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Transmittal

To:	Geoffrey Grote, City Administrator	Date:	April 7, 2011
Company:	City of Piedmont	Project:	Blair Park
Address:	120 Vista Avenue Piedmont, CA 94611	Project No:	200814
		Subject:	Traffic Calming Alternatives
From:	Clarence D. Mamuyac, Jr., AIA, LEED® AP, NCARB		

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Should you have any questions, please do not hesitate to contact me.

All the best,

Clarence

cc

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M E M O R A N D U M

To: Clarence Mamuyac, ELS Architects

From: Michael Moule, PE, TE

Date: April 4, 2011

Subject: Blair Park – Moraga Avenue Traffic Calming Alternatives

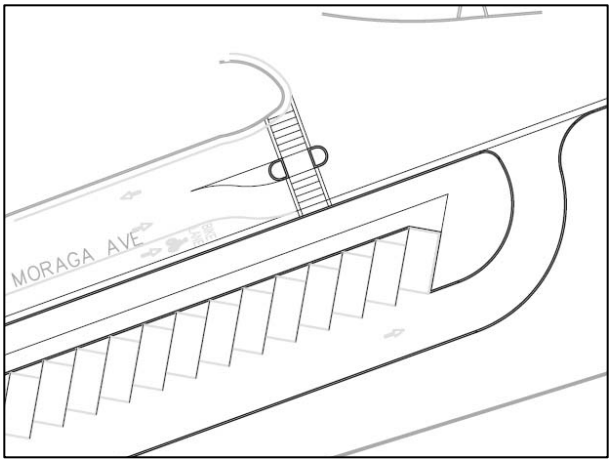
Introduction

The Environmental Impact Report ("EIR") for the Moraga Canyon Sports Fields Project recommended several solutions to calm traffic and improve the ease and safety of pedestrians crossing Moraga Avenue at and near Blair Park. This memorandum discusses and analyzes other alternate traffic calming measures that could also reduce traffic speeds and enhance pedestrian safety in the area. Those measures include: (1) a pedestrian crossing at Maxwelton Road; (2) a roundabout at Red Rock Road; and, (3) a roundabout at Maxwelton Road.

The impacts and benefits of each proposed traffic calming measure are discussed below.

Pedestrian Crossing at Maxwelton

A pedestrian crosswalk at Maxwelton Road would provide access for pedestrians between the north side of Moraga Avenue and the Blair Park fields.



The EIR recommends a crosswalk at Red Rock Road. It may also be appropriate to place another crosswalk at Maxwelton Road. The recommended crosswalk location is approximately where the crosswalk is shown on the image at right. With this placement, no specific pedestrian facilities would need to be built on the north side of Moraga. Pedestrians would simply walk across Moraga directly onto the roadway surface of Maxwelton Road (as dog walkers and others currently do when accessing the park site from Maxwelton Road).

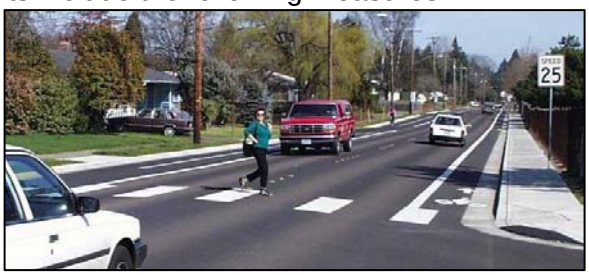
Whether a crosswalk at this location would improve the ease and safety of pedestrian access depends on sight distance. Sight distance means not only stopping sight distance for vehicular traffic to the crosswalk, but also pedestrian sight distance up and down Moraga Avenue. The necessary stopping sight distance is 155 feet for 25 mph and 250 feet for 35 mph. At the

proposed pedestrian crossing at Maxwelton, the available sight distance would be approximately 260 feet for eastbound traffic and 390 feet for westbound traffic. Thus the available sight distance would be sufficient for stopping sight distance, even if traffic continues to travel at the existing speeds.

With regard to pedestrian sight distance, the key is how far pedestrians can see in order to feel comfortable entering the street. The curb to curb distance on Moraga Avenue is 30 feet. At the normal walking speed of 3.5 feet per second, it takes a pedestrian 8.5 seconds to cross Moraga Avenue. A vehicle traveling at 35 mph travels 440 feet in 8.5 seconds. At this speed a pedestrian preparing to cross the street cannot determine whether there is a gap in traffic that would allow them to fully cross the street if drivers do not yield to them. While the only required sight distance is that evaluated in the previous paragraph, the lack of 440 feet of sight distance might be a bit disconcerting to pedestrians as they are trying to cross the street. Therefore, other features should be considered to encourage yielding and otherwise improve the ease of pedestrians crossing the street.

There are several possible enhancements that should be considered for implementation at this crosswalk to encourage drivers to yield to pedestrians and otherwise make it easier for pedestrians to cross the street. These enhancements include the following measures:

1. High-visibility crosswalk markings. Longitudinal markings could be used and spaced to avoid the wheel paths of vehicles as shown in the image at right.



2. Illumination. The crosswalk should have adequate illumination so that pedestrians are visible at night.
3. Pedestrian crossing island. A small raised median island could be placed to provide a refuge for pedestrians when they are crossing the street, as shown in the image at right. By providing an island, pedestrians only need to look one direction at a time (pedestrians look to the left, cross to the island, and then look to the right, and cross the second half of the road). This two-stage crossing technique provides pedestrians the adequate sight lines to be able to identify a gap in traffic that will allow them to cross, even if drivers do not yield to them. Research has shown that pedestrian refuge islands decrease pedestrian crossing crashes by about 40%. The island should preferably be 8 feet wide, but an absolute minimum of 6 feet wide in order to accommodate someone pushing a stroller or walking a bike. Placing an island at this location will require widening the street toward the parking lot at this location, and/or the elimination of the bike lane. It should be noted that any physical object placed in the roadway (including this proposed crossing island) will occasionally be hit by errant (usually speeding) motor vehicle drivers.

4. In-Street Pedestrian Crossing Sign. In addition to normal pedestrian crossing warning signs in advance of and at the crosswalk, the In-Street Pedestrian Crossing sign (R1-6, shown at right) could be placed on the centerline of the roadway or on a median island if one is used as described above.

5. Flashing yellow beacons. These could be installed on the pedestrian warning signs as shown in the image at left. The beacon would be activated by pedestrians. With a flashing yellow beacon, the crosswalk would operate under normal pedestrian right-of-way rules – motorists would be required to yield to pedestrians in the crosswalk. The beacon simply serves to provide additional notice that pedestrians are using the crosswalk when the beacon is flashing.

6. Rectangular Rapid Flash Beacon. As discussed above, a standard round flashing yellow beacon is beneficial, but there is a new experimental device called the Rectangular Rapid Flash Beacon (RRFB) as pictured at right. This beacon has a rapid, very bright LED flash that has been shown to result in much higher yielding rates than normal round beacons. The RRFB is not yet approved for use in California, but this approval may be coming soon. If the RRFB has been approved by the time the Blair Park project is constructed, it could be used instead of a round beacon.

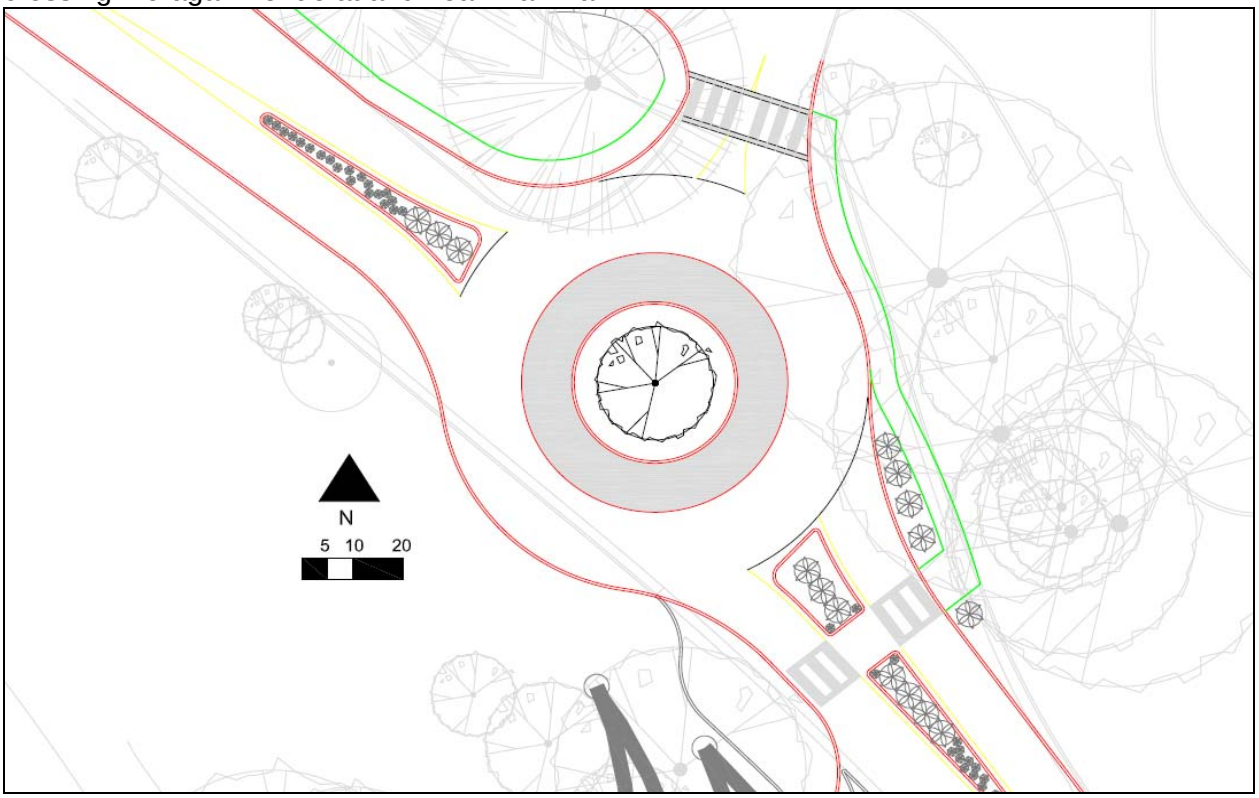
Roundabouts

A roundabout is a type of intersection, but also acts as a traffic calming measure. Due to their geometric design, roundabouts slow vehicles traveling through them to about 15-20 mph. These slower speeds improve safety for all users by making it easier for drivers to react and avoid a crash, and by reducing the severity of crashes since there is less kinetic energy. Because roundabouts are a great traffic calming alternative they are discussed at two possible locations along Moraga Avenue: (1) at Red Rock Road and (2) at Maxwelton Road.

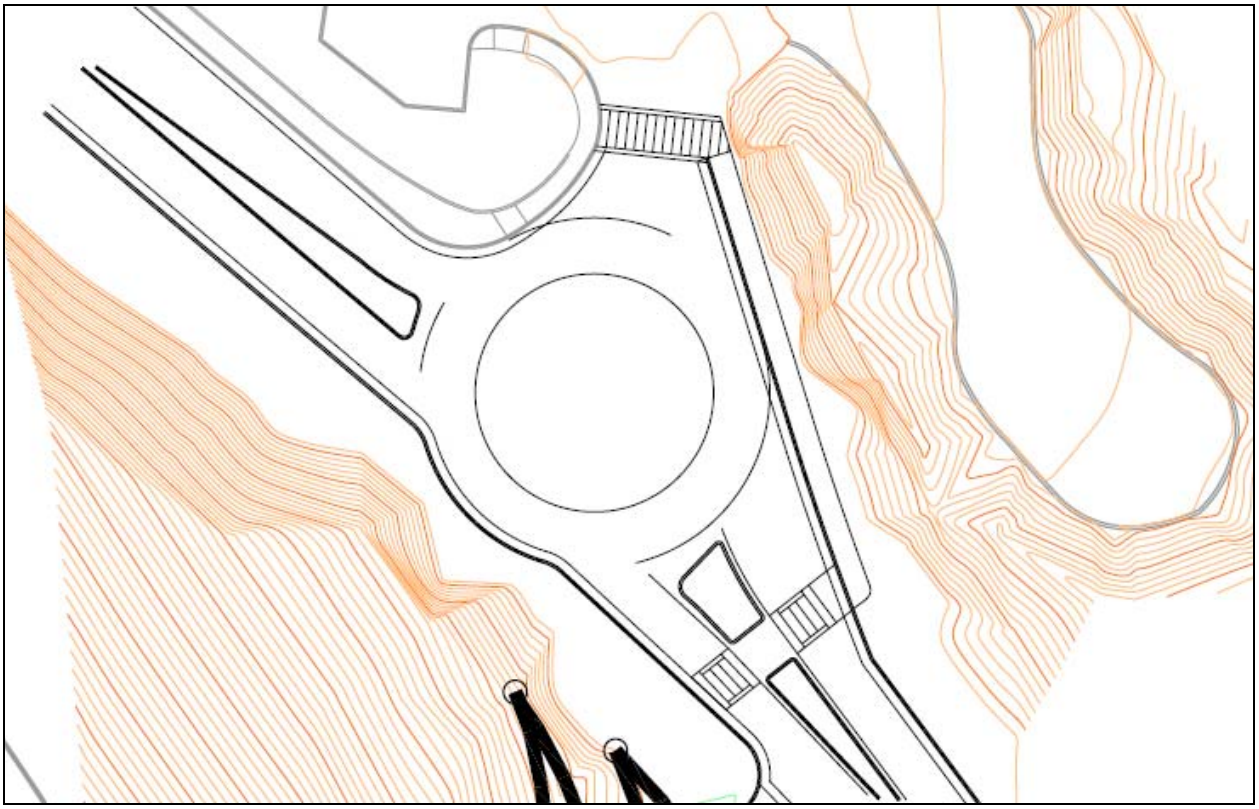
Roundabout at Red Rock Road

A roundabout at the intersection of Moraga Avenue and Red Rock Road would physically reduce traffic speeds, enhance pedestrian safety, and control traffic at the intersection. This intersection provides access to Coaches Field and the City Corporate Yard, as shown below. There are two potential options for a roundabout at Red Rock Road: (1) an 85-foot diameter roundabout; and, (2) a 75-foot diameter mini-roundabout.

A roundabout at Red Rock Road could have an inscribed circle diameter of 85 feet and could include a mountable truck apron as well as a raised central island that would have landscaping installed, such as ground cover and a tree in the center. The conceptual design shown below is of this larger roundabout, which would require cutting into the existing embankment at the roundabout on the south side of Moraga Avenue. Cutting into the embankment is necessary to allow for the installation of a raised central island that can be landscaped, making the roundabout more visible to approaching drivers. However, a smaller roundabout would also address City concerns regarding traffic calming and improving ease and safety of pedestrians crossing Moraga Avenue at and near Blair Park.

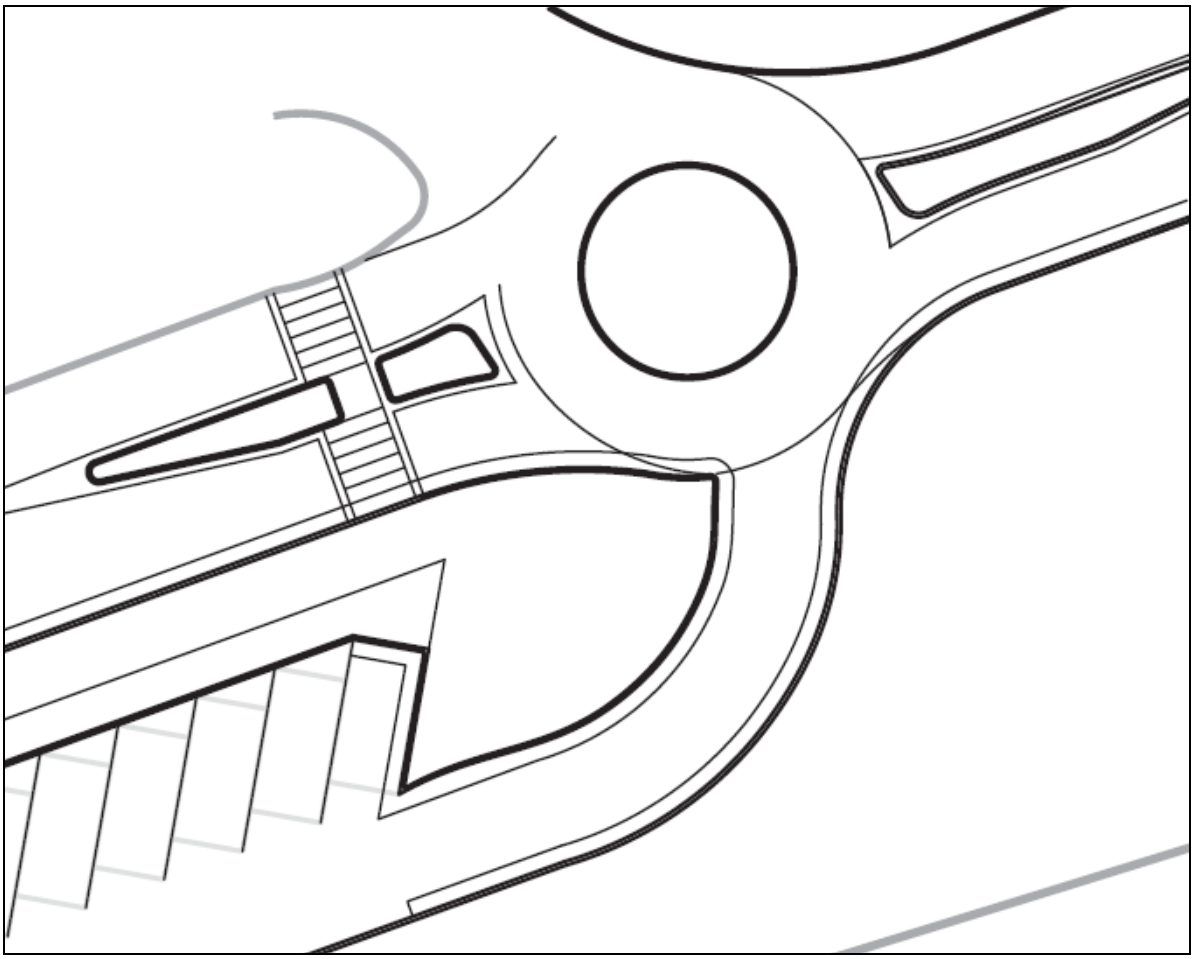


The intersection at Red Rock Road could also have a mini-roundabout with an inscribed circle diameter of about 75 feet, but with a fully-mountable central island so trucks can access the roundabout. The image below shows how such a mini-roundabout could fit approximately into the available existing intersection area. This smaller roundabout diameter reduces earthwork requirements while providing similar benefits to the larger roundabout design. Those benefits include physically reduced traffic speeds to 15-20 mph, enhanced pedestrian safety, and traffic control at the intersection.



Roundabout at Maxwelton

A roundabout at the intersection of Moraga Avenue with Maxwelton Road and the exit of the easternmost proposed parking lot would physically reduce traffic speeds, enhance pedestrian safety, and control traffic at the intersection. As shown below this proposed roundabout is a mini-roundabout that would have an inscribed circle diameter of 51 feet. The entire central island would be mountable to allow for truck access.



Benefits of a Roundabout on Moraga

Installation of each of the proposed roundabouts on Moraga Avenue would have many benefits as discussed below. The roundabouts do not need to be considered together as a package, but rather as two independent solutions that provide benefits at different locations.

Slower Travel Speeds

As mentioned above, all of the roundabout designs proposed would slow vehicles traveling through them to about 15-20 mph due to their geometric designs. These slower speeds improve safety for all users by making it easier for drivers to react and avoid a crash, and by reducing the severity of crashes since there is less kinetic energy.

Landscaping

Roundabouts provide an opportunity for landscaping. The larger roundabout design at Red Rock Road may include a raised central island where low shrubs may be placed, as well as at least one tree. The smaller mini-roundabout designs at Red Rock Road and Maxwelton Road include raised “splitter islands” between the entrance and exit lanes on the Moraga Avenue approaches that would be landscaped with low shrubs. The addition of landscaping in these areas indicates to approaching drivers that the environment is changing. Instead of seeing a continuous road ahead of them, they see landscaping in the middle, which causes them to slow down and change their driving behavior in a way that would be appropriate for driving past a park.

Ease and Safety of Pedestrian Crossings

The installation of a roundabout along Moraga Avenue at either location would make it significantly easier and safer for pedestrians to cross the street. One major reason for this is the slower vehicle speeds, which would make it easier to find a gap in traffic. Lower speeds would also improve pedestrian safety because drivers could more easily react to avoid a crash if necessary. Additionally, the lower kinetic energy resulting from lower vehicle speeds significantly reduces the severity of pedestrian crashes. Research has shown that if a pedestrian is hit by a vehicle at 40 mph there is an 85% chance that the pedestrian will be killed, but if the crash occurs at 20 mph, the chance of being killed is only 5%.

Crosswalks proposed along Moraga Avenue should be located at a roundabout, as roundabouts are placed so that the raised splitter islands act as a refuge for pedestrians crossing the street. This allows pedestrians to cross only one direction at a time, greatly simplifying the crossing task, and reducing pedestrian crashes by up to 40%.

Improved Turning Movements

A roundabout at Red Rock Road or Maxwelton Road would result in easier and safer turning movements to and from side streets and driveways onto Moraga Avenue.

Moraga Avenue has a curvilinear alignment. As noted in the Environmental Impact Report, this results in only marginally enough sight distance for reasonably safe turning movements to and from the proposed park driveways at the current 85th percentile speed on Moraga Avenue or 35 mph.

This is one of the major reasons why the EIR called for traffic calming measures on Moraga Avenue. As discussed above, installing roundabouts along Moraga Avenue would reduce traffic speeds at the roundabouts to about 15 to 20 mph. The roundabouts would also reduce vehicle speeds before and after each roundabout, likely resulting in lower overall speeds on the entire road frontage of Blair Park. The reduced speeds and the operation of the roundabout would make it easier to enter and/or exit each of the driveways and intersections in the vicinity of Blair Park.

The roundabouts would have the greatest benefits for left turn movements onto and off of Moraga Avenue. The largest benefits would be for drivers making left turns from minor streets or driveways onto Moraga Avenue where a roundabout is installed. Instead of looking both left and right to find a gap in 25 to 35 mph traffic, at a roundabout, drivers would only need to look to the left, and the approaching traffic would be traveling at no more than about 20 mph. At other

locations where drivers make left turns, any reduction in speed resulting from the installation of a roundabout would reduce the necessary sight distance, which would make it easier for drivers to find a gap in traffic and safely make their turn.

Impacts of Roundabouts on Traffic Flow

Installation of roundabouts along Moraga Avenue would calm traffic and improve the ease and safety of pedestrians crossing the street, but would these roundabouts result in worse level of service along Moraga Avenue?

To analyze how the roundabouts would perform, Nelson\Nygaard staff used the same "opening year plus project" traffic projections used in the EIR traffic study. At Red Rock Road, the traffic projections were adjusted slightly to account for the fact that the roundabout design prohibits direct left turns into the entrance of the proposed westernmost parking lot at Blair Park. The traffic conditions were analyzed using Sidra Intersection traffic analysis software. For both the AM and PM peak hours, the table below compares the estimated delay (in seconds) and Level of Service (LOS) for stop control, as set forth in the EIR traffic study, to roundabouts. Level of Service is measured on a scale from A (least delay) to F (most delay). Each intersection is evaluated independently and the results for one intersection would be the same whether or not a roundabout is installed at the other intersection.

Delay and Level of Service Comparison of Stop Control to Roundabouts
Opening Year Plus Blair Park Project

Intersection	Traffic Control	AM Peak Hour		PM Peak Hour	
		Delay (sec)	LOS	Delay (sec)	LOS
Moraga/Red Rock Road	1-way Stop Control	0.4 (19.9)	A (C)	3.2 (34.8)	A (D)
Moraga/Red Rock Road	Roundabout	2.2 (9.8)	A (A)	2.7 (6.4)	A (A)
Moraga/Maxwelton	2-way Stop Control	0.4 (24.1)	A (C)	1.9 (39.2)	A (E)
Moraga/Maxwelton	Roundabout	4.0 (12.0)	A (B)	4.2 (9.3)	A (A)

Average delay and LOS for the entire intersection is listed first, followed by the delay and LOS for the worst approach (in parentheses).

As shown in the table above, the overall delay is worse for the roundabouts when compared to stop control. This is due to the fact that with stop control, traffic on Moraga doesn't stop or slow down; but with roundabouts, traffic on Moraga must slow down to negotiate the roundabout, and occasionally yield to a vehicle entering or exiting one of the side streets or driveways. Almost all of the additional delay calculated for the roundabout is a result of "geometric delay" for vehicles traveling along Moraga Avenue. Geometric delay is simply an estimate of how much more time it takes for vehicles to negotiate the intersection due to the fact that they must physically slow down to get through the roundabout. In other words, this is the extra time that is experienced by drivers when they must slow down from an average speed of about 30 mph to an average speed of about 15 to 20 mph at the roundabout.

When comparing the delay of the worst approach of the intersections (see values in parentheses), the roundabouts perform far better than two-way stop control. With stop control, during the PM Peak Hour, traffic on the Red Rock Road approach is estimated to experience 34.8 seconds of delay, which equates to Level of Service D. Likewise, traffic exiting the easternmost proposed parking lot is estimated to experience 39.2 seconds of delay, which

equates to LOS E. With roundabouts at both locations, the delay for these two approaches during the PM Peak Hour is estimated to be 6.4 and 9.3 seconds, both equating to Level of Service A. As such, while the roundabouts would result in a small amount of geometric delay along Moraga Avenue, the delay does not result in a reduction in Level of Service that would be considered potentially significant. The roundabouts result in far less delay for traffic on the minor streets when compared to the delay experienced in a stop-controlled environment.