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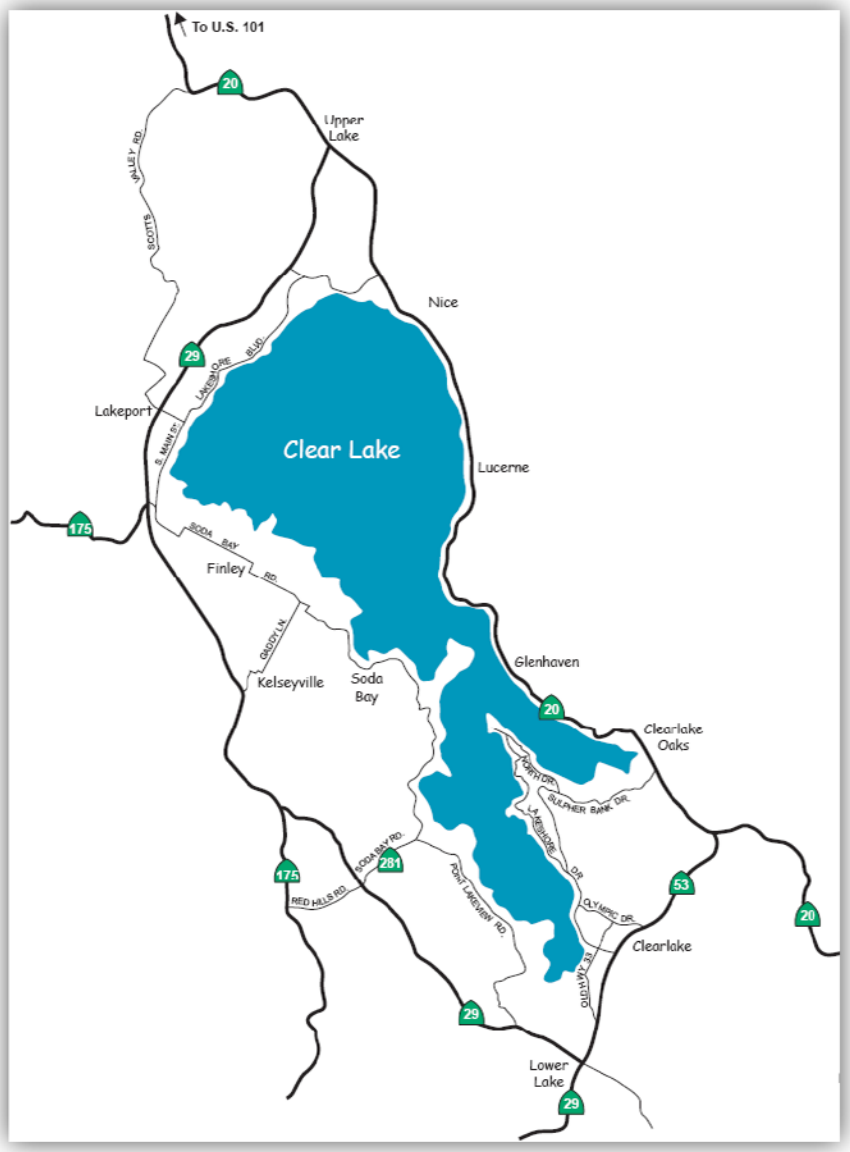

Final Report

SR 53 Corridor Study

In Lake County

April 25, 2011

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Table of Contents

Introduction and Summary 1
Introduction 1
Overall Goal 1
Summary 1
Existing Conditions 3
Roadway Network 3
Documents Reviewed 4
Level of Service Analysis Methodology 7
Standards of Significance 7
Existing Traffic Volumes and Level of Service Analysis 8
Signal Warrants 8
Collision Analysis 9
Project Goals and Objectives 12
Traffic Demand Model 13
Intersection Turning Movement Factoring Methodology 13
Future 2020 Cumulative Traffic Conditions 15
Methodology 15
Level of Service Analysis 15
Evaluation of the Two Lane Segment 17
Future 2030 Cumulative Conditions 19
Methodology 19
Level of Service Analysis 19
Future Phillips Avenue Extension Cumulative Conditions 21
Methodology 21
2020 Cumulative with Phillips Avenue Extension 21
Level of Service Analysis 21
2030 Cumulative with Phillips Avenue Extension 23
Level of Service Analysis 23
Other Potential North-South Connections 27
Access Management 29
Potential At-Grade Interim and Ultimate Long-Term Improvement Alternatives 31
Conceptual Alternatives Cost Estimates 37
Capital Improvement Program (CIP) 40
Summary and Recommendations 41
Study References 45
TJKM Personnel 45
Quincy Engineering, Inc. 45
Persons Consulted 45
Citizen Advisory Committee (CAC) 45
References 45

List of Appendices

Appendix A – Level of Service Methodology
Appendix B – Level of Service Worksheets: Existing Conditions
Appendix C – Collision Analysis
Appendix D – Model Review
Appendix E – Level of Service Worksheets: 2020 Conditions
Appendix F – Level of Service Worksheets: 2030 Conditions
Appendix G – Level of Service Worksheets: 2020 Conditions (Phillips Avenue Extension)
Appendix H – Level of Service Worksheets: 2030 Conditions (Phillips Avenue Extension)
Appendix I – Conceptual Alternatives
Appendix J – Detailed Cost Estimates

List of Tables

Table I: Intersection LOS – Existing Conditions 8
Table II: Intersection Levels of Service – 2020 Cumulative Alternative 17
Table III: Intersection Levels of Service – 2030 Cumulative Traffic Conditions 19
Table IV: Intersection Levels of Service – 2020 Cumulative with Phillips Avenue Extension 22
Table V: Intersection Levels of Service – 2030 Cumulative with Phillips Avenue Extension 24
Table VI: Summary of Cost Estimates 39
Table VII: Summary of CIP Benefit Cost Analysis 40

List of Figures

Figure 1: Vicinity Map and Study Locations 6
Figure 2: Existing Volumes and Lane Configurations 11
Figure 3: 2020 Volumes and Lane Configurations 18
Figure 4: 2030 Volumes and Lane Configurations 20
Figure 5: Projected 2020 Peak Hour Volumes at Study Intersection (Extension of Phillips Avenue) 25
Figure 6: Projected 2030 Peak Hour Volumes at Study Intersection (Extension of Phillips Avenue) 26
Figure 7: Potential Future North-South Connections 28

Introduction and Summary

Introduction

The purpose of this report is to present the traffic forecasting data and the TJKM findings for the State Route (SR) 53 Corridor study. This report presents the existing traffic conditions, an overview of project goals and objectives, results of the traffic analysis based on model forecasts, preliminary improvement measures, and cost.

Overall Goal

One of the long term goals concerning this corridor is for SR 53 to become part of the future interregional traffic route between I-5 and U.S. 101 in the SR 20 corridor. The distance along SR 20, from SR 53 to SR 29 around the north shore of Clear Lake, is about 23 miles, while the alternative route of SR 53 and SR 29, through Clearlake and the west side of Clear Lake, is about 38 miles.

Today the travel times are similar, in part due to the limited passing opportunities and lower travel speeds on SR 20 along the lake shore. With increasing travel in the future, including trucks, delays to interregional travel and goods movement are likely to increase, and the impacts of through traffic will continue to impact the resort-like quality of development along the north shore of Clear Lake. Current SR 20 through traffic use is incompatible with the area it traverses along the north shore. At the same time, SR 29 is already improved to the extent that average travel times and speeds are satisfactory.

In addition, there are plans to install traffic calming speed reducing elements on the north shore that will be implemented as funding permits. This will increase travel times on the north shore which will make travel on the south shore more attractive. Additional strategies could be implemented in the future to make travel on the south shore more attractive including advance truck activation loops and advance changeable message signs that will direct westbound traffic traveling on SR 20 to use SR 53.

Summary

The following is a summary based on the results of the TJKM analysis.

Existing Conditions

All seven study intersections on SR 53 operate at acceptable LOS C or better except the Two-Way Stop controlled intersection of SR 53 and SR 20 that operates at LOS F during the p.m. peak hour.

2020 Cumulative Conditions

Midterm intersections improvements including a roundabout at Dam Road/Walmart Driveway and a roundabout at SR 53/SR 20 were evaluated. It is estimated that all intersections will operate at LOS C or better with the assumed improvements.

2030 Cumulative Conditions

The same improvements evaluated for 2020 were assumed for 2030. It is estimated that all intersections will operate at LOS C or better except the intersection of SR 53/Dam Road which will operate at LOS E (SR 53/Dam Road / Old Highway 53) and three at LOS D (SR 53/Olympic Drive, SR 53/18th Avenue and SR 53 / SR 29/Main Street).

2020 Cumulative Conditions (Phillips Avenue Extension)
This alternative includes the potential southerly extension of Phillips Avenue from 18th Avenue in the north to connect with Dam Road Extension that leads to Dam Road in the south.
The model run indicated that the proposed Phillips Avenue will attract approximately 2,800 vehicles per day. A slightly smaller amount of traffic reduction (approximately 1,700 vpd) was forecasted on SR 53 between 18th Avenue and Dam Road. It is estimated that the intersection of SR 53 and 18th Avenue will operate with a slight reduction in delay at the intersection of SR 53 and 18th Avenue (LOS B) as compared to the 2020 scenario without the extensions.

2030 Cumulative Conditions (Phillips Avenue Extension)
The model run indicated that the proposed Phillips Avenue will attract approximately 6,300 vehicles per day. A slightly smaller amount of traffic reduction (approximately 5,200 vpd) was forecasted on SR 53 between 18th Avenue and Dam Road.

Potential At-Grade Interim and Ultimate Long-Term Improvement Alternatives
Based on the results of the model forecasts and traffic analysis prepared by TJKM, Quincy Engineering, Inc. drafted the preliminary civil conceptual plans. At-grade improvements are generally less costly and have less right of away impacts. The ultimate long-term improvement alternatives are all grade separated interchange alternatives. These alternatives are more costly, have more impact on the right of way but will also provide greater travel speed on SR 53 which in turn will shorten the travel times on SR 53 and make it a more attractive travel alternative for vehicles going from SR 20/SR 53/SR 29 to US 101than those vehicles using SR 20 on the north shore.

Conceptual Alternatives Cost Estimates
Construction cost estimates were prepared that identifies the range of probable costs based upon square foot estimates and Quincy's experience from similar projects. Quincy Engineering, Inc. prepared area of proposed right of way take, and Lake County staff provided the right of way unit cost. A cost estimate summary was prepared for some of the potential improvement projects.

Capital Improvement Program (CIP)
Based on the project goals and objectives, the most appropriate or cost effective solutions should help achieve those goals and objectives. Any potential Capital Improvement Program (CIP) could include a dollar per vehicle trips served by these long-term alternatives.

The potential economic analysis indicated for each project is based on cost per person trip served ($/Person Trip), with the lowest values being the most cost effective or the best. This is an expression of Benefit/Cost (b/c).

Existing Conditions

Roadway Network

State Route 53 (SR 53) is a major arterial that extends from SR 20 at the north to SR 29 at the south for approximately 7.5 miles. The four lane section extends from SR 29 in the south to approximately 600 feet north of 40th Avenue. It is a two lane roadway from north of 40th Avenue to SR 20. It has a posted speed limit of 50 mph. Daily traffic volumes on SR 53 vary from 19,000 vpd on the south to about 10,000 vpd near SR 20. The annual traffic growth rate along the SR 53 corridor is a little under one percent. The SR 53 vicinity map is shown in Figure 1.

State Route 29 (SR 29) is a two-lane highway with posted speed limits of 55 mph in the area near Lower Lake. SR 29 south of Lower Lake extends through Middletown near Mt. Saint Helena into Napa County where it is the major north-south roadway. From its intersection with SR 53 in Lower Lake, it heads in a northwesterly direction to the west of Clear Lake and ends at SR 20 in the Upper Lake area. Some segments have been improved to expressway and freeway standards (some with four lanes) and have a 65 mph posted speed limit (eg. Kelseyville and north Lakeport). SR 29 carries 12,000 vpd at Lower Lake, south of Clearlake.

State Route 20 (SR 20) is generally a two-lane highway through the study area. The posted speed limit is 55 mph to the east and west of SR 53. SR 20 runs along the north shore of Clear Lake serving many tourist communities. It has limited capacity, and generally low speeds within built up areas along the lake. The annual growth rate has been four percent east of SR 53 and two percent west of SR 53.

40th Avenue is a two-lane arterial street. To the east of SR 53, it leads to a generally residential area. To the west it leads into a commercial area before branching into Lakeshore Drive within 400 feet of SR 53.

Dam Road forms the east leg of an intersection at SR 53. The west leg is formed by Old Highway 53. Approximately 300 feet to the east of the signalized intersection of SR 53/Dam Road/Old Highway is an All-Way Stop controlled intersection. Dam Road forms the west and south legs while the east leg serves as entrance to Wal-Mart and the north leg (Dam Road Extension) provides access to community college campus and other uses.

18th Avenue is a two-lane collector street with intermittent dirt shoulders, significant vertical curves and includes a horizontal "S" curve to the east of SR 53. It provides access to the Redbud Hospital and several other streets serving a rural residential area.

Olympic Drive is a two-lane road with the eastbound approach that T's into SR 53. The intersection of Olympic Drive/SR 53 is currently all-way stop controlled. It is our understanding that Caltrans plans to signalize the intersection in the near future.

The Provinsalia Golf Community EIR Traffic & Parking Analysis Report, April 10, 2007, collected intersection turning movement data for 11 intersections, including several on SR 53. The data were collected in 2005. Based on seasonal count information provided by Caltrans and the City of Clearlake, the a.m. peak hour counts were adjusted upwards by seven percent while the p.m. peak hour counts were adjusted upwards by 10 percent to reflect peak tourist season conditions.

TJKM collected 24-hour average daily traffic (ADT) volumes at three locations to verify the volumes in the Provinsalia report. The peak hour volumes from the ADT counts were compared to the peak hour data shown in the Provinsalia report. The results of the comparison showed that the current peak hour counts at all of the locations are lower than the factored counts shown in Provinsalia report by 15 to 20 percent. Consequently, it could be concluded that the factored counts shown in the Provinsalia were conservatively high and could be used in the current SR 53 Corridor Study. Note the lower volume figures may have been influenced by the current recession as recreational travel may be lower than is typical during the summer. The detailed peak hour intersection turning movements and lane configuration for the study intersections are shown in Figure 2.

Documents Reviewed

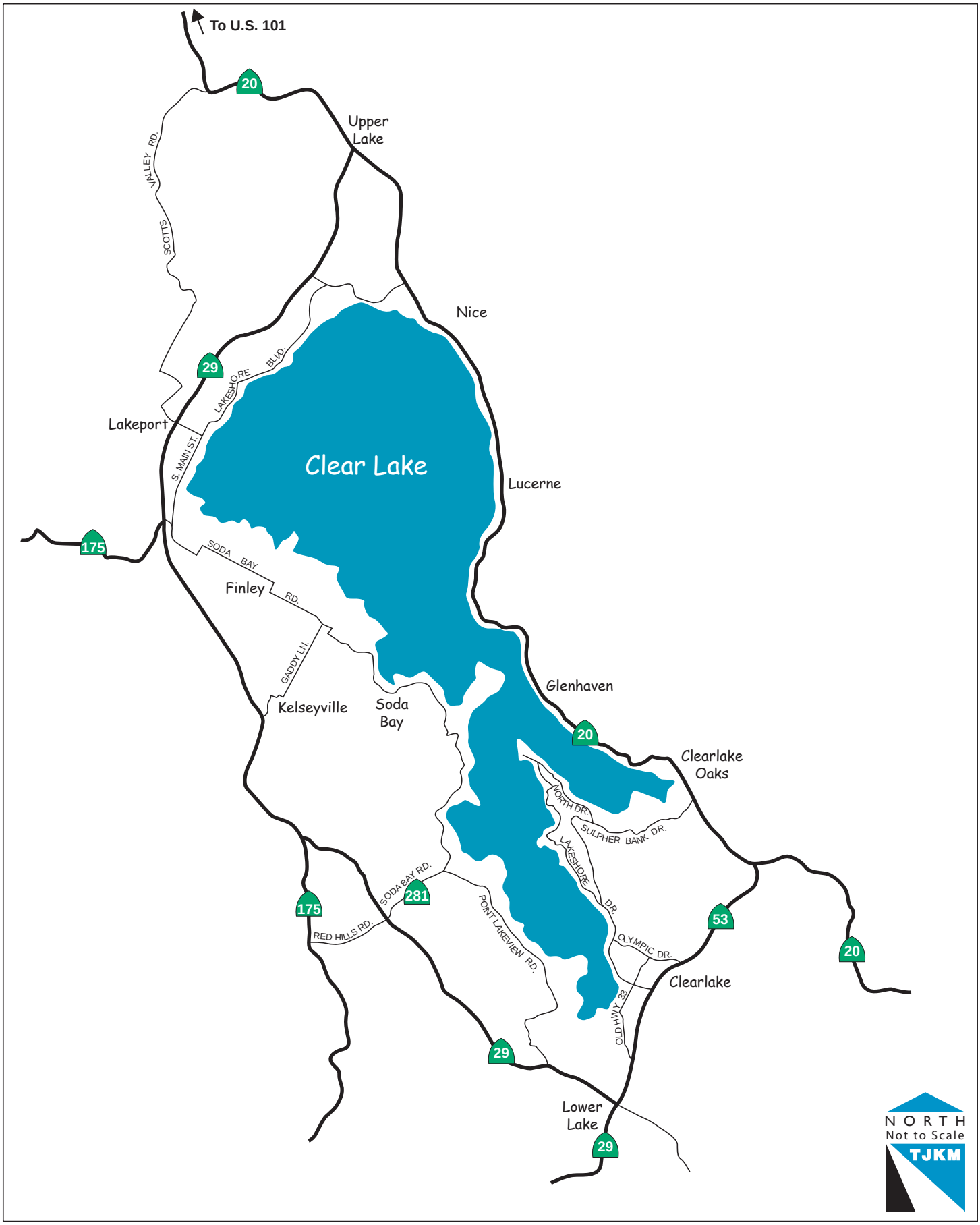
In preparation for the study, many documents were reviewed. The following is a summary of key findings of documents that have been reviewed:

1. *Provinsalia Golf Community EIR Traffic & Parking Analysis Report*, April 10, 2007 – the report includes results of the 2010 and 2020 analysis for the proposed project. It was assumed project at half Buildout by 2010 (with 360 units and 9 holes golf course) and full Buildout by 2020 (720 units and 9 holes golf course). Due to the current economy, city staff indicated the 2010 land use assumption is off target.
2. *Lake 20/29/53 Corridor Study Final Report*, November 8, 2005, Caltrans District 1, Division of Transportation Planning, prepared by System Metrics Group, Inc. - The purpose of the Lake 20/29/53 Comprehensive Corridor Study is to determine how many through trips on the north shore route could be re-directed to the south shore route if roadway improvements were made to the south shore route and traffic calming measures were implemented on the north shore route. One of the conclusions was that in the 2025 Build Out scenario, predicted traffic volumes through the north shore communities are lower than what was observed in 2004. This was estimated for weekdays and weekends, and for passenger car traffic as well as truck traffic. According to the report, there is a clear indication that based on the model, the proposed combination of capacity improvements and traffic calming measures can contribute to effectively redistribute traffic along the corridor from the north shore to the south shore route. Caltrans staff indicated not being aware of any significant traffic calming project that has been implemented on the north shore.
3. *SR 20 Corridor Study Traffic Calming*, March 2005 – a discussion of potential traffic calming measures that would be most relevant in discouraging the use of north shore Route 20 and diverting traffic towards the south shore.
4. *Freeway Agreement*, Office of Project Planning & Design, October 6, 1989 – freeway agreement executed between Caltrans and the City of Clearlake on July 17, 1989, calling for ultimate construction at 18th and 40th Avenues and the closure of the at-grade intersection at Dam Road.
5. Rte. 53 Freeway Agreement at Dam Road/Old Hwy 53 letter, dated October 20, 2005, by Jesse Robertson, Caltrans to Bob Galusha, Interim City Engineer – a summary of the Dam Road/SR 53 closure dialogue from 1989 to 2005. One of the points was provided by former Caltrans District Director, Rick Knapp dated May 10, 1996: "The feasibility of an interchange at Dam Road could be considered by the APC and the City, in conjunction with studies for development of the airport site. Should an interchange at this location prove feasible, and more desirable than one at 18th Street, amendment of the Freeway Agreement could be considered. "

6. Lake County Travel Demand Model – Countywide model with land use data for 2007, 2020 and 2030. It is an ADT and not peak hour model. The model was also used for the Countywide Regional Transportation Impact Fee (TIF) Program study with the final report completed in May 2008.
7. Countywide Regional Transportation Impact Fee Program Final Report, May 30, 2008 – Report which details the development of impact fee program designed to develop funding sources to ensure adequate infrastructure is constructed concurrent with new development. Specifically the adopted program will help to ensure that necessary multi-modal transportation improvements are constructed as new development projects are approved.

State Route 53 Corridor Study in Lake County
Vicinity Map

Figure
1



149-023 - 2/4/11 - CT

Level of Service Analysis Methodology

Level of Service is a qualitative index of the performance of an element of the transportation system. Level of Service (LOS) is a rating scale running from A to F, with A indicating no congestion of any kind, and F indicating intolerable congestion and delays.

The *2000 Highway Capacity Manual (HCM)* is the standard reference published by the Transportation Research Board, and contains the specific criteria and methods to be used in assessing LOS. There are several software packages that have been developed to implement HCM. In this study the Synchro software was used to calculate the LOS at the study intersections. A detailed description of the methodology is provided in Appendix A.

The method of unsignalized intersection capacity analysis used in this study is from Chapter 10, "Unsignalized Intersections" of the *Highway Capacity Manual, Special report No. 209,* Transportation Research Board, updated October 2000. This method applies to two-way STOP sign or YIELD sign controlled intersections (or one-way STOP sign or YIELD sign controlled intersections at three-way intersections). At such intersections, drivers on the minor street are forced to use judgment when selecting gaps in the major flow through which to execute crossings or turning maneuvers. Thus, the capacity of the controlled legs of an intersection is based on three factors:

1. The distribution of gaps in the major street traffic stream.
2. Driver judgment in selecting gaps through which to execute their desired maneuvers.
3. Follow-up time required to move into the front-of-queue position.

The level of service criterion for Two-Way STOP controlled intersections is somewhat different from the criterion used in Chapter 9 for signalized intersections. The primary reason for this difference is that drivers expect a signalized intersection to carry higher traffic volumes than unsignalized intersections. Additionally, several driver behavior conditions combine to make delays at signalized intersections less onerous than at unsignalized intersections.

The LOS is reported for the minor approach. Depending on the availability of gaps, the minor approach might be operating at LOS D, E, or F while the intersection LOS operates at LOS C or better. A minor approach that operates at LOS D, E, or F does not automatically translate into a need for a traffic signal. A signal warrant still needs to be met. There are many instances where only a few vehicles are experiencing LOS D, E, or F on the minor approach while the whole intersection operates at an acceptable LOS. A signal is usually not warranted under such conditions. The justification for the installation of a traffic signal at an intersection is based on the warrants stated in the California Manual on Uniform Traffic Control Devices (MUTCD) published by Caltrans and the Federal Highway Administration (FHWA). The decision to install a signal should not be based solely upon the warrants, since the installation of traffic signals may increase certain types of collisions. Delay, congestion, approach conditions, driver confusion, future land use or other evidence of the need for right of way assignment beyond that which could be provided by stop signs must be demonstrated.

Standards of Significance

The minimum acceptable level of service standard for the City of Clearlake and Lake County roadway segments is LOS C. Therefore, for local intersections this report uses LOS C as the minimum acceptable standard and mitigation measures are recommended where service levels are below LOS C.

Facilities under the jurisdiction of Caltrans include freeway segments, ramps, ramp terminals, and arterials. Caltrans standards strive to maintain acceptable traffic operations on state facilities between LOS C and LOS D. Mitigation measures are recommended where service levels exceed this LOS C/D transition.

Existing Traffic Volumes and Level of Service Analysis

Based on consultations with Caltrans and the Technical Advisory Committee (TAC), seven intersections were selected for analysis. The turning movement counts and lane geometry are shown in Figure 2. Based on peak hour data and available truck information[1], the peak hour factor and truck factors were derived and utilized in the analysis. The truck percentages vary from five percent to 12 percent in the study area. Truck percentages on SR 53 in the Clearlake area range between five and six percent and as high as 12 percent on SR 20. The peak hour factors used in the analysis vary from 0.78 to 0.97. Other assumptions of HCM parameters are based on Caltrans District1guidelines as contained in Appendix A.

All study intersections operate at acceptable LOS C or better except the two-way stop controlled intersection of SR 53 and SR 20 that operates at LOS F during the p.m. peak hour. Also, due to the close spacing of less than 350 feet between the intersections of Dam Road/SR 53 and Dam Road/ Walmart Driveway which is currently All-Way Stop controlled, some queue overflow has been experienced between these two intersections.

Results of the intersection levels of service (LOS) analysis based on the 2000 Highway Capacity Manual (2000 HCM) are shown in Table I. Detailed LOS calculation sheets are contained in Appendix B.

Table I: Intersection LOS – Existing Conditions

ID	*Intersection*	*Control*	*Existing Conditions*			
			A.M. Peak Hour		*P.M. Peak Hour*	
			Delay	*LOS*	*Delay*	*LOS*
1	SR 53 / SR 20	Two-Way Stop	18.0	C	113.2	**F**
2	SR 53/Olympic Dr	All-Way Stop	9.3	A	10.9	B
3	SR 53 / 40th Ave	Signal	21.1	C	31.3	C
4	SR 53/18th Ave	Signal	12.2	B	13.5	B
5	SR 53 / Dam Road / Old Highway 53	Signal	25	C	32.5	C
6	Dam Rd / Walmart Dwy	All-Way Stop	-	A	-	A
7	SR 53 / SR 29 / Main Street	Signal	23.5	C	23.1	C

Notes: LOS = Level of Service

Signal Warrants

Signal warrants based on peak hour volumes were evaluated for the unsignalized intersections of SR 53 / SR 20 and Dam Rd / Walmart Dwy. A signal warrant was not met for either intersection and the results are contained in Appendix B.

[1] *2007 Annual Daily Truck Traffic on California Highway System, Caltrans*

Collision Analysis

Before proposing any redesign or alternatives for the roadway segment along SR 53, it is critical to know if there are any inherent flaws or safety issues with the intersection. It is important to understand the existing collision patterns so that future designs can incorporate countermeasures to correct existing safety related problems.

TJKM has obtained 11years of State Wide Integrated Traffic Records System (SWITRS) collision data for the study. As shown in the collision diagrams in the appendices, TJKM has generated the collision analysis between 1999 and 2008 for the following intersections:

	Intersection	Total Collisions	Average per year	Acc. Rate	Comments
1	SR 20/SR 53	96	9	2.49	Predominantly broadside and rear end collisions, with 39 percent due to auto right of way, 16 percent unsafe speeds and 15 percent improper turning. [A]
2	Olympic Drive/SR 53	53	9	1.09	Predominantly due to failure to yield auto right of way (42 percent). It is primarily due to vehicles making a left-turn from Olympic Drive to travel northbound on SR 53 or northbound vehicles making a left-turn to travel westbound on Olympic Drive. Three fatalities were recorded in the time period.
3	40th Avenue/SR 53	22	5	0.25	Predominantly broadside (27 percent) and rear end collisions (41 percent), with 23 percent unsafe speeds and 14 percent improper turning.
4	18th Avenue/SR 53	33	3	0.41	Predominantly due to unsafe speed (30 percent).
5	Old Highway 53/SR 53	93	8	0.86	Predominantly rear end collisions (52 percent) and broadside (16 percent), with 36 percent unsafe speeds, 13 percent improper turning and 12 percent following too close.
6	Dam Rd/Walmart Dwy	8	1	0.14	Predominantly rear end collisions (50 percent).
7	SR 29/SR 53	83	7	1.04	Predominantly rear end collisions (27 percent) and side swipe (33 percent), with 16 percent unsafe speeds, 22 percent auto right of way and 17 percent unsafe lane change.

Note: [A] Stop Sign was installed in 2006 as an interim measure to signalization so the rate is probably lower after the installation of Stop signs.

Four of the intersections (SR 20/SR 53, Olympic Dr/SR 53, Dam Rd/Old Highway 53/SR 53 and SR 29/Main St/SR 53) showed intersection collision rates higher than the statewide average.

Detailed collision diagrams, associated statistical breakdowns and the collision rates for each intersection are contained in Appendix C.

Travel Time

One of the overall goals concerning this corridor is to identify improvements needed on SR 53 to facilitate its function as a component of the Principal Arterial System through Lake County between I-5 and U.S. 101. SR 20, from SR 53 to SR 29 around the north shore of Clearlake, is approximately 23 miles long, while the alternative route of SR 53 and SR 29, through Clearlake and the south side of Clearlake, is about 38 miles long.

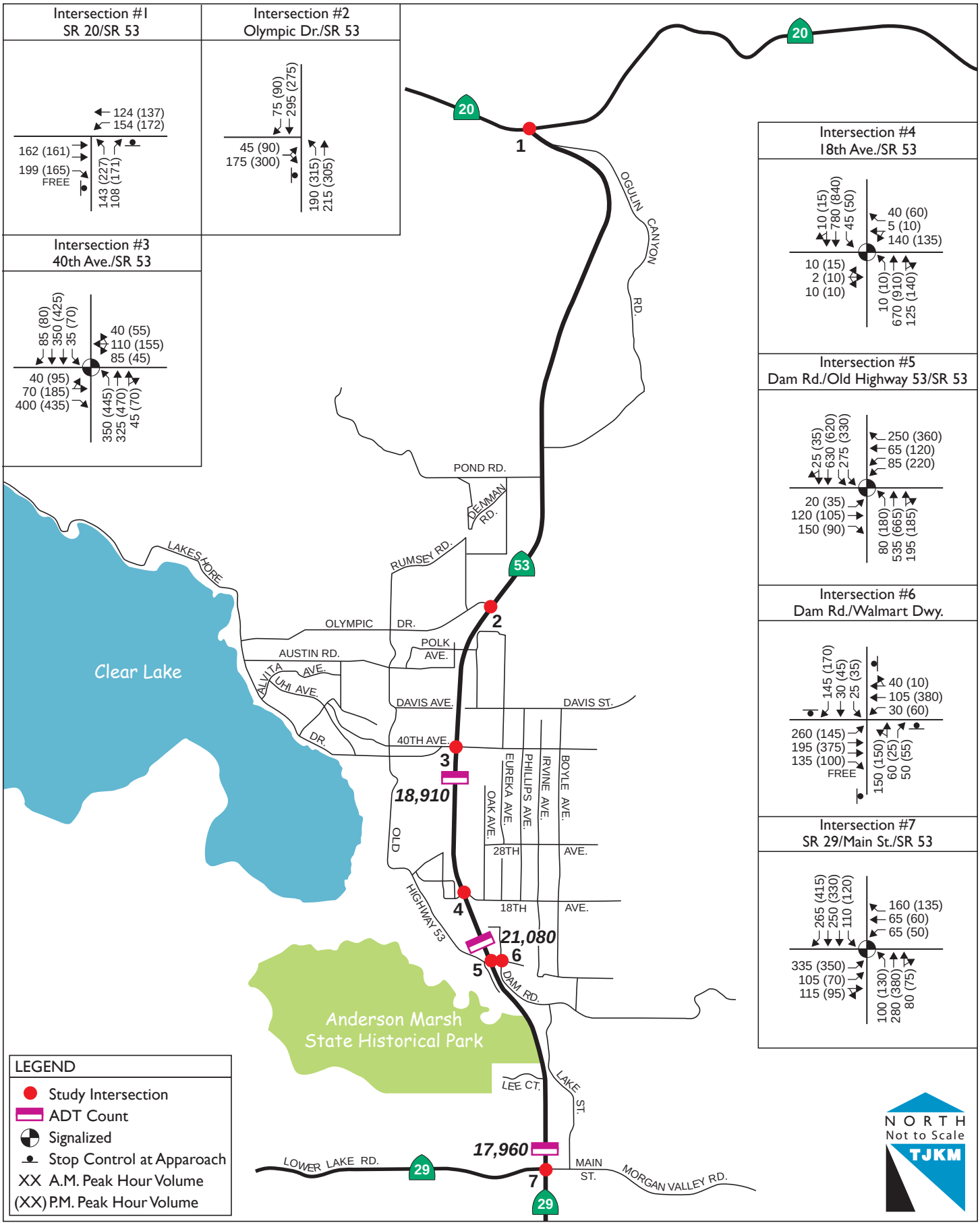
Field review indicated that travel along the lakeshore to the north is generally slower with posted speeds limits generally in the 35 to 50 mph ranges. In contrast, traveling around the south shore and along the west side of Clearlake is generally faster with posted speed limits that range from 55 to 65 mph.

TJKM conducted floating car runs during mid-morning and afternoons in October of 2009. The floating car runs (driving in normal traffic condition) show that the travel time along the north shore from the intersection of SR20/53 to SR/20/29 averages approximately 33 minutes while the route around the longer south shore averages 43 minutes.

State Route 53 Corridor Study in Lake County

Existing Peak Hour Volumes & Lane Configurations at Study Intersections

Figure 2



149-023 - 2/4/11 - CT

Project Goals and Objectives

With increasing traffic in the future, including truck traffic, delays to interregional travel and goods movement are likely to increase as SR 20 gets closer to capacity at peak times. Through traffic including trucks will increasingly impact the resort-like neighborhoods along the north shore of Clearlake. Current SR 20 use by regional through traffic is incompatible with the area it traverses along the north shore. If interregional travel is to be attracted to the preferred routing, SR 53 should ultimately be upgraded to an expressway. Several sections of SR 29 are already improved to expressway standards and some freeway standards of 60 to 65 mph.

To achieve reduction in travel time through the SR53/SR29 corridor, strategies can include better signal efficiency, increases in capacity or a reduction in local traffic using the corridor. Any potential improvements should be based on context sensitive design principles and be in tune with the concept of complete streets; that is, to promote alternate modes of travel. To achieve the project goal, TJKM recommends incorporating some of the following project objectives:

- Improve local circulation in Clearlake so that SR 53 traffic is less impacted by local traffic;
- Consider frontage roads along SR 53 to buffer development in the corridor from increased travel volumes and speeds of through traffic, as well as to improve currently discontinuous north-south local circulation on either side of SR 53;
- Explore feasibility of a roundabout at Dam Road/Walmart Driveway/Dam Road Extension;
- Facilitate non-motorized access across and parallel to SR 53 through Clearlake so that pedestrians, bicyclists and transit patrons have a reasonable, convenient and safe means of local travel. Recent improvements include bikeway improvements on Old State Highway and Lake Street as well as a Safe Route to School project on Dam Road;
- Widen the two-lane section of SR 53 before it drops below LOS C;
- Minimizing access points along SR 53 to only major, controlled locations or very low volume local access driveways;
- Determine the feasibility or desirability of an interchange at Dam Road or constructing an interchange at 18th Street based on the original Freeway Agreement. Due to spacing issues of less than 2,500 feet, only one interchange could be accommodated within this section;
- Consider an alternative interchange site between Dam Road and 18th Avenue, perhaps in alignment with South Center Drive;
- Grade separate major junctions to maintain good average highway speeds for through traffic; and
- Match the scope and costs of needed corridor improvements to the level of demand so that positive benefit/cost ratios may be obtained.
- Prepare policy recommendations that will ensure long-term functionability of the corridor.

Traffic Demand Model

A long-range traffic-forecasting model was used to prepare the traffic forecasts. TJKM used the most current version of the countywide model in the study. [2] The countywide model includes land use and network data for 2007, 2020 and 2030. The model forecasts average daily weekday traffic (ADT) and does not include peak hour forecasts.

To prepare the Countywide Traffic Impact Fee (TIF) study[3], the model was used to determine the future transportation improvement needs within unincorporated Lake County, and the cities of Lakeport and Clearlake. The model includes all major transportation facilities within both the county and city areas. Both existing and future land use estimates were prepared and for all Traffic Analysis Zones (TAZ). As shown in the Appendix D, Figure ES-1 from the Countywide TIF study provides a summary of both existing and anticipated future development estimates by County Planning Areas and cities. Also contained in the appendix is Figure ES-2 from the Countywide TIF study that provides a summary of 2030 capacity needs. The study includes these assumed improvements for the appropriate forecast years. It appears the forecasts for SR 20, SR 29 and SR 53 are reasonably consistent with the growth trends of volumes on these routes.

The County and the City of Clearlake have reviewed and approved the 2030 land use contained in the model. Detailed land use data for all the TAZ's (which includes the Provinsalia project) in the study area are contained in Appendix D.

Lane/Speed/Capacity Reviews

In order for the model to perform accurately, TJKM reviewed key network attributes (speeds, lanes, capacities) of the model in the project area and along SR 20 and SR 29 roadways around the lake. They were modified as appropriate. In addition, the location of centroid connectors was reviewed and modified to better reflect existing and potential future conditions.

Intersection Turning Movement Factoring Methodology

Since this is a daily model, a process was developed to derive the peak hour turning movement volumes at the seven study intersections. One of the standard processes to derive intersection peak hour turning movement volumes from a daily model is the procedure documented in National Cooperative Highway Research Program Report (NCHRP 255), *Highway Traffic Data for Urbanized Area Project Planning and Design*. Several agencies have implemented the procedure including Council of Fresno County Governments and Caltrans District 10.

Based on the methodology, the two methods available to factor ADT forecasts to peak hour volumes are the growth factor and increment methods. The growth method adjusts traffic counts by applying the ratio of future year to base year volumes in the model to base year volumes. The increment method adjusts traffic counts by increment from the base year model to the future year model. In this study, the growth method was used. A software version of NCHRP 255 called Turns 32 was used to derive the peak hour turning movement volumes in this study.

TJKM used the daily model forecasts for scenarios 2007, 2020 and 2030 including the existing intersection peak hour turning movements to develop the future intersection peak hour turning movement volumes for all the study intersections.

---

[2] *Countywide Model obtained from Omni Means, April 15, 2009 through APC*

[3] *Countywide Regional Transportation Impact Fee Program Final Report, May 30, 3008*

Historical Growth rate

For some background perspective on the traffic growth, it is also useful to determine the traffic growth rate of key roadways in the study area. Based on the available roadway data for the past 17 years, the following annual growth rates have been determined:

- SR 20 – growth rate of one to three percent per year
- SR 53 - growth rate of two to three percent per year
- SR 29 - growth rate of approximately three percent per year

Details of the historical traffic growth data are contained in Appendix D.

TJKM completed the forecasts for intersection turning movement volumes utilizing the NCHRP 255 methodology indicated above and made appropriate adjustments. Generally, the overall annual growth rate is approximately 2.5 percent for through movements on SR 53 and approximately 1.5 percent for turning movements. Volumes were also balanced between intersections as appropriate.

Future 2020 Cumulative Traffic Conditions

Methodology

The Year 2020 Model land use and network assumptions were used for the traffic projections and were based on the Lake County Model.

As mentioned previously, the intersection turning movement volumes forecasts were derived utilizing the NCHRP 255 methodology with appropriate adjustments.

Level of Service Analysis

Figure 3 shows the forecasted peak hour turning movement volumes for the Future Year 2020 Alternative conditions. Also the proposed lane geometry for the Future Year 2020 Alternative conditions is shown. The potential midterm improvements are shown in bold. SR 53/Olympic Drive will be signalized soon and it is assumed to be signalized under the 2020 condition. Based on discussions with TAC members, due to diminished funding, a midterm improvements alternative that is more feasible to be implemented in the near term should be developed.

In consultation with the City and TAC members, it was suggested that a roundabout design should be investigated as a possible treatment for the intersection of SR 53 at SR 20. In addition, due to the congestion and queuing that occurs in the short distance on Dam Road between the two intersections of SR 53 and Walmart Driveway, the City of Clearlake requested an investigation to determine if a roundabout design at the Walmart Driveway would improve traffic operations. Both of these ideas were incorporated into the analysis.

Potential Roundabout Locations

SR 53/SR 20 - Based on input from the TAC, the intersection of SR 53/SR 20 has been analyzed with a single-lane roundabout with a single bypass lane on each of the approach lanes. To facilitate the flow of traffic, an eastbound to southbound right-turn bypass, westbound through and a northbound to eastbound right-turn bypass were assumed in the analysis.

State Hwy 13 @ County Road 2 in Scott County, MN

Dam Road/Walmart Driveway: Signal vs. Roundabout Alternative - TJKM performed analyses assuming both a roundabout and signal control for the intersection of Dam Road at Walmart Driveway/Dam Road Extension. Based on the results of the analysis, a two-lane roundabout will work acceptably under the Existing Conditions and 2020 p.m. peak hour condition. A queuing analysis based on Sidra was performed for the roundabout at Dam Road/Walmart Driveway. The analysis showed that the queue will not overflow into the adjacent intersection of SR 53/Dam Road to the west.

A peak hour signal warrant was conducted for Dam Road/Walmart Driveway/ Dam Road Extension. A signal warrant was met and the result is contained in Appendix E. However, a signal at the intersection of SR 53 and Walmart Driveway might work but due to the short distance between the two intersections, it is critical to coordinate green times for the critical movements so that

queue overflows between the intersections can be avoided. Since the policy of Caltrans is to give signal coordination preference on SR 53, it would be difficult to ensure that adequate green time is provided on a side street approach such as Dam Road.

A common misconception is that if an intersection has high-speed approaches, a modern roundabout should not be constructed at that location. However, studies in the United Kingdom (U.K.) have found just the opposite to be true. Placing a modern roundabout at these locations in most cases increased safety by reducing traffic crashes. In 2001, the Kansas Department of Transportation constructed their first modern roundabout at the intersection of State Route 68 and Old KC Road in Paola, Kansas. Since opening to traffic in 2001, officials reported three low speed crashes (property damage only) between the years 2001-2003, and a 77% reduction in intersection delay from 19 seconds to 5.5 seconds.[4]

Another example location is State Highway 13 and County Road 2 in Scott County, Minnesota. All approach speeds at this intersection are 55 mph. Prior to a modern roundabout being installed, the intersection was controlled as a two-way stop. Prior to converting the intersection to a modern roundabout, 50 injury crashes were reported over a five-year period, two of them resulting in fatalities. Twelve months after the roundabout was opened to traffic, one low speed crash occurred. There have been no injuries reported at this location since the roundabout was implemented. The example showed that when designed correctly, modern roundabouts can be used as an effective tool to reduce vehicular crash rates and in most cases eliminate critical, life threatening injuries at high-speed approach intersections.

In the *NCHRP Report 613, Guidelines for Selection of Speed Reduction Treatments at High-Speed Intersections,* guidelines are provided for the selection of appropriate speed reduction treatments at intersections located in high speed environments. Specific treatments applicable for high speed approaches to a roundabout include dynamic warning signs, transverse pavement markings, transverse rumble strips and approach curvature. These treatments should be considered for implementation as part of the design for the intersection of SR 53/SR 20.

Summary of 2020 LOS Results
The following are potential midterm improvements assumed at study intersections and shown in bold on Figure 3:

- SR 53/SR 20: intersection improved with roundabout
- SR 53/Olympic Drive: signalized intersection with eastbound right-turn lane added
- SR 53/40th Avenue: additional northbound left-turn lane added
- SR 53/Dam Road / Old Highway 53: northbound right-turn lane added
- Dam Road /Walmart Driveway: add northbound left-turn lane with roundabout control

With the assumed improvements, it is estimated that all intersections will operate at LOS C or better. Three intersections will operate at LOS C and four at LOS B during the p.m. peak hour. Table II summarizes the results of the intersection level of service analysis in this scenario. Detailed calculations are shown in Appendix E.

[4] *Common Misperceptions about Modern Roundabouts, DLZ Michigan, Inc.*

Table II: Intersection Levels of Service – 2020 Cumulative Alternative

ID	Intersection	Control	2020 Traffic Conditions			
			A.M. Peak Hour		P.M. Peak Hour	
			Delay	LOS	Delay	LOS
1	SR 53 / SR 20	Two-Way Stop	21.7	C	120	**F**
	Proposed Improvements	***Roundabout***	*4.2*	*A*	*4.9*	*A*
2	SR 53/Olympic Dr	One Way Stop	11.5	B	14.3	B
	Proposed Improvements	***Signal*** [1]	*17.3*	*B*	*23.9*	*C*
3	SR 53 / 40th Ave	Signal	49.6	D	83.1	**F**
	Proposed Improvements[2]	***Signal***	*18.2*	*B*	*26*	*C*
4	SR 53/18th Ave	Signal	15.6	B	19.2	B
5	SR 53 / Dam Road / Old Highway 53	Signal	34.1	C	60	**E**
	Proposed Improvements[3]	***Signal***	*32*	*C*	*32.7*	*C*
6	Dam Rd / Walmart Dwy	All Way Stop	-	A	-	B
	Proposed Improvements	***Roundabout***	*6.8*	*A*	*6.4*	*A*
7	SR 53 / SR 29 / Main Street	Signal	23.1	C	26.2	C

Notes: LOS = Level of Service
***Signal* = Assumed Improvements**
[1] = Proposed SR 53/Olympic Dr signal improvement estimated to be completed by Summer 2012.
[2] = additional northbound left-turn lane added
[3] = northbound right-turn lane added

Evaluation of the Two Lane Segment

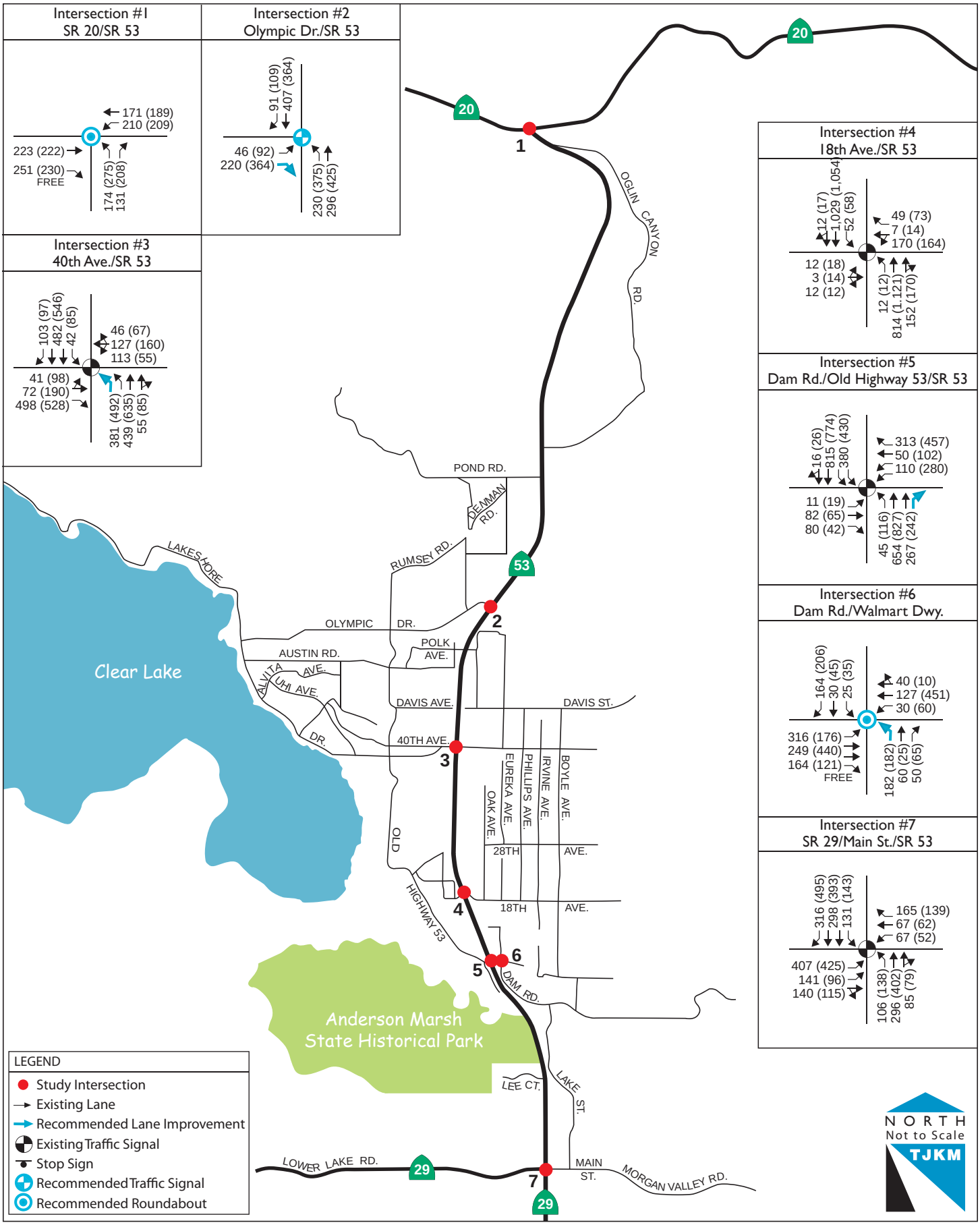
From just south of Olympic Drive (approximately 4,600 feet south) to SR 20, SR 53 is a two lane highway. The model estimated ADT volumes of approximately 8,960 vpd in 2007 and projected volumes of approximately 12,140 vpd in 2020.

It is estimated that the existing LOS is D and will continue at LOS D through 2026. After that, it is estimated that it will operate at LOS E by 2027, at which time a 4-lane facility will be necessary to accommodate the increased traffic volumes.

State Route 53 Corridor Study in Lake County

Projected 2020 Peak Hour Volumes at Study Intersections

Figure 3



149-023 - 2/4/11 - CT

Future 2030 Cumulative Conditions

Methodology

The Year 2030 Model land use and network assumptions that were used for the traffic projections were based on the Lake County Model. As mentioned previously, the intersection turning movement volumes forecasts were derived utilizing the NCHRP 255 methodology and appropriate adjustments were made.

Level of Service Analysis

Figure 4 shows the forecasted peak hour turning movement volumes for the Future Year 2030 Alternative conditions. It also shows the proposed lane geometry for the Future Year 2030 Alternative conditions. The following are potential improvements assumed at study intersections and shown in bold on Figure 4:

- SR 53/SR 20: intersection improved with roundabout
- SR 53/Olympic Drive: signalized intersection with eastbound right-turn lane added
- SR 53/40th Avenue: add eastbound and westbound left-turn lanes and additional northbound left-turn lane
- SR 53/18TH Avenue: add east and westbound left-turn lanes and northbound right-turn lane
- SR 53/Dam Road / Old Highway 53: add northbound right-turn lane, northbound left-turn lane and westbound right-turn lane
- Dam Road / Walmart Driveway: add eastbound left-turn lane, northbound left-turn lane with roundabout control
- SR 53 / SR 29 / Main Street: add southbound right-turn lane

With these improvements, it is estimated that all intersections will operate at LOS D or better except the intersection of SR 53/Dam Road which will operate at LOS E. A queuing analysis based on Sidra was performed for the roundabout at Dam Road/Walmart Driveway. The analysis showed that the queue will not overflow into the adjacent intersection of SR 53/Dam Road to the west. Table III summarizes the results of the intersection level of service analysis in this scenario. Detailed calculations are shown in Appendix F.

Table III: Intersection Levels of Service – 2030 Cumulative Traffic Conditions

ID	*Intersection*	*Control*	*2030 Traffic Conditions*			
			A.M. Peak Hour		*P.M. Peak Hour*	
			Delay	*LOS*	*Delay*	*LOS*
1	SR 53 / SR 20	Roundabout	14.6	B	31	C
2	SR 53/Olympic Dr	Signal	24.8	C	37.8	D
3	SR 53 / 40th Ave	Signal	25.3	C	34.5	C
4	SR 53/18th Ave	Signal	26.5	C	37.5	D
5	SR 53 / Dam Road / Old Highway 53	Signal	71.1	**E**	120	**F**
	Proposed Improvements[1]	***Signal***	40.1	D	62.6	**E**
6	Dam Rd / Walmart Dwy	Signal	24.5	C	29.2	C
	Proposed Improvements	***Roundabout***	7.0	A	7.9	A
7	SR 53 / SR 29 / Main Street	Signal	33.1	C	35.7	D

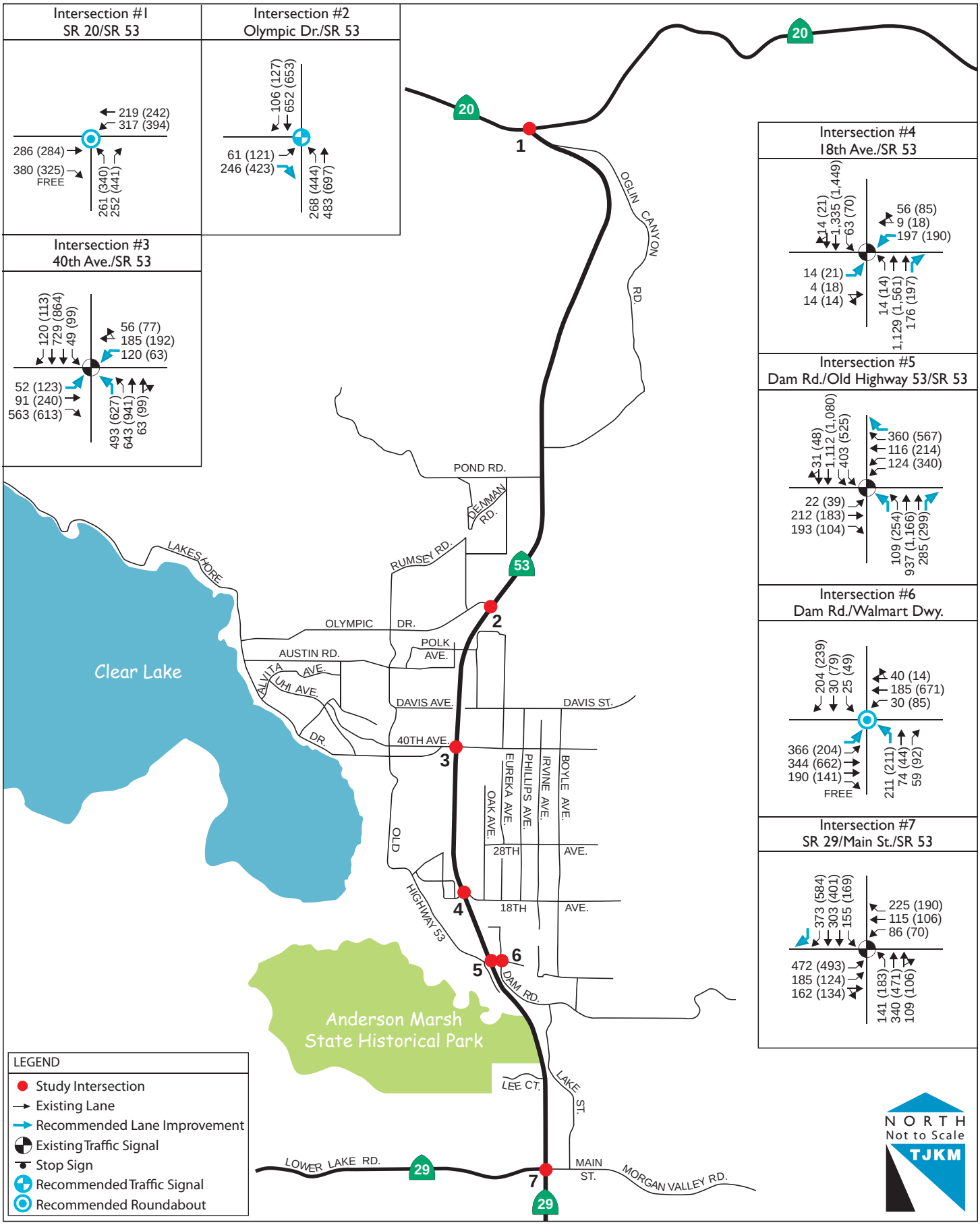
Notes: LOS = Level of Service

[1] = northbound right-turn lane, northbound left-turn lane and westbound right-turn lane added

State Route 53 Corridor Study in Lake County

Projected 2030 Peak Hour Volumes at Study Intersections

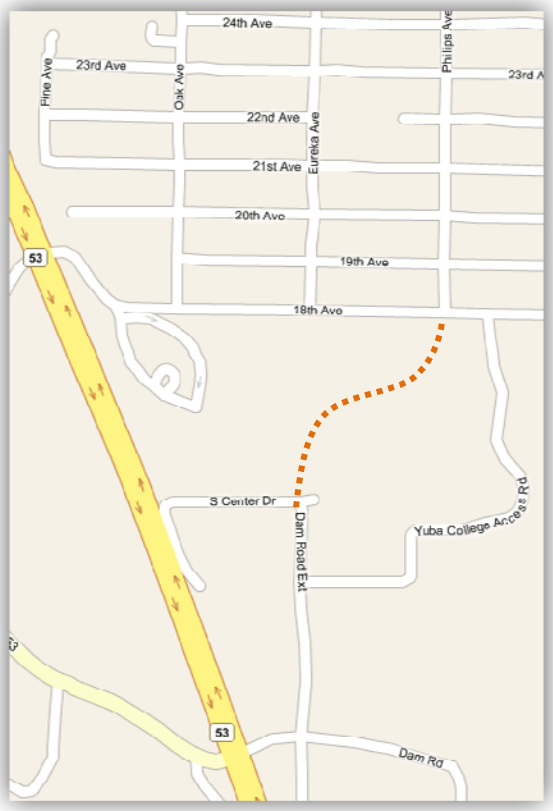
Figure 4



149-023 - 2/4/11 - CT

Future Phillips Avenue Extension Cumulative Conditions

At the October 2009 meeting, the City of Clearlake[5] requested a model run for the potential extension of Phillips Avenue from 18th Avenue in the north to connect with Dam Road Extension that leads to Dam Road in the south. Currently any traffic in the vicinity of 18th Avenue and to the east of SR 53 has no viable alternative to access Dam Road in the south except through SR 53. Therefore it is anticipated that the extension of Phillips Avenue might provide a parallel access route to SR 53. Basically, this acts as a local north-south connector road for residents to the east of SR 53.



Phillips Avenue Extension

Methodology

The Phillips Avenue extension was added to the Year 2020 and 2030 Model network assumptions and used for the traffic projections. Both the 2020 and 2030 model land use and network assumptions were based on the Lake County Model.

2020 Cumulative with Phillips Avenue Extension

The model run indicated that the proposed Phillips Avenue will attract approximately 2,800 vehicles per day. A slightly smaller amount of traffic reduction (approximately 1,700 vpd) was forecasted on SR 53 between 18th Avenue and Dam Road. The model seems to indicate that the proposed Phillips Avenue extension would be an attractive alternative for traffic to the east of SR 53. Instead of having to use SR 53 for intra neighborhood trips between 18th Avenue and Dam Road (east of SR 53), the proposed extension will serve this local function. This will mean less traffic and therefore less congestion on SR 53.

Level of Service Analysis

Figure 5 shows the forecasted peak hour turning movement volumes for the Future Year 2020 Phillips Avenue Parallel Route Connection Alternative conditions. The following are potential midterm improvements assumed at study intersections and shown in bold on Figure 5:

- SR 53 / SR 20: intersection improved with roundabout
- SR 53/Olympic Drive: signalized intersection with eastbound right-turn lane added
- SR 53 / 40th Avenue: additional northbound left-turn lane added
- SR 53 / Dam Road / Old Highway 53: northbound right-turn lane added
- Dam Road / Walmart Driveway: add northbound left-turn lane with roundabout control

Due to the estimated reduction of traffic using the intersection of SR 53 and 18th Avenue, it is estimated that there will be a slight reduction in delay at the intersection of SR 53 and 18th Avenue (LOS B) as compared to the 2020 scenario without the extensions. Table IV summarizes the

[5] *Robert Galusha, City of Clear Lake, October 2009 TAC Meeting*

results of the intersection level of service analysis in this scenario. Detailed calculations are shown in Appendix G.

Table IV: Intersection Levels of Service – 2020 Cumulative with Phillips Avenue Extension

ID	*Intersection*	*Control*	*2020 Traffic Conditions*			
			A.M. Peak Hour		*P.M. Peak Hour*	
			Delay	*LOS*	*Delay*	*LOS*
1	SR 53 / SR 20	**Roundabout**	6.8	A	7.7	A
2	SR 53/Olympic Dr	Signal	15.2	B	22.6	C
3	SR 53 / 40th Ave	Signal	18.5	B	24.9	C
4	SR 53/18th Ave	Signal	11	B	14	B
5	SR 53 / Dam Road / Old Highway 53	Signal	23.1	C	32.9	C
6	Dam Rd / Walmart Dwy	**Roundabout**	7.0	A	7.6	A
7	SR 53 / SR 29 / Main Street	Signal	20.9	C	22.3	C

Notes: LOS = Level of Service
Signal = Mitigated

2030 Cumulative with Phillips Avenue Extension

Similar to the 2020 Cumulative scenario, this scenario assumed the extension of Phillips Avenue from 18th Avenue in the north to connect with Dam Road Extension that leads to Dam Road in the south.

The model run indicated that the proposed Phillips Avenue will attract approximately 6,300 vehicles per day. A slightly smaller amount of traffic reduction (approximately 5,200 vpd) was forecasted on SR 53 between 18th Avenue and Dam Road. The model seems to indicate that the proposed Phillips Avenue extension would be an attractive alternative for traffic to the east of SR 53.

Level of Service Analysis

Figure 6 shows the forecasted peak hour turning movement volumes for the Future Year 2030 Cumulative volumes with the extension of Phillips Avenue Alternative conditions. The following are potential long-term improvements assumed at study intersections and shown in bold on Figure 6:

- SR 53 / SR 20: intersection improved with roundabout
- SR 53/Olympic Drive: signalized intersection with eastbound right-turn lane added
- SR 53 / 40th Avenue: add east and westbound left-turn lanes and northbound left-turn lane
- SR 53/18TH Avenue: add east and westbound left-turn lanes and northbound right-turn lane
- SR 53 / Dam Road / Old Highway 53: add northbound right-turn lane, northbound left-turn lane and westbound right-turn lane
- Dam Road / Walmart Driveway: add eastbound left-turn lane, northbound left-turn lane with roundabout control
- SR 53 / SR 29 / Main Street: add southbound right-turn lane

With these improvements, it is estimated that all intersections will operate at LOS D or better except the intersection of SR 53/Dam Road which will operate at LOS E. Compared to the 2030 Cumulative without the proposed Phillips Avenue Extension, the intersection of SR 53/18th Avenue would be improved from LOS D to LOS B during the peak hour. Therefore, the Phillips Avenue Extension project is a key contributor in facilitating the flow of local north-south local traffic and reducing its dependence on SR 53.

Table V summarizes the results of the intersection level of service analysis in this scenario. Detailed calculations are shown in Appendix H.

Table V: Intersection Levels of Service – 2030 Cumulative with Phillips Avenue Extension

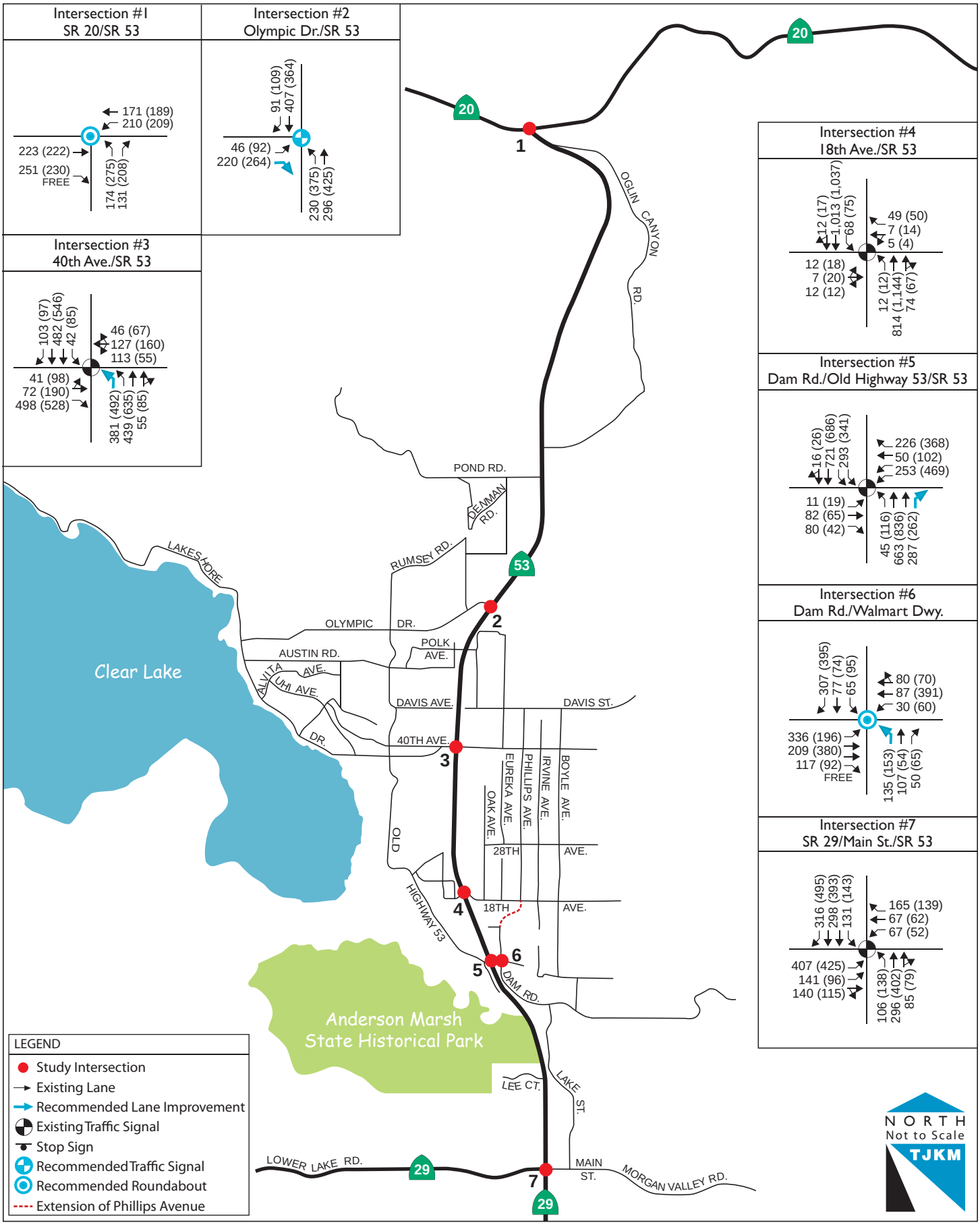
ID	*Intersection*	*Control*	*2030 Traffic Conditions*			
			A.M. Peak Hour		*P.M. Peak Hour*	
			Delay	*LOS*	*Delay*	*LOS*
1	SR 53 / SR 20	**Roundabout**	14.6	B	31	C
2	SR 53/Olympic Dr	Signal	28.1	C	38	D
3	SR 53 / 40th Ave	Signal	26.1	C	32.4	C
4	SR 53/18th Ave	Signal	15.3	B	19.6	B
5	SR 53 / Dam Road / Old Highway 53	Signal	39.5	D	66.4	**E**
6	Dam Rd / Walmart Dwy	**Roundabout**	7.5	A	11.6	B
7	SR 53 / SR 29 / Main Street	Signal	33.1	C	35.7	D

Notes: LOS = Level of Service
Signal = Mitigated

State Route 53 Corridor Study in Lake County

Projected 2020 Peak Hour Volumes at Study Intersections (Extension of Phillips Avenue)

Figure 5

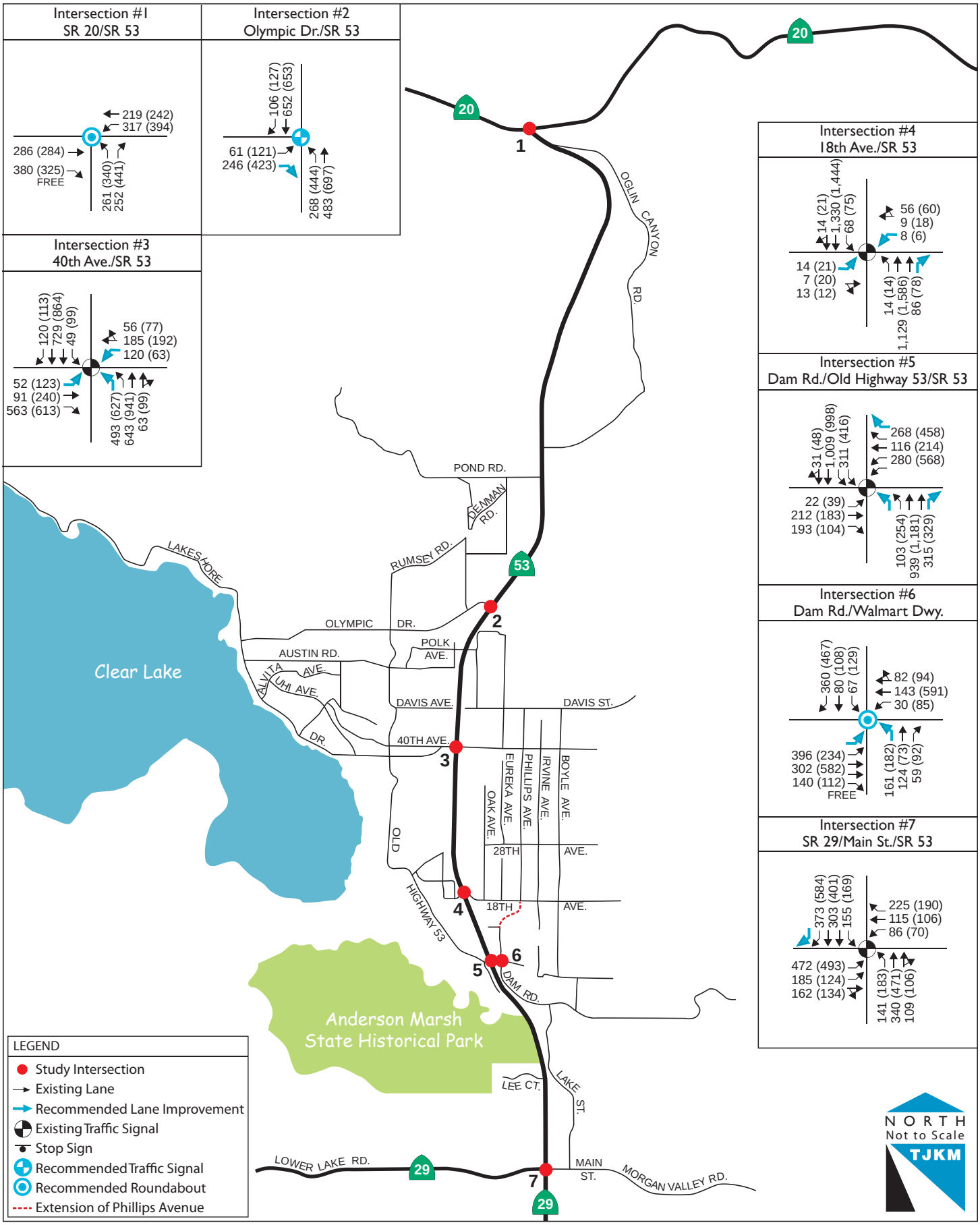


149-023 - 2/4/11 - CT

State Route 53 Corridor Study in Lake County

Projected 2030 Peak Hour Volumes at Study Intersections (Extension of Phillips Avenue)

Figure 6



149-023 - 2/4/11 - CT

Other Potential North-South Connections

Opportunities for potential future north-south connections to the west of SR 53 are very limited. Unlike the general grid street layout system to the east of SR 53, many sections of the street system to the west of SR 53 are generally disjointed, discontinuous and often separated by large gaps between segments. They do not lend themselves easily to parallel north-south roadway continuity. Other issues to be considered include the topography and terrain, existing land use and cost associated with right of way.

However a few potential routes are shown in Figure 7. One of the potential alignments is on Spruce Avenue that runs from the vicinity of 18th Avenue in the south to Lakeshore Avenue in the north (nearly one mile). This will provide a significant alternate north-south connection to the west of SR 53. Also shown on Figure 7 is the Snook Avenue extension that will further extend the Spruce Avenue from near Davis Avenue to Olympic Drive. The two extensions will provide nearly two miles of north-south connectivity on the west side of SR 53. Besides Phillips Avenue discussed earlier, the other potential north-south connection to the east of SR 53 is Oak Avenue. This extension will provide north-south connectivity between 18th Avenue and 40th Avenue.

Non-Auto Modes of Travel

Transportation Demand Management (TDM) (also known as *Mobility Management*) is a general term for various strategies that increase transportation system efficiency. TDM treats mobility as a means to an end, rather than an end in itself. It emphasizes the movement of people and goods, rather than motor vehicles, and so gives priority to more efficient modes (such as walking, cycling, ridesharing and public transit), particularly under congested conditions. It prioritizes travel based on the value and costs of each trip, giving higher value trips and lower cost modes priority over lower value, higher cost travel, when doing so increases overall system efficiency.

This section will explore some potential TDM options for SR 53 corridor. Some of the viable non auto modes of travel include walking, bicycling and transit. Bicycling and walking may not be very attractive options at some locations due to the hilly terrain at some locations along SR 53 such as along Olympic Drive. However, the generally level terrain along Old Highway 53 would be viable options for bicycling or walking between the east and west side of SR 53. A study should be conducted to identify specific roadways for locating potential Class II bike lanes.

Based on discussions with the TAC members, a few locations have been identified that require special attention:

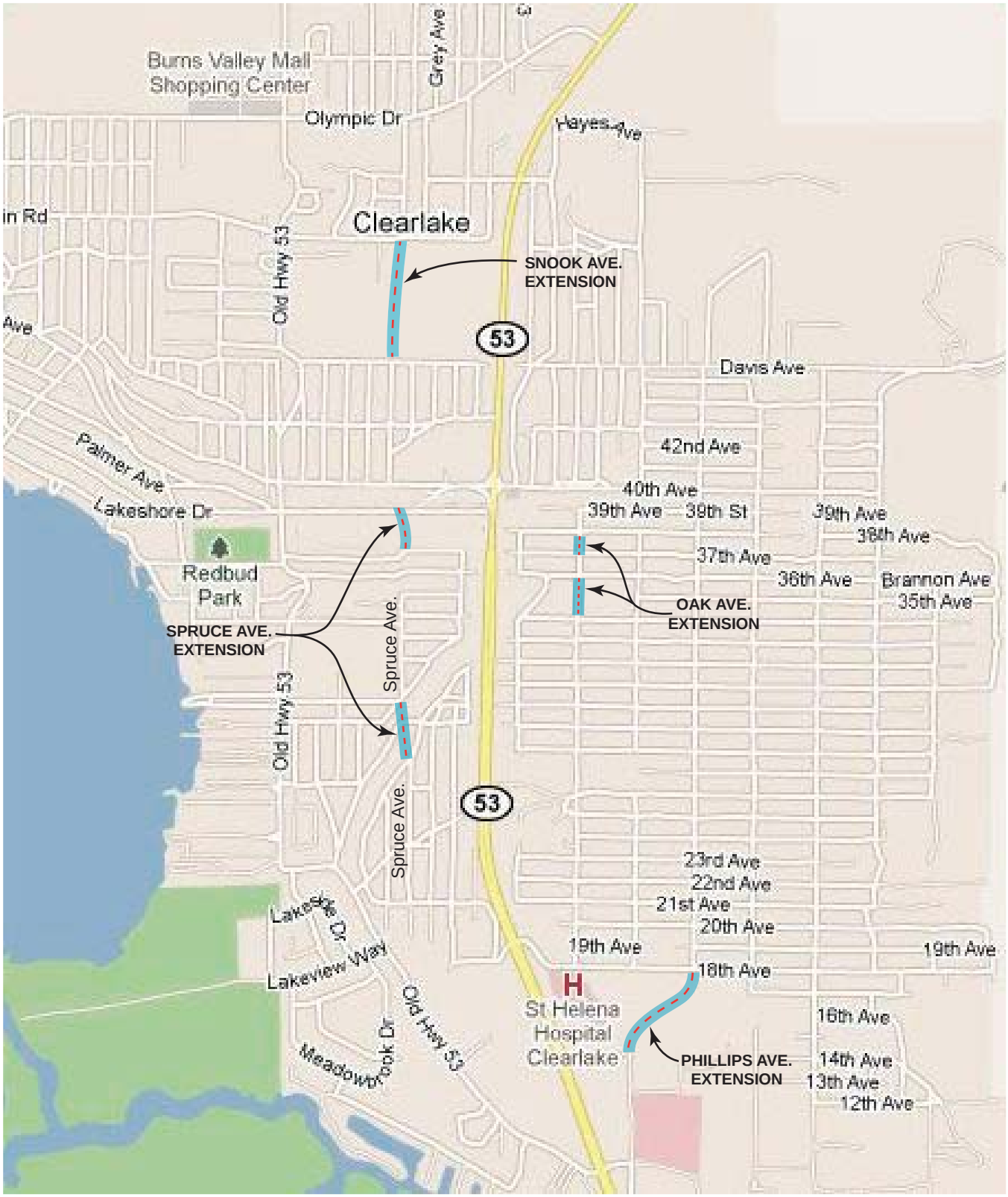
40th Avenue – It was indicated that many residents use the 40th Avenue intersection to cross SR 53. The intersection should be improved with better striping and pedestrian crossings at some of the approaches. Sidewalks that lead from the intersection to retail shops on the west side would also be needed in the future.

SR 53 near County Rd 141- The social services office is located on the west side of SR 53 near County Road 141. Since there is no pedestrian crossing near this segment of SR 53, some pedestrians are running across SR 53 near this area. It is suggested that a pedestrian overpass be considered in the vicinity. It will also be a good location to provide pedestrian and bicyclist access to the Anderson Marsh State Park as well as providing overall good pedestrian and bike connectivity between east and west of SR 53.

State Route 53 Corridor Study in Lake County

Potential Future North-South Roadway Connections

Figure 7



NORTH
Not to Scale
TJKM

LEGEND

Potential North-South Connections

149-023 - 2/4/11 - CT

Access Management

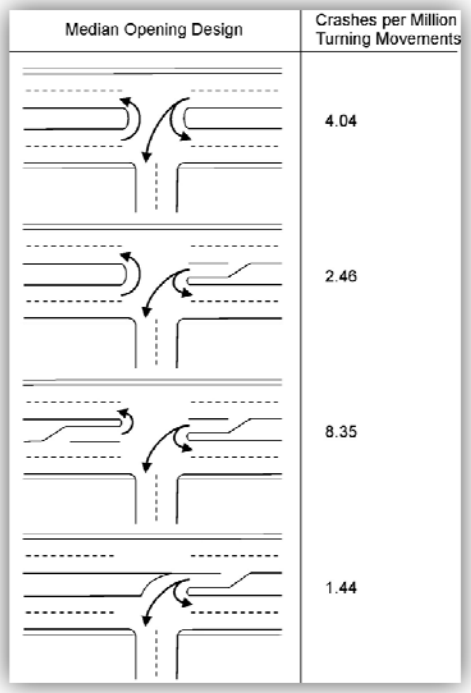
Access management involves the coordination and spacing of access along a highway corridor. Typically access management limits the number of locations where vehicles can enter, exit, or cross the highway and includes techniques such as spacing intersections at adequate distances, consolidating multiple driveways, controlling the number of traffic signals, providing auxiliary lanes for turning vehicles, and ensuring an integrated street network that supports the corridor. The appropriate use of access management techniques has been shown to improve the safety and traffic operations of a highway corridor. [6]

Generally, some of the benefits of access management include:

1. Reduce traffic congestion and impacts to the level of service of highways, leading to reduced fuel consumption and air pollution.
2. Enhance public safety by decreasing traffic crash rates.
3. Reduce the need for new highways and road widening by improving the performance of existing systems of state highways.
4. Preserve the public investment in new highways by maximizing their performance.

Extensive studies have shown that speed and travel time will improve if access is properly managed. For every additional access point per mile, studies have shown that free flow speed is reduced by 0.15 mph[7]. According to a Transportation Research Board (TRB) report, substandard driveway spacing reduces average travel speeds by 5 to 10 mph, and each additional traffic signal per mile reduces speeds by 2 to 3 mph.

For many suburban cities, the proper spacing and coordination of traffic signals is one of the most important factors in ensuring that a roadway will operate efficiently. At a spacing of ¼ mi, progression speeds are 26 to 30 mph if traffic is spread out among many streets, cycle lengths are approximately one minute, and two phase operations dominate. For traffic on suburban highways where progression speeds of 45 mph are desired, ½-mi spacing is required. For traffic to progress through multiple signals without stopping, proper spacing is essential.



As regards safety, the density of signalized intersections is a major contributor to the crash rate. When the number of signals per mile increases, crashes will increase. Having adequate turning lanes at signalized intersections is also an important factor in ensuring the safety of intersections. Median openings can take many forms, as illustrated on figure to the right. The safety of the median opening

[6] *Impacts of Access Management Techniques, NCHRP Report 420, Transportation Research Board of the National Academies, Washington, DC, 1999.*

[7] *Transportation Research Board, Access Management Manual. Washington, DC, 2003.*

depends on its form. Accident rates at mid-block median openings are "substantially lower" than at intersections[8]. It was also noted for urban arterial facilities that crash rates for median openings are lower at midblock locations than in situations where the median is located at an intersection.

Existing Unsignalized Intersections on SR 53

Currently, the distance between the intersections of SR 20/SR 53 in the north to SR 53/Olympic Drive in the south of approximately three miles. There are several unsignalized intersections within the segment. These are all minor unsignalized or T-intersections that serve small businesses or sparsely populated communities. They are:

- Ogulin Canyon Road (2 access points)
- Access to Villa La Brenta Winery
- Access to farm road
- Old Highway 53/Pond Road

Since these are all minor unsignalized intersections spread out over quite a long distance, continued access to these locations should not affect the traffic operations on the SR 53 corridor. However, adding a left-turn pocket on SR 53 may improve safety. In the long run, perhaps some of the full access intersections could be consolidated while allowing some for only left-in and right-in and right-out only operations.

The distance between the intersection of Olympic Drive and 40th Avenue is approximately 5,300 feet, about one mile. The unsignalized intersection of SR 53/Polk Avenue is located approximately 1,800 feet to the south of Olympic Drive and approximately 3,500 feet to the north of 40th Avenue. Adding a left-turn pocket on the median of SR 53 will improve safety.

Due to the physical constraints at Olympic Drive, the study evaluated alternative locations for a SR53 connection that will relieve the traffic at the intersection. One alternative that was evaluated was an extension of Denton Lane. Another alternative that was evaluated was an improvement to Pond Road. Both alternatives would require local street improvements to facilitate traffic flow to travel west into town. Together with the potential Spruce Avenue north-south extensions as mentioned earlier, the alternatives will provide more local circulation.

[8] *Transportation Research Record: Journal of the Transportation Research Board, No. 1912. Transportation Research Board of the National Academies, Washington, DC, 2005, pp. 72-81.*

Potential At-Grade Interim and Ultimate Long-Term Improvement Alternatives

Based on the results of the model forecasts and traffic analysis prepared by TJKM, Quincy Engineering, Inc. drafted the preliminary civil conceptual plans.

Digital aerial photographs of the Route 53 corridor were provided by the County and supplemented with imagery from Caltrans inventory photos. Contour information for the corridor was provided by the County from its GIS system.

The following section describes potential at-grade interim as well as ultimate long-term improvement alternatives. At-grade improvements are generally less costly and have less right of away impact. The ultimate long-term improvement alternatives are all grade separated interchange alternatives. These alternatives are more costly, have more impact on the right of way but will also provide greater travel speeds on SR 53. This will shorten the travel times on SR 53 and make it a more attractive travel alternative for vehicles traveling from SR 20/SR 29 to US 101 than for those using SR 20 on the north shore.

Several conference calls and meetings were held to discuss the merits, land use and operational impacts and constraints of each alternative. Suggestions were incorporated into revised conceptual plans and presented here. Some of these alternatives were deemed infeasible or have serious impacts in the vicinity of each alternative.

At-Grade Interim Improvement Alternatives

Below is a list of the potential at-grade interim alternatives. Each of the conceptual alternative drawings is presented as an exhibit. A total of nine at-grade interim alternatives are presented.

- Exhibit #1 - State Route 53 at State Route 20
- Exhibit #2 - State Route 53 at Olympic Drive Signalized
- Exhibit # 5 – Bypass for SR 53 at Olympic Drive
- Exhibit #6 - State Route 53 at 40th Avenue
- Exhibit #12 - State Route 53 at 18th Ave
- Exhibit #13 & #14 - State Route 53 at Dam Road
- Exhibit #19 & #20 - State Route 53 at State Route 29

More details are contained in Appendix I.

Ultimate Long-Term Improvement Alternatives

Nearly 20 different ultimate long-term conceptual alternatives were prepared. Extensive discussions of the pros and cons of each alternative were examined by the TAC. There was general consensus about the merits or serious impacts of each alternative. The following is a summary of some of the alternatives that were evaluated. More details are contained in Appendix I.

Exhibit #3 & #4 - State Route 53 at Olympic Drive – Tight Diamond & Roundabout Alternatives

A Tight Diamond Interchange configuration at Olympic Drive would allow northbound and southbound traffic to safely exit and enter SR53. Single lane entrance and exit ramps would be provided on SR53 using signals at the ramp intersections with Olympic Drive. It is also possible to

have roundabouts as intersections control instead of signals. A two lane over crossing would be provided for Olympic Drive to cross SR53.

However, the terrain at this location has large grade differences that will result in large cuts and fills requiring several retaining walls. These alternatives are not feasible due to the terrain constraints and other options should be evaluated.

Due to steep side slopes at the existing Olympic Drive intersection, the study evaluated two potential alternative access connections to the north of Olympic Drive. One of the alignments could be located at the extension of Denton Lane and the other further north at Pond Road. Both alternatives would require local street improvements to allow traffic to travel west into town. This is depicted as Exhibit 5 in Appendix I.

Exhibit #7 – SR 53 at 40th Avenue – Tight Diamond Alternative
A Tight Diamond Interchange configuration at 40th Avenue would allow traffic to safely exit and enter SR53 from both the east and the west. Single lane entrance and exit ramps would be provided on SR53 using signals at the ramp intersections with 40th Ave. A three lane over crossing would be provided for 40th Ave. with the center lane being used for left turn movements onto SR53.

Terrain and right-of-way will affect the layout at this location. Retaining walls will be necessary to limit the project footprint resulting in higher project costs. Minimizing impacts to properties is a consideration.

Exhibit #8 - SR 53 at 40th Avenue – Hook Ramps North
Entrance and Exit ramps for SR53 would be shifted north to align with County Road 213B. By constructing the ramps at this location it would allow for all ramps to be at grade. To the west of SR53, Manzanita Avenue would be extended south from Co. Rd 213B to 40th Ave to allow for connectivity. On the east of SR53, Moss Ave would need to be realigned to allow room for the new ramps. An over crossing would be constructed at 40th Ave to allow traffic to cross SR53 without interference.

Terrain and right-of-way affect the layout at this location. A new intersection will require right-of-way that will require the acquisition of several properties.

Caltrans is not in favor of hook ramps due to potential operational and safety issues. However, other members note that hook ramps present a much more affordable alternative considering that a full interchange runs generally more than $20 to $25 million while a hook ramp could range between $10 and $15 million.

Exhibit #9 & #10 – SR 53 at 40th Avenue – Hook Ramp South Alt #1 & #2
Entrance and Exit ramps for northbound SR53 would be shifted north to align with County Road 213B. Entrance and Exit ramps for southbound SR53 would be shifted south to align with 36th Avenue. By constructing the ramps at these locations it would allow for all ramps to be at grade. On the west of SR53, Moss Ave would need to be realigned to allow room for the new ramps. An over crossing would be constructed at 40th Ave to allow traffic to cross SR53 without interference.
Alternative #1 - To the west of SR53 a new frontage road would be needed to connect 40th Ave to Pacific Ave and the new entrance and exit ramps.
Alternative #2 - To the west of SR53 entrance and exit ramps would connect directly to 40th Ave.

Local frontage roads will be impacted due to ramps and some properties may lose access. Terrain and right-of-way will affect the layouts at this location.

As mentioned above, Caltrans is not in favor of hook ramps due to potential operational and safety issues. However, other members note that hook ramps present a much more affordable alternative considering that a full interchange runs generally more than $20 to $25 million.

Exhibit #11 - SR 53 at 40th Avenue – Partial Cloverleaf
A Partial Cloverleaf Interchange configuration at 40th Avenue would allow traffic to safely exit and enter SR53. Single lane entrance and exit ramps would be provided on SR53 using signals at the ramp intersections with 40th Ave. A three lane over crossing would be provided for 40th Ave.

New intersection will require new right-of-way acquisition, including some full parcels. Two variations of the Partial Cloverleaf were examined for this alternative but have been dismissed due to larger impacts to properties.

Exhibit # 15 to 18 - SR 53 between 18th and Dam Road

As mentioned previously, a SR 53 Freeway Agreement at SR 53/18th Avenue between Caltrans and the City of Clearlake points out that the feasibility of an interchange at Dam Road could be considered by the APC and the City if a study finds the alternative to be more desirable than one at 18th Street.

Due to the short distance of less than 2,600 feet between 18th Avenue and Dam Road, it is feasible to have only one interchange within this segment. Caltrans spacing guidelines of one mile between interchanges preclude having more than one interchange within this short distance. The following are discussions of pros and cons of each potential alternative.

Center Drive Alternatives – several concept alternatives were developed near Center Drive. Center Drive is centrally located between 18th Avenue and Dam Road. So in terms of accessibility, it is centrally located and equally accessible for traffic near 18th Avenue as well as Dam Road. Due to vertical grade, spacing and existing developments at Dam Road, it is not feasible to construct an interchange at Dam Road.

Exhibit #15A – Tight Diamond interchange concept design with an overpass at Center Drive and overpass at 18th Avenue and at Dam Road. On/-off ramps would only be available at Center Drive and not at 18th Avenue and Dam Road. The new connection over SR53 would connect at the proposed commercial development. On the east side of SR53, Dam Road Ext would be extended north to 18th Ave and Phillips Ave for connectivity on the east. 18th Ave would be realigned and extended west to connect to Old Highway 53.

Overall, there will be land use and access challenges for the three alternatives evaluated for this location. However, ease of access to freeway would still be an improvement for the area. Entrance and Exit ramps to SR53 will make travel onto the freeway easier.

Exhibit #15B - Yuba College Access Road: Yuba College Access Road would be extended west to Old Highway 53 and would become a tight diamond interchange. On the east side of SR53, Dam Road Ext would be extended north to 18th Ave and Phillips Ave for connectivity on the east. 18th Ave would be realigned and extended west to connect to Old Highway 53. Center Drive would be

extended with a new frontage road and connecting to18th Ave. Access to the existing hospital near 18th Avenue will also be provided near the new Center Drive frontage road. Ambulance vehicles from the west side of SR 53 could use the 18th Avenue Overcrossing or through the Yuba College Access Road but will go through three new signals and be equipped with signal preemption priority.

This seems to be a better geometric solution with less right of way impact near SR 53 and meets 4% grade design near the ramp area. Also it provides a good view of future development from SR 53 ramp.

Exhibit #15C – Loop Ramp at 18th Avenue: Construct overcrossings for 18th Avenue and Old Highway 53 at SR 53 with freeway access at 18th Ave. On the east side of SR53, Dam Road Ext would be extended north to 18th Ave and Phillips Ave for connectivity on the east. 18th Ave would be realigned and extended west to connect to Old Highway 53.

Truck delivery to future commercial development (to the west) will be an issue due to the elevated grade near the ramp – there is a potential for trucks tipping over due to the steep grade. Also, this will be a less direct route to Walmart and other commercial developments to the east of SR 53.

Exhibit #16A – Dam Rd and 18th Ave Split Diamond with half ramps at Center Drive and 18th Avenue was also evaluated. The northbound off-ramp and southbound on-ramp will be located at the proposed Center Drive and the northbound on-ramp and southbound off-ramp will be located at the 18th Avenue. Frontage roads on both sides of SR 53 would be required to facilitate the flow of north-south traffic between the two corridors.

A one-way frontage road would run south on the west side of SR53 from 18th Ave to Center Drive. A one-way frontage road would run north on the east side of SR53 from Center Drive to 18th Avenue. On the east side of SR53 Dam Road Ext would be extended north to 18th Ave and Phillips Ave. for connectivity on the east. 18th Avenue would be realigned and extended west to connect to Old Highway 53.

Exhibit #16B - Dam Rd and 18th Ave Split Diamond Construct overcrossings for 18th Avenue and Old Highway 53 at SR 53 with freeway access at Dam Road and 18th Avenue. Dam Road would become a split diamond in conjunction with 18th Ave. A one-way frontage road would run south on the west side of SR53 from 18th Ave to Old Highway 53. A one-way frontage road would run north on the east side of SR53 from Dam Road to 18th Avenue. On the east side of SR53, Dam Road Ext would be extended north to 18th Avenue and Phillips Avenue for connectivity on the east. Dam Road would also have to be realigned east to allow for the off-ramps at Dam Road. Cache Creek Way would also have to be realigned west to Highlands Harbor Road to allow connection to Cache Creek Way. 18th Avenue would be realigned and extended west to connect to Old Highway 53.

Parts of the one-way frontage road will function as two-way local access roadway. Local access to the frontage road will occur at Center Drive on the east side and at the future Airport Road extension on the west side. This alternative will impact some of the existing businesses.

Exhibit #17 – 18th Avenue and Old Hwy 53 Braided Ramp variation Construct overcrossings for 18th Avenue and Old Highway 53 at SR 53. Southbound SR53 would exit at 18th Avenue and Old Highway 53, northbound SR53 traffic would exit onto Dam Road and between Old Highway 53 and

18th Avenue onto a frontage road that would run up to 18th Avenue. Traffic would enter SR53 southbound from 18th Avenue with a braided ramp and then again from Old Highway 53. Traffic would enter SR53 northbound from Dam Road with a braided ramp and again at 18th Avenue. 18th Ave would be realigned and extended west to connect to Old Highway 53.

The purpose of the braided ramp concept is to provide ease of access with on/-off ramps near both 18th Avenue and Dam Road.

The potential for problematic weaving and merging issues due to the short distance are being avoided through the braided ramp design. The off-ramp exits before the on-ramp comes on. Frontage roads on both sides of SR 53 would also be needed to facilitate local traffic follow between the two corridors.

One major drawback is the high cost and right of way needed to accommodate the proposed design.

Exhibit #18 - 18th Avenue and Old Hwy 53 Center Drive hook ramp concept Construct overcrossings for 18th Avenue and Old Highway 53 at SR 53 with at grade freeway entrance and exit ramps at South Center Drive on the east of SR53 and Airport Drive on the west of SR53. At grade ramps on the west would extend out and connect to Old Highway 53. On the east side of SR53 Dam Road Ext would be extended north to 18th Ave and Phillips Ave for connectivity on the east. 18th Avenue would be realigned and extended west to connect to Old Highway 53.

The proposed design concept provides button hook loop on/-off ramp access on each side of SR 53 near Center Drive. However, there will not be an overpass over SR 53 at Center Drive. Dam Road and 18th Avenue would each be served by an overpass.

Exhibit #21 & #22 – SR 53 at SR 29 – Flyover Alternatives
Improvements would be made to the at grade intersection. Improvements would include widening each approach to allow turning lanes in each direction. To improve circulation from SR53 to SR 29 direct connections would be made. From southbound SR53 to westbound SR29 a high speed free right lane would be added. From northbound SR 53 to eastbound SR 29 a flyover would be constructed to allow for a direct connection. Both of these free movements are necessary due to the large amounts of traffic in these directions.

Construction a flyover of such length will be costly. Both the flyover and the free right lane require large amounts of right-of-way.

Exhibit # 23 - 18th Avenue/SR 53 Tight Diamond Interchange design It is our understanding that a preliminary tight diamond design has been prepared for the City. A partial cloverleaf loop ramp is shown on the northwest quadrant. The proposed interchange would be able to serve all movements.
The downside is that it is nearly half a mile to the north of Clearlake Shopping Center where major retail shops such as Walmart are located. The biggest challenge for this alternative might be the steep vertical grades on 18th Avenue to the west of SR 53 which is estimated to be nearly 10 percent.

Alternative Scenario Analysis: This alternative scenario assumed an 18th Avenue/SR 53 Tight Diamond Interchange (Exhibit # 23) with an at-grade intersection at Dam Road/SR 53. Under this scenario,

traffic in the area of 18th Avenue would be able to access SR 53 through a grade separated interchange. At the same time, an at-grade intersection is assumed at the intersection of Dam Road and SR 53. This will provide some benefit for direct access to the existing commercial and retail redevelopments in the immediate area including Walmart.

A grade separated interchange will provide much benefit for traffic in the area of 18th Avenue. It is anticipated that the capacity of the immediate local intersections would be much more enhanced due to the interchange and therefore less congestion could be expected.

Under this scenario, it is anticipated that more traffic in the vicinity of 18th Avenue and SR 53 would be using this interchange. Assuming that 10 percent more traffic would be using the 18th Avenue interchange instead of the at-grade intersection at Dam Road, it is estimated the intersection of SR 53/Dam Road would be able to function at acceptable levels of service for six to seven additional years (approximately 2036).

Conclusion (Long-Term Improvement Alternatives)
As indicated earlier, nearly 20 different ultimate long-term conceptual alternatives were prepared and reviewed. Extensive discussions of the pros and cons of each alternative were examined. There was general consensus about the merits or serious impacts of each alternative.

Those alternatives that are most promising were simply called Category A and all the other alternatives Category B. Category A alternatives include:

- Exhibit 1(Roundabout - State Route 53 at State Route 20),
- Exhibit 15-A (Tight Diamond Intersection - State Route 53 at Center Drive),
- Exhibit 15-B (Tight Diamond Intersection - State Route 53 at Yuba College Access Road),
- Exhibit 16B (Dam Rd and 18th Ave Split Diamond) and
- Exhibit 20 (At Grade Intersection with Free Right Turn - State Route 53 at State Route 29).

Conceptual Alternatives Cost Estimates

Construction cost estimates were prepared that identify the range of probable costs based upon unit cost estimates and Quincy's experience from similar projects. Quincy Engineering, Inc. prepared estimates of proposed right of way take, and Lake County staff provided the right of way unit cost. A cost estimate summary was prepared for some of the potential improvement projects.

The following are key assumptions used in the derivation of cost estimates.

Existing Mapping Information

The following data was collected relative to the preliminary proposed improvements.

- As-built Plans for Route 53 were obtained from Caltrans District 1.
- Aerial photographs - Digital aerial photographs of the Route 53 corridor provided by the County and supplemented with imagery from Caltrans inventory photos.
- The contour file provided by the County from its GIS system.

Design Criteria and Application of Standards

The primary design standards applied for the various project locations limits were based on the latest Caltrans "*Highway Design Manual (HDM) - Sixth Edition*", NCHRP 672 FOR *Roundabout.*
The following represents some general design criteria used to develop the alignment alternatives.

General Roadway Parameters

- Design Vehicle: STAA and California (HDM, Index 404.3)
- Design Speed (V): 45 mph (advisory standard minimum) on local routes at overcrossings (OC)
- Horizontal Curves: 25 mph at ramp termini and 50 mph at ramp exit nose. (HDM, Index 504.3)
- Typical Cross Section(s): 12-foot lanes, 8-foot shoulders, 4-foot shoulders (left shoulders along ramps)
- Slopes: fills @ 4: 1per HDM, Index 304.1 and cuts @ 2: 1
- Lane Drops: 50: 1 minimum (HDM, Index 504.3)
- Vertical Clearance: 16.5 feet, (HDM, Index 309.2)
- Overcrossing profiles set at 25 feet above SR 53 to allow for falsework and cast in place construction.
- Deceleration Length: used Table 405.2B

Grades and Profiles

All proposed grades for ramp intersections and local roadway alignments shall meet all geometric design standards for profile grades noted in HDM. Overcrossing grades are assumed to be 4% or less.

Base Drawings

After identifying the limits of the various interchange projects, a Microstation (MS) drawing file was created to facilitate the layout of the improvements for each project location. The MS drawing file referenced information from the base drawing and therefore included the limits of each roadway

project and any preliminary proposed improvements. The appropriate digital aerial photographs were also inserted into the computer drawing to aid in the layout of the proposed improvements and identify potential impacts.

To create a base map for the future interchange improvements, existing alignments and roadway features from as-built plans for the various project locations along Route 53 were obtained from Caltrans and checked on the aerial photos. This information was further supplemented by a digital aerial photograph within the Route 53 corridor.

Interchange concepts/alternatives were developed for each existing at grade intersection on SR 53 and is described below (also see attached schematic layouts). Each concept is intended to address the forecasted traffic volumes and meet Caltrans design standards. The concepts do, however, by utilizing the Caltrans Preliminary Project Cost Estimate Summary Worksheets, represent an order of magnitude of potential cost.

Finally, quantities of the various cost estimate items were measured from the drawings.

Unit Costs
For the various project locations, current Caltrans Cost Data were used to develop unit costs for various items of work.

Cost Estimates
Multiple cost estimate items were considered in the development of the preliminary cost estimates (see attached preliminary cost estimates). Where possible, relationships between construction items were developed and incorporated into the cost estimate sheets to simplify the quantity take-off process and reduce the potential for errors. An example of such a relationship is the correlation between asphalt concrete, aggregate base and roadway excavation. A single measurement of new paved area is sufficient to derive a quantity for all three of these cost estimate items. Of course, many major items do not have a consistent relationship with other items and must be measured separately. Following is a partial list of items considered in the cost estimate process and the criteria for their measurement:

Earthwork – Each location was evaluated by the roadway widths shown on the alternatives. Excavation and imported barrow were estimated with consideration given to the surrounding terrain. Rough profile grades were established to determine the quantities of both excavation and fill. Digital terrain models were not used to develop these quantities.

Storm Drainage - The determination of which type of drainage system to be used on each roadway project was beyond the scope of this estimate. Therefore, for estimate purposes, storm drainage costs were based on five percentage of the earthwork and structural section totals.

• *Specialty Items* -The determination of which type of specialty items to include on each roadway project was beyond the scope of this estimate. Therefore, for estimate purposes, the following items were included and based on similar projects for the region: retaining walls (Type I), sidewalks, Metal Beam Guard Rail and some Best Management Practice (BMP) items. Temp Construction BMPs are not estimated; however these should be covered in contingencies used.

• *Traffic Items* - The determination of certain traffic items to include on each roadway project was beyond the scope of this estimate. Therefore, for estimate purposes, the following items were

included and based on similar projects for the region: maintain traffic, overhead signs and striping, lighting, signals and traffic management plan.

• *Structural Items* -The costs for *bridge/OC* widening were based on a square-footage taken from the proposed widths shown on the preliminary drawings.

• *Right-of-Way Items* -The costs for preliminary right-of-way acquisitions were estimated at $15 and $13 per square foot (SF) respectively for the commercial and rural land use in the area. [9]

A summary of key alternatives is shown in Table VI. Detailed construction cost estimates for each alternative are contained in Appendix J.

Table VI: Summary of Cost Estimates

Project Descriptions	***Total Roadway Items***	***Total Structure Items***	***Total Right of Way Items***	***Total Project Cost***
Exhibit #1 - Roundabout - State Route 53 at State Route 20	$ 5,900,000	$ -	$ 1,340,000	$ 7,240,000
Exhibit #15A - Tight Diamond Intersection - State Route 53 at Center Drive	$ 28,100,000	$ 6,700,000	$ 14,100,000	$ 48,900,000
Exhibit #15B - Tight Diamond Intersection - State Route 53 at Yuba College Access Road	$ 28,195,280	$ 4,745,520	$ 3,640,000	$ 36,580,800
- 18th Avenue Overpass*a	$ 1,857,120	$ 3,358,368	$ 1,560,000	$ 6,775,488
- Dam Road Overpass*a	$ 1,547,600	$ 1,568,320	$ 1,300,000	$ 4,415,920
Exhibit #16B - Local Intersections - State Route 53 at Center Drive	$ 26,000,000	$ 3,100,000	$ 15,200,000	$ 44,300,000
Exhibit #20 - At Grade Intersection with Free Right Turn - State Route 53 at State Route 29	$ 4,200,000	$ 400,000	$ 1,900,000	$ 6,500,000
Phillips Avenue Extension *b	$ 1,231,000	$ 500,000	$ 512,000	$ 2,243,000

Note: *a = Cost estimates based on total cost estimates of Exhibit 15B and a part of alternative; the cost estimates for a few other alternatives are included in Appendix J.
*b = Cost estimates provided in the report "The Ten Year Transportation Needs and Capital Improvement Program In Lake County, Final Report, August 2010."

An order of magnitude cost is provided to improve the north section of SR 53 from just south of Olympic Drive (approximately 4,600 feet south) to SR 20 from two to four lanes. Based on a construction unit cost of $6,500,000 per centerline mile and $13 per square feet for ROW for a distance of nearly 3.7 miles, it is estimated that the order of magnitude cost is approximately $22.6 million. Some of the details are contained in Appendix J.

[9] *Based on information provided by Todd Mansell, County of Lake, January 24, 2011*

Capital Improvement Program (CIP)

Given the project goals and objectives indicated above, the most likely effective improvements will include:

- Improvement alternatives that draw new trips to SR 53 by virtue of increased speed and capacity on SR 53.
- Future long-term upgrades of SR 53 as a freeway.
- Reduced speed on SR 20 on the north shore which will be achieved through some of the approved traffic calming projects.
- Improve travel for non-auto modes.

Generally, the most appropriate solutions should help achieve their objectives in a cost effective way. Any potential Capital Improvement Program (CIP) could include a cost per vehicle trip served by these long-term alternatives. TJKM performed 2030 Cumulative model runs to obtain the projected average daily traffic on SR 53.

The potential economic analysis indicated for each project could include cost per person trip served ($/Person Trip), with the lowest values being the most cost effective or the best. This is an expression of Benefit/Cost (b/c). The results of the analysis are shown in Table VII.

Table VII: Summary of CIP Benefit Cost Analysis

Project Descriptions	Total Project Cost	Estimated ADT Volumes	Estimated Cost per Vehicle Trip
Exhibit #1 - Roundabout - State Route 53 at State Route 20	$ 7,240,000	17,269	$419
Exhibit #15A - Tight Diamond Intersection - State Route 53 at Center Drive	$ 48,900,000	36,409	$1,343
Exhibit #15B - Tight Diamond Intersection - State Route 53 at Yuba College Access Road	$ 47,800,000	36,409	$1,313
Exhibit #16B - Local Intersections - State Route 53 at Center Drive	$ 44,300,000	36,409	$1,217
Exhibit #20 - At Grade Intersection with Free Right Turn - State Route 53 at State Route 29	$ 6,500,000	33,513	$194
Phillips Avenue Extension	$ 2,243,000	6,300	$356

Based on the results of the benefit/cost analysis, the State Route 53 at Yuba College Access Road, Tight Diamond Alternative (Exhibit #15B) seems to be one of the best values for grade separated alternatives.

Summary and Recommendations

It is estimated that traffic along the SR 53 corridor should operate reasonably well for the next 10 years. However, local and regional agencies should adopt transportation policies that will ensure continued good traffic movements and promote effective traffic flow for all modes of transportation.

The following is a summary of project objectives and discussions of potential solutions of how they were accomplished in this study:

Objective # 1- Improve local circulation in Clearlake so that SR 53 traffic is less impacted by local traffic and consider frontage roads along SR 53 to buffer development in the corridor from increased travel volumes and speeds of through traffic, as well as to improve currently discontinuous north-south local circulation on either side of SR 53.
Solution - Due to the lack of local north-south connectivity, some local traffic were using SR 53 for intra-town travel. These types of travel could be accomplished if local connectivity is available. Some of the potential north-south connections or extensions reviewed in this study should be further studied and as appropriate plan line studies should be prepared. These include: Phillips Avenue Extension and Oak Avenue Extension on the eastside of SR 53 and Spruce Avenue Extension and Snook Avenue Extension on the west side of SR 53 as shown on Figure 7.

Several north-south connections were recommended to facilitate the flow of local traffic. Particularly the extension of Phillips Avenue will accomplish the goals of both of these objectives.

Objective # 2 - Explore feasibility of a roundabout at Dam Road/Walmart Driveway/Dam Road Extension.
Solution - Results of LOS and queuing analysis demonstrated that a roundabout will operate well at this location for the 2020 and 2030 cumulative scenarios. Specific improvement measures are shown on page 16 and 19.

Objective # 3 - Facilitate non-motorized access across and parallel to SR 53 through Clearlake so that pedestrians, bicyclists and transit patrons have a reasonable, convenient and safe means of local travel.
Solution - Proposed north-south connections to the east and west of SR 53 will facilitate more convenient local access for no-motorized traffic. Additional details are shown on page 27 and Figure 7.

Objective # 4 - Widen the two-lane section of SR 53 before it drops below LOS C.
Solution - It is estimated that a 4-lane facility will be necessary to accommodate the increased traffic volumes by approximately 2028 (see page 17 for additional information).

Objective # 5 - Minimize access points along SR 53 to only major, controlled locations or very low volume local access driveways.
Solution - In the near term, all major access will be controlled intersection. And since all minor unsignalized intersections are spread out over quite a long distance, continued access to these locations should not affect the traffic operations on the SR 53 corridor (see page 29-30).

Objective # 6 - Determine the feasibility or desirability of an interchange at Dam Road or constructing an interchange at 18th Street based on the original Freeway Agreement. Due to

spacing issues of less than 2,500 feet, only one interchange could be accommodated within this section.
Solution - Due to elevated grade near the ramp, truck delivery to future commercial development to the west of SR 53 could be an issue. And, since the location is nearly half a mile to the north of Dam Road, access to Walmart and other businesses to the south would not be as convenient (see page 35 for additional details). However, a future interchange at 18th Avenue/SR 53 (Exhibit 23) is a viable alternative.

Objective # 7 - Consider an alternative interchange site between Dam Road and 18th Avenue, perhaps in alignment with South Center Drive.
Solution - As mentioned previously, due to the short distance of less than 2,500 feet between 18th Avenue and Dam Road, it is feasible to have only one interchange within this segment. Several alternatives were discussed and extensively evaluated. It is not feasible to construct an interchange at Dam Road due to geometric constraints and extensive right of way impacts near Walmart. Seven potential alternative concept plans were developed and analyzed for this location between Dam Road and 18th Avenue.

An interchange at 18th Avenue/SR 53 could be a viable alternative. However, truck delivery to future commercial development to the west of SR 53 could be an issue due to elevated grade near the ramp – there is a potential for trucks tipping over due to the steep grade. And since the location is nearly half a mile to the north of Dam Road, access to Walmart and other business to the south will not be as accessible. However, this is a viable alternative.

Based on the results of the study, the Yuba College Access Road Tight Diamond Alternative (Exhibit 15-B) seems to be the most viable alternative. Since it is more centrally located than the 18th Avenue Alternative, it will provide equally convenient access for destination points located near Dam Road as well as on 18th Avenue. With its tight diamond design, this alternative has the least amount of right of way impact. And Benefit/Cost analysis showed this alternative to provide the most value (see least cost per vehicle trip analysis on page 40).

Objective #8 - Grade separate major junctions to maintain good average highway speeds for through traffic.
Solution - Potential alternatives have been developed to grade separate all major intersections in the long term. Some of these include the Tight Diamond interchange overpass at Center Drive Alternative (Exhibit 15A), the Yuba College Access Road Tight Diamond Alternative (Exhibit 15-B) and 18th Ave Split Diamond Alternative (Exhibit 16B). Detailed discussions of each alternative are shown on page 33 and 34 with geometric concept plans shown in Appendix I.

Objective # 9 - Match the scope and costs of needed corridor improvements to the level of demand so that positive benefit/cost ratios may be obtained.
Solution - Based on the results of the benefit/cost analysis, the State Route 53 at Yuba College Access Road, Tight Diamond Alternative (Exhibit #15B) provides the best value for grade separated alternatives as shown in Table VII on page 40.

Roadway Improvement Recommendations

Lastly, for planning of the future improvements and phasing purposes TJKM recommends the following minor and major improvements for the 2020 and 2030 scenarios:

Year 2020 Improvements
The proposed interim minor improvements for study intersections are shown in Figure 3 and indicted as follows:

- SR 53/SR 20: improve intersection with roundabout
- SR 53/Olympic Drive: signalize intersection and add eastbound right-turn lane
- SR 53/40th Avenue: add northbound left-turn lane
- SR 53/Dam Road / Old Highway 53: add northbound right-turn lane
- Dam Road /Walmart Driveway: add roundabout control and a northbound left-turn lane

The major improvements are as follows:

- Phillips Avenue Extension (see page 21)
- SR 20/SR 53 Roundabout (Exhibit 1in Appendix I)

The Phillips Avenue Extension project will be a key link in facilitating the flow of local north-south local traffic and reducing its dependence on SR 53. In addition, it provides local connectivity for pedestrians and bike travel.

The improvement of SR 20/SR 53 as a roundabout will greatly facilitate the flow of traffic and improve the safety for the intersection which is the northern entry point into the SR 53 corridor.

Year 2030 Improvements
The proposed interim minor improvements for study intersections are shown in Figure 4 and indicted as follows:

- SR 53/40th Avenue: add eastbound and westbound left-turn lanes and a northbound left-turn lane
- SR 53/18TH Avenue: add east and westbound left-turn lanes and a northbound right-turn lane
- SR 53/Dam Road/Old Highway 53: add northbound left-turn lane and westbound right-turn lane
- Dam Road / Walmart Driveway: add eastbound left-turn lane
- SR 53/SR 29 /Main Street: add southbound right-turn lane

Note it is assumed that the following improvements were made in 2020:
SR 53/SR 20 - improve intersection with roundabout; SR 53/Olympic Drive - signalize intersection and add eastbound right-turn lane; SR 53/40th Avenue - add a northbound left-turn lane; SR 53/Dam Road/Old Highway 53 - add northbound right-turn lane; Dam Road / Walmart Driveway - add roundabout control and northbound left-turn lane

The major improvements are as follows:

- Yuba College Access Road Tight Diamond Alternative (preferred alternative as shown in Exhibit 15-B in Appendix I), or
- 18th Avenue/SR 53 Tight Diamond Interchange (acceptable but not preferred as shown in Exhibit 23 in Appendix I)

Additional more detailed level analysis would be required in the future to determine the feasibility of the proposed alternatives. In addition, the potential economic impacts on the surrounding property and right of way should be assessed.

Lastly, note that based on the available traffic forecasting model data, year 2030 was the cumulative long-term scenario selected for the study. However, this does not translate to mean that improvements are needed by 2030. Instead, due to the current economic stagnation it is more likely that the need for these improvements based on the projected traffic demand would be even further out in the future.

Study References

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References

1. Caltrans, 2008, Traffic Volumes (Annual Average Daily Traffic (AADT) for all vehicles on California State Highways.
2. Caltrans, 2008 Annual Daily Truck Traffic on California Highway System.

Appendix A – Level of Service Methodology

Appendix B – Level of Service Worksheets: Existing Conditions

Appendix C – Collision Analysis

- Collision Diagrams
- Primary Collision Factors
- Collision Types
- Collision Rates Analysis

Intersections

- SR 20/SR 53
- SR 53/Olympic Drive
- SR 53/40th Avenue
- SR 53/18th Avenue
- SR 53/Old Hwy 53/Dam Rd
- SR 53/SR 29

Appendix D – Model Review

- 2030 Model Land Use
- 2030 Network Improvements

Appendix E – Level of Service Worksheets: 2020 Conditions

Appendix F – Level of Service Worksheets: 2030 Conditions

Appendix G – Level of Service Worksheets: 2020 Conditions (Phillips Avenue Extension)

Appendix H – Level of Service Worksheets: 2030 Conditions (Phillips Avenue Extension)

Appendix I – Conceptual Alternatives

Appendix J – Detailed Cost Estimates