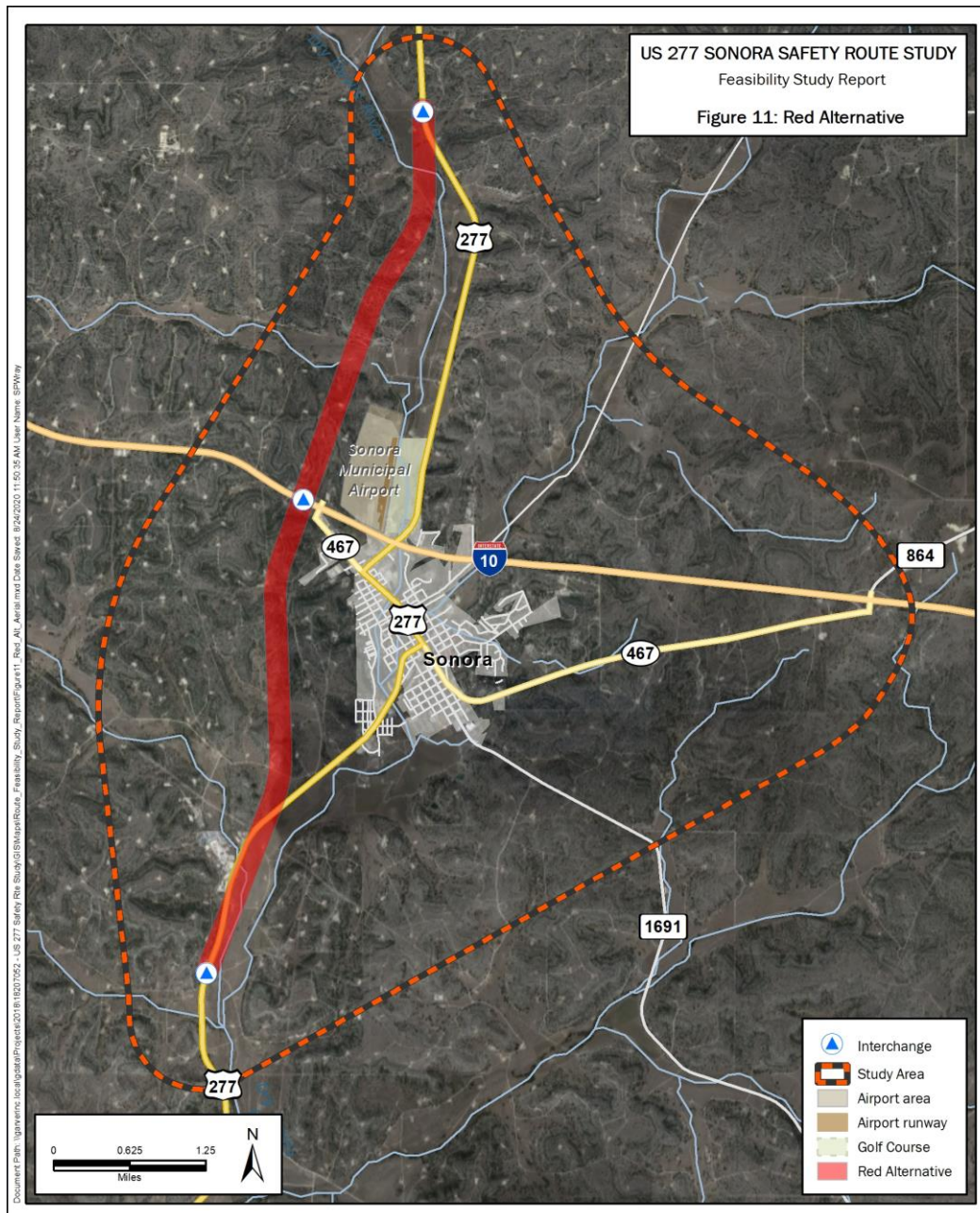
The Purple Alternative is approximately 7.7 miles long. It begins at US 277 south of Sonora and extends north on the west side of Sonora. South of I-10, the Purple Alternative follows the same alignment north as the Green Alternative. One new interchange would be required at I-10 (in the initial phase) and it would require two new interchanges, one at US 277 south of Sonora and one at US 277 north of Sonora (in the ultimate phase). **Figure 10** shows the Purple Alternative.





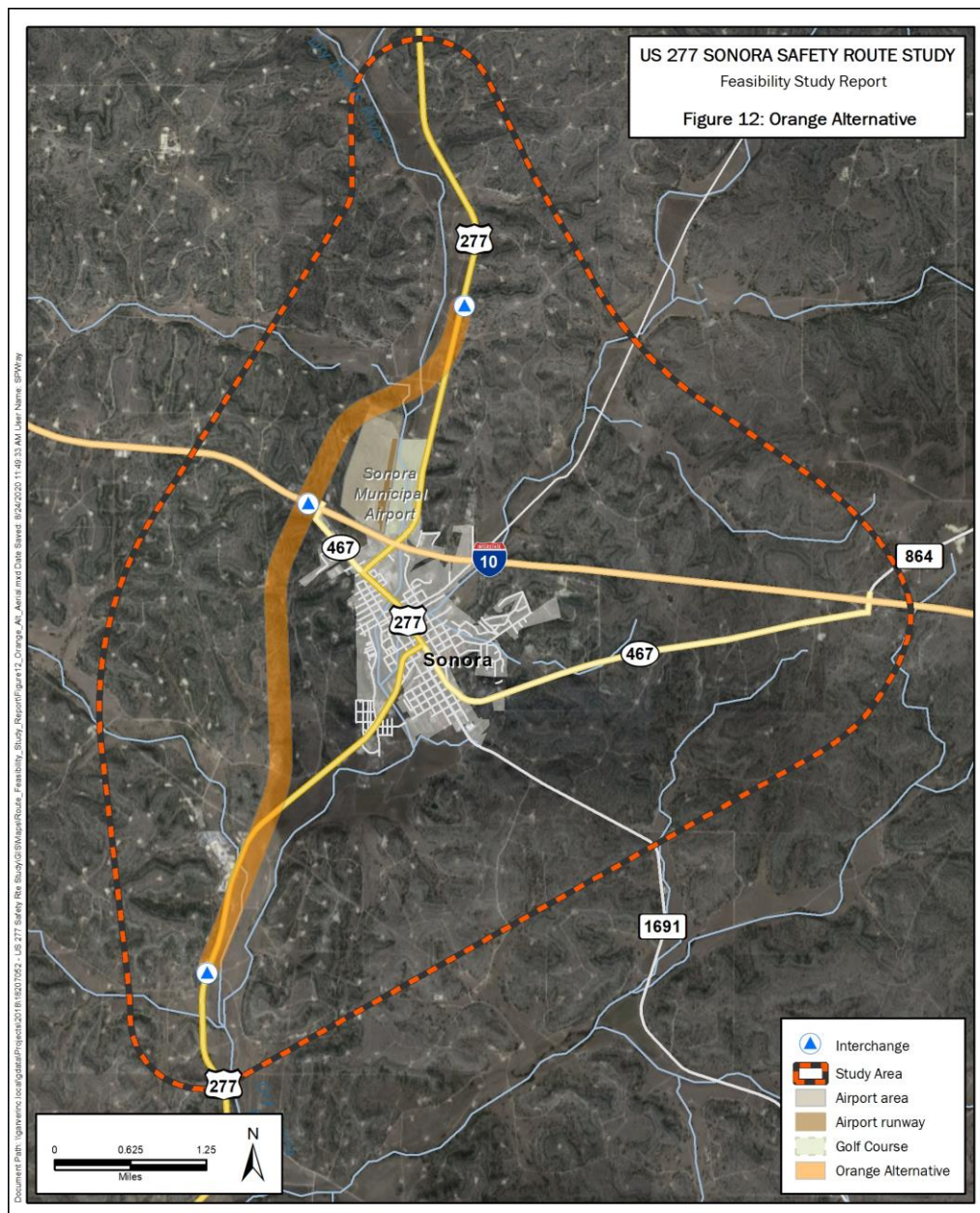
### 7.2.3 Red Alternative Description

The Red Alternative is approximately 7.5 miles long. It follows the same path as the Orange Alternative, beginning at US 277 south of Sonora and extending west of Sonora. However, when it crosses I-10, it extends farther west of the airport, and connects back to US 277. This alternative utilizes an existing interchange at I-10 (in the initial phase) and it would require two new interchanges, one at US 277 south of Sonora and one at US 277 north of Sonora (in the ultimate phase). **Figure 11** shows the Red Alternative.



### 7.2.4 Orange Alternative Description

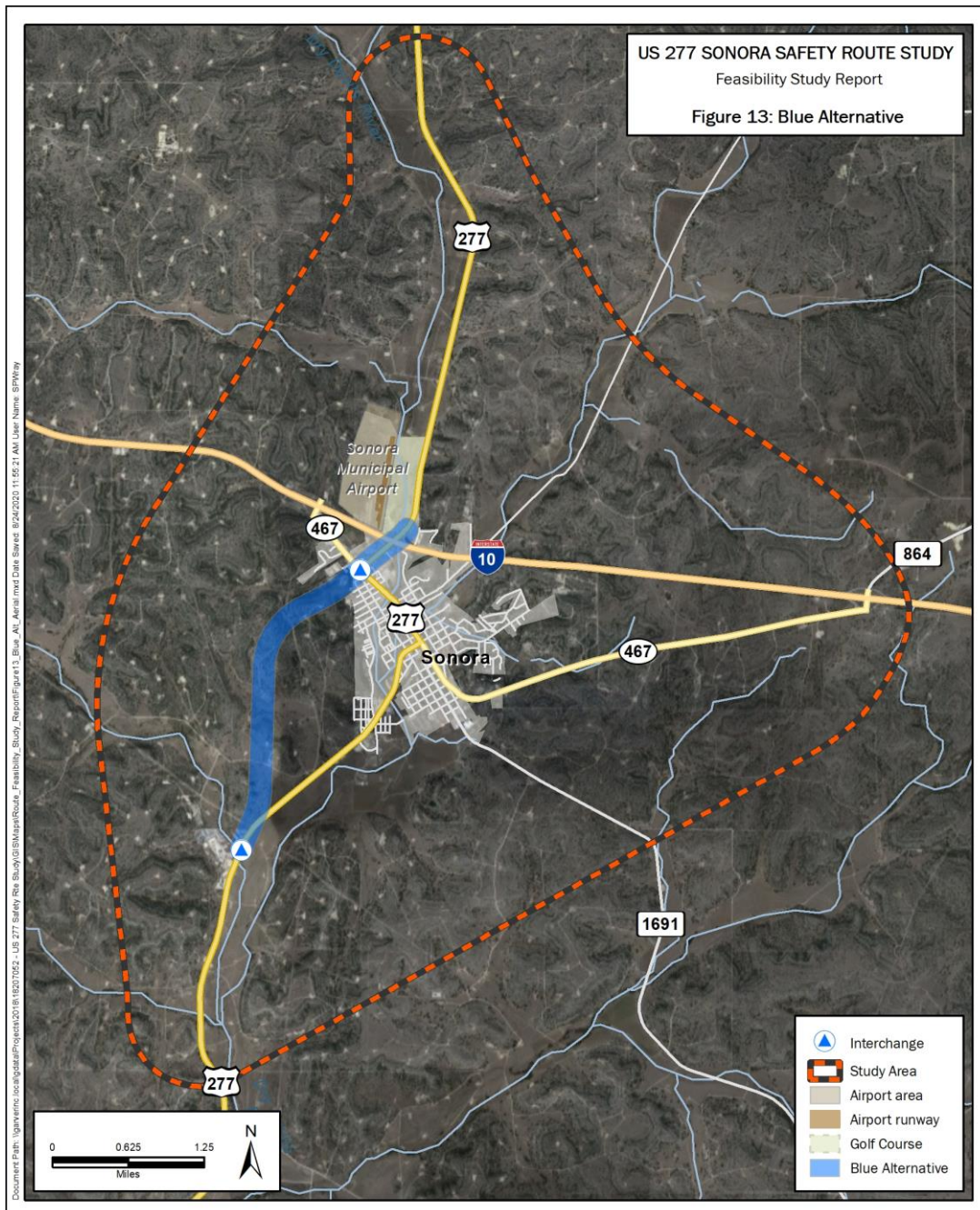
The Orange Alternative is approximately 6.3 miles long. It begins at US 277 south of Sonora (the starting point is farther north than the Green and Purple Alternatives) and north on the west side of Sonora and stays closer to downtown Sonora than the Purple Alternative. The Orange Alternative connects back to US 277 north of the Sonora Municipal Airport. This alternative uses an existing interchange at I-10 (in the initial phase) and it would require two new interchanges, one at US 277 south of Sonora and one at US 277 north of Sonora (in the ultimate phase). **Figure 12** shows the Orange Alternative.





### 7.2.5 Blue Alternative Description

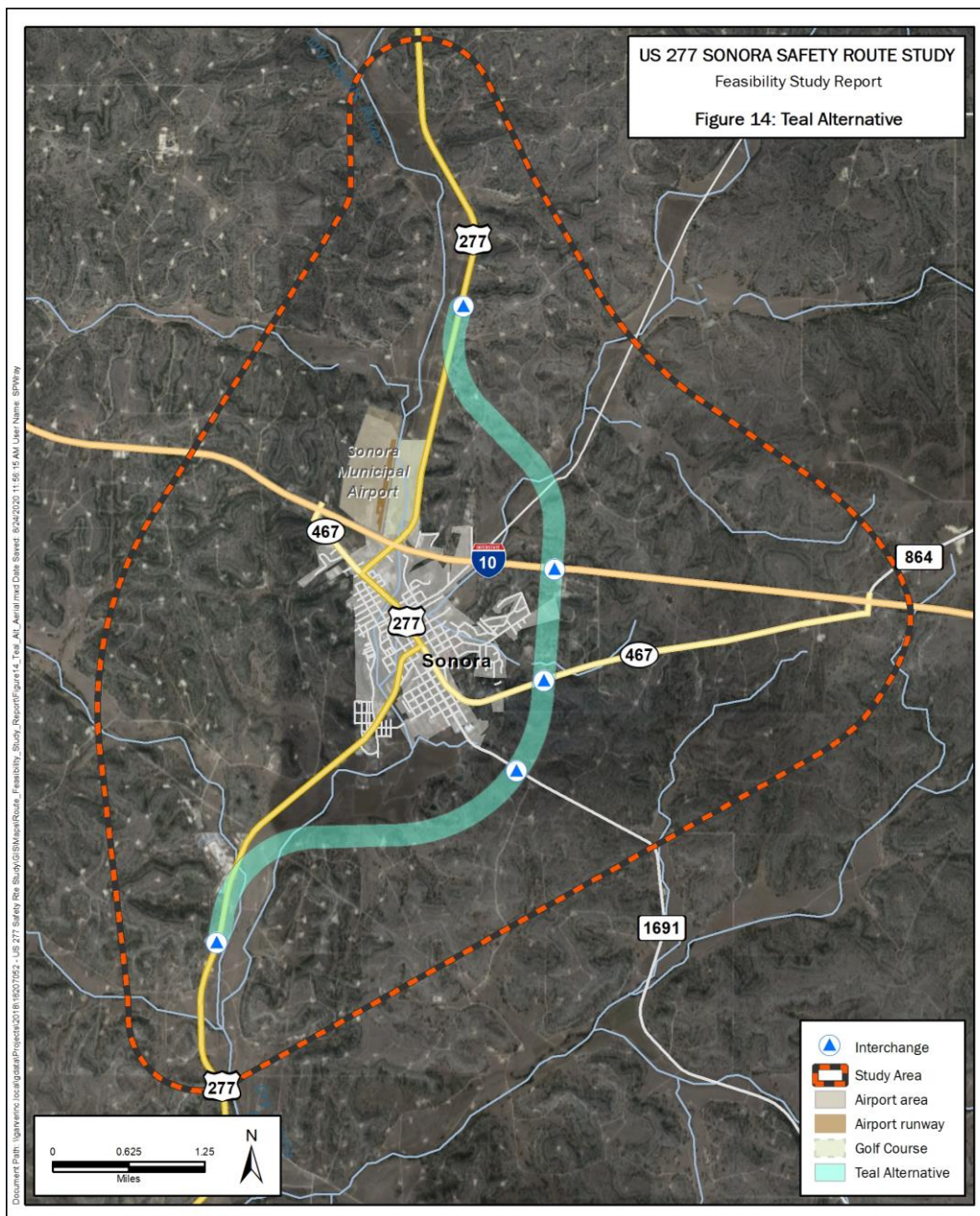
The Blue Alternative is approximately 2.8 miles long and is the shortest of the preliminary alternatives. It begins at US 277 south of Sonora. It extends west of Sonora, staying close to downtown. It crosses through downtown Sonora just south of I-10 at US 277 and terminates just north of I-10. It would require two new interchanges, one at US 277 south of Sonora and one at LP 467 (in the ultimate phase). **Figure 13** shows the Blue Alternative.





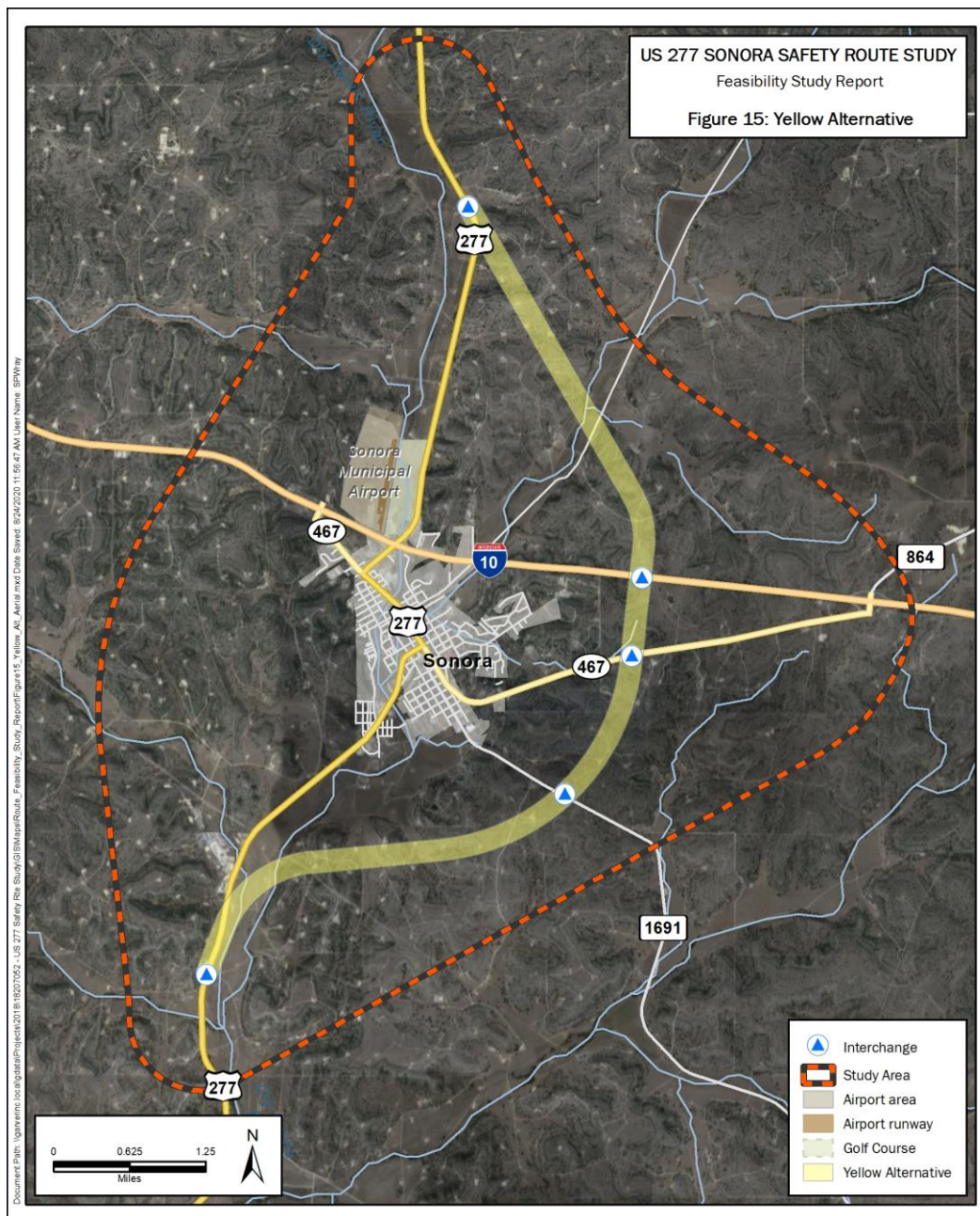
### 7.2.6 Teal Alternative Description

The Teal Alternative is approximately 7.2 miles long. It begins at US 277 south of Sonora at the same location of the Red and Orange Alternatives. It extends north on the east side of Sonora, staying close to downtown. It ends at US 277 north of Sonora. It would require a new interchange at I-10 (in the initial phase) and it would require four new interchanges, including one at LP 467, one at Ranch Road 1691, one at US 277 south of Sonora and one at US 277 north of Sonora (in the ultimate phase). **Figure 14** shows the Teal Alternative.



### 7.2.7 Yellow Alternative Description

The Yellow Alternative is approximately 9 miles long and is the farthest alternative from downtown Sonora. It begins at US 277 south of Sonora in the same location that the Orange, Red, and Teal Alternatives start and extends north on the east side of Sonora. It would require a new interchange at I-10 (initial phase) and it would require four new interchanges, including one at LP 467, one at Ranch Road 1691, one at US 277 south of Sonora and one at US 277 north of Sonora (ultimate phase). **Figure 15** shows the Yellow Alternative.





### 7.2.8 Phase I Alternatives Screening

The Phase I Screening evaluated the preliminary alternatives against criteria based on proximity of the alternative from sensitive features that could pose fatal flaws. The TxDOT Team developed a matrix containing the data for each screening criterion to compare the alternatives. The criteria included in the Phase I Screening Matrix is listed below:

- 100-year floodplain (acres)
- Dams (distance to nearest dam in miles)
- Archaeological Sites (distance to nearest archaeological site in miles)
- Golf Course (distance in miles)
- Within Airport Runway Protection Zone (yes/no)
- Limits Airport Expansion Opportunities (yes/no)
- Proximity to downtown Sonora (Sonora can/cannot be seen from this alternative)

The preliminary alternatives and a Phase I Alternatives Screening Matrix were presented to the public at the second public meeting on October 22, 2019. The public was asked on the comment form to choose the preliminary alternative they preferred. The feedback gathered from the public during the comment period was then included in the Phase I Screening Matrix. **Table 3** includes the Phase I Screening Matrix which shows the results of the screening for each preliminary alternative and how many stakeholders indicated they preferred that alternative.



Table 3. Phase I Screening Matrix

CRITERIA	ALTERNATIVES						
	Green (8.1 miles)	Purple (7.7 miles)	Red (7.5 miles)	Orange (6.3 miles)	Blue (2.8 miles)	Teal (7.2 miles)	Yellow (9.0 miles)
100-year floodplain (acres)	6.4	23.6	48.0	91.1	8.7	46.8	6.3
Dams (distance to nearest dam – miles)	0.9	0.1	0.1	0.1	1.4	0.1	0.1
Archaeological Site (distance to nearest archaeological site – miles)	0.2	0	0	0	0	0	0
Golf Course (distance – miles)	0.8	0.8	0.5	0.3	0	0.4	1.2
Within Airport Runway Protection Zone (yes/no)	No	No	No	Yes	No	No	No
Limits Airport Expansion Opportunities (yes/no)	No	No	No	Yes	No	No	No
Proximity to downtown Sonora (Sonora can/cannot be seen from this alternative)	Can	Can	Can	Can	Can	Can	Cannot
<b>Stakeholder Involvement</b>							
Stakeholder Preference	17	29	7	3	1	6	4

The Green Alternative crosses upstream of the existing dam. It avoids floodplain impacts at Dry Devil's River and avoids potential impacts to an archaeological site. The Green Alternative was the second most preferred alternative by the stakeholders. TxDOT carried the Green Alternative forward for further study in Phase II because it had minimal impacts to the criteria considered in the Phase I Screening and was the second most preferred by the stakeholders.

The Purple Alternative has potential floodplain impacts and potential impacts to an archaeological site. Most comments received from the public indicated a preference for the Purple Alternative. TxDOT carried the Purple Alternative forward for further study in Phase II because it had minimal impacts to the criteria considered in the Phase I Screening and was preferred by the stakeholders.

The Red Alternative avoids the Sonora Municipal Airport and crosses upstream of the existing dam. There are potential floodplain impacts and potential impacts to an archaeological site. TxDOT carried the Red Alternative forward for further study in Phase II because it had minimal impacts to the criteria considered in the Phase I Screening and was the third most preferred by the stakeholders.

The Orange Alternative may limit future expansion at the Sonora Municipal Airport due to its proximity to the airport. It also has potential floodplain impacts and potential impacts to an archaeological site. The proximity of the Orange Alternative to the airport limits airport expansion opportunities. TxDOT eliminated the Orange Alternative from further study.

The Blue Alternative may limit the potential for developing this option as a future interstate due to its location in downtown Sonora and anticipated impacts to businesses, as well as requiring the use of existing US 277 north of I-10 which does not meet interstate standards. It also has potential floodplain impacts and potential impacts to an archaeological site and a golf course. Based on public feedback, the Blue Alternative is the least preferred. TxDOT eliminated the Blue Alternative from further study since it had potential impacts to floodplains, an archaeological site and golf course, limited future interstate potential and was the least preferred alternative by the stakeholders.

The Teal Alternative would minimize floodplain impacts as compared to other alternatives. TxDOT modified the Teal Alternative by using the path of the southern portion of the Yellow Alternative to minimize potential wetland impacts. A more detailed explanation of why this decision was made is provided below.

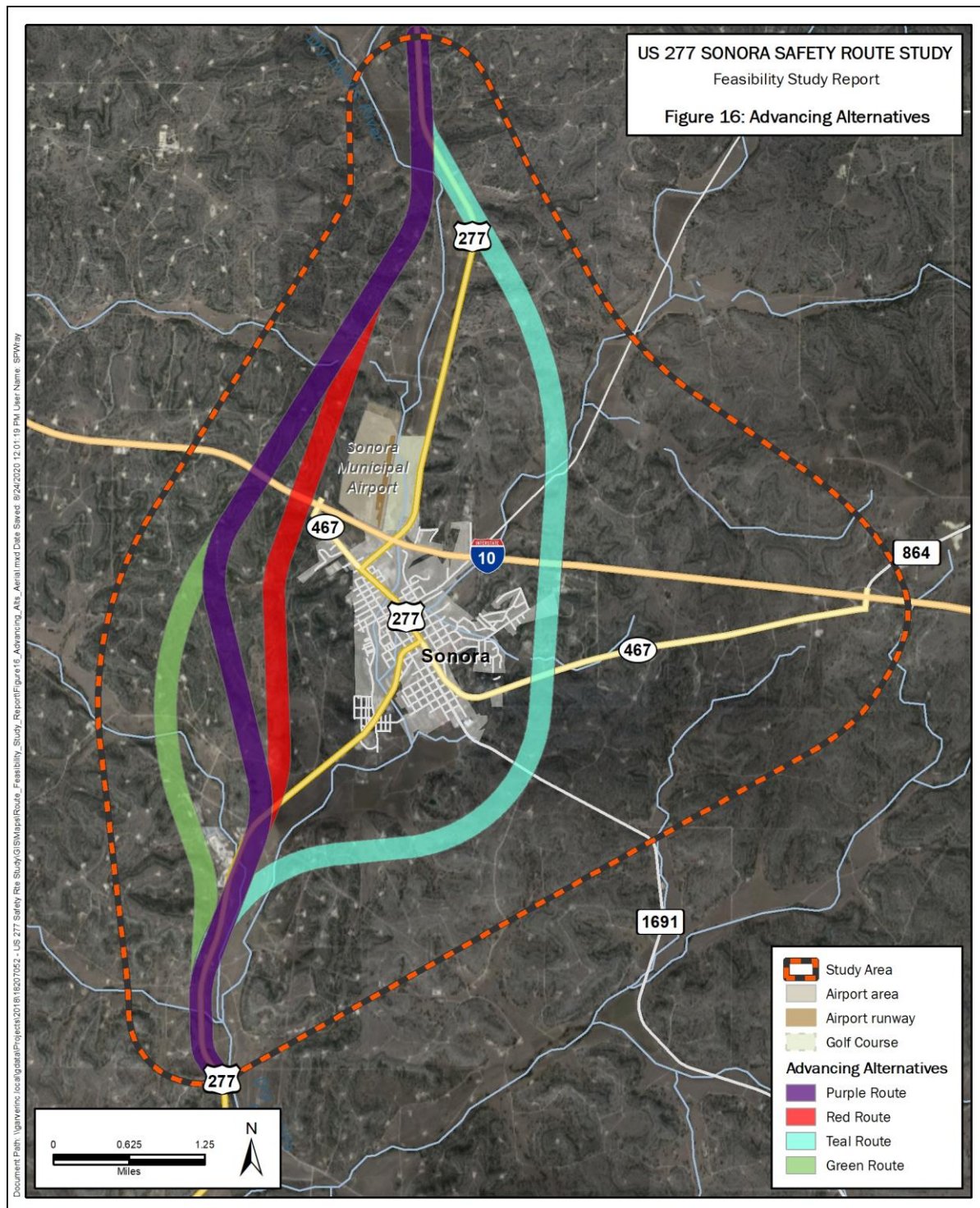
The Yellow Alternative minimizes floodplain impacts but is farther away from downtown Sonora than other alternatives. TxDOT eliminated the Yellow Alternative from further study because the northern section was too far from downtown Sonora. However, TxDOT modified the Teal Alternative by combining the southern section of the Yellow Alternative with the Teal Alternative. Further explanation of why this decision was made is provided in the paragraph below.

After evaluating the floodplain impacts for the Teal and Yellow Alternatives, the TxDOT Team determined that to have a feasible eastern alternative, the southern end of the Teal Alternative would need to slightly shift. Therefore, following the Phase I Screening process, TxDOT combined the Yellow and Teal Alternatives by using the northern end of the Yellow Alternative and the southern end of the Teal Alternative. This modified Teal Alternative advanced to the Phase II Screening.

TxDOT decided to advance the Green, Purple, Red and Teal (modified) Alternatives for further study and eliminated the Orange, Blue and Yellow Alternatives for the reasons described above. The Advancing Alternatives are shown in **Figure 16**. The TxDOT Team developed a Phase II Matrix to



screen the Advancing Alternatives to identify a Recommended Alternative to advance into environmental and design studies. The Phase II Screening process and results are described below.



## 7.2 Phase II Screening

The Phase II screening process involved developing criteria that could be quantitatively measured and would likely provide a distinction between the Advancing Alternatives for comparison. The TxDOT Team developed planning-level cost estimates for right-of-way and construction for each Advancing Alternative. The Phase II screening criteria included safety, mobility, cost, and environmental considerations. **Table 4** provides the Phase II Alternatives Screening Matrix.

Table 4. Phase II Alternatives Screening Matrix

CRITERIA	ALTERNATIVES			
	Green (8.1 miles)	Purple (7.7 miles)	Red (7.5 miles)	Teal (7.2 miles)
<b>Safety</b>				
Improves substandard/outdated infrastructure (yes/no)	Yes	Yes	Yes	Yes
Improves access of emergency services to emergency facilities (yes/no)	Yes	Yes	Yes	Yes
Improves access of motorists to emergency services (yes/no)	Yes	Yes	Yes	Yes
Reduces crashes (estimated 2050 crashes per year)	-23	-23	-20	-17
<b>Mobility</b>				
Reduces oversize traffic through downtown Sonora (yes/no)	Yes	Yes	Yes	Yes
Travel time savings (minutes)	6.6	6.6	6.8	5.5
Interstate compatibility (yes/ no)	Yes	Yes	Yes	Yes
Modifications to local connectivity and access (yes/no)	No	No	Yes	No
<b>Cost</b> (All costs are for planning purposes only. They are escalated to 2021 dollars and are not separated by funding source. Costs shown are not a guarantee that all project costs will be funded by TxDOT.)				
Right-of-way cost (dollars)	500,000	451,000	446,000	563,000
Construction Cost (dollars)	510,400,000	451,900,000	476,300,000	610,800,000
<b>Environmental</b> (Within a 1,000-foot corridor, based on the typical section, an alignment would only require 400 feet of right-of-way with the 1,000-foot corridor.)				
Streams (linear feet)	20,664	19,491	18,565	22,423
Oil and gas wells (counts)	37	31	28	31
Pipeline crossings (feet)	87,187	78,293	80,301	75,681
Residences (count)	0	0	1	4
Businesses (count)	1	2	3	1
Environmental Justice populations (within one mile)	Yes	Yes	Yes	Yes
Parks and Recreational areas	0	0	0	0
<b>Stakeholder Involvement</b>				
Stakeholder Preference ranking	17	29	7	6

The TxDOT Team further developed the estimated earthwork, construction limits, and right-of-way information for the Advancing Alternatives to determine quantities for planning-level cost estimates. Drainage areas, and drainage structure sizes, were developed using the 5-foot contours from GIS. Bridges were developed using standard crossing lengths and widths. Due to the number of alternatives evaluated, additional design such as the interchanges at I-10 and the north and south tie-ins, were not included in this phase. Additional information on design considerations and development of cost estimates can be found in US 277 Sonora Safety Route Study Draft Preliminary Cost Estimates Report (TxDOT, August 2020).

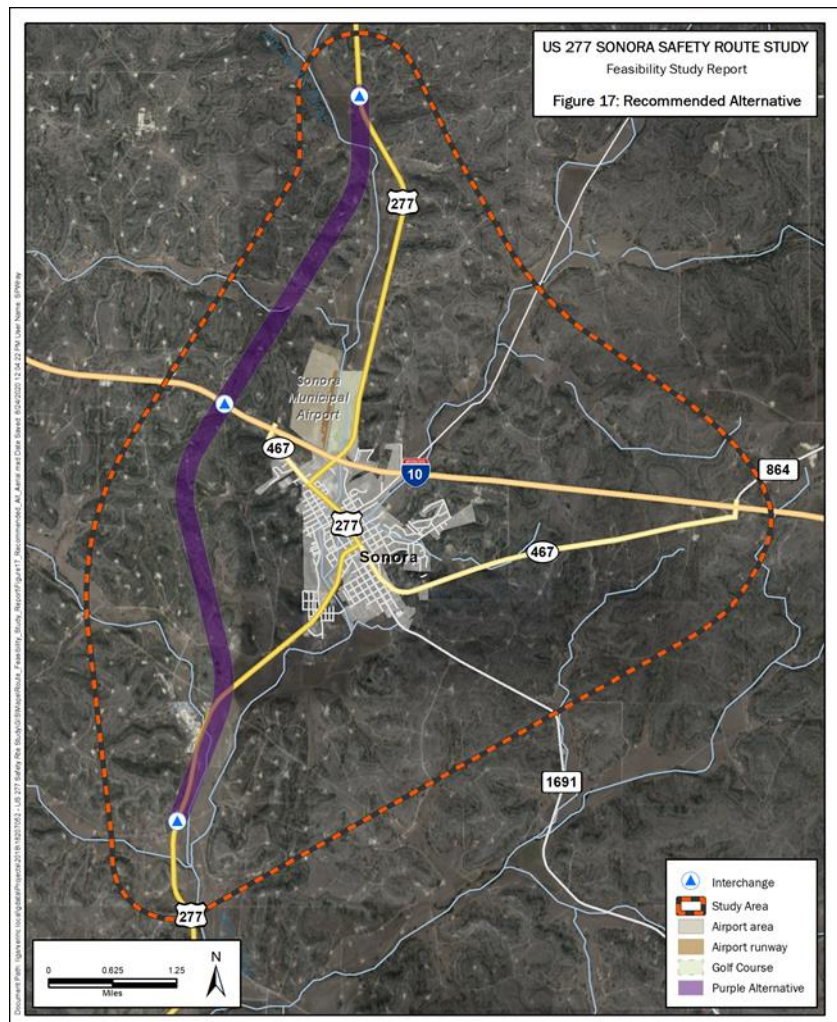


In Spring 2020, TxDOT held a third public meeting on the US 277 Sonora Safety Route Study. The purpose of the public meeting was to present the Phase II Screening Matrix and to get public input on the Recommended Alternative. Due to the COVID-19 virus pandemic and stay-at-home orders, the meeting was held as a Virtual Public Meeting hosted online on TxDOT's website. The online public meeting was accessible from April 30 to May 15, 2020. The public comments received during the comment period were positive toward the Purple Alternative.

### 7.3 Recommended Alternative

After applying the Phase II Screening Matrix to the Advancing Alternatives and receiving the public's input on the Recommended Alternative, **the Purple Alternative was chosen by TxDOT as the Recommended Alternative**. TxDOT determined the Purple Alternative best met the project Purpose and Need, the Phase I and II Screening criteria, and had the most stakeholder support. As a result, TxDOT recommends moving the Purple Alternative forward for further project development, environmental analysis in the National Environmental Policy Act (NEPA) process, and design.

The US 277 Sonora Safety Route Study Recommended Purple Alternative is shown in **Figure 17**. Additional information regarding the alternatives analysis is provided in the US 277 Sonora Safety Route Study Alternatives Analysis Report (TxDOT, June 2020).





Once TxDOT selected the Recommended Alternative, the TxDOT Team performed additional preliminary design on the Purple Alternative, focusing on reducing or avoiding impacts, refining earthwork costs, and further design of the interchanges. Three options were considered for the US 277/I-10 interchange: a fully directional interchange, a partial cloverleaf interchange, and a partial turbine interchange. The fully directional interchange option consists of four directional ramps and four flyover ramps providing efficient free-flow operation for all movements within the interchange. The partial cloverleaf interchange option consists of four directional ramps, flyover ramps for the I-10 westbound to US 277 southbound movement and the US 277 southbound to I-10 eastbound movement, and loop ramps for the US 277 northbound to I-10 westbound movement and the I-10 eastbound to US 277 northbound movement. A collector-distributor road is also provided adjacent to US 277 for the weaving movements between the loop ramps. The partial turbine interchange option is similar to the partial cloverleaf option except that instead of fly-over ramps, large loop ramps are provided for the I-10 westbound to US 277 southbound movement and the US 277 southbound to I-10 eastbound movement.

These interchange options were then evaluated for quantitative measures such as pavement, earthwork, and major structures, as well as quantitative measures such as weaving distances, driver expectancy, frontage road continuity, and adjacent property impacts. Based on the considerations above, the recommended interchange between the proposed US 277 and I-10 was the fully directional interchange option. This interchange had better weaving distances, no loop ramps, and lesser right-of-way impacts. However, due to the following considerations, the final determination of this interchange should occur during the next phase of design:

- The need for more accurate/final land survey,
- Consideration of one-way versus two-way frontage roads,
- Consideration of elongated wind turbine blades and the design vehicle,
- Evaluation of final ramp distances and access justification, and
- Establishment of base flood elevations.

The additional design at the interchanges results in a slight modification to the footprint of the Recommended Alternative. This change is noted in **Figure 18**. Additional information on the preliminary interchange design can be found in US 277 Sonora Safety Route Study Draft Interchange Analysis Technical Report (TxDOT, August 2020).

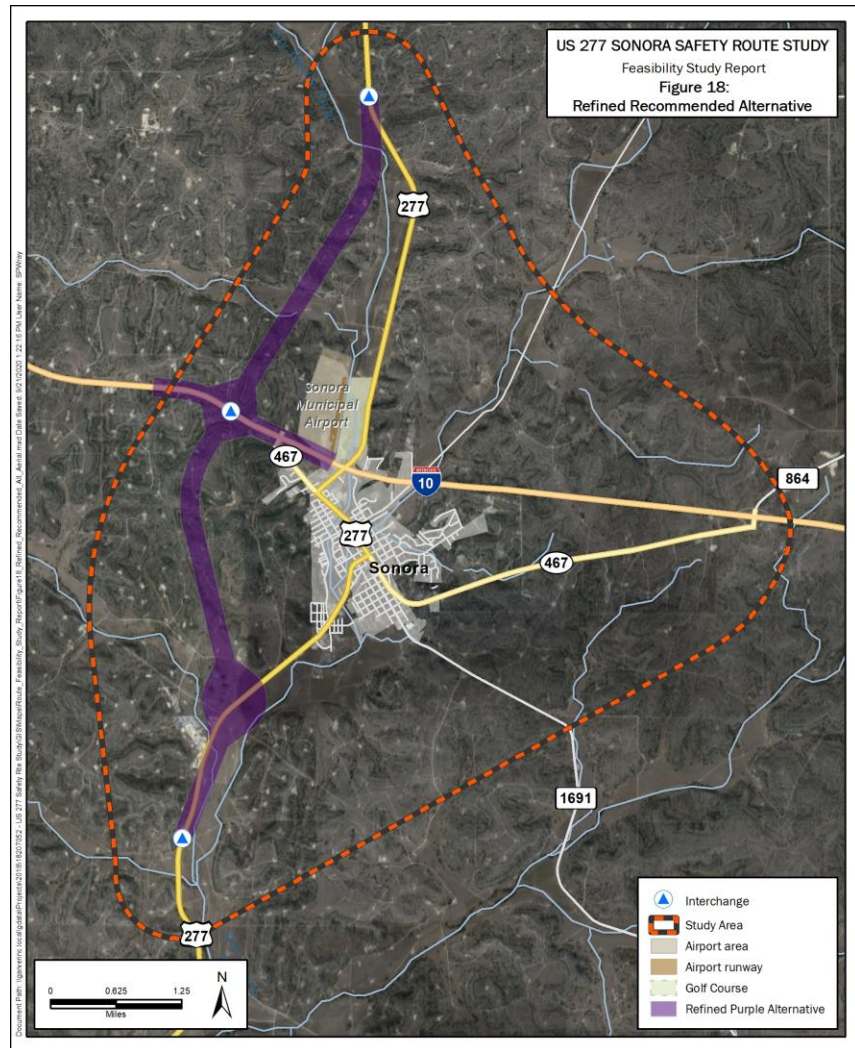
## 8. Summary of Public Outreach

One stakeholder meeting and three public meetings were held for the US 277 Sonora Safety Route Study. The meetings provided opportunities for the public to learn about and give their

input on the needs and concerns for the proposed project, as well as provide feedback on the alternatives. The first two public meetings were held at the Sutton County Civic Center in Sonora. The meetings consisted of an open house format with a formal presentation. The third meeting was held virtually due stay-at-home orders during the COVID-19 pandemic.

### 8.1 Stakeholder Meeting

A stakeholder meeting was held on June 24, 2019. The purpose of the meeting was to gather input from key stakeholders about the study area and any constraints the TxDOT Team should be aware of prior to the first public meeting. Stakeholders included Sutton County Judge Stephen Smith as well as a Sutton County Commissioner, City of Sonora staff, business owners, and landowners.



The meeting included a discussion about the impacts of trucks to downtown Sonora, potential impacts to business owners, and potential alternative corridors. Stakeholders were provided an initial constraints map and were asked for feedback. Stakeholders also offered to help distribute flyers about the upcoming public meeting.

## 8.2 Public Meeting #1

The first public meeting was held on July 18, 2019 at the Sutton County 4-H Civic Center in Sonora. The meeting included an open house starting at 5 p.m. with a formal presentation at 5:30 p.m. The TxDOT Team presented the study purpose and need, crash rate data, environmental constraints, and the process they would use for conducting the study. Maps were also on display and attendees could provide their input about the proposed study area boundary, potential constraints in the study area, and provide suggestions of where a future Safety Route for US 277 could be located.



Thirty-three citizens and four elected officials attended the first public meeting. TxDOT received five formal comments during the comment period. Attendees also provided their input during the meeting. Feedback received from the public at the meeting and during the comment period included:

- Maintain potential future interstate compatibility
- Expand the study area to the north
- Avoid oil and natural gas wells within the study area
- Limit the study area to the east
- Preserve the gas station on the east side of Sonora and its economic impact
- Consider corridor placement in relation to downtown Sonora

### 8.3 Public Meeting #2

The second public meeting was held on October 22, 2019 at the Sutton County 4-H Civic Center in Sonora. The meeting included an open house starting at 5 p.m. with a formal presentation at 5:30 p.m. The TxDOT Team presented historic traffic data and population forecasts. Next, the preliminary alternatives were presented along with the Phase I Screening Matrix that was used to determine which alternatives would advance. Maps of each alternative were displayed for attendees to view. The public was asked on the comment form to choose their preferred alternative.



The TxDOT Team Presenting at Public Meeting #2 on  
October 22, 2019

Thirty-five citizens and four elected officials attended the October 22, 2019 public meeting. TxDOT received 64 formal comments during the comment period. Attendees were asked to report their preference for an alternative on the comment form. Of the comments received, the majority preferred the purple alternative (29), followed by the green alternative (17). General public comments included:

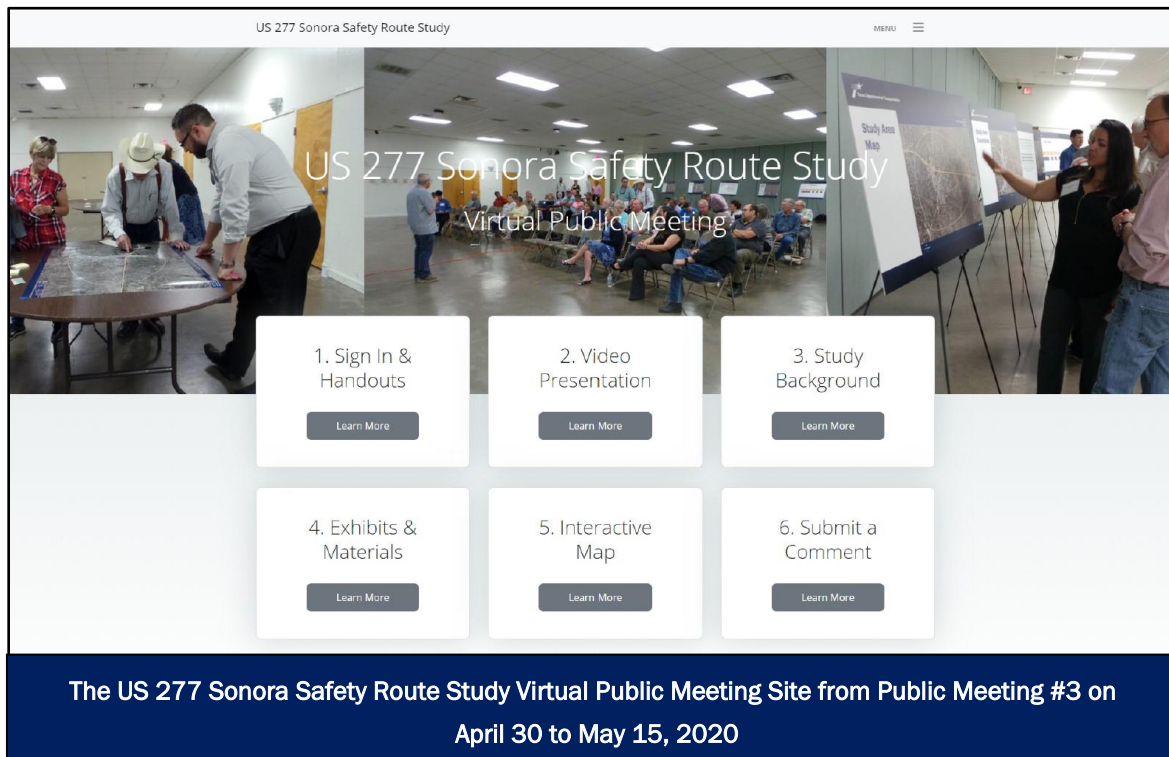
- Avoid residences
- Keep the corridor close to Sonora

### 8.4 Public Meeting #3

The third public meeting was held virtually from April 30, 2020 to May 15, 2020. The purpose of the meeting was to present the Advancing Alternatives and receive input on the Recommended Alternative. The Advancing Alternatives, Phase II Evaluation Matrix, and Recommended Alternative were presented in a virtual format with a pre-recorded presentation explaining how the TxDOT team used the Phase II Evaluation Matrix to determine the Purple Alternative as the Recommended Alternative.



A total of 89 page-views were recorded for the virtual public meeting. Eight formal comments were received. Most of the comments were in support of the Purple Alternative. One commenter wanted to know the precise location of the alignment due to their property being impacted and another commenter voiced concern for the impact to access at the Sonora Airport as it is part of the emergency services response.



## 9. Recommendations

As a result of the evaluation of potential alternatives for a US 277 Sonora Safety Route based on technical analyses, stakeholder, and public input, the TxDOT Team recommends the Purple Alternative for further project development. The Sutton County Commissioner's Court adopted a resolution on September 14, 2020, supporting the Purple Alternative as the Recommended Alternative and requesting TxDOT advance the project to the next stage of project development. A copy of the Sutton County Commissioner's Court resolution is included in Appendix A.

## 10. Next Steps

The information in this report will be used to advance the project to the next stage of project development as funding is identified. The next stage of project development includes preliminary design and environmental analysis in the NEPA process. After approval of the preliminary design schematic and environmental clearance, the project could advance to final design, letting, and construction, depending on TxDOT priorities and available funding. TxDOT anticipates the project would be implemented in phases with the initial project phase consisting of the construction of a two-lane rural roadway and the ultimate project phase would include construction of a four-lane divided highway with frontage roads.

## 11. References

US 277 Sonora Safety Route Study Existing Traffic Conditions Report. TxDOT. July 2020.

US 277 Sonora Safety Route Study Traffic Forecast and Future Conditions Report. TxDOT. August 2020.

US 277 Sonora Safety Route Study Purpose and Need. TxDOT. May 2020.

US 277 Sonora Safety Route Study Alternatives Analysis Report. TxDOT. July 2020.

US 277 Sonora Safety Route Draft Preliminary Cost Estimate Report. TxDOT. August 2020

US 277 Sonora Safety Route Study Draft Interchange Analysis Technical Report. TxDOT. August 2020

## Appendix A: Sutton County Commissioner's Court Resolution



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CB

**Whereas, the Sutton County Commissioners Court appreciates the effort of many of our citizens to express their thoughts and desires for a reliever route for Highway 277 and for those citizens who conducted countless meetings to enable planning for such a reliever route; and**

**Whereas**, the Sutton County Commissioners appreciates the most recent work of Texas Department of Transportation employees to provide the most transparent efforts to provide information on a nonstop effort to allow the citizens of Sutton County to inform themselves of the need for a safety route and specifically recognizes the tremendous efforts of Randee Shields, the Tx Dot engineer responsible for the Sonora Safety Route; and

**Whereas, the Sutton County Commissioners acknowledges the selection of one route over all the others suggested by Garver Consultants that being the “purple” route, the most western around Sonora. This selection will ensure the safety of all Sutton County as the crossroads of Sonora will become of great importance to all of America.**

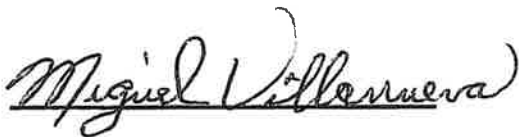
Now THEREFORE, BE IT RESOLVED BY THE COMMISSIONERS COURT OF Sutton  
COUNTY, TEXAS

Section 1 That the Sutton County Commissioners Court supports the designation of the far Western route (the purple route) as the choice to be the Sonora Safety Route and we urge the Texas Department of Transportation to support such designation.

Section 2. This resolution is to <sup>be</sup> forward to Texas Transportation Planning and Programming Division for its appropriate review before quickly sending it to Texas Transportation Commission for its full approved as the Sonora Safety Route.

Section 3. The resolution is to be in full force and effect from and after its passage and approval.

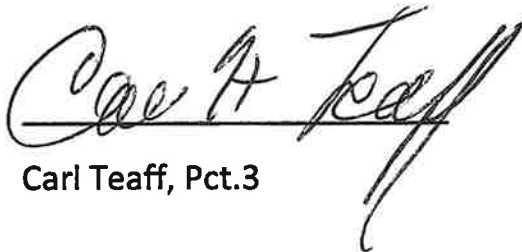
ADOPTED AND APPROVED this fourteenth day of September, 2020



Mike Villanueva, Pct. 1



Bob Brockman, Pct.2



Carl Teaff, Pct.3



Fred Perez, Pct. 4



Steve Smith Sutton County Judge

ATTEST



Clerk of Sutton County