Department of Veterans Affairs Sierra Nevada Health Care System

Renovation and Modernization

Traffic Study Report

June 2016

DRAFT
KIRMAN AVENUE LANE REDUCTION
TRAFFIC STUDY REPORT
FOR DEPARTMENT OF VETERANS AFFAIRS
SIERRA NEVADA HEALTH CARE SYSTEM
RENO, NEVADA

GHD Project No. 11110661

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1. Executive Summary

1.1 Study Introduction and Purpose

The Department of Veterans Affairs Sierra Nevada Health Care System (VASNHCS) is located at 975 Kirman Ave, Reno, Nevada. The medical campus provides inpatient and outpatient health care to veteran patients in northern Nevada and northeastern California. In anticipation of growth in the demand for veteran care and mental health services, the VASNHCS has begun the planning and implementation of service expansion and infrastructure improvements to meet the projected demands, while minimizing impacts to daily operations. A number of renovation and modernization projects and one Major project are planned for completion and operation with recommendations included in the VA Reno 5-Year Master Plan (VASNHCS, 2015). The Master Plan aims to create a physical framework for future development and project phasing to assure a high quality campus environment. The Master Plan includes recommendations and considerations for the implementation and scheduling of these projects.

This traffic impact study evaluates the potential traffic impacts associated with the VASNHCS near-term renovation and modernization projects and the Major clinical expansion project. The study also evaluates the traffic conditions and potential changes to traffic circulation associated with the reduction of Kirman Avenue from two southbound travel lanes to one lane between East Taylor Street and Burns Street / Balzar Circle.

1.2 Project Summary

The proposed Major project consists of seismic retrofits and renovation to Building 1 for administrative space, a clinical expansion for patient care, and associated improvements that will increase the building area on the existing site by 97,000 square feet. Construction of the Major project is anticipated to begin in 2017 adjacent to Kirman Avenue.

The proposed renovation and modernization and Major projects are summarized in Table 11 and Table 12 (Section 4), and are expected to be implemented within the next five years. The Major and renovation and modernization projects are collectively referred to as the “Project” throughout this report.

A reduction in the width of Kirman Avenue is proposed, narrowing the roadway from two southbound lanes to one southbound lane and a dedicated bicycle lane. As a part of this study, several concepts were developed to evaluate options for the lane reduction. These concepts considered the following key issues:

- Geometric alternatives
- Pedestrian access and safety
- Traffic calming
- Integration with other planned improvements
- Access to existing driveways
- Emergency vehicle access

The selected Kirman Avenue lane reduction concept was developed in close coordination with the City of Reno Community Development Department, Department of Public Works, Traffic Engineering and Fire Department to assure that the proposed concept met City requirements with

regard to planning and neighborhood context, traffic operations, improvement standards and emergency response requirements. A detailed discussion of the Kirman Avenue lane reduction is provided in Section 10.

1.3 Analysis Summary

The study analyzed 23 intersections and reviewed 19 roadway segments for potential traffic impacts resulting from the Project. Five scenarios were evaluated in this study, which are 1) Existing Conditions, 2) 2025 Conditions, 3) 2025 + Project Conditions, 4) 2035 Conditions and 5) 2035 + Project Conditions. Traffic volumes associated with future conditions were estimated by applying established growth factors from the current version of the Washoe County Regional Transportation Commission *Regional Travel Demand Forecasting Model* to existing traffic turning movement counts from 2016. Scenarios 2 – 5 were also evaluated for potential traffic impacts associated with the proposed Kirman Avenue lane reduction. Level of Service thresholds of significance adopted by the City of Reno, City of Sparks and the Washoe County RTC are used to determine traffic impacts.

The peak hour Signal Warrant 3 is met at study Intersection No. 23 (Kietzke Lane / East Taylor Street) in the Existing Conditions. Signalization is recommended to improve the operation of this intersection.

1.3.1 Existing Conditions

The analysis of existing conditions found that, in general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. Based on the adopted LOS thresholds of significance all study intersections are operating acceptably with the exception of Intersection No. 2 (Wells Avenue / East Taylor Street), 3 (Wells Avenue / Crampton Street) and 23 (Kietzke Lane / East Taylor Street). Intersection 23 meets Part A of the MUTCD Signal Warrant 3. Signalization of this intersection will improve the Level of Service to LOS A (5.2 second delay) in the a.m. peak hour and LOS A (6.2 second delay) in the p.m. peak hour. Peak hour 95th percentile queue lengths exceed existing storage lane capacity at the northbound thru/right and westbound thru/left movements at Intersection No. 5 (Wells Avenue / Vassar Street).

1.3.2 2025 + Project Conditions

The analysis found that the Project contributes traffic to approaches at Intersection No. 2, 3 and 23 that operate unacceptably without the Project, which is an **impact**.

The Project contributes traffic to the westbound approach to Intersection No. 2 (Wells Avenue / Burns Street), which operated acceptably without Project trips. The addition of Project trips reduced the intersection LOS from acceptable to unacceptable during the p.m. peak hour. Because the Project contributes traffic to this intersection causing it to operate unacceptably, this is an **impact**. The peak hour warrant is not met at this intersection.

The peak hour 95th percentile queue lengths at Intersection No. 5 (Wells Avenue / Vassar Street) exceed existing lane storage capacity for the northbound thru/right and southbound thru/right movements:. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

1.3.3 2035 + Project Conditions

The analysis found that the Project contributes traffic to approaches at Intersections No. 2, 3, 4 and 23 that operate unacceptably without the Project, which is an **impact**.

The Project contributes traffic to Intersection No. 1 (Wells Avenue / Roberts Street) which operated acceptably without Project trips. The addition of Project trips reduced the intersection LOS from acceptable to unacceptable during the a.m. peak hour. Because the Project contributes traffic to this intersection causing it to operate unacceptably, this is an **impact**. The peak hour warrant is not met at this intersection.

The peak hour 95th percentile queue lengths at Intersection No. 5 (Wells Avenue / Vassar Street) exceed existing lane storage capacity for the northbound thru/right, southbound thru/right and westbound thru/left movements. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

1.4 City of Reno Review

Following completion of the draft study, it was provided to the City of Reno for review. A meeting was held on June 29, 2016 with the City of Reno Public Works Department and Community Development Departments to discuss the findings of the study, impacts identified and any required mitigations or improvements. During the meeting the City confirmed that they have reviewed the potential traffic impacts of the project and concluded that no roadway improvements or traffic mitigation measures are required at this time; however, the City will continue to monitor the traffic conditions and will implement roadway improvements in the future, as necessary.

1.5 Scope Limitations

This report: has been prepared by GHD for Department of Veterans Affairs Sierra Nevada Health Care System and may only be used and relied on by Department of Veterans Affairs Sierra Nevada Health Care System for the purpose agreed between GHD and the Department of Veterans Affairs Sierra Nevada Health Care System as described in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Department of Veterans Affairs Sierra Nevada Health Care System arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on the data collected and assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Department of Veterans Affairs Sierra Nevada Health Care System and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Study Parameters

2.1 Introduction

This traffic impact study evaluates the potential traffic impacts associated with the VA Sierra Nevada Health Care System (VASNHCS) near-term renovation and modernization projects and the Major seismic upgrade and clinical expansion project, collectively referred to as the "Project". The study also evaluates the traffic conditions and potential changes to traffic circulation associated with the reduction of Kirman Avenue from two southbound travel lanes to one lane between East Taylor Street and Burns Street / Balzar Circle. Improvements are recommended to mitigate intersection and roadway impacts to an acceptable level of operation as described in Exhibit F of the *Regional Road Impact Fee (RRIF) Traffic Report Guidelines* (RTC, 2016) adopted by the City of Reno, City of Sparks and the Washoe County Regional Transportation Commission (RTC). Traffic impacts are typically evaluated by determining the number of trips the "Project" would be expected to generate, distributing the new trips to the surrounding street system based on existing travel patterns or anticipated travel patterns specific to the Project, then analyzing the impact the new traffic would be expected to have on study intersections and roadways.

2.2 Study Intersections and Roadways

The study area is residential, and the terrain is generally level. The intersections analyzed in this study are listed below in Table 1. Intersections have been numbered for reference in the remainder of this report.

Table 1 Study Intersections

No.	Intersection (Control)	Jurisdiction
1	Wells Avenue / Roberts Street (TWSC)	City of Reno
2	Wells Avenue / East Taylor Street (TWSC)	City of Reno
3	Wells Avenue / Crampton Street (TWSC)	City of Reno
4	Wells Avenue / Burns Street (TWSC)	City of Reno
5	Wells Avenue / Vassar Street (Signal)	City of Reno
6	East Taylor Street / Locust Street (AWSC)	City of Reno
7	Locust Street / Crampton Street (TWSC)	City of Reno
8	Locust Street / Burns Street (TWSC)	City of Reno
9	East Taylor Street / Kirman Avenue (AWSC)	City of Reno
10	Kirman Avenue / Belli Drive (TWSC)	City of Reno
11	Kirman Avenue / SNHCS North Driveway (TWSC)	City of Reno
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	City of Reno
13	Kirman Avenue / SNHCS South Driveway (TWSC)	City of Reno
14	Kirman Avenue / Burns Street – Balzar Circle (TWSC)	City of Reno
15	Kirman Avenue / Balzar Circle-Wonder Street (TWSC)	City of Reno
16	Belli Drive / West Parking Structure Driveway (TWSC)	City of Reno
17	Belli Drive / East Parking Structure Driveway (TWSC)	City of Reno
18	Kirman Avenue / Vassar Street (AWSC)	City of Reno
19	East Taylor Street / Wilkinson Avenue (TWSC)	City of Reno
20	Belli Drive / Wilkinson Avenue (TWSC)	City of Reno
21	Vassar Street / Wilkinson Avenue (TWSC)	City of Reno
22	Kietzke Lane / Roberts Street (TWSC)	NDOT
23	Kietzke Lane / East Taylor Street (TWSC)	NDOT

TWSC = Two-Way Stop-Control AWSC = All-Way Stop-Control NDOT = Nevada Department of Transportation

Traffic conditions at the study intersections were analyzed for the weekday a.m. and p.m. peak hours of traffic. The a.m. peak hour of traffic is generally between 7:00 and 9:00 a.m. and the p.m. peak hour is generally between 4:00 and 6:00 p.m. It is during the peak hour of traffic that the most congested traffic conditions generally occur on an average day.

The roadway segments analyzed in this study are listed below in Table 2. All are within the jurisdiction of the City of Reno. Reported capacities correspond with a Level of Service "E" for each 2-lane roadway type as reported in Transportation Research Board Special Report 209: Highway Capacity Manual (TRB, 1985). Roadway segments have been numbered for reference in the remainder of this report.

Table 2 Study Roadway Segments

No.	Roadway Segments	Functional Classification	Capacity (vpd)[1]
1	Locust Street: Taylor Street to Cheney Street	Arterial*	12,000
2	Locust Street: Wonder Street - Claremont Street	Arterial*	12,000
3	Taylor Street: Wilkinson Avenue - Bates Avenue	Collector	12,000
4	Burns Street: Wilson Avenue - Locust Street	Local	2,000
5	Taylor Street: Wilson Avenue - Locust Street	Collector	12,000
6	Wells Avenue: Crampton Street - Burns Street	Arterial	18,000
7	Wells Avenue: Cheney Street - Taylor Street	Arterial	18,000
8	Wells Avenue: Moran Street - Roberts Street	Arterial	18,000
9	Kirman Avenue: Wonder Street - Vassar Street	Collector	12,000
10	Kirman Avenue: Cheney Street - Taylor Street	Collector	12,000
11	Burns Street: Locust Street - Kirman Avenue	Local	2,000
12	Wilkinson Avenue: Taylor Street - Belli Drive	Local	2,000
13	Belli Drive: East Driveway - Wlikinson Avenue	Local	2,000
14	Belli Drive: West Driveway - Kirman Avenue	Local	2,000
15	Kirman Avenue: Belli Drive - Burns Street	Collector	12,000
16	Kirman Avenue: Taylor Street - Belli Drive	Collector	12,000
17	Taylor Street: Kirman Avenue - Edelweiss Street	Collector	12,000
18	Taylor Street: Locust Street - Kirman Avenue	Collector	12,000
19	Locust Street: Burns Street - Crampton Street	Arterial*	12,000

[1]Source: TRB (1985).

*Collector capacity used for this roadway due to narrow roadway width.

vpd = vehicles per day

For the interrupted flow facilities in this study, traffic conditions are anticipated to be controlled primarily by the intersections, therefore the study roadway segments were not analyzed for the weekday a.m. and p.m. peak hours of traffic. Rather, they were used to confirm and adjust traffic progression between the study intersections. A volume/capacity (V/C) ratio is reported for each segment for the Existing Condition based on anticipated roadway capacity and 24-hour volume.

2.3 Study Scenarios and Periods

Five scenarios were evaluated in this study, which are Existing Conditions, 2025 Conditions, 2025 + Project Conditions, 2035 Conditions, and 2035 + Project Conditions. Each of these scenarios are described in detail below.

Scenario 1: Existing Conditions. This scenario represents current traffic operations based on data collected in the field in February 2016.

Scenario 2: 2025 Conditions. This scenario represents traffic conditions based on existing traffic volumes adjusted to the year 2025 utilizing traffic growth projections obtained from the Washoe County Regional Transportation Commission (RTC) Regional Travel Forecasting Model.

Scenario 3: 2025 + Project Conditions: This scenario presents an evaluation of the potential impacts that would be expected to occur with the addition of Project-generated traffic to Scenario 2 – 2025 Conditions.

Scenario 4: 2035 Conditions. This scenario represents traffic conditions based on existing traffic volumes adjusted to the year 2035 utilizing traffic growth projections obtained from the Washoe County RTC Regional Travel Forecasting Model.

Scenario 5: 2035 + Project Conditions: This scenario presents an evaluation of the potential impacts that would be expected to occur with the addition of Project-generated traffic to Scenario 4 – 2035 Conditions.

Scenarios 2 – 5 were also evaluated for potential traffic impacts associated with the proposed Kirman Avenue lane reduction.

2.4 Data Requirements

The data requirements for the traffic impact analysis include:

- Existing intersection turning movement traffic volume counts.
- 24-hour roadway traffic volume classification counts.
- Intersection geometry and configuration.
- Roadway widths.
- Vehicle accident data.
- VA Project program.

GHD's traffic data collection subconsultant, Counts Unlimited, Inc., collected existing traffic volumes at all study locations Tuesday, February 23, 2016 through Thursday, February 25, 2016. These counts consisted of intersection turning movement counts and roadway classification counts taken while school was in session at all study intersections, inclusive of bicycles and pedestrians. Vehicle classifications are in accordance with the Federal Highway Administration (FHWA) Vehicle Classification 13-Category Scheme, inclusive of bicycles. Site visits were also made to confirm intersection geometry and roadway widths at all intersection approaches.

All intersection vehicle turning movement volume counts are included in Appendix B.

For the purpose of this study, Average Daily Traffic (ADT) is reported as the total traffic volume during the 24-hour count period, excluding bicycles. Volumes for trucks and buses are converted to Passenger Car Equivalents (PCEs) using the HCM2010 method and a PCE factor of 1.5. All 24-hour roadway segment vehicle classification volume counts are included in Appendix C.

Vehicle accident data reports for the study roadways and intersection were obtained from the Nevada Department of Transportation (NDOT).

2.5 Measures of Effectiveness

The City of Reno maintains jurisdiction over the operation of roadways and intersections in the study area. The City uses measures of effectiveness (MOEs) established and adopted by the City of Reno, City of Sparks and the Washoe County RTC (RTC, 2016) to describe the measures best suited for analyzing City transportation facilities. MOEs are calculated performance measures that reflect the operating conditions of a facility, given a set of roadway, traffic, and control conditions. Table 3 summarizes the MOEs by facility type recommended by the City, and the MOEs used in this study.

Table 3 Measures of Effectiveness (MOE) by Facility Type

Type of Facility	Study MOE
Signalized Intersections	Control Delay per Vehicle (sec/veh)
Un-signalized Intersections	Control Delay per Vehicle (sec/veh)
Roadway Segment	Volume / Capacity Ratio (V/C)

2.6 Thresholds of Significance

Thresholds of significance in traffic analyses are principally used to determine whether a project may have an impact on study intersections and roadways. A threshold of significance is a quantitative or qualitative standard, or set of criteria from which the significance of a given impact may be determined. In the context of traffic, levels of service based standards are typically used to establish thresholds of significance and qualify potential impacts.

2.6.1 City of Reno

The City of Reno, City of Sparks and the Washoe County RTC have adopted the Level of Service thresholds of significance summarized in Table 4 for assessing the need for street and highway improvements at a planning level.

Table 4 Level of Service Thresholds of Significance

Level of Service	Transportation Facility
LOS D	• All regional roadway facilities projected to carry less than 27,000 ADT at the latest Regional Transportation Plan (RTP) horizon
LOS E	• All regional roadway facilities projected to carry 27,000 or more ADT at the latest RTP horizon
LOS F	• Plumas Street –Plumb Lane to California Avenue • Rock Boulevard – Glendale Avenue to Victorian Avenue • South Virginia Street – Kietzke Lane to South McCarran Boulevard • Sun Valley Boulevard – 2nd Avenue to 5th Avenue • Intersection of North Virginia Street and Interstate 80 ramps

A traffic **impact** is noted if the Project traffic results in a degradation of an acceptable Level of Service (LOS) to an unacceptable LOS, or if the Project contributes traffic to an intersection movement or approach that operates unacceptably without the Project. When impacts occur, mitigation measures may be recommended to improve the operation of the transportation facility to an acceptable condition. This study does not assess the significance of the identified impacts.

All of the study roadways are projected to carry less than 27,000 ADT at the latest RTP horizon, therefore LOS D is the minimum acceptable LOS for this study.

2.7 Level of Service Methodology

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, LOS A represents free flow conditions and LOS F represents forced flow or breakdown conditions. The LOS designation for intersections is generally accompanied by a unit of measure that indicates a level of delay and/or volume to capacity ratios.

2.8 Level of Service

The study intersections were analyzed using methodologies from the *HCM2010 Highway Capacity Manual – Volume 3 Interrupted Flow* (HCM2010) (TRB, 2010). This source contains methodologies for various types of intersection control, including signalized intersections, TWSC intersections and roundabouts.

The analysis level in this study is recognized as planning and preliminary engineering. The "analysis level" describes the level of detail used when the methodology is applied. The "planning and preliminary engineering level" of analysis requires only the most fundamental types of information. Default values are then used as substitutes for other input data.

The methodologies utilized in this study are for the automobile mode, although other modes are discussed.

Synchro 8 (Synchro) with SimTraffic software was used for the traffic analysis in this study.

2.8.1 Signalized Intersections

The signalized methodology for the automobile mode is based on input data requirements for traffic characteristics, geometric design, signal control and other factors including analysis period duration and approach speed limit.

Traffic characteristic inputs include (among others) demand flow rate, percent heavy vehicles, peak hour factors and base saturation flow rate.

Geometric design inputs include the number of lanes, average lane width, number of receiving lanes, turn bay (or pocket) lengths, presence of on-street parking and approach grade.

Signal control inputs include the type of signal control, phase sequence, protected for permissive left-turn operations, maximum green time, minimum green time, yellow change interval, red clearance, walk time, pedestrian clear time and phase recall. Intersection No. 5 (Wells Avenue / Vassar Street) is the only signalized intersection in the study area. The signal operates with a shared through-left movement in the westbound direction. The *HCM2010* methodology does not provide a means of computing the delay with this type of lane geometry, and is a non-standard NEMA phasing. Therefore, the *HCM2000* methodology, which can be used to determine delay with this type of geometry, was used at this intersection.

Computed control delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology to describe the signalized intersection operation as a whole. The ranges of delay associated with the various signalized levels of service are summarized in Table 5.

Table 5 Signalized Intersection Level of Service

Level of Service	Description	Control Delay (Seconds Per Vehicle)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	< 10
B	Operations with low delay occurring with good progression and/or short cycle lengths.	>10 to 20
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	>20 to 35
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and/or high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	>35 to 55
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences. This is considered to be the limit of acceptable delay.	>55 to 80
F	Operation with delays unacceptable to most drivers occurring due to oversaturation, poor progression, or very long cycle lengths.	> 80
Source: 2010 Highway Capacity Manual (TRB, 2010).		

2.8.2 Unsignalized Intersections

The AWSC or TWSC (unsignalized) intersection methodology for motor vehicles is determined by the computed or measured control delay and the volume-to-capacity ratio. For motor vehicles, LOS is determined for each minor-street movement (or shared movement) as well as major-street left turns using the criteria shown in Table 4. LOS for TWSC intersections is not defined for the intersection as a whole or for major-street approaches.

The input data required for the evaluation of TWSC intersections includes the number and configuration of lanes on each approach; percent heavy vehicles for each movement; demand flow rate for each entering vehicular movement and each pedestrian crossing movement during the peak hour; peak hour factor; existence of a two-way left-turn lane (TWLTL) or raised or striped median storage (or both); approach grades; existence of flared approaches on the minor street; and existence of upstream traffic signals. Several TWSC intersections include one-way roadways (Locust Street and Kirman Avenue). The *HCM2010* methodology does not compute control delay for these intersections. Therefore, the *HCM2000* methodology, which can be used to determine delay with this type of geometry, was used at these intersections.

Computed control delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology to describe each minor-street movement and major-street left-turn movement. The ranges of delay associated with the TWSC levels of service are indicated in Table 6.

Table 6 Unsignalized Intersection Level of Service

Level of Service	Description	Control Delay (Seconds Per Vehicle)	LOS
A	Little or no delay	< 10	A
B	Short traffic delays	>10 to 15	B
C	Average traffic delays	>15 to 25	C
D	Long traffic delays	>25 to 35	D
E	Very long traffic delays	>35 to 50	E
F	Extreme traffic delays with intersection capacity exceeded (for an all-way stop), or with approach/turn movement capacity exceeded (for a side street stop controlled intersection)	> 50.0	F
Source: 2010 Highway Capacity Manual (TRB, 2010).			

2.8.3 Roadway Segments

The roadway segment analysis methodology for motor vehicles uses the Volume / Capacity (V/C) ratio. The V/C ratio is determined by dividing the 24-hour Average Daily Traffic (ADT) volume by the roadway capacity. For the purpose of this study, ADT is reported as the total Passenger Car Equivalent (PCE) traffic volume during the 24-hour count period, excluding bicycles. Volumes for trucks and buses were converted to PCEs using the HCM2010 method and a PCE factor of 1.5. Capacity is defined as the maximum rate at which vehicles can pass through the measurement point in an hour under prevailing conditions; it is often estimated based on assumed values for saturation flow. For the purpose of this study, only the V/C ratio is reported for roadway segments and no roadway segment LOS is reported. The V/C ratio thresholds and corresponding descriptions for roadways are show in Table 7, and are similar to those described for intersections in the Federal Highway Administration publication *Signalized Intersections: An Informational Guide* (FHWA, 2013).

Table 7 Roadway V/C Ratio Threshold Descriptions

Critical Volume-to-Capacity Ratio	Assessment
< 0.85	Roadway is operating under capacity. Excessive delays are not experienced.
0.85 – 0.95	Roadway is operating near its capacity. Higher delays may be expected.
0.95 – 1.00	Unstable flow results in a wide range of delay. Improvements will be required soon to avoid excessive delays
> 1.00	The demand exceeds the available capacity of the roadway. Excessive delays are anticipated.
Source: Signalized Intersections: An Informational Guide (FHWA, 2013).	

Due to the relatively close spacing of the study intersections, it is expected that the intersections are the traffic facilities that control the capacity of the roadway network. Therefore, the V/C ratios are reported only for the Existing Conditions (Section 3).

2.9 Vehicle Queuing

Vehicle queuing analysis was completed for all signalized intersections to assess the capacity of intersections to accommodate the number of vehicles expected to wait at the intersections before being able to pass through or turn. This analysis is important because if there is not enough queuing space between intersections, in left-turn or right-turn pockets, the overflow of vehicles can obstruct the operations of the roadway.

The Synchro software program was used to determine the 95th percentile queue, which is the maximum back of queue with 95th percentile traffic volumes. The queue analysis will determine the 95th percentile movement queue lengths based on HCM2010 methodology.

3. Existing Conditions

This section describes the existing conditions at the study intersections and roadways during the weekday a.m. and p.m. peak hours based on peak hour traffic conditions. Also included is a discussion of transportation facilities in the Project area, including the roadway network, transit services, and bicycle and pedestrian facilities.

3.1 Study Area

The VASNHCS campus is located within the planning area of the *Wells Avenue Neighborhood Plan*, included in Part 3 of *The Great City Plan, The City of Reno Master Plan* (City of Reno, 2008). Within the planning area, the VASNHCS campus is designated a Public Facility (PF), and is generally surrounded to the North, South and West by Multifamily Residential (MF-14) neighborhoods, and to the east by Single Family Residential (SF) neighborhoods. The study area and intersection locations are shown in Figure 1. Figure 2 shows the existing VASNHCS campus, surrounding streets and general vehicular and pedestrian circulation routes.

3.1.1 Streets

The VASNHCS campus is generally bounded by the following four streets:

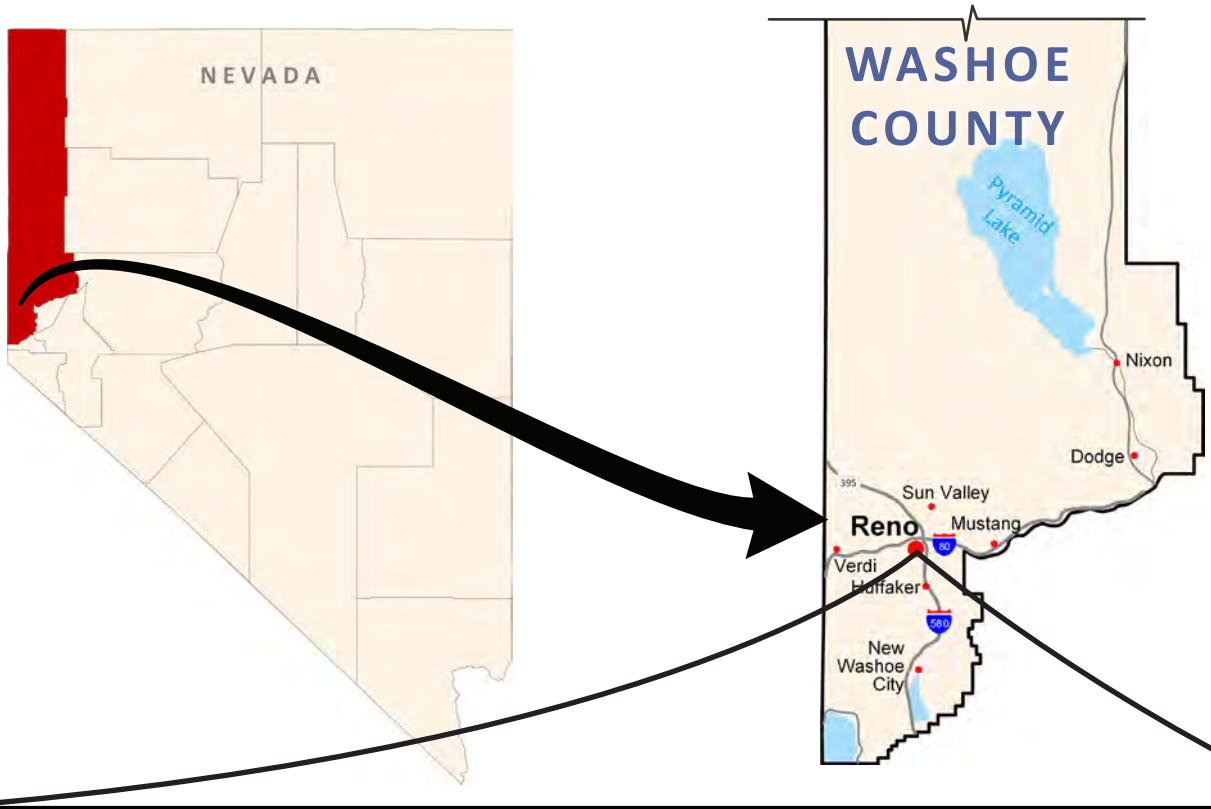
- East Taylor Street
- Locust Street
- Kirman Avenue
- Burns Street

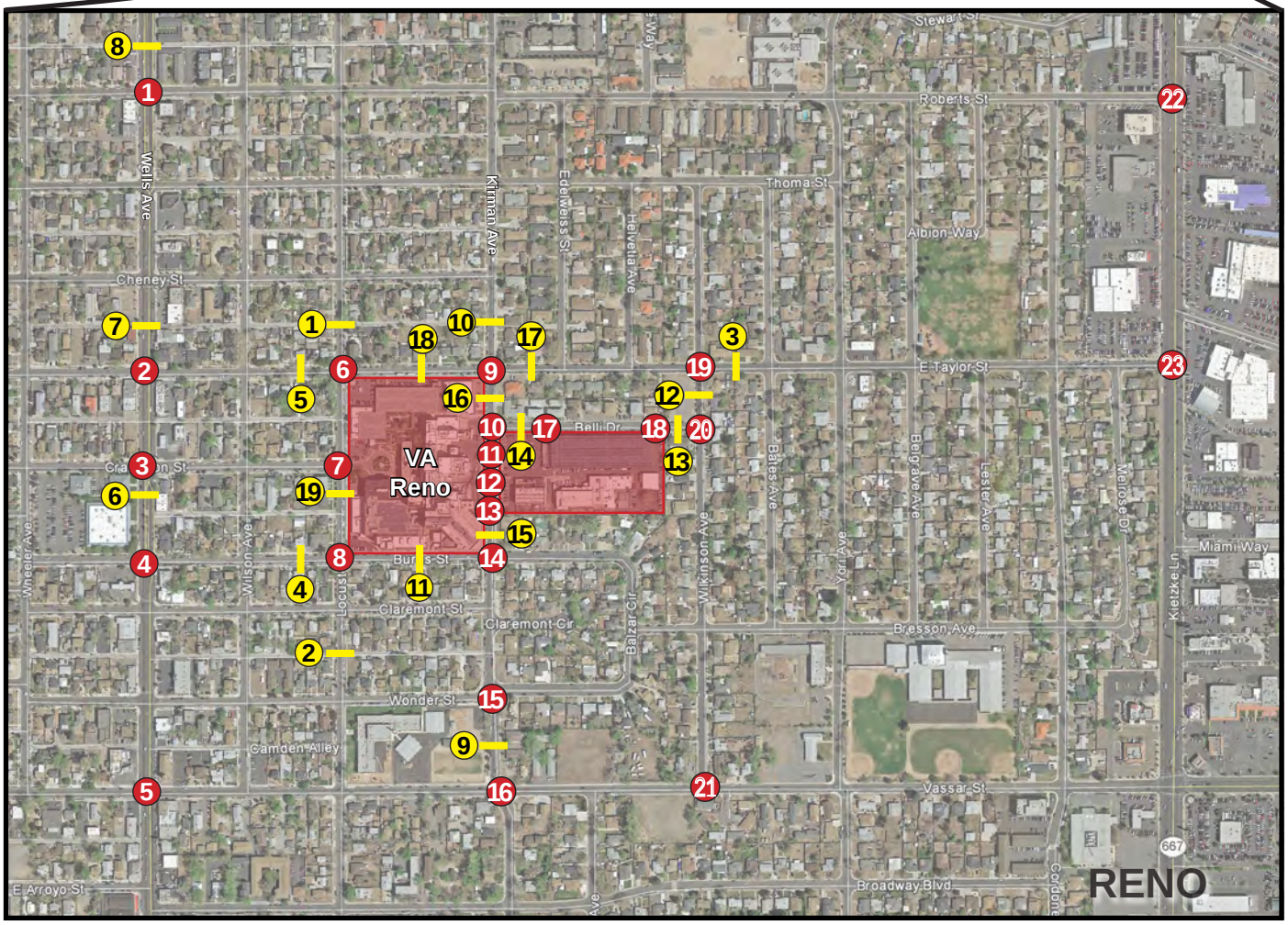
Facility parking and plant operations are located adjacent to and east of Kirman Avenue, and also accessed from Belli Drive. *The Public Services, Facilities, and Infrastructure Plan*, included in Part 1 of *The Great City Plan, The City of Reno Master Plan* (City of Reno, 2008) defines the street classifications in the study area. These street classifications are generally based on the parameters defined in the City of Reno Public Works Design Manual and are not limited to the major street system designations listed within the City of Reno Master Plan.

A **major arterial** accommodates large volumes of through traffic between city districts. Direct access is strongly discouraged to individual properties, although limited access to major projects (i.e., business park, shopping mall, etc.) is allowable, provided such access does not compromise the roadway's ability to handle large volumes of through traffic. Access, parking and loading may be restricted to improve capacity. New major arterials should be intersected by other major arterials, minor arterials, and collectors only. Signalization occurs at intersections with major and minor arterials and some collector streets.

A **minor arterial** provides access between neighborhoods and city centers. It is subject to limiting access control, channelized intersections, and parking restrictions. Direct access to residential areas should be precluded whenever an alternate access is available. It is signalized at intersections with major and other arterials, and some collectors.

A **collector** functions as a connection between local streets in neighborhood areas and arterial streets. When average daily traffic for a commercial collector exceeds 4,000 trips, direct access to new residential properties is prohibited. Stop signs are often found at the intersections with local streets and intersections with arterial streets may have traffic signals. For those collectors with less than 4,000 projected trips, no truck traffic, and no frontage provided to adjacent lots, the constructed width of the collector may be reduced.





Legend:

- Project Area
- Study Intersection
- Roadway Segments

N.T.S.

VA Sierra Nevada Health Care System
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Project Vicinity and Location Map

Figure 1

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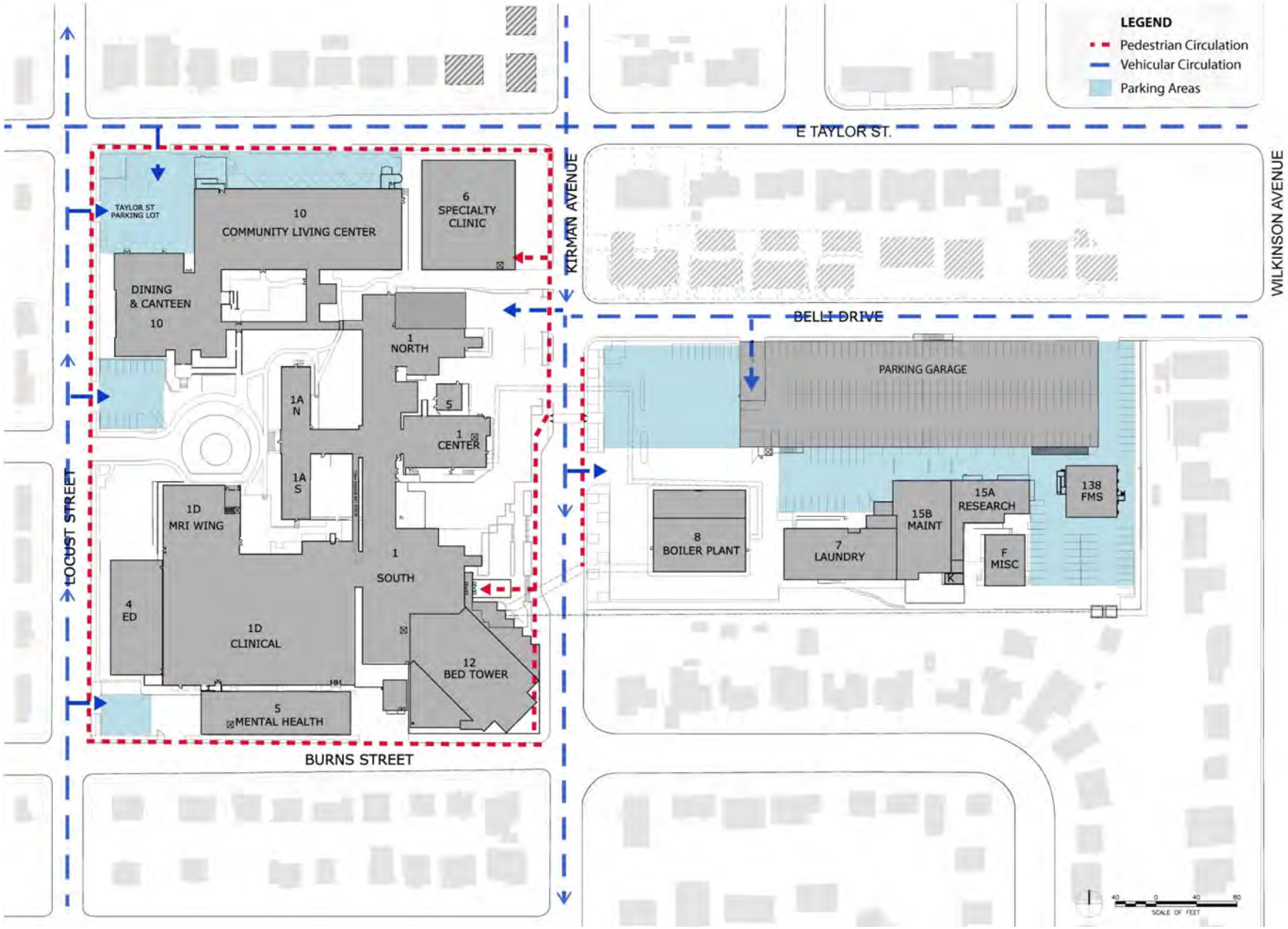

Source: Jensen + Partners

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Project 654-16-619 Renovation and Modernization Traffic Study

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Existing VASNHCS Campus Map and Site Circulation

Figure 2

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A **local street** provides direct access to abutting properties. Local streets are designed for the lowest traffic volumes of any street. Narrower widths are encouraged to reduce travel speed in residential areas for maximum safety.

The study area roadways are described below in alphabetical order. The categorizations are designated in the Regional TPC functional classifications

Belli Drive	Belli Drive is an east-west *local street* extending from Kirman Avenue east to Wilkinson Avenue. The roadway has a single lane in each direction with parallel parking allowed on both sides of the street. Belli Drive provides the main access for the existing SNHCS parking structure. The roadway is approximately 40 feet wide from curb to curb.
Burns Street / Balzar Circle	Burns Street is an east-west *local street* extending from Wheeler Avenue west of Wells Avenue to Kirman Avenue. East of Kirman Avenue the roadway changes name to Balzar Circle. Balzar Circle is a semi-circular roadway that returns to intersect Kirman Avenue about 500' to the south. The roadway consists of a single lane in each direction and parallel parking is allowed along both sides of the street. Burns Street is approximately 36 feet wide from curb to curb. Balzar Circle is approximately 43 – 44 feet wide from curb to curb.
Claremont Street	Claremont Street is an east-west *local street* extending from Wheeler Avenue west of Wells Avenue to Kirman Avenue. The roadway consists of single lanes in each direction and parallel parking is allowed along both sides of the street.
Crampton Street	Crampton Street is an east-west *local street* connecting Wells Avenue to Locust Street. The street's east terminus occurs at the VASNHCS site. The roadway consists of single lanes in each direction and parallel parking is provided along both sides of the street. The roadway is approximately 36 feet wide from curb to curb.
Kietzke Lane	Kietzke Lane is a north-south *major arterial* street east of the VASNHCS. The roadway extends from Neil Road in the south to Victorian Avenue in Sparks in the north. In the Project vicinity Kietzke Lane consists of 2 through lanes and a center TWTL. The roadway is approximately 66 feet wide from curb to curb.
Kirman Avenue	Kirman Avenue is a southbound two-lane one-way *collector* street that extends from the Kuenzli Street / Sutro Street intersection past the VASNHCS to Plumb Lane. Kirman Avenue fronts the east side of the VASNHCS. Parallel parking is allowed on both sides of the street in most locations. The primary VASNHCS patient drop-off area is on Kirman Avenue just south of Belli Drive. The roadway is approximately 36 feet wide from curb to curb.
Locust Street	Locust Street is a northbound two-lane one-way *collector* street that extends from an intersection with Casazza Drive, past the VASNHCS to Willow Street. Locust Street fronts the west side of the VASNHCS. Parallel parking is allowed on both sides of Locust Street. The roadway is approximately 36 feet wide from curb to curb.

Roberts Street	Roberts Street is an east-west *local street* that is parallel to and north of Taylor Street. Roberts Street extends from Wells Avenue to Kietzke Lane, and features a single travel lane in each direction with parallel parking allowed on both sides of the street. The roadway is approximately 36 feet wide from curb to curb.
East Taylor Street	East Taylor Street is an east-west *collector* street connecting Wells Avenue to Kietzke Lane. East Taylor Street fronts the north side of the VASNHCS. The roadway consists of a single lane in each direction, and parallel parking is allowed along both sides of the street. The roadway is approximately 36 feet wide from curb to curb.
Vassar Street	Vassar Street is an east-west *minor arterial* street extending from South Virginia Street east across Kietzke Lane to the north end of the Reno-Stead Airport. In the VASNHCS vicinity the roadway has single lanes in each direction with parallel parking allowed on both sides of the street. The roadway is approximately 36 – 40 feet wide from curb to curb.
Wells Avenue	Wells Avenue is a north-south *minor arterial* street west of the VASNHCS. The roadway extends from South Virginia Street in the south to north of Interstate 80 in the north. In the Project vicinity the roadway consists of a single through lane in each direction with raised medians, left turn lanes or center TWTL. The roadway is approximately 66 feet wide from curb to curb.
Wilkinson Avenue	Wilkinson Avenue is a north-south *local street* extending from Thoma Street on across Taylor Street to Vassar Street. Wilkinson Avenue provides access to the VASNHCS parking structure via Belli Drive. In the VASNHCS vicinity the roadway has a single lane in each direction with parallel parking allowed on both sides of the street. The roadway is approximately 31 feet wide from curb to curb.
Wilson Avenue	Wilson Avenue is a north-south *local street* that lies between Wells Avenue and Kirman Avenue. Wilson Avenue has a single travel lane in each direction and parallel on-street parking is allowed.
Wonder Street	Wonder Street is an east-west *local street* that runs from Wells Avenue to Kirman Avenue. Veterans Memorial Elementary School is located on the south side of Wonder Street west of Kirman Avenue. This street has a single travel lane in each direction, and parallel on-street parking is allowed.

It is noted that many of the local study streets are quite narrow in the vicinity of the VASNHCS campus, with parallel on-street parking travel lanes often less than 10 feet wide.

3.1.2 Transit Service

Public transit service in the area of the hospital is provided by the RTC RIDE, a service of the Washoe County RTC. The RTC RIDE operates a variety of fixed routes throughout the City of Reno.

Route #13 currently provides direct access to the VASNHCS campus with a southbound stop on Kirman Avenue and a northbound stop on Locust Street. Both stops are in front of the VASNHCS

campus. The route operates seven days a week including holidays with hourly service beginning at 6:15 a.m. Monday through Saturday, running until 12:30 a.m. On Sundays and holidays a reduced schedule provides service between 6:15 a.m. and 10:00 a.m. and between 2:15 p.m. to 7:00 p.m.

Route #19, operates along Wells Avenue between downtown Reno and the Reno / Tahoe International Airport. Bus stops are available along Wells Avenue, two blocks west of the VASNHCS campus. The bus operates Monday through Friday between 6:15 a.m. and 6:30 p.m.

3.1.3 Bicycle and Pedestrian Facilities

The VASNHCS campus is located in the Wells Avenue residential neighborhood of Reno along a one-way street couplet, Locust Street and Kirman Avenue on either side of the hospital. Bicycle facilities are classified into three categories:

- Class I (Multi-Use Trails) – A Class I facility is a multi-use trail for the exclusive use of bicycles and pedestrians, separate from the auto traveled way.
- Class II (Bike Lanes) – A Class II facility is an on-street bicycle lane, with painted markings and signs designating the lane's bicycle-only use. The bicycle lane is separated from vehicle and pedestrian traffic, but the route may be interrupted by vehicle turning movements at intersections.
- Class III (Bike Routes) – A Class III bicycle facility is a route for bicyclists in which the available traveled way is shared with vehicles. The facility is designated by signs or other markings and is usually provided when a Class I or Class II facility cannot be provided.

Class III bike routes are present in all study roadways, with the exception of Wells Avenue and Kietzke Lane, which have Class II bike lanes.

Pedestrian facilities in the study area consist primarily of sidewalks, which are part of each of the corridors within the study area. Crosswalks are generally present at each of the study area intersections. Curb ramps are present surrounding the VASNHCS campus, and also generally present at all of these intersections. Drop off areas are located at various locations around the VASNHCS campus, including the historic main entrance on Locust Street and the existing primary curb-side drop off area on Kirman Avenue just south of Belli Drive. There is also an enhanced pedestrian mid-block marked crossing between the VASNHCS and the patient parking on the east side of Kirman Avenue. This mid-block crossing consists of an overhead flashing beacon with yield markings. Compliance with Americans with Disabilities Act (ADA) requirements was not confirmed as a part of this study.

The level of pedestrian activity occurring at the study intersections was measured during peak traffic hours with vehicular traffic volume counts. Figure 5 shows the number of pedestrians and bicyclists observed crossing at each study intersection during the highest volume hours in the morning (i.e., 7:00 to 9:00 a.m.) and evening (i.e., 4:00 to 6:00 p.m.). The highest concentration of pedestrian activity was observed along the Locust Street and Kirman Avenue one-way roadway couplet surrounding the VASNHCS campus (Intersection Nos. 6 – 17). Intersection Nos. 10, 11 and 12 had the highest measured pedestrian volumes, which are attributed to VA staff, patients and visitors crossing Kirman Avenue between the parking facilities to the east and the medical facilities to the west. While not quantified over the course of a typical weekday, pedestrian activity in the area of Kirman Avenue occurs throughout the day, with most of the pedestrian traffic being patients who generally walk more slowly.

3.2 Study Intersections

The intersections (including traffic control type) identified for analysis as the locations most likely to experience impacts due to the Project-generated traffic are summarized in Table 1. These are the same intersections investigated in previous traffic studies. Figure 1 shows the study area context map, including study roadways and intersections. Table 2 summarizes the study roadway segments, which are also the same as those investigated in previous traffic studies.

Figure 3 shows the existing intersections and lane configurations.

3.3 Traffic Volumes

Peak weekday a.m. and p.m. traffic counts were collected as part of this study on Tuesday February 23, 2016 through Thursday, February 25, 2016. Intersection traffic data is included in Appendix B, and roadway traffic volume data is included in Appendix C. The weekday a.m. and p.m. peak hour intersection turning movement volumes are shown on Figure 4. Roadway average daily traffic (ADT) volumes are summarized in Table 10.

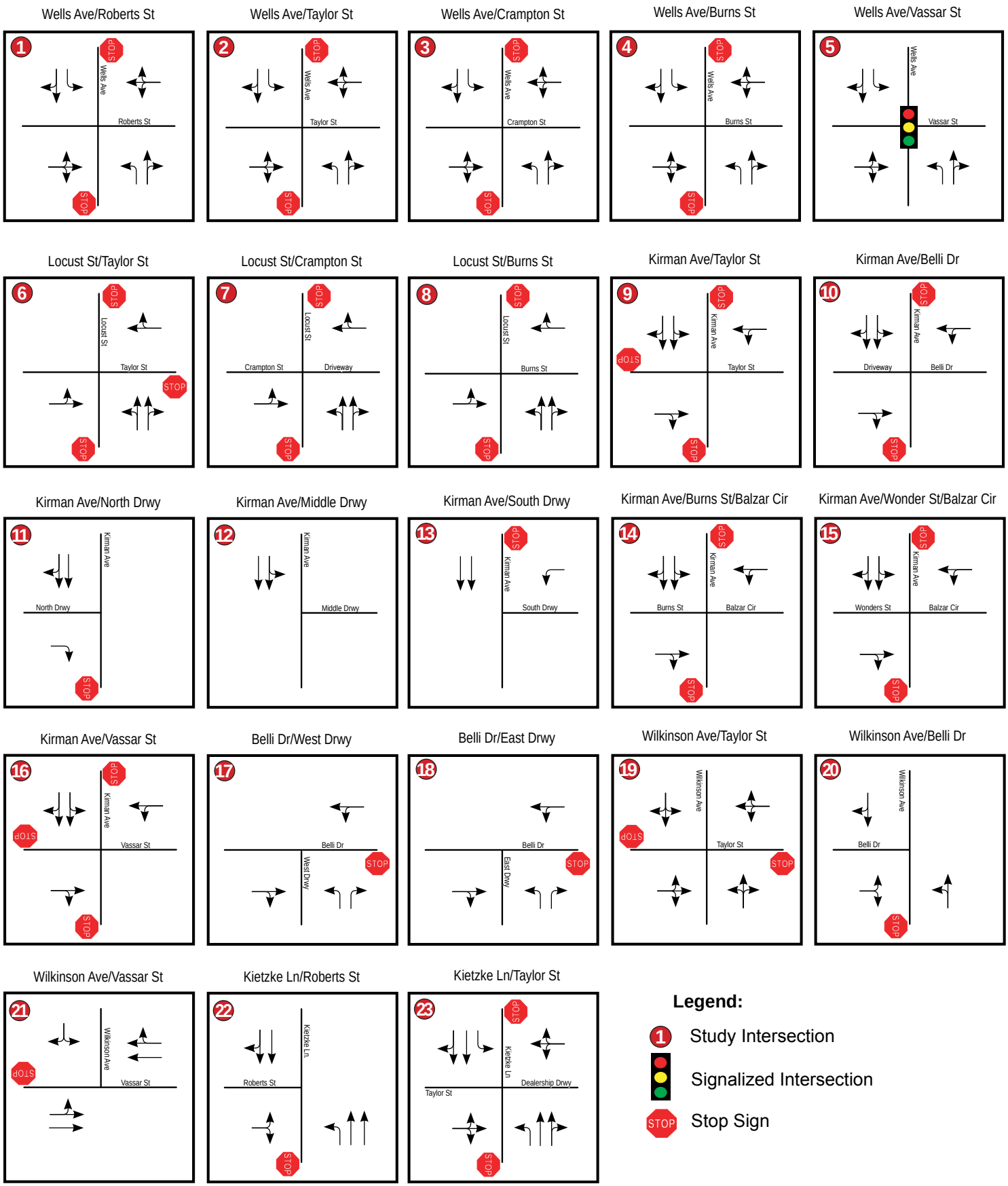
3.4 Existing Conditions Intersection Level of Service Analysis

The results of the intersection level of service analysis based on existing turning movement traffic volumes are summarized in Table 8. In general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. This finding is consistent with previous traffic studies. There are no results reported for Intersection No. 12 because of the absence of traffic controls (i.e., stop signs or traffic signals). The analysis finds that, based on the adopted the LOS thresholds of significance all study intersections are operating acceptably with the exception of the following:

2. Wells Avenue / East Taylor Street:
    - The eastbound approach during the p.m. peak hour.
3. Wells Avenue / Crampton Street:
    - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
    - The eastbound approach during the a.m. and p.m. peak hours.
    - The westbound approach during the p.m. peak hour.

These results are generally consistent with the analysis results of previous traffic impact studies, although variations in existing traffic volumes used in the analysis resulted in some differences in reported delay and LOS. Note that the westbound approach at Intersection No. 23 is a private driveway for an auto dealership with very little traffic. The delay at this approach is very sensitive to the westbound approach volumes, which can experience a high delay due to the significant northbound and southbound volumes on Kietzke Lane.

The signalized intersection within the study area was evaluated assuming optimized signal cycle lengths, as well as appropriate pedestrian crossing time considerations. The Existing Conditions Scenario Level of Service calculations are provided in Appendix D.



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Existing Intersection Lane Geometry and Traffic Control

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Date Jun 2016

Figure 3

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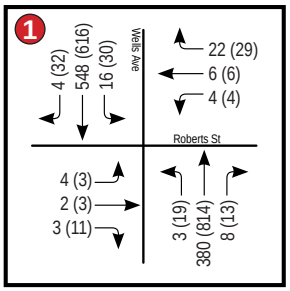
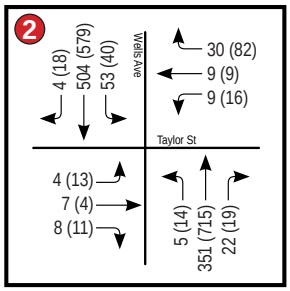
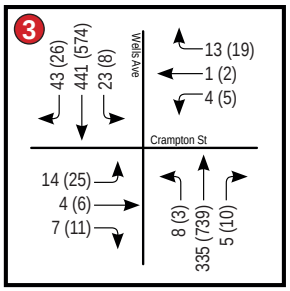
Wells Ave/Roberts St



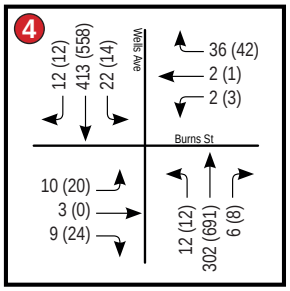
Wells Ave/Taylor St



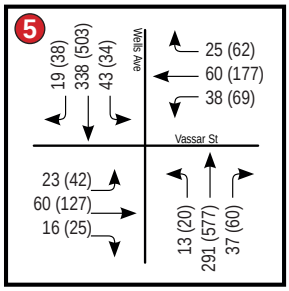
Wells Ave/Crampton St



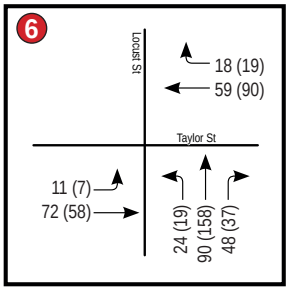
Wells Ave/Burns St



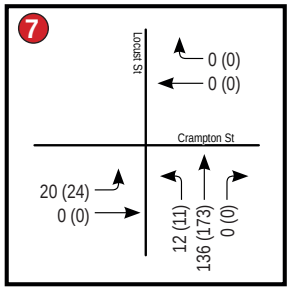
Wells Ave/Vassar St



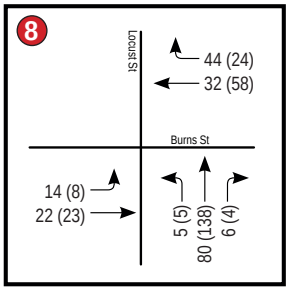
Locust St/Taylor St



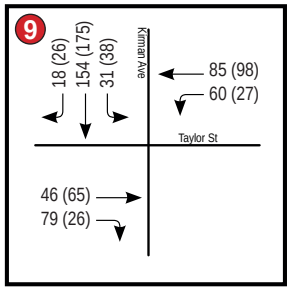
Locust St/Crampton St



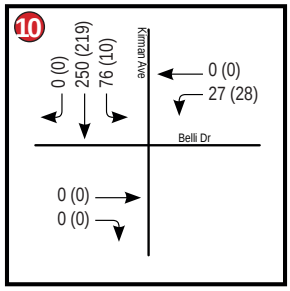
Locust St/Burns St



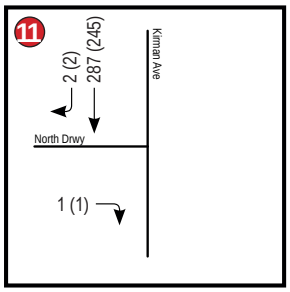
Kirman Ave/Taylor St



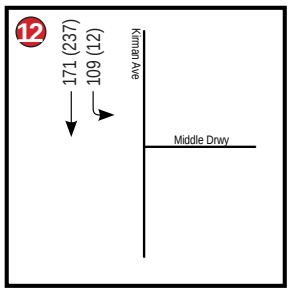
Kirman Ave/Belli Dr



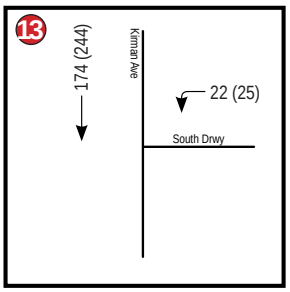
Kirman Ave/North Drwy



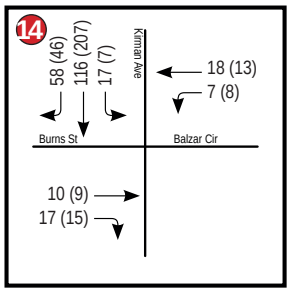
Kirman Ave/Middle Drwy



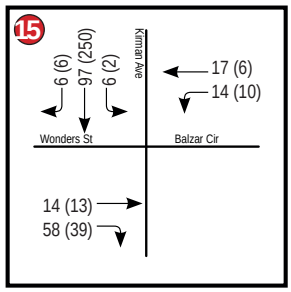
Kirman Ave/South Drwy



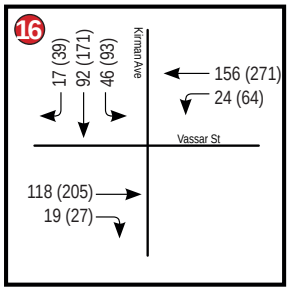
Kirman Ave/Burns St/Balzar Cir



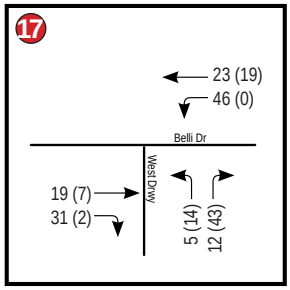
Kirman Ave/Wonder St/Balzar Cir



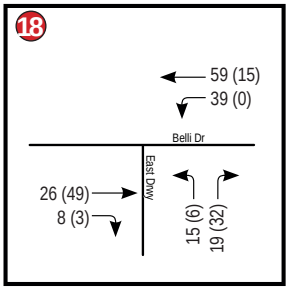
Kirman Ave/Vassar St



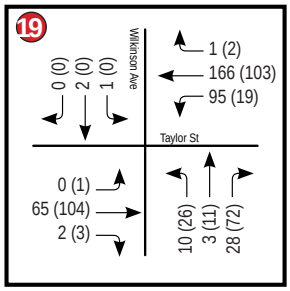
Belli Dr/West Drwy



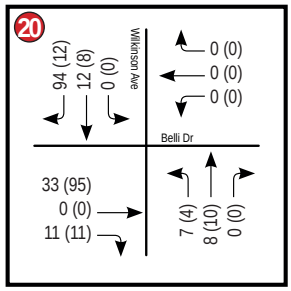
Belli Dr/East Drwy



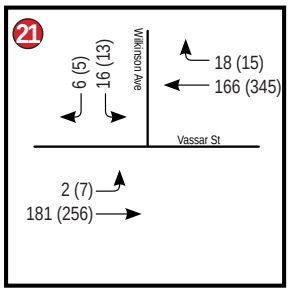
Wilkinson Ave/Taylor St



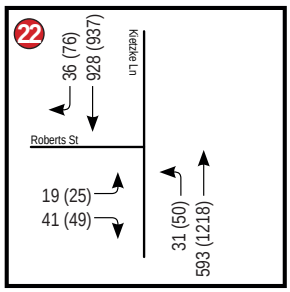
Wilkinson Ave/Belli Dr



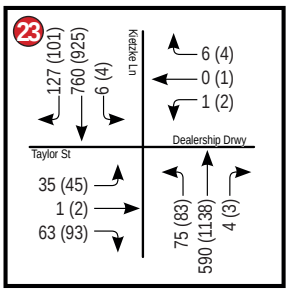
Wilkinson Ave/Vassar St



Kietzke Ln/Roberts St



Kietzke Ln/Taylor St



Legend:

1 Study Intersection

xxx AM Peak Hour Volume

(xxx) PM Peak Hour Volume

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Existing Conditions Intersection
Turning Movement Traffic olumes

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Figure 4

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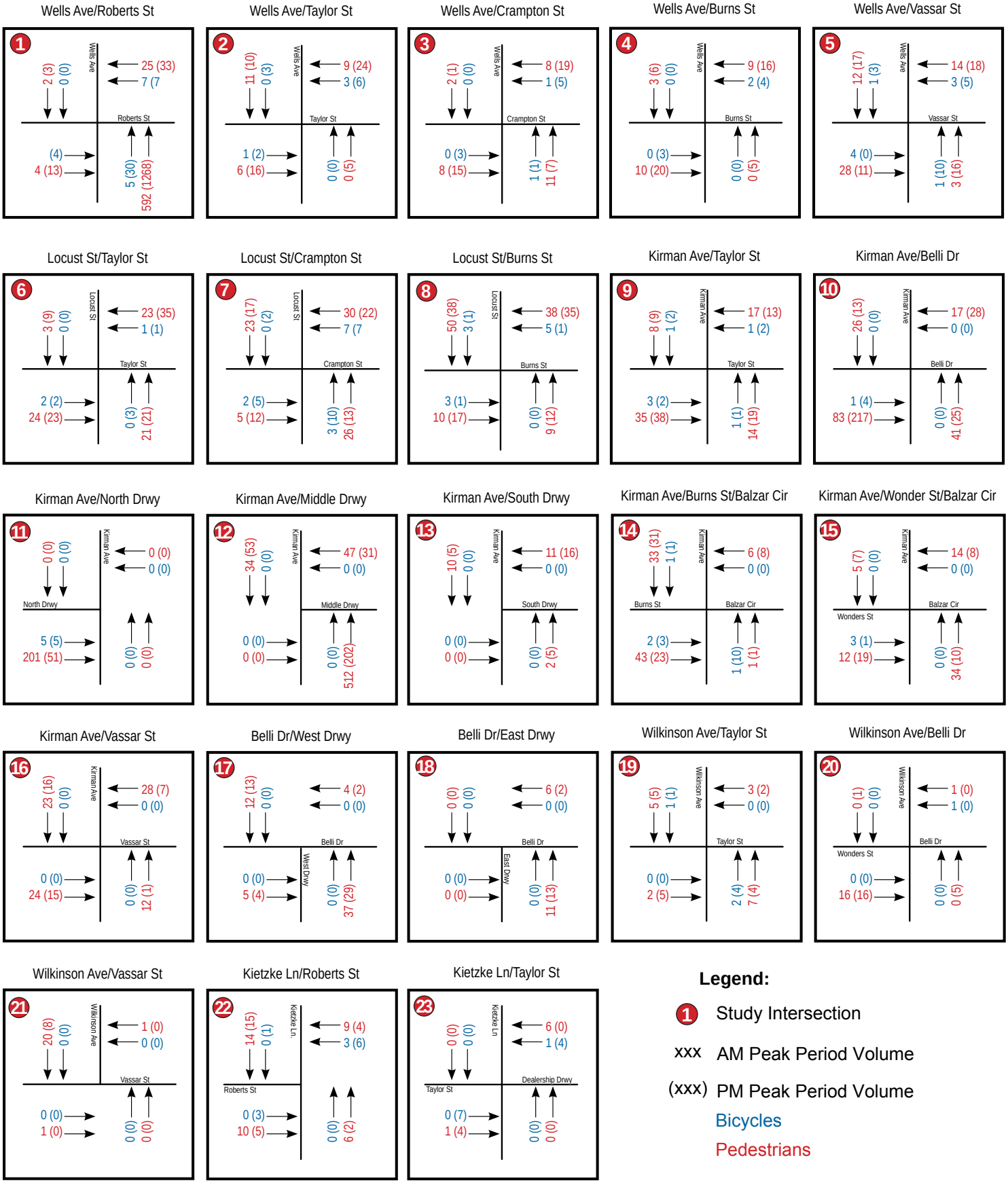

Legend:

1 Study Intersection

xxx AM Peak Period Volume

(xxx) PM Peak Period Volume

Bicycles

Pedestrians

VA Sierra Nevada Health Care System
Project 654-16-619 Renovation and Modernization Traffic Study

Existing Conditions Intersection (Bicycle/Pedestrian)

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Figure 5

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Table 8 Existing Conditions Intersection Level of Service

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
1	Wells Avenue / Roberts Street[3]				
	Northbound Left	*8.7*	*A*	*9.2*	*A*
	Eastbound Approach	*20.6*	*C*	*32.6*	*D*
	Westbound Approach	*15.3*	*C*	*31.9*	*D*
	Southbound Left	*8.2*	*A*	*10.1*	*B*
2	Wells Avenue / East Taylor Street[3]				
	Northbound Left	*8.6*	*A*	*8.8*	*A*
	Eastbound Approach	*20.0*	*C*	***46.0***	***E***
	Westbound Approach	*17.3*	*C*	*32.2*	*D*
	Southbound Left	*8.3*	*A*	*9.5*	*A*
3	Wells Avenue / Crampton Street[3]				
	Northbound Left	*8.6*	*A*	*8.8*	*A*
	Eastbound Approach	*20.3*	*C*	***42.4***	***E***
	Westbound Approach	*14.0*	*B*	*22.2*	*C*
	Southbound Left	*8.2*	*A*	*9.4*	*A*
4	Wells Avenue / Burns Street[3]				
	Northbound Left	*8.3*	*A*	*8.8*	*A*
	Eastbound Approach	*16.9*	*C*	*31.8*	*D*
	Westbound Approach	*11.4*	*B*	*17.3*	*C*
	Southbound Left	*8.0*	*A*	*9.2*	*A*
5	Wells Avenue / Vassar Street[2]	8.3	A	14.8	B
6	East Taylor Street / Locust Street[1]	8.1	A	8.5	A
7	Locust Street / Crampton Street[3]				
	Eastbound Approach	*9.4*	*A*	*9.4*	*A*
8	Locust Street / Burns Street[3]				
	Eastbound Approach	*10.0*	*B*	*10.3*	*B*
	Westbound Approach	*9.5*	*A*	*10.4*	*B*
9	East Taylor Street / Kirman Avenue[1]	8.9	A	9.1	A
10	Kirman Avenue / Belli Drive[3]				
	Westbound Approach	*11.0*	*B*	*9.8*	*A*
11	Kirman Avenue / SNHCS North Driveway[3]				
	Eastbound Right	9.3	A	9.2	A
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	-	-	-	-
13	Kirman Avenue / SNHCS South Driveway[3]				
	Westbound Approach	*9.1*	*A*	*9.5*	*A*
14	Kirman Avenue / Burns Street – Balzar Circle[3]				
	Eastbound Approach	*9.5*	*A*	*9.9*	*A*
	Westbound Approach	10.4	B	10.6	B

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
15	Kirman Avenue / Balzar Circle-Wonder Street[3]				
	Eastbound Approach	*9.4*	*A*	*10.3*	*B*
	Westbound Approach	*10.4*	*B*	*11.1*	*B*
16	Kirman Avenue / Vassar Street[1]	9.1	A	12.0	B
17	Belli Drive / West Parking Structure Driveway[1]				
	Northbound Approach	*8.9*	*A*	*8.7*	*A*
	Westbound Left	*7.4*	*A*	*0.0*	*A*
18	Belli Drive / East Parking Structure Driveway[3]				
	Northbound Approach	*9.7*	*A*	*8.9*	*A*
	Westbound Left	*7.5*	*A*	*0.0*	*A*
19	East Taylor Street / Wilkinson Avenue[3]				
	Northbound Approach	*10.5*	*B*	*10.8*	*B*
	Eastbound Left	*0.0*	*A*	*7.5*	*A*
	Westbound Left	*7.6*	*A*	*7.6*	*A*
	Southbound Approach	*13.7*	*B*	*0.0*	*A*
20	Belli Drive / Wilkinson Avenue[3]				
	Northbound Left	*7.5*	*A*	*7.3*	*A*
	Eastbound Approach	*9.2*	*A*	*9.4*	*A*
21	Vassar Street / Wilkinson Avenue[3]				
	Eastbound Left	*7.6*	*A*	*8.1*	*A*
	Southbound Approach	*10.7*	*B*	*13.0*	*B*
22	Kietzke Lane / Roberts Street[3]				
	Northbound Left	*11.2*	*B*	*11.1*	*B*
	Eastbound Approach	*18.1*	*C*	*20.1*	*C*
23	Kietzke Lane / East Taylor Street[3]				
	Northbound Left	*11.2*	*B*	*11.7*	*B*
	Eastbound Approach	***65.9***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*15.9*	*C*	***77.4***	***F***
	Southbound Left	*9.0*	*A*	*11.4*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS.
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

The unsignalized intersections were evaluated using the urban Signal Warrant 3, per the MUTCD thresholds of significance, which is discussed in Section 9 of this report. The peak hour warrant is not met at any of the study intersections in the Existing Conditions with the exception of Intersection 23 (Kietzke Lane / East Taylor Street) which meets Part A of the warrant. Signalization of this intersection would improve the Level of Service to LOS A (5.2 second delay) in the a.m. peak hour

and LOS A (6.2 second delay) in the p.m. peak hour. No other intersection or roadway improvements are recommended.

The peak hour warrant is not met at any of the study intersections for Existing Conditions. Signal Warrant 3 analysis results are included in Appendix J.

3.5 Existing Conditions Signalized Intersection Queue Analysis

Existing traffic volumes were applied to the signalized study intersection and the peak hour demand 95th percentile queue lengths were reviewed against the existing lane storage capacity at the intersection. Intersection No. 5 Wells Avenue / Vassar Street is the only existing signalized intersection in the study area.

The Existing Conditions peak hour intersection queue analysis is summarized in Table 9. Detailed results are included in Appendix D.

Table 9 Existing Conditions Peak Hour Intersection Queue Analysis

Movement	Lanes / Avail. Storage	Queue Length - 95th Percentile (feet)	
		a.m.	p.m.
Intersection No. 5 – Wells Avenue / Vassar Street			
NBT/R	1 / 300 ft	109	**348**
NBL	1 / 135 ft	25	25
SBT/R	1 / 300 ft	123	266
SBL	1 / 135 ft	25	25
EBT/L/R	1 / 170 ft	54	138
WBT/L	1 / 150 ft	58	**182**
WBR	1 / 85 ft	25	27

Notes: Queue shown is maximum after two cycles
Bold = results where available storage is exceeded by more than one standard vehicle, 25 ft.

Peak hour 95th percentile queue lengths exceed existing storage lane capacity at two movements at Intersection No. 5. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

3.6 Existing Roadway Segments

The existing 24-hour ADT bi-directional volumes for the study roadway segments and the corresponding V/C ratios are summarized in Table 10. Volumes for trucks and buses were converted to PCEs in accordance with the HCM2010 methodology. These volumes are generally higher than those measured in previous traffic studies with and without the PCE adjustment. The V/C ratios are determined from the estimated capacities summarized in Table 2 (Section 2). In general, all study roadway segments appear to operate under the capacity, with the exception of the following segments that exceed a V/C ratio of 1.00:

7. Wells Avenue: Cheney Street - Taylor Street
8. Wells Avenue: Moran Street - Roberts Street

The V/C ratios for these two roadway segments indicate that the demand exceeds the available capacity and that excessive travel delays may be experienced by drivers, particularly during peak periods of traffic.

The V/C ratio for Segment No. 6 (Wells Avenue: Crampton Street - Burns Street) indicates that the roadway is operating near its capacity, and that some high delays may be experienced by drivers, particularly during peak periods of traffic.

Table 10 Existing Conditions Roadway Segment V/C Ratio

No.	Roadway Segments	24-hour ADT Volume	V/C Ratio
1	Locust Street: Taylor Street to Cheney Street	2209	0.18
2	Locust Street: Wonder Street - Claremont Street	1809	0.15
3	Taylor Street: Wilkinson Avenue - Bates Avenue	4016	0.33
4	Burns Street: Wilson Avenue - Locust Street	885	0.44
5	Taylor Street: Wilson Avenue - Locust Street	2280	0.19
6	**Wells Avenue: Crampton Street - Burns Street**	**16,637**	**0.92**
7	**Wells Avenue: Cheney Street - Taylor Street**	**18,162**	**1.01**
8	**Wells Avenue: Moran Street - Roberts Street**	**19,467**	**1.08**
9	Kirman Avenue: Wonder Street - Vassar Street	3080	0.26
10	Kirman Avenue: Cheney Street - Taylor Street	3305	0.28
11	Burns Street: Locust Street - Kirman Avenue	1433	0.72
12	Wilkinson Avenue: Taylor Street - Belli Drive	1475	0.74
13	Belli Drive: East Driveway - Wlikinson Avenue	1471	0.74
14	Belli Drive: West Driveway - Kirman Avenue	782	0.39
15	Kirman Avenue: Belli Drive - Burns Street	3994	0.33
16	Kirman Avenue: Taylor Street - Belli Drive	4334	0.36
17	Taylor Street: Kirman Avenue - Edelweiss Street	3122	0.26
18	Taylor Street: Locust Street - Kirman Avenue	2773	0.23
19	Locust Street: Burns Street - Crampton Street	2533	0.21

Notes: **Bold =** results indicate roadway operates near or above capacity. Excessive delays are anticipated.

As noted earlier in this report, due to the relatively close spacing of the study intersections, it is expected that the intersections are the traffic facilities that control the capacity of the roadway network.

3.7 Traffic Crash Data

Traffic crash data was obtained from the Nevada Department of Transportation Records System. Crash history data for the study intersections was reviewed for the 5 year period from October 1, 2010 through October 1, 2015. Crash information for the following roadway segments and intersections was obtained:

- Burns Street – Wells Avenue to Balzar Court
- Intersection No. 22: Kietzke Lane / Roberts Street
- Wells Avenue – Moran Street to Broadway Boulevard
- East Taylor Street – Wells Avenue to Kietzke Lane
- Kirman Avenue – Cheney Street to Wonder Street

- Wilkinson Avenue – Thoma Street to Vassar Street
- Belli Drive from Kirman Avenue to Wilkinson Avenue

There were a total of 205 crashes reported. The following summary statistics present the total crashes within the Project area by crash severity and type:

- The crash severity for those reported within the Project area:
    1. Property Damage Only 106 (51.7%)
    2. Injury 99 (48.3%)
    3. Fatalities 0 (0.0%)
- The primary crash types for those reported within the Project area:
    1. Rear End 104 (50.7%)
    2. Angle 42 (20.5%)
    3. Non-Collision 22 (10.7%)
    4. Sideswipe (overtaking) 18 (8.8%)
    5. Sideswipe (meeting) 11 (5.4%)

The crash types are defined as follows:

Rear-end: a traffic accident wherein a vehicle crashes into the vehicle in front of it.

Angle: a traffic accident wherein a vehicle crashes into the side of another vehicle, typically at a right angle. Also referred to as a T-bone crash.

Non-collision: a traffic accident that does not involve two vehicles, and includes pedestrian accidents.

Sideswipe: a traffic accident that occurs when two vehicles are driving next to one another in the same direction and the sides of the two vehicles contact one another when meeting or when one vehicle is overtaking another.

The crashes were further examined and compared against State averages for roadway segments and intersections. Traffic crash data are included in Appendix A.

3.7.1 Roadway Segments

The *Nevada Traffic Crashes 2010* (NDOT, 2010) provides a means of calculating the statewide average crash rate (total collisions divided by vehicle miles traveled) for roadway segments. Crash rates for roadway segments are expressed as the rate per 100 million vehicle miles traveled (VMT). A statewide average crash rate was calculated to be 233.21 crashes per 100 million VMT.

The 24-hour bi-directional volumes collected for this study were used to approximate VMT along with estimated block lengths.

Compared with this statewide average, the following roadway segments consistently reported a higher crash rate than the statewide average (statewide average exceeded 3 or more years):

- Wells Avenue between Crampton Street and Burns Street
- Wells Avenue between Cheney Street and East Taylor Street
- Wells Avenue between Moran Street and Roberts Street

- Kirman Drive between Belli Drive and Burns Street
- East Taylor Street between Locust Street and Kirman Avenue

In 2003 the City implemented a “road diet” improvement project on Wells Avenue. A road diet typically consists of the conversion of a street or roadway from two travel lanes in each direction to one lane in each direction with a raised or two-way left-turn lane median, bike lanes, pedestrian enhancements (bulb outs, etc.) and provisions for on-street parking. The National Cooperative Highway Research Program (NCHRP) has estimated that road diets can have a 19% reduction in crashes. A case study conducted by the RTC two years after completion of the road diet reported a 30% decrease in crashes a result of the project. The road diet is also credited with reducing the number of pedestrian crashes by 54% (RTC, 2008).

Because both Kirman Avenue and East Taylor Street experience relatively low traffic volumes, it takes only one crash per year for these roadways to exceed the calculated statewide average.

3.7.2 Intersections

Crash rates are typically considered better indicators of accident risk than crash frequencies alone because they account for differences in traffic volumes, which is exposure. Crash rates for intersections are normally expressed in crashes per 1 million entering vehicles (MEV). To estimate the number of entering vehicles over a 24-hour period, it was assumed that the peak hour accounts for 10% of the daily entering traffic volume.

A statewide average for intersections in Nevada was not readily available, thus a comparison is made against the California statewide averages of 0.43 per MEV for an urban intersection with signal controls and 0.15 for urban intersections with stop and yield control. Statewide crash rates can be found in the *2010 Collision Data on California State Highways* (Caltrans, 2012).

Compared with these statewide averages, the following intersections consistently reported a higher crash rate than the statewide average (statewide average exceeded 3 or more years of the 5 years of crash data reviewed):

- Wells Avenue / East Taylor Street
- Kirman Avenue / East Taylor Street
- Wilkinson Avenue / East Taylor Street
- Kietzke Lane / Roberts Road

As discussed above, Wells Avenue has undergone a road diet, which was documented in the *Wells Avenue Traffic Study* (RTC, 2008) improve traffic safety.

Kirman Avenue and Wilkinson Avenue both experience lower volumes and lower number of crashes, but there are consistently one to two crashes per year.

Kietzke Lane at Roberts Road is trending positively over the last five years, from 5 crashes in 2011 to 1 crash in 2015.

4. Project Trip Generation, Distribution and Assignment

This section discusses the methods and analysis conducted in selecting trip generation rates and assigning Project trips to the existing roadway network. The magnitude of traffic produced by the proposed Project and the locations where that traffic would appear was estimated using the three-step process of trip generation, trip distribution and trip assignment. The number of Project trips generated during the weekday a.m. and p.m. peak hour were estimated using standard Institute of Transportation Engineers (ITE) *Trip Generation Manual 9th Edition* (ITE, 2012) rates for the Project land use type. This standard reference is used by jurisdictions throughout the country, and is based on actual trip generation studies performed at numerous locations in areas of various populations.

4.1 Project Description

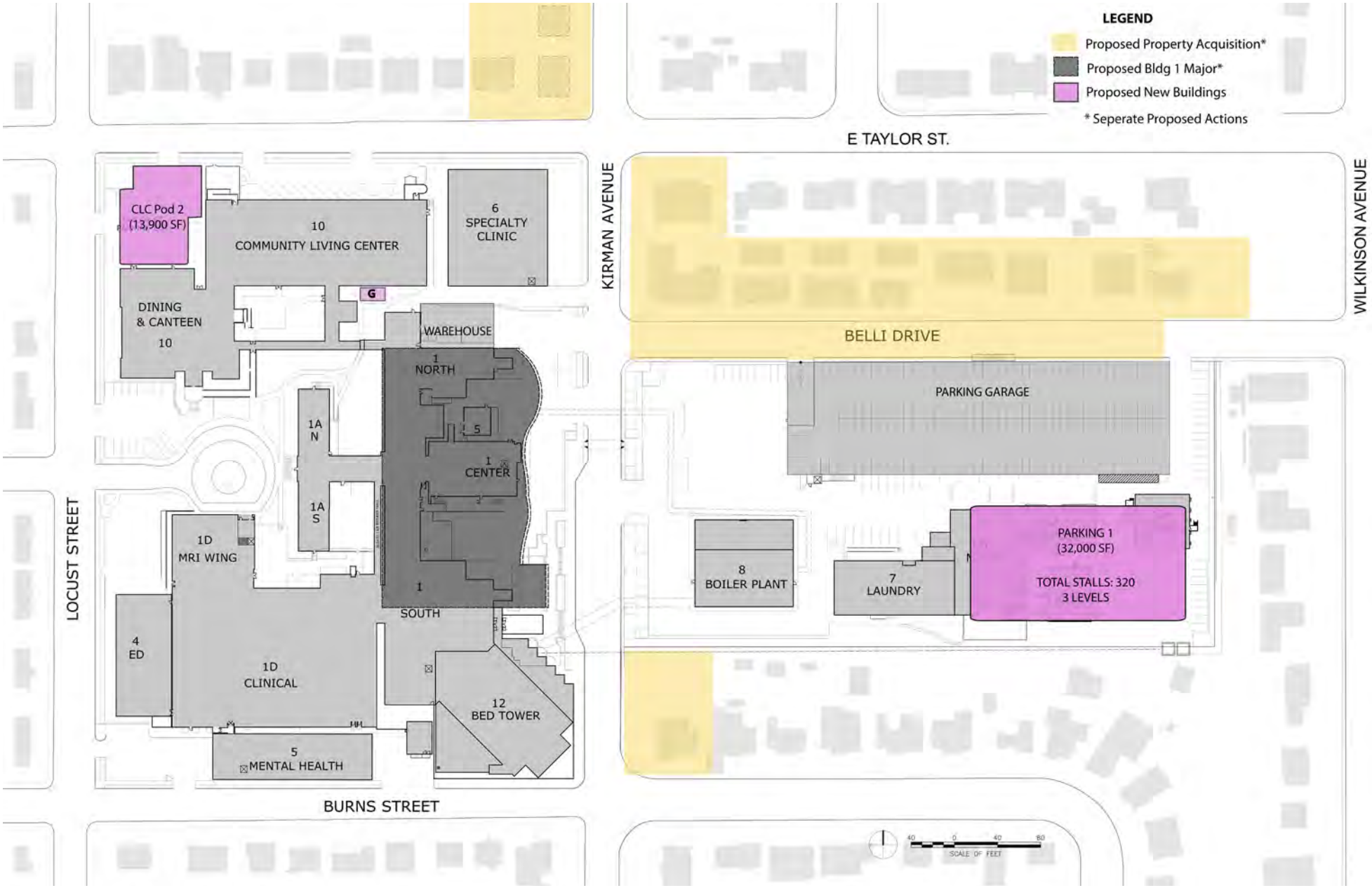
The VASNHCS, located in Reno, Nevada, provides inpatient and outpatient health care to a large geographical area that includes 21 counties in northern Nevada and northeastern California. The demand for Veteran healthcare in this portion of the VA Sierra Pacific VISN 21 is projected to grow due to new residents, the aging population of Veterans and increased demand for mental health services. To meet this anticipated demand, the VASNHCS is undertaking a number of projects to expand services and address needed infrastructure improvements. These projects include a series of renovation and modernization projects and one Major project, and are shown conceptually on Figure 6.

4.1.1 Master Plan Projects

The recently completed VA Reno 5-Year Master Plan prepared by Jensen + Partners in September 2015 defines the physical and programmatic direction of the campus over the next 5 years (VASNHCS, 2015). The Master Plan aims to create a physical framework for future development and project phasing to assure a high quality campus environment. The Master Plan includes recommendations and considerations for the implementation and scheduling of these projects as well as programmatic information used to develop trip generation rates for the collective projects. A traffic impact analysis was prepared by KDAnderson & Associates, Inc. in April 2014 for the Major project, and was used as a reference in this study.

The proposed Major project consists of seismic retrofits and renovation to Building 1 for administrative space, a clinical expansion for patient care, and associated improvements that will increase the building area on the existing site by 97,000 gross square feet (gsf). Construction of the Major project is anticipated to begin in 2017 adjacent to Kirman Avenue.

The proposed renovation and modernization projects and sizes that are expected to be implemented within the next five years (Renovation and Modernization) are summarized in Table 11. Additional projects and sizes, including the Major project, are summarized in Table 12. Negative sizes indicate existing floor space that is being demolished or renovated. Project No. 2 constructs a new parking garage, which is not considered a project trip generator. The table reflects a 1,000 square foot storage area proposed within the parking garage, which is also not considered a project trip generator.



Source: Jensen + Partners

VA Sierra Nevada Health Care System
Project 654-16-619 Renovation and Modernization
Traffic Stud

Job Number 11109061
Revision
Date Jun 2016

VASNHCS 5-Year Campus
Master Plan Projects

Figure 6

Table 11 Summary of Renovation and Modernization EA Projects

No.	Description	Size (gsf)
1	Demolish East Campus Buildings (15A, 15B, F, K & 138) • 15A Maintenance Relocation to Building 7 • 15B Research Relocation to Building 7 • F Safety Department Relocation to Building 7 • K Relocation to Building 7 • 138 Engineering Admin Offices Relocation to Building 7	 0 0 0 0 0
2	Parking Structure 1	36,000
3	New Community Living Center (Pod 2) • CLC/Hospice • Common/Vacant	 12,900 1,000
4	Expand/Renovate Magnetic Resonance Imaging Space • Ancillary/Diagnostic • Common/Vacant	 3,400 600
5	Renovate and Rightsize Operating Rooms • Renovated and Expanded Specialty Care • Existing Speciality Care	 14,300 -13,000
6	Renovate Space Adjacent to ICU Wing B3 of Bldg 12 • Renovated Specialty Care • Existing Specialty Care	 5,000 -5,000
7	Renovate Sterile Processing Service Area • Renovated Support • Existing Support	 3,000 -3,000
8	Renovate Vacated Primary Care for Pharmacy • Renovated Ancillary/Diagnostic • Existing Mental Health • Existing Primary Care • Existing Specialty Care	 19,776 -3,000 -13,148 -3,628
9	Provide Redundant Electrical Power, North Campus	0

Notes: gsf = gross square feet

Table 12 Summary of Cumulative Projects

No.	Description	Size (as indicated)
10	Building 1 Seismic Upgrade & Clinical Expansion (Major)[1]	97,000 gsf
11	Acquisition of 11 Properties • 691/693 East Taylor Street – Duplex • 697/699 East Taylor Street – Duplex • 700/710 East Taylor Street – Duplex • 825/835 Kirman Avenue – Duplex • 701/707/715 Belli Drive – Triplex • 735 Belli Drive – 4 unit Apt Building • 765 Belli Drive – 4 unit Apt Building • 801 Belli Drive – Triplex • 805/807 Belli Drive – Duplex • 825/827/829/831 Belli Drive – Fourplex • 845 Belli Drive – 6 unit Apt Building • 865 Belli Drive – 6 unit Apt Building • 885 Belli Drive – Single Family Residence • 703 Balzar Circle – Single Family Residence	 2 du 2 du 2 du 2 du 3 du 4 du 4 du 3 du 2 du 4 du 6 du 6 du 1 du 1 du
12	Kirman Avenue Lane Reduction	0

Notes: gsf = gross square feet
du = dwelling unit
[1]Source: (VASNHCS, 2014a)

4.2 Trip Generation

For the analysis of potential Project-related traffic impacts, trip generation rates were selected for the Project based on ITE trip generation rates and previous traffic studies. Several potential trip generation rates were reviewed for the proposed Project, which includes the demolition / renovation of some existing land uses and construction of new medical land uses. The *Guidelines for Estimating Trip Generation* from ITE *Trip Generation Manual 9th Edition* (ITE, 2012) were utilized in selecting the appropriate trip generation rates along with rates used in the *Traffic Impact Analysis for Building 1 Seismic Upgrade & Clinical Expansion, Reno, NV* (VASNHCS, 2014a). *Trip Generation Manual* land use classifications are based on specific sites and data collected over years of study for the purpose of estimating trip generation for specific land uses. To calculate the total number of additional trips that Project could create, the total trips removed from circulation due to the demolition / renovation and repurposing of existing land uses and facilities were deducted from the total number of trips generated by the proposed Project land uses.

The ITE trip generation rates (and ITE land use code) selected for evaluation, including the split between entering/exiting trips are:

- Hospital (610) – “A hospital is any institution where medical or surgical care and overnight accommodations are provided to non-ambulatory and ambulatory patients.”
    - a.m. Entering: 63%
    - a.m. Exiting: 37%
    - p.m. Entering: 38%
    - p.m. Exiting: 62%
- Nursing Home (620) - "A nursing home is any facility whose primary function is to provide care for persons who are unable to care for themselves. Examples of such facilities include rest homes and chronic care and convalescent homes. Skilled nurses and nursing aides are present 24 hours a day at these sites. Nursing homes are occupied by residents who do little or no driving; traffic is primarily generated by employees, visitors, and deliveries."

- a.m. Entering: 71%
- a.m. Exiting: 29%
- p.m. Entering: 52%
- p.m. Exiting: 48%

- Medical-Dental Office Building (720) - "A medical-dental office building is a facility that provides diagnoses and outpatient care on a routine basis but is unable to provide prolonged in-house medical and surgical care. One or more private physicians or dentists generally operate this type of facility."
  - a.m. Entering: 79%
  - a.m. Exiting: 21%
  - p.m. Entering: 28%
  - p.m. Exiting: 72%

Land uses classified under the 'Medical" category that are included in the proposed Project were analyzed in terms of the number of gross square footage of the proposed facility. The range of rates suggested by the *Trip Generation Manual* were compared to actual turning movement traffic volume counts taken at the existing medical center entrances/exits, and trip generation rates were chosen appropriately.

Table 13 shows the trip generation rates and corresponding trips generated by the land uses that are proposed to be removed under the Project for the weekday a.m. and p.m. peak hours. Table 14 shows the trip generation rates and corresponding trips generated by the land uses that are proposed for construction under the proposed Project for the weekday a.m. and p.m. peak hours. The total number of additional trips to the Project site involves deducting the total removed Project trips, listed in Table 13, from the total new Project trips, listed in Table 14. The total number of additional trips in the a.m. peak hour would be 289 - 81 = 208, while the total number of additional trips in the p.m. peak hour would be 340 - 83 = 257. Appendix E includes the full trip generation calculation.

4.3 Discussion of Pass-By Trips

It is acknowledged that the estimated number of Project-generated trips may be different from the amount of new traffic added to the street system; however, pass-by and diverted linked trips were not evaluated for the Project trip generation as they are not expected to significantly change results of the study.

It is generally accepted that healthcare-related developments such as hospitals do not typically attract a portion of their trips from traffic passing the site on the way from an origin to an ultimate destination. Such trips are called "pass-by," and can be one component of the trip generation for a site. Trip generation, if applicable, can be broken down into pass-by trips and non-pass-by trips.

While there may be a small percentage of pass-by trips already on the roadway network, the component of the trips is not expected to significantly change the study results; therefore, the study provides a conservative confidence level of the potential impacts from the Project, if any.

4.4 Trip Distribution and Assignment

Trip distribution was based on the trip distribution patterns used in the *Traffic Impact Analysis for Building 1 Seismic Upgrade & Clinical Expansion, Reno, NV* (VASNHCS, 2014a) and the existing traffic circulation established from the intersection turning movement counts. Trip distribution percentages are shown on Figure 7 and Project trips assigned to each intersection are shown graphically on Figure 8. The values shown on Figure 7 represent percentages applicable to entering or exiting peak hour Project trips presented in Table 13 and Table 14.

Table 13 Project Trip Generation – Removed Trips

Project	ITE Land Use (#)	Units	a.m. Peak Hour		p.m. Peak Hour	
			Rate	Trips	Rate	Trips
Renovation and Modernization EA Projects						
No. 1: Demolish East Campus Buildings (15A, 15B, F, K & 138)	None	0.00 kgsf	0.00	0	0.00	0
No. 5: Renovate and Rightsize Operating Rooms • Specialty Care	Hospital (610)	-13.000 kgsf	0.95	-13	0.93	-13
No. 6: Renovate Apace Adjacent to ICU Wing B3 of Bldg 12 • Specialty Care	Hospital (610)	-5.000 kgsf	0.95	-5	0.93	-5
No. 7: Renovate Sterile Processing Service Area • Support	Hospital (610)	-3.000 kgsf	0.95	-4	0.93	-4
No. 8: Renovate Vacated Primary Care for Pharmacy • Mental Health • Primary Care • Specialty Care	 Hospital (610) Hospital (610) Hospital (610)	 -3.000 kgsf -13.148 kgsf -3.628 kgsf	 0.95 0.95 0.95	 -4 -13 -5	 0.93 0.93 0.93	 -4 -13 -5
Subtotal Removed Renovation and Modernization EA Projects				*-44*		*-44*
Cumulative Projects						
No. 11: Acquisition of 11 Properties • Demolish Duplex, Triplex, Fourplex and Apt Buildings • Demolish Single Family Residence	 Apartment (220) Single-Family Detached Housing (210)	 -40 du -2 du	 0.51 0.75	 -33 -4	 0.62 1.00	 -35 -4
Subtotal Removed Cumulative Projects				*-37*		*-39*
Total Removed Project Trips				**-81**		**-83**

Notes: kgsf = 1,000 gross square feet
du = dewelling unit (per each)
MDOB = Medical-Dental Office Building

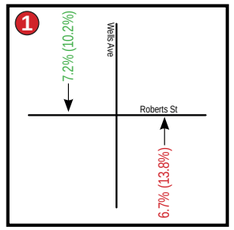
Table 14 Project Trip Generation – New Trips

Project	ITE Land Use (#)	Units (kgsf)	a.m. Peak Hour		p.m. Peak Hour	
			Rate	Trips	Rate	Trips
Renovation and Modernization EA Projects						
No. 2: Parking Structure 1	None	36.000	0.00	0	0.00	0
No. 3: New Community Living Center Building (Pod 2)						
• CLC/Hospice	Nursing Home (620)	12.900	0.55	9	0.74	10
• Common/Vacant	None	1.000	0.00	0	0.93	0
No. 4: Expand/Renovate Magnetic Resonance Imaging Space						
• Ancillary/Diagnostic	Hospital (610)	3.400	0.95	5	0.93	4
• Common Vacant	None	0.600	0.00	0	0.00	0
No. 5: Renovate and Rightsize Operating Rooms						
• Specialty Care	Hospital (610)	14.300	0.95	15	0.93	15
No. 6: Renovate Space Adjacent to ICU Wing B3 of Bldg 12						
• Specialty Care	Hospital (610)	5.000	0.95	5	0.93	5
No. 7: Renovate Sterile Processing Service Area						
• Support	Hospital (610)	3.000	0.95	4	0.93	4
No. 8: Renovate Vacated Primary Care for Pharmacy						
• Ancillary/Diagnostic	Hospital (610)	19.776	0.95	19	0.93	19
No. 9: Provide Redundant Electrical Power, North Campus	None	0.000	0.00	0	0.00	0
Subtotal Removed Renovation and Modernization EA Projects				*57*		*57*
Cumulative Projects						
No. 10: Building 1 Seismic Upgrade & Clinical Expansion (Major)[1]				232		283
No. 12: Kirman Avenue Lane Reduction	None.	0.000	0.00	0	0.00	0
Subtotal Removed Cumulative Projects				*232*		*283*
Total New Project Trips				**289**		**340**

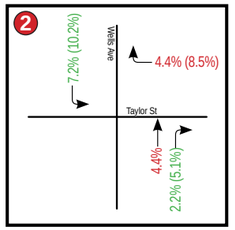
Notes: kgsf = 1,000 gross square feet

[1]Source: *NV* (VASNHCS, 2014a)

Wells Ave/Roberts St



Wells Ave/Taylor St



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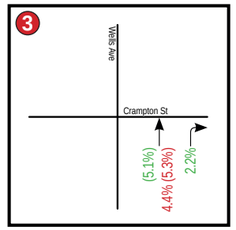

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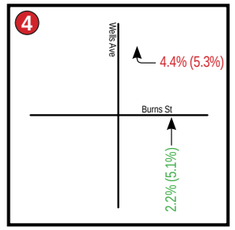

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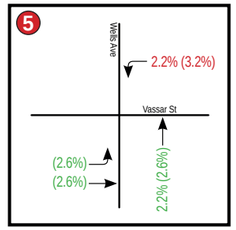

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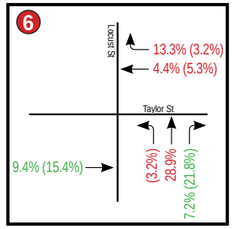

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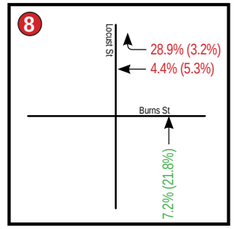
Locust St/Burns St



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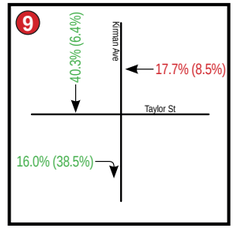

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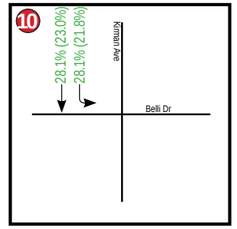

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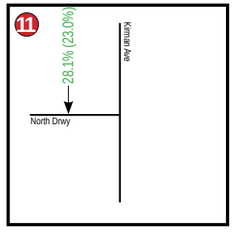

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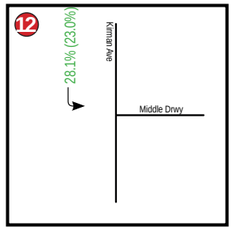

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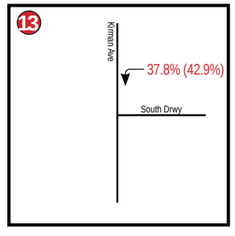

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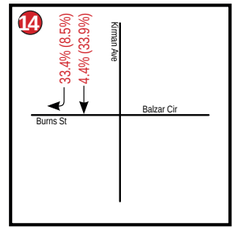

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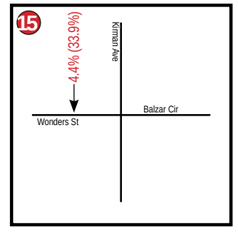

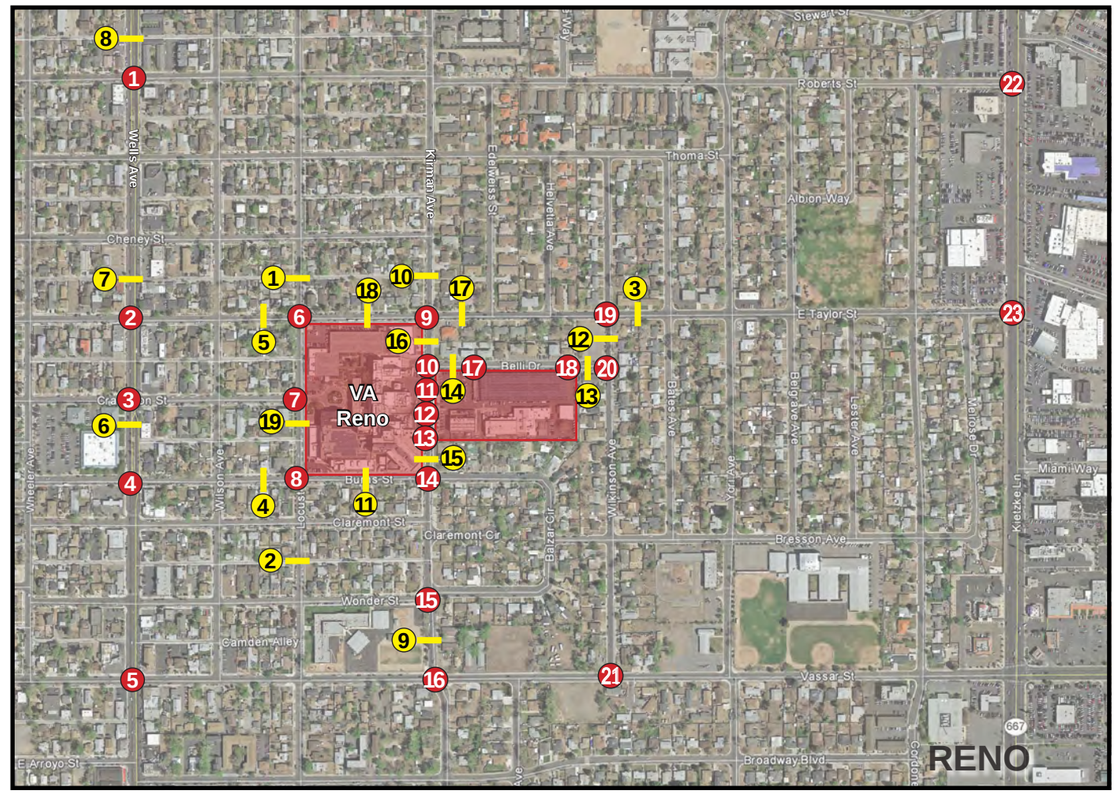

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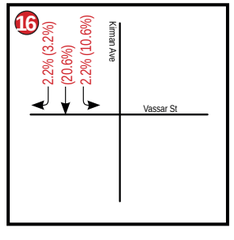

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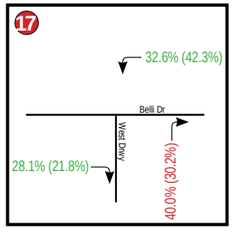

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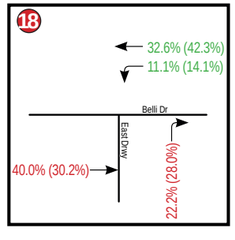

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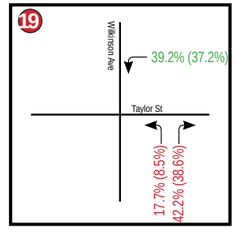

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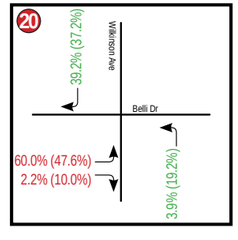

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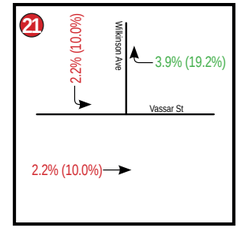

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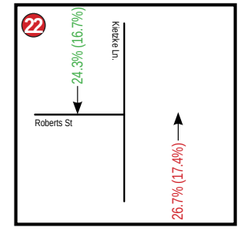

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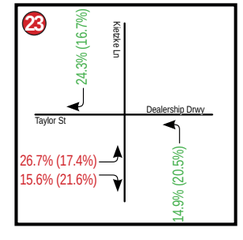

Legend:

- 1 Study Intersection
- 1 Road Segments
- XX AM Peak Hour Volume
- (XX) PM Peak Hour Volume
- Entering Traffi
- Exiting Traffi

VA Sierra Nevada Health Care System
Project 654-16-619 Renovation and
Modernization Traffic Study

Job Number	11110661
Revision	
Date	Jun 2016

Project Trip Distribution

Figure 7

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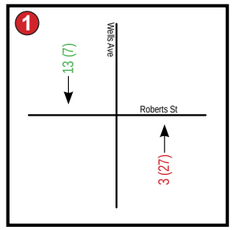
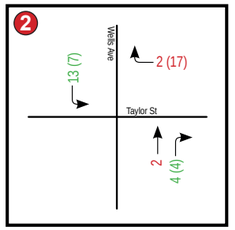
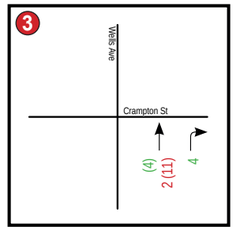
Wells Ave/Roberts St



Wells Ave/Taylor St



Wells Ave/Crampton St



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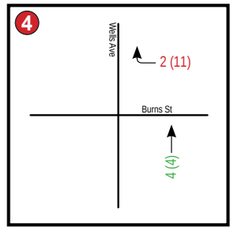

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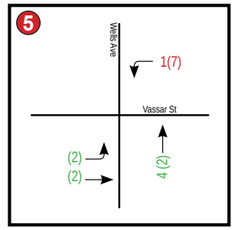

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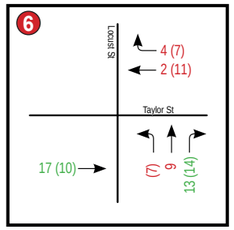

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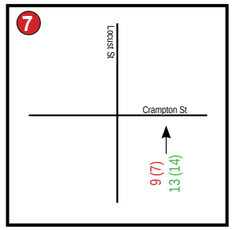

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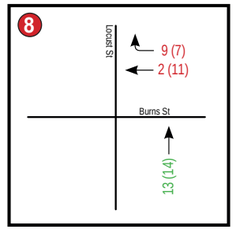

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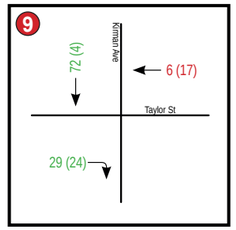

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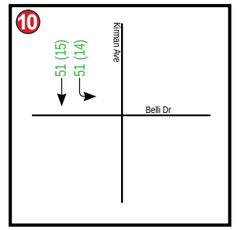

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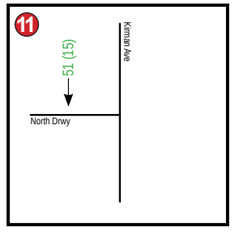
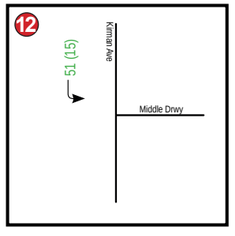


Kirman Ave/Middle Drwy



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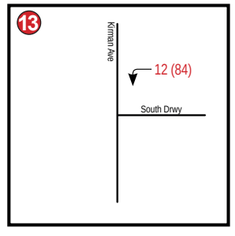
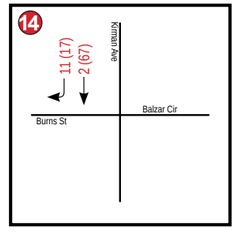


Kirman Ave/Burns St/Balzar Cir



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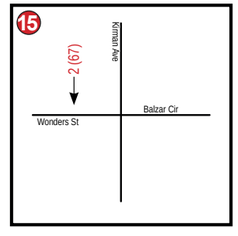

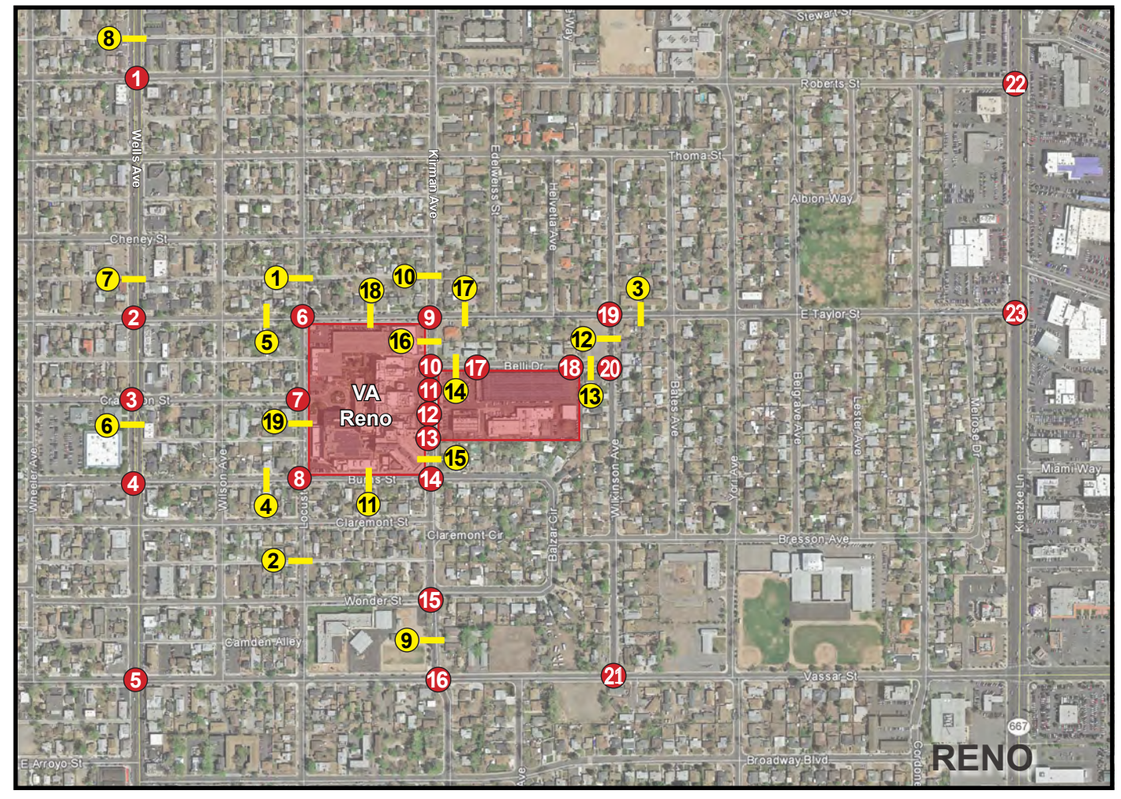

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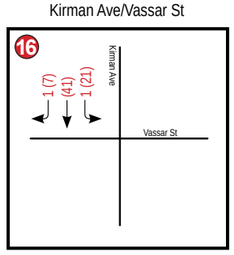

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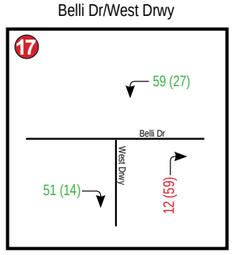

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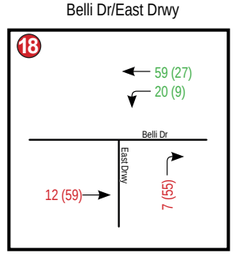

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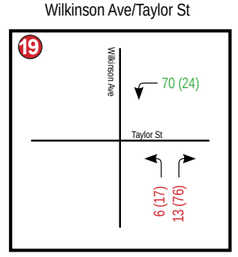

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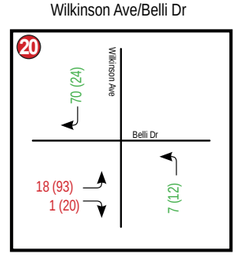
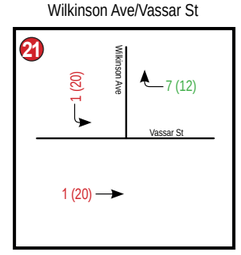


Wilkinson Ave/Vassar St



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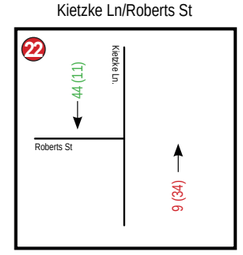

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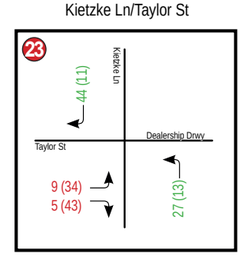

Legend:

- 1 Study Intersection
- 1 Road Segments
- XX AM Peak Hour Volume
- (XX) PM Peak Hour Volume
- Entering Traffi
- Exiting Traffi

N

VA Sierra Nevada Health Care System
Project 654-16-619 Renovation and
Modernization Traffic Study

Job Number	11110661
Revision	
Date	Jun 2016

Project Trip Assignment

Figure 8

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5. 2025 Conditions

This section describes the 2025 Conditions, potential impacts and recommended improvements, if any, at the study intersections during the weekday a.m. and p.m. peak hours. The forecasted traffic volumes at each of the study intersections for year 2025 were estimated by applying established growth factors to existing traffic turning movement counts from 2016. Yearly growth rates were estimated by utilizing traffic growth data obtained from the current version of the RTC Regional Travel Demand Forecasting Model, and these rates were used with the existing traffic count data to forecast the year 2025 traffic volumes. Based on this model, each intersection approach features slight variances in annual growth rates. When calculated, these rates are low and represent a range between -1.18% and +1.16% annual growth. In forecasting 2025 regional growth to the turning movement counts performed with this study, the approach-specific annual growth rates were applied to the respective movements of the study area intersections. The growth factors used in the analysis are included in Appendix E.

5.1 2025 Conditions Traffic Volumes

The 2025 traffic volumes are shown on Figure 9. These traffic volumes are represented by the projected future traffic volumes in the year 2025 applied to the existing roadway network and geometry.

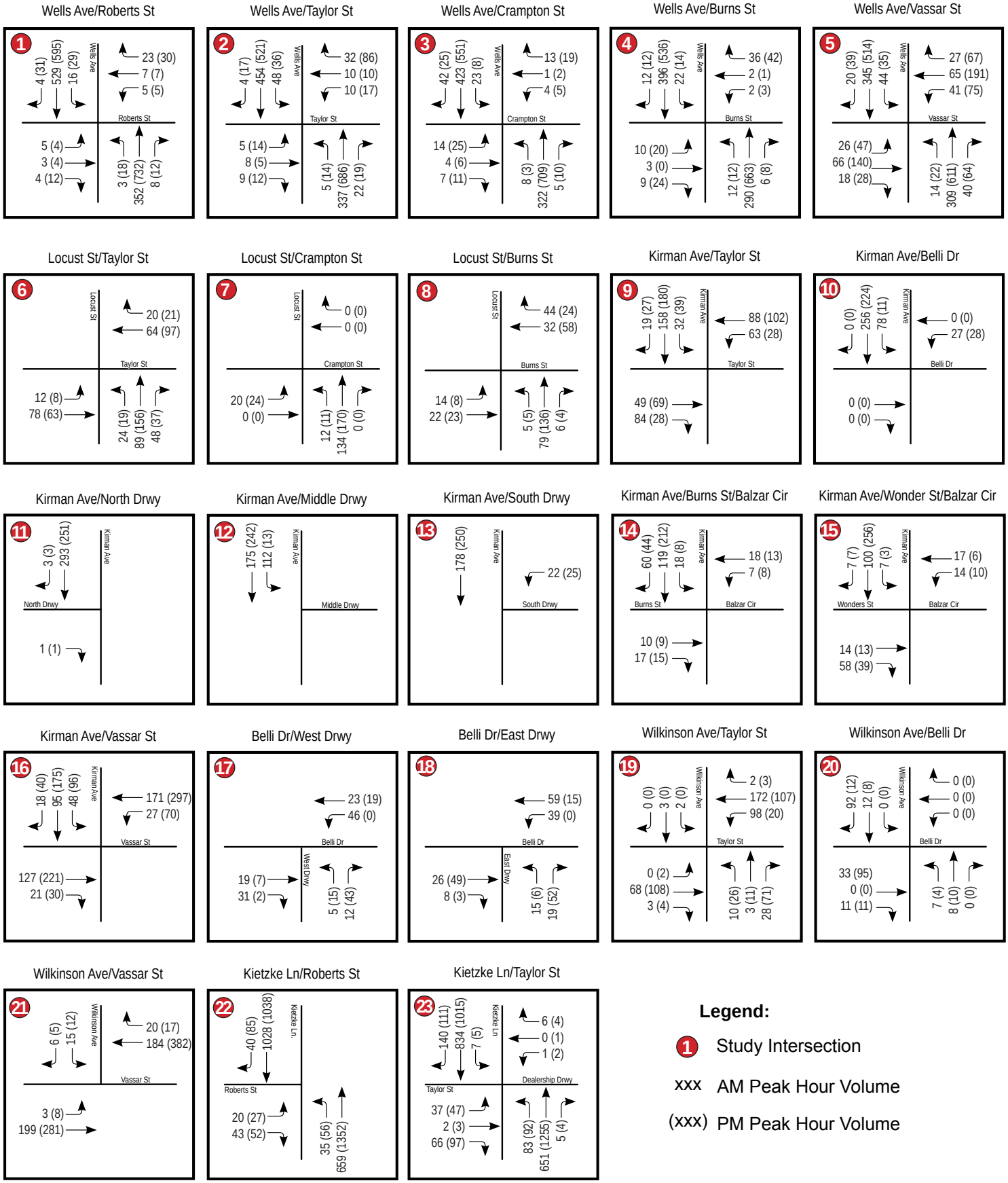
5.2 2025 Conditions Intersection Level of Service Analysis

The results of the intersection level of service analysis based on 2025 Conditions turning movement traffic volumes are summarized in Table 15. In general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. This finding is consistent with previous traffic studies. The analysis finds that, based on the adopted the LOS thresholds of significance all study intersections operate acceptably with the exception of the following:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the p.m. peak hour.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hours.

These are the same intersections that were not operating acceptably in the Existing Conditions analysis, and are generally consistent with the analysis results of previous traffic impact studies, although variations in existing traffic volumes and future volume growth rates used in the analysis resulted in some differences in reported delay and LOS. As previously noted in Section 3.4, the westbound approach at Intersection No. 23 is a private driveway for an auto dealership with very little traffic.

The signalized intersection within the study area was evaluated assuming optimized signal cycle lengths, as well as appropriate pedestrian crossing time considerations. The 2025 Conditions Level of Service calculations are provided in Appendix F.



Legend:

1 Study Intersection

xxx AM Peak Hour Volume

(xxx) PM Peak Hour Volume

VA Sierra Nevada Health Care System
Project 654-16-619 Renovation and
Modernization Traffic Study

2025 Conditions Intersection
Turning Movement Traffic olumes

Job Number 11110661
Revision
Date Jun 2016

Figure 9

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Table 15 2025 Conditions Intersection Level of Service

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
1	Wells Avenue / Roberts Street[3]				
	Northbound Left	*8.6*	*A*	*9.0*	*A*
	Eastbound Approach	*19.5*	*C*	*29.9*	*D*
	Westbound Approach	*15.0*	*C*	*28.2*	*D*
	Southbound Left	*8.1*	*A*	*9.6*	*A*
2	Wells Avenue / East Taylor Street[3]				
	Northbound Left	*8.4*	*A*	*8.7*	*A*
	Eastbound Approach	*18.7*	*C*	***47.8***	***E***
	Westbound Approach	*16.4*	*C*	*34.0*	*D*
	Southbound Left	*8.2*	*A*	*9.5*	*A*
3	Wells Avenue / Crampton Street[3]				
	Northbound Left	*8.4*	*A*	*8.8*	*A*
	Eastbound Approach	*18.4*	*C*	***43.5***	***E***
	Westbound Approach	*13.2*	*B*	*22.3*	*C*
	Southbound Left	*8.1*	*A*	*9.4*	*A*
4	Wells Avenue / Burns Street[3]				
	Northbound Left	*8.3*	*A*	*8.7*	*A*
	Eastbound Approach	*16.2*	*C*	*31.7*	*D*
	Westbound Approach	*11.2*	*B*	*17.1*	*C*
	Southbound Left	*8.0*	*A*	*9.2*	*A*
5	Wells Avenue / Vassar Street[2]	8.4	A	17.7	B
6	East Taylor Street / Locust Street[1]	8.1	A	8.4	A
7	Locust Street / Crampton Street[3]				
	Eastbound Approach	*9.2*	*A*	*9.3*	*A*
8	Locust Street / Burns Street[3]				
	Eastbound Approach	*9.9*	*A*	*10.2*	*B*
	Westbound Approach	*9.4*	*A*	*10.2*	*B*
9	East Taylor Street / Kirman Avenue[1]	8.9	A	8.9	A
10	Kirman Avenue / Belli Drive[3]				
	Westbound Approach	*11.1*	*B*	*9.5*	*A*
11	Kirman Avenue / SNHCS North Driveway[3]				
	Eastbound Approach	*9.2*	*A*	*9.1*	*A*
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	-	-	-	-
13	Kirman Avenue / SNHCS South Driveway[3]				
	Westbound Approach	*9.2*	*A*	*9.4*	*A*

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
14	Kirman Avenue / Burns Street – Balzar Circle[3]				
	Eastbound Approach	*9.5*	*A*	*9.9*	*A*
	Westbound Approach	10.5	B	10.6	B
15	Kirman Avenue / Balzar Circle-Wonder Street[3]				
	Eastbound Approach	*9.2*	*A*	*9.9*	*A*
	Westbound Approach	*10.0*	*B*	*10.6*	*B*
16	Kirman Avenue / Vassar Street[1]	9.1	A	13.7	B
17	Belli Drive / West Parking Structure Driveway[3]				
	Northbound Approach	*8.9*	*A*	*8.7*	*A*
	Westbound Left	*7.4*	*A*	*0.0*	*A*
18	Belli Drive / East Parking Structure Driveway[3]				
	Northbound Approach	*9.1*	*A*	*8.8*	*A*
	Westbound Left	*7.4*	*A*	*0.0*	*A*
19	East Taylor Street / Wilkinson Avenue[3]				
	Northbound Approach	*10.3*	*B*	*10.2*	*B*
	Eastbound Left	*0.0*	*A*	*7.5*	*A*
	Westbound Left	*7.5*	*A*	*7.5*	*A*
	Southbound Approach	*13.2*	*B*	*0.0*	*A*
20	Belli Drive / Wilkinson Avenue[3]				
	Northbound Left	*7.5*	*A*	*7.3*	*A*
	Eastbound Approach	*9.1*	*A*	*9.1*	*A*
21	Vassar Street / Wilkinson Avenue[3]				
	Eastbound Left	*7.7*	*A*	*8.2*	*A*
	Southbound Approach	*10.9*	*B*	*13.8*	*B*
22	Kietzke Lane / Roberts Street[3]				
	Northbound Left	*11.5*	*B*	*12.1*	*B*
	Eastbound Approach	*19.0*	*C*	*24.7*	*C*
23	Kietzke Lane / East Taylor Street[3]				
	Northbound Left	*11.4*	*B*	*12.7*	*B*
	Eastbound Approach	***79.4***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*16.6*	*C*	***144.2***	***F***
	Southbound Left	*9.1*	*A*	*12.3*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

The unsignalized intersections were evaluated using the urban Signal Warrant 3, per the MUTCD thresholds of significance, which is discussed in Section 9 of this report. The peak hour warrant is not met at any of the study intersections in the 2025 Conditions with the exception of Intersection 23 (Kietzke Lane / East Taylor Street) which meets Part A and Part B of the warrant. Signalization of this intersection was recommended in Section 3, and will improve the Level of Service to LOS A (5.1 second delay) in the a.m. peak hour and LOS A (6.9 second delay) in the p.m. peak hour. No other intersection or roadway improvements are recommended.

Signal Warrant 3 analysis results are included in Appendix J.

5.3 2025 Conditions Signalized Intersection Queue Analysis

The 2025 Condition traffic volumes were applied to the signalized study intersection and the peak hour demand 95th percentile queue lengths were reviewed against the existing lane storage capacity at the intersection. Intersection No. 5 Wells Avenue / Vassar Street is the only existing signalized intersection in the study area.

The 2025 Condition Peak Hour Intersection Queue Analysis is summarized in Table 17, and copies are provided in Appendix F.

Table 16 2025 Condition Peak Hour Intersection Queue Analysis

Movement	Lanes / Avail. Storage	Queue Length - 95th Percentile (feet)	
		a.m.	p.m.
Intersection No. 5 – Wells Avenue / Vassar Street			
NBT/R	1 / 300 ft	117	**423**
NBL	1 / 135 ft	25	25
SBT/R	1 / 300 ft	125	297
SBL	1 / 135 ft	25	25
EBT/L/R	1 / 170 ft	57	166
WBT/L	1 / 150 ft	61	**213**
WBR	1 / 85 ft	25	32

Notes: Queue shown is maximum after two cycles
Bold = results where available storage is exceeded by more than one standard vehicle, 25 ft.

Peak hour 95th percentile queue lengths exceed existing storage lane capacity at two movements at Intersection No. 5. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

6. 2025 + Project Conditions

This section describes the 2025 plus Project Conditions, potential impacts and recommended improvements, if any, at the study intersections during the weekday a.m. and p.m. peak hours.

6.1 2025 + Project Conditions Traffic Volumes

The 2025 + Project Conditions traffic volumes are shown in Figure 10. The 2025 + Project traffic volumes are represented by the 2025 traffic volumes, with annual growth rate factors discussed in Section 5, with the addition of Project related trips assigned to the roadway network, as discussed in Section 4.

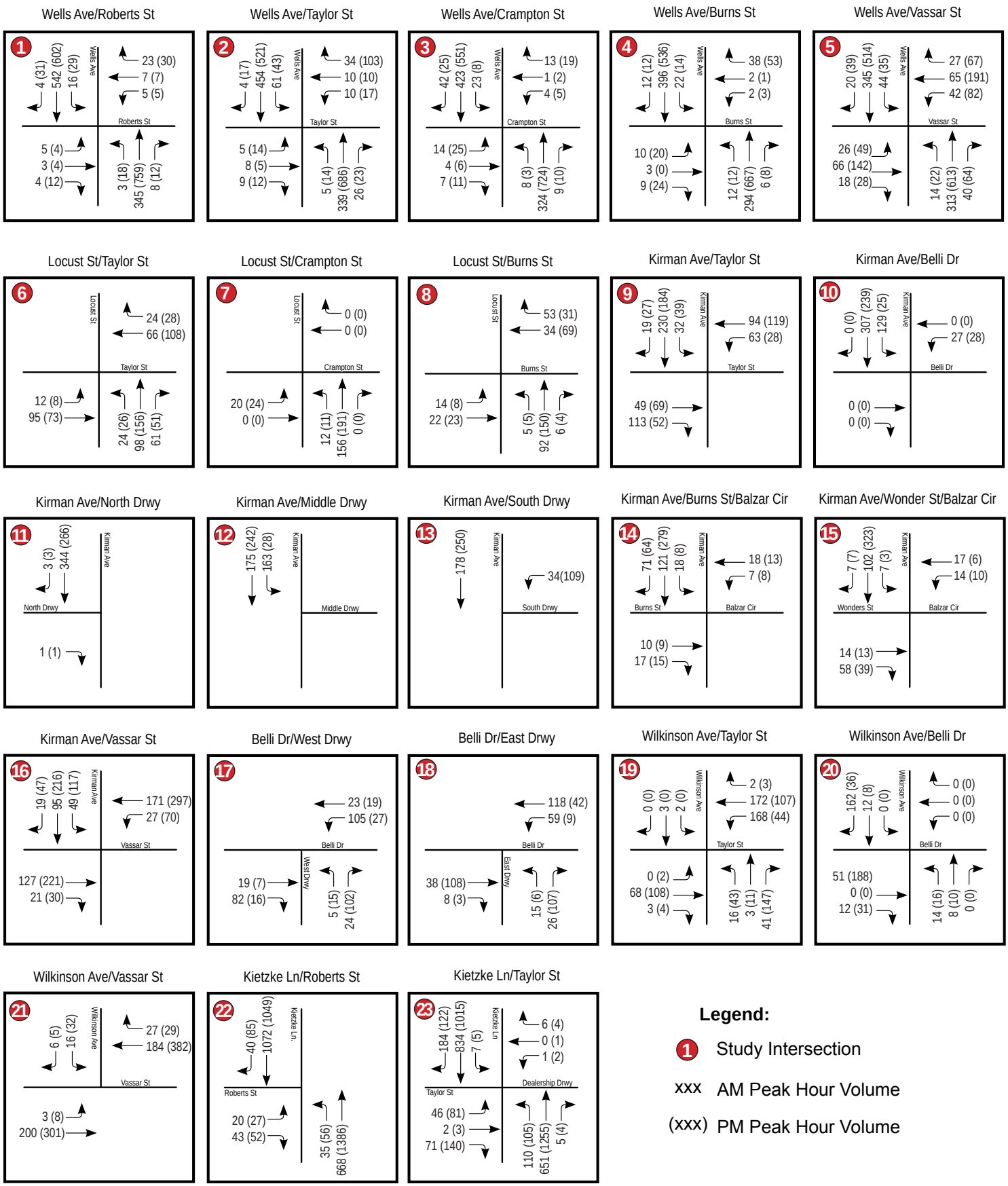
6.2 2025 + Project Conditions Intersection Level of Service Analysis

The results of the intersection level of service analysis for the 2025 + Project turning movement traffic volumes are summarized in Table 17. In general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. This finding is consistent with previous traffic studies. The analysis finds that, based on the adopted the LOS thresholds of significance all study intersections operate acceptably with the exception of the following:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the p.m. peak hour.

These are the same intersections that were not operating acceptably in the 2025 Conditions analysis, and are generally consistent with the analysis results of previous traffic impact studies, although variations in existing traffic volumes and future volume growth rates used in the analysis resulted in some differences in reported delay and LOS. As previously noted in Section 3.4, the westbound approach at Intersection No. 23 is a private driveway for an auto dealership with very little traffic. The delay at this approach is very sensitive to the westbound approach volumes, which can experience a high delay due to the significant northbound and southbound volumes on Kietzke Lane.

The signalized intersection within the study area was evaluated assuming optimized signal cycle lengths, as well as appropriate pedestrian crossing time considerations. The 2025 + Project Conditions Level of Service calculations are provided in Appendix G.



VA Sierra Nevada Health Care System
Project 654-16-619 Renovation and Modernization Traffic Study

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Revision
Date Jun 2016

2025 Plus Project Conditions Intersection Turning Movement Traffic olumes

Figure 10

Table 17 2025 + Project Conditions Intersection Level of Service

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
1	Wells Avenue / Roberts Street[3]				
	Northbound Left	*8.7*	*A*	*9.1*	*A*
	Eastbound Approach	*19.7*	*C*	*31.4*	*D*
	Westbound Approach	*15.1*	*C*	*29.7*	*D*
	Southbound Left	*8.1*	*A*	*9.7*	*A*
2	Wells Avenue / East Taylor Street[3]				
	Northbound Left	*8.4*	*A*	*8.7*	*A*
	Eastbound Approach	*19.4*	*C*	***54.0***	***F***
	Westbound Approach	*16.8*	*C*	***36.3***	***E***
	Southbound Left	*8.3*	*A*	*9.5*	*A*
3	Wells Avenue / Crampton Street[3]				
	Northbound Left	8.4	A	8.8	A
	Eastbound Approach	18.5	C	**44.7**	**E**
	Westbound Approach	13.2	B	22.7	C
	Southbound Left	8.1	A	9.4	A
4	Wells Avenue / Burns Street[3]				
	Northbound Left	*8.3*	*A*	*8.7*	*A*
	Eastbound Approach	*16.3*	*C*	*33.1*	*D*
	Westbound Approach	*11.2*	*B*	*17.2*	*C*
	Southbound Left	*8.0*	*A*	*9.2*	*A*
5	Wells Avenue / Vassar Street[2]	8.5	A	18.7	B
6	East Taylor Street / Locust Street[1]	8.3	A	8.7	A
7	Locust Street / Crampton Street[3]				
	Eastbound Approach	*9.3*	*A*	*9.4*	*A*
8	Locust Street / Burns Street[3]				
	Eastbound Approach	*10.0*	*B*	*10.3*	*B*
	Westbound Approach	*9.5*	*A*	*10.4*	*B*
9	East Taylor Street / Kirman Avenue[1]	9.4	A	9.1	A
10	Kirman Avenue / Belli Drive[3]				
	Westbound Approach	*12.8*	*B*	*9.8*	*A*
11	Kirman Avenue / SNHCS North Driveway[3]				
	Eastbound Approach	*9.2*	*A*	*9.1*	*A*
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	-	-	-	-
13	Kirman Avenue / SNHCS South Driveway[3]				
	Westbound Approach	*9.2*	*A*	*10.0*	*A*

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
14	Kirman Avenue / Burns Street – Balzar Circle[3]				
	Eastbound Approach	*9.6*	*A*	*10.3*	*B*
	Westbound Approach	10.5	B	11.3	B
15	Kirman Avenue / Balzar Circle-Wonder Street[3]				
	Eastbound Approach	*9.2*	*A*	*10.2*	*B*
	Westbound Approach	*10.0*	*B*	*11.0*	*B*
16	Kirman Avenue / Vassar Street[1]	9.1	A	14.8	B
17	Belli Drive / West Parking Structure Driveway[3]				
	Northbound Approach	*9.1*	*A*	*9.0*	*A*
	Westbound Left	*7.6*	*A*	*7.3*	*A*
18	Belli Drive / East Parking Structure Driveway[3]				
	Northbound Approach	*9.5*	*A*	*9.5*	*A*
	Westbound Left	*7.4*	*A*	*7.5*	*A*
19	East Taylor Street / Wilkinson Avenue[3]				
	Northbound Approach	*11.4*	*B*	*11.1*	*B*
	Eastbound Left	*0.0*	*A*	*7.5*	*A*
	Westbound Left	*7.7*	*A*	*7.5*	*A*
	Southbound Approach	*15.9*	*C*	*0.0*	*A*
20	Belli Drive / Wilkinson Avenue[3]				
	Northbound Left	*7.6*	*A*	*7.3*	*A*
	Eastbound Approach	*9.5*	*A*	*10.2*	*B*
21	Vassar Street / Wilkinson Avenue[3]				
	Eastbound Left	*7.7*	*A*	*8.3*	*A*
	Southbound Approach	*11.0*	*B*	*15.5*	*C*
22	Kietzke Lane / Roberts Street[3]				
	Northbound Left	11.8	B	12.2	B
	Eastbound Approach	19.9	C	25.3	D
23	Kietzke Lane / East Taylor Street[3]				
	Northbound Left	*12.1*	*B*	*13.1*	*B*
	Eastbound Approach	***170.9***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*17.8*	*C*	***176.0***	***F***
	Southbound Left	*9.1*	*A*	*12.3*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

The unsignalized intersections were evaluated using the urban Signal Warrant 3, per the MUTCD thresholds of significance, which is discussed in Section 9 of this report. The peak hour warrant is not met at any of the study intersections in the 2025 + Project Conditions with the exception of Intersection 23 (Kietzke Lane / East Taylor Street) which meets Part A and Part B of the warrant. Signalization of this intersection was recommended in Section 3, and will improve the Level of Service to LOS A (5.5 second delay) in the a.m. peak hour and LOS A (9.4 seconds) in the p.m. peak hour. No other intersection or roadway improvements are recommended.

Signal Warrant 3 analysis results are included in Appendix J.

6.3 2025 + Project Conditions Signalized Intersection Queue Analysis

The 2025 + Project Conditions traffic volumes were applied to the signalized study intersection and the peak hour demand 95th percentile queue lengths were reviewed against the existing lane storage capacity at the intersection. Intersection No. 5 Wells Avenue / Vassar Street is the only existing signalized intersection in the study area.

The 2025 + Project Condition Peak Hour Intersection Queue Analysis is summarized in Table 18, and copies are provided in Appendix G.

Table 18 2025 + Project Condition Peak Hour Intersection Queue Analysis

Movement	Lanes / Avail. Storage	Queue Length - 95th Percentile (feet)	
		a.m.	p.m.
Intersection No. 5 – Wells Avenue / Vassar Street			
NBT/R	1 / 300 ft	118	**492**
NBL	1 / 135 ft	25	25
SBT/R	1 / 300 ft	126	**360**
SBL	1 / 135 ft	25	28
EBT/L/R	1 / 170 ft	57	124
WBT/L	1 / 150 ft	62	163
WBR	1 / 85 ft	25	25

Notes: Queue shown is maximum after two cycles
Bold = results where available storage is exceeded by more than one standard vehicle, 25 ft.

Peak hour 95th percentile queue lengths exceed existing lane storage capacity at two movements at Intersection No. 5. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

6.4 2025 + Project Impacts and Mitigation Measures

The following intersection approaches were determined to operate unacceptably with and without Project traffic:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the p.m. peak hour.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.

23. Kietzke Lane / East Taylor Street:
    - The eastbound approach during the a.m. and p.m. peak hours.
    - The westbound approach during the p.m. peak hour.

Because the Project contributes traffic to these intersections that operate unacceptably without the Project, this is an **impact**. Signalization of Intersection 23 (Kietzke Lane / East Taylor Street) was recommended in Section 3 to improve the operation of this intersection.

The following intersection approach operates acceptably without the Project, but operates unacceptably with the addition of Project generated trips:

2. Wells Avenue / East Taylor Street:
    - The westbound approach during the p.m. peak hour.

The addition of Project trips to this intersection reduces the LOS from an acceptable D to an unacceptable E. Because the Project generated traffic causes this intersection approach to operate unacceptably, this is an **impact**.

7. 2035 Conditions

This section describes the 2035 Conditions, potential impacts and recommended improvements, if any, at the study intersections during the weekday a.m. and p.m. peak hours. The forecasted traffic volumes at each of the study intersections for year 2035 were estimated by applying established growth factors to existing traffic turning movement counts from 2016. Yearly growth rates were estimated by utilizing traffic growth data obtained from the current version of the RTC Regional Travel Demand Forecasting Model, and these rates were used with the existing traffic count data to forecast the year 2035 traffic volumes. Based on this model, each approach of each intersection features slight variances in yearly growth rates. When calculated, these rates are low and represent a range between -0.36% and +4.94% annual growth. In forecasting 2035 regional growth to the turning movement counts performed with this study, the approach-specific annual growth rates were applied to the respective movements of the study area intersections. The growth factors used in the analysis are included in Appendix E.

7.1 2035 Conditions Traffic Volumes

The 2035 traffic volumes are shown on Figure 11. These traffic volumes are represented by the projected future traffic volumes in the year 2035 applied to the existing roadway network and geometry.

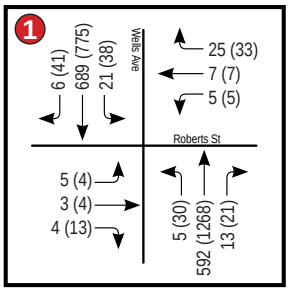
7.2 2035 Conditions Intersection Level of Service Analysis

The results of the intersection level of service analysis based on 2035 turning movement traffic volumes are summarized in Table 19. In general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. This finding is consistent with previous traffic studies. The analysis finds that, based on the adopted the LOS thresholds of significance all study intersections operate acceptably with the exception of the following:

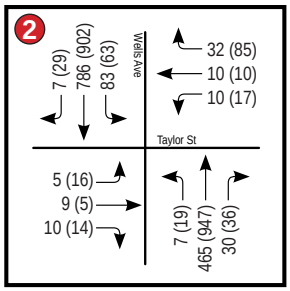
1. Wells Avenue / Roberts Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hours.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
4. Wells Avenue / Burns Street:
   - The eastbound approach during the p.m. peak hour.

23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the p.m. peak hour.

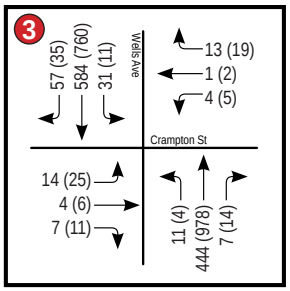
Wells Ave/Roberts St



Wells Ave/Taylor St



Wells Ave/Crampton St



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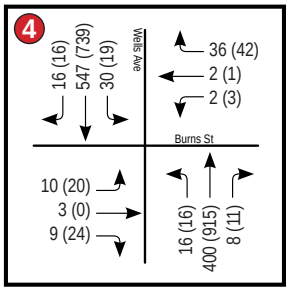
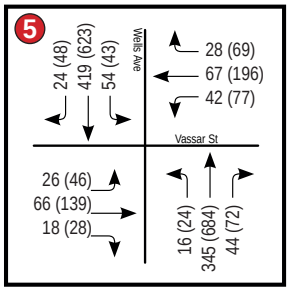
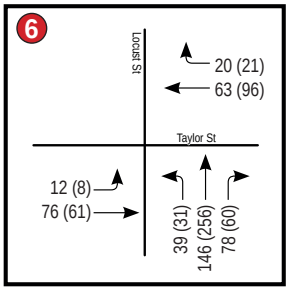


Wells Ave/Vassar St



Locust St/Taylor St



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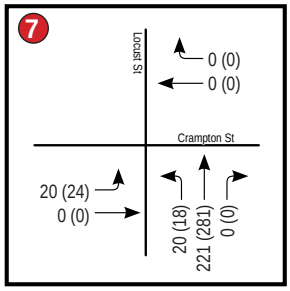

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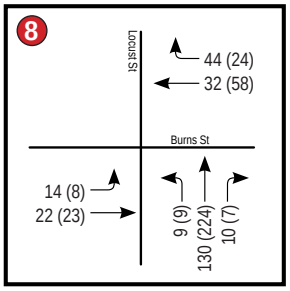

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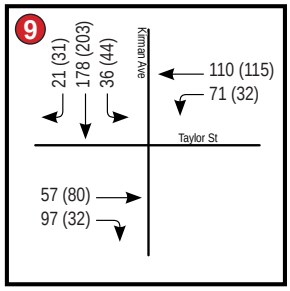

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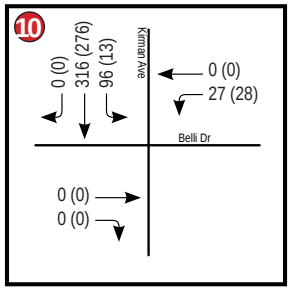
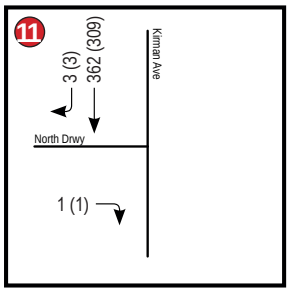


Kirman Ave/North Drwy



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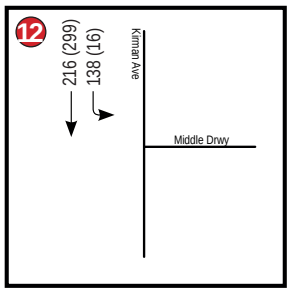
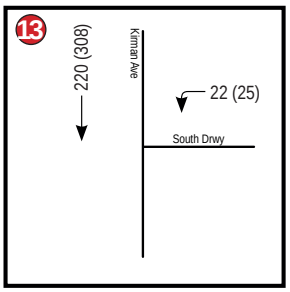
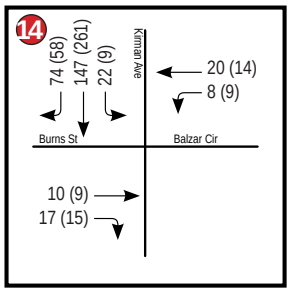


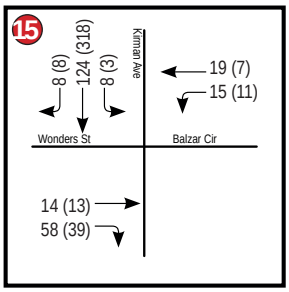
Kirman Ave/South Drwy



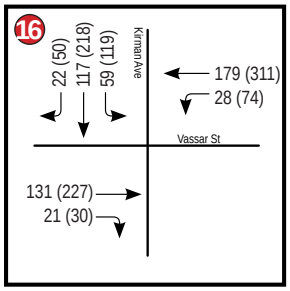
Kirman Ave/Burns St/Balzar Cir



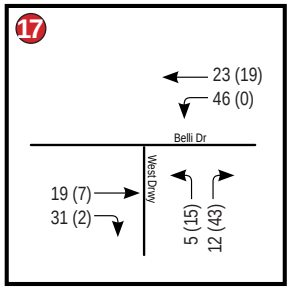
Kirman Ave/Wonder St/Balzar Cir



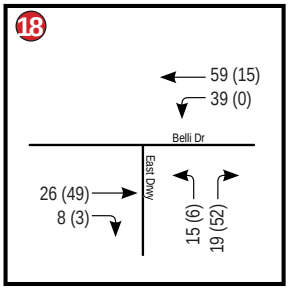
Kirman Ave/Vassar St



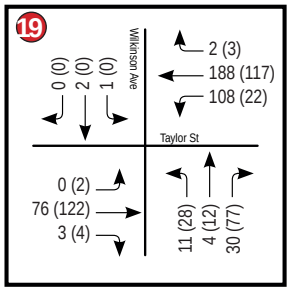
Belli Dr/West Drwy



Belli Dr/East Drwy



Wilkinson Ave/Taylor St



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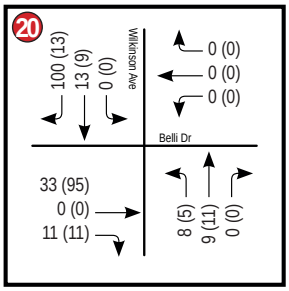
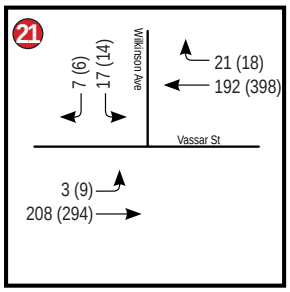
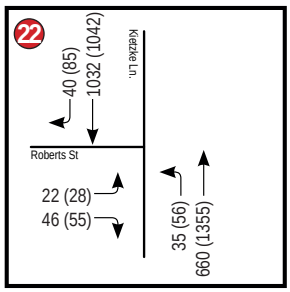


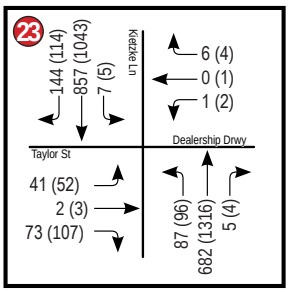
Wilkinson Ave/Vassar St



Kietzke Ln/Roberts St



Kietzke Ln/Taylor St



Legend:

1 Study Intersection

xxx AM Peak Hour Volume

(xxx) PM Peak Hour Volume

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Project 654-16-619 Renovation and
Modernization Traffic Study

2035 Conditions Intersection
Turning Movement Traffic olumes

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Revision
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Figure 11

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Table 19 2035 Conditions Intersection Level of Service

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
1	Wells Avenue / Roberts Street[3]				
	Northbound Left	*9.3*	*A*	*9.9*	*A*
	Eastbound Approach	*34.5*	*D*	***154.1***	***F***
	Westbound Approach	*23.8*	*C*	***161.8***	***F***
	Southbound Left	*9.0*	*A*	*13.1*	*B*
2	Wells Avenue / East Taylor Street[3]				
	Northbound Left	*9.7*	*A*	*10.4*	*B*
	Eastbound Approach	***42.0***	***E***	***OVERFLOW***	***F***
	Westbound Approach	***35.3***	***E***	***OVERFLOW***	***F***
	Southbound Left	*8.9*	*A*	*11.1*	*B*
3	Wells Avenue / Crampton Street[3]				
	Northbound Left	*9.1*	*A*	*9.6*	*A*
	Eastbound Approach	*28.7*	*D*	***175.0***	***F***
	Westbound Approach	*17.3*	*C*	***45.3***	***E***
	Southbound Left	*8.5*	*A*	*10.7*	*B*
4	Wells Avenue / Burns Street[3]				
	Northbound Left	*8.8*	*A*	*9.6*	*A*
	Eastbound Approach	*23.3*	*C*	***97.7***	***F***
	Westbound Approach	*13.0*	*B*	*27.7*	*D*
	Southbound Left	*8.3*	*A*	*10.4*	*B*
5	Wells Avenue / Vassar Street[2]	8.6	A	21.3	C
6	East Taylor Street / Locust Street[1]	8.6	A	9.2	A
7	Locust Street / Crampton Street[3]				
	Eastbound Approach	*9.7*	*A*	*9.8*	*A*
8	Locust Street / Burns Street[3]				
	Eastbound Approach	*10.3*	*B*	*11.0*	*B*
	Westbound Approach	*9.7*	*A*	*10.9*	*B*
9	East Taylor Street / Kirman Avenue[1]	9.3	A	9.2	A
10	Kirman Avenue / Belli Drive[3]				
	Westbound Approach	*11.9*	*B*	*9.8*	*A*
11	Kirman Avenue / SNHCS North Driveway[3]				
	Eastbound Approach	*9.5*	*A*	*9.3*	*A*
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	-	-	-	-
13	Kirman Avenue / SNHCS South Driveway[3]				
	Westbound Approach	*9.3*	*A*	*9.6*	*A*
14	Kirman Avenue / Burns Street – Balzar Circle[3]				
	Eastbound Approach	*9.8*	*A*	*10.2*	*B*
	Westbound Approach	10.9	B	11.1	B

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
15	Kirman Avenue / Balzar Circle-Wonder Street[3]				
	Eastbound Approach	*9.3*	*A*	*10.2*	*B*
	Westbound Approach	*10.2*	*B*	*11.0*	*B*
16	Kirman Avenue / Vassar Street[1]	9.4	A	15.5	C
17	Belli Drive / West Parking Structure Driveway[1]				
	Northbound Approach	*8.9*	*A*	*8.7*	*A*
	Westbound Approach	*7.4*	*A*	*0.0*	*A*
18	Belli Drive / East Parking Structure Driveway[3]				
	Northbound Approach	*9.1*	*A*	*8.8*	*A*
	Westbound Left	*7.4*	*A*	*0.0*	*A*
19	East Taylor Street / Wilkinson Avenue[3]				
	Northbound Approach	*10.7*	*B*	*10.5*	*B*
	Eastbound Left	*0.0*	*A*	*7.5*	*A*
	Westbound Left	*7.6*	*A*	*7.5*	*A*
	Southbound Approach	*13.8*	*B*	*0*	*A*
20	Belli Drive / Wilkinson Avenue[3]				
	Northbound Left	*7.5*	*A*	*7.3*	*A*
	Eastbound Approach	*9.1*	*B*	*9.2*	*A*
21	Vassar Street / Wilkinson Avenue[3]				
	Eastbound Left	*7.7*	*A*	*8.3*	*A*
	Southbound Approach	*11.1*	*B*	*14.3*	*B*
22	Kietzke Lane / Roberts Street[3]				
	Northbound Left	*11.5*	*B*	*12.1*	*B*
	Eastbound Approach	*19.5*	*C*	*25.2*	*D*
23	Kietzke Lane / East Taylor Street[3]				
	Northbound Left	*11.6*	*B*	*13.1*	*B*
	Eastbound Approach	***112.9***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*17.7*	*C*	***184.2***	***F***
	Southbound Left	*9.2*	*A*	*12.8*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

These results are generally consistent with the analysis results of previous traffic impact studies, although variations in existing traffic volumes and future volume growth rates used in the analysis resulted in some differences in reported delay and LOS. As previously noted in Section 3.4, the westbound approach at Intersection No. 23 is a private driveway for an auto dealership with very little traffic. The delay at this approach is very sensitive to the westbound approach volumes, which

can experience a high delay due to the significant northbound and southbound volumes on Kietzke Lane. The 2035 Conditions Level of Service calculations are provided in Appendix H.

The unsignalized intersections were evaluated using the urban Signal Warrant 3, per the MUTCD thresholds of significance, which is discussed in Section 9 of this report. The peak hour warrant is not met at any of the study intersections in the 2035 Conditions with the exception of Intersection 23 (Kietzke Lane / East Taylor Street) which meets Part A and Part B of the warrant. Signalization of this intersection was recommended in Section 3 and will improve the Level of Service to LOS A (5.4 second delay) in the a.m. peak hour and LOS A (7.7 second delay) in the p.m. peak hour. No other intersection or roadway improvements are recommended.

Signal Warrant 3 analysis results are included in Appendix J.

7.3 2035 Conditions Signalized Intersection Queue Analysis

The 2035 Conditions traffic volumes were applied to the signalized study intersection and the peak hour demand 95th percentile queue lengths were reviewed against the existing lane storage capacity at the intersection. Intersection No. 5 Wells Avenue / Vassar Street is the only existing signalized intersection in the study area.

The 2035 Condition peak hour intersection queue analysis is summarized in Table 20, and copies are provided in Appendix H.

Table 20 2035 Condition Peak Hour Intersection Queue Analysis

Movement	Lanes / Avail. Storage	Queue Length - 95th Percentile (feet)	
		a.m.	p.m.
Intersection No. 5 – Wells Avenue / Vassar Street			
NBT/R	1 / 300 ft	135	**#549**
NBL	1 / 135 ft	25	25
SBT/R	1 / 300 ft	162	**416**
SBL	1 / 135 ft	25	31
EBT/L/R	1 / 170 ft	57	**194**
WBT/L	1 / 150 ft	63	**#278**
WBR	1 / 85 ft	25	42

Notes: Queue shown is maximum after two cycles
- 95th percentile volume exceeds capacity, queue may be longer
Bold = results where available storage is exceeded by more than one standard vehicle, 25 ft.

Peak hour 95th percentile queue lengths exceed existing storage lane capacity at four movements at Intersection No. 5. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

8. 2035 + Project Conditions

This section describes the 2035 plus Project Conditions, potential impacts and recommended improvements, if any, at the study intersections during the weekday a.m. and p.m. peak hours.

8.1 2035 + Project Conditions Traffic Volumes

The 2035 + Project Conditions traffic volumes are shown in Figure 12. The 2035 + Project traffic volumes are represented by the 2035 traffic volumes, with annual growth rate factors discussed in Section 7, with the addition of Project related trips assigned to the roadway network, as discussed in Section 4.

8.2 2035 + Project Conditions Intersection Level of Service Analysis

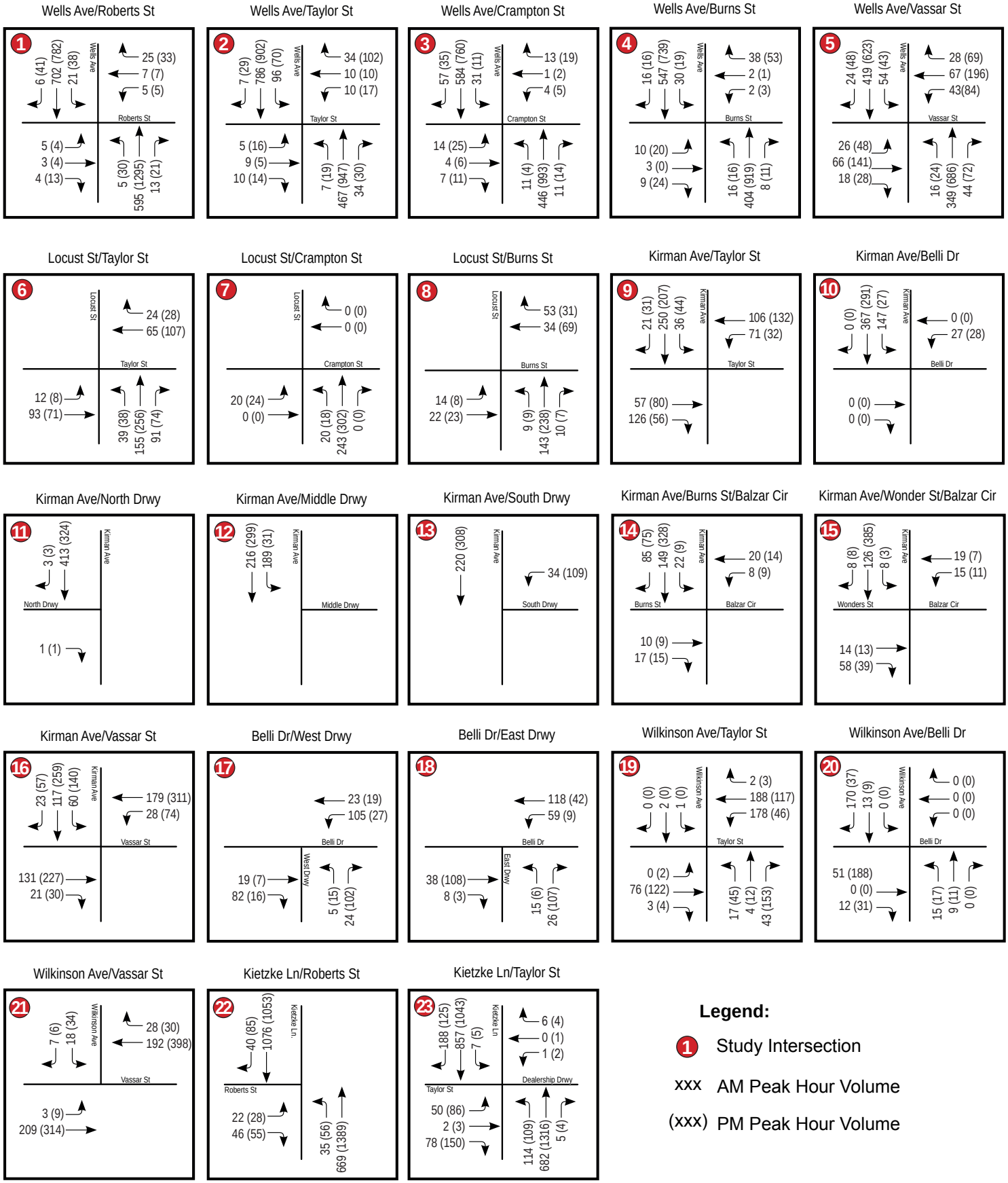
The results of the intersection level of service analysis for the 2035 + Project turning movement traffic volumes are summarized in Table 21. In general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. This finding is consistent with previous traffic studies. The analysis finds that, based on the adopted the LOS thresholds of significance all study intersections operate acceptably with the exception of the following:

1. Wells Avenue / Roberts Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the p.m. peak hour.
2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hours.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
4. Wells Avenue / Burns Street:
   - The eastbound approach during the p.m. peak hour.

23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hours.

These results are generally consistent with the analysis results of previous traffic impact studies, although variations in existing traffic volumes and future volume growth rates used in the analysis resulted in some differences in reported delay and LOS. As previously noted in Section 3.4, the westbound approach at Intersection No. 23 is a private driveway for an auto dealership with very little traffic. The delay at this approach is very sensitive to the westbound approach volumes, which can experience a high delay due to the significant northbound and southbound volumes on Kietzke Lane.

The 2035 + Project Conditions Level of Service calculations are provided in Appendix I.



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Job Number 11110661
Revision
Date Jun 2016

2035 Plus Project Conditions Intersection Turning Movement Traffic olumes

Figure 12

Table 21 2035 + Project Conditions Intersection Level of Service

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
1	Wells Avenue / Roberts Street[3]				
	Northbound Left	*9.3*	*A*	*10.0*	*A*
	Eastbound Approach	***35.3***	***E***	***178.5***	***F***
	Westbound Approach	*24.2*	*C*	***189.3***	***F***
	Southbound Left	*9.0*	*A*	*13.3*	*B*
2	Wells Avenue / East Taylor Street[3]				
	Northbound Left	*9.7*	*A*	*10.4*	*B*
	Eastbound Approach	***44.8***	***E***	***OVERFLOW***	***F***
	Westbound Approach	***37.0***	***E***	***OVERFLOW***	***F***
	Southbound Left	*8.9*	*A*	*11.2*	*B*
3	Wells Avenue / Crampton Street[3]				
	Northbound Left	9.1	A	9.6	A
	Eastbound Approach	28.8	D	**186.8**	**F**
	Westbound Approach	17.4	C	**46.7**	**E**
	Southbound Left	8.5	A	10.8	B
4	Wells Avenue / Burns Street[3]				
	Northbound Left	*8.8*	*A*	*9.6*	*A*
	Eastbound Approach	*23.3*	*C*	***111.7***	***F***
	Westbound Approach	*13.0*	*B*	*27.8*	*D*
	Southbound Left	*8.4*	*A*	*10.4*	*B*
5	Wells Avenue / Vassar Street[2]	8.7	A	22.0	C
6	East Taylor Street / Locust Street[1]	8.7	A	9.4	A
7	Locust Street / Crampton Street[3]				
	Eastbound Approach	*9.8*	*A*	*9.9*	*A*
8	Locust Street / Burns Street[3]				
	Eastbound Approach	*10.5*	*B*	*11.1*	*B*
	Westbound Approach	*9.8*	*A*	*11.2*	*B*
9	East Taylor Street / Kirman Avenue[1]	9.9	A	9.4	A
10	Kirman Avenue / Belli Drive[3]				
	Westbound Approach	*13.9*	*B*	*10.1*	*B*
11	Kirman Avenue / SNHCS North Driveway[3]				
	Eastbound Approach	*9.7*	*A*	*9.3*	*A*
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	-	-	-	-
13	Kirman Avenue / SNHCS South Driveway[3]				
	Westbound Approach	*9.4*	*A*	*10.2*	*B*

No.	Intersection	Weekday Peak Hour			
		a.m.		p.m.	
		Delay (sec)	LOS	Delay (sec)	LOS
14	Kirman Avenue / Burns Street – Balzar Circle[3]				
	Eastbound Approach	*9.8*	*A*	*10.7*	*B*
	Westbound Approach	11.0	B	11.8	B
15	Kirman Avenue / Balzar Circle-Wonder Street[3]				
	Eastbound Approach	*9.3*	*A*	*10.6*	*B*
	Westbound Approach	*10.2*	*B*	*11.5*	*B*
16	Kirman Avenue / Vassar Street[1]	9.5	A	16.9	C
17	Belli Drive / West Parking Structure Driveway[1]				
	Northbound Approach	*9.1*	*A*	*9.0*	*A*
	Westbound Left	*7.6*	*A*	*7.3*	*A*
18	Belli Drive / East Parking Structure Driveway[3]				
	Northbound Approach	*9.5*	*A*	*9.5*	*A*
	Westbound Left	*7.4*	*A*	*7.5*	*A*
19	East Taylor Street / Wilkinson Avenue[3]				
	Northbound Approach	*11.9*	*B*	*11.5*	*B*
	Eastbound Left	*0.0*	*A*	*7.5*	*A*
	Westbound Left	*7.7*	*A*	*7.6*	*A*
	Southbound Approach	*16.7*	*C*	*0.0*	*A*
20	Belli Drive / Wilkinson Avenue[3]				
	Northbound Left	*7.7*	*A*	*7.3*	*A*
	Eastbound Approach	*9.6*	*A*	*10.2*	*B*
21	Vassar Street / Wilkinson Avenue[3]				
	Eastbound Left	*7.7*	*A*	*8.3*	*A*
	Southbound Approach	*11.1*	*B*	*16.1*	*C*
22	Kietzke Lane / Roberts Street[3]				
	Northbound Left	11.8	B	12.2	B
	Eastbound Approach	20.3	C	25.8	D
23	Kietzke Lane / East Taylor Street[3]				
	Northbound Left	*12.4*	*B*	*13.5*	*B*
	Eastbound Approach	***248.4***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*19.2*	*C*	***238.5***	***F***
	Southbound Left	*9.2*	*A*	*12.8*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

The unsignalized intersections were evaluated using the urban Signal Warrant 3, per the MUTCD thresholds of significance, which is discussed in Section 9 of this report. The peak hour warrant is not met at any of the study intersections in the 2035 + Project Conditions with the exception of Intersection 23 (Kietzke Lane / East Taylor Street) which meets Part A and Part B of the warrant. Signalization of this intersection was recommended in Section 3, and will improve the Level of Service to LOS A (5.9 second delay) in the a.m. peak hour and LOS B (10.3 second delay) in the p.m. peak hour. No other intersection or roadway improvements are recommended.

Signal Warrant 3 analysis results are included in Appendix J.

8.3 2035 + Project Conditions Signalized Intersection Queue Analysis

The 2035 + Project Conditions traffic volumes were applied to the signalized study intersection and the peak hour demand 95th percentile queue lengths were reviewed against the existing lane storage capacity at the intersection. Intersection No. 5 Wells Avenue / Vassar Street is the only existing signalized intersection in the study area.

The 2035 + Project Condition Peak Hour Intersection Queue Analysis is summarized in Table 21, and copies are provided in Appendix I.

Table 22 2035 + Project Condition Peak Hour Intersection Queue Analysis

Movement	Lanes / Avail. Storage	Queue Length - 95th Percentile (feet)	
		a.m.	p.m.
Intersection No. 5 – Wells Avenue / Vassar Street			
NBT/R	1 / 300 ft	138	**#586**
NBL	1 / 135 ft	25	25
SBT/R	1 / 300 ft	163	**#482**
SBL	1 / 135 ft	25	35
EBT/L/R	1 / 170 ft	57	157
WBT/L	1 / 150 ft	63	**208**
WBR	1 / 85 ft	25	30

Notes: Queue shown is maximum after two cycles
- 95th percentile volume exceeds capacity, queue may be longer
Bold = results where available storage is exceeded by more than one standard vehicle, 25 ft.

Peak hour 95th percentile queue lengths exceed existing storage lane capacity at three movements at Intersection No. 5. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

8.4 2035 + Project Impacts and Mitigation Measures

The following intersection approaches were determined to operate unacceptably with and without Project traffic:

1. Wells Avenue / Roberts Street:
   - The eastbound approach during the p.m. peak hour.

- The westbound approach during the p.m. peak hour.

2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hours.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
4. Wells Avenue / Burns Street:
   - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hours.

Because the Project contributes traffic to these intersection approaches that operate unacceptably without the Project, this is an **impact**. Signalization of Intersection 23 (Kietzke Lane / East Taylor Street) was recommended in Section 3 to improve the operation of this intersection.

The Project contributes traffic to the following intersection which operated acceptably without Project trips. The addition of Project trips reduced the intersection LOS from an acceptable LOS D to an unacceptable LOS E during the a.m. peak hour:

1. Wells Avenue / Roberts Street:
   - The eastbound approach during the a.m. peak hour.

Because the Project contributes traffic to this intersection approach causing it to operate unacceptably, this is an **impact**. The peak hour warrant is not met at this intersection.

9. Peak Hour Signal Warrant 3

The section presents an evaluation of “urban” Signal Warrant 3 for the peak hour for unsignalized intersections in all study scenarios to determine if the warrant is met.

9.1 Peak Hour Signal Warrant 3 Methodology

Traffic Signal Warrant 3 is based on the 2009 edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) with 2012 Revisions (FHWA, 2012). The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street (FHWA, 2012). It is noted that Warrant 3 should only be applied in unusual cases, such as at facilities that attract or discharge large amounts of vehicles over short periods of time.

Warrant 3 has two Parts, A and B, either of which must be met to consider the potential need for a signal based on the peak hour condition. Part A contains three conditions, which are:

1. The total delay experience by traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds 4 vehicle-hours for one-lane approach, or 5 vehicle-hours for a two-lane approach; AND
2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vehicles per hour (vph) for one moving lane of traffic or 150 vph for two moving lanes; AND
3. The total entering volume serviced during the hour equals or exceeds 800 vph for the intersection with 4 or more approaches or 650 vph for intersections with 3 approaches.

Part B of the Traffic Signal Warrant 3 contains figures that plot minor street versus major street approaches for urban and rural areas. The entire Signal Warrant 3 is included in Appendix J.

The satisfaction of a traffic signal warrant or warrants is not considered an impact based on City of Reno significance criteria, and does not in itself require the installation of a traffic signal. Applicable to this study, it has been determined through engineering judgment that, in order for the installation of a traffic signal to be considered, the scenario must have an intersection LOS which is not acceptable with respect to the applicable significance thresholds <u>and</u> meet the requirements of either part of Traffic Signal Warrant 3.

9.2 Peak Hour Signal Warrant 3 Analysis

Table 23 summarizes the results of the Warrant 3 analysis. Part B was evaluated under “urban” conditions.

Table 23 Summary of Traffic Signal Warrant 3 for Study Conditions

Intersection	Part A				Part B
	1	2	3		
	Total Delay (veh-hrs)	Highest Minor Appr. Volume (veh)	Total Entering Volume (veh)	Met (Y/N)	Met (Y/N)
Existing Conditions					
No. 1 – Wells Avenue / Roberts Road	*Intersection Operates Acceptably*				
No. 2 – Wells Avenue / East Taylor Street	< 4	107	1520	N	N
No. 3 - Wells Avenue / Crampton Street	< 4	42	1428	N	N
No. 4 – Wells Avenue / Burns Street	*Intersection Operates Acceptably*				
No. 6 – Locust Street / East Taylor Street	*Intersection Operates Acceptably*				
No. 7 – Locust Street / Crampton Street	*Intersection Operates Acceptably*				
No. 8 – Locust Street / Burns Street	*Intersection Operates Acceptably*				
No. 9 – Kirman Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 10 – Kirman Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 11 – Kirman Avenue / SNHCS North Driveway	*Intersection Operates Acceptably*				
No. 12 – Kirman Avenue / SNHCS Mid Driveway (Inbound Only)	*Intersection Operates Acceptably*				
No. 13 – Kirman Avenue / SNHCS South Driveway	*Intersection Operates Acceptably*				
No. 14 – Kirman Avenue / Burns Street – Balzar Circle	*Intersection Operates Acceptably*				
No. 15 – Kirman Avenue / Balzar Circle – Wonder Street	*Intersection Operates Acceptably*				
No. 16 – Kirman Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 17 – Belli Drive / West Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 18 – Belli Drive / East Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 19 – Wilkinson Avenue / East	*Intersection Operates Acceptably*				

Intersection	Part A				Part B
	1	2	3		
	Total Delay (veh-hrs)	Highest Minor Appr. Volume (veh)	Total Entering Volume (veh)	Met (Y/N)	Met (Y/N)
Taylor Street					
No. 20 – Wilkinson Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 21 – Wilkinson Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 22 – Kietzke Lane / Roberts Road	*Intersection Operates Acceptably*				
No. 23 – Kietzke Lane / East Taylor Street	**> 4**	**140**	**2401**	**Y**	N
2025 Conditions					
No. 1 – Wells Avenue / Roberts Road	*Intersection Operates Acceptably*				
No. 2 – Wells Avenue / East Taylor Street	< 4	113	1437	N	N
No. 3 - Wells Avenue / Crampton Street	< 4	42	1374	N	N
No. 4 – Wells Avenue / Burns Street	*Intersection Operates Acceptably*				
No. 6 – Locust Street / East Taylor Street	*Intersection Operates Acceptably*				
No. 7 – Locust Street / Crampton Street	*Intersection Operates Acceptably*				
No. 8 – Locust Street / Burns Street	*Intersection Operates Acceptably*				
No. 9 – Kirman Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 10 – Kirman Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 11 – Kirman Avenue / SNHCS North Driveway	*Intersection Operates Acceptably*				
No. 12 – Kirman Avenue / SNHCS Mid Driveway (Inbound Only)	*Intersection Operates Acceptably*				
No. 13 – Kirman Avenue / SNHCS South Driveway	*Intersection Operates Acceptably*				
No. 14 – Kirman Avenue / Burns Street – Balzar Circle	*Intersection Operates Acceptably*				
No. 15 – Kirman Avenue / Balzar Circle – Wonder Street	*Intersection Operates Acceptably*				

Intersection	Part A				Part B
	1	2	3		
	Total Delay (veh-hrs)	Highest Minor Appr. Volume (veh)	Total Entering Volume (veh)	Met (Y/N)	Met (Y/N)
No. 16 – Kirman Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 17 – Belli Drive / West Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 18 – Belli Drive / East Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 19 – Wilkinson Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 20 – Wilkinson Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 21 – Wilkinson Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 22 – Kietzke Lane / Roberts Road	*Intersection Operates Acceptably*				
No. 23 – Kietzke Lane / East Taylor Street	**> 4**	**147**	**2636**	**Y**	**Y**
2025 + Project Conditions					
No. 1 – Wells Avenue / Roberts Road	*Intersection Operates Acceptably*				
No. 2 – Wells Avenue / East Taylor Street	< 4	130	1465	N	N
No. 3 - Wells Avenue / Crampton Street	< 4	42	1389	N	N
No. 4 – Wells Avenue / Burns Street	*Intersection Operates Acceptably*				
No. 6 – Locust Street / East Taylor Street	*Intersection Operates Acceptably*				
No. 7 – Locust Street / Crampton Street	*Intersection Operates Acceptably*				
No. 8 – Locust Street / Burns Street	*Intersection Operates Acceptably*				
No. 9 – Kirman Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 10 – Kirman Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 11 – Kirman Avenue / SNHCS North Driveway	*Intersection Operates Acceptably*				
No. 12 – Kirman Avenue / SNHCS Mid Driveway (Inbound Only)	*Intersection Operates Acceptably*				

Intersection	Part A				Part B
	1	2	3		
	Total Delay (veh-hrs)	Highest Minor Appr. Volume (veh)	Total Entering Volume (veh)	Met (Y/N)	Met (Y/N)
No. 13 – Kirman Avenue / SNHCS South Driveway	*Intersection Operates Acceptably*				
No. 14 – Kirman Avenue / Burns Street – Balzar Circle	*Intersection Operates Acceptably*				
No. 15 – Kirman Avenue / Balzar Circle – Wonder Street	*Intersection Operates Acceptably*				
No. 16 – Kirman Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 17 – Belli Drive / West Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 18 – Belli Drive / East Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 19 – Wilkinson Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 20 – Wilkinson Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 21 – Wilkinson Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 22 – Kietzke Lane / Roberts Road	*Intersection Operates Acceptably*				
No. 23 – Kietzke Lane / East Taylor Street	**> 4**	**264**	**2799**	**Y**	**Y**
2035 Conditions					
No. 1 – Wells Avenue / Roberts Road	< 4	45	2239	N	N
No. 2 – Wells Avenue / East Taylor Street	< 4	112	2133	N	N
No. 3 - Wells Avenue / Crampton Street	< 4	42	1870	N	N
No. 4 – Wells Avenue / Burns Street	< 4	46	1806	N	N
No. 6 – Locust Street / East Taylor Street	*Intersection Operates Acceptably*				
No. 7 – Locust Street / Crampton Street	*Intersection Operates Acceptably*				
No. 8 – Locust Street / Burns Street	*Intersection Operates Acceptably*				
No. 9 – Kirman Avenue / East Taylor	*Intersection Operates Acceptably*				

Intersection	Part A				Part B
	1	2	3		
	Total Delay (veh-hrs)	Highest Minor Appr. Volume (veh)	Total Entering Volume (veh)	Met (Y/N)	Met (Y/N)
Street					
No. 10 – Kirman Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 11 – Kirman Avenue / SNHCS North Driveway	*Intersection Operates Acceptably*				
No. 12 – Kirman Avenue / SNHCS Mid Driveway (Inbound Only)	*Intersection Operates Acceptably*				
No. 13 – Kirman Avenue / SNHCS South Driveway	*Intersection Operates Acceptably*				
No. 14 – Kirman Avenue / Burns Street – Balzar Circle	*Intersection Operates Acceptably*				
No. 15 – Kirman Avenue / Balzar Circle – Wonder Street	*Intersection Operates Acceptably*				
No. 16 – Kirman Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 17 – Belli Drive / West Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 18 – Belli Drive / East Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 19 – Wilkinson Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 20 – Wilkinson Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 21 – Wilkinson Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 22 – Kietzke Lane / Roberts Road	*Intersection Operates Acceptably*				
No. 23 – Kietzke Lane / East Taylor Street	**> 4**	**162**	**2770**	**Y**	**Y**
2035 + Project Conditions					
No. 1 – Wells Avenue / Roberts Road	< 4	45	2273	N	N
No. 2 – Wells Avenue / East Taylor Street	> 4	129	2161	Y	N
No. 3 - Wells Avenue / Crampton Street	< 4	42	1885	N	N
No. 4 – Wells Avenue / Burns Street	< 4	57	1821	N	N

Intersection	Part A				Part B
	1	2	3		
	Total Delay (veh-hrs)	Highest Minor Appr. Volume (veh)	Total Entering Volume (veh)	Met (Y/N)	Met (Y/N)
No. 6 – Locust Street / East Taylor Street	*Intersection Operates Acceptably*				
No. 7 – Locust Street / Crampton Street	*Intersection Operates Acceptably*				
No. 8 – Locust Street / Burns Street	*Intersection Operates Acceptably*				
No. 9 – Kirman Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 10 – Kirman Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 11 – Kirman Avenue / SNHCS North Driveway	*Intersection Operates Acceptably*				
No. 12 – Kirman Avenue / SNHCS Mid Driveway (Inbound Only)	*Intersection Operates Acceptably*				
No. 13 – Kirman Avenue / SNHCS South Driveway	*Intersection Operates Acceptably*				
No. 14 – Kirman Avenue / Burns Street – Balzar Circle	*Intersection Operates Acceptably*				
No. 15 – Kirman Avenue / Balzar Circle – Wonder Street	*Intersection Operates Acceptably*				
No. 16 – Kirman Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 17 – Belli Drive / West Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 18 – Belli Drive / East Parking Structure Driveway	*Intersection Operates Acceptably*				
No. 19 – Wilkinson Avenue / East Taylor Street	*Intersection Operates Acceptably*				
No. 20 – Wilkinson Avenue / Belli Drive	*Intersection Operates Acceptably*				
No. 21 – Wilkinson Avenue / Vassar Street	*Intersection Operates Acceptably*				
No. 22 – Kietzke Lane / Roberts Road	*Intersection Operates Acceptably*				
No. 23 – Kietzke Lane / East Taylor Street	**> 4**	**239**	**2841**	**Y**	**Y**

10. Kirman Avenue Lane Reduction

10.1 Proposed Kirman Avenue Lane Reduction Concept

A key element of this study is the proposed reduction in the width of Kirman Avenue adjacent to the VASNHCS campus, narrowing it between East Taylor Street in the north and Burns Street / Balzar Circle in the south. The complete closure of Kirman Avenue from Belli Street to Burns Street / Balzar Circle was previously studied by the VA in the *VA Hospital Kirman Avenue Abandonment Traffic Analysis* (VASNHCS, 2014b). The narrowing would reduce the roadway from two southbound lanes to one southbound lane and a dedicated Class II bicycle lane. This segment of Kirman Avenue is approximately 700 feet long and southbound only. It forms a one-way *collector* couplet with Locust Street, which provides northbound traffic circulation on the west side of the campus. Kirman Avenue is the primary vehicular ingress / egress for the VASNHCS campus, and is the main access to Belli Drive and the existing 2-level parking garage, as well as a small surface parking lot to the east. It also provides direct access to the primary patient / visitor loading area just south of Belli Drive immediately adjacent to the main hospital and for deliveries. Figure 13 shows an existing plan of Kirman Avenue in this study area.

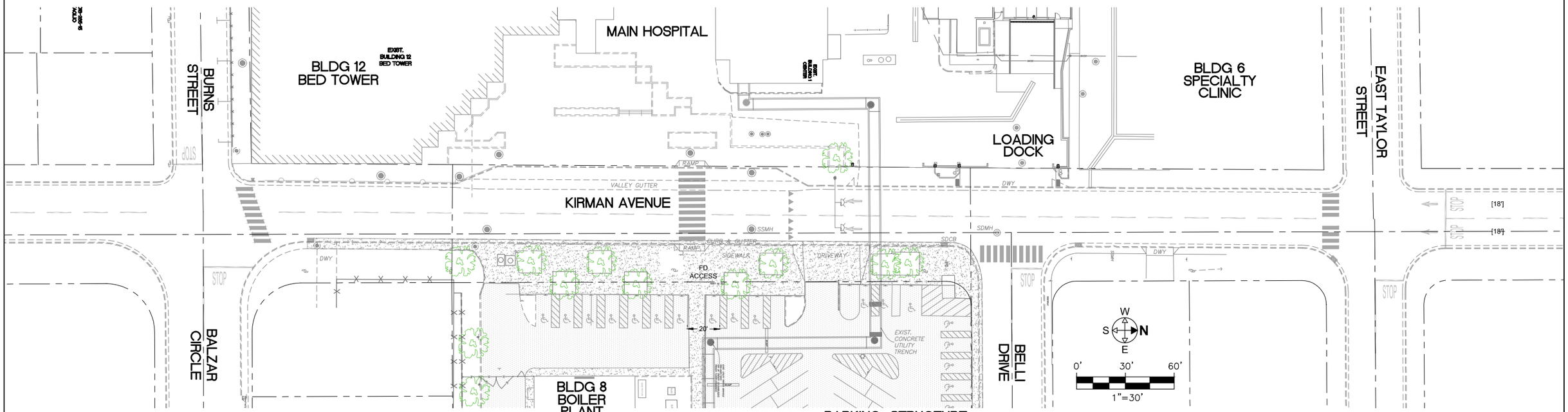
10.1.1 Concept Development

As a part of this study, several concepts were developed to evaluate options for the Kirman Avenue lane reduction. These concepts considered the following key issues:

- Geometric alternatives
- Integration with other planned VA improvements
- Integration with other planned City of Reno improvements
- Pedestrian access and safety
- Traffic calming
- Maintain access to existing driveways and delivery / loading areas
- Emergency vehicle access requirements

As previously discussed in the study introduction (Section 1) and in Section 4, the VASNHCS is undertaking a number of projects to expand services and address needed infrastructure improvements. These projects include a series of renovation and modernization projects and one Major project, which is the construction of seismic retrofits to Building 1, including hospital frontage improvements on the west side of Kirman Avenue. The implementation of these projects is discussed in the VA Reno 5-Year Master Plan (VASNHCS, 2015). The VA Reno 5-Year Master Plan also describes the creation an open space on the east side of Kirman Avenue to help unify the campus with a new arrival plaza, to provide a safe and pleasant pedestrian corridor connecting the core campus with parking areas, and to create a “heart” for campus events and wellness activities (VASNHCS, 2015).

The selected Kirman Avenue lane reduction concept was developed in close coordination with the City of Reno Community Development Department, Department of Public Works, Traffic Engineering and Fire Department to assure that the proposed concept met City requirements with regard to planning and neighborhood context, traffic operations, improvement standards and emergency response requirements. The plan was also developed to be consistent with the City of Reno Complete Streets program, which is currently under development. Figure 14 shows the proposed Kirman Avenue lane reduction concept plan. Several typical roadway cross sections are also included on the plan.



PLAN

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Client
Project KIRMAN AVENUE LANE REDUCTION
Title **EXISTING KIRMAN AVENUE PLAN**
Contract No. 11110661
Original Size Ansi D Drawing No: **FIGURE 13**
Sht 1 of 1
Rev:

Plot Date: 7 April 2016 - 1:44 PM Plotted by: Chris Bach Cad File No: G:\111\11110661 Kirman Lane Reduction Traffic Study \06-CAD\Sheets\Kirman Avenue Existing.dwg

10.1.2 Lane Reduction Features

The key features of the Kirman Avenue lane reduction concept plan include:

- Trap lane / required right turn on the Kirman Avenue SB approach to East Taylor Street.
- Sidewalk bulb-out at NW corner of East Taylor Street / Kirman Avenue, which facilitates the trap lane and required right turn.
- Parallel parking adjacent to Building 6 (Specialty Clinic) on the west side of Kirman Avenue.
- Widened sidewalk on the west side of Kirman Avenue between East Taylor Street and Belli Drive.
- New pedestrian crosswalk north of Belli Drive adjacent to Building 6 (Specialty Clinic).
- Gentle meander in Kirman Avenue south of Belli Drive (traffic calming measure).
- New 15-foot wide raised primary pedestrian crossing adjacent to Building 1 (the Main Hospital). This is crossing serves to both calm traffic and facilitate pedestrian crossing.
- New enhanced pedestrian flashing beacon at the raised primary pedestrian crossing (pedestrian safety).
- Landscape planters with low plantings and railings to channel pedestrians to the primary crossing location.
- Widened sidewalk and proposed open space / plaza area on the east side of Kirman Avenue between Belli Drive and Burns Street / Balzar Circle.

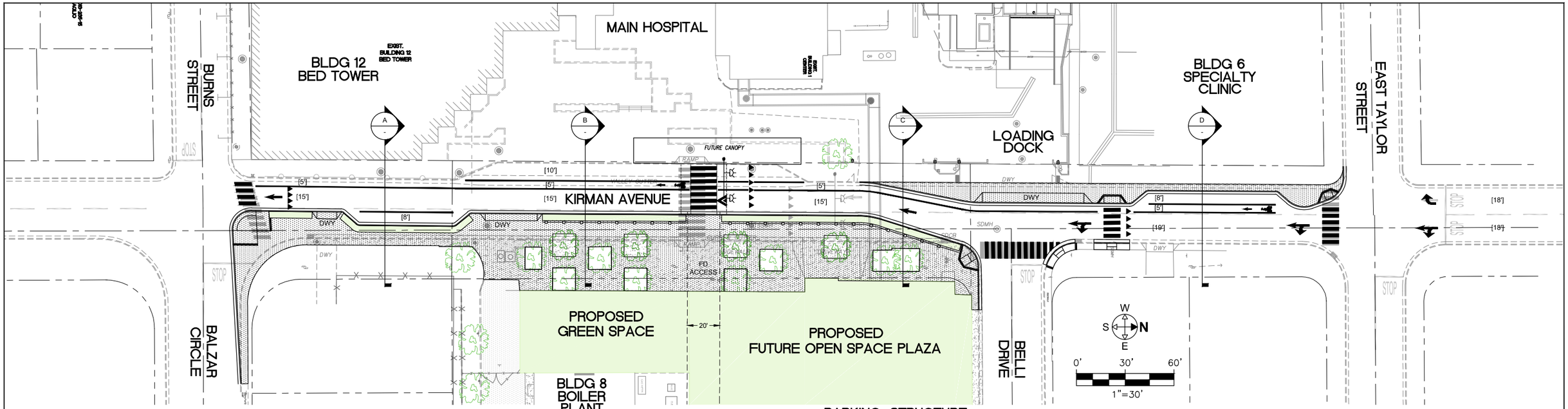
The narrowing of Kirman Avenue is intended to calm traffic using a variety of design features. The *Traffic Engineering Handbook* (ITE, 2009) states that by slowing traffic, eliminating conflicting movements and/or sharpening drivers' attention, traffic calming may result in fewer collisions. Due to lower speeds, collisions may be less serious when they do occur (ITE, 2009). Studies have shown that narrowing a roadway reduces traffic volumes by an average of 10% because they reroute non-local traffic (ITE, 2009).

The use of bulbouts shortens the pedestrian crossing distance, reducing the crossing time and improving pedestrian safety.

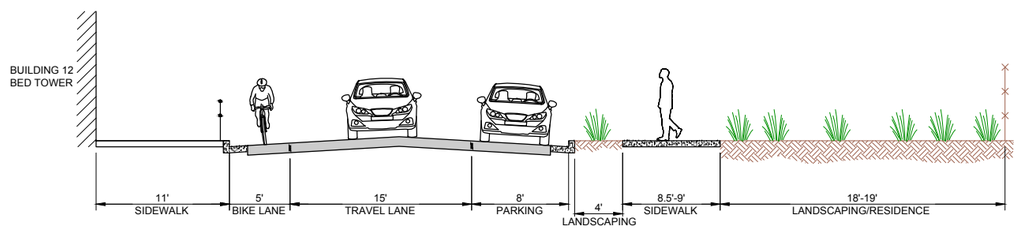
The single wide lane maintains the flow of traffic and accommodates delivery vehicles, buses and large emergency vehicles.

The raised crossing is similar to a City of Reno Speed Bump (Standard Drawing No. R-403A, R-403B and R-403C), but wider to serve as both a traffic calming measure and raised pedestrian crossing. Studies have shown that speed tables or humps reduce vehicle speeds by an average of about 20% (ITE, 2009), The gentle meander in the roadway also requires drivers to perform a maneuver, and helps to contain or reduce travel speeds.

The design of the raised pedestrian crossing shall be consistent with City of Reno Speed Bump standards to facilitate emergency vehicle access to the VA facilities and buildings on the east side of Kirman Avenue.

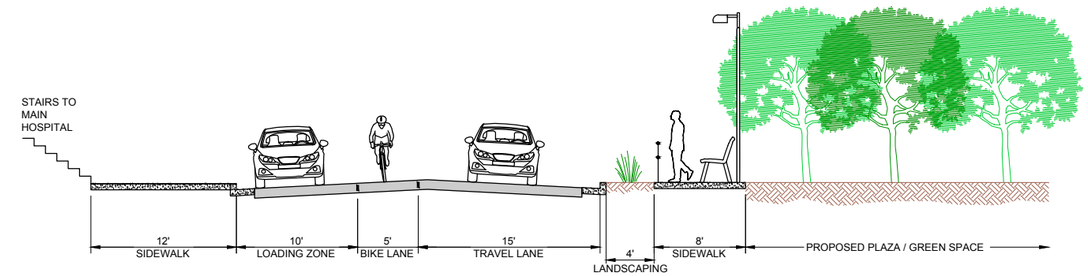


PLAN



SECTION A

NTS



SECTION B

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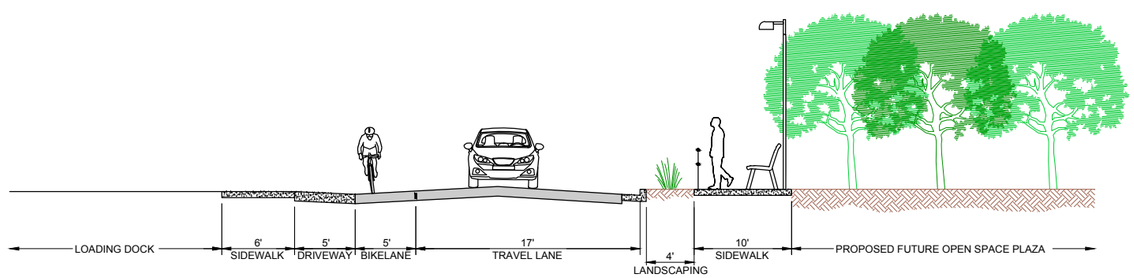

SECTION C

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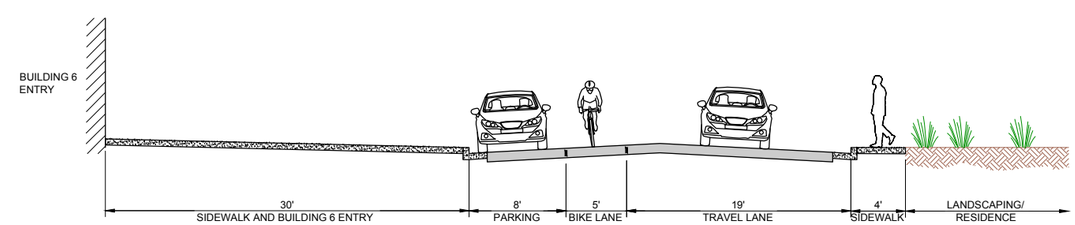

SECTION D

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Client

Project KIRMAN AVENUE LANE REDUCTION

Title **PROPOSED KIRMAN AVENUE LANE REDUCTION CONCEPT PLAN AND SECTIONS**

Contract No. 11110661

Original Size Ansi D Drawing No: **FIGURE 14**

Sht 1 of 1

Rev:

Plot Date: 7 April 2016 - 1:22 PM Plotted by: Chris Bach Cad File No: G:\111\11110661 Kirman Lane Reduction Traffic Study \06-CAD\Sheets\Kirman Avenue Option-1 - Copy.dwg

10.2 Kirman Avenue Lane Reduction Traffic Analysis

This section describes the traffic impact analysis of the Kirman Avenue lane reduction, potential impacts and recommended improvements or modifications, if any, during the weekday a.m. and p.m. peak hours.

10.2.1 Study Scenarios and Traffic Volumes

The Kirman Avenue lane reduction traffic analysis considers the following study scenarios:

- 2025 Conditions
- 2025 + Project Conditions
- 2035 Conditions
- 2035 + Project Conditions

The traffic volumes used in each scenario analysis are the same as those used in the previous analysis except that a total of 20% of the future 2025 and 2035 projected traffic volumes on the Kirman Avenue southbound through approach at East Taylor Street (Intersection No. 9) are diverted from Kirman Avenue to the east and west on East Taylor Street. The analysis assumes that 60% of the diverted traffic travels east on East Taylor Street, and 40% of the diverted traffic travels west on East Taylor Street. This distribution is based on existing traffic patterns at this intersection, and is generally consistent with the methodology used in the *VA Hospital Kirman Avenue Abandonment Traffic Analysis* (VASNHCS, 2014b). The diverted traffic was then routed through to the other study intersections based on existing traffic circulation patterns. The analysis assumes that Project generated trips are not diverted or otherwise effected by the Kirman Avenue lane reduction because the destination of those trips is the VASNHCS campus. The Project trips are added to the revised traffic volumes. Results are reported only for those study intersections that received more than two additional diverted vehicle trips. Also, results are reported only during the p.m. peak hour, which was previously identified as the worst-case peak hour traffic conditions during a typical weekday.

The Kirman Avenue lane reduction Level of Service calculations are provided in Appendix K.

10.2.2 2025 Conditions and 2025 + Project Conditions Intersection Level of Service Analysis

The results of the intersection level of service analysis for the Kirman Avenue lane reduction based on 2025 and 2025 + Project turning movement traffic volumes are summarized in Table 24. The analysis finds that, based on the adopted the LOS thresholds of significance all study intersections operate acceptably with the exception of the following:

2. Wells Avenue / East Taylor Street (2025 and 2025 + Project):
   - The eastbound approach.
   - The westbound approach.
3. Wells Avenue / Crampton Street (2025 and 2025 + Project):
   - The eastbound approach.
23. Kietzke Lane / East Taylor Street (2025 and 2025 + Project):
   - The eastbound approach.
   - The westbound approach.

Table 24 2025 & 2025 + Project Conditions With Lane Reduction Intersection Level of Service

No.	Intersection	Weekday p.m. Peak Hour			
		2025 With Lane Reduction		2025 + Project With Lane Reduction	
		Delay (sec)	LOS	Delay (sec)	LOS
2	Wells Avenue / East Taylor Street[3]				
	Northbound Left	*8.7*	*A*	*8.7*	*A*
	Eastbound Approach	***47.8***	***E***	***54.0***	***F***
	Westbound Approach	***50.5***	***F***	***56.0***	***F***
	Southbound Left	*9.5*	*A*	*9.5*	*A*
3	Wells Avenue / Crampton Street[3]				
	Northbound Left	*8.8*	*A*	*8.8*	*A*
	Eastbound Approach	***44.7***	***E***	***46.0***	***E***
	Westbound Approach	*22.6*	*C*	*23.1*	*C*
	Southbound Left	*9.4*	*A*	*9.4*	*A*
4	Wells Avenue / Burns Street[3]				
	Northbound Left	8.8	A	8.8	A
	Eastbound Approach	32.3	D	33.8	D
	Westbound Approach	17.2	C	17.3	C
	Southbound Left	9.2	A	9.2	A
5	Wells Avenue / Vassar Street[2]	17.8	B	18.3	B
6	East Taylor Street / Locust Street[1]	8.5	A	8.7	A
9	East Taylor Street / Kirman Avenue[1]	9.4	A	9.6	A
10	Kirman Avenue / Belli Drive[3]	10.0	B	10.4	B
14	Kirman Avenue / Burns Street – Balzar Circle[3]				
	Eastbound Approach	*9.9*	*A*	*10.5*	*B*
	Westbound Approach	10.7	B	11.5	B

No.	Intersection	Weekday p.m. Peak Hour			
		2025 With Lane Reduction		2025 + Project With Lane Reduction	
		Delay (sec)	LOS	Delay (sec)	LOS
15	Kirman Avenue / Balzar Circle-Wonder Street[3]				
	Eastbound Approach	*9.7*	*A*	*10.0*	*B*
	Westbound Approach	10.3	B	10.8	B
19	East Taylor Street / Wilkinson Avenue[3]				
	Northbound Approach	*10.4*	*B*	*11.4*	*B*
	Eastbound Left	*7.5*	*A*	*7.5*	*A*
	Westbound Left	*7.5*	*A*	*7.6*	*A*
	Southbound Left	0.0	A	0.0	A
23	Kietzke Lane / East Taylor Street[3]				
	Northbound Left	*12.7*	*B*	*13.1*	*B*
	Eastbound Left	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Westbound Left	***54.0***	***F***	***66.5***	***F***
	Southbound Left	*12.3*	*B*	*12.3*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

10.2.3 2025 + Project Impacts and Mitigation Measures

The following intersection approaches were determined to operate unacceptably with and without Project traffic with the Kirman Avenue lane reduction:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.
3. Wells Avenue / Crampton Street:
   - The eastbound approach.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.

These are the same impacted intersections identified in the 2025 + Project Conditions. Because the Project contributes traffic to these intersection approaches that operate unacceptably without the Project, this is an **impact**. Signalization of Intersection 23 (Kietzke Lane / East Taylor Street) was recommended in Section 3 to improve the operation of this intersection.

10.2.4 2035 Conditions and 2035 + Project Conditions Intersection Level of Service Analysis

The results of the intersection level of service analysis for the Kirman Avenue lane reduction based on 2035 and 2035 + Project turning movement traffic volumes are summarized in Table 25. The analysis finds that, based on the adopted LOS thresholds of significance all study intersections operate acceptably with the exception of the following:

2. Wells Avenue / East Taylor Street (2035 and 2035 + Project):
   - The eastbound approach.
   - The westbound approach.
3. Wells Avenue / Crampton Street (2035 and 2035 + Project):
   - The eastbound approach.
   - The westbound approach.
4. Wells Avenue / Burns Street (2035 and 2035 + Project):
   - The eastbound approach.

23. Kietzke Lane / East Taylor Street (2035 and 2035 + Project):
   - The eastbound approach.
   - The westbound approach.

Table 25 2035 & 2035 + Project Conditions With Lane Reduction Intersection Level of Service

No.	Intersection	Weekday Peak Hour			
		2035 With Lane Reduction		2035 + Project With Lane Reduction	
		Delay (sec)	LOS	Delay (sec)	LOS
2	Wells Avenue / East Taylor Street[3]				
	Northbound Left	*10.4*	*B*	*10.4*	*B*
	Eastbound Approach	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Westbound Approach	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Southbound Left	*11.1*	*B*	*11.2*	*B*
3	Wells Avenue / Crampton Street[3]				
	Northbound Left	*9.7*	*A*	*9.7*	*A*
	Eastbound Approach	***180.7***	***F***	***186.8***	***F***
	Westbound Approach	***47.2***	***E***	***48.2***	***E***
	Southbound Left	10.7	B	10.8	B
4	Wells Avenue / Burns Street[3]				
	Northbound Left	*9.6*	*A*	*9.6*	*A*
	Eastbound Approach	***106.6***	***F***	***120.1***	***F***
	Westbound Approach	*28.0*	*D*	*27.9*	*D*
	Southbound Left	*10.4*	*B*	*10.4*	*B*
5	Wells Avenue / Vassar Street[2]	21.3	C	22.3	C
6	East Taylor Street / Locust Street[1]	9.3	A	9.5	A
9	East Taylor Street / Kirman Avenue[1]	9.9	A	10.1	B
10	Kirman Avenue / Belli Drive[3]	10.4	B	10.8	B
14	Kirman Avenue / Burns Street – Balzar Circle[3]				
	Eastbound Approach	*10.3*	*B*	*10.9*	*B*
	Westbound Approach	11.2	B	*12.1*	*B*
15	Kirman Avenue / Balzar Circle-Wonder Street[3]				

No.	Intersection	Weekday Peak Hour			
		2035 With Lane Reduction		2035 + Project With Lane Reduction	
		Delay (sec)	LOS	Delay (sec)	LOS
	Eastbound Approach	*10.0*	*B*	*10.4*	*B*
	Westbound Left	10.7	B	11.2	B
19	East Taylor Street / Wilkinson Avenue[3]				
	Northbound Approach	*10.7*	*B*	*11.8*	*B*
	Eastbound Left	*7.5*	*A*	*7.5*	*A*
	Westbound Left	*7.6*	*A*	*7.6*	*A*
	Southbound Approach	0.0	A	0.0	A
23	Kietzke Lane / East Taylor Street[3]				
	Northbound Left	*13.1*	*B*	*13.5*	*B*
	Eastbound Left	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Westbound Left	***67.6***	***F***	***89.5***	***F***
	Southbound Left	*12.8*	*B*	*12.8*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

10.2.5 2035 + Project Impacts and Mitigation Measures

The following intersection approaches were determined to operate unacceptably with and without Project traffic with the Kirman Avenue lane reduction and diverted traffic:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.
3. Wells Avenue / Crampton Street:
   - The eastbound approach.
4. Wells Avenue / Burns Street:
   - The eastbound approach.

23. Kietzke Lane / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.

Because the Project contributes traffic to these intersection approaches that operate unacceptably without the Project, this is an **impact**. Signalization of Intersection 23 (Kietzke Lane / East Taylor Street) was recommended in Section 3 to improve the operation of this intersection.

11. Conclusions

This section summarizes the conclusions regarding the proposed Project and any potential traffic impacts and recommended mitigation measures. In general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. In addition to existing conditions, the study analyzed Project conditions in the years 2025 and 2035. The study also analyzed traffic conditions associated with the narrowing of Kirman Avenue from two southbound lanes to one.

Project trips were estimated for proposed renovation and modernization and Major projects to be implemented within the next five years using ITE trip generation rates and trip generation from a previous traffic study. Trip distribution was based on the trip distribution patterns used in a previous traffic study and the existing traffic circulation established from the intersection turning movement counts.

As a part of this study, several concepts were developed to evaluate options for the Kirman Avenue lane reduction. A preferred concept was selected in close coordination between the VASNHCS the City of Reno Community Development Department, Department of Public Works, Traffic Engineering and Fire Department. The narrowing of Kirman Avenue to a single lane is intended to calm traffic using a variety of design features discussed in Section 10. The traffic volumes used in the analysis were adjusted to divert 20% of the future 2025 and 2035 projected traffic volumes on the Kirman Avenue southbound through approach at East Taylor Street (Intersection No. 9). Results are reported for the p.m. peak hour and only for those study intersections that received more than two additional diverted vehicle trips.

11.1 Existing Conditions

Existing traffic volumes were collected and analyzed at the 23 study intersections and 19 roadway segments for potential traffic impacts resulting from the Project. The analysis of existing conditions determined that, in general, the p.m. peak hour represents worst-case peak hour traffic conditions during a typical weekday. Based on the adopted the LOS thresholds of significance all study intersections are operating acceptably with the exception of the following intersections:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the p.m. peak hour.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the p.m. peak hour.

Intersection 23 also meets Part A of the MUTCD Signal Warrant 3. Signalization of this intersection would improve the Level of Service to LOS A (5.2 second delay) in the a.m. peak hour and LOS A (6.2 second delay) in the p.m. peak hour.

Peak hour 95th percentile queue lengths exceed existing storage lane capacity at the northbound thru/right and westbound thru/left movements at Intersection No. 5 (Wells Avenue / Vassar Street). These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

11.2 2025 + Project Conditions

The forecasted traffic volumes at each of the study intersections for year 2025 were estimated by applying established growth factors to existing traffic turning movement counts from 2016. Growth factors were obtained from the current version of the RTC Regional Travel Demand Forecasting Model, which was discussed in Section 5.

The 2025 + Project traffic volumes are represented by the 2025 traffic volumes and the addition of Project generated trips assigned to the roadway network. Project trip generation, trip distribution and trip assignment was discussed in Section 4.

11.2.1 Intersection Operations and Queuing

The results of the intersection level of service analysis for the 2025 + Project Conditions are summarized in Table 26. The analysis finds that, based on the LOS thresholds of significance, the following study intersections operate unacceptably:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the p.m. peak hour.

The peak hour Signal Warrant 3 is met at study Intersection No. 23 in the Existing Conditions. Signalization of this intersection was recommended in Section 3.

The 95th percentile queue lengths were reviewed against the existing lane storage capacity at Intersection No. 5 (Wells Avenue / Vassar Street). The peak hour 95th percentile queue lengths exceed existing lane storage capacity at the following two intersection movements: northbound thru/right and southbound thru/right.

11.2.2 Proposed Kirman Avenue Lane Reduction

The following intersection approaches were determined to operate unacceptably with and without Project traffic with the Kirman Avenue lane reduction and diverted traffic:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.
3. Wells Avenue / Crampton Street:
   - The eastbound left approach.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.

These are the same intersections that operate unacceptably in the 2025 + Project Conditions analysis without the Kirman Avenue lane reduction.

11.2.3 2025 + Project Impacts and Proposed Mitigation Measures

The Project contributes traffic to these intersections, which operate unacceptably with and without the Project:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach during the p.m. peak hour.
3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hour.

This is an **impact**. The peak hour Signal Warrant 3 is met at study Intersection No. 23 in the Existing Conditions. Signalization of this intersection was recommended in Section 3 to improve the operation of this intersection.

The addition of Project trips to the following intersection reduced the intersection LOS from an acceptable LOS D to an unacceptable LOS E:

2. Wells Avenue / East Taylor Street:
   - The westbound approach during the p.m. peak hour.

This is an **impact**. The peak hour Signal Warrant 3 is not met at this intersection, and no improvements are recommended.

The peak hour 95th percentile queue lengths at Intersection No. 5 (Wells Avenue / Vassar Street) exceed existing lane storage capacity for the northbound thru/right and southbound thru/right movements:. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

11.3 2035 + Project Conditions

The forecasted traffic volumes at each of the study intersections for year 2035 were estimated by applying established growth factors to existing traffic turning movement counts from 2016. Growth factors were obtained from the current version of the RTC Regional Travel Demand Forecasting Model, which was discussed in Section 7.

The 2035 + Project traffic volumes are represented by the 2035 traffic volumes and the addition of Project generated trips assigned to the roadway network. Project trip generation and trip assignment was discussed in Section 4.

11.3.1 Intersection Operations and Queuing

The results of the intersection level of service analysis for the 2035 + Project Conditions are summarized in Table 27. The analysis finds that, based on the LOS thresholds of significance, the following study intersections operate unacceptably:

1. Wells Avenue / Roberts Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
2. Wells Avenue / East Taylor Street:

- The eastbound approach during the a.m. and p.m. peak hours.
- The westbound approach during the a.m. and p.m. peak hours.

3. Wells Avenue / Crampton Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.
4. Wells Avenue / Burns Street:
   - The eastbound approach during the p.m. peak hour.

23. Kietzke Lane / East Taylor Street:
   - The eastbound approach during the a.m. and p.m. peak hours.
   - The westbound approach during the a.m. and p.m. peak hours.

The peak hour Signal Warrant 3 is met at study Intersection No. 23 in the Existing Conditions. Signalization of this intersection was recommended in Section 3.

The 95th percentile queue lengths were reviewed against the existing lane storage capacity at Intersection No. 5 (Wells Avenue / Vassar Street). The peak hour 95th percentile queue lengths exceed existing lane storage capacity at the following three intersection movements: northbound thru/right, southbound thru/right and westbound thru/left.

11.3.2 Proposed Kirman Avenue Lane Reduction

The following intersection approaches were determined to operate unacceptably with and without Project traffic with the Kirman Avenue lane reduction and diverted traffic:

2. Wells Avenue / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.
3. Wells Avenue / Crampton Street:
   - The eastbound approach.
   - The westbound approach
4. Wells Avenue / Burns Street:
   - The eastbound approach.

23. Kietzke Lane / East Taylor Street:
   - The eastbound approach.
   - The westbound approach.

These are the same intersections that operate unacceptably in the 2035 + Project Conditions analysis without the Kirman Avenue lane reduction.

11.3.3 2035 + Project Impacts and Proposed Mitigation Measures

The Project contributes traffic to these intersections, which operate unacceptably with and without the Project:

1. Wells Avenue / Roberts Street:
   - The eastbound approach during the p.m. peak hour.
   - The westbound approach during the p.m. peak hour.

2. Wells Avenue / East Taylor Street:
    - The eastbound approach during the a.m. and p.m. peak hours.
    - The westbound approach during the a.m. and p.m. peak hours.
3. Wells Avenue / Crampton Street:
    - The eastbound approach during the p.m. peak hour.
    - The westbound approach during the p.m. peak hour.
4. Wells Avenue / Burns Street:
    - The eastbound approach during the p.m. peak hour.
23. Kietzke Lane / East Taylor Street:
    - The eastbound approach during the a.m. and p.m. peak hours.
    - The westbound approach during the a.m. and p.m. peak hours.

This is an **impact**. The peak hour Signal Warrant 3 is met at study Intersection No. 23 in the Existing Conditions. Signalization of this intersection was recommended in Section 3 to improve the operation of this intersection.

The addition of Project trips to the following intersection reduced the intersection LOS from an acceptable LOS D to an unacceptable LOS E during the a.m. peak hour:

1. Wells Avenue / Roberts Street:
    - The eastbound approach during the a.m. peak hour.

This is an **impact**. The peak hour warrant is not met at this intersection, and no improvements are recommended.

The peak hour 95th percentile queue lengths at Intersection No. 5 (Wells Avenue / Vassar Street) exceed existing lane storage capacity for the northbound thru/right, southbound thru/right and westbound thru/left movements:. These movements should be monitored to assess whether queues block driveways and intersections or contribute to traffic congestion. Additional storage capacity may be needed.

Table 26 Summary of Existing and 2025 Conditions Peak Hour Intersection Level of Service Calculations

No.	Intersection	Existing Conditions Weekday Peak Hour				2025 Conditions Weekday Peak Hour				2025 + Project Conditions Weekday Peak Hour				Weekday p.m. Peak Hour w/Lane Reduction			
		a.m.		p.m.		a.m.		p.m.		a.m.		p.m.		2025		2025 + Project	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Wells Avenue / Roberts Street[3]																
	Northbound Left	*8.7*	*A*	*9.2*	*A*	*8.6*	*A*	*9.0*	*A*	*8.7*	*A*	*9.1*	*A*				
	Eastbound Approach	*20.6*	*C*	*32.6*	*D*	*19.5*	*C*	*29.9*	*D*	*19.7*	*C*	*31.4*	*D*				
	Westbound Approach	*15.3*	*C*	*31.9*	*D*	*15.0*	*C*	*28.2*	*D*	*15.1*	*C*	*29.7*	*D*				
	Southbound Left	*8.2*	*A*	*10.1*	*B*	*8.1*	*A*	*9.6*	*A*	*8.1*	*A*	*9.7*	*A*				
2	Wells Avenue / East Taylor Street[3]																
	Northbound Left	*8.6*	*A*	*8.8*	*A*	*8.4*	*A*	*8.7*	*A*	*8.4*	*A*	*8.7*	*A*	*8.7*	*A*	*8.7*	*A*
	Eastbound Approach	*20.0*	*C*	***46.0***	***E***	*18.7*	*C*	***47.8***	***E***	*19.4*	*C*	***54.0***	***F***	***47.8***	***E***	***54.0***	***F***
	Westbound Approach	*17.3*	*C*	*32.2*	*D*	*16.4*	*C*	*34.0*	*D*	*16.8*	*C*	***36.3***	***E***	***50.5***	***F***	***56.0***	***F***
	Southbound Left	*8.3*	*A*	*9.5*	*A*	*8.2*	*A*	*9.5*	*A*	*8.3*	*A*	*9.5*	*A*	*9.5*	*A*	*9.5*	*A*
3	Wells Avenue / Crampton Street[3]																
	Northbound Left	*8.6*	*A*	*8.8*	*A*	*8.4*	*A*	*8.8*	*A*	8.4	A	8.8	A	*8.8*	*A*	*8.8*	*A*
	Eastbound Approach	*20.3*	*C*	***42.4***	***E***	*18.4*	*C*	***43.5***	***E***	18.5	C	**44.7**	**E**	***44.7***	***E***	***46.0***	***E***
	Westbound Approach	*14.0*	*B*	*22.2*	*C*	*13.2*	*B*	*22.3*	*C*	13.2	B	22.7	C	*22.6*	*C*	*23.1*	*C*
	Southbound Left	*8.2*	*A*	*9.4*	*A*	*8.1*	*A*	*9.4*	*A*	8.1	A	9.4	A	*9.4*	*A*	*9.4*	*A*
4	Wells Avenue / Burns Street[3]																
	Northbound Left	*8.3*	*A*	*8.8*	*A*	*8.3*	*A*	*8.7*	*A*	*8.3*	*A*	*8.7*	*A*	8.8	A	8.8	A
	Eastbound Approach	*16.9*	*C*	*31.8*	*D*	*16.2*	*C*	*31.7*	*D*	*16.3*	*C*	*33.1*	*D*	32.3	D	33.8	D
	Westbound Approach	*11.4*	*B*	*17.3*	*C*	*11.2*	*B*	*17.1*	*C*	*11.2*	*B*	*17.2*	*C*	17.2	C	17.3	C
	Southbound Left	*8.0*	*A*	*9.2*	*A*	*8.0*	*A*	*9.2*	*A*	*8.0*	*A*	*9.2*	*A*	9.2	A	9.2	A
5	Wells Avenue / Vassar Street[2]	8.3	A	14.8	B	8.4	A	17.7	B	8.5	A	18.7	B	17.8	B	18.3	B
6	East Taylor Street / Locust Street[1]	8.1	A	8.5	A	8.1	A	8.4	A	8.3	A	8.7	A	8.5	A	8.7	A
7	Locust Street / Crampton Street																
	Eastbound Approach	*9.4*	*A*	*9.4*	*A*	*9.2*	*A*	*9.3*	*A*	*9.3*	*A*	*9.4*	*A*				
8	Locust Street / Burns Street[3]																
	Eastbound Approach	*10.0*	*B*	*10.3*	*B*	*9.9*	*A*	*10.2*	*B*	*10.0*	*B*	*10.3*	*B*				
	Westbound Approach	*9.5*	*A*	*10.4*	*B*	*9.4*	*A*	*10.2*	*B*	*9.5*	*A*	*10.4*	*B*				
9	East Taylor Street / Kirman Avenue[1]	8.9	A	9.1	A	8.9	A	8.9	A	9.4	A	9.1	A	9.4	A	9.6	A
10	Kirman Avenue / Belli Drive[3]																
	Westbound Approach	*11.0*	*B*	*9.8*	*A*	*11.1*	*B*	*9.5*	*A*	*12.8*	*B*	*9.8*	*A*	10.0	B	10.4	B
11	Kirman Avenue / SNHCS North Driveway[3]																
	Eastbound Approach	9.3	A	9.2	A	*9.2*	*A*	*9.1*	*A*	*9.2*	*A*	*9.1*	*A*				
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	-	-	-	-	-	-	-	-	-	-	-	-				
13	Kirman Avenue / SNHCS South Driveway[3]																
	Westbound Approach	*9.1*	*A*	*9.5*	*A*	*9.2*	*A*	*9.4*	*A*	*9.2*	*A*	*10.0*	*A*				
14	Kirman Avenue / Burns Street – Balzar Circle[3]																
	Eastbound Approach	*9.5*	*A*	*9.9*	*A*	*9.5*	*A*	*9.9*	*A*	*9.6*	*A*	*10.3*	*B*	*9.9*	*A*	*10.5*	*B*
	Westbound Approach	10.4	B	10.6	B	10.5	B	10.6	B	10.5	B	11.3	B	10.7	B	11.5	B

No.	Intersection	Existing Conditions Weekday Peak Hour				2025 Conditions Weekday Peak Hour				2025 + Project Conditions Weekday Peak Hour				Weekday p.m. Peak Hour w/Lane Reduction			
		a.m.		p.m.		a.m.		p.m.		a.m.		p.m.		2025		2025 + Project	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
15	Kirman Avenue / Balzar Circle-Wonder Street[3]																
	Eastbound Approach	*9.4*	*A*	*10.3*	*B*	*9.2*	*A*	*9.9*	*A*	*9.2*	*A*	*10.2*	*B*	*9.7*	*A*	*10.0*	*A*
	Westbound Approach	*10.4*	*B*	*11.1*	*B*	*10.0*	*B*	*10.6*	*B*	*10.0*	*B*	*11.0*	*B*	10.3	B	10.8	A
16	Kirman Avenue / Vassar Street[3]	9.1	A	12.0	B	9.1	A	13.7	B	9.1	A	14.8	B				
17	Belli Drive / West Parking Structure Driveway[1]																
	Northbound Approach	*8.9*	*A*	*8.7*	*A*	*8.9*	*A*	*8.7*	*A*	*9.1*	*A*	*9.0*	*A*				
	Westbound Left	*7.4*	*A*	*0.0*	*A*	*7.4*	*A*	*0.0*	*A*	*7.6*	*A*	*7.3*	*A*				
18	Belli Drive / East Parking Structure Driveway[3]																
	Northbound Approach	*9.7*	*A*	*8.9*	*A*	*9.1*	*A*	*8.8*	*A*	*9.5*	*A*	*9.5*	*A*				
	Westbound Left	*7.5*	*A*	*0.0*	*A*	*7.4*	*A*	*0.0*	*A*	*7.4*	*A*	*7.5*	*A*				
19	East Taylor Street / Wilkinson Avenue[3]																
	Northbound Approach	*10.5*	*B*	*10.8*	*B*	*10.3*	*B*	*10.2*	*B*	*11.4*	*B*	*11.1*	*B*	*10.4*	*B*	*11.4*	*B*
	Eastbound Left	*0.0*	*A*	*7.5*	*A*	*0.0*	*A*	*7.5*	*A*	*0.0*	*A*	*7.5*	*A*	*7.5*	*A*	*7.5*	*A*
	Westbound Left	*7.6*	*A*	*7.6*	*A*	*7.5*	*A*	*7.5*	*A*	*7.7*	*A*	*7.5*	*A*	*7.5*	*A*	*7.6*	*A*
	Southbound Approach	*13.7*	*B*	*0.0*	*A*	*13.2*	*B*	*0.0*	*A*	*15.9*	*C*	*0.0*	*A*	0.0	A	0.0	A
20	Belli Drive / Wilkinson Avenue[3]																
	Northbound Left	*7.5*	*A*	*7.3*	*A*	*7.5*	*A*	*7.3*	*A*	*7.6*	*A*	*7.3*	*A*				
	Eastbound Approach	*9.2*	*A*	*9.4*	*A*	*9.1*	*A*	*9.1*	*A*	*9.5*	*A*	*10.2*	*B*				
21	Vassar Street / Wilkinson Avenue[3]																
	Eastbound Left	*7.6*	*A*	*8.1*	*A*	*7.7*	*A*	*8.2*	*A*	*7.7*	*A*	*8.3*	*A*				
	Southbound Approach	*10.7*	*B*	*13.0*	*B*	*10.9*	*B*	*13.8*	*B*	*11.0*	*B*	*15.5*	*C*				
22	Kietzke Lane / Roberts Street[3]																
	Northbound Left	*11.2*	*B*	*11.1*	*B*	*11.5*	*B*	*12.1*	*B*	11.8	B	12.2	B				
	Eastbound Approach	*18.1*	*C*	*20.1*	*C*	*19.0*	*C*	*24.7*	*C*	19.9	C	25.3	D				
23	Kietzke Lane / East Taylor Street[3]																
	Northbound Left	*11.2*	*B*	*11.7*	*B*	*11.4*	*B*	*12.7*	*B*	*12.1*	*B*	*13.1*	*B*	*12.7*	*B*	*13.1*	*B*
	Eastbound Approach	***65.9***	***F***	***OVERFLOW***	***F***	***79.4***	***F***	***OVERFLOW***	***F***	***170.9***	***F***	***OVERFLOW***	***F***	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*15.9*	*C*	***77.4***	***F***	*16.6*	*C*	***144.2***	***F***	*17.8*	*C*	***176.0***	***F***	***54.0***	***F***	***66.5***	***F***
	Southbound Left	*9.0*	*A*	*11.4*	*B*	*9.1*	*A*	*12.3*	*B*	*9.1*	*A*	*12.3*	*B*	*12.3*	*B*	*12.3*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

Table 27 Summary of Existing and 2035 Conditions Peak Hour Intersection Level of Service Calculations

No.	Intersection	Existing Conditions Weekday Peak Hour				2035 Conditions Weekday Peak Hour				2035 + Project Conditions Weekday Peak Hour				Weekday p.m. Peak Hour w/Lane Reduction			
		a.m.		p.m.		a.m.		p.m.		a.m.		p.m.		2035		2035 + Project	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Wells Avenue / Roberts Street[3]																
	Northbound Left	*8.7*	*A*	*9.2*	*A*	*9.3*	*A*	*9.9*	*A*	*9.3*	*A*	*10.0*	*A*	-	-	-	-
	Eastbound Approach	*20.6*	*C*	*32.6*	*D*	*34.5*	*D*	***154.1***	***F***	***35.3***	***E***	***178.5***	***F***	-	-	-	-
	Westbound Approach	*15.3*	*C*	*31.9*	*D*	*23.8*	*C*	***161.8***	***F***	*24.2*	*C*	***189.3***	***F***	-	-	-	-
	Southbound Left	*8.2*	*A*	*10.1*	*B*	*9.0*	*A*	*13.1*	*B*	*9.0*	*A*	*13.3*	*B*	-	-	-	-
2	Wells Avenue / East Taylor Street[3]																
	Northbound Left	*8.6*	*A*	*8.8*	*A*	*9.7*	*A*	*10.4*	*B*	*9.7*	*A*	*10.4*	*B*	*10.4*	*B*	*10.4*	*B*
	Eastbound Approach	*20.0*	*C*	***46.0***	***E***	***42.0***	***E***	***OVERFLOW***	***F***	***44.8***	***E***	***OVERFLOW***	***F***	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*17.3*	*C*	*32.2*	*D*	***35.3***	***E***	***OVERFLOW***	***F***	***37.0***	***E***	***OVERFLOW***	***F***	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Southbound Left	*8.3*	*A*	*9.5*	*A*	*8.9*	*A*	*11.1*	*B*	*8.9*	*A*	*11.2*	*B*	*11.1*	*B*	*11.2*	*B*
3	Wells Avenue / Crampton Street[3]																
	Northbound Left	*8.6*	*A*	*8.8*	*A*	*9.1*	*A*	*9.6*	*A*	9.1	A	9.6	A	*9.7*	*A*	*9.7*	*A*
	Eastbound Approach	*20.3*	*C*	***42.4***	***E***	*28.7*	*D*	***175.0***	***F***	28.8	D	**186.8**	**F**	***180.7***	***F***	***186.8***	***F***
	Westbound Approach	*14.0*	*B*	*22.2*	*C*	*17.3*	*C*	***45.3***	***E***	17.4	C	**46.7**	**E**	***47.2***	***E***	***48.2***	***E***
	Southbound Left	*8.2*	*A*	*9.4*	*A*	*8.5*	*A*	*10.7*	*B*	8.5	A	10.8	B	10.7	B	10.8	B
4	Wells Avenue / Burns Street[3]																
	Northbound Left	*8.3*	*A*	*8.8*	*A*	*8.8*	*A*	*9.6*	*A*	*8.8*	*A*	*9.6*	*A*	*9.6*	*A*	*9.6*	*A*
	Eastbound Approach	*16.9*	*C*	*31.8*	*D*	*23.3*	*C*	***97.7***	***F***	*23.3*	*C*	***111.7***	***F***	***106.6***	***F***	***120.1***	***F***
	Westbound Approach	*11.4*	*B*	*17.3*	*C*	*13.0*	*B*	*27.7*	*D*	*13.0*	*B*	*27.8*	*D*	*28.0*	*D*	*27.9*	*D*
	Southbound Left	*8.0*	*A*	*9.2*	*A*	*8.3*	*A*	*10.4*	*B*	*8.4*	*A*	*10.4*	*B*	*10.4*	*B*	*10.4*	*B*
5	Wells Avenue / Vassar Street[2]	8.3	A	14.8	B	8.6	A	21.3	C	8.7	A	22.0	C	21.3	C	22.3	C
6	East Taylor Street / Locust Street[1]	8.1	A	8.5	A	8.6	A	9.2	A	8.7	A	9.4	A	9.3	A	9.5	A
7	Locust Street / Crampton Street																
	Eastbound Approach	*9.4*	*A*	*9.4*	*A*	*9.7*	*A*	*9.8*	*A*	*9.8*	*A*	*9.9*	*A*	-	-	-	-
8	Locust Street / Burns Street[3]																
	Eastbound Approach	*10.0*	*B*	*10.3*	*B*	*10.3*	*B*	*11.0*	*B*	*10.5*	*B*	*11.1*	*B*	-	-	-	-
	Westbound Approach	*9.5*	*A*	*10.4*	*B*	*9.7*	*A*	*10.9*	*B*	*9.8*	*A*	*11.2*	*B*	-	-	-	-
9	East Taylor Street / Kirman Avenue[1]	8.9	A	9.1	A	9.3	A	9.2	A	9.9	A	9.4	A	9.9	A	10.1	B
10	Kirman Avenue / Belli Drive[3]																
	Westbound Approach	*11.0*	*B*	*9.8*	*A*	*11.9*	*B*	*9.8*	*A*	*13.9*	*B*	*10.1*	*B*	10.4	B	10.8	B
11	Kirman Avenue / SNHCS North Driveway[3]																
	Eastbound Approach	9.3	A	9.2	A	*9.5*	*A*	*9.3*	*A*	*9.7*	*A*	*9.3*	*A*	-	-	-	-
12	Kirman Avenue / SNHCS Mid Driveway (inbound only)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Kirman Avenue / SNHCS South Driveway[3]																
	Westbound Approach	*9.1*	*A*	*9.5*	*A*	*9.3*	*A*	*9.6*	*A*	*9.4*	*A*	*10.2*	*B*	-	-	-	-
14	Kirman Avenue / Burns Street – Balzar Circle[3]																
	Eastbound Approach	*9.5*	*A*	*9.9*	*A*	*9.8*	*A*	*10.2*	*B*	*9.8*	*A*	*10.7*	*B*	*10.3*	*B*	*10.9*	*B*
	Westbound Approach	10.4	B	10.6	B	10.9	B	11.1	B	11.0	B	11.8	B	11.2	B	*12.1*	*B*

No.	Intersection	Existing Conditions Weekday Peak Hour				2035 Conditions Weekday Peak Hour				2035 + Project Conditions Weekday Peak Hour				Weekday p.m. Peak Hour w/Lane Reduction			
		a.m.		p.m.		a.m.		p.m.		a.m.		p.m.		2035		2035 + Project	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
15	Kirman Avenue / Balzar Circle-Wonder Street[3]																
	Eastbound Approach	*9.4*	*A*	*10.3*	*B*	*9.3*	*A*	*10.2*	*B*	*9.3*	*A*	*10.6*	*B*	*10.0*	*B*	*10.4*	*B*
	Westbound Approach	*10.4*	*B*	*11.1*	*B*	*10.2*	*B*	*11.0*	*B*	*10.2*	*B*	*11.5*	*B*	10.7	B	11.2	B
16	Kirman Avenue / Vassar Street[3]	9.1	A	12.0	B	9.4	A	15.5	C	9.5	A	16.9	C	-	-	-	-
17	Belli Drive / West Parking Structure Driveway[1]																
	Northbound Approach	*8.9*	*A*	*8.7*	*A*	*8.9*	*A*	*8.7*	*A*	*9.1*	*A*	*9.0*	*A*	-	-	-	-
	Westbound Left	*7.4*	*A*	*0.0*	*A*	*7.4*	*A*	*0.0*	*A*	*7.6*	*A*	*7.3*	*A*	-	-	-	-
18	Belli Drive / East Parking Structure Driveway[3]																
	Northbound Approach	*9.7*	*A*	*8.9*	*A*	*9.1*	*A*	*8.8*	*A*	*9.5*	*A*	*9.5*	*A*	-	-	-	-
	Westbound Left	*7.5*	*A*	*0.0*	*A*	*7.4*	*A*	*0.0*	*A*	*7.4*	*A*	*7.5*	*A*	-	-	-	-
19	East Taylor Street / Wilkinson Avenue[3]																
	Northbound Approach	*10.5*	*B*	*10.8*	*B*	*10.7*	*B*	*10.5*	*B*	*11.9*	*B*	*11.5*	*B*	*10.7*	*B*	*11.8*	*B*
	Eastbound Left	*0.0*	*A*	*7.5*	*A*	*0.0*	*A*	*7.5*	*A*	*0.0*	*A*	*7.5*	*A*	*7.5*	*A*	*7.5*	*A*
	Westbound Left	*7.6*	*A*	*7.6*	*A*	*7.6*	*A*	*7.5*	*A*	*7.7*	*A*	*7.6*	*A*	*7.6*	*A*	*7.6*	*A*
	Southbound Approach	*13.7*	*B*	*0.0*	*A*	*13.8*	*B*	*0*	*A*	*16.7*	*C*	*0.0*	*A*	0.0	A	0.0	A
20	Belli Drive / Wilkinson Avenue[3]																
	Northbound Left	*7.5*	*A*	*7.3*	*A*	*7.5*	*A*	*7.3*	*A*	*7.7*	*A*	*7.3*	*A*	-	-	-	-
	Eastbound Approach	*9.2*	*A*	*9.4*	*A*	*9.1*	*B*	*9.2*	*A*	*9.6*	*A*	*10.2*	*B*	-	-	-	-
21	Vassar Street / Wilkinson Avenue[3]																
	Eastbound Left	*7.6*	*A*	*8.1*	*A*	*7.7*	*A*	*8.3*	*A*	*7.7*	*A*	*8.3*	*A*	-	-	-	-
	Southbound Approach	*10.7*	*B*	*13.0*	*B*	*11.1*	*B*	*14.3*	*B*	*11.1*	*B*	*16.1*	*C*	-	-	-	-
22	Kietzke Lane / Roberts Street[3]																
	Northbound Left	*11.2*	*B*	*11.1*	*B*	*11.5*	*B*	*12.1*	*B*	11.8	B	12.2	B	-	-	-	-
	Eastbound Approach	*18.1*	*C*	*20.1*	*C*	*19.5*	*C*	*25.2*	*D*	20.3	C	25.8	D	-	-	-	-
23	Kietzke Lane / East Taylor Street[3]																
	Northbound Left	*11.2*	*B*	*11.7*	*B*	*11.6*	*B*	*13.1*	*B*	*12.4*	*B*	*13.5*	*B*	*13.1*	*B*	*13.5*	*B*
	Eastbound Approach	***65.9***	***F***	***OVERFLOW***	***F***	***112.9***	***F***	***OVERFLOW***	***F***	***248.4***	***F***	***OVERFLOW***	***F***	***OVERFLOW***	***F***	***OVERFLOW***	***F***
	Westbound Approach	*15.9*	*C*	***77.4***	***F***	*17.7*	*C*	***184.2***	***F***	*19.2*	*C*	***238.5***	***F***	***67.6***	***F***	***89.5***	***F***
	Southbound Left	*9.0*	*A*	*11.4*	*B*	*9.2*	*A*	*12.8*	*B*	*9.2*	*A*	*12.8*	*B*	*12.8*	*B*	*12.8*	*B*

Notes: Delay is calculated in average seconds per vehicle in queue
LOS = Level of Service
Bold = results exceed acceptable LOS
OVERFLOW = unstable results due to excessive delay
[1]LOS based on HCM2010 method of analysis for AWSC intersections.
[2]LOS based on HCM2000 method of analysis for Signalized intersections.
[3]LOS based on HCM2010 method of analysis for TWSC intersections.

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