

Picacho Hills Drive/ Barcelona Ridge Road Corridor Safety Assessment (CSA)

Final Report

Revision 1

Prepared for:



Submitted by:



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Executive Summary

This Corridor Safety Assessment (CSA) is being used by Dona Ana County (DAC) to identify and mitigate safety issues proactively along Picacho Hills Drive and Barcelona Ridge Road. This, in turn, may assist DAC to utilize safety funding for projects that will mitigate identified safety problems. The residents living within the subdivisions, which are adjacent to Picacho Hills Drive and Barcelona Ridge Road, expressed concerns about speeding, pedestrian safety, sight distance, and general operations safety to DAC. DAC presented these concerns to Lee Engineering, as well as potential concerns about the intersection of these two corridors and their overall cross-sectional lane geometry. The principal goal of the CSA is to identify potential safety deficiencies and hazards to public right-of-way (ROW) users at the corridors mentioned above and provide potential mitigation treatments for identified safety issues and to determine if a Road Diet and Roundabout would be appropriate mitigation. A location map of the study area is provided in **Figure 1**.

The intent of the Picacho Hills/Barcelona Ridge safety assessment is to:

- Identify operational deficiencies and potential traffic safety hazards to the public ROW users along Picacho Hills and Barcelona Ridge.
- Review Vehicular Operations
 - Speeds
 - Volumes
 - Queues
 - Intersection Sight Distances
- Observe pedestrian and bicycle facilities
 - Street crossings
 - Interactions with traffic
 - General walking/biking atmosphere
- Provide recommendations to improve safety concerns and quality of life

This report contains a summary of the field review that was conducted for the Picacho Hills Drive and Barcelona Ridge Road corridor, located in Dona Ana County, NM, west of Las Cruces as well as the field review scope, procedure, preliminary data analyses, field observations, findings, mitigation, and conclusions.

An existing conditions analysis was conducted for the Picacho Hills Drive and Barcelona Ridge Road study area and is provided in this report and includes the following:

- Turn movement data and road volumes for 2019 and projected in the year 2030 utilizing the Fratar Method

- Operational capacity analysis based on 2019 turn movement counts and projected year 2030
- Vehicle speed data provided by MVMPO
- Evaluation of Intersection Sight Distances
- Determination of safe advisory curve speeds for horizontal curves along the corridor
- Analyses of crash data history
- Corridor-wide Road Diet feasibility, utilizing elements of NMDOT's Road Diet Guide

The scoping meeting was held on September 10, 2019, and an initial public meeting was held on October 10, 2019, to discuss the purpose of the project and summarize the concerns that had been raised. A final public meeting was held on January 7, 2020, where possible mitigation solutions were discussed based on field investigations, data, and analysis.

Results and Mitigation Alternatives

The review of the data collection identified the following safety concerns with recommended mitigation for each. Safety issues, other than speeding, were not identified at the Picacho Hills Drive/Barcelona Ridge Road intersection that could be effectively mitigated by the installation of a roundabout; therefore, that mitigation was not recommended due to the high cost.

Issue 1: Existing Road Geometry and Lane Configuration

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors

Description of the Safety Issue:

Field visits and analysis of aerial imagery indicate lane geometry consists of a 4-lane corridor with no median and a varying shoulder width throughout both Barcelona Ridge Road and Picacho Hills Drive. Currently, lane widths are approximately 11'. Picacho Hills Dr. has an existing bicycle lane that begins at US 70 and ends near the Picacho Hills & Barcelona Ridge intersection. The bicycle lane begins to narrow from 6' to 4' after the Picacho Hills Drive & Fairway Village Drive intersection. The bicycle lane narrows, which is a concern, and left turns need to make turns from a thru lane. Horizontal curvature existing throughout the corridor segment between US 70 & San Marcos Ct and vertical grades exist throughout the entire corridor, and that can affect higher vehicle speeds. Horizontal & vertical curves and existing roadway geometry influences reduced sight distances at some intersections. Reducing the number of lanes may improve intersection sight distance.

Suggested Mitigation:

- Warning Flashers at strategic locations

- Cost estimation - \$30,000 - \$50,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet)
 - Cost estimation - \$440,000

Issue 2: Vehicle Speeding

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors

Description of Safety Issue:

Posted signage for the roadway is 35 MPH throughout the Picacho Hills Drive/Barcelona Ridge corridor, with a suggested advisory speed limit of 30 MPH posted before horizontal curves on Picacho Hills Dr in both directions near the business area. The speed data indicates 85th percentile average speeds are 5 to 10 MPH above posted speed limit throughout the corridor. Therefore, speeding appears to be an issue throughout the corridor. The corridor's horizontal/vertical alignment and cross-sectional geometry may also be a contributing factor.

Suggested Mitigation:

- Speed Feedback Signs
 - Cost estimation - \$45,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet)
 - Cost estimation - \$440,000
- Roadway Re-Configuration (Decrease lane widths and stripe or increase existing bike lane)
 - Cost estimation - \$440,000
- Overtime for Police Enforcement (yearly)
 - Cost estimation - \$100,000 - \$150,000

Issue 3: Intersection Sight Distance

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors

Description of Safety Issue:

Throughout the Picacho Hills Dr/Barcelona Ridge Rd corridor, intersection sight distances are limited at most intersections due to horizontal and vertical curvature, vegetation overgrowth, terrain, and landscaping features. Many of the intersections and driveways lie within the horizontal or vertical curves, especially near the business areas, which can obstruct vehicle operators' line of sight. An evaluation of Intersection Sight Distances at 18 intersections within the corridor highlight this issue. Results show only 2 of 18 stop-control intersections met the sight distance criteria set forth by the

American Association of State Highway and Transportation Officials (AASHTO) for turning movements in both directions for the posted speed limit with only one meeting when the 85th percentile speeds are considered.

Suggested Mitigation:

- Driveway Restrictions at the business area
 - Cost estimation - \$1,000-\$2,000
- Remove and reduce vegetation/landscaping obstructions
 - Cost estimation - \$5,000-7,000
- Warning Flashers near the business area
 - Cost estimation - \$30,000
- Road Diet in the business area
 - Cost estimation - \$50,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet) (traffic is pulled away from the edge of the traveled lane)
 - Cost estimation - \$440,000
- Roadway Re-Configuration (Decrease lane widths and stripe or increase existing bike lane)
 - Cost estimation - \$440,000

Issue 4: Worn or Outdated Signage and Roadway Striping & Markings

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors and Intersections

Description of Safety Issue:

Many posted signs along the Picacho Hills/Barcelona Ridge corridor are worn and may not be up to current standards. Striping and markings along the corridor and at intersections, including bicycle lane striping along Picacho Hills Drive, are faded, missing, and or outdated. A ball bank study indicated advisory speeds around curves are appropriately designated; however, oversized signs with flashers may be considered.

Suggested Mitigation:

- Signage upgrades
 - Cost estimation - \$3,500
- Roadway Striping and Markings (2 applications)
 - Cost estimation - \$ 20,000
- Warning Flashers near the business area
 - Cost estimation - \$30,000

Issue 5: Condition or Lack of Multi-Modal Facilities

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors

Description of Safety Issue:

Pedestrians, as well as bicyclists, were seen using the shoulder for travel during field visits. Pertaining to bicyclists, safety issues included: no buffer between them and vehicle traffic; vegetation overgrowth that obstructs their lane of travel; narrowed lanes between the Picacho Hills Drive & Fairway Village Drive intersection and the Picacho Hills & Barcelona Ridge intersection; no signage on intersecting roads that warn of bicyclists; and no bicycle lanes along Barcelona Ridge and portions of Picacho Hills. Pertaining to pedestrians, safety issues included: no available path or sidewalk for pedestrians on either Picacho Hills Dr or Barcelona Ridge Rd. Vehicle speeding, sight distances, and intersection geometry issues discussed for the Picacho Hills Dr/Barcelona Ridge Rd intersection could affect pedestrians and bicyclists as well. Signage and markings for bicycle users appear to be minimal at this intersection. These bicycle lanes are approximately 4' wide in some areas, and smaller in others. There are no crosswalks for pedestrians to cross the Picacho Hills Drive/Barcelona Ridge Road intersection.

Suggested Mitigation:

- Install crosswalks and related signage at the Picacho Hills Dr/Barcelona Ridge Rd Intersection
 - Cost estimation - \$2,000-\$3,000
- Install new crosswalk markings at the Picacho Hills Dr/Picacho Ave Intersection and evaluate the timing for pedestrians
 - Cost estimation - \$3,000-\$6,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet with bike lanes)
 - Cost estimation - \$440,000
- Roadway Re-Configuration (Decrease lane widths and stripe or increase existing bike lane)
 - Cost estimation - \$440,000
- Installation of 4' sidewalks
 - Cost estimation - \$425,000 (one side of corridor)
 - Cost estimation - \$850,000 (both sides of corridor)
- Installation of a Multi-use path
 - Cost estimation - \$650,000

Discussion of Findings

The findings indicate that a Road Diet would be beneficial to address many of the safety issues identified along the corridors: Existing Road Geometry and Lane Configuration, Vehicle Speeding, Intersection Sight Distance, and Lack of Multi-Modal Facilities. This mitigation is recommended; however, DAC should consider that public support for a Road Diet was not widely accepted at the public meetings. Although a Road Diet would likely be a good fit, other mitigation could be considered to address these concerns such as adding sidewalks or a multi-use path, changing the roadway configuration to reduce lane widths to accommodate a bike lane, installation of speed indicators, and clearing the vegetation and landscaping that is found to be limiting the sight distance. Except for the direct removal of vegetation, these mitigations may not be as effective as a Road Diet. DAC should consider the benefits of installing a Road Diet with its cost and level of public support.

It is recommended that the intersection of Picacho Hills and US 70 be reevaluated in future years to determine if signal timing or additional turn lanes can mitigate the expected queues.

Streetlighting is absent throughout the corridors except near the intersection of Picacho Hills and US 70. It is also uncommon in the Picacho Hills subdivisions, likely due to development preference. However, adding streetlighting along the two corridors, at intersections, and along curves is recommended should Dona Ana County consider this option.

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Introduction

This Corridor Safety Assessment (CSA) will be used by Dona Ana County (DAC) to identify and mitigate safety issues proactively along Picacho Hills Drive and Barcelona Ridge Road. This, in turn, may assist DAC to utilize safety funding for projects that will mitigate identified safety problems. The residents living within the subdivisions, which are adjacent to Picacho Hills Drive and Barcelona Ridge Road, expressed concerns about speeding, pedestrian safety, sight distances, and general operations safety to DAC. DAC presented these concerns to Lee Engineering (LEE), as well as concerns about the intersections of these two corridors and their overall cross-sectional lane geometry. The principal goal of the CSA is to identify potential safety deficiencies and hazards to public right-of-way (ROW) users at the corridors mentioned above and provide potential mitigation treatments for identified safety issues. A location map of the study area is presented in **Figure 1**.

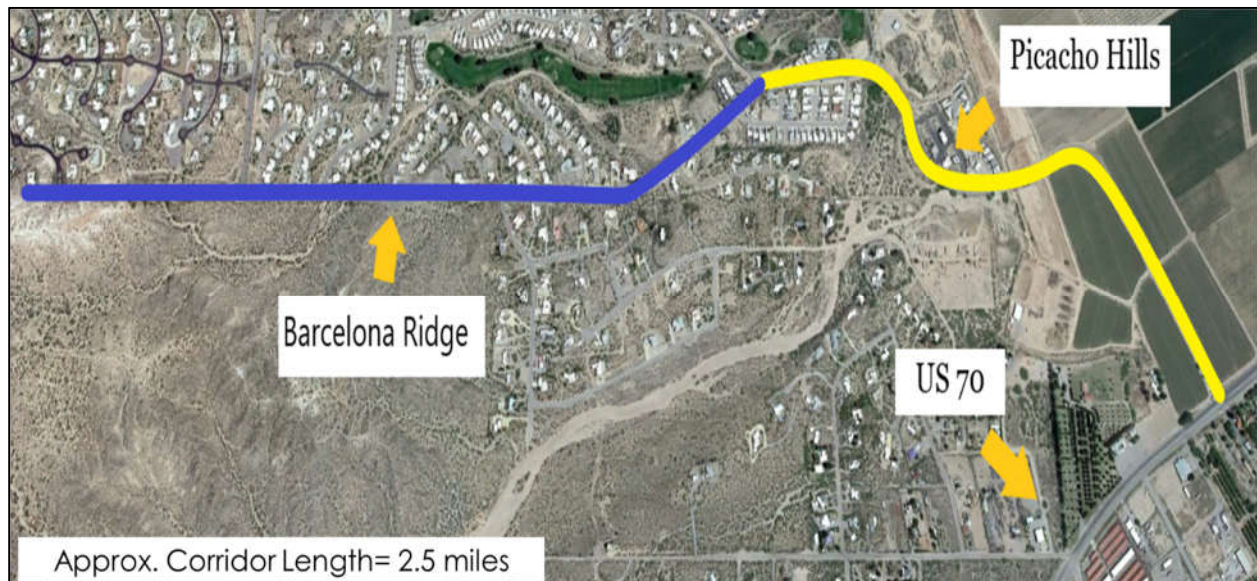


Figure 1. Location Map

Corridor Safety Assessment Procedure

The intent of the Picacho Hills/Barcelona Ridge safety assessment is to:

- Identify operational deficiencies and potential traffic safety hazards to the public ROW users along Picacho Hills and Barcelona Ridge.
- Review Vehicular Operations
 - Speeds
 - Volumes
 - Queues
 - Intersection Sight Distances

- Observe pedestrian and bicycle facilities
 - Street crossings
 - Interactions with traffic
 - General walking/biking atmosphere
- Provide recommendations to improve safety concerns and quality of life

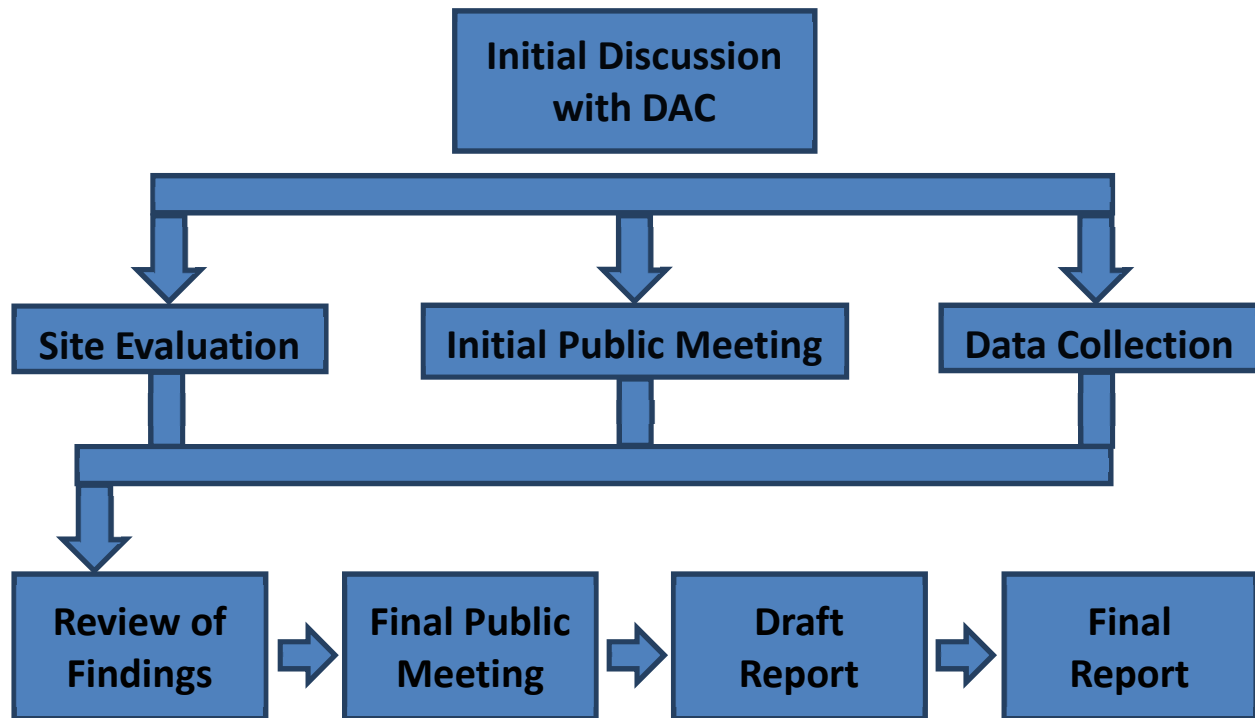


Figure 2. CSA Procedure

The scoping meeting was held on September 10, 2019, and an initial public meeting was held on October 10, 2019, to discuss the purpose of the project and summarize the concerns that had been raised. A final public meeting was held on January 7, 2020, where possible mitigation solutions were discussed based on field investigations, data, and analysis.

Field Survey and Data Acquisition

LEE collected turning movement data, vehicle speed data, reviewed crash data, conducted field visits for review of existing street and operation characteristics, evaluated intersection sight distances, and conducted a ball bank study to determine proper advisory speeds around horizontal curves. Field reviews were conducted on October 1st, 9th, 23rd, 2019, & January 22nd, 2020, and included an initial briefing

and field visits to the study area for the AM, Noon, and PM peak hours. Photos during field visits were taken and can be found in **Appendix B**.

October 1, 2019

- 1:00 PM – 3:00 PM – Mid-day field observation

October 9, 2019

- 7:00 AM – 11:00 AM – Morning turning movement counts
- 11:00 AM – 2:00 PM – Mid-day turning movement counts
- 3:30 PM – 6:30 PM – Evening turning movement counts

October 23, 2019

- 7:00 AM – 8:00 AM – AM peak period field review
- 8:30 AM – 10:00 AM – PM peak period field review

January 22, 2020

- 9:30 AM-1:00 PM Intersection Sight Distance evaluation and Ball Bank Study

General Observations

Picacho Hills Drive/Barcelona Ridge Road Corridors

- Road Geometry Issues
- Vehicle Speeds
- Sight Distance Obstructions
- Worn and Outdated Signage and Striping
- Pedestrian/Bicyclist Issues

Picacho Hills Drive/Barcelona Ridge Road Intersection

- Vehicle Speeds
- Sight Distance Obstructions
- Pedestrian/Bicyclist Issues

Existing Road Characteristics

Within the study area, Picacho Hills Drive currently incorporates the following traffic operations and geometric characteristics:

- Picacho Hills Drive, from where it intersects at US Highway 70 to where it intersects at Fairway Village Drive, is a rural minor arterial multi-lane road incorporating two-through lanes in each direction, and an approximate 6' shoulder/bicycle lane on each side; there is no median, no sidewalks, and no curb or gutter on either side of the roadway.
- Picacho Hills Drive, from where it intersects Fairway Village Drive to where it intersects Barcelona Ridge Road, is a rural minor arterial multi-lane road incorporating two through lanes in each direction, and an approximate 4' shoulder/bicycle lane and curb & gutter on each side; there is no median and no sidewalks on either side of the roadway.
- Currently, the road is signed for 35 mph in both directions near the study intersections, with a 30 mph advisory speed posted near some of the horizontal curves in the business area.
- Current land-use appears to be generally rural in nature with pockets of residential land use and some commercial businesses such as AG New Mexico Farm Credit, Estrada Law, P.C., Chaney & Marin Financial Planning, David Dean & Associates, INC, The Wal Real Estate Group, TND Real Estate, and Cole Communities.



Figure 3. Horizontal Curve along Picacho Hills Drive



Figure 4. Picacho Hills near US70

Within the study area, Barcelona Ridge Road currently incorporates the following traffic operations and geometric characteristics:

- Barcelona Ridge Road is a rural minor arterial incorporating two through lanes in each direction, and a shoulder and curb & gutter on each side; there is no median and no sidewalks on either side of the roadway.
- Barcelona Ridge Road currently has no bicycle lanes.
- Currently, the road is signed for 35 mph in both directions.
- Prevailing land-use appears to be generally rural in nature with pockets of residential.



Figure 5. Barcelona Ridge Vertical Grade



Figure 6. Barcelona Ridge Intersection

Road intersections along the corridor include:

- Signal controlled intersection at Picacho Hills & US 70.
- Two-way stop control intersection at Picacho Hills & Pueblo Gardens Ct.

- Two-way stop control intersection at Picacho Hills & Calle Vista Bella.
- Two-way stop control intersection where Picacho Hills & Barcelona Ridge meet.
- Two-way stop control intersection at Barcelona Ridge & Mira Montes.
- Two-way stop control intersection at Barcelona Ridge & Spanish Point Rd.
- Two-way stop control intersection at Barcelona Ridge & San Marcos Ct.
- Two-way stop control intersection at Barcelona Ridge & San Savino Ct.
- Two-way stop control intersection at Barcelona Ridge & Cantabria Ct.
- Two-way stop control intersection at Barcelona Ridge & Contana Ct.
- Two-way stop control intersection at Barcelona Ridge & Tuscany Dr.
- Two-way stop control intersection at Barcelona Ridge & Catalonia Ct.
- Two-way stop control intersection at Barcelona Ridge & Saragossa Ct.
- Two-way stop control intersection at Barcelona Ridge & Anthem Rd.
- Two-way stop control intersection at Barcelona Ridge & Constitution Rd.

The study intersection of Picacho Hills Drive / US Highway 70 has the following traffic operations and geometric characteristics:

- Picacho Hills Drive forms the north leg of the intersection, while US Highway 70 forms the east and west legs of the intersection.
- There are exclusive left-turn and right-turn lanes on the southbound approach.
- There is an exclusive right turn on the westbound approach.
- The intersection is signalized with a protected left on the eastbound and westbound approaches.
- The intersection contains curb, gutters, sidewalks, crosswalks, and pedestrian ramps.
- The intersection does not contain any islands.

The study intersection of Picacho Hills Drive / Barcelona Ridge Road has the following traffic operations and geometric characteristics:

- Picacho Hills Drive forms the north and east legs of the intersection, while Barcelona Ridge Road forms the west leg of the intersection.
- The intersection is unsignalized with stop control on the southbound approach.
- The intersection contains curb & gutter and an island.
- The intersection does not contain any sidewalks, crosswalks, or pedestrian ramps.
- The southbound left and the westbound right are separated by an island and merge approximately 100 feet north of the intersection.

Traffic Characteristics

Turn Movement Volumes

Turning movement counts were collected for Picacho Hills Drive/Barcelona Ridge Avenue corridor safety assessment on October 9, 2019. Turn movement data were obtained at the signalized intersection of

Picacho Hills & US 70, and at Picacho Hills & Barcelona Ridge, as shown in **Figure 7**. Turning movement data were collected three times in a 12-hr period from 7:00 AM-11:00 AM, 11:00 AM-2:00 PM, and 3:30 PM-6:30 PM to obtain an AM, Mid-Day, and PM peak hour. Peak hours observed are shown in **Table 1**. See **Appendix C** for detailed traffic count data.



Figure 7. Location of Turn Movement Counts

Table 1: Turning Movement Counts Collection Day & Peak Hours

Intersection	Data Collection Date	AM Peak Hour	Mid-Day Peak Hour	PM Peak Hour
Picacho Hills Dr & US 70	10/9/2019	7:45 AM	12:00 PM	3:45 PM
Picacho Hills Dr & Barcelona Ridge	10/9/2019	7:45 AM	12:00 PM	3:45 PM

The typical AM, Noon, and PM commuter peak were observed with the traffic peaks occurring at 7:45 AM, 12:00 PM, and 3:45 PM. Existing peak hour turning movement demands are depicted in **Figure 8** and **Figure 9** for each study intersection.



Figure 8. Existing Peak Hour Turning Movement Demands (Picacho Hills & US 70)

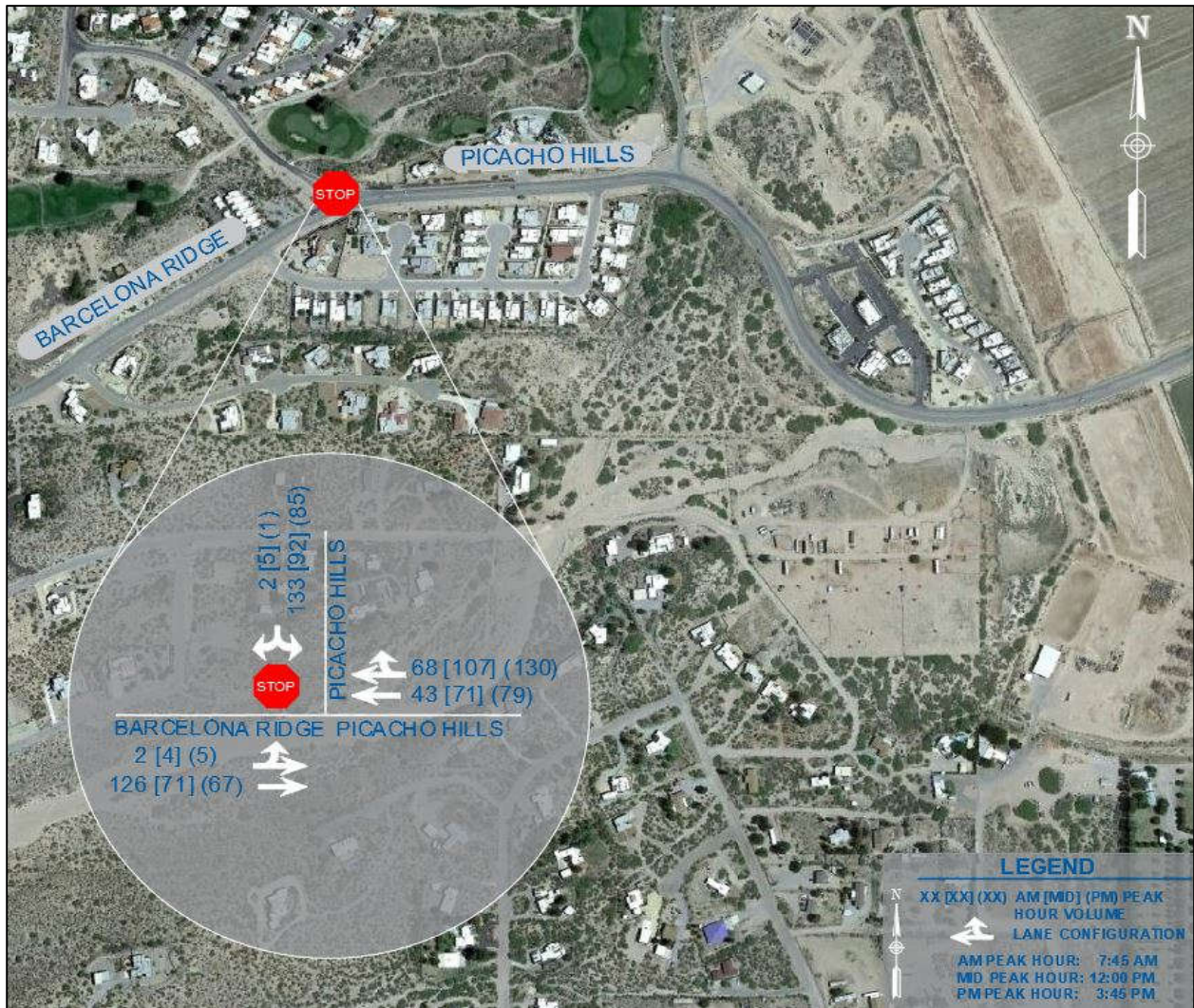


Figure 9. Existing Peak Hour Turning Movement Demands (Picacho Hills & Barcelona Ridge)

Speed Characteristics

Speed data and Average Annual Daily Traffic (AADT) was collected from the Mesilla Valley Metropolitan Planning Organization (MPO). Full description of speed data and AADT is provided in **Appendix D**. Speed data was analyzed at three appropriate locations and can be seen in **Figure 10**, with the following observations:

- The 85th Percentile speed for traffic at location 1 on Picacho Hills was observed to be in the range between 41-45 mph, which is greater than the posted speed limit of 35 mph within the data collection area. 84% of observed vehicles were driving over the posted speed limit.

- The 85th Percentile speed for traffic at location 2 on Picacho Hills was observed to be in the range between 36-40 mph, which is greater than the posted speed limit of 35 mph within the data collection area. 61% of observed vehicles were driving over the posted speed limit.
- The 85th Percentile speed for traffic on Barcelona Ridge was observed to be in the range between 41-45 mph, which is greater than the posted speed of 35 mph within the data collection area. 76% of observed vehicles were driving over the posted speed limit.

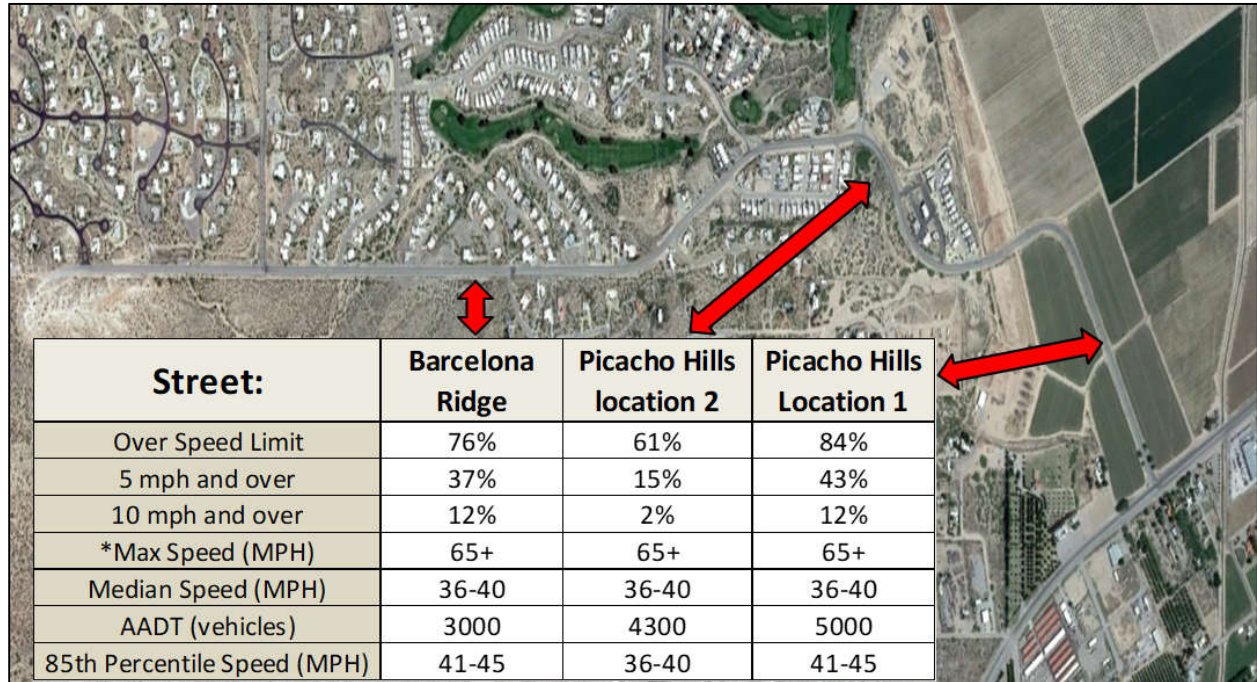


Figure 10. 2018-2019 Speed Data and Volumes

Traffic Analyses and Assessments

Traffic Projections and Growth Factor

Dona Ana County reviewed and compared historical traffic demand data and determined the annual growth rate of 1.3% would be most appropriate. This growth rate was used to forecast the expected traffic conditions in 2030 using the Fratar Method. **Figure 11** and **Figure 12** illustrate traffic demands for the year 2030.

Current Adjacent Projects

Currently, there no adjacent projects being constructed within the study area at this time. However, restaurants and additional commercial may occur in the business area of the study location. In addition, a sizeable residential subdivision is being reviewed by Dona Ana County. These developments would

increase traffic and potentially have an impact on traffic characteristics along the corridor. These potential developments were not considered in this assessment.

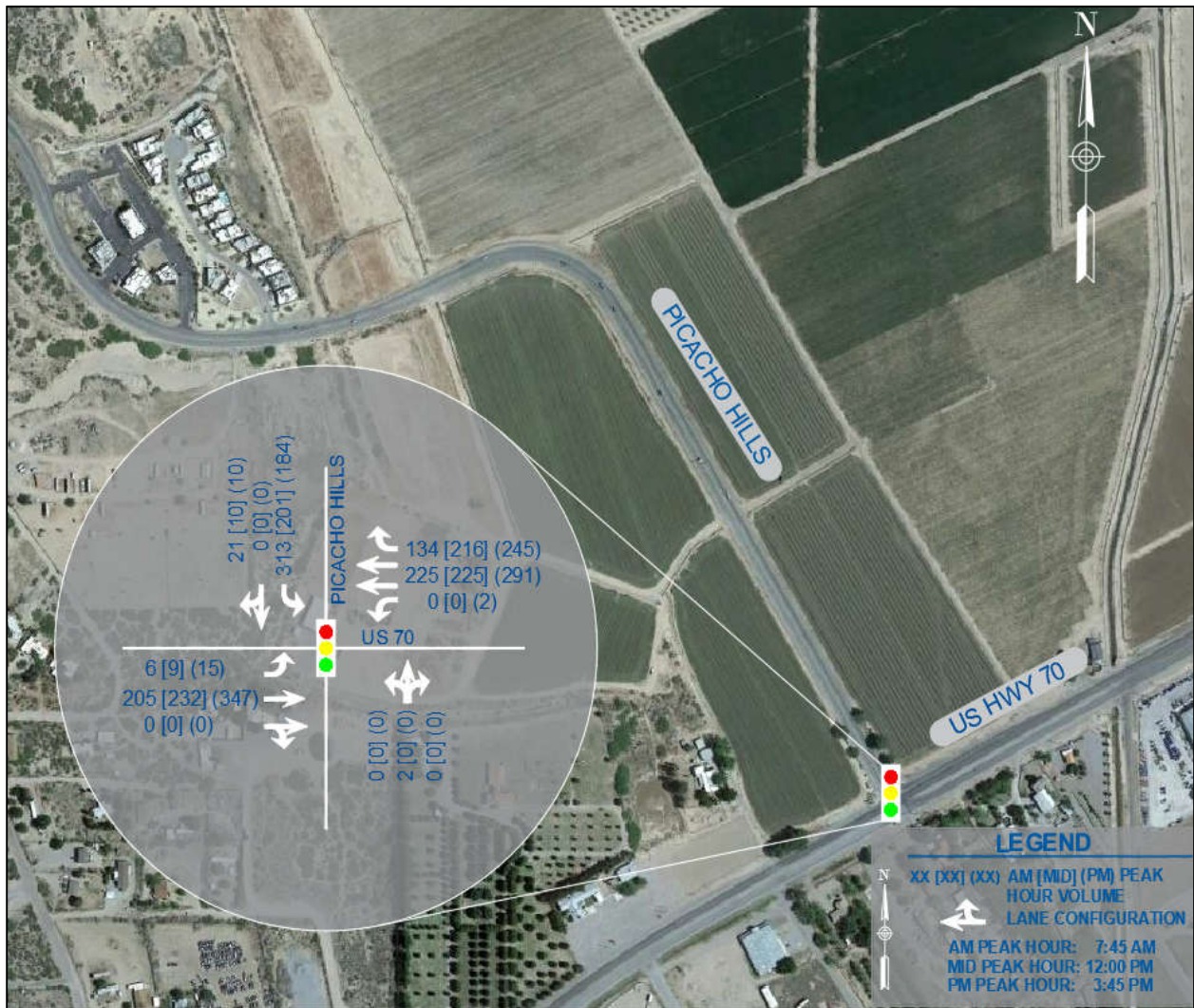


Figure 11. Projected 2030 Peak Hour Turning Movement Demands (Picacho Hills & US 70)

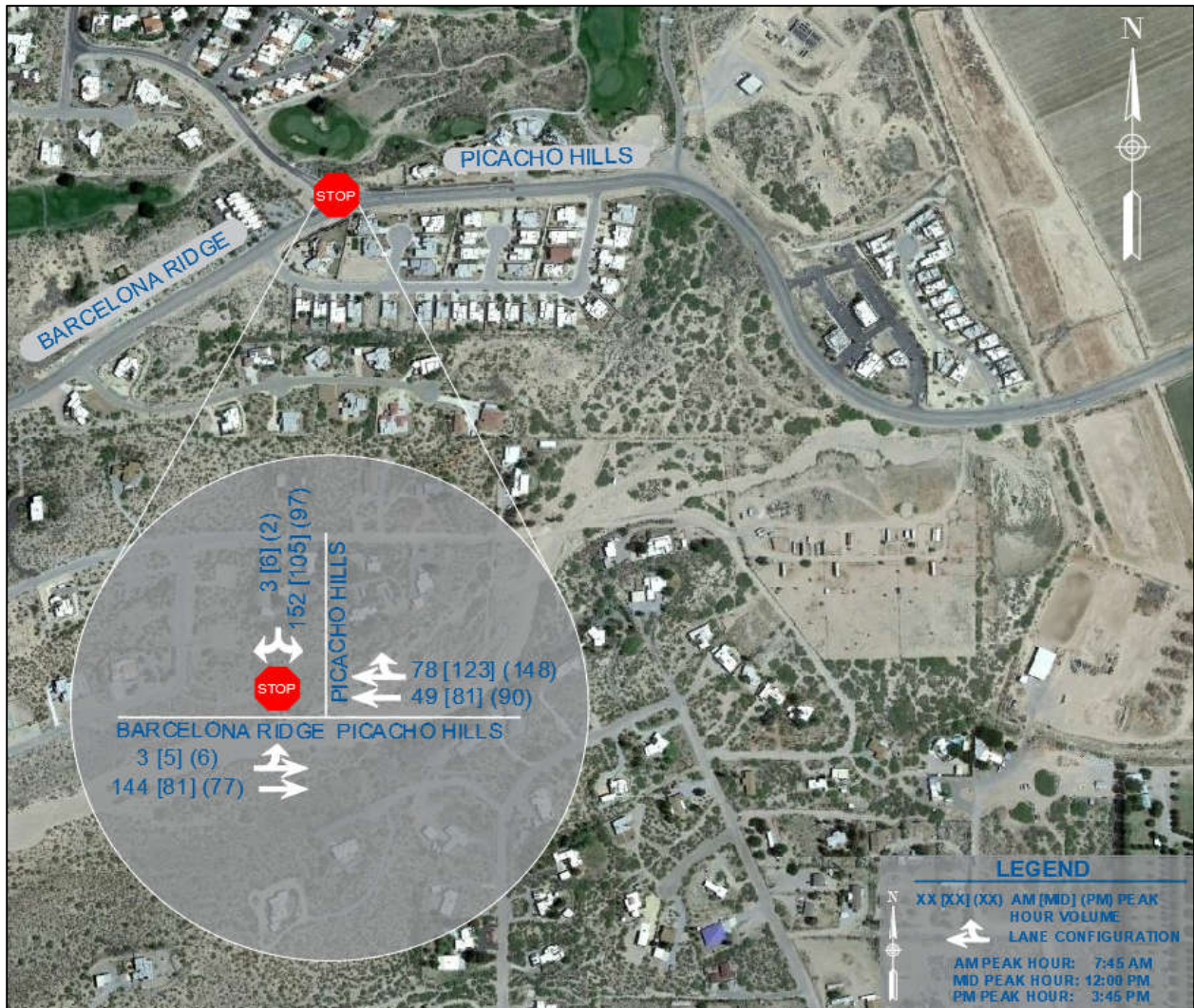


Figure 12. Projected 2030 Peak Hour Turning Movement Demands (Picacho Hills & Barcelona Ridge)

Capacity Analysis

A capacity analysis was performed for the following two study intersections under existing and 2030 scenarios:

- Picacho Hills and Barcelona Ridge (stop-control intersection)
 - **Critical movement-** North leg/Southbound left at Picacho Hills
- Picacho Hills and US 70 (signalized intersection)
 - **Critical movement-** North leg/Southbound left at Picacho Hills

In this report, **Table 2** and **Table 3** show the queue lengths and delays for the critical movement in the intersection. Queueing is reported in feet and indicates possible lengths of vehicles for worst-case

scenarios, either waiting to find an acceptable gap to complete their movement or queue caused by a vehicle waiting to make their intended movement. As indicated, there does not currently appear to be any significant capacity constraints within the study area as all existing movements are operating at an acceptable LOS C or greater for existing conditions. 2030 projected demands are expected to perform acceptably except for the critical movement at Picacho Hills & US 70, which is projected to operate at a LOS of E in the AM peak hour. It is recommended that the intersection of Picacho Hills and US 70 be reevaluated in future years to determine if signal timing or additional turn lanes can mitigate the expected queues. The results of the analysis and output sheets for all movements can be found in **Appendix G**.

Table 2: Capacity Analysis at Picacho Hills and Barcelona Ridge Intersection

Existing				
	2019		2030	
	AM	PM	AM	PM
LOS	B	B	B	B
QUEUE LENGTH (foot)	17	15	21	19
DELAY (secs)	11	11	12	12

Table 3: Capacity and Queuing Analysis at Picacho Hills and US 70 Intersection

Existing				
	2019		2030	
	AM	PM	AM	PM
LOS	C	B	E	B
QUEUE LENGTH (foot)	340	117	630	19
DELAY (secs)	34	11	69	12

Crash Analysis

Vehicle Crash history occurring from 2016 to 2018 for the study corridor was obtained from the Mesilla Valley MPO and Dona Ana County, respectively. Raw crash data and crash reports are provided in **Appendix F**.

Table 4 presents a summary of the crashes determined to have occurred within the study area from 2016 to 2018, and **Figure 13** shows the same data with the approximate locations with the crashes. From the summary, the following observations were made:

- The study corridor of Picacho Hills/Barcelona Ridge had a total of only six-vehicle collisions from 2016 to 2018.

- Based on the data available, no fatal crashes occurred in this corridor.
- 67% (4 crashes) of the total crashes occurred during daylight, with 33% (2 crashes) occurring during night time.
- 17% (1 crashes) of the total crashes were reported as injuries with 67% (4 crashes) of the total crashes reported as property damage only.
- Based on the small number of accidents in this study area, we were unable to determine a trend in the cause of the crashes that were reported.

Table 4: Crash History and Analysis

Intersection		Picacho Hills & Calle Vista Bella	Picacho Hills & Barcelona Ridge	Picacho Hills & Pueblo Gardens	Picacho Hills & Fairway Village	Barcelona Ridge & Constitution
Total Crashes		1	1	2	1	1
Year	2016	1	1	1	-	-
	2017	-	-	1	1	-
	2018	-	-	-	-	1
Type	Fixed Object/Parked Vehicle	-	-	2	-	1
	Other/Unknown/No Information	1	-	-	1	-
Time	Daylight	-	1	2	-	1
	Dawn/Dusk	-	-	-	-	-
	Night	1	-	-	1	-
Severity	Property Damage Only	-	1	2	1	-
	Injury	1	-	-	-	-
	Fatality	-	-	-	-	-
Cause	Improper Overtaking/Lane Changes/Backing/Driving	-	-	-	-	1
	Driver Inattention	-	1	1	1	-
	Unknown/No Error/Other	1	-	1	-	-



Figure 13. Vehicle Crash Locations form 2016-2018

Intersection Sight Distance Evaluation

Methodology of Intersection Sight Distances

Field measurements of Intersection Sight Distances were conducted following guidelines from “A Policy on Geometric Design of Highways and Streets AASHTO” (Green Book 2018). Full Identification and photos of sight obstructions within the sight triangles of the studied intersecting roadways are provided in **Appendix E**. Determination of a sight obstruction was considered for the horizontal and vertical alignment of analyzed intersecting roads. In making this determination, it was assumed that the driver’s eye was 3.50 ft above the roadway surface and that the object to be seen is 3.50 ft above the surface of the intersecting road. This object height is based on a vehicle height of 4.25 ft. This allowance represents a near-maximum value for the portion of a passenger car height that needs to be visible for another driver to recognize it as the object.

This decision point is the location at which the minor-road driver should begin to brake to a stop if another vehicle is present on an intersecting approach. The distance from the major road, along the minor road, is illustrated in **Figure 14**. Distance a_2 is equal to distance a_1 plus the width of the lanes departing from the intersection on the major road to the right. Distance a_2 should also include the width of any median present on the major road unless the median is wide enough to permit a vehicle to stop before entering or crossing the roadway beyond the median.

The geometry of a clear sight triangle is such that when the driver of a vehicle without the right-of-way sees a vehicle that has the right of way on an intersecting approach, the driver of that potentially

conflicting vehicle can also see the first vehicle. Distance b illustrates the length of this leg of the sight triangle. Thus, the provision of a clear sight triangle for vehicles without the right-of-way also permits the drivers of vehicles with the right-of-way to slow, stop, or avoid other vehicles, if needed.

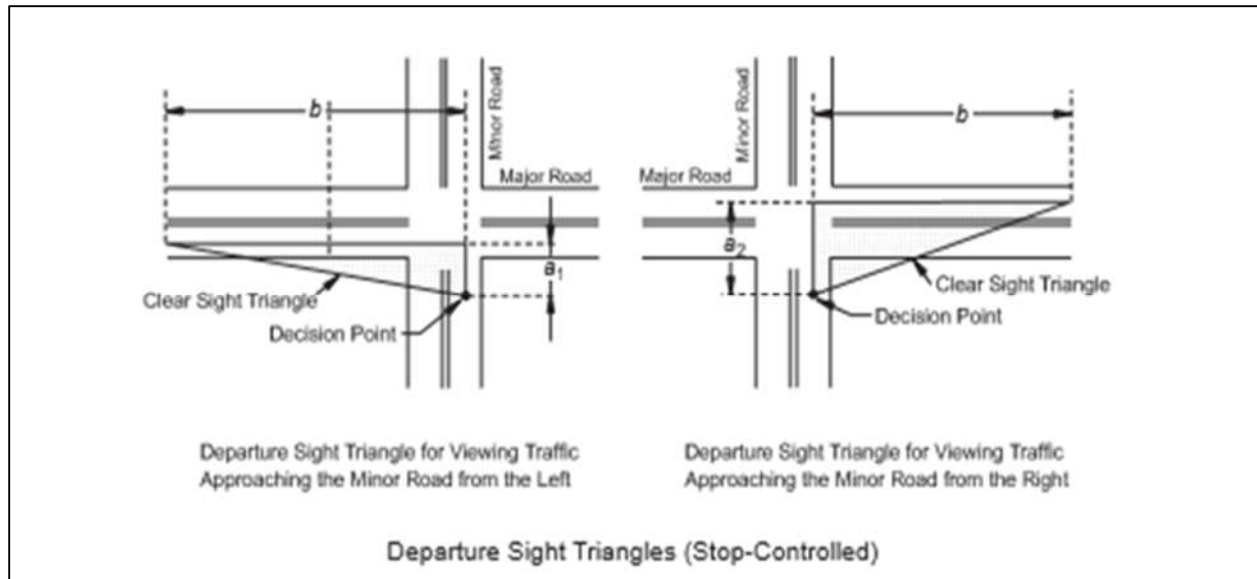


Figure 14. Intersection Departure Sight Triangles. A Policy on Geometric Design of Highways and Streets AASHTO 2011 “Green Book”

Intersection Sight Distance Locations

In total, 18 stop-control intersections along the Picacho Hills and Barcelona Ridge corridor were selected by Dona Ana County to be measured and evaluated. The intersections assessed are listed below and can be seen in **Figure 15**:

- Barcelona Ridge & Anthem Rd.
- Barcelona Ridge & Tuscany Dr.
- Barcelona Ridge & Contana Ct.
- Barcelona Ridge & Cantabria Ct.
- Barcelona Ridge & Boiling Ln.
- Barcelona Ridge & San Savino Ct.
- Barcelona Ridge & San Marcos Ct.
- Barcelona Ridge & Barcelona Ridge Rd. (Bulb)
- Barcelona Ridge & Spanish Pointe Rd.
- Barcelona Ridge & Mira Montes
- Barcelona Ridge & Picacho Hills
- Picacho Hills & Calle Vista Bella
- Picacho Hills & Mira Montes

- Picacho Hills & Fairway Village Dr.
- Picacho Hills at The Plaza (North Driveway)
- Picacho Hills at The Plaza (Mid Driveway)
- Picacho Hills at The Plaza (South Driveway)
- Picacho Hills at Pueblo Gardens Ct.

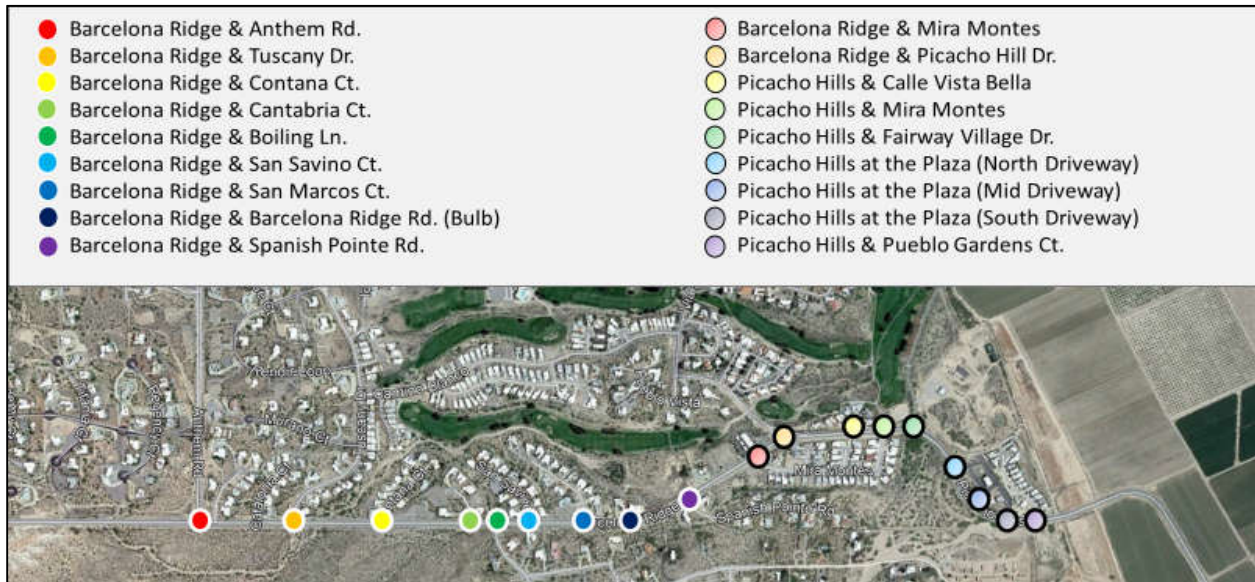


Figure 15. Location of Intersection Sight Distances along Picacho Hills/Barcelona Ridge Corridor

Intersection Sight Distance Results

The results of the Intersection Sight Distances were calculated based on the table values taken from the AASHTO Green Book. In addition, screenshots of those tables and calculations can be seen in **Appendix E**. Below in **Table 5** are the left-turn, right-turn design requirements based on existing roadway geometry and governing speed limit for 4-lane roadway at 35 MPH. **Table 6** and **Table 7** show the adjusted design requirements based on the 85th percentile max value speed obtained from speed data analysis.

Table 5: Intersection Sight Distances for Current Conditions at Picacho Hills/Barcelona Ridge (posted 35 mph 4-lane roadway)

Type of Vehicle	Left turn adjustment for 4-lane roadway		Right turn adjustment for 4-lane roadway	
	Calculated (ft)	Design (ft)	Calculated (ft)	Design (ft)
Passenger Car	411.60	415	360.15	365
Single-Unit Truck	514.50	515	463.05	465
Combination Truck	617.40	620	565.95	570

Table 6: Intersection Sight Distances for Current Conditions at Picacho Hills/Barcelona Ridge (posted 35 mph 4-lane roadway)

Type of Vehicle	Left turn adjustment for 4-lane roadway		Right turn adjustment for 4-lane roadway	
	Calculated (ft)	Design (ft)	Calculated (ft)	Design (ft)
Passenger Car	529.20	530	463.05	465
Single-Unit Truck	661.50	665	595.35	600
Combination Truck	793.80	795	727.65	730

Table 7: Intersection Sight Distances for Picacho Hills (85th percentile: 40 mph max value)

Type of Vehicle	Left turn adjustment for 4-lane roadway		Right turn adjustment for 4-lane roadway	
	Calculated (ft)	Design (ft)	Calculated (ft)	Design (ft)
Passenger Car	470.4	475	411.6	415
Single-Unit Truck	588	590	529.2	53
Combination Truck	705.6	710	646.8	650

Table 8 shows the results based on current conditions from each intersection, along with observed safety issues from the field visit. **Table 9** shows the results of the 85th Percentile max value (MPH). Highlighted are the movements from the minor road onto the major road that failed to meet the desired threshold requirements. **Table 8** indicates that only two intersections meet the required Intersection Sight Distances in both directions of travel. Those two intersections are located at Barcelona Ridge & Spanish Pointe Rd. and Picacho Hills & Fairway Village Dr. **Table 9** only has one intersection that meets the threshold in both directions due to the higher rate of speeds. That intersection is at Picacho Hills & Fairway Village Dr. **Figure 16** and **Figure 17** illustrate the locations of the failing intersections.

Table 8: Results of Current Intersection Sight Distances

Intersection	Movement from Minor Road		Notes
	left turn from stop (ft)	right turn from stop (ft)	
Barcelona Ridge & Anthem Rd.	137	235	Landscape obstructions and structure in both directions
Barcelona Ridge & Tuscany Dr.	195	127	Landscape obstructions and moderate vegetation overgrowth in both directions
Barcelona Ridge & Contana Ct.	2000	230	Landscape obstructions, vegetation overgrowth, and vertical curve
Barcelona Ridge & Cantabria Ct.	214	105	Landscape obstructions, and vertical curve
Barcelona Ridge & Boiling Ln.	250	143	obstructions due to vegation overgrowth, advertisement billboard, and vertical curve
Barcelona Ridge & San Savino Ct.	420	311	Landscape obstructions observed looking east
Barcelona Ridge & San Marcos Ct.	232	236	Earthwall dirt mound limiting sight distance, landscape wall obstruction, and horizontal curve
Barcelona Ridge & Barcelona Ridge (Bulb)	520	206	Obstructions caused by vertical and horizontal curves
Barcelona Ridge & Spanish Pointe Rd.	518	600	Obstructions caused by horizontal curves in both directions
Barcelona Ridge & Mira Montes	280	700	Landscape rock wall obstruction and horizontal curves
Barcelona Ridge & Picacho Hills	313	140	Landscape median obstruction in both directions, horizontal and verticle curves
Picacho Hills & Calle Vista Bella	330	1000	Obstructions caused by vertical and horizontal curves
Picacho Hills & Mira Montes	271	423	Landscape rockwall obsruction, horizontal and vertical curves
Picacho Hills & Fairway Village Dr.	700	700	Obstructions caused by moderate vegetation overgrowth
Picacho Hills at The Plaza (North Driveway)	700	327	Landscape obstructions and advertisement billboard
Picacho Hills at The Plaza (Mid Driveway)	367	177	Landscape obstructions in both directions and horizontal curves
Picacho Hills at The Plaza (South Driveway)	267	175	Landscape wall obstructions, vegetation overgrowth, and horizontal curves
Picacho Hills at Pueblo Gardens Ct.	375	2000	Landscape obstructions and horizontal curves

Table 9: 85th Percentile Results of Intersection Distances

Intersection	Movement from Minor Road		Notes
	left turn from stop (ft)	right turn from stop (ft)	
Barcelona Ridge & Anthem Rd.	137	235	Landscape obstructions and structure in both directions
Barcelona Ridge & Tuscany Dr.	195	127	Landscape obstructions and moderate vegetation overgrowth in both directions
Barcelona Ridge & Contana Ct.	2000	230	Landscape obstructions, vegetation overgrowth, and vertical curve
Barcelona Ridge & Cantabria Ct.	214	105	Landscape obstructions, and vertical curve
Barcelona Ridge & Boiling Ln.	250	143	obstructions due to vegetation overgrowth, advertisement billboard, and vertical curve
Barcelona Ridge & San Savino Ct.	420	311	Landscape obstructions observed looking east
Barcelona Ridge & San Marcos Ct.	232	236	Earthwall dirt mound limiting sight distance, landscape wall obstruction, and horizontal curve
Barcelona Ridge & Barcelona Ridge (Bulb)	520	206	Obstructions caused by vertical and horizontal curves
Barcelona Ridge & Spanish Pointe Rd.	518	600	Obstructions caused by horizontal curves in both directions
Barcelona Ridge & Mira Montes	280	700	Landscape rock wall obstruction and horizontal curves
Barcelona Ridge & Picacho Hills	313	140	Landscape median obstruction in both directions, horizontal and vertical curves
Picacho Hills & Calle Vista Bella	330	1000	Obstructions caused by vertical and horizontal curves
Picacho Hills & Mira Montes	271	423	Landscape rockwall obstruction, horizontal and vertical curves
Picacho Hills & Fairway Village Dr.	700	700	Obstructions caused by moderate vegetation overgrowth
Picacho Hills at The Plaza (North Driveway)	700	327	Landscape obstructions and advertisement billboard
Picacho Hills at The Plaza (Mid Driveway)	367	177	Landscape obstructions in both directions and horizontal curves
Picacho Hills at The Plaza (South Driveway)	267	175	Landscape wall obstructions, vegetation overgrowth, and horizontal curves
Picacho Hills at Pueblo Gardens Ct.	375	2000	Landscape obstructions and horizontal curves

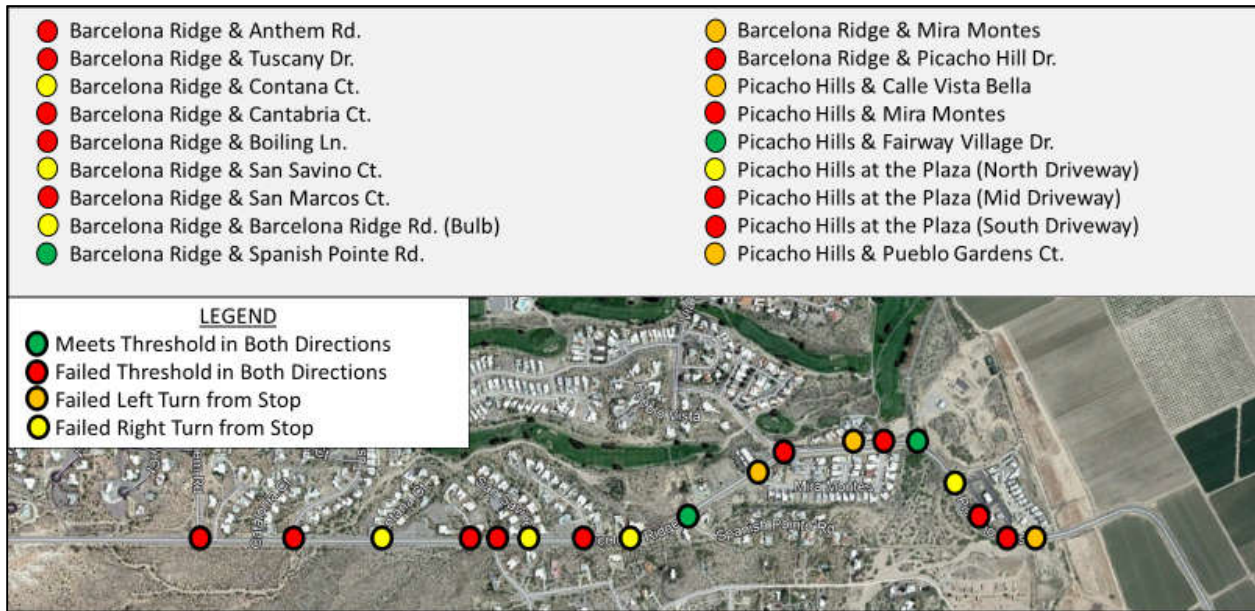


Figure 16. Location of Failing Intersection Sight Distances for current conditions

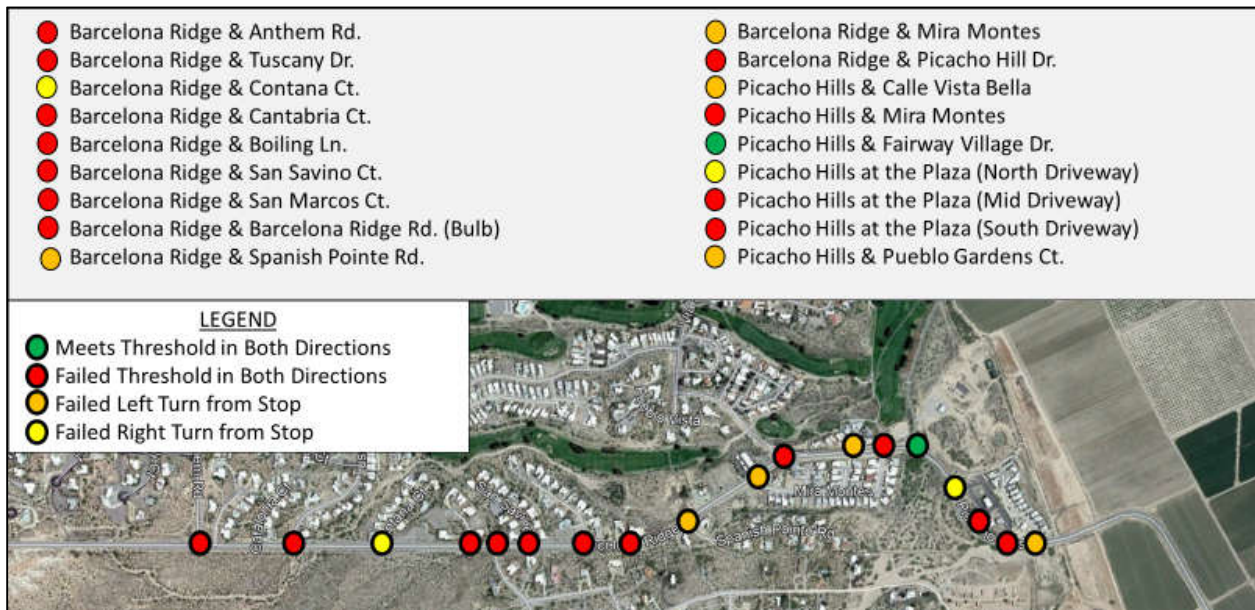


Figure 17. Location of Intersection Sight Distances for 85th Percentile conditions

Ball Bank Study

To evaluate the advisory speeds for horizontal curves, a ball bank indicator (BBI) evaluation was conducted based on the practice listed in the most current Manual of Uniform Traffic Control Devices (MUTCD). A ball bank study, using a digital inclinometer, was conducted on January 22nd, 2020, to

evaluate the horizontal curve locations along the Picacho Hills corridor are illustrated in **Figure 18**. Advisory speeds around these horizontal curves are currently signed for an auxiliary speed of 30 MPH. Three trial runs in both directions were conducted at three different speeds (+/-30MPH) of 25, 30, and 35 MPH to determine if current conditions meet the MUTCD threshold. A summarization of the BBI results can be review in **Table 10**. Highlighted in red are attempts that failed to meet proper MUTCD criteria. Results show that existing advisory speed is properly signed for an advisory speed of 30 MPH. MUTCD criteria for Advisory Speeds can be viewed in **Appendix E**.



Figure 18. Ball Bank Study Locations of Horizontal Curves

Table 10: Summary of Ball Bank Study Results

		TRIAL RUN 1			TRIAL RUN 2			TRIAL RUN 3		
		CURVE			CURVE			CURVE		
		1	2	3	1	2	3	1	2	3
Northbound	25 MPH	4	-7	7	4	-6	7	4	-6	7
	30 MPH	8	-8	10	8	-9	10	8	-10	10
	35 MPH	14	12	12	13	11	13	13	-12	12
Southbound	25 MPH	-8	5	-10	-7	4	-9	-8	4	-9
	30 MPH	-10	6	-11	-9	6	-11	-10	6	-10
	35 MPH	-14	8	-13	-14	8	-14	-15	7	-13

Road Diet Feasibility

Road Diet Definition

Road Diets, or a reallocation of roadway space, are a changing of the cross-section of a roadway in order to achieve potential benefits, such as safety, increased multimodal accommodation, or to better accommodate left-turning vehicles, in addition to numerous other potential benefits. Road Diets are considered a safety countermeasure by the Federal Highway Administration’s Office of Safety (FHWA). Analysis of before and after crash data, in locations where three-lane Road Diets are installed, demonstrates a reduction in the number of fatal or serious injuries compared to a four-lane cross-section.

Methodology

Road Diets most often involve restriping a four-lane undivided road to a three-lane road with two through lanes and a two-way left-turn lane (TWLTL), although larger roads could be considered. The New Mexico Department of Transportation (NMDOT) provides a guide to determine if a Road Diet should be considered. Within this guide, a Road Diet Matrix can be used to analyze whether a specific roadway is a good candidate for a Road Diet. The Decision Matrix was completed for the Picacho Hills/Barcelona Ridge Corridor and summarized in **Table 11**. Overall, the results of the matrix in comparison of “Option A: No build” versus “Option B: Road Diet” show that a Road Diet for the Picacho Hills/Barcelona Ridge roadway would be a good fit. In addition, according to NMDOT’s Road Diet Guide, for 4-lane roadways with less than 10,000 ADT, Road Diets should have virtually no impact on the roadway’s operations, as the roadway has excessive capacity¹. The Picacho Hills/Barcelona Ridge (3000-5000 AADT) corridor is far less than 10,000 AADT.

¹ “Infrastructure Design Directive IDD-2018-16 Road Diet Guide, NMDOT, April 2018.”

Table 11: Road Diet Decision Matrix

Project Elements	Alternatives	
	Option A: No Build	Option B: Road Diet
	Score	Score
	-2 = very poor fit, -1 = slightly poor fit, 0 = neutral, +1 = slightly positive fit, +2 = very positive fit	
Roadway Function, Operations & Environment		
1. Fits within Right of Way	+2	+2
2. Matches Desired Land Use Context	+2	+1
3. Integrates Context Sensitive Design Objectives	0	+2
4. Appropriately Manages Access	-1	+2
5. Roadway Capacity is Appropriate for AADT	0	+2
6. Addresses Heavy Commercial Vehicles	+2	0
7. Impact on Delay on Adjacent Parallel Facilities	+2	+2
Score Subtotal	+7	+11
Safety		
8. Addresses Actual Crash Data	0	0
9. Accommodates Volume of Turning Movements	-1	+2
10. Provides for Multimodal Uses	0	+2
11. Provides shorter Pedestrian Crossings	-2	+2
12. Reduces Incidents of Speeding	-2	+2
13. Design Speed Matches Target Speed	-1	+1
Score Subtotal	-6	+9
Community		
14. Complies with Local Plans	+1	0
15. Provides Economic Development Opportunities	0	0
16. Public Acceptance	+1	-2
17. Considers Livability	-2	+2
18. Provides Adequate Parking	0	0
19. Budget	0	0
20. Advances Public Health Goals and Initiatives	-2	+2
Score Subtotal	-2	+2
Multimodal Accommodation		
21. Meets Existing Bike/PED Demand	-2	+2
22. Meets Latent Bike/PED Demand	-2	+2
23. Complies with ADA	-2	0
24. Integrates Transit Accommodation	0	0
Score Subtotal	-6	+4
Total	-7	+26

Findings and Mitigation Alternatives

The review of the data collection identified the following safety concerns with recommended mitigation for each. Safety issues, other than speeding, were not identified at the Picacho Hills Drive/Barcelona Ridge Road intersection that could be effectively mitigated by the installation of a roundabout; therefore, that mitigation was not recommended due to the high cost.

Issue 1: Existing Road Geometry and Lane Configuration

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors

Description of the Safety Issue:

Field visits and analysis of aerial imagery indicate lane geometry consists of a 4-lane corridor with no median and a varying shoulder width throughout both Barcelona Ridge Road and Picacho Hills Drive. Currently, lane widths are approximately 11'. Picacho Hills Dr. has an existing bicycle lane that begins at US 70 and ends near the Picacho Hills & Barcelona Ridge intersection. The bicycle lane begins to narrow from 6' to 4' after the Picacho Hills Drive & Fairway Village Drive intersection. The bicycle lane narrows, which is a concern, and left turns need to make turns from a thru lane. Horizontal curvature existing throughout the corridor segment between US 70 & San Marcos Ct and vertical grades exist throughout the entire corridor, and that can affect higher vehicle speeds. Horizontal & vertical curves and existing roadway geometry influences reduced sight distances at some intersections. Reducing the number of lanes may improve intersection sight distance.

Suggested Mitigation:

- Warning Flashers at strategic locations
 - Cost estimation - \$30,000 - \$50,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet)
 - Cost estimation - \$440,000

Issue 2: Vehicle Speeding

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors

Description of Safety Issue:

Posted signage for the roadway is 35 MPH throughout the Picacho Hills Drive/Barcelona Ridge corridor, with a suggested advisory speed limit of 30 MPH posted before horizontal curves on Picacho Hills Dr in both directions near the business area. The speed data indicates 85th percentile average speeds are 5 to 10 MPH above posted speed limit throughout the corridor. Therefore, speeding appears to be an issue throughout the corridor. The corridor's horizontal/vertical alignment and cross-sectional geometry may also be a contributing factor.

Suggested Mitigation:

- Speed Feedback Signs
 - Cost estimation - \$45,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet)
 - Cost estimation - \$440,000
- Roadway Re-Configuration (Decrease lane widths and stripe or increase existing bike lane)
 - Cost estimation - \$440,000
- Overtime for Police Enforcement (yearly)
 - Cost estimation - \$100,000 - \$150,000

Issue 3: Intersection Sight Distance**Location:** Picacho Hills Drive/Barcelona Ridge Road Corridors**Description of Safety Issue:**

Throughout the Picacho Hills Dr/Barcelona Ridge Rd corridor, intersection sight distances are limited at most intersections due to horizontal and vertical curvature, vegetation overgrowth, terrain, and landscaping features. Many of the intersections and driveways lie within the horizontal or vertical curves, especially near the business areas, which can obstruct vehicle operators' line of sight. An evaluation of Intersection Sight Distances at 18 intersections within the corridor highlight this issue. Results show only 2 of 18 stop-control intersections met the sight distance criteria set forth by the American Association of State Highway and Transportation Officials (AASHTO) for turning movements in both directions for the posted speed limit with only one meeting when the 85th percentile speeds are considered.

Suggested Mitigation:

- Driveway Restrictions at the business area
 - Cost estimation - \$1,000-\$2,000
- Remove and reduce vegetation/landscaping obstructions
 - Cost estimation - \$5,000-7,000
- Warning Flashers near the business area
 - Cost estimation - \$30,000
- Road Diet in the business area
 - Cost estimation - \$50,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet) (traffic is pulled away from the edge of the traveled lane)
 - Cost estimation - \$440,000
- Roadway Re-Configuration (Decrease lane widths and stripe or increase existing bike lane)
 - Cost estimation - \$440,000

Issue 4: Worn or Outdated Signage and Roadway Striping & Markings

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors and Intersections

Description of Safety Issue:

Many posted signs along the Picacho Hills/Barcelona Ridge corridor are worn and may not be up to current standards. Striping and markings along the corridor and at intersections, including bicycle lane striping along Picacho Hills Drive, are faded, missing, and or outdated. A ball bank study indicated advisory speeds around curves are appropriately designated; however, oversized signs with flashers may be considered.

Suggested Mitigation:

- Signage upgrades
 - Cost estimation - \$3,500
- Roadway Striping and Markings (2 applications)
 - Cost estimation - \$ 20,000
- Warning Flashers near the business area
 - Cost estimation - \$30,000

Issue 5: Condition or Lack of Multi-Modal Facilities

Location: Picacho Hills Drive/Barcelona Ridge Road Corridors

Description of Safety Issue:

Pedestrians, as well as bicyclists, were seen using the shoulder for travel during field visits. Pertaining to bicyclists, safety issues included: no buffer between them and vehicle traffic; vegetation overgrowth that obstructs their lane of travel; narrowed lanes between the Picacho Hills Drive & Fairway Village Drive intersection and the Picacho Hills & Barcelona Ridge intersection; no signage on intersecting roads that warn of bicyclists; and no bicycle lanes along Barcelona Ridge and portions of Picacho Hills. Pertaining to pedestrians, safety issues included: no available path or sidewalk for pedestrians on either Picacho Hills Dr or Barcelona Ridge Rd. Vehicle speeding, sight distances, and intersection geometry issues discussed for the Picacho Hills Dr/Barcelona Ridge Rd intersection could affect pedestrians and bicyclists as well. Signage and markings for bicycle users appear to be minimal at this intersection. These bicycle lanes are approximately 4' wide in some areas, and smaller in others. There are no crosswalks for pedestrians to cross the Picacho Hills Drive/Barcelona Ridge Road intersection.

Suggested Mitigation:

- Install crosswalks and related signage at the Picacho Hills Dr/Barcelona Ridge Rd Intersection
 - Cost estimation - \$2,000-\$3,000

- Install new crosswalk markings at the Picacho Hills Dr/Picacho Ave Intersection and evaluate timing for pedestrians
 - Cost estimation - \$3,000-\$6,000
- Roadway Re-Configuration from 4-lane to 3-lane TWTL (Road Diet with bike lanes)
 - Cost estimation - \$440,000
- Roadway Re-Configuration (Decrease lane widths and stripe or increase existing bike lane)
 - Cost estimation - \$440,000
- Installation of 4' sidewalks
 - Cost estimation - \$425,000 (one side of corridor)
 - Cost estimation - \$850,000 (both sides of corridor)
- Installation of a Multi-use path
 - Cost estimation - \$650,000

Discussion of Findings

The findings indicate that a Road Diet would be beneficial to address many of the safety issues identified along the corridors: Existing Road Geometry and Lane Configuration, Vehicle Speeding, Intersection Sight Distance, and Lack of Multi-Modal Facilities. This mitigation is recommended; however, DAC should consider that public support for a Road Diet was not widely accepted at the public meetings. Although a Road Diet would likely be a good fit, other mitigation could be considered to address these concerns such as adding sidewalks or a multi-use path, changing the roadway configuration to reduce lane widths to accommodate a bike lane, installation of speed indicators, and clearing the vegetation and landscaping that is found to be limiting the sight distance. Except for the direct removal of vegetation, these mitigations may not be as effective as a Road Diet. DAC should consider the benefits of installing a Road Diet with its cost and level of public support.

It is recommended that the intersection of Picacho Hills and US 70 be reevaluated in future years to determine if signal timing or additional turn lanes can mitigate the expected queues.

Streetlighting is absent throughout the corridors except near the intersection of Picacho Hills and US 70. It is also uncommon in the Picacho Hills subdivisions, likely due to development preference. However, adding streetlighting along the two corridors, at intersections, and along curves is recommended should Dona Ana County consider this option.