Draft Traffic Impact Study

MOODY FLATS MINE EIR

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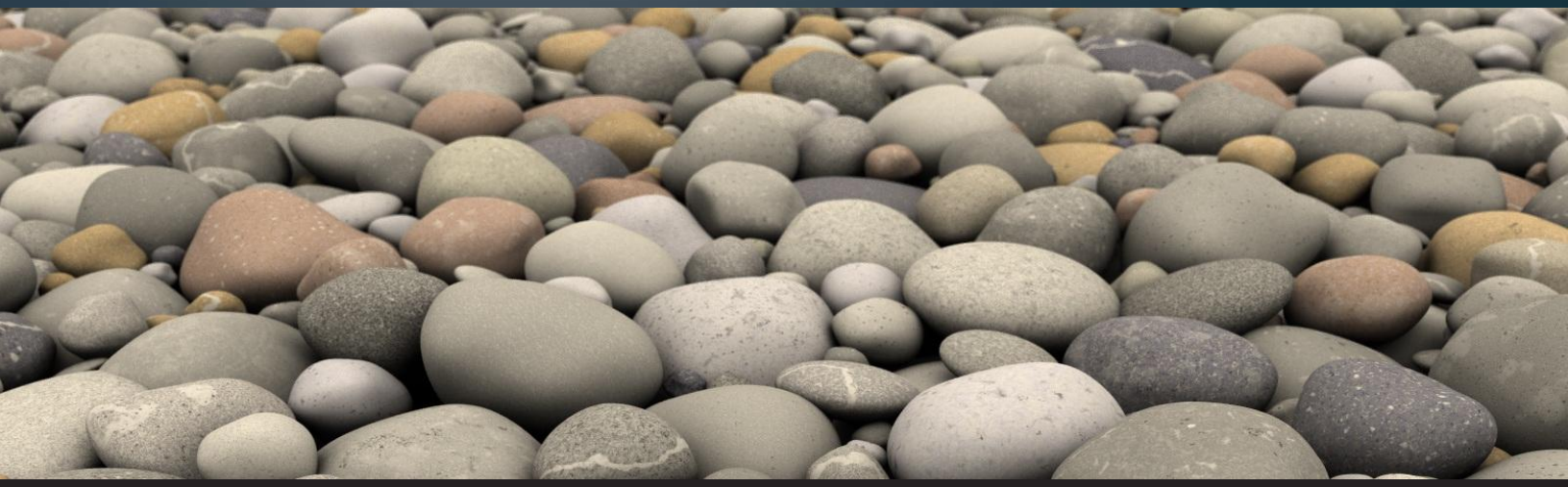

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

MOVING**FORWARD**THINKING™

Draft Transportation Impact Analysis

Moody Flats Quarry TIA

Shasta County, California

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Section 1
Executive Summary

EXECUTIVE SUMMARY

The Moody Flats Quarry project consists of a proposed hard rock quarry, aggregate processing facility, ancillary aggregate product facilities and aggregate truck and railcar load-out facility. Production and distribution goals include approximately 1.5 million tons of aggregate shipped via rail to regional markets annually, and 0.5 million tons of aggregate and finished products (e.g. ready-mix, asphalt) distributed to local markets via trucks. The maximum proposed annual aggregate sales for the project would be two million tons per year. The operation is planned for 100 years.

The project site is located in Shasta County about one mile west of Interstate 5 (I-5), north of the City of Shasta Lake, and nine miles north of the City of Redding on approximately a 1,900-acre property. Access to the project site would be via a private access road connecting with Wonderland Boulevard and also from Digger Bay Road (which connects to Shasta Park Drive). No material transport would occur through the access on Digger Bay Road.

FINDINGS

Existing (2012) No Project Conditions

- All of the study intersections operate at acceptable levels of service (LOS) during the weekday AM and PM peak hours per the applicable Caltrans, Shasta County, City of Shasta Lake, and City of Redding standards.
- All of the study roadway segments—except Shasta Dam Boulevard between Ashby Road and Cascade Boulevard—operate at an acceptable level of service per the applicable standards.
- Freeway segments north of SR 299 and south of SR 44 were found to operate at an acceptable level of service. The freeway segment between SR 44 and SR 299 is estimated to operate at LOS E in the northbound direction during the PM peak.

Proposed Development Plan

The proposed project is estimated to generate 560 new daily vehicle round-trips, equating to 1,120 one-way trips. 120 one-way trips would occur during the weekday AM peak hour and 26 would occur during the weekday PM peak hour. The large majority (95.7%) of these trips are expected to be heavy vehicles.

Existing (2012) plus Project Conditions

- The addition of project traffic would not result in unacceptable levels of service, except for those roadway and freeway segments that already fail to meet the minimum LOS without the project.
- While the project would add traffic to the roadway and freeway segments failing to meet standards, the increase in V/C ratio would be less than 1 percent. Therefore, the impacts would be less than significant.

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Cumulative (2030) No Project Conditions

- Four study intersections are forecast to operate at unacceptable levels of service:
  - I-5 NB Ramps & Old Oregon Trail
  - Cascade Boulevard & Shasta Dam Boulevard
  - I-5 NB Ramps & Pine Grove Avenue
  - I-5 SB Ramps & Pine Grove Avenue
- The Shasta Dam Boulevard roadway segment between Cascade Boulevard and Ashby Road is expected to operate at an unacceptable level of service E.
- Three freeway segments are forecast to operate at an unacceptable level of service:
  - I-5 NB between SR 44 and SR 299
  - I-5 NB between SR 299 and Twin View Boulevard
  - I-5 NB between Twin View Boulevard and SR 273

The rest of the study facilities are expected to operate satisfactorily in 2030.

Cumulative (2030) plus Project Conditions

- With the exception of the intersection of Wonderland Boulevard and Old Oregon Trail (#3), the project would not trigger unacceptable levels of service. All other intersections, roadway segments, and freeway segments that are expected to perform unacceptably do so even without the project.
- The project would add significant delay (i.e., more than five seconds) at the intersection of I-5 NB Ramps & Old Oregon Trail, which is expected to perform unacceptably in the Cumulative No Project scenario.
- The project would add traffic to the three freeway segments with unacceptable LOS, but would add traffic at levels less than 1% of capacity in all cases.

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Table 1: Mitigation Summary

Location/Scenario	AM		PM		Mitigation Measures
	Delay/Density [1]	LOS	Delay/Density	LOS	
Cumulative Conditions- Intersections					
I-5 NB Ramps & Old Oregon Trail					Install a fully-actuated traffic signal. The project would contribute 11.1% of the AM traffic increase from existing conditions.
Cumulative No Project	42.5	E	15.3	C	
Cumulative plus Project	115	F	16.6	C	
Cumulative Mitigated	12.9	B	8.8	A	
Wonderland Boulevard & Old Oregon Trail					Channelize the exclusive westbound right-turn lane, with at least 100 feet of storage The project would contribute 14.5% of the AM traffic increase from existing conditions
Cumulative No Project	15.6	C	14.7	C	
Cumulative plus Project	31.5	D	16.5	C	
Cumulative Mitigated	15.6	C	13.1	B	

OTHER ANALYSES

Safety

The additional rail trips are not expected to pose a safety concern.

Pavement Conditions

Traffic Indexes—which estimate traffic loading during the pavement design life—were calculated for six roadway segments and six interchanges, for No Project and plus Project scenarios. The project would increase traffic index requirements by 0.5-1.0 on Shasta Dam Boulevard segments and by 2.0-4.0 on the two Old Oregon Trail study segments. No impact is expected at the Shasta Park Drive or Black Canyon Road segments due to lack of project traffic. For freeway ramps, only the I-5 NB off-ramp and I-5 SB on-ramp at Old Oregon Trail would have higher (by 1.0-1.5) traffic index requirements with the project.

Truck Turning Radii

An analysis of truck turning radii was conducted at all intersections where the project would add turning movements. The AutoTurns software package was used to determine whether the 65-foot long California legal standard truck could make the turns within the paved surface and without encroaching on neighboring lanes. Minimal lane intrusions are expected at Old Oregon Trail & I-5 NB ramps and Pine Grove Avenue & I-5 ramps (NB and SB). The analysis identified a potential issue at Oasis Road & I-5 NB ramps, where the newly installed signal cabinets sit close to the travel way of the one-lane on-ramp, leaving little space for trucks.

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Section 2
Introduction

INTRODUCTION

PROJECT DESCRIPTION

Moody Flats Quarry, LLC, a wholly-owned subsidiary of 3M Company, proposes to develop the Moody Flats Quarry ("project"), a hard rock quarry that would provide a new source of aggregate construction material in Shasta County. Specifically, the applicant proposes to develop a hard rock quarry, aggregate processing facility, ancillary aggregate product facilities (e.g.., ready-mix concrete plant, asphalt batch plant, and recycled construction materials plant), and aggregate truck and railcar load-out facilities within the approximately 1,900-acre property. The project would provide a new source of high quality aggregate for use as construction material in the County. In addition to supplying aggregate to the local market, the project would supply construction aggregates to the northern California regional market by developing a rail siding/spur and load-out facility to access the Union Pacific rail line that traverses the site.

The project location is presented in Figure 1 and a schematic site plan is included in Figure 2**.**

SCOPE OF THE REPORT

This transportation impact analysis determines the transportation-related impacts associated with the proposed project. The study scope and traffic analysis locations were selected in consultation with Shasta County and Caltrans staff.

Transportation Impact Issues

The report evaluates the following transportation issues:

- Trip generation and distribution for the proposed quarry;
- Existing (2012) traffic conditions during the weekday AM and PM peak periods without and with the proposed quarry;
- Cumulative (2030) conditions during the weekday AM and PM peak periods without and with the proposed quarry;
- Railroad crossing operations
- Pavement impact analysis based on Traffic Index
- Evaluation of truck turning movements at study intersections

Traffic Analysis Locations

The traffic operational analyses were performed at selected study intersections and road segments. Intersection index numbers from 17 through 21 were reserved for railroad crossing locations.

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Figure 1: Site Vicinity Map

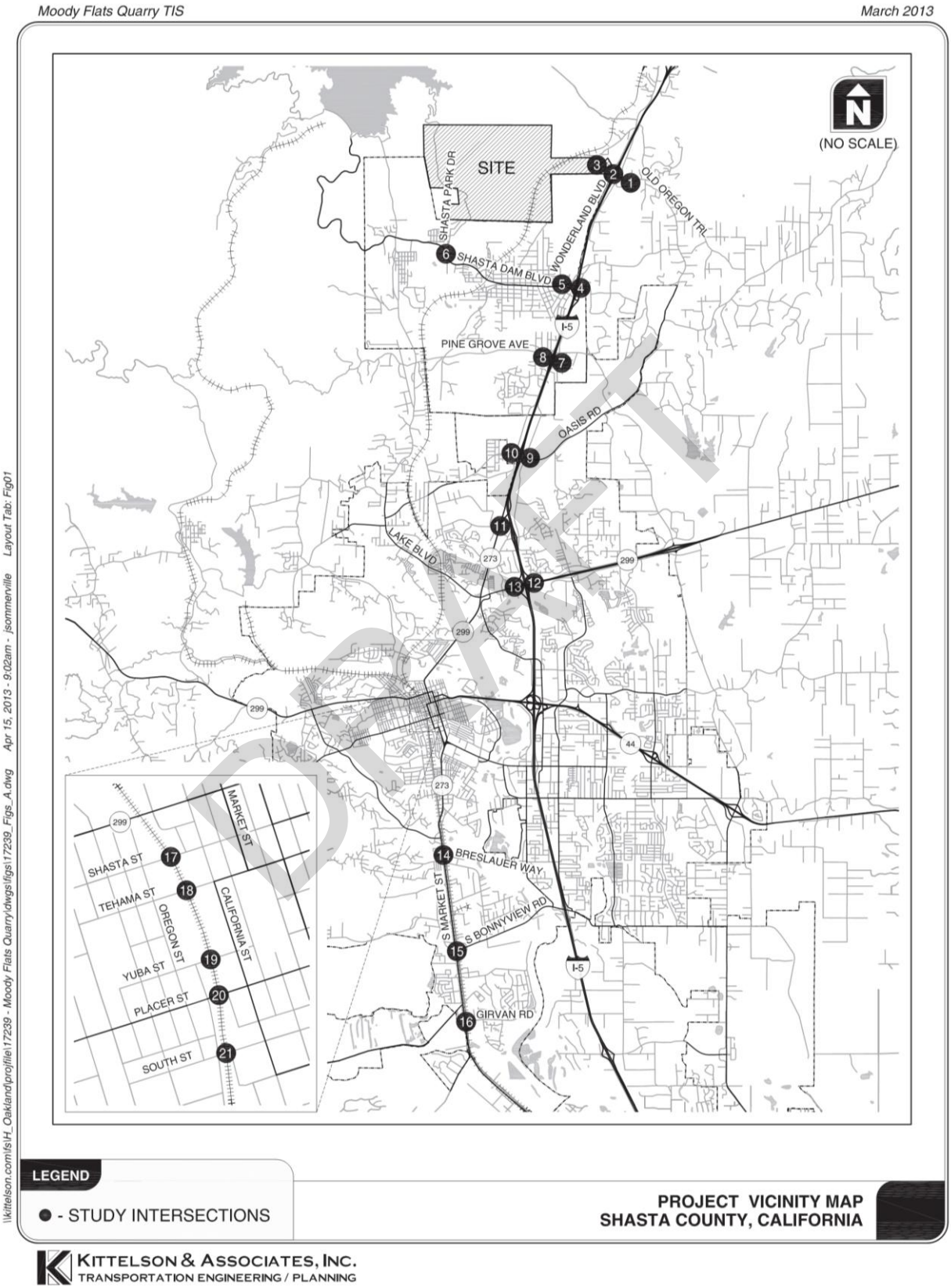
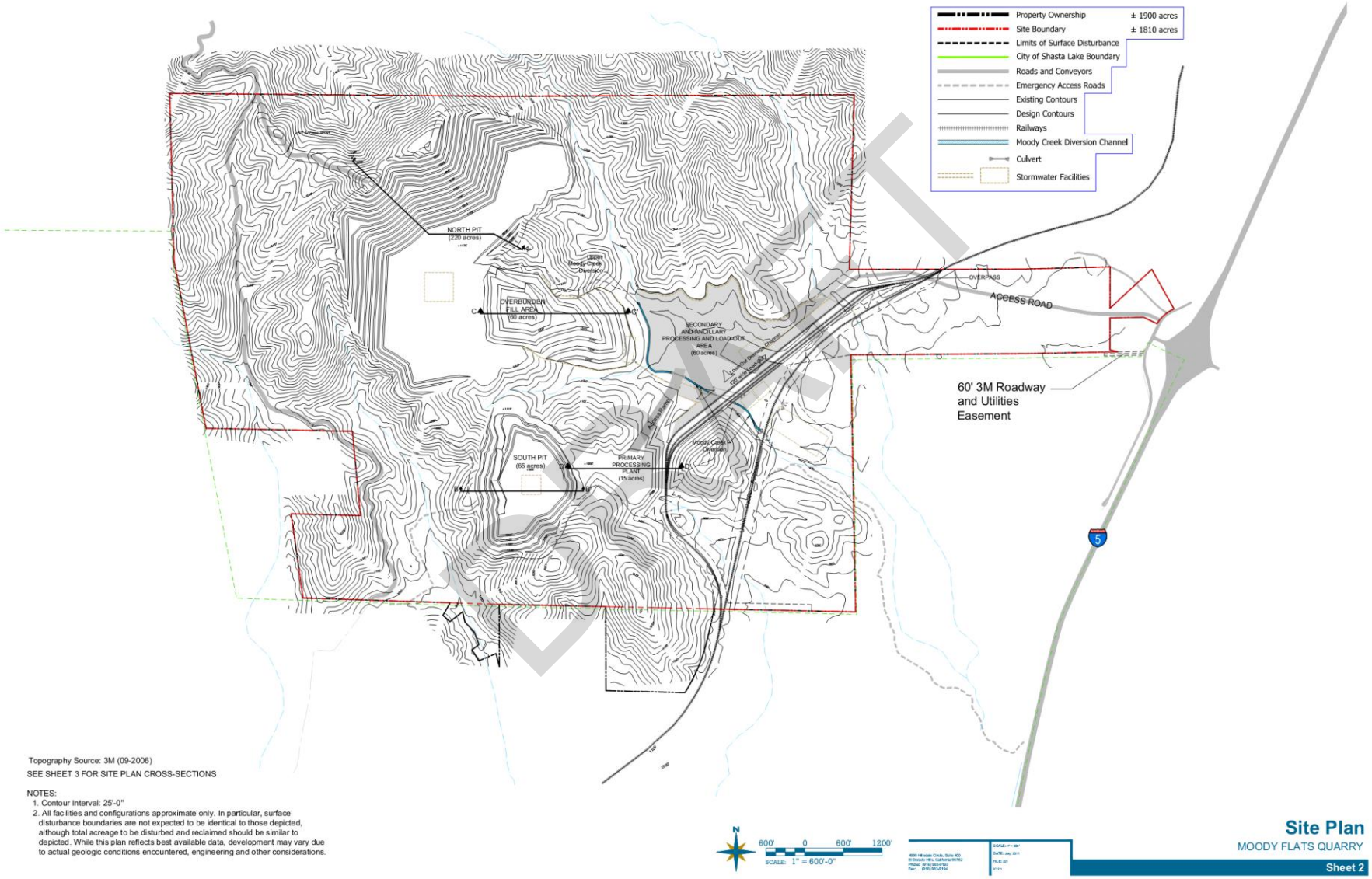


Figure 2: Project Site Plan



Intersections

1. Old Oregon Trail / I-5 NB Ramps
2. Old Oregon Trail / I-5 SB Ramps
3. Wonderland Boulevard / Old Oregon Trail
4. Shasta Dam Boulevard/ I-5 SB Off-Ramps
5. Cascade Boulevard / Shasta Dam Boulevard
6. Shasta Park Drive/ Shasta Dam Boulevard
7. Pine Grove Avenue / I-5 NB Ramps
8. Pine Grove Avenue / I-5 SB Ramps
9. Oasis Rd. / I-5 NB Ramps
10. Oasis Rd. / I-5 SB Ramps
11. SR 273 / Caterpillar Road
12. SR 299 / I-5 NB Ramps
13. SR 299 / I-5 SB Ramps
14. Breslauer Way / S. Market St.
15. S. Bonneyview Rd. / S. Market St.
16. Girvan Ln. / S. Market St.
22. Wonderland Boulevard / Project Driveway

Railroad Crossing Intersections

17. Shasta Street/ Railroad Crossing
18. Tehama Street/Railroad Crossing
19. Yuba Street/Railroad Crossing
20. Placer Street/ Railroad Crossing
21. South Street/Railroad Crossing

Roadway Segments

1. Shasta Park Drive – Project Driveway to Shasta Dam Boulevard
2. Shasta Dam Boulevard – Shasta Park to Ashby Road
3. Shasta Dam Boulevard – Ashby Rd. to Cascade Boulevard
4. Black Canyon Road – Project Driveway to Red Bluff Avenue
5. Old Oregon Trail – Wonderland to I-5 SB Ramps.
6. Old Oregon Trail – I-5 SB Ramps to I-5 NB Ramps.
7. Wonderland Boulevard – Old Oregon Trail to Project Driveway

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Freeway Segments

1. I-5 Mainline North of Old Oregon Trail (NB and SB)
2. I-5 Mainline between Old Oregon Trail and Shasta Dam Blvd. (NB and SB)
3. I-5 Mainline between Shasta Dam Blvd. and Pine Grove (NB and SB)
4. I-5 Mainline between Pine Grove and Oasis (NB and SB)
5. I-5 Mainline between Oasis and SR 273 (NB and SB)
6. I-5 Mainline between SR 273 and Twin View Boulevard (NB and SB)
7. I-5 Mainline between Twin View Boulevard and SR 299 (NB and SB)
8. I-5 Mainline between SR 299 and SR 44 (NB and SB)
9. I-5 Mainline south of SR 44 (NB and SB)

Contents of the Report

Section 3 of this report describes the environmental setting, including the regulatory setting and existing (2012) transportation conditions. Section 4 Impacts and Mitigation describes the project trip assumptions, analysis of existing conditions plus the project, and cumulative (2030) transportation conditions without and with the project. Section 5 contains additional impact assessments including safety and truck operations. Detailed calculations and background materials are included in the appendices.

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Section 3
Setting

SETTING

The Setting section includes a summary of regulatory policies, a description of the existing street system and traffic operations, and descriptions of other transportation characteristics in the study area including transit and non-motorized travel.

REGULATORY SETTING

Regulatory requirements are described for the state of California, Shasta County and the cities of Shasta Lake and Redding.

California Department of Transportation

California Department of Transportation (Caltrans) policies are applicable to all state routes including Interstate 5, and are summarized in the Caltrans' "Guide for the Preparation of Traffic Impact Studies" (State of California Department of Transportation, December 2002). These guidelines identify when a traffic impact study is required, what should be included in the study, analysis scenarios, and guidance on acceptable analysis methodologies.

Caltrans endeavors to maintain a target service level of LOS C on State highway facilities. However, this may not always be feasible and a lower service level may be acceptable.

Shasta County

The Circulation Element of the Shasta County General Plan describes the following policies pertinent to this project

Policy C-6b: In order to adequately plan for the future circulation network regarding highways, roads, and streets, the General Plan shall use the functional hierarchy and related policies shown in Table RS-1 in its circulation planning. Arterial and collectors are further divided into urban and rural roads. Urban roads generally require more right-of-way per lane, more lanes, and full urban improvements such as curbs, gutters, and sidewalks. All projects shall be evaluated as to their conformance with this circulation network.

Policy C-6d: New commercial and industrial development accessing arterial and collectors shall provide access controls for public safety by means such as limiting the location and number of driveway access points and controlling ingress and egress turning movements.

Policy C-6k: Shasta County shall adopt the following Level of Service (LOS) standards for considering any new roads:

- Rural arterial and collectors - LOS C
- Urban/suburban arterial and collectors - LOS C

Policy C-6l: New development which may result in exceeding LOS E on existing facilities shall demonstrate that all feasible methods of reducing travel demand have been attempted to reach LOS C. New development

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shall not be approved unless traffic impacts are adequately mitigated. Such mitigation may take the form of, but not limited to, the following:

- Provision of capacity improvements to the specific road link to be impacted, the transit system, or any reasonable combination;
- Provision of demand reduction measures included as part of the project design or project operation or any feasible combination

Policy C-8a: Existing accessibility to rail service in the SCR and Northeast Shasta Planning Areas shall be protected by the development pattern from preemption by incompatible land uses. Opportunities for increasing accessibility to existing rail service shall be preserved by the development pattern.

Policy C-8b: Working in conjunction with Caltrans, the County shall designate and provide signed truck routes, ensure that adequate pavement depth, lane widths, loading areas, bridge capacities, vertical height of overpasses and utility lines, and turn radii are maintained on the designated truck routes, and prohibit commercial truck traffic from non-truck routes except for deliveries.

Policy C-8c: Adequate truck access to off-street loading areas in commercial and industrial areas shall be provided in all new development applications.

City of Shasta Lake

The City of Shasta Lake General Plan Circulation Element contains the following policies and implementation measures, which could apply to the proposed project:

Policy C-a: Monitor, maintain and improve, as necessary, the operation, safety and performance of the street system, including roadway surfaces, capacity, and traffic signals. For capacity and operational purposes, strive to attain a Level of Service (LOS) C. to the maximum degree feasible, so that potential traffic congestion on streets and at intersections is minimized;

Implementation Measure C-(8): Continue to require that new development pays a fair share of the costs of street and other traffic and transportation improvements based on traffic generated and impacts on service levels;

Implementation Measure C-(14): Development shall mitigate any adverse impacts of a proposed development project on the existing street system. This may include necessary street improvements, traffic signs, or signals.

City of Redding

The circulation element of the City of Redding General Plan contains the following policies that apply to the proposed project

Policy T1A: Establish the following peak-hour LOS standards for transportation planning and project review. They reflect the special circumstances of various areas of the community:

- Use LOS C - for most arterial streets and their intersections.

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- Use LOS D - for the Downtown area where vitality, activity, and pedestrian and transit use are primary goals
- Use LOS D - for streets within the State highway system and interchanges.
- Use LOS D - for river-crossing street corridors whose capacity is affected by adjacent intersections.

Summary of Regulatory Requirements

The study area intersections, roadway and freeway segments are controlled by different jurisdictions (Shasta County, City of Shasta Lake, City of Redding, Caltrans). The appropriate jurisdiction LOS threshold summarized below is used as the target LOS for each individual location.

- Caltrans - LOS C is considered an acceptable LOS threshold. Freeway mainline segments that fall within the City of Redding have a target LOS of D or better.
- Shasta County – LOS C is considered an acceptable LOS threshold
- City of Shasta Lake – LOS C is considered an acceptable LOS threshold
- City of Redding - LOS C is considered an acceptable LOS threshold. LOS D is considered "tolerable" for the downtown area and for streets within the state highway system and interchanges (1).

EXISTING TRANSPORTATION SYSTEM

Kittelson & Associates, Inc. (KAI) staff visited and inventoried the proposed Moody Flats Quarry development site and surrounding study area in April 2012. At that time, KAI collected information regarding site conditions, adjacent land uses, existing traffic operations, and transportation facilities in the study area.

Roadway Facilities

State Routes

Interstate 5 (I-5) is a major north-south interstate freeway facility on the west coast of the United States. I-5 provides connections to Mexico to the south and Canada to the north. It is the primary route for trucks carrying goods to and from Mexico, Canada and California, Oregon and Washington. I-5 passes through Shasta County and provides access to the project site via Old Oregon Trail interchange.

State Route 151 (SR 151) is a Caltrans maintained facility and also an east-west arterial through the center of the City of Shasta Lake. It provides a primary connection between Shasta Dam and I-5, where it terminates.

State Route 273 (SR 273) operates as an arterial from the northern end of the Redding Central Business District to Benton Drive and as an expressway from Benton Drive to I-5. SR-273 merges with 1-5 in north Redding. To the south, SR 273 continues through downtown Redding to the City of Anderson. The facility is primarily a four lane divided roadway north and south of the downtown core with a speed limit ranging

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from 55-60 mph at its northern and southern sections near 1-5, reducing incrementally to 25-35 mph within the downtown core**.**

Shasta County

Old Oregon Trail is a two-lane, east-west minor collector that intersects I-5 north of the City of Shasta Lake's limits. The proposed project driveway would be the westerly extension of Old Oregon Trail past Wonderland Boulevard.

Wonderland Boulevard is a two-lane, north-south frontage road that runs parallel to I-5 north of the City of Shasta Lake's limits. It connects residences and businesses west of I-5 with the Old Oregon Trail interchange.

City of Shasta Lake

Ashby Road is a north-south residential collector that connects SR 151 to the north and Pine Grove Avenue to the south in the City of Shasta Lake.

Cascade Boulevard is a north-south arterial that runs parallel to I-5 connecting the SR 151 and the Pine Grove interchanges in the City of Shasta Lake and the Oasis Road interchange in the city of Redding.

Pine Grove Avenue is an east-west collector street that extends east from Lake Boulevard to Leona Avenue in the City of Shasta Lake. The overpass crossing I-5 has a three lane cross-section, two travel lanes with a center left tum lane.

City of Redding

Oasis Road is a two lane arterial, which is generally aligned in a northeast-southwest alignment in the northernmost sections of the City of Redding. Oasis Road provides a direct continuation of Old Oregon Trail, giving southbound traffic access to I-5 and a direct route for traffic as it continues or arrives from areas of downtown Redding and other locations to the south.

Caterpillar Road is a two-lane east-west collector street in Redding. It connects Beltline Road with North Market Street, where ramps to I-5 are located. Caterpillar Road serves a large residential subdivision to its south, but most of it is bordered by heavy equipment retail and service businesses.

South Market Street is a major four-lane arterial highway that links the city of Anderson with Redding's central business district. Near its northern terminus at Placer Street—in Redding's core—South Market Street becomes a three-lane one-way roadway.

Yuba Street is a two-lane local road in Redding's central business district. It has ample sidewalks and on-street parking throughout most of its short length.

Tehama Street is a two-lane major collector street in Redding's central business district. It is located immediately north of the Redding Amtrak train station. Its eastern end merges onto SR 44, which can be used to access I-5.

Placer Street is a four-lane arterial near Redding's central business district. It crosses the entire city of Redding east to west, and continues as County Road A16 for several miles west of the city.

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South Street is a four-lane east-west collector on the southern part of Redding's central business district. The roadway is purely residential east of East Street, and has offices and retail from East Street until its western terminus at West Street.

Existing Traffic Operations

Level of Service

Roads and intersections are evaluated in terms of "level of service" (LOS), which is a measure of driving conditions and vehicle delay. Levels of service range from A (best) to F (poorest).

- Levels of service A, B and C indicate conditions where traffic can move relatively freely.
- Level of service D describes conditions where delay is more noticeable.
- Level of service E describes conditions where traffic volumes are at or close to capacity, resulting in significant delays and unstable traffic flow.
- Level of service F characterizes conditions where traffic demand exceeds available capacity, with very slow speeds (stop and go) and long delays and queuing at signalized intersections or on freeways and highways.

Traffic Operations Analysis Methodology

Traffic operations analysis was performed using procedures from the *Highway Capacity Manual 2000* (Transportation Research Board, Washington D.C., 2000,). The 2000 HCM provides different analysis methodologies for each type of traffic control, as described below.

Signalized Intersection Analysis: Signalized intersection analyses were conducted using the operational methodology outlined in the 2000 HCM Chapters 10 and 16. This procedure calculates an average control delay per vehicle at a signalized intersection, and assigns a level of service designation based upon the delay. The method also provides a calculation of the volume-to-capacity (v/c) ratio of the critical movements at the intersection. In general, the HCM 2000 default peak hour factor (PHF) of 0.92 was applied to all intersections. However, for study intersections on Oasis Road, a PHF of 1.00 was used for existing conditions, consistent with the analysis reported in previous transportation impact studies in the region, including the Mountain Gate at Shasta Lake TIA Report and the Redding Oasis Center Final Master EIR.

Unsignalized Intersection Analysis: Unsignalized intersection analyses were conducted using the methodology outlined in the 2000 HCM Chapters 10 and 17. At one- or two-way stop-controlled intersections, each turning movement that yields to other vehicles is evaluated separately and assigned a separate level of service. Each yielding movement (stop-sign controlled movements or left-turns from the uncontrolled approaches) is evaluated for the relative ability of yielding traffic to find adequate gaps in the conflicting traffic flows. The level of service for each movement is then based on the resulting average delay for that movement. This method does not provide an average level of service for the entire intersection, so results cannot be compared directly to results for signalized or all-way stop intersections.

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Table 2: Level of Service Criteria – Signalized Intersections

Level of Service (LOS)	Average Delay (seconds/ vehicle)	Description
A	≤ 10	LOS A represents free-flow travel with an excellent level of comfort and convenience and the freedom to maneuver.
B	> 10 and ≤ 20	LOS B has stable operating conditions, but the presence of other road users causes a noticeable, though slight, reduction in comfort, convenience, and maneuvering freedom.
C	> 20 and ≤ 35	LOS C has stable operating conditions, but the operation of individual users is substantially affected by the interaction with others in the traffic stream.
D	> 35 and ≤ 55	LOS D represents high-density, but stable flow. Users experience severe restriction in speed and freedom to maneuver, with poor levels of comfort and convenience.
E	> 55 and ≤ 80	LOS E represents operating conditions at or near capacity. Speeds are reduced to a low but relatively uniform value. Freedom to maneuver is difficult with users experiencing frustration and poor comfort and convenience. Unstable operation is frequent, and minor disturbances in traffic flow can cause breakdown conditions.
F	> 80	LOS F is used to define forced or breakdown conditions. This condition exists wherever the volume of traffic exceeds the capacity of the roadway. Long queues can form behind these bottleneck points with queued traffic traveling in a stop-and-go fashion.
SOURCE: *Transportation Research Board, Highway Capacity Manual, Washington, D.C., 2010, pages 18-5 and 18-6. (For signalized intersections)*		

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Table 3: Level of Service Criteria – Unsignalized Intersections

Level of Service (LOS)	Average Delay (seconds / vehicle)	Description
A	≤ 10	Little or no delay
B	> 10 and ≤ 15	Short traffic delay
C	> 15 and ≤ 25	Average traffic delays
D	> 25 and ≤ 35	Long traffic delays
E	> 35 and ≤ 50	Very long traffic delays
F	> 50	Extreme delays potentially affecting other traffic movements in the intersection
SOURCE: *Transportation Research Board, Highway Capacity Manual, Washington, D.C., 2010, page 20-3. (For unsignalized)*.		

Roadway Segments: The LOS methodology used to analyze the capacity of roadway segments was based on the volume to capacity threshold. This methodology examines the average daily traffic (ADT) volumes as compared to the daily traffic volume capacity of the roadway facility. The threshold values are presented in Table 4.

Table 4: Segment Level of Service Threshold

Roadway	Lanes	Maximum Volume for Given Service Level				
		A	B	C	D	E
Freeway	4	24,000	28,000	32,000	36,000	40,000
Major Arterial	4	22,000	25,000	29,000	32,500	36,000
Major Collector	2	11,000	12,500	14,500	16,000	18,000
Minor Collector	2	9,000	10,500	12,000	13,500	15,000
Local Street	2	2,200	2,600	3,000	3,400	3,800
SOURCE: *Shasta Ranch Mining and Reclamation Plan DEIR*						

Freeway Mainline Segments The freeway mainline was analyzed utilizing the methodology outlined in the 2000 HCM Chapters 13 and 23. Maximum service flow rates of 2,200 vehicles per lane per hour for typical freeway lanes were used for this analysis. Table 5 shows the relationship of freeway volume-to-capacity ratios and density to LOS.

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Table 5: Freeway Level of Service Standards

Level of Service	Maximum Volume-to-Capacity Ratio	Maximum Density (passenger vehicles per mile per lane)
A	0.32	11
B	0.53	18
C	0.74	26
D	0.9	35
E	1	45
F	>1.00	>45

SOURCE: Transportation Research Board, Highway Capacity Manual, Washington, D.C., 2000, pages 23-3 and 23-4.

Signal Warrant Analysis

Traffic signal warrants are standards that provide guidelines in the determination of the need for a traffic signal. A traffic signal should not be installed if no warrants are met, since the installation of traffic signals may increase delays for the majority of through traffic and increase some types of accidents. If one or more warrants are met, a signal may be appropriate.

As stated in the 2009 Manual of Uniform Traffic Control Devices (MUTCD), "An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location. The investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the following traffic signal warrants and other factors related to existing operation and safety at the study location:

- Warrant 1, Eight-Hour Vehicular Volume.
- Warrant 2, Four-Hour Vehicular Volume.
- Warrant 3, Peak Hour.
- Warrant 4, Pedestrian Volume.
- Warrant 5, School Crossing.
- Warrant 6, Coordinated Signal System.
- Warrant 7, Crash Experience.
- Warrant 8, Roadway Network.

"The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal."

This traffic impact analysis did not evaluate the full panoply of warrants for traffic signals, but instead focused on the peak hour warrant. The MUTCD states that, "*This [peak hour] signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time*." The peak hour warrant is being used in this study as an "indicator" of the likelihood of an existing or future unsignalized intersection warranting a traffic signal in the future. Intersections that fail to exceed the peak hour warrant are considered (for the purposes of this impact analysis) to be unlikely to meet one or more of

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the other signal warrants (such as the 4-hour or 8-hour warrants). However, this does not mean that a signal is definitely unwarranted. A signal may be warranted by other criteria, some of which cannot be known until the intersection is constructed and operational. This peak hour analysis is not intended to replace a rigorous and complete traffic signal warrant analysis by the responsible jurisdiction.

Unsignalized intersections were evaluated using the Peak Hour Volume Warrant (Warrant No. 11) in the Caltrans *Traffic Manual*, which is the same as Warrant No. 3 in the MUTCD. The Peak Hour Volume Warrant was applied where the minor street experiences long delays in entering or crossing the major street for at least one hour in a day.

Even if the Peak Hour Volume Warrant is met, a more detailed signal warrant study is recommended before a signal is installed. The more detailed study should consider volumes during the daily peak hours of roadway traffic, pedestrian traffic, and accident histories.

Existing Traffic Volumes

Intersections: Turning movement traffic volumes were collected at the study intersections during the weekday AM and PM commute periods in January 2012. Since these volumes were collected in the non-peak season, they were adjusted to reflect peak summer volumes using a seasonal adjustment factor of 1.21. The 21 percent factor corresponds to the proportion of volume in the peak month (August) to the average monthly volume, and was derived from three years of continuous automatic traffic counts (PeMS) volume counts at a detector station on I-5 near the Oasis Road interchange. The adjusted traffic volumes (i.e., weekday peak period existing turning movements) and lane configurations are shown in Figure 3. Raw existing counts and data used for developing the seasonal adjustment factor are presented in Appendix 1**.**

Roadway Segments: Tube counts were conducted for three consecutive mid-week days from January 31st to February 2nd of 2012. Since these volumes were collected in the non-peak season, they were adjusted to reflect peak summer volumes using a seasonal adjustment factor of 1.21, as described in the previous section. A vehicle classification survey was also performed to determine the percentage of heavy vehicles in the study area and specific roadway segments. Heavy vehicles were converted to passenger car equivalents to obtain an analysis ADT. The original count sheets are provided in Appendix 1.

Freeway Segments: Nine study area freeway segments on Interstate 5 were analyzed for the weekday AM and PM commute periods. Freeway mainline volumes on two segments, just south of the project and just north of the project, were estimated by multiplying the bidirectional Peak Hour Volumes from the Caltrans 2010 Traffic Volumes report (2) with the appropriate directional (D)-factor from Caltrans 2010 Peak Hour Volume Data report (3). The applicable pages from the 2010 Traffic Volumes report and the 2010 Peak Hour Volume Data report are presented in Appendix 1. The freeway volumes for the other segments were estimated by adding and subtracting on-ramp and off-ramp volumes. The intersection turning movement counts described above were used to compute the on-ramp and off-ramp volumes (see Appendix 1).

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Figure 3 Existing No Project Lane Configurations

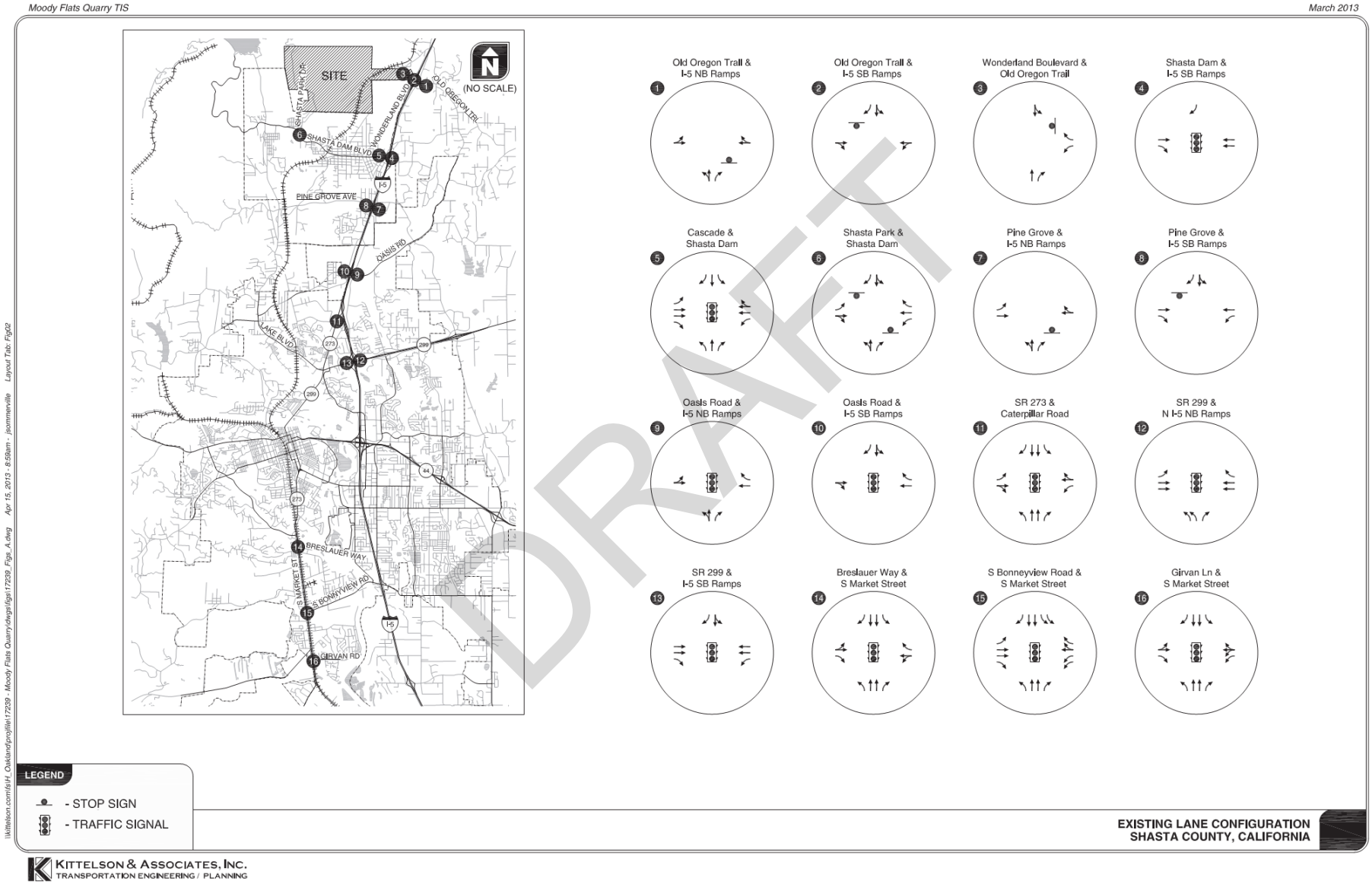


Figure 4: Existing No Project Peak Hour Volumes (AM)

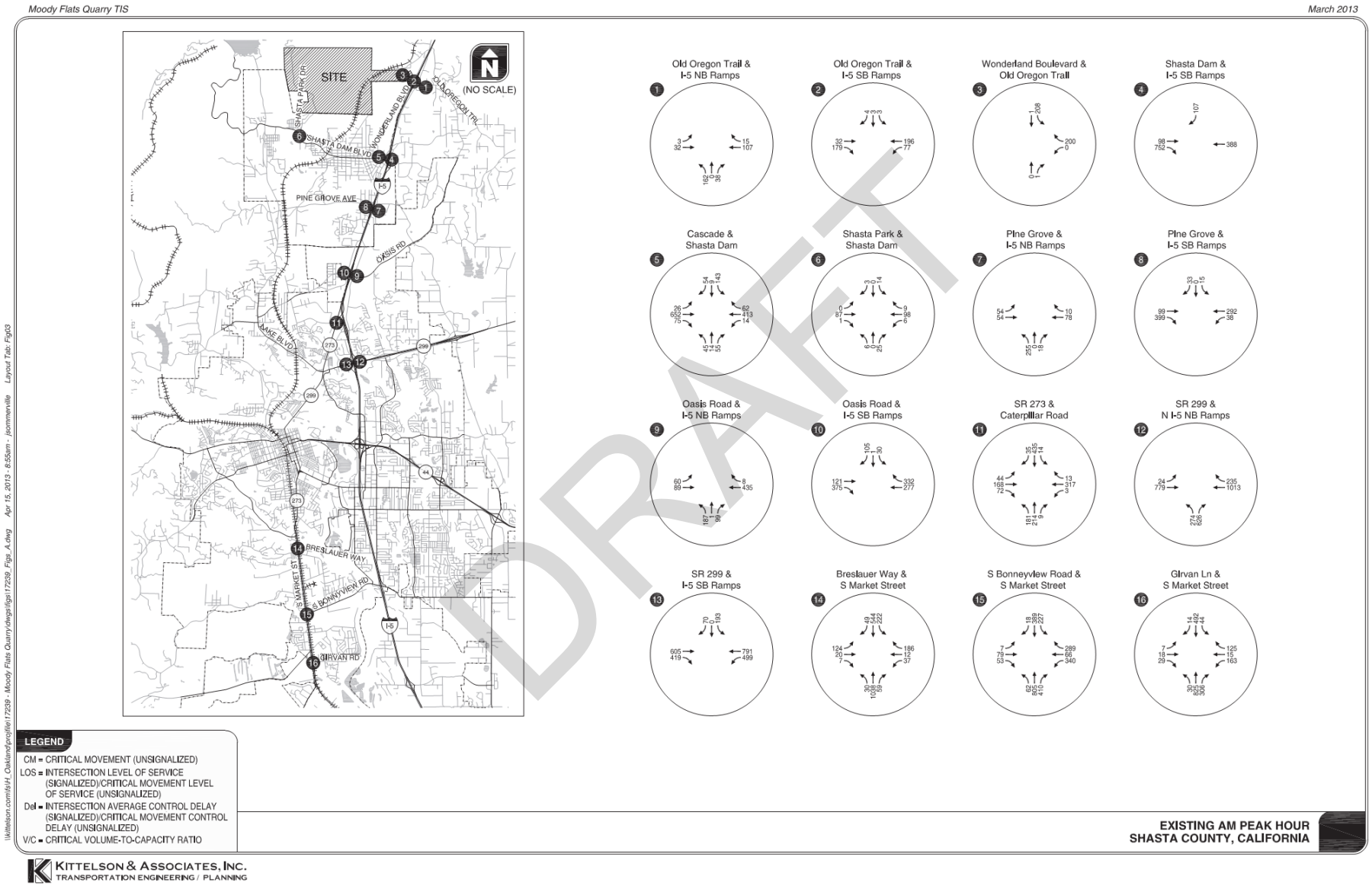
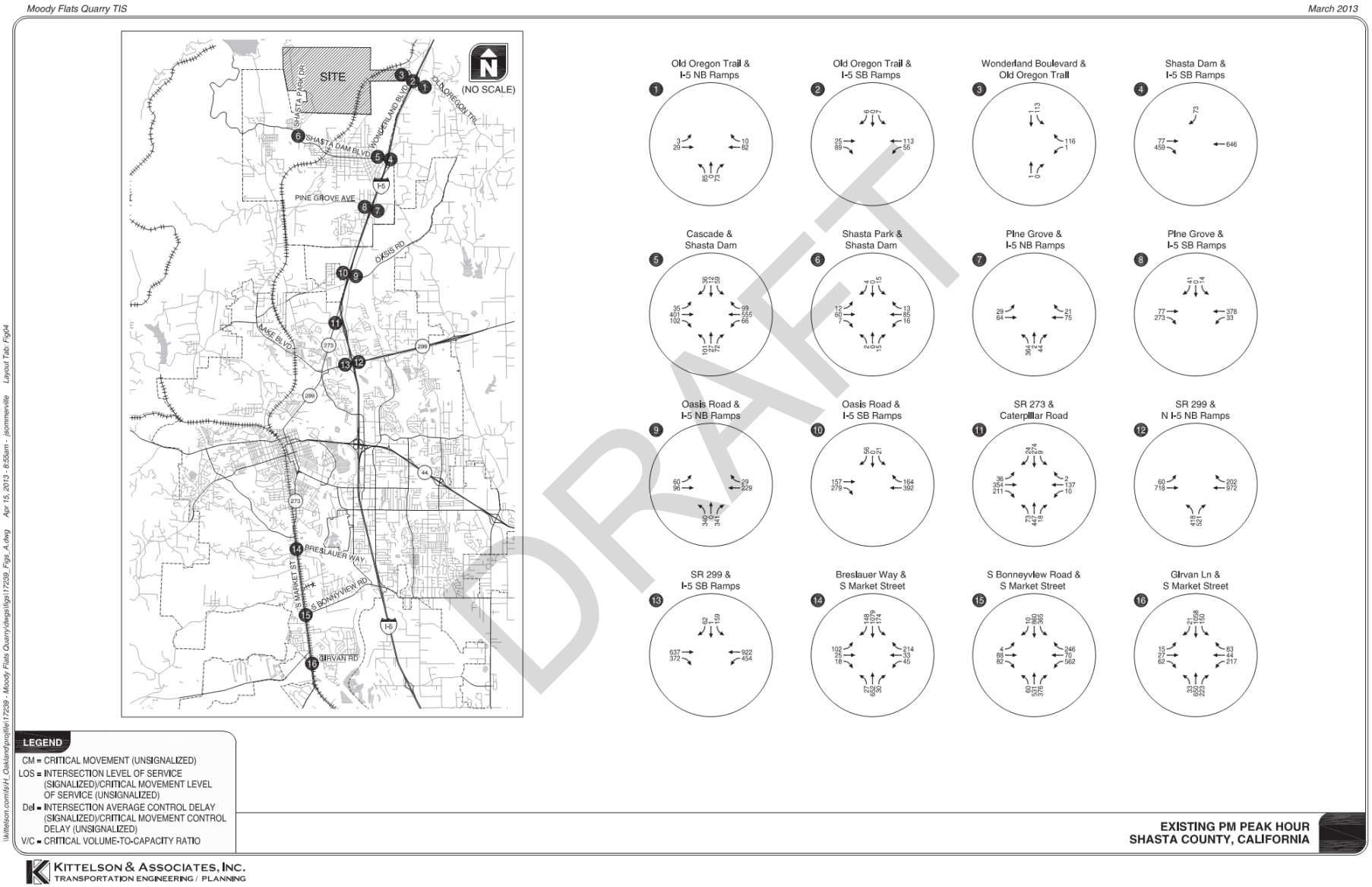


Figure 5: Existing No Project Peak Hour Volumes (PM)



Existing Traffic Operations

Existing Intersection Operations: Intersection level of service analysis was performed using the methodology described in the Traffic Operations Analysis Methodology section. As shown in Table 6, all of the study intersections operate at acceptable levels of service during the weekday AM and PM peak hours.

Table 6: Existing No Project Conditions - Intersection Level of Service Analysis

Intersection	Target LOS	Control	Peak Hour	Delay	LOS	Meet Signal Warrant?
1. I-5 NB Ramps & Old Oregon Trail	C	TWSC	AM	10.4	B	No
			PM	9.4	A	No
2. I-5 SB Ramps & Old Oregon Trail	C	TWSC	AM	12.6	B	No
			PM	10.1	B	No
3. Wonderland Blvd & Old Oregon Trail	C	TWSC	AM	9.1	A	No
			PM	8.8	A	No
4. I-5 SB Off-Ramp & Shasta Dam Blvd	C	Signalized	AM	17.3	B	---
			PM	10.5	B	---
5. Cascade Blvd & Shasta Dam Blvd	C	Signalized	AM	16.9	B	---
			PM	17.7	B	---
6. Shasta Park Dr & Shasta Dam Blvd	C	TWSC	AM	10.1	B	No
			PM	9.9	A	No
7. I-5 NB Ramps & Pine Grove Ave	C	TWSC	AM	14.2	B	No
			PM	16	C	No
8. I-5 SB Ramps & Pine Grove Ave	C	TWSC	AM	11.2	B	No
			PM	11.9	B	No
9. I-5 NB Ramps & Oasis Rd	D	Signalized	AM	11.3	B	---
			PM	9.4	A	---
10. I-5 SB Ramps & Oasis Rd	D	Signalized	AM	20.8	C	---
			PM	12.9	B	---
11. N Market St [SR-273] & Caterpillar Rd	D	Signalized	AM	36.8	D	---
			PM	48.5	D	---
12. I-5 NB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	5.8	A	---
			PM	7.5	A	---
13. I-5 SB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	20.8	C	---
			PM	17.9	B	---
14. S Market St [SR-273] & Breslauer Way	D	Signalized	AM	30.1	C	---
			PM	23.7	C	---
15. S Market St [SR-273] & S Bonneyview Rd	D	Signalized	AM	31.9	C	---
			PM	37.6	D	---
16. S Market St [SR-273] & Girvan Ln	D	Signalized	AM	20.2	C	---
			PM	26.9	C	---
LOS based on HCM2000, Signal warrant is based on Peak Hour Warrant						
Control delays for unsignalized intersections are for the worst movement of the intersection (TWSC) or intersection average (AWSC)						

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Existing Road Segment Operations: Roadway segment level of service analysis was performed using the methodology described in the Traffic Operations Analysis Methodology section. As shown in Table 7, all study area roadway segments are found to be operating at LOS A, except Shasta Dam Boulevard between Ashby Road and Cascade Boulevard. This segment was found to be at LOS D, below the City of Shasta Lake LOS C standard.

Table 7: Existing No Project Conditions - Roadway Level of Service Analysis

Roadway Segment	From	To	Roadway Type	Number of Lanes	Daily Volume[1]	LOS	V/C[2]
Shasta Park Drive	Project Dwy	Shasta Dam Blvd	Local Street	2	378	A	0.10
Shasta Dam Blvd	Shasta Park	Ashby Rd	Minor Collector	2	3,145	A	0.21
Shasta Dam Blvd	Ashby Rd	Cascade	Major Collector	2	14,589	**D**	0.81
Black Canyon Rd	Project Dwy	Red Bluff Ave	Local Street	2	538	A	0.14
Old Oregon Trail	Wonderland	I-5 SB Ramps	Minor Collector	2	2,995	A	0.20
Old Oregon Trail	I-5 SB Ramps	I-5 NB Ramps	Minor Collector	2	2,578	A	0.17
Wonderland Boulevard	Old Oregon Trail	Project Driveway	Minor Collector	2	2,995	A	0.20

[1]Daily Volume in Passenger Car Equivalents (PCE).
[2]The LOS E maximum service volume was used to compute the V/C ratio.

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Existing Freeway Segment Operations: Freeway basic segment level of service analysis was performed using the methodology described in the Traffic Operations Analysis Methodology section. As shown in Table 8 and Table 9, the only segment failing to meet the Caltrans LOS standard of "D" is the northbound I-5 segment between SR 44 and SR 299, which was evaluated as LOS E in the PM peak hour.

Transit Facilities

Shasta County is served by several transportation providers. Traditional fixed-route transit is operated by the Redding Area Bus Authority (RABA), which operates Monday through Friday from 6:30am-7:30pm and Saturday from 9:30am to 7:30pm. This service logs approximately 62,877 miles per month to complete approximately 27,161 passenger trips (4).

RABA operates 10 fixed routes within the cities of Redding, Shasta Lake and Anderson (see Appendix 9). All but two routes operate at one hour headways, with the exceptions being Route 7 (30 minutes) and Route 9 (two hours). The fixed routes have shown an increase in annual ridership since 2001, with the exception of the fiscal year ending June 30, 2003. That year, ridership decreased 12% due to unidentifiable reasons.

Table 8: Existing No Project Conditions - Freeway Level of Service Analysis (I-5NB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]
I-5NB	1	North	Old Oregon Tr	63.00	12.71	B	63.00	15.00	B
	2	Old Oregon Tr	Shasta Dam	63.00	14.48	B	63.00	16.38	B
	3	Shasta Dam	Pine Grove	64.50	10.98	A	64.50	13.98	B
	4	Pine Grove	Oasis	64.50	12.19	B	64.50	16.09	B
	5	Oasis	SR 273	64.50	13.40	B	64.50	19.55	C
	6	SR 273	Twin View	63.00	18.35	C	62.92	25.95	C
	7	Twin View	SR 299	63.00	21.71	C	61.83	29.99	D
	8	SR 299	SR 44	62.65	27.53	D	55.17	40.31	**E**
	9	SR 44	South	64.50	18.56	C	64.50	21.84	C

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

Table 9: Existing No Project Conditions - Freeway Level of Service Analysis (I-5SB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]
I-5SB	1	North	Old Oregon Tr	63.00	9.14	A	63.00	9.35	A
	2	Old Oregon Tr	Shasta Dam	63.00	11.56	B	63.00	10.60	A
	3	Shasta Dam	Pine Grove	64.50	11.38	B	64.50	9.15	A
	4	Pine Grove	Oasis	64.50	11.29	B	64.50	10.64	A
	5	Oasis	SR 273	64.50	15.02	B	64.50	11.75	B
	6	SR 273	Twin View	63.00	18.84	C	63.00	15.43	B
	7	Twin View	SR 299	63.00	20.95	C	63.00	18.05	C
	8	SR 299	SR 44	62.79	26.85	D	63.00	23.43	C
	9	SR 44	South	64.50	13.18	B	64.50	13.55	B

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

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The paratransit equivalent to the fixed-route transit service is also operated by RABA. The agency contracts with Veolia to offer lift-equipped demand-responsive transit to mobility-impaired residents. The service operates at the same time (i.e., concurrently) with the fixed-route service.

By far, the largest source of transportation besides the private auto is the public school bus. The 26 public school districts in Shasta County and the County Superintendent of Schools Office together operate 214 buses, traveling more than 2.85 million miles a year and transporting an average of 16,361 students a day.

Shasta College operates an interregional type of service between the college and Tehama County (Red Bluff), Trinity County (Weaverville) and Eastern Shasta County (McArthur). The college has a total of nine buses and uses four of these daily on the above runs, transporting 150-170 students daily, and also contracts for a lift-equipped van for disabled students. In 1995, Shasta College was awarded a medium-sized bus and a single-wheel cutaway van under the Federal Transit Administration Section 5310 grant program.

More than a dozen private companies offer demand-responsive transit for disadvantaged or disabled residents.

Pedestrian and Bicycle Facilities

No sidewalks or marked bicycle lanes are provided in the immediate vicinity of the proposed project driveways, but paved shoulders on Wonderland Avenue may serve non-motorized traffic. The 2010 Regional Transportation Plan for Shasta County shows a proposed Class II bicycle lane for Old Oregon Trail, leading to Wonderland Boulevard and the proposed project driveway.

In the final draft of the 2010 Regional Transportation Plan for Shasta County (4), the county's MPO reports that 3% of work trips are done by bicycling or walking. The aforementioned report attributes the relatively low 0.38% bicycling mode share to major barriers in the urbanized area, including I-5, the Union Pacific Railroad, and the Sacramento River. Facilities for bicycling and walking include approximately eight miles of paved pedestrian/bicycle trails along the Sacramento River between Hilltop Drive and Keswick Dam Road. Notable recent additions to non-motorized infrastructure include the Sundial Bridge and the conversion of a former railroad grade into a 12-mile paved and unpaved trail from Keswick Dam Road to Shasta Dam.

Table 10: Summary of Pedestrian/Bicycle Trails in the Redding Area

Metric	Trails (Paved and Dirt)	Bikeways (Class I, II, III)	Total System Miles
Existing Miles	80.25	75.46	155.71
Proposed Miles	78.45	54.56	133.01
Total	158.7	130.02	288.72

***Adapted from 2010 Regional Transportation Plan for Shasta County**

In addition to these recreational trails, bicyclists may use certain segments of state and federal highways in Shasta County. In the study area, bicycles are allowed on I-5, except between Shasta Lake Boulevard and Oasis Road.

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Existing Railroad Crossings

Railroad crossings are evaluated in terms of the length of time that streets are blocked by train movements, and the length of vehicle queues that result from railroad crossings. To evaluate the traffic operations and queue spill back at railroad crossings, a queue study was performed along with the traffic counts. Queues were observed for 8 study locations (Table 11). This table presents the (worst case scenario) queues during the AM and PM peak periods when the longest observed trains passed through the 8 study locations. 0 provides data from the queue observation study.

Table 11: Observed Queues (in vehicles) at Railroad Crossings for Existing No Project Conditions

Node	Intersection	Train Passage Time (s)		AM				PM			
		AM	PM	NB	WB	SB	EB	NB	WB	SB	EB
14	S Market St [SR-273] & Breslauer Way	90	95	0	3	3	0	0	24	7	1
15	S Market St [SR-273] & S Bonneyview Rd	73	100	8	15	8	2	15	30	5	6
16	S Market St [SR-273] & Girvan Ln	90	82	4	1	1	0	7	10	4	3
17	Shasta Street & Railroad Crossing	115	115	-	13	-	13	-	13	-	11
18	Tehama Street & Railroad Crossing	125	139	-	0	-	0	-	0	-	8
19	Yuba Street & Railroad Crossing	125	107	-	1	-	1	-	1	-	9
20	Placer Street & Railroad Crossing	134	110	-	4	-	4	-	4	-	18
21	South Street & Railroad Crossing	75	110	-	14	-	14	-	14	-	30

These observed queues are based on the longest train that occurred during the AM peak period that took between 73 seconds and 134 seconds to pass through the study locations. Similarly, the PM peak hour train took between 95 seconds and 139 seconds to pass through the study intersections. The average headway between train counts that were performed over three weekdays was found to be 1 hour and 13 minutes.

For signalized intersection locations, queues on the westbound approaches of locations 14, 15 and 16 were observed to be the longest as the approach would be stopped during train passage. Given that the distance between intersections 14 and 16 and Eastside Road is less than 50 feet, these queues could cause blockage at the following intersections:

1. Breslauer Way & Eastside Road – NB and SB approaches of Eastside Road would be blocked due to WB queues at intersection 14. However, since the intersection is so close to the railroad crossing, drivers would be able to notice the gate arm and should be able to refrain from blocking Eastside Road.
2. Girvan Lane & Eastside Road – NB and SB approaches of Eastside Road would be blocked due to WB queues at intersection 16. However, since the intersection is so close to the railroad crossing, drivers would be able to notice the gate arm and should refrain from blocking Eastside Road.

For unsignalized locations, the longest queues were observed at the crossings of Shasta Street, Placer Street and South Street. The available storage space, calculated assuming an average of 25 feet per vehicle, can be compared to the measured queues.

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1. Shasta Street –The nearest street intersections are 250 feet east and west of the railroad crossing. Because Shasta Street is four-lanes wide, it can hold about 20 cars in each direction. The observed queues indicate that this railroad crossing should not block adjacent street intersections.
2. Placer Street – The nearest street intersections are 250 feet east and west of the railroad crossing. Because Placer Street is four-lanes wide, it can hold about 20 cars in each direction. The observed queues indicate that this railroad crossing should not block adjacent street intersections. Note that vehicles on Railroad Avenue—a two-lane local street running parallel to the tracks—would be blocked by a two- or four-vehicle queue.
3. South Street –The nearest street intersection is South Street & California Street, about 350 feet to the east. The observed WB queue is not expected to exceed the 28-vehicle storage capacity. To the west, the intersection with Court Street is nearly 500 feet away, leaving room for 40 cars. The observed queues indicate that this railroad crossing should not affect adjacent street intersections. Note that vehicles on Railroad Avenue—a two-lane local street running parallel to the tracks—would be blocked by a two- or four-vehicle queue.

Since 2009, only one accident involving a train and a vehicle has been reported (see Appendix 6: Collision Records). Generally, the study area has good advance warning signage for railroad crossings including pavement markings, noticeable gate arms, and roadside signs.

Existing Safety Conditions

Collision records were obtained from Caltrans for the 36-month period between January 1st, 2008 and December 31st, 2010. The records cover select study locations, including SR 273 and several streets in downtown Redding near the railroad crossings. Appendix 6 includes the collision records.

An analysis of the data found that in the last three years, SR 273 has had crash rates (per million vehicles entering its intersections) that are consistent with the Caltrans' averages. The Tehama Street and Shasta Street segments from Pine Street to Market Street-in downtown Redding—have experienced crash rates significantly higher than the average. A total of one collision involving a train has been reported in the period from June 7th, 2009 to June 6th, 2012.

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Section 4
Impacts and Mitigation

IMPACTS AND MITIGATION

STANDARDS OF SIGNIFICANCE

Standards of significance define the thresholds used to analyze the impacts of a proposed project. Consistent with CEQA guidelines, the proposed project is considered to have a significant impact on the environment if it will:

- Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicles trips, the volume to capacity ratio on roads, or congestion at intersections)
- Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways
- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks
- Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)
- Result in inadequate emergency access
- Result in inadequate parking capacity
- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)

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Traffic Operations Impact Thresholds

Signalized Intersection

A traffic impact at signalized intersection is considered significant when:

- The traffic generated by the project degrades level of service (LOS) from an acceptable LOS (A, B, C) without project to an unacceptable LOS (D, E or F) with the project;
- The level of service (without project) is unacceptable and project generated traffic increases the average vehicle delay by 5 seconds or more.

Unsignalized Intersection

- The traffic generated by the project degrades level of service (LOS) from an acceptable LOS (A, B, C) without project to an unacceptable LOS (D, E or F) with the project;
- The level of service (without project) is unacceptable and project generated traffic increases the worst approach delay by 5 or more seconds.

Roadway Segments

- The traffic generated by the project degrades level of service (LOS) from an acceptable LOS (A, B, C) under without project to an unacceptable LOS (D, E or F) with the project;
- The level of service without project is unacceptable and project generated traffic increases the v/c by more than 0.05.

METHODOLOGY AND ASSUMPTIONS

Project Traffic Methodology

Project Trip Generation

The standard source for trip generation for land use development project impact analysis is the *Trip Generation* reference published by the Institute of Transportation Engineers (ITE). The ITE *Trip Generation* manual does not provide trip generation information for a quarry. Therefore this project trip generation estimate is based on operational information provided by the applicant.

The project applicant describes the proposed Moody Flats Quarry as a 100-year project with maximum annual sales of two million tons per year. Sufficient reserves (approximately 175 million tons) are expected within the proposed project site to support marketing of up to two million tons of aggregate material annually for 100 years. Actual production rates may vary, depending largely on aggregate consumption in the local and regional markets. Although sales would not exceed two million tons per year, annual sales in some years could be substantially less than proposed maximum annual levels.

Proposed operations, including mining, processing, and administrative functions, would employ between 25 and 50 people. Typical project operating hours would be from 6:00 AM to 10:00 PM (16 hours per day), Monday through Friday, and 6:00 AM to 3:00 PM on Saturdays. The employees in the morning shift would enter the facility around 6:00 AM and leave around 2:00 PM, when the employees for the second shift would arrive. Therefore no employee trips are expected during the standard morning and evening commute peak hours (typically 7:30 to 8:30 AM and 4:30 to 5:30 PM). However, this report assumes 5 entering and 5 exiting trips during the AM and PM peak hours to be conservative.

In addition to supplying aggregate to the local market, the proposed project plans to supply construction aggregates to the northern California regional market by developing a rail siding/spur and load-out facility to access the Union Pacific rail line that traverses the site. Production and distribution goals include shipping approximately 1.5 million tons of aggregate via rail to regional markets annually, and distributing 0.5 million tons of aggregate and finished products (e.g.., ready-mix concrete, asphalt) annually to local markets via trucks. The project is expected to generate 200 annual train trips.

Based on the information described above, the project applicant provided the estimates for employee trips, truck trips and train trips as shown in Table 12.

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Table 12: Project Trip Generation Estimate

Trip Type	Axles	Daily Trips	AM Peak		PM Peak	
			Entering	Exiting	Entering	Exiting
Facility employees [1]	2	24	5	5	5	5
Ready-mix trucks [2]	3/4	178	18	18	2	2
Asphalt trucks [3]	5	128	10	10	1	1
Aggregate trucks [4]	5	200	20	20	2	2
Cement trucks [5]	5	7	2	2	1	1
Liquid asphalt/propane trucks [6]	5	9	2	2	1	1
Recycled material trucks [7]	5	7	2	2	1	1
Fuel trucks [8]	5	3	1	1	0	0
Outside services [9]	2	4	0	0	0	0
Annual Train Trip	---	200	2		N/A	
Total		560	60	60	13	13

1. Estimate based on 24 employees operating entire facility (aggregate plant, ready-mix, and asphalt).

2. Read-mix truck capacity of 18.2 tons per truck; assume sales of 3,300 tons per day equaling 178 trips per day.

3. Assume 25 tons per truck and maximum daily sales of 3,200 tons per day (or 128 trips per day).

4. Aggregate based on estimate for maximum sales per day of 5,000 tons per day (or 200 trips per day).

5. Outside deliveries (e.g., FedEx), subcontractor services.

6. Round-trip is defined as an empty vehicle entering the site, picking up material (i.e., asphalt, aggregate ready-mix), and exiting the site.

7. Based on 80-car unit train with 100-ton capacity per car.

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Project Trip Distribution

The distribution of trips associated with the project site was derived from two sources:

- information provided by the applicant on the likely destinations of truck trips; and
- the Shasta County travel model maintained by the Shasta Regional Transportation Agency.

The travel model information was based on a "select zone" analysis of the area containing the project site (Transportation Analysis Zone or TAZ 1401) with industrial land uses coded into the model. The travel model is most reliable to identify the likely origins and destinations of employee-related trips, but would not have more specific information on truck trips related to quarry operations.

The draft trip distribution estimates were provided to the City of Shasta Lake, City of Redding, Shasta County and Caltrans for review. Comments and recommendations provided by Caltrans (March 1, 2012 email from Caltrans to Bill Walker, Shasta County) were incorporated in the final trip distribution estimates (Figure 6).

Project Traffic Assignment

Project-generated trips were assigned to the roadway network and study intersections based upon the trip distribution patterns described above. Project trips during the weekday AM peak hour and PM peak hour are presented for all study intersections in Figure 7 and Figure 8. Weekday total (24 hour) project volumes are shown in Figure 9.

Given that the majority of the project trips are expected to be five-axle trucks, the percentage of trucks was increased from the Existing (No Project) conditions to account for the increase in heavy vehicle activity in the study area. To estimate the increase, the percentage of existing trucks based on the vehicle classification counts were converted to absolute truck trips. Project only truck trips were added to the absolute truck trips and a percentage of trucks were recalculated for total truck trips with the project at all study intersections, roadway segment and freeway segments.

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Figure 6: Project Trip Distribution

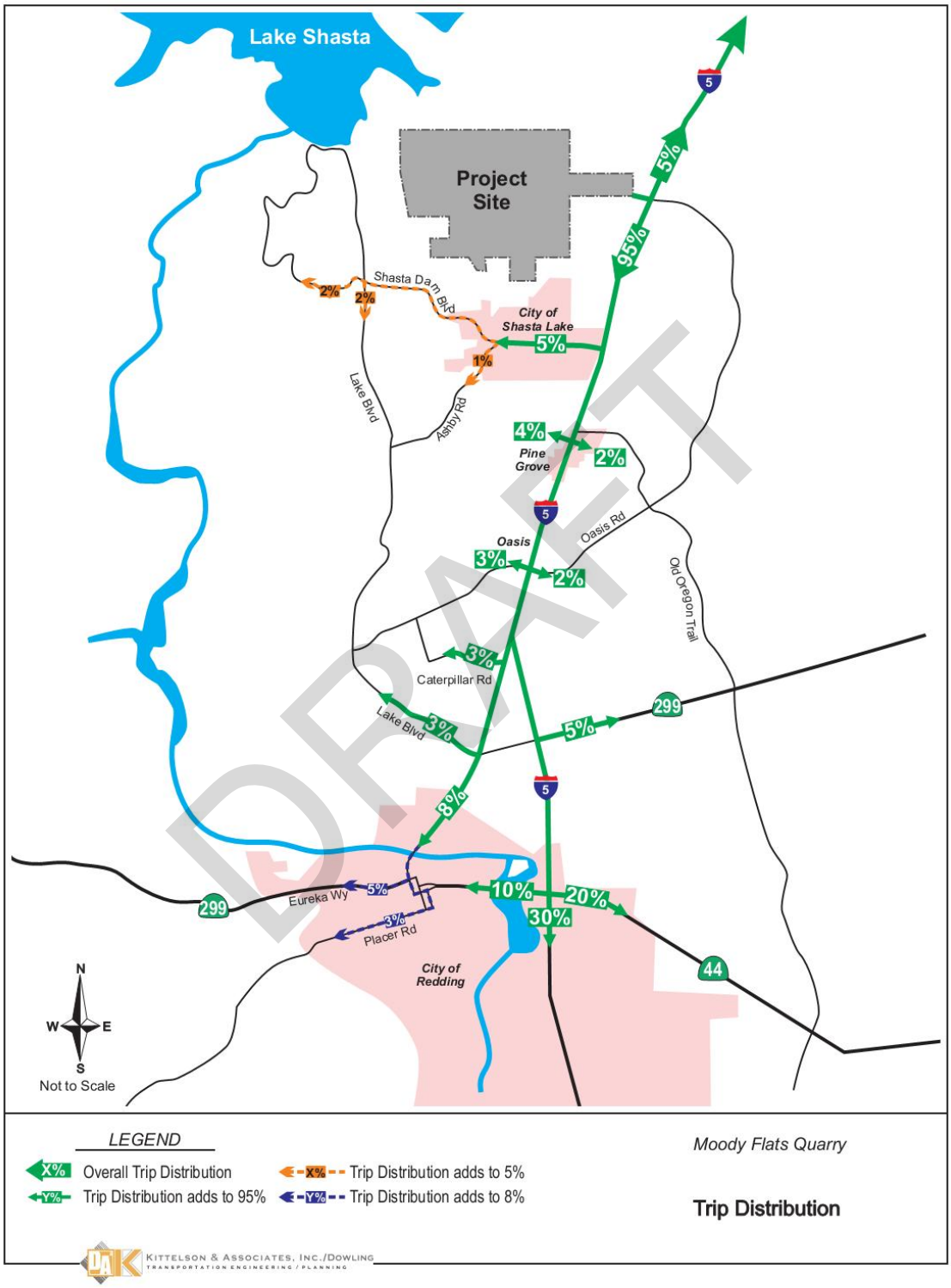

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Figure 7: Project Only Peak Hour Volumes (AM)

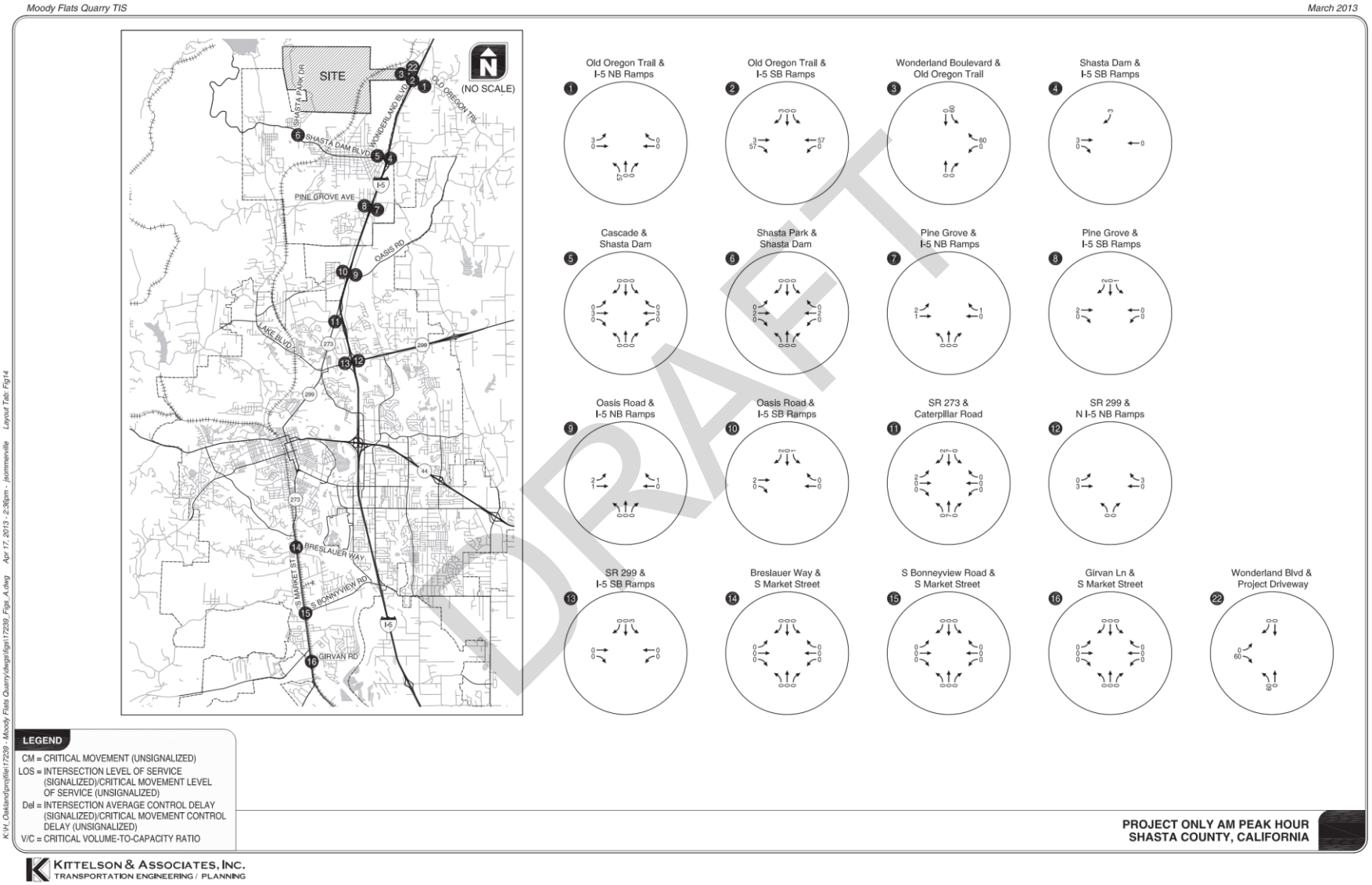


Figure 8: Project Only Peak Hour Volumes (PM)

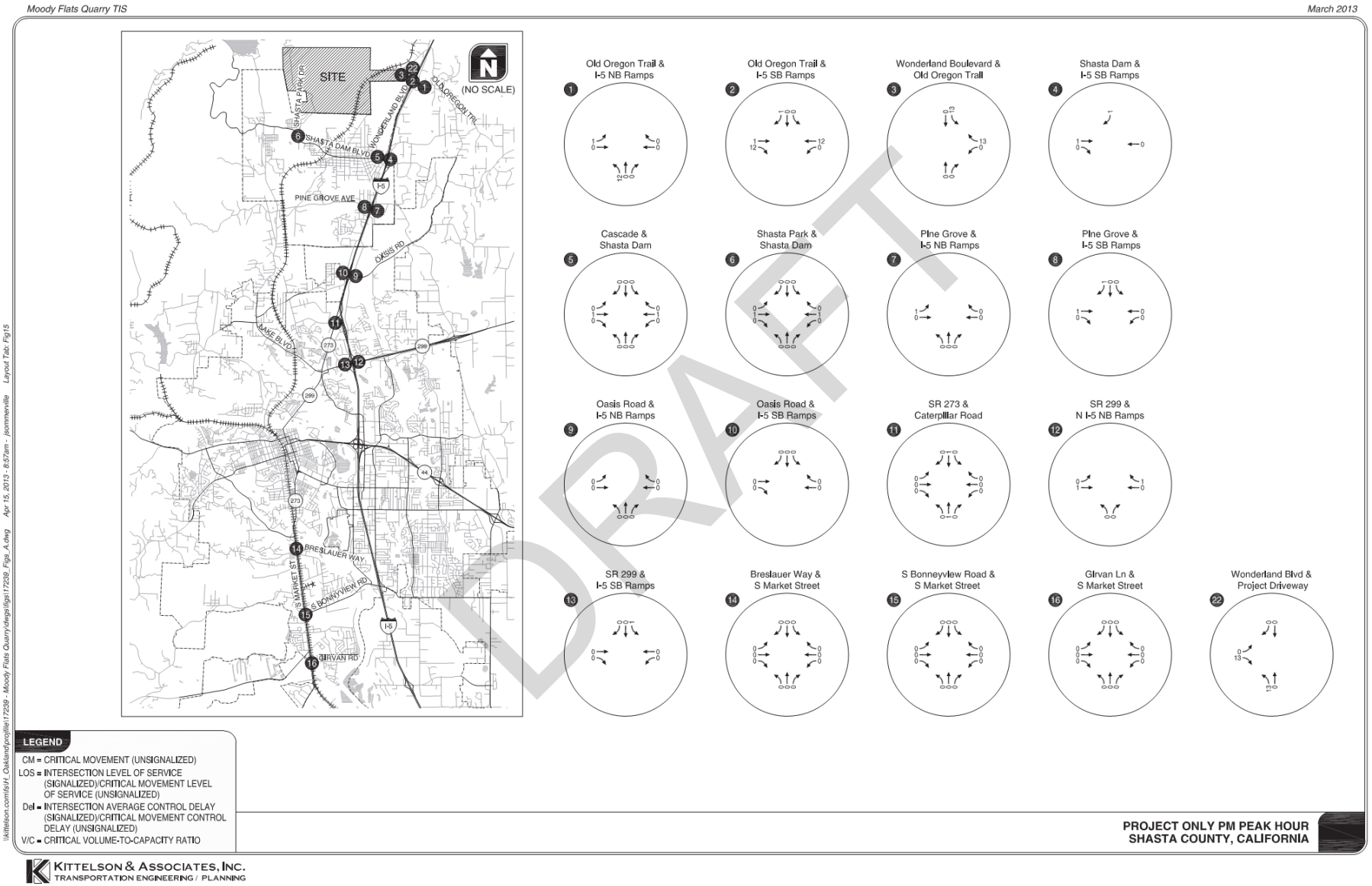
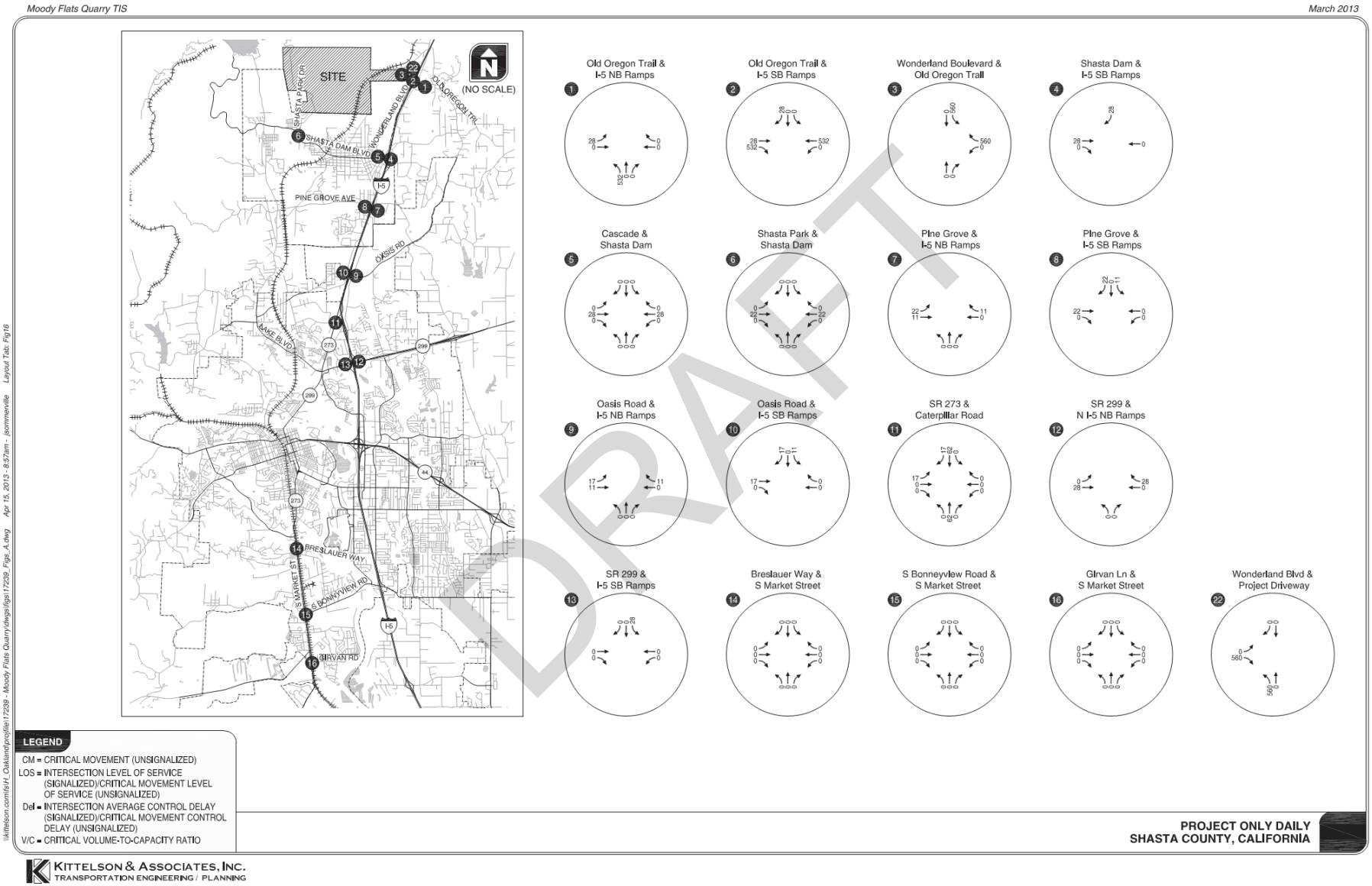


Figure 9: Project Only Weekday Volumes



Cumulative Traffic Methodology

The 2030 Cumulative No Project baseline conditions represent traffic conditions expected in 2030 without the proposed project. The cumulative 2030 traffic forecast volumes were developed based on the Shasta County travel demand model maintained by the Shasta Regional Transportation Agency (SRTA). The Shasta County model was updated in 2011 to reflect the most current information on overall countywide growth rates, specific development assumptions and road improvement projects.

Cumulative Baseline Roadway Improvements

The analysis of 2030 Cumulative No Project conditions includes the following road improvements that are assumed to be in place by 2030:

- **Improvement of the Oasis Road Interchange** - Although many potential road improvement projects in the study area were identified, only the plan to improve the Oasis Road interchange was considered likely to be funded and constructed by 2030. This project would build upon the recent completion of a loop on-ramp from westbound Oasis Road to southbound I-5 and traffic signals at the ramp intersections, which are part of the "Existing" geometry. In addition to these improvements, the cumulative scenario assumes that Oasis Road will be widened to four lanes in each direction at the I-5 interchange area, as shown in the reference material presented in 0.

- **Widening of Interstate 5** - Another project which was considered for inclusion was the widening of I-5 from SR 44 to SR 299. This segment was included in a TIGER grant proposal (see 0) to widen I-5 from South Bonnyview Road to SR 299. The proposal was partly successful as segments south of SR 44 were awarded funding for widening. Widening of I-5 south of SR 44 to six lanes was completed in 2012 and is thus reflected in the existing scenarios. With no committed funding for widening of I-5 to six lanes between SR 44 and SR 299, the cumulative I-5 geometry is assumed to be identical to the existing I-5 geometry.

The Cumulative No Project intersection lane configurations are shown in Figure 10.

Cumulative No Project Traffic Volumes

The cumulative traffic forecasts for study intersections were developed using a three-step adjustment process. The traffic forecasts for road segments and freeway segments used growth factors derived from the travel model that were applied to the traffic counts.

Intersection Traffic Volumes

Forecasts of year 2030 intersection turning movement traffic volumes were prepared based on the Shasta County travel demand model. Since the travel demand model is not calibrated to reflect the accuracy of individual turning movements at intersections, the final 2030 intersection turning movement volumes were derived by applying a series of adjustments based on NCHRP 255, *Highway Traffic Data for Urbanized Area Project Planning and Design* (Transportation Research Board, 1982). This adjustment process is recommended given that travel models are calibrated to produce more accurate results on road segments than on individual turn movements.

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The following steps describe the overall forecasting process for developing 2030 Cumulative No Project intersection traffic volumes for the Moody Flats Quarry project.

- **Step 1** – The 2030 total approach and departure link volumes on each leg at each intersection were estimated by applying the increment between the 2010 base year model estimate and the 2030 future year model estimate, and adding that increment to the 2010 base year traffic counts.

- **Step 2** – The 2030 turn movements at each intersection were estimated by factoring the 2010 turn movement traffic counts to match the adjusted 2030 approach and departure volumes from Step 1.

- **Step 3** – The estimated 2030 turn movements from Step 2 were further adjusted to fully account for two nearby development projects, Mountain Gate at Shasta Lake and Shasta Wine Village.

Factoring Process. The factoring process used for Step 2 is named after its developer, Furness. The Furness method iteratively adjusts turning movement ground counts until the directional sum of the movements balance to the adjusted future link volumes. This factoring process produces forecast turn distributions that resemble the count distribution, but turn movement proportions will change in response to different growth rates on different legs as forecast by the Shasta County Travel Demand Model. A negative growth was not allowed in the adjustment process, in other words, future turning movement volumes were not allowed to be lower than existing traffic turning movement counts. All future year turn movement volumes were reviewed and adjusted as needed to ensure a reasonable balance between intersections.

Specific Development Projects. The Shasta County travel model includes a forecast of countywide development to the year 2030, constrained to projected county economic growth rates. The model's 2030 forecast may not include all access points for specific development projects, and may not include full development and occupancy of all approved or anticipated individual development projects. However, individual traffic studies for individual development projects assume full development and occupancy regardless of economic forecasts. In order to provide consistency with traffic studies for nearby development projects, the intersection traffic forecasts based on the travel model were further adjusted based on traffic studies for two specific development projects.

Mountain Gate at Shasta Lake. The Shasta County model assumed that all access for the proposed Mountain Gate at Shasta Lake (MGS) project would be to the south through Shasta Lake, and did not include access to the north at Old Oregon Trail. Traffic model assumptions were compared to the Traffic Impact Study (TIS) prepared specifically for the MGS project (Omni-Means, 2008). The TIS assumed that 79% of MGS traffic would access the site to/from the south and 21% would access the MGS project on the north via Old Oregon Trail. The cumulative traffic volumes for this Moody Flats Quarry study were adjusted to account for the MGS north access traffic. The Shasta County model assumes that approximately 57% of the total land uses and trip generation for the MGS project will be active by 2030 (Table 13), as compared to the full buildout assumed in the TIS. To remain consistent with this 2030 phased development assumption, 57% of the full buildout MGS traffic from the TIS was added to study intersections 1 through 6, using the trip distribution from the TIS. Traffic volumes were then rebalanced between the Old Oregon Trail and Shasta Dam Boulevard interchanges.

Shasta Wine Village. The Shasta County model did not assume that the Shasta Wine Village project would be in place by 2030. Therefore the project only traffic from the Shasta Wine Village traffic study (Omni-

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Means, March 2012) was added to the Old Oregon Trail/I-5 Ramps and Old Oregon Trail/Wonderland Boulevard intersections. The Shasta Wine Village traffic study did not analyze intersections south of the Old Oregon Trail intersections. To ensure that these additional trips were reflected at the study intersections for the Moody Flats Quarry project, the additional traffic volumes from the Shasta Wine Village that would exit/enter Interstate 5 were distributed throughout the study area using a trip distribution similar to that assumed for the Moody Flats Quarry and Mountain Gate at Shasta projects.

Table 13 – Comparison of Shasta County Model Land Use with Mountain Gate at Shasta TIS

Land Use Type	Quantity	ITE Daily Trip Rates	SRTA Model Assumptions for 2030 Land Use		Mountain Gate at Shasta TIS	
			Land Use Quantity	Daily Trips	Land Use Quantity	Daily Trips
Single Family	DU	9.57	600	5,742	1,042	9,972
Multi-Family	DU	6.65	400	2,660	416	2,766
Retail	KSF	42.94	100	4,294	220	9,447
Office	KSF	3.32	---	---	15	50
Park	Acres	2.28	---	---	0.37	1
Total Trips				12,696		22,236
Percent Project Trips Assumed in Model (approximately)						**57%**
DU = Dwelling Units						
KSF = 1,000 square foot.						

Cumulative No Project 2030 weekday AM and PM peak hour intersection volumes are shown in Figure 11.

Road Segments

The forecast volumes on local road segments were estimated using growth factors applied to existing traffic counts. Base year and future year model link volumes were compared to estimate average annual growth rates. These growth rates were then applied to the roadway segment counts presented in Table 7 under the Existing No Project section. For roadway segments adjacent to a study intersection, the analysis uses the approach and departure cumulative volumes from the adjusted intersection forecasts described above. Heavy vehicle percentages were kept constant from their existing values. Consistent with the existing conditions analysis, heavy vehicle volumes were converted to passenger-car equivalents by multiplying by a 2.5 conversion factor based on the HCM 2000.

Freeway Segments

Freeway segment forecast volumes were estimated using a combination of growth factors on the I-5 mainline and the adjusted forecast intersection volumes at the freeway ramp intersections. The mainline volumes at the two control points north and south of the project area were factored based on growth rates obtained from the 2010 and 2030 scenarios from the Shasta County travel demand model. This resulted in approximately a 0.9% annual increase in entering and exiting mainline traffic volume, or slightly more than 30% over the 20 years. Freeway segment volumes *within* the study area exhibit growth due to both higher volumes at the two mainline control points and increased turning volumes at the on and off ramp intersections.

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Figure 10: Cumulative Lane Configuration

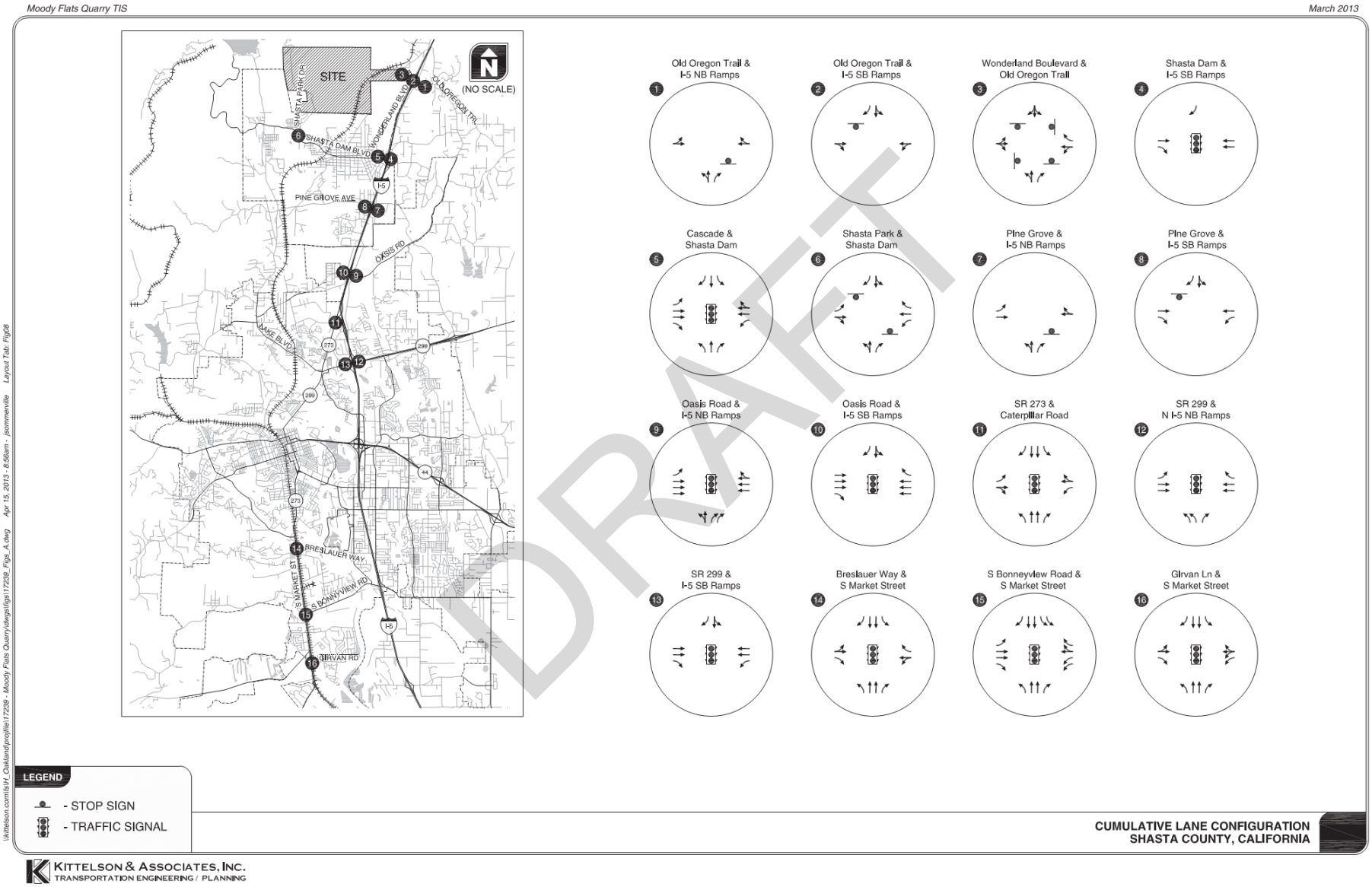


Figure 11: Cumulative No Project Traffic Volumes (AM)

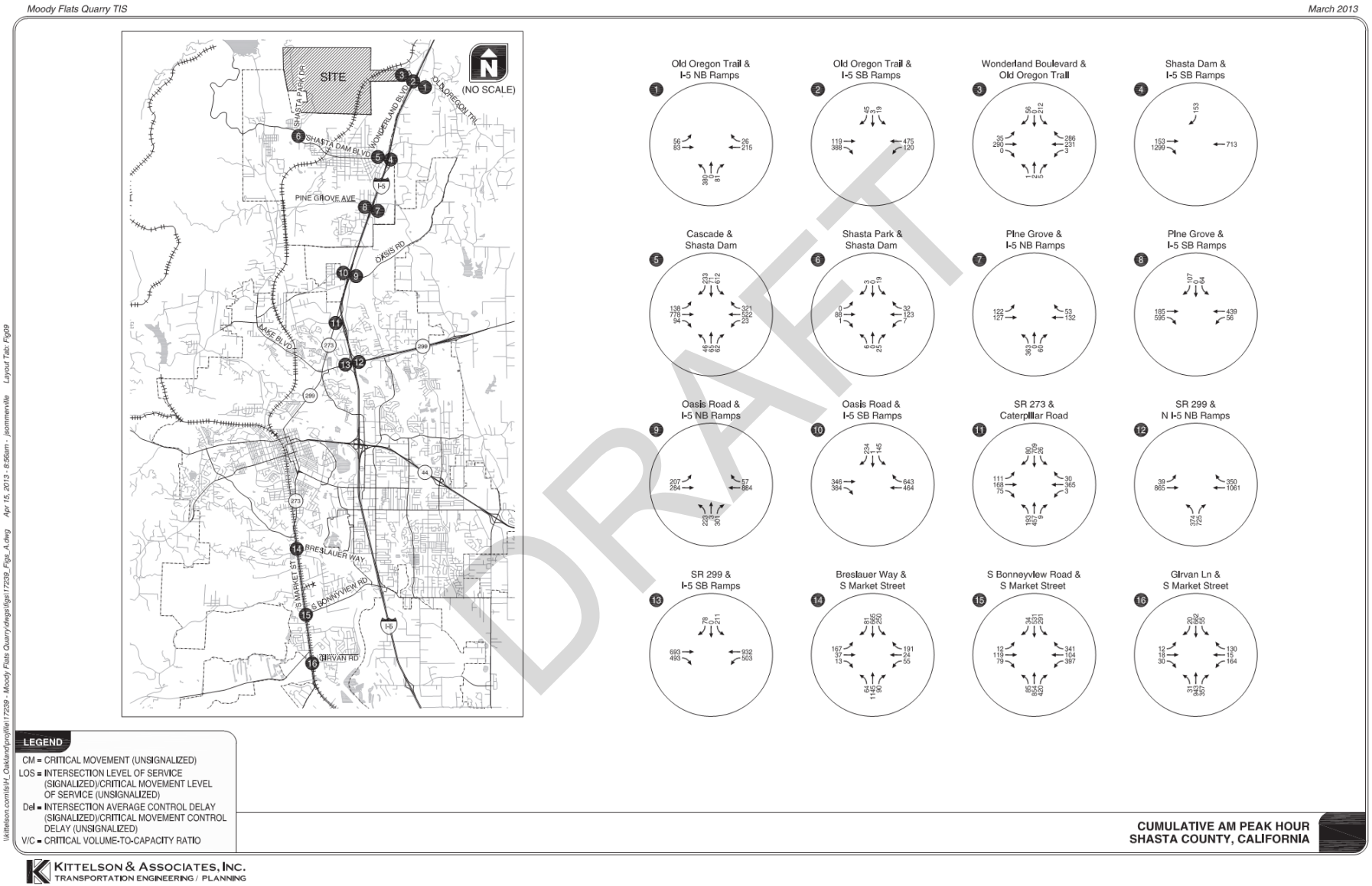
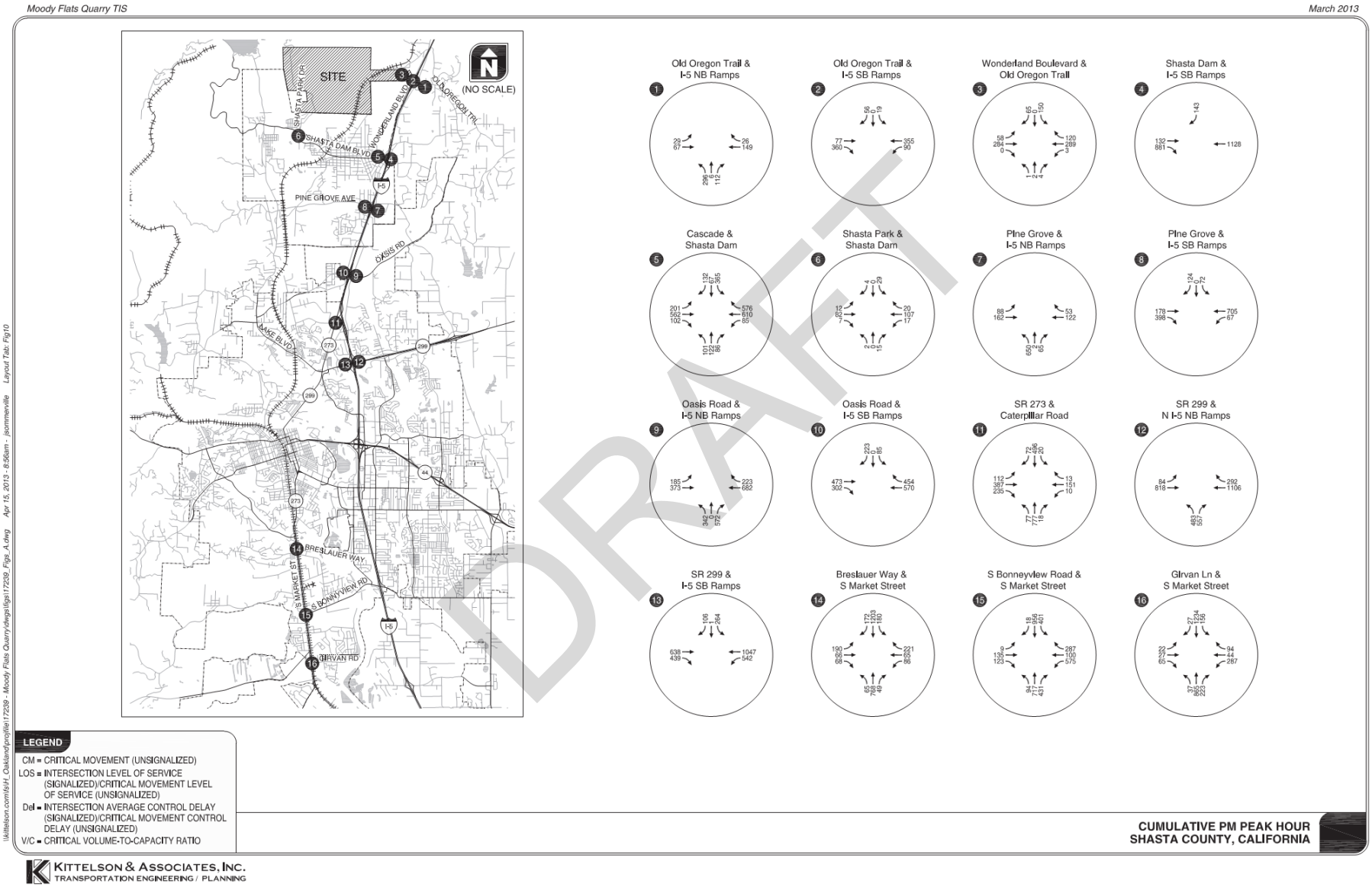


Figure 12: Cumulative No Project Traffic Volumes (PM)



Cumulative No Project Traffic Operations

Intersections

After balancing traffic volumes between interchanges on I-5 and study intersections, all turning movement volumes were input into the intersection operation analysis software SYNCHRO to estimate peak hour intersection level of service and length of queue. A future peak hour factor (PHF) of 0.92 was used at all study area locations, consistent with HCM 2000 recommended default values. Table 14 summarizes the LOS results for the study intersections under the Cumulative scenario. The LOS worksheet and calculations are presented in Appendix 4.

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Table 14: Cumulative No Project Conditions - Intersection Level of Service Analysis

Intersection	Target LOS	Control	Peak Hour	Delay	LOS	Meet Signal Warrant?
1. I-5 NB Ramps & Old Oregon Trail	C	TWSC	AM	42.5	**E**	Yes
			PM	15.3	C	No
2. I-5 SB Ramps & Old Oregon Trail	C	TWSC	AM	21.1	C	No
			PM	13.6	B	No
3. Wonderland Blvd & Old Oregon Trail	C	AWSC	AM	15.6	C	No
			PM	14.7	B	No
4. I-5 SB Off-Ramp & Shasta Dam Blvd	C	Signalized	AM	24.6	C	-
			PM	11.5	B	-
5. Cascade Blvd & Shasta Dam Blvd	C	Signalized	AM	54.8	**D**	-
			PM	52.2	**D**	-
6. Shasta Park Dr & Shasta Dam Blvd	C	TWSC	AM	10.4	B	No
			PM	10.5	B	No
7. I-5 NB Ramps & Pine Grove Ave	C	TWSC	AM	97.9	**F**	No
			PM	365	**F**	No
8. I-5 SB Ramps & Pine Grove Ave	C	TWSC	AM	16.2	C	No
			PM	26.8	**D**	No
9. I-5 NB Ramps & Oasis Rd	D	Signalized	AM	14.4	B	-
			PM	13.1	B	-
10. I-5 SB Ramps & Oasis Rd	D	Signalized	AM	8.5	A	-
			PM	8.4	A	-
11. N Market St [SR-273] & Caterpillar Rd	D	Signalized	AM	40.9	D	-
			PM	37.5	D	-
12. I-5 NB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	6.5	A	-
			PM	7.8	A	-
13. I-5 SB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	18.9	B	-
			PM	23	C	-
14. S Market St [SR-273] & Breslauer Way	D	Signalized	AM	40.7	D	-
			PM	35.9	D	-
15. S Market St [SR-273] & S Bonneyview Rd	D	Signalized	AM	37.9	D	-
			PM	43.5	D	-
16. S Market St [SR-273] & Girvan Ln	D	Signalized	AM	22.2	C	-
			PM	35.6	D	-
LOS based on HCM2000, Signal warrant is based on Peak Hour Warrant						
Control delays for unsignalized intersections are for the worst movement of the intersection (TWSC) or intersection average (AWSC)						

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Road Segments

Roadway segments volumes projected for the Cumulative No Project scenario were used to forecast the future LOS at the study segments. The Cumulative No Project daily volumes and levels of service for these segments are presented in Table 15. As shown in this table, all the study segments except Shasta Dam Boulevard between Ashby Road and Cascade Boulevard are projected to operate at an acceptable LOS C or better.

Table 15: Cumulative No Project Conditions - Roadway Level of Service Analysis

Roadway Segment	From	To	Roadway Type	Number of Lanes	Daily Volume[1]	LOS	V/C[2]
Shasta Park Drive	Project Dwy	Shasta Dam Blvd	Local Street	2	517	A	0.14
Shasta Dam Blvd	Shasta Park	Ashby Rd	Minor Collector	2	3,568	A	0.24
Shasta Dam Blvd	Ashby Rd	Cascade	Major Collector	2	17,316	**E**	0.96
Black Canyon Rd	Project Dwy	Red Bluff Ave	Local Street	2	563	A	0.15
Old Oregon Trail	Wonderland	I-5 SB Ramps	Minor Collector	2	8,755	A	0.58
Old Oregon Trail	I-5 SB Ramps	I-5 NB Ramps	Minor Collector	2	5,637	A	0.38
Wonderland Blvd.	Old Oregon Trail	Project Driveway	Minor Collector	2	4,078	A	0.27

[1]Daily Volume in Passenger Car Equivalents (PCE).
[2]The LOS E maximum service volume was used to compute the V/C ratio.

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Freeway Segments

Freeway mainline operations for Cumulative No Project conditions were evaluated for the northbound and southbound direction on Interstate 5. Freeway LOS for the AM and PM peak hour is presented in Table 16 for the northbound direction and

Table 17 for the southbound direction. In the northbound direction, the I-5 segments between SR 273 and Twin View Boulevard (#6), Twin View Boulevard and SR 299 (#7), and SR 299 and SR 44 (#8) are forecast to operate at unacceptable LOS E or worse during the AM, PM or both peak hours. In the southbound direction, all the freeway segments are anticipated to operate at acceptable LOS C or better.

Table 16: Cumulative No Project Condition - Freeway Level of Service Analysis (I-5 NB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]
I-5NB	1	North	Old Oregon Tr	63.00	17.30	B	63.00	19.25	C
	2	Old Oregon Tr	Shasta Dam	63.00	20.90	C	63.00	22.59	C
	3	Shasta Dam	Pine Grove	64.50	16.70	B	64.50	20.45	C
	4	Pine Grove	Oasis	64.50	18.08	C	64.48	23.77	C
	5	Oasis	SR 273	64.50	19.43	C	64.04	26.73	D
	6	SR 273	Twin View	62.99	24.76	C	58.62	35.50	**E**
	7	Twin View	SR 299	62.33	28.67	D	Unstable	44.36	**E**
	8	SR 299	SR 44	56.64	38.29	E	35.78	>45	**F**
	9	SR 44	South	64.36	25.19	C	63.45	28.46	D

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

Table 17: Cumulative No Project Condition - Freeway Level of Service Analysis (I-5 SB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]
I-5NB	1	North	Old Oregon Tr	63.00	10.73	A	63.00	11.97	B
	2	Old Oregon Tr	Shasta Dam	63.00	14.98	B	63.00	15.54	B
	3	Shasta Dam	Pine Grove	64.50	16.54	B	64.50	14.39	B
	4	Pine Grove	Oasis	64.50	16.40	B	64.50	15.91	B
	5	Oasis	SR 273	64.50	19.13	C	64.50	15.69	B
	6	SR 273	Twin View	63.00	22.25	C	63.00	19.02	C
	7	Twin View	SR 299	63.00	24.51	C	63.00	21.81	C
	8	SR 299	SR 44	61.05	31.58	D	62.73	27.18	D
	9	SR 44	South	64.50	15.55	B	64.50	17.38	B

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

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Cumulative No Project Recommended Improvements

This section identifies recommended improvements to address projected cumulative deficiencies. Improvements are recommended for locations where the forecasts indicate that unacceptable LOS would occur at the study intersections, roadways and freeway segments without the proposed project. The recommended improvements identified below would improve the LOS to the target LOS for the corresponding jurisdiction.

Intersections

- **I-5 NB Ramps & Old Oregon Trail** – This intersection is projected to operate at LOS E under the Cumulative No Project AM peak hour.
    - **Recommended Improvement**: Install a traffic signal. This intersection would meet the peak hour signal warrant during the AM peak hour. Installation of a traffic signal would improve the LOS to C or better.
- **Cascade Blvd and Shasta Dam Blvd** – This intersection is projected to operate at LOS D during the AM peak hour and LOS E during the PM peak hour.
    - **Recommended Improvement**: Provide an additional southbound left turn lane and convert the westbound through and a through-right turn lane to two separate through lanes and one separate right turn lane. These improvements would result in LOS C or better.
- **I-5 NB Ramps and Pine Grove Ave** – This intersection is projected to operate at LOS F during the AM and the PM peak hours. This intersection would meet the peak hour signal warrants during both peak hours.
    - **Recommended Improvement**: Install a traffic signal and convert the northbound approach from a shared left-through and a right turn lane to a separate left turn lane and a shared through-right turn lane. This improvement would improve the LOS to C or better during both the peak hours.
- **I-5 SB Ramps and Pine Grove Ave** – This intersection is projected to operate at LOS D during the PM peak hour. This intersection would not meet the peak hour signal warrants.
    - **Recommended Improvement**: There is no feasible mitigation measure to improve the LOS to C or better except installing a signal. Since the intersection does not meet the signal warrant analysis, no other mitigation measures are recommended.

Roadway Segments

- **Shasta Dam Blvd between Ashby Road and Cascade Blvd** – This segment would operate at LOS E, deficient compared to the acceptable LOS C for City of Shasta Lake roadway segments.
    - **Recommended Improvement** – The LOS at the roadway segment could be improved by adding more capacity. However, this may not be a feasible improvement.

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Freeway Segments

- **Interstate 5 Northbound between SR 273 and Twin View Boulevard –** This segment of I-5 would operate at LOS E during the PM peak hour.
    - **Recommended Improvement:** Addition of a 3rd lane in the northbound direction on Interstate 5 would mitigate the LOS to D or better.
- **Interstate 5 Northbound between Twin View Boulevard and SR 299 -** This segment of I-5 would operate at LOS E during the PM peak hour.
    - **Recommended Improvement:** Addition of a 3rd lane in the northbound direction on Interstate 5 would mitigate the LOS to D or better.
- **Interstate 5 Northbound between SR 299 and SR 44 -** This segment of I-5 would operate at LOS F during the PM peak hour.
    - **Recommended Improvement:** Addition of a 3rd lane in the northbound direction on Interstate 5 would mitigate the LOS to D or better.

All analysis worksheets for improvement measures are presented in Appendix 5.

Cumulative No Project Railroad Crossing Analysis

Several adjustments were required to represent future cumulative operating conditions at the study railroad crossing locations.

Signal Operation Adjustments

For purposes of representing future railroad crossing operations at intersections with railroad crossings, the timings at these signals were adjusted. The adjustment consisted of adding a "hold" phase—in which no movement is allowed to go—at each intersection. The length of this hold phase was equal to the prorated average train passage time, which was 7.5 seconds per signal cycle in the No Project condition (1 train per peak hour) and 12.5 seconds per signal cycle (2 trains per peak hour) with the project. These values were obtained by dividing the expected train passage time in an hour by the number of signal cycles in an hour. The minimum all-red time (0.5 seconds) and yellow times (2.0 seconds) were added to these train passage times to account for gate openings and start-up lost time.

Queue Analysis

Future signalized intersection queues were obtained from the Synchro analysis by coding additional time into the northbound and southbound through phases. This additional time, which was 120 seconds in the AM and 130 seconds in the PM, corresponds to the average train passage time. By assigning this time to through movements on South Market Street, the street paralleling the railroad tracks, the analysis emulates the passage of the train on the parallel track. The resulting 95th percentile queues on the WB and EB approaches were recorded and are presented in Table 18. To dissipate the northbound left turning queue, lead-lag phasing was assumed and part of the northbound through movement green time was allocated to the northbound left-turn as needed in order to ensure northbound left queues are cleared intermittently.

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Table 18: Railroad Crossing Queues (in number of vehicles) - Cumulative No Project

Node	Intersection	AM (cars)				PM (cars)			
		NB	WB	SB	EB	NB	WB	SB	EB
14	S Market St [SR-273] & Breslauer Way	2	14	34	24	1	22	25	25
15	S Market St [SR-273] & S Bonneyview Rd	2	26	21	6	2	34	29	8
16	S Market St [SR-273] & Girvan Ln	2	15	10	4	5	24	27	7
17	Shasta Street & Railroad Crossing	-	45	-	15	-	29	-	13
18	Tehama Street & Railroad Crossing	-	4	-	17	-	5	-	16
19	Yuba Street & Railroad Crossing	-	3	-	5	-	5	-	11
20	Placer Street & Railroad Crossing	-	30	-	19	-	25	-	23
21	South Street & Railroad Crossing	-	29	-	18	-	20	-	35

The unsignalized railroad crossings were also analyzed for train delays and resulting queues. To develop a cumulative peak hour volume data set, a growth rate was calculated based on the Shasta County model 2010 and 2030 scenarios. This growth rate was then applied to the existing tube count volumes to obtain Cumulative No Project volumes. The hourly volumes were further increased to represent a 95th percentile hourly volume-equivalent, assuming a Poisson (random) arrival rate.

Maximum queue lengths were based on the number of vehicles arriving during the train passage event. The calculations were based on the HCM 2000 Chapter 16: Signalized Intersections, which specifies that the proportion of vehicles arriving on green is:

$$P = R_p(\frac{g}{C}) \text{ from HCM 2000: Exhibit 16-12}$$

Thus, the proportion of vehicles arriving on red is 1 – P. By substituting (g/C) ratio with the proportion of the peak hour that the train does *not* block the roadway segment and assuming a random-arrival platoon ratio (R_p)—a measure of progression—of 1.0, it is possible to calculate the number of vehicles arriving during a train passage event of duration W. It can be shown through queuing theory that this number is equal to the maximum queue.

$$Q_{max} = Volume * (1 - 1.0 * \frac{3600 - W}{3600})$$

The resultant maximum queues for the Cumulative No Project condition are included in Table 18 for locations 17 to 21.

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Mitigation Share Calculations

Mitigation share percentages for recommended mitigation measures were calculated using intersection entering volumes and the equations below.

$$Mitigation\ Share\ \% = \begin{cases} \dfrac{Project\ Only\ Volume}{Existing\ Plus\ Project\ Volume}\ for\ Existing\ Scenario \\ \\ \dfrac{Project\ Only\ Volume}{Cumulative\ Plus\ Project - Existing\ No\ Project}\ for\ Cumulative\ Scenario \end{cases}$$

PROJECT EVALUATION

The impacts and mitigation measures are listed based on the relevant CEQA criterion.

Impact Criterion 1: The project would cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system.

Impact Criterion 1 is for situations where the addition of project traffic would result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections. This section includes evaluation of intersections and local road segments, for both the existing plus project and cumulative plus project scenarios. The evaluation of freeway segments is included under Impact Criterion 2.

Existing plus Project Intersection Operations

The project-only trips were added to the Existing (No Project) volumes to obtain Existing plus Project volumes (Figure 13 and Figure 14). The results of the Existing plus Project traffic analysis shown in Table 19 indicate that all of the study intersections are forecast to operate at acceptable levels of service during the weekday AM and PM peak hours.

> ***Impact 1:*** The project traffic added to existing traffic would not cause any study intersection to exceed level of service standards. The project impact on study intersections would be less than significant.
>
> ***Mitigation 1:*** No mitigation required.

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Figure 13: Existing plus Project Peak Hour Volumes (AM)

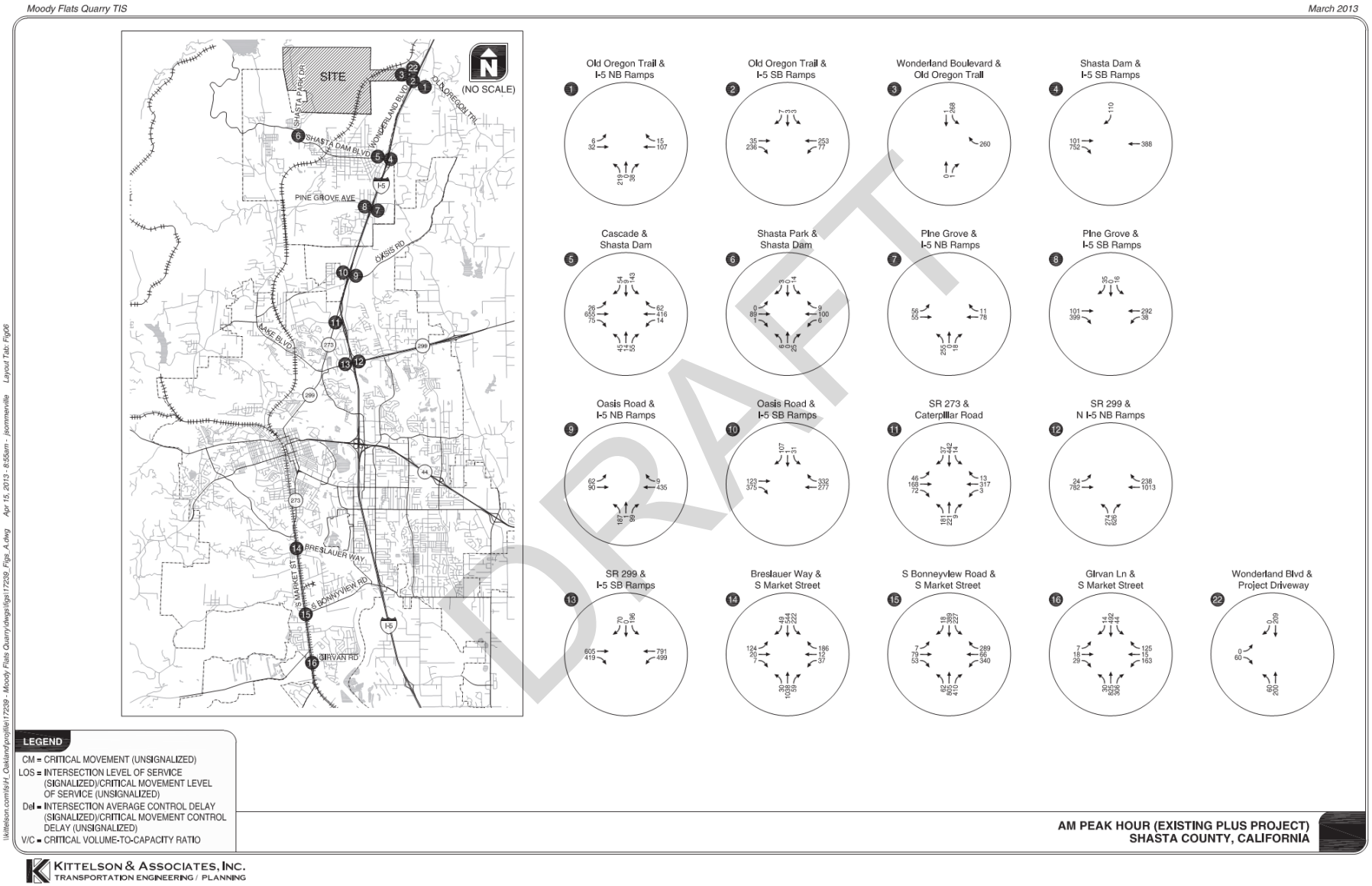

Figure 14: Existing plus Project Peak Hour Volumes (PM)

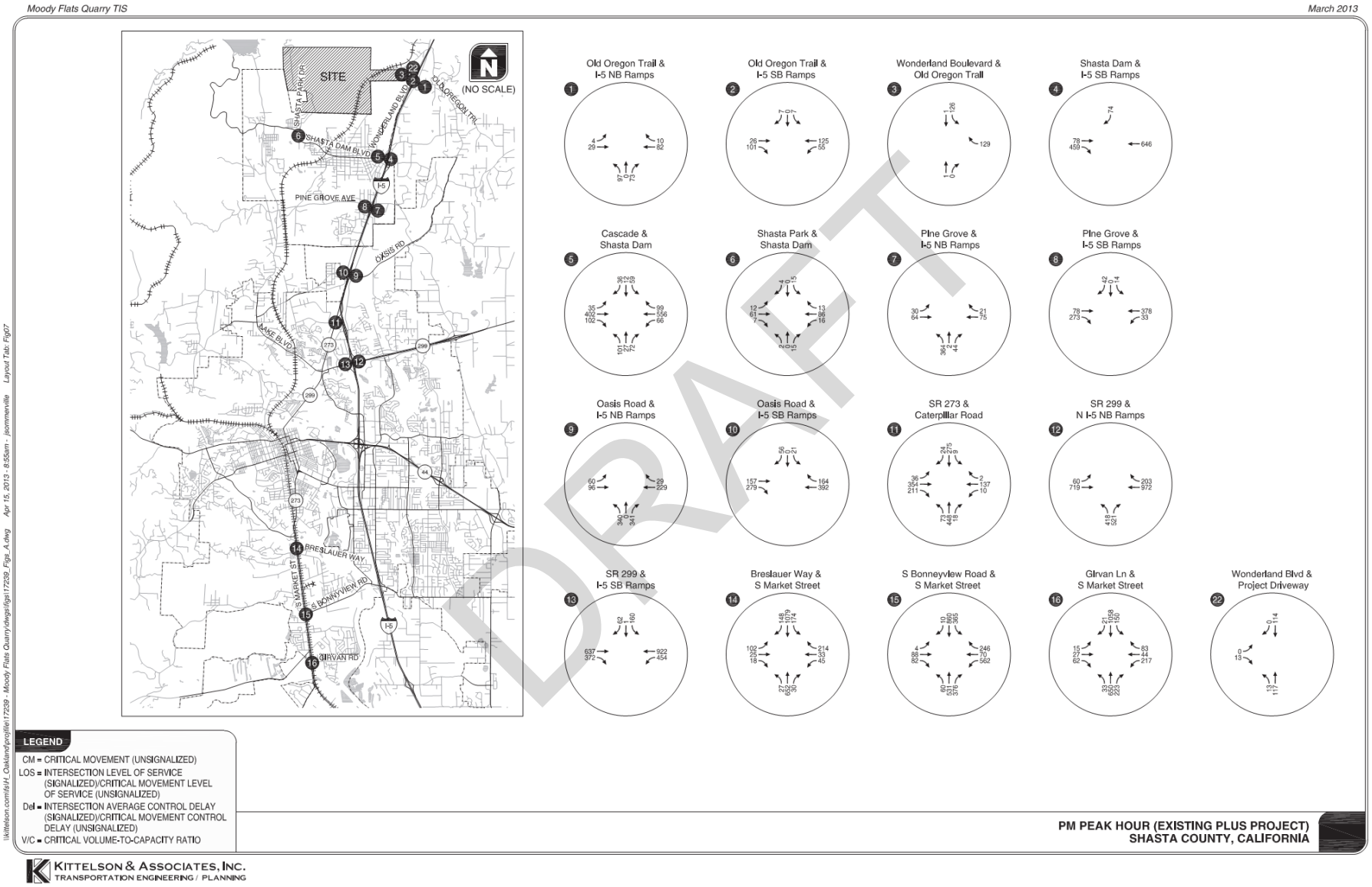

Table 19: Existing plus Project Conditions - Intersection Level of Service Analysis

Intersection	Target LOS	Control	Peak Hour	Existing No Project			Existing plus Project		
				Delay	LOS	Meet Signal Warrant?	Delay	LOS	Meet Signal Warrant?
1. I-5 NB Ramps & Old Oregon Trail	C	TWSC	AM	10.4	B	No	11.7	B	No
			PM	9.4	A	No	9.5	A	No
2. I-5 SB Ramps & Old Oregon Trail	C	TWSC	AM	12.6	B	No	13.2	B	No
			PM	10.1	B	No	10.3	B	No
3. Wonderland Blvd & Old Oregon Trail	C	TWSC	AM	9.1	A	No	11.1	B	No
			PM	8.8	A	No	9.5	A	No
4. I-5 SB Off-Ramp & Shasta Dam Blvd	C	Signalized	AM	17.3	B	---	17.2	B	---
			PM	10.5	B	---	10.5	B	---
5. Cascade Blvd & Shasta Dam Blvd	C	Signalized	AM	16.9	B	---	16.9	B	---
			PM	17.7	B	---	17.7	B	---
6. Shasta Park Dr & Shasta Dam Blvd	C	TWSC	AM	10.1	B	No	10.1	B	No
			PM	9.9	A	No	9.9	A	No
7. I-5 NB Ramps & Pine Grove Ave	C	TWSC	AM	14.2	B	No	14.4	B	No
			PM	16	C	No	16.1	C	No
8. I-5 SB Ramps & Pine Grove Ave	C	TWSC	AM	11.2	B	No	11.3	B	No
			PM	11.9	B	No	11.9	B	No
9. I-5 NB Ramps & Oasis Rd	D	Signalized	AM	11.3	B	---	11.4	B	---
			PM	9.4	A	---	9.4	A	---
10. I-5 SB Ramps & Oasis Rd	D	Signalized	AM	20.8	C	---	20.8	C	---
			PM	12.9	B	---	12.9	B	---
11. N Market St [SR-273] & Caterpillar Rd	D	Signalized	AM	36.8	D	---	36.9	D	---
			PM	48.5	D	---	48.5	D	---
12. I-5 NB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	5.8	A	---	5.7	A	---
			PM	7.5	A	---	7.5	A	---
13. I-5 SB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	20.8	C	---	20.8	C	---
			PM	17.9	B	---	18.1	B	---
14. S Market St [SR-273] & Breslauer Way	D	Signalized	AM	30.1	C	---	28.7	C	---
			PM	23.7	C	---	25	C	---
15. S Market St [SR-273] & S Bonneyview Rd	D	Signalized	AM	31.9	C	---	32.1	C	---
			PM	37.6	D	---	39.5	D	---
16. S Market St [SR-273] & Girvan Ln	D	Signalized	AM	20.2	C	---	20.9	C	---
			PM	26.9	C	---	27.8	C	---
22. Wonderland Blvd & Project Driveway	C	TWSC	AM	-	-	-	11.3	B	No
			PM	-	-	-	9.7	A	No
LOS based on HCM2000									
Signal warrant is based on Peak Hour Warrant									
Control delays for unsignalized intersections are for the worst movement of the intersection (TWSC) or intersection average (AWSC)									

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Existing plus Project Roadway Segments

The roadway level of service methodology is based on volume to capacity threshold and is insensitive to the direct input of percentage of heavy vehicles unlike the intersection LOS methodology. Therefore, to account for a significant increase in percentage of trucks on the study area roadway segments, project trips were converted into Passenger Car Equivalents (PCE) using a factor of 2.5 for heavy vehicles. The increase in volume was then compared to the volume to capacity threshold to forecast the LOS. Table 20 presents the roadway segment LOS under the Existing plus Project conditions.

Table 20: Existing plus Project Conditions - Roadway Level of Service Analysis

Roadway Segment	Roadway Type	Number of Lanes	Existing No Project			Existing plus Project		
			Daily Volume[1]	LOS	V/C[2]	Daily Volume[1]	LOS	V/C[2]
Shasta Park Dr between Project Dwy and Shasta Dam Blvd	Local Street	2	378	A	0.10	378	A	0.10
Shasta Dam Blvd between Shasta Park Dr and Ashby Rd	Minor Collector	2	3,145	A	0.21	3,252	A	0.22
Shasta Dam Blvd between Ashby Rd and Cascade Blvd	Major Collector	2	14,589	**D**	0.81	14,726	**D**	0.82
Black Canyon Rd between Project Dwy and Red Bluff Ave	Local Street	2	538	A	0.14	538	A	0.14
Old Oregon Trail between Wonderland Blvd and I-5SB Ramps	Minor Collector	2	2,995	A	0.20	5,723	A	0.38
Old Oregon Trail between I-5SB Ramps and I-5NB Ramps	Minor Collector	2	2,578	A	0.17	3,942	A	0.26
Wonderland Blvd between Old Oregon Trail and Project Dwy	Minor Collector	2	2,995	A	0.20	5,723	A	0.38

[1]Daily Volume in Passenger Car Equivalents (PCE).
[2]The LOS E maximum service volume was used to compute the V/C ratio.

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With the exception of Shasta Dam Boulevard between Ashby Road and Cascade Boulevard, all study area roadway segments are forecast to operate at an acceptable LOS under the Existing plus Project conditions. The Shasta Dam Boulevard segment was also found to operate unacceptably with Existing No Project conditions.

> ***Impact 2:*** The project would add traffic to a segment of Shasta Dam Boulevard that is already operating at a deficient LOS D without the project. Although the project would add traffic to the segment, it is not enough to increase the V/C ratio by 0.05. Therefore, the project impact is **less than significant.**
>
> ***Mitigation 2:*** No mitigation required.

Impact Criterion 2: The project would exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways.

Existing plus Project Freeway Segments

Project only trips on the freeway mainline segments were added to the Existing (No Project) freeway segment volumes to estimate Existing plus Project volumes on the freeway segments. The percentages of heavy vehicles were increased by adding the project truck trips to the overall absolute number of trucks on the freeway (estimated by using Caltrans data on volume and percentage of trucks on I-5) and recalculating the percentage of trucks on each individual segment.

The freeway segment LOS results are presented in Table 21 and Table 22. All segments except I-5 NB between SR 299 and SR 44 in the northbound direction are forecast to operate at acceptable LOS D or better with the project.

> ***Impact 3:*** The project would add traffic to one segment of northbound I-5 that is already operating at a deficient LOS E during the PM peak hour without the project. The project traffic contribution would be 0.13 percent of the total Existing plus Project traffic. Assuming an hourly capacity of 4,000 (2,000 per freeway lane), the project would add traffic that is less than one percent of the capacity. Therefore, the project impact is **less than significant.**
>
> ***Mitigation 3:*** No mitigation required.

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Table 21: Existing plus Project Condition - Freeway Level of Service Analysis (I-5NB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]
I-5NB	1	North	Old Oregon Tr	63.00	12.76	B	63.00	15.03	B
	2	Old Oregon Tr	Shasta Dam	63.00	15.14	B	63.00	16.62	B
	3	Shasta Dam	Pine Grove	64.50	11.38	B	64.50	14.12	B
	4	Pine Grove	Oasis	64.50	12.56	B	64.50	16.23	B
	5	Oasis	SR 273	64.50	13.74	B	64.50	19.67	C
	6	SR 273	Twin View	63.00	18.78	C	62.90	26.10	D
	7	Twin View	SR 299	63.00	22.16	C	61.75	30.17	D
	8	SR 299	SR 44	62.54	27.98	D	54.94	40.63	**E**
	9	SR 44	South	64.50	18.78	C	64.50	21.88	C

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

Table 22: Existing plus Project Condition - Freeway Level of Service Analysis (I-5SB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density 1 (pc/mi/ln)	LOS [2]
I-5SB	1	North	Old Oregon Tr	63.00	9.17	A	63.00	9.37	A
	2	Old Oregon Tr	Shasta Dam	63.00	12.21	B	63.00	10.79	A
	3	Shasta Dam	Pine Grove	64.50	11.78	B	64.50	9.27	A
	4	Pine Grove	Oasis	64.50	11.67	B	64.50	10.74	A
	5	Oasis	SR 273	64.50	15.38	B	64.50	11.86	B
	6	SR 273	Twin View	63.00	19.29	C	63.00	15.57	B
	7	Twin View	SR 299	63.00	21.38	C	63.00	18.19	C
	8	SR 299	SR 44	62.71	27.28	D	63.00	23.56	C
	9	SR 44	South	64.50	13.40	B	64.50	13.60	B

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

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Impact Criterion 3: The project would result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.

The Moody Flats Quarry project would not result in a change in air traffic patterns, increase air traffic levels or cause substantial safety risks for air travel.

> ***Impact 4:*** Implementation of the project would have a **less than significant** impact on air traffic.
>
> ***Mitigation 4:*** No mitigation required.

Impact Criterion 4: The project would substantially increase hazards due to a design feature or incompatible uses.

Existing plus Project Railroad Crossing Analysis

The proposed project is expected to generate about 200 annual train trips based on 80-car unit trains with 100-ton capacity per car and a maximum of two trains per day. The project generated trains are expected to be shorter than the longest existing train that was observed for the existing queue analysis in the Existing Railroad Crossings section. The Existing plus Project analysis assumes a conservative scenario of two project generated trains, one during the AM peak hour and the other during the PM peak hour. With an average headway of 1 hour and 13 minutes, there would be sufficient time between the departure of the No Project train and arrival of plus Project train (i.e., the train added by the Moody Flats Project) to dissipate traffic queues at the intersections. As a result the queues that would occur under the Project scenario are expected to be the same or better than the observed queues under No Project conditions.

> ***Impact 5:*** Implementation of the project would have a **less than significant** impact on the length of queues at railroad crossings.
>
> ***Mitigation 5:*** No mitigation required.

Collision Rates

The project is not projected to add significant traffic to the downtown Redding roadways identified as having higher-than-average crash rates.

> ***Impact 6:*** Implementation of the project would have a **less than significant** impact on collision rates.
>
> ***Mitigation 6:*** No mitigation required.

Impact Criterion 5: The project would result in inadequate emergency access.

The Moody Flats Quarry project would provide two emergency access driveways in addition to the main project entrance driveway.

> ***Impact 7:*** Implementation of the project would have a **less than significant** impact on emergency access.
>
> ***Mitigation 7:*** No mitigation required.

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Impact Criterion 6: The project would result in inadequate parking capacity.

The Moody Flats Quarry project would provide adequate parking capacity on-site for employees and visitors. There would be no parking demand at surrounding land uses.

> ***Impact 8:*** Implementation of the project would have a **less than significant** impact on parking capacity.
>
> ***Mitigation 8:*** No mitigation required.

Impact Criterion 7: The project would conflict with adopted policies, plans, or programs supporting alternative transportation.

The Moody Flats Quarry project would not conflict with adopted policies supporting transit, bicycle or pedestrian travel.

> ***Impact 9:*** Implementation of the project would have a **less than significant** impact on alternative transportation.
>
> ***Mitigation 9:*** No mitigation required.

CUMULATIVE EVALUATION

The cumulative evaluation focuses on CEQA Impact Criteria 1, 2 and 4. Cumulative conditions would have no effect on the project's potential impacts on air traffic, emergency access, parking, or policies supporting alternative modes, other than those already evaluated as project impacts.

Cumulative Impact Criterion 1: Cumulative conditions would cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system.

The Cumulative plus Project traffic analysis was performed by adding the project-generated traffic to the Cumulative No Project volumes. This section presents the traffic operations analysis for intersections and roadway segments

Cumulative plus Project Intersections

Table 23 summarizes the LOS results for the study intersections under the Cumulative plus Project scenario. The LOS worksheet and calculations are presented in Appendix 5. Except for the Wonderland Boulevard & Old Oregon Trail intersection, all the study intersections that are forecast to operate at unacceptable LOS under the plus Project scenario are also forecast to operate at unacceptable LOS without the proposed project.

> ***Impact 10:*** The project would add traffic to an intersection that would operate at a deficient LOS with cumulative traffic without the project, and the project traffic would cause the average intersection delay to increase by more than five seconds. The project impact is **significant.**

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Mitigation 10: Shasta County shall implement the following mitigation measures. The project shall contribute a proportionate share towards the cost of improvements.

- **I-5 NB Ramps & Old Oregon Trail:** This intersection is projected to operate at LOS F with cumulative traffic without the project during the AM peak hour. With the addition of project traffic, the intersection would continue to operate at LOS F and the delay would increase by more than 5 seconds**.** To mitigate this intersection, the installation of a fully-actuated traffic signal is recommended. The project would contribute 11.1 percent of the increase in traffic from existing conditions. Implementation of this mitigation measure would provide LOS B operations and reduce the impact to ***less than significant***.

Impact 11: The project would add traffic to one intersection that would operate at an acceptable LOS with cumulative traffic without the project, and the project traffic would cause the intersection to operate at a deficient LOS. The project impact is **significant.**

Mitigation 11: Shasta County shall implement the following mitigation measures. The project shall contribute a proportionate share towards the cost of improvements.

- **Wonderland Boulevard & Old Oregon Trail** – This intersection would operate at LOS C with cumulative traffic without the project. The addition of project traffic would cause the intersection to operate at LOS D, below the standard. To mitigate this intersection, provide a channelized, yield-controlled westbound right turn with at least 100 feet of storage. The project would contribute 14.5 percent of the increase in traffic from existing conditions. Implementation of the mitigation measure would provide LOS C operations and reduce the impact to ***less than significant.***

Impact 12: The project would add traffic to two intersections that would operate at a deficient LOS with cumulative traffic without the project, but the project traffic would not cause the average intersection delay to increase by more than five seconds. The project impact is **less than significant.**

- **Cascade Blvd and Shasta Dam Blvd** - This intersection would operate at LOS E with Cumulative No Project conditions and the project would cause delay to increase by less than 5 seconds.
- **I-5 NB Ramps & Pine Grove Avenue:** This intersection is projected to operate at LOS F under the Cumulative No Project conditions and the project would cause delay to increase by less than 5 seconds.
- **I-5 SB Ramps and Pine Grove Ave** - This intersection would operate at LOS D with Cumulative No Project conditions and the project would cause delay to increase by less than 5 seconds.

Mitigation 12: No mitigation is required.

Cumulative plus Project Roadway Segments

Project generated traffic volumes were added to the roadway segments volumes developed for the Cumulative No Project scenario to forecast the future LOS on the study road segments (Table 24). All the study area segments except Shasta Dam Boulevard are projected to operate at an acceptable LOS. The Shasta Dam Boulevard segment is projected to perform unacceptably even without the project.

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Impact 13: The project would add traffic to a segment of Shasta Dam Boulevard that would operate at a deficient LOS E without the project. Although the project would add traffic to the segment, it is not enough to increase the V/C ratio by 0.05. Therefore, the project impact is **less than significant.**

Mitigation 13: No mitigation required.

Cumulative Impact Criterion 2: Cumulative travel would exceed a level of service standard established by the county congestion management agency for designated roads or highways.

Cumulative plus Project Freeway Segments

Freeway mainline operations for Cumulative plus Project conditions were evaluated for the northbound and southbound direction on Interstate 5. Freeway LOS for the AM and PM peak hour is presented in Table 25 for the northbound direction and

Table 26 for the southbound direction. In the northbound direction, I-5 segments between SR 273 and Twin View Boulevard (#6), Twin View Boulevard and SR 299 (#7), and SR 299 and SR 44 (#8) are forecast to operate at unacceptable LOS E or worse during the AM, PM or both peak hours as shown in the tables below. In the southbound direction, all the freeway segments are projected to operate at acceptable LOS D or better.

Impact 14: The project would add traffic to three segments of northbound I-5 that are already projected to operate at a deficient LOS E or worse during the PM peak hour without the project. The project traffic contribution would be 2.4 percent of the traffic volume increment from existing conditions on the northbound I-5 segment between SR 44 and SR 299 and 0.7 percent of the traffic increase at the other two segments. Assuming an hourly capacity of 4,000 (2,000 per freeway lane), the project would add traffic that is less than one percent of the capacity. Therefore, the project impact is **less than significant.**

Mitigation 14: No mitigation required.

All analysis worksheets for mitigation measures are presented in Appendix 5**.**

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Figure 15: Cumulative plus Project Traffic Volumes (AM)

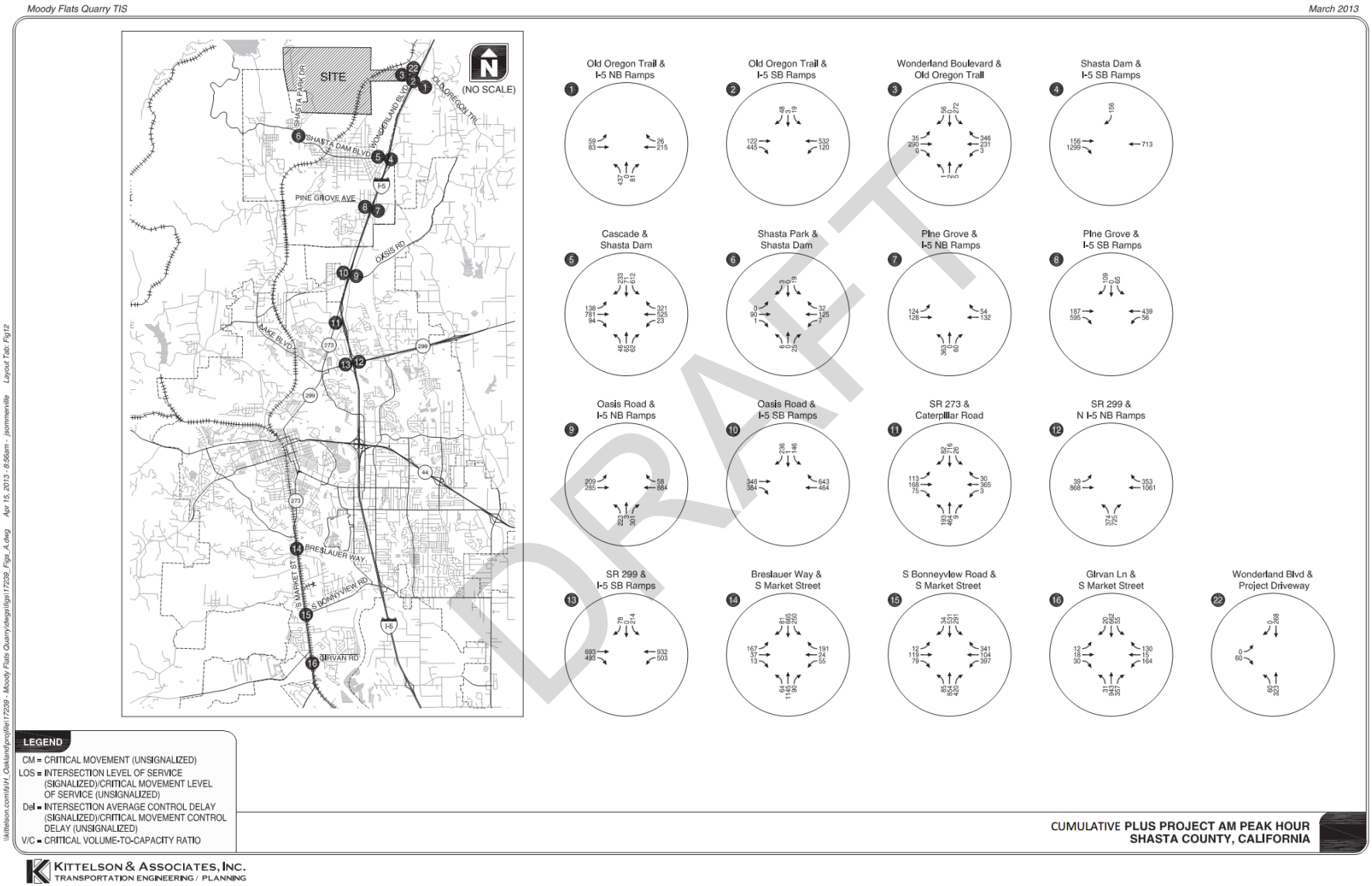

Figure 16: Cumulative plus Project Traffic Volumes (PM)

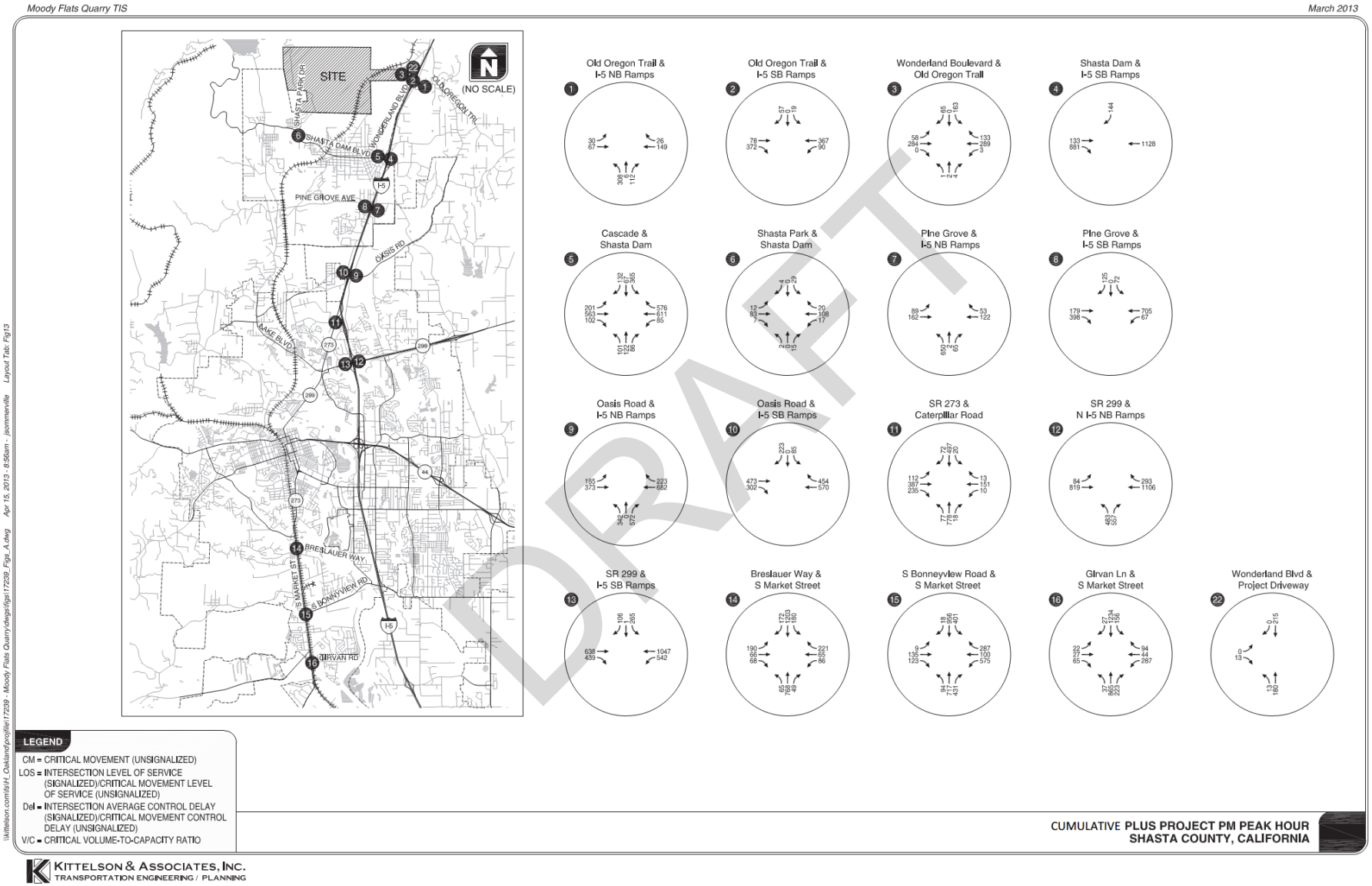

Table 23: Cumulative plus Project Conditions - Intersection Level of Service Analysis

Intersection	Target LOS	Control	Peak Hour	Cumulative No Project			Cumulative plus Project		
				Delay	LOS	Meet Signal Warrant?	Delay	LOS	Meet Signal Warrant?
1. I-5 NB Ramps & Old Oregon Trail	C	TWSC	AM	42.5	**E**	Yes	113.7	**F**	No
			PM	15.3	C	No	16.6	C	No
2. I-5 SB Ramps & Old Oregon Trail	C	TWSC	AM	21.1	C	No	24.7	C	No
			PM	13.6	B	No	14.1	B	No
3. Wonderland Blvd & Old Oregon Trail	C	AWSC	AM	15.6	C	No	31.5	**D**	No
			PM	14.7	B	No	16.5	C	No
4. I-5 SB Off-Ramp & Shasta Dam Blvd	C	Signalized	AM	24.6	C	-	24.6	C	-
			PM	11.5	B	-	11.5	B	-
5. Cascade Blvd & Shasta Dam Blvd	C	Signalized	AM	54.8	**D**	-	54.8	**D**	-
			PM	52.2	**D**	-	52.2	**D**	-
6. Shasta Park Dr & Shasta Dam Blvd	C	TWSC	AM	10.4	B	No	10.4	B	No
			PM	10.5	B	No	10.5	B	No
7. I-5 NB Ramps & Pine Grove Ave	C	TWSC	AM	97.9	**F**	No	102.8	**F**	Yes
			PM	365	**F**	No	368.8	**F**	Yes
8. I-5 SB Ramps & Pine Grove Ave	C	TWSC	AM	16.2	C	No	16.6	C	No
			PM	26.8	**D**	No	27	**D**	No
9. I-5 NB Ramps & Oasis Rd	D	Signalized	AM	14.4	B	-	14.7	B	-
			PM	13.1	B	-	13.1	B	-
10. I-5 SB Ramps & Oasis Rd	D	Signalized	AM	8.5	A	-	8.6	A	-
			PM	8.4	A	-	8.4	A	-
11. N Market St [SR-273] & Caterpillar Rd	D	Signalized	AM	40.9	D	-	41.8	D	-
			PM	37.5	D	-	38.2	D	-
12. I-5 NB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	6.5	A	-	6.5	A	-
			PM	7.8	A	-	7.8	A	-
13. I-5 SB Ramps & SR-299 [Lake Blvd E]	D	Signalized	AM	18.9	B	-	19.2	B	-
			PM	23	C	-	23.2	C	-
14. S Market St [SR-273] & Breslauer Way	D	Signalized	AM	40.7	D	-	41.4	D	-
			PM	35.9	D	-	37.2	D	-
15. S Market St [SR-273] & S Bonneyview Rd	D	Signalized	AM	37.9	D	-	38.9	D	-
			PM	43.5	D	-	45.2	D	-
16. S Market St [SR-273] & Girvan Ln	D	Signalized	AM	22.2	C	-	22.7	C	-
			PM	35.6	D	-	34.7	C	-
22. Wonderland Blvd & Project Driveway	C	TWSC	AM	-	--	-	12	B	No
			PM	-	-	-	10.4	B	No

LOS based on HCM2000

Signal warrant is based on Peak Hour Warrant

Control delays for unsignalized intersections are for the worst movement of the intersection (TWSC) or intersection average (AWSC)

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Table 24: Cumulative plus Project Conditions - Roadway Level of Service Analysis

Roadway Segment	Roadway Type	Number of Lanes	Cumulative No Project			Cumulative plus Project		
			Daily Volume[1]	LOS	V/C[2]	Daily Volume[1]	LOS	V/C[2]
Shasta Park Dr between Project Dwy and Shasta Dam Blvd	Local Street	2	517	A	0.14	517	A	0.14
Shasta Dam Blvd between Shasta Park Dr and Ashby Rd	Minor Collector	2	3,568	A	0.24	3,675	A	0.25
Shasta Dam Blvd between Ashby Rd and Cascade Blvd	Major Collector	2	17,316	**E**	0.96	17,453	**E**	0.97
Black Canyon Rd between Project Dwy and Red Bluff Ave	Local Street	2	563	A	0.15	563	A	0.15
Old Oregon Trail between Wonderland Blvd and I-5SB Ramps	Minor Collector	2	8,755	A	0.58	11,483	C	0.77
Old Oregon Trail between I-5SB Ramps and I-5NB Ramps	Minor Collector	2	5,637	A	0.38	7,001	A	0.47
Wonderland Blvd between Old Oregon Trail and Project Dwy	Minor Collector	2	4,078	A	0.27	6,806	A	0.45

[1]Daily Volume in Passenger Car Equivalents (PCE).

[2]The LOS E maximum service volume was used to compute the V/C ratio.

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Table 25: Cumulative plus Project Condition - Freeway Level of Service Analysis (I-5NB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]
I-5NB	1	North	Old Oregon Tr	63.00	17.35	B	63.00	19.27	C
	2	Old Oregon Tr	Shasta Dam	63.00	21.56	C	63.00	22.81	C
	3	Shasta Dam	Pine Grove	64.50	17.09	B	64.50	20.59	C
	4	Pine Grove	Oasis	64.50	18.43	C	64.48	23.92	C
	5	Oasis	SR 273	64.50	19.77	C	64.01	26.86	D
	6	SR 273	Twin View	62.98	25.22	C	58.42	35.79	**E**
	7	Twin View	SR 299	62.14	29.21	D	Unstable	44.80	**E**
	8	SR 299	SR 44	56.00	39.18	E	35.28	>45	**F**
	9	SR 44	South	64.33	25.42	C	63.43	28.50	D

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

Table 26: Cumulative plus Project Condition - Freeway Level of Service Analysis (I-5SB)

Freeway	Section	From	To	AM Peak			PM Peak		
				Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]	Average Speed (mph)	Density [1] (pc/mi/ln)	LOS [2]
I-5SB	1	North	Old Oregon Tr	63.00	10.76	A	63.00	11.98	B
	2	Old Oregon Tr	Shasta Dam	63.00	15.60	B	63.00	15.73	B
	3	Shasta Dam	Pine Grove	64.50	16.93	B	64.50	14.51	B
	4	Pine Grove	Oasis	64.50	16.79	B	64.50	16.03	B
	5	Oasis	SR 273	64.50	19.47	C	64.50	15.80	B
	6	SR 273	Twin View	63.00	22.68	C	63.00	19.16	C
	7	Twin View	SR 299	62.99	24.94	C	63.00	21.95	C
	8	SR 299	SR 44	60.74	32.16	D	62.70	27.32	D
	9	SR 44	South	64.50	15.77	B	64.50	17.43	B

[1] Density expressed in pc/mi/ln, passenger cars per mile per lane

[2] Level of service is based on density as described in Basic Freeway Segment, Chapter 23, HCM 2000

Bold indicates locations that do not satisfy Caltrans deficiency criteria

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Cumulative Impact Criterion 4: Cumulative conditions would substantially increase hazards due to a design feature or incompatible uses.

Cumulative plus Project Railroad Crossing Analysis

The proposed project is expected to generate about 200 annual train trips based on 80-car unit trains with 100-ton capacity per car with a maximum of two trains per day. The project-generated trains are expected to be shorter than the longest existing train that was observed for the queue analysis in Table 18. Additionally, the Cumulative plus Project analysis assumes the worst case scenario of two project-generated trips, one during the AM peak hour and other during the PM peak. With an average headway of 1 hour and 13 minutes, there would be sufficient time between the departure of the current train and arrival of a Project-added train to dissipate queues at the intersection. As a result, the queues that would occur under the plus Project scenario due to the additional train are expected to be the same or better than the observed queues under No Project conditions.

> ***Impact 15:*** The project would not increase maximum queues at railroad crossings compared to Cumulative No Project conditions. Therefore, the project impact is **less than significant.**
>
> ***Mitigation 15:*** No mitigation required.

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Section 7
Additional Project Evaluation

ADDITIONAL PROJECT EVALUATION

This section includes evaluation of project transportation issues that are not related to thresholds of significance for impact criteria. These issues include the project effects on pavement conditions and an assessment of truck turning movements at intersections.

PROJECT EFFECTS ON PAVEMENT CONDITIONS

The effect of traffic on pavement is measured through use of the Traffic Index (TI). The Traffic Index is a measure of the number of equivalent single-axle loads (ESAL) expected in the traffic lane over the pavement design life of the facility. Traffic indexes for the study roadway segments were calculated in accordance to the *California Highway Design Manual*, Chapter 610: Pavement Engineering Considerations (5).

$$Traffic\ Index\ = 9.0 * \left(\frac{ESAL * Lane\ Distribution\ Factor}{10^6}\right)^{0.119}$$

The resulting TI provides an estimate of traffic loading during the pavement design life. The primary factor for determining pavement load is the projected average annual daily truck volumes. The TI calculations are presented by lane.

Table 27 shows the No Project and plus Project TIs for the study roadway segments. The equivalent TIs for the study ramps are presented in Table 28.

The analysis indicates that the project would increase traffic index requirements slightly on the Shasta Dam Boulevard segments and more significantly on the two Old Oregon Trail segments. Project traffic through the Wonderland Boulevard segment from Old Oregon Trail to the project's driveway is also expected to result in higher Traffic Index requirements. No impacts are expected at the Shasta Park Drive or Black Canyon Road segments due to minimal project traffic.

At the I-5 freeway ramps, only the I-5 NB off-ramp and I-5 SB on-ramp at Old Oregon Trail would have significantly higher Traffic Index requirements in the plus Project scenario. The Market Street (SR 299) NB on-ramp is expected to have a slightly larger 10-Year Traffic Index compared to No Project conditions.

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Table 27: Road Segments No Project and plus Project Traffic Indexes

Location	Traffic Index	No Project		plus Project	
		EB or NB	WB or SB	EB or NB	WB or SB
		Lane 1	Lane 1	Lane 1	Lane 1
Shasta Park Drive – Project Dwy. To Shasta Dam Blvd.					
10 Year Design Constant - TI_{10}	TI_{10}	5.00	5.00	5.00	5.00
20 Year Design Constant - TI_{20}	TI_{20}	5.50	5.50	5.50	5.50
30 Year Design Constant - TI_{30}	TI_{30}	5.50	5.50	5.50	5.50
Shasta Dam – Shasta Park to Ashby Rd.					
10 Year Design Constant - TI_{10}	TI_{10}	6.50	6.50	**7.50**	**7.50**
20 Year Design Constant - TI_{20}	TI_{20}	7.00	7.00	**8.00**	**8.00**
30 Year Design Constant - TI_{30}	TI_{30}	7.50	7.50	**8.50**	**8.50**
Shasta Dam – Ashby Rd. to Cascade					
10 Year Design Constant - TI_{10}	TI_{10}	7.50	7.50	**8.00**	**8.00**
20 Year Design Constant - TI_{20}	TI_{20}	8.00	8.00	**9.00**	**9.00**
30 Year Design Constant - TI_{30}	TI_{30}	8.50	8.50	**9.50**	**9.00**
Black Canyon – Project Dwy to Red Bluff Ave.					
10 Year Design Constant - TI_{10}	TI_{10}	5.50	5.00	5.50	5.00
20 Year Design Constant - TI_{20}	TI_{20}	6.00	5.50	6.00	5.50
30 Year Design Constant - TI_{30}	TI_{30}	6.00	6.00	6.00	6.00
Old Oregon Trail – Wonderland to I-5 SB Ramps					
10 Year Design Constant - TI_{10}	TI_{10}	7.00	7.00	**10.50**	**10.50**
20 Year Design Constant - TI_{20}	TI_{20}	7.50	7.50	**11.50**	**11.50**
30 Year Design Constant - TI_{30}	TI_{30}	8.00	8.00	**12.00**	**12.00**
Old Oregon Trail – I-5 SB Ramps to I-5 NB Ramps					
10 Year Design Constant - TI_{10}	TI_{10}	6.00	7.50	**8.50**	**10.50**
20 Year Design Constant - TI_{20}	TI_{20}	6.50	8.00	**9.50**	**11.00**
30 Year Design Constant - TI_{30}	TI_{30}	7.00	8.50	**10.00**	**12.00**
Wonderland Blvd. -- Old Oregon Trail to Project Driveway					
10 Year Design Constant - TI_{10}	TI_{10}	7.00	7.00	**10.50**	**10.50**
20 Year Design Constant - TI_{20}	TI_{20}	7.50	7.50	**11.50**	**11.50**
30 Year Design Constant - TI_{30}	TI_{30}	8.00	8.00	**12.00**	**12.00**
Dark shading and bold numbers indicate Traffic Indexes that are higher in the plus Project scenario than in the No Project scenario.					

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Table 28: Ramps' No Project and plus Project Traffic Indexes

Location	No Project[1]					plus Project[1]				
	NB On	**NB Off**	**SB On**	**SB Off**	**SB Off[2]**	**NB On**	**NB Off**	**SB On**	**SB Off**	**SB Off[2]**
Old Oregon Trail										
10 Year Design Constant - TI_{10}	9.0	9.0	9.0	9.0		9.0	**10.5**	**10.5**	9.0	
20 Year Design Constant - TI_{20}	10.0	10.0	10.0	10.0		10.0	**11.5**	**11.5**	10.0	
30 Year Design Constant - TI_{30}	11.0	11.0	11.0	11.0		11.0	**12.0**	**12.0**	11.0	
Shasta Dam Blvd										
10 Year Design Constant - TI_{10}	9.0			9.0		9.0			9.0	
20 Year Design Constant - TI_{20}	10.0			10.0		10.0			10.0	
30 Year Design Constant - TI_{30}	11.0			11.0		11.0			11.0	
Pine Grove Ave										
10 Year Design Constant - TI_{10}	9.0			9.0		9.0			9.0	
20 Year Design Constant - TI_{20}	10.0			10.0		10.0			10.0	
30 Year Design Constant - TI_{30}	11.0			11.0		11.0			11.0	
Oasis Rd										
10 Year Design Constant - TI_{10}	9.0			9.0		9.0			9.0	
20 Year Design Constant - TI_{20}	10.0			10.0		10.0			10.0	
30 Year Design Constant - TI_{30}	11.0			11.0		11.0			11.0	
N Market St (SR 273)										
10 Year Design Constant - TI_{10}	9.0			9.0	9.0	**9.5**			9.0	9.0
20 Year Design Constant - TI_{20}	10.0			10.0	10.0	10.0			10.0	10.0
30 Year Design Constant - TI_{30}	11.0			11.0	11.0	11.0			11.0	11.0
SR 299										
10 Year Design Constant - TI_{10}	9.0			9.0		9.0			9.0	
20 Year Design Constant - TI_{20}	10.0			10.0		10.0			10.0	
30 Year Design Constant - TI_{30}	11.0			11.0		11.0			11.0	

[1]Truck Traffic Class = Medium dictates that traffic indexes should not be less than 9.0, 10.0, or 11.0 for 10-, 20-, and 30-year designs, respectively.
[2]This column is for ramps with a second lane
Dark shading and bold numbers indicate Traffic Indexes that are higher in the plus Project scenario than in the No Project scenario.

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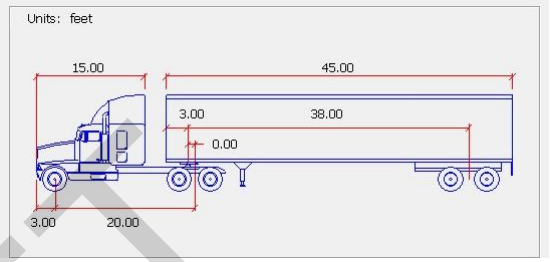
TRUCK TURNING MOVEMENTS

For each turning movement for which project trips are greater than zero, the ability of California standard 65-foot long design vehicles to make turns within the existing available pavement was evaluated. Checks were also made to determine if turns can be made without encroaching on adjacent unpaved areas and without encroaching on travel lanes for on-coming traffic. The AutoTurns software package was used to overlay truck turning paths on aerial photos of the existing intersections to make the determinations. Appendix 7 presents the worksheets used to make these determinations.

The vehicle assumed for this analysis was the California standard 65-foot design vehicle with a 45-foot trailer (CA LEGAL-50, see Figure 17). When its paths were applied to the study intersections, the following turning conditions were identified:

Figure 17: Schematic of AutoTurns Design Vehicle



Intersection 1 – Old Oregon Trail & I-5 NB Ramps

Trucks exiting northbound I-5 and turning left onto Old Oregon Trail must encroach into the oncoming travel lane to complete their turn within existing pavement. Since these trucks must stop and wait for adequate gaps regardless, no revisions are needed.

Intersection 2 – Old Oregon Trail & I-5 SB Ramps

No turning movement problems are expected.

Intersection 3 – Old Oregon Trail & Wonderland Boulevard

The project would not add any right- or left-turning vehicles at this intersection. Therefore, no turning movement problems are expected.

Intersection 4 – Shasta Dam Boulevard & I-5 SB Ramp

Trucks exiting southbound I-5 and turning right onto Shasta Dam Blvd must use the shoulder if they want to keep their turn within the outside lane. However, because a signal is in place at this intersection, trucks can turn onto the inside lane without disrupting traffic. As a result, no revisions are needed.

Intersection 5 – Shasta Dam Boulevard & Cascade Boulevard

The project would not add any right- or left-turning vehicles at this intersection. Therefore, no turning movement problems are expected.

Intersection 6 – Shasta Dam Boulevard & Cascade Boulevard

The project would not add any right- or left-turning vehicles at this intersection. Therefore, no turning movement problems are expected.

Intersection 7 – Pine Grove Avenue & I-5 NB Ramps

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Trucks entering northbound I-5 from eastbound Pine Grove Avenue may need to use the roadway shoulder to complete their turn. Since it is a minimal intrusion, no revisions are needed.

Intersection 8 – Pine Grove Avenue & I-5 SB Ramps

Trucks exiting southbound I-5 and turning left onto Pine Grove Avenue must encroach onto opposing travel lanes, especially the westbound left turn (i.e., vehicles wishing to enter southbound I-5). Because vehicles on the westbound left turn lane must yield to eastbound Pine Grove Avenue traffic, there may be a queue in the path of the trucks. Re-striping the pavement or adding a "KEEP CLEAR" marking to maintain a clear path is recommended.

Intersection 9 – Oasis Road & I-5 NB Ramps

Trucks entering northbound I-5 from eastbound Oasis Road are expected to have trouble completing their turn in the narrow intersection. Because this problem will be solved by the proposed Oasis Road widening, no additional revisions are recommended.

Intersection 10 – Oasis Road & I-5 SB Ramps

Trucks exiting southbound I-5 and turning left onto Oasis Road may encroach into the opposing travel lane, near its stop bar. Because the intrusion is minimal and the Oasis Road widening will alleviate it, no additional revisions are recommended.

Intersection 11 – N Market Street (S.R. 273) & Caterpillar Road

No turning movement problems are expected.

Intersection 12 – S.R. 299 & I-5 NB Ramps

No turning movement problems are expected.

Intersection 13 – S.R. 299 & I-5 SB Ramps

No turning movement problems are expected.

Intersection 14 – S.R. 273 & Brensaluer Way

The project would not add any right- or left-turning vehicles at this intersection. Therefore, no turning movement problems are expected.

Intersection 15 – S.R. 273 & S Bonneyview Road

The project would not add any right- or left-turning vehicles at this intersection. Therefore, no turning movement problems are expected.

Intersection 16 – S.R. 273 & Girvan Lane

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The project would not add any right- or left-turning vehicles at this intersection. Therefore, no turning movement problems are expected.

Intersection 22 – Wonderland Boulevard & Project Driveway

Turning templates have been overlaid over the existing Wonderland Boulevard segment, at the approximate location and angle of the proposed project driveway as shown in the site plan (Figure 2). No turning movement problems are expected if the project sponsor designs the project driveway with (a) a flared approach and departure and/or (b) a skewed intersection angle that allows trucks to access the project easily from Wonderland Boulevard (south of the driveway).

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Section 8
Conclusions and Recommendations

CONCLUSIONS AND RECOMMENDATIONS

The potential traffic impact of the Moody Flats Quarry project can be feasibly mitigated by following the recommended mitigation measures. None of the mitigation measures are needed in the Existing (2012) plus Project scenario. The project's impact would become significant when there is increased cumulative traffic in 2030, particularly from approved projects in the project's vicinity.

- Shasta County should coordinate with the project sponsor to implement a mitigation monitoring program for the intersections forecasted to have significant impacts, beginning with the opening of neighboring approved projects and ending in 2030 or when mitigations are implemented. It is expected that mitigations would be needed shortly after the Mountain Gate at Shasta project adds traffic on Old Oregon Trail.

- To minimize truck-passenger car conflicts on Wonderland Boulevard, the project sponsor should consider designing the Wonderland Boulevard project driveway with (a) a flared approach and departure and/or (b) a skewed intersection angle, enabling trucks to access the project easily from Wonderland Boulevard (south of the driveway).

- Traffic Index requirements (i.e., for pavement loading) would be significantly higher (2.0-4.0) at the Old Oregon Trail interchange with project traffic. The TI on Shasta Dam Boulevard is expected to be between 0.5 and 1.0 higher due to the addition of project traffic (based on the assumptions that the trip distribution assigns 5% of project-generated traffic to Shasta Dam Boulevard). As a result, the project sponsor should coordinate with Shasta County to ensure that the roadways' base structures can handle these higher Traffic Indexes.

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REFERENCES

1. **City of Redding.** City of Redding 2000-2020 General Plan. *Planning Division.* [Online] 2000. [Cited: 5 23, 2012.] http://www.ci.redding.ca.us/devserv/planning/index.html.

2. **Caltrans.** *2010 Traffic Volumes on the California State Highway System.* Sacramento, CA : Division of Traffic Operations, 2010.

3. —. Peak Hour Volume. *Traffic Counts.* [Online] 2010. http://traffic-counts.dot.ca.gov/.

4. **Shasta County Regional Transportation Planning Agency.** *2010 Regional Transportation Plan for Shasta County.* Redding, CA : Shasta County, 2010.

5. **Caltrans.** *Highway Design Manual.* Sacramento, CA : Caltrans, 2008.

6. —. 2010 All Traffic Volumes on CSHS. [Online] Traffic and Vehicle Data Systems Unit, 2011. [Cited: 5 22, 2012.] http://traffic-counts.dot.ca.gov/2010all/index.html.

7. **Transportation Research Board.** *Highway Capacity Manual.* Washington, D.C. : TRB, 2010.

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