iteris

213.488.0345
iteris.com

801 South Grand Avenue, Suite 530
Los Angeles, CA 90017

WEST PARCEL SOLAR (TRUCK HAUL PLAN)

To: Gary Nellesen, Mt San Antonio College

From: Deepak Kaushik, P.E., Sowmya Chandrasekhar, T.E., P.E., Iteris Inc.

Date: July 20, 2017

Subject: West Parcel Solar (WPS) – Truck Haul Plan

1. INTRODUCTION

This memorandum presents Iteris' assessment of potential traffic impacts and mitigation related to the West Parcel Solar (WPS) project construction truck hauling activities in the City of Walnut. This Truck Haul Plan is based on discussions with Mt. San Antonio College (Mt. SAC) and City of Walnut staff.

The first leg of the haul route, where trucks are fully loaded, is planned to start from the dirt hill adjacent to Hilmer Lodge Stadium on the Mt. SAC campus and end at the WPS construction site along Grand Avenue approximately 1,000 feet southeast of Temple Avenue. Trucks would be loaded or fill up at the hill site, or borrow site, and travel to the WPS construction site to dump their load. The second leg of the haul route, where trucks are empty, would begin at the WPS construction site and loop around Grand Avenue, Valley Boulevard, and Temple Avenue back to the hill site. **Figure 1** shows the proposed truck haul route.

The following four (4) intersections are analyzed as part of the haul route in this memorandum:

1. Grand Avenue/Temple Avenue-Amar Road;
2. Bonita Avenue/Temple Avenue;
3. Valley Boulevard/Temple Avenue; and
4. Grand Avenue/Valley Boulevard.

While the Grand Avenue/La Puente Avenue Road intersection is also a signalized intersection along the proposed return route (empty truck route), it is not expected that truck traffic making only a southbound through movement would impact the intersection operations. Thus, this intersection was not analyzed. Storage space for vehicles queued at through movements are not limited in the same manner as storage space for vehicles queued at left-turn movements. There is more storage space available at the former, and less storage space available at the latter movements.

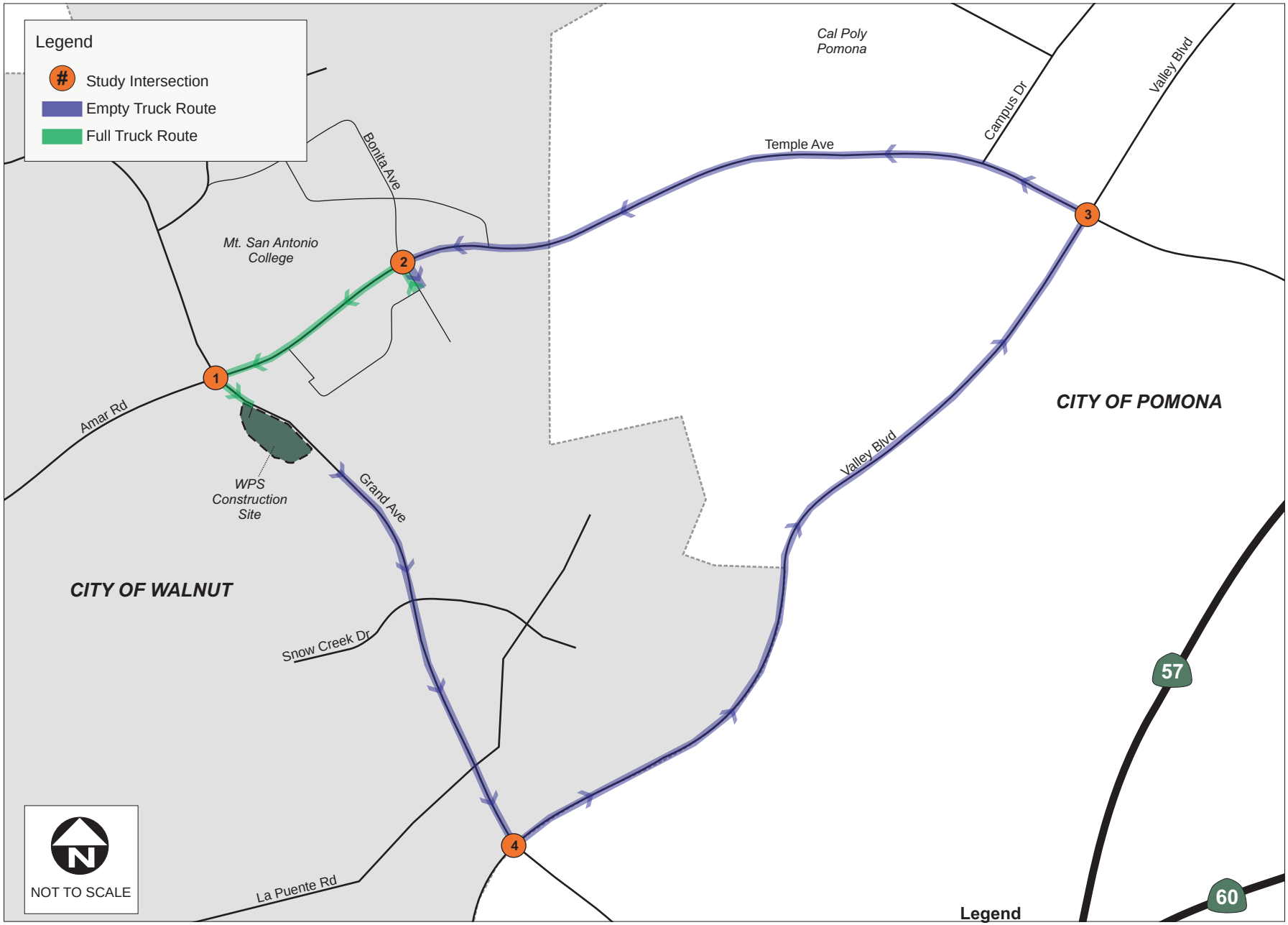

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FIGURE 1
Proposed Truck Route and Study Intersections

2. Traffic Operations Methodology

The quality of traffic operations is characterized using the concept of level of service (LOS). Level of service is defined by a range of grades from A (best) to F (worst). At intersections, LOS "A" represents relatively free operating conditions with little or no delay. LOS "F" is characterized by extremely unstable flow conditions and severe congestion with volumes at or near the intersection's design capacity. This results in long queues backing up from all approaches to intersections.

In this report, analysis of traffic operations analysis was conducted according to the Los Angeles County traffic impact analysis guidelines. Utilizing these guidelines, intersection operating conditions were quantified using the Intersection Capacity Utilization (ICU) method. Volume-to-capacity (V/C) ratios and corresponding levels of service (LOS) were calculated at study intersections during the weekday a.m. and p.m. peak hours most closely matching the construction time periods. LOS analyses for all study intersections were conducted using TRAFFIX software. **Table 1** presents a brief description of each level of service letter grade, as well as the range of V/C ratios associated with each grade for signalized intersections.

Table 1: Intersection Level of Service Definitions

Level of Service	Description	Intersection Volume to Capacity (V/C) Ratio
A	Excellent operation. All approaches to the intersection appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation.	0.000-0.600
B	Very good operation. Many drivers begin to feel somewhat restricted within platoons of vehicles. This represents stable flow. An approach to an intersection may occasionally be fully utilized and traffic queues start to form.	>0.600-0.700
C	Good operation. Occasionally drivers may have to wait more than 60 seconds, and back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted.	>0.700-0.800
D	Fair operation. Cars are sometimes required to wait more than 60 seconds during short peaks. There are no long-standing traffic queues.	>0.800-0.900
E	Poor operation. Some long-standing vehicular queues develop on critical approaches to intersections. Delays may be up to several minutes.	>0.900-1.000
F	Forced flow. Represents jammed conditions. Backups form locations downstream or on the cross street may restrict or prevent movement of vehicles out of the intersection approach lanes; therefore, volumes carried are not predictable. Potential for stop and go type traffic flow.	> 1.000

This analysis conservatively utilizes the Los Angeles County Public Works traffic impact review guidelines, which state that a project's traffic impact is evaluated based on ICU and is considered significant if the change in volume to capacity ratio (V/C) relative to the "without project" signalized intersection level of service (LOS) meets or exceeds the thresholds contained in **Table 2**. These guidelines are more stringent than the Los Angeles County Metropolitan Transportation Authority (LACMTA) guidelines which were used in the 2008 traffic impact analysis for the Mt. SAC Master Plan Update EIR.

TABLE 2: INTERSECTION SIGNIFICANT IMPACT CRITERIA

Intersection LOS in Pre-Project Conditions	V/C	Project V/C Increase
C	0.71 to 0.80	0.04 or more
D	0.81 to 0.90	0.02 or more
E / F	0.91 or more	0.01 or more

3. EXISTING CONDITIONS

This section presents the existing conditions of the study area. Existing intersection traffic counts were collected on October 1, 2015 during the a.m. peak period (7:00 – 9:00 a.m.) and the p.m. peak period (4:00 – 6:00 p.m.) on a typical weekday with school in session. The volumes collected between 8:00 to 9:00 a.m. and 4:00 to 5:00 p.m. were used in this analysis to be most consistent with the truck hauling process which is planned to occur between 8:30 a.m. and 4:30 p.m. on weekdays and Saturday. This data is consistent with the data used in the 2015 Facility Master Plan Program/Project EIR and the 2017 Physical Education Project (Phase 1, 2) EIR. Any changes in traffic volumes between 2015 and 2017 would not substantially alter the study conclusions. **Figure 2** shows the existing traffic volumes at the study intersections. Existing traffic count data is provided in **Appendix A**.

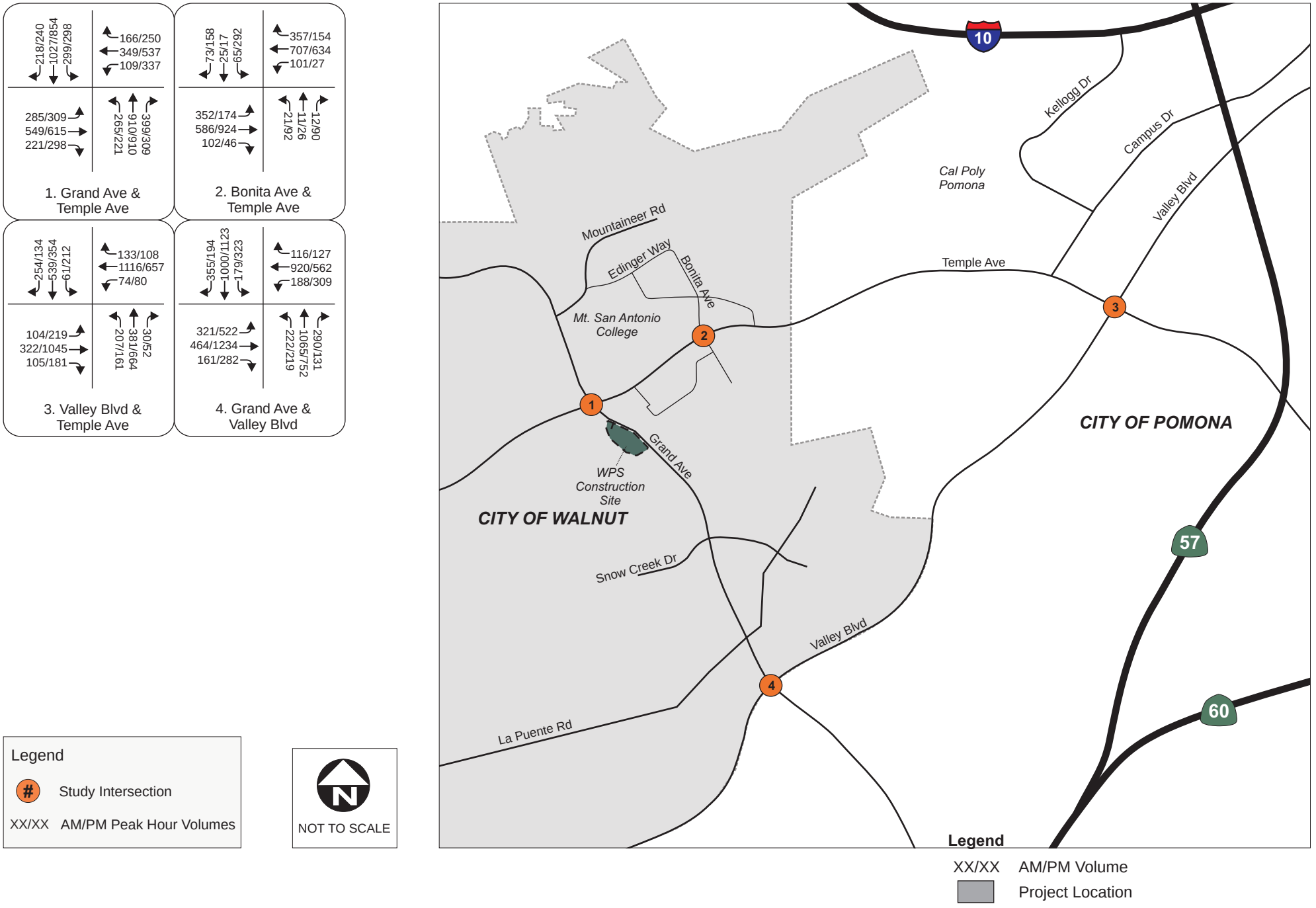

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FIGURE 2
Existing Peak Hour Traffic Volumes

A level of service analysis was conducted to evaluate existing intersection operations during the a.m. and p.m. peak hours at the four study intersections. **Table 3** summarizes the existing LOS at the study intersections. LOS calculations sheets are provided in **Appendix B**.

TABLE 3: EXISTING INTERSECTION PEAK HOUR LEVEL OF SERVICE

Intersection		Control Type	AM Peak Hour		PM Peak Hour	
			V/C	LOS	V/C	LOS
1	Grand Ave/Temple Ave	Signalized	0.665	B	0.698	B
2	Bonita Ave/Temple Ave	Signalized	0.570	A	0.568	A
3	Valley Blvd/Temple Ave	Signalized	0.723	C	0.745	C
4	Grand Ave/Valley Blvd	Signalized	0.670	B	0.756	C

Notes:
V/C = Volume to Capacity Ratio, LOS = Level of Service.

As shown in **Table 3**, all study intersections are currently operating at LOS C or better.

4. CONSTRUCTION TRAFFIC

This section summarizes the total truck traffic forecast to be generated by construction activities related to trucks hauling dirt from the borrow site to the construction site as well as trucks returning from the construction site back to the borrow site. It is anticipated that 40' length trucks would be used for truck hauling. These trucks have a capacity of 14 cubic yards. The empty weight of a typical truck is 47,000 lbs, while the estimated full weight (carrying 14 cubic yards of dirt) would be 80,000 lbs.

A limiting factor regarding the amount of trucks that can be accommodated within the circulation network are the existing left-turn pocket storage lengths at the four study intersections, where left-turn movements would be made. These storage lengths are as follows:

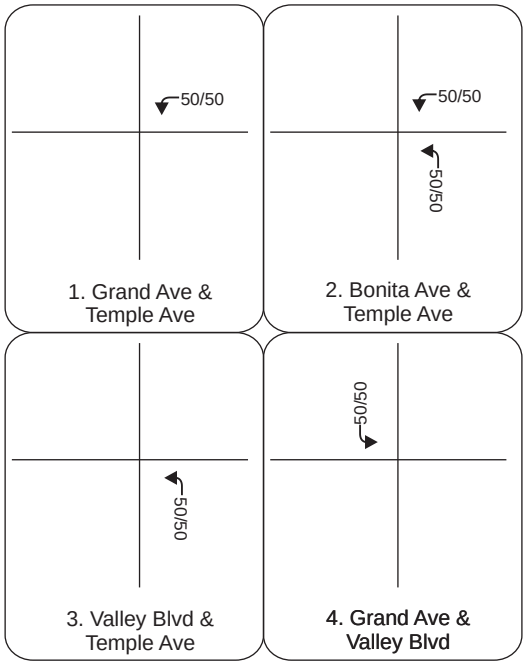
- Grand Avenue/Temple Avenue – 260' WB left-turn pocket length (dual left-turn lanes)
- Bonita Avenue/Temple Avenue – 170' NB left-turn pocket length and 120' WB left-turn pocket length
- Valley Boulevard/Temple Avenue – 180' NB left-turn pocket length
- Grand Avenue/Valley Boulevard – 250' SB left-turn pocket length (dual left-turn lanes)

Based on these pocket lengths and the 40' length of the typical truck, it is recommended that, in order to avoid queue back up outside a left-turn pocket, no more than two trucks exit the borrow site at the same time. Ideally, each truck would leave the borrow and construction sites no more than every three minutes, resulting in a total of 20 trucks per hour.

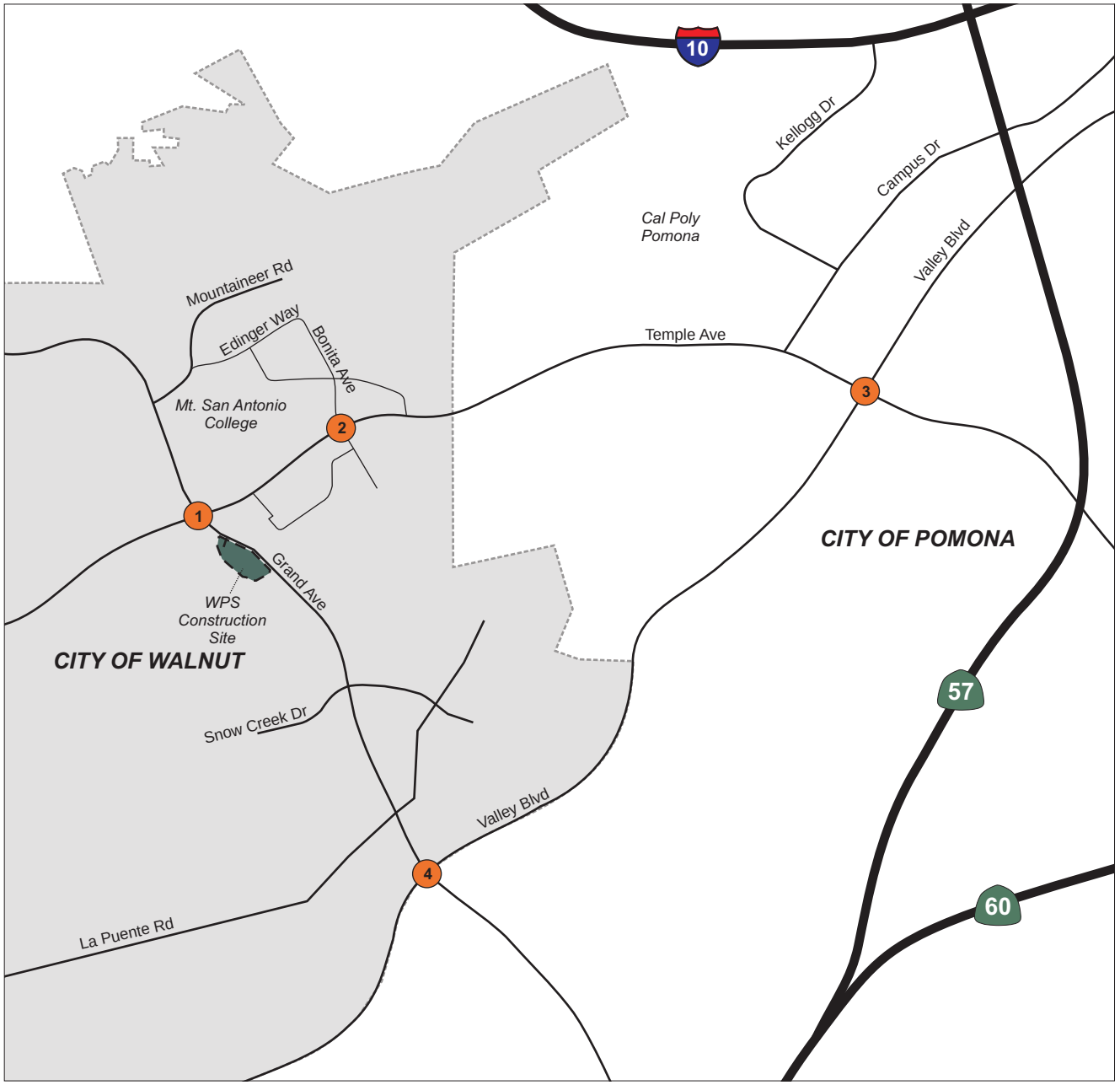
The process used to calculate the total number of days needed for construction assuming 20 trucks hauling dirt to the construction site per hour, as well as the Passenger Car Equivalent (PCE) truck trips, is summarized below. PCE is the number of passenger cars that would occupy the same space in a lane as one truck (i.e. 2.5 passenger vehicles):

- A total of 139,000 cubic yards of dirt is expected to be hauled (provided by Psomas)
- The capacity of a 40' truck, to be used for this construction, is 14 cubic yards
- As a result, a total of 9,929 truck loads are required:
    - 139,000 / 14 = 9,929 truck loads
- It is anticipated that construction would occur for a total of 8 hours a day
- As a result, a total 160 truck loads would be delivered per day:
    - 20 truck loads per hour * 8 hours a day = 160 truck loads per day
- As a result, the construction period is expected to last approximately 62 days:
    - 9,929 truck loads / 160 truck loads per day = 62 days
- Based on the 40' truck size, a PCE factor of 2.5 passenger vehicles per truck is assumed, resulting in approximately 50 PCE trips per hour generated at each site:
    - 20 truck trips x 2.5 vehicles per truck = 50 PCE-adjusted trips.

Figure 3 shows the assignment of PCE-adjusted truck trips within the study area during the a.m. and p.m. peak hours.



Note:
The truck volumes shown have been adjusted to
Passenger Car Equivalent (PCE) trips using a PCE factor of 2.5



Legend

Study Intersection

XX/XX AM/PM Peak Hour Volumes

N

NOT TO SCALE

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FIGURE 3
Construction Truck Traffic Peak Hour PCE-adjusted Volumes

5. EXISTING PLUS PROJECT CONDITIONS

This section summarizes the traffic operations of the study intersections for existing conditions with the construction truck hauling activities described in Section 4. **Figure 4** shows the existing plus construction traffic volumes which include the PCE-adjusted truck volumes at the study intersections. **Table 4** summarizes the existing plus construction LOS at the study intersections. The LOS calculations sheets are provided in **Appendix B**.

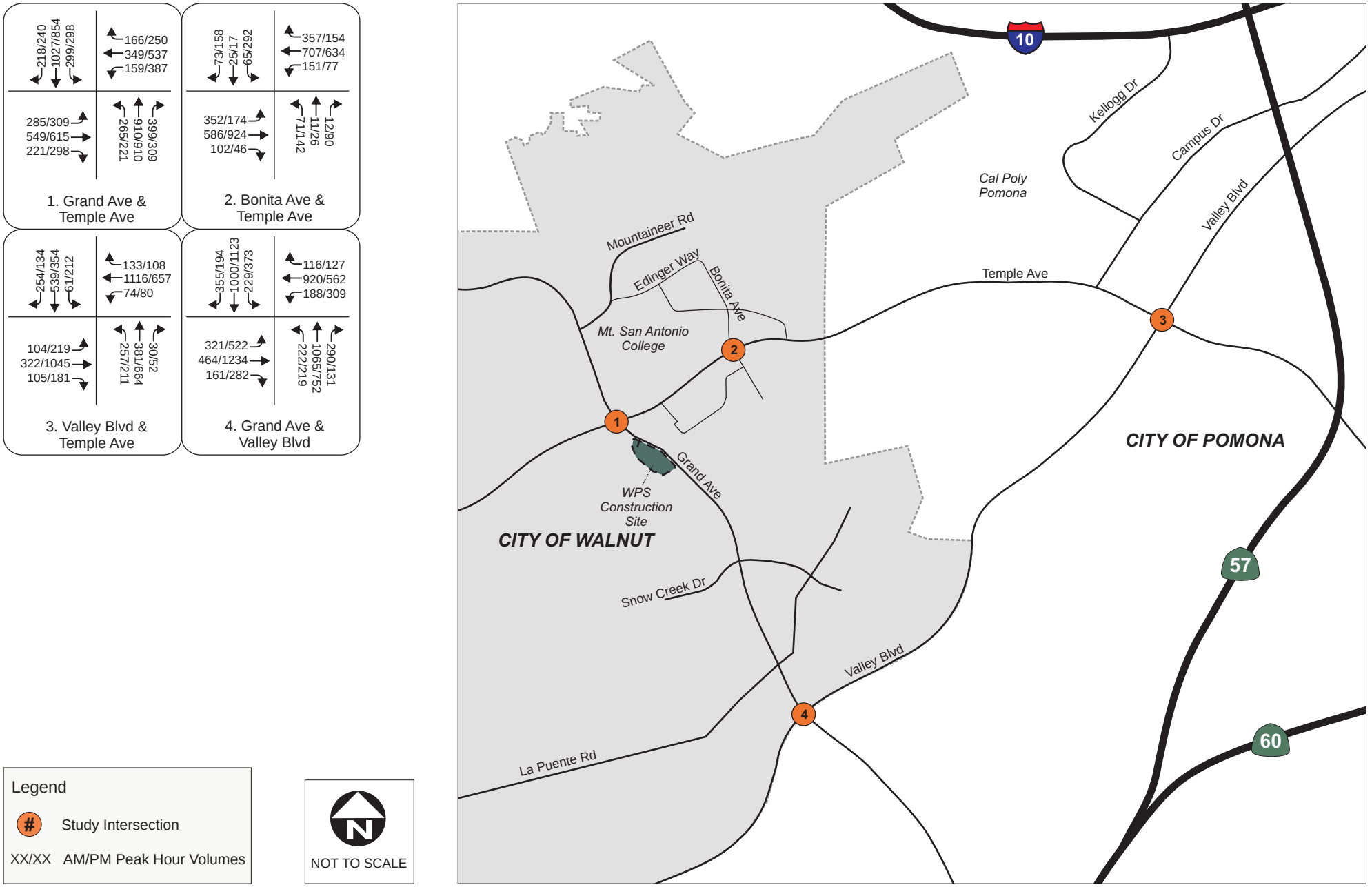

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FIGURE 4
Existing Plus Construction Traffic Peak Hour Volumes

TABLE 4: EXISTING PLUS CONSTRUCTION INTERSECTION PEAK HOUR LEVEL OF SERVICE

Intersection		Existing Conditions				Existing Plus Construction Conditions				Change in AM V/C	Change in PM V/C	Significant Impact?
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour				
		V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS			
1	Grand Ave/Temple Ave	0.665	B	0.698	B	0.681	B	0.714	C	0.016	0.016	No
2	Bonita Ave/Temple Ave	0.570	A	0.568	A	0.602	B	0.599	A	0.032	0.031	No
3	Valley Blvd/Temple Ave	0.723	C	0.745	C	0.754	C	0.745	C	0.031	0.000	No
4	Grand Ave/Valley Blvd	0.670	B	0.756	C	0.685	B	0.756	C	0.015	0.000	No

Notes:
V/C = Volume to Capacity Ratio, LOS = Level of Service.

As shown in **Table 4**, assuming the additional PCE-adjusted truck trips in the circulation network, the study intersections are forecast to continue to operate at LOS C or better during both peak hours. As also shown, the truck hauling activities are not forecast to result in any significant traffic impacts based on LA County thresholds of significance.

6. RECOMMENDATIONS

It is recommended that separate truck ingress and egress points be provided at the WPS site. Truck ingress would occur at the northern driveway along Grand Avenue, approximately 650 feet south of Temple Avenue/Amar Road. There is an existing driveway curb cut, which is approximately 20 feet in width, at this location. If two-directional (ingress/egress) operations occur at this driveway, the existing driveway should be widened to 40 feet. This would be needed to accommodate the rare situation where trucks would be exiting and entering the site at the same time. It is recommended that radio communication be used between truck operators waiting to exit the borrow site and construction staff at the construction site. This would ensure that entering and exiting trucks are spaced accordingly.

Truck egress is recommended to occur at a new second driveway approximately 1,260 feet south of the northern ingress driveway. **Figure 5** shows the locations of the two driveways. **Figure 6** shows the detailed truck turning paths and minimum recommended driveways widths.

Some benefits to separating the truck ingress and egress are as follows:

- Southbound Grand Avenue tapers down from four lanes to three lanes to two lanes within a short distance south of its intersection with Temple Avenue. At the northern driveway, vehicles are currently merging from the number three lane to the number two lane due to the lane taper. This taper width at the northern driveway can be utilized for truck ingress operations without obstructing the southbound through movement along Grand Avenue.
    - However, for the egress movement with the existing lane configuration, the trucks have to yield to three lanes of oncoming southbound vehicles (including the merge lane) at the northern driveway. At the proposed southern driveway location, the exiting trucks have to yield to only two lanes of oncoming traffic prior to making a right-turn onto Grand Avenue.
- If the ingress and egress operations occurred at the same time at only the northern driveway, the line of exiting trucks would be obstructed by entering trucks. This situation is avoided by separating the ingress and egress access points.

The location of the southern egress driveway was initially evaluated at a location approximately 1,110 feet south of the northern driveway. However, based on the posted speed limit on Grand Avenue (50 miles per hour), the calculated sight distance for right-turn maneuvers from the southern driveway would be 775 feet. This distance was calculated based on American Association of State Highway and Transportation Officials (AASHTO) – A Policy on Geometric Design of Highways and Streets (6th Edition). The line of sight is anticipated to be obstructed by the hill (on west side of Grand Avenue) as shown in **Figure 7**. Hence, it is recommended that appropriate temporary signage be provided along Grand Avenue to alert motorists along southbound Grand Avenue of construction traffic. The recommended signage would consist of a California Manual on Uniform Traffic Control Devices (CA MUTCD) C44 (CA) "Trucks Entering Exiting" Sign (with flashers, if needed).

Alternatively, it is recommended that the south driveway be constructed at a location 1,260 feet south of the north driveway (150 feet south of the initially proposed location). The minimum required sight

distance per AASHTO of 775 feet is met at this location without any sight obstruction (as shown in **Figure 7**).

However, it should be noted that for a small portion of the construction activities, only one driveway (north) would be utilized. It is estimated that use of the southerly driveway for exiting the site will be available for approximately 75 percent to 80 percent (i.e. a maximum of 50 days of hauling) of the estimated total 62-day import period before the area needs to be filled, graded and compacted to/from the solar array pad. When the southern driveway is no longer available, only the northern driveway will be available for both ingress and egress. In this case (approximately 12 days of the 62-day period), the single northern driveway condition is not expected to result in traffic congestion. As described below, adequate gaps in southbound traffic are anticipated, based on a site survey.

Field Assessment

Iteris staff performed a recent site visit during a typical weekday to observe the following:

- Gaps in southbound Grand Avenue traffic south of Temple Avenue.
- Average vehicle travel time from borrow site to fill site and from fill site back to borrow site.

The Gap Analysis was performed from 2:30 – 3:30 p.m., which represents peak southbound Grand Avenue volume conditions. During this hour, a total of 27 gaps in traffic exceeding 15 seconds were observed. Based on these observed gaps in traffic, it can be expected that 20 trucks could exit the construction site per hour and not create a significant delay to southbound Grand Avenue traffic.

The following average vehicle travel times were observed during the site visit, utilizing the proposed routes shown in **Figure 1**:

- Borrow Site to Construction Site: 3 minutes
- Construction Site to Borrow Site: 10 minutes and 30 seconds

It can be expected that a truck traveling along these routes would experience slightly higher travel times due to lower speeds of travel.

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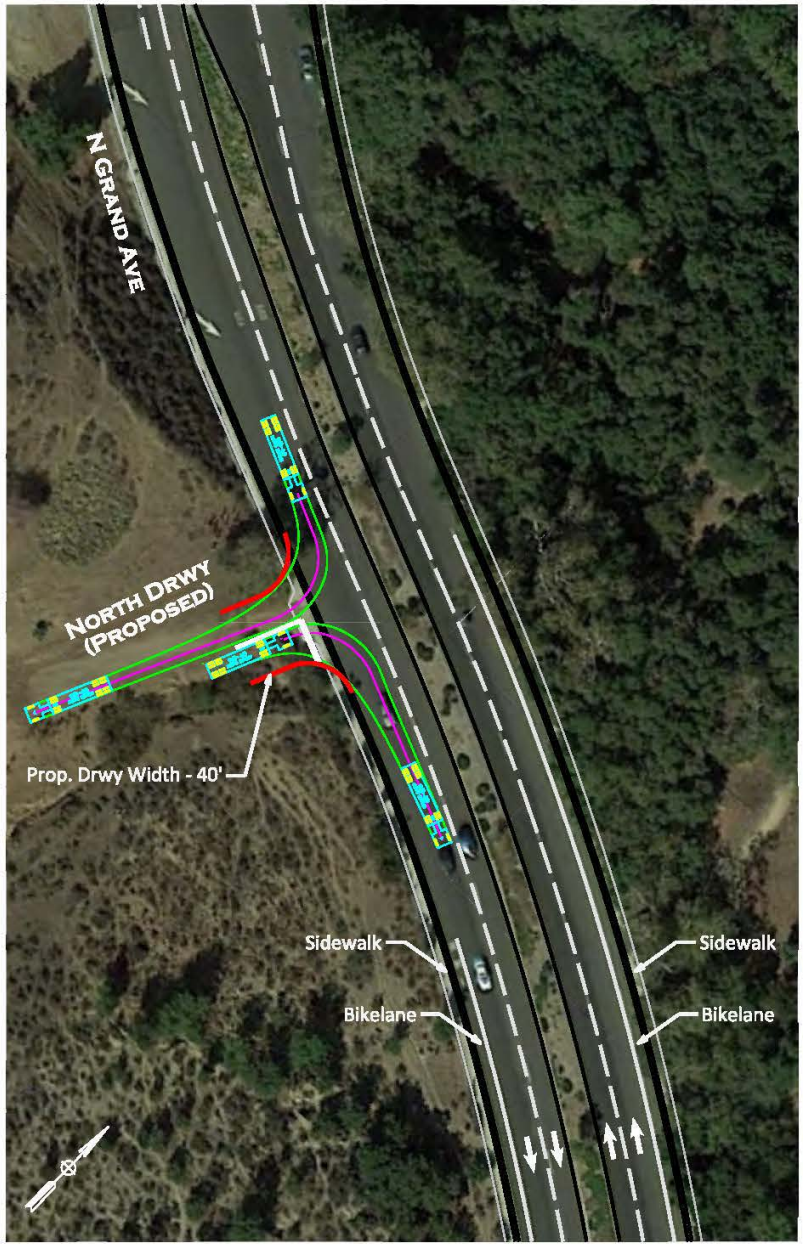
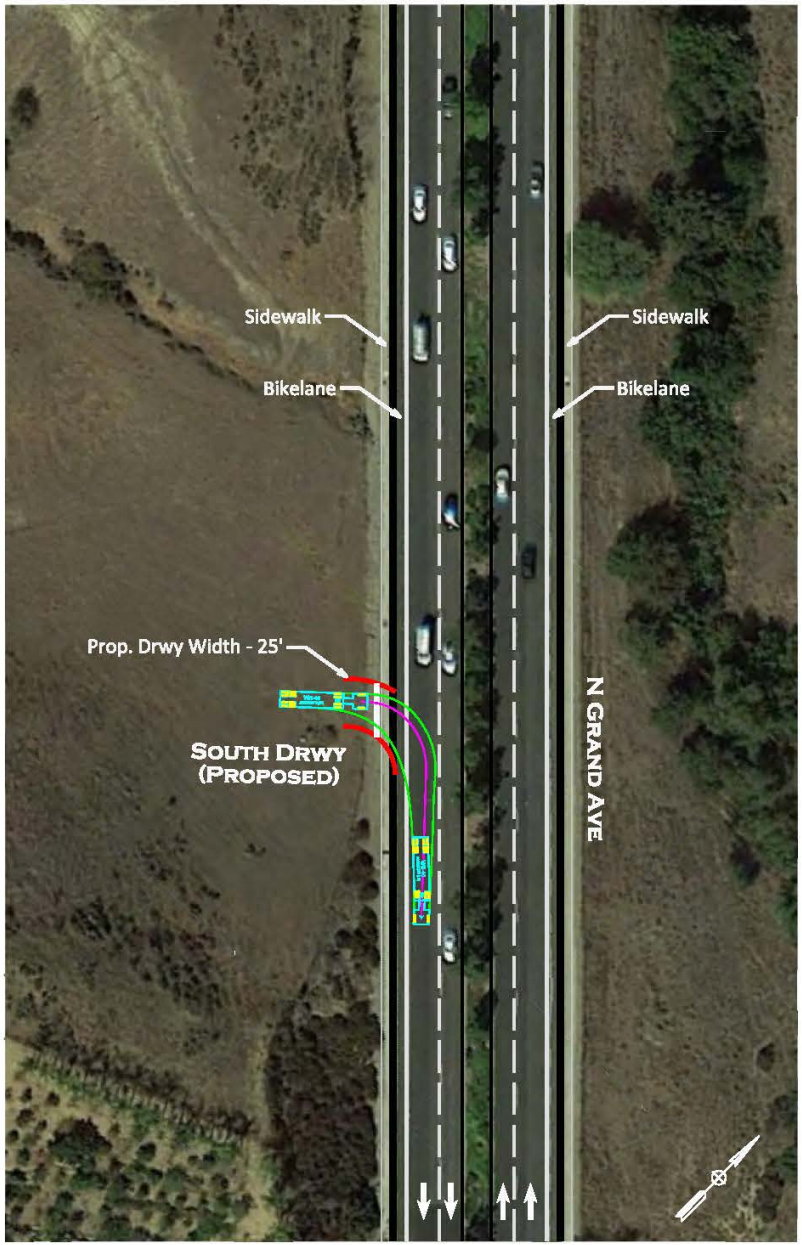
FIGURE 5
WPS Site Access Points





LEGEND

- Exist. Edge of Pavement
- Exist. Pavement Markings
- Prop. Edge of Pavement
- Prop. Pavement Markings (White)

NOTES:

1. North Driveway is proposed to have two-way operations.
2. South Driveway is proposed to be used for egress only.
3. AASHTO Intermediate Semi-Trailer (WB-40) was considered as the design vehicle for the turn-path analysis.

SCALE: 1" = 100'

THIS CONCEPTUAL LAYOUT HAS BEEN PREPARED FOR ILLUSTRATIVE PURPOSES ONLY. IT IS NOT TO BE USED FOR PERMITTING OR CONSTRUCTION PURPOSES.

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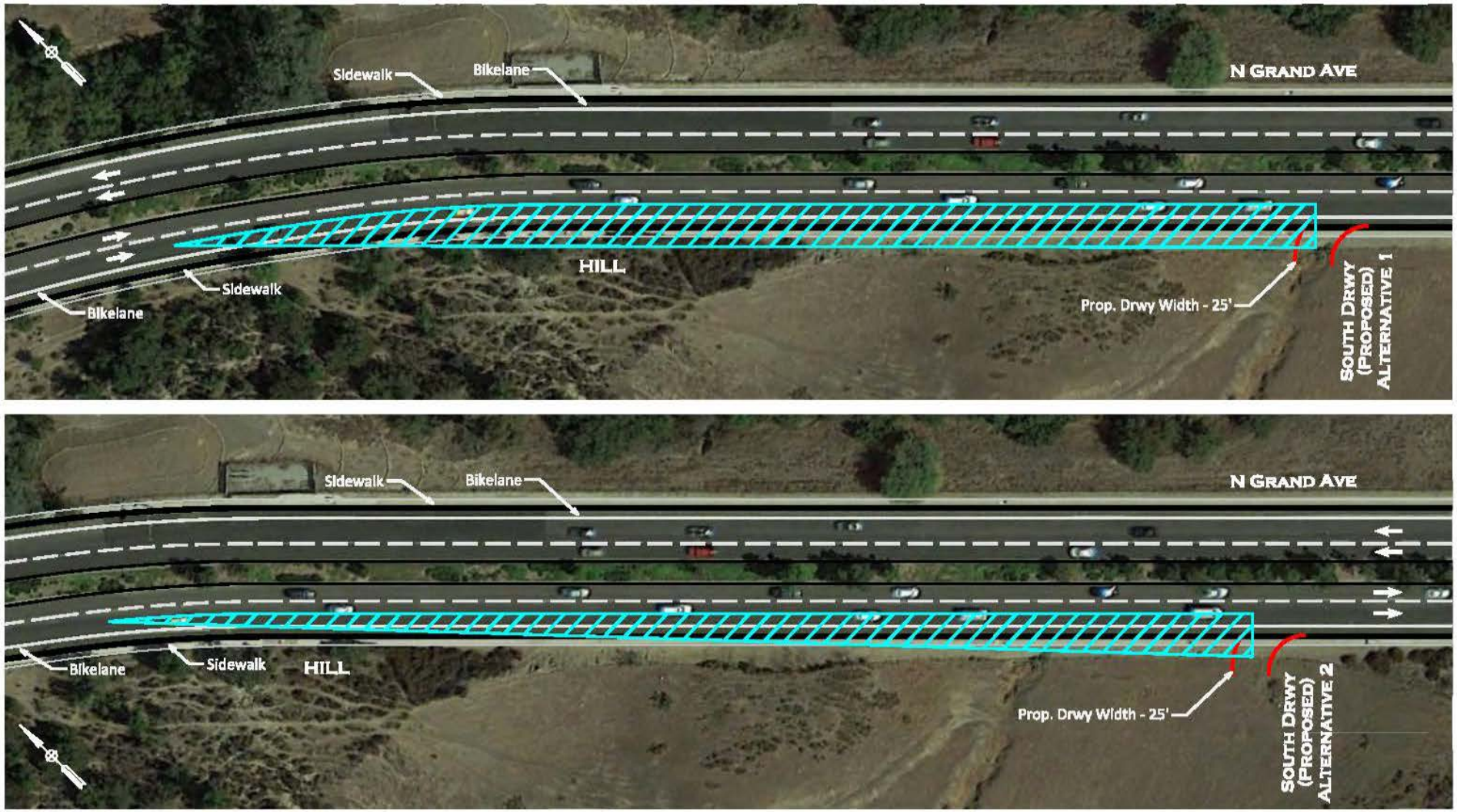
FIGURE 6
WPS Site Driveway Widths & Truck Turning Paths



LEGEND

- Exist. Edge of Pavement
- Exist. Pavement Markings
- Prop. Edge of Pavement
- Sight Triangle

NOTES:

1. The stopping sight distance calculated for right-turns exiting South Driveway for both alternatives is 775 feet.
2. The sight distance is obstructed by hill for Alternative 1 location as shown in this exhibit. CAMUTCD C44 (CA) "Trucks Entering Exiting" Sign is recommended to be used (with flashers, if needed) to alert drivers along southbound N Grand Avenue.
3. The sight distance restriction for Alternative 1 location can be mitigated by relocating the driveway approximately 150 feet south along N Grand Avenue.

SCALE: 1" = 100'

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FIGURE 7
WPS Site South Egress Driveways - Alternative Locations & Sight Distance

Currently, the southbound departure leg at the intersection of Grand Avenue and Temple Avenue has a sign prohibiting trucks over 5 tons on this stretch of roadway (shown in **Figure 8**). It is recommended that this sign be temporarily bagged.

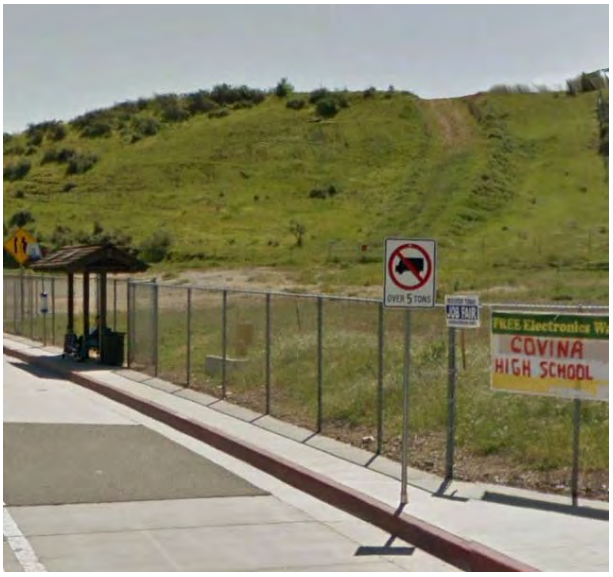

Figure 8 *– Sign Prohibiting Trucks over 5 Tons on Southbound Departure Leg of Grand Avenue South of Temple Avenue*

In addition, it is recommended that the City of Walnut consider temporarily removing/disengaging the eastbound Amar Road right-turn overlap phase at Grand Avenue and placing a temporary CA MUTCD R13A (CA) "No Right Turn on Red" sign. This signal modification will allow for more traffic gaps along southbound Grand Avenue, as eastbound Amar Road right-turning vehicles would only be able to turn during the eastbound green phase. This scenario was evaluated using the Synchro software, utilizing the Highway Capacity Manual (HCM) 2010 methodology which uses average vehicle delay in seconds to measure levels of service. The results are shown in **Table 5**.

TABLE 5: EXISTING PLUS CONSTRUCTION INTERSECTION PEAK HOUR LEVEL OF SERVICE - WITH EB RIGHT-TURN SIGNAL PHASE ADJUSTMENT

Intersection		Existing Plus Construction Conditions				Existing Plus Construction Conditions (Removal of EB Right-turn Overlap & Added "No Right-turn on Red")			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
1	Grand Ave/Temple Ave	37.5	D	41.2	D	38.1	D	42.4	D

Notes:
s = Seconds, LOS = Level of Service.

As shown in **Table 5**, modifying the traffic signal to remove the eastbound right-turn overlap phase and prohibiting right-turn-on-red would not have a significant effect on traffic operations at the Grand Avenue/Temple Avenue intersection.

In addition, traffic signal timing was reviewed at the Grand Avenue/Temple Avenue-Amar Road intersection. Currently, the Grand Avenue corridor traffic signals are part of a coordinated signal system. It is recommended that the City consider "lagging" the westbound left-turn phase, resulting in the westbound through movement as the "leading" phase. This would ensure that left-turning trucks would be able to access the left-turn pocket during cycles where the westbound through movement queues extend beyond the length of the left-turn pocket. It is recommended that this adjustment to the traffic signal phasing be implemented during the 9:00 a.m. to 3:00 p.m. period, outside of the peak period timing plans. It is anticipated that this signal phasing modification would have no significant adverse impacts on the operations at this intersection. The scenario was evaluated using the Synchro software utilizing HCM 2010. The results are shown in **Table 6**.

TABLE 6: EXISTING PLUS CONSTRUCTION INTERSECTION PEAK HOUR LEVEL OF SERVICE - WITH WB LEFT-TURN SIGNAL PHASE ADJUSTMENT

Intersection		Existing Plus Construction Conditions				Existing Plus Construction Conditions (WB Left-turn Lagging)			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)	LOS
1	Grand Ave/Temple Ave	37.5	D	41.2	D	36.6	D	39.8	D

Notes:
s = Seconds, LOS = Level of Service.

As shown in **Table 6**, modifying the traffic signal phasing by lagging the westbound left-turn phase is not projected to have a significant effect on traffic operations at the intersection of Grand Avenue and Temple Avenue.

In summary, the following recommendations are proposed as a result of this evaluation:

- A maximum of 20 trucks per hour existing the site (no more than every 3 minutes);
- Separate truck ingress (north) and egress (south) driveways along Grand Avenue;
- Modification of the Grand Avenue/Temple Avenue traffic signal to include:
  - "No Right Turn on Red" for the eastbound Amar Road approach
  - Lagging the westbound Temple Avenue left-turn movement
- Addition of MUTCD C44 (CA) "Trucks Entering Exiting" Sign along Grand Avenue at the north and south driveways.