



DATE: July 20, 2020

TO: Transportation Authority of Marin Citizens' Oversight Committee

FROM: Anne Richman, Executive Director
Bill Whitney, Principal Project Delivery Manager

SUBJECT: Highway 101 Interchange Studies Project Report (Information), Agenda Item No. 7

RECOMMENDATION

None – Informational Item Only

BACKGROUND

The Highway 101 Interchange and Approaching Roadway Study is a new project that was included in the Measure AA ½-Cent Transportation Sales Tax Expenditure Plan. The Expenditure Plan allocates 3% of the revenue from the sales tax, estimated at \$24.8 million over the 30-year period of the Measure.

The Expenditure Plan states the following:

“Accessing Highway 101 in Marin is a major source of congestion on local roads, which reduces the connectivity of communities across Marin. These funds would be used to attract regional, state, and federal funds for a program of improvements to local road interchanges. These improvements would improve the operation and safety of these interchanges for all users, allowing smoother travel to and from Highway 101 and local roads. The funds provide seed money to perform the planning, the public outreach, and to develop the scope of improvements needed at these interchanges. The interchange planning would include recommended improvements for all users.”

The funds would address Highway 101 interchanges at eleven locations in Marin as listed below:

- Alexander Avenue
- Sausalito / Marin City
- Tiburon Blvd / East Blithedale
- Paradise Drive/Tamalpais Drive
- Sir Francis Drake Blvd
- San Rafael Onramp at 2nd Street and Hetherton Avenue
- Merrydale Road/North San Pedro Road
- Manuel T Freitas Parkway
- Lucas Valley/Smith Ranch Road
- Ignacio Blvd

- San Marin Drive/Atherton Avenue

The Board, at its April meeting, authorized the Executive Director to retain the professional services of the consulting firm of HNTB. HNTB has teamed up with Parisi Transportation Consulting as well as other consulting firms to provide specialized services such as structural condition assessment, development and prioritization of improvement concepts, and public outreach.

DISCUSSION

Study Approach

The overall approach to begin the study program is to identify operational and safety improvements for all users of an interchange and approaching roadways including adjacent intersections. Many of the Highway 101 interchanges were built many years ago when Marin's traffic was much different than today and are considered to have numerous operational deficiencies and non-standard features as compared to current design practices. They were also built during an era that was auto centric and did not accommodate or equally consider other users such as pedestrians and cyclists.

Staff is proposing a multi-step process to understand and document the existing conditions of the interchanges and approaching roadways and then identify deficiencies that contribute to congestion and impact mobility and safety. As a first step we are proposing to initiate an in-depth study of each interchange location and to prepare an independent report that will recommend a series of actions to address the identified needs.

The following will be the steps taken in this initial scope of work:

- Identify and Establish Program Goals and Objectives
- Develop Evaluation Criteria & Performance Metrics
- Conduct Focused Stakeholder Engagement
- Perform Cost-Effective Data Collection & Review of Existing Reports and Studies
- Perform Traffic Assessment & Forecasts
- Identify Deficiencies, Constraints and Opportunities
- Prepare Planning Level Cost Estimates and Cost-Benefit Analysis
- Determine Sea Level Rise Susceptibility and Adaptive Capacity
- Prepare Interchange Study Report (for up to 12 Interchanges)
- Prepare a Prioritization and Implementation Plan
- Identify and Pursue Funding Opportunities

TAM will work collaboratively with our member agency staff, including the Public Works Departments and Community Development Departments as well as Golden Gate Bridge Highway and Transportation District (GGBHTD) and Marin Transit, and Caltrans. We will also engage interested stakeholders throughout the communities where the interchanges are located. We envision a web-based survey to engage the public and solicit input and will host a small-scale workshop in Southern Marin, Central Marin and Northern Marin as the studies are developed.

Goals and Objectives

Establishing a clear and concise set of goals and objectives is a critical step to help guide TAM as we begin the study process. By using the foundation of program goals established by the Board the team can remain focused and advance these studies as efficiently as possible. Staff is proposing five major categories of Goals and Objectives that will set the stage to establish Evaluation Criteria. The evaluation criteria will then be used to

identify Performance Metrics. As the improvement options and/or alternatives are developed they can be evaluated and prioritized for further consideration. The proposed goals and objectives are as follows:

- Goal 1: Enhance Health and Safety
- Goal 2: Relieve Local Traffic Congestion
- Goal 3: Improve Multimodal Access to/from and across Highway 101
- Goal 4: Promote Economic Vitality
- Goal 5: Implementability

A Memorandum outlining the goals and objectives with draft evaluation criteria and performance measures is attached to this report (Attachment A). At this time, the evaluation criteria and performance measures are still being developed.

Consideration to Include an Additional Interchange Location

The eleven interchanges listed in the Measure AA Expenditure Plan were selected using information from past Regional Transportation Plans (RTPs), previous studies and reports at interchange locations (Caltrans Project Initiation Documents (PID's), input from the Measure AA Expenditure Plan Advisory Committee and stakeholders, including jurisdictional partners and the public. The Expenditure Plan did not state the eleven "would" be studied, only that they "may be" studied. The Measure AA Expenditure Plan was crafted to not preclude other locations from being considered.

As the interchange program was being developed and based on previous discussions with TAM's Executive Committee, staff explored options to complete a high-level review of the remaining interchanges not included in the Measure AA Expenditure Plan, but which may warrant further consideration. There are known congestion points on local roads approaching Highway 101 that would not currently be considered a study area as part of this effort.

At the request of TAM, the consulting team has prioritized this effort as a first order of work to make the study process more effective and efficient. The attached Memorandum (Attachment B) defines the remaining access points to the Highway and outlines a process of elimination based on logical and technical criteria.

The Memorandum outlines specific considerations for the thirty access points and provides a discussion as to why certain locations warrant further consideration, or not. For example, the US 101/I-580 Interchange is being pursued separately and therefore is not included in this effort. The discussion narrows the remaining locations down to six logical candidates for consideration. A more in-depth analysis compared these six locations based on parameters such as traffic congestion, multi-modal safety including accident history, multi-modal access, and susceptibility to sea level rise and storm surge.

Based on the screening assessment and considering each of the factors, two interchanges stand out as potential candidates for evaluation as the additional, or twelfth study interchange: Shoreline Highway (Highway 1) and Alameda del Prado/Nave Drive. Both interchanges exhibit recurring traffic congestion, multimodal safety challenges, and multimodal access issues. Shoreline Highway also routinely experiences storm surge issues and is vulnerable to sea level rise. In contrast, the other four interchanges do not experience the same severity of problems.

When comparing the two interchanges, Alameda del Prado/Nave Drive experiences higher weekday traffic congestion, while on weekends Shoreline Highway can see substantial congestion levels and back-ups. The total number of reported collisions over a five-year period was about twice as high at Alameda del Prado/Nave Drive compared to Shoreline Highway.

The Shoreline Highway interchange is predicted to continue to experience impacts from sea level rise; on average the area floods 20 to 30 times a year between November and March. The interchange area has been studied over the years to address flooding and transportation issues with input from various stakeholders, including public and regulatory agencies. Many short-term strategies to address flooding have been implemented, but the ultimate solution that has been identified includes raising 1,500 feet of Shoreline Highway and 1,300 feet of Highway 101, including the Richardson Bay Bridge, by seven to nine feet (Caltrans Fact Sheet, US 101/State Route 1 Junction, January 2020). The ultimate plan is estimated to cost about \$160 million. These projects are proposed to be added to the State Highway Operation and Protection Program (SHOPP) 10-Year Plan in FY 2024.

Another potential consideration in selecting between the Shoreline Highway and Alameda del Prado/Nave Drive interchanges is the intention of the language in the Measure AA Expenditure Plan. According to the plan, TAM's tax-generated funds "would be used to attract regional, state, and federal funds for a program of improvements to local road interchanges." Shoreline Highway is a state highway (Highway 1) that is owned and maintained by the State of California. Alameda del Prado and Nave Drive are local roadways within the City of Novato.

Therefore, due to Caltrans' implementation of short-term measures and intention to include major improvements to the Shoreline Highway interchange in the 2024 SHOPP, as well as the intention of the Measure AA Expenditure Plan, staff recommends including Alameda del Prado/Nave Drive as the twelfth interchange in TAM's program.

FISCAL IMPACTS

The study is fully funded with Measure AA funds and no additional funds are requested for this action.

NEXT STEPS

Upon approval of the TAM Board, staff will continue to advance the Study Program based on the established goals and objectives and include the Alameda Del Prado/Nave Drive Interchange as the twelfth interchange in addition to the eleven listed in the Measure AA Expenditure Plan. The team will begin to collect traffic and usage data at the interchange and local road locations. There is a large library of "big data" that exists pre-Covid19 and will be used in the studies, however the team will collect current vehicular, bicycle and pedestrian data and adjust it as necessary using engineering judgement and experience.

ATTACHMENTS

Attachment A: Goals and Objectives Memorandum

Attachment B: Selection Process to Identify Twelfth Interchange Memorandum



Memorandum

Date: June 30, 2020
To: Bill Whitney, TAM
From: Kim Franchi, HNTB
David Parisi, Parisi Transportation Consulting
Subject: Highway 101 Interchange and Approaching Roadway Study:
Goals and Objectives

INTRODUCTION

Throughout Marin County, Highway 101 serves as the primary north-south roadway and key link between communities. Twelve interchanges with existing deficiencies will be studied as part of TAM's Highway 101 Interchanges and Approaching Roadways project. Deficiencies identified to date include traffic congestion, intermodal connectivity, non-standard or outmoded design features, flooding, and vulnerability to sea level rise (SLR). The HNTB/Parisi team is working to objectively develop, evaluate, and prioritize potential improvements. This will facilitate implementation of approvable, phase-able, and fundable mobility solutions that effectively leverage local, state, and federal funding for short, medium, and long-term projects.

This memorandum provides a summary of proposed project goals and objectives, evaluation criteria, and associated performance measures against which improvement concepts can be developed, evaluated and prioritized. The HNTB/Parisi team requests feedback regarding the goals and objectives, their prioritization or relative weighting, and the evaluation methodology.

GOALS AND EVALUATION CRITERIA

The goals and objectives outlined below were compiled from the 2017 Strategic Vision Plan, 2018 Measure AA Final Expenditure Plan, the latest Highway 101 corridor planning documents, and numerous local, regional, and statewide sources, as referenced herein. They are intended to be aligned with the larger planning context to guide development of the Highway 101 Interchanges program as a whole and of the proposed interchange improvement concepts themselves. They are also intended to be aligned with the guiding principles outlined in the Measure AA Strategic Plan, which identifies the following themes on how the sales tax funds should be spent:

1. Maximize leveraging of outside fund sources
2. Support timely and cost-effective project delivery, ensuring all strategies progress towards measurable improvements
3. Maximize the cost-effective use of sales tax dollars
4. Promote a balanced use of funds throughout the County
5. Promote high environmental and conservation awareness

A summary of the proposed goals and evaluation criteria is included in Table 1.

Highway 101 Interchange and Approaching Roadway Study Goals and Objectives

- **Goal 1: Enhance Health and Safety¹**
 - **Evaluation Criterion 1:** Improve safety for all modes
 - *Performance Measure:* Reduction in prevalence of incidents
Scoring: Higher scoring for concepts that would remedy non-standard design features or other features that contribute to potentially unsafe conditions
 - *Performance Measure:* Increased walking/biking²
Scoring: Higher scoring for improvements that propose new or improved pedestrian/bicyclist infrastructure, including improvements that connect to existing infrastructure or close gaps
 - **Evaluation Criterion 2:** Reduces greenhouse gas (GHG) emissions and improves air quality
 - *Performance Measure:* Improved travel times
Scoring: Higher scoring for improvements that improve traffic flow, thereby reducing emissions
 - *Performance Measure:* Reduction in delay
Scoring: Higher scoring for improvements with the highest forecasted reduction in vehicle delays
 - *Performance Measure:* Incorporation of transportation system management (TSM) measures
Scoring: Higher scoring for improvements that include TSM elements, thereby reducing vehicle emissions
- **Goal 2: Relieve Local Traffic Congestion³**
 - **Evaluation Criterion 1:** Alleviates congestion and improves traffic flow for current and future traffic
 - *Performance Measure:* Degree of improvement in
 - Level of Service (LOS) and average vehicular delays
 - Vehicle hours of delay
 - Vehicle miles traveled (VMT)*Scoring:* Higher scoring for concepts where greatest improvements would occur
- **Goal 3: Improve Multimodal Access to/from and across Highway 101⁴**
 - **Evaluation Criterion 1:** Enhances intermodal connectivity and removes access barriers
 - *Performance Measure:* Improved connectivity for vehicular and active transportation
Scoring: Higher scoring for concepts that provide most improvement in connectivity for transit users, bicyclist, and pedestrians
 - **Evaluation Criterion 2:** Encourages mode shift from single-occupancy vehicles
 - *Performance Measure:* Mode shift to non-single occupant vehicles
Scoring: Higher scoring for improvements that facilitate transit or HOV usage

¹ The “Getting Around Marin” online survey identified safety as a priority after travel time and flexibility (TAM Strategic Vision Plan, Figure 16 page 47). Factors that rated lower than safety included cost, comfort, and environment. This is also consistent with goals listed in MTC Plan Bay Area 2040 (Table 2.1 page 27) and is listed in the Caltrans US 101 North Comprehensive Corridor Plan.

² A guiding principle of the TAM Strategic Vision Plan was promoting a healthy environment and health population (Figure 1 page 14). The walking/biking network was identified as a means to support public health (page 37) by encouraging exercise.

³ Transportation priorities identified during 2015 public outreach were ranked (TAM Strategic Vision Plan). Congestion relief was the public’s top priority (Figure 15, page 45). Reduced congestion is consistent with the goals of the Caltrans US 101 North Comprehensive Corridor Plan.

⁴ Public outreach identified multimodal priorities (bike facility installation/upgrades) as the second transportation priority (TAM Strategic Vision Plan). Bus, rail service, and safe routes to school were ranked as priorities three through six (Figure 15, page 45). Improved multimodal access is consistent with the goals of the Caltrans US 101 North Comprehensive Corridor Plan, as well.

Highway 101 Interchange and Approaching Roadway Study Goals and Objectives

- **Goal 4: Promote Economic Vitality⁵**
 - **Evaluation Criterion 1:** Accommodates future land use changes and growth
 - *Performance Measure:* Assessment of future operating conditions with forecast growth
 - Scoring:* Higher scoring for improvements that accommodate future anticipated growth with multimodal solutions⁶
 - **Evaluation Criterion 2:** Cost effectiveness
 - *Performance Measure:* Cost-benefit ratio
 - Scoring:* Higher scoring for interchanges with favorable ratios
 - **Evaluation Criterion 3:** Reduces transportation costs
 - *Performance Measure:* Peak period travel time
 - Scoring:* Higher scoring for improvements with lower peak period travel times⁷
- **Goal 5: Implementability**
 - **Evaluation Criterion 1:** Attractiveness to funding sources
 - *Performance Measure:* Funding criteria/potential
 - Scoring:* Higher scoring for projects that meet funding criteria⁸, or could be substantially funded by multiple sources
 - **Evaluation Criterion 2:** Ease of regulatory approval
 - *Performance Measure:* Project can obtain necessary approvals
 - Scoring:* Higher scoring projects with limited right-of-way and/or permitting needs
 - *Performance Measure:* Environmentally cleared (or exempt)
 - Scoring:* Higher scoring for improvements with minimal environmental impacts (or exempt)
 - *Performance Measure:* Consistency with Regional Plans
 - Scoring:* Higher scoring for improvements whose needs have been identified in other published local or regional planning documents

REFERENCES:

- California Department of Transportation. 2018. US 101 North Comprehensive Corridor Plan.
- Metropolitan Transportation Commission. 2017. Plan Bay Area 2040.
- Metropolitan Transportation Commission. 2016. San Francisco Bay Area Goods Movement Plan.
- Transportation Authority of Marin. 2019. 2019 Congestion Management Program Update.
- Transportation Authority of Marin. 2017. Getting Around Marin: Strategic Vision Plan.

⁵ Consistent with the goals of the Caltrans US 101 North Comprehensive Corridor Plan.

⁶ Table 10 (page 39) lists major development projects in the near-term (TAM Strategic Vision Plan).

⁷ US 101 is identified as a major goods movement corridor (MTC San Francisco Bay Area Goods Movement Plan). This highway also connects agriculture shippers with markets in the Bay Area. Highway reliability is a key to movement of goods (Table 4.1, page 27).

⁸For example, improvements that reduce traffic congestion, improve pedestrian/bike infrastructure, and expand transit services meets several categories of Marin County Measure AA funding (TAM 2019 CMP Update).

Highway 101 Interchange and Approaching Roadway Study
Goals and Objectives

Table 1: Goals and Draft Evaluation Methodology

Goals & Objectives	Draft Evaluation Criteria	Draft Performance Measures	Prioritization/Weight (0-5)
Enhance Health and Safety	Improves safety for all modes	Reduction in prevalence of incidents	
	Increased walking/biking	Improved pedestrian/bicyclist infrastructure & gap closure	
	Reduces greenhouse gas emissions and improves air quality	Improved travel times	
		Reduction in delay	
	Incorporation of TSM Measures		
Relieve Local Traffic Congestion	Alleviates congestion and improves traffic flow for current and future traffic	Level of Service and average vehicular delays	
		Vehicle hours of delay	
		Vehicle miles traveled (VMT)	
Improve Multimodal Access to/ from and across Highway 101	Enhances intermodal connectivity and removes access barriers	Improved connectivity for vehicular and active transportation	
	Encourages mode shift from single-occupancy vehicles	Mode shift to non-single-occupant vehicles	
Promote Economic Vitality	Accommodates future land use changes and growth	Assessment of future operating conditions with forecast growth	
	Cost effectiveness	Cost-benefit ratio	
	Reduces transportation costs	Peak period travel time	
Implementability	Attractiveness to funding sources	Funding criteria/potential	
	Ease of regulatory approval	Project can obtain necessary approvals	
		Funded, environmentally cleared, or exempt	
		Consistency with Regional Plans	



Memorandum

Date: July 2, 2020
To: Bill Whitney, TAM
From: Kim Franchi, HNTB
 David Parisi, Parisi Transportation Consulting
Subject: Highway 101 Interchange and Approaching Roadway Study:
 Selection of 12th Study Interchange

Background

The Highway 101 Interchange and Approaching Roadway Study is a new project that was approved by Marin voters as part of the Measure AA – Transportation Sales Tax Expenditure Plan. The Expenditure Plan, adopted in June 2019, allocates 3% of the revenue from the sales tax, estimated at \$24.8 million over the 30-year period of the Measure, to fund a program of improvements to local road interchanges.

Accessing Highway 101 in Marin is a major source of congestion on local roads, which reduces the connectivity of communities across Marin. The allocated funds will be used to attract regional, state, and federal funds for a program of improvements to local road interchanges. These enhancements will improve the operation and safety of these interchanges for all users, allowing smoother travel to, from and across Highway 101 and local roads.

Pursuant to the Expenditure Plan, the following 11 interchanges will be addressed:

- Alexander Avenue
- Sausalito/Marin City
- Tiburon Blvd./East Blithedale Avenue
- Paradise Drive/Tamalpais Drive
- Sir Francis Drake Boulevard
- San Rafael On-Ramp at 2nd Street and Hetherton Avenue
- Merrydale Road/North San Pedro Road
- Manuel T. Freitas Parkway
- Lucas Valley Road/Smith Ranch Road
- Ignacio Boulevard
- San Marin Drive/Atherton Avenue

These interchanges were selected based on input from stakeholders, including jurisdictional partners and the public, during the development of the Expenditure Plan. Each represents significant access for adjacent communities along Highway 101. Some of the interchanges have been cooperatively planned amongst partners for years and other locations have had long-standing visions for improvements that have not yet been planned in detail. The interchanges vary in age; many of them were built in the 1950s and 1960s and have not been altered in meaningful ways to meet current and future demands of vehicles, transit, bicyclists, and pedestrians.

The Transportation Authority of Marin has contracted with the HNTB Parisi team to support the interchange program. HNTB Parisi will assess the above 11 interchanges plus an additional twelfth interchange to be selected and approved by the TAM Board.

Selection of the 12th Interchange for Assessment

There are 30 interchanges located along Highway 101 in Marin County. These include interchanges with other State Highways (e.g., Highways 1, 37 and 131), multi-ramp interchanges with local arterial roadways, and isolated single-lane ramps to or from Highway 101. Some interchanges are located very close to one or more of the selected 11 interchanges. For example, the Vista Point interchange is in proximity to Alexander Avenue; the Madera Boulevard interchange closely interacts with the Paradise Drive/Tamalpais Drive interchange; and the Fifer Avenue/Industrial Way interchange functions with the Sir Francis Drake Boulevard interchange. Thus, the assessment of these three interchanges will be integrated into the overall work for the interchanges that they are adjacent to.

The remaining 16 Highway 101 interchanges within Marin County are:

- Spencer Avenue
- Rodeo Avenue
- Shoreline Highway (Highway 1)
- Redwood Hwy. Frontage Road (Seminary)
- Redwood Hwy. Frontage Road (Southbound Off-Ramp)
- Casa Buena Drive
- Interstate 580/Bellam Boulevard
- Francisco Blvd. West
- Mission/Irwin/Hetherington Streets
- Lincoln Avenue/Villa Avenue
- Miller Creek Road
- Alameda del Prado/Nave Drive
- Highway 37/S. Novato Blvd.
- Rowland Boulevard
- DeLong Avenue
- San Antonio Road

Three of the above 16 interchanges will be studied as part of other on-going or planned interchange planning efforts. The Interstate 580/Bellam Boulevard interchange is being considered as part of TAM's Highway 101 to I-580 Direct Connector project. The Francisco Boulevard West interchange's ramps were recently relocated and realigned during the HOV Gap Closure project. The Highway 37/South Novato Boulevard interchange will be evaluated by Caltrans as part of the Highway 37 project.

Seven of the above interchanges serve a low number of daily traffic volumes, and several of these have a limited number of directional highway ramps and/or provide restricted connectivity. The Spencer Avenue, Rodeo Avenue, Redwood Highway Frontage Road (Southbound Off-Ramp), Casa Buena Drive, Lincoln Avenue/Villa Avenue, Miller Creek Road and San Antonio Road interchanges each only accommodate between 1,000 and 12,000 vehicles each weekday along their ramps (compared to the 11 study interchanges which serve an average of 55,000 vehicles each on weekdays).

The Spencer Avenue interchange serves limited uses to the west of Highway 101 and the Rodeo Avenue interchange southbound ramps are discontinuous west of the highway. Redwood Highway Frontage Road (Southbound Off-Ramp) is served by a single southbound off-ramp to the frontage road (near the Arco fueling station) and the Casa Buena Drive southbound on-ramp is a single connector on the west side of the highway in Corte Madera. Both the Lincoln Avenue/Villa Avenue and Miller Creek Road interchanges have limited connectivity east of Highway 101. The San Antonio Road interchange

primarily serves the Redwood Landfill and Olompali State Historic Park and was recently reconstructed in conjunction with the Marin-Sonoma Narrows Project.

It is recommended that none of the 10 interchanges identified above be evaluated as part of TAM's interchange study for the reasons provided.

This would leave the following six interchanges as candidates for the 12th interchange to be evaluated:

- Shoreline Highway (Highway 1)
- Redwood Highway Frontage Road (Seminary)
- Mission/Irwin/Hetherston Streets
- Alameda del Prado/Nave Drive
- Rowland Boulevard
- DeLong Avenue

TAM and the HNTB Parisi team are developing goals and objectives that will be used to comprehensively evaluate the 12 interchanges to be studied. These goals and objectives will be vetted with partner stakeholders. They will likely cover the intent of the Expenditure Plan and focus on a variety of measures including, but not limited to, addressing traffic congestion relief, improving safety, enhancing multimodal access, and considering sea level rise and flooding.

The HNTB Parisi team has collected data, conducted limited analyses, and compared each of the six candidate interchanges based on the above measures. The following areas were of specific focus:

- *Traffic congestion relief:* Using INRIX roadway analytics data for weekday conditions throughout 2019, the percentage of the weekday between 7 AM and 7 PM that experiences congestion, i.e., non-free flow speeds, along interchange roadways and off-ramps was reviewed based on prevailing travel speeds throughout the day. In addition, total daily ramp volumes were reviewed.
- *Multimodal safety:* Reported collisions over a five-year period were reviewed, including collisions that involved a fatality or severe injury, as well as the modes involved in the collisions (vehicle, bicyclist and/or pedestrian). In addition, the presence of key non-standard design features was considered.
- *Multimodal access:* Each interchange was qualitatively reviewed to identify the level of pedestrian and bicycle amenities, including presence of continuous sidewalks, bikeways, crosswalks, and access to transit facilities. In addition, the level of public transit use based on bus routes and park-and-ride facilities was considered.
- *Sea level rise and flooding:* A review was undertaken on the potential five-year and 100-year water level at each of the six interchanges due to predicted sea level rise and the potential for flooding from storm surges.

The following table summarizes the comparison of the six candidate interchanges based on the above parameters.

Comparison of Six Candidate Interchanges

Interchange	Traffic Congestion Relief			Multimodal Safety			Multimodal Access		SLR & Storm Surge
	Weekday Congestion	Ramps ADT	Total Collisions	Fatal / Injury	Ped / Bike	Key Nonstd. Conditions	Pedestrian & Bicycle	Transit Service Use	Flooding / Vulnerability Risk
Shoreline Highway (Highway 1)	43%	44,200	6	0 / 0	0 / 2	SB Decel	Constrained	Substantial	High
Redwood Highway Frontage Road	39%	20,100	1	0 / 0	0 / 0	SB Accel	Constrained	Minor	Moderate-High
Mission/Irwin/Hetherton Streets	46%	51,500	4	0 / 0	0 / 1	n/a	Constrained	Minor	Moderate
Alameda del Prado/Nave Drive	48%	37,800	11	0 / 1	0 / 0	NB Accel	Constrained	Substantial	Low-Moderate
Rowland Boulevard	47%	40,300	3	1 / 0	0 / 0	n/a	Limited	Substantial	High
DeLong Avenue	30%	26,800	3	0 / 0	0 / 0	n/a	Limited	Minor	Low-Moderate

Recommendation

Based on the screening assessment and considering each of the factors, two interchanges stand out as potential candidates for evaluation as the twelfth study interchange: Shoreline Highway (Highway 1) and Alameda del Prado/Nave Drive. Both interchanges exhibit recurring traffic congestion, multimodal safety, and multimodal access issues. Shoreline Highway, also, routinely experiences storm surge issues and is vulnerable to sea level rise. In contrast, the other four interchanges do not experience the same severity of problems.

When comparing the two interchanges, Alameda del Prado/Nave Drive experiences higher weekday traffic congestion, while on weekends Shoreline Highway can see substantial congestion levels and back-ups. The total number of reported collisions over a five-year period were about twice as high at Alameda del Prado/Nave Drive compared to Shoreline Highway. No pedestrian or bicycle-related collisions were reported within the former interchange area, while two bike crashes were reported within the Shoreline Highway interchange.

Both interchanges have constrained pedestrian and bicycle infrastructure. Shoreline Highway has sidewalk gaps and no bicycle facilities. At the Alameda del Prado/Nave Drive interchange, pedestrian accessibility is constrained, and cyclists must navigate through free-flowing highway ramp movements. Both interchanges include park-and-ride lots (the Manzanita and Alameda del Prado park-and-rides) and serve major transit lines.

The Shoreline Highway interchange is predicted to continue to experience high risks from storm surge issues and impacts from sea level rise; on average the area floods 20 to 30 times a year between November and March. The interchange area has been studied over the years to address various flooding (and transportation) issues with input from various stakeholders, including public and regulatory agencies. Many short-term strategies to address flooding have been implemented, but the ultimate solution that has been identified includes raising 1,500 feet of Shoreline Highway and 1,300 feet of Highway 101, including the Richardson Bay Bridge, by seven to nine feet (Caltrans, US 101/State Route 1 Junction, January 2020). The ultimate plan is estimated to cost about \$160 million. These projects are proposed to be added to the State Highway Operation and Protection Program (SHOPP) 10-Year Plan in FY 2024. Another potential consideration in selecting between the Shoreline Highway and Alameda del Prado/Nave Drive interchanges is the intention of the language in the Expenditure Plan. According to the plan, TAM's tax-generated funds "would be used to attract regional, state, and federal funds for a program of improvements to local road interchanges." Shoreline Highway is a State highway (Highway 1) that is owned and maintained by the State of California. Alameda del Prado and Nave Drive are local roadways within the City of Novato.

Therefore, due to Caltrans' implementation of short-term measures and intention to include major improvements to the Shoreline Highway interchange in the 2024 SHOPP, as well as the Expenditure Plan's language, it may be appropriate to include Alameda del Prado/Nave Drive as the twelfth interchange in TAM's program.