Project No. T0230 01L | Federal Project No. MMO-0(222)T

US 93 AT PIERCE FERRY ROAD FEASIBILITY STUDY

FEASIBILITY REPORT

Prepared for ADOT

Prepared by Kimley»Horn
Expect More. Experience Better.

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Feasibility Report

Project No.: T0230 01L

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February 11, 2021

Prepared for:

ADOT

SEAL OF MOHAVE COUNTY ARIZONA
DITAT DEUS
1864

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1. INTRODUCTION

Mohave County and the Arizona Department of Transportation (ADOT) initiated the *US 93 at Pierce Ferry Road Feasibility Study*. The study identified alternatives to reduce crashes and improve safety at the intersection.

US 93 is a state highway that connects Wickenburg, Arizona to the Las Vegas metropolitan area. The Arizona segment begins at the junction of US 60/US 93 in Wickenburg and ends at the Mike O'Callaghan-Pat Tillman Memorial Bridge at the Arizona/Nevada state line.

The US 93 and Pierce Ferry Road (County Route 25) intersection is located at MP 41.8, approximately 25 miles northwest of Kingman, Arizona in Mohave County. The intersection location is illustrated in **Figure 1.**

The intersection is a gateway to Grand Canyon West and is heavily trafficked by international visitors, tour buses, passenger vehicles, and vans. Crash data shows that there were five fatal and nine suspected serious injury crashes within a five-year period (2015-2019). All but two of the fatal/suspected serious injury crashes were angle crashes in which drivers "failed to yield right-of-way" and "ran stop sign."

US 93 at Pierce Ferry Road. In Fall 2020, ADOT completed a project to modify the northbound and southbound US 93 left-turn lanes at the intersection. The US 93 at Pierce Ferry Road Feasibility Study evaluates grade-separation alternatives.

Project Goals

US 93 and Pierce Ferry Road Feasibility Study project goals include the following:

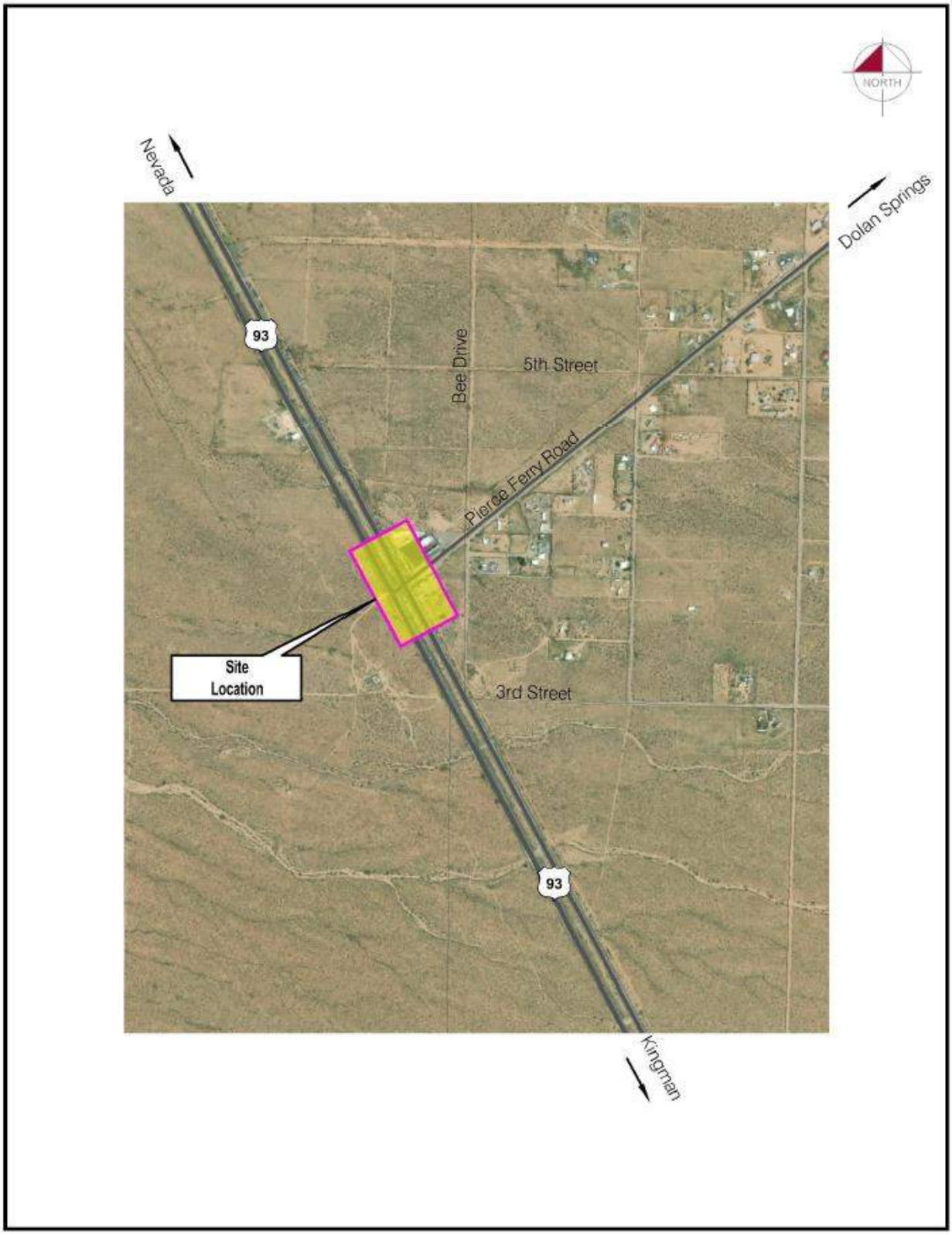
- Identify improvements alternatives to reduce the number and severity of crashes at the intersection.
- Identify which alternative provides the highest return on investment as measured by its effectiveness to reduce crashes, in comparison with cost of the improvements.

Project Activities

US 93 and Pierce Ferry Road Feasibility Study project activities include:

- Analyze crash data;
- Assess existing and projected traffic data;
- Develop and evaluate grade-separation alternatives;
- Prepare a benefit-cost analysis on recommended alternative; and
- Document findings in a Feasibility Report.

FIGURE 1: STUDY INTERSECTION AND VICINITY MAP



2. EXISTING ROADWAY AND INTERSECTION FEATURES

This section summarizes historical conditions of the US 93 at Pierce Ferry Road intersection.

US 93

- Functional Classification: Rural Principal Arterial
- Number of lanes: four (two northbound and two southbound)
- Lane width: 12’
- Speed limit: 65 MPH.
- Median: depressed median dividing northbound and southbound
- Median width: 66’
- Right of way: approximately 250’

Figure 2 shows intersection conditions, in August 2020. The photo on the left depicts US 93 viewing north from the median crossing. The photo on the right is US 93 viewing south from Pierce Ferry Road.

Left – US 93 SB viewing north from the median crossing.

Right – US 93 NB viewing south from Pierce Ferry Road.

FIGURE 2: PHOTO, US 93 AT PIERCE FERRY ROAD

Pierce Ferry Road

- Functional Classification: Rural Major Collector
- Number of lanes: three lanes at intersection approach and adjacent to Chevron service station, with one travel lane eastbound, one westbound, and a two-way center left-turn lane.
- Lane width: 12’
- Speed limit: 45 MPH
- Median: two-way left-turn lane

- Right of way: 100’

Pierce Ferry Road viewing west

Pierce Ferry Road viewing east

FIGURE 3: PHOTO, PIERCE FERRY ROAD

Intersection

- The intersection includes a westbound through lane to access median crossing, a right-turn lane to access US 93 northbound, and an eastbound receiving lane.
- A median crossing enables US 93 southbound traffic to access Pierce Ferry Road, and westbound Pierce Ferry Road to access southbound US 93. The two-lane median crossing is 42’ wide and 66’ long.

US 93 at Pierce Ferry Road, August 2020

- Northbound US 93 has 12’ designated right- and left-turn lanes, and a 12’ acceleration lane for vehicles turning right from westbound Pierce Ferry Road.
- Southbound US 93 has a 12’ designated left-turn lane to the median crossing, and a 12’ acceleration lane for vehicles crossing from westbound Pierce Ferry Road to southbound US 93. The left-turn lanes were recently modified (November 2020) from this configuration. However, traffic and crash data and analysis were completed for the pre-improved condition.
- The intersection is stop controlled with stop signs located at westbound Pierce Ferry Road entrance to US 93 and in the median crossing where vehicles from US 93 southbound making a left-turn must stop before crossing US 93 northbound.
- There are five existing luminaires near the intersection, one on each approach and one on the departing legs of US 93.

Figure 4 shows US 93 viewing south, from the median crossing, as of August 2020. The difference in elevation between the northbound and southbound travel lanes is evident.

Viewing south from north of median crossing

FIGURE 4: PHOTO, MEDIAN CROSSING AT PIERCE FERRY ROAD / US 93 INTERSECTION

Completed Constructed Projects

Table 1 summarizes recent improvements to the intersection and vicinity.

- In 2000, a northbound left-turn lane was added at Pierce Ferry Road; the southbound acceleration lane was extended, and the median crossover was milled and replaced.
- In 2019, a pavement preservation and crack seal were completed.
- In 2020, shoulder widening and a realignment of the left-turn lanes at US 93 and Pierce Ferry Road were constructed. The new configuration, completed in November 2020, is depicted in **Figure 5** and **Figure 6.**

TABLE 1: PREVIOUS PROJECTS CONSTRUCTED

Project Number	Begin MP	End MP	Project Plans Date	As-Built Year	Description
H4902 01 C	36.20	58.40	2000	N/A	US 93 new NB left-turn lane, extended SB acceleration, and mill and replace crossover

Project Number	Begin MP	End MP	Project Plans Date	As-Built Year	Description
H8916 01 C	36.00	50.00	2017	2019	US 93 pavement preservation and crack seal
H8658 01 C	38.00	47.92	2020	N/A	Shoulder widening and modifying the left-turn lanes to bring them closer to the centerline of US 93 to create a more traditional left-turn movement and bringing the southbound left-turn lane up to approximately the same elevation as the northbound lanes.

US 93 at Pierce Ferry Road, viewing east from center island.

US 93 at Pierce Ferry Road, viewing south at southbound US 93 left-turn lane, view from center island.

FIGURE 5: LEFT-TURN MODIFICATIONS, COMPLETED NOVEMBER 2020

FIGURE 6: LEFT-TURN MODIFICATIONS AT US 93/PIERCE FERRY ROAD INTERSECTION

Adjacent Land Use

A Chevron service station and convenience store, parcel 326-03-121G, is located on the northeast quadrant of the intersection, as illustrated in **Figure 7**.

There are two driveways to the Chevron gas station. The western driveway is located approximately 220’ from the intersection, and the eastern driveway is located 370’ from the intersection (as measured from the stop bar). There is a gated road that is colinear with the median crossing on the west side of US 93. The road connects to 3rd street and to multiple occupied properties on the west side of US 93.

FIGURE 7: ADJACENT PARCELS

Source: *Mohave County, GIS,* https://mcgis2.mohavecounty.us/html5/?viewer=moh

Each parcel adjacent to the intersection is privately owned. Property owners of parcels adjacent to the intersection are identified below.

TABLE 2: PROPERTY OWNERS ADJACENT TO INTERSECTION

Parcel Number	Name	Mailing Address
326-03-122C	WARD WALLACE H	2607 MIRABELLA ST HENDERSON, NV 89052-3172
326-03-126C	NU GEN LLC	8843 N CENTRAL AVE PHOENIX, AZ 85020-2816
326-03-121G	DOLAN SPRINGS INVESTMENT LLC	1131 DU FORT HILLS CT HENDERSON, NV 89002-6602 SITE ADDRESS: 14097 N PIERCE FERRY RD, DOLAN SPRING, AZ

Parcel Number	Name	Mailing Address
326-03-121E	NU GEN LLC	8843 N CENTRAL AVE PHOENIX, AZ 85020-2816
326-03-126D	NU GEN LLC	8843 N CENTRAL AVE PHOENIX, AZ 85020-2816
326-03-139D	CITIZENS UTILITIES RURAL CO	ATTN TAX DEPARTMENT 401 MERRITT 7, NORWALK, CT 068511000 SITE ADDRESS: 14033 N BEE DR, DOLAN SPRING, AZ
326-03-139C	WARD WALLACE HAMILTON TRUSTEE	2607 MIRABELLA ST HENDERSON, NV 890523172
326-03-140	NGUYEN TRI ETAL, LA THANH	6314 MOUNT EDEN AVE LAS VEGAS, NV 891397210

Utilities

Arizona Blue Stake was used to identify known utilities providers within the vicinity of the study area. **Table 3** is a list of the utility service companies with facilities in the project area, their representative, and contact information.

TABLE 3: EXISTING UTILITIES

Utility	Utility Type	Contact
Unisource Energy Services – Kingman	Electric	Paul Martin 928-681-8924
Frontier Communications	Telephone	Jim Hanson 928-757-0218
Arizona Department of Transportation	Electric	Jason Dupee 928-681-6093
Arizona Department of Transportation	Culverts, Storm Drains	Gabriel Alvarado 928-681-6025
Mount Tipton Water Company	Water	Brenda Sisco 928-767-3713

Future Corridor Improvements

US 93 from Wickenburg up to the Arizona/Nevada state line is planned to be a part of the future Interstate-11. I-11 will extend from the US/Mexico border in southern Arizona, through the Phoenix metropolitan area, and to Las Vegas. Ultimately, the corridor will extend north to Canada.

Intersection improvements to US 93 at Pierce Ferry Road should be consistent with a future interstate corridor. Considerations include:

- Grade separation of all movements
- Design speed to interstate standards
- Establishment of access control
- Minimize “throw-away” improvements

3. TRAFFIC AND CRASH ANALYSIS

Current and Projected Traffic Volumes

Daily Traffic Volumes

Average Annual Daily Traffic (AADT) and traffic information for US 93 and Pierce Ferry Road was obtained from ADOT's Transportation Data Management System (TDMS).

ADOT maintains a continuous count location on US 93 (Location ID: 102085) at milepost 47, south of the study intersection. Mohave County maintains a continuous count station on Pierce Ferry Road (Location ID: MC-9104) located 0.3 miles east of the intersection. **Table 4** summarizes information obtained from each count station.

In 2018, daily traffic on US 93 was 15,626 vehicles per day (vpd). A review of historical data (2015-2019) shows that traffic has increased at an average annual rate of 3.6% on US 93, and at 1.8% on Pierce Ferry Road.

TABLE 4: ROADWAY AADT AND TRAFFIC VOLUME INFORMATION

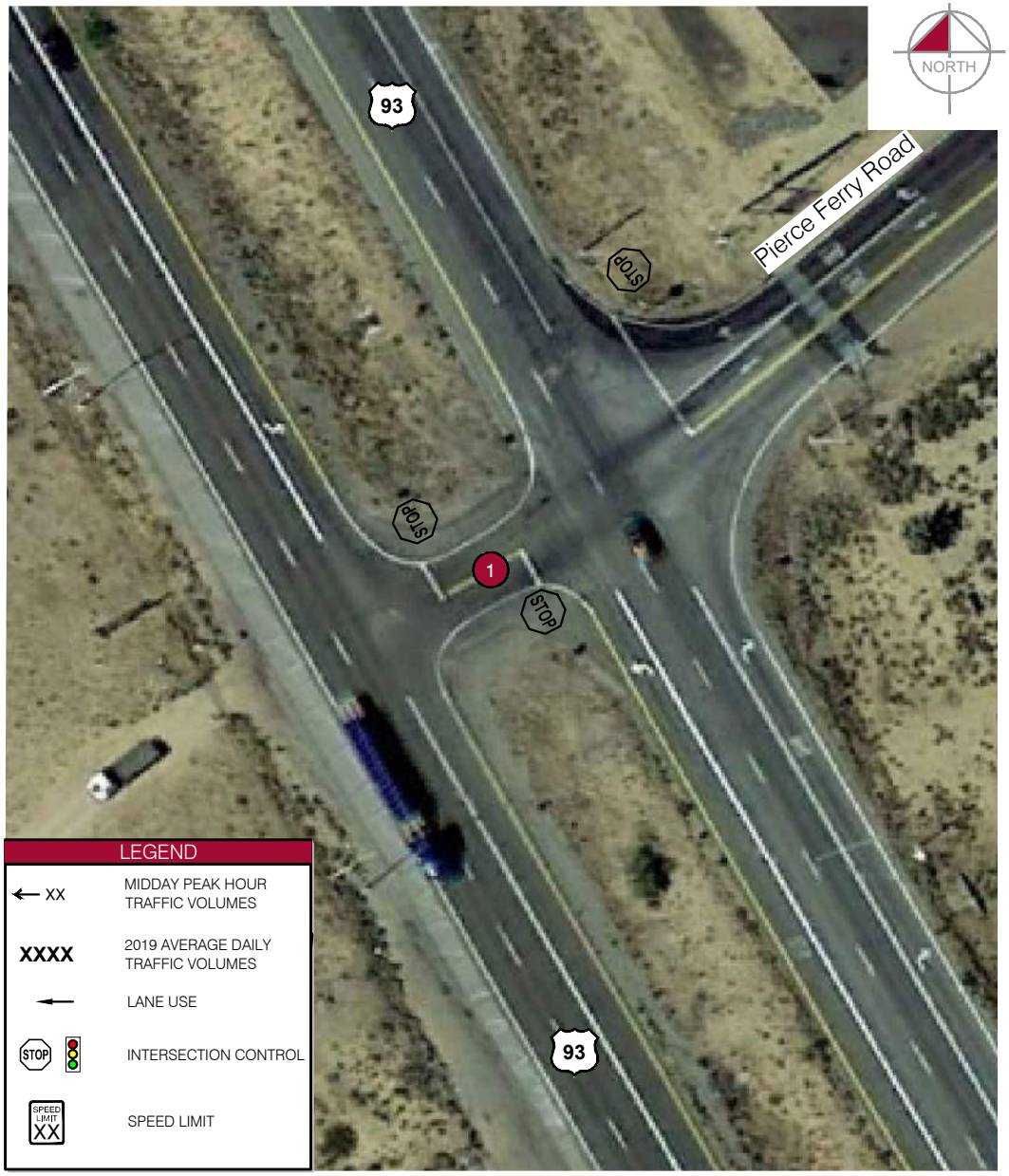
Route	Loc ID	AADT 2018 (vpd)	K Factor %	D Factor %	Growth Rate %	AADT 2019 (vpd)
US 93 South of Pierce Ferry Road	102085	15,626	15%	51%	3.6%	16,189
US 93 North of Pierce Ferry Road	-	-	-	-	-	-
Pierce Ferry Road	MC-9104	2,100	12%	63%	1.8%	2,138

Intersection Turning Movement Counts

Traditional methods of collecting turning movement counts (TMCs) at the intersection in 2020 were not viable due to COVID-19, and the impact on traffic volumes. As a substitute for ground counts, StreetLight data was purchased. StreetLight is "big data" that collects and anonymizes geospatial location data from mobile devices and processes the data to estimate travel patterns. Data obtained from StreetLight, in conjunction with historical data, were used to determine TMCs for the US 93 at Pierce Ferry Road intersection.

StreetLight data was obtained for weekdays (Tuesday-Thursday), during the peak three-month period (April-June), 2019. The peak three-month period was determined from the continuous count station located on Pierce Ferry Road. StreetLight data is illustrated in **Figure 8.** A midday peak hour is expected for this intersection that is used heavily by tourists.

- Weekday AM Peak Period: 8:00 am to 9:00 am; 786 VPH (peak hour entering vehicles)
- ***Weekday Midday Peak Period: 1:00 pm to 2:00 pm; 1,451 VPH*** (peak hour entering vehicles)
- Weekday PM Peak Period: 4:00 pm to 5:00 pm; 1,048 VPH (peak hour entering vehicles)
- Daily traffic volumes:
    - US 93 south of Pierce Ferry Road (sum of US 93 southbound thru / US 93 northbound thru/ US 93 northbound right/ Pierce Ferry Road westbound left): **14,940 VPD**
    - Pierce Ferry Road (sum of Pierce Ferry Road westbound left and right, US 93 northbound right, and US 93 southbound left): **2,563 VPD**



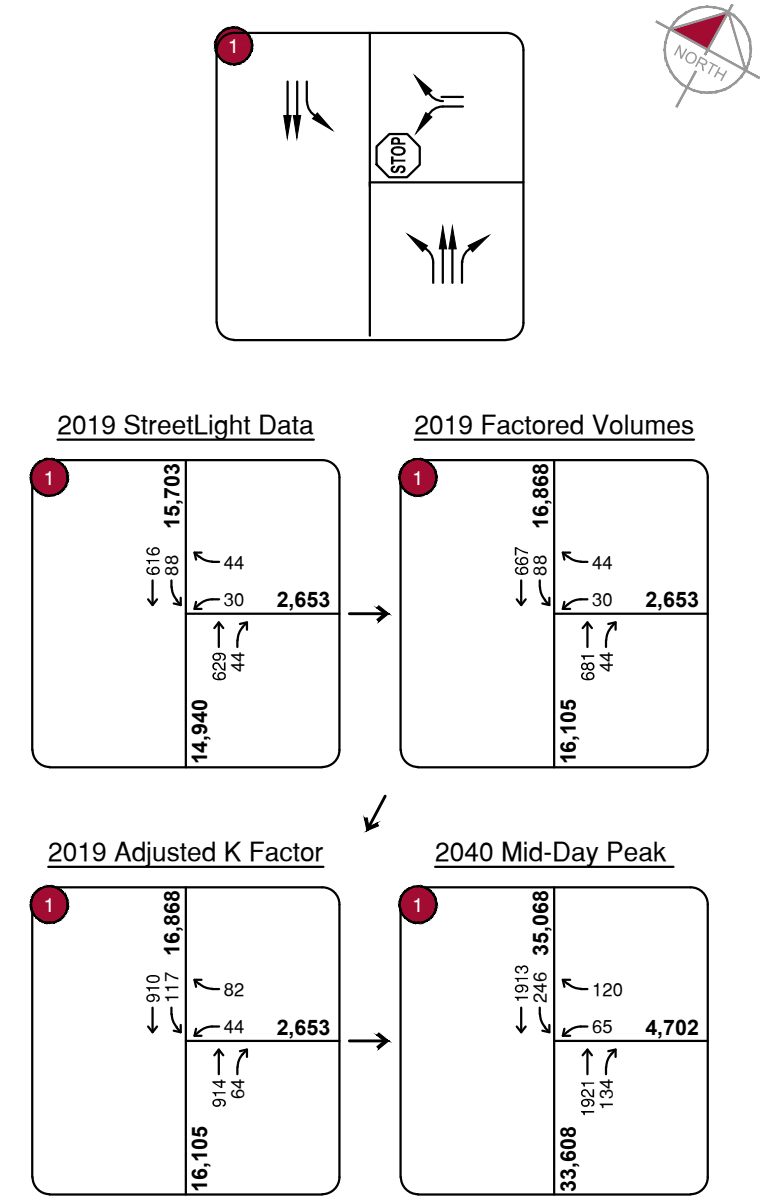


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Figure 8

Existing Conditions and 2019/2040 Weekday Traffic Counts

T0230 01L - US 93 at Pierce Ferry Road Feasibility Study

Design Values

The StreetLight **average daily traffic** (ADT) volumes (**Appendix G**) were compared to available data from ADOT TDMS as illustrated in **Table 5.** The comparison shows that StreetLight ADT is approximately 8.3% fewer vehicles than the ADOT count data.

TABLE 5: DAILY TRAFFIC COMPARISON

Route	StreetLight Data Daily Traffic Volumes (April-June 2019)	2019 AADT
US 93 South of Pierce Ferry Road	14,940 vpd	16,189 vpd [1]
Pierce Ferry Road	2,563 vpd	2,138 vpd [2]

1. *ADOT TDMS*
2. *WACOG TDMS*

As such, to calculate the through volumes at the intersection, the StreetLight data *through* volumes were factored up by 8.3%. The resulting factored volumes are included in **Appendix G.**

Table 6 summarizes the ***directional factor*** (D) for US 93 based on ADOT TDMS and for Pierce Ferry based on WACOG TDMS. Also summarized is the D factor for both US 93 and Pierce Ferry Road based on StreetLight data. Based on the data, the design D-factor is identified.

TABLE 6: D FACTOR

Route	2018 D Factor % (ADOT TDMS)	2018 D Factor % (WACOG TDMS)	2019 StreetLight Data	Design D Factor %
US 93	51%	-	50%	50%
Pierce Ferry Road	-	63%	64%	64%

Table 7 summarizes ***K factors*** from ADOT, WACOG, and StreetLight. A review of the ADOT data shows that the US 93 K factor, as published in the TDMS, is based on a 2010 count. As such, recognizing that corridor conditions have changed since 2010, an average (12%) of the K factor from 2018 TDMS (15%) and 2019 StreetLight data (8.7%) is used in the analysis for both roadways.

TABLE 7: K FACTOR COMPARISON

Route	2018 K Factor % (ADOT TDMS)	2018 K Factor % (WACOG TDMS)	2019 StreetLight Data	Design K Factor %
US 93	15%	-	8.7%	12%
Pierce Ferry Road	-	12%	8.0%	12%

To provide a conservative analysis, the design K factor (12%) was applied to the factored StreetLight data daily turning movement volumes to calculate an adjusted intersection turning movement count design volume, as depicted in **Figure 8.** The resulting adjusted volumes are included in **Appendix G.**

Truck percentage is not available from ADOT or WACOG TDMS. The ADOT US 93/US 60 Corridor Profile Study, March 2017, identified a truck percentage of 7.5%. Design values are summarized in **Table 8.**

TABLE 8: TRAFFIC DESIGN VALUES

Route	Factored 2019 Average Daily Traffic	Design D Factor (%)	Design K Factor (%)	Design Growth Rate (%)	2040 Average Daily Traffic
US 93 South of Pierce Ferry Road	16,105 vpd	50%	12%	3.6%	33,608 vpd
US 93 North of Pierce Ferry Road	16,868 vpd	50%	12%	3.6%	35,006 vpd
Pierce Ferry Road	2,563 vpd	64%	12%	1.8%	4,702 vpd

Crash Analysis

Crash data for the US 93 at Pierce Ferry Road intersection was obtained from ADOT's Arizona Crash Information System (ACIS) for an analysis period of January 1, 2015 to December 31, 2019. During the period, 57 crashes were reported. **Figure 9** shows that between 12 and 15 crashes occurred each year, from 2016-2019, with only two crashes reported in 2015.

Table 9 and **Figure 10** summarize the crashes by injury severity. Of the 57 total crashes, five fatal crashes resulted in ten fatalities and nine suspected serious injuries.

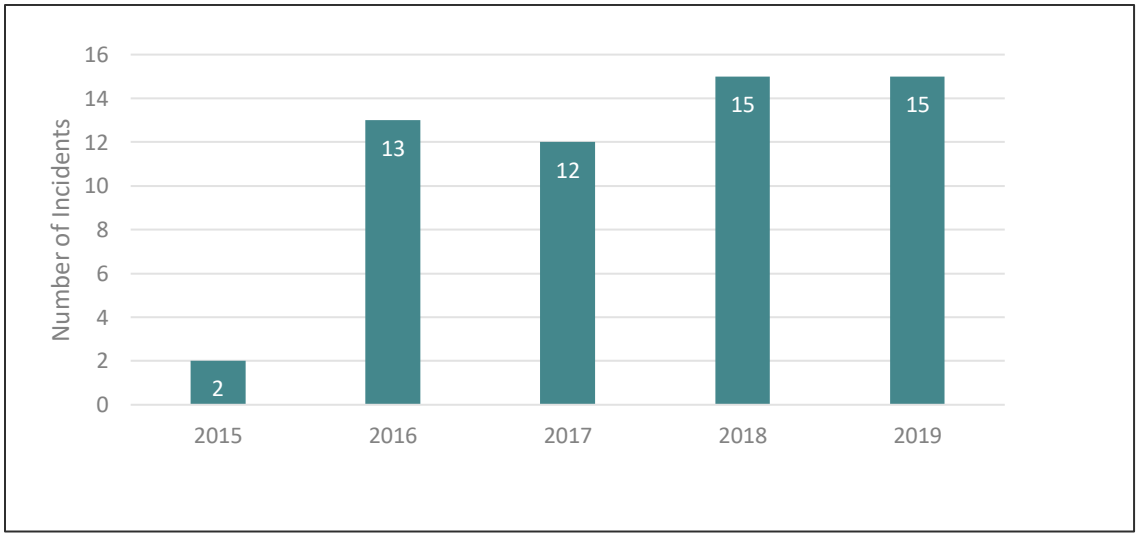

FIGURE 9: CRASHES PER YEAR

TABLE 9: CRASH RATE FOR US 93 AT PIERCE FERRY ROAD

Injury Severity	Occurrence	%
Fatal	5	9%
Suspected Serious Injury	9	16%
Minor Injury	8	14%
No Injury	3	5%
Property Damage Only	32	56%

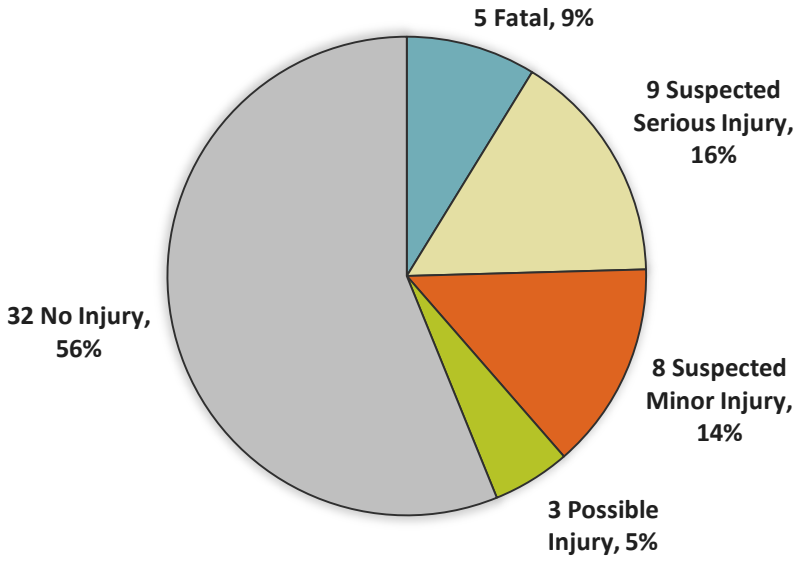

FIGURE 10: CRASHES BY INJURY SEVERITY

Crash Rate

The *WACOG Strategic Transportation Safety Plan (STSP)* documented an intersection crash rate based on data from 2011-2015. Crash rate is the number of crashes that occurred per million vehicles entering the intersection. The WACOG study showed that in the 2011-2015 period, there were 12 crashes at the intersection (crash frequency) and a crash rate of 0.17 crashes per million vehicles entering the intersection (MEV).

Analysis of the most recent five-year period (2015 - 2019) crash data shows that the crash rate increased by 10-fold to 1.88 (+1.71) crashes per MEV (**Table 10**). The fatal crash rate is 16.5 fatal crashes per 100 MEV.

TABLE 10: CRASH RATE (2015-2019)

Crash Rate Equation	
$CR = \frac{1,000,000 * Crashes}{365 * Years * Volume}$	$CR = \frac{1,000,000 * 57 \text{ crashes}}{365 \text{ days} * 5 \text{ years} * 16,603 \text{ vpd}}$ **CR = 1.88 crashes per MEV (2015-2019)**

Fatal Crash Rate Equation	
$CR = \frac{100,000,000 * Crashes}{365 * Years * Volume}$	$CR = \frac{100,000,000 * 5 \text{ fatal crashes}}{365 \text{ days} * 5 \text{ years} * 16,603 \text{ vpd}}$ **CR = 16.5 fatal crashes per 100 MEV (2015-2019)***

**Analysis of crash data April 2013 - March 2018 identifies 8 fatal crashes and a crash rate of 26.4 fatal crashes per 100 MEVs.*

Incident Collision Manner

Incident collision manner are summarized in **Table 11**.

Summary

- 36 (63%) of 57 crashes are angle crashes.
- Single vehicle crashes account for 12 (21%) crashes.
- All (100%) of the fatal crashes are angle crashes, and 78% (7) of the serious injury incidents are angle crashes.

TABLE 11: COLLISION MANNER BY SEVERITY

Collision Manner	Crashes	%	Fatal	%	Serious Injury	%	Injury	%	PDO	%
Angle	36	63%	5	100%	7	78%	9	82%	15	47%
Rear End	5	9%	0	0%	0	0%	0	0%	5	16%
Sideswipe Same Direction	3	5%	0	0%	0	0%	1	9%	2	6%
Single Vehicle	12	21%	0	0%	1	11%	1	9%	10	31%
Other	1	2%	0	0%	1	11%	0	0%	0	0%
Total	57		5		9		11		32	

Person Violation

Table 12 summarizes the person violations by injury severity.

Summary

- Failure to yield right of way is the most common person violation with 32 (56%) of crashes.
- Violations for four fatal crashes and eight suspected serious injury crashes were failure to yield right of way, representing 86% of the 14 fatal or suspected serious injury crashes.
- Speed too fast for conditions is the second leading violation with 11 (19%) of crashes.
- Violations for suspected serious injury crashes were failure to yield right of way at eight crashes (89%), and speed too fast for conditions at one (11%) crash.

Crash Report Review

Submitted police reports for all fatal and suspected serious injury crashes were obtained from ADOT's Traffic Safety Section. These reports provide a detailed account of the crash, with statements from those involved and witnesses, roadway and environmental conditions, and a collision diagram.

A review of written narratives for the fatal (five crashes) and suspected serious injury (nine crashes) shows that most involved a southbound US 93 vehicle turning left to eastbound Pierce Ferry Road, and a vehicle

headed northbound on US 93. This condition is described in 11 of the 14 crashes.

The reports describe that the southbound vehicle, that desires to turn left, fails to yield right of way to the northbound approaching vehicle. Vehicles failed to see the northbound vehicle approaching or underestimated its speed or distance from the intersection.

Weather, time of day, and other environmental factors do not appear to be a contributing factor.

TABLE 12: PERSON VIOLATION BY SEVERITY

Person Violation	Crashes	%	Fatal	%	Serious Injury	%	Injury	%	Property Damage Only	%
Aggressive Driving	1	2%	0	0%	0	0%	0	0%	1	3%
Failed to Yield Right of Way	32	56%	4	80%	8	89%	9	82%	11	34%
Followed Too Closely	2	3%	0	0%	0	0%	0	0%	2	6%
Made Improper Turn	1	2%	0	0%	0	0%	0	0%	1	3%
No Improper Action	3	5%	0	0%	0	0%	0	0%	3	9%
Other	2	4%	0	0%	0	0%	0	0%	2	6%
Ran Stop Sign	4	7%	1	20%	0	0%	1	9%	2	6%
Speed Too Fast for Conditions	11	19%	0	0%	1	11%	1	9%	9	28%
Unsafe Lane Change	1	2%	0	0%	0	0%	0	0%	1	3%
Total	57		5		9		11		32	

Table 13 summarizes each of the fatal crashes in the 2015-2019 analysis period. All of the fatal crashes involved a southbound vehicle on US 93 that was making a left turn into the median refuge and proceeding across northbound US 93 and colliding with a northbound vehicle. All the crashes were a result of driver error for the southbound US 93 vehicle.

TABLE 13: FATAL CRASHES SUMMARY

Incident ID	Incident Date & Time	Unit Number	Injury Severity	Residence of Crash Victims	Incident Collision Manner Desc	Incident Light Condition Desc	Incident Weather Desc	Unit Body Style Desc	Unit Travel Direction Desc	Surface Condition	Person Violation	Narrative Summary
3089758	4/21/2016 12:02:00 PM	1	Fatal	Diamond Bar, CA (Chinese national)	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Passenger 4Dsd Sedan 4 Dr	6 - Northeast	Dry	***Ran Stop Sign***	Unit 1 turned from SB US 93 to EB Pierce Ferry Road. Vehicle 1 did not stop at the stop sign at US 93 and crossed in front of the on-coming vehicle. Two individuals in Unit 1 were deceased.
		2		Layton, UT	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Passenger 12Pu Pickup 1 2 Ton	5 - Northwest	Dry	No Improper Action	
3117584	7/24/2016 1:40:00 PM	1	Fatal	China	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Truck Vn Van	3 - East	Dry	***Failed To Yield Right Of Way***	Unit 1 failed to yield to NB US 93 unit 2. Unit 2 was a large RV/Bus. The collision resulted in 4 fatalities, all of whom were in Unit 1.
		2		Lancaster, TX	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Truck Bs Bus	1 - North	Dry	No Improper Action	
3314678	12/24/2017 2:19:00 PM	1	Fatal	Chesterton, Indiana	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Passenger 4Dsd Sedan 4 Dr	3 - East	Dry	***Failed To Yield Right Of Way***	Unit 1 (traveling SB US 93 making a left turn to EB Pierce Ferry Road) failed to yield right of way to Unit 2, traveling NB US 93. Fatal victim was in Unit 2.
		2		Pahrump, Nevada	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Passenger 12Pu Pickup 1 2 Ton	1 - North	Dry	No Improper Action	
3340144	3/1/2018 1:36:00 PM	1	Fatal	Alhambra, California (Chinese nationals)	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Passenger Sw Station Wagon	3 - East	Dry	***Failed To Yield Right Of Way***	Unit 1 (traveling SB US 93 to EB Pierce Ferry Road failed to stop at the stop sign at NB US 93. Unit 2 on NB US 93, a cargo van, struck Unit 1. Two individuals in Unit 1 were deceased.
		2		Phoenix, Arizona	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Truck 1Tvn Van 1 Ton	1 - North	Dry	No Improper Action	
3532255	6/26/2019 10:46:00 AM	1	Fatal	Chinese national	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Truck Vn Van	3 - East	Dry	***Failed To Yield Right Of Way***	Unit 1 turned from SB US 93 to eastbound Pierce Ferry Road. Unit 1 stopped at the

Incident ID	Incident Date & Time	Unit Number	Injury Severity	Residence of Crash Victims	Incident Collision Manner Desc	Incident Light Condition Desc	Incident Weather Desc	Unit Body Style Desc	Unit Travel Direction Desc	Surface Condition	Person Violation	Narrative Summary
		2		Mesa, Arizona	Angle (Front To Side) (Other Than Left Turn)	Daylight	Clear	Passenger 34Pu Pickup 3 4 Ton	1 - North	Dry	No Improper Action	stop sign, and then proceed into the intersection where it was struck by Unit 2. The deceased individual was a passenger in Unit 1. Unit 1 had 10 passengers.

4. ALTERNATIVES

This section reviews three improvement alternatives to the US 93 at Pierce Ferry Road intersection. The purpose of each alternative is to remove conflicts between southbound US 93 left turn vehicles and the northbound US 93 through vehicles.

Each alternative provides grade separation between vehicles turning left from US 93 southbound to eastbound Pierce Ferry Road, and vehicles traveling north on US 93. No at-grade intersections were considered during the alternative selection process as ADOT recently completed at-grade improvements to modify the left-turn lanes to bring them closer to the centerline of US 93 in order to have a more traditional left-turn movement.

- **Alternative 1** – Half-Traffic Interchange (TI), Northbound US 93 bridge over Pierce Ferry Road
- **Alternative 2** – Flyover Ramp, Southbound US 93 bridge to Pierce Ferry Road
- **Alternative 3** – Half-Traffic Interchange (TI), Northbound US 93 bridge over Pierce Ferry Road and a Roundabout Intersection with Ramps

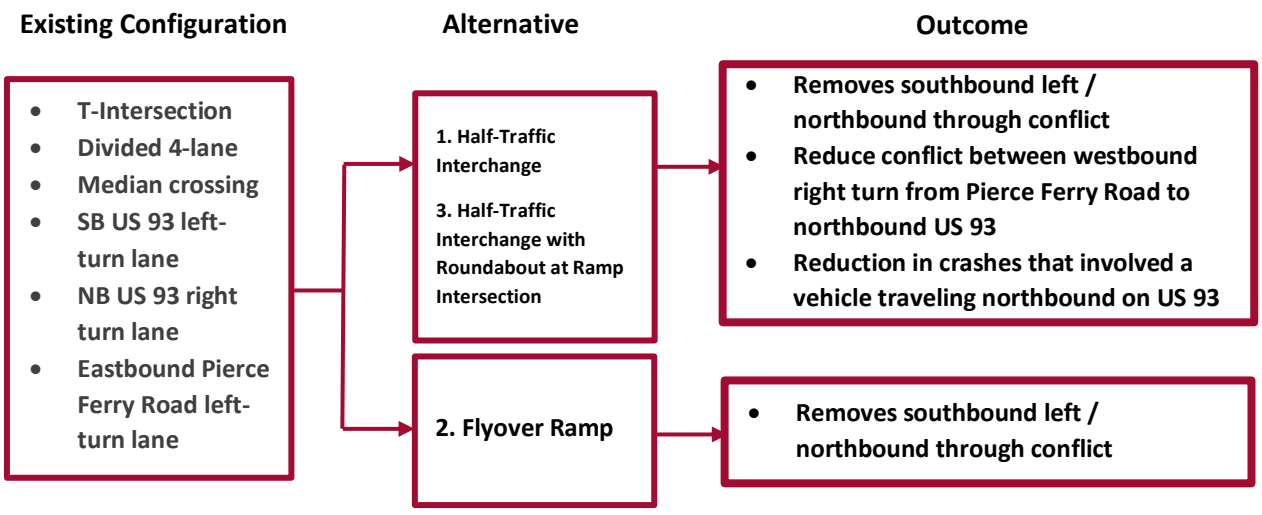

FIGURE 11: US 93 AND PIERCE FERRY ROAD ALTERNATIVE SELECTION FLOW CHART

Alternative 1 – Half-TI, Northbound US 93 Over Pierce Ferry Road

See Alternative 1, Appendix A1

Alternative 1, **Figure 12**, removes the conflict between the northbound US 93 traffic vehicles traveling from southbound US 93 to eastbound Pierce Ferry Road, by grade separating the northbound lanes of US 93 from those of Pierce Ferry Road.

The structures footprint will have impacts on the businesses and residences near the intersection of US 93 and Pierce Ferry Road. Notably, the interchange will encroach on the Chevron station/propane service property, overtaking the westernmost access driveway. It is uncertain whether this property will require a full or partial acquisition and should be investigated further during final design. Properties adjacent to Pierce Ferry Road on the south will also lose access because of the US 93 off ramp and will have to be relocated to Bee Drive or Calico Drive.

A new bridge would be constructed for northbound US 93 over Pierce Ferry Road. It is recommended that the bridge utilizes two-span, precast concrete I-girders. The US 93 northbound profile would be elevated to accommodate the new structure. New taper-type ramps, which are typically used in rural areas per ADOT *Roadway Design Guidelines* (RDG), would be installed: an off-ramp connecting US 93 northbound to Pierce Ferry Road and an on-ramp connecting Pierce Ferry Road to US 93 northbound. A stop-controlled intersection at the on-ramp/off-ramp/Pierce Ferry Road intersection will be located at the west end of the adjacent Chevron service station parking area. Geometrics for US 93 southbound and Pierce Ferry Road would remain intact as is. New right-of-way will be required for the new northbound on/off ramps.

Estimate of Probable Cost

The estimate of probable construction cost for the half-TI alternative is **$11,579,883.** This includes construction, right-of-way/property acquisition, and design. Construction and right-of-way cost details are included in **Appendix B.** The right-of-way acquisition costs include title, fees, survey, acquisition consultant, land acquisition costs, and relocation costs. The costs assume involvement of federal funding and processes. It should be noted that cost for right-of-way plans at $440,000 is due to the closest ADOT survey monumentation being located 13 miles away.

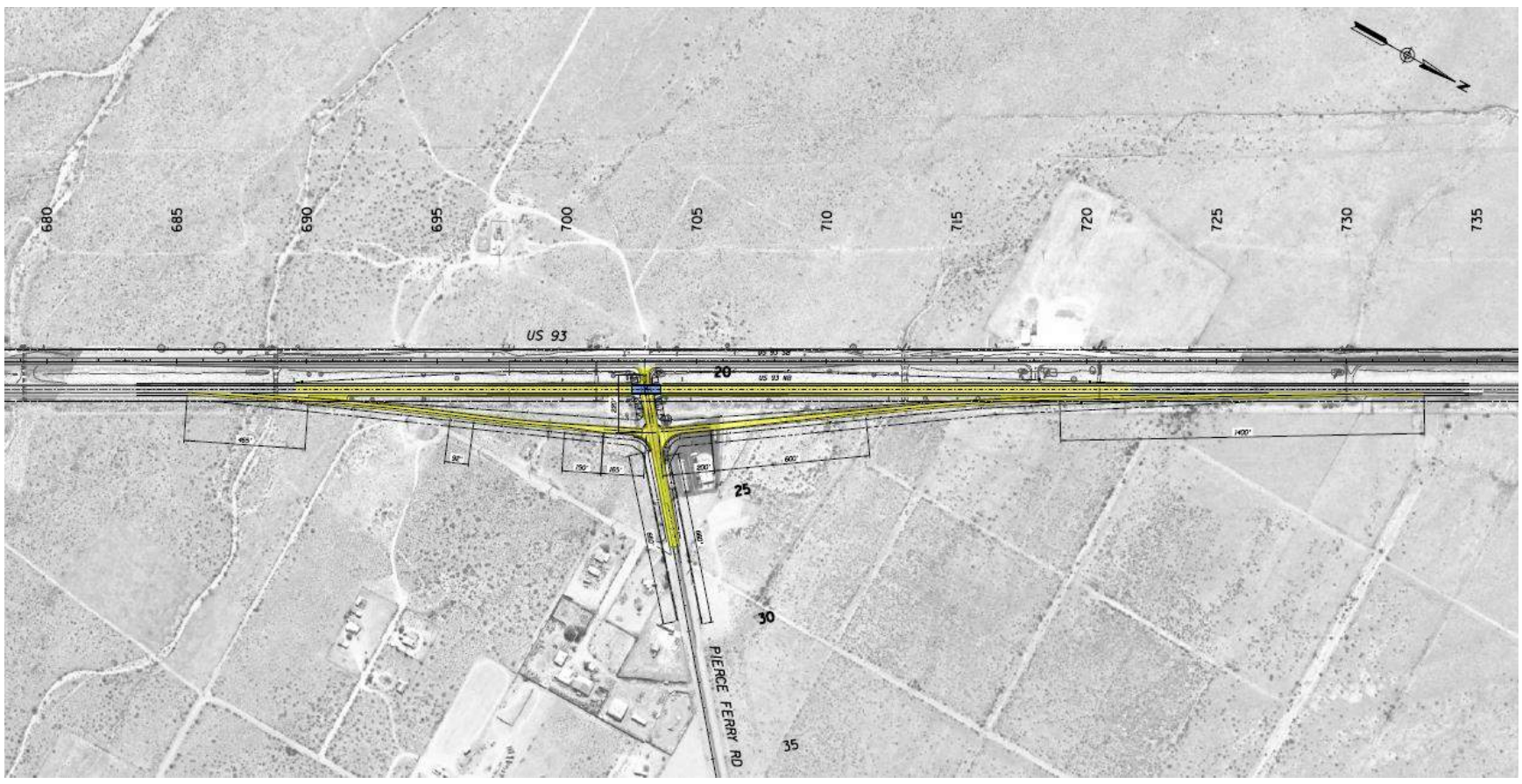

FIGURE 12: ALTERNATIVE 1, HALF-TRAFFIC INTERCHANGE

Alternative 2 – Flyover Ramp, Southbound US 93 to Pierce Ferry Road

See Alternative 2, Appendix A2

Alternative 2, **Figure 13**, removes the conflict between the northbound US 93 traffic and the vehicles traveling from southbound US 93 to eastbound Pierce Ferry Road by grade separating the exiting southbound traffic over US 93 using a flyover ramp and providing direct access to Pierce Ferry Road.

The flyover ramp bridge will be a curved and super-elevated one-lane structure with a 30-mph design speed. It is recommended the structure be four-span, precast concrete I-girders. ADOT's RDG states that desirable speed through the main body of the ramp should be 50 mph, but lower design speeds may be used to accommodate loop ramps and other geometric features. Signing and rumble strips may be used to alert drivers to the changing conditions. The southbound left-turn lane will also be removed and signing added prohibiting vehicles from making a left turn from southbound US 93 to Pierce Ferry Road at the median crossing.

The structure footprint will be extensive in the southeast quadrant to accommodate the curve geometrics and vertical impacts such as walls and embankment slopes. The flyover ramp will merge onto Pierce Ferry Road. Driveways at the service station will not be impacted. Parcels along the east side of Pierce Ferry Road that have access at the merge lane will be cut off and driveways will have to be closed and accesses pushed eastward. This alternative would require partial or full acquisition of the Gateway Trading Post property that is on the west side of US 93 north of the intersection.

Geometrics for US 93 northbound and Pierce Ferry Road would remain intact as is. Southbound US 93 through traffic will continue to use existing roadway facilities. Northbound US 93 will also continue to use existing roadway facilities. New right-of-way will be required for the southbound new taper-type exit ramp and the flyover structure in the southeast quadrant.

Estimate of Probable Cost

The estimate of probable construction cost for the flyover alternative is **$9,691,499.** This includes construction, right-of-way/property acquisition, and design. Construction and right-of-way cost details are included in **Appendix B.** The right-of-way acquisition costs include title, fees, survey, acquisition consultant, land acquisition costs, and relocation costs. The costs assume involvement of federal funding and processes. It should be noted that cost for right-of-way plans at $440,000 is due to the closest ADOT survey monumentation being located 13 miles away.

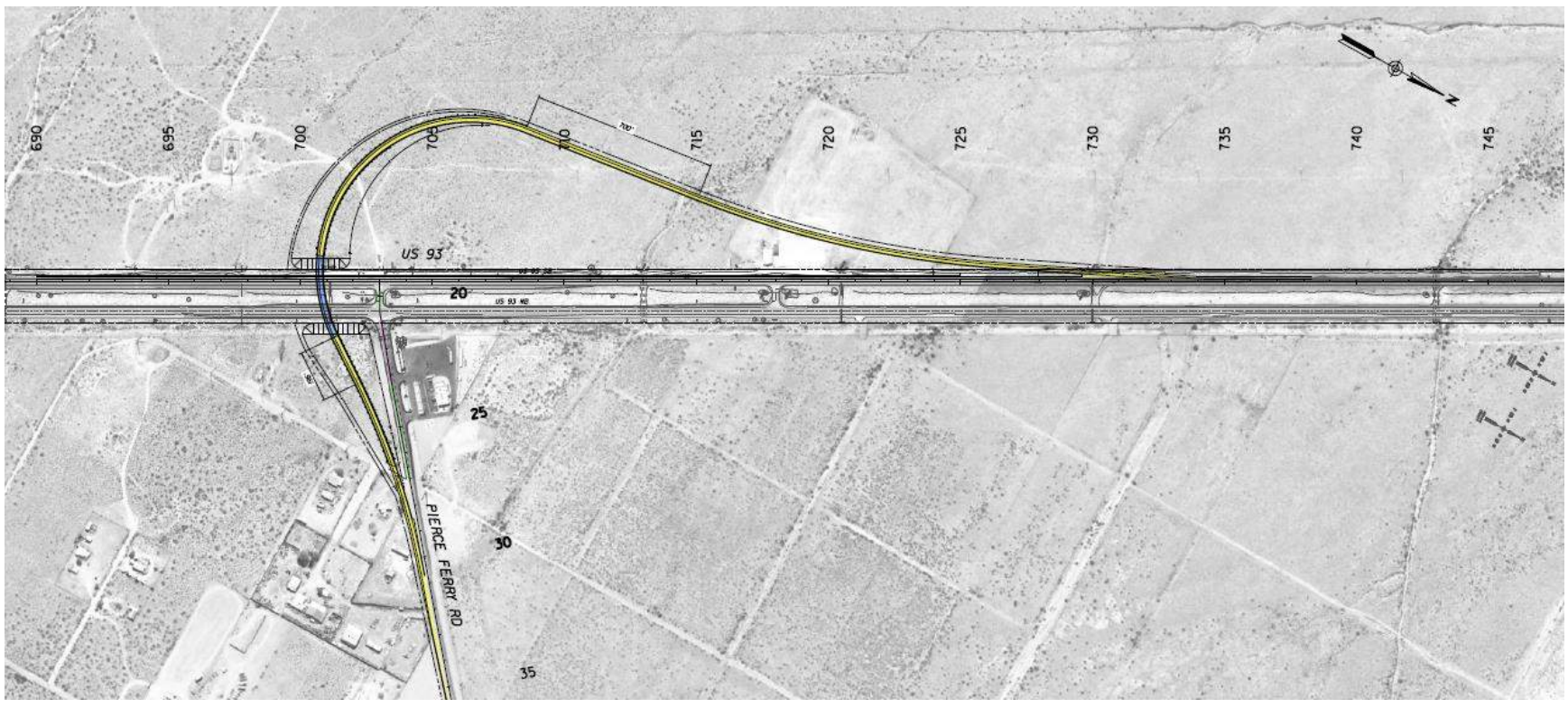

FIGURE 13: ALTERNATIVE 2, FLYOVER

Alternative 3 – Half-TI, Northbound US 93 Over Pierce Ferry Road with Roundabout at Ramp Intersection Shifted South of Pierce Ferry Road

See Alternative 3, Appendix A3

Alternative 3, **Figure 14,** is a modification of Alternative 1. Alternative 3 removes the conflict between the northbound US 93 traffic vehicles traveling from southbound US 93 to eastbound Pierce Ferry Road by grade separating the northbound lanes of US 93 from those of Pierce Ferry Road.

The purpose of Alternative 3 is similar to Alternative 1, while minimizing the impact to the service station located at the intersection of US 93 and Pierce Ferry Road. Alternative 3 shifts the Pierce Ferry Road and US 93 intersection to the south by approximately 700 feet. Pierce Ferry Road dead-ends at the service station. A new connecting road is constructed between the new interchange and Pierce Ferry Road. A new roundabout-controlled intersection will be located at the on-ramp/off-ramp/new connecting road intersection.

Properties adjacent on the south side of Pierce Ferry Road will need to be acquired to accommodate the new roundabout and connecting road. As design progresses, the alignment can be modified to minimize impacts to residential parcels.

A new bridge would be constructed for northbound US 93 over Pierce Ferry Road. It is recommended that the bridge utilizes two-span, precast concrete I-girders. The US 93 northbound profile would be elevated to accommodate the new structure. New taper-type ramps, which are typically used in rural areas per ADOT *Roadway Design Guidelines* (RDG), would be installed: an off-ramp connecting US 93 northbound to Pierce Ferry Road and an on-ramp connecting Pierce Ferry Road to US 93 northbound. New right-of-way will be required for the new northbound on/off ramps.

Estimate of Probable Cost

The estimate of probable construction cost for the half-TI with a roundabout is **$11,324,788.** This includes construction, right-of-way/property acquisition, and design. Construction and right-of-way cost details are included in **Appendix B.** The right-of-way acquisition costs include title, fees, survey, acquisition consultant, land acquisition costs, and relocation costs. The costs assume involvement of federal funding and processes. It should be noted that cost for right-of-way plans at $440,000 is due to the closest ADOT survey monumentation being located 13 miles away.

FIGURE 14: ALTERNATIVE 3, HALF-TRAFFIC INTERCHANGE WITH ROUNDABOUT AT RAMP INTERSECTION

5. EFFECTIVENESS EVALUATION

This section summarizes the effectiveness of each improvement alternative. The evaluation quantifies benefits, in terms of improved safety, that will be achieved through implementation of each alternative.

Methodology Summary

The effectiveness evaluation follows these steps:

1. Predict number of crashes for no-build for 30-year period.
2. Estimate the number of crashes, by severity, that could be mitigated by Alternative 1 and by Alternative 2. It is assumed that Alternative 3 will have the same effectiveness as Alternative 1.
3. Apply a Crash Modification Factor (for grade separation) to the expected number of crashes that would be affected by each alternative.
4. Multiply expected number of crashes for each alternative by societal costs.
5. Calculate a Benefit-Cost Ratio (BCR).

Detailed Methodology

The effectiveness evaluation incorporates Part C of the HSM, Predictive Method. This method quantifies safety performance by predicting the annual number in crashes to occur at a location based on geometric features and traffic volumes.

An overview of the Predictive Method for a rural multilane highway intersection as performed at the intersection of US 93 at Pierce Ferry Road can be found in Chapter 11 of the HSM. The method utilizes historic crash data, daily traffic volumes, and geometric features, and applies the Empirical Bayes (EB) Method to estimate the expected crash frequency at the intersection. The EB Method results in a statistically reliable estimation of crashes by accounting for regression-to-mean bias.

The Interactive Highway Safety Design Model (IHSDM), which implements HSM Part C – Predictive Method, was used to determine the expected number of crashes for the no-build alternative over a 30-year period.

The expected number of crashes for each alternative was calculated by applying a crash modification factor (CMF) to the expected future crashes without treatment affected by the alternative. A CMF is a ratio of the estimated expected average crash frequency with treatment over the expected average crash frequency without treatment, as shown below.

$$CMF = \frac{Expected\ Crashes\ with\ Treatment}{Expected\ Crashes\ without\ Treatment}$$

The procedure for determining the expected number of crashes over the 30-year period for each grade-separated alternative is as follows:

1. Estimate the 30-year Total Expected Crash Frequency No-Build Alternative using the HSM Predictive Method. A total of 357.8 crashes would be expected to occur at the intersection during the 30-year period for the No-Build Alternative, see **Appendix D** for IHSDM results. IHSDM accounts for the random nature of crashes and regression to the mean.
2. Based on review of historical crash data (2015-2019), determine the percentage of Observed Crashes Affected by the alternative. The analysis shows that 48 of 57 (84.2%) crashes would have been affected by Alternative 1 and Alternative 3, and 30 of 57 (52.6%) crashes would have been affected by Alternative 2. Refer to Arizona Crash Information System, Standard Detail Report selected in **Appendix C**. Crashes affected by each of the alternatives are:

Alternative 1 Half-TI and Alternative 3 Half TI with Roundabout	• *All crashes that involved a vehicle making a left turn from southbound US 93 to eastbound Pierce Ferry Road* • *All crashes that involved a vehicle making a westbound right turn from Pierce Ferry Road to northbound US 93* • *All crashes that involved a vehicle traveling northbound on US 93*
Alternative 2 Flyover	• *All crashes that involved a vehicle making a left turn from southbound US 93 to eastbound Pierce Ferry Road*

3. Determine 30-year Expected Crashes Affected by the alternatives.

$$Total\ Expected\ Crashes\ No-Build\ *\ \%\ Observed\ Crashes\ for\ No-Build\ Affected = Expected\ Crashes\ Affected\ by\ Alternative$$

4. Multiply the Expected Crashes Affected by Alternative by the Crash Modification Factor (conversion of existing intersection to a grade-separated intersection), which has a value of 0.58 and is applicable to all crash types and severities, to get the Expected Crashes with Treatment by Alternative.

Crash Prediction Results

The improvements evaluation results are summarized in **Table 14**.

TABLE 14: ALTERNATIVES CRASH PREDICTION SUMMARY (30-YEAR PERIOD)

		No-build	Alternative 1 Half-TI and Alternative 3 Half-TI with Roundabout	Alternative 2 Flyover
1	Total Expected Crashes (30 years, for no-build, as estimated using IHSDM)	357.8	357.8	357.8
2	% of Observed Crashes for No-Build Affected	-	84.2%	52.6%
3	Expected Crashes Affected by Alternative (Row 1 x Row 2)	-	301.3	188.2
4	CMF	-	0.58	0.58
5	Expected Crashes with Treatment (Row 3 x Row 4)		174.8	109.2
6	Expected Crash Reduction with Treatment (Row 3 – Row 5)	-	126.5	79.0
7	Total Expected Crashes (Row 1 – Row 6)	357.8	231.3	278.8
8	Annual Intersection Crash Rate (crashes/year) (Row 7 / 30 years)	11.9	7.7	9.3

The total reduction in crashes for each alternative are expected to be:

- **Alternative 1 – Half-TI** and **Alternative 3 – Half-TI with Roundabout:** A total reduction of 126.5 crashes.
- **Alternative 2 – Flyover:** A total reduction of 79.1 crashes.

Alternative 1 (Half-TI) and Alternative 3 (Half-TI with Roundabout) each reduce crashes by 35%. Alternative 2 (Flyover) reduces crashes by 22%.

$$Crash\ Reduction\ Factor = 1 - \frac{Total\ Expected\ Crashes\ (Alternative)}{Total\ Expected\ Crashes\ (Base\ Condition)}$$

The results illustrate that each alternative improves the safety performance of the intersection.

Benefit-Cost Evaluation

This section evaluates the economic effectiveness of the proposed alternatives.

As previously described, the number of crashes over the 2015-2019 period, that would have been mitigated by the intersection improvements, was determined as explained in footnote 1 and 2. The analysis yields that 48 of 57 (84.2%) of crashes would have been affected by Alternative 1, and 30 of 57 (56.2%) would have been affected by Alternative 2.

Table 15 shows a breakdown of the crashes observed between 2015-2019 that would have been affected by each alternative (see **Appendix C** for standard detail reports highlighting crashes related to each alternative). **Table 15** shows that 50% of the crashes that would have been affected by Alternative 1 were Property Damage Only (PDO) crashes, 6% possible injury, 16.7% suspected minor injury, 16.7% suspected serious injury, and 10% fatal. Alternative 2 values are also shown in **Table 15.**

TABLE 15: NUMBER OF CRASHES AFFECTED BY ALTERNATIVE

Alternative 1 – Half-TI and Alternative 3 (Half-TI with Roundabout)							Alternative 2 - Flyover					
Year	# Crashes	Injury Severity[1]					# Crashes	Injury Severity[2]				
		PDO	Possible Injury	Suspected Minor Injury	Suspected Serious Injury	Fatality		PDO	Possible Injury	Suspected Minor Injury	Suspected Serious Injury	Fatality
2015	2	1	1	-	-	-	1	1	-	-	-	-
2016	12	7	1	2	0	2	6	2	2	1	-	1
2017	8	3	1	0	3	1	8	3	1	-	3	1
2018	15	6	0	6	2	1	6	2	-	2	1	1
2019	11	7	0	0	3	1	9	5	-	-	3	1
Total	48	24	3	8	8	5	30	13	3	3	7	4
Percent of crashes by Injury Severity		50.0%	6.3%	16.7%	16.7%	10.4%	-	43.3%	10.0%	10.0%	23.3%	13.3%

Table 16 multiplies the predicted number of crashes for each year over the 30-year period, as predicted by IHSDM, by the percentage of crashes by injury severity from **Table 15**.

Table 17 shows the Expected Crashes Affected by Alternative 1/Alternative 3 and Alternative 2, by taking the Expected Crashes (IHSDM) and multiplying it by the Percent of Crashes Affected by Alternatives.

Table 19 breaks down the Expected Crashes Affected by Alternative into injury severity by year for each alternative.

Table 20 and **Table 21** apply the Expected Crashes Affected by Alternative to the CMF (grade-separated interchange) and the injury severity distribution from **Table 15** to calculate the Expected Crashes With Treatment by alternative that can be expected over the 30-year period, by injury severity. The societal cost of crashes (**Table 18**) is then applied to each crash injury severity level, and the estimated societal benefit is calculated by alternative in **Table 20** and **Table 21**.

The societal cost per crash in Arizona is based on the average economic cost per incident found in the 2019 Arizona Crash Facts Summary.

The analysis ends with calculation of a Benefit-Cost Ratio (BCR). A BCR equal to or greater than one indicates that the improvement is economically favorable to implement. The results of the BCR for each alternative for a 30-year period are summarized in **Table 22**.

- Alternative 1 returned a BCR of 4.49
- Alternative 2 a BCR of 4.28
- ***Alternative 3 (Half-Interchange with Roundabout) returned a BCR of 4.59***

[1] Alternative 1 and 3: includes all crashes (2015-2019) that involved a vehicle traveling northbound on US 93, all crashes that involved a vehicle making a left turn from southbound US 93 to eastbound Pierce Ferry Road, and all crashes that involved a vehicle making a westbound right turn from Pierce Ferry Road to northbound US 93

[2] Alternative 2: includes all (2015-2019) crashes that involved a vehicle making a left turn from southbound US 93 to eastbound Pierce Ferry Road

TABLE 16: EXPECTED CRASHES FOR NO-BUILD CONDITION

Year	Expected Crashes (IHSDM)	No Injury	Possible Injury	Suspected Minor Injury	Suspected Serious Injury	Fatality
2020	8.0	4.3	0.3	1.1	1.3	0.7
2021	8.2	4.5	0.3	1.2	1.3	0.7
2022	8.5	4.6	0.3	1.2	1.3	0.7
2023	8.8	4.8	0.3	1.2	1.4	0.8
2024	9.0	4.9	0.3	1.3	1.4	0.8
2025	9.3	5.0	0.3	1.3	1.5	0.8
2026	9.5	5.2	0.3	1.3	1.5	0.8
2027	9.8	5.3	0.3	1.4	1.5	0.9
2028	10.1	5.5	0.4	1.4	1.6	0.9
2029	10.3	5.6	0.4	1.5	1.6	0.9
2030	10.6	5.8	0.4	1.5	1.7	0.9
2031	10.9	5.9	0.4	1.5	1.7	1.0
2032	11.2	6.1	0.4	1.6	1.8	1.0
2033	11.4	6.2	0.4	1.6	1.8	1.0
2034	11.7	6.4	0.4	1.6	1.8	1.0
2035	12.0	6.5	0.4	1.7	1.9	1.1
2036	12.3	6.7	0.4	1.7	1.9	1.1
2037	12.6	6.8	0.4	1.8	2.0	1.1
2038	12.9	7.0	0.5	1.8	2.0	1.1
2039	13.1	7.1	0.5	1.8	2.1	1.2
2040	13.4	7.3	0.5	1.9	2.1	1.2
2041	13.7	7.5	0.5	1.9	2.2	1.2
2042	14.0	7.6	0.5	2.0	2.2	1.2
2043	14.3	7.8	0.5	2.0	2.3	1.3
2044	14.6	7.9	0.5	2.1	2.3	1.3
2045	14.9	8.1	0.5	2.1	2.4	1.3
2046	15.2	8.3	0.5	2.1	2.4	1.3
2047	15.5	8.4	0.5	2.2	2.4	1.4
2048	15.8	8.6	0.6	2.2	2.5	1.4
2049	16.1	8.8	0.6	2.3	2.5	1.4
Total	**357.8**	**194.6**	**12.6**	**50.2**	**56.5**	**31.4**

TABLE 17: EXPECTED CRASHES AFFECTED BY ALTERNATIVE

Year	Expected Crashes (IHSDM)	Expected Crashes Affected by Alternative 1 / 3	Expected Crashes Affected by Alternative 2
% of Crashes Affected by Alternative		84.2%	52.6%
2020	7.98	6.72	4.20
2021	8.23	6.93	4.33
2022	8.49	7.15	4.47
2023	8.75	7.37	4.61
2024	9.01	7.59	4.74
2025	9.27	7.81	4.88
2026	9.53	8.03	5.02
2027	9.80	8.25	5.16
2028	10.07	8.48	5.30
2029	10.34	8.71	5.44
2030	10.61	8.93	5.58
2031	10.88	9.16	5.73
2032	11.16	9.40	5.87
2033	11.44	9.63	6.02
2034	11.71	9.86	6.16
2035	12.00	10.11	6.32
2036	12.28	10.34	6.46
2037	12.56	10.58	6.61
2038	12.85	10.82	6.76
2039	13.14	11.07	6.92
2040	13.43	11.31	7.07
2041	13.72	11.55	7.22
2042	14.02	11.81	7.38
2043	14.31	12.05	7.53
2044	14.61	12.30	7.69
2045	14.91	12.56	7.85
2046	15.21	12.81	8.01
2047	15.51	13.06	8.16
2048	15.82	13.32	8.33
2049	16.13	13.58	8.49
Total	**357.77**	**301.28**	**188.30**

TABLE 18: SOCIETAL CRASH COSTS BY INJURY SEVERITY

Injury Severity	Societal Cost
Fatality	$9,515,371
Suspected Serious Injury	$550,499
Suspected Minor Injury	$149,132
Possible Injury	$103,145
Property Damage Only	$10,680

TABLE 19: EXPECTED FUTURE CRASHES FROM NO-BUILD AFFECTED BY ALTERNATIVES

Year	Expected Future Crashes Without Treatment Affected By Alternative 1 / 3 (By Severity)						Expected Future Crashes Without Treatment Affected By Alternative 2 (By Severity)					
	Expected Crashes Affected by Alternative 1	No Injury	Possible Injury	Suspected Minor Injury	Suspected Serious Injury	Fatality	Expected Crashes Affected by Alternative 2	No Injury	Possible Injury	Suspected Minor Injury	Suspected Serious Injury	Fatality
2020	6.72	3.36	0.42	1.12	1.12	0.70	4.20	1.82	0.42	0.42	0.98	0.56
2021	6.93	3.47	0.43	1.16	1.16	0.72	4.33	1.88	0.43	0.43	1.01	0.58
2022	7.15	3.57	0.45	1.19	1.19	0.74	4.47	1.94	0.45	0.45	1.04	0.60
2023	7.37	3.68	0.46	1.23	1.23	0.77	4.61	2.00	0.46	0.46	1.07	0.61
2024	7.59	3.79	0.47	1.26	1.26	0.79	4.74	2.05	0.47	0.47	1.11	0.63
2025	7.81	3.90	0.49	1.30	1.30	0.81	4.88	2.11	0.49	0.49	1.14	0.65
2026	8.03	4.01	0.50	1.34	1.34	0.84	5.02	2.17	0.50	0.50	1.17	0.67
2027	8.25	4.13	0.52	1.38	1.38	0.86	5.16	2.24	0.52	0.52	1.20	0.69
2028	8.48	4.24	0.53	1.41	1.41	0.88	5.30	2.30	0.53	0.53	1.24	0.71
2029	8.71	4.35	0.54	1.45	1.45	0.91	5.44	2.36	0.54	0.54	1.27	0.73
2030	8.93	4.47	0.56	1.49	1.49	0.93	5.58	2.42	0.56	0.56	1.30	0.74
2031	9.16	4.58	0.57	1.53	1.53	0.95	5.73	2.48	0.57	0.57	1.34	0.76
2032	9.40	4.70	0.59	1.57	1.57	0.98	5.87	2.55	0.59	0.59	1.37	0.78
2033	9.63	4.82	0.60	1.61	1.61	1.00	6.02	2.61	0.60	0.60	1.40	0.80
2034	9.86	4.93	0.62	1.64	1.64	1.03	6.16	2.67	0.62	0.62	1.44	0.82
2035	10.11	5.05	0.63	1.68	1.68	1.05	6.32	2.74	0.63	0.63	1.47	0.84
2036	10.34	5.17	0.65	1.72	1.72	1.08	6.46	2.80	0.65	0.65	1.51	0.86
2037	10.58	5.29	0.66	1.76	1.76	1.10	6.61	2.86	0.66	0.66	1.54	0.88
2038	10.82	5.41	0.68	1.80	1.80	1.13	6.76	2.93	0.68	0.68	1.58	0.90
2039	11.07	5.53	0.69	1.84	1.84	1.15	6.92	3.00	0.69	0.69	1.61	0.92
2040	11.31	5.65	0.71	1.88	1.88	1.18	7.07	3.06	0.71	0.71	1.65	0.94
2041	11.55	5.78	0.72	1.93	1.93	1.20	7.22	3.13	0.72	0.72	1.68	0.96
2042	11.81	5.90	0.74	1.97	1.97	1.23	7.38	3.20	0.74	0.74	1.72	0.98
2043	12.05	6.03	0.75	2.01	2.01	1.26	7.53	3.26	0.75	0.75	1.76	1.00
2044	12.30	6.15	0.77	2.05	2.05	1.28	7.69	3.33	0.77	0.77	1.79	1.03
2045	12.56	6.28	0.78	2.09	2.09	1.31	7.85	3.40	0.78	0.78	1.83	1.05
2046	12.81	6.40	0.80	2.13	2.13	1.33	8.01	3.47	0.80	0.80	1.87	1.07
2047	13.06	6.53	0.82	2.18	2.18	1.36	8.16	3.54	0.82	0.82	1.90	1.09
2048	13.32	6.66	0.83	2.22	2.22	1.39	8.33	3.61	0.83	0.83	1.94	1.11
2049	13.58	6.79	0.85	2.26	2.26	1.41	8.49	3.68	0.85	0.85	1.98	1.13
Total	**301.28**	**150.64**	**18.83**	**50.21**	**50.21**	**31.38**	**188.30**	**81.60**	**18.83**	**18.83**	**43.94**	**25.11**

TABLE 20: ALTERNATIVE 1 ESTIMATED MONETARY BENEFIT

Year	Expected Crashes Affected by Alternative 1 and Alternative 3	CMF	Expected Crashes with Treatment, Alternative 1 / 3 (By Severity)					Expected Crash Reduction with Treatment, Alternative 1 / 3 (By Severity)					Expected Reduction in Crashes	Expected Crashes with Treatment	Estimated Societal Benefit	Present Value Factor	Estimated Present Benefit
			No Injury	Possible	Suspected Minor	Suspected Serious	Fatal	No Injury	Possible	Suspected Minor	Suspected Serious	Fatal					
1	6.72	0.58	1.95	0.24	0.65	0.65	0.41	1.41	0.18	0.47	0.47	0.29	2.82	3.90	$3,159,892	0.93	$2,953,169.99
2	6.93	0.58	2.01	0.25	0.67	0.67	0.42	1.46	0.18	0.49	0.49	0.30	2.91	4.02	$3,258,886	0.87	$2,846,437.24
3	7.15	0.58	2.07	0.26	0.69	0.69	0.43	1.50	0.19	0.50	0.50	0.31	3.00	4.15	$3,361,840	0.82	$2,744,262.75
4	7.37	0.58	2.14	0.27	0.71	0.71	0.45	1.55	0.19	0.52	0.52	0.32	3.09	4.27	$3,464,794	0.76	$2,643,274.55
5	7.59	0.58	2.20	0.28	0.73	0.73	0.46	1.59	0.20	0.53	0.53	0.33	3.19	4.40	$3,567,748	0.71	$2,543,754.74
6	7.81	0.58	2.26	0.28	0.75	0.75	0.47	1.64	0.20	0.55	0.55	0.34	3.28	4.53	$3,670,701	0.67	$2,445,943.39
7	8.03	0.58	2.33	0.29	0.78	0.78	0.48	1.69	0.21	0.56	0.56	0.35	3.37	4.65	$3,773,655	0.62	$2,350,042.90
8	8.25	0.58	2.39	0.30	0.80	0.80	0.50	1.73	0.22	0.58	0.58	0.36	3.47	4.79	$3,880,569	0.58	$2,258,526.48
9	8.48	0.58	2.46	0.31	0.82	0.82	0.51	1.78	0.22	0.59	0.59	0.37	3.56	4.92	$3,987,483	0.54	$2,168,926.35
10	8.71	0.58	2.53	0.32	0.84	0.84	0.53	1.83	0.23	0.61	0.61	0.38	3.66	5.05	$4,094,396	0.51	$2,081,383.44
11	8.93	0.58	2.59	0.32	0.86	0.86	0.54	1.88	0.23	0.63	0.63	0.39	3.75	5.18	$4,201,310	0.48	$1,996,012.07
12	9.16	0.58	2.66	0.33	0.89	0.89	0.55	1.92	0.24	0.64	0.64	0.40	3.85	5.31	$4,308,224	0.44	$1,912,902.77
13	9.40	0.58	2.73	0.34	0.91	0.91	0.57	1.97	0.25	0.66	0.66	0.41	3.95	5.45	$4,419,097	0.41	$1,833,768.12
14	9.63	0.58	2.79	0.35	0.93	0.93	0.58	2.02	0.25	0.67	0.67	0.42	4.05	5.59	$4,529,970	0.39	$1,756,800.59
15	9.86	0.58	2.86	0.36	0.95	0.95	0.60	2.07	0.26	0.69	0.69	0.43	4.14	5.72	$4,636,884	0.36	$1,680,620.14
16	10.11	0.58	2.93	0.37	0.98	0.98	0.61	2.12	0.27	0.71	0.71	0.44	4.24	5.86	$4,751,717	0.34	$1,609,570.99
17	10.34	0.58	3.00	0.37	1.00	1.00	0.62	2.17	0.27	0.72	0.72	0.45	4.34	6.00	$4,862,591	0.32	$1,539,371.63
18	10.58	0.58	3.07	0.38	1.02	1.02	0.64	2.22	0.28	0.74	0.74	0.46	4.44	6.13	$4,973,464	0.30	$1,471,468.52
19	10.82	0.58	3.14	0.39	1.05	1.05	0.65	2.27	0.28	0.76	0.76	0.47	4.54	6.28	$5,088,297	0.28	$1,406,956.55
20	11.07	0.58	3.21	0.40	1.07	1.07	0.67	2.32	0.29	0.77	0.77	0.48	4.65	6.42	$5,203,130	0.26	$1,344,587.73
21	11.31	0.58	3.28	0.41	1.09	1.09	0.68	2.37	0.30	0.79	0.79	0.49	4.75	6.56	$5,317,963	0.24	$1,284,357.76
22	11.55	0.58	3.35	0.42	1.12	1.12	0.70	2.43	0.30	0.81	0.81	0.51	4.85	6.70	$5,432,797	0.23	$1,226,253.71
23	11.81	0.58	3.42	0.43	1.14	1.14	0.71	2.48	0.31	0.83	0.83	0.52	4.96	6.85	$5,551,590	0.21	$1,171,090.51
24	12.05	0.58	3.49	0.44	1.16	1.16	0.73	2.53	0.32	0.84	0.84	0.53	5.06	6.99	$5,666,423	0.20	$1,117,116.08
25	12.30	0.58	3.57	0.45	1.19	1.19	0.74	2.58	0.32	0.86	0.86	0.54	5.17	7.14	$5,785,216	0.18	$1,065,921.22
26	12.56	0.58	3.64	0.46	1.21	1.21	0.76	2.64	0.33	0.88	0.88	0.55	5.27	7.28	$5,904,009	0.17	$1,016,643.66
27	12.81	0.58	3.71	0.46	1.24	1.24	0.77	2.69	0.34	0.90	0.90	0.56	5.38	7.43	$6,022,801	0.16	$969,251.65
28	13.06	0.58	3.79	0.47	1.26	1.26	0.79	2.74	0.34	0.91	0.91	0.57	5.49	7.58	$6,141,594	0.15	$923,709.38
29	13.32	0.58	3.86	0.48	1.29	1.29	0.80	2.80	0.35	0.93	0.93	0.58	5.60	7.73	$6,264,347	0.14	$880,534.26
30	13.58	0.58	3.94	0.49	1.31	1.31	0.82	2.85	0.36	0.95	0.95	0.59	5.70	7.88	$6,387,100	0.13	$839,054.88
Total	**301.28**		**87.37**	**10.92**	**29.12**	**29.12**	**18.20**	**63.27**	**7.91**	**21.09**	**21.09**	**13.18**	**126.54**	**174.74**	**$141,668,486**		**$52,081,714.04**

TABLE 21: ALTERNATIVE 2 ESTIMATED MONETARY BENEFIT

Year	Expected Crashes Affected by Alternative 2	CMF	Expected Crashes with Treatment, Alternative 2 (By Severity)					Expected Crash Reduction with Treatment, Alternative 2 (By Severity)					Expected Reduction in Crashes	Expected Crashes	Estimated Societal Benefit	Present Value Factor	Estimated Present Benefit
			No Injury	Possible	Suspected Minor	Suspected Serious	Fatal	No Injury	Possible	Suspected Minor	Suspected Serious	Fatal					
1	4.20	0.58	1.06	0.24	0.24	0.57	0.32	0.76	0.18	0.18	0.41	0.24	1.76	2.44	$2,517,266	0.93	$2,352,585.14
2	4.33	0.58	1.09	0.25	0.25	0.59	0.33	0.79	0.18	0.18	0.42	0.24	1.82	2.51	$2,596,128	0.87	$2,267,558.58
3	4.47	0.58	1.12	0.26	0.26	0.60	0.35	0.81	0.19	0.19	0.44	0.25	1.88	2.59	$2,678,144	0.82	$2,186,163.27
4	4.61	0.58	1.16	0.27	0.27	0.62	0.36	0.84	0.19	0.19	0.45	0.26	1.93	2.67	$2,760,160	0.76	$2,105,713.00
5	4.74	0.58	1.19	0.28	0.28	0.64	0.37	0.86	0.20	0.20	0.46	0.27	1.99	2.75	$2,842,176	0.71	$2,026,432.48
6	4.88	0.58	1.23	0.28	0.28	0.66	0.38	0.89	0.20	0.20	0.48	0.27	2.05	2.83	$2,924,193	0.67	$1,948,512.99
7	5.02	0.58	1.26	0.29	0.29	0.68	0.39	0.91	0.21	0.21	0.49	0.28	2.11	2.91	$3,006,209	0.62	$1,872,115.73
8	5.16	0.58	1.30	0.30	0.30	0.70	0.40	0.94	0.22	0.22	0.51	0.29	2.17	2.99	$3,091,379	0.58	$1,799,210.97
9	5.30	0.58	1.33	0.31	0.31	0.72	0.41	0.96	0.22	0.22	0.52	0.30	2.23	3.07	$3,176,550	0.54	$1,727,832.77
10	5.44	0.58	1.37	0.32	0.32	0.74	0.42	0.99	0.23	0.23	0.53	0.30	2.29	3.16	$3,261,721	0.51	$1,658,093.43
11	5.58	0.58	1.40	0.32	0.32	0.76	0.43	1.02	0.23	0.23	0.55	0.31	2.35	3.24	$3,346,891	0.48	$1,590,083.99
12	5.73	0.58	1.44	0.33	0.33	0.77	0.44	1.04	0.24	0.24	0.56	0.32	2.41	3.32	$3,432,062	0.44	$1,523,876.60
13	5.87	0.58	1.48	0.34	0.34	0.79	0.45	1.07	0.25	0.25	0.58	0.33	2.47	3.41	$3,520,387	0.41	$1,460,835.52
14	6.02	0.58	1.51	0.35	0.35	0.81	0.47	1.10	0.25	0.25	0.59	0.34	2.53	3.49	$3,608,712	0.39	$1,399,520.85
15	6.16	0.58	1.55	0.36	0.36	0.83	0.48	1.12	0.26	0.26	0.60	0.35	2.59	3.57	$3,693,883	0.36	$1,338,833.18
16	6.32	0.58	1.59	0.37	0.37	0.85	0.49	1.15	0.27	0.27	0.62	0.35	2.65	3.66	$3,785,363	0.34	$1,282,233.26
17	6.46	0.58	1.62	0.37	0.37	0.87	0.50	1.18	0.27	0.27	0.63	0.36	2.71	3.75	$3,873,688	0.32	$1,226,310.32
18	6.61	0.58	1.66	0.38	0.38	0.89	0.51	1.20	0.28	0.28	0.65	0.37	2.78	3.83	$3,962,013	0.30	$1,172,216.63
19	6.76	0.58	1.70	0.39	0.39	0.92	0.52	1.23	0.28	0.28	0.66	0.38	2.84	3.92	$4,053,492	0.28	$1,120,824.43
20	6.92	0.58	1.74	0.40	0.40	0.94	0.53	1.26	0.29	0.29	0.68	0.39	2.90	4.01	$4,144,972	0.26	$1,071,139.53
21	7.07	0.58	1.78	0.41	0.41	0.96	0.55	1.29	0.30	0.30	0.69	0.40	2.97	4.10	$4,236,452	0.24	$1,023,158.50
22	7.22	0.58	1.81	0.42	0.42	0.98	0.56	1.31	0.30	0.30	0.71	0.40	3.03	4.19	$4,327,931	0.23	$976,871.05
23	7.38	0.58	1.85	0.43	0.43	1.00	0.57	1.34	0.31	0.31	0.72	0.41	3.10	4.28	$4,422,565	0.21	$932,926.36
24	7.53	0.58	1.89	0.44	0.44	1.02	0.58	1.37	0.32	0.32	0.74	0.42	3.16	4.37	$4,514,045	0.20	$889,928.69
25	7.69	0.58	1.93	0.45	0.45	1.04	0.59	1.40	0.32	0.32	0.75	0.43	3.23	4.46	$4,608,679	0.18	$849,145.30
26	7.85	0.58	1.97	0.46	0.46	1.06	0.61	1.43	0.33	0.33	0.77	0.44	3.30	4.55	$4,703,313	0.17	$809,889.30
27	8.01	0.58	2.01	0.46	0.46	1.08	0.62	1.46	0.34	0.34	0.78	0.45	3.36	4.64	$4,797,947	0.16	$772,135.38
28	8.16	0.58	2.05	0.47	0.47	1.10	0.63	1.49	0.34	0.34	0.80	0.46	3.43	4.73	$4,892,581	0.15	$735,855.02
29	8.33	0.58	2.09	0.48	0.48	1.13	0.64	1.52	0.35	0.35	0.82	0.47	3.50	4.83	$4,990,370	0.14	$701,460.41
30	8.49	0.58	2.13	0.49	0.49	1.15	0.66	1.55	0.36	0.36	0.83	0.48	3.57	4.92	$5,088,158	0.13	$668,416.67
Total	**188.30**		**47.33**	**10.92**	**10.92**	**25.48**	**14.56**	**34.27**	**7.91**	**7.91**	**18.45**	**10.54**	**79.09**		**$112,857,430**		**$41,489,879.36**

TABLE 22: 30-YEAR BCR SUMMARY

	Alternative 1 – Half-TI	Alternative 2 – Flyover	Alternative 3 – Half-TI with Roundabout
Total Benefits	$52,081,714	$41,489,879	$52,081,714
Total Cost	$11,579,883	$9,691,499	$11,324,788
Benefit-Cost Ratio	4.49	4.28	4.59

6. ENVIRONMENTAL OVERVIEW

It is anticipated that a Categorical Exclusion (CE) Checklist will be appropriate National Environmental Policy Act (NEPA) documentation for the project; however, this should be evaluated as design continues.

Biological Resources

Based on the review of the Arizona Game and Fish Department (AGFD) Online Environmental Review Tool (OERT), no federal or state listed species have been documented within two miles of the project limits. A Biological Evaluation Short Form (BESF) will be prepared by a qualified biologist to evaluate impacts to biological resources during the environmental clearance process.

Wetland and Riparian Areas

According to the National Wetlands Inventory Wetlands Mapper, one ephemeral wash within the footprint of Alternative 1 is considered riverine habitat.[3] However, based on a review of aerial photography, there are no wetlands or riparian areas in or adjacent to the project limits. Therefore, no impacts are anticipated. This should be reevaluated during the environmental clearance process.

Section 401/404 of the Clean Water Act

Based on the review of aerial photography and USGS topographic mapping, ephemeral washes extend through the footprint of both alternatives.[4] These washes should be evaluated for waters of the U.S. during the environmental clearance process to determine Section 404/401 permitting requirements, if applicable.

Floodplain Encroachment

Based on the review of Federal Emergency Management Agency (FEMA) data, one special flood hazard area (Zone A) is depicted on FEMA FIRM 04015C3675G (Map Effective Date: on 11/18/2009).[5] Impacts to floodplains typically occur when the topography within a floodplain is substantially modified either by placement or removal of materials within the floodplain. This should be evaluated during the environmental clearance process.

Sole Source Aquifer

The project is not located within the limits of a Sole Source Aquifer.[6] Therefore, no impacts are anticipated. This should be reevaluated during the environmental clearance process.

[3] https://www.fws.gov/wetlands/data/Mapper.html
[4] https://www.fws.gov/wetlands/data/Mapper.html
[5] https://msc.fema.gov/portal/search?AddressQuery=kingman%20az#searchresultsanchor

[6] https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=9ebb047ba3ec41ada1877155fe31356b

Cultural Resources

The project limits for Alternative 1 include portions of US 93 right-of-way and Pierce Ferry Road. The project limits for Alternative 2 include portions of US 93 right-of-way, Pierce Ferry Road, and undeveloped land west of the US 93 right-of-way. The project limits for Alternative 3 include portions of US 93 right-of-way, Pierce Ferry Road, and undeveloped land south of Pierce Ferry Road and east of the US 93 right-of-way.

The US 93 ROW was surveyed in 2018. The survey resulted in the recordation of Pierce Ferry Road as an in-use historic road. Pierce Ferry Road and the land west of the US 93 ROW has not been surveyed. No additional survey is recommended for US 93, however, Pierce Ferry Road and the land east and west of US 93 ROW should be subjected to a Class III pedestrian survey in compliance with 36 CFR 800, the regulations implementing the National Historic Preservation Act, the Arizona Antiquities Act, ARS 41-841 et seq., and the Arizona Historic Preservation Act, ARS 41-861 through 41-864. These requirements should be reevaluated during the environmental clearance process based on the project scope of work and environmental clearance limits.

Section 4(f) Resources

The project is subject to Section 4(f) of the United States Department of Transportation (USDOT) Act of 1966 (49 U.S.C. 303). Based on preliminary review, there are no potential protected Section 4(f) properties within or adjacent to the project limits; therefore, Section 4(f) analysis/consultation is not anticipated. This should be reevaluated during the environmental clearance process.

Section 6(f) Resources

Section 6(f) of the Land and Water Conservation Fund (LWCF) Act of 1965 (16 U.S.C. 4601-4 et seq.) applies to all transportation projects, regardless of funding source or approval authority, which propose to use land from a Section 6(f) property. Based on preliminary review, there are no potential protected Section 6(f) properties in the project area; therefore, Section 6(f) analysis/consultation is not required.[7] This should be reevaluated during the environmental clearance process.

Visual

The addition of a traffic interchange would change the visual contrast of the project area. This should be evaluated during the environmental clearance process.

[7] http://projects.invw.org/data/lwcf/grants-az.html

Scenic and Historic Route

This portion of US 93 is not considered a Historic or Scenic Road.[8] This should be reevaluated during the environmental clearance process.

Socioeconomic Impacts

Detours will not be required for this project and at least one lane will be maintained during construction. Disproportionate impacts to protected populations are not anticipated. This should be reevaluated during the environmental clearance process.

New right-of-way will be required for construction of each alternative, notably the potential full or partial acquisition of land from the Chevron station/propane service property and Gateway Trading Post.

Alternative 1 (Half-Interchange) would likely require full acquisition of land from the Chevron/propane service property on the north side of Pierce Ferry Road and east side of US 93. Alternative 1 would not impact any residential parcels.

Alternative 2 (Flyover Ramp) would require full acquisition of the Gateway Trading Post, on the west side of US 93 and north of Pierce Ferry Road. Alternative 2 would also require acquisition of undeveloped land on the south side of Pierce Ferry Road and east of US 93. It would also impact residential properties on the south side of Pierce Ferry Road and east of US 93.

Alternative 3 (Half-Interchange with Roundabout) would require acquisition of undeveloped land on the south side of Pierce Ferry Road and east of US 93. It would not impact the Chevron station. It may impact one residential parcel on the south side of Pierce Ferry Road. The impact may potentially be mitigated during design.

Hazardous Materials

Based on the review of the Arizona Department of Environmental Quality (ADEQ) eMaps website, there are no documented hazardous materials cased in the project area.[9] A Preliminary Initial Site Assessment (PISA) will be prepared during the environmental clearance process to further investigate the potential for facilities with hazardous materials concerns. Testing for asbestos and lead-based paint will also be conducted during the environmental clearance process.

Noise

Sensitive noise receptors are located in the project area. The proposed project would result in a substantial vertical and horizontal alteration and is considered a Type I project. Therefore, noise impacts would need to be evaluated for sensitive receptors within 650 feet of the TI. Noise impacts should be evaluated during the environmental clearance process.

[8] https://azdot.gov/about/historic-and-scenic-roads
[9] http://gisweb.azdeq.gov/arcgis/emaps/?topic=places

AZPDES Stormwater Permit

Construction is anticipated to disturb more than one acre of land; therefore, a Section 402 (Arizona Pollutant Discharge Elimination System [AZPDES]) permit and a Stormwater Prevention Pollution Plan (SWPPP) will be required from the ADEQ. This should be reevaluated during the environmental clearance process.

Air Quality

The project is not located within non-attainment or maintenance areas for carbon monoxide (CO); lead (Pb); nitrogen dioxide (NO2); ozone (O3); or particulate matter (PM) for both PM10 and PM2.5; and sulfur dioxide (SO2). This project has not been linked with any special mobile source air toxic (MSAT) concerns and will not have a negative effect on air quality in the area. Air quality analysis is not required. This should be reevaluated during the environmental clearance process.

Agency Scoping

Public/agency scoping will be completed during the environmental clearance process in the form of scoping letters and will be documented in the CE.

7. IMPACTS EVALUATION

The three build alternatives and the no-build alternative were evaluated considering the evaluation criteria listed in **Table 23**. The evaluation results are summarized in **Table 24**.

TABLE 23: EVALUATION CRITERIA

Evaluation Criteria	Definition
System Continuity and Safety	How the alternative contributes to a continuous transportation network.
Right-of-Way	Right-of-way impacts or requirements of each alternative.
Building/Property Impacts	Impacts to properties and buildings.
Future Development Capability	Impacts to planned development.
Utilities	Impacts to major utilities (relocations of power poles, lift stations).
Environment	Impacts to environmental considerations.
Drainage	Impacts to drainage facilities/infrastructure.
Estimate of Probable Cost	Estimate of probable cost of each alternative. Costs include construction, right-of-way/property acquisition, and design.
Benefit-Cost Ratio	Relationship between the estimate of probable construction cost and the societal benefits (crashes reduced) expressed in monetary or qualitative terms. If the alternative has a BCR greater than 1.0, the alternative is expected to deliver a positive net present value.

TABLE 24: IMPACTS EVALUATION

Criterion	No-Build	Alternative 1 (Half-TI)	Alternative 2 (Flyover)	Alternative 3 (Half-Interchange with Roundabout)
Safety	The base condition does not address safety concerns at the intersection caused by the conflict point between southbound left turning and northbound through vehicles.	Eliminates the conflict between southbound left turning and northbound through vehicles by creating a grade-separated interchange; reduces other potential crashes. Estimated crash reduction of 32 crashes.	Eliminates the conflict point between southbound left and northbound vehicles. Estimated crash reduction of 20 crashes.	Eliminates the conflict between southbound left turning and northbound through vehicles by creating a grade-separated interchange; reduces other potential crashes. Estimated crash reduction of 32 crashes.
Right-of-Way	No adjustment to right-of-way. Currently has 250' of right-of-way.	Requires right-of-way acquisition east of US 93. Seven parcels are affected for a total of 4.0 acres, private owned. Would require relocation of large propane tank.	Requires right-of-way acquisition west and east of US 93. Ten (10) parcels are affected for a total of 31 acres.	Requires right-of-way acquisition east of US 93. Six (6) parcels are affected for a total of 4.8 acres, private owned, for approximately $556,300. Would require relocation of large propane tank.
Building/Property Impacts	No impact to existing buildings and property.	Property acquisition required on east side of US 93. Parcel 326-03-121G has a Chevron gas station and a propane distribution center and will lose an access.	Property acquisition required along south side of Pierce Ferry Road from Parcels 326-03-120D (home), 326-03-111E (home), and 326-03-111C (business). Access to Pierce Ferry Road from these parcels and Bee Drive will be eliminated. Property acquisition required of Gate Way Trading Post on Parcel 326-03-086E.	Property acquisition required on east side of US 93 to accommodate ramps. Some acquisition required from the service station, which is not anticipated to impact its functionality or viability. In addition to a portion of the service station, portions of 6 parcels are required.
Future Development Capability	Base condition is not consistent with interstate design standard, that have full access control.	Design is consistent with interchange standards.	Design modifications would be required to accommodate additional ramps.	Design is consistent with interchange standards.
Utilities	No impacts to utilities.	Buried communications in area. Hydrant near the west access to the Chevron and water line located along north side of Pierce Ferry. Underground/overhead electric.	Buried and aerial communications in area. Overhead electric in vicinity.	Buried communications in area. Hydrant near the west access to the Chevron and water line located along north side of Pierce Ferry. Underground/overhead electric.
Environment	No impact to existing environment.	No major impacts to environment.	No major impacts to environment.	No major impacts to environment.
Drainage	No impact to existing drainage patterns.	Grading over culvert located south of intersection and removal of median ditch approaching the intersection from both directions.	Culvert located where the abutments are.	Grading over culvert located south of intersection and removal of median ditch approaching the intersection from both directions.

8. PUBLIC AND STAKEHOLDER INPUT

Stakeholder and public input to the study was obtained through two efforts:

- Technical Advisory Committee
- Information posting to ADOT website

Project Management Team

The Project Management Team consisted of ADOT Project Manager Tricia Brown and Mohave County Public Works Director Steven Latoski. The Project Management Team met frequently throughout the study to discuss alternatives, evaluation methods, and study results and findings. Notes from key Project Management Team meetings are included in **Appendix E.**

Technical Advisory Committee

A Technical Advisory Committee (TAC) was established to provide input to the Feasibility Study. The TAC consisted of representatives from ADOT and Mohave County. The TAC met at key points during the study to review and provide input on study deliverables. TAC Meetings were held:

- April 30, 2020, which was the project kick-off meeting.
- July 7, 2020, which discussed Technical Memorandum No. 1 (Development of Alternatives).

Technical Advisory Committee Meeting notes are included in **Appendix E.**

Technical Memorandum No. 2 (Evaluation of Alternatives) was distributed to the TAC on October 22, 2020 for review and comment. A TAC meeting was not convened to discuss Technical Memorandum No. 2.

The draft Final Report was also distributed electronically to TAC members for review and comment.

Information Posting to ADOT Website

Study information was posted to the ADOT website[10]. Information posted included Technical Memorandum No. 1 (Development of Alternatives), and a study fact sheet. The study fact sheet is included in **Appendix F.**

ADOT Community Relations issued a press release on September 30, 2020, notifying the public of the availability of study materials and information. The press release was emailed to regional media and ADOT's US 93 stakeholder list. No comments from the public were received during the course of the study.

[10] https://azdot.gov/planning/transportation-studies/us-93-pierce-ferry-road-feasibility-study

9. RECOMMENDED ALTERNATIVE

Based on the evaluation results, the study team recommends Alternative 3 – Half-Traffic Interchange with a Roundabout as the recommended alternative for the following reasons:

- Safety: Alternative 3 has an estimated reduction in crashes of 126.5 compared to Alternative 2's 79.1.
- Right-of-Way: Alternative 3 avoids impacts to the service station. While some commercial property acquisition is required from the service station parcel, the acquisition will not impact the viability of the service station. Alternative 3 minimizes impacts to residential parcels.
- Benefit-Cost Ratio: Alternative 3 results in the highest benefit/cost ratio.

	Alternative 1 – Half-TI	Alternative 2 – Flyover	Alternative 3 – Half-TI with Roundabout
Total Benefits	$52,081,714	$41,489,879	$52,081,714
Total Cost	$11,579,883	$9,691,499	$11,324,788
Benefit-Cost Ratio	**4.49**	**4.28**	**4.59**

9. RECOMMENDED ALTERNATIVE

Based on the evaluation results, the study team recommends Alternative 3 – Half-Traffic Interchange with a Roundabout as the recommended alternative for the following reasons:

- Safety: Alternative 3 has an estimated reduction in crashes of 126.5 compared to Alternative 2's 79.1.
- Right-of-Way: Alternative 3 avoids impacts to the service station. While some commercial property acquisition is required from the service station parcel, the acquisition will not impact the viability of the service station. Alternative 3 minimizes impacts to residential parcels.
- Benefit-Cost Ratio: Alternative 3 results in the highest benefit/cost ratio.

	Alternative 1 – Half-TI	Alternative 2 – Flyover	Alternative 1 – Half-TI with Roundabout
Total Benefits	$52,081,714	$41,489,879	$52,081,714
Total Cost	$11,579,883	$9,691,499	$11,324,788
Benefit-Cost Ratio	**4.49**	**4.28**	**4.59**

Appendix A – Improvement Alternatives

Appendix A1: Alternative 1 (Half-interchange)

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	ARIZ.	T0230 01L	2	3	

LEGEND

Reconstruction Limits - Highway, Ramps, and Crossroad

New Bridge

	NAME	DATE
DESIGN	RADDEMAN	11/20
DRAWN	RADDEMAN	11/20
CHECKED	TAPIA/HATHCOCK	11/20

Kimley»Horn

ARIZONA DEPARTMENT OF TRANSPORTATION
INFRASTRUCTURE DELIVERY AND OPERATIONS DIVISION
ROADWAY DESIGN SERVICES

ALTERNATIVE 1
HALF TI, NORTHBOUND US 93 OVER PIERCE FERRY RD

PRELIMINARY
NOT FOR CONSTRUCTION
OR
RECORDING

ROUTE	LOCATION	DWG NO.
US 93	US 93 AND PIERCE FERRY RD	
TRACS NO. T0230 01L	-	___ OF ___

SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-

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Appendix A2: Alternative 2 (Flyover Ramp)

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	ARIZ.	T0230 01L	3	3	

DATE- | LOCATION- | REVISIONS- | FINISHED PLANS- | SURVEY NO.

690 695 700 705 710 715 720 725 730 735 740 745

700'

US 93

US 93 SB

US 93 NB

20

25

30

35

180'

PIERCE FERRY RD

N

LEGEND

Reconstruction Limits - Highway, Ramps, and Crossroad

New Bridge

	NAME	DATE
DESIGN	RADDEMAN	11/20
DRAWN	RADDEMAN	11/20
CHECKED	TAPIA/HATHCOCK	11/20

Kimley»Horn

ARIZONA DEPARTMENT OF TRANSPORTATION
INFRASTRUCTURE DELIVERY AND OPERATIONS DIVISION
ROADWAY DESIGN SERVICES

ALTERNATIVE 2
FLYOVER RAMP, SOUTHBOUND
US 93 TO PIERCE FERRY RD

PRELIMINARY
NOT FOR
CONSTRUCTION
OR
RECORDING

ROUTE	LOCATION	DWG NO.
US 93	US 93 AND PIERCE FERRY RD	___ OF ___

TRACS NO. T0230 01L | - |

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Appendix A3: Alternative 3 (Half-Interchange with Roundabout)

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	ARIZ.	T0230 01L	2	3	

DATE- | LOCATION- | REVISIONS- | FINISHED PLANS- | SURVEY NO.

DATE- | LOCATION- | REVISIONS- | FINISHED PLANS- | SURVEY NO.

675 680 685 690 695 700 705 710 715 720 725 730

US 93

US 93 SB

US 93 NB

20

465'

149'

660'

660'

1400'

25

PIERCE FERRY RD

30

35

LEGEND

- *Reconstruction Limits - Highway, Ramps, and Crossroad*
- *New Bridge*
- *Roadway Demolition*

	NAME	DATE
DESIGN	RADDEMAN	11/20
DRAWN	RADDEMAN	11/20
CHECKED	TAPIA/HATHCOCK	11/20

Kimley»Horn

ARIZONA DEPARTMENT OF TRANSPORTATION
INFRASTRUCTURE DELIVERY AND OPERATIONS DIVISION
ROADWAY DESIGN SERVICES

ALTERNATIVE 3
HALF-INTERCHANGE WITH ROUNDABOUT
SOUTH OF PIERCE FERRY ROAD

PRELIMINARY
NOT FOR
CONSTRUCTION
OR
RECORDING

ROUTE	LOCATION	DWG NO.
US 93	US 93 AND PIERCE FERRY RD	
TRACS NO. T0230 01L	-	___ OF ___

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Appendix B - Estimate of Probable Cost

Appendix B1: Alternative 1, Estimate of Probable Cost

Arizona Department of Transportation
Estimated Engineering Construction Cost

Project Number: T0230 01L

Location: US 93 Pierce Ferry Road

Version: Final Report
Alternative 1 (Half-Interchange)

ITEM NO	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2010001	CLEARING AND GRUBBING	L.SUM	1	$50,000.00	$50,000
2020029	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ.YD.	29,440	$2.75	$80,960
2020041	REMOVAL OF PIPE	L.FT.	600	$20.00	$12,000
2020175	REMOVAL OF LIGHT POLES AND BASES	EACH	3	$800.00	$2,400
2030301	ROADWAY EXCAVATION	CU.YD.	6,335	$20.00	$126,700
2030900	BORROW (IN PLACE)	CU.YD.	151,799	$15.00	$2,276,987
3030022	AGGREGATE BASE, CLASS 2	CU.YD.	6,800	$45.00	$306,000
4040111	BITUMINOUS TACK COAT	TON	16	$550.00	$8,800
4040116	APPLY BITUMINOUS TACK COAT	HOUR	24	$450.00	$10,800
4160002	ASPHALTIC CONCRETE (3/4" MIX) (END PRODUCT)	TON	8,492	$50.00	$424,600
6080101	MISCELLANEOUS WORK (SIGNS)	L.SUM	1	$7,625.00	$7,625
7040005	PAVEMENT MARKING (WHITE EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	22,460	$0.50	$11,230
7040006	PAVEMENT MARKING (YELLOW EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	17,330	$0.50	$8,665
7040074	PAVEMENT SYMBOL (EXTRUDED THERMOPLASTIC) (ALKYD) (0.090")	EACH	10	$125.00	$1,250
7060013	PAVEMENT MARKER, RAISED, TYPE C	EACH	130	$4.00	$520
7060015	PAVEMENT MARKER, RAISED, TYPE D	EACH	19	$4.00	$76
7360300	ROADWAY LIGHTING	L.SUM	1	$40,000.00	$40,000
9050006	GUARD RAIL, W-BEAM, SINGLE FACE	L.FT.	2,080	$5.00	$10,400
9050025	GUARD RAIL TERMINAL (MASH)	EACH	2	$6,000.00	$12,000
9050419	GUARD RAIL TRANSITION (C-10.31)(STEEL POST)	EACH	4	$5,000.00	$20,000
9100002	CONCRETE BARRIER (SINGLE FACE)	L.FT.	230	$150.00	$34,500
9140178	RETAINING WALL (REINFORCED CONCRETE CANTILEVER)	SQ.FT.	6,825	$65.00	$443,625
9240038	MISCELLANEOUS WORK (BRIDGE)	SQ.FT.	4,582	$175.00	$801,861
9240050	MISCELLANEOUS WORK (DRAINAGE IMPROVEMENTS)	L.SUM	1	$50,000.00	$50,000
9240051	MISCELLANEOUS WORK (EROSION CONTROL)	L.SUM	1	$40,000.00	$40,000
				ITEM TOTAL	**$4,780,998**
	PROJECT WIDE				
	Mobilization (10%)				$478,100
	Dust and Water Palliative (1%)				$47,810
	Quality Control (2%)				$95,620
	Construction Surveying (2%)				$95,620
	Maintenance And Protection Of Traffic (10%)				$478,100
				PROJECT WIDE SUBTOTAL	**$1,195,250**
	Unidentified Item Allowance (20%)				$1,195,250
				PROJECT WIDE TOTAL	**$2,390,500**
	OTHER COSTS				
	Construction Engineering (15%)				$968,153
	Construction Contingencies (5%)				$322,718
	Consultant Services (1%)				$64,544
	Right-of-Way				$2,009,832
				OTHER COSTS TOTAL	**$3,365,247**

SUMMARY

ITEM TOTAL	**$4,780,998**
PROJECT WIDE	**$2,390,500**
OTHER COST TOTAL	**$3,365,247**
SUBTOTAL PROJECT COST	**$10,536,745**
INDIRECT COST ALLOCATION (9.90%)	**$1,043,138**
TOTAL PROJECT COST	**$11,579,883**

Project No.: T0230 01L
Federal Project No. MMO-0(222)T

Alternative 1 Right-of-Way Acquisitions Costs

Cost Item	Description	Alternative 1 Half-Interchange
Title, Fees, Survey	*Title Work*	*$ 70,000.00*
	ROW Plans	*$ 440,000.00*
	Project Management	*$ 15,000.00*
	Appraisal Fee	*$ 7,000.00*
	Subtotal	$ 532,000.00
Acquisition Consultant	*Service Station (Full Acquisition)*	$ 151,500.00
	Service Station (Partial Acquisition)	
	Residential (4)	
Acquisition Cost, Land	*Service Station*	*$ 692,168.00*
	Trading Post	-
	Vacant Land	$ 134,164.00
	Single-Family Residential	-
Relocation Costs	*SUBJECT TO APPRAISAL*	$ 500,000.00
Total		$ 2,009,832.00

Acquisition Assumptions

ID	Parcel Size (Acres)	Cost / SF	Owner	Address	Area Needed (Square Feet)	Cost	Notes
326-03-139D	1.3	$1.00	Citizens Utilities Rural CO	ATTN TAX DEPARTMENT 401 MERRITT 7, Norwalk, CT 06851	30492.00	$30,492.00	
326-03-126D	2.71	$1.00	NU Gen LLC	8843 N CENTRAL AVE, Phoenix, AZ 85020	32670.00	$32,670.00	
326-03-121G	2.27	$7.00	Dolan Springs Investment LLC	1131 DU FORT HILLS CT, Henderson, NV 89002	39204.00	$692,168.40	Assume full acquisition
326-03-108C	1.25	$1.00	Dolan Springs Investment LLC	1131 DU FORT HILLS CT, Henderson, NV 89002	17424.00	$17,424.00	
326-03-102C	1.96	$1.00	Desert Property Holdings Trust	318 S MARYLAND PKWY, Las Vegas, NV 89101	23958.00	$23,958.00	
326-03-089C	3.37	$1.00	Railroad Pass Land Trust	1333 N Buffalo Dr Unit 135, Las Vegas, NV 89128	14374.80	$14,374.80	
326-03-085A	4.75	$1.00	Yukes Richard	4218 Bronze Ridge St, Las Vegas, NV 89135	15246.00	$15,246.00	
				Total	173368.8	$826,333.20	
				Vacant land		$134,164.80	

Appendix B2: Alternative 2, Estimate of Probable Cost

Arizona Department of Transportation
Estimated Engineering Construction Cost

Project Number: T0230 01L

Location: US 93 Pierce Ferry Road

Version: Final Report
Alternative 2 (Fly-Over)

ITEM NO	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2010001	CLEARING AND GRUBBING	L.SUM	1	$60,500.00	$60,500
2020041	REMOVAL OF PIPE	L.FT.	200	$20.00	$4,000
2020175	REMOVAL OF LIGHT POLES AND BASES	EACH	1	$800.00	$800
2030301	ROADWAY EXCAVATION	CU.YD.	2,565	$20.00	$51,300
2030900	BORROW (IN PLACE)	CU.YD.	63,365	$15.00	$950,475
3030022	AGGREGATE BASE, CLASS 2	CU.YD.	2,751	$45.00	$123,795
4040111	BITUMINOUS TACK COAT	TON	7	$550.00	$3,850
4040116	APPLY BITUMINOUS TACK COAT	HOUR	11	$450.00	$4,950
4160002	ASPHALTIC CONCRETE (3/4" MIX) (END PRODUCT)	TON	3,436	$50.00	$171,800
6080101	MISCELLANEOUS WORK (SIGNS)	L.SUM	1	$7,625.00	$7,625
7040005	PAVEMENT MARKING (WHITE EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	10,310	$0.50	$5,155
7040006	PAVEMENT MARKING (YELLOW EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	6,280	$0.50	$3,140
7360300	ROADWAY LIGHTING	L.SUM	1	$100,000.00	$100,000
9050006	GUARD RAIL, W-BEAM, SINGLE FACE	L.FT.	2,615	$5.00	$13,075
9050025	GUARD RAIL TERMINAL (MASH)	EACH	2	$6,000.00	$12,000
9050419	GUARD RAIL TRANSITION (C-10.31)(STEEL POST)	EACH	4	$5,000.00	$20,000
9100002	CONCRETE BARRIER (SINGLE FACE)	L.FT.	635	$150.00	$95,250
9240038	MISCELLANEOUS WORK (BRIDGE)	SQ.FT.	8,816	$175.00	$1,542,824
9240050	MISCELLANEOUS WORK (DRAINAGE IMPROVEMENTS)	L.SUM	1	$20,000.00	$20,000
9240051	MISCELLANEOUS WORK (EROSION CONTROL)	L.SUM	1	$15,000.00	$15,000
				ITEM TOTAL	**$3,205,539**

PROJECT WIDE	
Mobilization (10%)	$320,554
Dust and Water Palliative (1%)	$32,056
Quality Control (2%)	$64,111
Construction Surveying (2%)	$64,111
Maintenance And Protection Of Traffic (10%)	$320,554
PROJECT WIDE SUBTOTAL	**$801,386**
Unidentified Item Allowance (20%)	$801,386
PROJECT WIDE TOTAL	**$1,602,772**
OTHER COSTS	
Construction Engineering (15%)	$649,122
Construction Contingencies (5%)	$216,374
Consultant Services (1%)	$43,275
Right-of-Way	$2,101,388
Utility (Transmission Line Relocation)	$1,000,000
OTHER COSTS TOTAL	**$4,010,159**

SUMMARY

ITEM TOTAL	**$3,205,539**
PROJECT WIDE	**$1,602,772**
OTHER COST TOTAL	**$4,010,159**
SUBTOTAL PROJECT COST	**$8,818,470**
INDIRECT COST ALLOCATION (9.90%)	**$873,029**
TOTAL PROJECT COST	**$9,691,499**

Project No.: T0230 01L
Federal Project No. MMO-0(222)T

Alternative 2 Right-of-Way Acquisitions Costs

Cost Item	Description	Alternative 2
		Fly-Over Ramp
Title, Fees, Survey	*Title Work*	$ 70,000.00
	ROW Plans	$ 440,000.00
	Project Management	$ 15,000.00
	Appraisal Fee	$ 7,000.00
	Subtotal	$ 532,000.00
Acquisition Consultant	*Service Station (Full Acquisition)*	-
	Service Station (Partial Acquisition)	-
	Residential (4)	
Acquisition Cost, Land	*Service Station*	-
	Trading Post	*$479,704.50*
	Vacant Land	$915,195.60
	Single-Family Residential	$74,487.60
Relocation Costs	*SUBJECT TO APPRAISAL*	$ 100,000.00
Total		**$ 2,101,387.70**

Acquisition Assumptions

ID	Parcel Size (Acres)	Cost / SF	Owner	Address	Area Needed (Square Feet)	Cost	Notes
326-03-086E	8.81	$1.25	Salmu Layla	PO BOX 578, Dolan Springs, AZ 86441	383763.60	$479,704.50	Assume full acquisition
326-03-121E	0.95	$1.00	NU Gen LLC	8842 N CENTRAL AVE, Phoenix, AZ 85020	41382.00	$41,382.00	
326-03-126D	2.71	$1.00	NU Gen LLC	8843 N CENTRAL AVE, Phoenix, AZ 85020	56628.00	$56,628.00	
326-03-103	5	$1.00	JONES STEVEN W & NANCY S	PO BOX 68653, Portland, OR 97268	71874.00	$71,874.00	
326-03-106	5	$1.00	MOHAVE COUNTY	PO BOX 7000, Kingman, AZ 86402	58806.00	$58,806.00	
326-03-123	10	$1.00	WARD WALLACE H	2607 MIRABELLA ST, Henderson, NV 89052	63162.00	$63,162.00	
326-03-140	4.54	$1.00	Nguyen Tri Etal	6314 MOUNT EDEN AVE, Las Vegas, NV 89139	105850.80	$105,850.80	
326-03-126C	0.24	$1.00	NU GEN LLC	8843 N CENTRAL AVE, Phoenix, AZ 85020	10454.40	$10,454.40	
326-03-139C	1.47	$1.00	Ward Wallace Hamilton Trustee	2607 MIRABELLA ST, Henderson, NV 89052	32670.00	$32,670.00	
326-03-107C	2.27	$1.00	Ward Wallace Hamilton Trustee	2607 MIRABELLA ST, Henderson, NV 89052	98881.20	$98,881.20	
326-03-122C	8.62	$1.00	Ward Wallace Hamilton Trustee	2608 MIRABELLA ST, Henderson, NV 89052	375487.20	$375,487.20	
326-03-120D	1.14	$1.50	Kisling Lalaine M	831 Zinnia Cir, Henderson, NV 89015	49658.40	$74,487.60	Assume full acquisition
				Total	1348617.6	$1,469,387.70	
				Vacant land		$915,195.60	

Appendix B3: Alternative 3, Estimate of Probable Cost

Arizona Department of Transportation
Estimated Engineering Construction Cost

Project Number: T0230 01L

Location: US 93 Pierce Ferry Road

Version: Final Report
Alternative 3 (Half-Interchange with Roundabout)

ITEM NO	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
2010001	CLEARING AND GRUBBING	L.SUM	1	$50,000.00	$50,000
2020029	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ.YD.	15,705	$2.75	$43,189
2020041	REMOVAL OF PIPE	L.FT.	600	$20.00	$12,000
2020175	REMOVAL OF LIGHT POLES AND BASES	EACH	3	$800.00	$2,400
2030301	ROADWAY EXCAVATION	CU.YD.	9,646	$20.00	$192,920
2030900	BORROW (IN PLACE)	CU.YD.	147,029	$15.00	$2,205,435
3030022	AGGREGATE BASE, CLASS 2	CU.YD.	9,646	$45.00	$434,070
4040111	BITUMINOUS TACK COAT	TON	22	$550.00	$12,100
4040116	APPLY BITUMINOUS TACK COAT	HOUR	32	$450.00	$14,400
4160002	ASPHALTIC CONCRETE (3/4" MIX) (END PRODUCT)	TON	12,046	$50.00	$602,300
6080101	MISCELLANEOUS WORK (SIGNS)	L.SUM	1	$14,000.00	$14,000
7040005	PAVEMENT MARKING (WHITE EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	40,800	$0.50	$20,400
7040006	PAVEMENT MARKING (YELLOW EXTRUDED THERMOPLASTIC) (0.090")	L.FT.	1,580	$0.50	$790
7040074	PAVEMENT SYMBOL (EXTRUDED THERMOPLASTIC) (ALKYD) (0.090")	EACH	10	$125.00	$1,250
7060013	PAVEMENT MARKER, RAISED, TYPE C	EACH	130	$4.00	$520
7060015	PAVEMENT MARKER, RAISED, TYPE D	EACH	19	$4.00	$76
7360300	ROADWAY LIGHTING	L.SUM	1	$40,000.00	$40,000
9050006	GUARD RAIL, W-BEAM, SINGLE FACE	L.FT.	2,080	$5.00	$10,400
9050025	GUARD RAIL TERMINAL (MASH)	EACH	2	$6,000.00	$12,000
9050419	GUARD RAIL TRANSITION (C-10.31)(STEEL POST)	EACH	4	$5,000.00	$20,000
9100002	CONCRETE BARRIER (SINGLE FACE)	L.FT.	230	$150.00	$34,500
9140178	RETAINING WALL (REINFORCED CONCRETE CANTILEVER)	SQ.FT.	6,825	$65.00	$443,625
9240038	MISCELLANEOUS WORK (BRIDGE)	SQ.FT.	4,582	$175.00	$801,861
9240050	MISCELLANEOUS WORK (DRAINAGE IMPROVEMENTS)	L.SUM	1	$50,000.00	$50,000
9240051	MISCELLANEOUS WORK (EROSION CONTROL)	L.SUM	1	$40,000.00	$40,000
				ITEM TOTAL	**$5,058,235**
	PROJECT WIDE				
	Mobilization (10%)				$505,824
	Dust and Water Palliative (1%)				$50,583
	Quality Control (2%)				$101,165
	Construction Surveying (2%)				$101,165
	Maintenance And Protection Of Traffic (10%)				$505,824
				PROJECT WIDE SUBTOTAL	**$1,264,561**
	Unidentified Item Allowance (20%)				$1,264,560
				PROJECT WIDE TOTAL	**$2,529,121**
	OTHER COSTS				
	Construction Engineering (15%)				$1,024,293
	Construction Contingencies (5%)				$341,431
	Consultant Services (1%)				$68,287
	Right-of-Way				$1,283,262
				OTHER COSTS TOTAL	**$2,717,273**

SUMMARY

ITEM TOTAL	**$5,058,235**
PROJECT WIDE	**$2,529,121**
OTHER COST TOTAL	**$2,717,273**
SUBTOTAL PROJECT COST	**$10,304,629**
INDIRECT COST ALLOCATION (9.90%)	**$1,020,158**
TOTAL PROJECT COST	**$11,324,788**

Project No.: T0230 01L
Federal Project No. MMO-0(222)T

Alternative 3 Right of Way Acquisitions Costs

Cost Item	Description	Alternative 3
		Half-Interchange with Roundabout
Title, Fees, Survey	*Title Work*	$ 70,000.00
	ROW Plans	$ 440,000.00
	Project Management	$ 15,000.00
	Appraisal Fee	$ 7,000.00
	Subtotal	$ 532,000.00
Acquisition Consultant	*Service Station (Full Acquisition)*	
	Service Station (Partial Acquisition)	$ 112,000.00
	Residential (4)	$ 40,000.00
Acquisition Cost, Land	*Service Station*	$ 104,220.00
	Trading Post	-
	Vacant Land	$429,147.61
	Single-Family Residential	$ 85,895.00
Relocation Costs	*SUBJECT TO APPRAISAL*	$ 20,000.00
Total		**$ 1,283,262.61**

Acquisition Assumptions

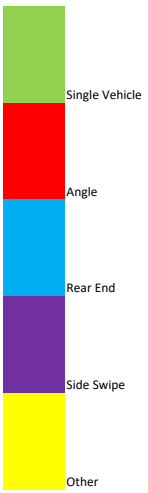
ID	Parcel Size (Acres)	Cost / SF	Owner	Address	Area Needed (Square Feet)	Cost	Notes
326-03-121G	2.27	$7.00	Dolan Springs Investment LLC	1131 DU FORT HILLS CT, Henderson, NV 89002	14888.50	$104,219.50	Partial acquisition
326-03-121E	0.95	$1.00	NU Gen LLC	8842 N CENTRAL AVE, Phoenix, AZ 85020	36188.20	$36,188.20	
326-03-126D	2.71	$1.00	NU Gen LLC	8843 N CENTRAL AVE, Phoenix, AZ 85020	88781.00	$88,781.00	
326-03-127	5	$1.00	LIM JOHNNY & HA TRS 50	11 DOUGLAS GROVE RD, Henderson, NV 89052	46411.06	$46,411.06	
326-03-138B	9.36	$1.00	ARIZONA SERIES 5	3141 BEACH VIEW CT, Las Vegas, NV 89117	129138.38	$129,138.38	
326-03-139D	1.3	$1.00	CITIZENS UTILITIES RURAL CO	ATTN TAX DEPARTMENT 401 MERRITT 7, Norwalk, CT 06851	42733.98	$42,733.98	
326-03-120A	1.25	$1.50	MARCY PATRICIA LIVING TRUST	3615 TARPON DR, Lake Havasu City, AZ 86406	57263.33	$85,894.99	Full acquisition
				Total	415404.4	$533,367.11	
				Vacant land		$429,147.61	

Appendix C – Crashes Affected by Alternatives

Appendix C1: Crashes Affected by Alternative 1 and Alternative 3

Incident ID	Incident Microfilm	Incident Date & Time	Incident On Road	Incident Crossing Feature	Incident Offset	Incident Injury Severity Description	Incident First Harmful Description	Incident Collision Manner	Incident Junction Relation Desc	Unit Travel Direction Desc	Unit Action Desc	Unit Event Sequence Desc1	Person Violation Desc1	Geocode On Road	Geocode Crossing Feature
2940764		3/25/2015 4:33:00 PM	U 093	Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection Non Interchange	3 - East	Making Left Turn	Ran Off Road Left	Speed To Fast For Conditions	US-93	Pierce Ferry Rd
2975571		7/20/2015 10:11:00 AM	U 093 0	Pierce Ferry Rd	0	Possible Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Not Junction Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3041040		1/10/2016 6:12:00 PM	U 093 0	Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Interchange	4 - West	Making Left Turn	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3043605		1/4/2016 12:11:00 PM	U 093	Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Crossover Related	8 - Southeast	Making Left Turn	Traffic Sign Support	Speed To Fast For Conditions	US-93	Pierce Ferry Rd
3066167		3/19/2016 11:26:00 AM	U 093 0	Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	Pierce Ferry Rd
3084919		4/28/2016 10:17:00 AM	U 093 0	Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related Non Interchange	2 - South	Going Straight Ahead	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	Pierce Ferry Rd
3084924		5/5/2016 12:46:00 PM	U 093 0	Pierce Ferry Rd	0	No Injury	Other Non Collision	Single Vehicle	Not Junction Related	1 - North	Making Right Turn	Other Non Collision	Speed To Fast For Conditions	US-93 Non-Cardinal	Pierce Ferry Rd
3085294		5/5/2016 11:38:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Making Left Turn	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3089758		4/21/2016 12:02:00 PM	U 093 0	Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	6 - Northeast	Going Straight Ahead	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	Pierce Ferry Rd
3102469		7/3/2016 3:32:00 PM	U 093 0	Pierce Ferry Rd	0	Possible Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3109083		6/6/2016 4:12:00 PM	08 PIERCE FERRY RD	US-93	25	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related Interchange	3 - East	Making Right Turn	Motor Vehicle In Transport	Speed To Fast For Conditions	N Pierce Ferry Rd	US-93
3117584		7/24/2016 1:40:00 PM	U 093 0	Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3148135		10/15/2016 4:49:00 PM	08N PIERCE FERRY RD	US-93	42	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related Non Interchange	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Followed Too Closely	N Pierce Ferry Rd	US-93
3160832		11/10/2016 4:20:00 PM	08N PIERCE FERRY RD	US-93 Non-Cardinal	103	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related Non Interchange	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Speed To Fast For Conditions	N Pierce Ferry Rd	US-93 Non-Cardinal
3172733		12/27/2016 2:24:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3186125		1/29/2017 12:02:00 PM	U 093	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection Non Interchange	2 - South	Slowing In Trafficway	Ran Off Road Right	Speed To Fast For Conditions	US-93	N Pierce Ferry Rd
3209826		3/26/2017 12:42:00 PM	U 093	M041	0.82	Suspected Serious Injury	Overturn Rollover	Single Vehicle	Not Junction Related	2 - South	Going Straight Ahead	Overturn Rollover	Speed To Fast For Conditions	US-93	M041
3212449		4/9/2017 2:00:00 PM	U 093	N Pierce Ferry Rd	100	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related Non Interchange	2 - South	Slowing In Trafficway	Motor Vehicle In Transport	Made Improper Turn	US-93	N Pierce Ferry Rd

Collision Type Applicable to Alternative



3223753		5/7/2017 12:30:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3229059		5/17/2017 1:18:00 PM	U 093 0	N Pierce Ferry Rd	0	Possible Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3234114		5/19/2017 10:10:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3240960		6/12/2017 12:05:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3244894		6/24/2017 12:55:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Crossing Road	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3276276		9/20/2017 9:49:00 AM	U 093	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Sideswipe Same Direction	Not Junction Related	2 - South	Slowing In Trafficway	Motor Vehicle In Transport	Unsafe Lane Change	US-93	N Pierce Ferry Rd
3276809		9/25/2017 11:20:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Ran Off Road Left	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3276899		9/17/2017 1:21:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3314678		12/24/2017 2:19:00 PM	U 093 0	N Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3340144		3/1/2018 1:36:00 PM	U 093 0	N Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3354717		4/8/2018 1:11:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Stopped In Trafficway	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3364935		5/3/2018 10:50:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3375530		5/22/2018 2:17:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3382763		6/16/2018 1:00:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Overturn Rollover	Single Vehicle	Not Junction Related	3 - East	Going Straight Ahead	Ran Off Road Right	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3385615		6/24/2018 9:42:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Other Non Fixed Object	Single Vehicle	Intersection	1 - North	Avoiding Vehicle Object Pedestrian	Ran Off Road Right	No Improper Action	US-93 Non-Cardinal	N Pierce Ferry Rd
3387465		7/5/2018 6:47:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3387622		6/1/2018 8:42:00 AM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3390998		7/17/2018 10:21:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection 4 Way	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3399008		7/25/2018 8:55:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	1 - North	Making Right Turn	Motor Vehicle In Transport	Speed To Fast For Conditions	US-93 Non-Cardinal	N Pierce Ferry Rd

3406339		8/31/2018 12:18:00 PM	U 093	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection T Inter	2 - South	Making Left Turn	Traffic Sign Support	Speed To Fast For Conditions	US-93	N Pierce Ferry Rd
3411382		8/23/2018 8:49:00 PM	08N PIERCE FERRY	US-93 Non-Cardinal	29	No Injury	Animal	Single Vehicle	Not Junction Related	4 - West	Going Straight Ahead	Animal	No Improper Action	N Pierce Ferry Rd	US-93 Non-Cardinal
3414020		8/23/2018 5:30:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Sideswipe Same Direction	Intersection T Inter	1 - North	Making Right Turn	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	N Pierce Ferry Rd
3416191		9/15/2018 7:24:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3456678		12/31/2018 2:27:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3460151		1/13/2019 2:58:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Other	Intersection T Inter	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3463369		1/12/2019 1:59:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3469530		1/28/2019 1:43:00 PM	U 093	N Pierce Ferry Rd	0	No Injury	Other Non Fixed Object	Single Vehicle	Intersection Related	2 - South	Going Straight Ahead	Other Non Fixed Object	No Improper Action	US-93	N Pierce Ferry Rd
3473149		2/11/2019 12:54:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3487607		3/15/2019 10:27:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Other	US-93 Non-Cardinal	N Pierce Ferry Rd
3493917		4/8/2019 4:54:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3498970		4/12/2019 11:49:00 AM	U 093	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection	2 - South	Making Left Turn	Traffic Sign Support	Speed To Fast For Conditions	US-93	N Pierce Ferry Rd
3519885		6/3/2019 3:21:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3532255		6/26/2019 10:46:00 AM	U 093 0	N Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	3 - East	Going Straight Ahead	Fence	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3542722		8/6/2019 5:30:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Rear End	Intersection T Inter	1 - North	Making Right Turn	Motor Vehicle In Transport	Other	US-93 Non-Cardinal	N Pierce Ferry Rd
3546913		8/16/2019 12:00:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3554538		9/3/2019 10:41:00 AM	U 093 0	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection 4 Way	2 - South	Going Straight Ahead	Ran Off Road Right	Speed To Fast For Conditions	US-93 Non-Cardinal	N Pierce Ferry Rd
3557840		6/11/2019 1:25:00 PM	08N PIERCE FERRY	US-93 Non-Cardinal	40	No Injury	Parked Motor Vehicle	Sideswipe Same Direction	Other	1 - North	Going Straight Ahead	Parked Motor Vehicle	Aggressive Driving	N Pierce Ferry Rd	US-93 Non-Cardinal
3572557		10/14/2019 2:18:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3599594		11/25/2019 4:40:00 PM	08N PIERCE FERRY RD	N Highway 93	45	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Followed Too Closely	N Pierce Ferry Rd	N Highway 93

Appendix C2: Crashes Affected by Alternative 2

Incident ID	Incident Microfilm	Incident Date & Time	Incident On Road	Incident Crossing Feature	Incident Offset	Incident Injury Severity Description	Incident First Harmful Description	Incident Collision Manner	Incident Junction Relation Desc	Unit Travel Direction Desc	Unit Action Desc	Unit Event Sequence Desc1	Person Violation Desc1	Geocode On Road	Geocode Crossing Feature
2940764		3/25/2015 4:33:00 PM	U 093	Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection Non Interchange	3 - East	Making Left Turn	Ran Off Road Left	Speed To Fast For Conditions	US-93	Pierce Ferry Rd
2975571		7/20/2015 10:11:00 AM	U 093 0	Pierce Ferry Rd	0	Possible Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Not Junction Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3041040		1/10/2016 6:12:00 PM	U 093 0	Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Interchange	4 - West	Making Left Turn	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3043605		1/4/2016 12:11:00 PM	U 093	Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Crossover Related	8 - Southeast	Making Left Turn	Traffic Sign Support	Speed To Fast For Conditions	US-93	Pierce Ferry Rd
3066167		3/19/2016 11:26:00 AM	U 093 0	Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	Pierce Ferry Rd
3084919		4/28/2016 10:17:00 AM	U 093 0	Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related Non Interchange	2 - South	Going Straight Ahead	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	Pierce Ferry Rd
3084924		5/5/2016 12:46:00 PM	U 093 0	Pierce Ferry Rd	0	No Injury	Other Non Collision	Single Vehicle	Not Junction Related	1 - North	Making Right Turn	Other Non Collision	Speed To Fast For Conditions	US-93 Non-Cardinal	Pierce Ferry Rd
3085294		5/5/2016 11:38:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Making Left Turn	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3089758		4/21/2016 12:02:00 PM	U 093 0	Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	6 - Northeast	Going Straight Ahead	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	Pierce Ferry Rd
3102469		7/3/2016 3:32:00 PM	U 093 0	Pierce Ferry Rd	0	Possible Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3109083		6/6/2016 4:12:00 PM	08 PIERCE FERRY RD	US-93	25	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related Interchange	3 - East	Making Right Turn	Motor Vehicle In Transport	Speed To Fast For Conditions	N Pierce Ferry Rd	US-93
3117584		7/24/2016 1:40:00 PM	U 093 0	Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	Pierce Ferry Rd
3148135		10/15/2016 4:49:00 PM	08N PIERCE FERRY RD	US-93	42	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related Non Interchange	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Followed Too Closely	N Pierce Ferry Rd	US-93
3160832		11/10/2016 4:20:00 PM	08N PIERCE FERRY RD	US-93 Non-Cardinal	103	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related Non Interchange	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Speed To Fast For Conditions	N Pierce Ferry Rd	US-93 Non-Cardinal
3172733		12/27/2016 2:24:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3186125		1/29/2017 12:02:00 PM	U 093	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection Non Interchange	2 - South	Slowing In Trafficway	Ran Off Road Right	Speed To Fast For Conditions	US-93	N Pierce Ferry Rd
3209826		3/26/2017 12:42:00 PM	U 093	M041	0.82	Suspected Serious Injury	Overturn Rollover	Single Vehicle	Not Junction Related	2 - South	Going Straight Ahead	Overturn Rollover	Speed To Fast For Conditions	US-93	M041
3212449		4/9/2017 2:00:00 PM	U 093	N Pierce Ferry Rd	100	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related Non Interchange	2 - South	Slowing In Trafficway	Motor Vehicle In Transport	Made Improper Turn	US-93	N Pierce Ferry Rd

Collision Type Applicable to Alternative

3223753		5/7/2017 12:30:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3229059		5/17/2017 1:18:00 PM	U 093 0	N Pierce Ferry Rd	0	Possible Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3234114		5/19/2017 10:10:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3240960		6/12/2017 12:05:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3244894		6/24/2017 12:55:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Crossing Road	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3276276		9/20/2017 9:49:00 AM	U 093	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Sideswipe Same Direction	Not Junction Related	2 - South	Slowing In Trafficway	Motor Vehicle In Transport	Unsafe Lane Change	US-93	N Pierce Ferry Rd
3276809		9/25/2017 11:20:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Ran Off Road Left	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3276899		9/17/2017 1:21:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3314678		12/24/2017 2:19:00 PM	U 093 0	N Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3340144		3/1/2018 1:36:00 PM	U 093 0	N Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3354717		4/8/2018 1:11:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Stopped In Trafficway	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3364935		5/3/2018 10:50:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3375530		5/22/2018 2:17:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Non Interchange	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3382763		6/16/2018 1:00:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Overturn Rollover	Single Vehicle	Not Junction Related	3 - East	Going Straight Ahead	Ran Off Road Right	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3385615		6/24/2018 9:42:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Other Non Fixed Object	Single Vehicle	Intersection	1 - North	Avoiding Vehicle Object Pedestrian	Ran Off Road Right	No Improper Action	US-93 Non-Cardinal	N Pierce Ferry Rd
3387465		7/5/2018 6:47:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3387622		6/1/2018 8:42:00 AM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3390998		7/17/2018 10:21:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection 4 Way	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd

3399008		7/25/2018 8:55:00 AM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	1 - North	Making Right Turn	Motor Vehicle In Transport	Speed To Fast For Conditions	US-93 Non-Cardinal	N Pierce Ferry Rd
3406339		8/31/2018 12:18:00 PM	U 093	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection T Inter	2 - South	Making Left Turn	Traffic Sign Support	Speed To Fast For Conditions	US-93	N Pierce Ferry Rd
3411382		8/23/2018 8:49:00 PM	08N PIERCE FERRY RD	US-93 Non-Cardinal	29	No Injury	Animal	Single Vehicle	Not Junction Related	4 - West	Going Straight Ahead	Animal	No Improper Action	N Pierce Ferry Rd	US-93 Non-Cardinal
3414020		8/23/2018 5:30:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Minor Injury	Motor Vehicle In Transport	Sideswipe Same Direction	Intersection T Inter	1 - North	Making Right Turn	Motor Vehicle In Transport	Ran Stop Sign	US-93 Non-Cardinal	N Pierce Ferry Rd
3416191		9/15/2018 7:24:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3456678		12/31/2018 2:27:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3460151		1/13/2019 2:58:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Other	Intersection T Inter	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3463369		1/12/2019 1:59:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3469530		1/28/2019 1:43:00 PM	U 093	N Pierce Ferry Rd	0	No Injury	Other Non Fixed Object	Single Vehicle	Intersection Related	2 - South	Going Straight Ahead	Other Non Fixed Object	No Improper Action	US-93	N Pierce Ferry Rd
3473149		2/11/2019 12:54:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3487607		3/15/2019 10:27:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection Related	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Other	US-93 Non-Cardinal	N Pierce Ferry Rd
3493917		4/8/2019 4:54:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3498970		4/12/2019 11:49:00 AM	U 093	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection	2 - South	Making Left Turn	Traffic Sign Support	Speed To Fast For Conditions	US-93	N Pierce Ferry Rd
3519885		6/3/2019 3:21:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3532255		6/26/2019 10:46:00 AM	U 093 0	N Pierce Ferry Rd	0	Fatal	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	3 - East	Going Straight Ahead	Fence	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3542722		8/6/2019 5:30:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Rear End	Intersection T Inter	1 - North	Making Right Turn	Motor Vehicle In Transport	Other	US-93 Non-Cardinal	N Pierce Ferry Rd
3546913		8/16/2019 12:00:00 PM	U 093 0	N Pierce Ferry Rd	0	Suspected Serious Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd
3554538		9/3/2019 10:41:00 AM	U 093 0	N Pierce Ferry Rd	0	No Injury	Traffic Sign Support	Single Vehicle	Intersection 4 Way	2 - South	Going Straight Ahead	Ran Off Road Right	Speed To Fast For Conditions	US-93 Non-Cardinal	N Pierce Ferry Rd
3557840		6/11/2019 1:25:00 PM	08N PIERCE FERRY RD	US-93 Non-Cardinal	40	No Injury	Parked Motor Vehicle	Sideswipe Same Direction	Other	1 - North	Going Straight Ahead	Parked Motor Vehicle	Aggressive Driving	N Pierce Ferry Rd	US-93 Non-Cardinal
3572557		10/14/2019 2:18:00 PM	U 093 0	N Pierce Ferry Rd	0	No Injury	Motor Vehicle In Transport	Angle (Front To Side)(Other Than Left Turn)	Intersection T Inter	3 - East	Going Straight Ahead	Motor Vehicle In Transport	Failed To Yield Right Of Way	US-93 Non-Cardinal	N Pierce Ferry Rd

3599594		11/25/2019 4:40:00 PM	08N PIERCE FERRY RD	N Highway 93	45	No Injury	Motor Vehicle In Transport	Rear End	Intersection Related	4 - West	Going Straight Ahead	Motor Vehicle In Transport	Followed Too Closely	N Pierce Ferry Rd	N Highway 93

Appendix D – IHSDM Results

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

September 30, 2020

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

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Report Overview

Report Generated: Sep 30, 2020 2:06 PM
Report Template: System: Single Page, 508 Compliant [System] (sscpm5, Sep 18, 2020 1:32 PM)

Evaluation Date: Wed Sep 30 13:30:34 MST 2020
IHSDM Version: v15.0.0 (Oct 31, 2019)
Site Set Crash Prediction Module: v|ModuleInfo.moduleVersion| (|ModuleInfo.moduleDate|)

User Name: daniel.iwicki
Organization Name: Kimley-Horn
Phone: 8477911464
E-Mail: daniel.iwicki@kimley-horn.com

Project Title: US 93 and Pierce Ferry Road
Project Comment: 9/22/2020
Project Unit System: U.S. Customary

Site Set: US 93 and Pierce Ferry Road (Copy 1)
Site Set Comment: Copied from US 93 and Pierce Ferry Road (v1)
Site Set Version: v1

Evaluation Title: Evaluation 2
Evaluation Comment: Created Wed Sep 30 13:30:21 MST 2020
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
First Year of Analysis: 2020
Last Year of Analysis: 2049
Empirical-Bayes Analysis: Site-Specific
Crash History Siteset: US 93 and Pierce Ferry Road (Copy 1)
Crash History Siteset Comment: Copied from US 93 and Pierce Ferry Road (v1)
Crash History Siteset Version: 1
First Year of Observed Crashes: 2015
Last Year of Observed Crashes: 2019

Disclaimer Regarding Crash Prediction Method

IMPORTANT NOTICE ABOUT COMPARING RESULTS FROM HIGHWAY SAFETY MANUAL FIRST EDITION (2010) MODELS TO RESULTS FROM NEW MODELS DEVELOPED UNDER NCHRP PROJECTS 17-70 AND 17-58

Since the publication of the Highway Safety Manual - First Edition (HSM-1), in 2010 by the American Association of State Highway and Transportation Officials (AASHTO), multiple research efforts have been undertaken through the National Cooperative Highway Research Program (NCHRP) to develop safety performance models for road segment and intersection facility types that were not initially reflected in the HSM-1, in order to expand the breadth and depth of the HSM in the future.

The IHSDM Crash Prediction Module (CPM) is intended as a faithful implementation of HSM Part C predictive methods. As NCHRP projects to develop new predictive methods for the HSM are completed, FHWA works to incorporate the new methods into IHSDM, sometimes in advance of publication in the HSM. The following new crash predictive methods have been accepted by NCHRP project panels and incorporated into IHSDM, while pending AASHTO's approval for incorporation into a future edition of the HSM:

- Roundabouts: completed in 2018 under NCHRP Project 17-70, the new methods will provide improved outcomes for the safety analysis of roundabouts.
- 6+ lane and one-way urban/suburban arterials (including models for segments and intersections): completed under NCHRP Project 17-58.

However, in the absence of local calibration factors (see HSM-1 Part C, Appendix A for guidance on calibration of the predictive models), it is neither appropriate nor advisable to directly compare the results from new models (from NCHRP Projects 17-58 and 17-70) to results from HSM-1 models, as the models were not calibrated to the same base state data sets, and consequently can produce unexpected results. If local calibration factors are available and applied to both new models and HSM-1 models, then it may be appropriate to directly compare the results.*[Note: Work being performed under NCHRP Project 17-72 (Update of Crash Modification Factors for the Highway Safety Manual) is expected to re-calibrate many of the old (HSM-1) and new (e.g., NCHRP 17-70) models to data from a single (or small number of) states, that would allow results from all models to be directly compared.]*

The models produced for NCHRP Project 17-70 have independent value in terms of informing the design of a roundabout and assessing the effects of different design characteristics on the expected safety performance of a roundabout.

The HSM-1 interim method previously included in IHSDM for evaluating roundabouts on urban/suburban arterials (i.e., evaluating an existing intersection and then applying a Crash Modification Factor for replacing the existing intersection with a roundabout) has been deactivated in IHSDM, to minimize any confusion with the new roundabout methodology.

Section Types

Rural MultiLane Site Set CPM Evaluation

Site Type

Type: 3ST
Calibration Factor: 1

Table 1. Observed Crashes Used in the Evaluation (3ST)

Year	Observed Crashes	Total Crashes Used	FI Crashes	FI no/C Crashes	PDO Crashes
2015	2	2	1	0	1
2016	13	13	3	2	8
2017	12	12	1	4	7
2018	15	15	11	3	1
2019	15	15	0	4	11
All Years	57 [1]	57	16	13	28

Footnotes

[1] Note: Observed crash data that does not comply with the associated CPM model requirements may not be used in EB processing.

Table 2. Evaluation and Crash Data (CSD) (if applicable) Intersection Sites

Site No.	Type	Highway	Site Description	Major AADT	Minor AADT	Number of Approaches with Left-Turn Lanes	Number of Approaches with Right-Turn Lanes	Skew Angle 1 (deg)	Presence of Lighting
1	3ST	CSD:US 93	T-Intersection	2015-2019: 15525	2015-2019: 1057	1	1	0.0000	yes
1	3ST	US 93	T-Intersection	2020: 15525; 2021: 15900; 2022: 16276; 2023: 16652; 2024: 17028; 2025: 17404; 2026: 17780; 2027: 18156; 2028: 18532; 2029: 18908; 2030: 19283; 2031: 19659; 2032: 20035; 2033: 20411; 2034: 20787; 2035: 21163; 2036: 21539; 2037: 21915; 2038: 22291; 2039: 22667; 2040: 23042; 2041: 23418; 2042: 23794; 2043: 24170; 2044: 24546; 2045: 24922; 2046: 25298; 2047: 25674; 2048: 26050; 2049: 26426	2020: 1057; 2021: 1068; 2022: 1079; 2023: 1090; 2024: 1101; 2025: 1112; 2026: 1124; 2027: 1135; 2028: 1146; 2029: 1157; 2030: 1168; 2031: 1179; 2032: 1191; 2033: 1202; 2034: 1213; 2035: 1224; 2036: 1235; 2037: 1246; 2038: 1258; 2039: 1269; 2040: 1280; 2041: 1291; 2042: 1302; 2043: 1313; 2044: 1325; 2045: 1336; 2046: 1347; 2047: 1358; 2048: 1369; 2049: 1381	1	1	0.0000	yes

Table 3. Expected Crash Frequencies and Rates by Site

Site No.	Type	Highway	Site Description	Total Expected Crashes for Evaluation Period	Total Predicted Crashes for Evaluation Period	Expected Total Crash Frequency (crashes/yr)	Expected FI Crash Frequency (crashes/yr)	Expected FI no/C Crash Frequency (crashes/yr)	Expected PDO Crash Frequency (crashes/yr)	Predicted Total Crash Frequency (crashes/yr)	Predicted FI Crash Frequency (crashes/yr)	Predicted FI no/C Crash Frequency (crashes/yr)	Predicted PDO Crash Frequency (crashes/yr)	(Expected - Predicted) Total Crash Frequency (crashes/yr)	(Expected - Predicted) FI Crash Frequency (crashes/yr)	(Expected - Predicted) FI no/C Crash Frequency (crashes/yr)	(Expected - Predicted) PDO Crash Frequency (crashes/yr)	Expected Intersection Travel Crash Rate (crashes/million veh)	Intersection Crash Rate (crashes/yr)
1	3ST	US 93	T-Intersection	357.753	40.351	11.9251	3.6947	0.1687	8.2304	1.3450	0.4141	0.2330	0.9309	10.5801	3.2805	-0.0643	7.2995	1.51	11.9251
		Total	Total	357.753	40.351	11.9251	3.6947	0.1687	8.2304	1.3450	0.4141	0.2330	0.9309	10.5801	3.2805	-0.0643	7.2995	1.51	11.9251

Table 4. Predicted Crash Frequencies by Year (3ST)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	0.90	0.28	31.581	0.62	68.419
2021	0.93	0.29	31.519	0.64	68.481
2022	0.96	0.30	31.460	0.66	68.540
2023	0.99	0.31	31.401	0.68	68.599
2024	1.02	0.32	31.345	0.70	68.655
2025	1.04	0.33	31.290	0.72	68.710
2026	1.07	0.34	31.237	0.74	68.763
2027	1.10	0.34	31.184	0.76	68.816
2028	1.14	0.35	31.133	0.78	68.867
2029	1.17	0.36	31.084	0.80	68.916
2030	1.20	0.37	31.035	0.82	68.965
2031	1.23	0.38	30.987	0.85	69.013
2032	1.26	0.39	30.942	0.87	69.058
2033	1.29	0.40	30.896	0.89	69.104
2034	1.32	0.41	30.852	0.91	69.148
2035	1.35	0.42	30.808	0.94	69.192
2036	1.39	0.43	30.765	0.96	69.235
2037	1.42	0.43	30.724	0.98	69.276
2038	1.45	0.45	30.683	1.00	69.317
2039	1.48	0.45	30.643	1.03	69.357
2040	1.51	0.46	30.604	1.05	69.396
2041	1.55	0.47	30.566	1.07	69.434
2042	1.58	0.48	30.528	1.10	69.472
2043	1.61	0.49	30.490	1.12	69.510
2044	1.65	0.50	30.455	1.15	69.545
2045	1.68	0.51	30.419	1.17	69.581
2046	1.72	0.52	30.384	1.19	69.616
2047	1.75	0.53	30.349	1.22	69.651
2048	1.78	0.54	30.315	1.24	69.685
2049	1.82	0.55	30.283	1.27	69.717
Total	40.35	12.42	30.787	27.93	69.213
Average	1.34	0.41	30.787	0.93	69.213

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 5. Expected Crash Frequencies by Year (3ST)

Year	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
2020	7.98	2.54	31.780	5.45	68.227
2021	8.23	2.61	31.719	5.62	68.288
2022	8.49	2.69	31.659	5.80	68.347
2023	8.75	2.76	31.600	5.98	68.406
2024	9.01	2.84	31.543	6.17	68.462
2025	9.27	2.92	31.488	6.35	68.517
2026	9.53	3.00	31.435	6.54	68.570
2027	9.80	3.08	31.382	6.72	68.622
2028	10.07	3.15	31.330	6.91	68.673
2029	10.34	3.23	31.280	7.10	68.723
2030	10.61	3.31	31.231	7.29	68.771
2031	10.88	3.39	31.183	7.49	68.819
2032	11.16	3.47	31.137	7.68	68.864
2033	11.44	3.56	31.092	7.88	68.909
2034	11.71	3.64	31.047	8.08	68.954
2035	12.00	3.72	31.003	8.28	68.997
2036	12.28	3.80	30.960	8.48	69.040
2037	12.56	3.88	30.918	8.68	69.082
2038	12.85	3.97	30.878	8.88	69.121
2039	13.14	4.05	30.837	9.09	69.162
2040	13.43	4.14	30.798	9.29	69.201
2041	13.72	4.22	30.759	9.50	69.239
2042	14.02	4.31	30.721	9.71	69.277
2043	14.31	4.39	30.683	9.92	69.314
2044	14.61	4.48	30.648	10.13	69.350
2045	14.91	4.56	30.611	10.35	69.385
2046	15.21	4.65	30.576	10.56	69.420
2047	15.51	4.74	30.541	10.78	69.455
2048	15.82	4.83	30.507	10.99	69.489
2049	16.13	4.91	30.474	11.21	69.521
Total	357.75	110.84	30.982	246.91	69.018
Average	11.93	3.69	30.982	8.23	69.018

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 6. Comparing Predicted and Expected Crashes for the Evaluation Period (3ST)

Scope	Total Crashes	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)
Predicted	40.35	12.42	30.787	27.93	69.213
Expected	357.75	110.84	30.982	246.91	69.018
Expected - Predicted	317.40	98.42		218.99	
Percent Difference	88.72	88.79		88.69	

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Expected 3ST Crash Type Distribution

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Intersection	Angle Collision	40.90	11.4	48.89	13.7	94.09	26.3
Intersection	Head-on Collision	4.77	1.3	4.94	1.4	10.38	2.9
Intersection	Other Collision	7.09	2.0	10.86	3.0	18.60	5.2
Intersection	Rear-end Collision	27.38	7.7	77.78	21.7	103.39	28.9
Intersection	Sideswipe	6.43	1.8	41.73	11.7	47.58	13.3
Intersection	Single	24.27	6.8	60.25	16.8	83.71	23.4
	Total Crashes	110.84	31.0	244.44	68.3	357.75	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Appendix E – Technical Advisory Committee

PROJECT DEVELOPMENT ON-CALL
2018-006.11
T0230 01L – US 93 Pierce Ferry Road Feasibility Study
Mohave County & Northwest District

Project Management Team Meeting No. 1 / Kickoff Meeting NOTES

Meeting Date:	April 30, 2020
Meeting Time:	1:00pm – 2:00pm
Location:	Teleconference call
Attendees:	Tricia Brown – ADOT ~ Project Manager Steven Latoski – Mohave County Leslie Henley – Mohave County Brent Crowther – Kimley – Horn ~ Consultant Project Manager Allen Hathcock – Kimley-Horn ~ Roadway
Prepared by:	Brent Crowther

** *Action items from the meeting are shown in* bold **

1. Introductions and Project Team (Tricia Brown, ADOT Project Manager)
    - Representatives from ADOT, Mohave County (County), and the Consultant Team, Kimley-Horn (K-H) introduced themselves.
2. Project Overview (Brent Crowther – Kimley-Horn)
    - Project goals were outlined by B. Crowther. These are to assess the feasibility of a grade separated improvement to the intersection at US 93 and Pierce Ferry Road, to improve safety of the southbound to eastbound left turn movement which has had a series of fatal crashes.
    - As the project progresses through development, the project management team will meet for progress meetings. These meetings will scheduled to follow memorandum submittals so that comments and resolutions can be discussed. Stakeholder meeting will also be held as needed.
    - B. Crowther reviewed the printed scope of work. Steve Latoski stated that the need is to focus on grade separation solutions only, and that he believes ADOT will only support these types of alternatives. Tricia Brown agreed and stated that ADOT Traffic Safety is designing interim solutions that may improve safety utilizing, signage or technology, in conjunction with the current shoulder widening improvements project.
    - Areas of work not within the scope of the feasibility study
        - ADA Improvements
        - Drainage and hydraulic Design
        - Landscape architecture design
        - Structure design
        - Signals, lighting
        - Environmental clearance & permitting
        - Geotechnical investigations
        - Pavement design
        - Construction phasing/sequencing
    - The project schedule was reviewed with the team as shown in section six below. All agreed upon the schedule. Based on the project schedule, the revised recommended alternative will be completed in September to share with the public

and garner their input. This schedules' critical path item is to complete the opinion of probable cost for the preferred alternative in the fall so that ADOT can consider adding the project to the 5-Year Plan in January. The final report would be delivered at the end of January.

3. Discipline Discussions – Data Gathering and Information Needed

- Traffic data
  - B. Crowther explained that traffic volumes are down 40-60% of what they were pre COVID-19 outbreak, and so taking or gathering new counts is not recommended. He asked Mohave County if there are any historic counts along Pierce Ferry Road. They confirmed the presence of a permanent counting station on Pierce Ferry Road east of the project limits. ADOT also has a count station on US 93 in the area. Brent asked the County for the data from their counter. **K-H to research this information from WACOG TDMS.** K-H recommended for the individual movements, that they do traffic volume estimating and projections to produce volumes. The County stated that the volumes are not the driver for this project, but the crash information is. Therefore, the County confirmed to not recommend doing counts but to move the project forward with projections as acceptable.
  - Turning movement counts available (pre-COVID19) – None are available.
- Crash data
  - Available from ACIS – B. Crowther shared preliminary crash data. Angle crashes are the highest type of crash as anticipated by the County. Brent inquired if 5 fatal crashes was accurate, and the County confirmed and noted that the number of fatalities is much higher, as there have been several multiple fatality crashes. Les Henley mentioned that there were 8 in one crash a few years ago.
  - 5-years crash data to be reviewed
  - Supplemental crash data (e.g. police reports) will be requested from ADOT. Police reports can shed additional light on the reason for the fatal crashes at this intersection. It may describe more detail concerning line of sight issue, trying gage velocity of traffic. **B. Crowther will send the list of incident numbers to Tricia for her to pull information about each key accident.**
- Survey and mapping
  - ADOT
    - Obtained survey data for US 93 from ADOT. B. Crowther shared a screenshot of the topo over aerial and asked if the survey seemed sufficient for the project needs. Allen Hathcock explained that anything outside this area, the existing surface could be projected for earthwork number pretty easily, so the team agreed no further survey is anticipated/warranted.
  - Mohave County
    - Record Drawing information – **County will research if they have any Asbuilts for Pierce Ferry Road.**
    - GIS data / property ownership – Mohave county to provide parcel information.

- Aerial imagery – County recommended that K-H visit their GIS site – and check the base maps that are available.

- Utility Coordination
  - Blue Stake
    - ADOT-Type: ELECTRIC
    - ADOT-Type: CULVERTS, STORM DRAINS
    - FRONTIER COMMUNICATIONS Type: TELEPHONE
    - MOUNT TIPTON WATER COMPANY Type: WATER
    - UNISOURCE ENERGY SERVICES (ELECT) - Type: ELECTRIC
  - No additional facilities were known by County or ADOT.
  - Utilities on plans
    - K-H will include utility information from maps received from utility companies. No designation will be done for this project.
- Available plans
  - ADOT shoulder widening project – **T. Brown to request internally within ADOT if the CAD files for this project could be made available.**
  - I-11 Corridor Study – **B. Crowther will search or Typical sections and Interchange locations/information** and will contact T. Brown to help if needed.

4. Alternatives Discussion

- Alternatives development – A. Hathcock verbally shared the two configurations below. Discussions about potential pros and cons for each were discussed.
  - 2-grade separated alternatives
    - Fly-over
      - SB ramp connection
    - ½ interchange
      - Raise NB profile over Pierce Ferry Road with off-ramp to Pierce Ferry Road
- Alternatives evaluation and selection criteria will be established after alternatives are developed initially.
- Recommendations from the County as potential evaluation criteria were: effectiveness, cost, impacts to ROW, ability to be incorporated into future interchange, and amount of “throw away”.
- The County recommended applying a weighted average system to the process.
- Major utility relocations might become Alternative “deal-breakers”
- Right-of-Way
  - ADOT will provide exist ROW Files
  - Design will limit impact to ROW, but ROW cost will be key factor for project cost and may impact alternative selection

5. Stakeholders

- Mohave County

- ADOT's Northwest District
- Utility Companies
- Property Owners
- Hualapai Tribe

6. Schedule

Milestone	Date
Project Kickoff Meeting / PMT Mtg No. 1	4/30/2020
Draft Tech Memo No. 1 (Alternatives Development)	6/12/2020
PMT Mtg. No. 2	6/15/2020*
Stakeholder Mtg No. 1	7/13/2020*
PMT Mtg. No. 3	8/3/2020*
Draft Tech Memo No. 2 (Recommended Alternative)	8/28/2020
Stakeholder Mtg No. 2	9/28/2020*
Draft Feasibility Report	12/4/2020
Final Feasibility Report	1/22/2020

**denotes week of*

7. Next Steps

- Data collection
- Alternatives development
- June 15, 2020 (week of)

PROJECT DEVELOPMENT ON-CALL
2018-006.11
T0230 01L – US 93 Pierce Ferry Road Feasibility Study
Mohave County & Northwest District

Project Management Team Meeting No. 2 / Progress Meeting

Meeting Date:	July 7, 2020
Meeting Time:	2:00 pm – 3:00 pm
Location:	Teleconference call
WebEx:	https://meet.google.com/ois-ujce-ask
Call-In Number:	(833) 779-7795
Conference Code:	799619495#

B. Crowther welcomed attendees to the meeting. He reviewed the agenda items. Follows are a summary items from the discussion, with a focus on action items.

1. Review Tech Memo No. 1

Traffic Analysis

B. Crowther and D. Iwicki explained the justification for a K-factor of 12%. D. Iwicki stated that ADOT had not collected 24-hour counts (that are in the TDMS) for several years, and the 12% was carried forward from several years ago.

Action: Add additional context to the selection of the 12% K-factor in the Traffic Report.

It was commented that at 3.6% growth rate may be high.

Action: KH to review 3.6% growth rate to determine if a less-aggressive rate is reasonable. It was suggested that a 2% growth rate may be more reasonable.

A question was asked if Streetlight Data was commonly accepted amongst the traffic engineering profession. B. Crowther responded that the Working Paper attempted to demonstrate that the 24-hour count from Streetlight Data was reasonably similar to 24-hour data reported in ADOT TDMS. The team recognizes that it is not a perfect data set and is adjusted because it is a sample. However, due to lack of other turning movement count data, we feel it provides a reasonable estimate of turning movement counts at the site. *Note: Streetlight has published data validation white papers that are available to review*.

Crash Analysis

S. Latoski noted that the roadway to Grand Canyon West entrance from US 93/PFR was not fully paved until 2014. After pavement completion, there was a significant increase in travelers from the Las Vegas area as it was marketed as a day trip.

B. Crowther noted that all the fatal crashes were southbound US 93 vehicles making a left onto PFR and failing to yield right of way or just driving through stop sign and colliding with vehicle traveling northbound on US 93. 4 of the 5 incidents involved foreign (Chinese) nationalists, people unfamiliar with the roadway.

It was noted that changes are being made to the intersection in August. Improvements will eliminate the double turn movement made by southbound left from US 93 to PFR by creating a separate left turn lane that bring vehicles closer to the northbound lanes before turning left. K. Wilcoxon provided design plans.

Discussion of Alternatives

B. Crowther reviewed comments received on the developed alternatives. The three developed alternatives are:

- Alternative 1 – Half TI, Northbound US 93 Over Pierce Ferry Road
- Alternative 2 – Full TI, Piece Ferry Road Over US 93
- Alternative 3 – Flyover Ramp, Southbound US 93 to Pierce Ferry Road

Actions:

- *TAC input is that alternatives 1 and 3 will be further explored. Alternative 2 will be discarded.*
- *Alternative 1:*
  - *Extend access control and remove the driveways at the gas station if needed. Maintain full ADOT access control. Note that spreading the ramps so that there is 400' between intersections (per RDG), with full access limits will impact the service station – at a minimum reconfigure driveway entrances, and likely require a full-take of the service station.*
  - No curb and gutter or sidewalk are needed in this rural area.
- *Alternative 3,*
  - *Lane widths for alternative 3 (with a 25 mph design speed around the curve) will need to be wider due to large vehicles on turning roadway.*
  - Modify to provide a merge lane with PFR. Will not require access control on PFR since this is a bypass configuration. Note that the merge lane configuration will double the size of the footprint and bypass gas station access points.

It was noted that the service station caters to northbound vehicles and vehicles leaving Grand Canyon West area. The TAC briefly discussed a comment that asked if relocating PFR had been considered. TAC discussion was that this would not eliminate the issue with the SB left turn.

2. Stakeholders

Two rounds of stakeholder meetings are identified in the contract. The TAC briefly discussed how stakeholder outreach should proceed (in-person meetings, vs. individual telephone outreach). B. Crowther and T. Brown to discuss further. T. Brown to discuss with M. Beggs.

Other suggestions are to reach out to property owners to discuss project individually with them or send a newsletter with project information.

Project stakeholders include:

- Mohave County
- ADOT's Northwest District
- Utility Companies
- Property Owners
- Hualapai Tribe

3. Next Steps

- Revised TM No. 1
- Alternatives Evaluation: right of way, cost estimate, b/c analysis
- Stakeholder Meeting
- Refine Conceptual Alternative 1 and 3
- PMT Meeting No. 3

PROJECT DEVELOPMENT ON-CALL
2018-006.11
T0230 01L – US 93 Pierce Ferry Road Feasibility Study
Mohave County & Northwest District

Project Management Team Meeting No. 1 / NOTES

Meeting Date:	August 28, 2020
Meeting Time:	2:30pm – 3:00pm
Location:	Teleconference call
Attendees:	Tricia Brown – ADOT ~ Project Manager Steven Latoski – Mohave County Les Henley – Mohave County Brent Crowther – Kimley–Horn ~ Consultant Project Manager Dan Iwicki – Kimley–Horn ~ Project Analyst

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1. Discussion of Alternatives Evaluation

Tech Memo No. 1 includes two interchange alternatives that will be evaluated: a compact diamond interchange (half TI) and Alternative 2 (flyover ramp).

Discussion of alternatives process:

- S. Latoski reviewed his proposed process to conduct a benefit analysis for each alternative. Benefits are defined by the potential crash reduction. The benefits evaluation should be defined for both alternatives.

- B. Crowther stated that costs would be defined by impacts. For example, impacts to the service station from Alternative 1.

- S. Latoski suggested that we may want to consider hiring an appraiser to estimate the cost of acquiring a portion of or all of the service station parcel. S. Latoski noted that the propane business is separate from the service station. Impacts to the tanks would result on a full acquisition of the propane business.

- B. Crowther noted that Alternative 2 avoids impact to service station but is likely not compatible with I-11 because it only addresses one movement. S. Latoski stated that we can't be sure that Alternative 2 is incompatible with I-11, as the additional ramps could possibly be constructed without demolition of the fly-over option.

- S. Latoski stated that Alternative 2 addresses the crash issue; impacts will be driven by land development and ability to accommodate the fly over ramp design.

- B. Crowther stated that we will conduct the evaluation iteratively. Kimley-Horn will first estimate the benefits, costs, and identify potential fatal flaws.

2. Discussion of Public Outreach

T. Brown about public engagement next steps. B. Crowther stated that it would be following the evaluation of alternatives, but we can post the existing materials on a website created by ADOT.

B. Crowther will proceed to prepare a project fact sheet and vicinity map. S. Latoski asked if a mailer might be considered to the adjacent property owners, as there are so few in the vicinity.

T. Brown stated that decision previously was to post to the website, but that ADOT may view it as premature to notify property owners of the alternatives. She stated that if we want to do mailers, etc. we should schedule a call with Michelle Beggs. B. Crowther will schedule a conversation with Michelle, Tricia, Steven, and Les.

S. Latoski emphasized that getting information out there will help the project to gain traction with elected officials. At the very least, email them to notify about the project, distribute a press release through Mohave County, email (if available), etc. Elected officials need to be aware of the project. T. Brown stated that the original plan was to post on the website, and not to do a mailer.

S. Latoski stated that it's important to make elected officials aware. He asked if we can we consent to a brief press release that we can put out, couple paragraphs describing project and website? T. Brown stated that we need to engage ADOT communications in this discussion.

3. Action Items / Next Steps

- B. Crowther: prepare fact sheet and vicinity map for website.
- B. Crowther: set up meeting with Michelle, Tricia, Steven, Les to discuss public outreach.
- T. Brown: inquire if there is budget capacity for appraiser, consider if ADOT would like to proceed with this.
- B. Crowther: Proceed with evaluation (benefits, cost, fatal flaws, etc.)

Distribution:	All attendees and invitees
Attachments	None
Date Issued:	August 25, 2020

NOTE TO RECIPIENTS: These meeting minutes record Kimley-Horn's understanding of the meeting and intended actions arising therefrom. Your agreement that the notes form a true record of the discussion will be assumed unless adverse comments are received in writing within five days of receipt

PROJECT DEVELOPMENT ON-CALL
2018-006.11
T0230 01L – US 93 Pierce Ferry Road Feasibility Study
Mohave County & Northwest District

Ramp Design Speed Discussion NOTES

Meeting Date:	November 23, 2020
Meeting Time:	10:00am – 10:30am
Location:	Teleconference call
Attendees:	Tricia Brown – ADOT ~ Project Manager Steven Latoski – Mohave County Reed Henry - ADOT Brent Crowther – Kimley-Horn ~ Consultant Project Manager Allen Hathcock – Kimley-Horn ~ Roadway Daniel Iwicki – Kimley-Horn ~ Traffic

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** *Action items from the meeting are shown in* bold **

1. Project Overview (Brent Crowther)

- B. Crowther provided a project overview. The purpose of the project is to assess the feasibility of a grade separated improvement to the intersection at US 93 and Pierce Ferry Road, to improve safety of the southbound to eastbound left turn movement which has had a series of fatal crashes.

- Two alternatives have been moving forward, Alternative 1 (Half TI) and Alternative 2 (Flyover Ramp).

- Alternative 2 (Flyover Ramp) was designed with 30 MPH for the controlling portion of the curve.

2. Discuss Design Speed of Alternative 2 and Comparing Alternatives

- B. Crowther – What are thoughts and inputs of 30 MPH design speed?

- R. Henry – This is future corridor for I-11 and assuming the alignment meets 75 MPH design speed, when it becomes controlled access it will likely have a design speed of 75 MPH. 30 MPH design speed does meet requirements of the RDG and Green Book.

- R. Henry – Would not want to build something now and end up scrapping it later. Seems like Alternative 1 is a better solution.

- T. Brown – Does it seem imbalanced if the layout of Alternative 2 is not accommodating I-11, would the design speed of Alternative 1 need to be increased to fit with I-11?

- S. Latoski – There looks to be traction for this project to move forward to design and construction. With a 30-year Benefit-Cost Analysis both alternatives return good results.

We cannot predict the future interchange with I-11. It is plausible that this could be a 30-year improvement and I-11 buildout may incorporate or scrap and reconstruct. Need to balance cost now and service life.

- T. Brown –Should Alternative 1 be viewed as a long-term alternative, whereas Alternative 2 as a shorter shelf-life alternative?

- A. Hathcock – This difference can be viewed as one of the key differentiators between alternatives and may lead to selection of one alternative over another. The question is if Alternative 2 should be updated to larger footprint or remain at a 30 MPH design speed consistent with the current roadway and near-term.

- R. Henry – There would appear to be some benefit to construction and traffic control with Alternative 2. When I-11 is completed, this interchange would likely require a 40-mph design speed or request a design exception.

- R. Henry – We can keep the 30 MPH but need to discuss it and the effects in the report.

- T. Brown – If the interstate is completed, a full TI would be required, and the ramp would come out. It would be difficult to improve Alternative 2 to be consistent with I-11 criteria.

- A. Hathcock – I-11 would likely require the flyover ramp to be removed and replaced with a diamond TI.

- R. Henry – Agree, difficult to put a northbound off ramp with Alternative 2.

- T. Brown – That needs to be captured in report.

- B. Crowther – Note that Alternative 2 was designed to be a lower-cost alternative. However, we are not seeing the advantages of the lower cost option versus the diamond TI. Increasing the design speed to 40 mph would increase the cost and result in fewer benefits for Alternative 2. In addition, Alternative 2 addresses fewer turning movements as compared to Alternative 1. Are we ready state that Alternative 1 is recommended alternative, considering the concerns in Alternative 2 with I-11 compatibility, the off ramp, and other movements being accommodated?

- S. Latoski – Supports moving forward with Alternative 1 as the recommended, as long as we also show Alternative 2 in the report. Suggest we not use the term “I-11 compatibility” but use “compatible with standard interchange design for an interstate.”

- T .Brown – FHWA will be looking for alternatives to address the future I-11. That does not need to be the only criteria but needs to be part of it.

- B. Crowther – Are we all in support of moving forward with Alt 1, but keeping Alt 2 in report and discussing the challenges?

- All – Consensus was to move forward with Alternative 1 as recommended alternative.

Appendix F – News Release and Study Fact Sheet

Project No. T0230 01L | Federal Project No. MMO-0(222)T

US 93 AT PIERCE FERRY ROAD FEASIBILITY STUDY

ADOT
U.S Department of Transportation
Federal Highway Administration

SCHEDULE:

The Draft Final Report will be completed in October 2020, with the Final Report completed in January 2021.

BACKGROUND

Mohave County and the Arizona Department of Transportation initiated the US 93 at Pierce Ferry Road Feasibility Study to evaluate potential improvements to the intersection of US 93 and Pierce Ferry Road in Mohave County, Arizona.

US 93 connects Wickenburg, Arizona to the Las Vegas metropolitan area. The US 93 and Pierce Ferry Road (County Route 25) intersection (study area) is located at MP 41.8, approximately 25 miles northwest of Kingman, Arizona in Mohave County. The intersection is a primary gateway to Grand Canyon West and is heavily traveled by international visitors, tour buses, and passenger vehicles.

Several multi-vehicle crashes have occurred at the intersection during the five-year period from 2015-2019, with five fatal crashes and nine serious injury crashes. Several of the crashes had multiple fatalities.

All but two of the crashes were angle crashes (T-bone) in which a southbound vehicle on US 93 was attempting to make a left turn eastbound to Pierce Ferry Road and collided with a vehicle that was traveling on northbound US 93. A review of police reports shows that vehicles turning onto Pierce Ferry Road either ran the median stop sign or underestimated the available gap and speed of the northbound vehicle.

PROJECT GOALS

The US 93 at Pierce Ferry Road Feasibility Study will evaluate and recommend potential improvements to reduce the number and severity of crashes at this intersection. Two alternatives are proposed.

Alternative 1 (Half-Traffic Interchange) removes the conflict between vehicles making a left turn from southbound US 93 to eastbound Pierce Ferry Road, and those traveling northbound on US 93, by elevating the northbound lanes of US 93 over Pierce Ferry Road. A new bridge would be constructed for northbound US 93 over Pierce Ferry Road. New ramps would be installed: an off-ramp connecting US 93 northbound to Pierce Ferry Road and an on-ramp connecting Pierce Ferry Road to US 93 northbound.

Alternative 2 (Fly-Over Ramp) removes the conflict between vehicles making a left turn from southbound US 93 to eastbound Pierce Ferry Road, and those traveling northbound on US 93, by elevating the exiting southbound traffic over US 93 and providing direct access to Pierce Ferry Road. The flyover ramp bridge will be a curved one-lane structure.

PROJECT ACTIVITIES

US 93 at Pierce Ferry Road Feasibility Study project activities include:

- Analyze crash and traffic volume data.
- Develop and evaluate conceptual grade-separation alternatives.
- Assess the benefits and costs of each alternative.
- Select and refine a recommended alternative.
- Prepare a feasibility report to document findings.

For additional information, visit *https://azdot.gov/projects/northwest-district-projects/us-route-93-corridor-projects* or contact:

Tricia Brown, P.E.
ADOT Project Management Group
tbrown2@azdot.gov
602.712.7046

Crowther, Brent

From: Michele Beggs <mbeggs@azdot.gov>
Sent: Wednesday, September 30, 2020 3:55 PM
To: Steven Latoski; Les Henley (Mohave County); Crowther, Brent; Tricia Brown
Cc: Todd Steinberger; Nathan Escoffier
Subject: Fwd: Courtesy Copy: Study underway to address potential safety improvements at US 93 and Pierce Ferry Road intersection in Mohave County

Categories: External

Good afternoon all: the study information has been posted to the project site https://azdot.gov/US93PierceFerry , emailed to regional media and US 93 stakeholder list.
Thank you for your help.
Sincerely,
Michele

ADOT

SHARE

Study underway to address potential safety improvements at US 93 and Pierce Ferry Road intersection in Mohave County

Mohave County and the Arizona Department of Transportation have initiated a feasibility study to evaluate potential safety improvements to the intersection of US 93 and Pierce Ferry Road.

The US 93 and Pierce Ferry Road intersection (County Route 25, milepost 42) is located approximately 25 miles northwest of Kingman. It is a primary gateway to Grand Canyon West and Lake Mead National Recreation Area and serves a high volume of tourists year-round as well as the communities of Dolan Springs and Meadview.

The project team is working on a draft report, which is expected to be completed in October 2020. Initial study information, including the Technical Working Paper #1, is posted https://azdot.gov/US93PierceFerry.

The study's final feasibility report is expected to be completed in January 2021, and will be posted to the project site. The final report will include:

- Traffic engineering evaluation of crash and traffic volume data.
- Conceptual improvement alternatives, including engineering analysis of monetized benefits and costs.

- A recommended improvement alternative to provide physical separation of traffic movements – by way of ramp(s) of similar grade separation – that may significantly reduce the likelihood of future crash occurrences at the study location.

*Schedules are subject to change based on weather and other unforeseen factors. For more information, please call the ADOT Bilingual Project Information Line at 855.712.8530 or go to azdot.gov/contact and select **Projects** from the drop-down menu. For real-time highway conditions statewide, visit ADOT's Traveler Information Site at www.az511.gov, follow ADOT on Twitter (@ArizonaDOT) or call 511, except while driving.*

To plan your trip, get travel times or see ADOT cameras, download the AZ 511 app.

Download the free ADOT Alerts app and know when unplanned, major events are impacting traffic near you.

Visit us on social media on Facebook, Twitter, YouTube, Flickr or the ADOT blog.

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Arizona Department of Transportation
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mbeggs@azdot.gov

ADOT | Arizona Department of Transportation
Our True North: *Safely Home*

Appendix G – StreetLight Traffic Volume Data

Day Type

1: Weekday (Tu-Th)

TURNING MOVEMENT COUNTS - ORIGINAL STREELIGHT DATA

				Pierce Ferry Road WB			US 93 South Leg NB			US 93 North Leg SB			
Day Part	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	Total
00: All Day (12am-12am)	-	-	-	370	-	687	-	7,035	530	976	7,005	-	16,603
01: 6am-7am (6am-7am)	-	-	-	25	-	3	-	145	31	13	176	-	393
02: 7am-8am (7am-8am)	-	-	-	9	-	6	-	196	11	26	302	-	550
03: 8am-9am (8am-9am)	-	-	-	16	-	14	-	291	25	72	368	-	786
04: 9am-10am (9am-10am)	-	-	-	19	-	17	-	313	39	156	524	-	1,068
05: 10am-11am (10am-11am)	-	-	-	34	-	18	-	441	39	154	587	-	1,273
06: 11am-12pm (11am-12noon)	-	-	-	22	-	15	-	461	38	144	626	-	1,306
07: 12pm-1pm (12noon-1pm)	-	-	-	39	-	23	-	530	33	120	679	-	1,424
08: 1pm-2pm (1pm-2pm)	-	-	-	30	-	44	-	629	44	88	616	-	1,451
09: 2pm-3pm (2pm-3pm)	-	-	-	27	-	67	-	598	39	68	526	-	1,325
10: 3pm-4pm (3pm-4pm)	-	-	-	21	-	78	-	569	38	30	490	-	1,226
11: 4pm-5pm (4pm-5pm)	-	-	-	27	-	109	-	470	33	26	383	-	1,048
12: 5pm-6pm (5pm-6pm)	-	-	-	30	-	103	-	393	47	25	367	-	965
13: 6pm-7pm (6pm-7pm)	-	-	-	15	-	84	-	408	45	15	235	-	802
14: 7pm-8pm (7pm-8pm)	-	-	-	8	-	53	-	364	16	8	224	-	673
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					74			673			704		

Day Type

1: Weekday (Tu-Th)

TURNING MOVEMENT COUNTS - ADJUSTED US 93 NORTHBOUND AND SOUTHBOUND VOLUMES (grown 8.3%)

				Pierce Ferry Road WB			US 93 South Leg NB			US 93 North Leg SB			
Day Part	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	Total
00: All Day (12am-12am)	-	-	-	370	-	687	-	7,619	530	976	7,586	-	17,768
01: 6am-7am (6am-7am)													-
02: 7am-8am (7am-8am)													-
03: 8am-9am (8am-9am)													-
04: 9am-10am (9am-10am)													-
05: 10am-11am (10am-11am)													-
06: 11am-12pm (11am-12noon)													-
07: 12pm-1pm (12noon-1pm)													-
08: 1pm-2pm (1pm-2pm)		-	-	30	-	44	-	681	44	88	667	-	- 1,554
09: 2pm-3pm (2pm-3pm)													
10: 3pm-4pm (3pm-4pm)													-
11: 4pm-5pm (4pm-5pm)													-
12: 5pm-6pm (5pm-6pm)													-
13: 6pm-7pm (6pm-7pm)													-
14: 7pm-8pm (7pm-8pm)													-
	-	-	-	-	-	-	-	-	-	-	-	-	-
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					74			725			755		

Day Type

1: Weekday (Tu-Th)

TURNING MOVEMENT COUNTS - ADJUSTED K FACTOR (0.12)

Day Part	Pierce Ferry Road WB						US 93 South Leg NB			US 93 North Leg SB			Total
	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	
00: All Day (12am-12am)	-	-	-	370	-	687	-	7,619	530	976	7,586	-	17,768
01: 6am-7am (6am-7am)													-
02: 7am-8am (7am-8am)													-
03: 8am-9am (8am-9am)													-
04: 9am-10am (9am-10am)													-
05: 10am-11am (10am-11am)													-
06: 11am-12pm (11am-12noon)													-
07: 12pm-1pm (12noon-1pm)													-
08: 1pm-2pm (1pm-2pm)		-	-	44	-	82	-	914	64	117	910	-	- 2,132
09: 2pm-3pm (2pm-3pm)													-
10: 3pm-4pm (3pm-4pm)													-
11: 4pm-5pm (4pm-5pm)													-
12: 5pm-6pm (5pm-6pm)													-
13: 6pm-7pm (6pm-7pm)													-
14: 7pm-8pm (7pm-8pm)													-
	-	-	-	-	-	-	-	-	-	-	-	-	-
0	-	-	-										
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					127			978			1,027		

Day Type

1: Weekday (Tu-Th)

TURNING MOVEMENT COUNTS - ADJUSTED K FACTOR (0.12)

Day Part	Pierce Ferry Road WB						US 93 South Leg NB			US 93 North Leg SB			Total
	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	
00: All Day (12am-12am)	-	-	-	538	-	999	-	16,012	1,114	2,051	15,944	-	36,658
01: 6am-7am (6am-7am)													-
02: 7am-8am (7am-8am)													-
03: 8am-9am (8am-9am)													-
04: 9am-10am (9am-10am)													-
05: 10am-11am (10am-11am)													-
06: 11am-12pm (11am-12noon)													-
07: 12pm-1pm (12noon-1pm)													-
08: 1pm-2pm (1pm-2pm)		-	-	65	-	120	-	1,921	134	246	1,913	-	- 4,399
09: 2pm-3pm (2pm-3pm)													-
10: 3pm-4pm (3pm-4pm)													-
11: 4pm-5pm (4pm-5pm)													-
12: 5pm-6pm (5pm-6pm)													-
13: 6pm-7pm (6pm-7pm)													-
14: 7pm-8pm (7pm-8pm)													-
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0	-	-	-										
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					184			2,055			2,159		