

**Traffic Study Report
Improvement Project of
SR-57/SR-60 Confluence at Grand Avenue Interchange
in the City of Diamond Bar and the City of Industry**

December, 2011

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Subject: Traffic Study Report - Improvement Project of SR-57/SR-60 Confluence at Grand Avenue Interchange in the City of Diamond Bar and the City of Industry

Dear Mr. Koo:

KOA Corporation is pleased to present the revised traffic study to accompany the Project Report and Environmental Document for the modification improvements of the Grand Avenue Interchange at SR-57/60 in the City of Industry and the City of Diamond Bar. This report was prepared to meet the requirements of California Department of Transportation (Caltrans).

It has been a pleasure to provide this study to you, Caltrans, the City of Industry, and the City of Diamond Bar. Please contact me if you have any questions about the report, or if you need additional information. If there are any comments or revisions that require my response, please notify me as soon as possible for prompt attention.

Sincerely,



Min Zhou, P.E.
Principal

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Introduction

This report evaluates the feasibility of constructing improvements for the Pomona Freeway (SR-60)/Orange Freeway (SR-57) interchange at Grand Avenue within the Cities of Industry and Diamond Bar in the County of Los Angeles. The Pomona Freeway (SR-60) and the Orange Freeway (SR-57) merge together for approximately two miles in the project vicinity. The SR-60/SR-57 and Grand Avenue interchange is located roughly in the middle of the merged segment of freeway. The interchange is a diamond configuration on the south side of the freeway with a partial cloverleaf configuration on the north side of the freeway.

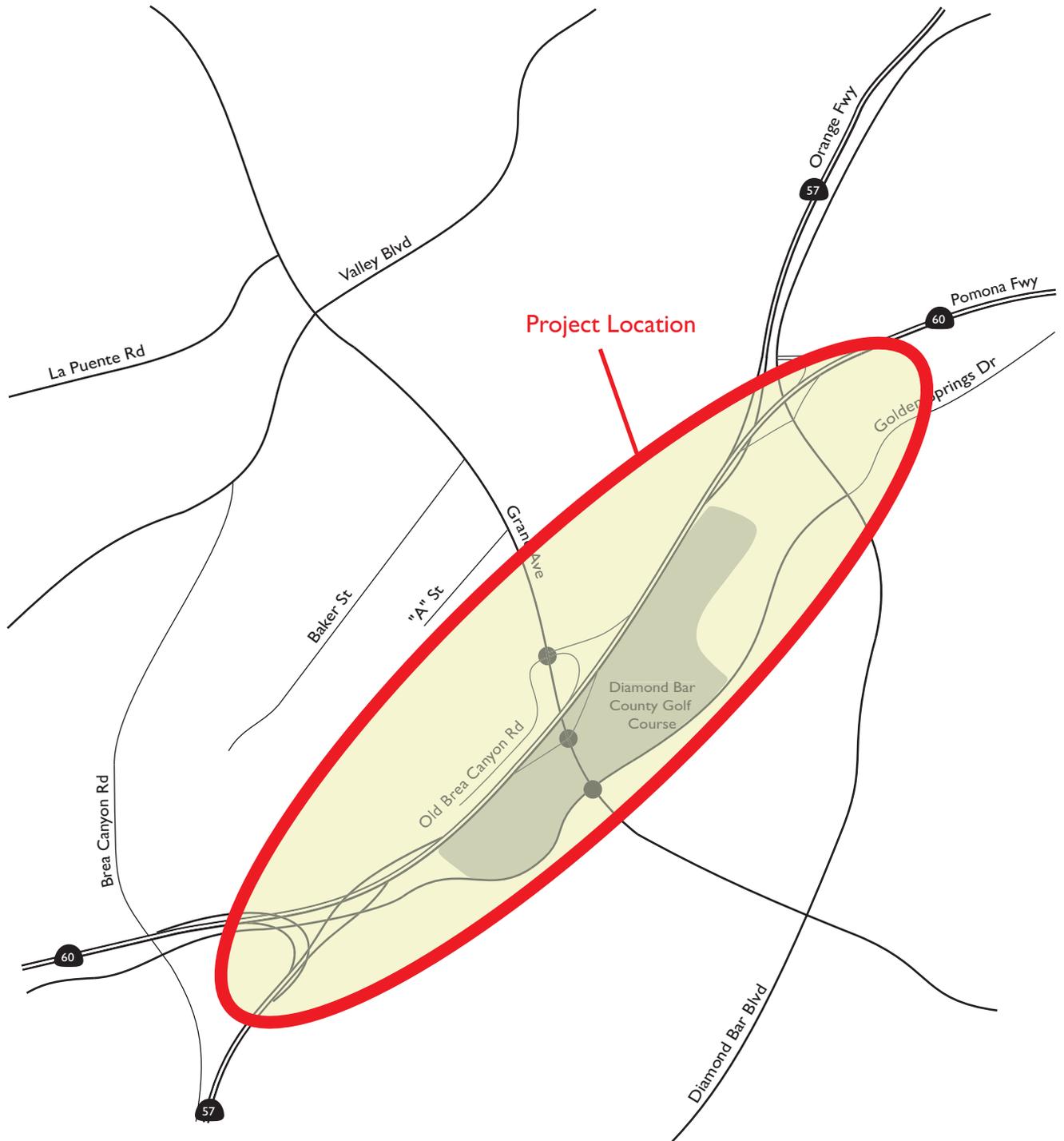
A separate ramp improvement is currently being planned for the location that will provide a new slip ramp from southbound Grand Avenue to westbound SR-60 in the northwest quadrant. This project will also change lane assignments and traffic operations at the ramp intersections.

The project seeks to replace and widen the overcrossing structure to provide additional travel and turn lanes and to modify the ramp configuration to provide additional capacity. The need for improvements was identified in an approved Environmental Impact Report for the Industry Business Center commercial development project, which is located in the City of Industry north of the interchange area.

The Pomona Freeway (SR-60) is an east-west route, extending from Interstate 5 in the City of Los Angeles to the City of Beaumont in Riverside County, where it joins Interstate 10. The Orange Freeway (SR-57) is a north-south route, extending from its southern terminus at the interchange with Interstate 5 and State Route 22 in the City of Orange to the Interstate 210 Freeway in Glendora. SR-60 travels on a northeast /southwest alignment in the project vicinity while Grand Avenue runs northwest/southeast in the project vicinity. This report identifies SR-57/60 as the east/west route and Grand Avenue as the north/south route.

Figure I shows the project area and vicinity. The Project Report / Environmental Document (PR/ED) is a step in advancing the project through the Caltrans project development process toward construction. A variety of feasible projects are identified in the previous completed Project Study Report (PSR). One or more promising alternatives are studied further in the PR/ED to identify the most appropriate project for construction and implementation. The selected alternative for this project is expected to receive full local agency support after successful completion of the PR/ED.

Two viable “build” alternatives were developed for analysis in the Project Study Report (PSR) and are carried forward into this analysis. The build alternatives presented in this study are described in detail in a later section of this report.



LEGEND

- Study Intersection
- Major Street
- Minor Street



Not to Scale

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Background

Area Characteristics and Roadways

The City of Industry (population 800) is located approximately 16 miles east of downtown Los Angeles. Municipal boundaries encompass approximately 12 square miles of land in the San Gabriel Valley in Los Angeles County. The City is served by the Pomona Freeway (SR-60), which runs east west from the City of Los Angeles to Riverside County.

In an effort to address additional traffic associated with future commercial developments, the City of Industry has proposed to Caltrans and to the City of Diamond Bar to improve the SR-60 interchange at Grand Avenue. The project goal is to improve traffic operations by modifying the configuration and lanes for the SR-60 interchange at Grand Avenue, and by replacing and widening the existing overcrossing structure.

The proposed improvements would considerably increase capacity of the existing interchange and improve interchange operations. The modified interchange would also accommodate project traffic growth in the area.

Due to the proximity of the Grand interchange to the two major freeway-to-freeway interchanges between SR-57 and SR-60, mainline traffic operations and weaving are a very important consideration for this project. The mainline flows for SR-57 & SR-60 experience heavy traffic flows and lane changes, because the two routes are carried on a single multi-lane (12-14 lane) roadway in the Grand Avenue interchange vicinity.

Existing Conditions

State Route 60

California State Route 60 (SR-60, Pomona Freeway) is included in the National Highway System (NHS) and has been recognized as an essential link in a multi-modal transportation network. SR-60 is an interregional freeway, which originates at Interstate 5 in Los Angeles County and extends to I-10 in Riverside County. The route spans a total of approximately 68 miles.

SR-60 is generally an 8-lane freeway; however the segment of SR-60 that is in the vicinity of Grand Avenue is a 12-14-lane freeway. Carpool lanes have recently been completed in the project vicinity, including an extension of the HOV lanes from the confluence area west to I-605.

State Route 57

California State Route 57(SR-57, Orange Freeway) is a major north-south freeway. SR-57 originates in the City of Orange in Orange County and terminates in the City of Glendora in Los Angeles County. The route spans approximately 25 miles, and provides services to ten cities, including the cities of Orange, Anaheim, Fullerton, Brea, Diamond Bar, Industry, Walnut, Pomona, San Dimas, and Glendora.

SR-57 is generally an 8-lane freeway and also provides carpool lanes in both directions south of SR-60. In the project vicinity it travels along the same alignment as SR-60. The combined route has 12-14 travel lanes.

Grand Avenue

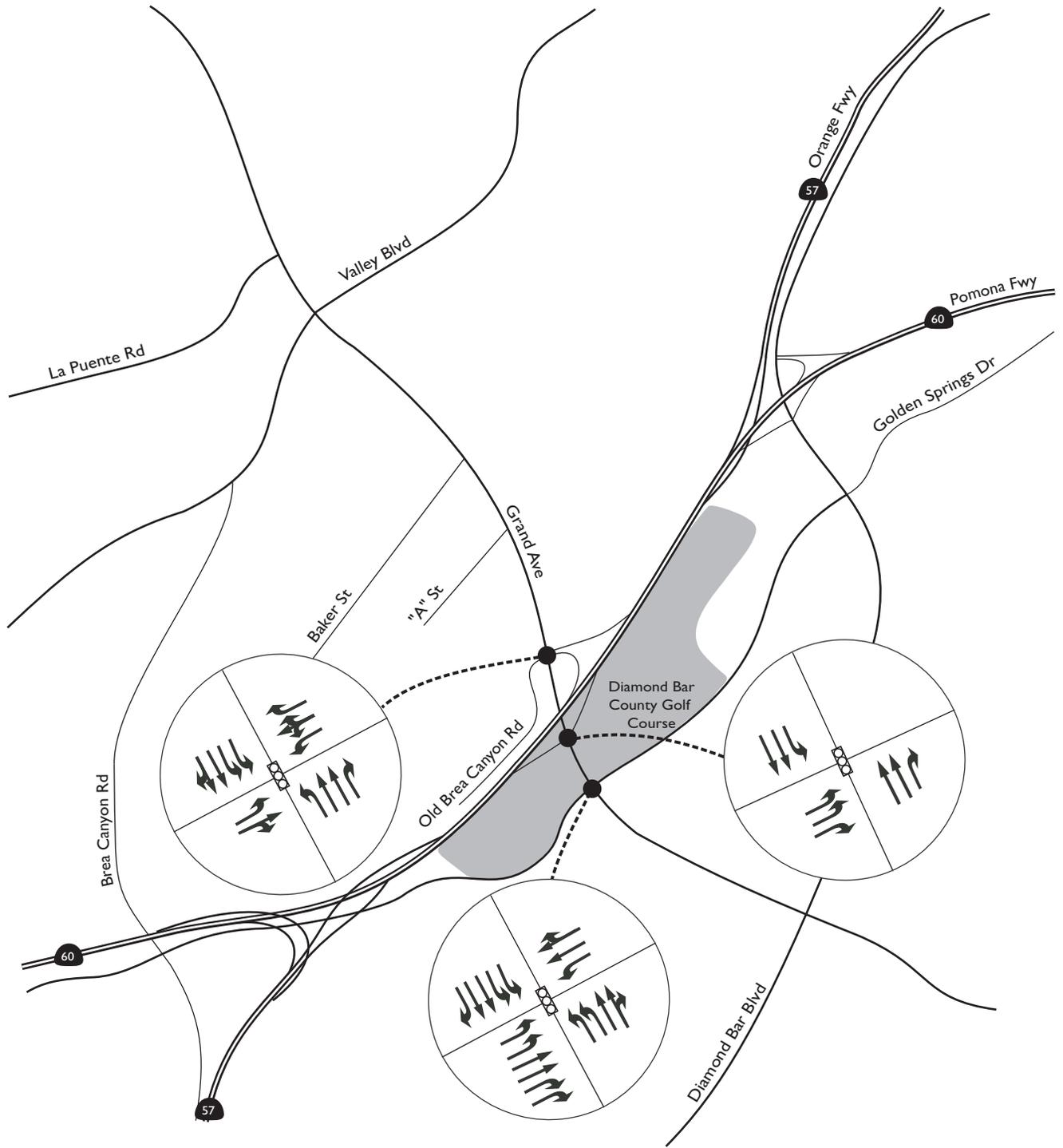
Grand Avenue is a major north/south arterial road, providing service to City of Industry, Diamond Bar, Walnut and West Covina. The existing SR-60/Grand Avenue interchange is a diamond configuration for the south side of the interchange and a cloverleaf configuration in the northeast quadrant.

Grand Avenue is an existing 4-6 lane arterial street that provides a full interchange with State Route 60. It provides 4 lanes north of the interchange and 6 lanes south of the interchange. It is planned as a 6-8 lane arterial highway in the vicinity of the interchange upon the completion of the proposed improvement.

Grand Avenue is currently striped as a four-lane roadway with left turn lanes on the freeway overcrossing. North of the freeway ramps, Grand Avenue widens to 84 feet curb to curb and provides width for additional travel lanes. Lands along both sides of Grand Avenue are largely vacant north of SR-60/57. Grand Avenue extends north over two railroad crossings to a major intersection with Valley Boulevard and continues north to the City of West Covina and beyond. On-street parking is not allowed on Grand Avenue.

Grand Avenue provides 6 lanes south of the interchange to Diamond Bar Boulevard. It reduces to four lanes southeast of Diamond Bar Boulevard and continues east to the City of Chino Hills. Both legs of Grand Avenue are strategically located to serve relatively long trips. It is one of the few arterials that pass through the Industry Hills to the north and through the Chino Hills to the south and east. In particular, it carries significant traffic volumes from the SR-60 area to the City of Chino Hills as an alternative to continuing on SR-60.

The existing lane geometry for the SR-60/Grand Avenue interchange is shown in Figure 2.



LEGEND

- Study Intersection
- ⊠ Signalized Intersection
- ↔ Lane Geometry



Not to Scale

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Regional Planning

Development plans for this area indicate that traffic growth will continue into the foreseeable future, resulting in an overall increase in intra-regional, interregional and commuter traffic. The City of Industry has approved plans for a large commercial development to be located on vacant lands along both sides of Grand Avenue north of the interchange area. Based on regional and City of Industry future land use forecasts, improvement and expansion of the existing interchange at Grand Avenue is essential to reduce congestion at the interchange and on adjacent local streets. Project alternatives have been developed and are discussed in the following section.

A major sports stadium has recently been proposed on a site near the northwest quadrant of the interchange. This stadium is proposed and intended for an NFL football team. A supplemental EIR for the stadium has been prepared and circulated, but the stadium has not been fully committed for construction at this time. Its traffic impacts were analyzed in studies prepared for the stadium supplemental EIR. If constructed, the stadium would likely lower future AM and PM peak period traffic levels and increase traffic levels on game-days.

The traffic forecast developed for this study assumes no stadium land use, and will generate higher weekday peak period traffic levels than a stadium alternative.

The City of Industry intends to work through the formation of a traffic management steering committee to develop a comprehensive traffic & parking management plan to deal with the traffic impact for game-day traffic.

Project Alternatives

There are two build alternatives under consideration in addition to the no-build alternative. Other alternatives were considered but eliminated due to site restrictions, geometric deficiencies, poor level of service and/or weaving characteristics, right-of-way issues, or extreme costs. The build alternatives are considered to be the only reasonable alternatives for the project. Conceptual drawings of the no-build alternative and the build alternatives are shown in Figures 3 – 5. They are described below.

Alternative 1 (No Build Alternative)

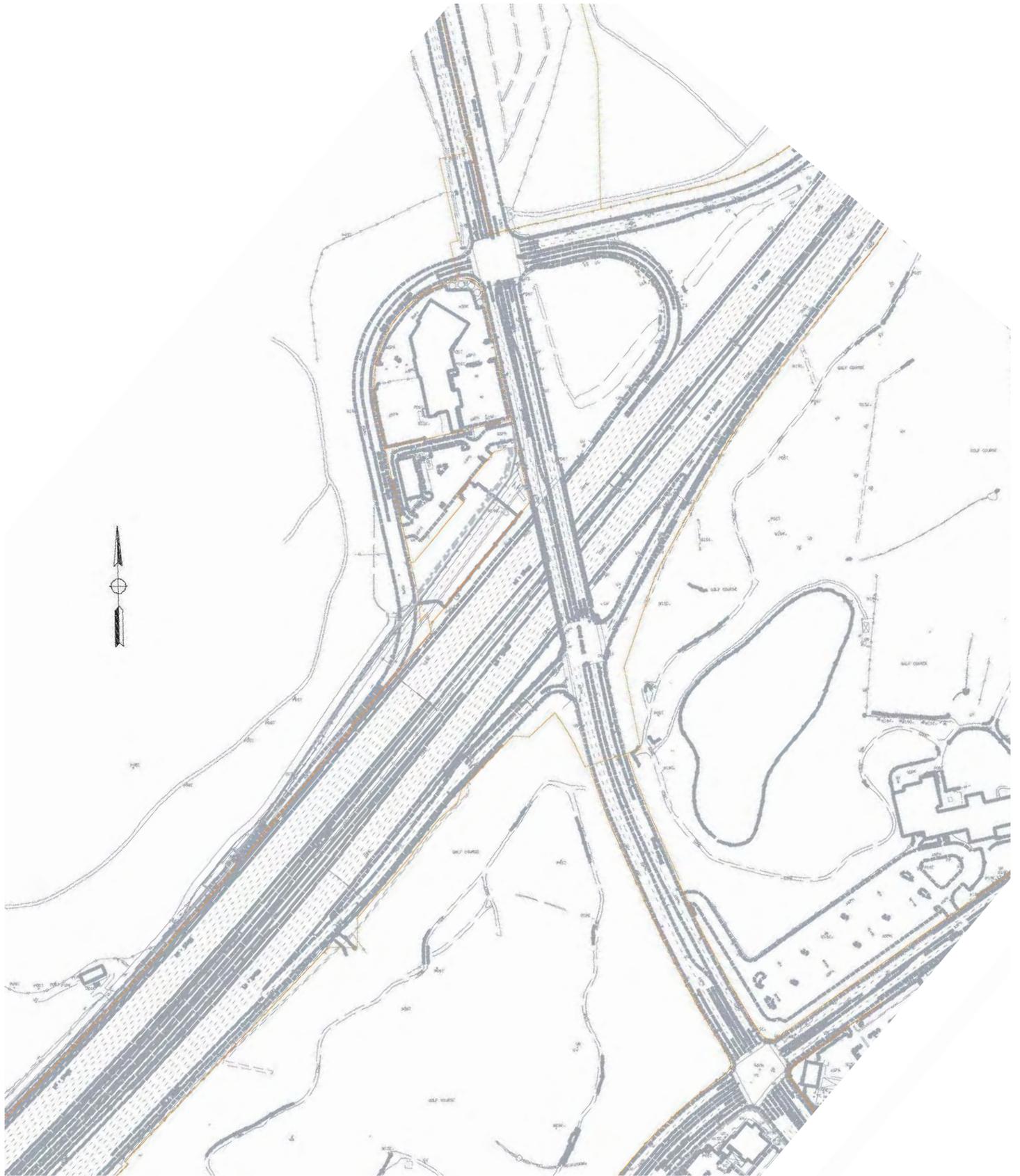
Figure 3 shows the existing SR-57/SR-60 confluence and the Grand Avenue interchange that sits within this confluence. Southwest of the western-most SR-57/SR-60 freeway to freeway merge, there are 4 mixed flow lanes and 1 High Occupancy Vehicle (HOV) lane on eastbound SR-60 and 3 mixed flow lanes and 1 HOV lane on northbound SR-57. Northbound SR-57 merges into eastbound SR-60, at the west junction, to provide 7 mixed flow lanes and 2 HOV lanes heading east toward Grand Avenue. The 2 HOV lanes are reduced to 1 HOV lane at the Grand Avenue overcrossing and 1 eastbound mixed flow lane becomes an exit only lane to the eastbound Grand Avenue off-ramp. The 6 remaining mixed flow lanes and 1 HOV lane continue east. At the SR-60 east junction with SR-57, 2 mixed flow lanes diverge to become the SR-57 northbound. A third lane serving SR-57 northbound begins less than 1000 feet prior to the merge. The remaining HOV lane and 4 mixed flow lanes continue as the eastbound SR-60.

Northeast of the eastern-most SR-57/SR-60 freeway to freeway merge, there are 4 mixed flow lanes and 1 HOV lane on westbound SR-60 and 3 mixed flow lanes on southbound SR-57. There is a lane drop on southbound SR-57 just after it merges with SR-60. The lane drop occurs as the westbound SR-60 traffic to the off-ramp at Grand Avenue attempts to weave over the remaining two lanes from SR-57. The westbound HOV lane widens to 2 HOV lanes at the Grand Avenue overcrossing, with 1 lane heading westbound SR-60 and the other heading to the southbound SR-57. The westbound loop on-ramp from Grand Avenue adds one mixed flow lane to the westbound SR-60 totaling 7 mixed flow lanes west from Grand Avenue. A westbound slip on-ramp (to be completed in 2013) adds an 8th lane. At the SR-60 west junction with SR-57, 3 mixed flow lanes diverge to become southbound SR-57 and 1 mixed flow lane diverges to become a bypass ramp to westbound SR-60. The remaining 4 mixed flow lanes and 1 HOV lane continue as the westbound SR-60.

The existing Grand Avenue Interchange is a combination of Type L-7 for westbound and a Type L-1 for eastbound.

Alternative 2

In Alternative 2 the interchange configuration for SR-60 at Grand Avenue would be a combination of Type L-9 for the westbound direction and Type L-1 for the eastbound direction. An auxiliary lane approximately 2,500 foot long would be constructed from the dropped lane at southbound SR-57 to the Grand Avenue westbound off-ramp, and a two lane exit ramp would be provided.



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The westbound off-ramp will be relocated approximately 100 feet north of the existing intersection on Grand Avenue. The intersection relocation would also require the westbound loop on-ramp and Old Brea Canyon Road (to be renamed Grand Crossing Parkway) to be widened from two lanes to five lanes 500 feet prior to intersecting with Grand Avenue. The loop on-ramp accessing westbound SR-60 would parallel the westbound off-ramp for nearly 200 feet before looping westward to join the freeway as an auxiliary lane. The westbound loop on-ramp would also accommodate HOV traffic from southbound Grand Avenue, per direction from Caltrans (see Figure 4).

Alternative 2 introduces an eastbound SR-60 bypass off-ramp to Grand Avenue that begins prior to the SR-57 merge. This realigns the existing northbound SR-57 to eastbound SR-60 connector at the SR-57/SR-60 (west junction). This realignment requires a new separation structure for the new off-ramp from SR-57 northbound. The proposed SR-60 eastbound bypass off-ramp would allow traffic along eastbound SR-60 to access Grand Avenue without weaving across the three northbound lanes of mainline SR-57.

Alternative 2 also adds a seventh eastbound mainline freeway lane on SR-60 from the merge of SR-57 and SR-60 south of Grand Avenue to their diverge north of Grand Avenue. The seventh lane is added by extending the existing third northbound SR-57 lane that is dropped at the Grand Avenue off-ramp to meet the add lane 2,400 feet to the east. This lane would become an optional off-ramp lane to Grand Avenue. This would require relocation of the slip on-ramp from Grand Avenue to form an auxiliary lane connecting directly to the new SR-60 bypass connector.

Alternative 2 would reconfigure the eastbound off-ramp to one lane at the diverge, combining with the SR-60 bypass off-ramp and widened to four lanes approximately 350 feet before the ramp intersection with Grand Avenue. The eastbound on-ramp would be realigned to provide three lanes from Grand Avenue to the ramp meter, reducing to one auxiliary lane which would connect directly to the new SR-60 bypass connector. This lane would join SR-60 with an 1,800 foot auxiliary lane until joining the location where an eastbound bypass connector at the SR-57/ SR-60 east junction is added. With the added northbound SR-57 lane, the number four SR-60 lane does not have the option to exit the SR-57. The number one SR-57 lane south of the interchange remains the number one SR-57 lane north of the interchange.

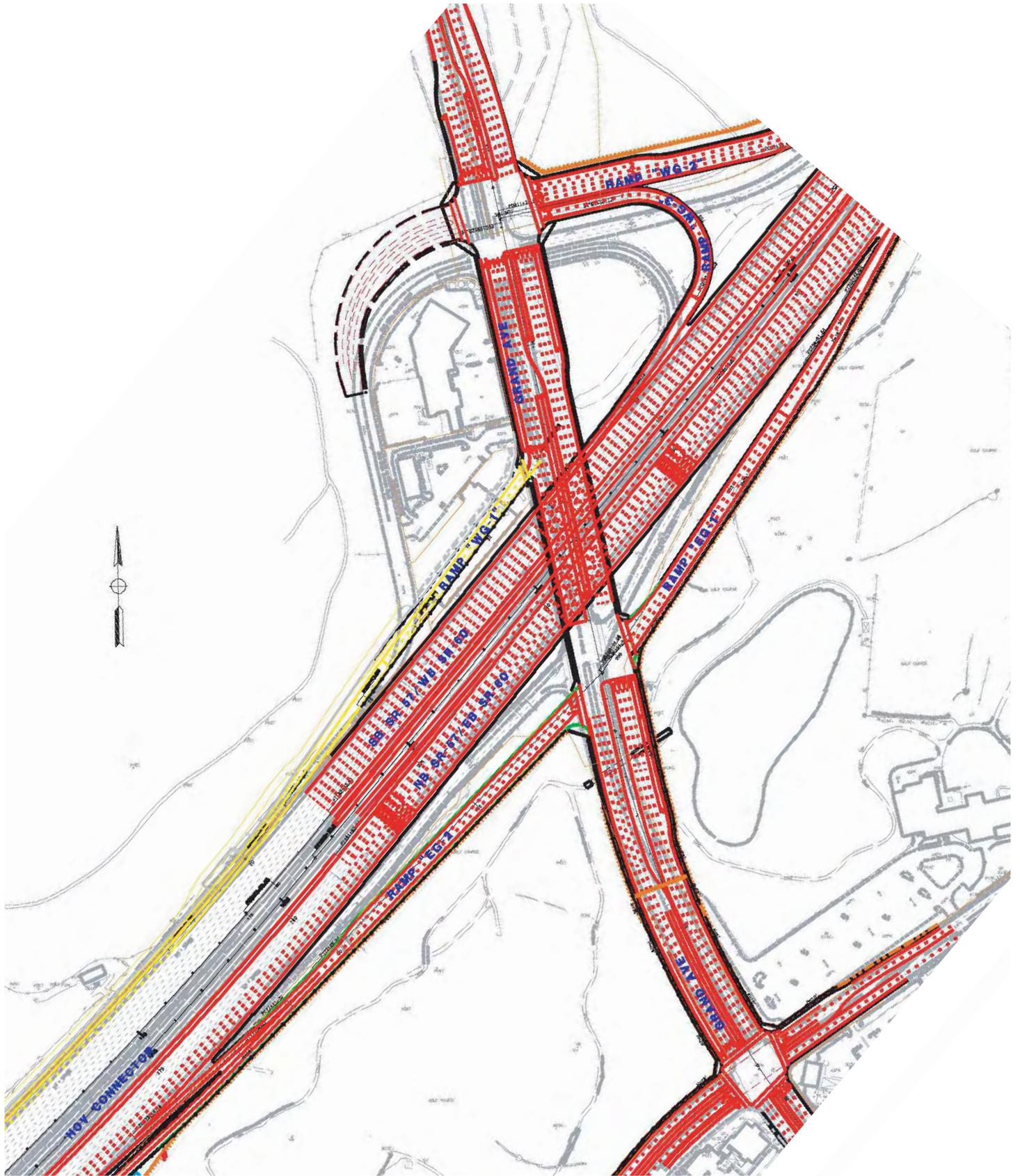
The existing eastbound on-ramp from Diamond Bar Boulevard would be realigned to accommodate the new bypass connector. The proposed bypass connector would allow traffic from the Grand Avenue interchange to access eastbound SR-60 by using the proposed bypass connector without weaving across the three northbound lanes on mainline SR-57. This connector would require new structures crossing Prospectors Road and Diamond Bar Boulevard.

Although the eastbound bypass connector would result in a shortened weaving length between the eastbound Grand Avenue on-ramp to the Diamond Bar Boulevard off-ramp, the project would be an improvement over current conditions. The bypass connector would reduce the majority of the weaving currently occurring between the Grand Avenue on-ramp and the Diamond Bar Boulevard off ramp.

This weave would be performed by only a small fraction of the vehicles entering eastbound SR-60 from Grand Avenue to exit via Diamond Bar Boulevard. This small volume is not expected to reduce the operational efficiency of the interchange. The VISSIM simulation model assigns a small volume to the Grand Avenue on-ramp to Diamond Bar Boulevard off-ramp move, thus this move is captured in the project modeling, which showed acceptable interchange operations. Though the weave length is reduced, the weave length from the end of the direct on-ramp is 2,000 feet to SR-60, which provides the 500 feet per lane change required.

Improvements at Grand Avenue and Golden Springs Drive are expected to improve local circulation, reducing the need to utilize the freeway for local trips. Ramp metering will also discourage this movement by increasing the travel time from Grand Avenue to Diamond Bar Boulevard via the bypass connector.

A new Grand Avenue overcrossing structure will be constructed with eight through lanes and double left-turn lanes. Alternative 2 requires a 450 foot long double left turn lane for the southbound left turn at Grand Avenue and the eastbound on-ramp.



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The intersection of Grand Avenue and Golden Springs Drive is reconfigured for double left-turn lanes and a single right-turn lane at all four legs of the intersection (except eastbound, which would retain its current configuration of two right-turn lanes). Grand Avenue in the northbound direction would require median reconstruction and re-striping for 3 through lanes starting approximately 600 feet south of the intersection at Golden Springs Drive.

The inclusion of the eastbound bypass connectors would eliminate most of the weaving between eastbound SR-60 and northbound SR-57, thus alleviating the main cause for the bottleneck on SR-60 within the confluences of SR-57. Alternative 2 would also provide the missing third lane from southbound SR-57. This additional lane on southbound SR-57 provides the ability to allow an additional option lane to the Grand Avenue off-ramp, resulting in minimizing the weave to crossing only two lanes for traffic from westbound SR-60 to the Grand Avenue off-ramp.

Alternative 3

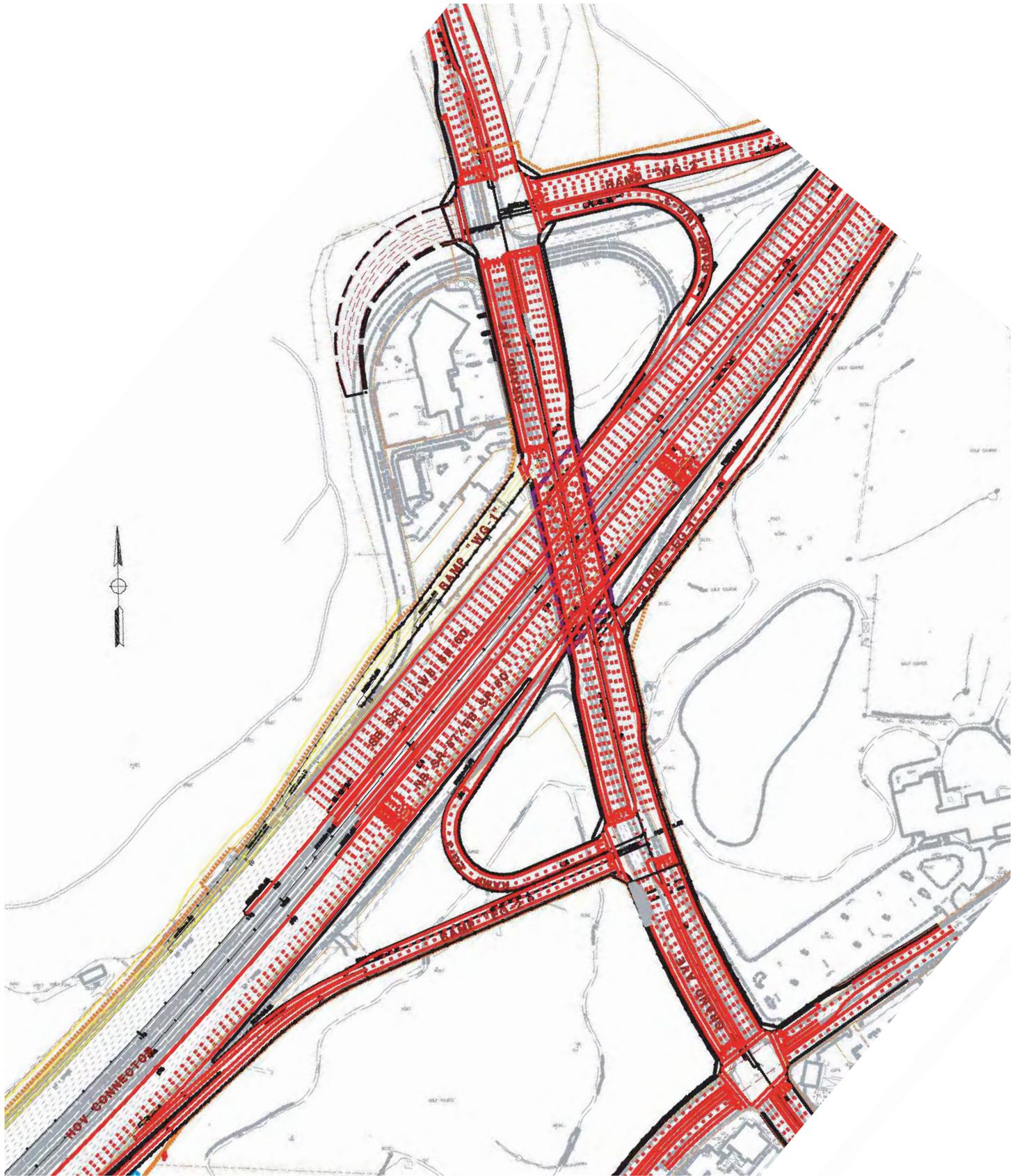
Alternative 3 (Figure 5) proposes a Type L-9 interchange configuration for the Grand Avenue / SR-60 Interchange. The westbound access to and from SR-60 is identical to that of Alternative 2, including the east-side widening Grand Avenue and the relocation of the westbound on- and off-ramp intersection approximately 100 feet to the north of existing intersection.

The eastbound access to and from SR-60 would be reconfigured from the existing Type L-1 interchange to a Type L-9 interchange. The eastbound off-ramp would begin approximately 500 feet west of the diverge point from the existing off-ramp. The two-lane off-ramp would be widened to four lanes 600 feet before intersecting Grand Avenue.

The new intersection would be located approximately 500 feet south of the existing intersection, or mid-way between the freeway and Golden Springs Drive. A southbound to eastbound loop on-ramp would be constructed. The loop on-ramp merges with SR-60 as an eastbound auxiliary lane. Northbound traffic on Grand Avenue would use the eastbound direct on-ramp. The eastbound on-ramp would be realigned to accommodate the widened Grand Avenue at the intersection and would merge into the eastbound auxiliary lane created by the loop on-ramp. The auxiliary lane would continue until joining the location where the existing mainline lane is added on eastbound SR-60.

Similar to Alternative 2, Alternative 3 would require the construction of an eastbound SR-60 bypass off-ramp to Grand Avenue and realign the existing northbound SR-57 to eastbound SR-60 connector at the SR-57/SR-60 (west junction), which would allow traffic along eastbound SR-60 to exit to Grand Avenue without weaving across the three northbound lanes of mainline SR-57.

Similar to Alternative 2, Alternative 3 would add an eastbound bypass connector at the SR-57/60 east junction. The existing eastbound on-ramp from Diamond Bar Boulevard would be realigned to join SR-60 approximately 1,100 feet east of the bypass connector. The proposed bypass connector would allow traffic from the Grand Avenue interchange to access eastbound SR-60 by using the proposed bypass connector without weaving across the three northbound lanes on mainline SR-57.



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As with Alternative 2, the proposed eastbound bypass connector from the Grand Avenue on-ramp to eastbound SR-60 would result in a shortened weaving length for traffic entering the freeway at the Grand Avenue direct on-ramp and exiting at the Diamond Bar Boulevard off-ramp. As discussed above, this weave would be performed by only a small fraction of the vehicles entering the freeway at Grand Avenue to exit via Diamond Bar Boulevard, while the majority of traffic would use the bypass connector eliminating the need to make any weaves. Further, the weave length from the loop on-ramp is significantly longer than existing resulting in an even smaller fraction completing the weave. The weave length from the end of the direct on-ramp would be 2,000 feet to SR-60, which would provide the 500 feet per lane change required.

As with Alternative 2, Alternative 3 also adds a seventh eastbound mainline freeway lane on SR-60 from the merge with SR-57 south of Grand Avenue to the diverge north of Grand Avenue. The seventh lane is added by extending the existing third northbound SR-57 lane that is dropped at the Grand Avenue off-ramp to meet the add lane 2,400 feet to the east. This lane would become an optional off-ramp lane to Grand Avenue. In alternative 3, the new loop ramp on-ramp from Grand Avenue would form an auxiliary lane connecting directly to the new SR-60 bypass connector, and the existing slip ramp would be relocated to merge with this auxiliary lane.

Grand Avenue and Golden Springs Drive would be widened to allow additional through lanes, double left turn lanes and one right-turn lane on three legs of the intersection of Grand Avenue/Golden Springs. Two right-turn lanes would be provided on Grand Avenue on the eastbound approach to Golden Springs Drive. Similar to Alternative 2, Alternative 3 would include 600 feet of re-striping and median construction on Grand Avenue in the northbound direction south of the intersection at Golden Springs.

Compared with Alternative 2, Alternative 3 would provide better performance and an improved level of service at the intersection of Grand Avenue and the eastbound off-ramp, by eliminating the long double left turn lanes on Grand Avenue to the eastbound on-ramp. The new Grand Avenue intersection with the eastbound ramps is within a standard intersection distance with the Golden Springs Drive intersection, approximately 600 feet to the south. This alternative also eliminated the skew intersection of the eastbound on- and off-ramp on Grand Avenue.

Project Need and Purpose

Problem, Deficiencies, Justification

Existing Interchange Capacity

Presently Grand Avenue over SR-60 has a compact diamond interchange configuration on the eastbound direction of SR-60, and a cloverleaf interchange configuration on the westbound direction of SR-60. The Grand Avenue Interchange is currently approaching capacity and experiencing level of service deficiencies at ramp intersections that would affect adversely the mainline flows in the future.

Existing Freeway Capacities

SR-60 and SR-57 are major inter-regional freeways linking the San Gabriel Valley cities and the Inland Empire with Los Angeles County and Orange County. The forecasted population and employment growth between the years 2008 and 2037 on SR-60 is expected to result in traffic growth approximately 25% higher than the existing volumes for the mainline and proposed/new HOV lanes based on the 2008 traffic forecast from the SCAG travel forecasting model. The 2037 forecasted traffic would result in further deficiencies in the mainline freeway demand over capacity ratio and an estimated LOS on the mainline of F3 westbound and F4 eastbound.

SR-57 terminates as it approaches SR-60 from Orange County and resumes approximately one mile east of the Grand Avenue Interchange on SR-60, heading north to Pomona. Along the two mile segment of the SR-60 confluence segment that carries traffic for both routes through the Grand Avenue interchange, SR-60 is heavily congested during the AM and PM peak periods.

Short Weaves

There are operational deficiencies on SR-60 between the merge and diverge points with SR-57. The deficiencies are primarily due to the short weaving length provided between the Grand Avenue interchange and merges and diverges of the two freeways. The Grand Avenue interchange is located 1,800 feet east of the merge between northbound SR-57 and eastbound SR-60. The eastbound SR-60 traffic headed for the Grand Avenue exit ramp must make a 3-lane weave in this distance across lanes that are heavily used by SR-57 traffic in the confluence area. The forecast traffic for the eastbound off-ramp at Grand Avenue is expected to increase the length of the queue that would exceed the length of the single exit lane to Grand Avenue.

A similar short weaving condition exists at the eastbound on-ramp from Grand Avenue to SR-60/57. The on-ramp traffic from Grand Avenue must make a 3-lane weave across traffic lanes that serve SR-57 to continue eastbound on SR-60, thus creating a bottleneck to the SR-57 traffic heading north. In the westbound direction of SR-60, a lane drop occurs on the SR-57 connector just before the merge with the westbound SR-60 mainline. The westbound SR-60 traffic exiting on Grand Avenue must make a 2-lane weave across the traffic on this connector in order to exit at Grand Avenue. The added weaving traffic further reduces the capacity of the two lane connector for SR-57.

Existing Lane Drop

This segment of SR-60 maintains four through lanes in each direction. The northbound SR-57 is reduced from three lanes to two lanes as it merges with the eastbound SR-60 at the west end of the project, thus providing a total of six lanes on eastbound SR-60 at the Grand Avenue Interchange. Similarly, southbound SR-57 is reduced from three lanes to two lanes as it merges with westbound SR-60, thus westbound mainline SR-60 carries a total of six lanes through the Grand Avenue Interchange. At the peak AM and PM hours, the lane drops on SR-57 cause bottleneck conditions on SR-60 and SR-57 which result in long delays beyond the confluence segment on both freeways. The mainline freeway overcapacity results in travel delays with a Level of Service (LOS) F over many hours of the day (approximately F2 westbound and F3 eastbound). PM peak hour mainline queues frequently back up south of Pathfinder Road on SR-57 and west of Fairway Drive on SR-60 for three to four hours per day due to deficiencies at the confluence of SR-57 and SR-60.

The existing geometric and operational deficiencies present potential safety concerns. Existing deficient weaving distances between the ramps and SR-57 connectors, plus the lack of storage capacity on the ramps contribute to less than optimum safety conditions.

Purpose

The purpose of the proposed improvements is to meet the five primary objectives:

1. Improve traffic operation on Grand Avenue from Golden Spring Drive to the interchange at SR-60
2. Increase capacity at the Grand Avenue interchange
3. Improve the traffic operation on the freeway mainline
4. Reduce traffic weaving and increase weaving distance
5. Improve safety

The five primary objectives address the need to improve the operational deficiencies of the Grand Avenue interchange and the freeway. A secondary objective is to minimize the right of way impact along Grand Avenue, and SR-60, and to maintain the functionality of the existing County owned golf course along SR-60.

Regional System Planning

SR-60 is part of the National Highway System (NHS) and the State Freeway and Expressway (F&E) System. The proposed project on SR-60 at the Grand Avenue Interchange is identified in the draft 2006 Regional Transportation Improvement Program (RTIP) prepared by SCAG. A Transportation Concept Report (TCR) for SR-60 was approved in July 2005. The TCR identifies seven distinct segments for improvements to SR-60. The Grand Avenue interchange is within Segment 5 of the approved TCR report. This project provides the recommended lane configuration as specified in the approved TCR in terms of mixed-flow lanes and HOV lanes in each direction. It is anticipated that dedicated truck lanes,

if required, will follow a separate corridor alignment outside the existing or proposed Caltrans right of way.

A Project Feasibility Study to develop an ultimate concept to improve the SR-57 and SR-60 freeways was conducted by the Los Angeles County Metropolitan Transportation Authority (LACMTA) with Caltrans, the City of Industry and the City of Diamond Bar in 2008. The purpose of the study is to develop a long-range plan and to evaluate concepts for improving the overlapping system of interchanges at SR-57 and SR-60 at Grand Avenue. A subset of that study is to identify opportunities for improving the interchange operation at Grand Avenue and reduce the amount of traffic weaving between the mainline and on and off-ramp traffic at Grand Avenue. The study would also include a concept for completing the missing connectors of the two freeway to freeway interchanges from WB-60 and NB-57 and the reverse move, and the HOV connectors from NB-57 and WB-60 and the reverse move. LACMTA completed the study and circulated a draft feasibility report of the concept plan in late 2009. The Grand Avenue interchange project designs have been coordinated with the concepts developed in the Feasibility Report.

Lemon Avenue is located approximately two miles west of the Grand Avenue interchange in the City of Diamond Bar and crosses SR-60. The Project Report and Environmental Documents for the proposed Lemon Avenue interchange were approved by Caltrans in April 2009. Construction of the interchange is currently scheduled for 2012. The Lemon Avenue project will not have a direct impact on the proposed Grand Avenue project.

Analysis of Existing Traffic Conditions

The Project Team identified the area intersections that would be most likely to be impacted by implementation of the various project alternatives. Those intersections are listed below:

- Grand Avenue at SR-60 Eastbound Ramps
- Grand Avenue at SR-60 Westbound Ramps
- Grand Avenue at Golden Springs Drive

Mainline weaving conditions are also a significant concern for this project. Traffic queues along the mainlines of SR-60 and SR-57 back up for significant distances beyond the confluence area at Grand Avenue. For this project, mainline traffic and weaving conditions were analyzed using a freeway simulation model. The AM model extends along SR-60 from Philips Ranch Road to Brea Canyon Road and along SR-57 from Sunset Crossing to Pathfinder Road. The PM model is much longer, in order to properly simulate more extensive queuing. Modeling for SR-60 begins at Azusa Avenue and extends to Phillips Ranch Road. SR-57 is modeled from Tonner Canyon Road to Temple Avenue. The congestion patterns on both freeways within these limits could potentially be improved by the project alternatives.

Existing Conditions

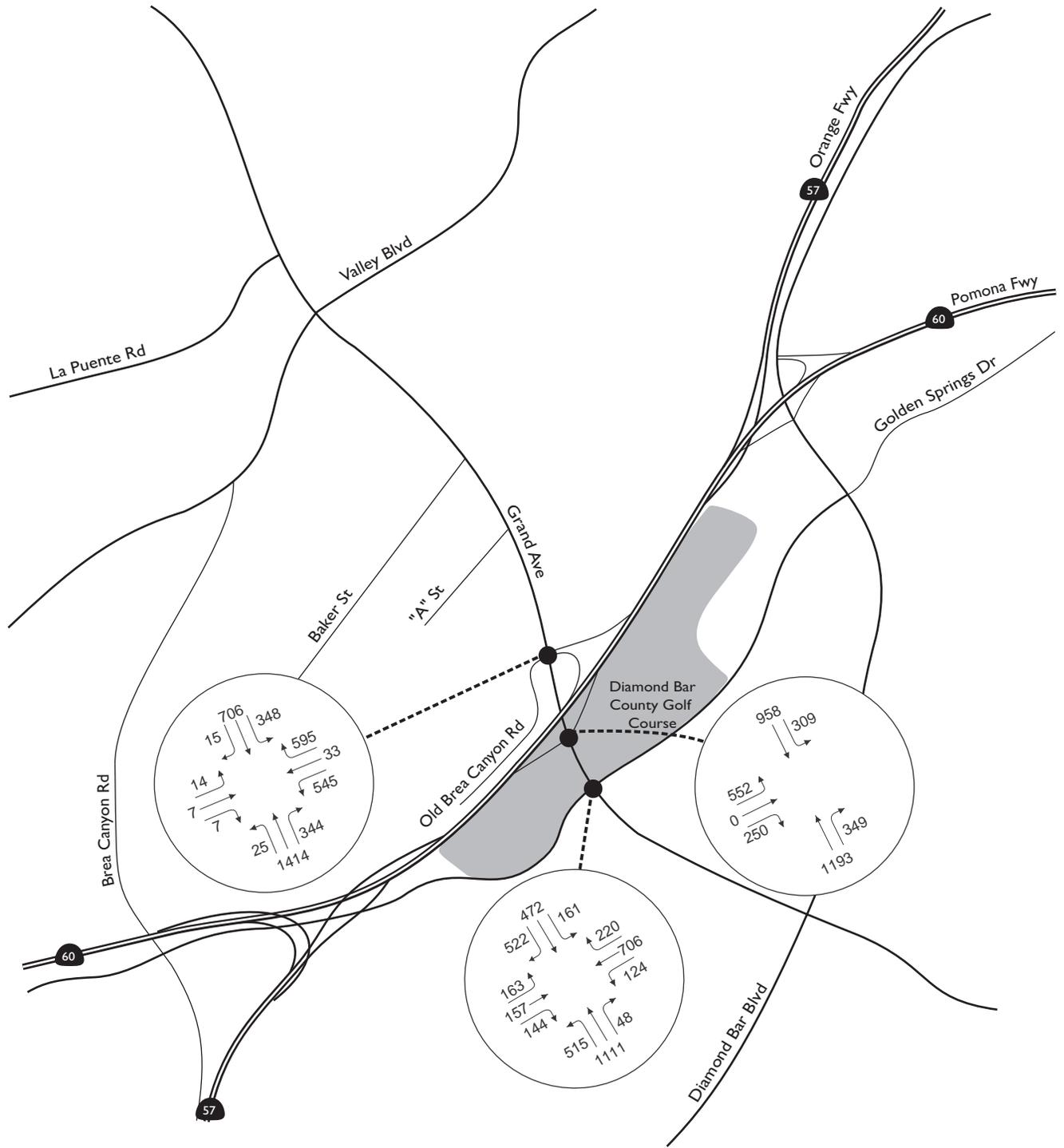
Existing turning movement volumes for the AM and PM peak periods were obtained at all project intersections and are shown in Figures 6 and 7. The existing turning movement volumes were collected by a traffic counting specialist firm, National Data and Surveying Services. Average Daily Traffic (ADT) volumes were also collected for this project on Grand Avenue immediately north of the freeway interchange. The 2009 ADT volumes for Grand Avenue, SR-60, and SR-57 in the project vicinity are shown in Table I.

Freeway mainline and ramp counts were obtained by traffic count specialist firms, Traffic Data Services of Santa Ana and True Counts of San Diego.

Existing traffic volume data can be found in Appendix A of this report. Truck survey data is provided in Appendix H.

Table I – Existing 2009 Daily Traffic Volumes

	Average Daily Traffic	AM Peak Hour	PM Peak Hour
Grand Avenue, North of SR-60 WB Ramps	30,920	3,092	2,861
Grand Avenue, Between SR-60 WB and SR-60 EB Ramps	31,500	3,050	2,572
Grand Avenue, South of SR-60 EB Ramps	27,500	2,697	2,815
SR-60 Freeway west of SR-57	213,000	9,135	10,245
SR-60 Freeway between Grand Avenue Ramps	340,000	17,946	18,282
SR-60 Freeway east of SR-57	223,000	11,453	10,394
SR-57 South of SR-60	202,000	10,312	9,293
SR-57 North of SR-60	129,000	8,324	9,317



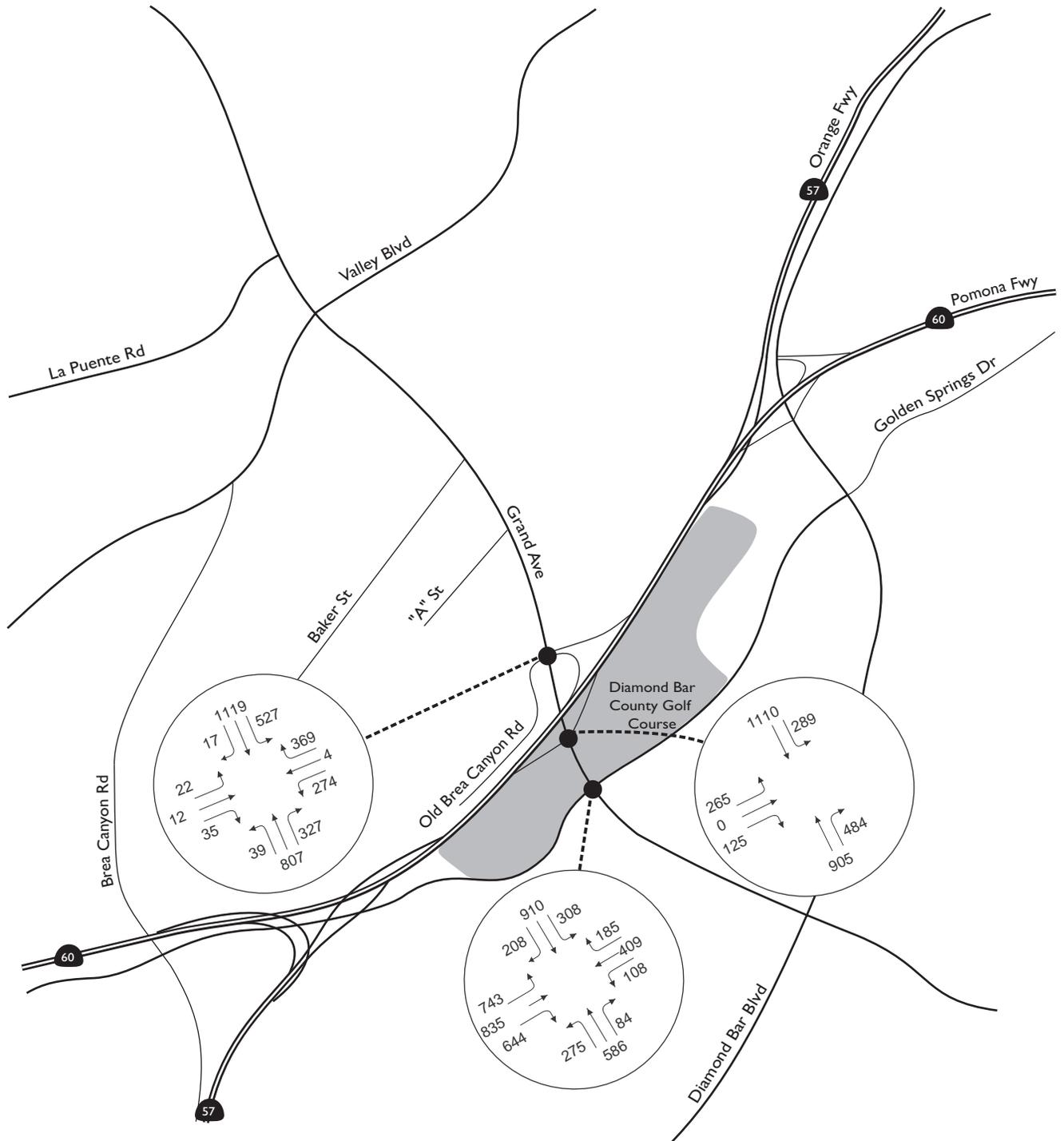
LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX ↘ Peak Hour Turning Movement Volume



Not to Scale

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LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX ↘ Peak Hour Turning Movement Volume



Not to Scale

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Intersection Analysis

Traffic conditions on most roadway facilities are analyzed using the principles or the specific analysis methods contained in the *Highway Capacity Manual, 2000 Edition, (HCM)*, a publication of the Transportation Research Board, a research agency associated with the Federal Government. All methodologies in the HCM method are based upon the concept of traffic Level of Service. This concept is also fundamental to many other forms of traffic analysis. Level of service is a report card scale ranging from A to F, which describes the varying conditions on a roadway during a specific time interval of study. Brief definitions of level of service are found in Table 2.

Table 2 – Level of Service Descriptions

Level of Service	Traffic Description
A	Excellent, Light Traffic
B	Good, Light to Moderate Traffic
C	Moderate Traffic, with Insignificant Delay
D	Heavy Traffic, with Significant Delay
E	Severe Congestion and Delay
F	Failed, Indicated Levels Cannot Be Handled

Chapter 9 of the HCM is devoted to analysis of signalized intersections. The methodology in this chapter is based upon measurements or forecasts of delay for traffic utilizing all approaches to the intersection. Chapter 24 is devoted to analysis of freeway weaving segments. Level of service is based upon vehicle density and speed within the weaving area.

Table 3 shows the relationship between level of service and the performance measures for signalized and unsignalized intersections.

Table 3 – Levels of Service for Intersections

Level of Service	Signalized Intersection Control Delay ¹	Unsignalized Intersection Control Delay ¹
A	0 – 10	0 – 10
B	10.1 – 20	10 – 15
C	20.1 – 35	15 – 25
D	35.1 – 55	25 – 35
E	55.1 – 80	35 – 50
F	80.1 or more	50 or more

Note 1: Average delay in seconds/vehicle

Level of Service guidelines for Caltrans, the City of Industry, and the City of Diamond Bar are included in Appendix I of this report.

All level of service analyses were performed by evaluating peak hour conditions at the identified intersections and weaving sections in the project area. Level of service calculations for signalized intersections were performed using the HCM-2000 “operational analysis” procedure as defined in the 2000 *Highway Capacity Manual (HCM)*. This technique uses 1,900 passenger cars per hour of green per lane (pcphgpl) as the maximum saturation flow of a single lane at an intersection, with a 3-second loss time per phase. This saturation flow rate is adjusted to account for lane width, on-street parking, conflicting pedestrian flow, traffic composition, (i.e., percent of trucks) and shared lane movements (e.g., through and right-turn movements from the same lane). Level of service for signalized intersections is based on the average time (seconds) that vehicles on intersection approaches are stopped, slowed, or delayed.

All signalized intersection level of service calculations for this study were performed using the Synchro intersection analysis software tool. This program is very similar to the HCM methodology, but Synchro considers the affect of nearby signalized intersections in a slightly different manner than the HCM. Synchro can also provide animated simulations of freeway mainline and weaving conditions through its Simtraffic module, however the program is not intended for this purpose and its results are not considered reliable.

Level of service calculations were performed based on existing peak hour turning movement volumes. Queue lengths for off-ramps and critical movements were also evaluated for this analysis. Table 4 shows the results of this analysis. Level of service calculation worksheets for existing traffic conditions can be found in Appendix C of this report.

Table 4 – Existing Traffic Conditions

Intersection	AM Peak Hour			PM Peak Hour		
	Queue Length	Delay ³	Level of Service	Queue Length	Delay ³	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp ¹	283 ft (WB)	42.2	D	192 ft (WB)	20.1	C
Grand Ave. at SR-60 Eastbound Off Ramp ¹	220 ft (EB)	16.2	B	88 ft (EB)	11.3	B
Grand Ave. at Golden Springs Drive ²	349 ft	38.6	D	306 ft ²	54.0	D

Note 1: Queue length in feet on freeway off-ramp approach

Note 2: Queue length in feet on southbound approach

Note 3: Delay in seconds per vehicle average

As shown in Table 4, the three intersections currently operate at acceptable levels of service at all study time periods.

Freeway Segment Analysis

The freeway segments adjacent to the interchange experience unique weaving conditions. Traffic entering or exiting at Grand Avenue must weave across multiple freeway lanes to utilize the proper approach or departure freeway in 3 of the 4 quadrants. This type of weave is known in the *HCM* as a Type C weave. This type of weave is relatively rare, and as a result, the *HCM* methodology for Type C weave analysis may not be reliable or well-calibrated for this application. In particular, the weaving sections for this project are generally longer than the maximum length specified in the *HCM* for Type C weave analysis. The *HCM* thus suggests that the segments affected by this project are not truly weaving segments and should be analyzed instead as simple on and off-ramps. Also the freeway contains 6-7 lanes in each direction within the weaving segments adjacent to the interchange, while the *HCM* clearly indicates that its results are based mainly upon traffic observations for 3 and 4 lane freeways. It recommends care and judgment in application to this type of situation. The results obtained using the traditional HCM analysis may thus not be properly calibrated or reliable for this application due to the longer length of the weaving sections and the excessive number of lanes within the weaving segments.

This report presents extensive study of mainline conditions along SR-57 and SR-60 using two mainline freeway analysis programs, VISSIM and FreQ. FreQ is a stochastic freeway analysis tool that evaluates traffic and weaving conditions using the basic HCM analysis equations, but the program also provides for analysis of vehicle queuing upstream of a capacity bottleneck and reduces downstream traffic flows based upon the capacity of the bottleneck. FreQ can produce a calibrated analysis of congested freeway conditions, including freeway speeds, spatial and temporal extent of queuing, and flows on all mainline and ramp elements. FreQ also prepares a freeway origin/destination matrix that can be used by other programs such as VISSIM, as discussed below.

FreQ can calculate freeway mainline and weaving capacities using HCM equations, but it is subject to the same weaknesses as manual HCM calculations. For a project of this complexity, the program authors recommend that capacities of bottlenecks be measured and overridden in FreQ to produce more accurate calibrations. This approach was used for this study. FreQ forecasts for the freeway are available, but the program was primarily used as a calibration tool for the VISSIM model.

Freeway performance and analysis for this project is primarily based upon the VISSIM traffic simulation model. VISSIM is a traffic simulation model that can analyze complex freeway geometrics based upon travel behavior of simulated motorists. This is a preferred method for analysis of complex freeway segments such as the project site. A calibration version of VISSIM is prepared reflecting existing conditions and adjusted to simulate existing congestion patterns precisely. The calibration version is then modified to reflect proposed geometric conditions and traffic inputs are modified to reflect future traffic forecasts.

The freeway analysis models for this study were prepared to allow for full analysis of existing queuing conditions which are considerable for both freeways. In the AM peak, both freeways are congested from the northeast confluence to the east and north. The freeway analysis models were designed to begin on SR-57 near the Temple Avenue interchange and on the SR-60 near the Phillips Ranch interchange. The AM models ended for SR-57 approaching Pathfinder Road and for SR-60 at Brea Canyon Road.

PM peak congestion is more extensive. The northeasterly limits of the freeway models are similar to the AM peak, but SR-57 is modeled south to the Tonner Canyon/Brea Canyon interchange near the Orange County line and includes the Diamond Bar Boulevard and Pathfinder Road interchanges. The SR-60 Freeway is modeled west to Azusa Avenue and includes the Fullerton Road, Nogales Street, Fairway Drive and Brea Canyon Road interchanges. These limits were chosen to contain the limits of normal PM peak hour queuing on both freeways.

Traffic data for the freeway mainline and supplemental interchanges were obtained from a variety of sources. KOA obtained freeway mainline counts at appropriate locations on each freeway to precisely determine flow rates at the model entry and exit points and to calibrate to existing flow rates near the confluence (please see Appendix H for calibration data). Ramp data was obtained from traffic counts taken for the NFL stadium EIR at relevant interchanges, and additional data for the mainline and for ramps was obtained from the UC Berkeley/Caltrans PEMS online traffic database. Both freeway models require input of counts in 15-minute interval time slices to properly reflect the build-up and dissipation of traffic queues throughout the peak period. HOV vehicle percentages were obtained from the traffic counts. Heavy truck percentages were developed from field surveys. Both are included in Appendix H of this report.

Level of service results for freeway mainline and weaving conditions were obtained from the VISSIM model for each modeled project alternative. The model was also used to refine project geometrics in areas with intense lane changing and weaving.

For freeway segments and merge/diverge areas, Caltrans uses the level of service thresholds described in Table 5 to evaluate operational performance. These levels are derived from the *Highway Capacity Manual*.

Table 5 - Freeway Segment Levels of Service

Level of Service	Weaving Segment Density	Merge/Diverge Segment Density
A	<10.0	< 10.0
B	10.0 - 20.0	10.0 – 20.0
C	20.0 – 28.0	20.0 – 28.0
D	28.0 – 35.0	28.0 – 35.0
E	35.0 – 43.0	> 35.0
F	> 43.0	Demand > Capacity

Existing Weaving Conditions, Eastbound

Tables 6 and 7 show the results of the weaving level of service analysis for eastbound SR-60 and northbound SR-57 traffic under existing conditions. The weaving analysis shows that the weave between Grand Avenue and the freeway split to the east is deficient, Level of Service F, in the PM peak period.

Field observations show extremely poor traffic conditions eastbound in the PM peak, and the traffic density generally appears to be much higher than indicated in the analysis. Also the extent of congestion and queuing from the west is extremely high, suggesting that there is a bottleneck in the vicinity that is much worse than suggested by the weaving analysis.

In contrast, conditions are not observed to be a serious problem in the AM peak for eastbound traffic. The weaving calculations suggest that there should be significant slowing approaching the SR-57 north leg, however this approach is normally free flowing at satisfactory density and speeds in the AM peak hours. These two observations combine to suggest that the weaving methodology applied to the segments may not be accurate or precise. It may also suggest that the weaving behavior is not the primary factor that determines level of service in the area, especially in the PM peak.

Table 6 - Eastbound SR-60 Existing Traffic Conditions

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Brea Canyon On Ramp to SR-57 SB Connector Ramp	WS	7,296	56	19	B
SR-57 SB Connector Ramp to HOV Lane Start	BF	5,055	60	17	B
HOV Lane Start to SR-57 NB Merge	BF	5,055	62	20	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	9,371	61	21	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	8,569	52	29	D
Grand Avenue On Ramp Merge Segment	WS	9,227	45	34	D
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	9,227	49	32	D
Additional Lane Opening to SR-57 NB Diverge	WS	9,227	56	23	C
SR-57 NB Diverge to Diamond Bar Blvd On Ramp	BF	4,791	61	20	C
PM Peak Hour					
Brea Canyon On Ramp to SR-57 SB Connector Ramp	WS	6,439	57	20	B
SR-57 SB Connector Ramp to HOV Lane Start	BF	5,374	59	18	B
HOV Lane Start to SR-57 Merge	BF	5,374	61	22	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	9,805	17	85	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,415	14	117	F
Grand Avenue On Ramp Merge Segment	WS	10,188	14	108	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	10,188	24	72	F
Additional Lane Opening to SR-57 NB Diverge	WS	10,188	47	32	D
SR-57 NB Diverge to Diamond Bar Blvd On Ramp	BF	5,215	61	23	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 7 - Northbound SR-57 Existing Traffic Conditions

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,316	60	22	C
SR-60 EB Merge to Grand Avenue Off Ramp	WS	9,371	61	21	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	8,569	52	29	D
Grand Avenue On Ramp Merge Segment	WS	9,227	45	34	D
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	9,227	49	32	D
Additional Lane Opening to SR-60 Diverge	WS	9,227	56	23	C
SR-60 EB Diverge to 4-Lane Opening	BF	3,976	62	20	C
PM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,431	18	89	F
SR-60 EB Merge to Grand Avenue Off Ramp	WS	9,805	17	85	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,415	14	117	F
Grand Avenue On Ramp Merge Segment	WS	10,188	14	108	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	10,188	24	72	F
Additional Lane Opening to SR-60 EB Diverge	WS	10,188	47	32	D
SR-60 EB Diverge to 4-Lane Opening	BF	4,444	61	25	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Observations indicate that there is a very large queue of eastbound vehicles that regularly extends back for 10 miles on SR-60 and for 5 miles on SR-57 during the PM peak. Analysis by KOA Corporation suggests that the queue may be due primarily to the configuration of the SR-57 northbound exit from the combined route. While three lanes are provided on the SR-57 northbound connector, the three lanes are fed by only two lanes on the 57/60 roadway until only about 500 feet before the divergence. Due to the short length of auxiliary lane present, the 57 connector functions generally as a two lane exit. However the observed volumes using the 57 connector are much higher than a two lane exit can service. There is likely a severe mainline deficiency approaching this exit that results in traffic restrictions that are much more severe than the Grand Avenue weave might be responsible for. This deficiency cannot be calculated by level of service procedures, unless the SR-57 connector is presumed to have only two lanes.

The PM traffic congestion caused by the SR-57 connector east of Grand Avenue also aggravates the weave condition west of Grand. The freeway operates in heavy stop and go traffic between the south leg of SR-57 and the Grand Avenue off-ramp. This requires cars on SR-60 who desire to exit at Grand Avenue to weave through two lanes of dense stopped traffic from the south leg of the 57 freeway to reach the Grand Avenue off-ramp.

There is a clear bottleneck and chokepoint on the merged SR-57/60 segment in the project vicinity. Traffic generally breaks up about 1,500 feet east of the Grand interchange in the PM peak. Downstream from the chokepoint, travel speeds and flows are generally observed as free-flow, both on the SR-60 eastbound to beyond the SR-71 Freeway and on SR-57 northbound to the I-10 Freeway.

The weave from the Grand Avenue eastbound on-ramp to SR-57/SR-60 aggravates the mainline and connector deficiency in the area, by requiring entering vehicles to weave across the two lanes that approach the SR-57 exit in order to reach the SR-60 eastbound lanes, however the net capacity reducing effect of this weave is probably not substantial when compared with the larger deficiencies. For a while, the on-ramp was closed during ongoing construction in the area. While it was closed, mainline conditions were not improved significantly.

PM traffic counts in the bottleneck area indicate that the six-lane eastbound cross section is carrying less than 80% of its theoretical 6-lane capacity due to the bottleneck and stop and go conditions. KOA Corporation believes that the effective two-lane off-ramp for northbound SR-57 is the primary bottleneck in the vicinity resulting in the 5-10 miles of mainline back up to the west and south along the two routes, aggravated somewhat by the Grand Avenue on-ramp traffic locally.

Existing Weaving Conditions, Westbound

Tables 8 and 9 show westbound and southbound existing weaving conditions for SR-60 and SR-57 traffic, respectively. The tables indicate that both segments are at LOS F in the AM peak hour. The westerly segment (near SR-57 south leg) is at LOS F in the AM while the easterly segment (near SR-57 north leg) is at LOS E in the PM.

Table 8 - Westbound SR-60 Existing Traffic Conditions

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 Merge	BF	6,202	13	107	F
SR-57 SB Merge to Grand Avenue Off Ramp	WS	10,550	17	83	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,377	37	44	F
Grand Avenue On Ramp to Additional Lane Opening	WS	10,076	52	28	C
Additional Lane Opening to SR-57 SB Diverge	WS	10,076	55	23	C
West of SR-57 SB Diverge	BF	4,080	62	16	B
PM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 Merge	BF	4,650	61	17	B
SR-57 SB Merge to Grand Avenue Off Ramp	WS	9,523	40	35	D
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	8,867	54	26	C
Grand Avenue On Ramp to Additional Lane Opening	WS	9,733	61	21	C
Additional Lane Opening to SR-57 SB Diverge	WS	9,733	61	18	B
West of SR-57 SB Diverge	BF	4,871	62	17	B

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 9 - Southbound SR-57 Existing Traffic Conditions

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	4,348	13	109	F
SR-60 WB Merge to Grand Avenue Off Ramp	WS	10,550	17	83	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,377	37	44	F
Grand Avenue On Ramp to Additional Lane Opening	WS	10,076	52	28	C
Additional Lane Opening to SR-60 WB Diverge	WS	10,076	55	23	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	5,996	60	34	D
PM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	4,873	53	31	E
SR-60 WB Merge to Grand Avenue Off Ramp	WS	9,523	40	35	D
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	8,867	54	26	C
Grand Avenue On Ramp to Additional Lane Opening	WS	9,733	61	21	C
Additional Lane Opening to SR-60 WB Diverge	WS	9,733	61	18	B
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	4,862	61	25	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Observed conditions prior to construction match these analysis results reasonably.

Weaving segment level of service worksheets and a map of the weaving segment locations are provided in Appendix D of this report. Information on vehicle miles traveled and daily traffic volumes can be found in Appendix E and Appendix F, respectively.

Accident Data Analysis

Traffic Accident Surveillance and Analysis System (TASAS) data was provided by Caltrans District 7 for northbound SR-57 (PM R4.160 to R5.272), southbound SR-57 (PMR4.460 to R5.272), westbound SR-60 (PM R022.743 to R023.343), and eastbound SR-60 (PM R024.257 to R024.657). The data covers the 36-month period from April 1, 2006 through March 31, 2009. Summary tables, analysis, and data on the actual accident rates for fatal, fatal plus injury, and total accidents vs the average rates for mainline per million vehicle miles, and for ramps and connectors per million vehicles is provided in Appendix K of this document.

The fatal plus injury accident rates and total accident rates were higher than average for the eastbound on and off-ramps, all four Diamond Bar Boulevard ramps, westbound SR-60, the connector from eastbound SR-60 to southbound SR-57, and on Northbound SR-57. The predominant collision types were either rear-end or sideswipe accidents, typically associated with congestion and weaving, respectively.

Analysis of Alternatives – Year 2017 Conditions

The two “Build” Alternatives and one “No Build” Alternative were studied for traffic performance in 2017. Refinements to the “Build” alternatives will be considered prior to the determination of the final design layout. Note that the westbound slip on-ramp is assumed to be completed for all alternatives. Each alternative is described in detail in the Project Alternatives chapter of this report.

Analysis of Alternatives

AM and PM peak hour analyses were performed to assess each of the proposed project alternatives. The analyses were performed by examining peak hour level of service at the identified intersections in the project area. Intersection level of service calculations were performed using the Synchro computer program. Freeway segment level of service analysis was conducted using a VISSIM simulation model.

Future traffic volumes were derived from a straight-line interpolation of the SCAG RTP 2008 Year 2035 Model (Regional Transportation Plan 2008) traffic forecast. The SCAG model provided the basis for the traffic forecast, with approximately 30% of the Industry Business Center (IBC) project traffic included in the 2017 forecast. These trips associated with the IBC land use were added to the SCAG model trip tables on a zone by zone basis to be included in the traffic assignment. The traffic model forecast prepared for the project thus includes trips associated with the Industry Business Center that were not reflected in the SCAG RTP 2008 Model.

Please see Appendix G for information on IBC trip generation.

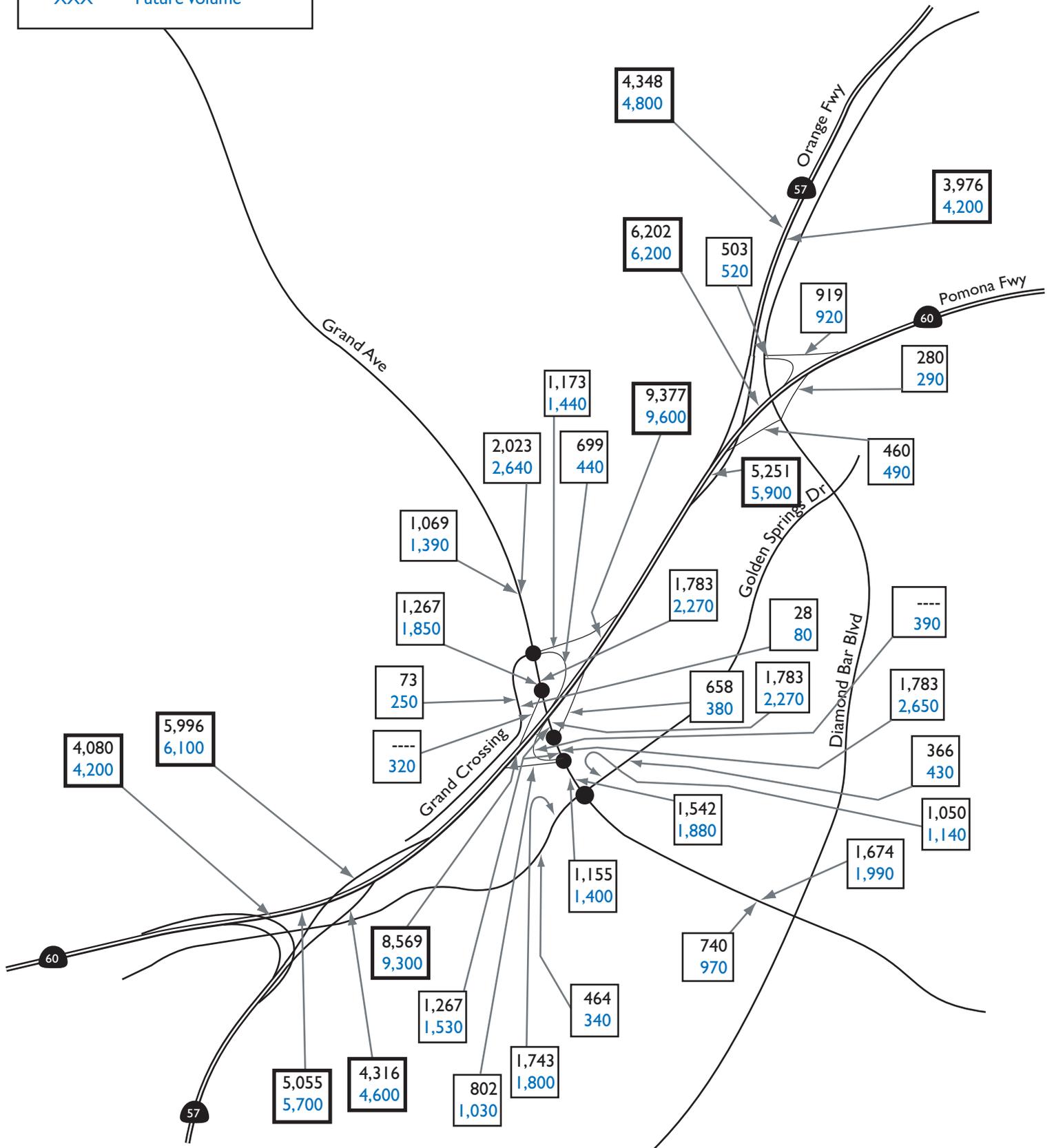
The AM and PM link volume forecasts from the base and future year models, along with the existing turning movement traffic counts, were used as the basis for producing future year traffic volumes. The traffic model forecasts were used to predict future turning movement volumes at the study intersections using a proprietary methodology which adjusts existing turning movement volumes based on expected growth in approach volumes.

Figures 8 and 9 illustrate expected 2017 AM and PM peak hour freeway traffic volumes for the build Alternative 3. Figures 8 and 9 in the 2011 report represent “build” condition forecasts for 2017, with the addition of the 7th mainline freeway lane. The 2017 build forecasts with the additional eastbound lane on the freeway mainline result in a large increase in traffic volumes compared to existing.

Year 2017 traffic forecast data can be found in Appendix B of this report.

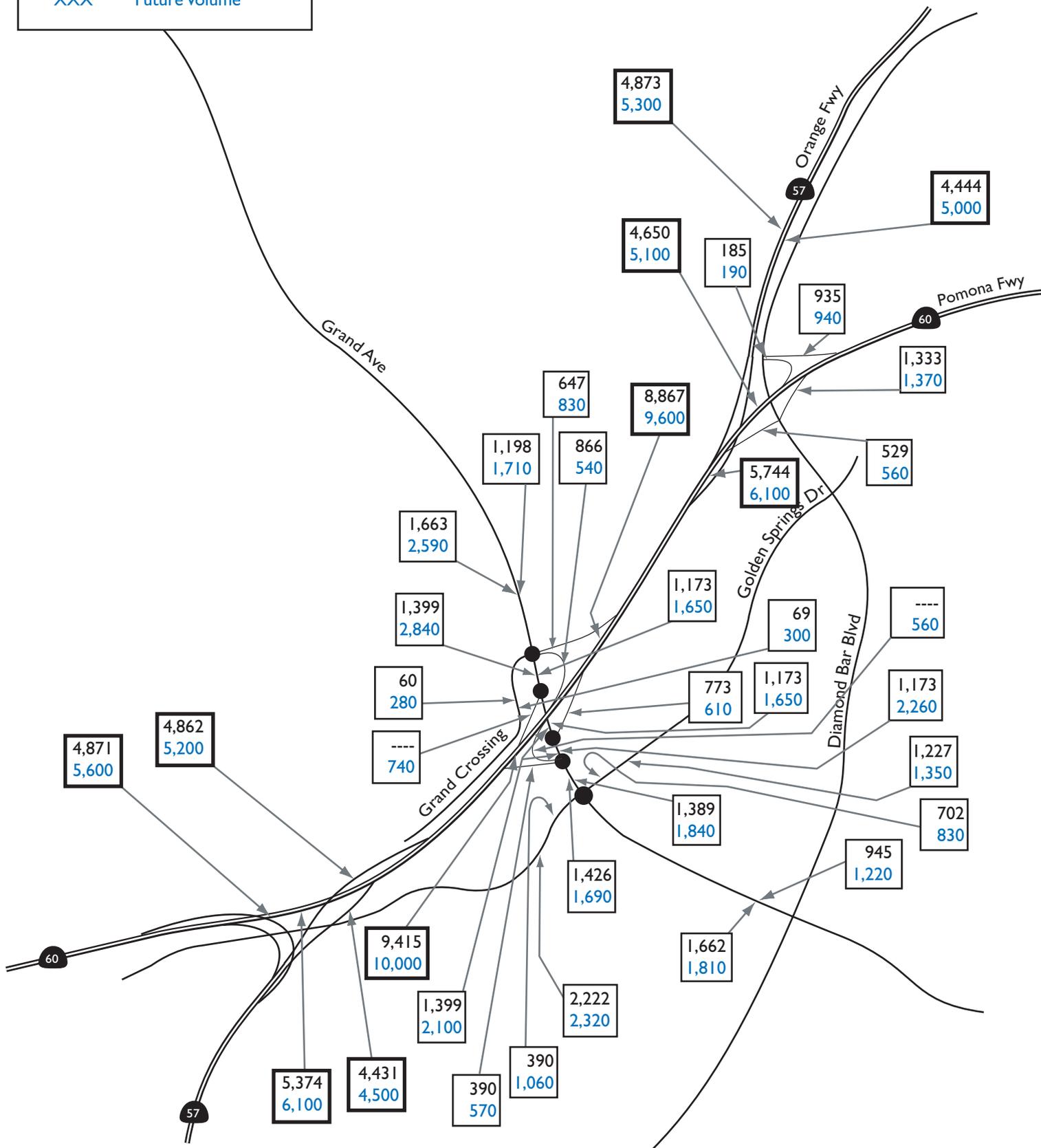
LEGEND

- XXX Existing Volume
- XXX Future Volume



LEGEND

XXX Existing Volume
 XXX Future Volume



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Alternative I (No Build)

Lane geometry for the SR-60/Grand Avenue interchange under Alternative I is shown in Figure 10. Figures 11 and 12 illustrate expected AM and PM traffic volumes under the no-build scenario for year 2017. Alternative I (No Project) shows the analysis results without project improvements but at 2017 traffic levels. The No Build alternative would create highly undesirable traffic conditions in the PM peak hour at both ramp intersections.

Intersection Analysis

Table 10 shows the summary results of the AM and PM peak hour intersection level of service calculations for build out conditions without project (Alternative I). Queue lengths for off-ramps and critical movements were also evaluated for this analysis. Table 11 shows the results of the AM and PM peak hour intersection level of service calculations for Alternative I by approach.

Appendix C contains the level of service calculation worksheets for all alternatives.

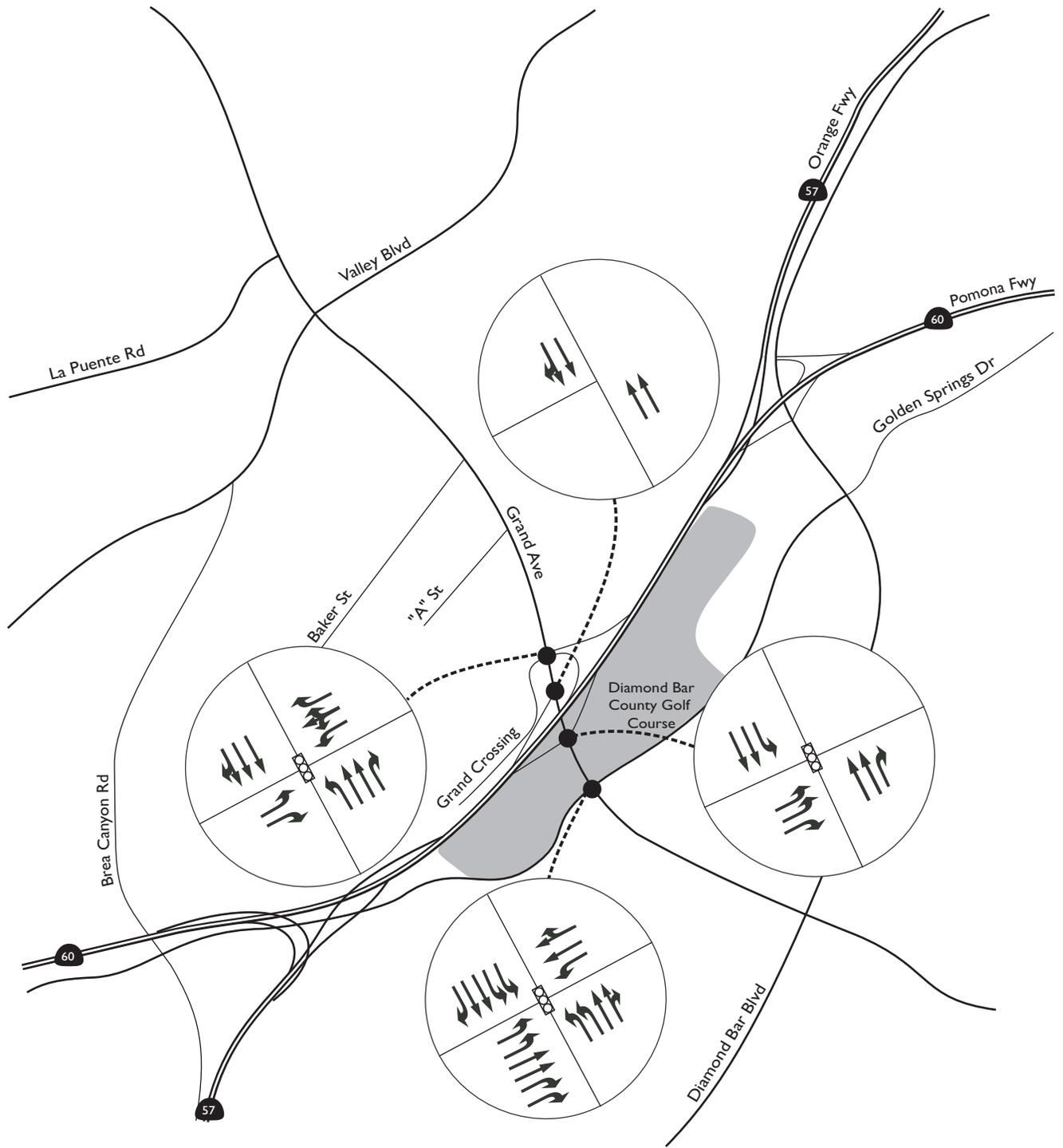
Table 10 – Year 2017 Summary of Traffic Conditions for Alternative I

Intersection	AM Peak Hour			PM Peak Hour		
	Queue Length	Delay ³	Level of Service	Queue Length	Delay ³	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp ¹	461 ft	29.7	C	303 ft	33.4	C
Grand Ave. at SR-60 Eastbound Off Ramp ¹	257 ft	27.8	C	87 ft	17.6	B
Grand Ave. at Golden Springs Drive ²	466 ft	54.9	D	433 ft	48.3	D

Note 1: Queue length in feet on freeway off-ramp approach

Note 2: Queue length in feet on southbound approach

Note 3: Intersection delay in seconds per vehicle average



LEGEND

- Study Intersection
- ◻◻◻◻ Signalized Intersection
- ↷ Lane Geometry



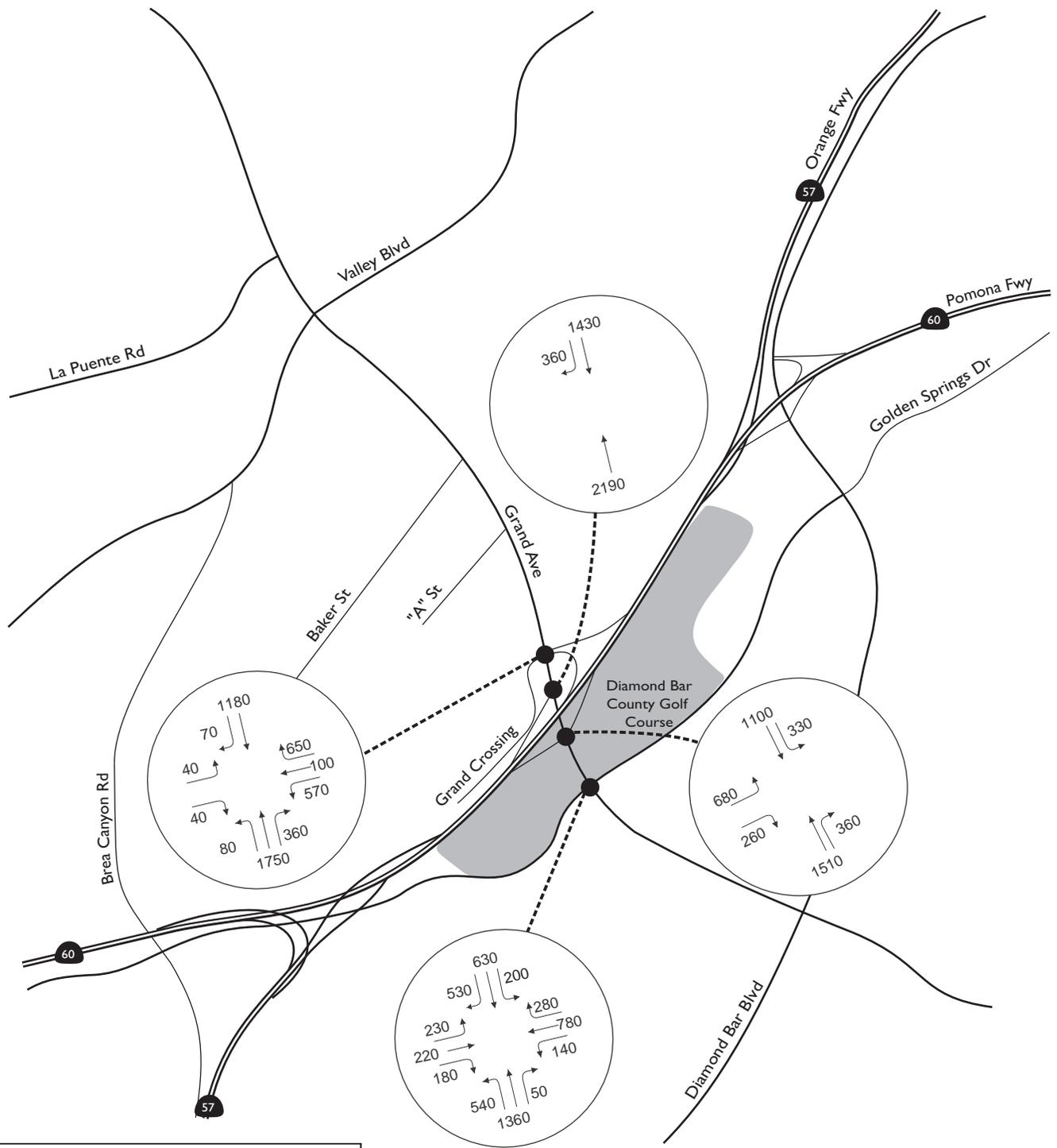
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Table 11 – Year 2017 Traffic Conditions by Approach for Alternative I

INTERSECTION		AM Peak Hour			PM Peak Hour		
		Queue Length	Delay ¹	Level of Service	Queue Length	Delay ¹	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp	NB	660 ft	24.7	C	186 ft	10.8	B
	SB	273 ft	21.8	C	593 ft	29.2	C
	EB	50 ft	36.4	D	111 ft	36.2	D
	WB	461 ft	45.2	D	303 ft	93.1	F
Intersection Average		N/A	29.7	C	N/A	33.4	C
Grand Ave. at SR-60 Eastbound Off Ramp	NB	462 ft	28.9	C	362 ft	26.6	C
	SB	109 ft	8.5	A	159 ft	10.2	B
	EB	257 ft	54.9	D	87 ft	13.8	B
Intersection Average		N/A	27.8	C	N/A	17.6	B
Grand Ave. at Golden Springs Drive	NB	772 ft	65.1	E	327 ft	35.4	D
	SB	466 ft	39.7	D	433 ft	45.5	D
	EB	138 ft	38.8	D	403 ft	47.9	D
	WB	588 ft	64.0	E	366 ft	71.2	E
Intersection Average		N/A	54.9	D	N/A	48.3	D

Note 1: Intersection approach delay in seconds per vehicle average



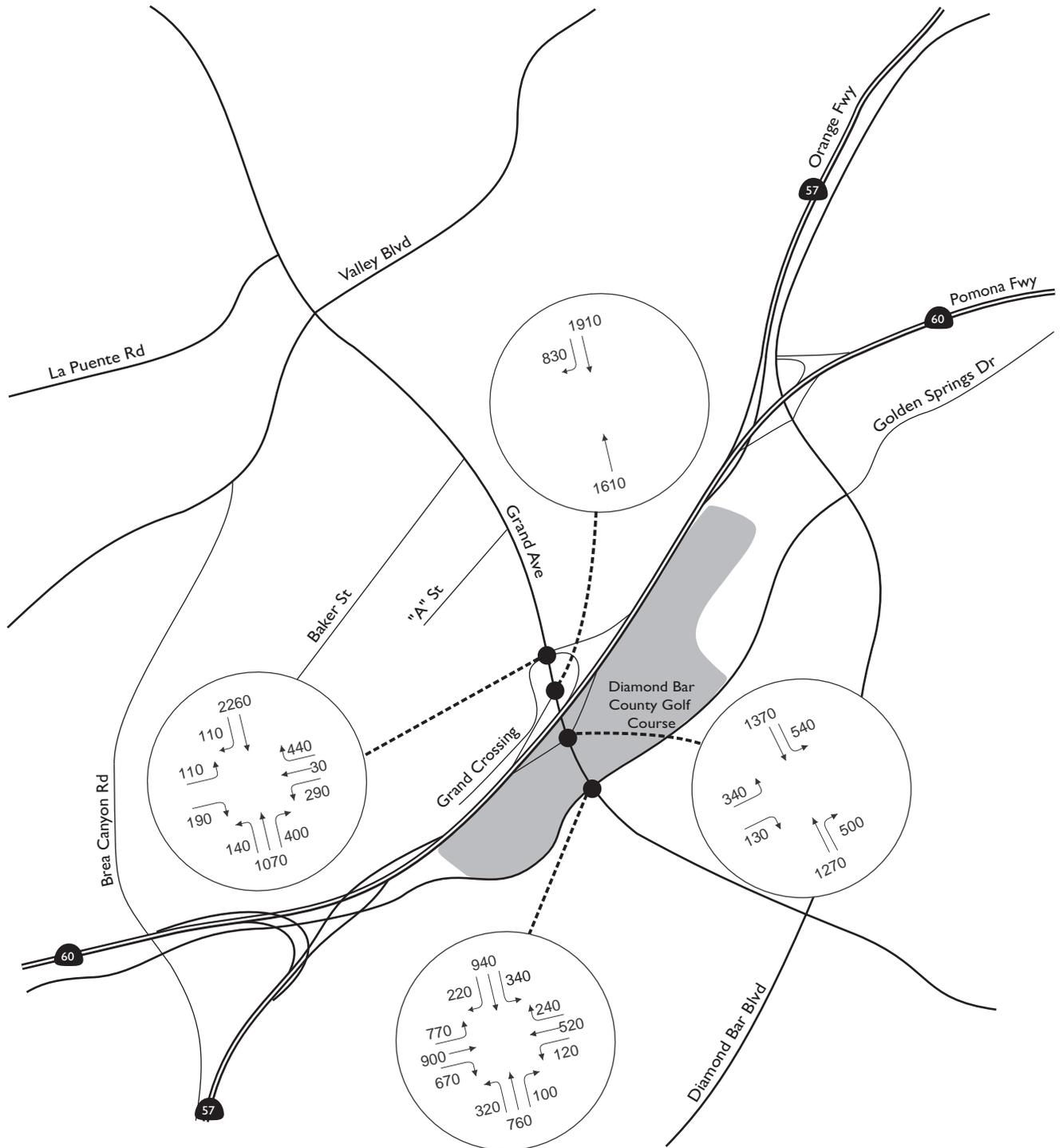
LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX → Peak Hour Turning Movement Volume



Not to Scale

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Not to Scale

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Freeway Segment Analysis

Alternative I (the no-build alternative) was analyzed at 2017 traffic levels using VISSIM software and the HCM-2000 weave methodology for the eastbound and westbound directions, both north and south quadrants. Tables 12 and 13 show the eastbound and northbound weaving section Level of Service calculations for Alternative I conditions. Tables 14 and 15 show the westbound and southbound weaving section Level of Service calculations for Alternative I conditions.

Appendix C contains the level of service calculation worksheets for all alternatives.

The weaving analysis shows that the both the eastbound/northbound and westbound/southbound weaves from SR-60 to SR-57 and Grand Avenue are clearly deficient, with the freeway operating at Segment Level of Service F at this location in both the AM and PM peak periods.

Table 12 - Eastbound SR-60 Year 2017 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	7,400	57	21	C
SR-57 SB Connector Ramp to HOV Lane Start	BF	5,600	60	19	B
HOV Lane Start to SR-57 NB Merge	BF	5,600	56	26	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	10,100	19	76	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,200	18	83	F
Grand Avenue On Ramp Merge Segment	WS	9,900	24	58	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	9,900	36	46	F
Additional Lane Opening to SR-57 NB Diverge	WS	9,900	53	27	C
SR-57 NB Diverge to Diamond Bar Blvd On Ramp	BF	5,200	61	23	C
PM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	6,700	59	20	B
SR-57 SB Connector Ramp to HOV Lane Start	BF	5,600	60	19	B
HOV Lane Start to SR-57 NB Merge	BF	5,600	61	23	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	10,000	17	87	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,500	12	123	F
Grand Avenue On Ramp Merge Segment	WS	10,500	13	107	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	10,500	28	59	F
Additional Lane Opening to SR-57 NB Diverge	WS	10,500	56	26	C
SR-57 NB Diverge to Diamond Bar Blvd On Ramp	BF	5,300	61	24	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 13 - Northbound SR-57 Year 2017 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,500	12	120	F
SR-60 EB Merge to Grand Avenue Off Ramp	WS	10,100	19	76	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,200	18	83	F
Grand Avenue On Ramp Merge Segment	WS	9,900	24	58	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	9,900	36	46	F
Additional Lane Opening to SR-60 EB Diverge	WS	9,900	53	27	C
SR-60 EB Diverge to 4 Lane Opening	BF	4,100	62	22	C
PM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,400	38	51	F
SR-60 EB Merge to Grand Avenue Off Ramp	WS	10,000	17	87	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,500	12	123	F
Grand Avenue On Ramp Merge Segment	WS	10,500	13	107	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	10,500	28	59	F
Additional Lane Opening to SR-60 EB Diverge	WS	10,500	56	26	C
SR-60 EB Diverge to 4 Lane Opening	BF	4,700	62	23	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 14 - Westbound SR-60 Year 2017 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB	BF	6,100	13	109	F
SR-57 SB Merge to Grand Avenue Off Ramp	WS	10,700	17	83	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,400	34	52	F
Grand Avenue Loop On Ramp to Slip On Ramp	WS	9,800	36	45	F
Additional Lane Opening to SR-57 SB Diverge	WS	10,100	51	25	C
SR-57 SB Diverge to WB Connector	BF	4,100	62	15	C
PM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB	BF	5,100	60	24	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	10,200	29	52	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,400	38	48	F
Grand Avenue Loop On Ramp to Slip On Ramp	WS	9,800	60	25	C
Additional Lane Opening to SR-57 SB Diverge	WS	10,600	61	23	C
SR-57 SB Diverge to WB Connector	BF	5,400	61	20	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 15 - Southbound SR-57 Year 2017 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	4,600	15	108	F
SR-60 WB Merge to Grand Avenue Off Ramp	WS	10,700	17	83	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,400	34	52	F
Grand Avenue Loop On Ramp to Slip On Ramp	WS	9,800	36	45	F
Additional Lane Opening to SR-60 WB Diverge	WS	10,200	51	25	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,300	60	36	E
PM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	5,100	15	112	F
SR-60 WB Merge to Grand Avenue Off Ramp	WS	10,200	29	52	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,400	38	48	F
Grand Avenue Loop On Ramp to Slip On Ramp	WS	9,800	60	25	C
Additional Lane Opening to SR-60 WB Diverge	WS	10,600	61	23	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	5,600	60	31	D

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Weaving segment level of service worksheets and a map of the weaving segment locations are provided in Appendix D of this document. Information on vehicle miles traveled and daily traffic volumes can be found in Appendix E and Appendix F, respectively.

Alternative 2

Lane geometry for the SR-60/Grand Avenue interchange under Alternative 2 is shown in Figure 13. Figures 14 and 15 illustrate expected AM and PM traffic volumes under Alternative 2 for year 2017. Alternative 2 shows the analysis results at 2017 traffic levels.

Intersection Analysis

Table 16 shows the results of the AM and PM peak hour intersection level of service calculations for build out conditions under Alternative 2. Queue lengths for off-ramps and critical movements were also evaluated for this analysis. Table 17 shows the results of the AM and PM peak hour intersection level of service calculations for Alternative 2 by approach.

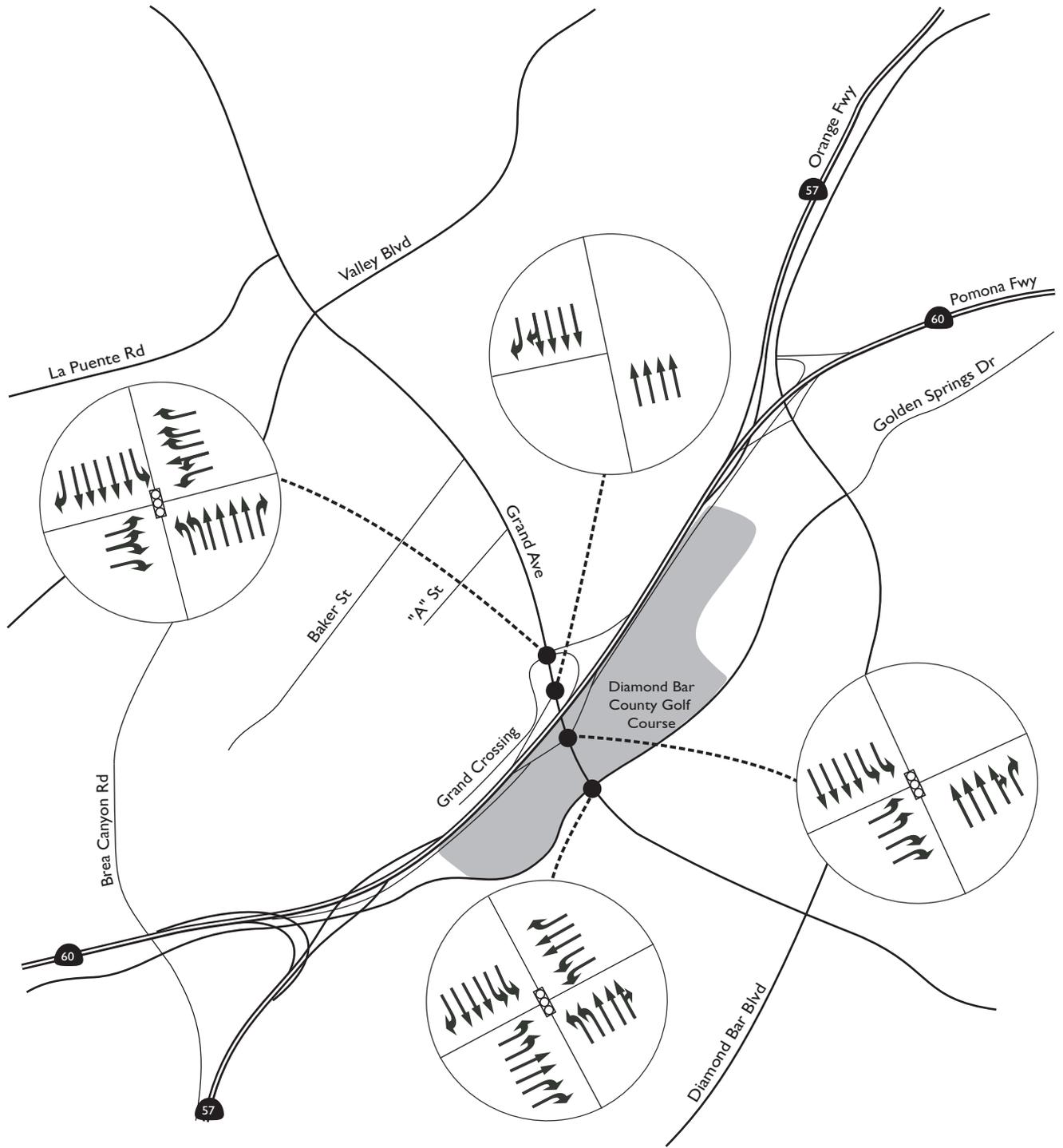
Table 16 – Year 2017 Summary of Traffic Conditions for Alternative 2

Intersection	AM Peak Hour			PM Peak Hour		
	Queue Length	Delay ³	Level of Service	Queue Length	Delay ³	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp ¹	331 ft	21.0	C	149 ft	17.9	B
Grand Ave. at SR-60 Eastbound Off Ramp ¹	186 ft	15.9	B	101 ft	12.6	B
Grand Ave. at Golden Springs Drive ²	493 ft	35.7	D	400 ft	38.7	D

Note 1: Queue length in feet on freeway off-ramp approach

Note 2: Queue length in feet on southbound approach

Note 3: Intersection delay in seconds per vehicle average



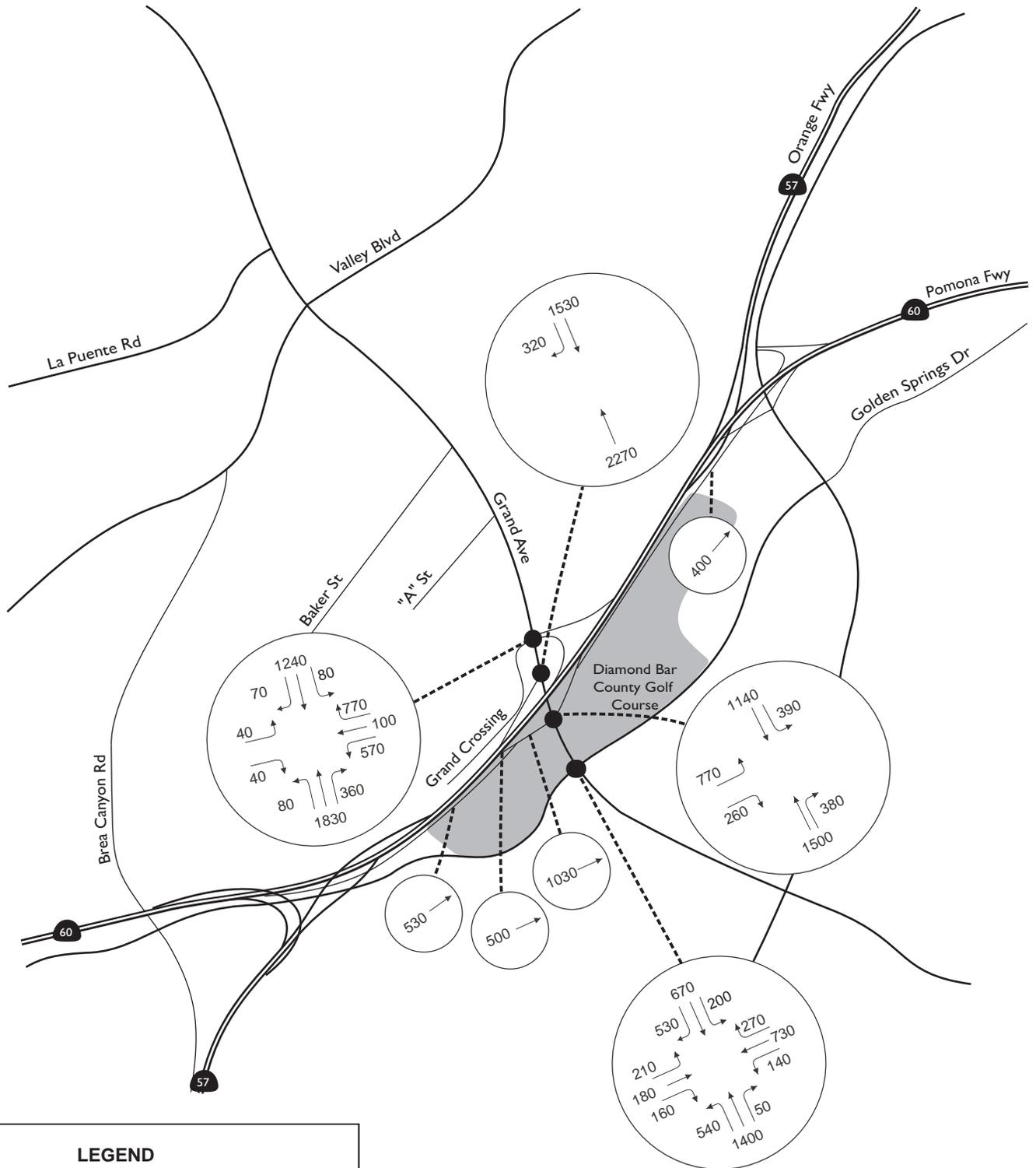
LEGEND

- Study Intersection
- ⊠ Signalized Intersection
- ↔ Lane Geometry



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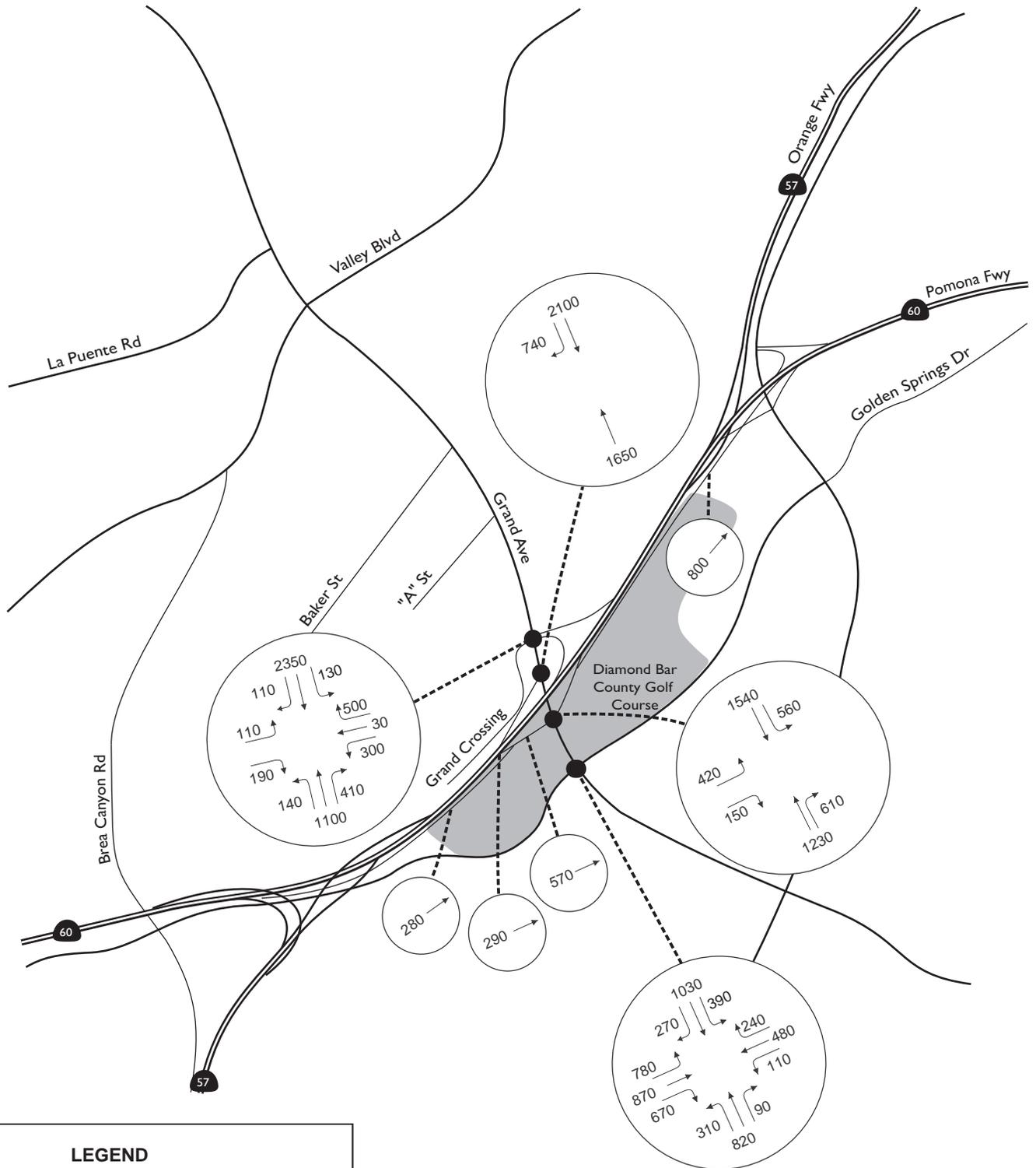
LEGEND

- Study Intersection
- Major Street
- - - Minor Street
- XX → Peak Hour Turning Movement Volume

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Table 17 – Year 2017 Traffic Conditions by Approach for Alternative 2

INTERSECTION		AM Peak Hour			PM Peak Hour		
		Queue Length	Delay ¹	Level of Service	Queue Length	Delay ¹	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp	NB	304 ft	20.1	C	155 ft	16.2	B
	SB	150 ft	15.5	B	313 ft	15.5	B
	EB	39 ft	34.4	C	83 ft	30.0	C
	WB	331 ft	27.0	C	149 ft	24.5	C
Intersection Average		N/A	21.0	C	N/A	17.9	B
Grand Ave. at SR-60 Eastbound Off Ramp	NB	241 ft	20.7	C	175 ft	16.2	B
	SB	112 ft	10.8	B	157 ft	9.2	A
	EB	186 ft	14.4	B	101 ft	13.2	B
Intersection Average		N/A	15.9	B	N/A	12.6	B
Grand Ave. at Golden Springs Drive	NB	460 ft	40.6	D	344 ft	44.7	D
	SB	493 ft	35.0	D	400 ft	44.7	D
	EB	127 ft	28.9	C	531 ft	30.7	C
	WB	310 ft	31.3	C	246 ft	39.8	D
Intersection Average		N/A	35.7	D	N/A	38.7	D

Note 1: Intersection approach delay in seconds per vehicle average

Freeway Segment Analysis

Alternative 2 was analyzed at 2017 traffic levels using the HCM-2000 weave methodology for the eastbound and westbound directions. Table 18 shows the eastbound weaving section Level of Service calculations under Alternative 2. Table 19 shows the northbound weaving section Level of Service calculations. Table 20 shows the westbound weaving section Level of Service calculations. Table 21 shows the eastbound weaving section Level of Service calculations.

Table 18 - Eastbound SR-60 Year 2017 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	7,500	61	22	C
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	5,750	60	21	C
EB Bypass Off Ramp to SR-57 NB Merge	BF	5,200	62	23	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	9,800	62	24	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,300	60	24	C
Grand Avenue On Ramp to SR-57 NB Diverge	M/D	10,100	60	23	C
SR-57 NB Diverge to EB Bypass Connector	M/D	5,900	62	24	C
EB Bypass Connector to Diamond Bar Off Ramp	BF	5,800	62	24	C
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	5,300	62	24	C
Diamond Bar On Ramp to EB Bypass Connector	M/D	5,600	63	19	B
EB Bypass Connector to Phillips Ranch Off Ramp	BF	5,700	63	19	B
PM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	7,000	56	22	C
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	6,100	60	19	B
EB Bypass Off Ramp to SR-57 NB Merge	BF	5,800	63	21	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	10,300	62	22	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	10,000	61	22	C
Grand Avenue On Ramp to SR-57 NB Diverge	M/D	11,200	62	23	C
SR-57 NB Diverge to EB Bypass Connector	M/D	6,200	62	20	B
EB Bypass Connector to Diamond Bar Off Ramp	BF	5,900	62	20	B
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	5,400	62	20	B
Diamond Bar On Ramp to EB Bypass Connector	M/D	6,500	62	22	C
EB Bypass Connector to Phillips Ranch Off Ramp	BF	6,800	62	22	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 19 - Northbound SR-57 Year 2017 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,600	62	24	C
SR-60 EB Merge to Grand Avenue Off Ramp	WS	9,800	62	24	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,300	60	24	C
Grand Avenue On Ramp to SR-60 EB Diverge	WS	10,100	60	23	C
SR-60 EB Diverge to EB Bypass Connector	BF	4,400	62	19	B
EB Bypass Connector to 4 Lane Opening	BF	4,300	62	23	C
PM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,500	62	23	C
SR-60 EB Merge to Grand Avenue Off Ramp	WS	10,300	62	22	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	10,000	61	22	C
Grand Avenue On Ramp to SR-60 EB Diverge	WS	11,200	62	23	C
SR-60 EB Diverge to EB Bypass Connector	BF	5,500	61	24	C
EB Bypass Connector to 4 Lane Opening	BF	5,200	61	27	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 20 - Westbound SR-60 Year 2017 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	6,200	59	21	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	11,000	50	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	62	22	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,000	61	20	B
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	10,300	61	18	B
SR-57 SB Diverge to HOV Lane Merge	BF	4,200	64	13	B
PM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	5,100	62	19	B
SR-57 SB Merge to Grand Avenue Off Ramp	WS	10,400	61	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	60	24	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,100	62	23	C
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	10,800	62	22	C
SR-57 SB Diverge to HOV Lane Merge	BF	5,600	63	19	B

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 21 - Southbound SR-57 Year 2017 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	4,800	61	28	C
SR-60 WB Merge to Grand Avenue Off Ramp	WS	11,000	60	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	62	22	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,000	61	20	C
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	10,300	61	18	B
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,300	61	12	B
PM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	5,300	61	29	D
SR-60 WB Merge to Grand Avenue Off Ramp	WS	10,400	61	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	60	24	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,100	62	23	C
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	10,800	62	22	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	5,700	63	19	B

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Weaving segment level of service worksheets are provided in Appendix D of this document. Information on vehicle miles traveled and daily traffic volumes can be found in Appendix E and Appendix F, respectively.

Alternative 3

Lane geometry for the SR-60/Grand Avenue interchange under Alternative 3 is shown in Figure 16. Figures 17 and 18 illustrate expected AM and PM traffic volumes under Alternative 3 for year 2017. Alternative 3 was analyzed using the HCM-2000 ramp diverge methodology for the eastbound direction, south quadrant. Alternative 3 shows the analysis results at 2017 traffic levels.

Intersection Analysis

Table 22 shows the results of the AM and PM peak hour intersection level of service calculations for build out conditions under Alternative 3. Queue lengths for off-ramps and critical movements were also evaluated for this analysis. Table 23 shows the results of the AM and PM peak hour intersection level of service calculations for Alternative 3 by approach.

Appendix C contains the level of service calculation worksheets for all alternatives.

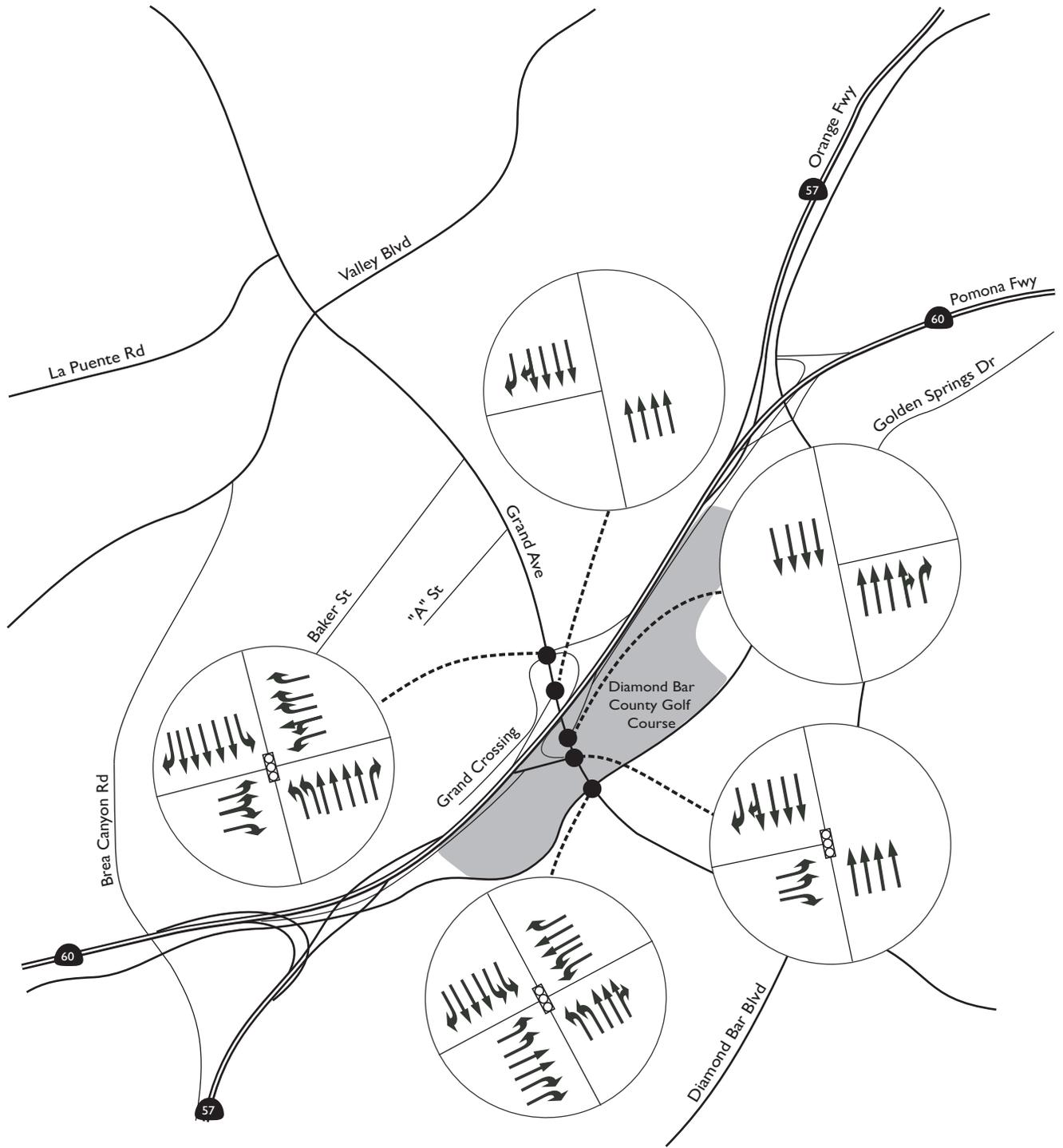
Table 22 – Year 2017 Summary of Traffic Conditions for Alternative 3

Intersection	AM Peak Hour			PM Peak Hour		
	Queue Length	Delay ³	Level of Service	Queue Length	Delay ³	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp ¹	285 ft	20.2	C	144 ft	17.7	B
Grand Ave. at SR-60 Eastbound Off Ramp ¹	201 ft	9.8	A	89 ft	6.2	A
Grand Ave. at Golden Springs Drive ²	250 ft	31.3	C	274 ft	31.6	C

Note 1: Queue length in feet on freeway off-ramp approach

Note 2: Queue length in feet on southbound approach

Note 3: Intersection delay in seconds per vehicle average



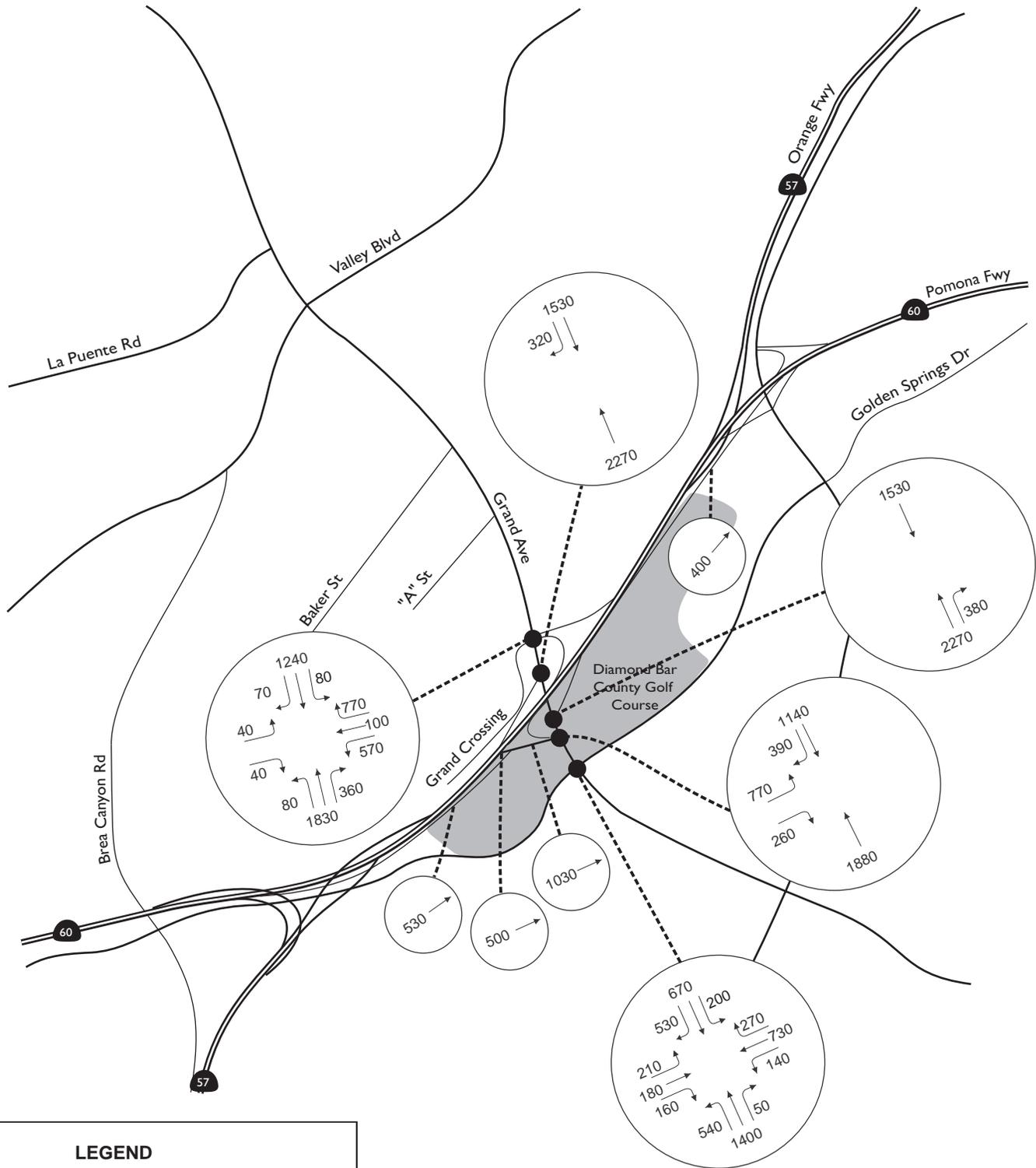
LEGEND

- Study Intersection
- ◻ Signalized Intersection
- ↷ Lane Geometry



Not to Scale

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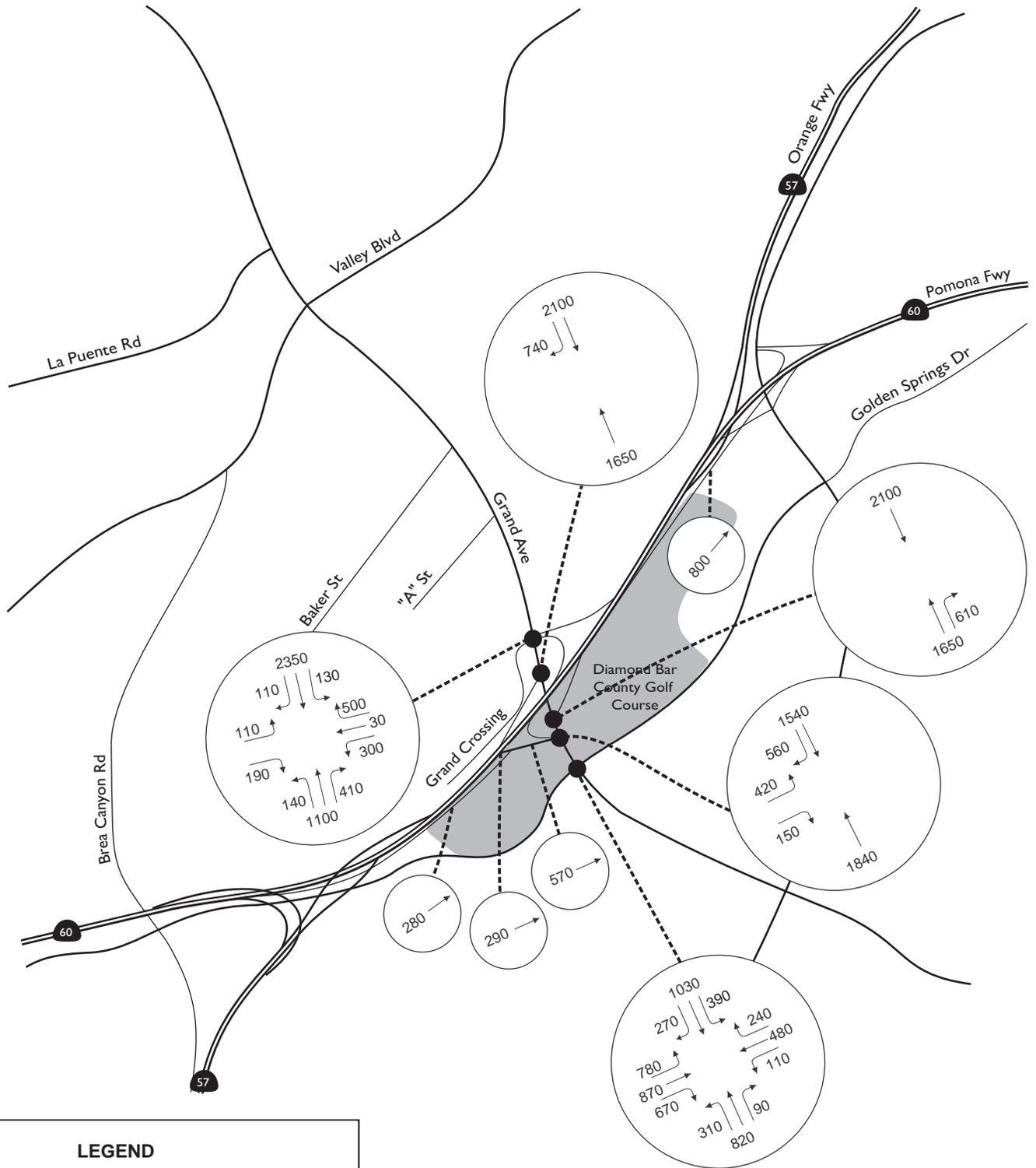
LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX → Peak Hour Turning Movement Volume



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Table 23 – Year 2017 Traffic Conditions by Approach for Alternative 3

INTERSECTION		AM Peak Hour			PM Peak Hour		
		Queue Length	Delay ¹	Level of Service	Queue Length	Delay ¹	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp	NB	332 ft	21.2	C	150 ft	16.1	B
	SB	145 ft	14.7	B	302 ft	15.7	B
	EB	35 ft	30.4	C	84 ft	28.2	C
	WB	285 ft	23.2	C	144 ft	23.8	C
Intersection Average		N/A	20.2	C	N/A	17.7	B
Grand Ave. at SR-60 Eastbound Off Ramp	NB	195 ft	9.6	A	136 ft	6.0	A
	SB	113 ft	6.2	A	117 ft	4.5	A
	EB	201 ft	15.6	B	89 ft	12.8	B
Intersection Average		N/A	9.8	A	N/A	6.2	A
Grand Ave. at Golden Springs Drive	NB	331 ft	30.3	C	235 ft	35.2	D
	SB	250 ft	33.4	C	274 ft	34.5	C
	EB	890 ft	22.7	C	344 ft	27.5	C
	WB	325 ft	34.8	C	201 ft	31.9	C
Intersection Average		N/A	31.3	C	N/A	31.6	C

Note 1: Intersection approach delay in seconds per vehicle average

Freeway Segment Analysis

Alternative 3 was analyzed at 2017 traffic levels using the HCM-2000 ramp diverge and merge methodologies. Table 24 shows the eastbound weaving section Level of Service calculations under Alternative 3. Table 25 shows the northbound weaving section Level of Service calculations. Table 26 shows the westbound weaving section Level of Service calculations. Table 27 shows the eastbound weaving section Level of Service calculations.

Table 24 - Eastbound SR-60 Year 2017 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	7,500	61	28	C
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	5,750	61	22	C
EB Bypass Off Ramp to SR-57 NB Merge	BF	5,200	63	21	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	9,800	61	23	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,300	61	24	C
Grand Avenue Loop On Ramp to Slip On Ramp	WS	9,700	59	23	C
Grand Avenue Slip On Ramp to SR-57 NB Diverge	M/D	10,100	59	23	C
SR-57 NB Diverge to EB Bypass Connector	M/D	5,900	62	24	C
EB Bypass Connector to Diamond Bar Off Ramp	BF	5,800	62	24	C
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	5,300	62	24	C
Diamond Bar On Ramp to EB Bypass Connector	M/D	5,600	63	20	B
EB Bypass Connector to Phillips Ranch Off Ramp	BF	5,700	63	20	B
PM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	7,000	52	30	D
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	6,100	55	24	C
EB Bypass Off Ramp to SR-57 NB Merge	BF	5,800	63	24	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	10,300	61	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	10,000	59	24	C
Grand Avenue Loop On Ramp to Slip On Ramp	WS	10,600	61	23	C
Grand Avenue Slip On Ramp to SR-57 NB Diverge	M/D	11,200	61	23	C
SR-57 NB Diverge to EB Bypass Connector	M/D	6,200	61	24	C
EB Bypass Connector to Diamond Bar Off Ramp	BF	5,900	61	24	C
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	5,400	62	18	B
Diamond Bar On Ramp to EB Bypass Connector	M/D	6,500	62	23	C
EB Bypass Connector to Phillips Ranch Off Ramp	BF	6,800	62	23	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 25 - Northbound SR-57 Year 2017 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,600	62	24	C
SR-60 EB Merge to Grand Avenue Off Ramp	WS	9,800	61	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,300	61	23	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	9,700	59	23	C
Grand Avenue Slip On Ramp to SR-60 EB Diverge	WS	10,100	59	23	C
SR-60 EB Diverge to EB Bypass Connector	BF	4,400	61	19	B
EB Bypass Connector to 4 Lane Opening	BF	4,300	62	23	C
PM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,500	62	23	C
SR-60 EB Merge to Grand Avenue Off Ramp	WS	10,300	61	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	10,000	59	24	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,600	61	23	C
Grand Avenue Slip On Ramp to SR-60 EB Diverge	WS	11,200	61	23	C
SR-60 EB Diverge to EB Bypass Connector	BF	5,500	61	23	C
EB Bypass Connector to 4 Lane Opening	BF	5,200	61	27	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 26 - Westbound SR-60 Year 2017 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	6,200	59	21	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	11,000	60	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	62	22	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,000	62	20	B
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	10,300	61	18	B
SR-57 SB Diverge to HOV Lane Merge	BF	4,200	64	12	B
PM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	5,100	62	19	B
SR-57 SB Merge to Grand Avenue Off Ramp	WS	10,400	62	22	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	61	23	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,100	62	21	C
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	10,800	62	21	C
SR-57 SB Diverge to HOV Lane Merge	BF	5,600	63	19	B

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 27 - Southbound SR-57 Year 2017 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	4,800	61	28	C
SR-60 WB Merge to Grand Avenue Off Ramp	WS	11,000	60	24	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	62	22	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,000	62	20	B
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	10,300	61	18	B
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,300	61	29	D
PM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	5,300	62	26	C
SR-60 WB Merge to Grand Avenue Off Ramp	WS	10,400	62	22	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	9,600	61	23	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,100	62	21	C
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	10,800	62	21	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	5,700	62	24	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Weaving segment level of service worksheets are provided in Appendix D of this document. Information on vehicle miles traveled and daily traffic volumes can be found in Appendix E and Appendix F, respectively.

Comparison of Alternatives

Table 28 presents the comparative performance for each alternative at the Grand Avenue/SR-60 westbound off-ramp intersection for the year 2017. Table 29 presents the comparative performance for each alternative at the Grand Avenue/SR-60 eastbound ramp intersection for the year 2017. Table 30 presents the comparative performance for each alternative at the Grand Avenue/Golden Springs intersection for the year 2017. Level of service, delay, and queue lengths are shown for each alternative.

Table 28 – Year 2017 Comparison of Alternatives, Grand Avenue at SR-60 WB Off Ramp

Alternative	AM Peak Hour			PM Peak Hour		
	Queue Length ¹	Delay ²	Level of Service	Queue Length ¹	Delay ²	Level of Service
Alternative 1	461 ft	29.7	C	303 ft	33.4	C
Alternative 2	331 ft	21.0	C	149 ft	17.9	B
Alternative 3	285 ft	20.2	C	144 ft	17.7	B

Note 1: Queue length in feet on freeway off-ramp approach

Note 2: Delay in seconds per vehicle average

Table 29 – Year 2017 Comparison of Alternatives, Grand Avenue at SR-60 EB Off Ramp

Alternative	AM Peak Hour			PM Peak Hour		
	Queue Length ¹	Delay ²	Level of Service	Queue Length ¹	Delay ²	Level of Service
Alternative 1	257 ft	27.8	C	87 ft	17.6	B
Alternative 2	186 ft	15.9	B	101 ft	12.6	B
Alternative 3	201 ft	9.8	A	89 ft	6.2	A

Note 1: Queue length in feet on freeway off-ramp approach;

Note 2: Delay in seconds per vehicle average

Table 30 – Year 2017 Comparison of Alternatives, Grand Avenue at Golden Springs Drive

Alternative	AM Peak Hour			PM Peak Hour		
	Queue Length ¹	Delay ²	Level of Service	Queue Length ¹	Delay ²	Level of Service
Alternative 1	466 ft	54.9	D	433 ft	48.3	D
Alternative 2	493 ft	35.7	D	400 ft	38.7	D
Alternative 3	250 ft	31.3	C	274 ft	31.6	C

Note 1: Queue length in feet on southbound intersection approach;

Note 2: Delay in seconds per vehicle average

Analysis of Alternatives – Build out 2037 Conditions

The two “Build” Alternatives and one “No Build” Alternative were studied for traffic performance in 2037. Refinements to the “Build” alternatives will be considered prior to the determination of the final design layout. Note that the westbound slip on-ramp is assumed to be completed for all alternatives. Each alternative is described in detail in the Project Alternatives chapter of this report.

Analysis of Alternatives

AM and PM peak hour analyses were performed to assess each of the proposed project alternatives. The analyses were performed by examining peak hour level of service at the identified intersections in the project area. Intersection level of service calculations were performed using the Synchro computer program. Freeway segment level of service analysis was conducted using a VISSIM simulation model, consistent with the Highway Capacity Manual methodology, modified for application to the longer weaving sections and number of lanes in each weaving section.

Future traffic volumes were derived from the SCAG RTP 2008 Year 2035 Model (Regional Transportation Plan 2008). The SCAG model provided the basis for the year 2037 traffic forecasts, but the land use associated with the Industry Business Center was not shown properly in the SCAG land use. The SCAG model was therefore modified by the addition of Industry Business Center trip generation to the SCAG model trip tables on a zone by zone basis to be included in the traffic assignment (please see Appendix G for information on IBC trip generation). The traffic model forecast prepared for the project thus includes trips associated with the Industry Business Center that were not reflected in the SCAG RTP 2008 Model.

The resulting 2035 traffic forecasts were increased by 2% (1% per year) to produce the final traffic forecast for the study area for the year 2037.

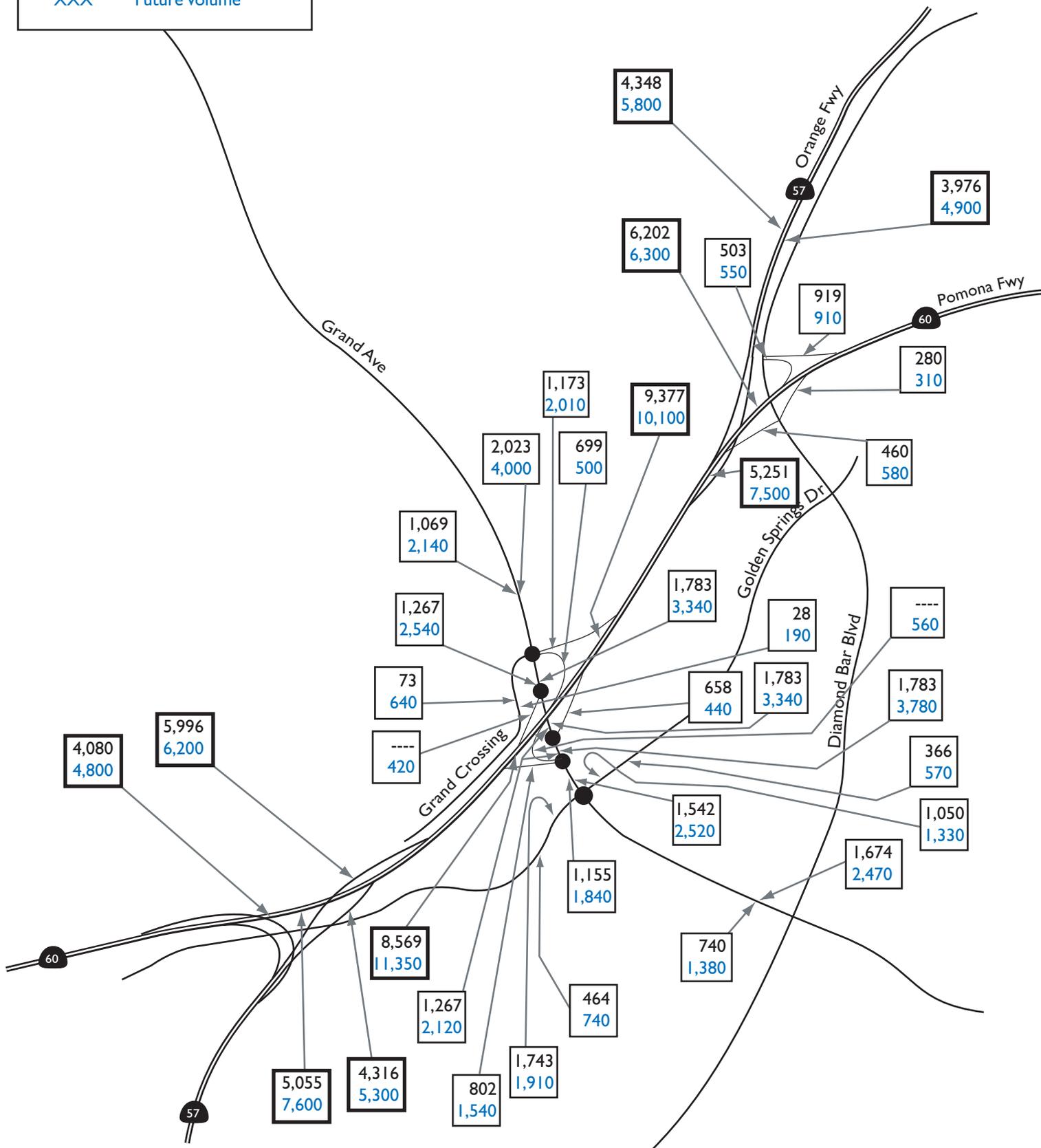
The AM and PM link volume forecasts from the base and future year models, along with the existing turning movement traffic counts, were used as the basis for producing future year traffic volumes. The traffic model forecasts were used to predict future turning movement volumes at the study intersections using a proprietary methodology which adjusts existing turning movement volumes based on expected growth in approach volumes.

Figures 19 and 20 illustrate expected AM and PM peak hour freeway traffic volumes for 2037 for the build alternatives. Figures 19 and 20 in the 2011 report represent "build" condition forecasts for 2037, with the addition of the 7th mainline freeway lane. The 2037 build forecasts with the additional eastbound lane on the freeway mainline result in an increase in traffic volumes compared to no-build.

Year 2035 traffic forecast data can be found in Appendix B of this report.

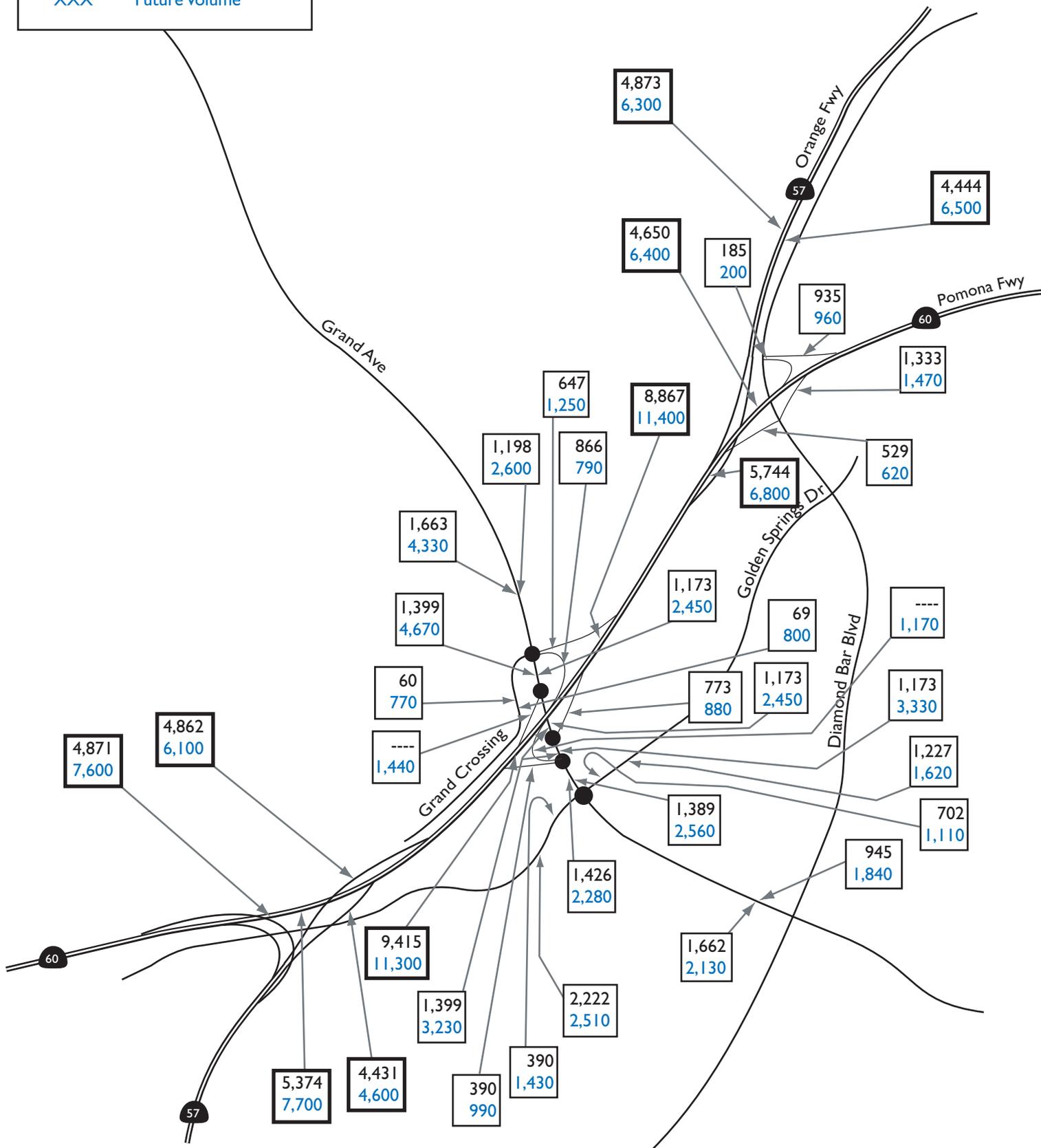
LEGEND

- XXX Existing Volume
- XXX Future Volume



LEGEND

- XXX Existing Volume
- XXX Future Volume



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Alternative I (No Build)

Lane geometry for the SR-60/Grand Avenue interchange under Alternative I was shown previously. Figures 21 and 22 illustrate expected AM and PM traffic volumes under the no-build scenario for year 2037. Alternative I (No Project) shows the analysis results without project improvements but at 2037 traffic levels. The No Build alternative would create highly undesirable traffic conditions in the PM peak hour at both ramp intersections.

Intersection Analysis

Table 31 shows the summary results of the AM and PM peak hour intersection level of service calculations for build out conditions without project (Alternative I). Queue lengths for off-ramps and critical movements were also evaluated for this analysis. Table 32 shows the results of the AM and PM peak hour intersection level of service calculations for Alternative I by approach.

Appendix C contains the level of service calculation worksheets for all alternatives.

Table 31 – Year 2037 Summary of Traffic Conditions for Alternative I

Intersection	AM Peak Hour			PM Peak Hour		
	Queue Length	Delay ³	Level of Service	Queue Length	Delay ³	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp ¹	1005 ft	99.7	F	700 ft	178.9	F
Grand Ave. at SR-60 Eastbound Off Ramp ¹	628 ft	81.9	F	268 ft	84.3	F
Grand Ave. at Golden Springs Drive ²	615 ft	111.6	F	673 ft	103.6	F

Note 1: Queue length in feet on freeway off-ramp approach

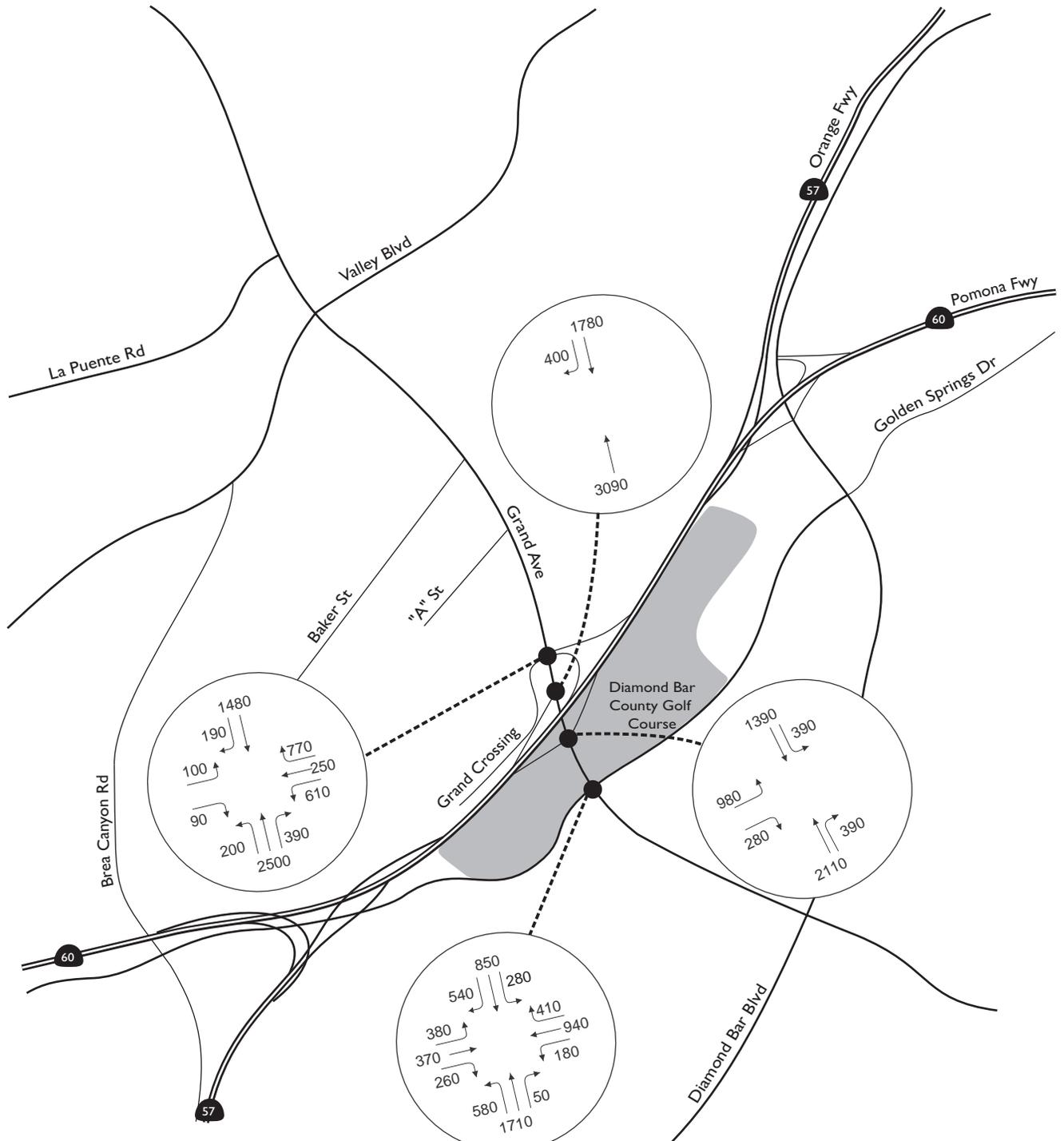
Note 2: Queue length in feet on southbound approach

Note 3: Intersection delay in seconds per vehicle average

Table 32 – Year 2037 Traffic Conditions by Approach for Alternative I

INTERSECTION		AM Peak Hour			PM Peak Hour		
		Queue Length	Delay ¹	Level of Service	Queue Length	Delay ¹	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp	NB	1,672 ft	107.0	F	646 ft	45.9	D
	SB	558 ft	37.4	D	1,793 ft	218.1	F
	EB	184 ft	73.7	E	672 ft	301.3	F
	WB	1005 ft	152.8	F	700 ft	247.3	F
Intersection Average		N/A	99.7	F	N/A	178.9	F
Grand Ave. at SR-60 Eastbound Off Ramp	NB	1,288 ft	118.4	F	1,140 ft	111.8	F
	SB	365 ft	22.4	C	736 ft	70.3	E
	EB	628 ft	93.5	F	268 ft	40.2	D
Intersection Average		N/A	81.9	F	N/A	84.3	F
Grand Ave. at Golden Springs Drive	NB	1,364 ft	143.7	F	918 ft	132.7	F
	SB	615 ft	71.0	E	673 ft	87.7	F
	EB	339 ft	74.2	E	654 ft	88.1	F
	WB	1,025 ft	131.3	F	777 ft	116.6	F
Intersection Average		N/A	111.6	F	N/A	103.6	F

Note 1: Intersection approach delay in seconds per vehicle average



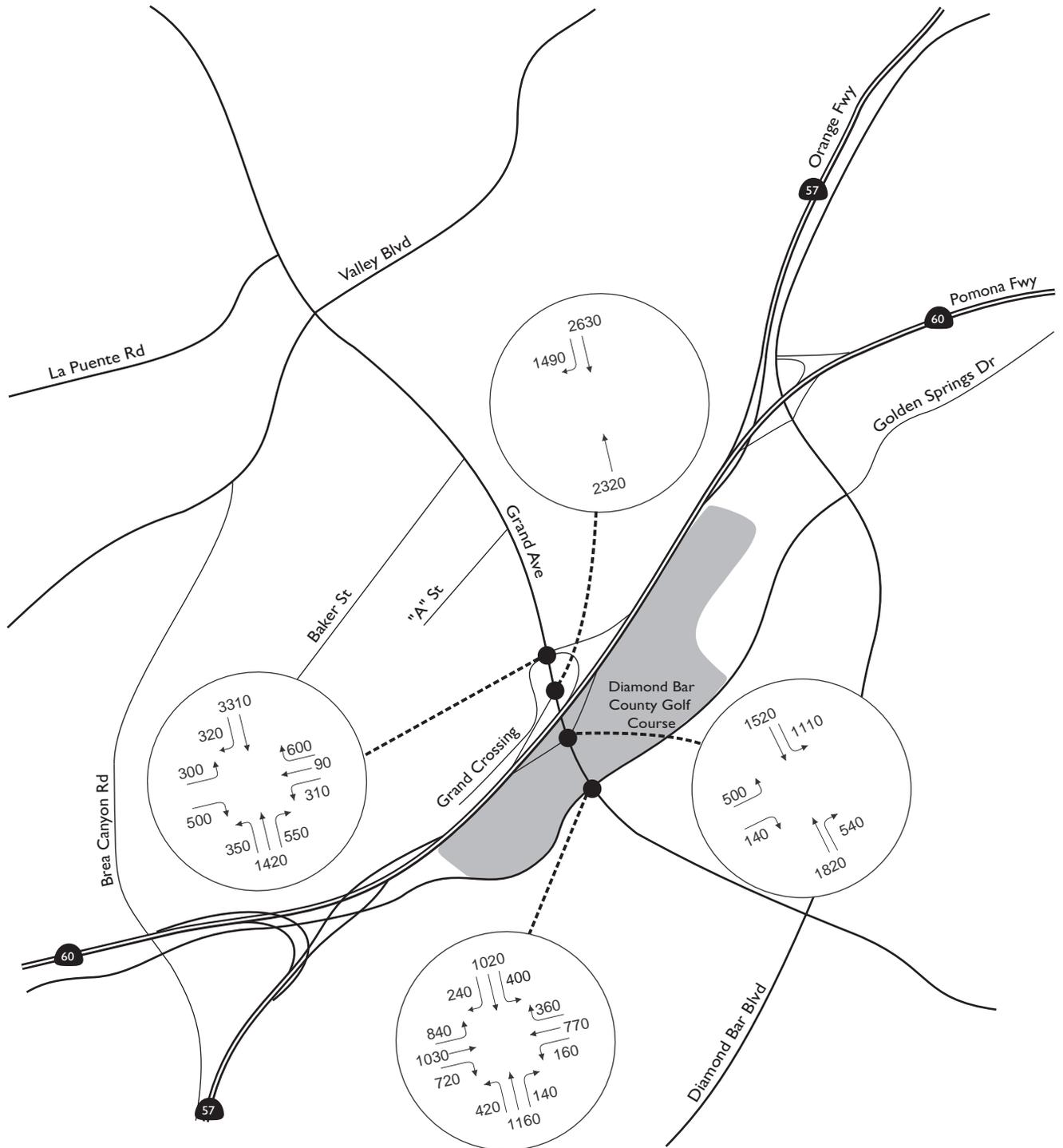
LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX ↘ Peak Hour Turning Movement Volume



Not to Scale

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LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX ↘ Peak Hour Turning Movement Volume



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Freeway Segment Analysis

Alternative I (the no-build alternative) was analyzed at 2037 traffic levels using VISSIM software and the HCM-2000 weave methodology for the eastbound and westbound directions, both north and south quadrants. Tables 33 and 34 show the eastbound and northbound weaving section Level of Service calculations for Alternative I conditions. Tables 35 and 36 show the westbound and southbound weaving section Level of Service calculations for Alternative I conditions.

Appendix C contains the level of service calculation worksheets for all alternatives.

The weaving analysis shows that the both the eastbound/northbound and westbound/southbound weaves from SR-60 to SR-57 and Grand Avenue are clearly deficient, with the freeway operating at Segment Level of Service F at this location in both the AM and PM peak periods.

Table 33 - Eastbound SR-60 Year 2037 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	9,600	48	31	D
SR-57 SB Connector Ramp to HOV Lane Start	BF	7,100	56	25	C
HOV Lane Start to SR-57 NB Merge	BF	7,100	56	30	D
SR-57 NB Merge to Grand Avenue Off Ramp	WS	12,100	22	73	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	10,800	36	47	F
Grand Avenue On Ramp Merge Segment	WS	11,600	38	42	E
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	11,600	50	37	E
Additional Lane Opening to SR-57 NB Diverge	WS	11,600	60	26	C
SR-57 NB Diverge to Diamond Bar Blvd On Ramp	BF	6,500	60	27	C
PM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	7,900	58	20	B
SR-57 SB Connector Ramp to HOV Lane Start	BF	6,000	59	20	B
HOV Lane Start to SR-57 NB Merge	BF	6,000	59	24	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	10,200	14	98	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,600	12	124	F
Grand Avenue On Ramp Merge Segment	WS	11,300	12	115	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	11,300	26	63	F
Additional Lane Opening to SR-57 NB Diverge	WS	11,300	51	28	C
SR-57 NB Diverge to Diamond Bar Blvd On Ramp	BF	5,500	61	24	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 34 - Northbound SR-57 Year 2037 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	5,000	13	116	F
SR-60 EB Merge to Grand Avenue Off Ramp	WS	12,100	22	73	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	10,800	36	47	F
Grand Avenue On Ramp Merge Segment	WS	11,600	38	42	E
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	11,600	50	37	E
Additional Lane Opening to SR-60 EB Diverge	WS	11,600	60	26	C
SR-60 EB Diverge to 4 Lane Opening	BF	4,600	62	23	C
PM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,300	15	99	F
SR-60 EB Merge to Grand Avenue Off Ramp	WS	10,200	14	98	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,600	12	124	F
Grand Avenue On Ramp Merge Segment	WS	11,300	12	115	F
Grand Avenue Merge Lane Drop to Additional Lane Opening	WS	11,300	26	63	F
Additional Lane Opening to SR-60 EB Diverge	WS	11,300	51	28	C
SR-60 EB Diverge to 4 Lane Opening	BF	5,200	62	22	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 35 - Westbound SR-60 Year 2037 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB	BF	5,900	9	115	F
SR-57 SB Merge to Grand Avenue Off Ramp	WS	11,100	21	95	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,500	27	55	F
Grand Avenue Loop On Ramp to Slip On Ramp	WS	9,900	60	20	B
Additional Lane Opening to SR-57 SB Diverge	WS	10,300	61	18	B
SR-57 SB Diverge to WB Connector	BF	6,100	62	13	B
PM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB	BF	6,400	58	26	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	11,900	26	59	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	10,900	31	56	F
Grand Avenue Loop On Ramp to Slip On Ramp	WS	11,400	60	25	C
Additional Lane Opening to SR-57 SB Diverge	WS	12,900	60	23	C
SR-57 SB Diverge to WB Connector	BF	6,800	61	20	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 36 - Southbound SR-57 Year 2037 Traffic Conditions, Alternative I

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	5,200	11	115	F
SR-60 WB Merge to Grand Avenue Off Ramp	WS	11,100	21	95	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	9,500	27	55	F
Grand Avenue Loop On Ramp to Slip On Ramp	WS	9,900	60	20	B
Grand Avenue Slip On Ramp to SR-60 WB Diverge	WS	10,300	61	18	B
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,100	61	28	C
PM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	5,500	13	114	F
SR-60 WB Merge to Grand Avenue Off Ramp	WS	11,900	26	59	F
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	10,900	31	56	C
Grand Avenue Loop On Ramp to Slip On Ramp	WS	11,400	60	25	C
Grand Avenue Slip On Ramp to SR-60 WB Diverge	WS	12,900	60	23	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,100	60	31	D

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Weaving segment level of service worksheets and a map of the weaving segment locations are provided in Appendix D of this document. Information on vehicle miles traveled and daily traffic volumes can be found in Appendix E and Appendix F, respectively.

Alternative 2

Lane geometry for the SR-60/Grand Avenue interchange under Alternative 2 was shown previously. Figures 23 and 24 illustrate expected AM and PM traffic volumes under Alternative 2 for year 2037. Alternative 2 shows the analysis results at 2037 traffic levels.

Intersection Analysis

Table 37 shows the results of the AM and PM peak hour intersection level of service calculations for build out conditions under Alternative 2. Queue lengths for off-ramps and critical movements were also evaluated for this analysis. Table 38 shows the results of the AM and PM peak hour intersection level of service calculations for Alternative 2 by approach.

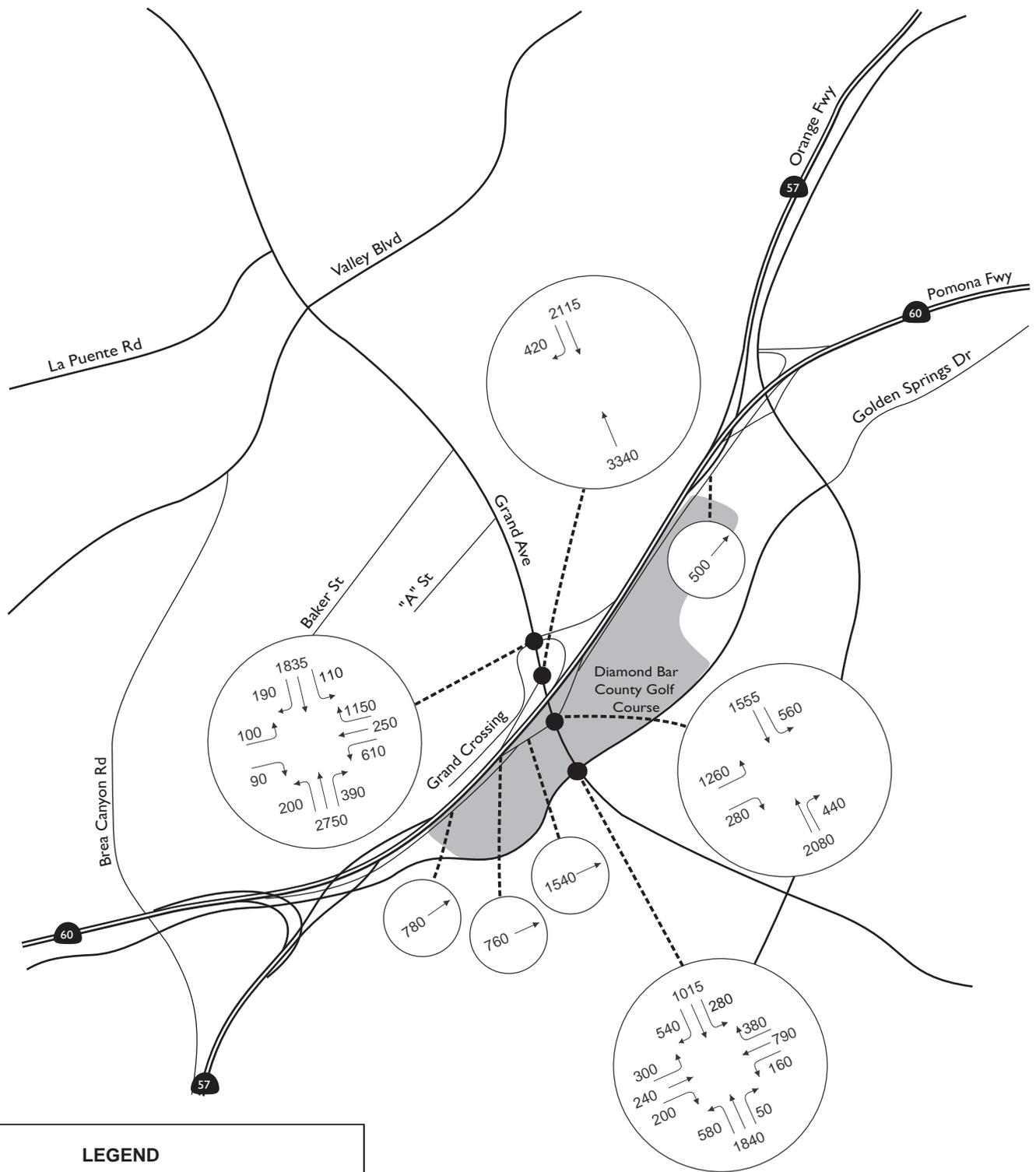
Table 37 – Year 2037 Summary of Traffic Conditions for Alternative 2

Intersection	AM Peak Hour			PM Peak Hour		
	Queue Length	Delay ³	Level of Service	Queue Length	Delay ³	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp ¹	508 ft	35.7	D	361 ft	46.8	D
Grand Ave. at SR-60 Eastbound Off Ramp ¹	635 ft	49.6	D	432 ft	55.4	E
Grand Ave. at Golden Springs Drive ²	523 ft	50.6	D	558 ft	64.6	E

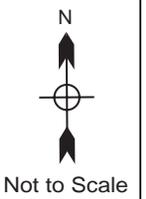
Note 1: Queue length in feet on freeway off-ramp approach

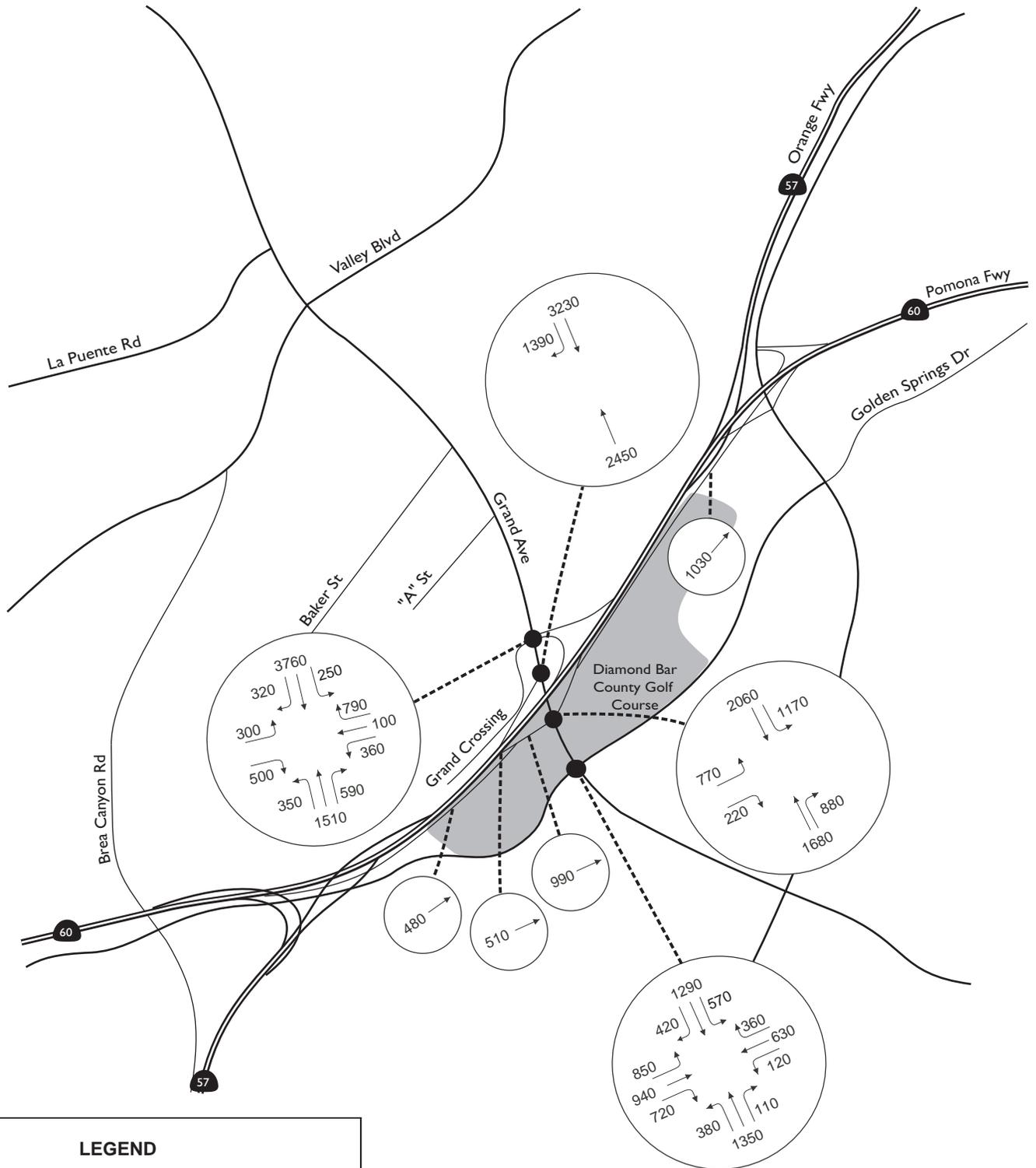
Note 2: Queue length in feet on southbound approach

Note 3: Intersection delay in seconds per vehicle average



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LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX ↘ Peak Hour Turning Movement Volume



Not to Scale

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Table 38 – Year 2037 Traffic Conditions by Approach for Alternative 2

INTERSECTION		AM Peak Hour			PM Peak Hour		
		Queue Length	Delay ¹	Level of Service	Queue Length	Delay ¹	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp	NB	620 ft	38.5	D	300 ft	29.8	C
	SB	260 ft	23.1	C	817 ft	49.4	D
	EB	75 ft	42.0	D	351ft	73.4	E
	WB	508 ft	44.0	D	361 ft	53.9	D
Intersection Average		N/A	35.7	D	N/A	46.8	D
Grand Ave. at SR-60 Eastbound Off Ramp	NB	618 ft	68.9	E	767 ft	89.6	F
	SB	336 ft	31.6	C	682 ft	32.1	C
	EB	635 ft	42.7	D	432 ft	43.3	D
Intersection Average		N/A	49.6	D	N/A	55.4	E
Grand Ave. at Golden Springs Drive	NB	741 ft	72.9	E	721 ft	79.0	E
	SB	523 ft	37.8	D	558 ft	64.4	E
	EB	211 ft	37.6	D	680 ft	62.3	E
	WB	340 ft	34.1	C	362 ft	46.3	D
Intersection Average		N/A	50.6	D	N/A	64.6	E

Note 1: Intersection approach delay in seconds per vehicle average

Freeway Segment Analysis

Alternative 2 was analyzed at 2037 traffic levels using the HCM-2000 weave methodology for the eastbound and westbound directions. Table 39 shows the eastbound weaving section Level of Service calculations under Alternative 2. Table 40 shows the northbound weaving section Level of Service calculations. Table 41 shows the westbound weaving section Level of Service calculations. Table 42 shows the eastbound weaving section Level of Service calculations.

Table 39 - Eastbound SR-60 Year 2037 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	9,700	59	26	C
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	7,500	58	25	C
EB Bypass Off Ramp to SR-57 NB Merge	BF	6,800	61	27	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	12,100	61	28	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	11,300	55	30	D
Grand Avenue On Ramp to SR-57 NB Diverge	M/D	12,300	60	26	C
SR-57 NB Diverge to EB Bypass Connector	M/D	7,400	61	27	C
EB Bypass Connector to Diamond Bar Off Ramp	BF	7,000	61	27	C
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	6,400	61	27	C
Diamond Bar On Ramp to EB Bypass Connector	M/D	6,700	62	23	C
EB Bypass Connector to Phillips Ranch Off Ramp	BF	7,200	62	23	C
PM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	8,900	57	24	C
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	7,700	54	25	C
EB Bypass Off Ramp to SR-57 NB Merge	BF	7,200	63	24	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	11,800	60	27	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	11,300	60	26	C
Grand Avenue On Ramp to SR-57 NB Diverge	M/D	13,300	60	27	C
SR-57 NB Diverge to EB Bypass Connector	M/D	6,800	61	24	C
EB Bypass Connector to Diamond Bar Off Ramp	BF	5,800	61	24	C
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	5,100	61	24	C
Diamond Bar On Ramp to EB Bypass Connector	M/D	6,600	61	26	C
EB Bypass Connector to Phillips Ranch Off Ramp	BF	7,600	61	26	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 40 - Northbound SR-57 Year 2037 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	5,300	61	28	C
SR-60 EB Merge to Grand Avenue Off Ramp	WS	12,100	61	28	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	11,300	56	30	D
Grand Avenue On Ramp to SR-60 EB Diverge	WS	12,300	60	26	C
SR-60 EB Diverge to EB Bypass Connector	BF	5,400	62	22	C
EB Bypass Connector to 4 Lane Opening	BF	4,900	61	27	C
PM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,700	60	29	D
SR-60 EB Merge to Grand Avenue Off Ramp	WS	11,800	60	27	C
Grand Avenue Off Ramp to Grand Avenue On Ramp	WS	11,300	60	26	C
Grand Avenue On Ramp to SR-60 EB Diverge	WS	13,300	60	27	C
SR-60 EB Diverge to EB Bypass Connector	BF	7,500	59	29	D
EB Bypass Connector to 4 Lane Opening	BF	6,500	60	33	D

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 41 - Westbound SR-60 Year 2037 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	6,300	58	25	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	12,100	57	34	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	10,100	61	26	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,600	60	23	C
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	11,000	60	21	C
SR-57 SB Diverge to HOV Lane Merge	BF	4,800	63	15	B
PM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	6,400	61	23	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	12,700	61	29	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,400	56	32	D
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	12,300	60	29	D
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	13,700	60	27	C
SR-57 SB Diverge to HOV Lane Merge	BF	7,600	62	24	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 42 - Southbound SR-57 Year 2037 Traffic Conditions, Alternative 2

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	5,800	56	36	E
SR-60 WB Merge to Grand Avenue Off Ramp	WS	12,100	57	34	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	10,100	61	26	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,600	60	23	C
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	11,000	60	21	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,200	60	33	D
PM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	6,400	60	37	E
SR-60 WB Merge to Grand Avenue Off Ramp	WS	12,700	61	29	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,400	56	32	D
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	12,300	60	29	D
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	13,700	60	27	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,100	60	34	D

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Weaving segment level of service worksheets are provided in Appendix D of this document. Information on vehicle miles traveled and daily traffic volumes can be found in Appendix E and Appendix F, respectively.

Alternative 3

Lane geometry for the SR-60/Grand Avenue interchange under Alternative 3 was shown previously. Figures 25 and 26 illustrate expected AM and PM traffic volumes under Alternative 3 for year 2037. Alternative 3 was analyzed using the HCM-2000 ramp diverge methodology for the eastbound direction, south quadrant. Alternative 3 shows the analysis results at 2037 traffic levels.

Intersection Analysis

Table 43 shows the results of the AM and PM peak hour intersection level of service calculations for build out conditions under Alternative 3. Queue lengths for off-ramps and critical movements were also evaluated for this analysis. Table 44 shows the results of the AM and PM peak hour intersection level of service calculations for Alternative 3 by approach.

Appendix C contains the level of service calculation worksheets for all alternatives.

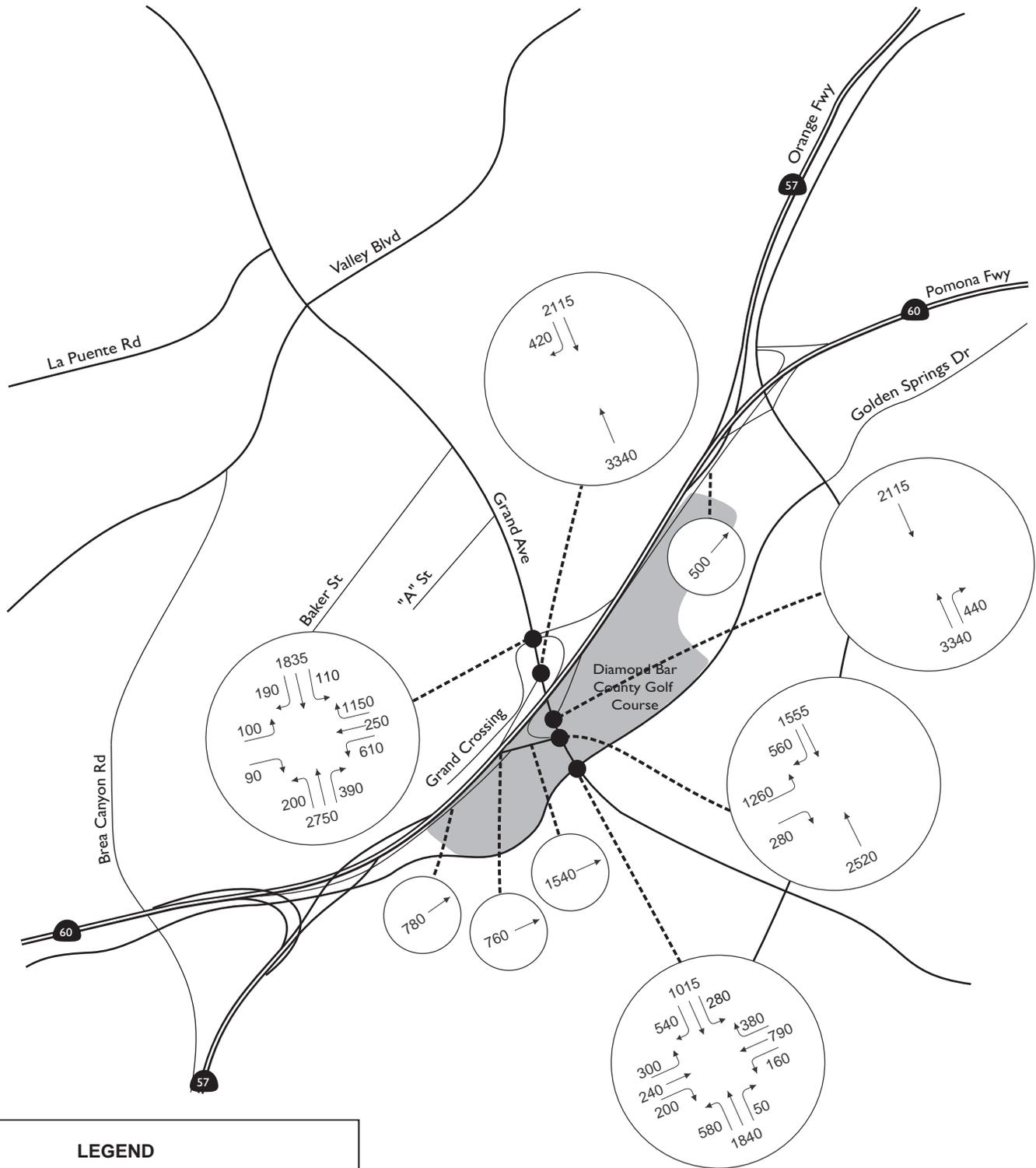
Table 43 – Year 2037 Summary of Traffic Conditions for Alternative 3

Intersection	AM Peak Hour			PM Peak Hour		
	Queue Length	Delay ³	Level of Service	Queue Length	Delay ³	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp ¹	552 ft	38.0	D	305 ft	51.4	D
Grand Ave. at SR-60 Eastbound Off Ramp ¹	443 ft	20.0	C	172 ft	10.3	B
Grand Ave. at Golden Springs Drive ²	372 ft	49.6	D	500 ft	53.0	D

Note 1: Queue length in feet on freeway off-ramp approach

Note 2: Queue length in feet on southbound approach

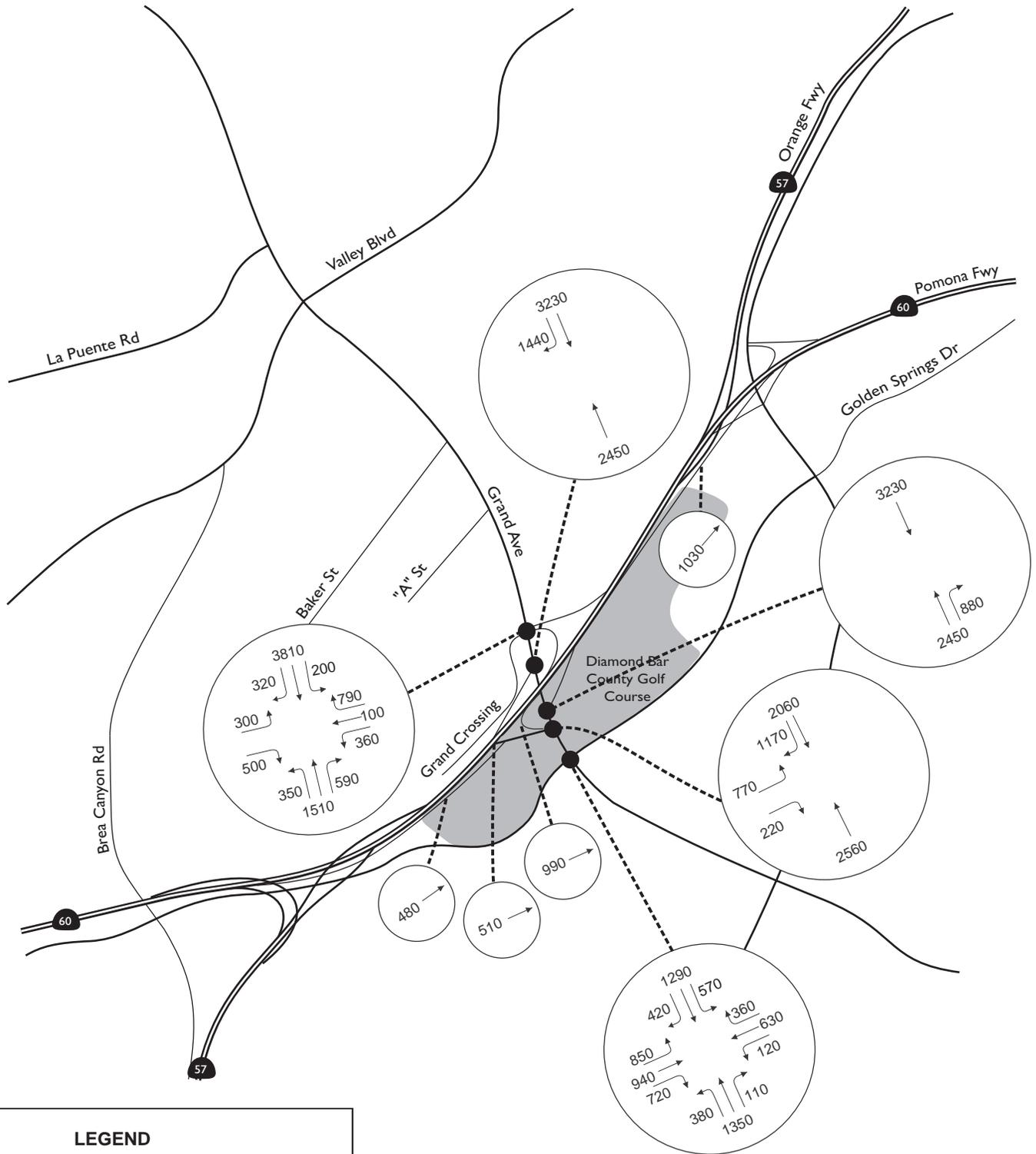
Note 3: Intersection delay in seconds per vehicle average



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Not to Scale



LEGEND

- Study Intersection
- Major Street
- Minor Street
- XX → Peak Hour Turning Movement Volume



Not to Scale

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Table 44 – Year 2037 Traffic Conditions by Approach for Alternative 3

INTERSECTION		AM Peak Hour			PM Peak Hour		
		Queue Length ¹	Delay ²	Level of Service	Queue Length ¹	Delay ²	Level of Service
Grand Ave. at SR-60 Westbound Off Ramp	NB	743 ft	36.9	D	251 ft	26.5	C
	SB	338 ft	27.9	C	739 ft	68.2	E
	EB	106 ft	59.4	E	333 ft	48.7	D
	WB	552 ft	48.5	D	305 ft	43.6	D
Intersection Average		N/A	38.0	D	N/A	51.4	D
Grand Ave. at SR-60 Eastbound Off Ramp	NB	446 ft	22.8	C	231 ft	10.2	B
	SB	242 ft	12.3	B	216 ft	8.2	A
	EB	443 ft	26.1	C	172 ft	17.3	B
Intersection Average		N/A	20.0	C	N/A	10.3	B
Grand Ave. at Golden Springs Drive	NB	667 ft	43.1	D	653 ft	59.4	E
	SB	372 ft	65.8	E	500 ft	53.0	D
	EB	236 ft	44.9	D	626 ft	49.6	D
	WB	406 ft	41.9	D	351 ft	50.3	D
Intersection Average		N/A	49.6	D	N/A	53.0	D

Note 1: 95th Percentile queue length

Note 2: Intersection approach delay in seconds per vehicle average

Freeway Segment Analysis

Alternative 3 was analyzed at 2037 traffic levels using the HCM-2000 ramp diverge and merge methodologies. Table 45 shows the eastbound weaving section Level of Service calculations under Alternative 3. Table 46 shows the northbound weaving section Level of Service calculations. Table 47 shows the westbound weaving section Level of Service calculations. Table 48 shows the eastbound weaving section Level of Service calculations.

Table 45 - Eastbound SR-60 Year 2037 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	9,700	59	26	C
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	7,500	58	25	C
EB Bypass Off Ramp to SR-57 NB Merge	BF	6,800	62	27	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	12,100	60	28	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,300	57	28	C
Grand Avenue Loop On Ramp to Slip On Ramp	WS	11,900	56	27	C
Grand Avenue Slip On Ramp to SR-57 NB Diverge	M/D	12,300	56	27	C
SR-57 NB Diverge to EB Bypass Connector	M/D	7,400	61	27	C
EB Bypass Connector to Diamond Bar Off Ramp	BF	7,000	61	27	C
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	6,400	61	27	C
Diamond Bar On Ramp to EB Bypass Connector	M/D	6,700	62	23	C
EB Bypass Connector to Phillips Ranch Off Ramp	BF	7,200	62	23	C
PM Peak Hour					
Brea Canyon Off Ramp to SR-57 SB Connector Ramp	WS	8,900	58	24	C
SR-57 SB Connector Ramp to EB Bypass Off Ramp	BF	7,700	55	25	C
EB Bypass Off Ramp to SR-57 NB Merge	BF	7,200	63	24	C
SR-57 NB Merge to Grand Avenue Off Ramp	WS	11,800	59	28	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,300	58	27	C
Grand Avenue Loop On Ramp to Slip On Ramp	WS	12,400	60	26	C
Grand Avenue Slip On Ramp to SR-57 NB Diverge	M/D	13,300	60	26	C
SR-57 NB Diverge to EB Bypass Connector	M/D	6,800	61	25	C
EB Bypass Connector to Diamond Bar Off Ramp	BF	5,800	61	25	C
Diamond Bar Off Ramp to Diamond Bar On Ramp	BF	5,100	62	24	C
Diamond Bar On Ramp to EB Bypass Connector	M/D	6,600	61	25	C
EB Bypass Connector to Phillips Ranch Off Ramp	BF	7,600	61	25	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 46 - Northbound SR-57 Year 2037 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	5,300	61	28	C
SR-60 EB Merge to Grand Avenue Off Ramp	WS	12,100	60	28	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,300	57	28	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	11,900	56	27	C
Grand Avenue Slip On Ramp to SR-60 EB Diverge	WS	12,300	56	27	C
SR-60 EB Diverge to EB Bypass Connector	BF	5,400	61	22	C
EB Bypass Connector to 4 Lane Opening	BF	4,900	61	27	C
PM Peak Hour					
SR-60 WB Connector Ramp to SR-60 EB Merge	BF	4,700	60	30	D
SR-60 EB Merge to Grand Avenue Off Ramp	WS	11,800	59	28	C
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,300	58	27	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	12,400	60	26	C
Grand Avenue Slip On Ramp to SR-60 EB Diverge	WS	13,300	60	26	C
SR-60 EB Diverge to EB Bypass Connector	BF	7,500	59	29	D
EB Bypass Connector to 4 Lane Opening	BF	6,500	60	34	D

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 47 - Westbound SR-60 Year 2037 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	6,300	62	23	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	12,100	57	29	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	10,100	60	26	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,600	60	23	C
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	11,000	60	22	C
SR-57 SB Diverge to HOV Lane Merge	BF	4,800	64	14	B
PM Peak Hour					
Diamond Bar Blvd On Ramp Merge Lane End to SR-57 SB Merge	BF	6,400	60	24	C
SR-57 SB Merge to Grand Avenue Off Ramp	WS	12,700	56	31	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,400	56	31	D
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	12,300	60	27	C
Grand Avenue Slip On Ramp to SR-57 SB Diverge	WS	13,700	60	26	C
SR-57 SB Diverge to HOV Lane Merge	BF	7,600	62	24	C

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Table 48 - Southbound SR-57 Year 2037 Traffic Conditions, Alternative 3

Freeway Segment	Freeway Type ¹	Volume	Speed (mph)	Density (Veh/Mi/Ln)	LOS
AM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	5,800	58	33	D
SR-60 WB Merge to Grand Avenue Off Ramp	WS	12,100	57	29	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	10,100	60	26	C
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	10,600	60	23	C
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	11,000	60	22	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,200	60	33	D
PM Peak Hour					
Sunset Crossing On Ramp Merge Lane End to SR-60 WB Merge	BF	6,400	60	33	D
SR-60 WB Merge to Grand Avenue Off Ramp	WS	12,700	56	31	D
Grand Avenue Off Ramp to Grand Avenue Loop On Ramp	WS	11,400	56	31	D
Grand Avenue Loop On Ramp to Grand Avenue Slip On Ramp	WS	12,300	60	27	C
Grand Avenue Slip On to Ramp SR-60 WB Diverge	WS	13,700	60	26	C
SR-60 WB Diverge to SR-60 EB Connector Ramp	BF	6,100	61	30	D

Note 1: BF=Basic Freeway, WS=Weaving Segment, M/D=Merge/Diverge

Weaving segment level of service worksheets are provided in Appendix D of this document. Information on vehicle miles traveled and daily traffic volumes can be found in Appendix E and Appendix F, respectively.

Comparison of Alternatives

Table 49 presents the comparative performance for each alternative at the Grand Avenue/SR-60 westbound off-ramp intersection for the year 2037. Table 50 presents the comparative performance for each alternative at the Grand Avenue/SR-60 eastbound ramp intersection for the year 2037. Table 51 presents the comparative performance for each alternative at the Grand Avenue/Golden Springs intersection for the year 2037. Level of service, delay, and queue lengths are shown for each alternative.

Table 49 – Year 2037 Comparison of Alternatives, Grand Avenue at SR-60 WB Off Ramp

Alternative	AM Peak Hour			PM Peak Hour		
	Queue Length ¹	Delay ²	Level of Service	Queue Length ¹	Delay ²	Level of Service
Alternative 1	1005 ft	99.7	F	700 ft	178.9	F
Alternative 2	508 ft	35.7	D	361 ft	46.8	D
Alternative 3	552 ft	38.0	D	305 ft	51.4	D

Note 1: Queue length in feet on freeway off-ramp approach

Note 2: Delay in seconds per vehicle average

Table 50 – Year 2037 Comparison of Alternatives, Grand Avenue at SR-60 EB Off Ramp

Alternative	AM Peak Hour			PM Peak Hour		
	Queue Length ¹	Delay ²	Level of Service	Queue Length ¹	Delay ²	Level of Service
Alternative 1	628 ft	81.9	F	268 ft	84.3	F
Alternative 2	635 ft	49.6	D	432 ft	55.4	E
Alternative 3	443 ft	20.0	C	172 ft	10.3	B

Note 1: Queue length in feet on freeway off-ramp approach;

Note 2: Delay in seconds per vehicle average

Table 51 – Year 2037 Comparison of Alternatives, Grand Avenue at Golden Springs Drive

Alternative	AM Peak Hour			PM Peak Hour		
	Queue Length ¹	Delay ²	Level of Service	Queue Length ¹	Delay ²	Level of Service
Alternative 1	615 ft	111.6	F	673 ft	103.6	F
Alternative 2	523 ft	50.6	D	558 ft	64.6	E
Alternative 3	372 ft	49.6	D	500 ft	53.0	D

Note 1: Queue length in feet on southbound intersection approach;

Note 2: Delay in seconds per vehicle average