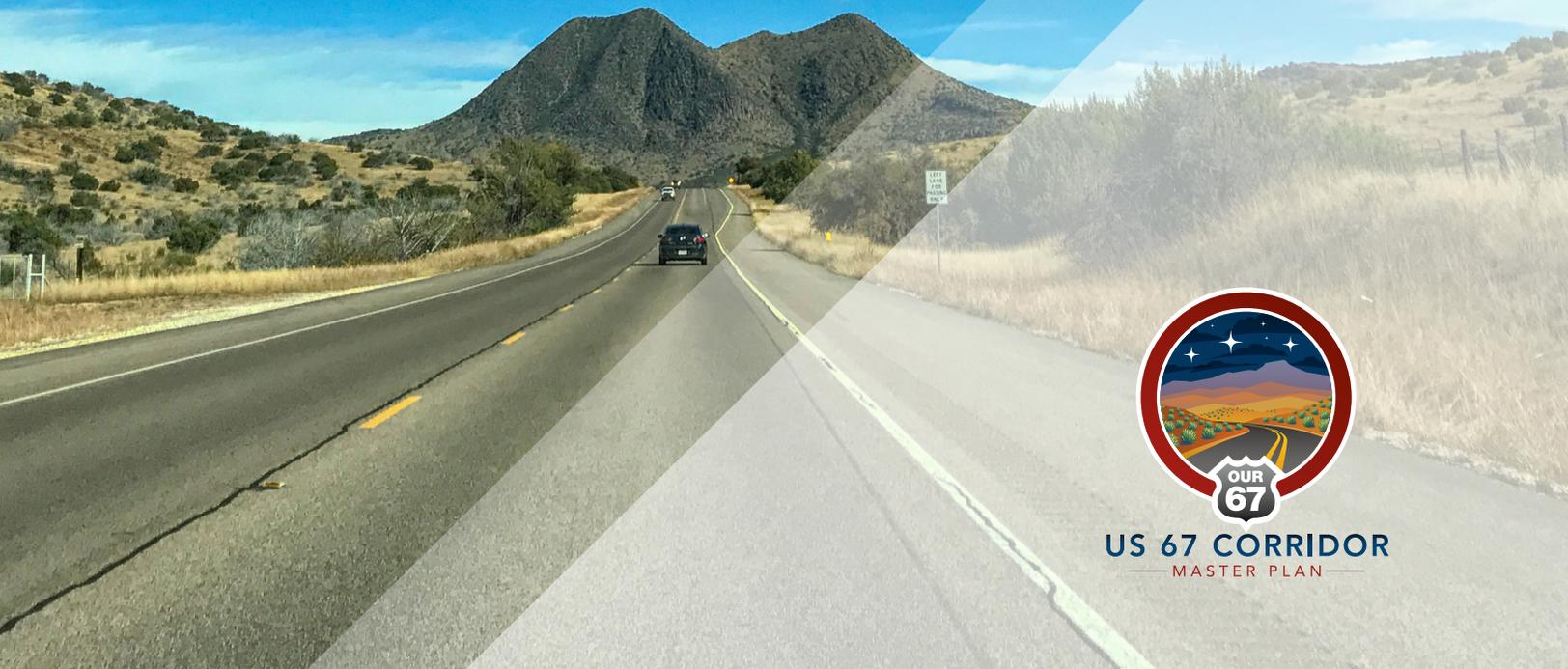
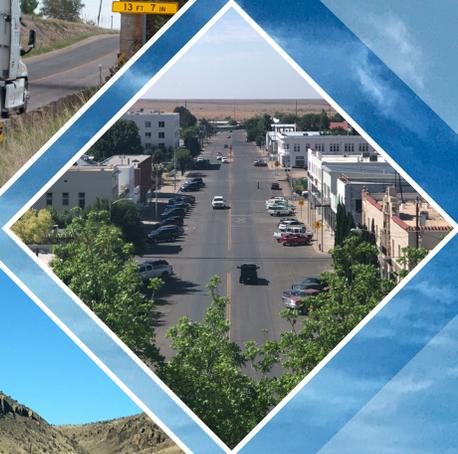




US 67 CORRIDOR MASTER PLAN

APPENDIX N

FEBRUARY 2020



US 67 CORRIDOR
MASTER PLAN

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US 67 CORRIDOR
— MASTER PLAN —

Memorandum

To: *Rebecca Reyes, TxDOT Project Manager*
Christopher Weber, TxDOT Alpine Area Engineer

From: *CDM Smith*

Date: *February 2020*

Subject: *US 67 Corridor Master Plan Alternatives Analysis Technical Memorandum*

1.0 Introduction

The purpose of this technical memorandum is to describe the process, development, and analysis of alternative improvements for the US 67 corridor. This memorandum describes the process used for developing a menu of conceptual improvements for the corridor, how this menu of conceptual improvements was evaluated and screened, how concepts were developed into detailed “core concepts” and “alternative concepts”, and the determination of recommended alternatives. **Figure 1** shows the study corridor.

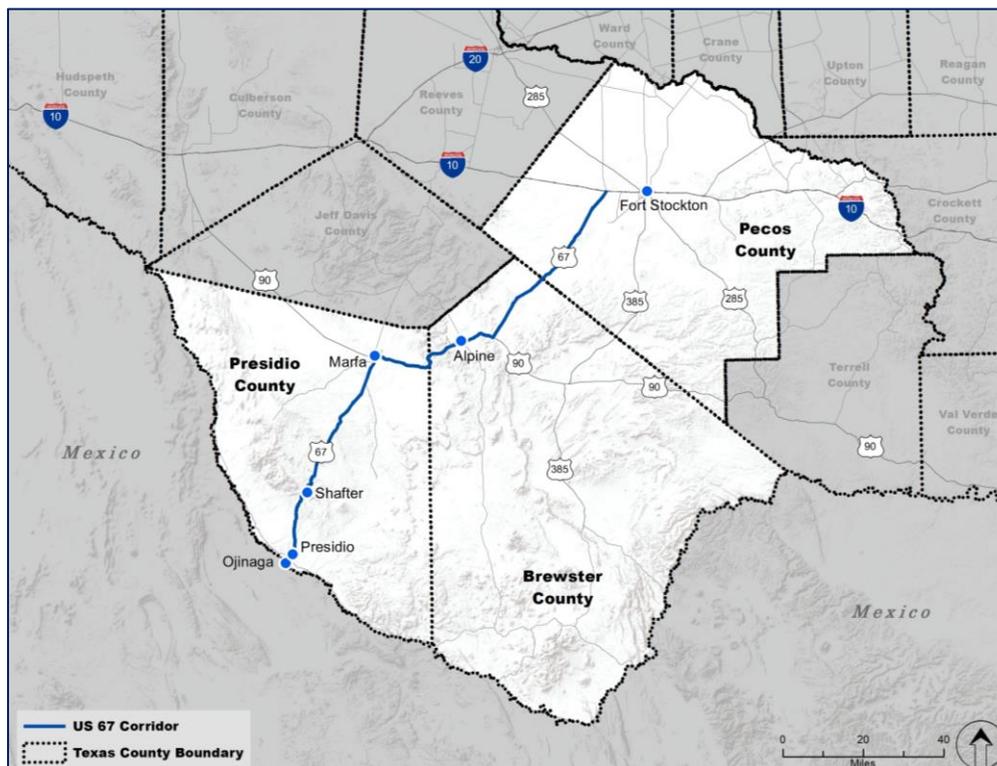


Figure 1: US 67 Corridor Master Plan Study Corridor

This memorandum outlines the short-, mid-, and long-term transportation improvements for the US 67 corridor, including recommendations to enhance mobility and safety along the corridor. This technical memorandum is divided into nine sections:

- **Section 2** – Concept Development
- **Section 3** – Gap Analysis
- **Section 4** – Conceptual Evaluation and Screening
- **Section 5** – Core Alternatives
- **Section 6** – Conceptual Alternatives
- **Section 7** – Complete Streets
- **Section 8** – Recommended Alternatives
- **Section 9** – Summary

2.0 Concept Development

For the purposes of the US 67 Corridor Master Plan, concepts are defined as individual corridor improvements developed throughout the planning process. Concepts represent a variety of improvement options that could improve safety, mobility, operations, or condition of the US 67 corridor if implemented. Concept types considered during this process include the following:

- Intersection improvements
- Safety-related improvements (i.e. curve treatments; signage and striping; guardrails; slope treatments; etc.)
- Intelligent Transportation Systems (ITS)-related improvements
- Complete Streets improvements
- Pull out/Rest Area improvements
- Operational improvements
- Port-of-Entry (POE) related improvements

Multiple technical and engagement avenues were used to develop the initial list of concept improvement options. A menu of corridor concepts was generated throughout the planning process from a variety of sources including stakeholder input, public engagement, and technical analyses of the corridor.

As a transparent, public-driven planning process, many of the concepts were identified through public outreach and engagement activities conducted at Steering Committee meetings, Corridor Working Group (CWG) meetings, Focus Group meetings, Stakeholder meetings, and Public Meetings.

Public meetings provided opportunities for the public to provide input on corridor needs and offer suggestions for potential corridor concepts. Through public comments, the public identified key issues and provided suggestions for potential solutions and improvements.

During the public meetings, two online public engagement platforms were introduced, the Corridor Planning Tool (ViewPro) and MindMixer. The Corridor Planning Tool allowed the public to provide comments and suggestions for improvements through an interface where users could drop a pin or draw a shape directly onto the corridor map. Users could then enter written comments on issues or concept suggestions at site-specific locations within the study area. MindMixer is an online social environment where users can ask questions, respond with answers, and build ideas. MindMixer was used to foster discussion of the public to identify needs and potential solutions for the corridor.

Technical analysis of the corridor served as another major contributor to the identification and development of corridor concepts. Significant analyses included as part of this study are included in **Appendix B – Define Existing Conditions and Demand; Appendix D - Safety Analysis; Appendix M - Freight Conditions; and Appendix G – Intelligent Transportation Systems (ITS) Plan.** Together, these technical analyses were used to generate corridor concepts.

3.0 Gap Analysis

A menu of corridor concepts was generated through public outreach activities and technical analysis of the corridor. Following the development of this menu of corridor concepts, a gap analysis was performed. A gap analysis attempts to determine *“Is anything missing?”*. The gap analysis was conducted by categorizing all concepts by goal area and improvement types through a series of matrices. If a particular goal area or improvement type did not have any concepts categorized, then a gap was identified. If a gap was identified, additional technical analysis and review of best practices were conducted to identify a concept that could fulfill a lacking goal area or improvement type.

4.0 Conceptual Evaluation and Screening

Following the gap analysis, a full menu of concepts was identified. The concepts were screened based on a generalized screening followed by a fatal flaw analysis. Evaluation criteria were used to perform the generalized screening on all concepts. Using evaluation criteria helped to determine the concepts that are most fitting for the corridor from environmental, engineering, and economic perspectives and best meets the goals and objectives of the US 67 Corridor Master Plan.

The evaluation criteria included considerations in the following categories, in no particular order are:

- Safety
- Environmental Concerns
- Accessibility & Mobility
- Resiliency, Reliability, and Security
- Tourism
- Public Input
- Hydrology

Additionally, improved connections to existing interstate highways, state highways, and other principal arterials are considerations for the US 67 Corridor Master Plan.

4.1 Generalized Screening

The US 67 Corridor Master Plan study team formulated a generalized screening process, to evaluate conceptual alternatives based on qualitative evaluation criteria. The purpose of the generalized screening was to screen and evaluate core and alternative conceptual improvements. The study team developed qualitative evaluation criteria allowing for high-level analysis of each conceptual alternative. The study team developed the evaluation criteria considering the following project elements:

- Consistency with the Fixing America's Surface Transportation (FAST) Act;
- Consistency with the goals and objectives of the US 67 Corridor Master Plan;
- Consistency with public and stakeholder input; and
- Environmental constraints on the project.

The evaluation criteria were applied to each potential conceptual improvement. Accordingly, each conceptual alternative was scored according to the evaluation criteria. The evaluation criteria for the generalized screening including specific measures and the alignment with goals and objectives by category are shown in **Table 1**.

Table 1: Evaluation Criteria for Generalized Screening

Category	Evaluation Criteria	Measure	Alignment with Goals and Objectives
Safety	Safety of travel for people and freight in the study area, specifically safe passing	<ul style="list-style-type: none"> Proposed changes to roadway characteristics including lane configuration, terrain, curvature, design speed limit Impact of proposed alternative on the number of crashes involving trucks 	<ul style="list-style-type: none"> Improve Safety - Reduce fatalities and serious injuries
	Safety of travel in the communities along the corridor	<ul style="list-style-type: none"> Proposed changes to roadway surfaces and landscapes Predicted impact of proposed changes on safety of travel within and between communities 	<ul style="list-style-type: none"> Improve Safety - Eliminate conflicts between rail, motorized and non-motorized modes wherever possible Improve Safety - Increase bicycle and pedestrian safety through construction of new facilities and improvements to existing facilities
	Conflicts between modes	<ul style="list-style-type: none"> Visible conflicts between railroad crossings and vehicular traffic in the alternative Visible conflicts between vehicular traffic and bicycle/pedestrian modes 	<ul style="list-style-type: none"> Improve Safety - Reduce fatalities and serious injuries Improve Safety - Eliminate conflicts between rail, motorized and non-motorized modes wherever possible Improve Safety - Increase bicycle and pedestrian safety through construction of new facilities and improvements to existing facilities
	Emergency response times	<ul style="list-style-type: none"> Proposed changes to roadway characteristics on emergency response travel routes Proposed changes to signal control and lane configuration at railroad grade crossings along emergency response routes Proposed deployment of ITS systems along emergency response routes Proposed changes to roadway characteristics or improvements to roadway surfaces within a quarter-mile of hospital facilities, fire stations, and police stations 	<ul style="list-style-type: none"> Improve Safety - Coordinate with emergency management to enhance incident response mechanisms Improve Safety - Improve incident response time Improve Mobility - Leverage technology to improve management and operations of the existing transportation system, including the development and deployment of ITS
Environmental	Potential impact on natural, historical, and cultural resources in the study area caused by proposed alternative	<ul style="list-style-type: none"> Potential impact of the proposed improvements on critical natural, historical, and cultural resources 	<ul style="list-style-type: none"> Promote Sustainability - Minimize impacts to natural, cultural, and historic resources and promote sustainability in project design and delivery

Table 1: Evaluation Criteria for Generalized Screening (continued)

Category	Evaluation Criteria	Measure	Alignment with Goals and Objectives
Accessibility & Mobility	Access to key destinations in the study area	<ul style="list-style-type: none"> •Impact on access from the communities to key destinations and event sites 	<ul style="list-style-type: none"> •Enhance Multimodal Connectivity - Provide and improve access to jobs, transportation choices, and services
	Mobility of the public	<ul style="list-style-type: none"> •Impact of proposed alternative on vehicle hours traveled (VHT) 	<ul style="list-style-type: none"> •Enhance Multimodal Connectivity - Provide and improve access to jobs, transportation choices, and services •Improve Mobility - Increase travel options and accessibility for all, especially elderly, disabled, and disadvantaged populations
	Freight travel reliability	<ul style="list-style-type: none"> •Impact of proposed alternative on freight VHT 	<ul style="list-style-type: none"> •Support Economic Development - Support strategic investments that improve and maintain multimodal freight infrastructure and connectivity •Enhance Multimodal Connectivity - Provide transportation choices and improve system connectivity for all passenger and freight modes •Enhance Multimodal Connectivity - Support efficient and coordinated movement of goods and services between freight modes to facilitate commerce •Improve Mobility - Increase freight and passenger travel time reliability
	Travel options and modes ensuring accessibility for all populations	<ul style="list-style-type: none"> •Impact of proposed alternative on the availability of multimodal transportation options accessible by residents 	<ul style="list-style-type: none"> •Promote Sustainability - Recognize quality-of-life concerns for all system users and future generations •Enhance Multimodal Connectivity - Provide transportation choices and improve system connectivity for all passenger and freight modes •Enhance Multimodal Connectivity - Provide active transportation options in demand areas •Improve Mobility - Increase travel options and accessibility for all, especially elderly, disabled, and disadvantaged populations
Resiliency, Reliability, and Security	Sustainable funding for the project	<ul style="list-style-type: none"> •Broad estimate of project cost based on historical data •Number of funding sources available that are sustainable over the timeframe of the project •Past performance of projects with similar elements 	<ul style="list-style-type: none"> •Maintain a State of Good Repair - Identify existing and new funding sources and innovative financing techniques for all modes of transportation •Support Economic Development - Reduce project delivery delays
	Security against natural or manmade threats	<ul style="list-style-type: none"> •Changes in resiliency to natural or manmade threats caused by proposed alternative 	<ul style="list-style-type: none"> •Promote Sustainability - Minimize impacts to natural, cultural, and historic resources and promote sustainability in project design and delivery

Table 1: Evaluation Criteria for Generalized Screening (continued)

Category	Evaluation Criteria	Measure	Alignment with Goals and Objectives
Tourism	Tourist economy	<ul style="list-style-type: none"> •Expected gained or reduced attractiveness to tourists •Convenience for tourists to travel to the region 	<ul style="list-style-type: none"> •Support Economic Development - Promote and enable public participation by local businesses in project planning and development •Assess the impact of transportation planning on land use and community character
Public Input	Consistency of conceptual alternative with public input	<ul style="list-style-type: none"> •Public comments for or against the conceptual alternative 	<ul style="list-style-type: none"> •Promote Sustainability - Promote and enable public participation in project planning and development
Hydrology	Impact on Hydrology	<ul style="list-style-type: none"> •Hydrological impacts of proposed improvement 	<ul style="list-style-type: none"> •Promote Sustainability - Minimize impacts to natural, cultural, and historic resources and promote sustainability in project design and delivery

The evaluation criteria were applied by scoring each conceptual alternative as Poor (-1), Fair (0), Good (+1), or Excellent (+2) against the alignment with plan goals and objectives. The scoring guide for the conceptual evaluation is shown in **Table 2**.

Table 2: Scoring Guide for Conceptual Evaluation

Rating	Score	Judgment
Poor	-1	Change in measure of proposed improvement would have a negative effect on project goals and objectives
Fair	+0	Change in measure of proposed improvement would have no effect on project goals and objectives
Good	+1	Change in measure of proposed improvement would be likely to have a positive effect on project goals or objectives or would have a positive effect on project goals and objectives pending future changes
Excellent	+2	Change in measure of proposed improvement would have an immediate positive effect on project goals and objectives once implemented

For each conceptual alternative, the study team scored each measure of alignment with study goals and objectives -1 through +2 and added the scores together to determine each project's rank in the screening process. The resulting total score was used to evaluate which conceptual improvement types best aligns with the study goals and objectives. A simplified version of the evaluation results with the score for each conceptual alternative is presented in **Table 3**. The "total score" shown in **Table 3** is a summation of the evaluation rating for each category shown in **Table 1**.

Table 3: Conceptual Evaluation Scores by Study Goals and Objectives

Concept	Location: Roadway/ Streets/ Intersections	Concept Description	Total Score
Presidio			
Dynamic Messaging Sign (DMS) at Port of Entry (POE)	US 67 at POE	<ul style="list-style-type: none"> ▪ Inform driver of real-time information ▪ Improve POE Access 	3
Queue Warning System, Intersection Collision Warning System, and Dynamic Speed Feedback System	US 67 / O'Reilly Intersection	<ul style="list-style-type: none"> ▪ Dynamic message signs warning drivers of downstream traffic ▪ Signals and signs flashing when a vehicle enters intersection ▪ Dynamic message signs messaging drivers exceeding speed threshold 	6
Intersection Collision Warning System, Dynamic Messaging Sign, Traveler Information System, and Dynamic Speed Feedback System	US 67 / FM 170 Intersection in Presidio city limits	<ul style="list-style-type: none"> ▪ Signals and signs flashing when a vehicle enters intersection ▪ Dynamic message signs showing various messages ▪ Electronic system presenting information assisting roadway users ▪ Dynamic message signs messaging drivers exceeding speed thresholds 	7
Intersection Collision Warning System and Speed Warning and Signage	US 67 / FM 170 Intersection outside of Presidio city limits	<ul style="list-style-type: none"> ▪ Signals and signs flashing when a vehicle enters intersection ▪ Dynamic message signs messaging drivers exceeding speed thresholds 	6
Gateway sign - Presidio	At locations entering/leaving Presidio	<ul style="list-style-type: none"> ▪ Improve the sense of place of the city 	3
Improve POE access (parking area)	US 67 at POE	<ul style="list-style-type: none"> ▪ Improve POE Access ▪ Clear traffic from the city during significant traffic events 	8
Reduce Speed limit	Along US 67	<ul style="list-style-type: none"> ▪ Reduce posted speed limit 	5
Improve Bicycle/Pedestrian Facilities	Along US 67 in Presidio city limits	<ul style="list-style-type: none"> ▪ Add bicycle lanes ▪ Add streetscapes/sidewalk improvements for pedestrians ▪ Add safety devices for pedestrians to cross the street more safely 	10
Add Signage/lighting	US 67 in Presidio city limits	<ul style="list-style-type: none"> ▪ Signage improvements ▪ Lighting improvements 	5
Harrington St and US 67 Intersection Improvements	Harrington St/US 67 Intersection	<ul style="list-style-type: none"> ▪ Proposed roundabout including new landscaping, roadway, shoulder, and curb and gutter improvements 	6

Table 3: Conceptual Evaluation Scores by Study Goals and Objectives (continued)

Concept	Location: Roadway/ Streets/ Intersections	Concept Description	Total Score
US 67 and FM 170 Intersection Improvements	US 67/FM 170 Intersection	<ul style="list-style-type: none"> Proposed restriping of the intersection 	6
BUS 67/O'Reilly St/US 67 Intersection improvements (Location 1)	US 67/BUS 67/O'Reilly St Intersection	<ul style="list-style-type: none"> Proposed improvements including new landscaping, shoulders, crash attenuators, and plumbing and drainage improvements 	6
BUS 67/US 67 Intersection Improvements (Location 1)	US 67/BUS 67/O'Reilly St Intersection	<ul style="list-style-type: none"> Intersection Improvements - converting TWLTL to raised median 	6
Between Presidio and Marfa			
Proposed Rest Area 1	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Add a TxDOT safety rest area 	5
Proposed Rest Area 2	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Add a TxDOT safety rest area 	5
Shoulder Widening	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Improve safety by creating more buffer between travel way and road edge 	3
Wildlife Warning Systems	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Sign (electronic or analog) warning drivers of wildlife presence 	3
Warning Lights	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Warning lights ahead of intersections/curvature/signal control 	3
Climbing lanes/passing lanes	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Installation of climbing and passing lanes 	5
Puerto Rico Street relief route	Puerto Rico Street between US 67 / Old FM 170 Intersection and US 67 / O'Reilly Street Intersection	<ul style="list-style-type: none"> Puerto Rico Street between Old FM 170 and US 67 	7
Re-open Cibolo Creek Bridge from Erma to US 67	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Ramp connecting FM 170 to Erma Street 	5
Re-open Cibolo Creek crossing from FM 170 into Presidio	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Reopen FM 170 crossing to traffic 	5
Metal Beam Guard Fence	US 67 between Presidio city limits and Marfa city limits	<ul style="list-style-type: none"> Prevent roadway departure crashes 	3
Marfa			
Dynamic Speed Feedback System	US 67 and E Madrid Street within the Marfa city limits	<ul style="list-style-type: none"> Dynamic message signs messaging drivers exceeding speed thresholds 	5
Pedestrian Hybrid Beacon and Intersection Collision Warning System	E San Antonio St/S Highland Ave Intersection Other intersections along US 67	<ul style="list-style-type: none"> Flashing beacon alerting drivers of pedestrians entering crosswalk Signals and signs flashing when a vehicle enters intersection 	8
Bicycle lanes along US 90/US 67	US 67 in Marfa city limits	<ul style="list-style-type: none"> Add bicycle lanes 	10

Table 3: Conceptual Evaluation Scores by Study Goals and Objectives (continued)

Concept	Location: Roadway/ Streets/ Intersections	Concept Description	Total Score
SH 17 and E Lincoln Intersection improvement	SH 17/E Lincoln St	<ul style="list-style-type: none"> ▪ Add bicycle lanes ▪ Add sidewalks ▪ Add streetscaping ▪ Add pavement markings 	10
Add street signs	US 67 in Marfa city limits	<ul style="list-style-type: none"> ▪ Add Street Signs 	2
Between Marfa and Alpine			
Shoulder Widening	Various stretches of US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Build a buffer between travel way and road edge 	3
Dynamic Speed Feedback System	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Dynamic message signs messaging drivers exceeding speed thresholds 	3
Intersection Collision Warning System	US 67/Nopal Rd Intersection US 67/FM 1703 Intersection Other intersections along US 67	<ul style="list-style-type: none"> ▪ Signals and signs flashing when a vehicle enters intersection 	3
Bicycle lanes from Marfa to Alpine with breaks in rumble strips	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Add bicycle lanes 	8
Warning Weather + Lights	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Lights and warning system alerting drivers of severe weather conditions ▪ Lighting improvements 	3
Roadway Improvements and Metal Beam Guard fence	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Metal beam preventing roadway departure crash 	3
Wildlife Warning Systems	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Sign (electronic or analog) warning drivers of wildlife presence 	4
Rest Area/Driveway Improvements	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Improve/expand current roadside park/picnic area to allow more drivers to park ▪ Restriping for driveway consolidation 	5
Proposed Roadway Safety Improvements	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Install rest area allowing drivers to park 	3
Two-Way Left-Turn Lanes	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Two-way left-turn lane providing a safe place for left-turning vehicles to wait 	3
Curve treatments and Metal Beam Guard fence	US 67 between Marfa city limits and Alpine city limits	<ul style="list-style-type: none"> ▪ Metal beam preventing roadway departure crash 	3
Alpine			
Dynamic Speed Feedback System [Eastbound]	US 67 in Alpine city limits at western entrance	<ul style="list-style-type: none"> ▪ Dynamic message signs messaging drivers exceeding speed thresholds 	5
Improve flooding at railroad bridges	US 67 in Alpine city limits at railroad bridges	<ul style="list-style-type: none"> ▪ Pump to remove floodwater 	6
Flashing Warning Sign	US 67 / FM 1703 in Alpine city limits	<ul style="list-style-type: none"> ▪ Warning signs warn driver of certain roadway geometry or control type ahead 	5

Table 3: Conceptual Evaluation Scores by Study Goals and Objectives (continued)

Concept	Location: Roadway/ Streets/ Intersections	Concept Description	Total Score
Intersection Collision Warning System	US 67/N Orange St Intersection W Holland Ave/N 13 th St Intersection W Holland Ave/N Phelps St Intersection E Avenue East/N Harrison St Intersection Other intersections along US 67	<ul style="list-style-type: none"> ▪ Signals and signs flashing when a vehicle enters intersection 	5
Replace Turndown GET	US 67 at the RR crossing	<ul style="list-style-type: none"> ▪ Replace guardrail end terminal 	5
Pedestrian Hybrid Beacon	US 67 at key intersections where pedestrian crossing volume is high	<ul style="list-style-type: none"> ▪ Alert driver of pedestrian crossing 	5
Replace X-Lite GET for Four Corners of Bridge	US 67 at bridge at east end of city	<ul style="list-style-type: none"> ▪ Replace X-Lite guardrail end terminal 	5
Complete Streets Concept within the city	US 67 in Alpine city limits	<ul style="list-style-type: none"> ▪ Add bicycle lanes ▪ Add streetscapes/sidewalk improvements for pedestrians ▪ Add safety devices for pedestrians to cross the street more safely ▪ Other Complete Streets conceptual improvements 	11
Pavement maintenance and striping within the city	US 67 in Alpine city limits	<ul style="list-style-type: none"> ▪ Provide pavement maintenance and restripe pavement markings within the city 	5
Add Signage/lighting	US 67 in Alpine city limits	<ul style="list-style-type: none"> ▪ Signage improvements ▪ Lighting improvements 	5
One-Way Bicycle Lane and Two-Way Sidewalk on Bifurcation Section	US 67 between Apple Street and N Bird Street	<ul style="list-style-type: none"> ▪ Add bicycle lanes ▪ Add streetscapes/sidewalk improvements for pedestrians 	9
Operational Improvements	Key intersections on US 67 where traffic volume is high	<ul style="list-style-type: none"> ▪ Intersection improvements using either traffic signals or additional stop signs. 	3
Hike/Bicycle Lane/Sidewalks	US 67 in Alpine city limits	<ul style="list-style-type: none"> ▪ Add bicycle lanes ▪ Add streetscapes/sidewalk improvements for pedestrians ▪ Add safety devices for pedestrians to cross the street more safely 	9
5 th Street E Avenue & Holland Avenue Intersection Improvement	5 th Street E Ave/Holland Ave Intersection	<ul style="list-style-type: none"> ▪ Proposed improvements including curb extensions and channelization 	6
Improve vertical clearance at two railroad bridges	US 67 at the RR crossing	<ul style="list-style-type: none"> ▪ Raise the two railroad bridges to improve vertical clearance 	1
Add over height warning system at two railroad bridges	US 67 at the RR crossing	<ul style="list-style-type: none"> ▪ Alert driver of height restriction 	1

Table 3: Conceptual Evaluation Scores by Study Goals and Objectives (continued)

Concept	Location: Roadway/ Streets/ Intersections	Concept Description	Total Score
Orange Street - West Sul Ross Avenue and US 67 Intersection Improvement	US 67/N Orange St/W Sul Ross Ave Intersection	<ul style="list-style-type: none"> ▪ Channelization ▪ Reduce conflict points 	5
FM 1703 Farm Land Road and US 67 Intersection Improvement	US 67/FM 1703 Intersection	<ul style="list-style-type: none"> ▪ Channelization ▪ Redirect traffic flow to reduce conflict points ▪ Widen outside shoulder ▪ Add right-turn lane 	5
Roundabout at Sul Ross University	US 67/Harrison St/Bird St Intersections	<ul style="list-style-type: none"> ▪ Convert multiple intersections in the area SW of Sul Ross University into a roundabout 	7
13 th & 15 th Street and US 67 Intersection Improvement	US 67/13 th St/15 th St Area	<ul style="list-style-type: none"> ▪ Streetscape improvements - curb extension or realignment ▪ Shoulder widening ▪ Add sidewalks ▪ Channelization 	8
Between Alpine and the Y-Intersection			
Shoulder Widening	US 67 between Alpine and Y-intersection	<ul style="list-style-type: none"> ▪ Improve safety by creating more buffer between travel way and road edge 	3
Proposed Y-intersection Improvements	US 67/US 90 Split	<ul style="list-style-type: none"> ▪ Lighting/signage/stripping 	3
Intersection Collision Warning System and Traveler Information System at Y Intersection	US 67/US 90 Split	<ul style="list-style-type: none"> ▪ Signals and signs flashing when a vehicle enters intersection 	3
Between the Y-Intersection and I-10			
Wildlife Warning Systems	US 67 between Y-intersection and I-10	<ul style="list-style-type: none"> ▪ Sign (electronic or analog) warning drivers of wildlife presence 	3
Dynamic Speed Feedback System + Intersection Collision Warning System	Along US 67 US 67/US 90 Split US 67/I-10 Intersection Other intersections along US 67	<ul style="list-style-type: none"> ▪ Dynamic message signs messaging drivers exceeding speed thresholds ▪ Signals and signs flashing when a vehicle enters intersection 	3
Intersection Collision Warning System	US 67/US 90 Split US 67/I-10 Intersection Other intersections along US 67	<ul style="list-style-type: none"> ▪ Signals and signs flashing when a vehicle enters intersection 	4

The highest scoring conceptual alternatives were bicycle and/or pedestrian facility concepts or Complete Streets concepts, with improved bicycle/pedestrian facilities in Presidio scoring a 10, bicycle lanes along US 67 and US 90 in Marfa scoring a 10, bicycle lanes between Marfa and Alpine scoring an 8, and one-way bicycle lanes with two-way sidewalks in Alpine scoring a 9. Pedestrian hybrid beacons and intersection collision warning systems in Marfa scoring an 8, and hiking/bicycle

lanes/sidewalks in Alpine scoring a 9. The Complete Streets concept in Alpine, which would add bicycle lanes, sidewalk improvements, safety devices for pedestrian crossing, and other measures, is the highest scored concept considered at 11.

Concepts scoring in the middle, between 5 and 7, tended to be ITS improvements and those that are oriented around improving safety of vehicle travel. Included in this category are queue warning systems, intersection collision warning systems, dynamic speed feedback systems, dynamic messaging signs, traveler information systems, and other projects focused on vehicle safety (signage and lighting improvements, speed limit reductions, etc.)

The lowest scored concepts, those scored at 4 and under, tended to be standalone safety concepts in the rural segments between the cities or concepts that have little to do with safety. The lowest scoring conceptual alternatives were improving vertical clearance and adding an over height warning system to US 67 at the railroad crossing in Alpine, both scoring a 1. The modal score for all concepts evaluated was a 3.

Overall, the evaluation results show that the highest priority concepts are those that propose more extensive changes, including multimodal connectivity and pedestrian and bicycle safety improvements in the urban areas, and in the case of the bicycle safety improvements between Marfa and Alpine. Collections of ITS and safety improvements ranked with middle scores, while the lowest-ranked were safety improvements on the rural segments since the treatments for those improvements are specific to safety and lightly populated sections of the corridor.

The results of the evaluation criteria scoring process for the conceptual improvements were presented at the bus tours, Corridor Working Group (CWG) meetings, public meetings, and other meetings to solicit input from the public and stakeholders.

4.2 Environmental Constraints

Environmental constraints along the corridor were identified through establishing the primary environmental factors that may affect the ability to implement a concept or alter how that concept could be implemented. Environmental constraints are the limitations on the conceptual alternatives that can be implemented and outline mitigation measures that may be required on the US 67 corridor due to any environmental factors, including:

- Infrastructural constraints such as existing utilities, roadways, railroads, airports, and ports of entry;
- Socioeconomic factors such as concentrations of environmental justice populations and populations with low average levels of English proficiency;
- Existing land use such as schools, places of worship, cemeteries, drainage and irrigation features, parks, section 4(f) and 6(f) properties, and community facilities;
- Natural resources such as native vegetation, protected wildlife habitats and migration routes, threatened and endangered species, floodplains, soils, and bodies of water; and

- Other factors such as archaeological and historic resources, hazardous materials, traffic noise, air quality, and air toxins.

The US 67 Corridor is characterized by a desert climate and low levels of urbanization and population density. The study area for environmental constraints consists of the limits of the US 67 Corridor Master Plan (142 miles from I-10 west of Fort Stockton to the Presidio/Ojinaga POE at the US/Mexico border) in addition to a buffer of 1,500 feet from the edge of the prescribed right-of-way (based on the County Appraisal District parcel boundary information) in all directions.

The study team documented the existing infrastructure and environmental constraints within the US 67 Corridor within this area using publicly available data sets from a variety of sources, including:

- TxDOT Roadway Inventory OnSystem for roadway, railroad, and airport attribute data;
- The Federal Highway Administration (FHWA) National Bridge Inventory for highway structure data;
- Data on administrative boundaries, hydrography, land use, and historical sites from a variety of sources;
- Google Earth data; and
- Data collected during the field reconnaissance process.

All elements of occurrence from these sources located within the study area were included on the map except for archaeological sites that are not available for public disclosure. This data is not being used to identify potential right-of-way (ROW) for potential conceptual alternatives in the US 67 Corridor Master Plan. It is an effort to include adjacent constraints that are not within existing (disturbed) right-of-way including historic structures and sites, ecologically sensitive habitats, floodplains and other bodies of water, and any other sites of public interest.

The data includes:

- **City limits** for incorporated urban areas in Presidio County and Brewster County from county appraisal districts;
- **Hospital facilities** throughout the study area from ESRI;
- **Parks and public institutions** from ESRI;
- **National park boundaries** from the National Park Service (NPS);
- **Lands and waters administered by the U.S. Fish and Wildlife Services (USFWS)** from the USFWS;
- **Wetlands** from the Texas National Wetland Inventory;
- **100-year floodplain boundaries** from the Federal Emergency Management Agency (FEMA);

- **Water bodies and flowlines** from the USGS;
- **Significant streams and impaired waters** from the U.S. Environmental Protection Agency (USEPA)
- **Water wells** from the Texas Water Development Board;
- **Roadways and railroads** from TxDOT;
- **Oil, gas well, and pipeline locations** from the Railroad Commission of Texas;
- **Public water supply wells** from the Texas Commission on Environmental Quality (TCEQ);
- **Historical markers and cemeteries** from the Texas Historical Society;
- **Historic sites, county courthouses, and historic highways** from the Texas Historical Commission;
- **Habitats of threatened, endangered, and rare species** from the Texas Natural Diversity Database;
- **Archaeological sites** from the Texas Historical Commission;
- **Satellite imagery** from the Texas Natural Resources Information System;
- **Parcels** from Brewster County and Presidio County appraisal districts;
- **Colonias** from the Attorney General’s Office (Colonias are substandard housing developments, often found along the Texas-Mexico border, where residents lack basic services such as drinking water, sewage treatment, and paved roads.); and
- **Public schools** from ESRI.

Using this data, the environmental constraints on and along the US 67 corridor was described in a series of land use maps. Parcel boundaries from the Presidio County, Brewster County, and Pecos County appraisal district offices were used as the spatial base for evaluating land use, along with the latest Google Earth imagery data. Where possible interpreted land use categories were cross-checked with land use or zoning codes within the parcel data or with Google Earth street view. These land use maps were presented to the public during the first series of public meetings, and they were also used for reference during a workshop with the study team and TxDOT in January 2019; see **Appendix A – Public Involvement Plan** for more detail.

4.3 Fatal Flaw Analysis

Following the conceptual evaluation, a fatal flaw analysis was undertaken for conceptual alternatives and core concepts in the US 67 Master Corridor Plan. Information on the cost, source, goal area satisfied, and amount of right-of-way needed by the conceptual improvement was presented to the public and stakeholders throughout the public outreach process. Conceptual alternatives that encountered broad public disfavor for one or more reasons such as cost, environmental impact, impact on traffic circulation, engineering or design obstacles, amongst other considerations, were considered “fatally flawed” and excluded from further consideration in the study.

A few of the concepts that were removed through the fatal flaw analysis are shown below.

Angled Parking in Marfa – The US 67 corridor study team developed a concept for angled parking along South Highland Avenue in Marfa after city officials asked for an angled parking concept. However, this concept was determined to be fatally flawed due to a TxDOT ordinance that no new angled parking will be built on US 67 or other system segments. However, the angled parking can still be implemented on other city streets and elsewhere. The angled parking concept is shown in **Figure 2**.

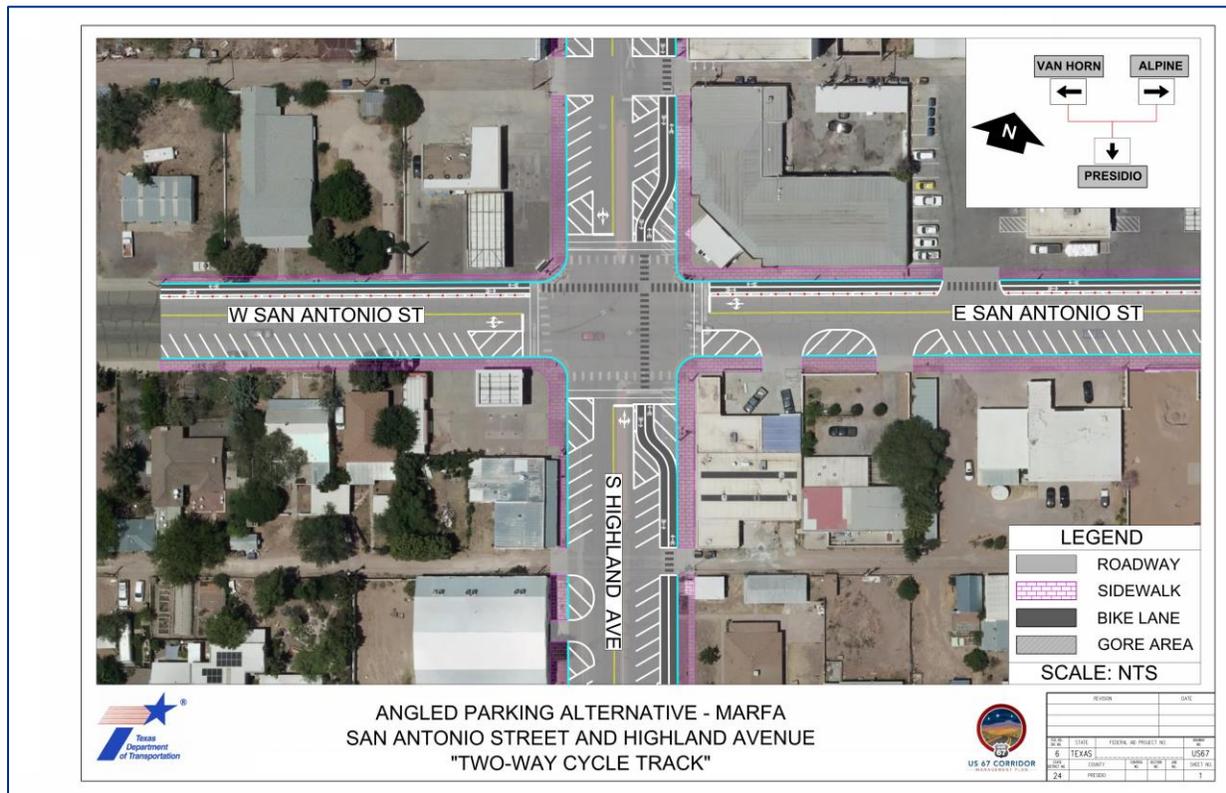


Figure 2: Two-Way Cycle Track with Angled Parking Alternative in Marfa

“Shoe-fly” Concept in Alpine – The “shoe-fly” concept was developed after concerns that the railroad bridge over US 67 leading into Alpine did not have enough clearance for trucks and other large vehicles. Multiple options were discussed, including raising the railroad bridge or lowering US 67 to achieve more clearance. However, engineering constraints made these improvements infeasible. The “shoe-fly” concept was formulated to bypass the bridge entirely. This concept was determined to be fatally flawed after the Union Pacific Railroad (UPRR) and Texas-Pacificco stated that it is their policy to limit the number of at-grade crossings such that if a new at-grade crossing were opened another at-grade crossing would need to be closed along the track. Although proposed as a solution to the issue at hand, an at-grade crossing introduces additional concerns. At-grade crossing introduces safety concerns with vehicles crossing the tracks, emergency access concerns when train traffic is preventing access across the railroad tracks, concerns about traffic back-ups at train crossings, and other concerns. The “shoe-fly” concept is shown in **Figure 3**.

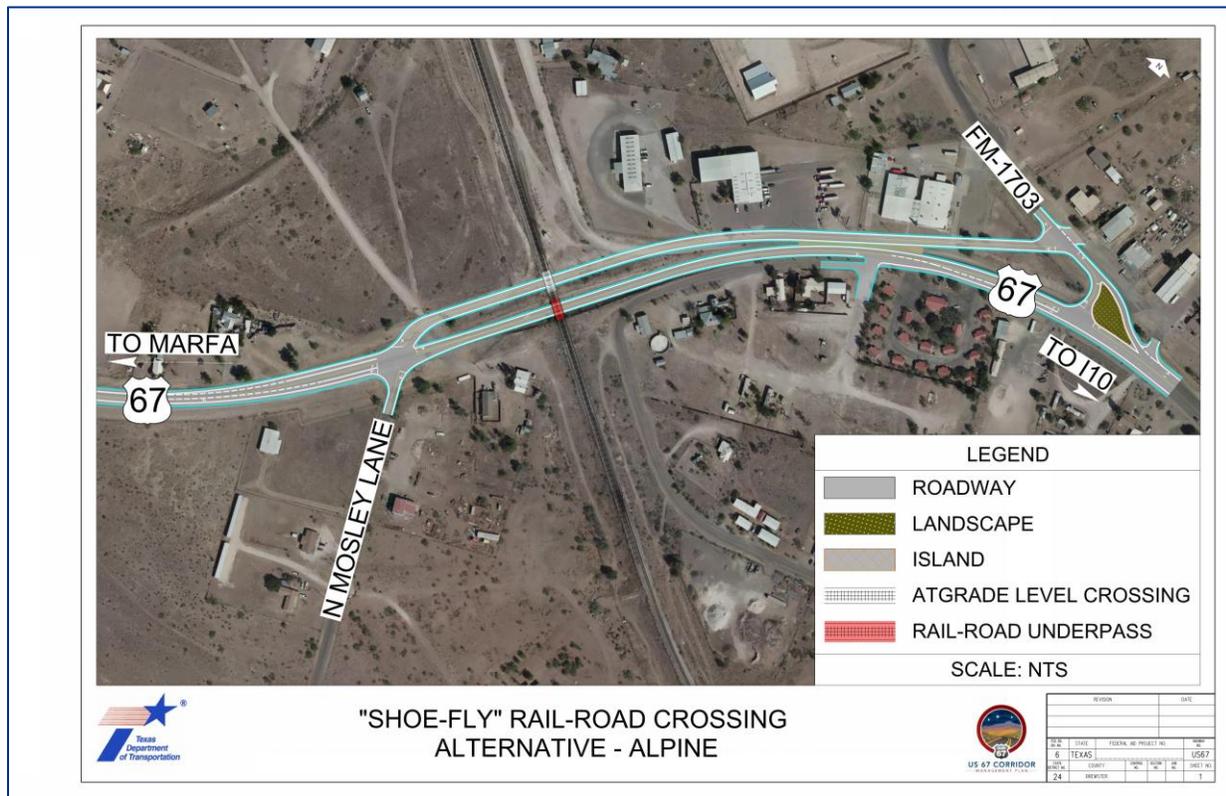


Figure 3: “Shoe-fly” Railroad Crossing Alternative in Alpine

Sul Ross / US 67 Intersection – This concept at the Sul Ross University and US 67 intersection was initially developed by the design team to alleviate traffic congestion and to create a safer alternative. However, after closer analysis, it was deemed that this concept would be too confusing to motorists once implemented and would not be a practical solution to the existing problem. The number of intersecting legs into the roundabout would be difficult and confusing to navigate through. The Sul Ross / US 67 intersection is shown in **Figure 4**. Other concepts for this intersection, however, were not considered “fatally flawed” and passed the fatal flaw screening.



Figure 4: Sul Ross / US 67 Intersection in Alpine

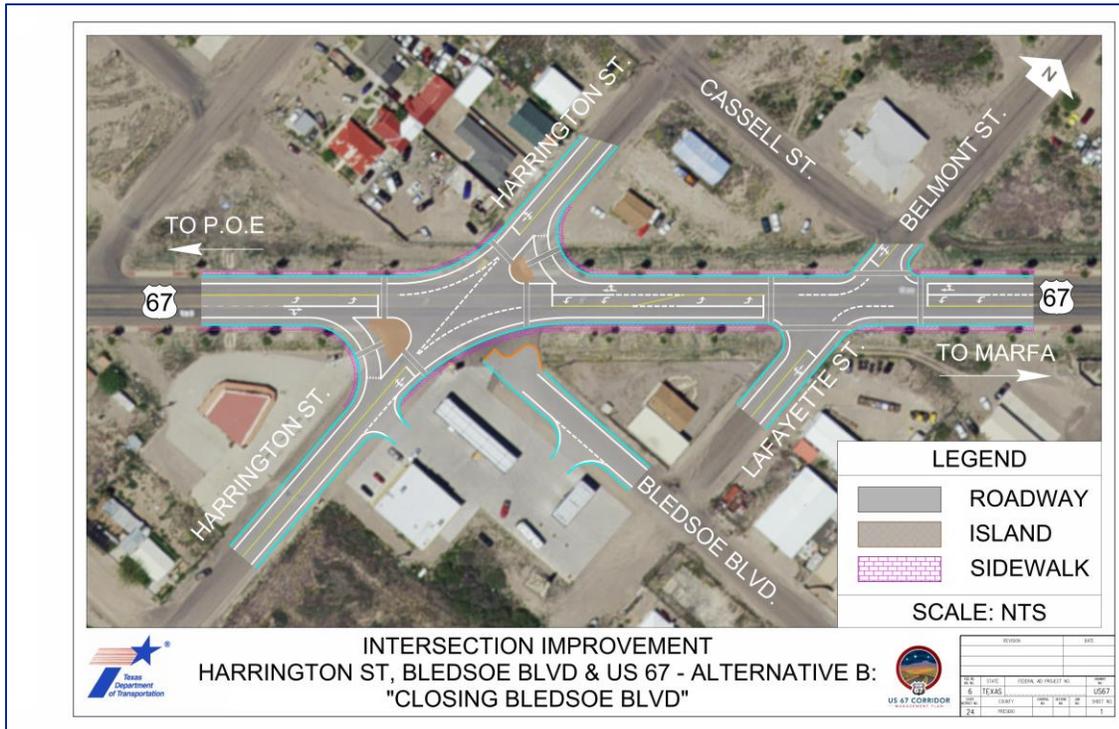


Figure 6: Presidio Location 4 Alternative B

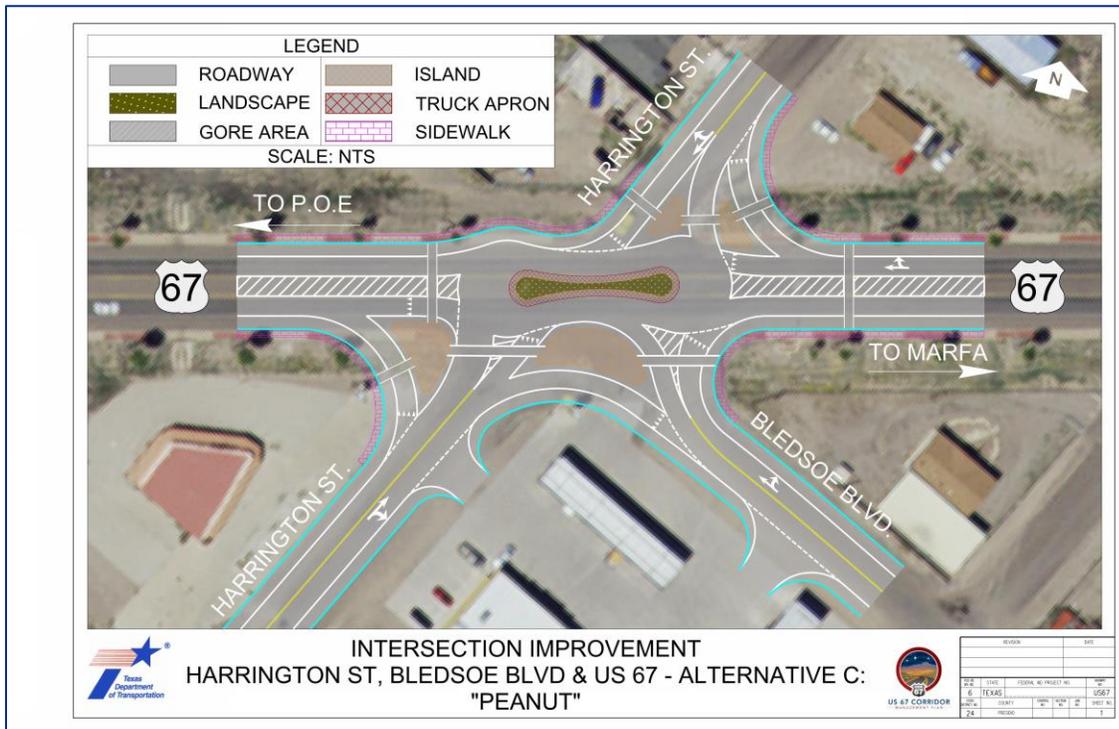


Figure 7: Presidio Location 4 Alternative C

5.0 Core Concepts

Through the fatal flaw analysis/generalized screening process, up to three alternatives were determined for each of the identified locations where improvements are recommended along the corridor. Several of the concepts developed during the concept generation process, however, have either “global” applications throughout the corridor or no competing alternative, other than a no-build alternative, for application at the improvement location. These concepts are referred to as “core concepts”. Most of the core concepts were identified through technical analyses for safety, ITS needs, and existing conditions.

5.1 ITS Concepts

The first category of core concepts considered in the US 67 Corridor Master Plan is ITS concepts. ITS incorporates modern telecommunications and computational technology into existing transportation systems in order to enhance safety and reduce congestion. Currently, existing ITS assets on the corridor are limited to a fiber optic cable owned by Big Bend Telephone Company, three weather stations, and traffic cameras at the Presidio Port of Entry (POE) and Marfa Border Patrol and none of the devices are used for traffic operations. However, over the course of the US 67 Corridor Master Plan study, the study team identified potential ITS projects to be implemented throughout the US 67 corridor. The categories of projects identified along with the number of projects and the planning level cost estimates are shown in **Table 4** and detailed by type below. For additional detailed information on ITS along the US 67 corridor, please see **Appendix F – Intelligent Transportation Systems (ITS) Needs Assessment** and **Appendix G – Intelligent Transportation Systems (ITS) Plan**.

Table 4: ITS Projects by Category

Capital Projects	Number of Projects	Total Planning Level Cost Estimates (2019 Dollars)
Crash Countermeasures and Surface Transportation and Weather	25	\$12,200,000
Traffic Management	1	\$500,000
Operations and Maintenance	2	\$1,500,000
Emergency Services	3	\$8,300,000
Tourism and Traveler Information	3	\$1,400,000
Communications and Power	3	\$1,300,000
Total Station	3	\$1,700,000
POE Smart Parking and Other ITS projects	4	\$2,100,000
Total ITS Estimated Cost (rounded to the nearest million)	44	\$29,000,000

5.1.1 Crash Countermeasures

ITS improvements that are categorized by FHWA as “crash countermeasures” are those that are designed to prevent or mitigate crashes of all types. The US 67 corridor has surpassed the Texas state average crash rate in crashes per 100 Million VMT for five of the nine years between 2010 and 2018, not including crashes occurring within the City of Alpine. If crashes in the City of Alpine were included, the corridor would see an even higher crash rate. Improved safety of travel on the US 67 corridor is considered to be the highest priority for the study leading to the US 67 Corridor Master Plan – therefore, crash countermeasures comprise the most ITS projects considered in the US 67 Corridor Master Plan at 25. The types of crash countermeasures considered are as follows:

- **Animal Warning Systems** are improvements to prevent animal-on-road collisions. There are two sections of the US 67 corridor that have high rates of animal-on-road collisions – a 12-mile stretch between Fort Stockton and Alpine and a 20-mile stretch between Marfa and Shafter. Within these corridors, large animal sensors can be placed every 500 feet. Sensors will then communicate to a cabinet at either end, triggering flashers on static signs placed every 4 miles if an animal is detected.
- **Automated Visibility Warning Systems** are intended to inform motorists of changing weather conditions, including inclement weather. The automated visibility warning system for the US 67 corridor is a road weather information system (RWIS) located at Paisano Pass with full power and communications. The controller of the station will connect to two DMS systems facing each direction approaching pass, displaying warnings for adverse weather conditions where applicable.
- **Bicycle/Pedestrian Safety Systems** are intended to warn motorists of cyclist and pedestrian crossings. There are three locations on the US 67 corridor where pedestrian and bicycle crashes have occurred since 2010 – W Holland Avenue / Garnett Street and W Holland Avenue / N 5th Street in Alpine and S Highland Avenue / E San Antonio Street in Marfa. The potential bicycle/pedestrian warning system for these locations consists of a pedestrian button on each side of US 67 that activates flashers on two static signs and pavement lighting.
- A **Highway-Rail Crossing Safety System** warns motorists near a highway-rail crossing of passing trains. There is one highway-rail crossing on the US 67 corridor, north of Alpine. The potential project consists of a controller that will activate flashers on static warning signs to detect stopped vehicles on the relative approach and will need to be evaluated as future traffic grows.
- A **Road Geometry Warning System** warns motorists of obstacles including areas with a high risk of ramp rollover, sharp curves, steep downhills, and low height structures using signboards and flashing beacons. There are two low bridge crossings on the US 67 corridor, both on the southwest side of Alpine, where safety would be increased by a road geometry warning system bringing attention to over height vehicles. The potential project consists of flashing beacons facing both directions of US 67.
- **Speed Warning Systems** inform motorists of the speed of their vehicles so they can adjust speed according to posted speed limits, weather conditions, road geometry, and other factors.

There are two types of speed warning system under consideration as ITS products. Flashing beacon curve warning systems are intended to warn motorists of curves at curve approaches. There are ten locations on the US 67 corridor where unsafe curves may have been a factor in causing a higher crash rate than the Texas state average where flashing beacon curve warning systems are recommended. At each location, the potential project consists of speed detectors on either direction of US 67 with controllers that will activate flashers on a static sign automatically when needed.

- **Sequential Dynamic Curve Warning Systems** consist of a series of blinking signs along a curve flashing at vehicles approaching the designated curve. There are seven locations on the US 67 corridor where unsafe curves may have been a factor in causing a higher crash rate than the Texas state average where sequential dynamic curve warning systems have been found to be potentially needed. The potential projects consist of controllers that will monitor speed detectors on either direction of US 67 and automatically light chevron signs in a sequential manner along the curve when recommended.
- **Work Zone Safety Systems** enhance safety in and around work zones by alerting construction workers of any vehicle passing and alerting motorists of changes on the roadway. Potential work zone safety systems projects are not permanent locations but are any potential work zones on the US 67 corridor that last longer than a month.

5.1.2 Traffic Management

ITS improvements that are characterized by FHWA as “Traffic Management” dynamically manage congestion based on prevailing and predicted traffic conditions. Because congestion is rare in the US 67 corridor, there are three potential traffic management concepts for the US 67 corridor.

- **Variable Speed Limit** signs lower the speed of vehicles approaching a hazard or unique condition to balance operational safety and efficiency. Variable speed limits would be used for weather events and integrated into other systems.
- **Vehicle Detection** tools allow agencies to identify specific characteristics of vehicles including presence, speed, weight, direction of travel, and occupancy. This tool enhances safety, provides travel-time information, reduces congestion, monitors travel flow, counts vehicles, detects queues, and identifies pedestrians/bicyclists. Vehicle detection systems would be integrated into other systems.
- **Planned Special Event Management Systems** provide information about upcoming events using social media, traveler information systems, DMS, and 511 using vehicle detection and camera systems. This application is useful for the various special events that take place on the US 67 corridor.

5.1.3 Operations and Maintenance

ITS improvements that are characterized by FHWA as “operations and maintenance” improve roadway operations and improve the overall quality of the system. Because the US 67 corridor is

relatively free of operational problems, there is only one potential operations and maintenance concept.

- **Rockslide Warning Systems** warn motorists of conditions that indicate a potential rockslide has taken place. The study team has identified two locations on the US 67 corridor at risk of rockslides – Shafter and Paisano Pass. The potential projects consist of sensors sending a message to Dynamic Message Signs (DMS) in both directions in the event of a potential rock slide.

5.1.4 Emergency Services

ITS improvements that are characterized by FHWA as “Emergency Services” related if the improvement results in improved management of an emergency situation. The study team has identified three potential corridor-wide emergency services concepts for the US 67 corridor.

- **Next Generation 911** refers to 911 systems that have been upgraded to a digital or IP base away from an analog system in order to create a more resilient and broadly capable 911 system that can take advantage of text and video messaging. The study team has identified Brewster County and Presidio County broadly as areas for the funding and deployment of Next Generation 911.
- A **Smartphone Application** is any software application that runs on a mobile device, such as a smartphone or tablet. The potential application would integrate traveler information and incident/conditions reporting for travelers along the US 67 corridor and would be available throughout the corridor.
- **Automatic Crash Notification Systems** use GPS receivers and mobile phones installed in vehicles to provide information to first responders. Stakeholders should monitor technological advances in automatic crash notification systems to coordinate use.

5.1.5 Surface Transportation and Weather

ITS improvements that are characterized as “Surface Transportation and Weather” are improvements focused on improving the resiliency and ease of travel during extreme weather events (e.g. a 500-year flood). The study team has identified one tool as relevant to the US 67 corridor.

- **Integrated Weather Monitoring and Prediction Systems** are combinations of technologies that collect, transmit, and disseminate weather and road condition information. An environmental sensor station (ESS) measures real-time weather conditions including pavement temperature, wind speed and direction, precipitation, water levels, humidity, and visibility and transmitted to traffic control facilities for decision support. This is rolled into the total station concept discussed in **Section 5.1.8**.

5.1.6 Tourism and Traveler Information

ITS improvements that are characterized by FHWA as “Tourism and Traveler Information” are improvements that convey real-time information to travelers with a special emphasis on communicating to tourists and travelers from outside the region who may not have familiarity with

the area. Because the US 67 corridor is of interest to tourists and travelers there is one potential tourism and traveler information concept in the corridor.

- A **Dynamic Messaging Sign (DMS)** is an electronic sign showing variable messages to travelers and motorists with information on travel in the corridor. The study team has identified five locations on the US 67 corridor where a DMS sign is recommended – north and south of Alpine city limits, north and south of Marfa city limits, and north of Presidio city limits.
- **Integrated Traveler Information Systems** collect roadway information using various sensor devices and transmit this information to public-facing platforms like websites, 511, DMS, social media, and radio broadcasts. It is recommended that TxDOT continues to examine available sources of funding and data to implement a US 67 corridor specific traveler information system when possible.

5.1.7 Communications and Power

ITS improvements that are characterized by FHWA as relating to “communications and power” are those that are focused on augmenting and increasing the capacity of the power systems on which other ITS systems rely. The study team has identified two potential studies that could be conducted to identify the correct solutions along the US 67 corridor. From those studies, communications and power projects would be implemented on a project by project basis.

- A **study to provide fiber access along the US 67 corridor** would identify locations for installing fiber optic cable to increase the capacity of ITS systems throughout the corridor.
- A **study to provide enhanced cellular connections through agreements** would analyze existing cellular connections in the US 67 corridor and the feasibility and costs of increasing cellular coverage.

5.1.8 Total Stations

ITS improvements that are characterized by FHWA as “total stations” are stations combining Road Weather Information System (RWIS), Closed-Circuit Television (CCTV), and a radio tower at a single location to minimize costs and improve maintainability. The study team has identified two locations where the construction of total stations is recommended.

- On US 67 between Alpine and Fort Stockton; and
- On US 67 between Marfa and Shafter.

5.1.9 Other

One ITS improvement and two outreach techniques have been identified as recommended for installation or implementation on the US 67 corridor.

- A **Smart Parking System** is a parking system integrated with technology that provides additional information to parking users including information on stall occupancy in various parts of the parking area, maps of the parking area, parking assignments, and other information meant to improve circulation. The study team has found one location on the

corridor where a lot operating based on smart parking principles would be based – the port of entry at the U.S.-Mexico border in Presidio. Travel between Presidio and Ojinaga created by major holidays and events causes significant backup on those days. The potential project consists of a smart parking system that will be used on these high demand days and will check in vehicles and assign them to park in designated areas.

- An **Incident Management Support Truck** uses a vehicle with arrow boards and Portable Changeable Message Signs (PCMS) to provide positive protection for emergency responders at the scene of an incident. This can be done using old fire trucks turned into blocker trucks by adding arrow boards on each side and the rear of each vehicle. The control panel for the amber LED light arrow sticks can be programmed to flash in the desired direction of travel.
- A **Traffic Management Incident Training Program** is a program consisting of a variety of training exercises intended to create a group of incident responders, including police, firefighters, and towing workers, capable of safe, quick clearance of traffic incidents. The potential program would be sourced from FHWA or other sources.
- A **Corridor Coordination Group** consists of recurring meetings of a corridor working group and management agencies to coordinate continued corridor planning past the end of the US 67 Corridor Master Plan study to facilitate continuous improvement.

5.2 Safety Concepts

The second category of core concepts considered in the US 67 Corridor Master Plan include those that have to do with increasing safety of travel throughout the corridor. Since safety of travel has been identified by the public and by federal, state, and regional documents as the most important plan goal, the study team performed a literature review and a safety analysis, scoring, and identifying safety risk factors at rural and urban segments and intersections throughout the US 67 corridor while selecting potential countermeasures. These countermeasures comprise both the ITS countermeasures and non-ITS countermeasures. The concepts discussed in this section consist of lower-cost alternatives to ITS countermeasures. For additional detail on the potential safety concepts, see **Appendix D – Safety Analysis**.

In the safety analysis, the US 67 Corridor study team divided the US 67 corridor into control segments with similar design characteristics to minimize variance in risk factors, analyzed crashes occurring along the corridor from 2010 to 2018 and identified risk factors contributing to crashes. Control sections with a risk score higher than the corridor average were prioritized for safety improvements.

The US 67 corridor study team used several data sources to compile recommended safety concepts. These include:

- The TxDOT Crash Records Information System Database;
- The Federal Highway Administration Highway Safety Improvement Program;
- Minnesota County Roadway Safety Plans; and

- The National Cooperative Highway Research Program 500.

5.2.1 Currently Implemented Safety Projects

TxDOT is currently implementing the following safety-related projects along the US 67 corridor:

- The **addition of passing lanes** along US 67 from I-10 to 16.8 miles south of I-10 to the Brewster County line (11.7 miles) and from 9 miles south of RM 169 to 22.9 miles north of FM 170 (18.7 miles);
- The **treatment of fixed objects** along US 67 from 1 mile west of the Brewster County line to 2.4 miles west of the Brewster County line (1.4 miles); and
- **Pedestrian and bicycle facilities** including a shared use path in Marfa and pedestrian and bicycle facilities in Presidio.

5.2.2 Recommended Safety Projects

The US 67 Corridor Master Plan recommends implementing the following safety projects throughout the US 67 corridor, see **Appendix D** for more detail:

- Striping changes within existing pavement can be used to resolve safety and operational issues at challenging intersections by changing the width and direction of lanes. Striping changes are recommended at the following intersections:
 - BUS 67/O'Reilly Street and Howard Street in Presidio;
 - BUS 67/O'Reilly St and Tremont Street in Presidio;
 - US 67 and Old Road 170 and Utopia Road north of Presidio;
 - US 67 and FM 1703 in Alpine; and
 - Holland Avenue and 5th Street in Alpine.
- **Signage changes** on and around challenging intersections to improve compliance with speed limits and compliance with decision points around challenging intersections can lead to safer travel for cars traveling through intersections. Signage changes are recommended at the following intersections:
 - BUS 67/O'Reilly Street and Howard Street in Presidio;
 - BUS 67/O'Reilly Street and Tremont Street in Presidio;
 - US 67 and Old Road 170 and Utopia Road in Presidio;
 - US 67/W Holland Ave and 13th Street in Alpine;
 - US 67/W Holland Avenue and 5th Street in Alpine;

- US 67/E Holland Avenue and N Phelps Street in Alpine;
 - US 67/E Holland Avenue and Harrison Street in Alpine;
 - US 67/E Avenue East and Bird Street in Alpine;
 - US 67/E Avenue E and Harrison Street in Alpine;
 - US 67 and Lackey Street in Alpine;
 - US 67 and Harmon Street in Alpine; and
 - US 67 and I-10 interchange located west of Fort Stockton.
- **Pavement marking** improvements can improve safety by delineating lanes and crosswalks at intersections where lane, crosswalk, and other markers have faded. Pavement marking improvements are recommended at the following intersections:
- BUS 67/O'Reilly Street and Tremont Street in Presidio;
 - US 67 and Old Road 170 and Utopia Road north of Presidio;
 - US 67 and Orange Street in Alpine;
 - US 67/W Holland Avenue and N 13th Street in Alpine;
 - US 67/W Holland Avenue and 5th Street in Alpine;
 - US 67/E Holland Avenue and Harrison Street in Alpine;
 - US 67/W Avenue E and Harrison Street in Alpine; and
 - US 67 and US 90 interchange located east of Alpine.
- **Centerline rumble strips and shoulder rumble strips** increase safety by alerting a driver to imminent departure from the lane of travel and lowering the risk of a roadway departure crash. Where they do not already exist, the installation of centerline and shoulder rumble strips is recommended on every rural segment of the corridor.
- **Advance warning signs** increase safety by making road users aware of upcoming hazards. Advanced warning signs per MUTCD guidelines are recommended throughout the corridor.
- **Passing lanes** allow fast traveling vehicles to overtake slower vehicles in traffic. Passing lanes are recommended in the US 67 corridor at locations north of Shafter, between Paisano Pass and Alpine, and south of I-10.
- **Slope treatment** can improve safety by removing non-recoverable slopes, which are defined by FHWA as a slope where a motorist can't retain or regain control of their vehicle. Slope treatments are recommended on all non-recoverable slopes in the corridor.

- **Guardrails** serve to alert drivers of dangerous slopes and might prevent cars from departing from the roadway. Guardrails are recommended throughout the US 67 corridor at roadway segments with steep side slopes and deficient clear zones.
- **Shoulder widening** puts more space between the edge of the road and the travel lanes. Shoulder widening is recommended throughout the US 67 corridor at all areas where shoulder width is currently less than 10 feet.
- **Tree trimming/brush removal** to increase visibility for road users is recommended throughout the US 67 corridor.
- **Intersection improvements** like ADA compliant sidewalks and curb returns, raised intersections, curb improvements, bollards, and pedestrian refuges make pedestrian travel in urban areas safer. These improvements are recommended at all intersections in the urban areas of the US 67 corridor.
- **Bicycle lanes** assist bicyclists by giving them their own right-of-way and separating them from car traffic. Bicycle lanes are recommended along the US 67 corridor in each urban area.
- **Striped crossings** are recommended for all urban intersections.
- **Raised medians** separating opposite directions of traffic are recommended for all urban segments.
- Ensuring **vertical and horizontal clearance values** are met is recommended at the railroad crossing of the Texas-Pacific Railroad with US 67.
- Adequate **lighting improvements** are recommended at all intersections.

The implementation timeframe expected for these corridor-wide safety improvements is shown in **Table 5**.

In addition to the global safety core concepts identified above, the safety analysis identified two locations of downtown Alpine as locations experiencing significant crashes. These two locations are 1) US 67 and 15th, 14th, 13th, and 12th Streets (**Figure 9**), and 2) US 67 and 6th, 5th, and 4th Streets (**Figure 10**). As shown in **Figures 9** and **10**, the improvements at these downtown Alpine locations include sidewalk improvements, pedestrian crossings at key locations, a mid-block pedestrian crossing on Holland Ave between 15th St and 14th St, channelized turns with raised medians, increased turning radii for large freight truck movements, and the conversion of the street system into one-way pairs. Additional ROW is required for full implementation. The planning level cost estimate for 1) the Alpine One-Way Streets with Pedestrian Improvements at US 67 and 15th, 14th, 13th, and 12th Streets (**Figure 9**) is \$1,400,000 and the planning level cost estimate for 2) the Alpine One-Way Streets with Pedestrian Improvements at US 67 and 6th, 5th, and 4th Streets (**Figure 10**) is \$900,000 (rounded).

Table 5: Safety Recommended Improvements with Timeframe and Planning Level Cost Estimates

Time	Improvements	Unit	Quantity	Planning Level Cost Estimate
Short	Horizontal Curve Warning Signs	Each	54	\$33,000
	Chevrons	Each	144	\$87,000
	Advisory Speed Limit Signs	Each	58	\$35,000
	Vertical Grade Signs	Each	72	\$44,000
	Curve Blocks View Sign	Each	19	\$12,000
	Install centerline rumble strip	Mile	83	\$166,000
	Install shoulder rumble strip	Mile	153	\$123,000
	Passing lane ahead and lane ends merge left sign	Each	100	\$60,000
	No passing zone signs	Each	213	\$128,000
	Tree Trimming/Brush Removal	Mile	26	\$52,000
	Install Weather Warning Sign	Each	33	\$20,000
	Install advanced warning signs for railroad crossing	Each	2	\$2,000
	Flashing beacon for railroad crossing	Each	2	\$12,000
	Total Short-term Projects (rounded with 45% Mobilization, Contingency, Construction Engineering, and Traffic Control)			
Mid	Improve design and application of barrier systems	Each	91	\$273,000
	Add/Extend Guardrail	Mile	20	\$3,340,000
	Provide Guardrail end treatment	Each	246	\$738,000
	Flashing Beacon Signs	Each	26	\$260,000
	Sequential Dynamic Curve Warning Sign	Each	7	\$182,000
	Provide adequate sight distance	Cubic Yard	35,310	\$7,062,000
	Provide lighting at intersections	Each	56	\$560,000
	Raised Pavement Markers	Each	11,985	\$1,199,000
	Design safer slopes when fill height is less than 5 feet	Cubic Yard	141,228	\$14,123,000
	Provide Turnouts	Square Yards	55,860	\$11,172,000
	Superelevation Improvement	Tons	21,500	\$2,150,000
	High Friction Surface Treatment	Square Yards	227,256	\$11,363,000
	Provide dynamic speed feedback system	Each	4	\$40,000
	Add left-turn lanes to existing rest area	Each	1	\$396,000
	Highway Rail Grade Crossing Safety System	Each	2	\$20,000
Provide Pull Outs	Each	2	\$2,000,000	
Total Mid-term Projects (rounded with 45% Mobilization, Contingency, Construction Engineering, and Traffic Control)				\$79,574,000
Long	Widen Shoulders (From 6 to 10 feet in both direction)	Mile	66	\$49,500,000
	Widen Shoulders (From 4 to 10 feet in both direction)	Mile	21	\$22,050,000
	Construct Texas Super 2	Mile	46	\$96,600,000
	Grade Separation at Old Alpine Highway	Each	1	\$5,200,000
	Total Long-term Projects (rounded with 45% Mobilization, Contingency, Construction Engineering, and Traffic Control)			
Total for All Safety Projects (rounded)				\$332,100,000



Figure 9: Alpine One-Way Streets with Pedestrian Improvements at US 67 and 15th, 14th, 13th, and 12th Streets



Figure 10: Alpine One-Way Streets with Pedestrian Improvements at US 67 and 6th, 5th, and 4th Streets

5.3 Traffic Projections Analysis

A comprehensive traffic data collection program was conducted in October 2017 and November 2017. The count data included a series of traffic counts within the US 67 study area encompassing the study corridor and at several locations on corridors that intersect US 67. These counts included volume counts, vehicle classification counts, and turning movement counts (TMCs) at select locations. Using the collected 2017 data, it was determined that all intersections along the study corridor currently operate at an acceptable Leve-of-Service (LOS) of C or better. A growth rate of two percent per year was then applied to the 2017 data in order to adequately plan future improvements along the US 67 study corridor. Traffic projections were made to plan for year 2045. Due to the projected increase in traffic in 2045, nine intersections all within Alpine worsened to a failing LOS of E or F. These locations and the operational analysis results are shown in **Table 6**.

Table 6: Level of Service Changes for Year 2045 Based on Two Percent Growth Rate

Main Street	Cross street	Current Control Type	2017				2045 No-Build			
			AM		PM		AM		PM	
			Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
US 67	Cherry Street	TWSC	14.8	B	16.9	C	25	D	38.5	E
W Avenue E	11 th Street	TWSC	15.9	C	16.3	C	36.7	E	44.5	E
Holland Avenue	11 th Street	TWSC	15.6	C	16.5	C	42.9	E	54.8	F
E Avenue E	5 th Street	AWSC	16	C	15.5	C	65.8	F	64.7	F
Holland Avenue	5 th Street	AWSC	16.2	C	14.9	B	65.9	F	57	F
E Avenue E	Cockrell Street	TWSC	18.2	C	22.1	C	97.7	F	268.5	F
Holland Avenue	Cockrell Street	AWSC	13.4	B	12.1	B	47.5	E	30.5	D
E Avenue E	Harrison Street	TWSC	19.3	C	16.4	C	233.7	F	81.8	F
Holland Avenue	Harrison Street	TWSC	19.4	C	16.9	C	112.3	F	64.6	F

Note: TWSC=Two-Way Stop Control; AWSC=All-Way Stop Control

Concepts were developed to improve the LOS at these locations in the future. These concepts are shown in **Figure 11** through **Figure 13**. **Table 7** displays the improved LOS with the addition of these concepts compared to 2045 No-Build. It also includes the estimated implementation year, based on the annual two percent growth rate, to prevent the intersections from reaching a failing LOS of E or F.

Table 7: Level of Service Changes with Implemented Concepts in 2045

Main Street	Cross street	Improvement	Planning Level Cost Estimate	Implement Year	2045 No-Build				2045 Build			
					AM		PM		AM		PM	
					Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
US 67	Cherry St	Add Southbound Left-Turn and Westbound Right-Turn Lane	\$400,000	2045	25	D	38.5	E	23.5	C	33.6	D
W Ave E	11 th St	Add Northbound Left-Turn Lane	\$200,000	2040	36.7	E	44.5	E	27.5	D	31.7	D
Holland Ave	11 th St	Add Southbound Left-Turn Lane		2040	42.9	E	54.8	F	23.2	C	30	D
E Ave E	5 th St	Signalize	\$305,000	2035	65.8	F	64.7	F	15.9	B	14.1	B
Holland Ave	5 th St	Signalize	\$305,000	2035	65.9	F	57	F	22.9	C	13.6	B
E Ave E	Cockrell St	Convert to All Way Stop Control	\$10,000	2025	97.7	F	268.5	F	27.9	D	25.3	D
Holland Ave	Cockrell St	Signalize	\$305,000	2040	47.5	E	30.5	D	9.9	A	9.5	A
E Ave E	Harrison St	Convert to All Way Stop Control	\$10,000	2030	233.7	F	81.8	F	30.5	D	22	C
Holland Ave	Harrison St	Convert to All Way Stop Control	\$10,000	2035	112.3	F	64.6	F	23.2	C	15.2	C
Total Planning Level Cost Estimate			\$1,545,000									

Intersection Improvements at US 67 and Cherry Street is shown in **Figure 11**. To improve LOS at the US 67 and Cherry Street intersection in the future, potential improvements include a dedicated right-turn lane for US 67 westbound traffic and a dedicated left-turn lane for Cherry Street southbound traffic. This concept would improve the future LOS from LOS E to LOS D. In coordination with other potential improvements (**Section 6.3.2**) and to improve safety, the angled intersection at W Sul Ross Ave was eliminated and a raised island was provided to prevent vehicle access at the NW corner of the Cherry Street intersection. This concept does not require the acquisition of additional right-of-way.

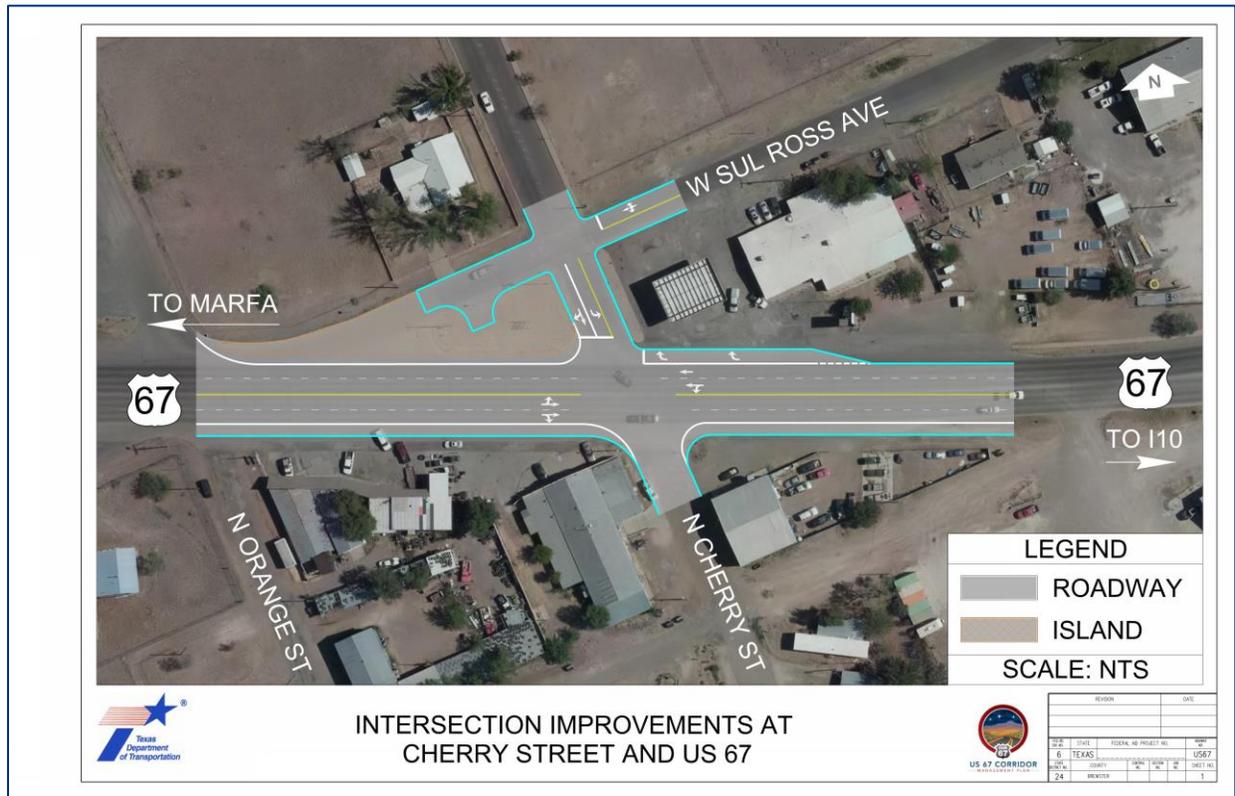


Figure 11: Intersection Improvements at US 67 and Cherry Street

Intersection Improvements at US 67 and 11th Street is shown in **Figure 12**. Inclusion of two left-turn lanes along 11th Street at its intersections with westbound and eastbound US 67 is intended to improve LOS from LOS E/F to an acceptable LOS D by reducing delay along 11th Street. This concept does not require the acquisition of additional right-of-way.



Figure 12: Intersection Improvement at US 67 and 11th Street

Intersection Improvements at US 67 and 5th Street, Cockrell Street, and Harrison Street are shown in **Figure 13**. To improve the LOS as well as safety along intersections which will have a failing LOS in the future, conversion of intersections from All Way Stop Control (AWSC) to signalization and from Two-Way Stop Control (TWSC) to AWSC is recommended at three locations (six intersections) along US 67 in Alpine. Currently, there are three AWSC intersections in Alpine: US 67 and 5th Street and US 67 eastbound (Holland Ave.) and Cockrell Street. Signalizing these intersections in the future is recommended to avoid failing LOS based on the future traffic projections. Conversion from TWSC to AWSC is recommended for the intersections of US 67 westbound (Ave. E) and Cockrell Street and US 67 at Harrison Street to also improve LOS. None of these concepts require the acquisition of additional right-of-way.

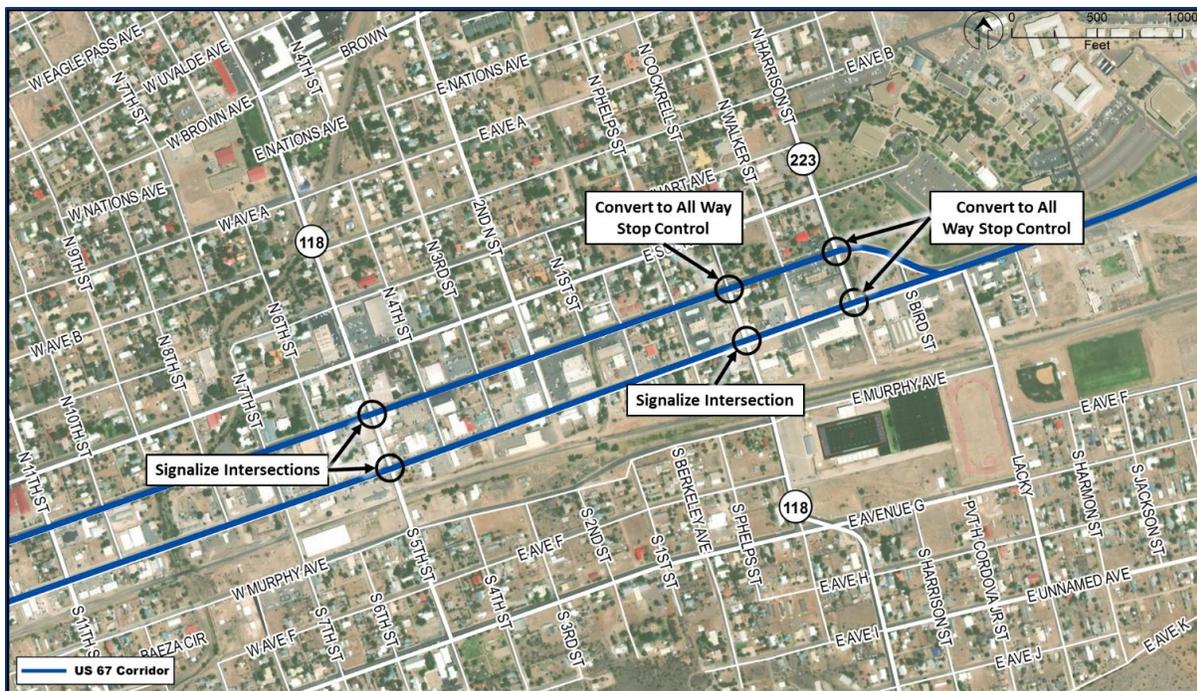


Figure 13: Intersection Improvements at US 67 and 5th Street, Cockrell Street, and Harrison Street

Because these potential improvements affect different locations in different ways, they are not strictly categorized into mutually exclusive alternative packages as at other locations throughout the US 67 study corridor. The pros and cons of each potential improvement compared to the No-Build option are shown in **Table 8**.

Table 8: Potential Improvements

	No-Build	Concept: “Intersection Improvement at US 67 and Cherry Street”	Concept: “Intersection Improvement at US 67 and 11 th Street”	Concept: “Intersection Improvements at US 67 and 5 th Street, Cockrell Street, and Harrison Street”
Cost	\$0	\$400,000	\$200,000	\$945,000
Pros	<ul style="list-style-type: none"> No cost Does not require ROW 	<ul style="list-style-type: none"> Improves LOS from E to D Addresses safety Does not require ROW 	<ul style="list-style-type: none"> Improves LOS from E/F to D Does not require ROW 	<ul style="list-style-type: none"> Avoids failing LOS at US 67 / 5th Street and US 67 EB / Cockrell Street Improved LOS at US 67 WB / Cockrell Street and US 67 / Harrison Street Does not require ROW
Cons	<ul style="list-style-type: none"> Does not address future LOS issues 	<ul style="list-style-type: none"> Potential for reduced sight distance along Cherry Street southbound 	<ul style="list-style-type: none"> Potential for reduced sight distance along 11th St southbound and northbound turning onto US 67 	<ul style="list-style-type: none"> Queues formed by vehicles waiting at the light may spill over to the upstream intersection Increases delay along US 67 at intersections where it is currently free moving

5.4 Rest Area/Pull Outs

During the variety of public outreach activities, the public and stakeholders consistently repeated a need for rest area and turnouts along the rural segments of the corridor, in particular between Presidio and Marfa. Existing and proposed rest area locations are shown in **Figure 14**. **Figure 15** shows how a potential rest area or pull out could be incrementally implemented from a short-, mid-, and long-term process. Pull outs could be implemented in the short-term and additional amenities could be added over time, transitioning into a full rest area. Rest areas and turnouts are recommended between Marfa and Presidio and between the US 67/US 90 intersection and I-10 interchange where there is an abundance of distraction-related crashes. **Table 9** shows the associated planning level cost estimates for the short-, mid-, and long-term implementation of a general rest area.

Table 9: Planning Level Cost Estimates for Rest Areas

Timeframe	Planning Level Cost Estimate (with 40% Contingency)
Short-term	\$75,000
Mid-term	\$225,000
Long-term	\$1,300,000

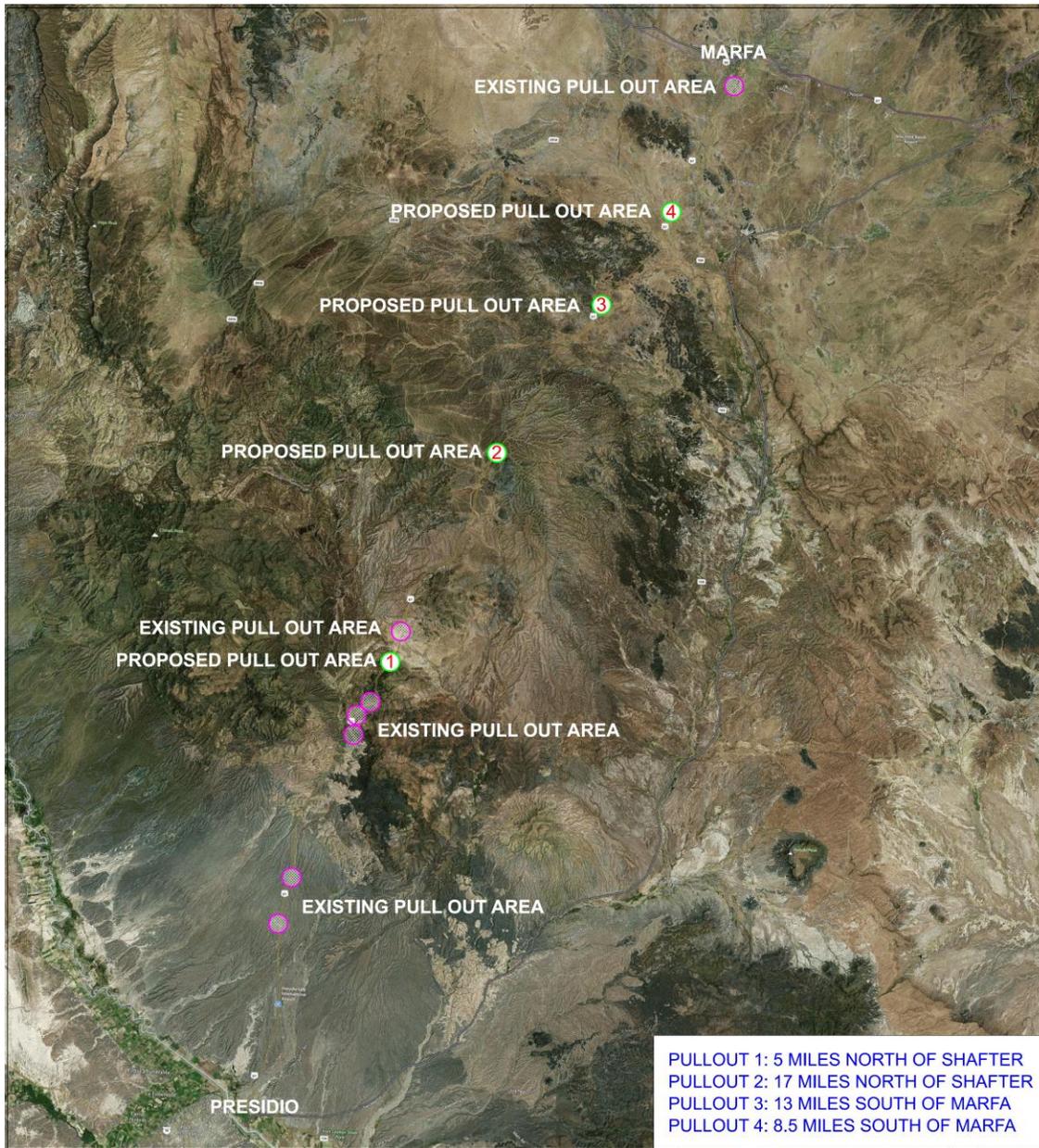


Figure 14: Existing and Proposed Rest Area Locations

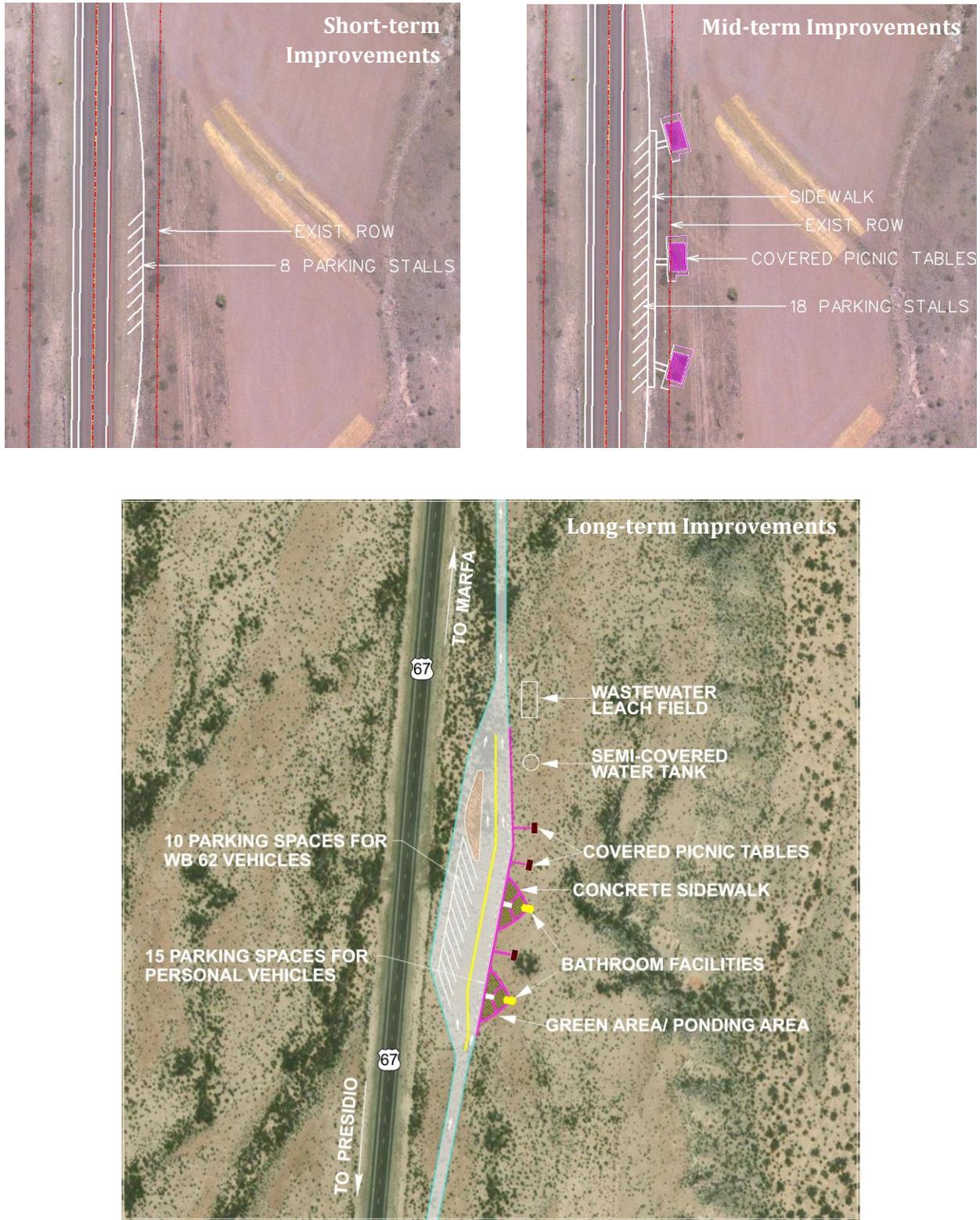


Figure 15: Implementation Phasing of Pull Outs and Rest Areas

5.5 I-10/US 67 Interchange Concept

During the public outreach activities, the public significantly commented on the perceived safety of the I-10 and US 67 interchange. In response to the public comments received, safety illumination at entrance and exit ramp locations is recommended. The exit ramp deceleration lanes and the entrance acceleration ramps are recommended to be reconfigured as shown in **Figure 16**. In addition, the removal of the northbound exit ramp from US 67 to I-10 is recommended to further improve the safety and geometry of the interchange. The recommended concepts are based on TxDOT Roadway Design Manual as per design speed of 75 mph. This core concept does not require any additional ROW. The planning level cost estimate for this improvement is \$1,000,000.

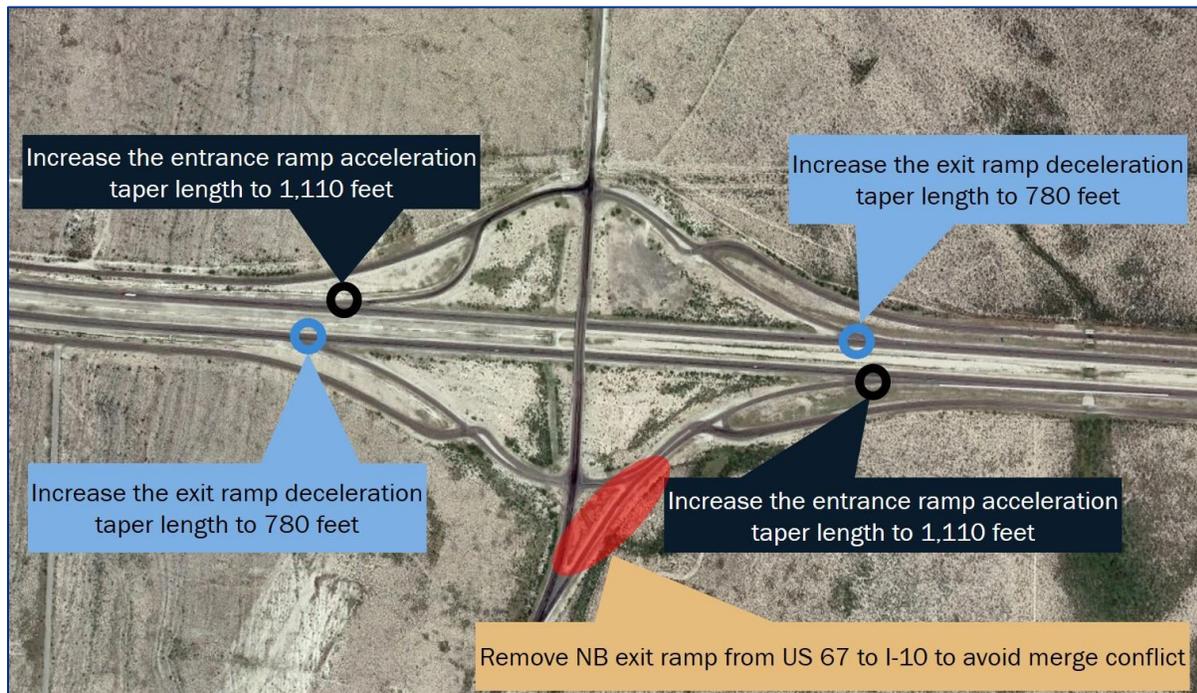


Figure 16: I-10/US 67 Interchange Concept

6.0 Intersection Alternative Concepts

The concept evaluation (generalized screening) and fatal flaw analysis narrowed down the menu of corridor concepts to a list of “core concepts” and “alternative concepts”. Core concepts are concepts for which no alternative to the recommended improvement exists. Core concepts were described in the preceding section, **Section 5**. Unlike core concepts, alternative concepts are concepts for which two or more concepts exist for the same improvement location. This section, **Section 6 Alternative Concepts**, will present all alternative concepts for 11 determined improvement locations. Alternative improvement locations were determined by stakeholders, the Corridor Working Group (CWG), and public input, along with recommendations from data analyses. Alternative concepts were developed for two improvement types: intersection improvements and Complete Streets improvements. Intersection Alternatives are summarized here in this section, **Section 7.0** summarizes the Complete Streets Alternatives. Other improvement types (safety, ITS, rest areas, etc.) are core concepts and summarized in **Section 5**.

Planning level cost estimates were developed for each intersection alternative based on the year 2019 unit prices.

6.1 Presidio Intersection Conceptual Alternatives

Alternative concepts were developed for five improvement locations in Presidio. The four intersection improvement locations are shown within the map in **Figure 17**, while the fifth location is at the Port of Entry (POE). The alternative concepts are defined and summarized in **Table 10**.



Figure 17: Overview of Presidio Improvement Locations

Table 10: Presidio Improvement Locations and Alternative Concepts

Location ID	Location Description	Intersection Alternative Concepts	Planning Level Cost Estimate
Presidio Location 1	US 67 & BUS 67 Intersection	No-Build	\$0
		Alternative A: "T-Intersection"	\$500,000
		Alternative B: "Roundabout"	\$700,000
		Alternative C: "Re-Route"	\$700,000
Presidio Location 2	O'Reilly St & Erma Ave Intersection	No-Build	\$0
		Alternative A: "Y-Intersection"	\$900,000
		Alternative B: "Roundabout with Raised Curb"	\$1,000,000
		Alternative C: "Roundabout"	\$1,100,000
Presidio Location 3	FM 170 & Utopia St at US 67 Intersection	No-Build	\$0
		Alternative A: "4-Way Intersection"	\$850,000
		Alternative B: "Two-Way Left-Turn Lane"	\$500,000
		Alternative C: "4-Lane Segment"	\$950,000
Presidio Location 4	Harrington St & Bledsoe Blvd Intersections at US 67 Intersection	No-Build	\$0
		Alternative A: "4-Way Intersection"	\$550,000
		Alternative B: "Closing of Bledsoe Blvd"	\$550,000
		Alternative C: "Peanut"	\$400,000
Presidio Location 5	Port of Entry (POE) Congestion Relief	No-Build	\$0
		Alternative A: "Parking Capacity at POE"	\$6,800,000
		Alternative B: "Utopia St Relief Route"	\$11,300,000
		Alternative C: "Erma Ave Relief Route over Cibolo Creek"	\$15,500,000

6.1.1 Presidio Location 1 Intersection Alternative Concepts

The existing condition, the *No-Build Alternative*, for Presidio Location 1 is shown in **Figure 18**. This improvement location was determined through the safety analysis (**Appendix D - Safety Analysis**), which found that four crashes occurred at this location between 2010 and 2018. There is a known operational issue, due to the recurrent queue that is formed in the southbound direction approaching the Presidio POE due to large volumes of traffic needing inspection. As shown in **Figure 18**, the roadway geometry of the intersection presents the likelihood for conflicts to occur during travel along US 67 and turning movements between BUS 67 and US 67. Within the existing condition, no islands are present to separate turning movements of vehicles.

Presidio Location 1 Alternative A, the “T-Intersection”, addresses the safety concerns of the existing condition, as shown in **Figure 19**. This alternative concept maintains the T-intersection geometry of the existing condition but introduces safety features including channelizing islands to separate turning movements and raised medians along US 67. *Presidio Location 1 Alternative A* provides clearly defined space for through movements along US 67 and separated space for turning movements between BUS 67 and US 67. No additional ROW is required to implement this alternative concept.

Presidio Location 1 Alternative B, the “Roundabout” addresses safety concerns of the existing condition and reduces conflict points of the intersection, as shown in **Figure 20**. The “Roundabout” alternative concept allows for travel movements in all directions simultaneously. The bypass lanes allow for through travel to bypass the roundabout. No additional ROW is required to implement this alternative concept.

Presidio Location 1 Alternative C, the “Re-Route”, addresses the safety concerns of the existing condition, as shown in **Figure 21**. The “Re-Route” introduces a roadway geometry that allows for the continuous flow of traffic while avoiding the use of a traditional three- or four-way intersection. This alternative concept converts US 67 and BUS 67 into a one-way pair at Location 1. The intersection is converted into a one-way street around the city block in a roundabout style of traffic flow. This roadway geometry introduces some of the safety benefits of a roundabout. Additional ROW is required to implement this alternative concept.



Figure 18: Presidio Location 1 Existing Condition/No-Build Alternative

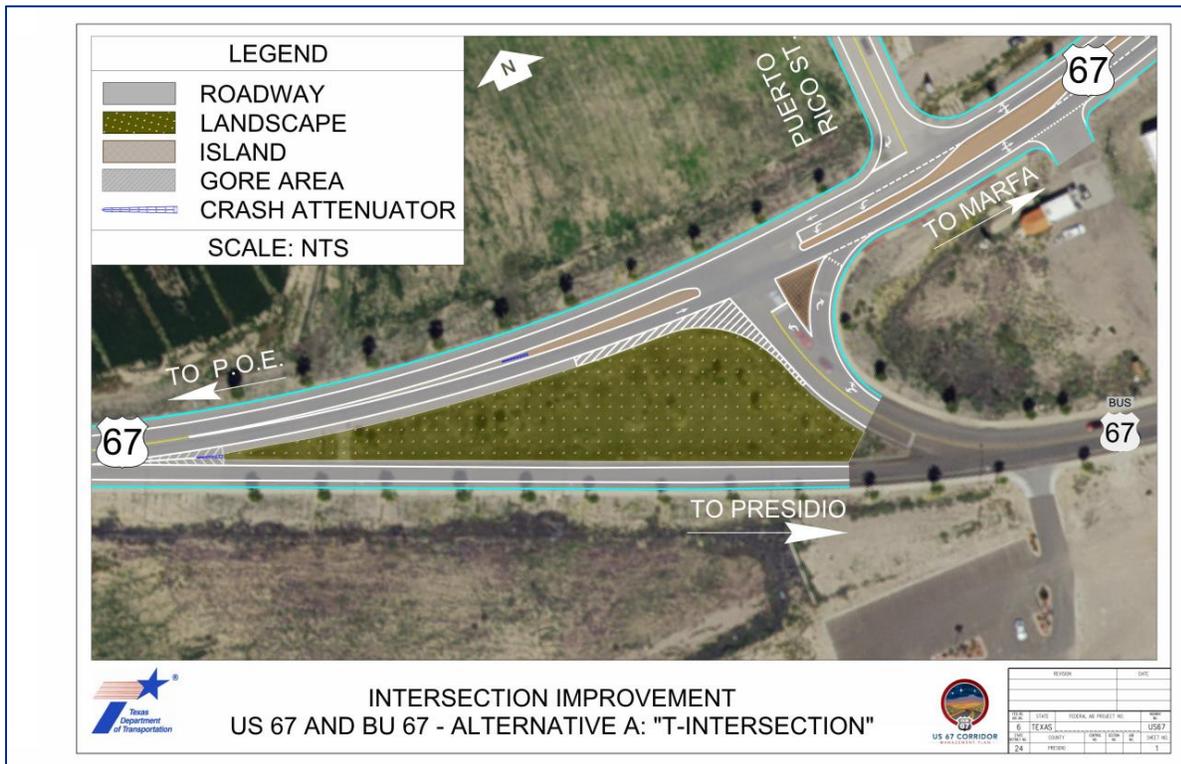


Figure 19: Presidio Location 1 Alternative A

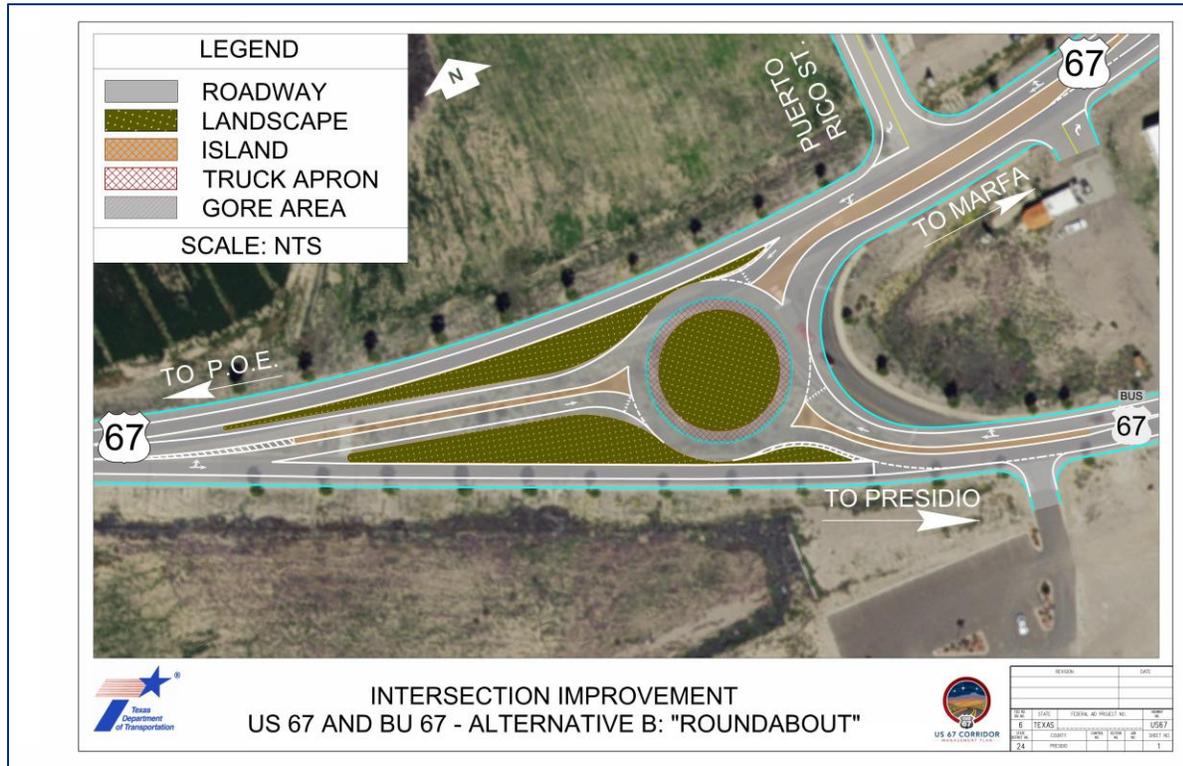


Figure 20: Presidio Location 1 Alternative B

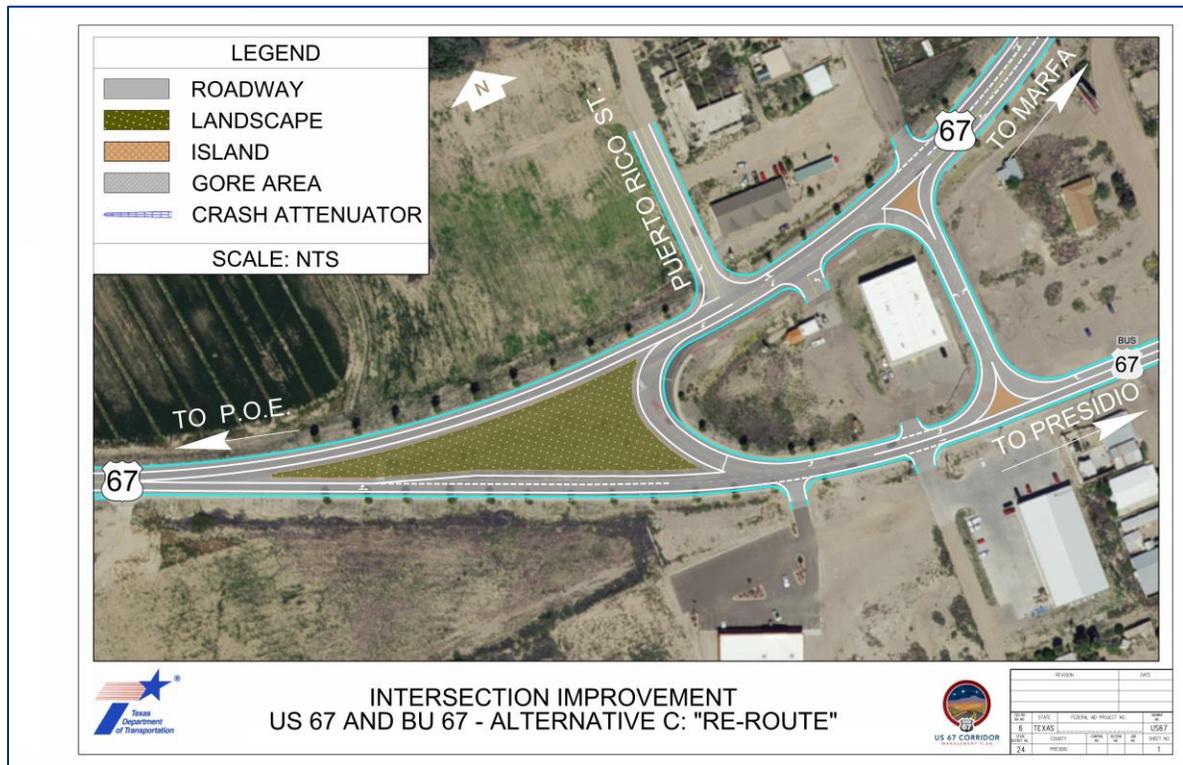


Figure 21: Presidio Location 1 Alternative C

Table 11 provides a summary of the alternative concepts presented for Presidio Location 1. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 11: Presidio Location 1 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ T-Intersections have more conflict points than Alternative B and C
Alternative A: "T-Intersection"	\$500,000	<ul style="list-style-type: none"> ▪ Addresses safety ▪ Well received by all ▪ Will not require ROW 	<ul style="list-style-type: none"> ▪ T-Intersections have more conflict points than Alternative B and C
Alternative B: "Roundabout"	\$700,000	<ul style="list-style-type: none"> ▪ Safer option that allows for fewer conflict points than the traditional intersection ▪ Allows for movement in all directions; Allows for placemaking opportunity ▪ Will not require ROW 	<ul style="list-style-type: none"> ▪ May be confusing to residents
Alternative C: "Re-Route"	\$700,000	<ul style="list-style-type: none"> ▪ Creates a one-way street around the intersection 	<ul style="list-style-type: none"> ▪ Will require ROW ▪ May be confusing to residents and tourists

6.1.2 Presidio Location 2 Intersection Conceptual Alternatives

The improvement location for Presidio Location 2 is O'Reilly St (BUS 67) and Erma Ave. The existing condition, the *No-Build Alternative*, for Presidio Location 2 is shown in **Figure 22**. This improvement location was determined through the safety analysis. The roadway geometry of the intersection creates conflicts by inducing traffic weaving in crossing traffic streams at each of the three corners, and two crashes occurred between 2010 and 2018. The intersection geometry is unusual and presents a confusing situation for drivers upon approach of the intersection.

Presidio Location 2 Alternative A, the "Y-Intersection", addresses the safety concerns present within the existing condition, as shown in **Figure 23**. The "Y-Intersection" alternative concept is a three-way stop-controlled intersection with free flow right turns. The intersection features raised medians to segregate turning movements. Sidewalks and crosswalks are included to improve safety for pedestrian travel and enhance the walkable character of the intersection. Access to the Exxon gas station is slightly limited; however, access to the railroad construction site is maintained as the existing condition. No additional ROW is required to implement this alternative concept.

Presidio Location 2 Alternative B, the "Roundabout Raised Curb", is a roundabout alternative concept that provides an intersection with fewer points of conflicts between the turning movements of vehicles, as shown in **Figure 24**. The roundabout provides traffic calming and the opportunity for placemaking features. The island in the center of the roundabout will include a truck apron to accommodate the turning movements of large trucks that typically carry freight. A raised curb down the center of O'Reilly St allows for east-west through movements without the need to enter the roundabout. The raised curb also provides a safety barrier for those exiting the roundabout and joining through traffic. The roundabout is designed so that outer lanes can bypass the roundabout when turning right. *Presidio Location 2 Alternative B* does provide some access constraints to the Exxon gas station and the railroad construction site. Sidewalks and crosswalks are included to improve safety for pedestrian travel and enhance the walkable character of the intersection. No additional ROW is required to implement this alternative concept.

Presidio Location 2 Alternative C, the "Roundabout", is a traditional roundabout alternative concept as shown in **Figure 25**. The roundabout provides for reduced conflict points between the turning movements of vehicles at the intersection. The traffic flow within a roundabout serves as a traffic calming device. The island within the center of the roundabout presents opportunities for placemaking features and features a truck apron to accommodate the turning movements of large trucks carrying freight. Access to the Exxon gas station is slightly reduced but maintains access for large refueling trucks. To maintain access to the railroad construction site, additional ROW is required to re-route Rio Grande Rd. The re-routed Rio Grande Rd will also provide additional access to the Exxon gas station.



Figure 22: Presidio Location 2 Existing Condition/No-Build Alternative

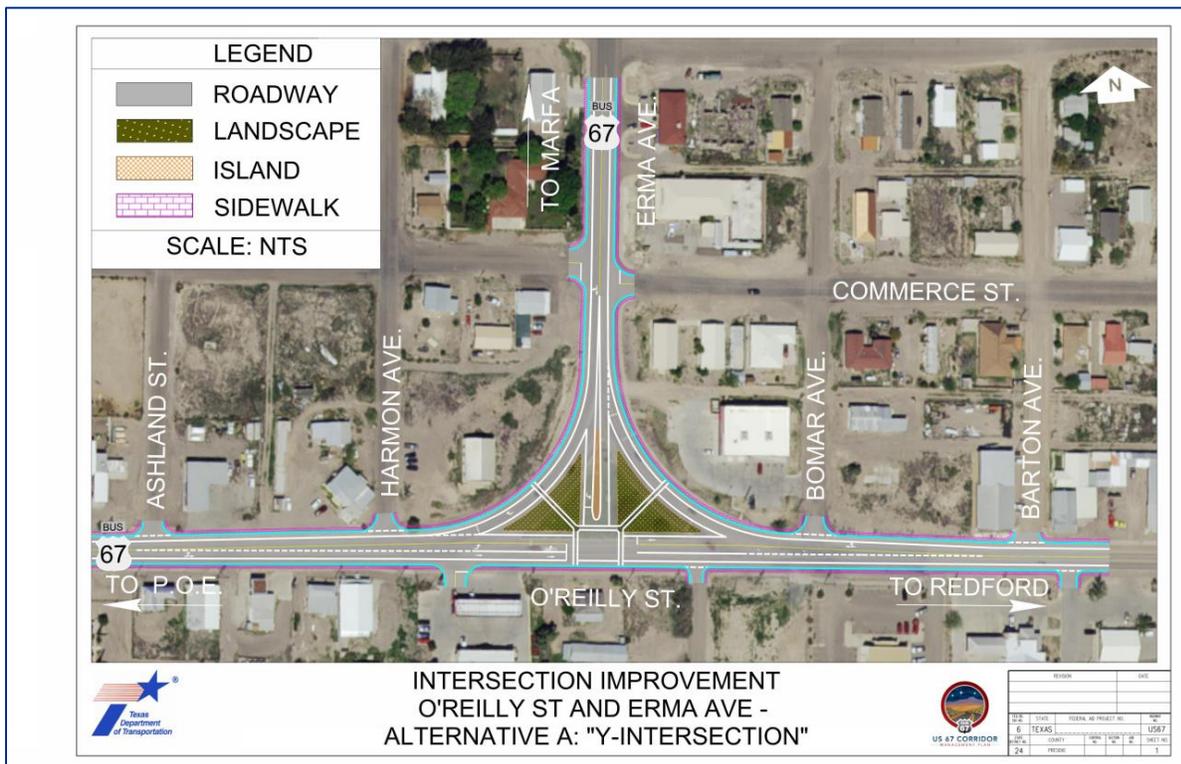


Figure 23: Presidio Location 2 Alternative A

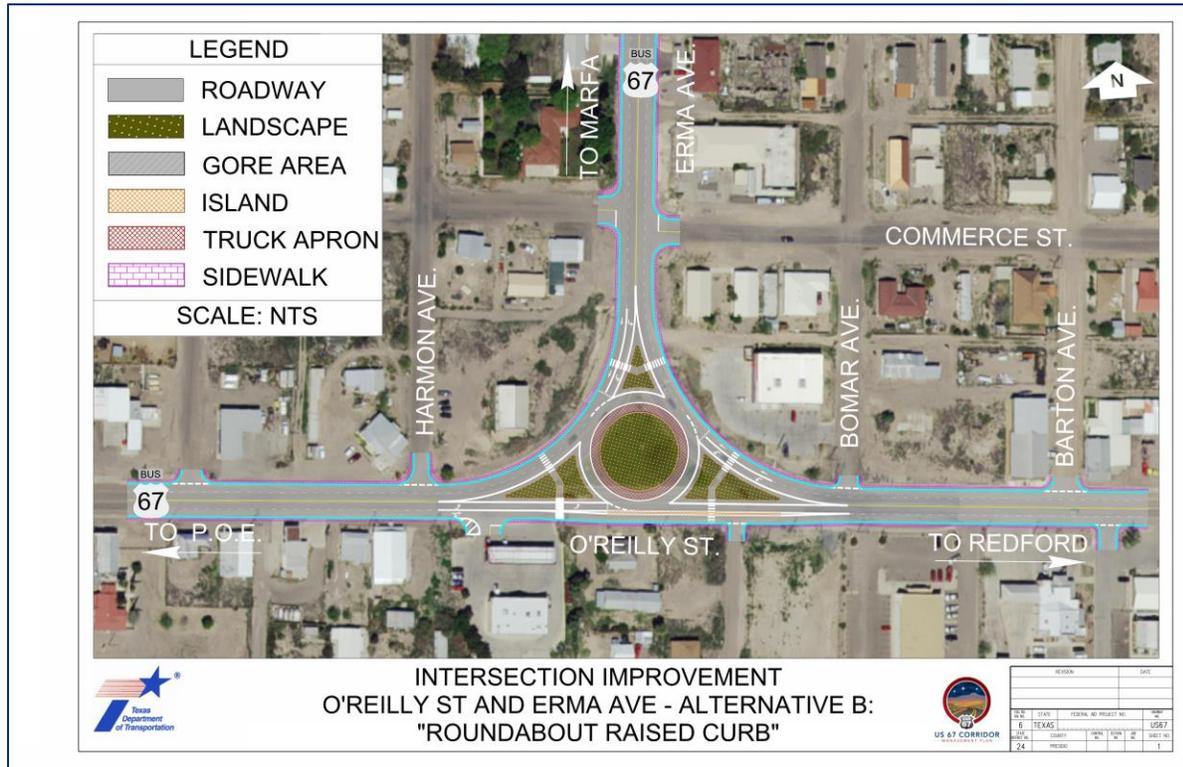


Figure 24: Presidio Location 2 Alternative B

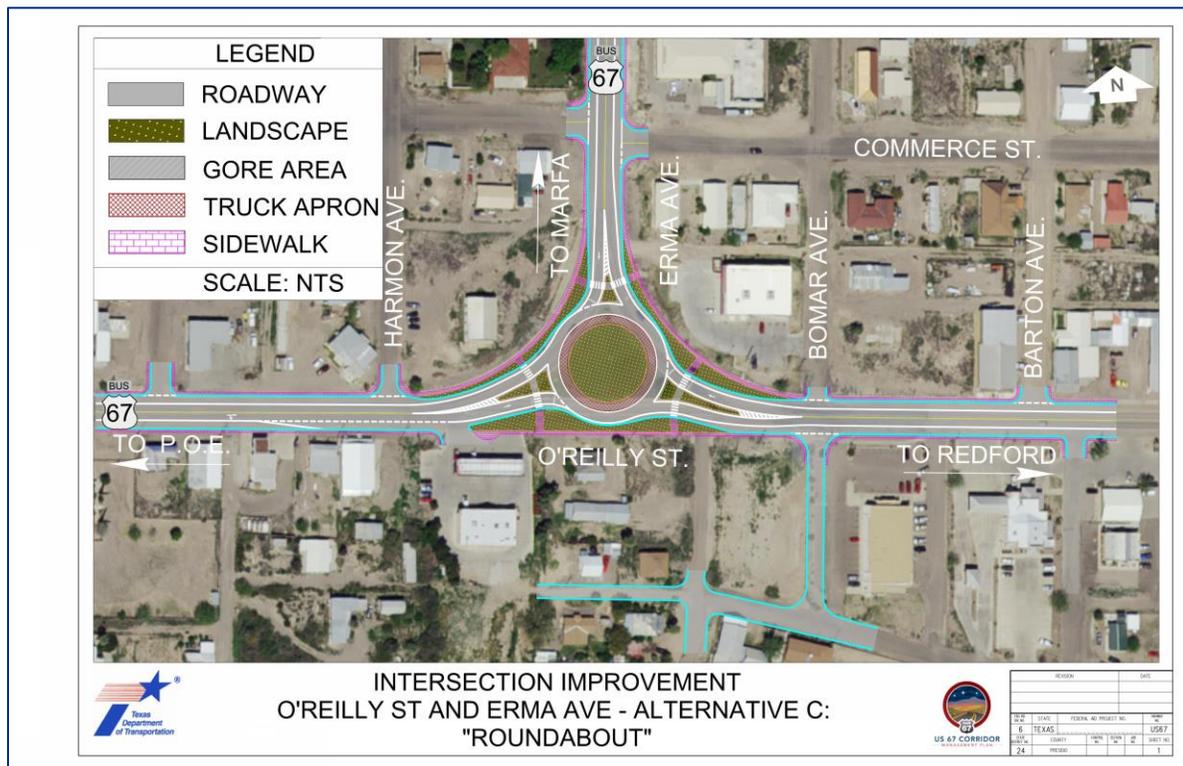


Figure 25: Presidio Location 2 Alternative C

Table 12 provides a summary of the alternative concepts presented for Presidio Location 2. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 12: Presidio Location 2 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety concerns
Alternative A: “Y-Intersection”	\$900,000	<ul style="list-style-type: none"> ▪ Allows movement in all directions ▪ Increases safety ▪ Will not require ROW 	<ul style="list-style-type: none"> ▪ Reduces access to new gas station on the south side
Alternative B: “Roundabout Raised Curb”	\$1,000,000	<ul style="list-style-type: none"> ▪ Addresses safety concerns by creating a safer intersection with fewer conflict points ▪ Placemaking opportunity; Traffic calming ▪ Will not require ROW 	<ul style="list-style-type: none"> ▪ Raised curb may not be preferable along US 67 ▪ Reduces access to new gas station on the south side ▪ Reduce access for West Bound traffic to the railroad
Alternative C: “Roundabout”	\$1,100,000	<ul style="list-style-type: none"> ▪ Addresses safety concerns by creating a safer intersection with fewer conflict points ▪ Placemaking opportunity; Traffic calming 	<ul style="list-style-type: none"> ▪ Reduces access to new gas station on the south side ▪ Maintains access to the railroad via newly re-routed Rio Grande Rd ▪ Will require ROW

6.1.3 Presidio Location 3 Intersection Conceptual Alternatives

The improvement location for Presidio Location 3 is the five-leg intersection of US 67 with FM 170 and Utopia St. The existing condition, the *No-Build Alternative*, for Presidio Location 3 is shown in **Figure 26**. This improvement location was determined through the concerns raised through public input. Two crashes occurred at this location between 2010 and 2018. As shown in **Figure 26**, the complex roadway geometry (the intersection has five legs, all at skewed angles) at Presidio Location 3 presents the likelihood for conflicts to occur. FM 170 serves the Presidio Industrial Park, where a number of large commercial plants and factories are located. The intersection experiences significant use by trucks and oversized vehicles, which currently have difficulty in accomplishing turn movements within the intersection.

Presidio Location 3 Alternative A, the “4-Way Intersection”, addresses the mobility concerns of the existing condition, as shown in **Figure 27**. This alternative concept provides for larger turning radii than the existing condition to accommodate for the large truck movements using the intersection. Additional ROW is required to obtain the space required to accommodate larger turning radii.

Presidio Location 3 Alternative B, the “Two-Way Left-Turn Lane”, is an alternative concept addressing the mobility concerns of the existing condition, as shown in **Figure 28**. For this alternative concept, the west portion of FM 170 is brought to a T-intersection with US 67, providing better visibility to drivers. The eastern portion of FM 170 is aligned across US 67 with Utopia St. The new T-intersection of the western portion of FM 170 with US 67 provides larger turning radii for trucks. Raised medians and striping provide buffer spaces and clarity to drivers for designated travel space. A two-way left-turn lane down the middle of US 67 is provided. Additional ROW is required to implement this alternative concept.

Presidio Location 3 Alternative C, the “4-Lane Segment”, is an alternative concept addressing the freight mobility concerns of the existing condition, as shown in **Figure 29**. This alternative concept provides a 4-lane segment of US 67 beginning south of the RV Park and tapers to two lanes approaching the bridge past the FM 170 intersection. Similar to *Presidio Location 3 Alternative B*, the west portion of FM 170 is brought to a T-intersection with US 67, providing better visibility to drivers. The eastern portion of FM 170 is aligned across US 67 with Utopia St. The new T-intersection of the western portion of FM 170 with US 67 provides larger turning radii for trucks. Raised medians and striping provide buffer spaces and clarity to drivers for designated travel space. Additional ROW is required to implement this alternative concept.

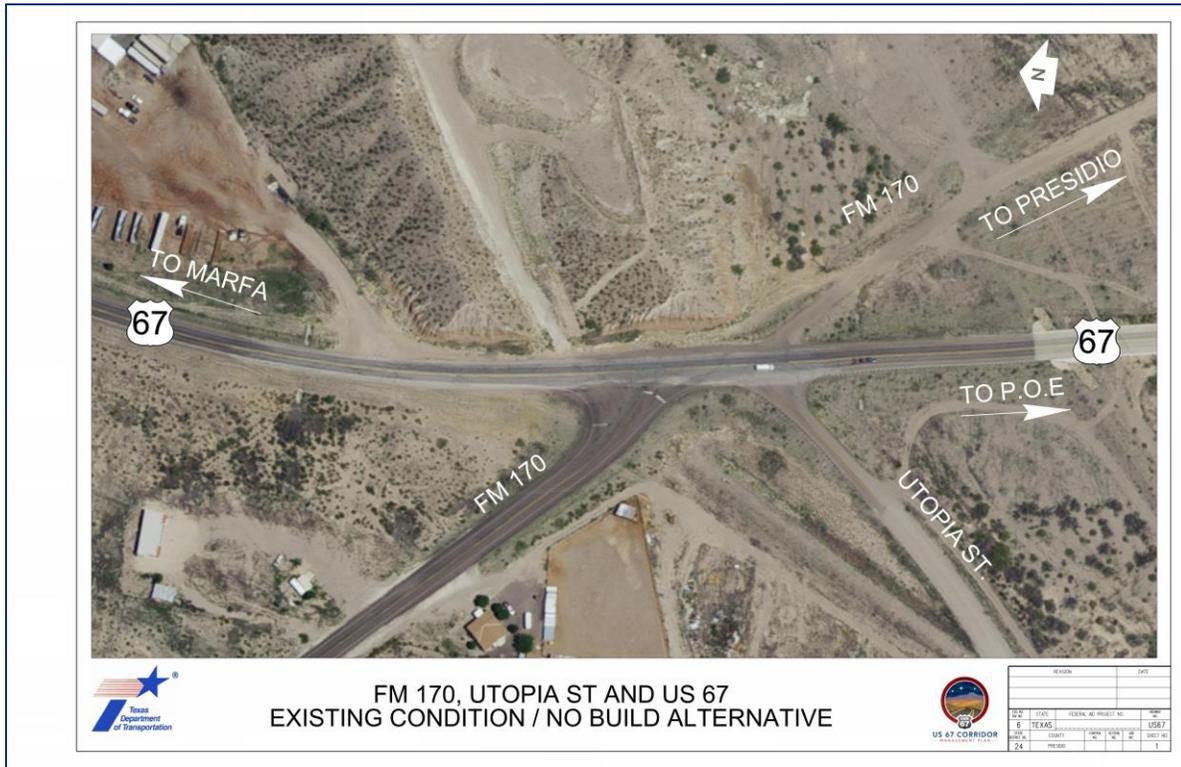


Figure 26: Presidio Location 3 Existing Condition/No-Build Alternative

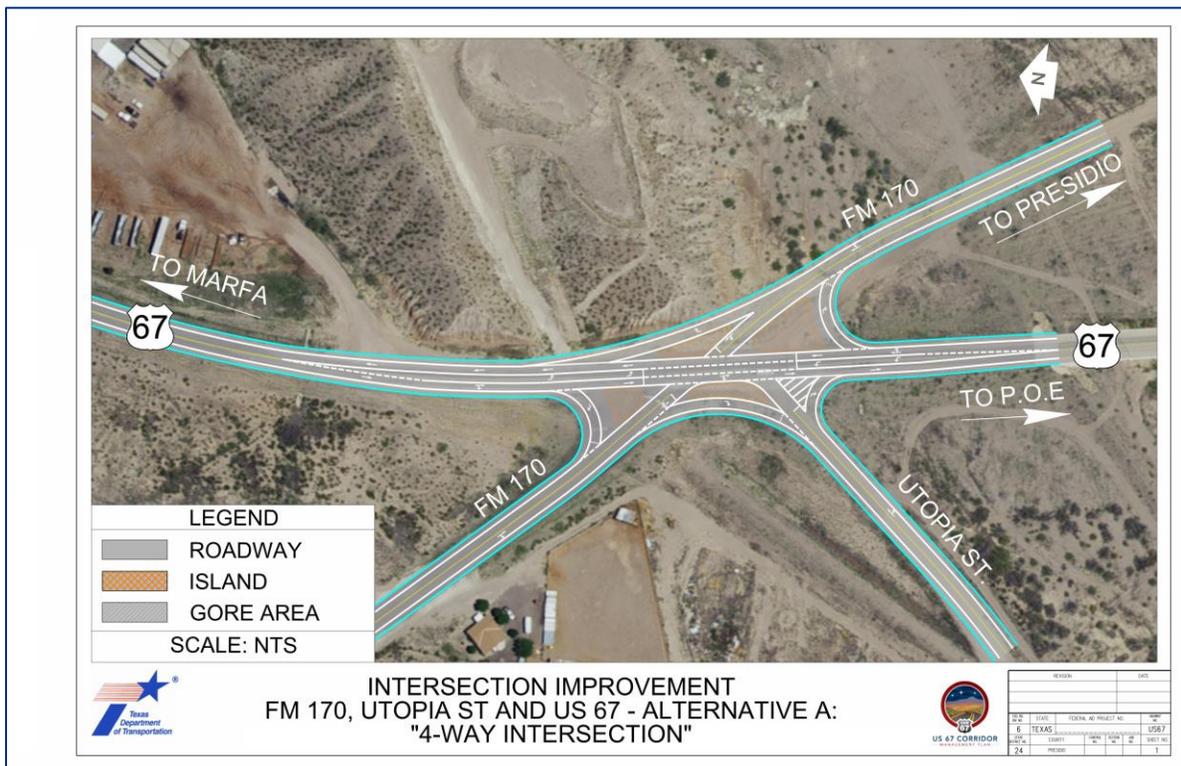


Figure 27: Presidio Location 3 Alternative A

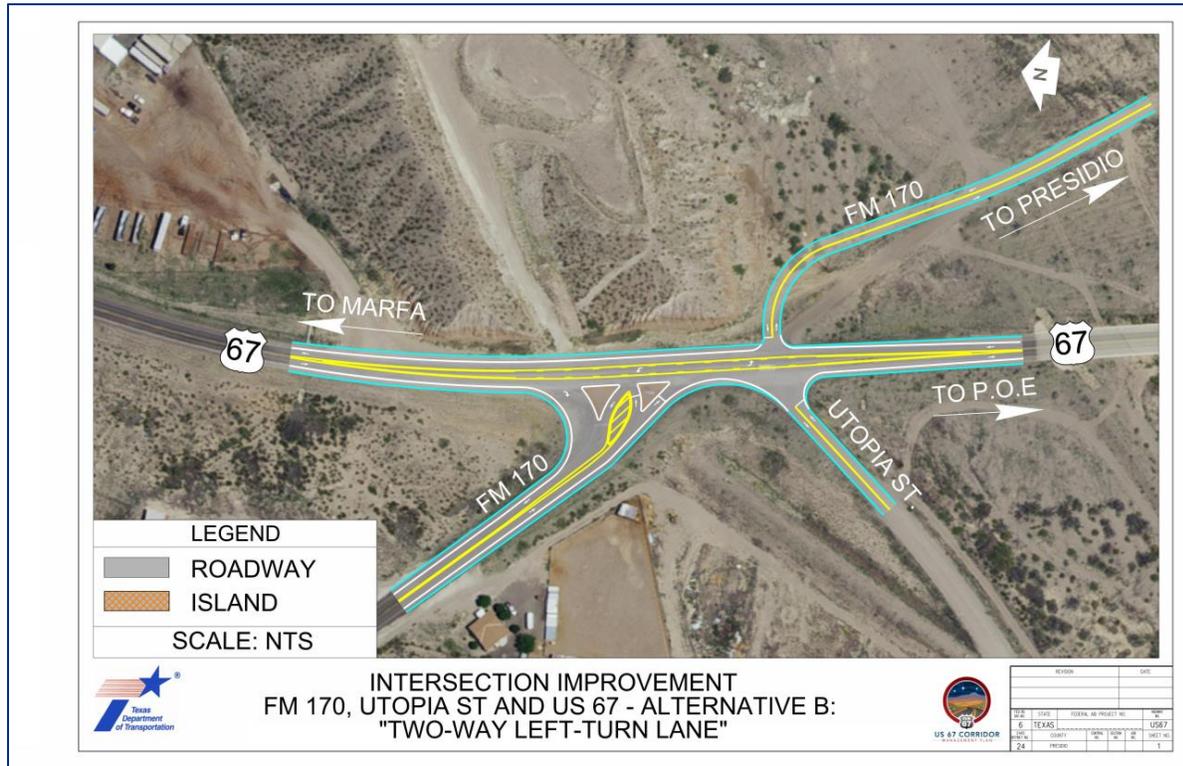


Figure 28: Presidio Location 3 Alternative B

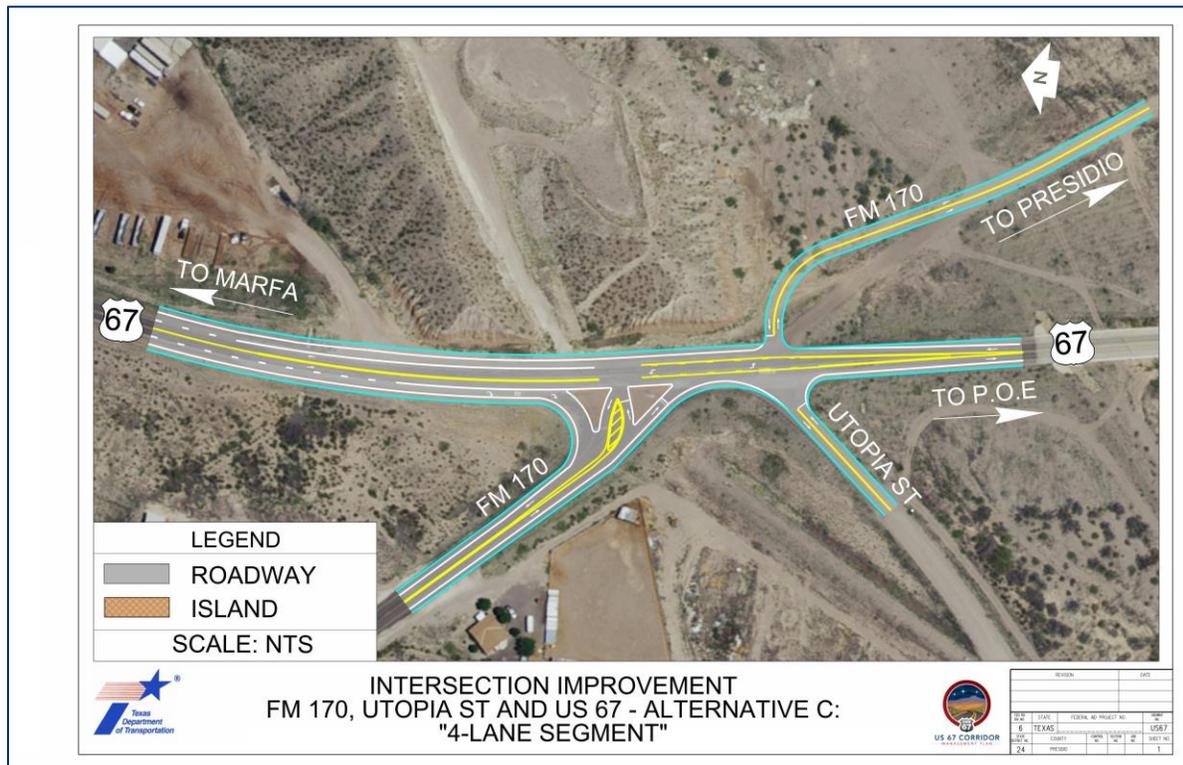


Figure 29: Presidio Location 3 Alternative C

Table 13 provides a summary of the alternative concepts presented for Presidio Location 3. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 13: Presidio Location 3 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety concerns
Alternative A: “4-Way Intersection”	\$850,000	<ul style="list-style-type: none"> ▪ Improved turning radius from US 67 onto FM 170 ▪ Directional medians 	<ul style="list-style-type: none"> ▪ Will require ROW
Alternative B: “Two-Way Left-Turn Lane”	\$500,000	<ul style="list-style-type: none"> ▪ Simple intersection design will limit driver confusion ▪ Large turning radius for trucks 	<ul style="list-style-type: none"> ▪ Will require ROW
Alternative C: “4-Lane Segment”	\$950,000	<ul style="list-style-type: none"> ▪ Dedicated right-turn lane onto FM 170 from US 67 	<ul style="list-style-type: none"> ▪ Current traffic projections do not warrant 4-lane section ▪ Will require ROW

6.1.4 Presidio Location 4 Intersection Conceptual Alternatives

The conceptual alternatives developed for Presidio Location 4, at the intersections of Harrington and Bledsoe with US 67, are shown and discussed on page 19 of this technical memorandum. Because the three conceptual alternatives received strong disfavor from the public and local stakeholders and elected officials, they were removed from the plan. However, they remain in this appendix document for future evaluation and reference, should there be a desire from public to look at this option.

6.1.5 Presidio Location 5 Intersection Conceptual Alternatives

The US 67 corridor serves as the single roadway as a means of access to Presidio and the Presidio POE. Without any alternative routes, US 67 experiences severe congestion within Presidio at particular times of the year when there is an increase in border crossings, usually during holidays. The need for a solution to this severe congestion at the POE was echoed by the CWG and significant public input. Improving the existing congestion at the POE would address mobility and emergency response concerns.

Presidio Location 5 Alternative A, the “Parking Capacity at POE”, is shown in **Figure 30**. This alternative concept involves the construction of a parking lot. Puerto Rico St would be paved and widened to Cibolo Creek to access the parking lot. The parking lot is designed to allow for vehicles to circulate through the parking lot system until queues are called for access to the POE. Implementation of the parking lot could alleviate approximately four miles of congestion. This “Parking Capacity at POE” alternative concept will require multi-jurisdictional collaboration for successful implementation and operation.

Presidio Location 5 Alternative B, the “Utopia St Relief Route”, is shown in **Figure 31**. This alternative concept provides a redundant route to US 67 from the FM 170 intersection to the Presidio POE. Utopia St and Puerto Rico St would be paved and constructed to serve as this redundant route beginning at the intersection of US 67 and FM 170. A new bridge across the Cibolo Creek is required. Implementation of this alternative concept would provide relief to US 67 during times of severe congestion.

Presidio Location 5 Alternative C, the “Erma Avenue Relief Route over Cibolo Creek”, is shown in **Figure 32** and in detail in **Figure 33**. Historically, Erma Ave served as BUS 67, splitting from US 67 0.5 miles north of the intersection of US 67 and FM 170. This alternative concept involves rebuilding Erma Ave as a relief route to US 67. The relief route would require the construction of a new bridge to cross the Cibolo Creek.



Figure 30: Presidio Location 5 Alternative A

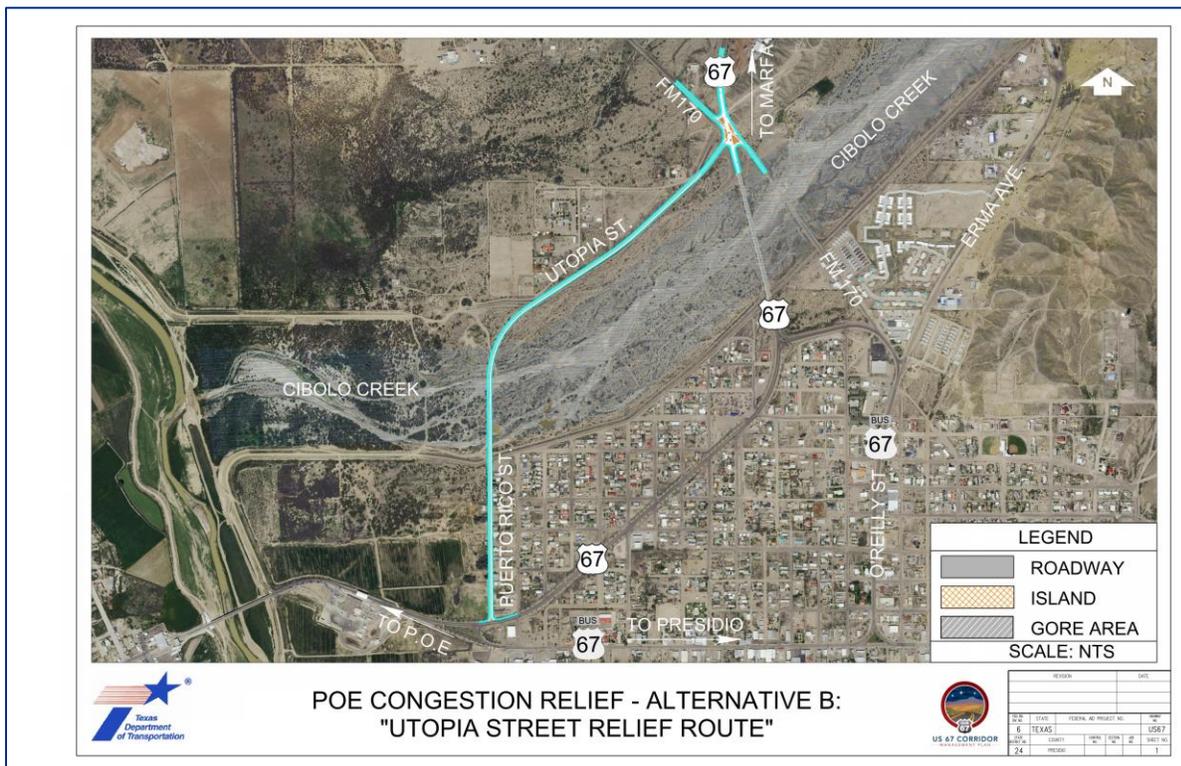


Figure 31: Presidio Location 5 Alternative B

Table 14 provides a summary of the alternative concepts presented for Presidio Location 5. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 14: Presidio Location 5 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety
Alternative A: “Parking Capacity at POE”	\$6,800,000	<ul style="list-style-type: none"> ▪ Cost-efficient ▪ Simple design and will alleviate traffic back up into Presidio 	<ul style="list-style-type: none"> ▪ Not under TxDOT jurisdiction, requires multijurisdictional collaboration ▪ Will require ROW
Alternative B: “Utopia St Relief Route”	\$11,300,000	<ul style="list-style-type: none"> ▪ Will provide some relief to City of Presidio ▪ Can be a phased approach, with parking lot being phase 1 with future build-out of Utopia St. 	<ul style="list-style-type: none"> ▪ Detour is close to city limits and will cause traffic to back up through the city ▪ Will require ROW
Alternative C: “Erma Ave Relief Route”	\$15,500,000	<ul style="list-style-type: none"> ▪ Will provide adequate relief away from the city. 	<ul style="list-style-type: none"> ▪ Will require significant amount of construction and bridge reconstruction as well ▪ Will require ROW

6.2 Marfa Conceptual Alternatives

Alternative concepts were developed for two improvement locations in Marfa. These improvement locations are shown within the map in **Figure 34**. The alternative concepts are defined and summarized in **Table 15**. For additional detail on Complete Streets concepts, please see **Section 7**.



Figure 34: Overview of Marfa Conceptual Alternatives

Table 15: Marfa Improvement Locations and Alternative Concepts

Location ID	Location Description	Intersection Alternative Concepts	Planning Level Cost Estimate
Marfa Location 1	San Antonio St and Highland Ave Intersection	No-Build	\$0
		Alternative A: "With Bicycle Lanes"	\$600,000
		Alternative B: "Without Bicycle Lanes"	\$550,000
		Alternative C: "Two-Way Cycle Track"	\$650,000
Marfa Location 2	Lincoln St and Highland Ave Intersection at Presidio County Courthouse	No-Build	\$0
		Alternative A: "Roundabout"	\$200,000
		Alternative B: "Roundabout with Bicycle Lanes"	\$650,000
		Alternative C: "T-Intersection"	\$650,000

6.2.1 Marfa Location 1 Intersection Conceptual Alternatives

The improvement location for Marfa Location 1 is the intersection of San Antonio St and Highland Ave. The existing condition, the *No-Build Alternative*, for Marfa Location 1 is shown in **Figure 35**. This improvement location was determined through both concerns raised through public input and the safety analysis (**Appendix D**). Between 2010 and 2018 there were 15 crashes at this intersection – two fixed objects, one incapacitating crash involving a pedestrian, one parked vehicle, and 11 property damage crashes. The improvement location is within the city center of Marfa. The Marfa City Hall abuts the intersection, and the Marfa Visitors Center, the Saint George Hotel, and other key destinations are within close proximity. Many residents and visitors walk or bicycle within the area to travel between destinations. Several bicycle share stations for the local bicycle share, Bike Marfa, are located throughout the area. This intersection and the surrounding area generate a demand for pedestrian and bicycle infrastructure, along with a need for parking spaces. This location also experiences heavy freight traffic. Within the existing condition, Marfa Location 1 lacks continuous standard sidewalks, bicycle lanes, and designated parking spaces. Turning movements between San Antonio St and Highland Ave are restricted for large vehicles.

Marfa Location 1 Alternative A, “With Bicycle Lanes”, is shown in **Figure 36**. This alternative concept provides larger turning radii for freight trucks, along with improved bicycle and pedestrian facilities. San Antonio St remains a two-lane street, and Highland Ave is upgraded to a four-lane street. On San Antonio St, bicycle lanes with buffers and designated parallel parking spaces are striped. On Highland Ave, bicycle lanes and designated parallel parking spaces are striped. The installation of a pedestrian hybrid beacon (PHB) is recommended. A PHB is a pedestrian-activated warning device that helps pedestrians safely cross major roadways at uncontrolled marked crosswalk locations. No additional ROW is required to implement this alternative concept.

Marfa Location 1 Alternative B, “Without Bicycle Lanes”, is shown in **Figure 37**. This alternative concept provides larger turning radii for freight trucks, along with improved pedestrian facilities and designated parallel parking spaces. Unlike *Alternative A*, *Alternative B* does not include bicycle facilities. San Antonio St remains two travel lanes, and Highland is upgraded to four travel lanes. The installation of a PHB is recommended. No additional ROW is required to implement this alternative concept.

Marfa Location 1 Alternative C, “Two-Way Cycle Track”, is shown in **Figure 38**. This alternative concept provides larger turning radii for freight trucks, along with improved pedestrian facilities, a two-way cycle track, and designated parallel parking facilities. A two-way cycle track is a physically separated bicycle facility that allows bicycle movement in both directions on one side of the road. Marfa Location 1 Alternative C includes a two-way cycle track on San Antonio St with physical separation provided by tubular delineators and a two-way cycle track on Highland Ave with physical separation provided by adjacent parallel parking spaces. For this alternative concept, both San Antonio St and Highland Ave remain two-lane roadways. The installation of a PHB is recommended. No additional ROW is required to implement this alternative concept.

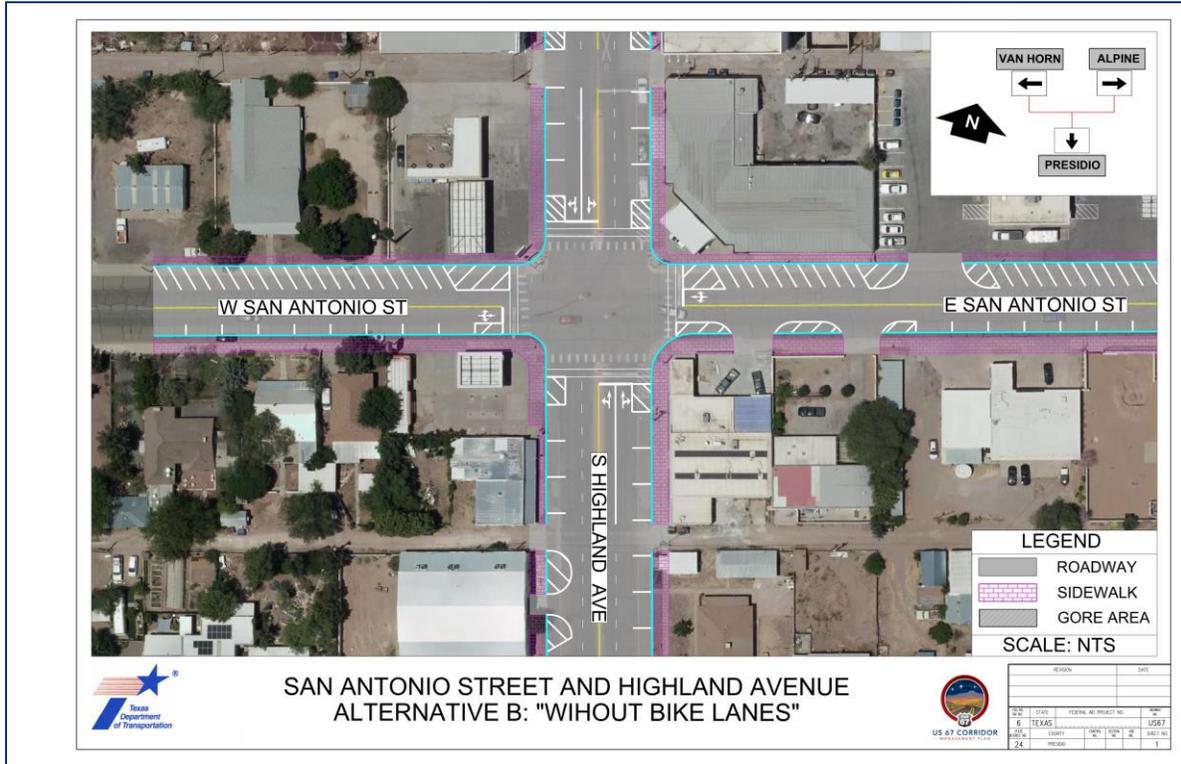


Figure 37: Marfa Location 1 Alternative B

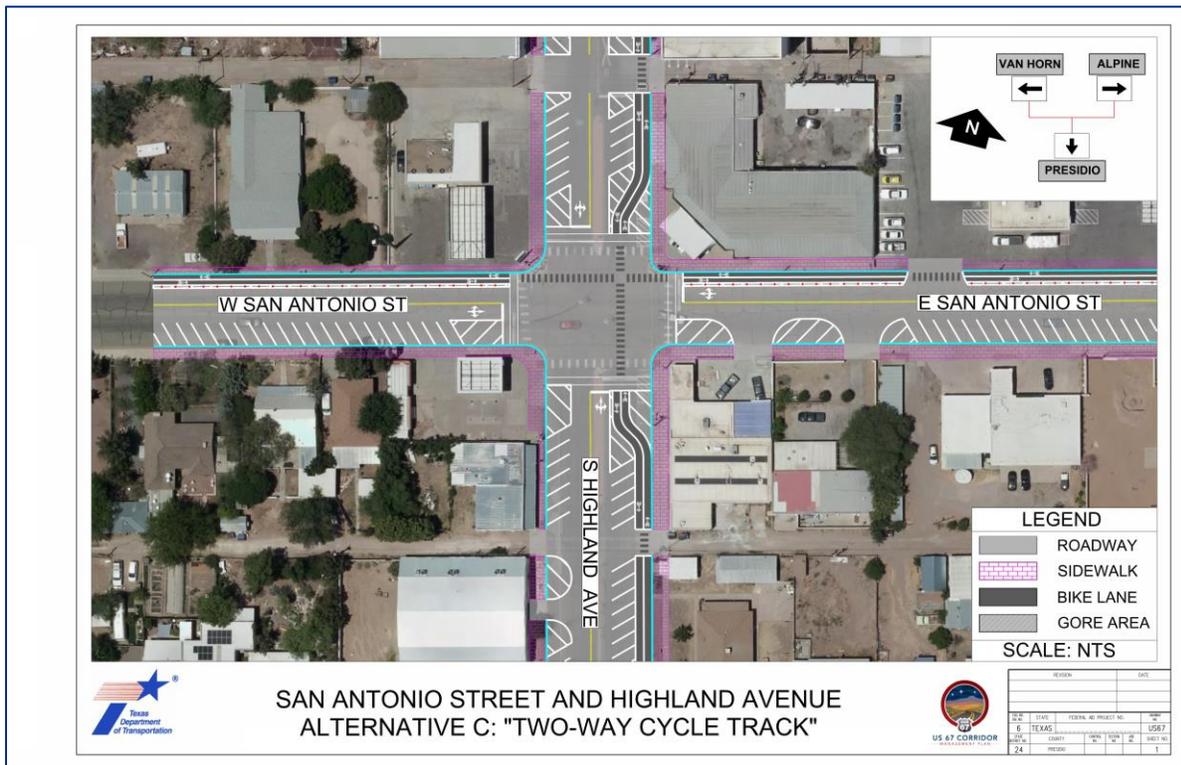


Figure 38: Marfa Location 1 Alternative C

Table 16 provides a summary of the alternative concepts presented for Marfa Location 1. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 16: Marfa Location 1 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety concerns
Alternative A: "With Bicycle Lanes"	\$600,000	<ul style="list-style-type: none"> ▪ Dedicated bicycle lane with buffer for safety ▪ Eliminates parking at intersections for better visibility ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ None
Alternative B "Without Bicycle Lanes"	\$550,000	<ul style="list-style-type: none"> ▪ Provides parallel parking along San Antonio St ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ No bicycle lane provided
Alternative C: "Two-Way Cycle Track"	\$650,000	<ul style="list-style-type: none"> ▪ Dedicated 2-way cycle track ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Decreased parking

6.2.2 Marfa Location 2 Intersection Conceptual Alternatives

The improvement location for Marfa Location 2 is the intersection of Lincoln St and Highland St at the Presidio County Courthouse. The existing condition, the *No-Build Alternative*, for Marfa Location 2 is shown in **Figure 39**. This improvement location was determined through both concerns raised through public input and TxDOT (**Appendix D**). The existing condition is a standard T-intersection. Highland St provides angled parking on both sides of the street and “T’s” into Lincoln St. Along Lincoln St, no designed parking is striped; however, drivers park in front of the Presidio County Courthouse and along Lincoln St in a head-in parking manner both angled and straight. Marfa Location 2 is also within the city center of Marfa, with the Presidio County Courthouse, the Marfa Fire Station, and other key destinations abutting the intersection. Many residents and visitors walk or bicycle within the area to travel between destinations. Several bicycle share stations for the local bicycle share, Bike Marfa, are located throughout the area. This intersection and the surrounding area generate a demand for pedestrian and bicycle infrastructure, along with a need for designated parking spaces. The intersection also experiences heavy use by freight trucks. Within the existing condition, Marfa Location 2 lacks continuous standard sidewalks, bicycle lanes, and designated parking spaces. Turning movements at this intersection are restricted for large vehicles.

Marfa Location 2 Alternative A, the “Roundabout”, is shown in **Figure 40**. This alternative concept provides larger turning radii for freight trucks, along with improved pedestrian facilities. As a roundabout facility, this alternative concept reduces conflict points at the intersection, improving safety. Designated parking spaces are provided. The angled parking along Highland St is maintained and head-in parking spaces are provided in front of the Presidio County Courthouse. The center of the roundabout is traversable to allow for the turning movements of larger freight trucks. No additional ROW is required to implement this alternative concept.

Marfa Location 2 Alternative B, the “Roundabout with Bicycle Lanes”, is shown in **Figure 41**. This alternative concept provides larger turning radii for freight trucks, along with improved pedestrian and bicycle facilities. Within this alternative concept, some space that is used for parking within the existing condition is allocated to bicycle facilities. Designated parking along the side streets east and west of the Presidio County Courthouse, however, are provided. Designated parallel parking is provided along Lincoln St and some angled parking along Highland St is maintained. Landscaping will be between the courthouse and the bicycle lanes. The center of the roundabout is traversable to allow for the turning movements of larger freight trucks. No additional ROW is required to implement this alternative concept.

Marfa Location 2 Alternative C, the “T-Intersection”, is shown in **Figure 42**. This alternative concept provides larger turning radii for freight trucks, along with improved bicycle and pedestrian facilities. Highland St maintains designated angled parking, and a bicycle lane is added. Along Lincoln St, designated parking spaces are striped, and a bicycle lane is added. The designated parking spaces are angled spaces in front of the courthouse and parallel spaces elsewhere along Lincoln St. No additional ROW is required to implement this alternative concept.



Figure 39: Marfa Location 2 Existing Condition/No-Build Alternative

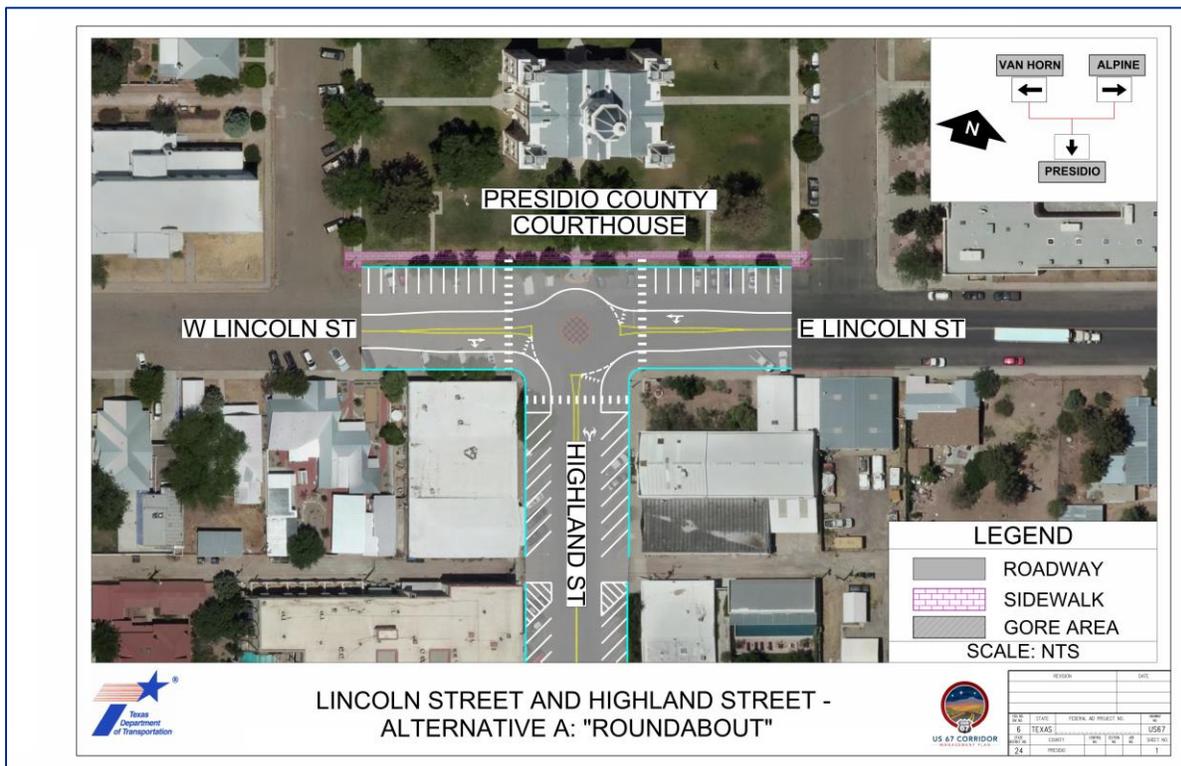


Figure 40: Marfa Location 2 Alternative A

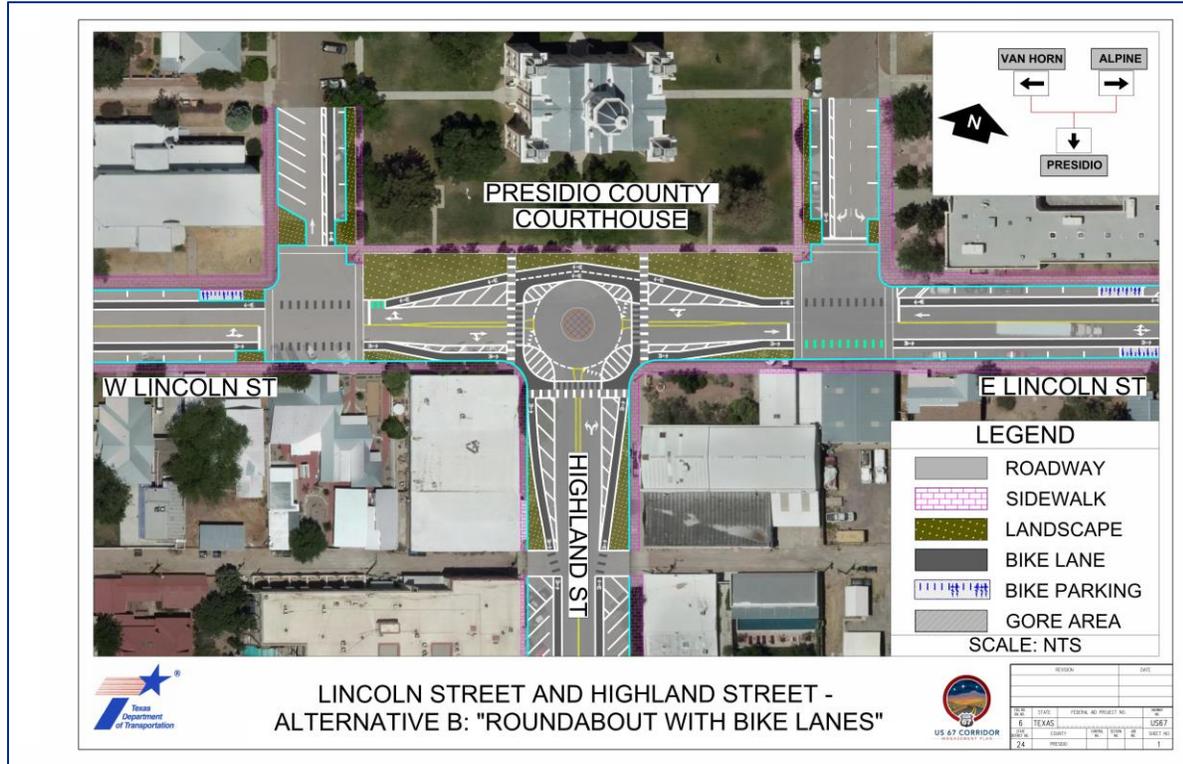


Figure 41: Marfa Location 2 Alternative B

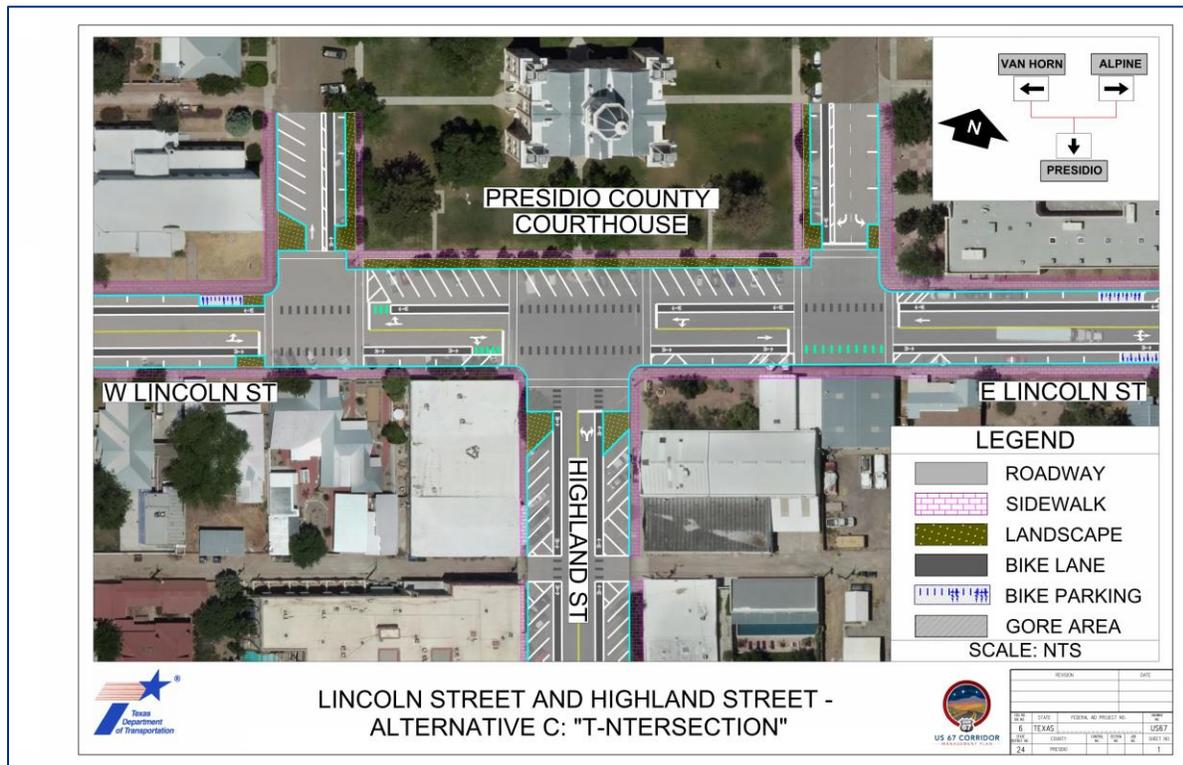


Figure 42: Marfa Location 2 Alternative C

Table 17 provides a summary of the alternative concepts presented for Marfa Location 2. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 17: Marfa Location 2 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety concerns
Alternative A "Roundabout"	\$200,000	<ul style="list-style-type: none"> ▪ Provides a safer intersection with continuous traffic flow ▪ Traversable center median for ease of large truck movement ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Removing some designated parking spaces ▪ No bicycle facilities
Alternative B: "Roundabout with Bicycle Lanes"	\$650,000	<ul style="list-style-type: none"> ▪ Provides a safer intersection with continuous traffic flow ▪ Dedicated bicycle lane ▪ Traversable center median for ease of large truck movement ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ No designated parking spaces
Alternative C: "T- Intersection"	\$650,000	<ul style="list-style-type: none"> ▪ Provides angled parking along Lincoln St in front of the courthouse ▪ Dedicated bicycle lanes with buffer for safety ▪ No learning curve required due to similar existing geometry ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Traditional 3-leg intersection which is generally less safe than a roundabout

6.3 Alpine Conceptual Alternatives

Alternative concepts were developed for three improvement locations in Alpine. These improvement locations are shown within the map in **Figure 43**. The alternative concepts are defined and summarized in **Table 18**.



Figure 43: Overview of Alpine Conceptual Alternatives

Table 18: Alpine Improvement Locations and Alternative Concepts

Location ID	Location Description	Intersection Alternative Concepts	Planning Level Cost Estimate
Alpine Location 1	FM 1703 and US 67 Intersection	No-Build	\$0
		Alternative A: "Two-Way Left-Turn Lane"	\$650,000
		Alternative B: "Three-Way Stop"	\$400,000
		Alternative C: "Roundabout"	\$650,000
Alpine Location 2	Orange St and Sul Ross Ave Intersections at US 67	No-Build	\$0
		Alternative A: "Closing Orange St and Sul Ross Ave"	\$450,000
		Alternative B: "Re-Route via Plum St"	\$900,000
		Alternative C: "Re-Route via Peach St"	\$900,000
Alpine Location 3	Intersection at Sul Ross University and US 67	No-Build	\$0
		Alternative A: "Pedestrian Ring"	\$850,000
		Alternative B: "Free Flow on US 67"	\$750,000
		Alternative C: "Roundabout"	\$950,000

6.3.1 Alpine Location 1 Intersection Conceptual Alternatives

The improvement location for Alpine Location 1 is the intersection US 67 and FM 1703. The existing condition, the *No-Build Alternative*, for Alpine Location 1 is shown in **Figure 44**. This improvement location was determined through both concerns raised through the safety analysis (**Appendix D**) and the Brain Dump Meeting with Alpine stakeholders. Five crashes occurred at Alpine Location 1 between 2010 and 2018. The existing condition includes two access points between US 67 and FM 1703 and is skewed, which confuses drivers. In addition, multiple driveways to businesses at the intersection further cause confusion to drivers when operating within the intersection.

Alpine Location 1 Alternative A, the “Two-Way Left-Turn Lane”, is shown in **Figure 45**. With the addition of a center turn lane, this alternative concept provides a safe vehicle refuge area for left-turning vehicles while maintaining free flow for through travel along US 67. This concept was a direct result of a public involvement meeting and the feedback received from a participant. The intersection with FM 1703 is reconstructed slightly to the west of the existing intersection, requiring the addition of ROW. The new intersection includes right-turn only and left-turn only lanes with raised medians and striped gore areas to delineate and clarify designated spaces for turning movements to drivers. Access to existing businesses along FM 1703 is maintained.

Alpine Location 1 Alternative B, the “Three-Way Stop”, is shown in **Figure 46**. This alternative concept provides a three-way stop at the intersection. FM 1703 is reconstructed slightly to the west of the existing intersection, requiring additional ROW. The intersection is designed for FM 1703 to “T” into US 67 with a three-way stop sign. As shown in **Figure 46**, designated turn lanes, raised medians, and striped gore areas are included to provide a safer, more clearly defined space for through and turning movements of vehicles. Access to existing businesses along FM 1703 is maintained.

Alpine Location 1 Alternative C, the “Roundabout”, is shown in **Figure 47**. This alternative concept provides a roundabout facility at the intersection of US 67 and FM 1703. The roundabout includes a truck apron along the center raised median to allow for the larger turning movements required of larger freight trucks. A through travel lane is provided to allow free-flow travel along US 67 for vehicles not desiring to enter the roundabout. A raised median separates the through travel lane from the roundabout as a buffer. Access to the businesses currently present along FM 1703 is maintained with the addition of an access road. Additional ROW is required to implement this alternative concept.



Figure 44: Alpine Location 1 Existing Condition/No-Build Alternative



Figure 45: Alpine Location 1 Alternative A

Table 19 provides a summary of the alternative concepts presented for Alpine Location 1. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 19: Alpine Location 1 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety concerns
Alternative A: “Two-Way Left-Turn Lane”	\$650,000	<ul style="list-style-type: none"> ▪ Includes lane drop going towards Marfa ▪ Provides a safe refuge area for vehicles turning left 	<ul style="list-style-type: none"> ▪ Left-turn to and from FM 1703 creates a conflict point ▪ Will require ROW
Alternative B: “Three-Way Stop”	\$400,000	<ul style="list-style-type: none"> ▪ Provides turning movements in all directions ▪ Addresses safety concerns ▪ Designated right-turn lane onto FM 1703 	<ul style="list-style-type: none"> ▪ Creates a stop condition along US 67 ▪ Will require ROW
Alternative C: “Roundabout”	\$650,000	<ul style="list-style-type: none"> ▪ Provides turning movements in all directions ▪ Addresses safety concerns ▪ Continuous flow on US 67 	<ul style="list-style-type: none"> ▪ Will require ROW; could be confusing to locals ▪ Reduced access to businesses south of US 67 from WB US 67 and EB FM 1703

6.3.2 Alpine Location 2 Intersection Conceptual Alternatives

The improvement location for Alpine Location 2 includes the Orange St and Sul Ross Ave intersections with US 67. The existing condition, the *No-Build Alternative*, for Alpine Location 2 is shown in **Figure 48**. This improvement location was determined through concerns raised through the safety analysis (**Appendix D**). Within the existing condition, US 67 bisects the city block grid system at a diagonal, creating a 5-legged, skewed, and unsafe intersection. Sul Ross Ave, Orange St, and US 67 meet at a single point. Within the existing condition, US 67 maintains unimpeded through travel at this intersection. Stop controls exist at the points where Sul Ross Ave and Orange St meet US 67.

Alpine Location 2 Alternative A, the “Closing Orange St and Sul Ross Ave”, is shown in **Figure 49**. This alternative concept addresses the safety concerns raised by limiting access and channelizing turn movement to US 67 from Sul Ross Ave and Orange St. Westbound Sul Ross Ave and northbound Orange St is closed at US 67. Eastbound Sul Ross Ave is realigned to a T-intersection with US 67 and includes channelized turn movements with a striped gore area. Southbound Orange St at US 67 is provided an intersection with channelized turn movements with a striped gore area. Cherry Street is striped with gore areas for channelized movements. No additional ROW is required to implement this alternative concept.

Alpine Location 2 Alternative B, “Re-Route via Plum Street”, is shown in **Figure 50**. This alternative concept builds off the previously introduced concept *Alpine Location 2 Alternative A*. Westbound Sul

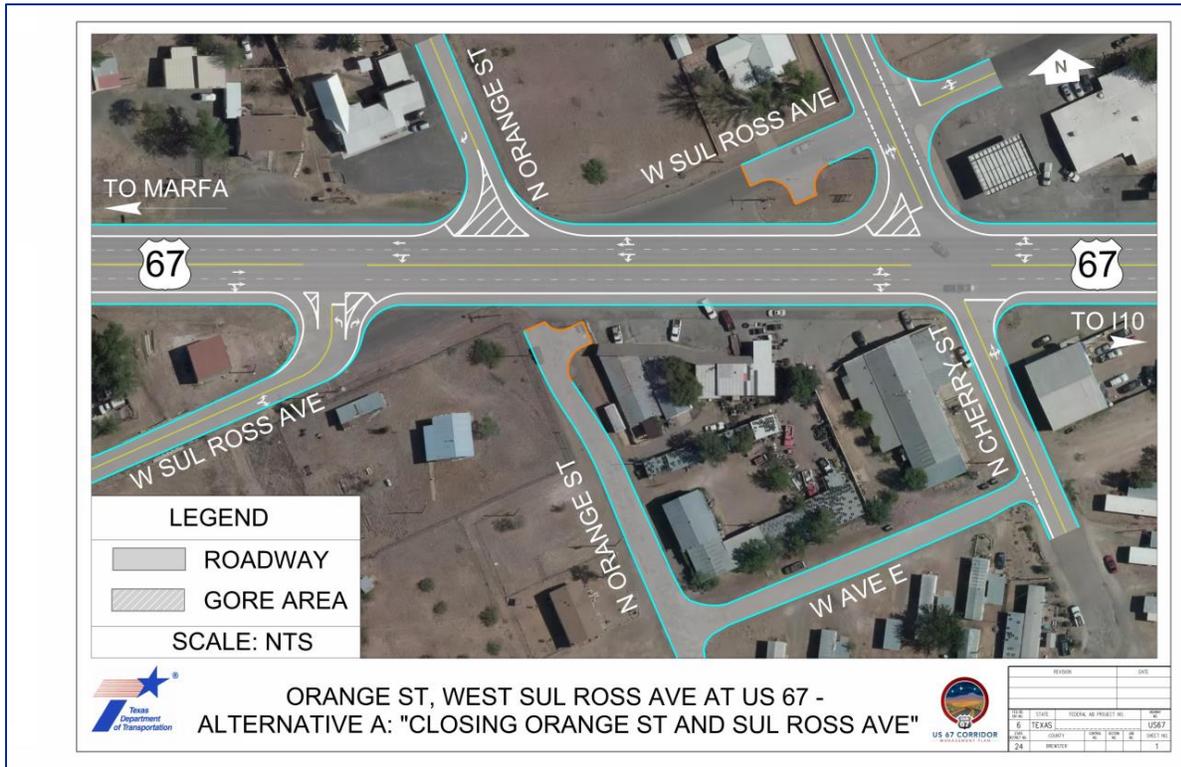


Figure 49: Alpine Location 2 Alternative A



Figure 50: Alpine Location 2 Alternative B

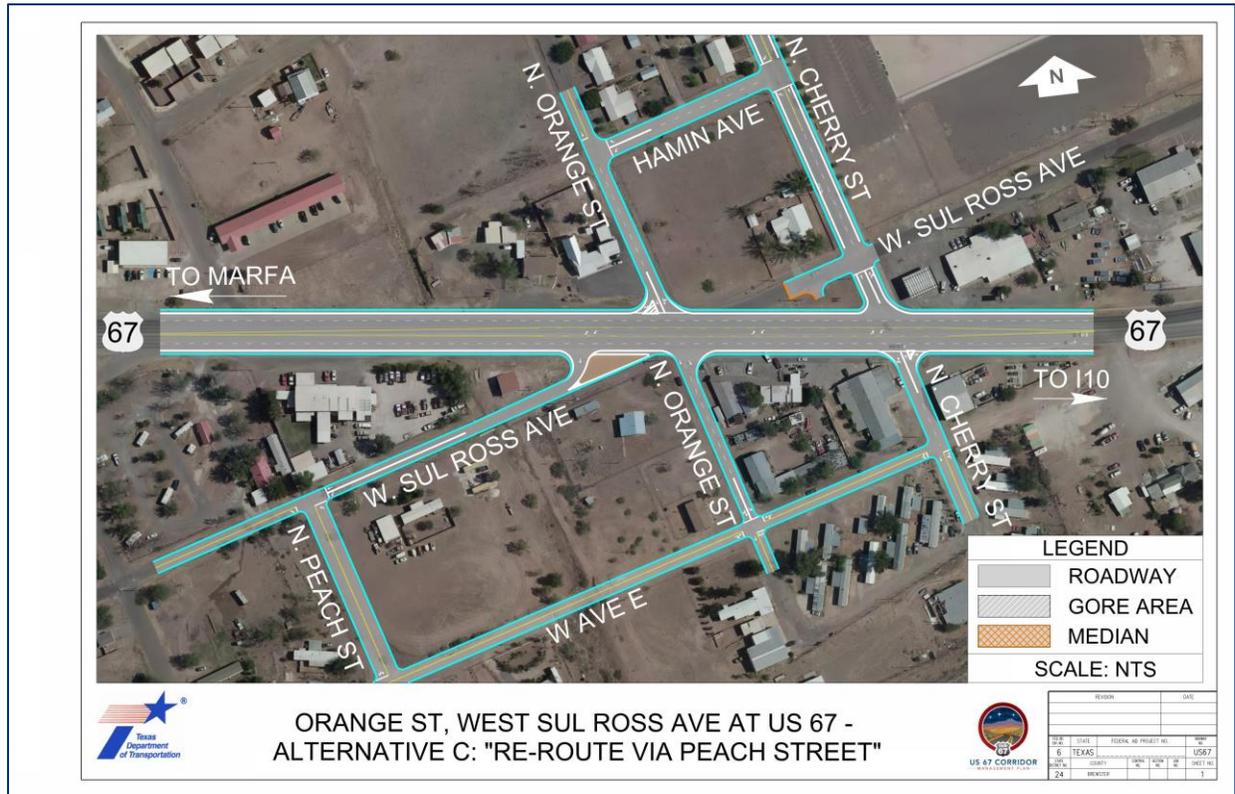


Figure 51: Alpine Location 2 Alternative C

Table 20 provides a summary of the alternative concepts presented for Alpine Location 2. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 20: Alpine Location 2 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> No cost Does not require ROW 	<ul style="list-style-type: none"> Does not address safety concerns
Alternative A: "Closing Orange St and Sul Ross Ave"	\$450,000	<ul style="list-style-type: none"> Limits access to US 67 Cost-efficient Will not require ROW 	<ul style="list-style-type: none"> Closes W Sul Ross Ave in the North and N Orange St in the South
Alternative B: "Re-Route via Plum St"	\$900,000	<ul style="list-style-type: none"> Removes offset intersection between W Sul Ross and N Orange Addresses safety issues; Closes W Sul Ross Ave in the north to US 67 Will not require ROW 	<ul style="list-style-type: none"> Will re-route traffic in the south all via N Cherry St
Alternative C: "Re-Route via Peach St"	\$900,000	<ul style="list-style-type: none"> Removes offset intersection between W Sul Ross and N Orange Addresses safety issues Will not require ROW 	<ul style="list-style-type: none"> Re-routes traffic on W Sul Ross via Orange St to access US 67

6.3.3 Alpine Location 3 Intersection Conceptual Alternatives

The improvement location for Alpine Location 3 is the intersections of Bird and Harrison with US 67 at Sul Ross State University. The existing condition, the *No-Build Alternative*, for Alpine Location 3 is shown in **Figure 52**. This improvement location was determined through concerns raised through the safety analysis (**Appendix D**). There have been 47 total crashes at Alpine Location 3 between 2010 and 2018 – 15 at Holland Avenue and Harrison Street, 17 at E Avenue E and Harrison Street, seven at US 67 and Bird Street, and eight at US 67 and Lackey Street. Crashes involving vehicles turning left predominate. At Alpine Location 3, US 67 splits into a one-way pair in the westbound direction. The existing condition is confusing to drivers when navigating the intersection.

Alpine Location 3 Alternative A, the “Pedestrian Ring”, is shown in **Figure 53**. This alternative concept addresses safety and mobility concerns raised by converting Harrison St into a one-way street and incorporating pedestrian facilities. Raised medians and striped gore areas are added at intersections to channelize movements. The eastbound intersection of Holland Ave (US 67) and Bird St includes an all-way stop control. The public land central to the intersection is an opportunity for landscaping and placemaking features.

Alpine Location 3 Alternative B, the “Free Flow”, is shown in **Figure 54**. Similar to the preceding *Alpine Location 3 Alternative A*, this alternative concept also addresses safety and mobility concerns by converting Harrison St into a one-way street. *Alpine Location 3 Alternative B*, however, does not include an all-way stop control at Bird St. Free flow travel movements along Holland Ave (US 67) are maintained, while a stop control is provided for northbound travel on Bird St. Landscaping is recommended for the public land central to these intersections.

Alpine Location 3 Alternative C, the “Roundabout”, is shown in **Figure 55**. *Alpine Location 3 Alternative C* provides for a roundabout at the center of the existing public land. A truck apron around the center raised median of the roundabout allows for larger trucks to achieve larger turning movements. The center median also presents an opportunity for placemaking features. As a roundabout alternative concept, safety and mobility concerns are addressed by reducing conflict points at the intersection. The facility is designed to allow free flow through movements without requiring entry into the roundabout. A roundabout will provide for an excellent placemaking opportunity.



Figure 52: Alpine Location 3 Existing Condition/No-Build Alternative

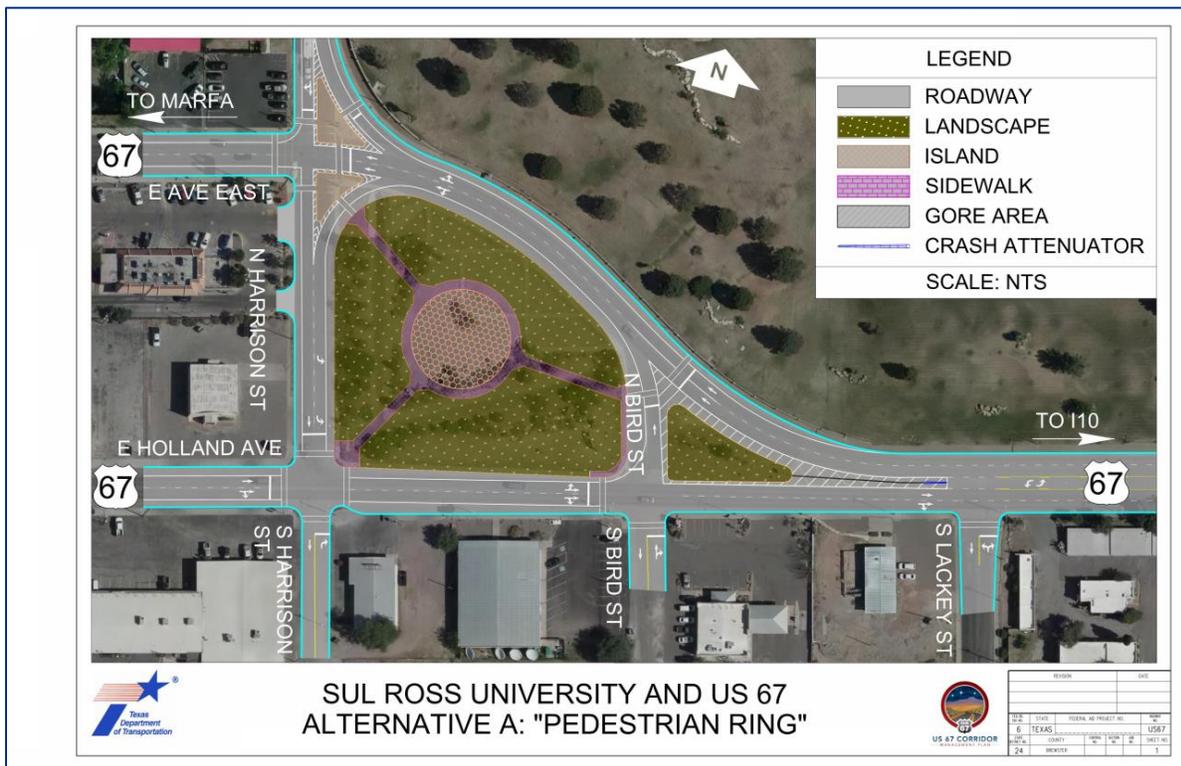


Figure 53: Alpine Location 3 Alternative A

Table 21 provides a summary of the alternative concepts presented for Alpine Location 3. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 21: Alpine Location 3 Conceptual Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> No cost Does not require ROW 	<ul style="list-style-type: none"> Does not address safety concerns
Alternative A: "Pedestrian Ring"	\$850,000	<ul style="list-style-type: none"> Addresses safety concerns Provides pedestrian access Placemaking opportunity Will not require ROW 	<ul style="list-style-type: none"> Bird St still open through intersection
Alternative B: "Free Flow on US 67"	\$750,000	<ul style="list-style-type: none"> Addresses safety concerns Closes Bird St through intersection 	<ul style="list-style-type: none"> Requires ROW
Alternative C: "Roundabout"	\$950,000	<ul style="list-style-type: none"> Improves safety by reducing conflict points Closes Bird St through intersection Provides for placemaking opportunity Will not require ROW 	<ul style="list-style-type: none"> May be confusing for drivers

6.4 Rural Intersection Conceptual Alternatives

Alternative concepts were developed for one improvement location within the rural areas, at the US 67 and US 90 intersection east of Alpine. The alternative concepts are defined and summarized in **Table 22**.

Table 22: Rural Improvement Location and Alternative Concepts

Location ID	Location Description	Intersection Alternative Concepts	Planning Level Cost Estimate
Rural Location 1	US 90 and US 67 Intersection	No-Build	\$0
		Alternative A: "Free Flow Y-Intersection"	\$2,100,000
		Alternative B: "Roundabout"	\$3,600,000
		Alternative C: "Single Point Intersection"	\$2,400,000

The improvement location for Rural Location 1 is the intersection of US 67 and US 90, east of Alpine. The existing condition, the *No-Build Alternative*, for Rural Location 1 is shown in **Figure 56**. This improvement location was determined through concerns raised through the safety analysis (**Appendix D**) due to four crashes between 2010 and 2018 and skewed left-turning movements. Within the existing condition, US 67 is split into two separate roadway legs. One roadway connects to US 67 westbound, and the other roadway connects US 67 to US 90 eastbound. Each leg accommodates bidirectional travel which presents a confusing situation to drivers and requires dangerous vehicle maneuvers. In addition, the US 67 eastbound has a short deceleration lane with limited storage capacity for turns onto US 67 northbound to Fort Stockton.

Rural Location 1 Alternative A, the “Free Flow Y-Intersection” is shown in **Figure 57**. This alternative concept provides free flow through movements for right-turns southbound along US 67 onto US 67 westbound and for right-turns westbound along US 90 onto US 67 northbound. Those vehicles wanting to continue onto US 67 coming from Marathon or Alpine, will come to a 3-way stop at the T-intersection and then make a left. If a vehicle needs to continue on towards Marathon, either coming from Ft. Stockton or Alpine will also need to come to a 3-way stop and then make a left or continue straight respectively. This alternative will not require any additional ROW.

Rural Location 2 Alternative B, “Roundabout” This unique alternative combines the Y-shape movement from Alternative A and a traditional roundabout and is shown in **Figure 58**. This alternative also provides free flow through movements for right-turns southbound along US 67 onto US 67 westbound and for right-turns westbound along US 90 onto US 67 northbound. However, instead of having a T-intersection that forces vehicles to stop, this alternative allows traffic to continuously flow through the roundabout. This alternative could also provide an excellent opportunity for placemaking opportunities. Alternative B will require some ROW as the roundabout will require more land.

Rural Location 3 Alternative C, “Single Point Intersection” Alternative C once again forces all vehicles coming from Alpine going towards Ft. Stockton, Marathon to Alpine, and Ft. Stockton to Marathon to come to a complete stop before proceeding and is shown in **Figure 59**. However, traffic will be allowed a free flow right-turn entering into the intersection from all directions. This alternative will not require any additional ROW.



Figure 56: Rural Location 1 Existing Condition/No-Build Alternative



Figure 57: Rural Location 1 Alternative A



Figure 58: Rural Location 1 Alternative B

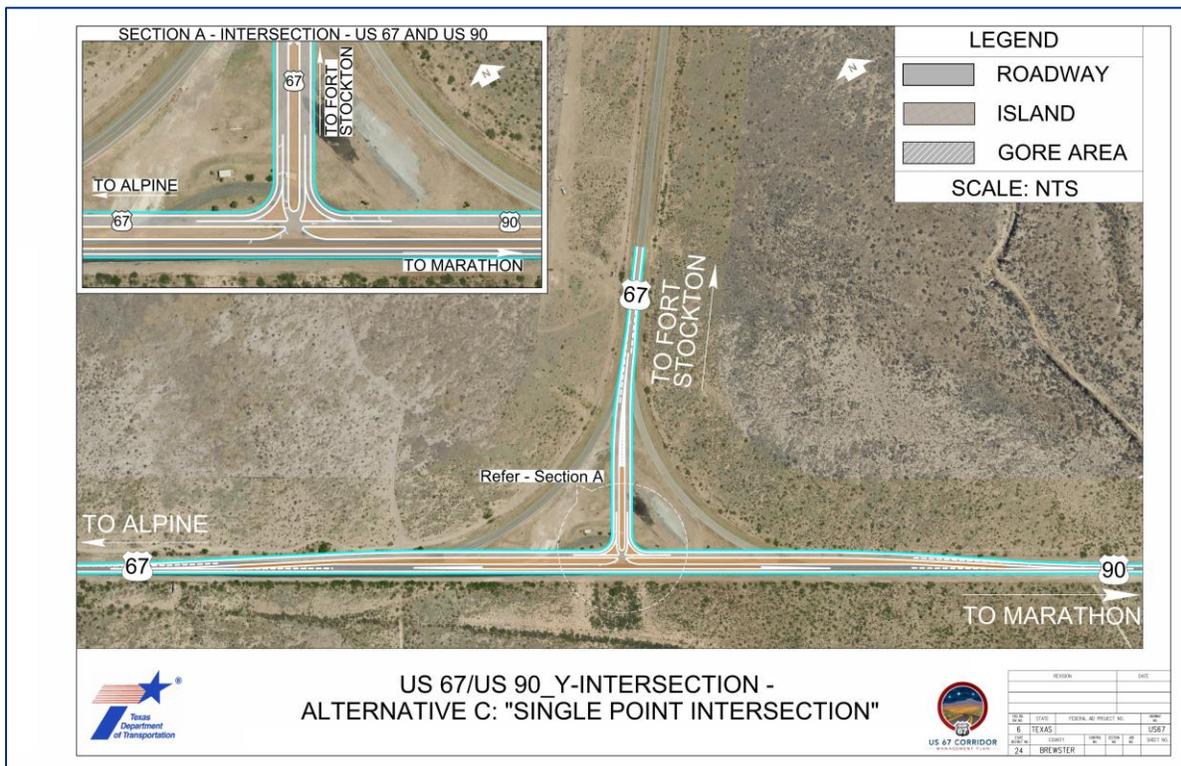


Figure 59: Rural Location 1 Alternative C

Table 23 provides a summary of the alternative concepts presented for Rural Location 1. The summary serves to compare the alternative concepts between one another based on cost, pros, and cons.

Table 23: Rural Location 1 Conceptual Alternatives Summary

Alternative	Cost	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety concerns
Alternative A: “Y-Intersection”	\$2,100,000	<ul style="list-style-type: none"> ▪ Provides turning movement in all directions ▪ Addresses safety concerns ▪ Cost-efficient design ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Cannot make a right-turn at T-intersection when coming from SB US 67
Alternative B: “Roundabout”	\$3,600,000	<ul style="list-style-type: none"> ▪ Addresses safety concerns ▪ Movement in all directions ▪ Placemaking opportunity 	<ul style="list-style-type: none"> ▪ Will require ROW
Alternative C: “Single Point Intersection”	\$2,400,000	<ul style="list-style-type: none"> ▪ Addresses safety issues ▪ Simple design easy to follow ▪ Provides continuous free flow along US 67 onto US 90 ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ T-Intersection design, more conflict points than roundabout (Alt. B)

7.0 Complete Streets Alternatives

Based on significant public input identifying the need for bicycle and pedestrian improvements within the communities along US 67, several Complete Streets alternatives were assessed in application to the US 67 corridor. In general, the corridor communities have several locations that may benefit from improved and safer bicycle and pedestrian infrastructure. Most importantly, the communities generally lack contiguous sidewalks. Infrastructure that supports the walkability of these rural communities seems to be an appropriate fit within the context and character.

Complete Streets are streets that are designed to accommodate all users of the roadway – vehicles, pedestrians, bicyclists, and even freight. They are designed for people of all ages to safely use the roadway, from young to old.

As part of this study, Complete Streets alternatives were developed for the communities of Presidio, Marfa, and Alpine. These Complete Streets alternatives are intended to provide the corridor communities with a toolbox of varying bicycle and pedestrian treatments that fit community context and support the demands of bicycle and pedestrian travel. Several recommendations are also made to enhance bicycle safety and comfort along the rural segments of the corridor.

7.1 Bicycle and Pedestrian Demand Data

Unlike vehicular travel, little data is collected or published to assist planning professionals to determine the demand for bicycle and pedestrian facilities. Typically, the public must express a need and demand for pedestrian and/or bicycle infrastructure. In addition to receiving public feedback expressing a need for pedestrian and bicycle infrastructure, Strava data was obtained to help assess bicycling activity and demand within the corridor communities. Strava is a mobile phone application through which people can track and log their bicycle rides, walks, and runs. The application utilizes the GPS functions of mobile phones to track travel routes. TxDOT maintains a subscription to access Strava data.

Strava data shows “heat maps” of bicycling activity. Roadways that are darker in color have a higher number of logged trips than roadways that are lighter in color. These Strava heat maps helped inform locations along the US 67 corridor where there is an existing demand for bicycle infrastructure. The Strava heat maps can be viewed in **Figure 60** through **Figure 62** below. **Figure 60** shows the Strava map for the City of Presidio, it indicates that cyclists are primarily using O’Reilly St. and US 67 as well as Erma Ave. The City of Marfa is shown in **Figure 61** and it is evident that cyclists ride along FM 2810 from the south and merge onto San Antonio St before continuing unto US 67 in the North. A smaller number of cyclists continue on towards Alpine. **Figure 62** shows the City of Alpine and shows that cyclists use both Sul Ross and US 67, the other highly trafficked street is 5th St.

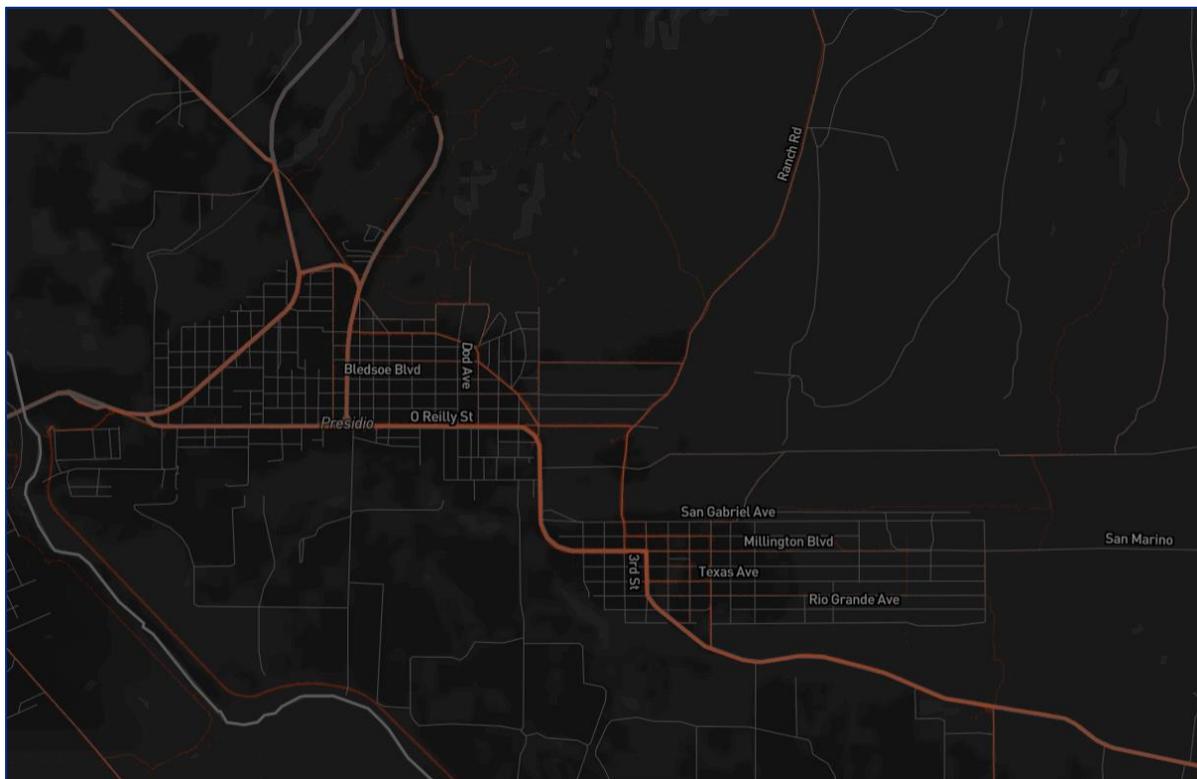


Figure 60: Strava Heat Map for Presidio

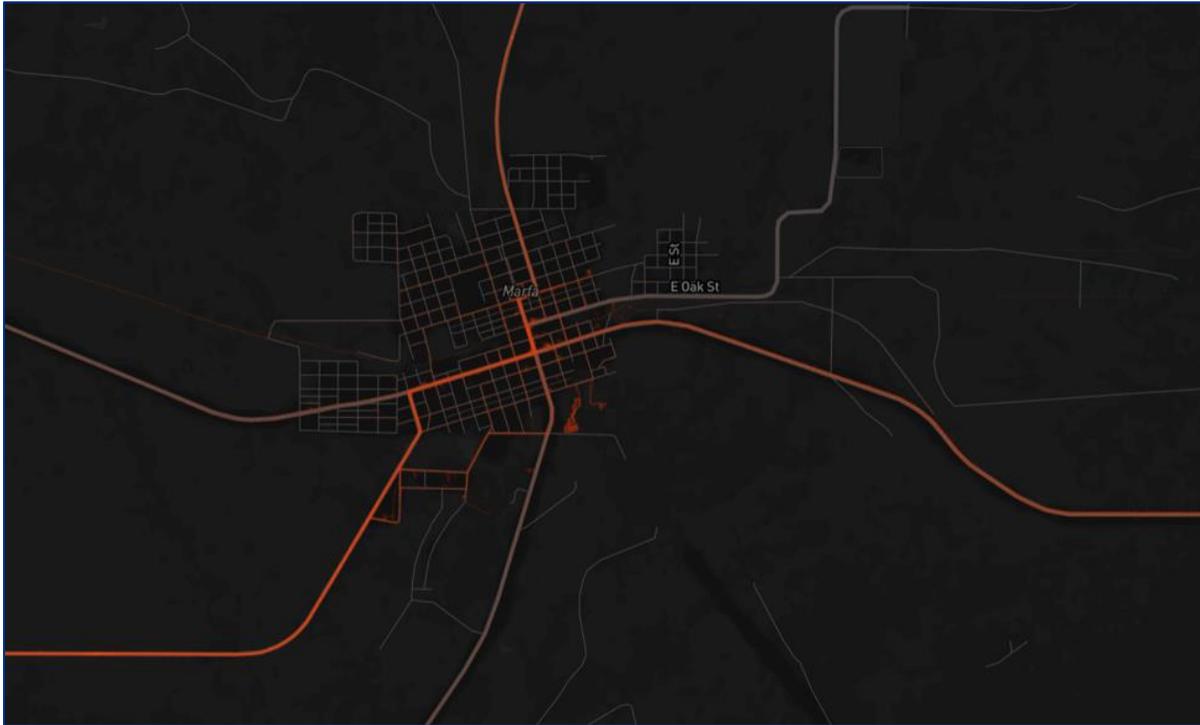


Figure 61: Strava Heat Map for Marfa

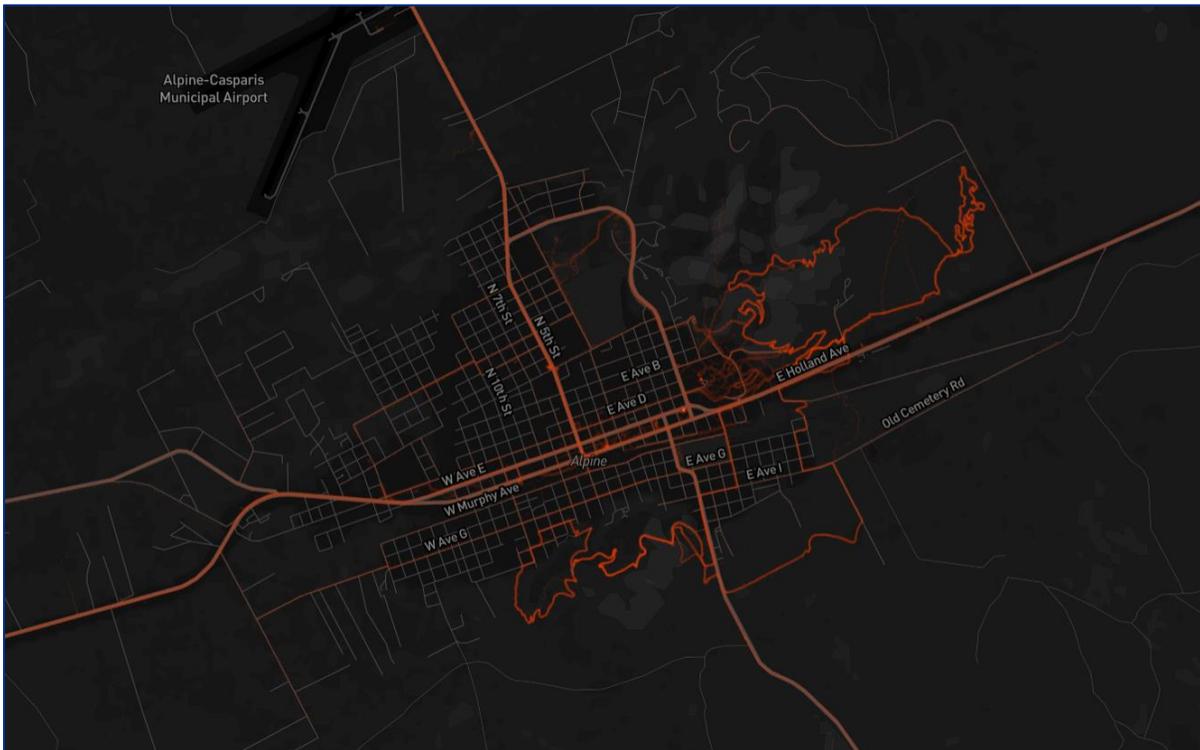


Figure 62: Strava Heat Map for Alpine

7.2 Presidio

The *Presidio Existing Roadway Cross Section* is shown in **Figure 63**. US 67 leads to the POE into Mexico. The existing condition in Presidio is a two-lane road with center turn lanes, a wide 8-foot shoulder, and 6-foot sidewalks on each side. Shoulders along the existing roadway in Presidio provide space for the use of a bicycle outside of the vehicular travel lanes.

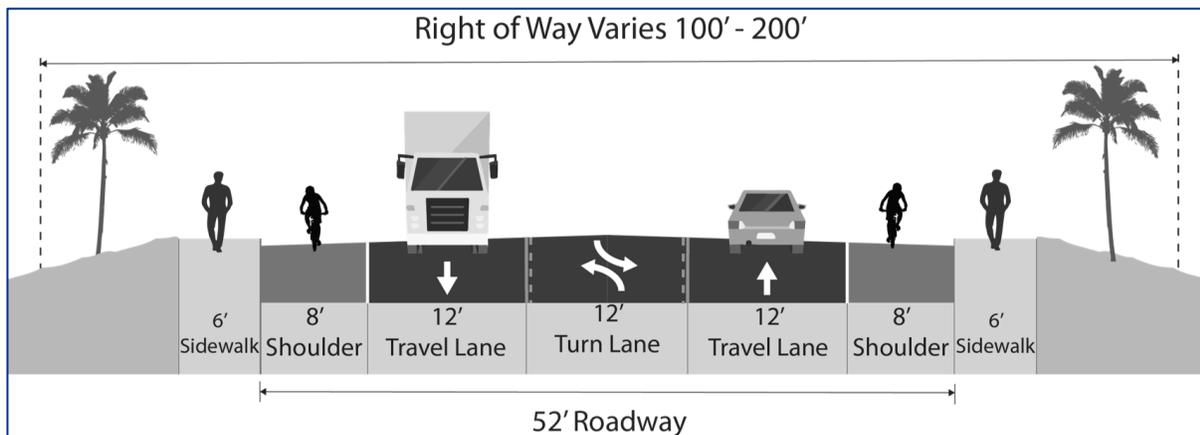


Figure 63: No-Build Alternative: "Existing Condition"

Presidio Complete Streets Alternative A, "Bicycle Lane with Striped Buffer", is shown in **Figure 64**. Where the shoulder currently exists, a five-foot bicycle lane with a three-foot buffer could be placed. As the space is already paved, this bicycle improvement could be a simple striping project. The cross-section of US 67 in Presidio with a bicycle lane with a buffer could resemble the rendering shown below.

Presidio Complete Streets Alternative B, "Bicycle Improvements Off US 67", is shown in **Figure 65**. Through public outreach activities, significant public input identified the need for bicycle and pedestrian infrastructure throughout the corridor communities. Using Strava data, the travel routes of bicycle users of the mobile application was collected and analyzed to determine roadways that have bicycle demand. Bicycle improvements could be more suitable for these roadways off US 67 as vehicular traffic and speed limits may be lower. **Figure 65** shows Alternative B, bicycle improvements off US 67.

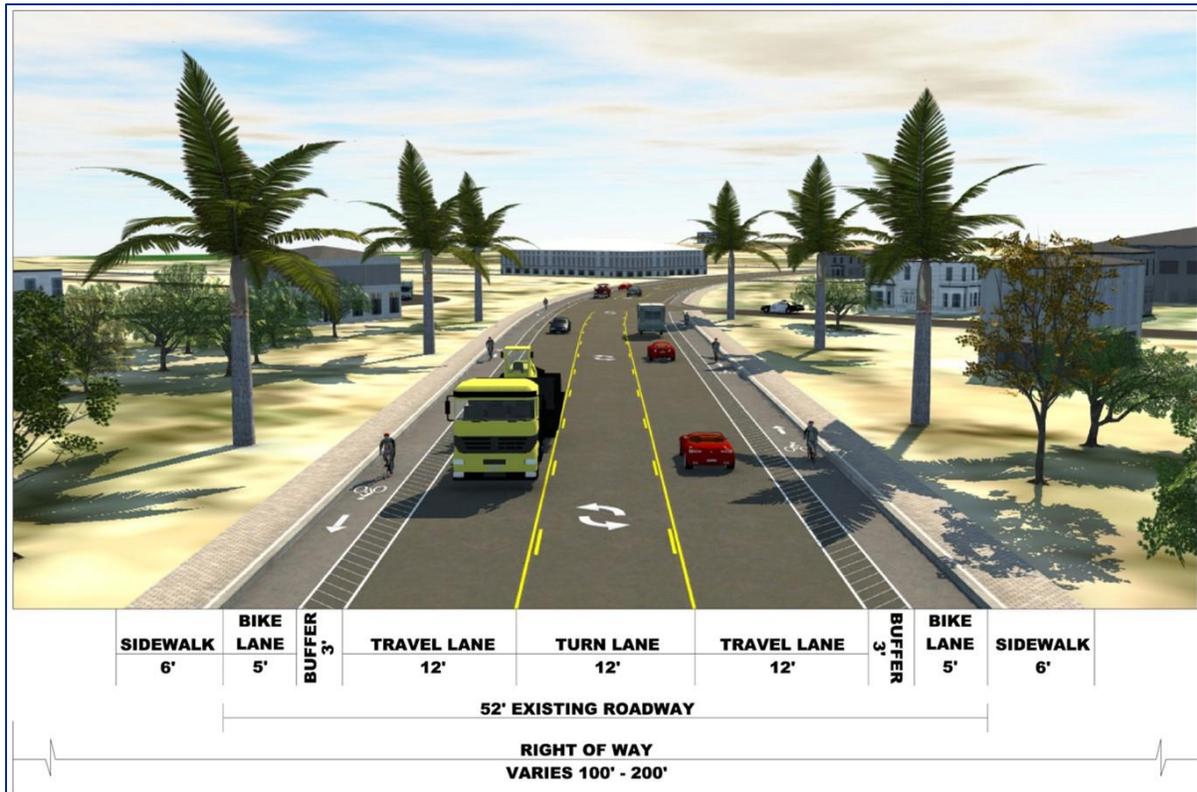


Figure 64: Alternative A: "Bicycle Lane with Striped Buffer"

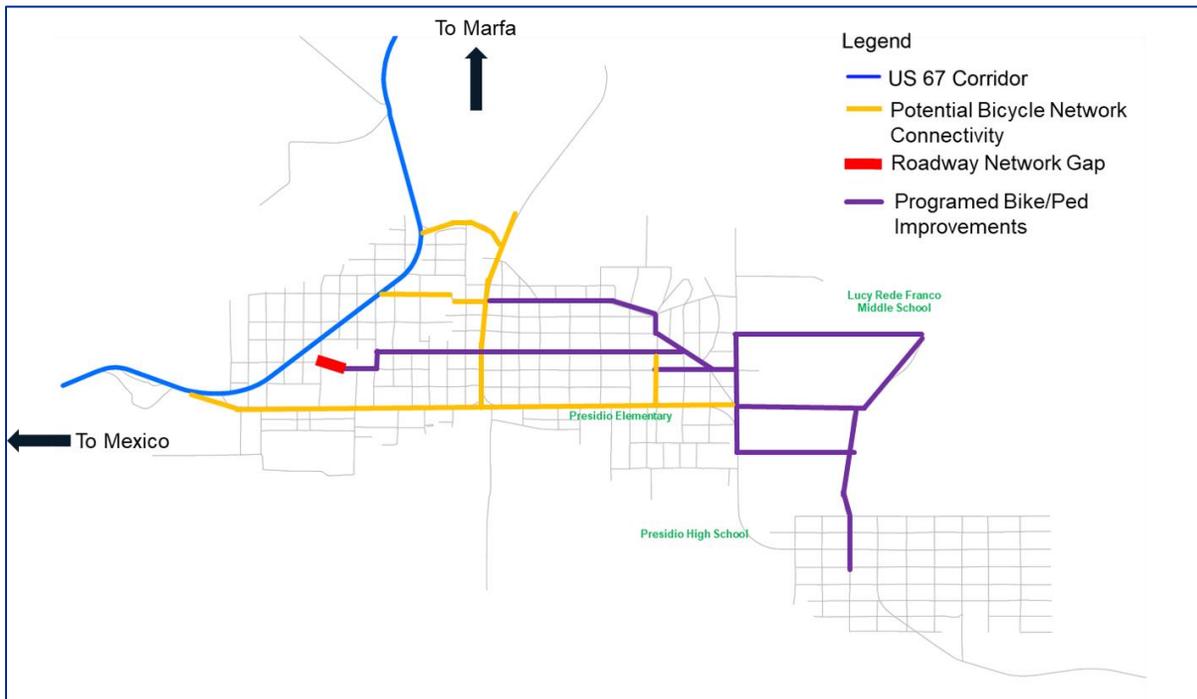


Figure 65: Alternative B: "Bicycle Improvements Off US 67"

The varying Complete Streets alternatives discussed for Presidio offer varying pros and cons. **Table 24** provides a summary comparing relative cost as well as the different benefits and challenges of these bicycle and pedestrian treatments.

Table 24: Presidio Complete Streets Alternatives Summary for Presidio

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> ▪ No cost ▪ Does not require ROW 	<ul style="list-style-type: none"> ▪ Does not address safety concern
Alternative A: "Bicycle Lane with Striped Buffer"	\$2,000,000	<ul style="list-style-type: none"> ▪ Addresses safety ▪ Does not require roadway widening 	<ul style="list-style-type: none"> ▪ None
Alternative B: "Bicycle Improvements Off US 67"	\$\$\$	<ul style="list-style-type: none"> ▪ Addresses safety ▪ Does not require roadway widening ▪ Provides a wider bicycle network 	<ul style="list-style-type: none"> ▪ Not under TxDOT jurisdiction, requires multijurisdictional collaboration

7.3 Marfa

The *Marfa Existing Roadway Cross Section* is shown in **Figure 66**. Within Marfa, US 67 is officially designated as Highland Avenue and then continues on towards Alpine as San Antonio Street. The intersection of Highland Avenue and San Antonio Street is an all-way stop signal that experiences heavy use by vehicles, freight, and pedestrians. Through public outreach activities, strong feedback from the public in Marfa highlighted a need and demand for pedestrian and bicycle improvements throughout the community. The existing condition in Marfa is a two-lane roadway with shoulders extending as wide as 25 feet along portions of US 67 within the City of Marfa. This wide pavement section provides the opportunity (and space) for a variety of Complete Streets alternatives in Marfa.

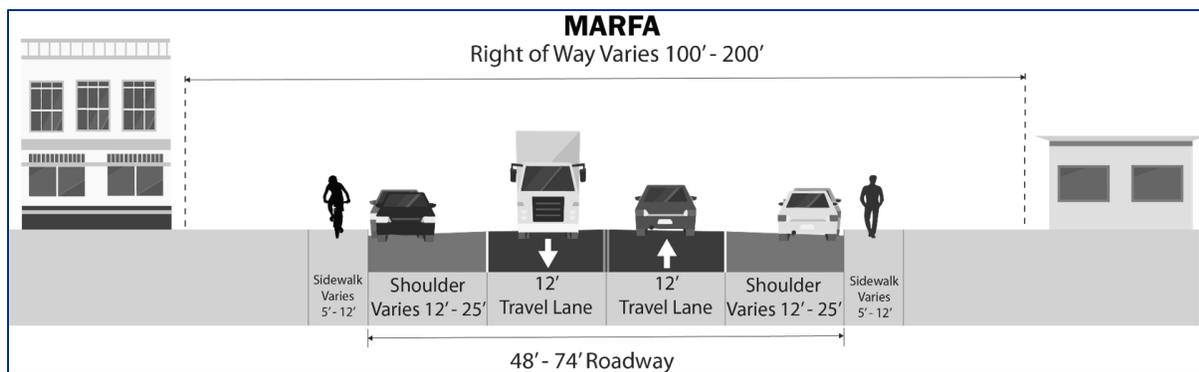


Figure 66: No-Build Alternative: “Existing Conditions”

Marfa Alternative A, “The Shared Use Path”, is shown in **Figure 67**. A shared use path is a wide sidewalk, recommended at 12 feet of width, that provides space for both pedestrians and bicycles. As shown in the figure, the shared use path can optionally show designated space for pedestrians and bicycles through striping or pavement differences. A shared use path could be implemented on one side of the street or both, depending on the community's desires. Implementation of a shared use path would involve the extension of the sidewalk or the paving of a new shared use path in some portions. With the implementation of the shared use path, US 67 would still maintain two travel lanes and ample space for parallel or angled street parking.

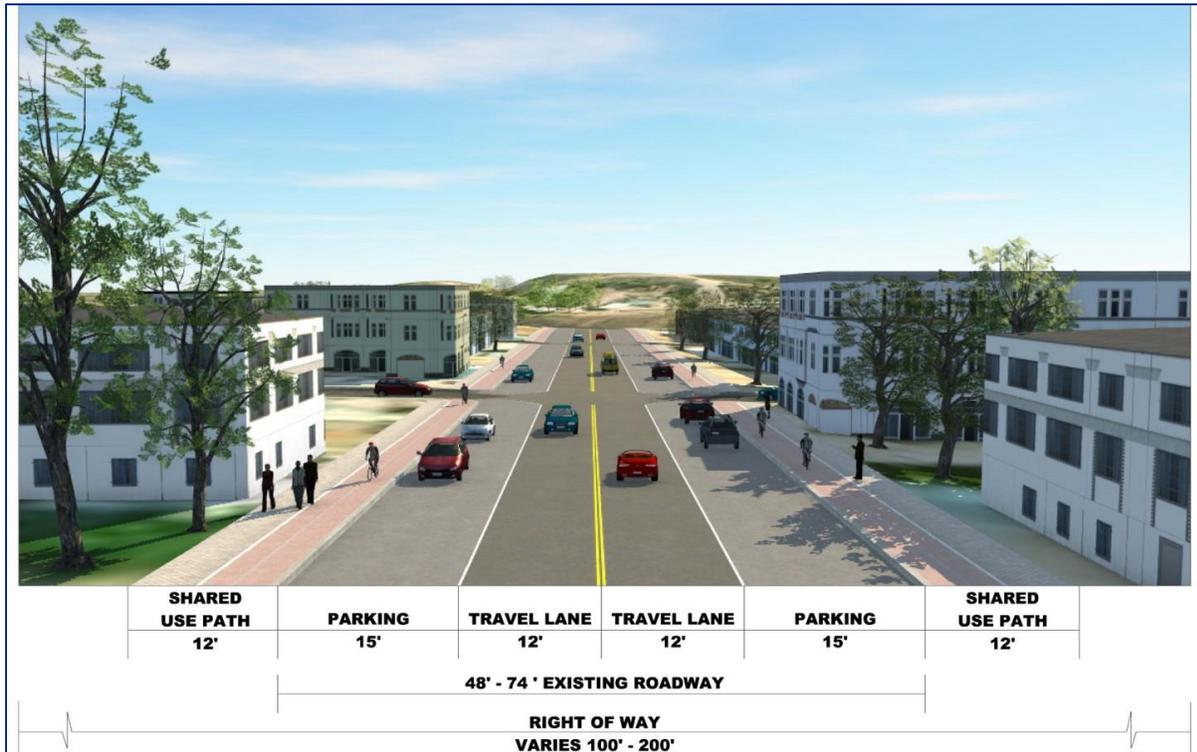


Figure 67: Alternative A: “Shared Used Path”

Marfa Alternative B, “The Two-Way Cycle Track with Flexible Delineators”, is shown in **Figure 68**. A two-way cycle track is a bicycle treatment that is placed on one side of the street. Bicycle travel moves in both directions, with striping down the middle to differentiate opposite travel directions. The cycle track is protected from adjacent vehicular travel with a striped buffer space, recommended to be 6 feet in width. Within the striped buffer space, flexible delineators are recommended. These flexible delineators are typically tubular treatments made of plastic that can be penetrated when necessary for emergency access and law enforcement. The flexible delineators are intended to serve as a visual partition to separate the cycle track from vehicular movements.

The two-way cycle track could fit within the existing pavement width and ROW constraints of US 67 in Marfa. Even with the addition of the two-way cycle track, space for parallel or angled parking is typically still available within the street cross section. The benefit of the cycle track is a safe bicycle treatment that provides a high level of comfort to the bicycle user. The challenge in implementing a cycle track in Marfa is the high number of intersections, driveways, and curb cuts along US 67. If a cycle track is implemented, the cycle track will have several disruptions for vehicular access into perpendicular roads, driveways, and other curb cuts.



Figure 68: Alternative B: “Two-Way Cycle Track with Flexible Delineators”

Marfa Alternative C, the “Angled Parking without Bicycle Lanes”, is shown in **Figure 69**. Alternative C shows a Complete Streets alternative that includes pedestrian and parking improvements, but no bicycle treatment. Marfa lacks contiguous sidewalks throughout the city. In the city center, there are sidewalk gaps between city blocks. Public feedback and analysis of the existing condition show a strong need for sidewalks. In addition, public feedback indicated a need to maintain and expand parking available along US 67. Angled parking allows for more parking spaces than parallel parking. Alternative C shows a scenario where parking is maximized with the existing pavement and ROW constraints.

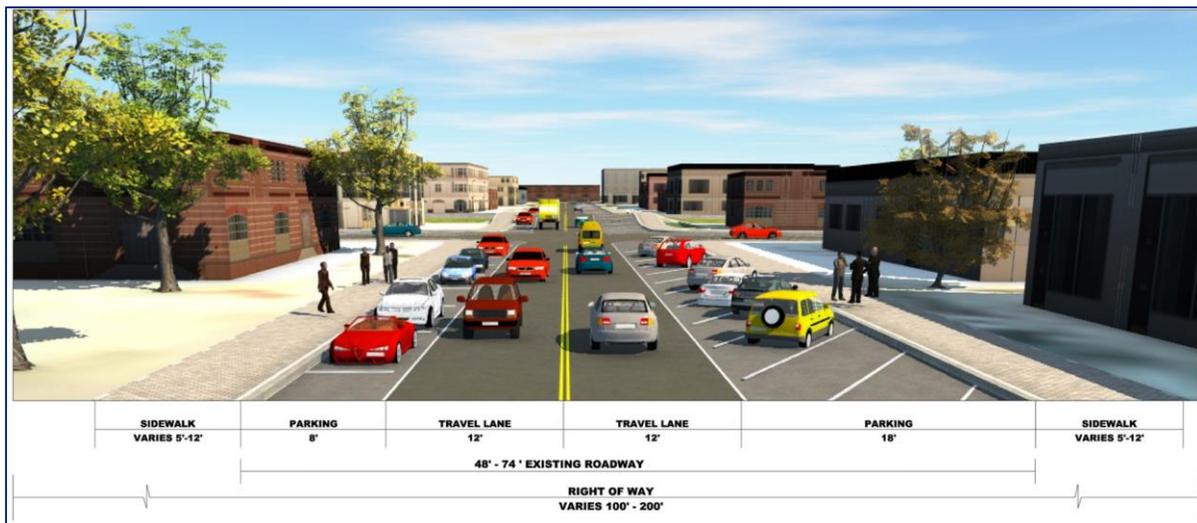


Figure 69: Alternative C: “Angled Parking Without Bicycle Lane”

Marfa Alternative D, “Bicycle Improvements Off US 67”, is shown in **Figure 70**. Although this study focuses on bicycle and pedestrian improvements along US 67, the need for Complete Streets improvements is not exclusive to US 67. In many scenarios, bicycle or pedestrian needs are better served on local roads with slower vehicular movements. Strava data was used to determine which roadways are used by bicyclists. These roadways were used to build a network of roadways where bicycle improvements could be appropriate to serve the needs of Marfa residents. **Figure 70** shows the identified potential bicycle network and existing roadway gaps in Marfa.



Figure 70: Alternative D: “Bicycle Improvements Off US 67”

Due to feedback from the community and local elected officials, the study team assessed the Complete Streets alternatives of angled and reverse angled parking with bicycle lanes in Marfa along Highland Avenue between San Antonio and Lincoln Streets. This segment is not located on US 67 but was determined to be an important segment with a heavy influence on the operation and character of US 67.

Both **Figure 71** and **Figure 72** show angled parking alternatives with bicycle lanes with striped buffers. **Figure 73** shows typical head-in angled parking. Angled parking creates a conflict with bicycles when vehicles are backing out of an angled parking space. The vehicle does not have a full-frame of vision and will not always see a bicycle within the bicycle lane when backing out of an angled parking space.

Reverse angled parking is a solution to the safety issues raised by traditional head-in angled parking. Reverse angled parking provides a safer environment for bicycles using the road. Vehicle drivers are able to see bicycles easily when exiting parking spaces. Several cities where reverse angled parking has been implemented have seen a reduction in the number of accidents compared to the number of accidents at regular parallel parking schemes.



Figure 71: Bicycle Lane with Striped Buffer, Angled Parking

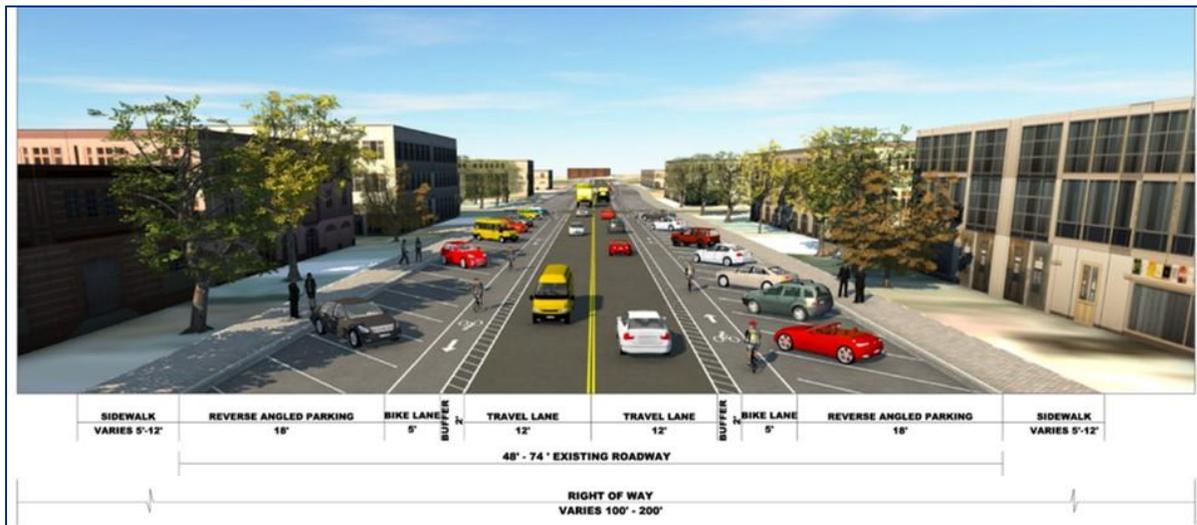


Figure 72: Bicycle Lane with striped Buffer, Reverse Angled Parking

The typical operation of how a vehicle enters a reverse angled parking space is shown in **Figure 73**.

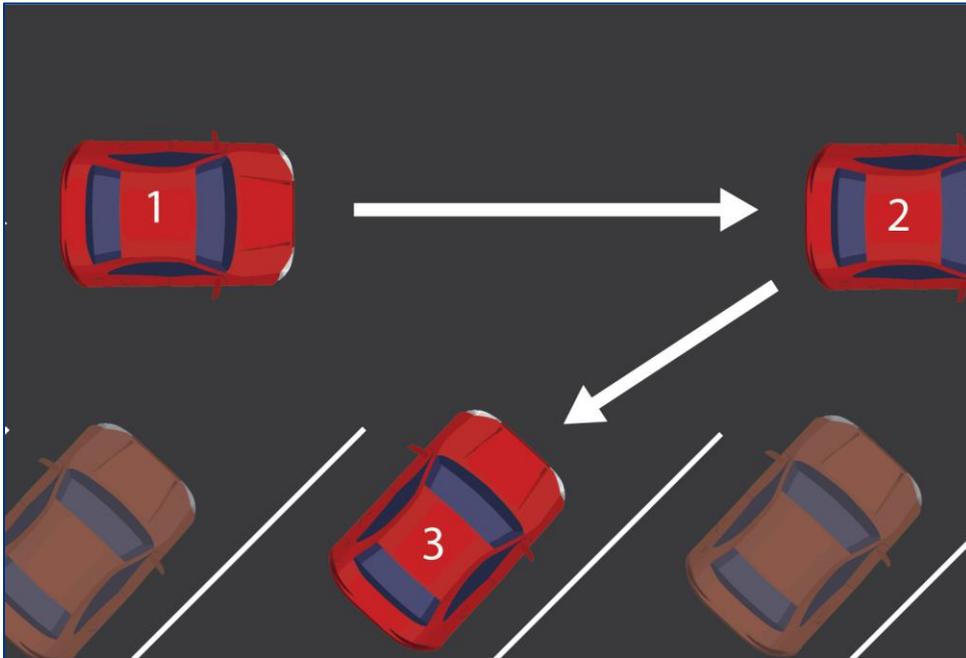


Figure 73: Reverse Angled Parking Movement

The varying Complete Streets alternatives discussed for Marfa offer varying pros and cons. **Table 25** provides a summary comparing relative cost and the benefits and challenges of these different bicycle and pedestrian treatments.

Table 25: Marfa Complete Streets Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> No cost Does not require ROW 	<ul style="list-style-type: none"> Does not address safety concern
Alternative A: "Shared Use Path"	\$2,000,000	<ul style="list-style-type: none"> Addresses safety Segregates modes Users feel safer with physical barrier Does not require ROW Consistent with programmed Shared Use Path along the west side of US 67 from Galveston St to El Cosmico 	<ul style="list-style-type: none"> Requires extended sidewalk Possible drainage relocation Multiple curb cuts and driveways add conflict points
Alternative B: "Two-Way Cycle Track"	\$2,000,000	<ul style="list-style-type: none"> Addresses safety Segregates modes Users feel safer with physical barrier Does not require ROW Low to Mid cost 	<ul style="list-style-type: none"> Multiple curb cuts, driveways exist Complicates intersection design Requires public education campaign Multiple curb cuts and driveways add conflict points
Alternative C: "Angled Parking without Bicycle Lane"	\$1,400,000	<ul style="list-style-type: none"> Provides designated parking spaces Accommodates community preference for angled parking 	<ul style="list-style-type: none"> Does not accommodate bicycle users Safety concerns during exit of parking spaces (backing out toward on-coming vehicles)
Alternative D: "Bicycle Improvements Off US 67"	\$\$\$	<ul style="list-style-type: none"> Fewer bicycle conflicts with automobiles Lower stress on bicycle user Access to more destinations Reverse angled parking allows for bicycle/ped safety 	<ul style="list-style-type: none"> Not under TxDOT jurisdiction Requires collaboration with other stakeholders (i.e. railroads) Reverse angled parking may be confusing to navigate

7.4 Alpine

The *Alpine Existing Roadway Cross Section* is shown in **Figure 74**. Through Alpine, US 67 splits into a one-way pair of streets. US 67 is represented by Holland Avenue for eastbound travel and Avenue E for westbound travel. Within the last five years, the City of Alpine invested in pedestrian and parking improvements within the city center. The streetscape within the city center of Alpine is a walkable environment to the variety of destinations along the corridor. The existing cross-section includes two travel lanes in each direction, designated parallel parking and sidewalks on both sides of the streets.

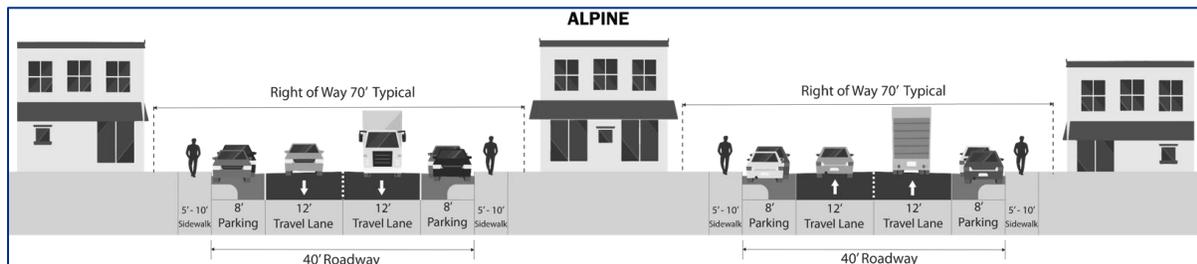


Figure 74: No-Build Alternative: “Existing Condition”

During public outreach efforts, the public indicated a need for bicycle improvements along and across US 67. As a compact community, bicycling serves as a viable mode of travel within Alpine. Although the Alpine cross-section already maintains the qualities of a Complete Street, the study team explored alternatives that could accommodate bicycle users too.

Alpine Alternative A, the “Shared Use Path”, is shown in **Figure 75**. A shared use path accommodates both pedestrians and bicycles. As shown in the figure, the shared use path can include delineations or pavement differences to indicate designated space for pedestrians and bicycles. If implemented in Alpine, a shared use path would represent an extension of the existing sidewalk. The multitude of intersections, driveways, and curb cuts within the city center of Alpine pose a challenge for the shared use path. The shared use path would certainly provide a safe and designated space for bicycles within the streetscape, but conflicts and implementation challenges would still exist with the high number of intersections, driveways, and curb cuts.

Alpine Alternative B, the “Bicycle Lane with Striped Buffer”, is shown in **Figure 76**. If in the future the residents of Alpine maintain a demand and desire for bicycle travel, one long-term alternative is to replace a lane currently designated for parallel parking with a bicycle lane with a striped buffer. One negative aspect of this alternative is the significant loss of free parking. The benefit of this alternative is the availability of a protected bicycle facility with access to the variety of destinations within the city center of Alpine.

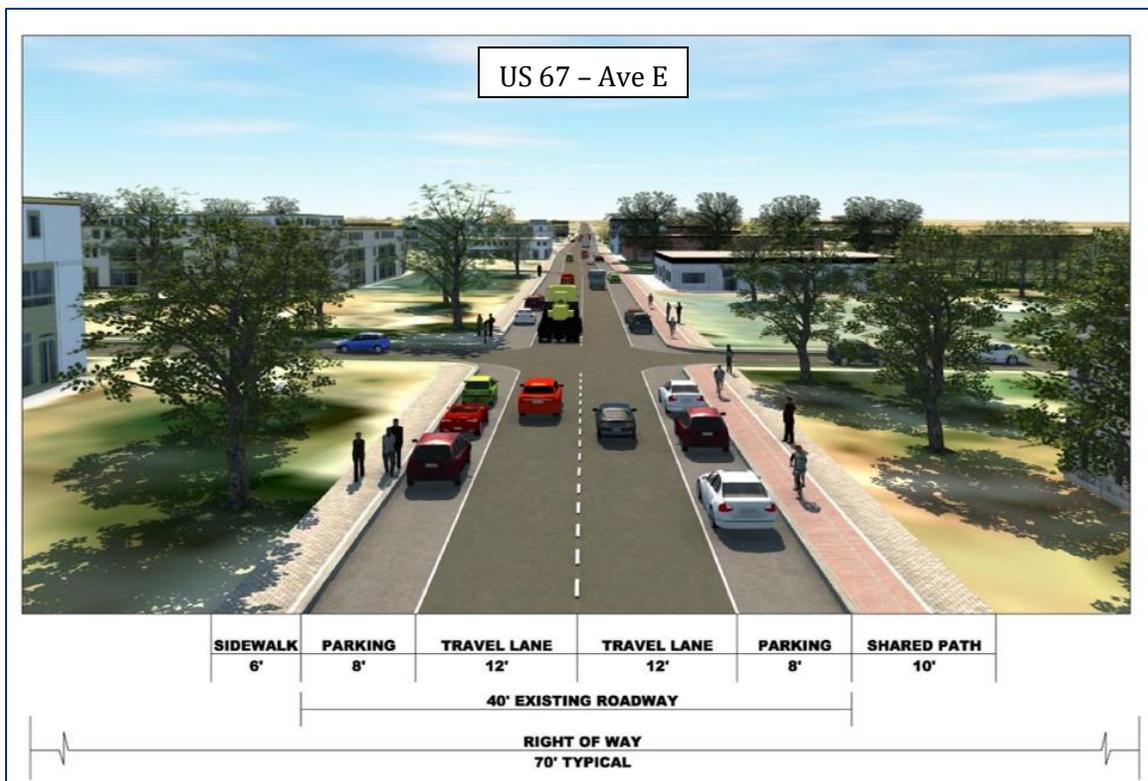
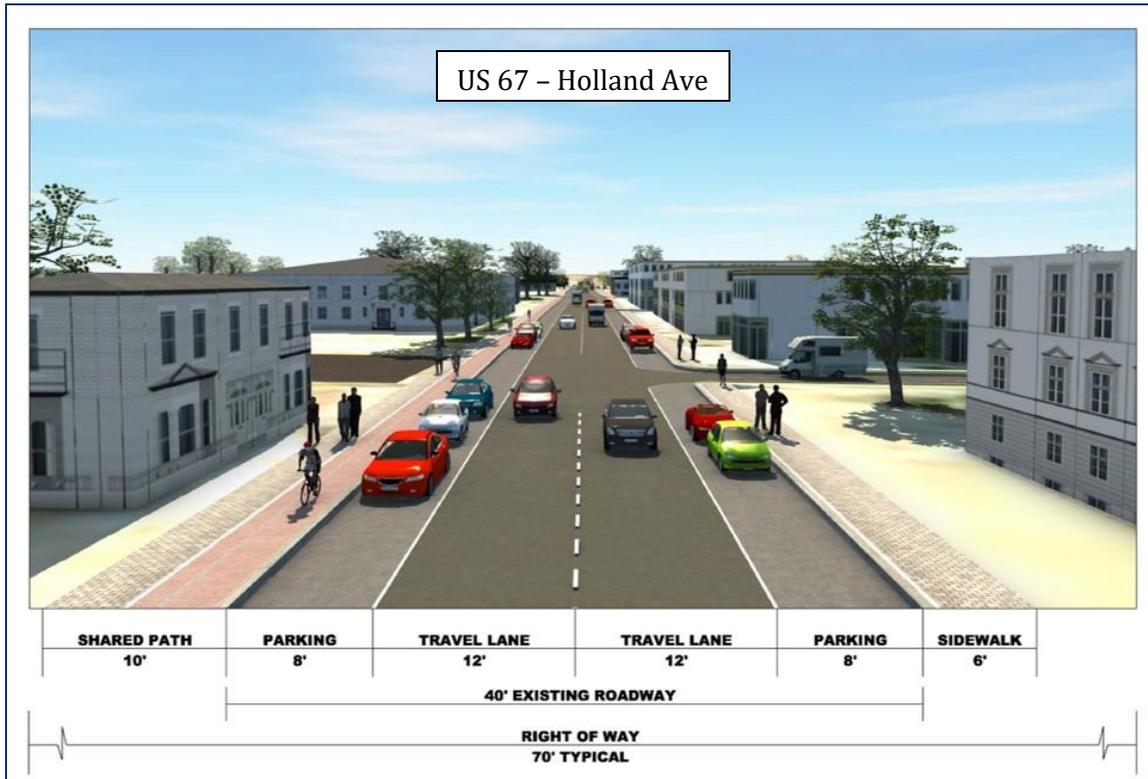


Figure 75: Alternative A: “Shared Used Path”

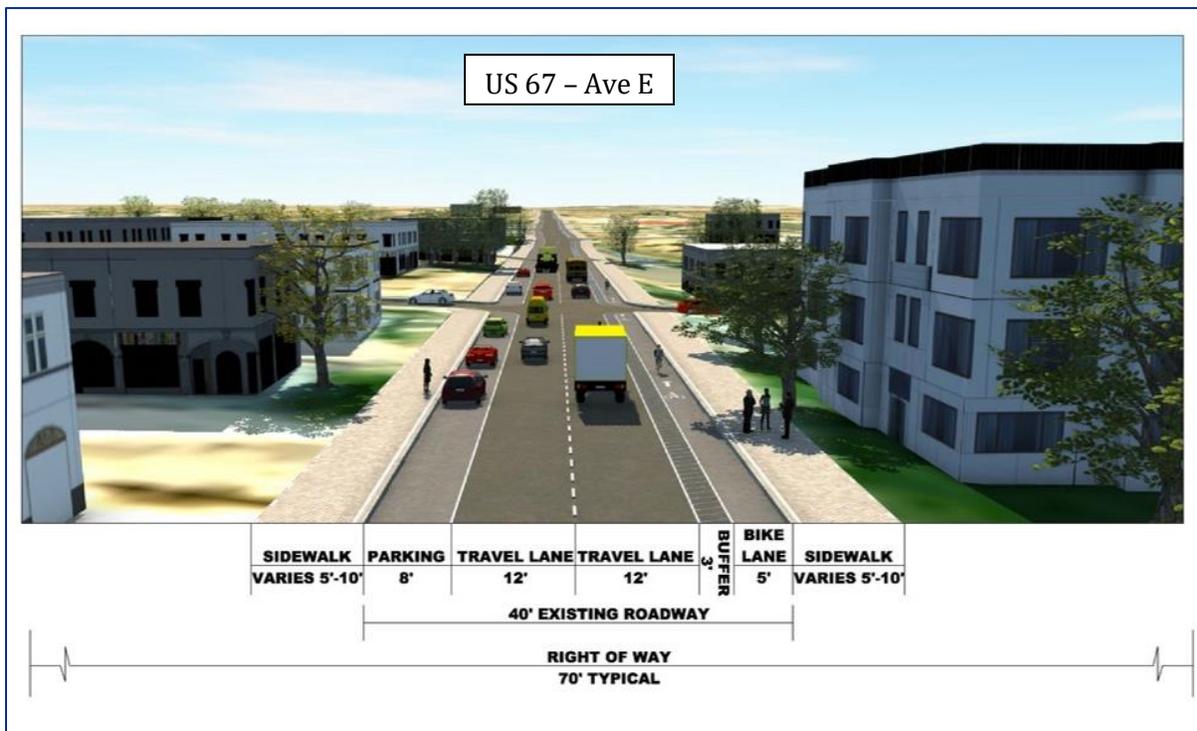
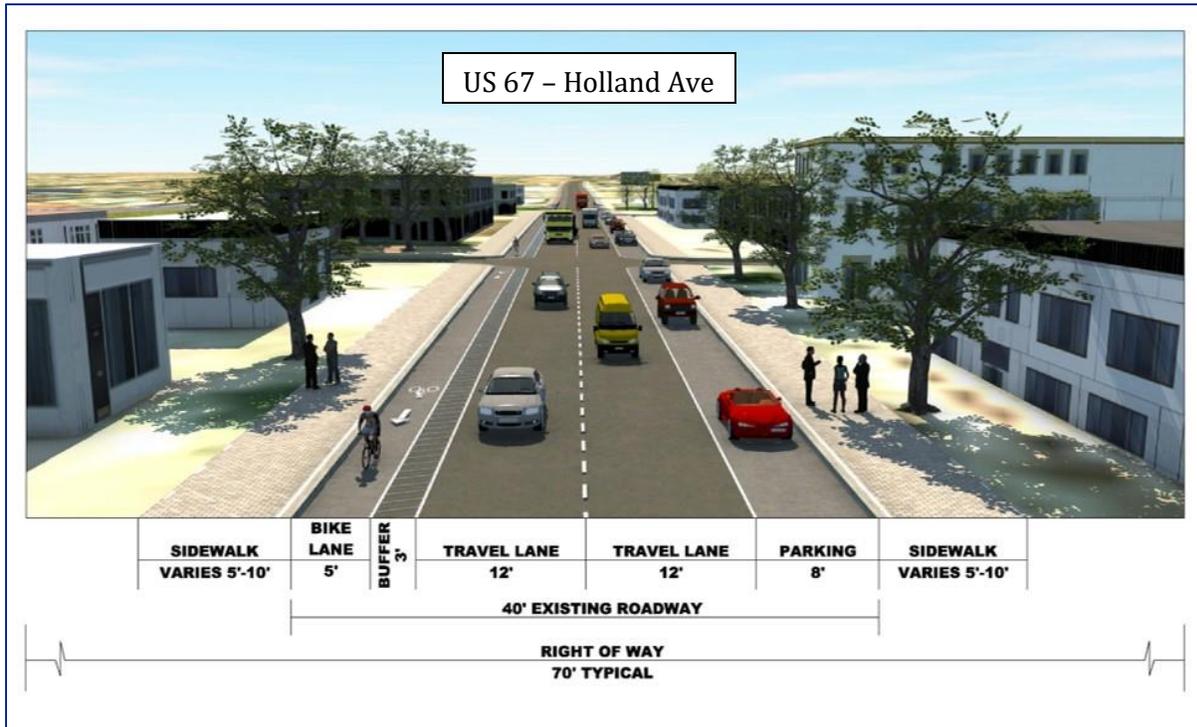


Figure 76: Alternative B: "Bicycle Lane with Striped Buffer"

Alpine Alternative C, “Bicycle Improvements Off US 67”, is shown in **Figure 77**. As the roadway currently exists, there is no space to add a bicycle facility to the roadway without taking away a travel lane or designated parking. Because of the space constraint, the study team explored the alternative of bicycle improvements off US 67. A parallel roadway with less and slower vehicular traffic could serve as a more fitting roadway for bicycle improvements. Using Strava data, roadways showing bicycle use were identified as additional roadways where bicycle improvements could be implemented. Developing a bicycle network across the community is important when implementing successful bicycle improvements.



Figure 77: Alternative C: “Bicycle Improvements Off US 67”

Table 26 shows a summary of the pros and cons of the various Complete Streets alternatives discussed for Alpine.

Table 26: Alpine Alternatives Summary

Alternative	Planning Level Cost Estimate	Pros	Cons
No-Build	\$0	<ul style="list-style-type: none"> No cost Does not require ROW 	<ul style="list-style-type: none"> Does not address safety concern
Alternative A: “Shared Use Path”	\$5,000,000	<ul style="list-style-type: none"> Provides designated space for use by both bicyclists and pedestrians Does not require ROW 	<ul style="list-style-type: none"> Might require extended sidewalk Multiple curb cuts, driveways add conflict points
Alternative B: “Bicycle Land with Striped Buffer”	\$2,500,000	<ul style="list-style-type: none"> Addresses safety concerns Segregates modes 	<ul style="list-style-type: none"> Reduces available parking spaces Requires construction and pavement reconfiguration
Alternative C: “Bicycle Improvements Off US 67”	\$\$\$	<ul style="list-style-type: none"> Parallel facility to US 67 that is more appropriate for cycling, less traffic on road Connects schools within Alpine 	<ul style="list-style-type: none"> Wayfinding needed to direct bicyclists to Sul Ross from US 67 More difficult to access businesses due to one-way street pattern

7.5 Rural Segments

The majority of the US 67 corridor serves rural areas. During public outreach activities, notable public input emphasized the need for bicycle accommodations along the rural portions of the corridor, particularly the segment between Marfa and Alpine. Due to the bicycle demand, enhanced shoulders are recommended between Marfa and Alpine.

According to FHWA *Small Town and Rural Multimodal Networks*, rumble strips are an FHWA Proven Safety Countermeasure for reducing roadway departure crashes. Research has shown that installing rumble strips can reduce severe crashes but may negatively impact bicycle travel if they are poorly constructed. The FHWA recommends the provision of a bicycle gap pattern to allow access into and out of the shoulder area by bicyclists. The gap pattern consists of 12 feet clear gap followed by rumble strips, typically 40-60 feet. The *TxDOT Bicycle Tourism Trail Study, Tech Memorandum 3: Recommended Bikeway Design Criteria* (2018) echoes the recommendation.

To accommodate bicycle demands between Marfa and Alpine, enhanced shoulders with rumble strips having a gap pattern of 12 feet clear gaps followed by rumble strips every 40 to 60 feet is recommended. Shoulders are recommended to be 10 feet (8 feet minimum), consistent with the guidance from FHWA *Small Town and Rural Multimodal Networks*, 2016. **Figure 78** shows a bicycle-friendly rumble strip pattern.

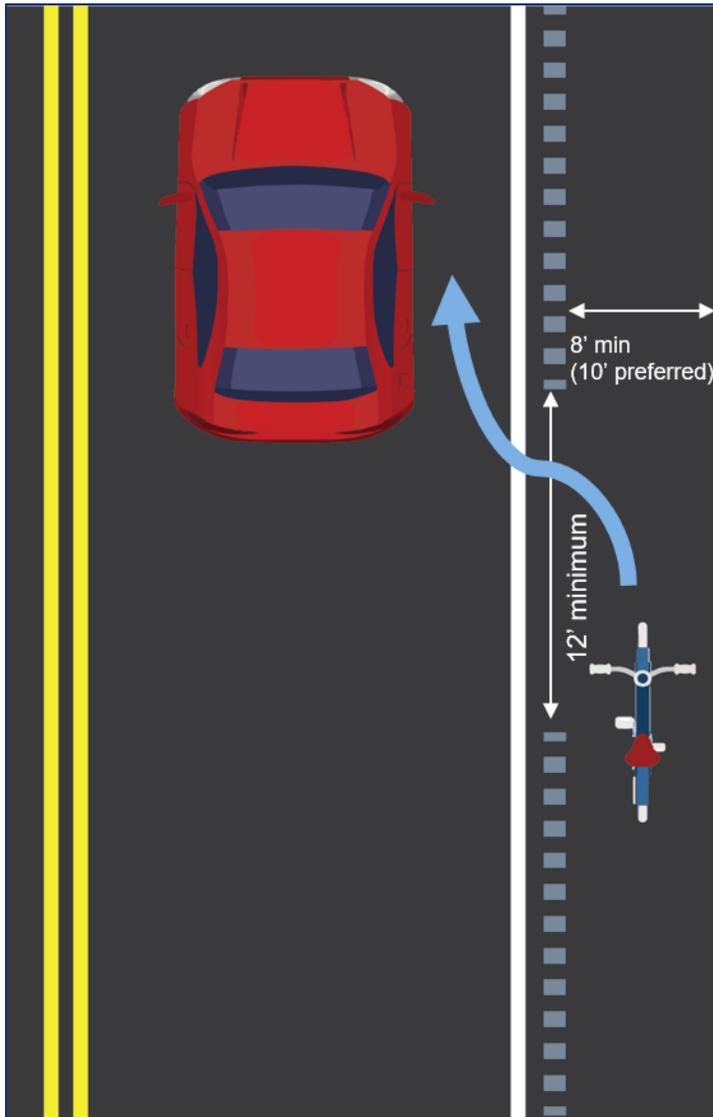


Figure 78: Bike Friendly Rumble Strips with Enhanced Shoulder (FHWA Small Town and Rural Multimodal Networks, 2016)

8.0 Recommended Alternatives

The US 67 corridor study team developed a process to review all alternative concepts considered for the US 67 Corridor Master Plan to result in a recommendation for a single recommended alternative for each location. The pros and cons of the alternative concepts for each location are identified in **Section 6 – Alternative Concepts** and **Section 7 - Complete Streets**. These pros and cons were considered by the team in addition to factors such as cost, average score from public surveys, scope of improvement (short-, mid-, or long-term), and many other factors specific to technical analysis at the individual locations.

During the third series of public meetings held in Fort Davis, Marfa, Alpine, and Presidio, the public was provided a survey to identify recommended alternatives for each improvement location. The public feedback received was heavily considered for the determination of the recommended alternative for each improvement location. While the recommended alternatives are selected here, all of these alternatives are only in conceptual level of design. Should any of these recommended alternatives receive funding and move towards implementation, further design would need to be conducted, thus altering the conceptual design demonstrated in this technical memorandum. **Table 27** lists the recommended alternative for each city as well as the rural segment.

Table 27: Recommended Alternatives

Concept Location	Recommended Intersection Concept	Implementation Term	Planning Level Cost Estimate (rounded)
Presidio Location 1: US 67 and BUS 67 Intersection	T-Intersection (Alternative A)	Short-term	\$500,000
Presidio Location 2: O'Reilly St and Erma Ave Intersection	Y-Intersection (Alternative A)	Mid-term	\$900,000
Presidio Location 3: FM 170 and Utopia St at US 67 Intersection	Two-Way Left-Turn Lane (Alternative B)	Long-term	\$500,000
Presidio Location 5: Port of Entry (POE) Congestion Relief	Parking Capacity at POE (Alternative A)	Mid-term	\$6,800,000
Presidio Complete Streets	Bicycle Lane with Striped Buffer (Alternative A)	Short-term	\$2,000,000
Marfa Location 1: San Antonio St and Highland Ave Intersection	With Bicycle Lanes Alternative (Alternative A)	Mid-term	\$600,000
Marfa Location 2: Lincoln St and Highland Ave Intersection at Presidio County Courthouse	Roundabout (Alternative A)	Short-term	\$200,000
Marfa Complete Streets	Shared Use Path (Alternative A)	Short-term	\$2,000,000
Alpine Location 1: FM 1703 and US 67 Intersection	Two-Way Left-Turn Lane" Alternative (Alternative A)	Mid-term	\$650,000
Alpine Location 2: Orange St and Sul Ross Ave Intersections at US 67	Closing Orange St and Sul Ross Ave Alternative (Alternative A)	Short-term	\$450,000
Alpine Location 3: Intersection at Sul Ross University and US 67	Pedestrian Ring (Alternative A)	Short-term	\$850,000
Alpine Complete Streets	Bicycle Lane with Striped Buffer (Alternative B)	Long-term	\$2,500,000
Rural Location 1: US 67/US 90 Intersection	Free Flow Y-Intersection (Alternative A)	Short-term	\$2,100,000

8.1 Recommended Alternatives

8.1.1 Presidio Location 1 Recommended Alternative

For Presidio Location 1 (US 67 and BUS 67), the recommended alternative is Alternative A, the “T-Intersection”, as shown below in **Figure 79**. For this location, members of the public chose the No-Build Alternative as the most highly ranked alternative. Alternative A addresses safety issues by introducing safety features including channelizing islands to separate turning movements and raised medians along US 67, while maintaining the T-intersection geometry of the existing condition. The recommended alternative does not require additional ROW for implementation. It is also the least expensive and has the shortest implementation period of the three alternatives. Alternative A was well received by members of the Corridor Working Group and other stakeholders reaffirming the US 67 corridor study team that this alternative is the most recommended.

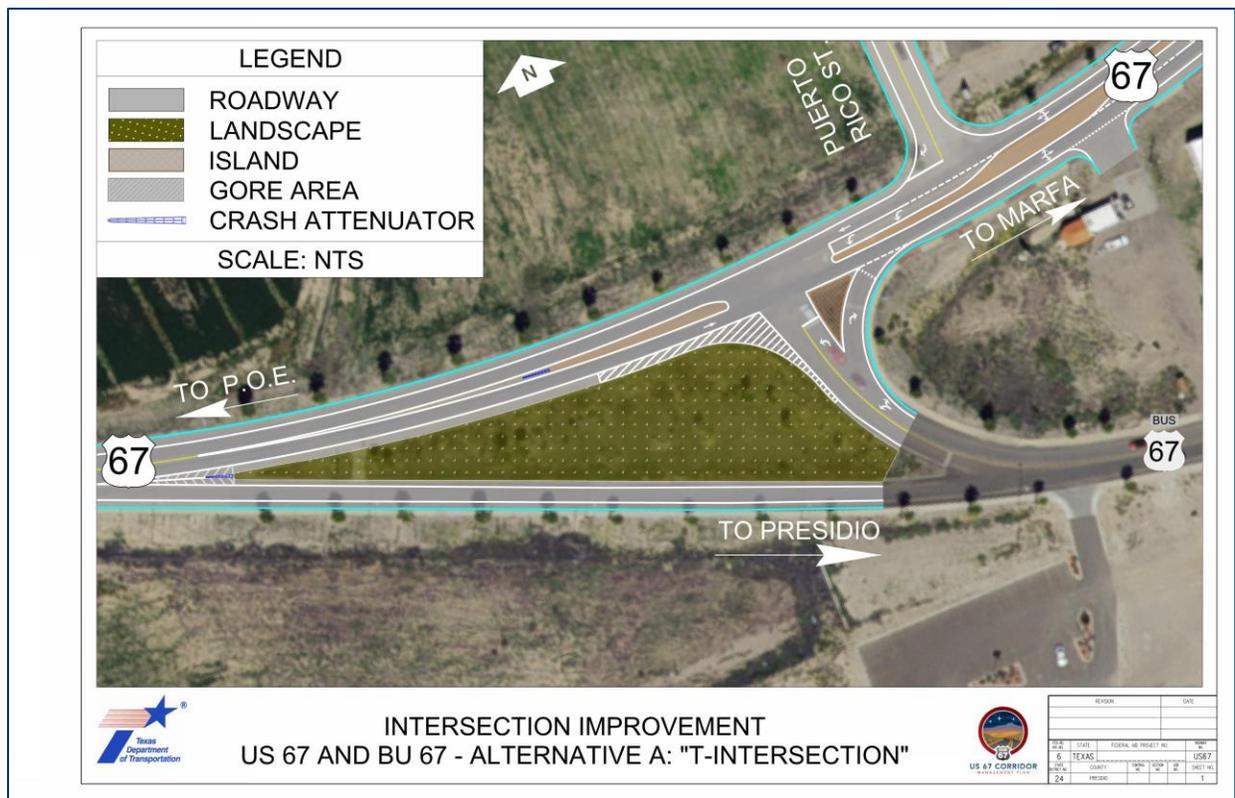


Figure 79: Presidio Location 1 Alternative A

8.1.2 Presidio Location 2 Recommended Alternative

Presidio Location 2 (O'Reilly Street and Erma Avenue) Alternative A, the "Y-intersection", is the recommended alternative for this intersection as shown below in **Figure 80**. The three-way stop-controlled intersection with free flow right-turns addresses safety concerns by featuring raised medians to segregate turning movements and sidewalks and crosswalks to improve safety for pedestrian travel. The No-Build Alternative received the most wide-ranging feedback from the public, getting both the greatest number of votes for the highest-ranked alternative and the greatest number of votes for the lowest-ranked alternative. However, even the members of the public who ranked the No-Build Alternative highest for this location commented that the intersection required some sort of safety treatment. The next highest-ranked alternative after the No-Build Alternative was Alternative B, "Roundabout Raised Curb," however, the Corridor Working Group raised concerns over Alternative B due to access constraints to the Exxon gas station and the railroad construction site. On the contrary, Alternative A maintains access to the railroad construction site while still addressing safety issues. No additional ROW is required to implement this alternative concept.

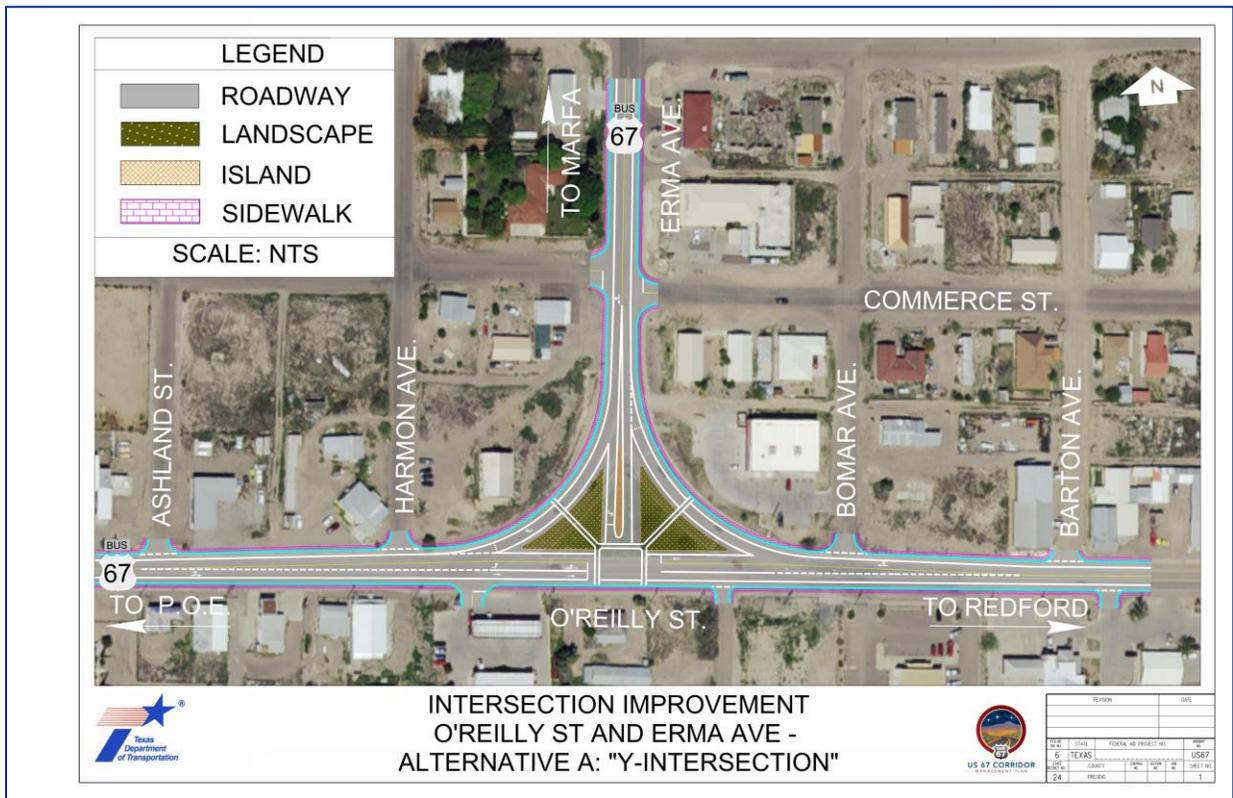


Figure 80: Presidio Location 2 Alternative A

8.1.3 Presidio Location 3 Recommended Alternative

For Presidio Location 3 (FM 170 and Utopia St at US 67), the recommended alternative is Alternative B, the “Two-Way Left-Turn Lane”. For this location, members of the public ranked Alternative B as the second-highest scoring alternative. Alternative C, the “4-Lane Segment,” was the public’s most highly ranked alternative. Alternative B was chosen by the study team due to the high cost of Alternative C and the lack of warrant for a 4-lane section. Alternative B addresses the mobility concerns of the existing condition, as shown in **Figure 81**. For this alternative concept, the west portion of FM 170 is realigned, providing better visibility to drivers, and the eastern portion of FM 170 is aligned across US 67 with Utopia St. A larger turning radius for trucks is provided, and mountable curbs and striping provide buffer spaces and clarity to drivers for designated travel space. Alternative B also includes a two-way left-turn lane down the middle of US 67. Regardless, construction of Alternative B would not be recommended until there is an increase in freight traffic and funding is available. Additional ROW is required to implement this alternative concept, as is required for all three Build alternative concepts at Presidio Location 3.

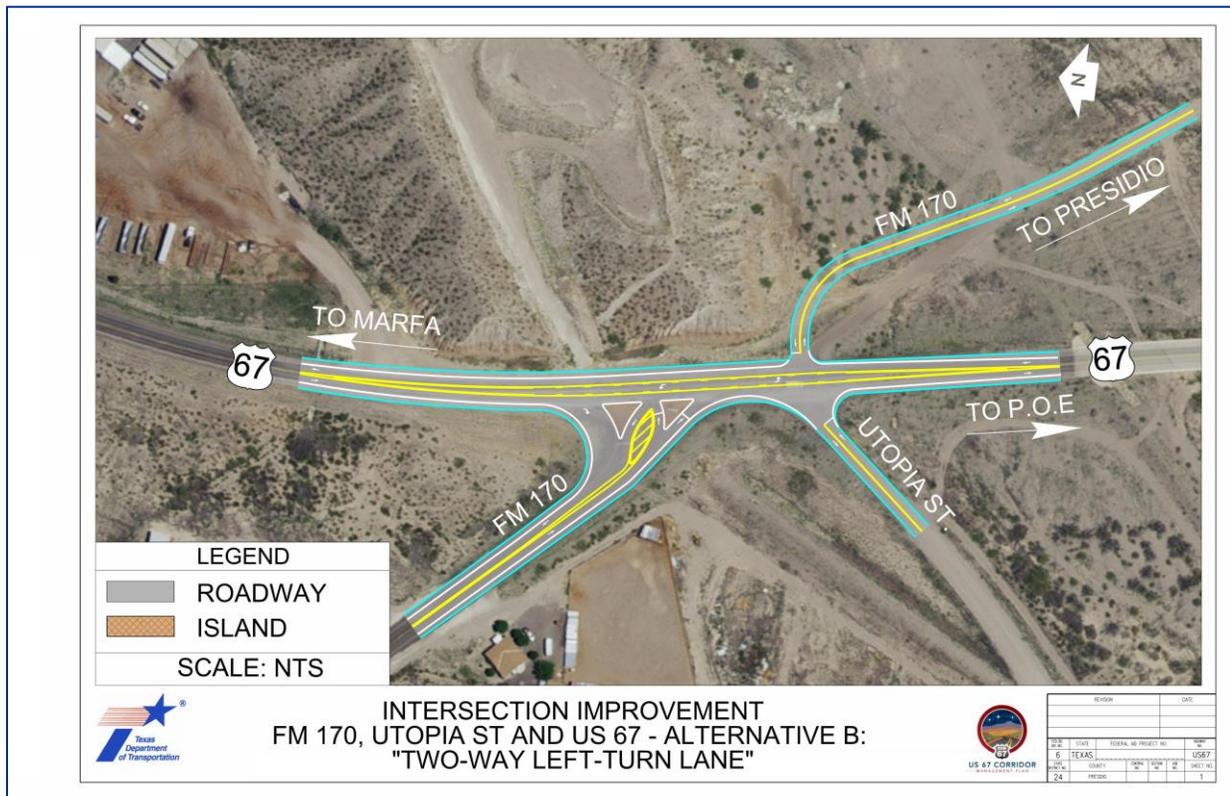


Figure 81: Presidio Location 3 Alternative B

8.1.4 Presidio Location 4 Recommended Alternative

The recommended alternative for Presidio Location 4 (Harrington Street and Bledsoe Boulevard at US 67) is the No-Build Alternative. The No-Build Alternative was the most highly ranked alternative by members of the public. Because there have not been any crashes at this intersection from 2010 to 2018 despite the 5-leg roadway geometry, the study team acknowledges the public's desire to not modify this intersection. The study team recommends Alternative A, the "4-Way Intersection" as a secondary option to create a safer traffic flow, should issues arise in the future.

8.1.5 Presidio Location 5 Recommended Alternative

Presidio Location 5 (POE Congestion Relief) Alternative A, the "Parking Capacity at POE", is the recommended alternative for this location as seen in **Figure 82**. Of the three Build alternatives, this option is the most cost-efficient. If multijurisdictional collaboration can be accomplished, the simple design of Alternative A could significantly alleviate traffic back up from the POE into Presidio. The need for time to establish this collaboration makes this a mid-term project. This alternative was also the most highly ranked by the public.

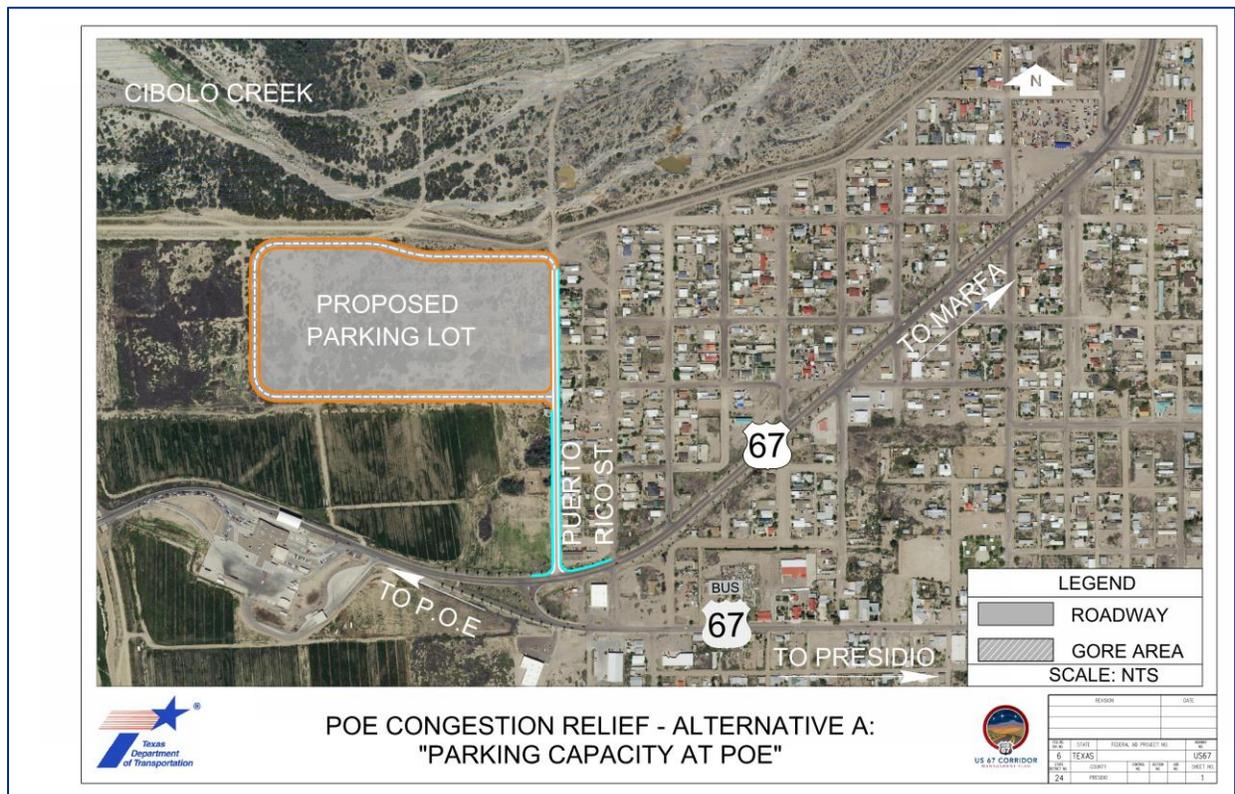


Figure 82: Presidio Location 5 Alternative A

8.1.6 Presidio Complete Streets

Of the Complete Streets concepts in Presidio, the recommended alternative was Alternative A, “Bicycle Lane with Striped Buffer” as seen in **Figure 83**. This alternative provides bicycle lanes along US 67 without the need for roadway widening and was the preferred alternative of the public. The study team also recommends Alternative B “Bicycle Improvements Off US 67” be considered in the long-term as it will require multijurisdictional collaboration.

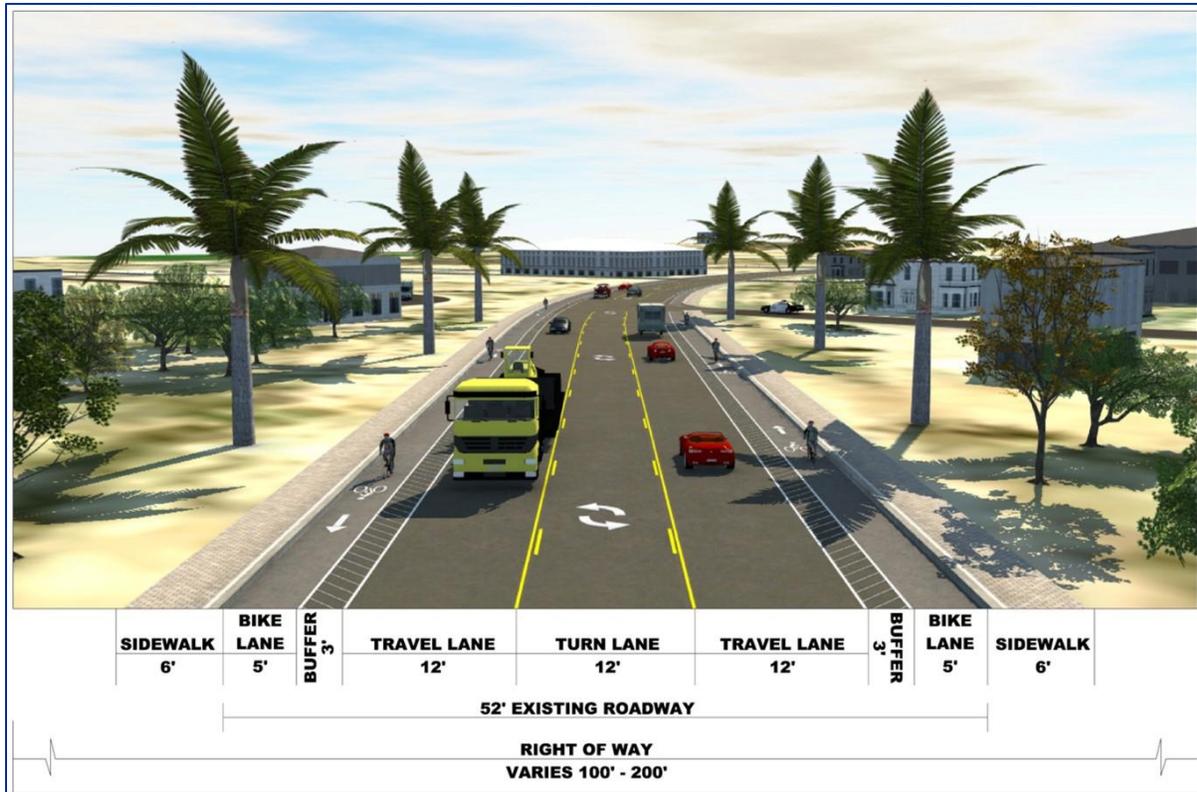


Figure 83: Alternative A: “Bicycle Lane with Striped Buffer”

8.1.7 Marfa Location 1 Recommended Alternative

For Marfa Location 1 (San Antonio Street and Highland Avenue), the recommended alternative is Alternative A, as shown below in **Figure 84**. Members of the public most highly ranked this alternative. Unlike the other two Build alternatives, this concept does not reduce parking availability and includes bicycle lanes. Alternative A also provides larger turning radii for freight trucks. San Antonio Street remains a two-lane street, and Highland Avenue is upgraded to a four-lane street. No additional ROW is required to implement this alternative concept.

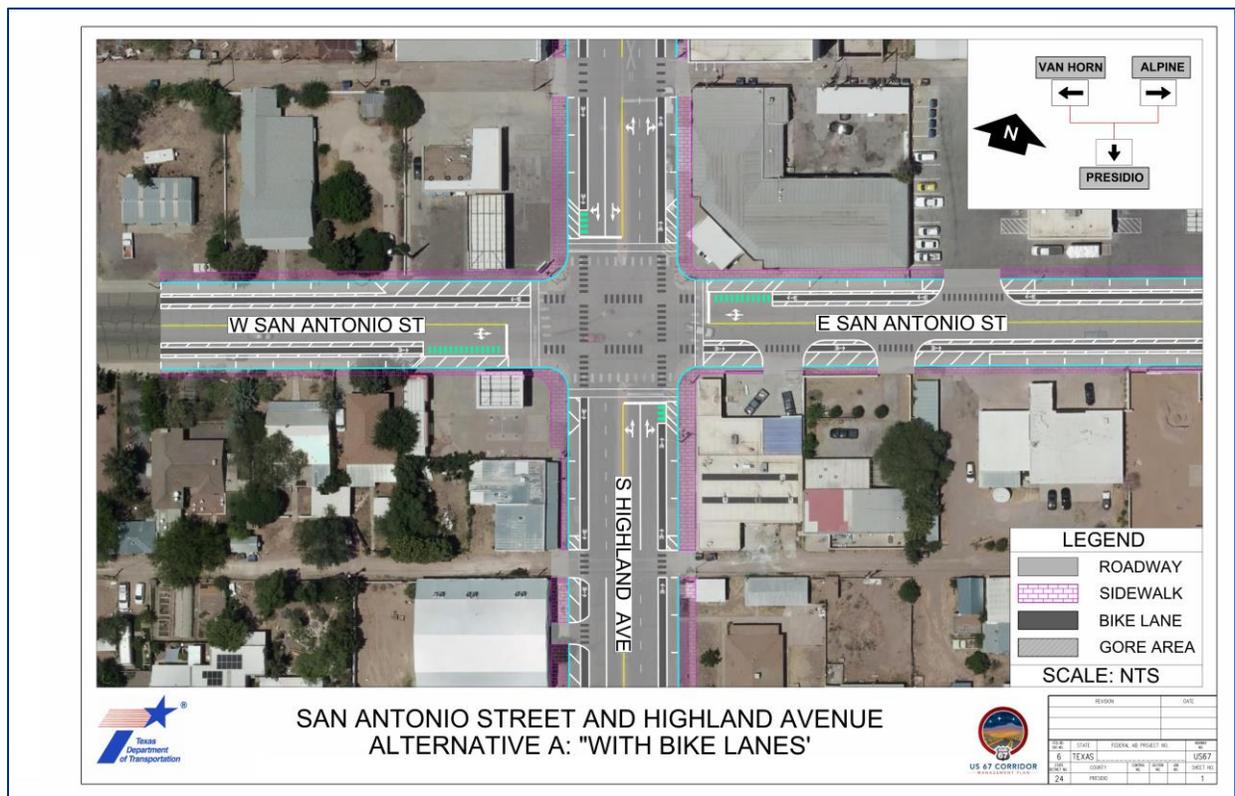


Figure 84: Marfa Location 1 Alternative A

8.1.8 Marfa Location 2 Recommended Alternative

For Marfa Location 2 (Lincoln Street and Highland Avenue) the recommended alternative is Alternative A, "Roundabout" as shown in **Figure 85**. The Roundabout addresses existing safety and freight mobility concerns by providing larger turning radii for freight trucks. The roundabout reduces conflict points to improve safety. The design also provides designated parking spaces, maintains angled parking along Highland St, and provides head-in parking spaces in front of the Presidio County Courthouse. The center of the roundabout is traversable to allow for large truck turning movements. The recommended alternative does not require additional ROW.



Figure 85: Marfa Location 2 Alternative A

8.1.9 Marfa Complete Streets

Of the Complete Street concepts in Marfa, the recommended alternative is Alternative A, “Shared Use Path” as seen in **Figure 86**. The shared use path can optionally show designated space for pedestrians and bicycles through striping or pavement differences and can be implemented on one side of the street or both, depending on the community desires. This alternative addresses safety, segregates modes, and does not require ROW. This alternative is also consistent with the programmed Shared Use Path along the west side of US 67 from Galveston Street to El Cosmico and was the public’s most highly ranked alternative. The study team also recommends Alternative D “Bicycle Improvements Off US 67” be considered in the long-term as it will require multijurisdictional collaboration.

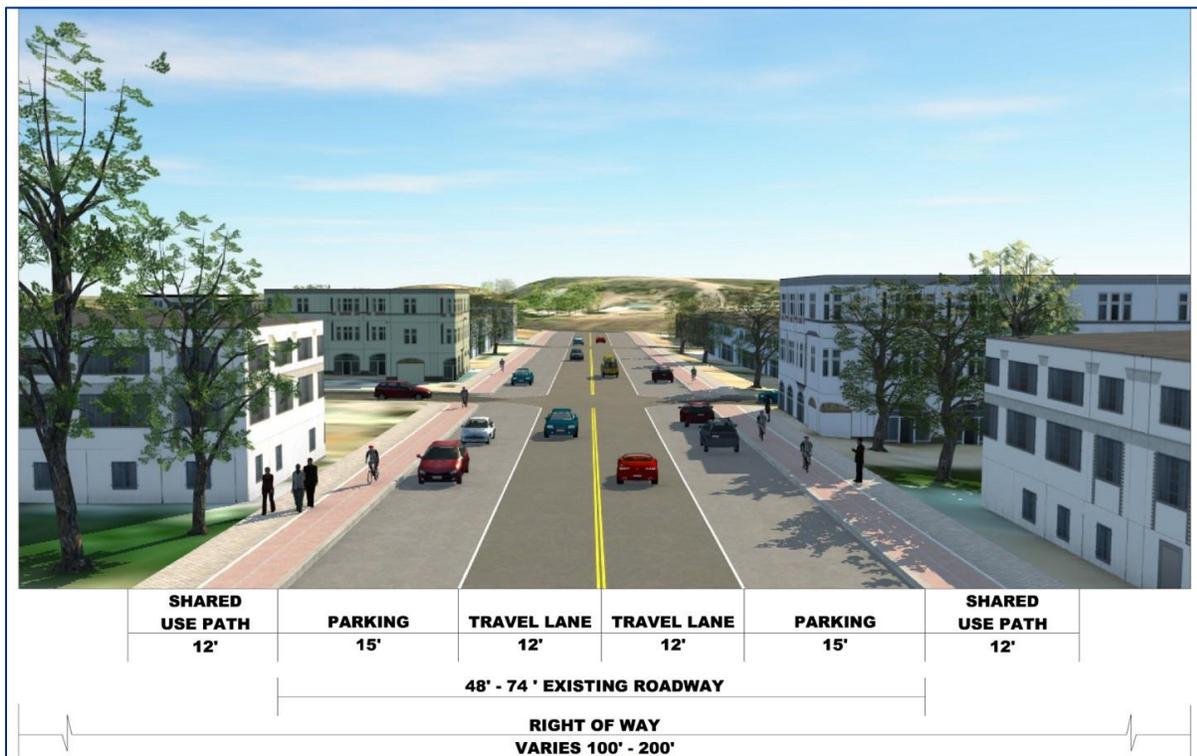


Figure 86: Alternative A: “Shared Used Path”

8.1.10 Alpine Location 1 Recommended Alternative

For Alpine Location 1 (FM 1703 and US 67), the recommended alternative is Alternative A, “Two-Way Left-Turn Lane” as shown in **Figure 87**. Members of the public ranked this alternative highest. Alternative A includes the addition of a center turn lane, which provides a safe vehicle refuge area for left-turning vehicles while maintaining free flow for through travel along US 67, unlike the other Build alternatives. Access to existing businesses along FM 1703 is maintained. Additional ROW is required to implement this alternative concept, as is required for all of the three Build concepts.

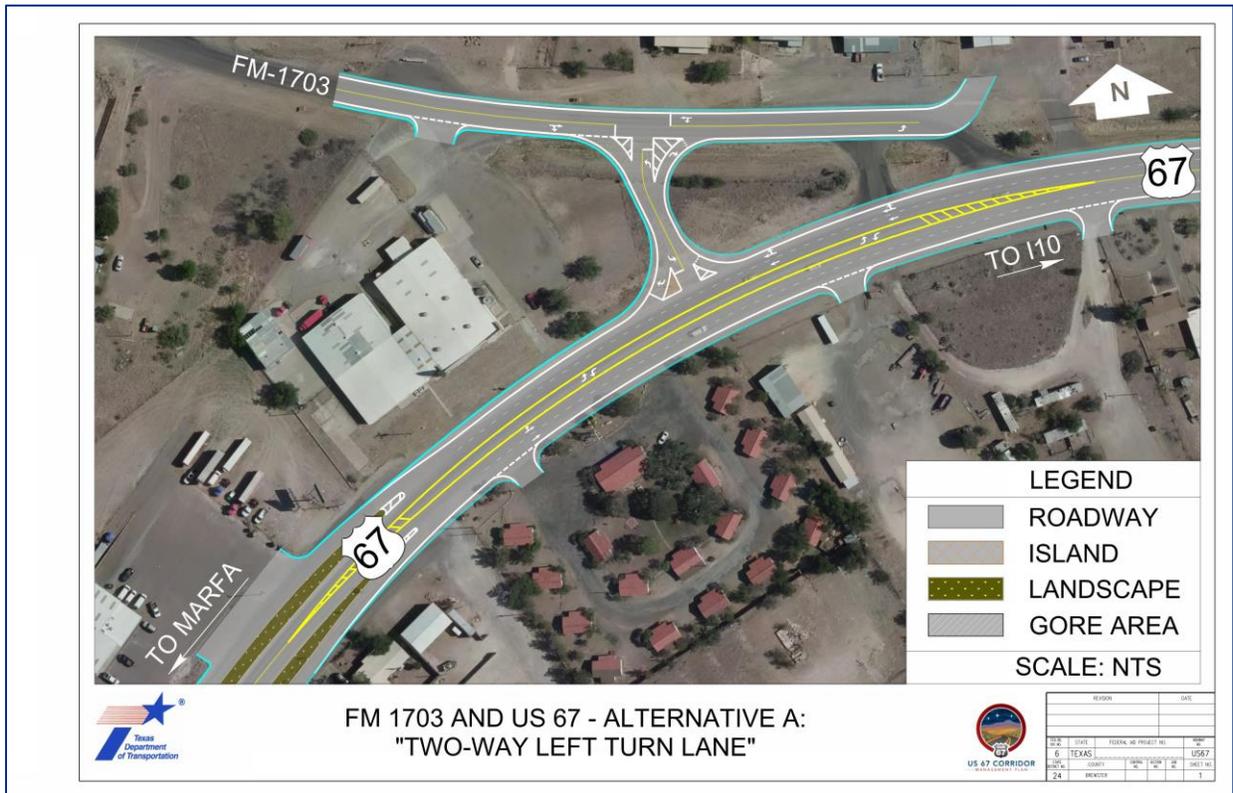


Figure 87: Alpine Location 1 Alternative A

8.1.11 Alpine Location 2 Recommended Alternative

For Alpine Location 2 (Orange Street and Sul Ross Avenue at US 67), the recommended alternative is Alternative A, "Closing Orange St and Sul Ross Ave" as seen in **Figure 88**. Members of the public ranked this alternative highest. Alternative A addresses the safety concerns raised at this intersection by limiting access and channelizing turn movement to US 67 from Sul Ross Ave and Orange St. This alternative maintains the most similar configuration to the existing condition and will not reroute any traffic along other streets. No additional ROW is required to implement this alternative concept.

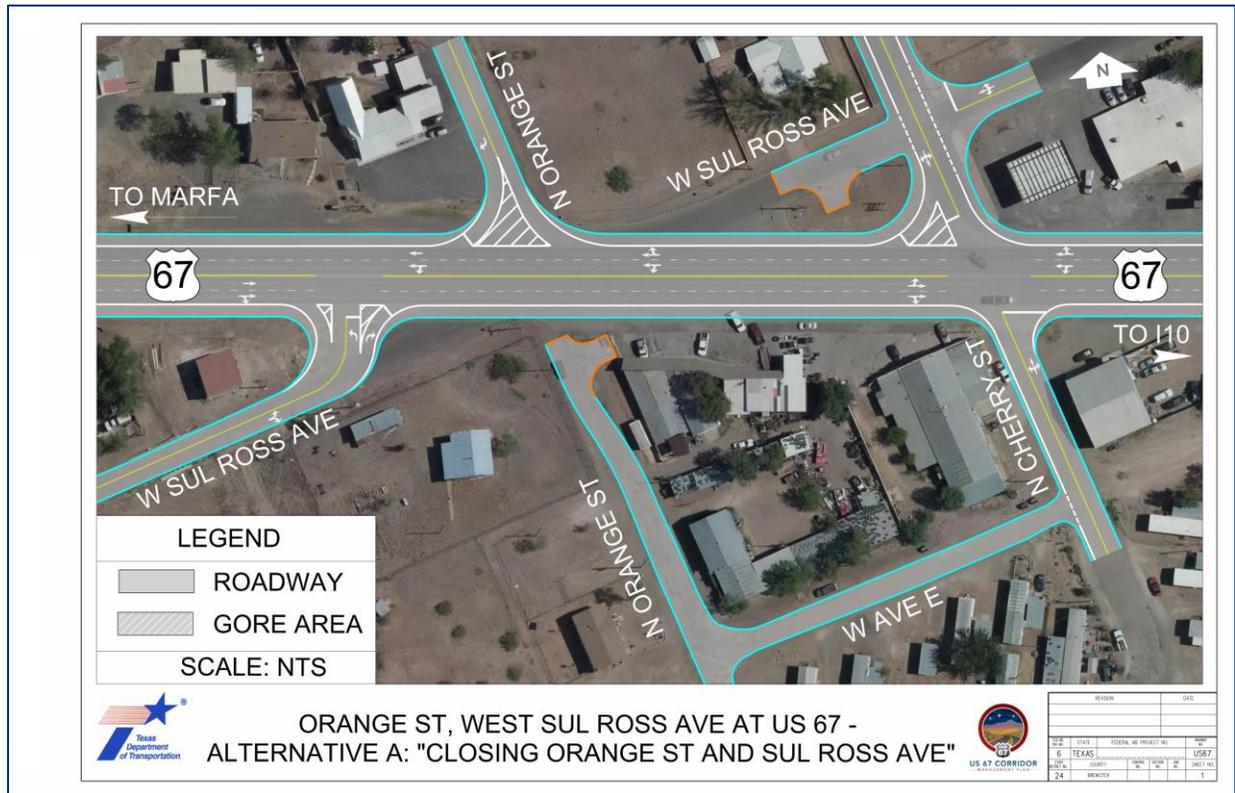


Figure 88: Alpine Location 2 Alternative A

8.1.12 Alpine Location 3 Recommended Alternative

For Alpine Location 3 (Sul Ross University and US 67), the recommended alternative is Alternative A, "Pedestrian Ring" As seen in **Figure 89**. Members of the public ranked this alternative highest. This alternative concept addresses safety and mobility concerns raised by converting Harrison Street into a one-way street and incorporating pedestrian facilities. The public land central to the intersection is an opportunity for landscaping and placemaking features. No additional ROW is required to implement this alternative concept unlike Alternative B, and it will be less confusing for drivers to navigate through compared to Alternative C.

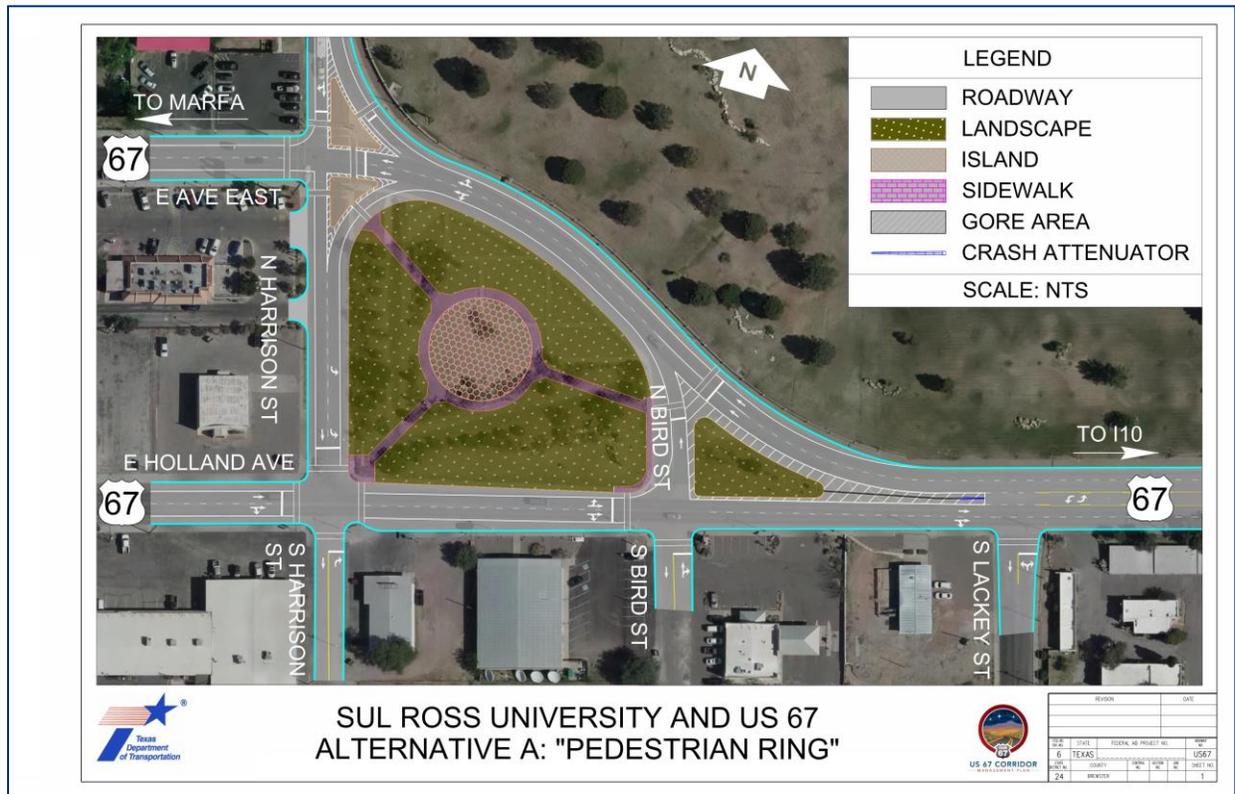


Figure 89: Alpine Location 3 Alternative A

8.1.13 Alpine Complete Streets

Of the Complete Streets concepts in Alpine, the recommended alternative was Alternative B, “Bicycle Lane with Striped Buffer” As seen in **Figure 90**. This alternative would replace a lane currently designated for parallel parking with a bicycle lane with a striped buffer with access to the variety of destinations within the city center of Alpine. This concept addresses safety, segregates modes, does not require ROW, and was the public’s most highly ranked alternative. The study team also recommends Alternative C “Bicycle Improvements Off US 67” for long-term implementation.

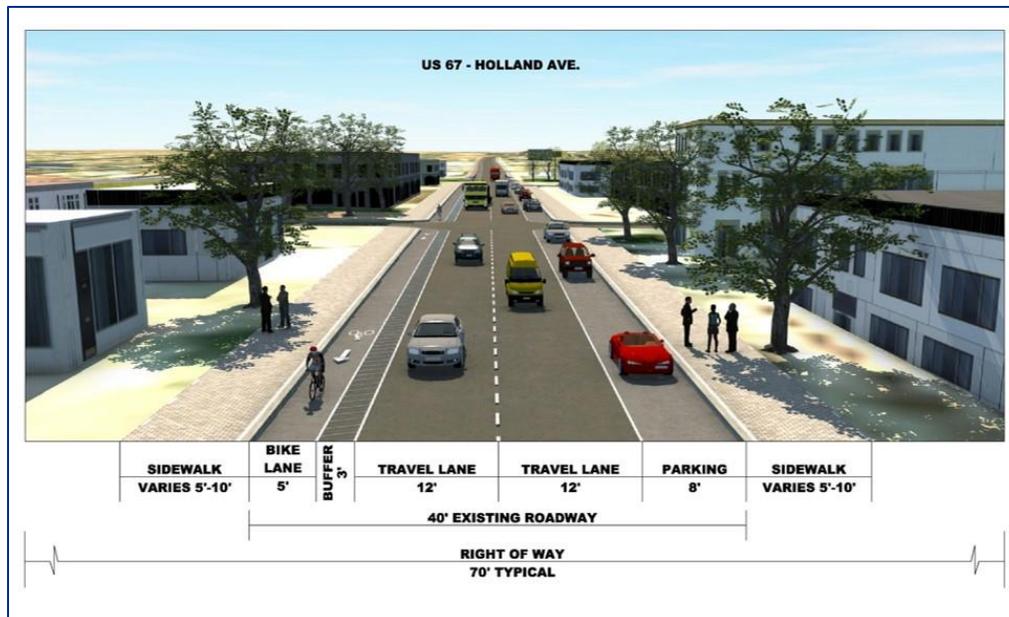
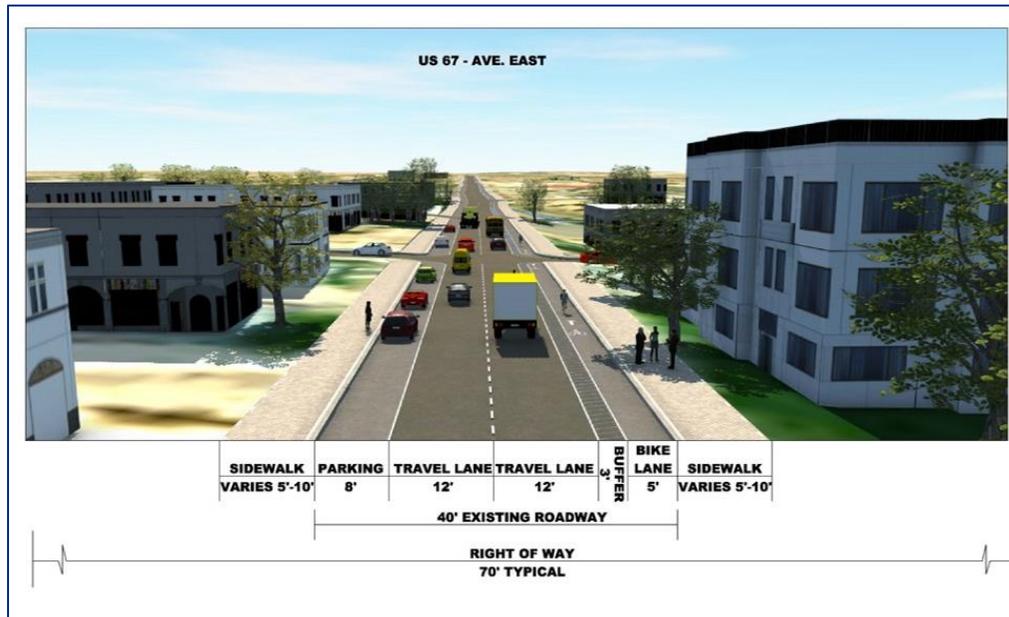


Figure 90: Alternative B: “Bicycle Lane with Striped Buffer”

9.0 Summary

Throughout the development of the US 67 Corridor Master Plan, a wide variety of short-, mid-, and long-term conceptual improvements to the study corridor were evaluated. Each concept represents a package of options that could improve mobility and safety on the US 67 corridor if implemented. Public input and technical analysis of the corridor was used by the US 67 Corridor Master Plan study team to generate a total of 17 conceptual alternatives in Presidio, 10 conceptual alternatives in Marfa, 17 conceptual alternatives in Alpine, and three conceptual alternatives in the rural part of the US 67 corridor.

In **Chapter 3 – Goals and Objectives**, the goals of the US 67 Corridor Master Plan are laid out. The goals of the US 67 Corridor Master Plan are to improve safety, mobility, and emergency response, promote sustainability, maintain a state of good repair, support economic development, and enhance multimodal connectivity. A series of 3-4 objectives were derived for each goal area to support their fulfillment. Together, the goals and their associated objectives were used to derive evaluation criteria to rate each conceptual improvement on its ability to fulfill the goals. The evaluation criteria consider transportation and mobility impacts, engineering and cost issues, environmental and land use issues, economic feasibility and cost-effectiveness, economic development benefits, and safety and crash mitigation impacts. Conceptual alternatives were scored at -1 (negative effect on project goals), +0 (no effect on project goals), +1 (future positive effect on project goals) or +2 (immediate positive effect on project goals).

After the conceptual evaluation of the conceptual alternatives was finished, the fatal flaw analysis was undertaken. The purpose of the fatal flaw analysis was to screen out any conceptual alternatives that were especially disfavored by the public for cost, environmental impact, impact on traffic circulation, or other reasons, or that were legally disallowed. Three concepts – angled parking on W San Antonio Street and S Highland Avenue in Marfa, the “shoe-fly” bridge bypass in Alpine, and the Sul Ross Avenue / US 67 intersection roundabout – were excluded from further consideration by this analysis.

Following the fatal flaw analysis, the recommended alternative for each of the study locations was selected based on an evaluation of the pros and cons of each, cost, timeframe of the improvement (short-, mid-, or long-term), and public input.



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