NEWELL ROAD/SAN FRANCISQUITO CREEK BRIDGE REPLACEMENT PROJECT
ALTERNATIVES SCREENING ANALYSIS REPORT

Newell Road Bridge at San Francisquito Creek

(Bridge No. 37C-0223)

Prepared for the

City of Palo Alto

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BEYOND ENGINEERING

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TABLE OF CONTENTS

SECTION 1 – INTRODUCTION & BACKGROUND

1.1 INTRODUCTION

The Newell Road Bridge spans over San Francisquito Creek and provides a connection between the cities of Palo Alto (CPA) and East Palo Alto (EPA) as well as the counties of Santa Clara and San Mateo. The City of Palo Alto intends to remove or replace the bridge in order to enable the creek to accommodate the 1% (100-year) flow rate at this location and prevent future flooding of the areas around the creek. San Francisquito Creek at Newell Road is under the jurisdiction of the Santa Clara Valley Water District (SCVWD), CPA, EPA, the San Mateo County Flood Control District (SMCFCD), and the San Francisquito Creek Joint Powers Authority (SFCJPA).

PROJECT VICINITY MAP

Eight potential project alternatives were identified after concerns about the proposed bridge replacement project were raised at community meetings held on June 27th, 2012 and January 8th, 2013. Six of the eight alternatives would build some form of replacement bridge structure, one would remove the existing bridge and not replace it, and one is a 'No-Build' alternative.

1.2 BACKGROUND

The primary reason for replacing the existing Newell Road/San Francisquito Creek bridge is to increase the hydraulic capacity of the creek through the bridge crossing. The SFCJPA has identified the Newell Road Bridge as one of five bridges that need to be replaced or removed as part of a comprehensive flood protection strategy for San Francisquito Creek. Once completed, the San Francisquito Creek Flood Protection Project would provide flood protection to more than 3,000 residents in Palo Alto, East Palo Alto, and Menlo Park.

Hydraulic Properties of Existing Bridge

The existing bridge has abutments located within the banks of San Francisquito Creek which cause a flow constriction or "bottleneck" of the natural creek channel flow. Once upstream creek flow restrictions caused by existing bridges and channel bottlenecks have been eliminated, neither the Newell Road Bridge nor the adjacent creek channel would have adequate capacity to convey the resultant 100-year storm flow. Without modifications to the existing bridge, there would be creek overtopping at this location during the 100-year event after upstream flood protection measures have been implemented.

Physical Properties of Existing Bridge

The existing bridge consists of a 76-foot-long single span, reinforced concrete girder structure, with an overall width of 22 feet. The bridge currently functions as a two-lane bridge, but has substandard lane and shoulder widths with only 18 feet between bridge railings. There are no dedicated bicycle lanes or sidewalks for bicyclists and pedestrians crossing the bridge. Caltrans maintenance staff periodically inspect and rate the condition of the bridge as part of their statewide local bridge inspection program. Caltrans has assigned the bridge a sufficiency rating of 40.9 (on a scale of 100) and has designated the bridge as functionally obsolete due to its substandard geometric design. The bridge's poor rating and classification make it eligible for funding to replace the bridge through the federal Highway Bridge Program (HBP), administered by Caltrans.

The CPA and Caltrans have adopted design standards that are applied to new bridge and roadway improvement projects in order to provide safe transportation facilities for all modes of travel. The existing Newell Road Bridge was built in 1911 and does not meet many current roadway and bridge geometric design standards, including:

- Roadway Section - The existing bridge has non-standard lane and shoulder widths. The existing bridge is 18-foot wide between bridge railings. Standard minimum width configurations are two 11-foot lanes plus separate 5-foot bicycle lanes (32-foot total width) or two 14-foot sharrow (shared vehicle and bicycle use) lanes (28-foot total width).

- Vertical Alignment - The vertical roadway alignment at the bridge approaches has steep grades (up to 7%) that reduce the amount of roadway a driver can see entering or leaving the bridge and reduce response time for drivers to respond to conditions in front of their vehicle. Current design standards require smooth, gradual vertical curves between grade differences, but none exist on the existing bridge.
- Stopping Sight Distance - Stopping sight distance is the distance required by a driver, traveling at a given speed, to bring the vehicle to a stop after an object on the road becomes visible. At the intersection of Newell Road and Woodland Avenue, the sight distance is limited by the existing bridge barriers and flood walls. Per current design standards, the stopping sight distance at this intersection under existing conditions would only accommodate a speed of 15 miles per hour.

Existing Setting at Newell Road Bridge

The south approach to the Newell Road Bridge is a two-lane local road in CPA with shoulder/parking areas, striped bicycle lanes, landscape strips, and sidewalks. The north approach is in the form of an offset T-intersection with Woodland Avenue in EPA.

Land uses in the vicinity of the Project site include single-family and multi-family residential. On the south side of the creek (CPA), the land use is single-family residential along Edgewood Drive and Newell Road. On the north side of the creek (EPA), the land use is multi-family residential along Newell Road and Woodland Avenue.

1.3 Purpose of the Report

The purpose of this Alternatives Screening Analysis Report is to describe the process and technical findings that were used to identify a reduced set of feasible alternatives for the Newell Road/San Francisquito Creek Bridge Replacement Project (Project). The Alternatives Screening section of the report describes the process and screening criteria that were used to evaluate and eliminate alternatives based on the adopted project alternative screening criteria.

The reduced set of project alternatives that results from this alternatives screening process will carry forward to the next phase of project development and undergo a more detailed and thorough analysis in the Environmental Impact Report (EIR) which is to be prepared for the Project. The EIR will inform the public and governmental decision-makers of possible environmental effects associated with the Project and describe measures that would be undertaken to avoid, minimize, and/or mitigate those effects.

Section 2 – Definition of Project Alternatives

Eight project alternatives were identified and selected for screening based on feedback from the initial community outreach meetings. Six of the alternatives would build some form of replacement bridge structure, one would remove the existing bridge and not replace it, and one is a No Build Alternative:

- Alternative 1 – No Build (Keep Existing Bridge)
- Alternative 2 – Remove Existing Bridge
- Alternative 3 – Bicycle/Pedestrian Bridge
- Alternative 4 – Bicycle/Pedestrian Bridge with Emergency Vehicle Access
- Alternative 5 – One-Lane Bridge with Bi-directional Traffic
- Alternative 6 – Two-Lane Bridge on Existing Alignment
- Alternative 7 – Two-Lane Bridge with Partial Realignment of Newell Road
- Alternative 8 – Two-Lane Bridge with Full Realignment of Newell Road

A more detailed description of each of the project alternatives, for the purposes of this analysis, is presented in the following Sections 2.1 through 2.8. A conceptual design layout for each of the project alternatives is also provided in Appendix A of this report.

In order to provide adequate clearance to convey the highest projected future 100-year San Francisquito Creek stream flow, this report assumes that the Newell Road roadway elevation over the creek must be built on a higher profile for any of the bridge replacement alternatives. Raising the bridge profile elevation would in turn result in the need for modifications to the Newell Road and Woodland Avenue roadway approaches on either end of the new bridge in order to meet the new bridge elevation. The final design creek flow rate and the related final bridge design elevation would be determined by the level of flood protection that the SFCJPA and the local communities agree to implement and the suite of upstream improvements that are identified to achieve that level of protection. The final bridge elevation and other design characteristics (e.g. lane widths, number of sidewalks, etc.) will be determined during the design development and environmental review process. The preliminary assumption that any replacement bridge would be built on a raised profile does not affect the results of the screening process described in this report.

2.1 Alternative 1 – No Build (Keep Existing Bridge)

For the purposes of this Alternatives Screening Analysis, the No Build Alternative, which would retain the existing bridge span, was evaluated primarily as a baseline or benchmark against which the Build Alternatives could be evaluated. The No Build Alternative is a "do nothing" option that involves no construction improvements to the existing infrastructure.

At the time of this Alternatives Screening Analysis, there are no other improvement projects currently under design or construction that would affect the performance of this alternative, and therefore none were considered in its evaluation. The No Build Alternative is defined as only the existing condition, which consists of the present physical and operational characteristics of the facility. There would be no benefit or impact to flood protection, public safety, or existing traffic conditions and modes of travel at the bridge.

2.2 Alternative 2 – Remove Existing Bridge

Alternative 2 would remove the existing bridge and eliminate all modes of travel across San Francisquito Creek at the Newell Road crossing location. Following removal of the bridge structure, the creek banks would be re-contoured to conform to the adjacent upstream and downstream creek sections.

Removing the bridge would increase the capacity of the creek, however future flood control improvements would need to be implemented in order to prevent flooding that would occur during a 100-year storm flow as a result of the existing channel's limited capacity. Downstream channel improvements that are currently in the design or construction phase could accommodate the increase in flow capacity that would result from bridge removal.

A majority of the roadway between Edgewood Drive and the creek would be retained in its existing condition in order to provide vehicular and emergency services access to the lone residential driveway located in this section of Newell Road.

A cul-de-sac terminus would be built at the north end of Newell Road adjacent to the creek to allow vehicular turnaround movements. The cul-de-sac would define the street as providing primarily an 'access to properties' function for all modes of transportation rather than having a 'through' function.

On the north side of the creek, the existing intersection of the bridge roadway and Woodland Avenue would be eliminated, leaving the northerly Newell Road/Woodland Avenue intersection as a standard T-intersection.

2.3 Alternative 3 – Bicycle/Pedestrian Bridge

Alternative 3 would remove the existing bridge and construct a replacement bridge on a higher profile that would provide access to pedestrians and bicyclists. The bridge crossing under Alternative 3 would be closed to all vehicular traffic.

The new bridge would be built higher than the existing roadway profile over the creek in order to accommodate the 100-year storm flow. Approach ramps on both ends of the bridge would be constructed on fill material placed within retaining walls to achieve the raised bridge elevation. The ramps would meet Americans with Disabilities Act (ADA) design criteria with a 5% maximum grade.

The south approach ramp to the bridge would be constructed on the west side of Newell Road, opposite from the existing residential driveway, in order to avoid impacts to the driveway and conflicts for bicycle and pedestrian traffic crossing the driveway. The north approach ramp to the bridge would be constructed along the south side of Woodland Avenue, west of the intersection with Newell Road.

Due to existing site constraints, primarily the proximity of the creek to Woodland Avenue, the conceptual alignment for Alternative 3 would not meet Class I or Class II bicycle path standards. Other alignments that would provide larger turning radii better suited for bicyclists could also be considered, but these options would increase the bridge span length and required structure depth, and the number of spans, and would also limit the range of structure types available. Alternative alignment options and bicycle design standards could be investigated if this project alternative were selected to advance.

On the north side of the creek, the existing northerly intersection at Newell Road and Woodland Avenue would become a standard T-intersection, maintaining the same alignment as the existing roadways.

The segment of Newell Road between Edgewood Drive and the creek would need to remain open in order to maintain access to the existing residential driveway. Similar to Alternative 2, a cul-de-sac terminus would be built at the north end of Newell Road adjacent to the creek to allow vehicular turnaround movements.

Alternative 3 would provide the narrowest bridge width and the smallest overall project footprint of all the build alternatives. Instead of requiring a complete raise in grade of both the north and south roadway approaches to the bridge that would be required for Alternatives 4 through 8, Alternative 3 would only require the pedestrian path itself to be raised. The approach ramps to the new bridge would be supported on fill material placed within retaining walls located outside of the existing roadway footprint. Newell Road and Woodland Avenue would be maintained at their current grade on both the CPA and EPA sides of the creek.

2.4 Alternative 4 – Bicycle/Pedestrian Bridge with Emergency Vehicle Access

Alternative 4 would remove the existing bridge and construct a replacement bridge on the existing alignment that would only provide access across the creek to pedestrians, bicyclists and emergency vehicles.

All public vehicular access across the creek would be eliminated with this alternative. Removable bollards would be provided at each end of the bridge that would allow continuous pedestrian and bicycle movements across the creek but would prevent public vehicular access. In an emergency, the bollards could be removed by emergency service personnel with special key access to allow passage of an emergency vehicle.

The new bridge would be wider than Alternative 3 to accommodate emergency service vehicles and would be built higher than the existing roadway profile in order to accommodate the 100-year storm flow. The Newell Road and Woodland Avenue roadway approaches on both sides of the bridge would need to be raised in order to meet the new bridge profile and provide vehicular access for emergency vehicles.

On the south side of the creek, the entire Newell Road roadway would be raised to meet the higher profile of the new bridge and would require some roadway approach work to conform down to the existing roadway elevation. Retaining walls would be required along both sides of the roadway to limit the right-of-way needs for the Project.

On the north side of the creek, Woodland Avenue would also need to be raised to meet the higher bridge profile and would require some roadway approach work to conform to the existing roadways to the east and west of the bridge. Newell Road north of Woodland Avenue would also need to be regraded to conform to the existing roadway elevation. Retaining walls would be required along the north side of Woodland Avenue and along both sides of Newell

Road north of Woodland Avenue to limit the right-of-way needs for the Project. The south side of Woodland Avenue would use the existing flood wall to support the raised roadway.

On the north side of the creek, the existing northerly intersection at Newell Road and Woodland Avenue would become a standard T-intersection, maintaining the same alignment as the existing roadways.

Options for the alignment of the new bridge could include several different paths including the existing alignment, a partial realignment and a full realignment, similar to Alternatives 6, 7 and 8. Various alignment options for the bridge crossing would be further developed if Alternative 4 were selected to advance.

2.5 Alternative 5 – One-Lane Bridge with Bi-directional Traffic

Alternative 5 would remove the existing bridge structure and construct a new one-lane bridge with bi-directional traffic on the existing alignment. Only one direction of travel for vehicles and bicycles would be provided on the bridge at a time. Pedestrian access would be provided on one or both sides of the bridge and would allow free movement of pedestrians in either direction at all times. The impetus for Alternative 5 is to limit the size of the replacement bridge in an effort to decrease the potential for increased vehicle traffic volume and speed over the new bridge.

In order to eliminate all potential conflicting vehicle movements, Alternative 5 would require complete signalization of the intersections of Newell Road with Woodland Avenue and Edgewood Drive in order to control the direction of travel on the bridge and adjacent roadways. One additional signal would be provided for the sole residential driveway on the Palo Alto side of the bridge to indicate the direction of traffic on Newell Road at all times.

Alternative 5 would provide bicycle access across the bridge via sharrows, but bicycles would only be allowed to travel in the same direction as the vehicle traffic. Effective control of bicyclist movements would rely on the willingness of bicyclists to obey the traffic signals at each intersection. However, since bicyclists sometimes ignore traffic signals if they feel it is safe to proceed, Alternative 5 may result in conflicting bicycle and vehicle movements. These operational safety concerns would need to be addressed if Alternative 5 is selected to advance.

The new bridge would be built higher than the existing roadway profile over the creek in order to accommodate the 100-year storm flow. Similar to Alternatives 4, 6, 7 and 8, the entire Newell Road roadway would need to be raised on the south side of the creek in order to meet the higher profile of the new bridge. Retaining walls would be required on both sides of the roadway to limit the right-of-way needs for the Project.

On the north side of the creek, Woodland Avenue would also need to be raised to meet the higher bridge profile and would require some roadway approach work to conform to the existing roadway to the east and west of the bridge. Newell Road north of Woodland Avenue would also need to be regraded to conform to the existing roadway elevation. Retaining walls would be required along the north side of Woodland Avenue and along both sides of Newell Road north of Woodland Avenue to limit the right-of-way needs for the Project. The south side of Woodland Avenue would use the existing flood wall to support the raised roadway.

2.6 Alternative 6 – Two-Lane Bridge on Existing Alignment

This alternative would remove the existing bridge and construct a new two-lane bridge on the existing bridge alignment. Alternative 6 would include bicycle access on both the northbound and southbound lanes of Newell Road via separated bicycle lanes or sharrows. Sidewalks would be provided on one or both sides of the bridge and conform or provide connection to the existing sidewalks on each end of the bridge.

The new bridge would be built higher than the existing roadway profile over the creek in order to accommodate the 100-year storm flow. Similar to Alternatives 4, 5, 7 and 8, the entire Newell Road roadway would need to be raised on the south side of the creek in order to meet the higher profile of the new bridge. Retaining walls would be required along both sides of the roadway to limit the right-of-way needs for the Project.

On the north side of the creek, Woodland Avenue would need to be raised to meet the new bridge profile and would require some roadway approach work to conform to the existing roadway on the east and west sides of the bridge. Newell Road north of Woodland Avenue would also need to be regraded to conform to the existing roadway elevation. Retaining walls would be required along the north side of Woodland Avenue and along both sides of Newell Road north of Woodland Avenue to limit the right-of-way needs for the Project. The south side of Woodland Avenue would use the existing flood wall to support the raised roadway.

2.7 Alternative 7 – Two-Lane Bridge with Partial Realignment of Newell Road

Alternative 7 is similar to Alternative 6 in many ways, except that Newell Road south of Woodland Avenue would be partially realigned so that the degree of offset between the existing north and south intersections with Woodland Avenue would be reduced from the existing condition. Alternative 7 provides pedestrian access via sidewalks and bicycle access via sharrows or separate bicycle lanes.

Alternative 7 was developed to address community concerns that a fully-realigned intersection would increase through traffic volumes and travel speeds. This alternative utilizes an alignment located between the existing alignment of Alternative 6 and the full realignment design of Alternative 8. It would provide a more compact intersection at Newell Road and Woodland Avenue, which would improve sight lines for motorists, pedestrians and bicyclists entering the intersection, but would also provide some of the traffic calming benefits that result from an offset intersection.

The new bridge would be built higher than the existing roadway profile over the creek in order to accommodate the 100-year storm flow. Similar to Alternatives 4, 5, 6 and 8, the entire Newell Road roadway would need to be raised on the south side of the creek in order to meet the higher profile of the new bridge. Retaining walls would be required along both sides of the roadway to limit the right-of-way needs for the Project.

On the north side of the creek, Woodland Avenue would need to be raised to meet the new bridge profile and would require some roadway approach work to conform to the existing roadway on the east and west sides of the bridge. Newell Road north of Woodland Avenue would also need to be regraded to conform to the existing roadway elevation. Retaining walls would be required along the north side of Woodland Avenue and along both sides of Newell Road north of Woodland Avenue to limit the right-of-way needs for the Project. The south side of Woodland Avenue would use the existing flood wall to support the raised roadway.

2.8 ALTERNATIVE 8 – TWO-LANE BRIDGE WITH FULL REALIGNMENT OF NEWELL ROAD

Alternative 8 is similar to Alternatives 6 and 7, except that Newell Road south of Woodland Avenue would be fully realigned to eliminate the offset between the existing north and south intersections with Woodland Avenue. Alternative 8 would provide pedestrian access via sidewalks and bicycle access via sharrows or separate bicycle lanes.

Alternative 8 would provide a standard four-way intersection at Newell Road and Woodland Avenue, which would improve sight lines for motorists, pedestrians, and bicyclists at the intersection, but would eliminate some of the traffic calming benefits that result from the existing offset intersection. Other traffic calming measures, such as sidewalk bulb-outs, raised crosswalks, or enhanced traffic striping could be employed to slow traffic through the intersection.

The new bridge would be built higher than the existing roadway profile over the creek in order to accommodate the 100-year storm flow. Similar to Alternatives 4, 5, 6 and 7, the entire Newell Road roadway would be raised on the south side of the creek in order to meet the higher profile of the new bridge. Retaining walls would be required along both sides of the roadway to limit the right-of-way needs for the Project.

On the north side of the creek, Woodland Avenue would be raised to meet the new bridge profile and would require some roadway approach work to conform to the existing roadway on the east and west sides of the bridge. Newell Road north of Woodland Avenue would also need to be regraded to conform to the existing roadway elevation. Retaining walls would be required along the north side of Woodland Avenue and along both sides of Newell Road north of Woodland Avenue to limit the right-of-way needs for the Project. The south side of Woodland Avenue would use the existing flood wall to support the raised roadway.

SECTION 3 – ALTERNATIVES SCREENING

3.1 ALTERNATIVES SCREENING METHODOLOGY

Each of the eight project alternatives has been developed up to a conceptual level in order to provide sufficient technical information to allow a comparison of the benefits and impacts of each alternative as measured by the screening criteria established for the Project.

In this screening phase, a conceptual level of analysis was performed on the initial set of eight project alternatives in order to provide comparative information on each alternative's relative benefits and impacts and to identify feasible alternatives that will be carried forward into the EIR process. The screening criteria used to evaluate and filter the alternatives address issues including flood protection, traffic impacts, and multi-modal mobility.

The screening process has been used to reduce the initial eight project alternatives to a smaller group of alternatives that best meet the project objectives. This reduced set of alternatives will advance to the next step of the process and be subsequently analyzed in greater detail during the EIR phase of the project.

Although the scope of this screening analysis was fairly limited, the level of detail on the comparative analysis of alternatives will increase after the number and range of alternatives has been narrowed through this screening process to ensure that the remainder of the Project study effort is focused on only the feasible alternatives.

The following sections describe each of the screening criteria applied to the project alternatives and discuss the key results of the screening analysis.

3.2 SCREENING CRITERIA

For the purposes of this Alternatives Screening Analysis, four basic project objectives were adopted for the Project:

1) Accommodate the 100-year storm flow of San Francisquito Creek
2) Maintain existing traffic volumes and speeds
3) Not increase traffic on surrounding residential streets
4) Safely accommodate multi-modal traffic.

The following screening criteria were selected as a measure of each alternative's ability to meet these basic project objectives.

Screening Criterion #1: Will the project alternative accommodate the 100-year (1%) storm flow of San Francisquito Creek?

The bridge is within the jurisdiction of both the SCVWD, the SFCJPA, and the San Mateo County Flood Control District. SFCJPA is currently conducting a study which identifies potential channel and bridge improvements that are needed to provide increased flood protection in the area.

The predominant reason for replacing the existing bridge is to increase the hydraulic capacity of San Francisquito Creek through the Newell Road crossing to accommodate the flow of a 100-year storm event and prevent future flooding.

At this time, the SFCJPA's baseline flood protection project includes replacement of the bridge crossings at Highway 101/West Bayshore Road/East Bayshore Road, Newell Road, University Avenue, Pope/Chaucer Street and Middlefield Road. Project alternatives that eliminate the existing creek channel flow constraint at the Newell Road bridge and could be designed to accommodate the future 100-year creek flow at this location are considered to meet the primary project objective and will receive a positive screening evaluation under this criterion.

Screening Criterion #2: Will the project alternative negatively impact the existing traffic Level of Service (LOS) or vehicular speeds on Newell Road or nearby streets and intersections?

Level of Service (LOS) is a qualitative index of the performance of an element of the transportation system. Level of Service is a rating scale running from A to F, with A indicating no congestion of any kind, and F indicating intolerable congestion and delays. The 2000 Highway Capacity Manual (HCM), the standard reference published by the Transportation Research Board, contains the specific criteria and methods to be used in assessing LOS.

The acceptable LOS in the City of Palo Alto is to maintain a “D” or better for non-Congestion Management Program (CMP) Agency intersections and LOS E for CMP intersections. Based on the City of East Palo Alto 1999 General Plan, the acceptable LOS is also LOS D.

A detailed traffic study was performed for the project vicinity to establish the LOS for existing and future traffic conditions, and for each of the eight project alternatives. The complete traffic evaluation report is included in Appendix B. Under the LOS screening criteria, project alternatives that do not negatively impact the existing LOS within the study area are given a positive screening evaluation under this criterion.

Based on community input received at the public meetings held for the Project, one of the concerns regarding vehicular replacement bridge Alternatives 5, 6, 7 and 8 is the potential for increased speeding. Physical deterrents that force speeding drivers to slow down include speed humps, speed cushions, and raised crosswalks. Other methods include psychological reminders such as a radar feedback sign. These traffic calming measures and other methods will be carefully evaluated during the final design of the Project to ensure that the speeding issue is properly addressed.

Screening Criterion #3: Will the project alternative increase the Traffic Infusion on Residential Environment (TIRE) Index of any street by 0.1 or greater?

Residential areas are more sensitive to traffic because relatively small increases in traffic can impact the “livability” of the neighborhood. One tool for measuring the effects of increases in traffic on neighborhood livability is the Traffic Infusion on Residential Environments (TIRE) index. The TIRE index is based on the hypothesis that an increase in traffic volume has a greater impact on the environment along a local residential street with a low traffic volume than along a street with a high volume. TIRE represents the effect of traffic on the safety and comfort of human activities such as walking, bicycling and playing on or near a street and on the freedom to maneuver personal autos in and out of residential driveways.

The TIRE index was utilized to measure the effects of each project alternative on the existing and forecasted traffic levels. Given the nature of drivers to shift among alternate routes to reduce their travel times, this measure also is used to measure the effect of each project alternative on the overall local roadway network analyzed in the traffic study. Additional information on the TIRE index and results of the TIRE analysis are included in Appendix B.

An increase in the TIRE index of 0.1, which corresponds to a 20%-30% increase in the Average Daily Traffic (ADT), is generally considered to be a significant impact and is considered an unacceptable increase for purposes of this alternatives screening analysis. Alternatives that do not increase the TIRE index by 0.1 are given a positive screening evaluation under this criterion.

Screening Criterion #4: How does the project alternative accommodate multi-modal traffic demand as compared to other project alternatives?

One of the project objectives is to provide safe, convenient and comfortable travel for motorists, bicyclists and pedestrians within the context of any proposed project improvements. The Project should maintain or improve the existing accessibility to local homes, area businesses, and movement of goods and services and emergency vehicles, and provide connectivity between and accessibility to local destinations.

Sharing and overlap between bicyclists and motor vehicles through the use of shared lanes or “sharrows” is common in developed areas of moderate to high density such as urban and suburban areas and is assumed to satisfy the vehicle/bicycle components of the criteria for the purposes of this analysis.

Ideally, pedestrians would be accommodated with a sidewalk separated from vehicles and bicycles by a raised curb and preferably a landscaped buffer to increase pedestrian safety and comfort.

The measure of multi-modal traffic accommodation for the purposes of this project alternatives screening is a qualitative evaluation of the relative ability of each alternative to accommodate a range of travel modes, including vehicular, bicycle and pedestrian. Alternatives that accommodate a larger range of travel modes are given a more positive screening evaluation under this criterion.

3.3 SCREENING ANALYSIS

The following sections describe the evaluation and performance of the eight conceptual project alternatives under each of the four adopted screening criteria.

3.3.1 Criterion #1: Accommodation of 100-year Storm Flow

Alternative 1, the No-Build Alternative, is the only project alternative that would not accommodate the 100-year storm flow criterion. Alternative 2 would permanently remove the existing bridge, and Alternatives 3-8 would remove the existing bridge and replace it with a new bridge at a higher elevation to accommodate the projected future 100-year storm flow and associated freeboard requirements. Screening results for the 100-year Storm Flow Criterion are shown in Table 3.1.

Table 3.1: Screening Results for Accommodation of 100-Year Storm Flow Criterion

Project Alternative	Description	Does Alternative Accommodate the 100-Year Storm Flow?
1	No Build (Keep Existing Bridge)	No
2	Remove Existing Bridge	Yes
3	Bicycle/Pedestrian Bridge	Yes
4	Bicycle/Pedestrian Bridge with Emergency Access	Yes
5	One-Lane Bridge with Bi-directional Traffic	Yes
6	Two-Lane Bridge on Existing Alignment	Yes
7	Two-Lane Bridge with Partial Realignment of Newell Road	Yes
8	Two-Lane Bridge with Full Realignment of Newell Road	Yes

3.3.2 Criterion #2: Traffic Level of Service (LOS)

An operational analysis was performed to determine the level of service (LOS) at 14 intersections under existing conditions and for Alternatives 2-8. The analysis included three scenarios: existing traffic, near-term traffic (year 2020) and cumulative traffic (year 2035). The LOS results were then used to measure the potential impact of each project alternative on existing and future traffic patterns. As shown in Table 3.2, the LOS for the 14 study intersections under existing conditions range from LOS A to LOS F. Projected future LOS results for the year 2020 and year 2035 are shown in Table 3.3. Complete LOS results for each of the eight project alternatives for existing, 2020 and 2035 conditions are included in the traffic study prepared by TJKM Traffic Consultants and are included for reference in Appendix B of this report.

Alternative 1: Alternative 1 would maintain the existing condition with the bridge as it exists today, and therefore the existing and future LOS results shown in Table 3.2 and Table 3.3 would not be changed if Alternative 1 were selected.

Alternatives 2-4: Newell Road is designated as a residential collector street in the street networks of the cities of Palo Alto and East Palo Alto. Residential collector streets are intended as collectors and distributors of residential traffic to higher level streets and roads. Alternatives 2-4 would remove the existing bridge and eliminate public vehicular traffic on Newell Road from crossing the creek. Under these project alternatives, the vehicular traffic that currently uses the bridge along the Newell Road residential collector street route would be diverted to many of the local streets in the area, including Hamilton Avenue, Center Drive, Lincoln Avenue, Crescent Drive and Chaucer Street. This diverted traffic would be anticipated to increase the level of vehicular noise and speed on these streets. Adjacent intersections that would be affected by the diverted traffic include University Avenue to the west and West Bayshore Road to the east. Although bicycle and pedestrian access would vary between Alternatives 2-4, the vehicular traffic results are comparable between the three alternatives.

Table 3.2: Intersection Level of Service (LOS) – Existing Conditions

No.	Intersection	Level of Service (LOS)	
		AM	PM
1	Newell Rd & Edgewood Drive	A	A
2	Newell Rd & Hamilton Ave	B	B
3	Newell Rd and Channing Ave	B	B
4	Newell Rd & Woodland Ave – South Leg	A	A
	Newell Rd & Woodland Ave – North Leg	A	A
5	University Ave & Woodland Ave	D	D
6	University Ave & E Crescent Drive	F	E
7	University Ave & Center Drive	B	B
8	Hamilton Ave & W Crescent Drive	A	A
9	Channing Ave & Saint Francis Drive	A	A
10	Saint Francis Drive & Embarcadero Rd	B	A
11	W Bayshore Rd & Newell Rd	B	B
12	W Bayshore Rd & Woodland Ave	A	A
13	W Bayshore Rd & Channing Ave	A	B
14	W Bayshore Rd & Embarcadero Rd	E	F

Results for Alternatives 2-4 indicate that there would be a slight improvement to the p.m. peak hour traffic at the intersection of University Avenue and Woodland Avenue under existing traffic conditions and an improvement in the LOS from E to D for 2035 traffic. This LOS improvement is primarily due to the elimination of northbound traffic across the Newell Road bridge that previously made a westbound to northbound right-turn from Woodland Avenue onto University Avenue. Removal of the bridge as proposed under Alternatives 2-4 would also decrease traffic on Newell Road and result in an increase in LOS from B to A for the intersection of Newell Road and Hamilton Ave.

Table 3.3: Intersection Level of Service (LOS) –Projected 2020 & 2035 Traffic Conditions

No.	Intersection	2020		2035	
		AM	PM	AM	PM
1	Newell Rd & Edgewood Drive	A	A	A	A
2	Newell Rd & Hamilton Ave	B	B	B	B
3	Newell Rd and Channing Ave	B	B	B	B
4	Newell Rd & Woodland Ave – South Leg	A	A	A	A
	Newell Rd & Woodland Ave – North Leg	A	A	A	A
5	University Ave & Woodland Ave	E	D	F	E
6	University Ave & E Crescent Drive	F	F	F	F
7	University Ave & Center Drive	B	B	C	C
8	Hamilton Ave & W Crescent Drive	A	A	A	A
9	Channing Ave & Saint Francis Drive	A	A	A	A
10	Saint Francis Drive & Embarcadero Rd	B	A	C	B
11	W Bayshore Rd & Newell Rd	B	B	B	B
12	W Bayshore Rd & Woodland Ave	A	A	A	A
13	W Bayshore Rd & Channing Ave	A	B	B	B
14	W Bayshore Rd & Embarcadero Rd	F	F	F	F

The results of the traffic analysis for Alternatives 2-4 also indicate that the LOS at the intersection of University Avenue and East Crescent Drive would deteriorate from the existing LOS E to LOS F during the p.m. peak hour traffic with delay times that are roughly twice as long as the existing condition. In addition, the LOS at the intersection of University Avenue and Center Drive would deteriorate from the existing LOS B to LOS C during the p.m. peak hour traffic if vehicular access across the Newell Road bridge were eliminated.

The LOS screening analysis for Alternatives 2-4 projects that although there would be some improved traffic conditions that would result from removal of the existing bridge, there would be a significant decrease in LOS for two intersections along University Avenue in Palo Alto. It is therefore concluded that Alternatives 2-4 would have a negative effect on the existing LOS.

Alternative 5 (One-lane bridge with Bi-directional Traffic): Alternative 5 would require significant changes to the Newell Road intersections at Edgewood Drive and Woodland Avenue due to the need for full signalization of both intersections.

In order to limit all traffic movement to one direction across the bridge, bicycle and vehicle movement would only be allowed to proceed through one of the newly signalized intersections at a time. During the green signal phase at one of the intersections, all traffic at the opposite intersection would be held with a red signal until the bicycles and vehicles crossing the bridge in the active direction have crossed the bridge and cleared the intersection. This queuing of vehicles and bicycles at the intersections would result in delays and a decrease in LOS.

Alternative 5 would result in a reduction in LOS level from A to C at the Newell Road/Woodland Avenue and Newell Road/Edgewood Drive intersections.

Alternative 6 (Two-lane Bridge on Existing Alignment): Alternative 6 would provide a replacement bridge on the same alignment as the existing bridge and maintain the existing offset intersection at Newell Road and Woodland Avenue. The new bridge would provide sufficient width for autos, bicyclists and pedestrians. The increased width of the new bridge could slightly reduce travel times and may be perceived by some drivers as a more attractive route compared to the existing bridge. Based upon the professional judgment and experience of the traffic engineering consultant, a 4% increase in vehicular traffic volume was assumed for the new bridge as a result of these effects. The LOS analysis for Alternative 6 found that there would be no change from the existing condition and that, therefore, Alternative 6 would not have a negative effect on the existing LOS.

Alternative 7 (Two-lane Bridge with Partial Realignment of Newell Road): Alternative 7 would provide a replacement bridge on a new alignment that reduces the amount of offset at the existing intersection of Newell Road and Woodland Avenue. Similar to Alternative 6, the new bridge would be wider than the existing bridge with sufficient width for autos, bicyclists and pedestrians. The increased width and reduced offset of the partially realigned bridge could further reduce travel times and may be perceived by some drivers as an even more attractive route compared to Alternative 6. Based upon the professional judgment and experience of the traffic engineering consultant, a 6% increase in vehicular traffic volume was assumed for the partially realigned bridge as a result of these effects. The LOS analysis for Alternative 7 found that there would be no change from the existing condition and that, therefore, Alternative 7 would not have a negative effect on the existing LOS.

Alternative 8 (Two-lane Bridge with Full Realignment of Newell Road): Alternative 8 would provide a replacement bridge on a new alignment of Newell Road that eliminates the offset at the existing intersection of Newell Road and Woodland Avenue, creating a standard four-way intersection. Similar to Alternatives 6 and 7, the new bridge would be wider than the existing bridge with sufficient width for autos, bicyclists and pedestrians. The increased width and improved geometry of the standard four-way intersection would further reduce travel times and delays at the intersection and may be perceived by some drivers as an even more attractive route compared to Alternatives 6 and 7. Based upon the professional judgment and experience of the traffic engineering consultant, a 10% increase in vehicular traffic volume was assumed for the fully realigned bridge option. The LOS analysis for Alternative 8 found that there would be no change from the existing condition and that, therefore, Alternative 8 would not have a negative effect on the existing LOS. The screening results for the effect on LOS criterion are shown in Table 3.4.

Table 3.4: Screening Results for Effect on Level of Service (LOS) Criterion

Project Alternative	Description	Does Alternative have a negative effect on LOS?
1	No Build (Keep Existing Bridge)	No
2	Remove Existing Bridge	Yes
3	Bicycle/Pedestrian Bridge	Yes
4	Bicycle/Pedestrian Bridge with Emergency Access	Yes
5	One-Lane Bridge with Bi-directional Traffic	Yes
6	Two-Lane Bridge on Existing Alignment	No
7	Two-Lane Bridge with Partial Realignment of Newell Road	No
8	Two-Lane Bridge with Full Realignment of Newell Road	No

3.3.3 Criterion #3: Traffic Infusion on Residential Environment (TIRE)

The existing TIRE index was determined for twelve residential roadways in the project vicinity as shown in Figure 3.1. A TIRE index was similarly determined for these locations for each of the project alternatives for comparison with the existing condition. An increase in the TIRE index of 0.1 or more, which corresponds to an approximate increase of 20 to 30 percent in ADT, is considered unacceptable.

The TIRE analysis for Alternatives 2, 3 and 4, which would eliminate vehicular access across the creek at Newell Road, determined that an increase in the TIRE index of 0.1 or more as compared to the existing condition would be exhibited on three of the roadway study segments as a result of traffic diversion:

- East Crescent Drive between University Avenue and Southwood Drive
- Center Drive between University Avenue and Hamilton Avenue
- Hamilton Avenue between Center Drive and Newell Road

The TIRE analysis for Alternative 8 (Two-Lane Bridge with Full Realignment of Newell Road) determined that an increase in the TIRE index of 0.1 or more as compared to the existing condition would be exhibited on one of the roadway study segments:

- Woodland Avenue between Cooley Avenue and Clarke Avenue

In summary, Alternatives 1, 5, 6 and 7 would not increase the TIRE index by 0.1 or more and consequently are not anticipated to have a negative impact on the surrounding local residential streets. Alternatives 2, 3, 4 and 8 would all increase the TIRE index by 0.1 or more and do not satisfy the TIRE index screening criterion.

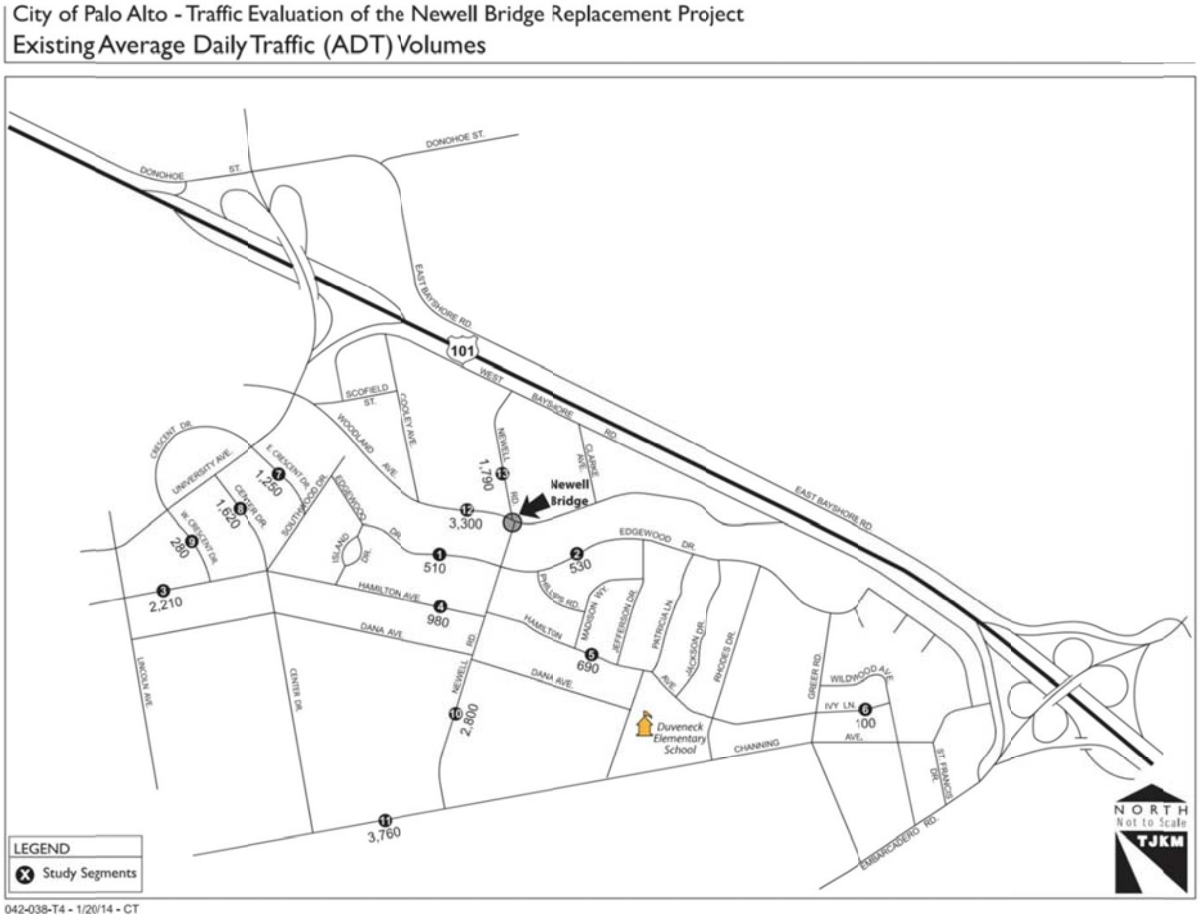


Figure 3.1 Roadway Study Segments for TIRE Index evaluation

Table 3.5: Screening Results for TIRE Index Criterion

Project Alternative	Description	Does Alternative increase TIRE index on a residential street by 0.1 or more?
1	No Build (Keep Existing Bridge)	No
2	Remove Existing Bridge	Yes
3	Bicycle/Pedestrian Bridge	Yes
4	Bicycle/Pedestrian Bridge with Emergency Access	Yes
5	One-Lane Bridge with Bi-directional Traffic	No
6	Two-Lane Bridge on Existing Alignment	No
7	Two-Lane Bridge with Partial Realignment of Newell Road	No
8	Two-Lane Bridge with Full Realignment of Newell Road	Yes

3.3.4 Criterion #4: Accommodation of Multi-modal Traffic

The measure of multi-modal traffic accommodation for the purposes of this project alternatives screening is a qualitative evaluation of the relative ability of each alternative to accommodate a range of travel modes, including vehicular, bicycle and pedestrian. Alternatives that accommodate a larger range of travel modes are given a more positive screening evaluation under this criterion. A system of “star” ratings (with each alternative being assigned a rating of zero to three stars) has been adopted to depict the relative level of multi-modal travel accommodated by each project alternative.

Alternative 1 preserves the existing bridge and thereby provides an 18-foot-wide roadway that is shared by all modes of travel including autos, bicycles and pedestrians. Under this scenario, all users would be able to cross the bridge in both directions. Due to the lack of standard lane widths, modal separation, and effective traffic control devices, however, the level of traffic safety for bridge users (particularly bicyclists and pedestrians) is lower than desirable. Therefore, Alternative 1 has been assigned a two-star rating for this criterion.

Alternative 2 would remove the existing bridge and would not provide any means for travel across the creek and has therefore been assigned a zero-star rating for this screening criterion.

Alternatives 3 and 4 would replace the existing bridge with a new bridge that provides bicycle and pedestrian access across the bridge, but would not provide access to vehicles. Based on this relatively low level of modal accommodation, Alternatives 3 and 4 have been assigned a one-star rating for this screening criterion.

Alternative 5 would provide a new bridge that accommodates all modes of travel, but the direction of travel for vehicles and bicycles would be limited to movement in one direction at a time on Newell Road, creating traffic delays at the signalized intersections of Newell Road with Woodland Avenue and Edgewood Drive. Alternative 5 has been assigned a two-star rating for this criterion.

Alternatives 6, 7 and 8 would all provide full multi-modal access across the creek conforming to current safety standards. Therefore, these alternatives have been assigned a three-star rating for this criterion.

Table 3.6: Screening Results for Accommodation of Multi-Modal Traffic Criterion

Project Alternative	Description	How Does Alternative accommodate multi-modal traffic?
1	No Build (Keep Existing Bridge)	★★
2	Remove Existing Bridge	
3	Bicycle/Pedestrian Bridge	★
4	Bicycle/Pedestrian Bridge with Emergency Access	★
5	One-Lane Bridge with Bi-directional Traffic	★★
6	Two-Lane Bridge on Existing Alignment	★★★
7	Two-Lane Bridge with Partial Realignment of Newell Road	★★★
8	Two-Lane Bridge with Full Realignment of Newell Road	★★★

SECTION 4 – RESULTS OF PROJECT ALTERNATIVES SCREENING

A tabularized summary of the screening analysis results is provided in Table 4.1. The results show that only two of the build alternatives, Alternative 6 and Alternative 7, satisfactorily met all four adopted screening criteria. Based on the screening analysis results, it is recommended that Alternatives 2, 3, 4, 5 and 8 be eliminated from further consideration because they were unable to satisfy one or more of the project screening criteria. Alternative 1 is selected to advance to the next phase of project development because the No Build alternative must always be included and analyzed in an EIR. Based on the screening analysis results, it is recommended that Alternatives 6 and 7 be carried forward for further detailed evaluation in the EIR process.

TABLE 4.1: ALTERNATIVES SCREENING SUMMARY OF RESULTS

Alternative	Description	Does Alternative accommodate 100-Year Storm Flow Event?	Does Alternative have a negative effect on LOS?	Does Alternative increase TIRE index on any residential street by 0.1 or more?	How Does Alternative Accommodate Multi-Modal Traffic?	Advance or Eliminate?
1	No Build (Keep Existing Bridge)	No	No	No	★★	Advance*
2	Remove Existing Bridge	Yes	Yes	Yes		Eliminate
3	Bicycle/Pedestrian Bridge	Yes	Yes	Yes	★	Eliminate
4	Bicycle/Pedestrian Bridge with Emergency Access	Yes	Yes	Yes	★	Eliminate
5	One-Lane Bridge with Bi-directional Traffic	Yes	Yes	No	★★	Eliminate
6	Two-Lane Bridge on Existing Alignment	Yes	No	No	★★★	Advance
7	Two-Lane Bridge with Partial Realignment of Newell Road	Yes	No	No	★★★	Advance
8	Two-Lane Bridge with Full Realignment of Newell Road	Yes	No	Yes	★★★	Eliminate

*- The “No build” option always advances to the EIR process.

SECTION 5 – QUALITATIVE ASSESSMENT OF RELATIVE ENVIRONMENTAL EFFECTS

A qualitative assessment of potential environmental effects was performed to both identify significant impacts that might preclude any of the eight project alternatives from further development and to give a relative comparison of each alternative's environmental effects (see Appendix C). Although this assessment was not included as a criterion for screening the alternatives, the results serve as an effective measure of the relative environmental benefits and impacts of each project alternative and may facilitate future discussions of environmental issues for the Project. An important aspect of this assessment was to identify any key features of the alternatives that have lesser environmental impacts that could be incorporated into the reduced set of alternatives selected to move forward for further analysis in the EIR.

SECTION 6 – COMPARABLE CONSTRUCTION COSTS

Comparable construction cost estimates were prepared for each alternative and are summarized in Table 6.1. Costs were prepared at a conceptual level and include only the major cost components associated with the construction of the roadway approach work, bridge removal, and bridge and retaining wall construction. These costs are presented as a measure of the relative costs between the alternatives for reference only, and should not be used for planning or budgeting purposes.

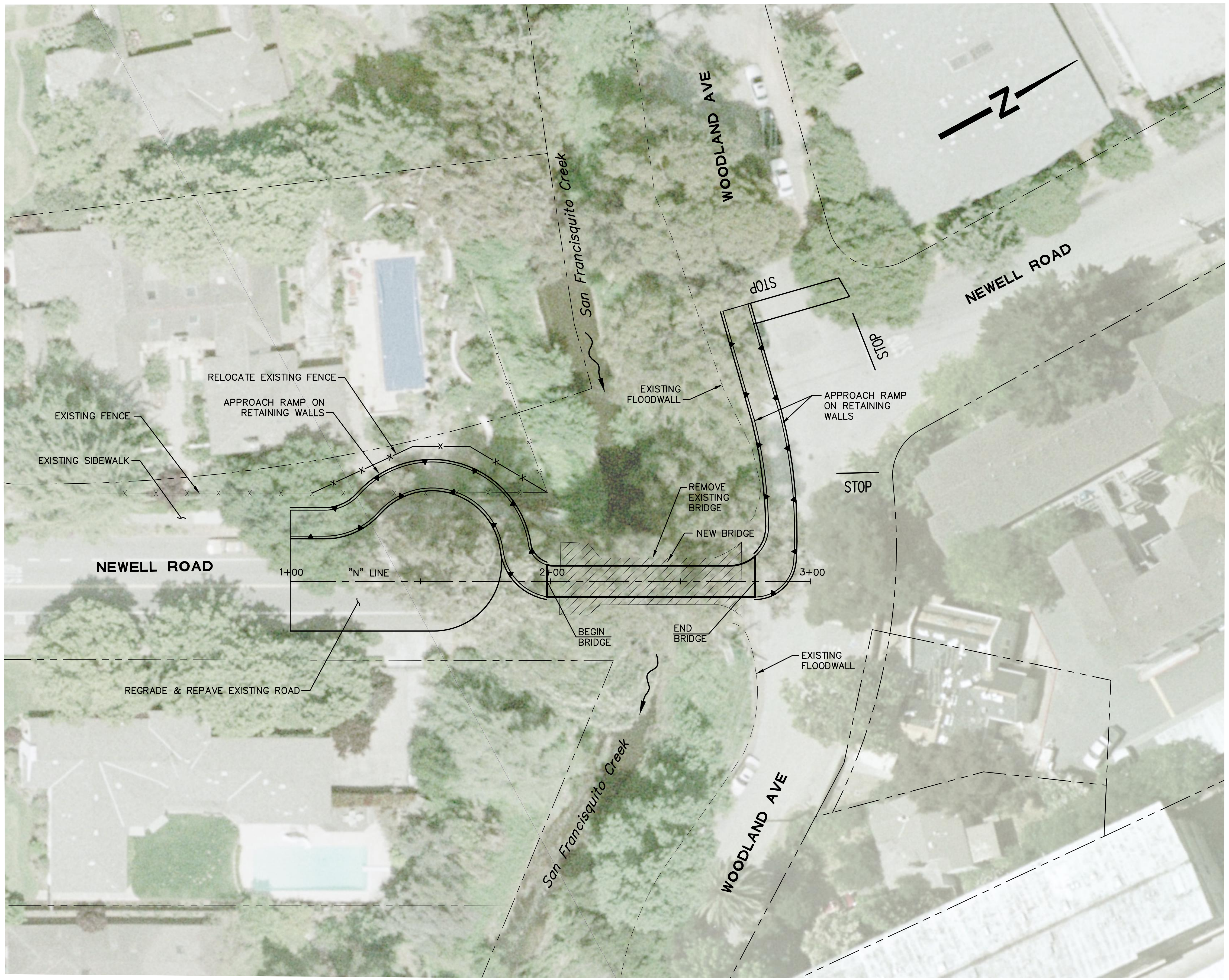
Table 6.1: Comparable Construction Costs

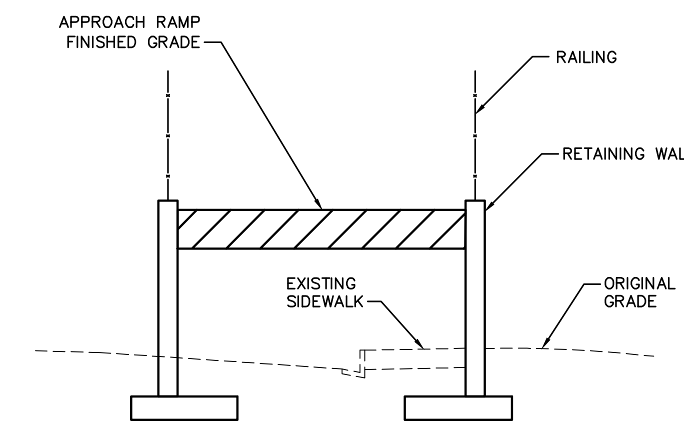
Alternative	Description	Cost to Construct (2014 Dollars)
1	No Build (Keep Existing Bridge)	$0
2	Remove Existing Bridge	$200,000
3	Bicycle/Pedestrian Bridge	$700,000
4	Bicycle/Pedestrian Bridge with Emergency Access	$1,300,000
5	One-Lane Bridge with Bi-directional Traffic	$1,600,000
6	Two-Lane Bridge on Existing Alignment	$2,000,000
7	Two-Lane Bridge with Partial Realignment of Newell Road	$2,000,000
8	Two-Lane Bridge with Full Realignment of Newell Road	$2,100,000

APPENDIX A: CONCEPTUAL PLANS FOR ALTERNATIVES 2-8

NEWELL ROAD BRIDGE
PROJECT ALTERNATIVE 2 -
REMOVE EXISTING BRIDGE

NV5
BEYOND ENGINEERING



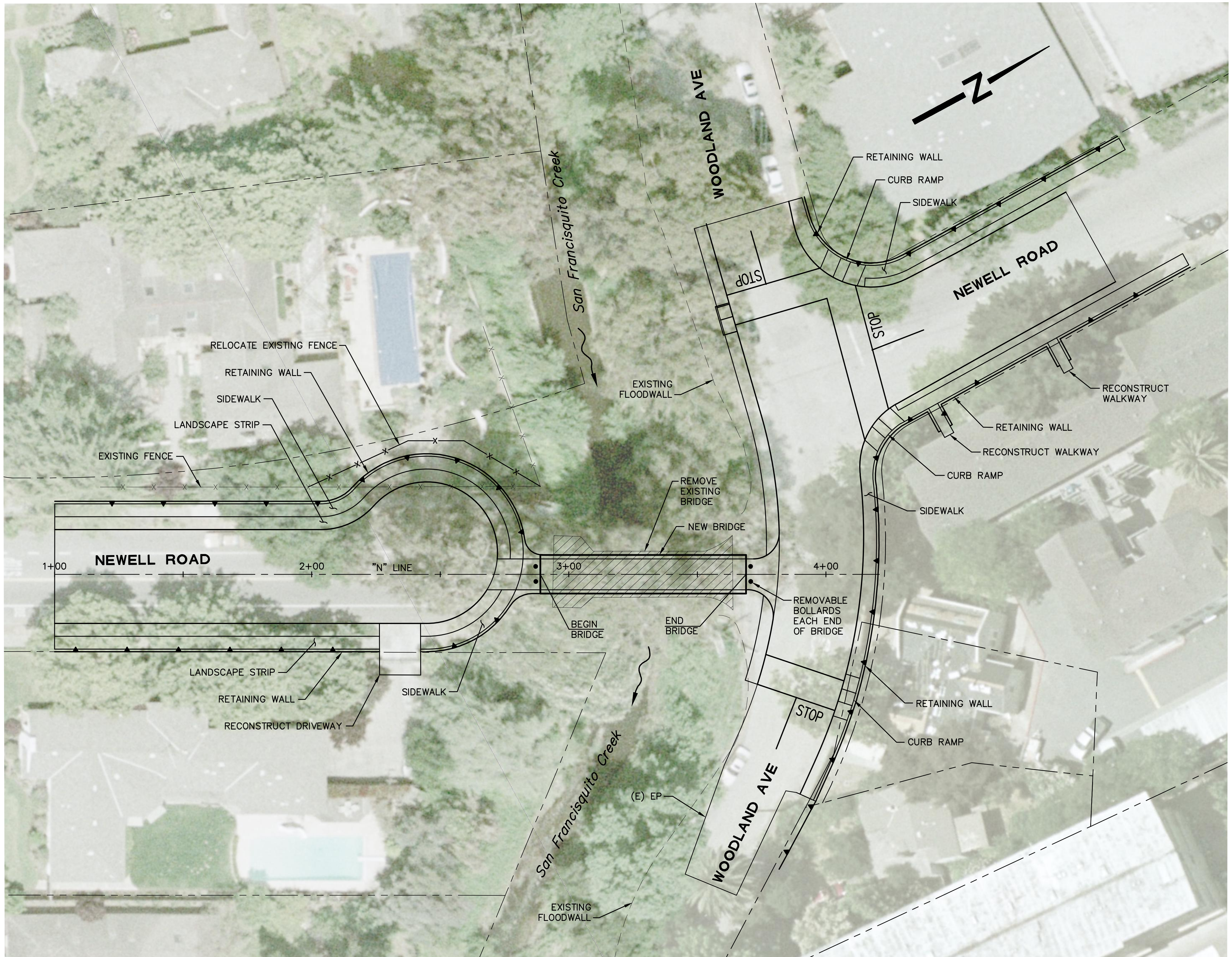


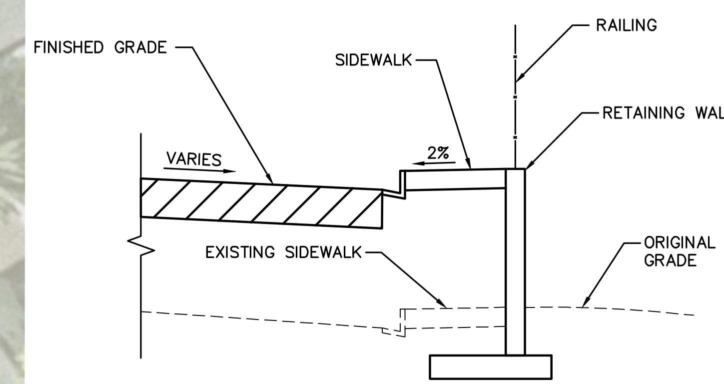
TYPICAL SECTION AT APPROACH RAMPS

NO SCALE

NEWELL ROAD BRIDGE
PROJECT ALTERNATIVE 3 -
PEDESTRIAN/BIKE BRIDGE

NV5
BEYOND ENGINEERING





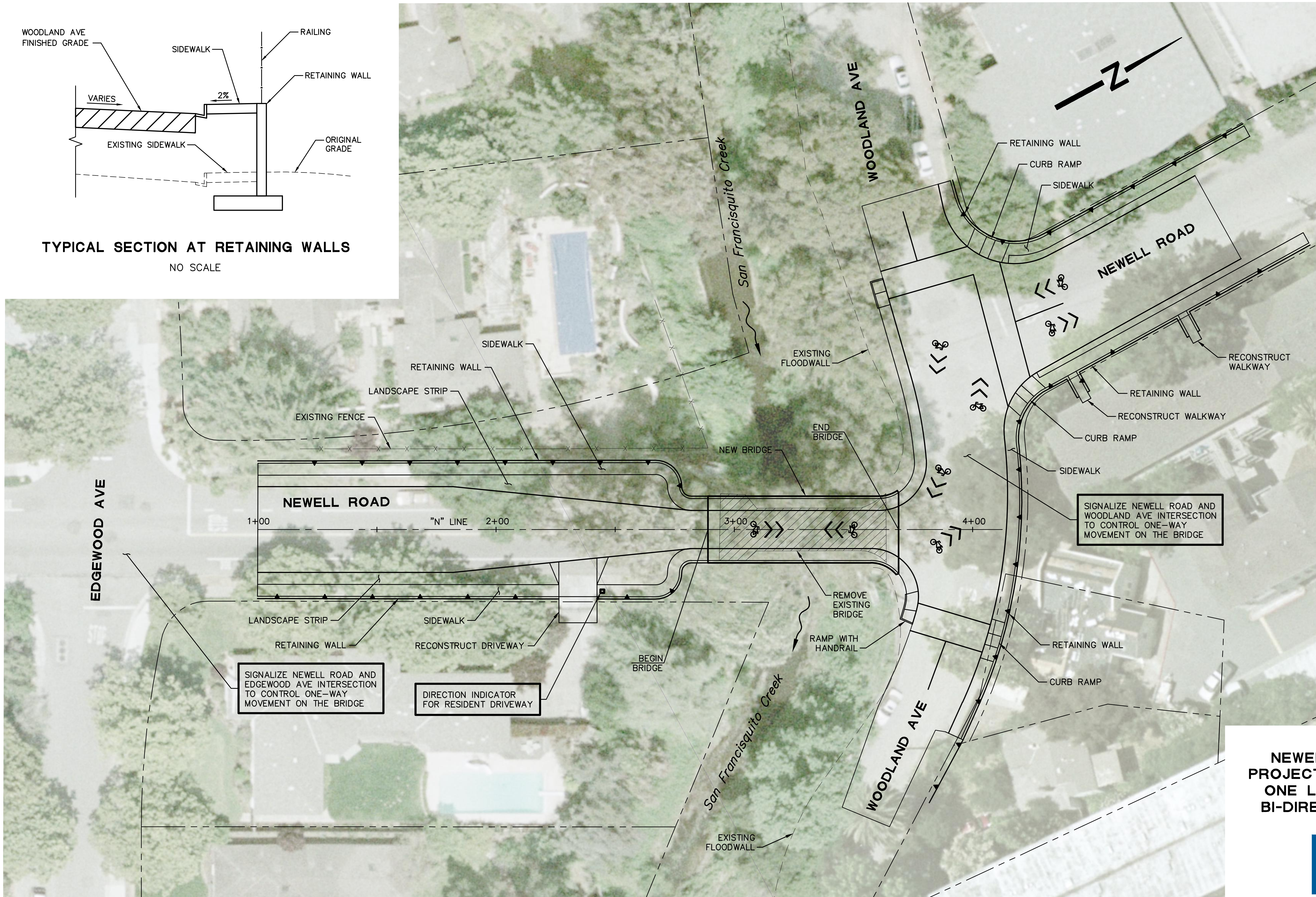
TYPICAL SECTION AT RETAINING WALLS

NO SCALE

NEWELL ROAD BRIDGE PROJECT ALTERNATIVE 4 - PEDESTRIAN/BIKE BRIDGE WITH EMERGENCY VEHICLE ACCESS

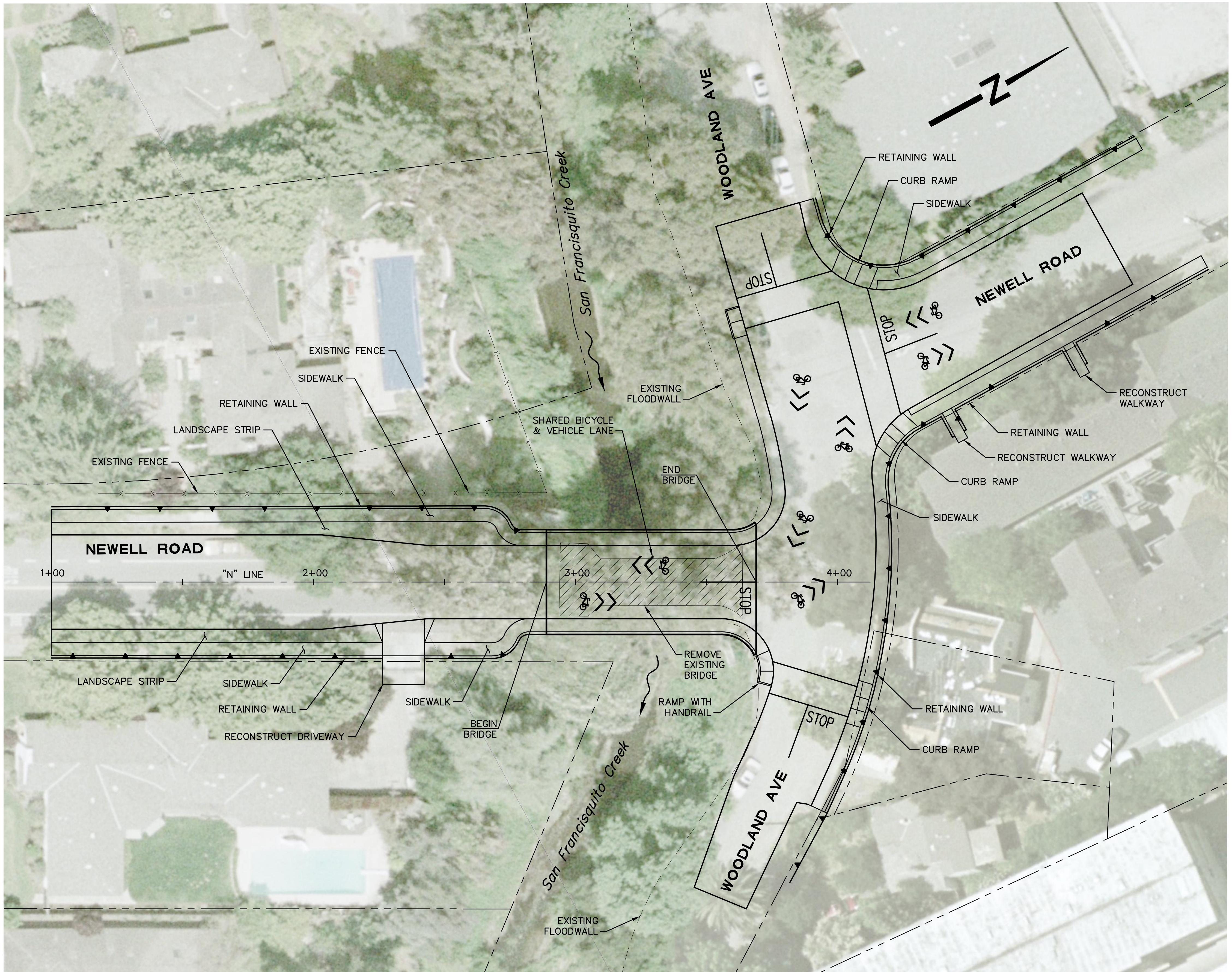
NV5

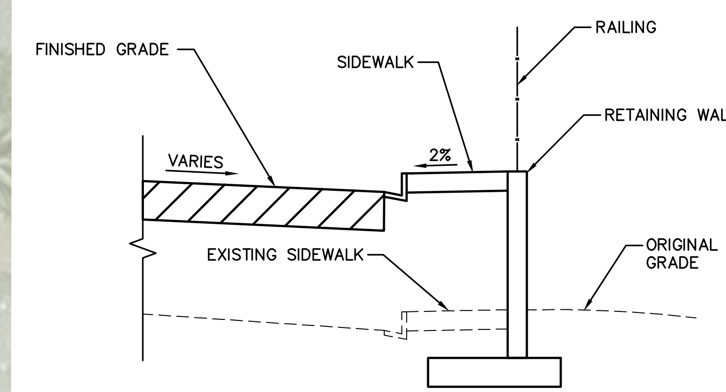
BEYOND ENGINEERING



NEWELL ROAD BRIDGE PROJECT ALTERNATIVE 5 - ONE LANE BRIDGE WITH BI-DIRECTIONAL TRAFFIC

BEYOND ENGINEERING



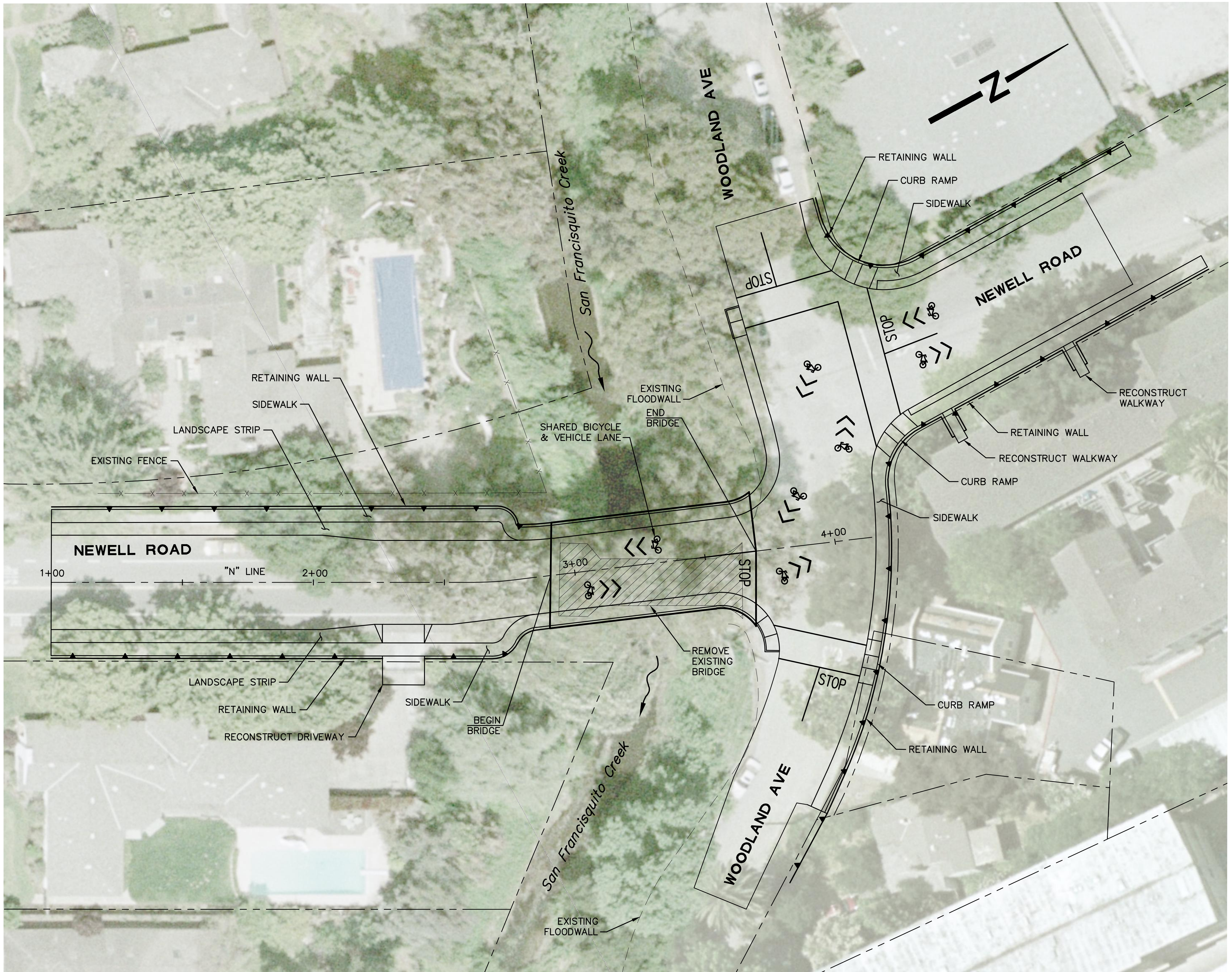


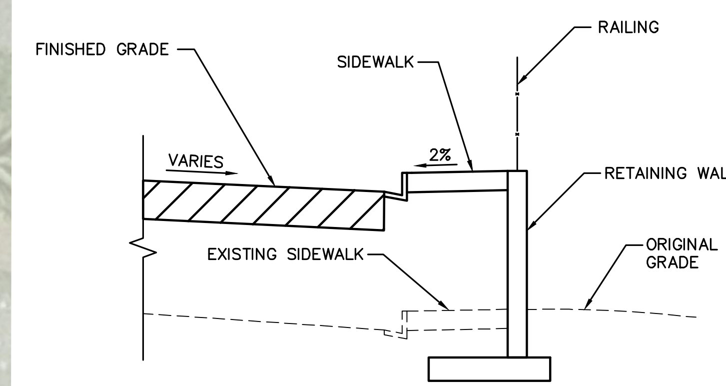
TYPICAL SECTION AT RETAINING WALLS

NO SCALE

NEWELL ROAD BRIDGE PROJECT ALTERNATIVE 6 - TWO LANE BRIDGE ON EXISTING ALIGNMENT

NV5
BEYOND ENGINEERING





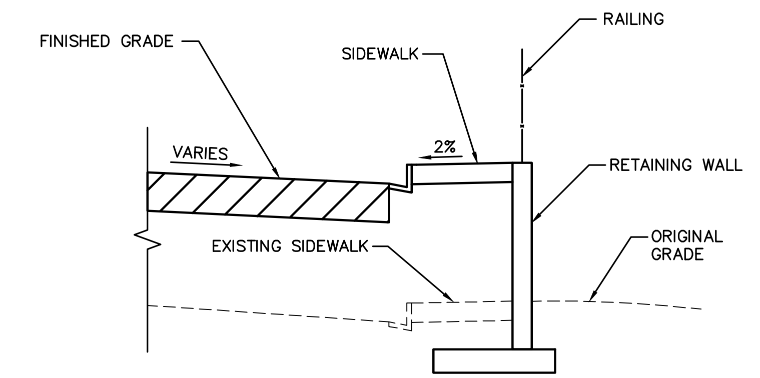
TYPICAL SECTION AT RETAINING WALLS

NO SCALE

NEWELL ROAD BRIDGE PROJECT ALTERNATIVE 7 - TWO LANE BRIDGE ON PARTIAL REALIGNMENT

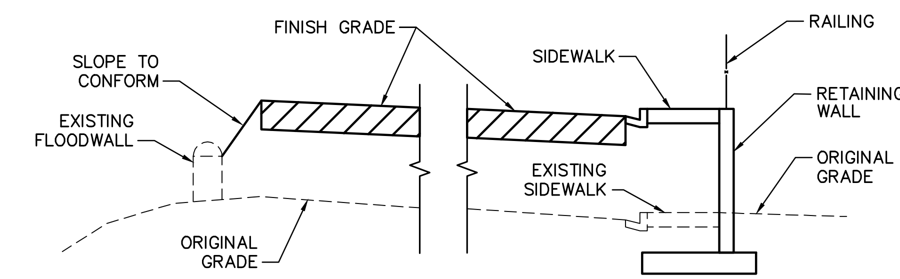
NV5

BEYOND ENGINEERING



TYPICAL SECTION AT RETAINING WALLS

NO SCALE



TYPICAL SECTION OF WOODLAND AVE

LOOKING WEST

NEWELL ROAD BRIDGE PROJECT ALTERNATIVE 8 - TWO LANE BRIDGE ON FULL REALIGNMENT

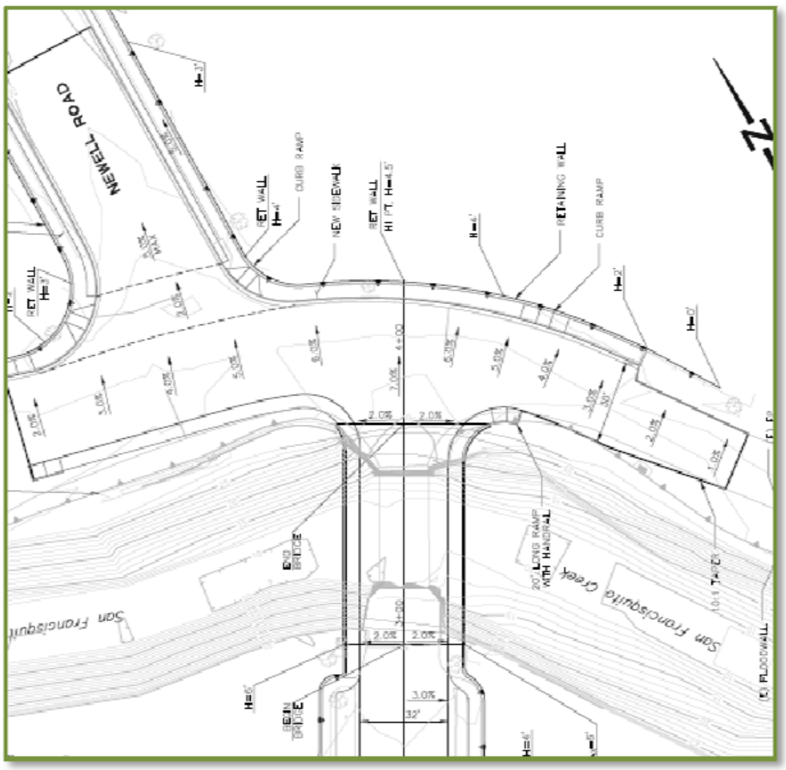
NV5

BEYOND ENGINEERING

APPENDIX B: NEWELL ROAD TRAFFIC STUDY (TJKM TRANSPORTATION CONSULTANTS)

TJKM
Transportation
Consultants

Vision That Moves Your Community



Draft Report

Traffic Evaluation of the Newell Road Bridge Project

In the City of Palo Alto

February 21, 2014

Pleasanton
Fresno
Sacramento
Santa Rosa

TJKM
www.tjkm.com

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Transportation
Consultants

Vision That Moves Your Community

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In the City of Palo Alto

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Table of Contents

List of Appendices

List of Figures

List of Tables

Introduction and Summary

Introduction

The purpose of this report is to document the findings for the traffic evaluation of the Newell Road Bridge Project. According to the City, the main purpose of the replacement of the bridge is to resolve flood issues and not traffic issues at the bridge. The existing bridge is too narrow to comfortably accommodate two-way vehicular traffic and has no provisions for bicycle and pedestrian traffic, even though there are bicycle lanes and sidewalks on the south approach to the bridge.

Summary

A total of eight different scenarios were analyzed in this study:

1. No Project (Leave Existing Bridge In Place)
2. No Bridge Option
3. Bicycle-Pedestrian Bridge Option
4. Bicycle-Pedestrian Bridge With Limited Emergency Vehicle Access
5. One Lane Bi-Directional Vehicle Bridge With Traffic Signal Control
6. New Two Lane Vehicle Bridge on Existing Bridge Alignment
7. Two Lane Vehicle Bridge With A Partial Realignment Of Newell Rd
8. Two Lane Vehicle Bridge With A Full Realignment Of Newell Rd

Based on input from City staff and stakeholders, eight scenarios and14 intersections were selected for analysis. The existing traffic conditions and near-term 2020 and cumulative 2035 future years were analyzed.

Scenario 1: No Project (Leave Existing Bridge in Place)

Under this scenario, the existing bridge would be left in place as is. That is, the existing 18-foot wide bridge would continue to operate. The level of service would not change as shown under the existing condition in Table I. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and to LOS F in 2035.

Scenario 2: No Bridge Option

This alternative assumes a bridge would not be accessible to autos, bikes or pedestrians. Consequently, auto traffic that currently has access to the bridge would be diverted to the adjacent roadways and intersections.

Even though there is a slight LOS improvement during the p.m. peak hour at the intersection of University Avenue/Woodland Avenue, it should be noted that most of the diverted traffic would be using University Avenue and other side streets in the area to reach their destinations.
The analysis results indicated that the LOS at the intersection of University Avenue and E. Crescent Drive would deteriorate from the existing LOS E to LOS F during the p.m. peak hour. The LOS at the intersection of University Avenue and Center Drive would deteriorate from the existing LOS B to LOS C during the p.m. peak hour. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and to LOS F in 2035.

Scenario 3: Bicycle-Pedestrian Bridge Option

This alternative assumes that the proposed future Newell Road Bridge project would serve only bicycles and pedestrians and not be accessible to autos. Consequently, auto traffic that currently has access to the bridge would be diverted to the adjacent roadways and intersections.

Rerouting of vehicular traffic under this scenario is similar to Scenario 2. The only difference is that only bicycle-pedestrian traffic would be allowed on the bridge. Therefore it is anticipated that the level of service results for autos would be similar to LOS results shown in Table III and IV of Scenario 2.

Scenario 4: Bicycle-Pedestrian Bridge Option with Limited Emergency Vehicle Access

This scenario would be similar as Scenario 3, the only difference is allowing limited emergency vehicles access. Therefore it is anticipated that the level of service results for autos would be similar to LOS results shown in Table III and IV of Scenario 2.

It is anticipated that special key access or sensor activated bollard should be installed for Emergency Vehicle Access only.

Scenario 5: One Lane Bi-Directional Vehicle Bridge Option with Signal Control

The operational analysis for this scenario relies primarily on the signal control and timing at the intersections of Newell Road/Woodland Avenue and Newell Road/Edgewood Road. It is assumed that only one direction of traffic would be able to cross the bridge at any one time. It is estimated that both of the signalized intersections at Newell Road/Woodland Avenue and Newell Road/Edgewood Road would operate at LOS C for the Existing Traffic Conditions in this scenario. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and LOS F in 2035.

Scenario 6: New Two Lane Vehicle Bridge on Existing Bridge Alignment

This alternative assumes keeping the bridge in its current location but widening it to accommodate autos, pedestrians and bicyclists (sharrows) in both directions of travel. It is estimated that only slight changes of delays are expected at a few intersections with no change in LOS under the Existing Traffic Volume Conditions. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and LOS F in 2035.

Scenario 7: Two Lane Vehicle Bridge with a Partial Realignment of Newell Rd

The proposed project would reduce the distance of the current North-South off-set of Newell Road by 30 feet. The partial realignment would result in the offset intersection being approximately 60 feet apart. The proposed project is wider with sharrows and sidewalks, similar to Scenario 6. It is estimated that only slight changes of delays are expected at a few intersections with no change in LOS under the Existing Traffic Volume Conditions. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and LOS F in 2035.

Scenario 8: Two Lane Vehicle Bridge with a Full Realignment of Newell Rd

This scenario assumes the full realignment of Newell Road Bridge and addition of bike lanes in both directions of travel. The proposed project is wider with sharrows and sidewalks, similar to Scenario 6. Only slight increases in delays are shown for a few intersections with no change in LOS under the Existing Traffic Volume Conditions. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and LOS F in 2035.

TIRE Index (Traffic Infusion on Residential Environment) Analysis

The results indicated that an increase in the TIRE Index of 0.1 or more could be experienced on three roadways under the existing traffic volumes for Scenario 2, 3 and 4:

- E. Crescent Drive between University Avenue and Southwood Drive
- Center Drive between University Avenue and Hamilton Avenue
- Hamilton Avenue between Center Drive and Newell Road

The results indicated that an increase of 0.1 or more could be experienced on one roadway under the existing traffic volumes for Scenario 8 – Vehicle Bridge with Full Realignment:

- Woodland Ave between Cooley Avenue and Clarke Avenue

Roadways under Scenarios 1, 5, 6 and 7 would not increase in the TIRE Index.

Existing Condition

The existing Newell Road Bridge is a narrow two lane bridge that connects Palo Alto and East Palo Alto. Near the bridge, the land use to the south in Palo Alto is primarily single family residential homes and to the north in East Palo Alto there is a mix of single family, multi-family residential homes and some non-residential land uses.

Roadway Network

Figure 1 shows the existing local street circulation in the area and peak hour intersection turning movement volumes at the study locations. Key roadways in the project vicinity are described below:

Newell Road is a two lane collector street that connects from Channing Avenue in the south to West Bayshore Road to the north. Across the bridge at Woodland Avenue, the intersection is currently off-set into two intersections forming two stop-controlled T- intersections at Woodland Avenue. The existing average daily traffic (ADT) is approximately 2,800 vehicles per day (vpd) on the bridge.

Woodland Avenue is a two-lane collector street in East Palo Alto in the vicinity of Newell Road. The existing ADT is approximately 3,300 vpd to the west of Newell Road.

Edgewood Drive is a two lane local residential street with roll curbs and sidewalks. The ADT is approximately 500 vpd.

West Bayshore Road is generally a wide two-lane frontage road on the west side of US 101. Some non-residential land uses front on the roadway. It serves many residential land uses in the area.

Channing Avenue is a two lane east-west collector street with a Class II bike lane and located to the south of Newell Road. The ADT is approximately 3,760 vpd.

Hamilton Avenue is a long east-west street that runs from near Newell Road to downtown. It is a two-lane residential street in the project area with ADT volumes of approximately 980 vpd and 690 vpd respectively west and east of Newell Road. The ADT is much higher at approximately 2,210 vpd west of Center Drive.

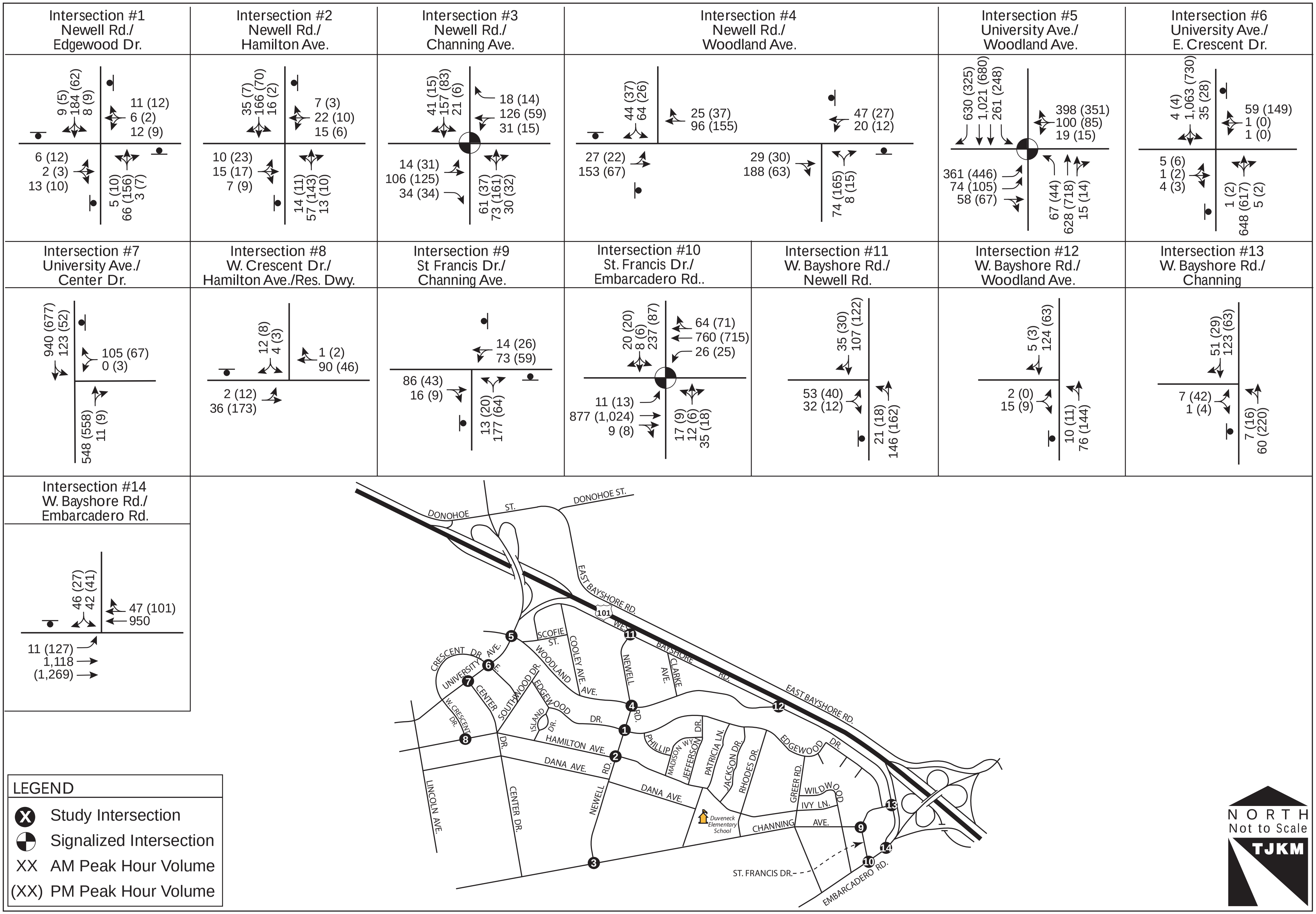
Center Drive is a two lane north-south local residential street that extends from Channing Avenue in the south to University Avenue in the north. The ADT is approximately 1,620 vpd south of University Avenue.

Crescent Drive is a narrow two lane loop road that starts at Hamilton Avenue in the south (W. Crescent Drive) and crosses University Avenue to the north before looping south to cross University Avenue and ends at Southwood Drive to the south (E. Crescent Drive). The ADT volumes are approximately 280 vpd and 1,250 vpd on W. Crescent Drive and E. Crescent Drive respectively.

City of Palo Alto - Traffic Evaluation of the Newell Bridge Replacement Project

Existing Peak Hour Volumes, Lane Configurations

Figure 1



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Level of Service Analysis Methodology

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

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

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

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

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

The LOS is reported for the minor approach. Depending on the availability of gaps, the minor approach might be operating at LOS D, E, or F while the overall intersection operates at LOS C or better. A minor approach that operates at LOS D, E, or F does not automatically translate into a need for a traffic signal. A signal warrant would still need to be met. There are many instances where only a few vehicles are experiencing LOS D, E, or F on the minor approach while the whole intersection operates at an acceptable LOS. A signal is usually not warranted under such conditions.

The justification for the installation of a traffic signal at an intersection is based on the warrants stated in the California Manual on Uniform Traffic Control Devices (MUTCD) published by Caltrans and the Federal Highway Administration (FHWA). The decision to install a signal should not be based solely upon the warrants, since the installation of traffic signals may increase certain types of collisions. Delay, congestion, approach conditions, driver confusion, future land use or other evidence of the need for right of way assignment beyond that which could be provided by stop signs must be demonstrated.

Standards of Significance

The acceptable Level of Service (LOS) in the City of Palo Alto is to maintain a "D" or better for non-Congestion Management Program (CMP) Agency intersections and LOS E for CMP intersections. Based on the City of East Palo Alto 1999 General Plan, the acceptable LOS is also LOS D.

Existing Traffic Volumes and Level of Service Analysis

Based on consultations with city staff, 14 intersections[1] were selected for analysis. Peak hour turning movement counts were obtained for the 12 intersections in May 2013 and two intersections in August 2012. The existing turning movement counts and lane geometry are shown in Figure 1. Three of the 14 intersections are currently signalized (University Avenue/Woodland Avenue, Newell Road/Channing Avenue and St. Francis Drive/Embarcadero Road). The remaining 11 intersections are currently stop controlled. The intersection levels of service (LOS) analysis results are shown in Table I. The intersection of University Avenue/E. Crescent Drive and W. Bayshore Rd & Embarcadero Rd operate at LOS F.

Average daily traffic (ADT) volumes for all the approaches on Newell Road and Woodland Avenue were also collected.[2] The general traffic flow at the bridge seems to indicate that during the a.m. peak hour, approximately 70 percent of the traffic is southbound and approximately 30 percent is northbound. It is generally reverse during the p.m. peak hour. Detailed traffic count information is contained in Appendix B and detailed LOS calculations are shown in Appendix C.

The existing bicycle and pedestrian peak hour volumes are shown in Figure 2. The volumes are generally low. Near the bridge, the peak bicycle volumes of 17 occur during the a.m. peak hour on Newell Road near the bridge. The peak pedestrian volumes of 15 occur during the p.m. peak hour on Newell Road near the bridge.

Average daily traffic (ADT) volumes collected for 13 roadway segments are shown in Figure 3.

Current Traffic Control and Sight Distance

Currently both of the off-set intersections of Newell Road at Woodland Avenue are All Way Stop control and have limited sight distance for vehicles that use the two intersections.

Woodland Ave at Newell Rd (Looking West)

Without the All Way Stop control, the northbound Newell Road traffic could experience difficulty discharging from the stop line since the sight visibility is not totally clear. In addition to the limited sight distance, since the two Newell Road intersections on Woodland Avenue are off-set, it takes additional time for vehicles to clear the intersections.

[1] *Email February 20, 2013*
[2] *Some of the ADT volumes were provided by the City of Palo Alto*

Table I: Intersection Level of Service – Existing Condition

Int No.	Intersection	Traffic Control	Existing			
			A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Drive	AWS	8.0	A	7.8	A
2	Newell Rd & Hamilton Ave	TWS	11.1	B	10.4	B
3	Newell Rd and Channing Ave	Signal	15.5	B	15.4	B
4	Newell Rd & Woodland Ave - South Leg	AWS	7.8	A	8.0	A
	Newell Rd & Woodland Ave - North Leg	AWS	8.2	A	7.9	A
5	University Ave & Woodland Ave	Signal	46.4	D	40.0	D
6	University Ave & E Crescent Drive	TWS	56.4	**F**	44.0	**E**
7	University Ave & Center Drove	TWS	13.3	B	13.7	B
8	Hamilton Ave & W Crescent Drive	OWS	8.9	A	8.9	A
9	Channing Ave & Saint Francis Drive	AWS	7.8	A	7.4	A
10	Saint Francis Drive & Embarcadero Rd	Signal	18.7	B	9.6	A
11	W. Bayshore Rd & Newell Rd	OWS	10.4	B	10.5	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.0	A	8.6	A
13	W. Bayshore Rd & Channing Ave	OWS	9.7	A	10.6	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	42.9	**E**	57.8	**F**

Notes: LOS = Level of Service
X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections

Collision Analysis

TJKM conducted a collision analysis based on the Statewide Integrated Traffic Records System (SWITRS) for five years between 2006 and 2011. The analysis showed two collisions were recorded for the intersection of Newell Road and Edgewood Drive. The collisions involved parked cars on the east leg of Edgewood Drive. Two collisions in five years are not considered high. There were no collisions recorded for the other two study intersections on Newell Road. The collision information is contained in Appendix C.

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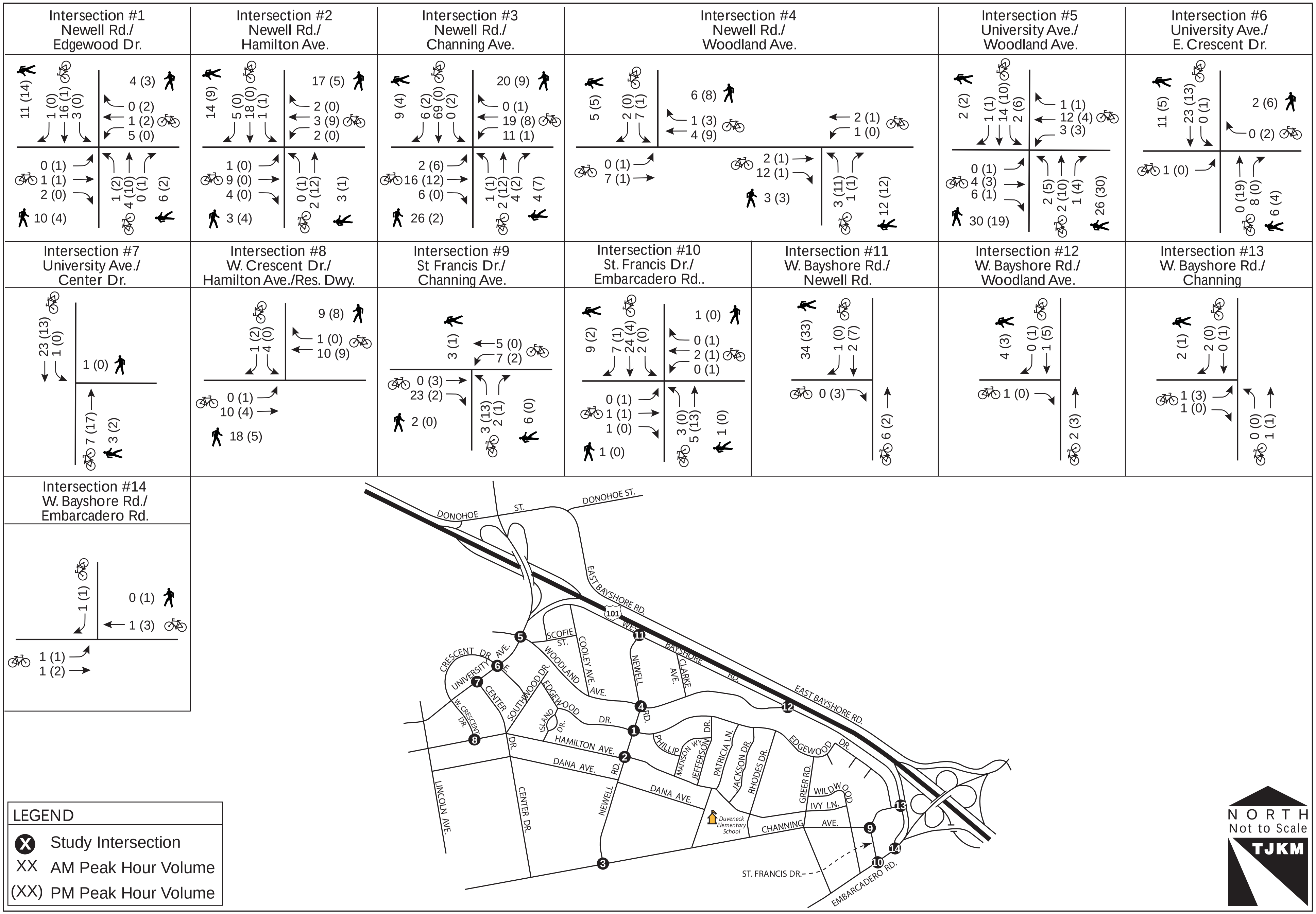
Figure 2

Existing Pedestrian and Bicycle Volumes



042-038-T4 - 1/20/14 - CT

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Existing Average Daily Traffic (ADT) Volumes

Figure 3

Scenario 1: No Project (Leave Existing Bridge in Place)

Under this scenario, the existing bridge would be left in place as is. That is, the existing 18-foot wide bridge would continue to operate. The level of service would not change from the existing condition in Table I.

No Project 2020 and 2035 Traffic Conditions

The study also includes a near-term (2020) and cumulative (2035) analysis. Based on the existing and projected 2035 information provided by the city for the intersection of University Avenue and Woodland Avenue, [3] TJKM was able to derive a growth factor. The analysis showed a growth rate of approximately one percent per year. Using the growth rate, TJKM developed the 2020 and 2035 No Project peak hour volumes as shown in Figure 4 and Figure 5 respectively.

Level of Service Analysis

Table II shows the results of the intersection No Project 2020 Condition level of service in this scenario. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and to LOS F in 2035. Detailed calculations are shown in Appendix D.

Table II: Intersection Level of Service: Scenario 1: No Project 2020 & 2035 Traffic Conditions

			2020				2035			
			A.M.		P.M.		A.M.		P.M.	
Int. No.	Intersection	Traffic Control	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	8.1	A	7.9	A	8.4	A	8.1	A
2	Newell Rd & Hamilton Ave	TWS	11.3	B	10.6	B	12.0	B	11.0	B
3	Newell Rd and Channing Ave	Signal	15.6	B	15.5	B	15.9	B	15.8	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	7.9	A	8.2	A	8.2	A	8.5	A
	Newell Rd & Woodland Ave - N. Leg	AWS	8.3	A	8.0	A	8.7	A	8.3	A
5	University Ave & Woodland Ave	Signal	55.1	**E**	44.5	D	84.0	**F**	65.4	**E**
6	University Ave & E Crescent Dr	TWS	72.1	**F**	55.1	**F**	145.5	**F**	109.0	**F**
7	University Ave & Center Dr	TWS	14.1	B	14.5	B	16.3	C	17.0	C
8	Hamilton Ave & W Crescent Dr	OWS	8.9	A	9.0	A	9.0	A	9.1	A
9	Channing Ave & Saint Francis Dr	AWS	7.9	A	7.5	A	8.3	A	7.6	A
10	Saint Francis Dr & Embarcadero Rd	Signal	19.3	B	9.9	A	21.1	C	10.4	B
11	W. Bayshore Rd & Newell Rd	OWS	10.6	B	10.7	B	11.1	B	11.3	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A	9.3	A	8.7	A
13	W. Bayshore Rd & Channing Ave	OWS	9.8	A	10.9	B	10.0	B	11.4	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	59.5	**F**	85.5	**F**	172.4	**F**	272.4	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

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[3] *November 26, 2013 email*

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Scenario I - No Project 2020 Peak Hour Volumes

Figure 4

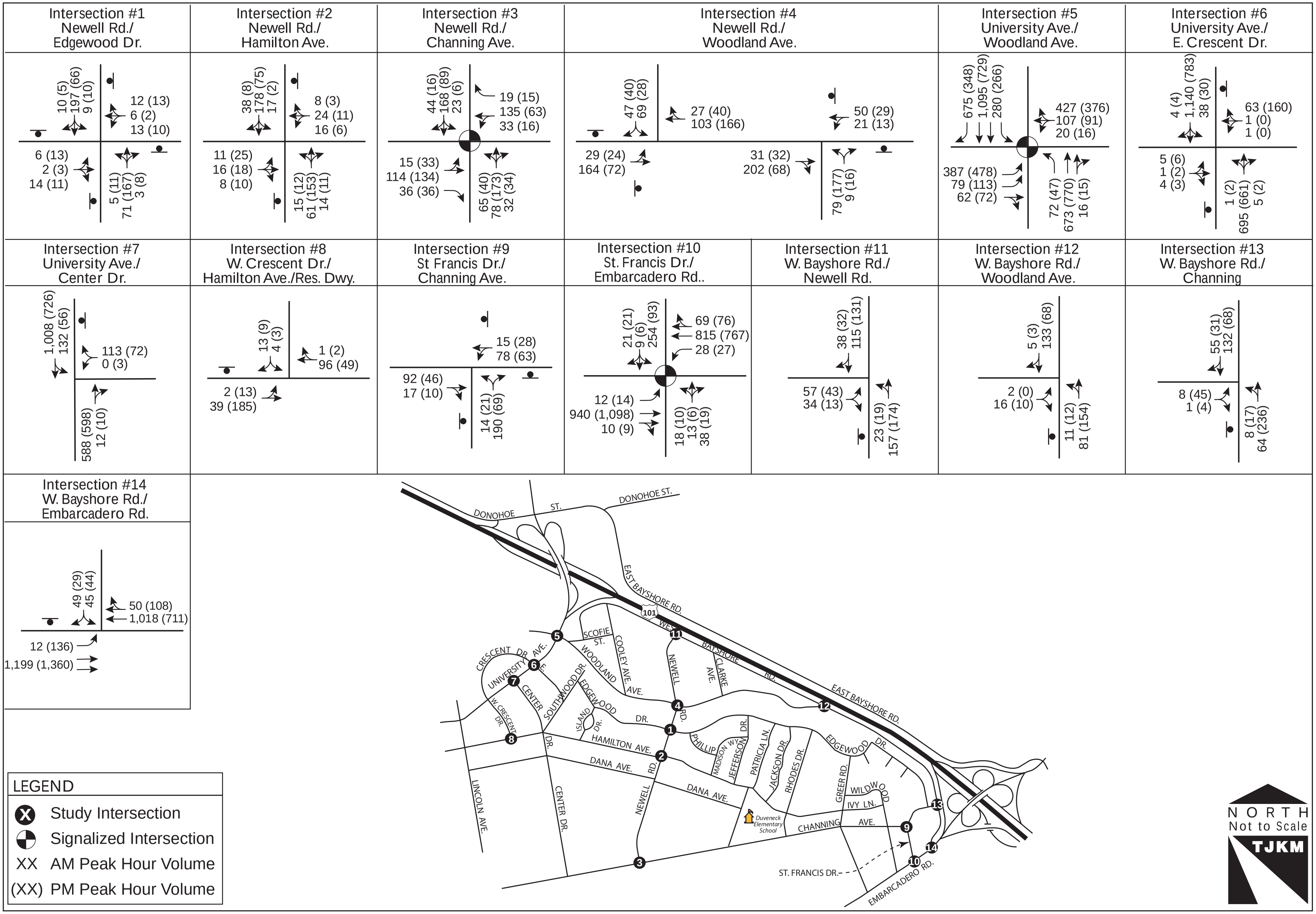

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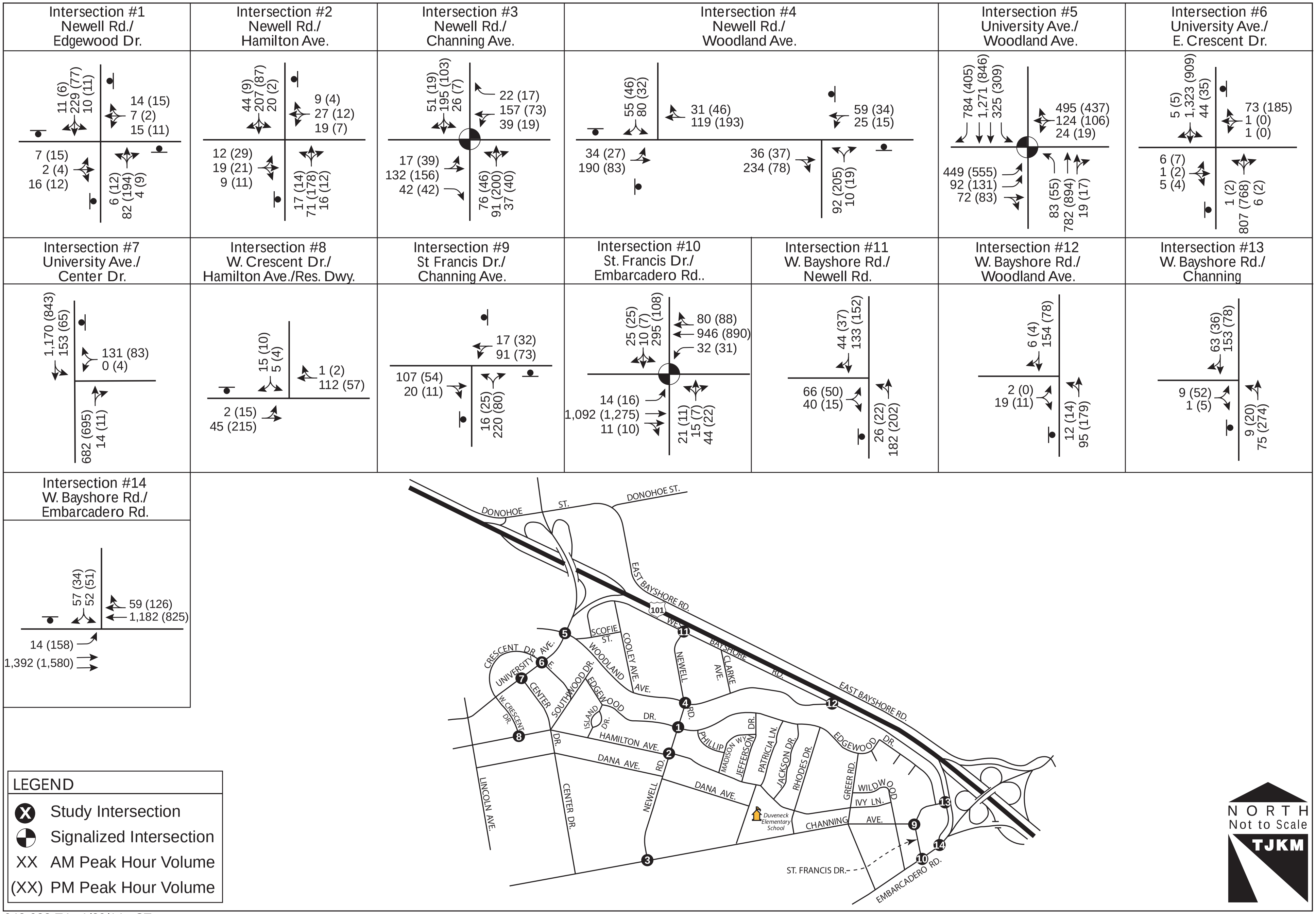
Figure 5

Scenario I - No Project 2035 Peak Hour Volumes



042-038-T4 - 1/20/14 - CT

Scenario 2: No Bridge Option

Proposed Project
This alternative assumes a bridge would not be accessible to autos, bikes or pedestrians. Consequently, auto traffic that currently has access to the bridge would be diverted to the adjacent roadways and intersections.

Traffic Distributions and Methodology
Redistribution of the auto traffic for the existing three intersections of Woodland Avenue and Newell Road (n), Woodland Avenue and Newell Road (s) and Woodland Avenue and Edgewood Drive was based on analyzing the existing traffic characteristics at the study intersections. Without the Newell Road Bridge being open to vehicle traffic, the existing vehicular traffic that uses the bridge would be diverted to either the study intersections along University Avenue to the west or to the study intersections to the east along West Bayshore Road. The traffic re-routing was based on the shortest routes, existing traffic patterns and knowledge of the area.
The redistributed peak hour turning movement volumes at the study intersections are shown in Figure 6.

Level of Service Analysis
Figure 6 shows Scenario 2: No Bridge Option existing peak hour turning movement volumes and lane geometry. Table III shows the results of the intersection level of service for the estimated existing traffic volume in this alternative. It is anticipated that there would be a slight increase in delay during the a.m. peak hour (no change with LOS D) and a slight decrease in delay during the p.m. peak hour (remains at LOS D) at the intersection of University Avenue/Woodland Avenue. The improvement is largely due to the fact that traffic that previously made a westbound to northbound right-turn from Woodland Avenue to University Avenue during the p.m. peak hour (a critical movement) would not be making that movement due to the closure of the bridge to vehicular traffic. Most of that traffic is estimated to become northbound through movements on University Avenue heading towards US 101.

Even though there is a slight LOS improvement during the p.m. peak hour at the intersection of University Avenue/Woodland Avenue, it should be noted that most of the diverted vehicles would be using University Avenue and other side streets in the area to reach their destinations.
The existing average daily traffic of approximately 3,000 vehicles per day that used the Newell Bridge would be diverted to many of the streets in the area, particularly Hamilton Avenue since it parallels University Avenue. Many of the side streets such as Center Drive, Lincoln Avenue, Crescent Drive and Chaucer Street that connect to University Avenue and Hamilton Avenue could also be impacted by the diverted traffic. It is anticipated that these streets would experience an increased level of noise and speed from the additional traffic. The analysis results indicated that the LOS at the intersection of University Avenue and E. Crescent Drive would deteriorate from the existing LOS E to LOS F during the p.m. peak hour. The LOS at the intersection of University Avenue and Center Drive would deteriorate from the existing LOS B to LOS C during the p.m. peak hour.

Naturally with the traffic being diverted away from the Newell Road Bridge, it is estimated that there would be a slight decrease in delay at the Newell Road and Woodland Avenue intersections. Detailed calculations are shown in Appendix D.

It could also be assumed that any emergency response times to this area might also be impacted under this scenario.

The results of the LOS analysis for the projected 2020 and 2035 No Bridge Option are shown in Table IV. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and to LOS F in 2035.

Table III: Intersection Level of Service: Scenario 2: No Bridge Project – Existing Traffic Conditions

Int. No.	Intersection	Traffic Control	No Bridge (Existing)			
			A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	6.9	A	6.9	A
2	Newell Rd & Hamilton Ave	TWS	9.5	A	9.3	A
3	Newell Rd and Channing Ave	Signal	15.6	B	16.2	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	-	-	-	-
	Newell Rd & Woodland Ave - N. Leg	AWS	7.2	A	7.2	A
5	University Ave & Woodland Ave	Signal	49.7	D	36.2	D
6	University Ave & E Crescent Dr	TWS	107.6	**F**	87.4	**F**
7	University Ave & Center Dr	TWS	14.3	B	15.7	C
8	Hamilton Ave & W Crescent Dr	OWS	9.0	A	8.9	A
9	Channing Ave & Saint Francis Dr	AWS	7.9	A	7.5	A
10	Saint Francis Dr & Embarcadero Rd	Signal	18.7	B	9.6	A
11	W. Bayshore Rd & Newell Rd	OWS	10.5	B	10.5	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A
13	W. Bayshore Rd & Channing Ave	OWS	9.8	A	10.9	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	42.2	**E**	54.2	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

Table IV: Intersection Level of Service: Scenario 2: No Bridge Project 2020 & 2035 Traffic Conditions

Int. No.	Intersection	Traffic Control	No Bridge (2020)				No Bridge (2035)			
			A.M.		P.M.		A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	6.9	A	6.9	A	6.9	A	6.9	A
2	Newell Rd & Hamilton Ave	TWS	9.6	A	9.3	A	9.8	A	9.4	A
3	Newell Rd and Channing Ave	Signal	15.7	B	16.3	B	16.0	B	16.6	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	-	-	-	-	-	-	-	-
	Newell Rd & Woodland Ave - N. Leg	AWS	7.2	A	7.3	A	7.4	A	7.3	A
5	University Ave & Woodland Ave	Signal	58.3	**E**	38.7	D	90.0	**F**	50.5	D
6	University Ave & E Crescent Dr	TWS	156.7	**F**	135.7	**F**	466.4	**F**	750.9	**F**
7	University Ave & Center Dr	TWS	15.2	C	17.1	C	18.4	C	22.2	C
8	Hamilton Ave & W Crescent Dr	OWS	9.1	A	9.0	A	9.2	A	9.1	A
9	Channing Ave & Saint Francis Dr	AWS	8.0	A	7.5	A	8.4	A	7.7	A
10	Saint Francis Dr & Embarcadero Rd	Signal	19.3	B	9.9	A	21.1	C	10.4	B
11	W. Bayshore Rd & Newell Rd	OWS	10.8	B	10.8	B	11.4	B	11.3	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A	9.3	A	8.7	A
13	W. Bayshore Rd & Channing Ave	OWS	10.0	A	11.2	B	10.3	B	11.9	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	58.7	**F**	79.5	**F**	172.7	**F**	254.3	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

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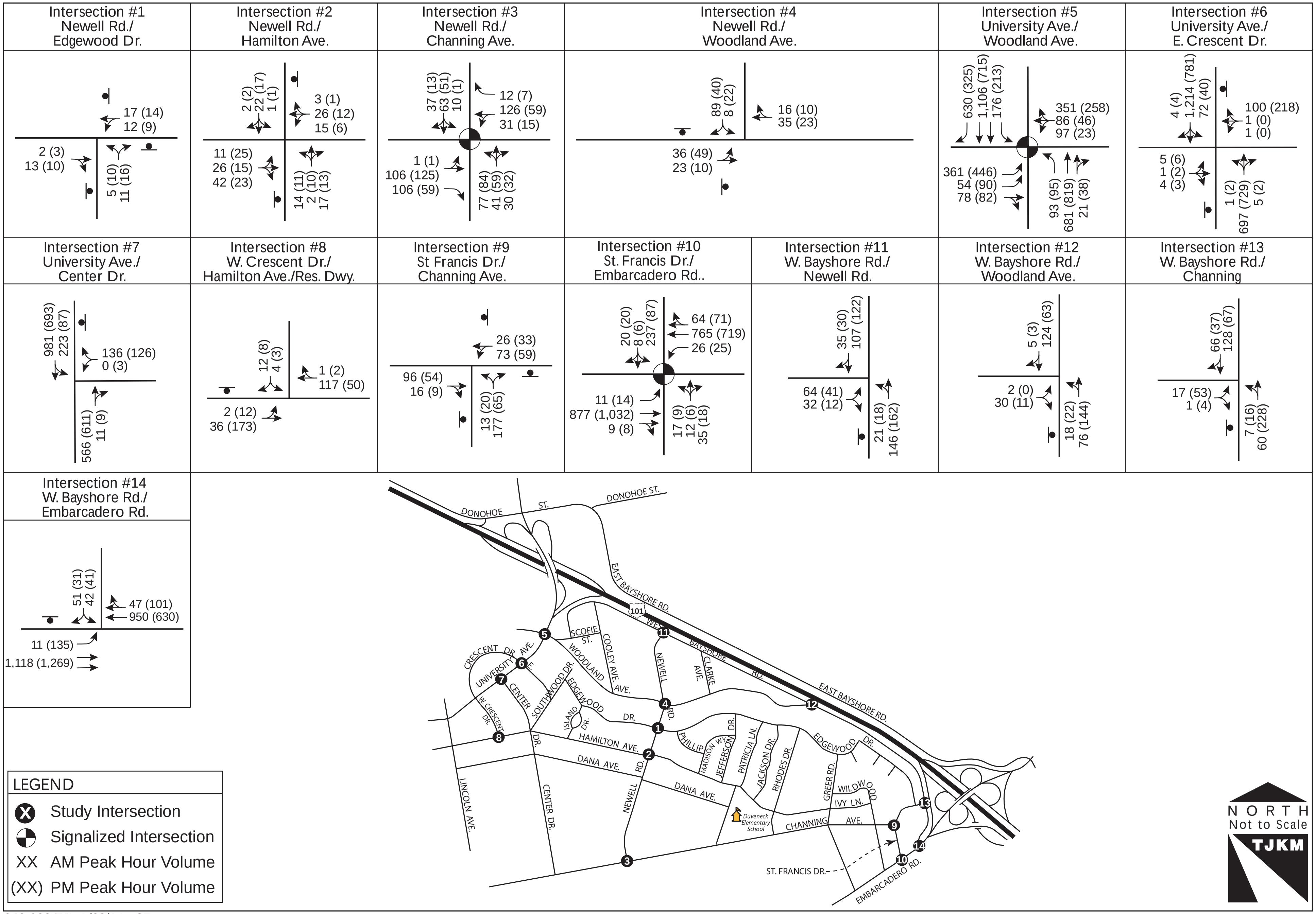
Scenario 2 - No Bridge Option - Existing Peak Hour Volume Estimates

Figure 6



042-038-T4 - 1/20/14 - CT

Scenario 3: Bicycle-Pedestrian Bridge Option

This alternative assumes that the proposed future Newell Road Bridge project would serve only bicycles and pedestrians and not be accessible to autos. Consequently, all auto traffic that currently has access to the bridge would be diverted to the adjacent roadways and intersections.

Rerouting of vehicular traffic under this scenario is similar to Scenario 2. The only difference is that only bicycle-pedestrian traffic would be allowed on the bridge. Therefore it is anticipated that the level of service results for autos would be similar to LOS results shown in Table III and IV of Scenario 2.

Under this scenario, it is anticipated that slightly more bicycles and pedestrians than that shown for the existing conditions in Figure 2 would use the bridge. Currently the maximum number of bicyclists that use the bridge during a.m. or p.m. peak hour is 17. The maximum existing pedestrian volume is 15 during both peak hours.

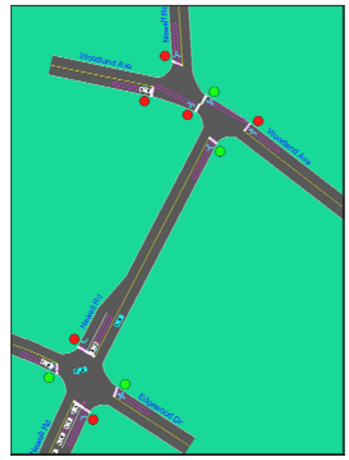
Scenario 4: Bicycle-Pedestrian Bridge Option with Limited Emergency Vehicle Access

This scenario would be similar to Scenario 3, the only difference is that vehicle access would be limited to emergency vehicles only. It is anticipated that the level of service results for autos would be similar to LOS results shown in Table III and IV of Scenario 2.

It is anticipated that special key access or sensor activated bollard would be installed to allow Emergency Vehicle Access only.

Scenario 5: One Lane Bi-Directional Vehicle Bridge Option with Traffic Signal Controls at Newell Rd & Woodland Ave

The operational analysis for this scenario relies primarily on the signal control and timing at the intersections of Newell Road/Woodland Avenue and Newell Road/Edgewood Road. The analysis was conducted by assuming that both of the intersections would be signalized to reflect the proposed One Lane Bi-Directional Vehicle Bridge option.



It is assumed that only one direction of traffic would be able to cross the bridge at any one time. The single family home on the east side and just south of the bridge would have its own directional signal to indicate direction of travel at all times.

Level of Service Analysis

Figure 7 shows the peak hour turning movement volumes and lane geometry of the proposed alternative. Table V shows the results of the intersection level of service for the Existing Traffic Conditions in this scenario. It is estimated that both of the signalized intersections at Newell Road/Woodland Avenue and Newell Road/Edgewood Road would reduce from LOS A to LOS C. Detailed calculations are shown in Appendix E.

Table V: Intersection Level of Service: Scenario 5 - Existing Traffic Conditions

Int. No.	Intersection	Traffic Control	1 Lane Bi-Directional Vehicle Bridge (Existing)			
			A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	**Signal**	15.7	B	23.7	C
2	Newell Rd & Hamilton Ave	TWS	11.1	B	10.4	B
3	Newell Rd and Channing Ave	Signal	15.5	B	15.4	B
4	Newell Rd & Woodland Ave - S. Leg	**Signal**	6.6	A	6.1	A
	Newell Rd & Woodland Ave - N. Leg	**Signal**	25.1	C	16.9	B
5	University Ave & Woodland Ave	Signal	46.4	D	40.0	D
6	University Ave & E Crescent Dr	AWS	56.4	**F**	44.0	**E**
7	University Ave & Center Dr	TWS	13.3	B	13.7	B
8	Hamilton Ave & W Crescent Dr	OWS	8.9	A	8.9	A
9	Channing Ave & Saint Francis Dr	AWS	7.8	A	7.4	A
10	Saint Francis Dr & Embarcadero Rd	Signal	18.7	B	9.6	A
11	W. Bayshore Rd & Newell Rd	OWS	10.4	B	10.5	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.0	A	8.6	A
13	W. Bayshore Rd & Channing Ave	OWS	9.7	A	10.6	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	42.9	**E**	57.8	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

The results of the LOS analysis for the projected 2020 and 2035 Scenario V: One Lane Bi-Directional Vehicle Bridge Option is shown in Table VI. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and to LOS F in 2035.

Table VI: Intersection Level of Service: Scenario 5 - 2020 & 2035 Traffic Conditions

Int. No.	Intersection	Traffic Control	1 Lane Bi-Directional Vehicle Bridge (2020)				1 Lane Bi-Directional Vehicle Bridge (2035)			
			A.M.		P.M.		A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	16.3	B	24.6	C	17.4	B	26.6	C
2	Newell Rd & Hamilton Ave	TWS	11.3	B	10.6	B	12.0	B	11.0	B
3	Newell Rd and Channing Ave	Signal	15.6	B	15.5	B	15.9	B	15.8	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	6.7	A	6.3	A	7.1	A	7.0	A
	Newell Rd & Woodland Ave - N. Leg	AWS	26.1	C	17.1	B	28.8	C	18.7	B
5	University Ave & Woodland Ave	Signal	55.1	**E**	44.5	D	84.0	**F**	65.4	**E**
6	University Ave & E Crescent Dr	AWS	72.1	**F**	55.1	**F**	145.5	**F**	109.0	**F**
7	University Ave & Center Dr	TWS	14.1	B	14.5	B	16.3	C	17.0	C
8	Hamilton Ave & W Crescent Dr	OWS	8.9	A	9.0	A	9.0	A	9.1	A
9	Channing Ave & Saint Francis Dr	AWS	7.9	A	7.5	A	8.3	A	7.6	A
10	Saint Francis Dr & Embarcadero Rd	Signal	19.3	B	9.9	A	21.1	C	10.4	B
11	W. Bayshore Rd & Newell Rd	OWS	10.6	B	10.7	B	11.1	B	11.3	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A	9.3	A	8.7	A
13	W. Bayshore Rd & Channing Ave	OWS	9.8	A	10.9	B	10.0	B	11.4	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	59.5	**F**	85.5	**F**	172.4	**F**	272.4	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

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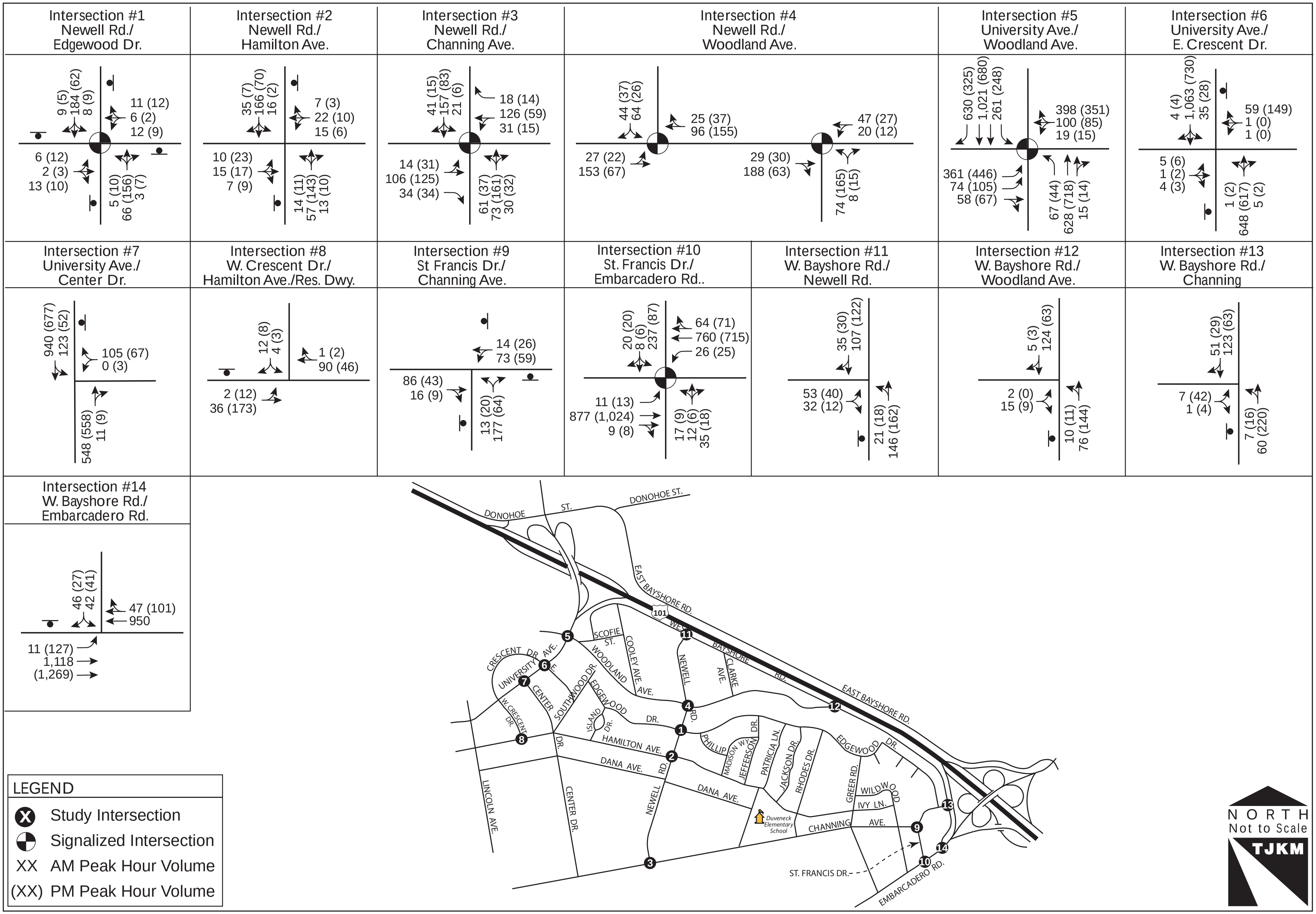
Scenario 5 - One-Lane Bi-Directional Vehicle Bridge Option with Signal Control

Figure 7



LEGEND

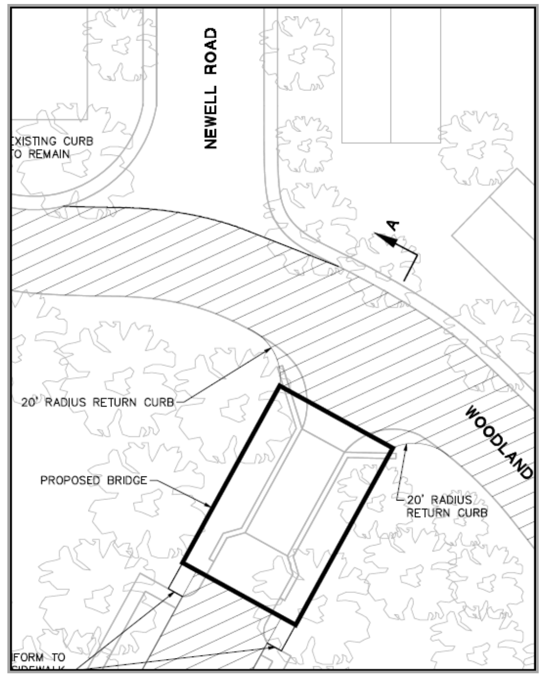
- Study Intersection
- Signalized Intersection
- XX AM Peak Hour Volume
- (XX) PM Peak Hour Volume

042-038-T4 - 1/20/14 - CT

Scenario 6: New Vehicle Bridge Using Existing Bridge Alignment

Proposed Project

This alternative assumes keeping the bridge in its current location but widening it to accommodate autos, pedestrians and bicyclists (sharrows) in both directions of travel. The limited intersection sight distance presented by the off-set alignment will continue to exist.



Traffic Estimation Methodology

Normally drivers tend to choose a route with the shortest travel time to their destinations. By improving the bridge geometry of the existing Newell Road Bridge, it is possible that a route using the improved bridge could become the shortest path for some drivers. Therefore, it is possible that the improved bridge might appear to be more attractive as compared to the existing unimproved bridge. Based primarily on the methodology to evaluate Urban Street Segments LOS contained in the 2010 Highway Capacity Manual (HCM 2010), TJKM estimated approximate change to the travel time for drivers using an improved bridge with existing alignment.

Based on Equation 17-6 of the HCM 2010, the travel time for traffic using the bridge consists of the following elements:

- Time for a through vehicle exiting the segment at the boundary intersections, including the time required to accelerate to the running speed, less the start-up lost time (stop or signal).
- Travel time along the segment
- Delay at boundary intersections
- Delay due to other factors along the segment (e.g. curb parking, lane width)

With a new vehicle bridge using the existing alignment, the lane width on the bridge would be widened from 9' per lane to at least 12' per lane (assumed to be 14' food lane with sharrows) which contributes to a width adjustment factor change from 0.96 to 1.0 for the saturation flow of the lane group on the improved bridge for the two intersections at the end of the bridge. In addition, the sight visibility and the pavement condition would be improved.

Using the potential changes for each component of travel as indicated above, for a new vehicle bridge using the existing alignment the travel time on the bridge could be reduced by approximately 0.9-1.0 second. Assuming a 20-25 mph speed on the bridge, a 0.9-1.0 second improvement translates to approximately 40 feet.

Therefore, in the vicinity of the project, it is assumed that motorists could find the new bridge alternative to be more attractive than the existing bridge due to the reduced travel time. Since the reduction in travel time is relatively small, it is anticipated that only a few vehicles would change their travel patterns based on this factor alone. However, in reality, an additional number of drivers might be attracted to use the bridge simply because it's new and easier to navigate. Based on professional engineering judgment and experience, TJKM has assumed that up to four percent more vehicles could use the new bridge due to the slight increase in capacity and the improved nature of the replacement bridge. Detailed HCM assumptions for each component of travel are contained in Appendix F.

Level of Service Analysis

Figure 8 shows the peak hour turning movement volumes and lane geometry of the proposed alternative. Table VII shows the results of the intersection level of service for the Existing Traffic Conditions in this scenario. The results show only minor increase in delays with no change in LOS for all study intersections. Detailed calculations are shown in Appendix F.

The results of the LOS analysis for the projected 2020 and 2035 Scenario 6: New Vehicle Bridge Using Existing Bridge Alignment is shown in Table VIII. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and to LOS F in 2035.

Table VII: Intersection Level of Service: Scenario 6 – Existing Traffic Conditions

Int. No.	Intersection	Traffic Control	New Bridge with Existing Alignment (Existing)			
			A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	8.0	A	7.8	A
2	Newell Rd & Hamilton Ave	TWS	11.2	B	10.5	B
3	Newell Rd and Channing Ave	Signal	15.5	B	15.3	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	7.8	A	8.1	A
	Newell Rd & Woodland Ave - N. Leg	AWS	8.2	A	7.9	A
5	University Ave & Woodland Ave	Signal	46.6	D	40.3	D
6	University Ave & E Crescent Dr	TWS	54.9	**F**	43.0	**E**
7	University Ave & Center Dr	TWS	13.3	B	13.7	B
8	Hamilton Ave & W Crescent Dr	OWS	8.9	A	8.9	A
9	Channing Ave & Saint Francis Dr	AWS	7.8	A	7.4	A
10	Saint Francis Dr & Embarcadero Rd	Signal	18.7	B	9.6	A
11	W. Bayshore Rd & Newell Rd	OWS	10.4	B	10.5	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.0	A	8.6	A
13	W. Bayshore Rd & Channing Ave	OWS	9.6	A	10.6	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	42.9	**E**	53.2	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

Table VIII: Intersection Level of Service: Scenario 6 - 2020 & 2035 Traffic Conditions

Int. No.	Intersection	Traffic Control	New Bridge with Existing Alignment (2020)				New Bridge with Existing Alignment (2035)			
			A.M.		P.M.		A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	8.1	A	7.9	A	8.4	A	8.2	A
2	Newell Rd & Hamilton Ave	TWS	11.4	B	10.7	B	12.1	B	11.1	B
3	Newell Rd and Channing Ave	Signal	15.6	B	15.5	B	15.9	B	15.7	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	7.9	A	8.2	A	8.2	A	8.6	A
	Newell Rd & Woodland Ave - N. Leg	AWS	8.4	A	8.1	A	8.8	A	8.4	A
5	University Ave & Woodland Ave	Signal	55.5	**E**	45.0	D	84.6	**F**	66.4	**E**
6	University Ave & E Crescent Dr	TWS	69.8	**F**	53.6	**F**	138.6	**F**	103.8	**F**
7	University Ave & Center Dr	TWS	14.0	B	14.4	B	16.2	C	16.9	C
8	Hamilton Ave & W Crescent Dr	OWS	8.9	A	9.0	A	9.0	A	9.1	A
9	Channing Ave & Saint Francis Dr	AWS	7.9	A	7.4	A	8.2	A	7.6	A
10	Saint Francis Dr & Embarcadero Rd	Signal	19.3	B	9.9	A	21.1	C	10.4	B
11	W. Bayshore Rd & Newell Rd	OWS	10.6	B	10.7	B	11.1	B	11.3	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A	9.3	A	8.7	A
13	W. Bayshore Rd & Channing Ave	OWS	9.7	A	10.9	B	10.0	B	11.4	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	59.5	**F**	76.8	**F**	172.4	**F**	236.6	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

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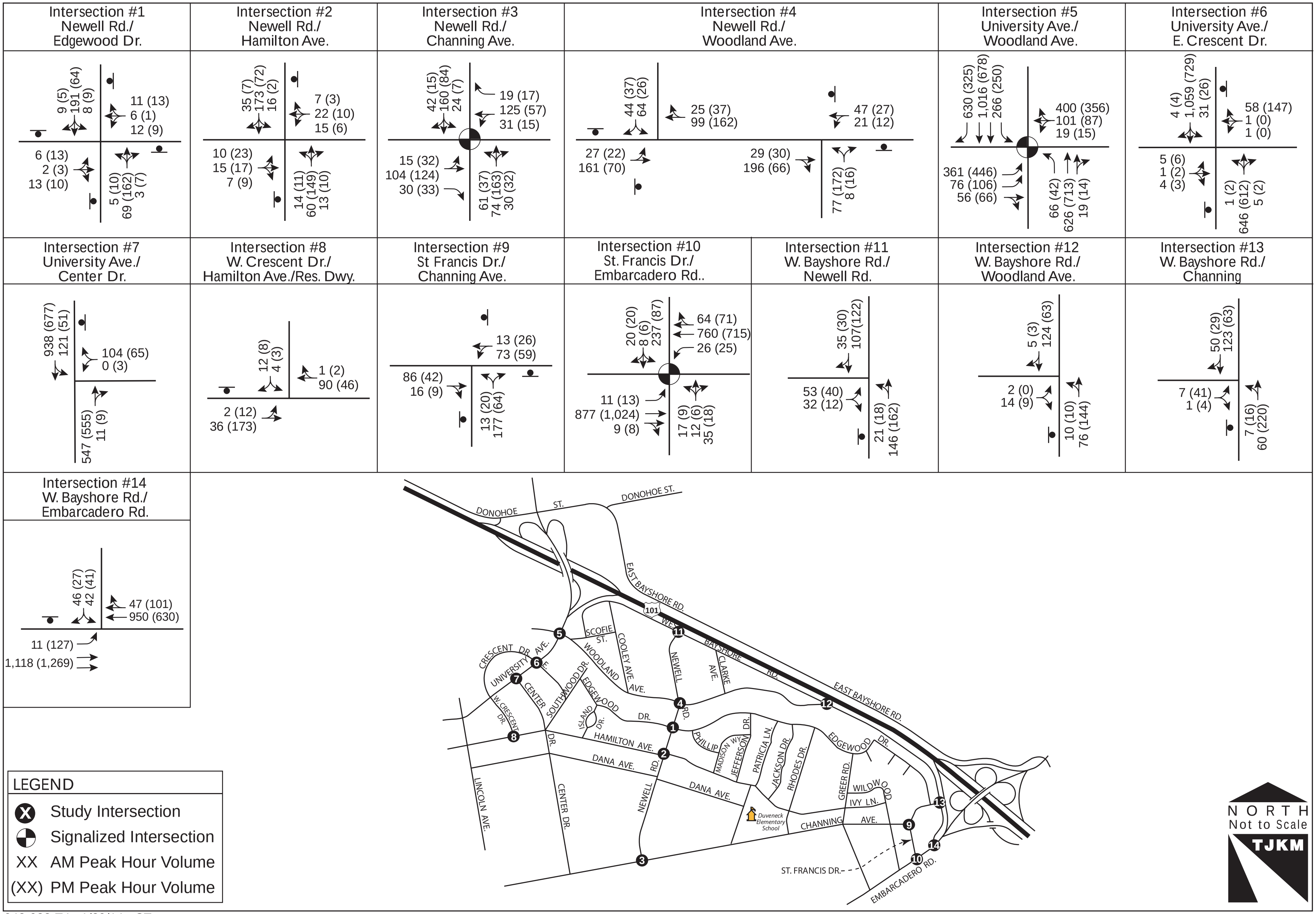
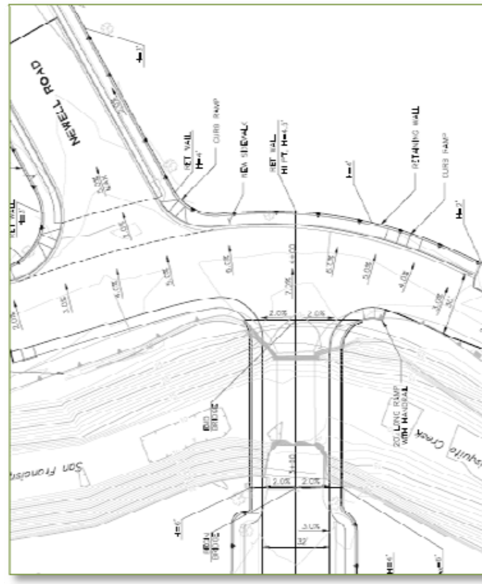
Scenario 6 - New Vehicle Bridge with Existing Alignment - Existing Peak Hour Volume Estimates

Figure 8



042-038-T4 - 1/20/14 - CT

Scenario 7: Two Lane Vehicle Bridge Option with a Partial Realignment of Newell Rd



Proposed Project
The proposed project would reduce the distance of the current North-South off-set of Newell Road by 30 feet. The partial realignment would result in the offset intersection being 60 feet apart.

Traffic Estimation Methodology
Normally drivers tend to choose a route with the shortest travel time to their destinations. By improving the bridge and changing the alignment or geometry of the existing Newell Road Bridge, it is possible that a route using the improved bridge could become the shortest path for some drivers. Therefore, it is possible that the improved bridge might appear to be more attractive as compared to the existing unimproved bridge. Based primarily on the methodology to evaluate Urban Street Segments LOS contained in the 2010 Highway Capacity Manual (HCM 2010), TJKM estimated approximate change to the travel time for drivers using an improved bridge with partial realignment.
Based on Equation 17-6 of the HCM 2010, the travel time for traffic using the bridge consists of the following elements:

- Time for a through vehicle exiting the segment at the boundary intersections, including the time required to accelerate to the running speed, less the start-up lost time (stop or signal).
- Travel time along the segment
- Delay at boundary intersections
- Delay due to other factors along the segment (e.g. curb parking, lane width)

With a partial realignment of Newell Road, the travel distance would be reduced from 410' to 380'. Also, the lane width on the bridge would be widened from 9' per direction to 14' per direction, which contributes to a width adjustment factor change from 0.96 to 1.0 for the saturation flow of the lane group on the bridge for northern intersection of the "bridge". In addition, the sight visibility and the pavement condition would also be improved.

That is, assuming a partial realignment of Newell Road, the combined cumulative influence due to changes for each component of travel as indicated above, the estimated reduction in travel time is approximately 1.4-1.55 seconds. Assuming a speed of 25mph on the partially aligned bridge, 1.4-1.55 seconds translates to approximately 60 feet.

Therefore, in the vicinity of the project, it is assumed that motorists could find the new bridge alternative to be more attractive than the existing bridge due to the reduced travel time. Since the reduction in travel time is relatively small, it is anticipated that only a few vehicles would change their travel patterns based on this factor alone. However, in reality, an additional number of drivers might be attracted to use the bridge simply because it's new and easier to navigate. Based on professional engineering judgment and experience, TJKM has assumed that up to six percent more vehicles could use the new bridge due to the slight increase in capacity and the improved nature of the replacement bridge. Detailed HCM assumptions for each component of travel are contained in Appendix F.

Level of Service Analysis
Figure 9 shows the peak hour turning movement volumes and lane geometry of the proposed alternative. Table IX shows the results of the intersection level of service for the existing condition in this scenario. It is estimated that only slight changes of delays are expected at a few intersections. Detailed calculations are shown in Appendix G.

Table IX: Intersection Level of Service: Scenario 7 – Existing Traffic Conditions

Int. No.	Intersection	Traffic Control	Partial Alignment (Existing)			
			A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	8.0	A	7.9	A
2	Newell Rd & Hamilton Ave	TWS	11.2	B	10.5	B
3	Newell Rd and Channing Ave	Signal	15.5	B	15.4	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	7.8	A	8.1	A
	Newell Rd & Woodland Ave - N. Leg	AWS	8.3	A	8.0	A
5	University Ave & Woodland Ave	Signal	46.8	D	40.8	D
6	University Ave & E Crescent Dr	TWS	54.1	**F**	42.6	**E**
7	University Ave & Center Dr	TWS	13.3	B	13.6	B
8	Hamilton Ave & W Crescent Dr	OWS	8.9	A	8.9	A
9	Channing Ave & Saint Francis Dr	AWS	7.8	A	7.4	A
10	Saint Francis Dr & Embarcadero Rd	Signal	18.7	B	9.6	A
11	W. Bayshore Rd & Newell Rd	OWS	10.4	B	10.5	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.0	A	8.6	A
13	W. Bayshore Rd & Channing Ave	OWS	9.6	A	10.6	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	42.9	**E**	53.2	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

The results of the LOS analysis for the projected 2020 and 2035 Scenario VII: Two Lane Vehicle Bridge Option with a Partial Realignment of Newell Rd is shown in Table X. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and to LOS F in 2035.

Table X: Intersection Level of Service: Scenario 7 - 2020 & 2035 Traffic Conditions

Int. No.	Intersection	Traffic Control	Partial Alignment (2020)				Partial Alignment (2035)			
			A.M.		P.M.		A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	8.2	A	8.0	A	8.5	A	8.2	A
2	Newell Rd & Hamilton Ave	TWS	11.5	B	10.7	B	12.2	B	11.2	B
3	Newell Rd and Channing Ave	Signal	15.6	B	15.5	B	15.9	B	15.8	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	7.9	A	8.3	A	8.3	A	8.6	A
	Newell Rd & Woodland Ave - N. Leg	AWS	8.4	A	8.1	A	8.8	A	8.4	A
5	University Ave & Woodland Ave	Signal	55.6	**E**	45.8	D	84.9	**F**	68.5	**E**
6	University Ave & E Crescent Dr	TWS	68.7	**F**	53.0	**F**	135.3	**F**	102.0	**F**
7	University Ave & Center Dr	TWS	14.0	B	14.4	B	16.2	C	16.8	C
8	Hamilton Ave & W Crescent Dr	OWS	8.9	A	9.0	A	9.0	A	9.1	A
9	Channing Ave & Saint Francis Dr	AWS	7.9	A	7.4	A	8.2	A	7.6	A
10	Saint Francis Dr & Embarcadero Rd	Signal	19.3	B	9.9	A	21.1	C	10.4	B
11	W. Bayshore Rd & Newell Rd	OWS	10.6	B	10.7	B	11.1	B	11.3	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A	9.3	A	8.7	A
13	W. Bayshore Rd & Channing Ave	OWS	9.7	A	10.8	B	10.0	B	11.4	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	59.5	**F**	76.8	**F**	172.4	**F**	236.6	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

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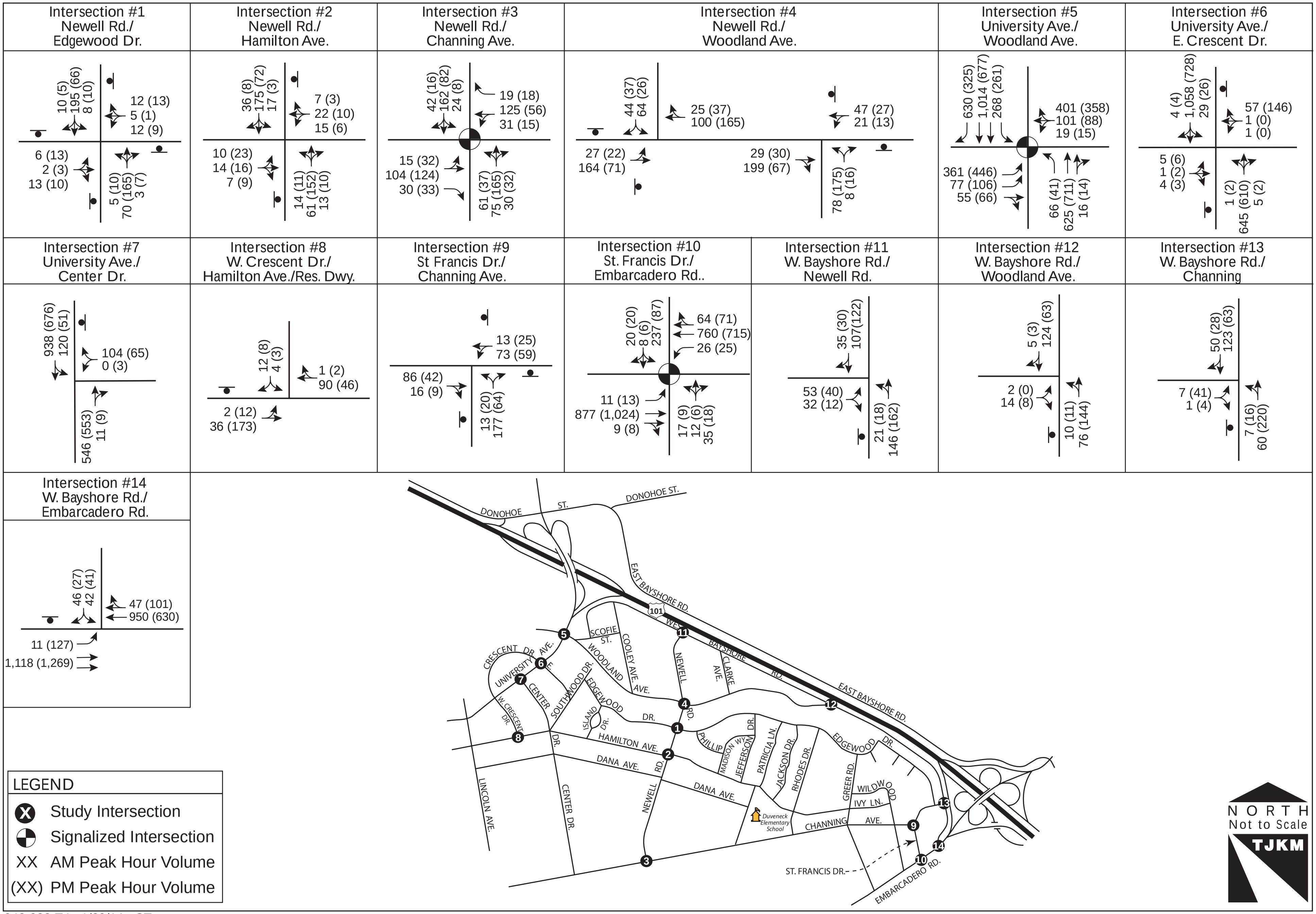
Figure 9

Scenario 7 - Two Lane Vehicle Bridge with Partial Realignment - Existing Peak Hour Volume Estimates

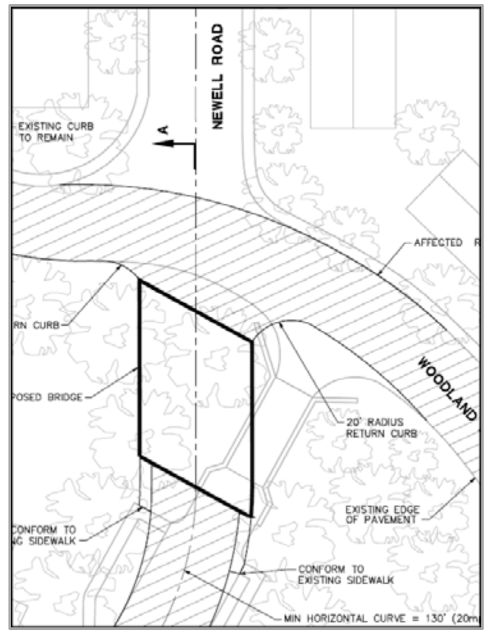


042-038-T4 - 1/20/14 - CT

Scenario 8: Two Lane Vehicle Bridge Option with Full Realignment of Newell Road

Proposed Project

This scenario assumes the full realignment of Newell Road Bridge and the addition of 14-foot sharrows in both directions of travel. Instead of being two off-set intersections, the two approaches of Newell Road at Woodland Avenue are combined and analyzed as a single intersection.



The proposed realignment of the intersection would totally remove the slight intersection visibility issue with the currently off-set intersections.

Traffic Estimation Methodology

Normally drivers tend to choose a route with the shortest travel time to their destinations. By improving the bridge and changing the alignment or geometry of the existing Newell Road Bridge, it is possible that a route using the improved bridge could become the shortest path for some drivers. Therefore, it is possible that the improved bridge might appear to be more attractive as compared to the existing unimproved bridge. Based primarily on the methodology to evaluate Urban Street Segments LOS contained in the 2010 Highway Capacity Manual (HCM 2010), TJKM estimated approximate change to the travel time for drivers using an improved bridge and full realignment.
Based on Equation 17-6 of the HCM 2010, the travel time for traffic using the bridge consists of the following elements:

- Time for a through vehicle exiting the segment at the boundary intersections, including the time required to accelerate to the running speed, less the start-up lost time (stop or signal).
- Travel time along the segment
- Delay at boundary intersections
- Delay due to other factors along the segment (e.g. curb parking, lane width)

Assuming full alignment of Newell Road, the combined cumulative influence due to changes for each component of travel as indicated above is estimated to be a reduction in running time of approximately 2.3-2.4 seconds. Assuming a speed of 25mph traveling on the fully aligned bridge, 2.3-2.4 seconds translates to approximately 90 feet.

Therefore, in the vicinity of the project, it is assumed that motorists could find the new bridge alternative to be more attractive than the existing bridge due to the reduced travel time. Since the reduction in travel time is relatively small, it is anticipated that only a few vehicles would change their travel patterns based on this factor alone. However, in reality, an additional number of drivers might be attracted to use the bridge simply because it's new and easier to navigate. Based on professional engineering judgment and experience, TJKM has assumed that up to 10 percent more vehicles could use the new bridge due to the slight increase in capacity and the improved nature of the replacement bridge. Detailed HCM assumptions for each component of travel are contained in Appendix F.

Level of Service Analysis

Figure 10 shows the peak hour turning movement volumes and lane geometry of the proposed alternative. Table XI shows the results of the Existing Traffic Volume Conditions intersection level of service in this scenario. Only slight increase in delays is shown for a few intersections with no change in LOS. Detailed calculations are shown in Appendix H.

Table XI: Intersection Level of Service: Scenario 8 – Existing Traffic Conditions

Int. No.	Intersection	Traffic Control	Full Alignment (Existing)			
			A.M.		P.M.	
			Delay (sec)	LOS	Delay (sec)	LOS
1	Newell Rd & Edgewood Dr	AWS	8.1	A	7.9	A
2	Newell Rd & Hamilton Ave	TWS	11.3	B	10.6	B
3	Newell Rd and Channing Ave	Signal	15.4	B	15.3	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	8.1	A	8.2	A
5	Newell Rd & Woodland Ave - N. Leg	Signal	47.0	D	40.7	D
6	University Ave & E Crescent Drive	TWS	52.9	**F**	41.9	**E**
7	University Ave & E Crescent Dr	TWS	13.3	B	13.6	B
8	University Ave & Center Dr	OWS	8.9	A	8.9	A
9	Hamilton Ave & W Crescent Dr	AWS	7.8	A	7.4	A
10	Channing Ave & Saint Francis Dr	Signal	18.7	B	9.6	A
11	Saint Francis Dr & Embarcadero Rd	OWS	10.4	B	10.5	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A
13	W. Bayshore Rd & Channing Ave	OWS	9.6	A	10.6	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	42.9	**E**	53.2	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

The results of the LOS analysis for the projected 2020 and 2035 Scenario VIII: Two Lane Vehicle Bridge Option with a Full Alignment of Newell Rd is shown in Table XII. The intersection of University Avenue and Woodland Avenue deteriorates to LOS E in 2020 and LOS F in 2035.

Table XII: Intersection Level of Service: Scenario 8 - 2020 & 2035 Traffic Conditions

Int. No.	Intersection	Traffic Control	Full Alignment (2020) A.M. Delay (sec)	Full Alignment (2020) A.M. LOS	Full Alignment (2020) P.M. Delay (sec)	Full Alignment (2020) P.M. LOS	Full Alignment (2035) A.M. Delay (sec)	Full Alignment (2035) A.M. LOS	Full Alignment (2035) P.M. Delay (sec)	Full Alignment (2035) P.M. LOS
1	Newell Rd & Edgewood Dr	AWS	8.2	A	8.0	A	8.6	A	8.3	A
2	Newell Rd & Hamilton Ave	TWS	11.6	B	10.8	B	12.3	B	11.3	B
3	Newell Rd and Channing Ave	Signal	15.6	B	15.5	B	15.9	B	15.7	B
4	Newell Rd & Woodland Ave - S. Leg	AWS	8.2	A	8.3	A	8.6	A	8.7	A
5	Newell Rd & Woodland Ave - N. Leg	Signal	55.9	**E**	45.6	D	85.5	**F**	68.0	**E**
6	University Ave & E Crescent Drive	TWS	66.7	**F**	51.9	**F**	129.6	**F**	98.6	**F**
7	University Ave & E Crescent Dr	TWS	14.0	B	14.3	B	16.2	C	16.7	C
8	University Ave & Center Dr	OWS	8.9	A	9.0	A	9.0	A	9.1	A
9	Hamilton Ave & W Crescent Dr	AWS	7.9	A	7.4	A	8.2	A	7.6	A
10	Channing Ave & Saint Francis Dr	Signal	19.3	B	9.9	A	21.1	C	10.4	B
11	Saint Francis Dr & Embarcadero Rd	OWS	10.6	B	10.7	B	11.1	B	11.3	B
12	W. Bayshore Rd & Woodland Ave	OWS	9.1	A	8.6	A	9.3	A	8.7	A
13	W. Bayshore Rd & Channing Ave	OWS	9.7	A	10.8	B	10.0	A	11.4	B
14	W. Bayshore Rd & Embarcadero Rd	OWS	59.5	**F**	76.8	**F**	172.4	**F**	236.6	**F**

Note:
LOS = Level of Service, X = Intersection level of service
X.X = Overall intersection delay in seconds per vehicle for signalized intersections
X.X = Delay for minor movement at Unsignalized intersections
AWS = All Way Stop control; TWS = Two Way Stop control; OWS = One Way Stop

Potential Concerns with the Full Realignment Alternative

One of the potential concerns with a realigned intersection is loss of apparent traffic calming effect of the existing offset intersection. Note that this might not be an issue with an All Way Stop controlled intersection. There are two ways to slow down drivers - physical deterrents or psychological reminders. With a radar feedback sign, drivers have two options: to slow down or keep going. On the other hand, when approaching a speed hump, speed cushion, or speed table, there is only one choice; drivers must slow down. The following two traffic calming treatments on Newell Road Bridge in advance of the intersection at Woodland Avenue could be considered: A speed cushion or a raised crosswalk.

Raised Crosswalk

When supplemented with an advance warning pedestrian crossing sign utilizing high brightness light emitting diodes (LED), either approach would provide optimum traffic calming both day and night.

TJKM recommends installing a raised crosswalk on each approach of Newell Road at the intersection of Newell Road and Woodland Avenue. The raised crosswalk would act as a deterrent to speeding and make the proposed realigned intersection alternative less attractive as a cut through route.

Speed Cushion

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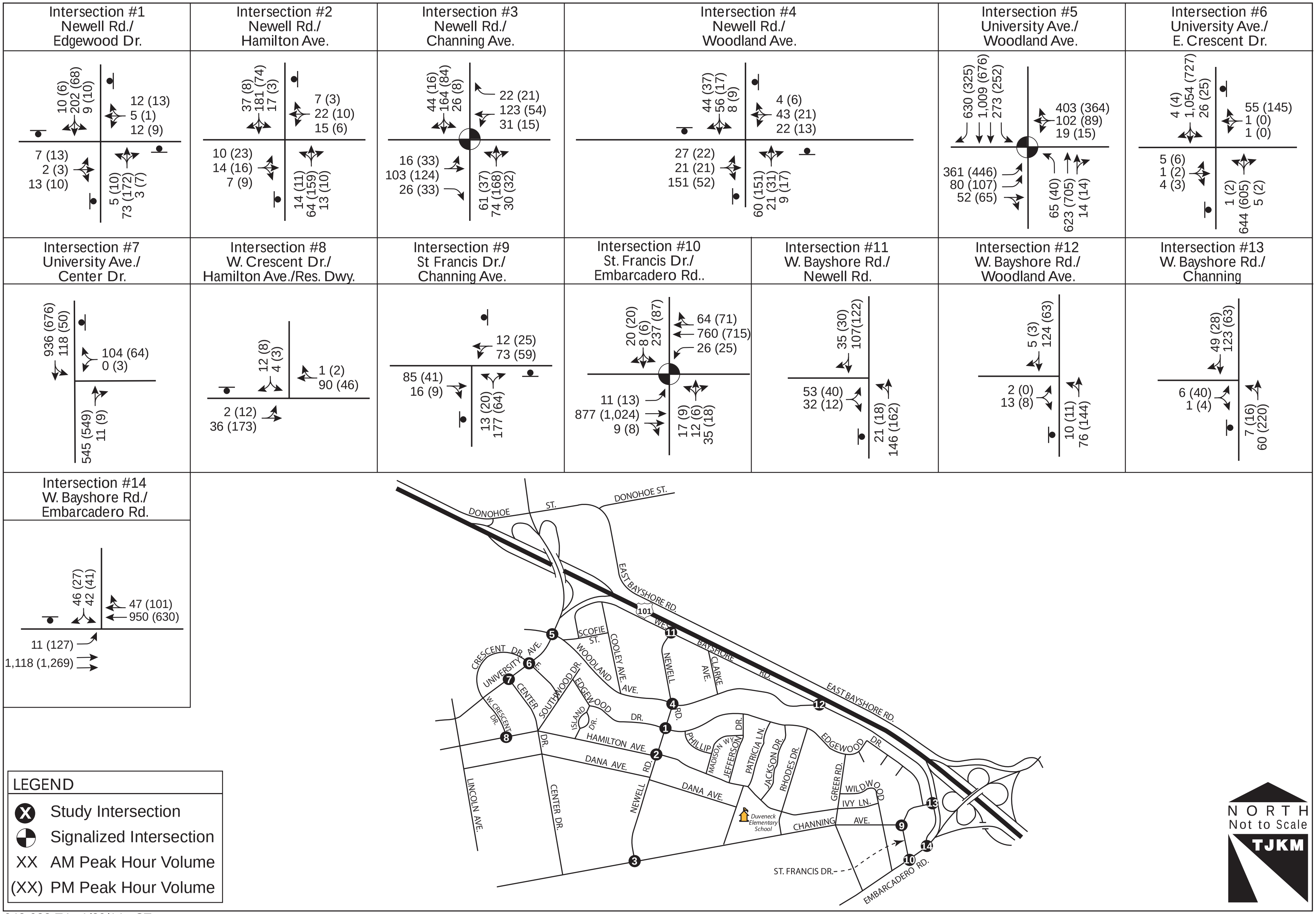
Scenario 8 - Two Lane Vehicle Bridge with Full Realignment - Existing Peak Hour Volume Estimates

Figure 10



042-038-T4 - 1/20/14 - CT

TIRE Index (Traffic Infusion on Residential Environment) Analysis

Residential areas are more sensitive to traffic because relatively small increases in traffic can impact the livability of the neighborhood. A tool for measuring the effects of increases in traffic on neighborhood "livability" is the TIRE index or Traffic Infusion on Residential Environments. The TIRE Index is derived from a theory by D.K. Goodrich based on work by Professor Appleyard of the University of California at Berkeley. TIRE is based on the hypothesis that a given increase in traffic volume has a greater impact on the residential environment along a residential street with a low traffic volume than along a street with a high pre-existing volume. TIRE represents the effect of traffic on the safety and comfort of human activities such as walking, bicycling and playing on or near a street and on the freedom to maneuver personal autos in and out of residential driveways.

The TIRE Index table gives TIRE values associated with various daily traffic volume ranges. The mathematical relationships are logarithmic. A street with a TIRE value of 3 or greater is considered to function primarily as a traffic street and to exhibit significantly impaired residential environment The projected difference between a pre and post-project TIRE value is the predicted impact of the project on residential environment. Any projected change of 0.1 or greater would be noticeable to residents.

Whereas most other traffic analysis methods are based on peak-hour traffic conditions, the TIRE index is based on daily traffic conditions. It uses average daily traffic (ADT) volumes to determine the amount of daily traffic that could be added to a roadway before residents would perceive the increase in traffic. The amount of daily traffic that can be added before residents would notice directly correlates to the amount of daily traffic already present on the street. According to this methodology, an impact occurs when the difference in index between existing and project conditions is 0.10 or more. An increase in index of 0.10 corresponds to an approximate increase in ADT of between 20 and 30 percent.

ADT for 12 roadway segments were conducted and are shown in Figure 3. A TIRE analysis for the existing and 2020 conditions was conducted for the eight Scenarios. The results of the TIRE analysis for the existing and 2020 conditions are shown in Table XIII and Table XIV respectively.

The results indicated that an increase of 0.1 or more could be experienced on three roadways under the existing traffic volumes for Scenario 2 - No Project Scenario (also related Scenario 3 and 4):

- E. Crescent Drive between University Avenue and Southwood Drive
- Center Drive between University Avenue and Hamilton Avenue
- Hamilton Avenue between Center Drive and Newell Road

The results indicated that an increase of 0.1 or more could be experienced on one roadway under the existing traffic volumes for Scenario 8 – Vehicle Bridge with Full Realignment:

- Woodland Ave between Cooley Avenue and Clarke Avenue

Table XIII: TIRE Analysis - Existing Conditions

Segment No.	Roadway	From	To	Existing							
				No Project	Scn. 2	Scn. 3	Scn. 4	Scn. 5	Scn. 6	Scn. 7	Scn. 8
ADT											
1	Edgewood Dr	Southwood Dr	Newell Rd	510	452	452	452	510	510	510	523
2		Newell Rd	Jefferson Dr	540	540	540	540	540	540	547	547
3	Hamilton Ave	Middlefield Rd	Center Dr	2,210	2,353	2,353	2,353	2,210	2,210	2,210	2,210
4		Center Dr	Newell Rd	990	1,129	1,129	1,129	990	990	990	995
5		Newell Rd	Jefferson Dr	690	690	690	690	690	690	690	703
6		Greer Rd	Wildwood Ln	110	110	110	110	110	110	110	110
7	E. Crescent Dr	University Ave	Southwood Dr	1,250	1,910	1,910	1,910	1,250	1,210	1,193	1,158
8	Center Dr	University Ave	Hamilton Ave	1,620	2,579	2,579	2,579	1,620	1,594	1,589	1,572
9	W. Crescent Dr	University Ave	Hamilton Ave	280	280	280	280	280	280	280	280
10	Newell Rd	Edgewood Dr	Channing Ave	2,810	1,289	1,289	1,289	2,810	2,905	2,937	3,033
11	Channing Ave	Middlefield Rd	Newell Rd	3,770	4,126	4,126	4,126	3,770	3,739	3,739	3,707
12	Woodland Ave	Cooley Ave	Clarke Ave	3,310	1,564	1,564	1,564	3,310	3,434	3,481	3,599
13	Newell Rd	Woodland Ave	W, Bayshore Rd	3,020	2,962	2,962	2,962	3,020	3,020	3,020	3,020
TIRE Index											
1	Edgewood Dr	Southwood Dr	Newell Rd	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
2		Newell Rd	Jefferson Dr	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
3	Hamilton Ave	Middlefield Rd	Center Dr	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
4		Center Dr	Newell Rd	3.0	3.1	3.1	3.1	3.0	3.0	3.0	3.0
5		Newell Rd	Jefferson Dr	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
6		Greer Rd	Wildwood Ln	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
7	E. Crescent Dr	University Ave	Southwood Dr	3.1	3.3	3.3	3.3	3.1	3.1	3.1	3.1
8	Center Dr	University Ave	Hamilton Ave	3.2	3.4	3.4	3.4	3.2	3.2	3.2	3.2
9	W. Crescent Dr	University Ave	Hamilton Ave	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
10	Newell Rd	Edgewood Dr	Channing Ave	3.5	3.1	3.1	3.1	3.5	3.5	3.5	3.5
11	Channing Ave	Middlefield Rd	Newell Rd	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
12	Woodland Ave	Cooley Ave	Clarke Ave	3.5	3.2	3.2	3.2	3.5	3.5	3.5	3.6
13	Newell Rd	Woodland Ave	W, Bayshore Rd	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

Note:
Scn. 1 - No Project; Scn. 2 - No Bridge option
Scn. 3 – Bicycle/Pedestrian Bridge option; Scn. 4 – Bicycle/Pedestrian Bridge with Limited Emergency Vehicle Access
Scn. 5 - One Lane Bi-Directional Vehicle Bridge option with Signal Control
Scn. 6 - New Vehicle Bridge using existing bridge alignment
Scn. 7 - Two Lane Vehicle Bridge option with a Partial Realignment of Newell Rd
Scn. 8 - Two Lane Vehicle Bridge option with a Full Realignment of Newell Rd

Table XIV: TIRE Analysis – 2020 Conditions

Segment No.	Roadway	From	To	Near-Term Cumulative 2020 No Project	Scn. 2	Scn. 3	Scn. 4	Scn. 5	Scn. 6	Scn. 7	Scn. 8
ADT											
1	Edgewood Dr	Southwood Dr	Newell Rd	547	484	484	484	547	547	547	561
2		Newell Rd	Jefferson Dr	579	579	579	579	579	579	586	586
3	Hamilton Ave	Middlefield Rd	Center Dr	2,369	2,522	2,522	2,522	2,369	2,369	2,369	2,369
4		Center Dr	Newell Rd	1,061	1,211	1,211	1,211	1,061	1,061	1,061	1,067
5		Newell Rd	Jefferson Dr	740	740	740	740	740	740	740	753
6		Greer Rd	Wildwood Ln	118	118	118	118	118	118	118	118
7	E. Crescent Dr	University Ave	Southwood Dr	1,340	2,048	2,048	2,048	1,340	1,298	1,279	1,241
8	Center Dr	University Ave	Hamilton Ave	1,737	2,765	2,765	2,765	1,737	1,709	1,704	1,685
9	W. Crescent Dr	University Ave	Hamilton Ave	300	300	300	300	300	300	300	300
10	Newell Rd	Edgewood Dr	Channing Ave	3,013	1,382	1,382	1,382	3,013	3,115	3,149	3,251
11	Channing Ave	Middlefield Rd	Newell Rd	4,042	4,423	4,423	4,423	4,042	4,008	4,008	3,974
12	Woodland Ave	Cooley Ave	Clarke Ave	3,549	1,676	1,676	1,676	3,549	3,682	3,732	3,859
13	Newell Rd	Woodland Ave	W, Bayshore Rd	3,238	3,176	3,176	3,176	3,238	3,238	3,238	3,238
TIRE Index											
1	Edgewood Dr	Southwood Dr	Newell Rd	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
2		Newell Rd	Jefferson Dr	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
3	Hamilton Ave	Middlefield Rd	Center Dr	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
4		Center Dr	Newell Rd	3.0	3.1	3.1	3.1	3.0	3.0	3.0	3.0
5		Newell Rd	Jefferson Dr	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
6		Greer Rd	Wildwood Ln	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
7	E. Crescent Dr	University Ave	Southwood Dr	3.1	3.3	3.3	3.3	3.1	3.1	3.1	3.1
8	Center Dr	University Ave	Hamilton Ave	3.2	3.4	3.4	3.4	3.2	3.2	3.2	3.2
9	W. Crescent Dr	University Ave	Hamilton Ave	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
10	Newell Rd	Edgewood Dr	Channing Ave	3.5	3.1	3.1	3.1	3.5	3.5	3.5	3.5
11	Channing Ave	Middlefield Rd	Newell Rd	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
12	Woodland Ave	Cooley Ave	Clarke Ave	3.6	3.2	3.2	3.2	3.6	3.6	3.6	3.6
13	Newell Rd	Woodland Ave	W, Bayshore Rd	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

Note:
Scn. 1 - No Project; Scn. 2 - No Bridge option
Scn. 3 – Bicycle/Pedestrian Bridge option; Scn. 4 – Bicycle/Pedestrian Bridge with Limited Emergency Vehicle Access
Scn. 5 - One Lane Bi-Directional Vehicle Bridge option with Signal Control
Scn. 6 - New Vehicle Bridge using existing bridge alignment
Scn. 7 - Two Lane Vehicle Bridge option with a Partial Realignment of Newell Rd
Scn. 8 - Two Lane Vehicle Bridge option with a Full Realignment of Newell Rd

Study References

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APPENDIX C: QUALITATIVE ASSESSMENT OF RELATIVE ENVIRONMENTAL EFFECTS (ICF INTERNATIONAL, INC.)

Table 1. Qualitative Assessment of Relative Environmental Effects

Environmental Topic Area	**Criteria/Ranking Consideration**	**Alternative #1** No project (leave existing bridge in place)	**Alternative #2** Removal of existing bridge without replacement	**Alternative #3** New bicycle/pedestrian bridge	**Alternative #4** New bicycle/pedestrian bridge with limited emergency vehicle access	**Alternative #5** New bi-directional one lane vehicle bridge with traffic signal control	**Alternative #6** New two lane vehicle bridge using existing bridge alignment	**Alternative #7** New two vehicle bridge with a partial realignment	**Alternative #8** New two lane vehicle bridge realigned to line up with Newell Road in East Palo Alto
Ranking is "1" (best/least impactful) through "8" (worst/most impactful). No weighting applied.									
Aesthetics	*Change in views along Newell Road*	2 No change to existing views.	1 Views would change from the existing vehicular bridge to a natural vegetated state associated with the San Francisquito Creek. In Palo Alto, Newell would become a cul-de-sac with landscaped strip and in East Palo Alto Newell would become a standard T-intersection.	3 Views of the project area would change from the existing vehicular bridge to a bicycle/pedestrian bridge with the smallest footprint of the new bridge alternatives.	4 Views of the project area would change from the existing vehicular bridge to a bicycle/pedestrian bridge (with limited emergency vehicle access) with the second smallest footprint of the new bridge alternatives. In this alternative a landscape strip would be located on both sides of Newell Road in Palo Alto.	4 Views of the project area would change from the existing vehicular bridge to a bi-directional one lane vehicle bridge with traffic signal control with the third smallest (second largest) footprint of the new bridge alternatives. In this alternative a landscape strip would be located on both sides of Newell Road in Palo Alto.	6 Views of the project area would change from the existing vehicular bridge to a new two lane vehicle bridge. However, the lines of sight would not change from existing conditions. The bridge footprint would be the largest of the new bridge alternatives (apx. same as #7 and #8). In this alternative a landscape strip would be located on both sides of Newell Road in Palo Alto.	7 Views of the project area would change from the existing vehicular bridge to a new two lane vehicle bridge partially realigned to line up with Newell Road in East Palo Alto. The new bridge would have a moderately longer line of sight across the bridge compared to other vehicular bridge alternatives (except #8). The bridge footprint would be the largest of new bridge alternatives (apx. same as #6 and #8). In this alternative a landscape strip would be located on both sides of Newell Road in Palo Alto.	8 Views of the project area would change from the existing vehicular bridge to a new two lane vehicle bridge realigned to line up with Newell Road in East Palo Alto. The new bridge would have the longest lines of sight across the bridge compared to all other vehicular bridge alternatives. The bridge footprint would be the largest of the new bridge alternatives (apx. Same as #6 and #7). In this alternative a landscape strip would be located on both sides of Newell Road in Palo Alto.
Air Quality	*Construction generation of air pollutant emissions*	1 No construction would occur (therefore there would be no construction generation of air pollutant emissions).	2 Bridge removal and utility relocation air pollutant emissions only.	3 Construction of the smallest bridge facility; anticipated smallest contribution of air pollutant emissions.	4 Construction of the second smallest bridge facility; anticipated second smallest contribution of air pollutant emissions.	5 Construction of the third smallest bridge facility; anticipated third smallest contribution of air pollutant emissions.	6 Construction of the largest bridge facility; anticipated largest contribution of air pollutant emissions.		
	Operational generation of air pollutant emissions	1 No change in operation (therefore there would be no increase in operational generation of air pollutant emissions).	8 With no bridge, all vehicular traffic would be diverted to surrounding roadways and lack of pedestrian/bicycle connection would limit non-vehicular travel opportunity. Operational generation of air pollutant emissions is anticipated to be greatest.	6 With no vehicular access, all vehicle traffic would be diverted to surrounding roadways. The new bridge would maintain pedestrian/bicycle travel access. Operation generation of air pollutant emissions is anticipated to be greater than new bridge alternatives providing vehicular access.	6 With no vehicular access, all vehicle traffic would be diverted to surrounding roadways. The new bridge would maintain pedestrian/bicycle travel access (and accommodate emergency vehicle access). Operation generation of air pollutant emissions is anticipated to be greater than new bridge alternatives providing vehicular access.	5 With bi-directional access, the new bridge won't divert vehicle trips but there is a potential for minimal air pollutant emissions increase due to queuing at bridge ends during signal changes.	1 No substantial change in operation anticipated (therefore there would be no increase in operational generation of air pollutant emissions).		

Environmental Topic Area	Criteria/Ranking Consideration	Alternative #1 No project (leave existing bridge in place)	Alternative #2 Removal of existing bridge without replacement	Alternative #3 New bicycle/pedestrian bridge	Alternative #4 New bicycle/pedestrian bridge with limited emergency vehicle access	Alternative #5 New bi-directional one lane vehicle bridge with traffic signal control	Alternative #6 New two lane vehicle bridge using existing bridge alignment	Alternative #7 New two vehicle bridge with a partial realignment	Alternative #8 New two lane vehicle bridge realigned to line up with Newell Road in East Palo Alto
Ranking is "1" (best/least impactful) through "8" (worst/most impactful). No weighting applied.									
Biological Resources	*Loss of biological habitat including tree removal*	2 No loss of biological habitat or tree removals.	1 There would be temporary impacts to biological habitat during bridge removal, however tree restoration along San Francisquito Creek would be possible, and a beneficial biological resources effect.	3 There would be temporary impacts to biological habitat during construction and a permanent loss of biological habitat. This is the smallest bridge facility.	4 There would be temporary impacts to biological habitat during construction and a permanent loss of biological habitat. This is the second smallest bridge facility.	5 There would be temporary impacts to biological habitat during construction and a permanent loss of biological habitat. This is the third smallest bridge facility.	6 There would be temporary impacts to biological habitat during construction and permanent loss of biological habitat. This is the largest bridge facility.		
Climate Change	*Construction greenhouse gas (GHG) emissions*	1 No construction would occur (and therefore no construction GHG emissions).	2 Bridge and utility removal and relocation GHG emissions only.	3 Construction of smallest bridge facility, anticipated smallest contribution to construction GHG emissions.	4 Construction of second smallest bridge facility; anticipated second smallest contribution to construction GHG emissions.	5 Construction of third smallest bridge facility; anticipated third smallest contribution to construction GHG emissions.	6 Construction of largest bridge facility, anticipated largest contribution to construction GHG emissions.		
	Operational GHG emissions	1 No change in operation (and therefore no change in GHG emissions).	8 With no bridge, all vehicle traffic would be diverted to surrounding roadways and lack of pedestrian/bicycle connection would limit non-vehicular travel opportunity. This is anticipated to have the greatest increase in operational GHG emissions.	6 With no vehicular access, all vehicle traffic would be diverted to surrounding roadways and potentially resulting in GHG emission increases. The new bridge would maintain pedestrian/bicycle travel pattern.	6 With no vehicular access, all vehicle traffic would be diverted to surrounding roadways and potentially resulting in GHG emission increases. The new bridge would maintain pedestrian/bicycle travel pattern (and accommodate emergency vehicle access).	5 With bi-directional access, the new bridge would not likely divert vehicle trips but there is a potential for minimal GHG emissions increase due to queuing on Newell Road during signal changes.	1 No change in operation (and therefore no change in GHG emissions).		
Cultural Resources	*Potential disturbance of known cultural resources*	The existing bridge is not a historic resource per NEPA, CEQA, or the NHPA. There are no known archaeological resources recorded within the project site. Thus, there is no known difference in impacts by alternative. No relative ranking provided.							
Geology and Soils	*Area of soil disturbance*	1 No construction would occur that would disturb the soil.	2 Bridge removal and utility relocation soil disturbance only.	3 Smallest bridge facility, smallest area of soil disturbance.	4 Second smallest bridge facility, second smallest area of soil disturbance.	5 Third smallest bridge facility, third smallest area of soil disturbance.	6 Largest bridge facility, largest area of bridge soil disturbance.		
Hazards and Hazardous Materials	*Potential to disturb hazardous materials*	1 No construction would occur that would potentially disturb hazardous materials.	All other alternatives are ranked a "2" as they would all remove the existing bridge which contains lead-based paint (white on concrete and asphalt/yellow on asphalt).						

Environmental Topic Area	Criteria/Ranking Consideration	Alternative #1 No project (leave existing bridge in place)	Alternative #2 Removal of existing bridge without replacement	Alternative #3 New bicycle/pedestrian bridge	Alternative #4 New bicycle/pedestrian bridge with limited emergency vehicle access	Alternative #5 New bi-directional one lane vehicle bridge with traffic signal control	Alternative #6 New two lane vehicle bridge using existing bridge alignment	Alternative #7 New two vehicle bridge with a partial realignment	Alternative #8 New two lane vehicle bridge realigned to line up with Newell Road in East Palo Alto
Ranking is "1" (best/least impactful) through "8" (worst/most impactful). No weighting applied.									
Flooding	*Accommodate 100-year flood*	8 The existing bridge does not accommodate the 100-year flood.	All other alternatives are ranked a "1" as they would all accommodate the 100-year flood.						
Water Quality	*Construction period water quality impacts*	1 There would be no change to the existing bridge and therefore no effect to water quality during construction.	2 Bridge removal and utility relocation disturbance only.	3 Construction of smallest bridge facility; smallest potential for water quality impacts.	4 Construction of second smallest bridge facility; second smallest potential for water quality impacts.	5 Construction of third smallest bridge facility; third smallest potential for water quality impacts.	6 Construction of largest bridge facility; greatest potential for water quality impacts.		
			Note: A temporary cofferdam will be installed in the creek during bridge removal/construction activities.						
Land Use and Planning	*Division of community/environ mental justice*	5 There would be no change to the existing bridge. Connection across San Francisquito Creek for vehicular, pedestrian, and bicycle travel would be maintained, however it would be less safe compared to #6–8.	8 Divides Palo Alto from East Palo Alto by severing one multi-modal connection between Palo Alto and East Palo Alto.	7 Eliminates vehicular connection but maintains bicycle/pedestrian connection.	6 Eliminates vehicular connection (except for emergency) but maintains bicycle/pedestrian connection.	4 Maintains a safe vehicular and bicycle/pedestrian connection. Does not provide as good of a vehicular connection as #6-8.	1 Maintains safest vehicular, bicycle, and pedestrian connection between Palo Alto and East Palo Alto.		
	Disruption of existing land uses through acquisition of residential land	There are no permanent ROW acquisitions anticipated under any alternative. Thus, there are no meaningful differences in potential for land use disruption. No relative ranking provided.							
Noise	*Construction noise*	1 No construction would occur (therefore no construction noise).	2 Bridge and utility removal noise only.	3 Construction of smallest bridge facility, anticipated smallest noise duration of bridge alternatives.	4 Construction of second smallest bridge facility; anticipated second smallest noise duration of bridge alternatives.	5 Construction of third smallest bridge facility; anticipated third smallest noise duration of bridge alternative.	6 Construction of largest bridge facility, anticipated longest noise duration of bridge alternatives.		
	Operational Noise along Newell Road	4 No change in operation (therefore no change in operational noise along Newell Road).	1 With no bridge, there would be no daily bridge vehicle traffic noise from traffic over the bridge.	1 With no vehicular access, there would be no daily bridge vehicle traffic noise from traffic over the bridge.	1 With no vehicular access, there would be no daily bridge vehicle traffic (with the exception of emergency vehicle) noise from traffic over the bridge.	4 No change in operation anticipated (therefore no change in operational noise along Newell Road).	4 No substantial change in operation (therefore no substantial change in operational noise along Newell Road).		

Environmental Topic Area	Criteria/Ranking Consideration	Alternative #1 No project (leave existing bridge in place)	Alternative #2 Removal of existing bridge without replacement	Alternative #3 New bicycle/pedestrian bridge	Alternative #4 New bicycle/pedestrian bridge with limited emergency vehicle access	Alternative #5 New bi-directional one lane vehicle bridge with traffic signal control	Alternative #6 New two lane vehicle bridge using existing bridge alignment	Alternative #7 New two vehicle bridge with a partial realignment	Alternative #8 New two lane vehicle bridge realigned to line up with Newell Road in East Palo Alto
Ranking is "1" (best/least impactful) through "8" (worst/most impactful). No weighting applied.									
	Operational Noise away from Newell Road	1 No change in operation (therefore no change in operational noise away from Newell Road).	6 With no vehicular bridge, all traffic would be diverted to surrounding roadways raising noise levels there.	6 With no vehicular bridge, all traffic would divert to surrounding roadways raising noise levels there.	6 With no vehicular bridge, all traffic (except emergency vehicles) would divert to surrounding roadways raising noise levels there.	1 No change in operation anticipated (therefore no change in operational noise away from Newell Road).	1 No change in operation anticipated (therefore no change in operational noise away from Newell Road).		
Public Services other than Emergency Response	*Demand for new public service facilities*	None of the alternatives would result in change in the demand for public service facilities. No relative ranking provided.							
Emergency Response	*Emergency Response Times*	1 No change in emergency response times.	6 Increased congestion due to traffic diversion to surrounding roadways may impact emergency response times.	6 Increased congestion due to traffic diversion to surrounding roadways may impact emergency response times.	6 Increased congestion due to traffic diversion to surrounding roadways may impact emergency response times; however emergency access at the bridge location would still be accommodated.	5 Queuing may result in traffic diversion to surrounding roadways; however vehicular access would still be provided. Increased congestion due to traffic conversion to surrounding roadways may impact emergency response times.	1 No change in emergency response times.		
Recreation	*Differences in terms of recreational opportunity*	6 Maintains but does not improve bicycle/pedestrian experience.	8 Eliminates bicycle/pedestrian opportunity.	1 Improves bicycle/pedestrian experience by reducing bicycle/pedestrian and vehicular interface.	1 Improves bicycle/pedestrian experience by reducing bicycle/pedestrian and vehicular interface.	7 Maintains bicycle/pedestrian access, but does not provide dedicated bicycle/pedestrian route (compared to #3 and #4) and would require queuing at stoplights with vehicles (compared to #1, #6, #7, and #8).	3 Improves bicycle/pedestrian experience but does not provide bicycle/pedestrian dedicated route (compared to #3 and #4).		
Transportation /Traffic	*Traffic operations*	1 No diversion of traffic to surrounding roadways.	6 Removal of the existing bridge would divert all vehicular traffic to surrounding roadways.	6 The bridge would divert all vehicular traffic to surrounding roadways.	6 The bridge would divert all vehicular traffic (except emergency vehicles) to surrounding roadways.	1 No diversion of traffic to surrounding roadways.	1 No diversion of traffic to surrounding roadways.		

Environmental Topic Area	Criteria/Ranking Consideration	Alternative #1 No project (leave existing bridge in place)	Alternative #2 Removal of existing bridge without replacement	Alternative #3 New bicycle/pedestrian bridge	Alternative #4 New bicycle/pedestrian bridge with limited emergency vehicle access	Alternative #5 New bi-directional one lane vehicle bridge with traffic signal control	Alternative #6 New two lane vehicle bridge using existing bridge alignment	Alternative #7 New two vehicle bridge with a partial realignment	Alternative #8 New two lane vehicle bridge realigned to line up with Newell Road in East Palo Alto
Ranking is "1" (best/least impactful) through "8" (worst/most impactful). No weighting applied.									
	Accommodate multi-modal traffic	5 Maintains substandard multi-modal access.	8 Removal of the existing bridge would eliminate all modes of travel across San Francisquito Creek at this location.	7 Only bicycle/pedestrian access accommodated.	6 Only bicycle/pedestrian (and emergency vehicle) access accommodated.	1 All modes of traffic would be accommodated.	1 All modes of traffic would be accommodated.		
	Safety	8 There would be no change to the existing bridge. A poor line of sight and substandard roadway width would continue to be a safety issue.	1 Removal of the existing bridge would eliminate traffic safety deficiencies at the existing bridge site.	1 The new bridge would eliminate vehicular safety hazards at the bridge.	1 The new bridge would eliminate vehicular (with the exception of emergency vehicles) safety hazards at the bridge.	4 The new bridge would improve vehicular and bicycle/pedestrian safety.	4 The new bridge would improve vehicular, and bicycle/pedestrian safety.		
Utilities	*Disruption/ relocation of utilities*	1 There would be no change to existing utilities.	2 Removal of the existing bridge and associated utilities would result in disruption during construction. Utilities would be relocated under San Francisquito Creek.	2 All other alternatives are ranked a "2" as they would all relocate utilities to the new bridge facility.					

Note: The following environmental topical areas are not included because none of the alternatives would have a substantial effect on them or the resource does not exist in the project area: farmland, timberland, mineral resources, Section 4(f) resources, and population and housing.