FINAL TECHNICAL MEMORANDUM

December 20, 2017

TO: Mr. Robert Demeule
Huitt-Zollars
333 Rio Rancho Dr NE Suite 101
Rio Rancho, NM 87124

RE: Camino De Las Huertas Speed Study

At the request of Huitt-Zollars on behalf of Sandoval County, Lee Engineering has completed a speed study of Camino De Las Huertas in Placitas, New Mexico. Lee Engineering's services includes bi-directional roadway counts with speed and classification data, field review, and speed data analysis to determine 85th percentile speeds, daylight average speed, pace, and standard deviation. Following the speed analysis, common traffic calming mitigation is detailed per the current City of Albuquerque Neighborhood Traffic Management Program (NTMP) and recommendations provided.

Existing Conditions

Camino De Las Huertas serves as a principal access road for a large housing community in Placitas, New Mexico. The roadway is a Sandoval County maintained two lane roadway, and is rural in overall design and features. The road runs north and south, is classified as a local road by the NMDOT, and connects NM 165 to an expansive neighborhood to the north. A single 10-foot wide lane is present in each direction. The road is signed for a speed limit of 30 MPH in both directions and the edge-of-pavement to edge-of-pavement width of the road is 20 feet. No median or shoulder is present, and much of the road consists of rolling hills and sharp turns. Access on the roadway is unrestricted with residential houses having direct access to Camino De Las Huertas. Other access to Camino De Las Huertas includes a Senior Citizen Community Center near NM 165.

Roadway characteristics vary as terrain traversed by the roadway changes. In general, the southern end of Camino Las Huertas near NM 165 has relatively fewer curves and grade changes and the vertical and horizontal curves that are present are not sharp or severe are wider and flatter providing a greater level of comfort for drivers. In general, the northern end of Camino Las Huertas consists of steep grades and sharp turns which tend to decrease driver's comfort levels.

Data Collection

Traffic data was collected on Camino De Las Huertas at two locations, one on the southern end of the roadway and one on the northern end of the roadway. Data collection locations were provided by Sandoval County and are shown in Figure 1. Bi-directional classification and speed counts were collected on November 14, 2017 from 12:00 AM to 12:00 PM to capture conditions for an entire 24-hour period. Summarized data sheets are provided in the attachments. Table 1 summarizes the data collection and speed calculations.

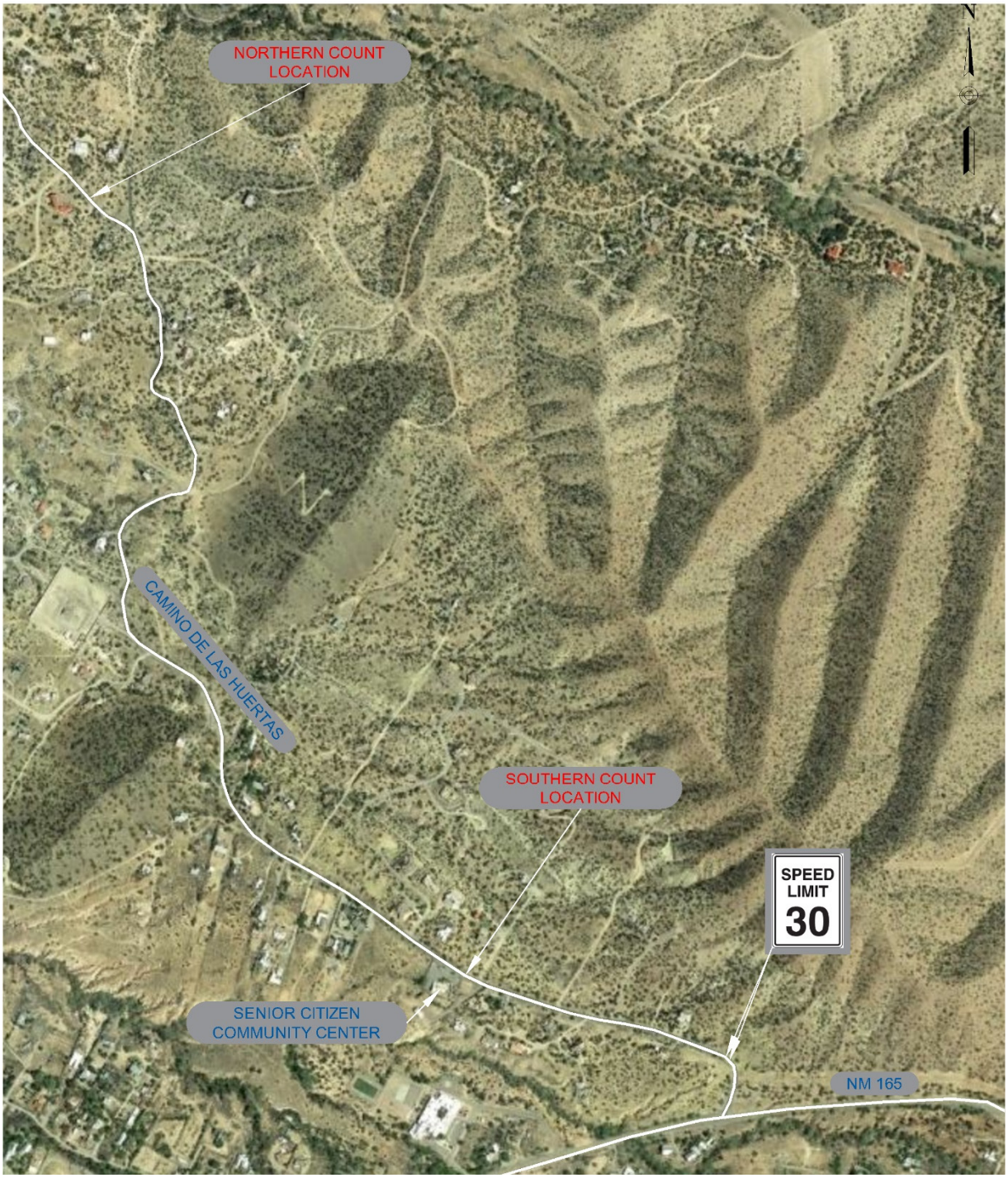

Figure 1: Vicinity Map

Table 1: Speed Data Summary

Count Location	Northern Count Location (30 MPH Speed Limit)	Southern Count Location (30 MPH Speed Limit)
Northbound Peak Hour Volume & Time	52 Vehicles at 5:00 PM – 6:00 PM	80 Vehicles at 4:00 PM – 5:00 PM
Southbound Peak Hour Volume & Time	48 Vehicles at 8:00 AM – 9:00 AM	87 Vehicles at 7:00 AM – 8:00 AM
Average Daily Traffic (24 Hour Volume)	777 Vehicles	1327 Vehicles
50th (Average) Percentile Speed	19 MPH	34 MPH
85th Percentile Speed	33 MPH	42 MPH
Daylight Average Speed (6:00 AM to 6:00 PM)	29 MPH	34 MPH
Pace	26 MPH to 35 MPH	31 MPH to 40 MPH
Speed Standard Deviation	4.8 MPH	7.5 MPH

Where:

- Northbound Peak Hour Volume & Time is the maximum volume of vehicles traveling northbound in an hour.
- Southbound Peak Hour Volume & Time is the maximum volume of vehicles traveling southbound in an hour.
- Average Daily Traffic is the total number of vehicles traveling northbound and southbound in a 24-hour period (12:00 AM to 12:00 AM).
- 50th (Average) Percentile Speed is the average of all speeds recorded on the roadway for a 24-hour period (12:00 AM to 12:00 AM).
- 85th Percentile Speed is the speed at which 85% of all speeds recorded on the roadway falls at or below.
- Daylight Average Speed is the average of all speeds recorded on the roadway for a 12-hour period during which it is daylight (6:00 AM to 6:00 PM).
- Pace is the 10 MPH range of speeds within which a majority of the recorded speeds are found to be within.
- Standard Deviation is the degree to which recorded speeds vary at the collection point.

Vehicle classification percentages are summarized for the two data collection locations as follows in Table 2:

Table 2: Vehicle Classification Distribution

Vehicle Classification	Northern Percentage	Southern Percentage
Motorcycles	0.0%	0.4%
Passenger Cars	65.4%	64.4%
2 Axle Long Vehicles (Small Pickup Trucks and Delivery Vehicles)	21.2%	23.1%
Buses	0.3%	0.5%
2 Axle 6 Tire Vehicle (Large Pickup Trucks and Delivery Vehicles)	10.4%	9.8%
Greater Than 2 Axle Vehicles	2.7%	1.8%

From the vehicle classification distribution table shown above it is determined that Camino De Las Huertas experiences a typical residential distribution with a majority of vehicles classified as passenger cars and trucks with few vehicles classified as busses and vehicles with more than two axles.

Speed Analysis and Findings

The findings of this report, based on the speed data collected at the two data collection sites, is discussed separately for the northern data collection location and the southern data collection. This discussion is separated because of differences in roadway characteristics at the two data collection locations and data collection results.

Northern Data Collection Location

Based on the data collected and field observations, a speed compliance issue is not identified at the northern data collection site. This conclusion was arrived at due to the following:

- 85th percentile speed was found to be 33 MPH meaning 85% of the speeds observed fall under 33 MPH. Only 3 MPH above the posted speed limit.
- Average speed was found to be 19 MPH. This is likely due to the roadway's characteristics of steep grades and tight curves that are present on the northern end of the road.

Furthermore, although a speeding issue at this location is not identified, it was observed during field visits that the northern end of Camino De Las Huertas traverses through mountainous terrain. Sections of the road experience steep grades, tight curves, and poor sight distances. These factors contribute to a decreased level of comfort and therefore act as natural deterrents to speeding. However, from field visits it was determined that speed reduction plaques were not present at critical points on the roadway where sharp turns or steep grades are present. Generally, speed reduction plaques are placed to advise drivers of roadway features that may be better suited for slower speeds. An engineering study is recommended to determine locations where speed reduction plaques could be present and to improve the overall safety of the roadway.

Southern Data Collection Location

Based on the data collected and field observations, a speed compliance issue is identified at the southern data collection site. This conclusion was arrived at due to following:

- The 85th percentile speed was found to be 42 MPH meaning that 85% of the speeds observed fall under 42 MPH, but 15% of speeds observed are higher than 42 MPH. This is 12 MPH greater than the posted speed limit of 30 MPH.
- The average speed was found to be 34 MPH, exceeding the posted speed limit by 4MPH.
- Pace, which is a range of 10 MPH within which a majority of the observed speeds were recorded, was found to be 31 MPH to 40 MPH, which is above the posted speed limit. This indicates that a majority of the observed speeds were found to be out of compliance with the posted speed limit.

Traffic Calming Strategies and Devices

There are many different traffic calming measures available that, when applied properly, can reduce speeds on roadways and provide the added bonus of increased safety for pedestrians and bicyclists. Several manuals and local policies have been developed to aid municipalities in choosing and implementing traffic calming measures. As an example, the City of Albuquerque has developed a manual titled the "City of Albuquerque Neighborhood Traffic Management Program (NTMP)" through which they have also developed a 'toolbox' of traffic calming measures. This 'toolbox' provides descriptions of traffic calming measures and guidance as to their typical placement.

The remainder of this section contains excerpts and summaries taken from the City of Albuquerque's NTMP and also engineering commentary regarding the pros, cons and typical costs of each traffic calming measure. The following sections are organized by increasing costs.

Targeted Police Enforcement

Targeted Police Enforcement is the deployment of police officers to enforce traffic laws and speed restrictions. This effort is very effective at reducing speeds and traffic violations but is likely not a long-term measure. Coordination efforts would need to be made with local law enforcement agencies to ensure officer availability, and although this measure is highly effective in the immediate term, long term effects may be limited. There are not typical costs associated with this measure where law enforcement agencies are willing and able to provide enforcement.

Figure 2: Targeted Police Enforcement. Source: CABQ NTMP

Permanent Radar Speed Signs (Speed Feedback)

Permanent Radar Speed Signs are devices similar to the common portable Radar speed trailers, which are deployed primarily by law enforcement, but instead are permanent electronic signs placed alongside a roadway. They are typically placed where speed compliance is an issue and function by informing drivers of their speed. Visual reminders of a driver's speed can sometimes cause them to decrease speed. They are suited for rural or residential areas as they can be powered by solar or metered electrical service. They have similar strengths and weaknesses to the Radar Speed Trailers (discussed below), but also have an additional disadvantage as these signs can over time blend into driver's perceptions of roads and become 'background noise' when driving. Typical costs for a single unit can range from $2,000 to $5,000.

Figure 3: Permanent Radar Speed Sign. Source: CABQ NTMP

Radar Speed Trailers (Speed Feedback)

Radar speed trailers are "mobile units placed on the side of the road that use radar to sense an oncoming vehicle's speed and display that speed back to the approaching driver. This is intended to give the driver an external visual indication of their speed, which if excessive, may remind them to slow down." Typically, these trailers are effective in reducing speeds in the vicinity of their deployment. They are also low cost and can be used at many different locations throughout a year. However, these units may only have temporary effectiveness limited to their deployment location and duration, and can often cause some (typically younger) drivers to recklessly increase their speed. The cost of a single unit can range from around $5,000 to upwards of $12,000.

Figure 4: Radar Speed Trailer. Source: CABQ NTMP

Speed Humps/Speed Tables

Speed humps and speed tables are perhaps the most common form of neighborhood traffic calming measures. They are paved devices that cause a vertical deflection of vehicles driving in the roadway. Speed humps are characteristically three to four inches in height and stretch across the entire width of the roadway. Speed tables are larger devices that operate in the same function as a speed hump but allow vehicles to pass with less of a speed reduction. The City of Albuquerque's Neighborhood Traffic Calming Measures Toolbox asserts that speed humps should be used when traffic volumes are recorded to be less than 400 vehicles per day, and that speed tables should be used where traffic volumes are recorded to be between 400 and 4,000 vehicles per day. Both measures are effective at reducing speeds

Figure 5: Speed Humps/Speed Table. Source: CABQ NTMP

on residential roadways and are inexpensive and relatively easy to construct. However, it has been observed that speed humps and speed tables can cause drivers to recklessly increase speed between speed humps and speed tables to 'recover' time lost due to reducing speed at the speed humps or speed tables. It has also been observed that speed humps and speed tables can sometimes face resistance from residents and community members. Typical costs for a speed hump are around $1,000 and $2,500 for each speed table.

Centerline/Edge line/Lane Striping

Centerline/Edge line/Lane Striping is a traffic calming measure that, in residential applications, adds a center line and edge line striping to a roadway. These roadway stripes are placed in a way that narrows a driver's perceived 'useable' lane width thereby causing the driver to feel more restricted. This feeling of restriction then prompts drivers to reduce their speeds. This method typically costs $0.67 per foot for a 4-inch-wide stripe. A typical 1,000-foot-long stretch of road that receives a double yellow center stripe, and two edge stripes would cost approximately $2,700.

Figure 6: Centerline/Edge line/Lane Striping. Source: CABQ NTMP

Lane Narrowing with Center Islands/Raised Crosswalks

Lane Narrowing with Center Islands is a traffic measure that uses the same principal as the roadway narrowing (via striping) measure discussed above. Under this measure, lanes are narrowed by providing a center island between opposing travel lanes. The center islands are typically constructed at pedestrian crossing locations as opportunity exists to provide pedestrian refuge in the islands. Opportunity also exists to provide a raised crosswalk (similar to a larger speed table) at these locations, which provide additional speed reduction and protection for crossing pedestrians. These center islands usually reduce driver speeds and provide an opportunity for enhanced pedestrian crossings, but can also sometimes result in unwanted U-turns and impacts to snow removal operations. Typical costs for such measures can range from $5,000 to $20,000.

Figure 7: Lane Narrowing with Center Islands. Source: CABQ NTMP

Chicanes

Chicanes are, as stated by the City of Albuquerque Neighborhood Traffic Calming Measures Toolbox, "Curb extensions that alternate from one side of the roadway to the other, forming s-shaped curves. They insert curvature in an otherwise straight stretch of roadway." They can be constructed in single lane and two-lane form, both of which provide speed reductions for drivers by causing drivers to navigate changing curves in the road. Chicanes provide enhanced traffic calming by visual cues of restricted line-of-sight and improved neighborhood aesthetics through landscaping. However, these traffic calming measures can be cost prohibitive and the effects on vehicles speeds can sometimes be negligible. Typical costs range from $8,000 to $15,000 depending on the conditions of the location.

Figure 8: Chicanes. Source: CABQ NTMP

Neck-downs/Bulb-outs

Neck-downs and Bulb-outs are a physical traffic calming measure that reconstruct curbs and roadway geometry to reduce roadway width from edge to edge. This method is also often used to draw driver's attention to pedestrians crossing in crosswalks that can be constructed at these locations. These neck-downs and bulb-outs can also sharpen turning radii at intersections thereby causing drivers to reduce speeds to safely complete turning movements. Typical costs for such measures can range from $10,000 to $15,000.

Figure 9: Neck-downs/Bulb-outs. Source: CABQ NTMP

Two Lane or Single Lane Chokers

Two lane or Single Lane Chokers are curb extensions constructed at a mid-block (midpoint between intersections) to narrow the road's traveled way. They can be constructed as a single lane, where drivers are forced to slow down and negotiate passing through the choker, and two lanes where the traveled way is narrowed but bi-directional travel is accommodated. These are the most effective when implemented by permanent curb and roadway modifications but can also be implemented using signing, striping and roadway delineators. Typical cost can range from $5,000 for delineators and striping to $20,000 for physical roadway modifications.

Figure 10: Two lane or Single Lane Chokers. Source: CABQ NTMP

Traffic Circles

Traffic circles are physical intersection traffic calming measures. These are raised islands placed in the center of a 3 or 4-way intersection. This method of traffic calming prevents drivers from driving at excessive speeds through intersections by impeding and restricting movements, and also forces drivers to reduce speed to yield to opposing vehicles. These are especially effective at neighborhood locations where speed and safety problems are a concern. The only disadvantage to this traffic calming measure is that it also slows emergency vehicles and can be difficult for large vehicles to navigate. However, a rolled curb can be constructed so that emergency vehicles are less restricted and large vehicles can utilize part of the rolled curb in their turning radii. Typical costs can range from $8,000 to $12,000.

Figure 11: Traffic Circles. Source: CABQ NTMP

Roundabouts

Roundabouts are intersection designs that require traffic to drive in a circular direction around a raised median placed in the center of an intersection. These are different from traffic circles in that they are typically used at higher volume intersections. The high volumes aid in causing traffic to slow down and yield to vehicles currently traversing the roundabout. Roundabouts are a viable alternative to traffic signals, in some cases, and offer improved safety compared to stop sign controlled intersections. They also offer opportunity to improve neighborhood aesthetics via landscaping in the center of the roundabout. However, depending on the size of the roundabout, the cost can be prohibitive and the design can be difficult for larger vehicles to navigate. For this purpose, a 'truck apron' is generally constructed so that large vehicles can better navigate the roundabout. Typical costs can range from $50,000 to $200,000 depending on the size of the roundabout and right-of-way availability.

Figure 12: Roundabouts. Source: CABQ NTMP

Recommendations

To mitigate the speed issue observed on Camino De Las Huertas, a scalable approach is recommended. It is recommended that mitigation efforts be implemented starting with low cost impacts such as enforcement and be escalated to incorporate more physically-reinforced impacts such as Centerline & Edge Striping to Lane Narrowing with Center Islands.

In the interim, it is recommended that the county coordinate with local law enforcement to increase speed enforcement efforts on Camino De Las Huertas. At this same time, it is recommended that Speed Feedback signs be placed at strategic locations on Camino De Las Huertas where speeds are an issue such as the southern end of the roadway. Speed Feedback signs combined with speed enforcement can be a viable option to reduce speeds on a roadway. However, the combination of these two mitigation efforts can have temporary effects on the roadway. This is mostly due to the effect that speed feedback signs can "blend in" to a driver's surroundings over time and thus become less effective. Therefore, it is also recommended that the speed issue on Camino De Las Huertas be revisited on a periodic basis to determine the effectiveness of the mitigation efforts.

If it is determined that Speed Feedback signs and enforcement does not produce desired results, it is recommended that a more physically prevalent mitigation effort, such as speed humps/speed tables/raised crosswalk, be implemented. Generally, speed humps/speed tables are effective measures for reducing speeds on a roadway. However, speed humps can have other side-effects in that drivers can have a tendency to increase speeds between speed humps in an effort to "make up time". Therefore, it is recommended that opportunities where lanes could be narrowed via centerline and edge striping in addition to speed humps should be reviewed. Raised crosswalks not only reduce roadway speeds but also have the added benefit of providing better visibility of a pedestrian crossing and should be located at points along the roadway where pedestrian crossings are likely. For example, a raised crosswalk could be considered ate the senior community center where parking was observed across the street and pedestrian crossing were observed during an event held at the site. The combined effects of these mitigation measures could be effective at reducing overall speeds on Camino De Las Huertas while potential enhancing pedestrian safety if a raised crosswalk is implemented. As stated above, it would also be recommended that the effects of these devices be studied on a periodic basis to determine the effectiveness of the mitigation efforts.

Lastly, after an engineering study has determined the effects of implementing speed humps/speed tables to be less than desirable, it is recommended that more significant mitigation efforts be looked at ranging from neck-downs/bulb-outs to chicanes and roundabouts. Due to the higher cost and roadway impacts of these options, these should be looked at if less costly options do not reduce speeds to desired levels. Additionally, these more costly options should also be accompanied by a much more significant study and public outreach effort including constructability review, utility impacts, crash analyses, a public involvement program, operational impacts analysis, drainage analysis, and detailed construction cost estimates.

Please let me know if you have any questions. I can be reached at 505-338-0988 or e-mail pbyrd@lee-eng.com.

Sincerely,

Patrick Byrd, P.E. PTOE

Attachments

A. **Traffic Count Data Sheets**