

# MEMORANDUM

August 23, 2022

Project #: 237910.501

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From: Mike Aronson, Lilian Wu, Miao Gao

RE: **I-680 Northbound Express Lane Completion: Analysis of VMT Mitigation Effectiveness**

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## Version Control

Version Number	Date	Description of Change	Author
1	8/18/22	Initial Document	MNA
	8/18/22	QA/QC Review	LL
	8/19/22	Review	SP/MK/SH

## Introduction

Kittelison & Associates (Kittelison) is providing results for modeling and analysis of projects and programmatic strategies with potential to mitigate vehicle-miles of travel (VMT) impacts associated with the Interstate 680 (I-680) Northbound Express Lane Completion project of the Innovate 680 Program.

This memorandum describes:

1. the potential increases in VMT related to Express Lane Completion alternatives;
2. the VMT mitigation projects considered;
3. the analysis methodology for each type of mitigation project, and;
4. the results of the VMT mitigation analysis.

## Summary

The Innovate 680 Program developed by the Contra Costa Transportation Authority (CCTA) includes the I-680 Northbound Express Lane Completion Project which has the potential to increase VMT due to increased road capacity and induced travel demand. The design year (2047) VMT increases would vary from approximately 83,000 to 102,000 daily VMT depending on the project alternative.

A variety of projects have been identified with the potential to mitigate the VMT increases:

- Shared mobility hubs
- Transit projects
- Active transportation projects
- Land use mitigation
- Transportation Demand Management programs

The effectiveness of these projects was evaluated using a combination of forecasting techniques, including using a regional travel model and analysis outside the model based on documented data sources.

There were several iterations for the evaluation, starting with an initial list of potential projects, then screening and refining the list to the most effective and appropriate projects and adding projects which were not included in the initial list.

The proposed mitigation projects and their effectiveness are summarized in Table 1.

**Table 1: Interstate 680 Express Lane Completion Proposed VMT Mitigation**

Mitigation Project	Change in 2047 Daily VMT
Northbound Express Lane Completion Project	+83,000 to +102,000
Innovate 680: Shared Mobility Hubs	-6,600 to -15,400
Innovate 680: I-680 Express Bus	-36,800
TDM Program	-30,800 to -58,600
<b>TOTAL</b>	<b>0</b>

Source: Kittelson & Associates, 2022

## 1. Induced VMT

The travel forecast report for the I-680 Northbound Express Lane Completion Project<sup>1</sup> lists the changes in VMT that are forecast with each of the project alternatives (Table 2). The VMT is reported for the five county Metropolitan Statistical Area (MSA) that is used in the NCST Calculator tool referenced in the Caltrans Transportation Analysis Framework for analysis of induced VMT.

**Table 2: Vehicle-Miles of Travel for Express Lane Completion Alternatives**

Alternative	2027 Daily VMT	2027 Difference from No Build	2047 Daily VMT	2047 Difference from No Build
No Build	99,598,879		111,430,750	
Alt. 1C	99,666,852	+67,974	111,533,333	+102,583
Alt. 2	99,661,011	+62,133	111,514,473	+83,723
Alt. 3 Ultimate	99,669,607	+70,728	111,531,732	+100,981

Vehicle-miles of travel for five county MSA: Alameda, Contra Costa, Marin, San Francisco, San Mateo counties

Source: Kittelson & Associates, "I-680 Northbound Express Lane Completion Project Travel Forecasts Report," February 2, 2022

Project alternatives 1C and 3, which would complete the gap in the northbound express lane through the State Route 24 (SR 24) interchange, are projected to increase daily VMT by about 70,000 in 2027 and about 102,000 in 2047. Alternative 2, which would extend the express lane north and south of SR 24 but would leave a two mile gap in the express lane through the SR 24 interchange, is projected to increase daily VMT by 62,000 in 2027 and by 84,000 in 2047.

## 2. Mitigation Projects Analyzed

Projects with potential to mitigate VMT were considered in several iterations. An initial set of projects were identified, tested, and compared for overall effectiveness and cost effectiveness. Several of the initial projects were dropped from further consideration based on this initial evaluation. Additional mitigation measures were then identified and tested. The proposed mitigation measures were then refined based on this second evaluation.

<sup>1</sup> Kittelson & Associates, Kittelson & Associates, "I-680 Northbound Express Lane Completion Project Travel Forecasts Report," February 2, 2022

## 2.1 EVALUATION OF INITIAL MITIGATION PROJECTS

The projects for initial VMT mitigation evaluation are listed in Table 3. The attached Table 14 lists these mitigation projects considered in more detail, including locations, modeling approach and notes on implementation. The attached exhibits illustrate specific alignments for many of the initial mitigation projects.

**Table 3: Initial Mitigation Projects**

Project	Locations
Innovate 680 Shared Mobility Hubs	Eight (8) prototype locations in I-680 Corridor (Figure 1, page 23)
Innovate 680: I-680 Express Bus (LAVTA/County Connection)	Martinez Amtrak to Dublin/Pleasanton BART and Pleasanton ACE (Figure 2, page 24)
WCCTAC Express Bus Routes 2, 6, 7	West Contra Costa County to downtown Berkeley and Oakland (Figure 3, page 25)
County Connection 15-Minute BART Feeder Network	Central Contra Costa County (Figure 4, page 26)
County Connection Downtown Concord Circulator	Concord BART – Willows Shopping Center (Figure 5, page 27)
Martinez Intermodal Station - Crockett SF Bay Trail Gap Closure Project	Martinez (Figure 6, page 28)
Parkside Drive Class IV Two-Way Cycle Track	Walnut Creek, Parkside Drive - Provide protected cycle track connection between Walnut Creek BART and Iron Horse Trail (Figure 7, page 29)
Safe Routes 2 BART	Iron Horse Trail to Walnut Creek BART via California Boulevard (Figure 8, page 31)

Source: Kittelson & Associates, 2022

## 2.2 ADDITIONAL MITIGATION PROJECTS

Following the evaluation of the initial mitigation projects, additional mitigation projects were identified for evaluation as listed in Table 4.

**Table 4: Additional Mitigation Projects**

Project	Locations
Innovate 680 Shared Mobility Hubs with Micromobility	3 to 11 locations along the I-680 Corridor
Land Use Mitigation	Prototype affordable housing project in Walnut Creek
Transportation Demand Management (TDM) Program: Expansion of 511 Contra Costa Programs	Contra Costa County

Source: Kittelson & Associates, 2022

## 2.3 PROPOSED MITIGATION PROJECTS

The projects currently proposed for VMT mitigation are listed in Table 5. They include the I-680 Express Bus from the initial list, a focused set of shared mobility hubs from the additional list, and the TDM program from the additional list.

**Table 5: Proposed Mitigation Projects**

Project	Locations
Innovate 680: I-680 Express Bus (LAVTA/County Connection)	Martinez Amtrak to Dublin/Pleasanton BART and Pleasanton ACE
Innovate 680 Shared Mobility Hubs	Three (3) locations in I-680 Corridor associated with I-680 Express Bus stops
Expansion of TDM Program	Contra Costa County

Source: Kittelson & Associates, 2022

## 3. Mitigation Analysis Methodology

Mitigation projects were evaluated using different methodologies based on whether or not they could be directly represented in the Contra Costa Countywide travel model.

The modeling of VMT mitigation is based on Alternative 2 for the 2047 design year. The Alternative 2 improvements are assumed to be implemented along with any VMT mitigation measures that are evaluated. It is expected that the changes in VMT associated with each mitigation project would be similar for any of the other Express Lane alternatives.

### 3.1 SHARED MOBILITY HUBS

Shared mobility hubs were modeled within the Contra Costa Countywide travel model by shortening the perceived time and distance for non-auto access connections between residences/businesses and the mobility hub locations. The perceived access improvements were tested for two distances from the mobility hubs:

- A one-mile radius, which assumes primarily walk or non-motorized access, and represents safety and access improvements at a mobility hub and Mobility on Demand/Mobility as a Service (MoD/MaaS) applications, without the provision of additional services such as microtransit.
- A two-mile radius, which assumes improvements at the mobility hub and improved local mobility access by modes such as expanded electric bikes or scooters and/or microtransit, connected to MoD/MaaS applications.

For the one-mile radius, a reduction in perceived time and distance of 30 percent was found to result in transit ridership increases at the mobility hub locations (approximately 45 percent) within the range of observations at mobility hubs that have been implemented and surveyed in various locations in the United States.<sup>2</sup> The same 30 percent reduction in perceived time and distance was also applied to the two-mile radius which assumes additional mobility services.

### 3.2 TRANSIT PROJECTS

Transit projects were evaluated by coding the routes, stops and peak and off-peak frequencies directly in the travel model. The calibrated model calculations were used to estimate the attractiveness and ridership for the transit services.

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<sup>2</sup> Kittelson & Associates, "CCTA Innovate 680 Shared Mobility Hubs Literature Review," December, 2021

The routes for the County Connection 15-minute BART feeder network were already coded in the model, but the frequencies (headways) were revised to a minimum of 15 minutes during peak periods. The following new routes were added to the model for evaluation:

- I-680 Express Bus
- WCCTAC Express Bus Routes 2, 6, 7
- County Connection Downtown Concord Circulator

### 3.3 ACTIVE TRANSPORTATION PROJECTS

The VMT reductions associated with bicycle/pedestrian projects were estimated using tools outside the travel model. The VMT benefits of active transportation projects were estimated using information from studies of travel behavior changes related to completion of protected bicycle and pedestrian networks. The team determined that the Alameda County Transportation Commission (ACTC) SB 743 and VMT Tool provides a clear, research backed methodology for estimating VMT reductions for the different projects.<sup>3</sup> The tool is supported by research summarized in the 2021 CAPCOA report.<sup>4</sup>

The available research indicates that VMT for an area can be reduced by up to 0.5 percent through extension or completion of protected bicycle network connections (Class I trails, Class IV cycle tracks or Class II buffered bike lanes). Using more detailed calculations for an area with a detailed inventory of existing and planned bicycle connections (Fremont, CA), the resulting VMT reduction would be approximately 300 daily VMT per mile of additional protected bike network.

### 3.4 LAND USE MITIGATION

The 2021 CAPCOA report lists several land use measures related to transportation emissions which can help to reduce greenhouse gas (GHG) emissions, based primarily on reductions in VMT (Table 6). Potential reductions in VMT are assumed to be proportional to reductions in GHG for these specific transportation/land use measures, as supported by the CAPCOA documentation.

The relative effectiveness of land use mitigation was evaluated based on an actual proposed project in the I-680 corridor. The proposed project is a 97 unit affordable housing development on a 0.91 acre site in Walnut Creek (107 units per acre). The site is less than 0.5 mile from the Walnut Creek BART Station and is also close to the Iron Horse Regional Trail.

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<sup>3</sup> <https://www.alamedactc.org/planning/sb743-vmt/>

<sup>4</sup> California Air Pollution Control Officers Association, *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*, December, 2021, accessed at [http://www.airquality.org/ClimateChange/Documents/Final%20Handbook\\_AB434.pdf](http://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf)

**Table 6: CAPCOA Land Use and Parking Mitigation Measures**

CAPCOA Measure	Maximum GHG Reduction
<b>Land Use Measures</b>	
T.1 Increase Residential Density	30.0%
T.2 Increase Job Density	30.0%
T.3 Provide Transit Oriented Development	27.0%
T.4 Integrate Affordable and Below Market Rate Housing	28.6%
<b>Maximum Total Reduction from Land Use Measures</b>	<b>65.0%</b>
<b>Other Measures</b>	
T.15 Limit Residential Parking Supply	13.7%
<b>Maximum Total Reduction from Combined Measures</b>	<b>70.0%</b>

Source: CAPCOA, 2021

The daily VMT generated by a “typical” 97-unit development in Walnut Creek is estimated as follows:

- 97 units
- \* 2.103 persons per unit (Census average for multi-family units)
- \* 13.7 daily VMT/capita (from Contra Costa Countywide travel model, year 2020)
- = 2,795 daily VMT

The potential VMT reductions from the land use and parking mitigation measures are shown in Table 7. The maximum total GHG and VMT reduction that can be expected from a high-density residential project near transit with 100 percent affordable units and a limited parking supply would be 70 percent. For the project in Walnut Creek, this would represent 1,956 daily VMT or approximately 20 daily VMT per residential unit provided.



**Table 7: Residential Project Reductions from CAPCOA Land Use Mitigation Measures**

CAPCOA Measure	Maximum GHG/VMT Reduction	Daily VMT
Without Mitigation		2,795
T.3 Provide Transit Oriented Development	-31.0%	-866
T.4 Integrate Affordable and Below Market Rate Housing	-28.6%	-799
T.15 Limit Residential Parking Supply	-13.7%	-383
<b>Maximum Total VMT Reduction</b>	<b>-70.0%</b>	<b>-1,956</b>

Source: CCTA, 2022

### 3.5 TRANSPORTATION DEMAND MANAGEMENT PROGRAMS

The 511 Contra Costa (511CC) program in Contra Costa County is a countywide program to reduce traffic congestion and improve air quality by providing the public with information, resources, and tools that promote mobility options beyond driving alone. Funding for 511CC is provided by Measure J, the county's half cent transportation sales tax, and the Transportation Fund for Clean Air Programs (TFCA) administered by the Bay Area Air Quality Management District (BAAQMD).

Recent trip reduction programs include:

- **Ride 4 Free Transit** – Free transit passes
- **Drive Less / Leave Car at Home** – Monetary incentive to pledge to replace at least one drive alone commute trip a week with alternate modes
- **BOGO** (Buy One Get One) – Discounted transit passes
- **School Pool/Pass2Class** - Free bus passes to school
- **E-bike Rebate** – Rebates to pledge to replace car with e-bikes for local trips

Participant surveys are used to document the effectiveness of the TFCA-funded programs, including the share of non-auto trips that are replacing auto trips, frequency of use, and distances traveled. The benefits of the programs in terms of VMT are calculated by multiplying the number of participants by the number of trips per participant and the average trip distance reported by survey respondents. Commute programs are generally expected to be effective for 240 typical commute days per year (appropriate as most of these results are pre-COVID), while school programs are calculated at 180 school days per year. The calculated VMT reductions are offset by miles driven by new transit riders who use autos to access transit stops, and by VMT generated by additional vanpool trips.

The total VMT reductions are reported to the Bay Area Air Quality Management District (BAAQMD) on an annual basis. The annual results were converted to average weekday VMT reductions for

comparison to the other VMT analyses. Since the TDM programs operate primarily on weekdays, a factor of 260 weekdays per year was used to divide annual VMT reductions and estimate average weekday reductions.

Data were compiled from the three most recent years of TFCA reporting (fiscal years 2017-2019) as shown in Table 8. Results are listed for several one-time only programs, such as a one-month free pass program on Tri-Delta Transit, but these one-time programs are not included in the average results.

The reporting indicates that the implemented TDM programs across all county subregions resulted in an average reduction of 313,956 VMT per weekday (Table 8). Initial reporting of the VMT benefits of the existing TDM programs of 46,800 daily VMT included only the Central and East subregions and included one-time programs in the three-year average. The updated reporting includes all county subregions and excludes one-time programs.

Additional VMT reductions related to expansion of these TDM programs are assumed to be proportional to increases in number of persons participating in the incentive programs. For example, a 15 percent increase in program funding and participation would be expected to decrease daily VMT by 47,093 ( $313,956 * 15\%$ ).

**Table 8: Contra Costa County TDM Program Average Weekday VMT Reductions**

Subregion and Program	Fiscal Year 2017-2018	Fiscal Year 2018-2019	Fiscal Year 2019-2020	Average of Ongoing Programs
<b>Central/East County</b>				
Drive Less	37,890	11,430	7,414	21,623
Buy One Get One Free Transit Pass (BOGO)	Included in Drive Less	7,449	687	Included in Drive Less
Schoolpool	20,403	14,642	None	17,522
One-Time Programs	89	56	35,154	
<b>Total Central/East</b>	<b>58,383</b>	<b>33,576</b>	<b>43,255</b>	<b>39,146</b>
<b>Southwest County (SWAT)</b>				
Employer Outreach	17,314	169,051	169,051	118,472
Student Bus	2,958	3,111	1,662	2,577
Student TRAFFIX	7,228	7,236	7,228	7,230
Vanpool	6,137	6,031	6,288	6,152
<b>Total Southwest</b>	<b>33,636</b>	<b>185,430</b>	<b>184,229</b>	<b>134,432</b>
<b>West County (WCCTAC)</b>				
Pass2Class	11,520		11,595	11,558
Commuter Transit Incentives	76,621	20,192	31,210	86,229
Guaranteed Ride Home	43,693	49,992	34,093	42,593
Employer-Based Trip Reduction (EBTR)	53,010	77,653		Included in Commuter Incentives
<b>Total West</b>	<b>184,844</b>	<b>147,837</b>	<b>76,898</b>	<b>140,379</b>
<b>Total Contra Costa County</b>	<b>276,863</b>	<b>366,843</b>	<b>304,381</b>	<b>313,956</b>

Sources: 511CC.org, SWAT, WCCTAC, Kittelson &amp; Associates, 2022

## 4. Evaluation Results

The initial evaluation of VMT mitigation projects applied the Contra Costa Countywide travel model, with methodology adjustments as noted in the prior sections. The VMT reduction effectiveness for projects which could not be represented in the travel model was calculated outside the modeling process.

### 4.1 TRAVEL MODEL RESULTS

The daily VMT was compared for Alternative 2 for the 2047 design year with the initial list of mitigation projects and with a revised list of mitigation projects (Table 9).

#### Initial Evaluation

The initial list of transit projects, including expansion of services within and outside the I-680 corridor, was projected to decrease 2047 daily VMT by 71,200 compared to Alternative 2 without mitigation. The initial evaluation of eight prototype mobility hub locations with a one-mile radius of effectiveness (no expanded mobility services) resulted in an additional reduction of 4,300 daily VMT for a total of 75,500. The three active transportation projects would reduce VMT by an additional 700 (evaluated outside the travel model) for a total of 76,200. This reduction would represent 91 percent of the VMT projected to be added by the implementation of Alternative 2 in 2047.

#### Additional Evaluation

The travel model evaluation of additional projects incorporated the following revisions:

- The Alternative 2 "No Mitigation" scenario was updated to ensure that future bus service in the I-680 corridor does not include any new service that lacks committed funding sources
- The mobility hub modeling was refined to ensure connections to all available bus and rail transit services
- The mobility hub modeling was refined to represent access improvements for either a one-mile or two-mile radius

With these revisions, the I-680 Express Bus was tested alone without the other initial transit services such as WCCTAC Express Buses, County Connection BART Feeder or the Concord Downtown Circulator. The I-680 Express Bus is forecast to reduce daily VMT by 36,800.

The mobility hub locations were reduced from the eight prototype locations to three key locations coinciding with stops in the proposed I-680 Express Bus Route:

- San Ramon Bollinger Canyon Road (near Bishop Ranch office park)
- Walnut Creek BART Station
- Martinez Amtrak Station

**Table 9: Travel Model Evaluation of Vehicle-Miles of Travel with Mitigation**

Evaluation Scenario	2047 Daily VMT	Difference from 2047 No Build	Difference from Unmitigated
No Build	111,430,800		
Alt. 2 (Unmitigated)	111,514,500	+83,700	
<b>Initial Evaluation</b>			
Alt. 2 with All Initial Transit Projects	111,443,300	+12,500	-71,200
Alt. 2 with All Initial Transit Projects and 8 Mobility Hubs (1 mile radius)	111,439,100	+8,200	-75,500
<b>Additional Evaluation</b>			
Alt. 2 with I-680 Express Bus	111,477,700	+46,900	-36,800
Alt. 2 with I-680 Express Bus and 3 Mobility Hubs (1-mile radius) <sup>1</sup>	111,471,100	+40,300	-43,400 (-6,600 associated with Mobility Hubs)
Alt. 2 with I-680 Express Bus and 3 Mobility Hubs (2-mile radius) <sup>2</sup>	111,462,300	+31,500	-52,200 (-15,400 associated with Mobility Hubs)

Vehicle-miles of travel for five county MSA: Alameda, Contra Costa, Marin, San Francisco, San Mateo counties

<sup>1</sup>One-mile radius includes mobility hub improvements and MoD/MaaS applications but no additional mobility services.

<sup>2</sup>Two-mile radius includes mobility hub improvements and MoD/MaaS applications and additional mobility services such as microtransit and/or increased eBike/eScooter operations.

Source: Kittelson & Associates, 2022

Assuming no new mobility services and a one-mile radius of effectiveness, the three mobility hubs would reduce daily VMT by 6,600. If new mobility services are assumed, with a two-mile radius of effectiveness, the three mobility hubs would reduce daily VMT by 15,400. A significant portion of the mobility hub benefits would come from additional ridership on the I-680 Express Bus, as noted in the next section.

## 4.2 TRANSIT RIDERSHIP

The projected ridership on the individual transit services was compiled, along with the VMT directly accounted for by that ridership (Table 10). The person-miles of travel on each transit route segment were converted to estimated equivalent automobile VMT assuming a typical automobile persons/vehicle ratio of 1.40.

### Initial Evaluation

In the evaluation of the initial list of transit projects, ridership on the added transit services themselves would account for about 31,000 of the daily VMT reduction. However, additional VMT reduction would be attributed to additional ridership on connecting routes such as BART. The improved connector access to BART on the Antioch and Richmond lines is expected to divert some passengers from other BART lines such as Dublin-Pleasanton. In addition, the improved WCCTAC express bus service is projected to divert some riders from existing AC Transit services. However, the total net daily VMT reductions were estimated at 71,200 as shown in Table 9, page 13.

### Additional Evaluation

The additional evaluation included refinement of the representation of assumed future bus service in the I-680 corridor (without the Innovate 680 program or mitigation) and connections enabled by the mobility hubs. With these refinements, the I-680 Express Bus is projected to attract 1,620 daily trips and directly account for reduction of 20,200 daily VMT. Additional VMT reduction would be caused by additional transfers to other transit services such as BART.

The proposed three mobility hubs would improve access to the I-680 Express Bus and would help to increase ridership. Mobility hubs with a one-mile radius of effectiveness are projected to increase express bus ridership by 40 percent, while a two-mile radius of effectiveness with additional mobility services would increase express bus ridership by 78 percent. These increases in express bus ridership would account for the majority of the VMT benefits of the mobility hubs.

**Table 10: Estimated 2047 Transit Ridership and Equivalent Direct VMT Reduction**

Transit Service	Daily Boardings Change	Direct VMT Reduction <sup>1</sup>
<b>Initial Evaluation</b>		
I-680 Express Bus	730	10,200
WCCTAC Express Bus Routes 2	440	4,100
WCCTAC Express Bus Routes 6	1,110	7,400
WCCTAC Express Bus Routes 7	1,000	5,100
County Connection 15-Minute BART Feeder Network	1,580	3,400
County Connection Downtown Concord Circulator	1,490	1,100
<b>TOTAL</b>	<b>6,350</b>	<b>31,300</b>
<b>Additional Evaluation</b>		
I-680 Express Bus	1,620	20,200
I-680 Express Bus with 3 Mobility Hubs (1-mile radius) <sup>2</sup>	2,270	25,620
I-680 Express Bus with 3 Mobility Hubs (2-mile radius) <sup>3</sup>	2,880	30,600

<sup>1</sup>Direct VMT reduction only includes VMT reduced parallel to the transit service and does not include additional VMT reduction caused by increased transit ridership on connecting transit services. Table x on page x includes both direct and additional induced VMT reduction.

<sup>2</sup>One-mile radius includes mobility hub improvements and MoD/MaaS applications but no additional mobility services.

<sup>3</sup>Two-mile radius includes mobility hub improvements and MoD/MaaS applications and additional mobility services such as microtransit and/or increased eBike/eScooter operations.

Source: Kittelson & Associates, 2022

### 4.3 ACTIVE TRANSPORTATION

The estimated VMT reduction for selected active transportation projects in the I-680 corridor are listed in Table 11. Note that these VMT reductions only account for diversion of vehicle trips between origins and destinations directly along these routes, and do not account for additional VMT reduction that may occur due to improved accessibility to transit for longer trips. Therefore these estimates represent a conservatively low estimate of the effectiveness of the active transportation projects to reduce total VMT.

**Table 11: Estimated VMT Reduction for Active Transportation Projects**

Project	Network Miles	VMT Reduction
Martinez Intermodal Station - Crockett SF Bay Trail Gap Closure Project	0.6	180
Parkside Drive Class IV Two-Way Cycle Track	0.4	120
Safe Routes 2 BART	1.5	450
<b>TOTAL</b>	<b>2.5</b>	<b>750</b>

Source: Kittelson & Associates, 2022

While the selected active transportation projects do not show high values of VMT reduction, it should be noted that active transportation projects can provide many other types of benefits including safety, health, and quality of life considerations.



## 4.4 EFFECTIVENESS OF CONSIDERED PROJECTS

The VMT reduction potential for all mitigation projects considered is summarized in Table 12.

**Table 12: Estimated VMT Reduction for All Mitigation Projects Considered**

Project	VMT Reduction
<b>Innovate 680: 3 Shared Mobility Hubs</b>	<b>6,600 to 15,400</b>
<b>Innovate 680: I-680 Express Bus</b>	<b>36,800</b>
WCCTAC Express Bus Routes 2,6,7	37,700
County Connection 15-Minute BART Feeder Network	7,750
County Connection Downtown Concord Circulator	2,570
Martinez Intermodal Station – Crockett SF Bay Trail Gap Closure	180
Parkside Drive Class IV Two-Way Cycle Track	120
Safe Routes 2 BART	450
699 Ygnacio Valley Road Affordable Housing Development	1,956
<b>TDM Program (Existing Level)</b>	<b>313,956</b>

Proposed mitigation projects are highlighted in **bold**

Source: Kittelson & Associates, 2022

The VMT reduction shown in Table 12 for the TDM programs is based on existing levels of investment and participation. It is assumed that the TDM programs can be expanded by increasing the level of funding to existing incentive programs and/or establishing new incentive programs to provide additional VMT benefits as project mitigation.

Table 13 lists the recommended VMT mitigation projects and the amount of increased TDM program required for each Express Lane alternative.

**Table 13: Interstate 680 Express Lane Completion Alternatives Proposed VMT Mitigation**

Mitigation Project	Express Lane Alternative 1C	Express Lane Alternative 2	Express Lane Alternative 3
Northbound Express Lane Completion Project	+102,583	+83,723	+100,981
Innovate 680: Shared Mobility Hubs	-15,400	-15,400	-15,400
Innovate 680: I-680 Express Bus	-36,800	-36,800	-36,800
TDM Program	-50,383	-31,523	-48,781
<b>TOTAL</b>	<b>0</b>	<b>0</b>	<b>0</b>

Source: Kittelson & Associates, 2022

# APPENDIX

**Table 14: Innovate 680 Initial VMT Mitigation Projects and Modeling Approach**

Initial Project	Locations	Effects on VMT	Modeling Approach	Notes
<b>Innovate 680 Shared Mobility Hubs<sup>1</sup></b>	I-680 Corridor (Figure 1) <ul style="list-style-type: none"> <li>• <b>Martinez Amtrak Station</b></li> <li>• Concord (Willow Pass/SR-242) PNR</li> <li>• <b>Walnut Creek BART</b></li> <li>• Mitchell Drive PNR</li> <li>• Danville Sycamore Valley PNR</li> <li>• San Ramon Transit Center</li> <li>• <b>Bollinger Canyon PNR</b></li> </ul>	Faster travel times for buses to/from hub due to transit priority treatments  More accessible bicycle options (e-Bikes, etc...)  Safer and more attractive pedestrian access	Reduce travel time for buses using hubs (1-2 minutes)  Decrease perceived travel times for bike/walk access to transit at hubs by 30%.	Results in approximately 45 percent higher boardings/alightings on buses at mobility hubs.
<b>I-680 Express Bus<sup>1</sup></b>	Option B from Tri-Valley Hub Network Integration Study (Figure 2): <ul style="list-style-type: none"> <li>• Martinez Amtrak</li> <li>• Walnut Creek BART</li> <li>• Bollinger PNR</li> <li>• Dublin/Pleasanton BART</li> <li>• Pleasanton ACE (peak only)</li> </ul>	Additional transit choice	Code peak and off-peak route.  Enable PNR access at all stops.  Use travel times from Hub study Appendix F.  Frequencies:  2027: 30 minute peak, 60 minute off-peak  2047: 30 minute peak and off-peak	Coded in model

**Table 14: Innovate 680 Initial VMT Mitigation Projects and Modeling Approach**

Initial Project	Locations	Effects on VMT	Modeling Approach	Notes
WCCTAC Express Bus Routes 2, 6, 7	West Contra Costa County (Figure 3) <ul style="list-style-type: none"> <li>Route 2: Hercules Transit Center to Emeryville and downtown Oakland</li> <li>Route 6: San Pablo and Richmond to downtown Berkeley</li> <li>Route 7: San Pablo and Richmond to downtown Oakland</li> </ul>	Decrease travel times for East Bay intercity trips	West Contra Costa County Express Bus Implementation Plan  Code routes, stops and travel times from Implementation Plan  Frequencies: 15 minute peak, 30 minute off-peak	Coded in model
County Connection 15-Minute BART Feeder Network	Central Contra Costa County (Figure 4)	Reduce wait times for transfers at BART stations	CCCTA 2016 – 2025 Short Range Transit Plan  15-minute maximum peak headways	Coded in model – revised frequencies for existing routes
County Connection Downtown Concord Circulator	Concord BART – Willows Shopping Center (Figure 5)	Additional transit choice	CCCTA 2016 – 2025 Short Range Transit Plan  Frequencies: 15 minute peak and off-peak (proposed service would not operate during AM peak but AM and PM peaks are not modeled separately)	Coded in model (longer version of route) as 51_DTConcord EB and WB
County Connection I-680 Corridor Service Improvements	I-680 corridor, San Ramon to Walnut Creek	Higher transit speeds, additional local connections	Not included in first round – recommended improvements overlap with other projects	Not modeled

**Table 14: Innovate 680 Initial VMT Mitigation Projects and Modeling Approach**

Initial Project	Locations	Effects on VMT	Modeling Approach	Notes
LAVTA Route 10 Rapid Bus	Pleasanton-Livermore	Higher travel speeds	Decrease travel times 20% to represent technology improvements.	Not modeled – Service not well represented in Contra Costa model
Lamorinda Bicycle and Pedestrian Connectivity Program	No new separated bike/ped facilities identified			Not modeled
Martinez Intermodal Station - Crockett SF Bay Trail Gap Closure Project	Martinez (Figure 6)	Provide protected connection to transit to increase bicycle/pedestrian trips	Decrease perceived travel time for bike/ped to reflect higher attractiveness of protected path	Estimated outside model based on CAPCOA
Parkside Drive Class IV Two-Way Cycle Track	Walnut Creek, Parkside Drive - Provide protected cycle track connection between BART and Iron Horse Trail	Provide protected connection to transit to increase bicycle/pedestrian trips	Decrease perceived travel time for bike/ped to reflect higher attractiveness of protected path	Estimated outside model based on CAPCOA
Safe Routes 2 BART	Walnut Creek – California Drive	Provide protected connection to transit to increase bicycle/pedestrian trips	Decrease perceived travel time for bike/ped to reflect higher attractiveness of protected path	Estimated outside model based on CAPCOA
Walnut Creek Ygnacio Valley Bus Lane	Shadelands to Walnut Creek BART	Increase bus speed/reliability connecting to BART	Reduce travel times for buses using corridor	Affected bus routes and implementation not fully specified. Not modeled

<sup>1</sup>Proposed mitigation projects shown in **bold**. Other proposed mitigation projects were not evaluated using the travel model.

Source: Kittelson & Associates, 2022

Figure 1: Potential Shared Mobility Hub Locations

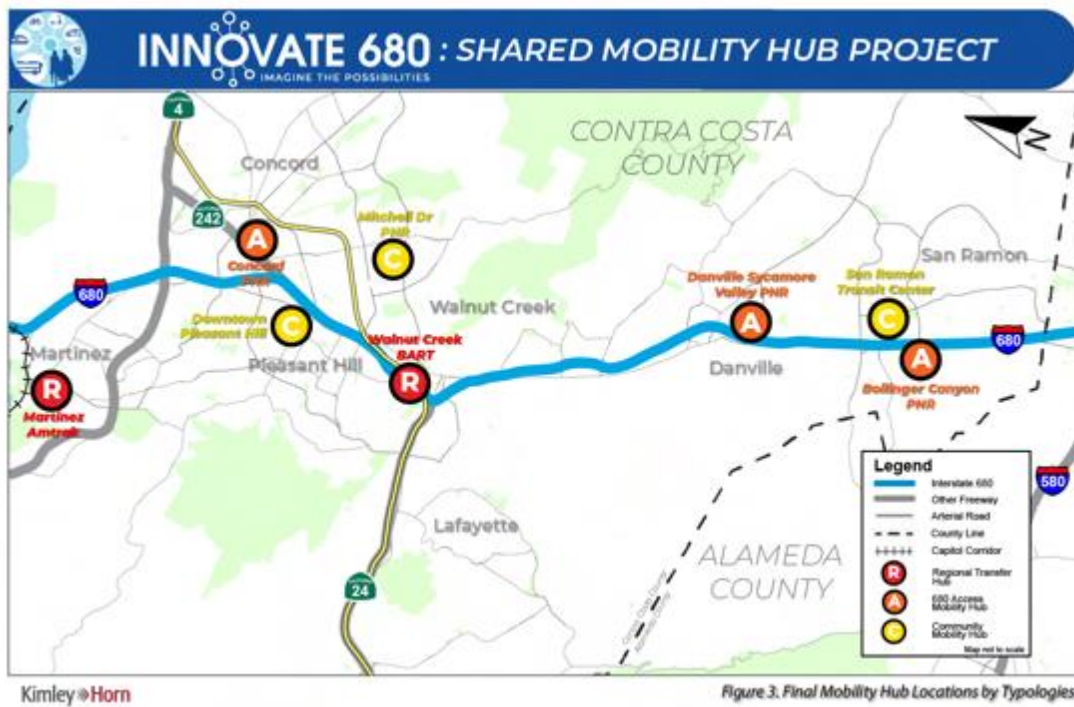
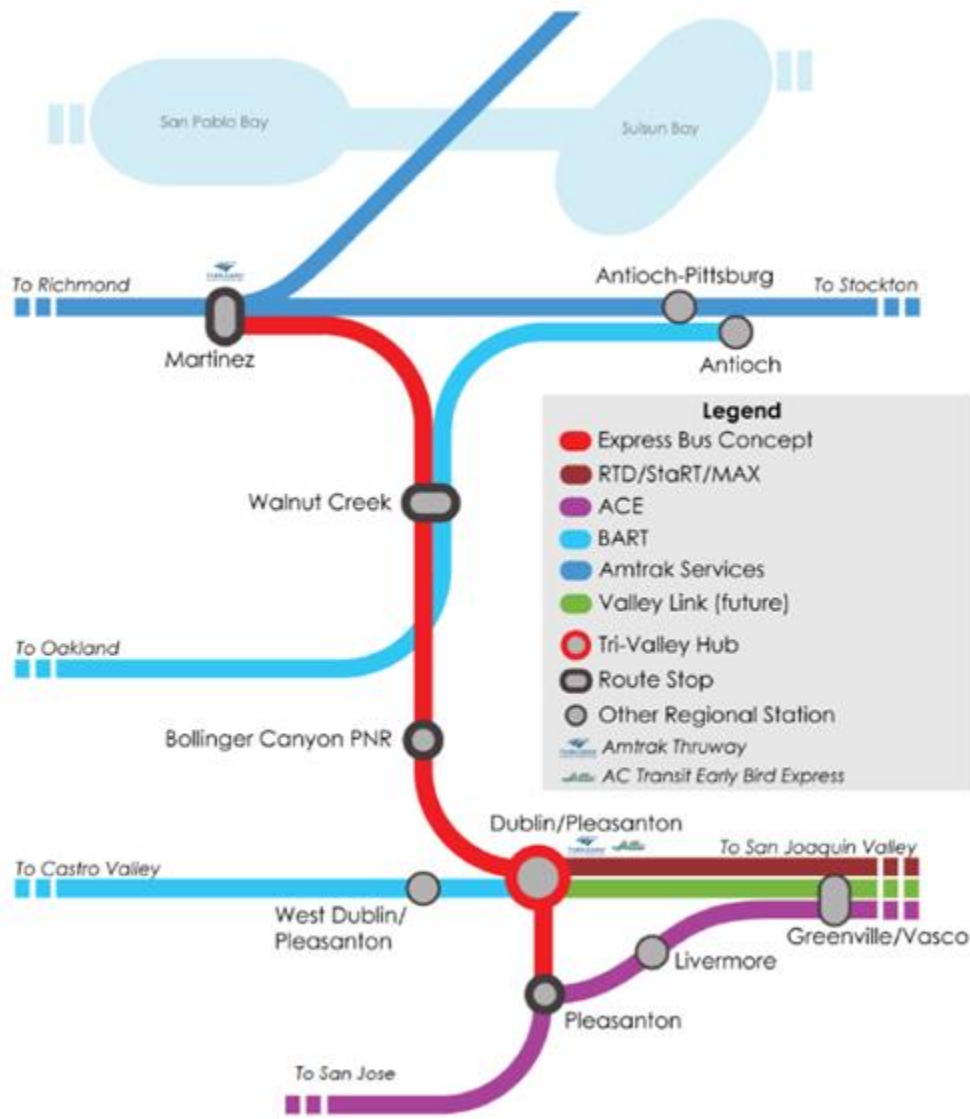


Figure 3. Final Mobility Hub Locations by Typologies

Source: Kimley-Horn, 2021

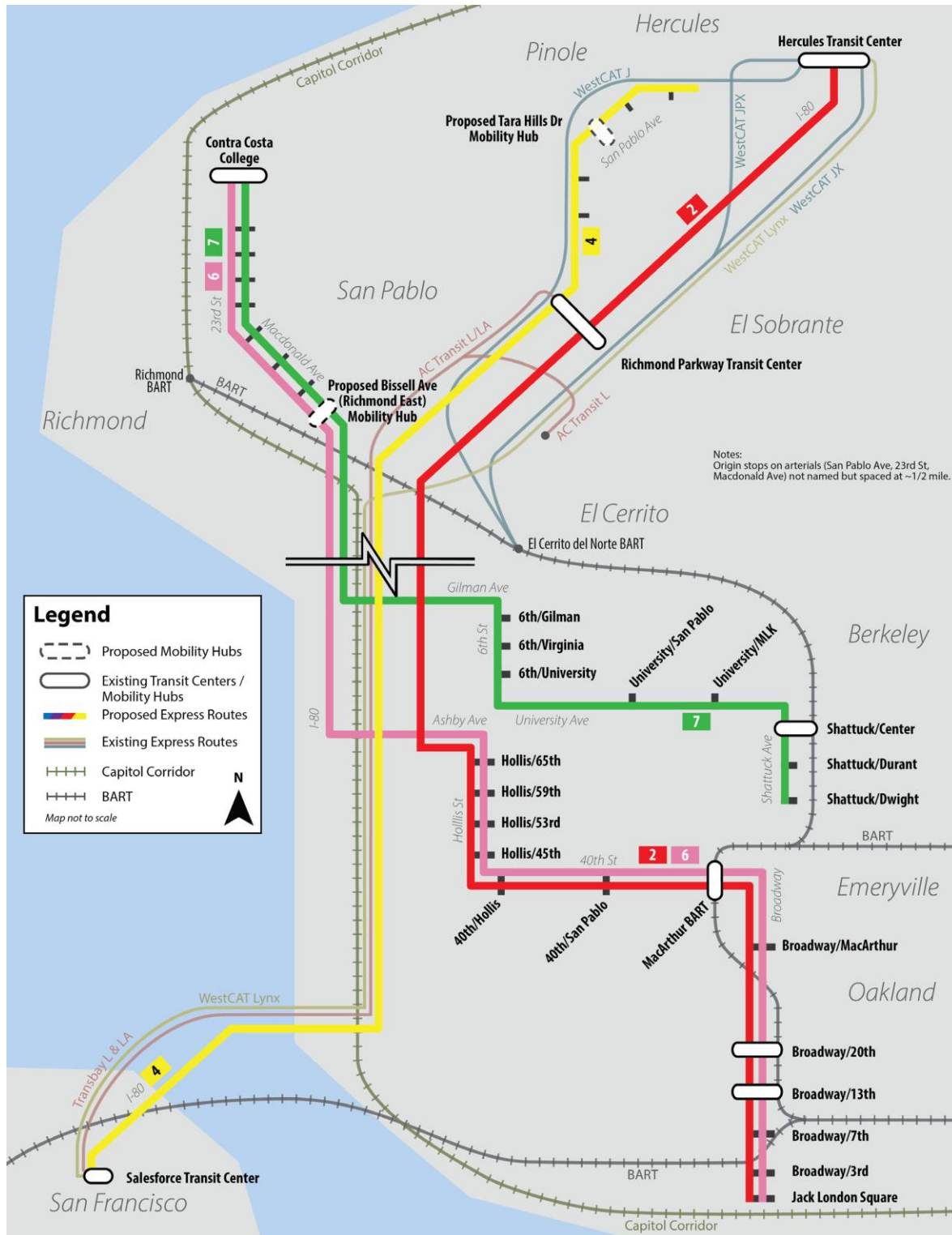
Figure 2: I-680 Express Bus Route Concept



Source: Livermore Amador Valley Transit Authority, *Tri-Valley Hub Network Integration Study Final Report*, May 27, 2021.

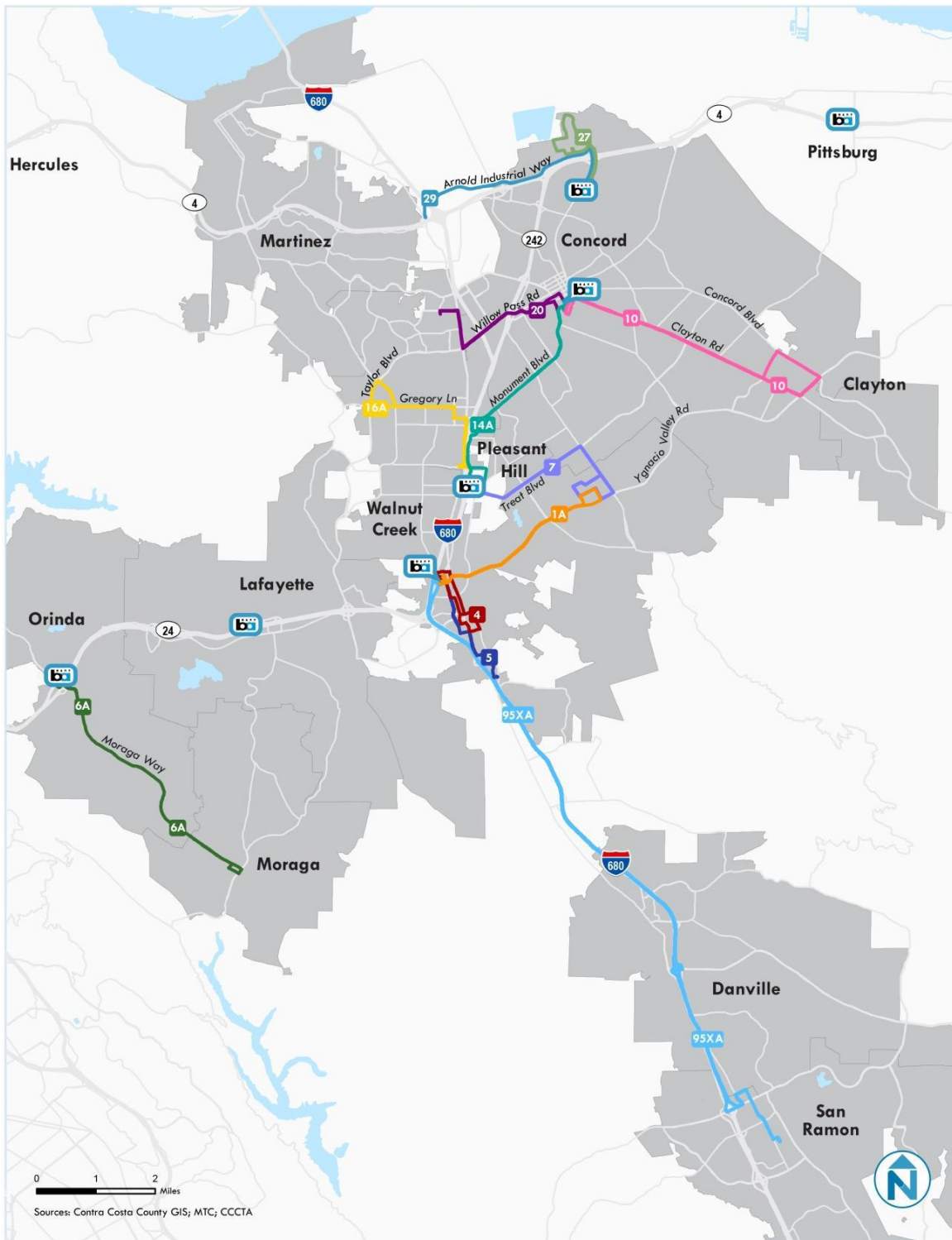


Figure 3: WCCTAC Express Bus Routes



Source: Kimley-Horn, West Contra Costa County Express Bus Implementation Plan, February 1, 2020, Figure 5-2, page 12

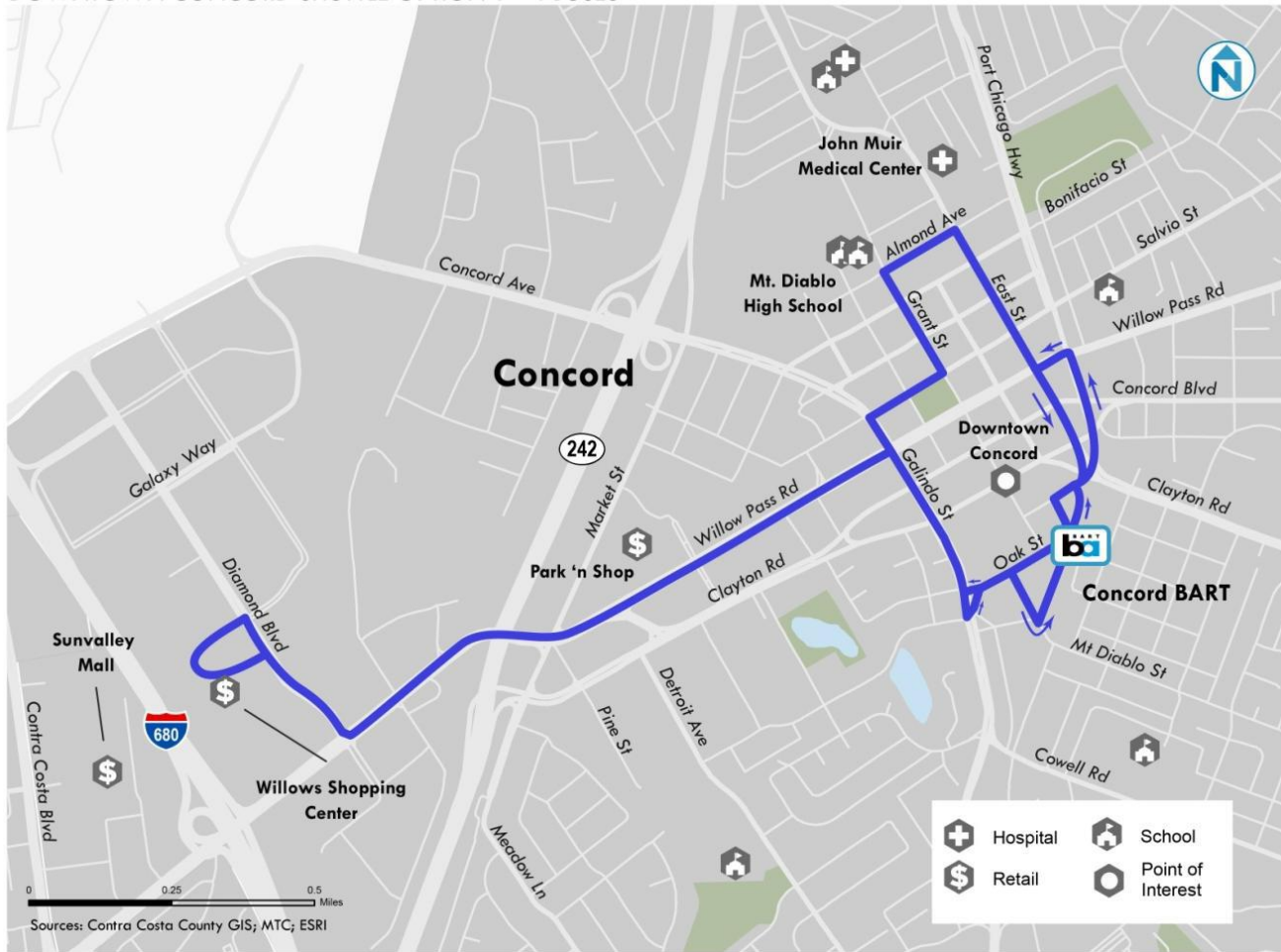
Figure 4: County Connection 15-Minute BART Feeder Network



Source: Nelson\Nygaard Consulting Associates, Inc., Central Contra Costa Transit Authority Short Range Transit Plan 2016-2025, Figure 9, page 63

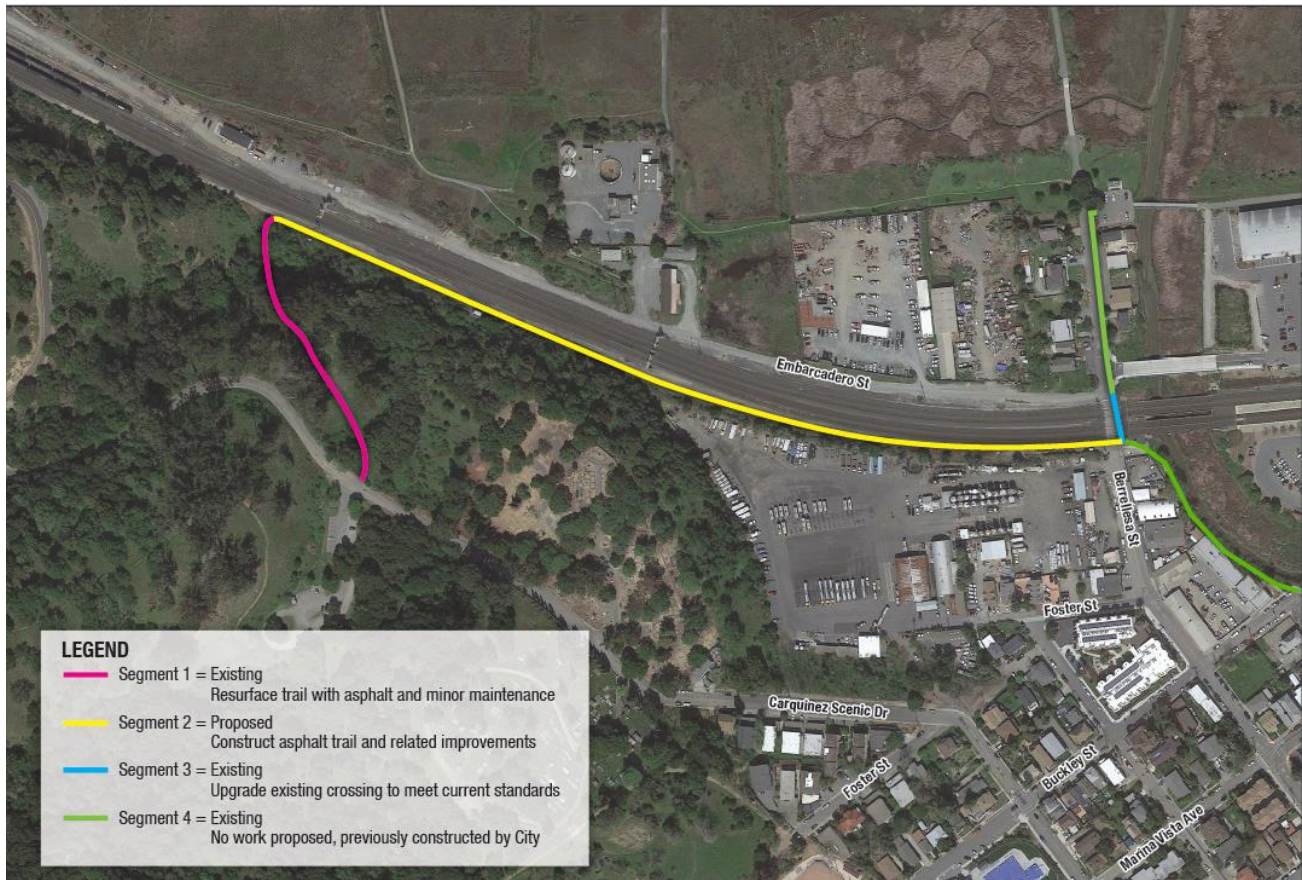
Figure 5: Downtown Concord Circulator Option 1

DOWNTOWN CONCORD SHUTTLE OPTION 1 - 4 BUSES



Source: Nelson\Nygaard Consulting Associates, Inc., Central Contra Costa Transit Authority Short Range Transit Plan 2016-2025, Figure 12, page 70

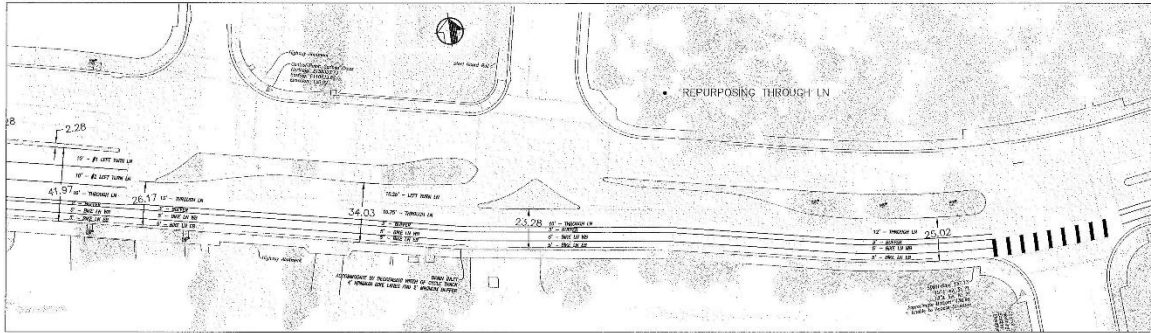
Figure 6: Martinez Intermodal Station to Crockett SF Bay Trail Gap Closure



Source: Kimley-Horn, Martinez Bay Trail Phase II Project, East Bay Regional Park District, Conceptual Alignment, 2020

Figure 7: Parkside Drive Class IV Two-Way Cycle Track

PARKSIDE DRIVE CYCLE TRACK CONCEPT PLANS



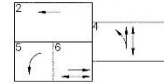
#58 PARKSIDE DRIVE & LAWRENCE WAY ON-RAMP

EXISTING SIGNAL PHASE DIAGRAM

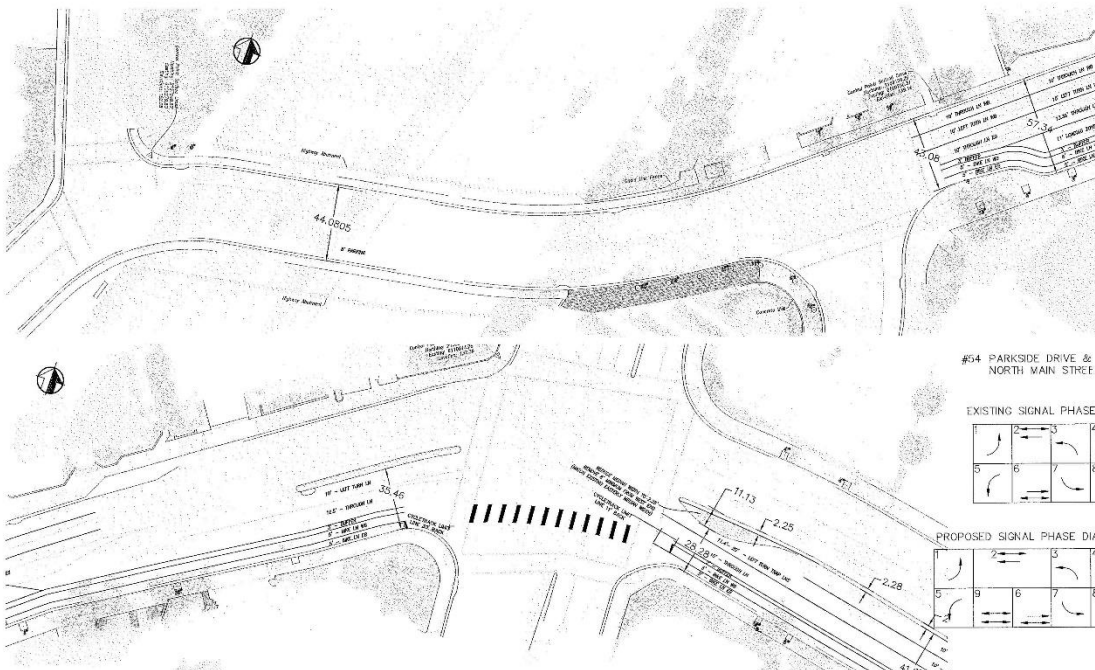


#64 PARKSIDE DRIVE & NORTH BROADWAY

EXISTING SIGNAL PHASE DIAGRAM

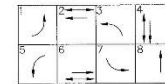


PARKSIDE DRIVE CYCLE TRACK CONCEPT PLANS



#54 PARKSIDE DRIVE & NORTH MAIN STREET

EXISTING SIGNAL PHASE DIAGRAM



PROPOSED SIGNAL PHASE DIAGRAM

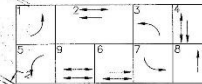
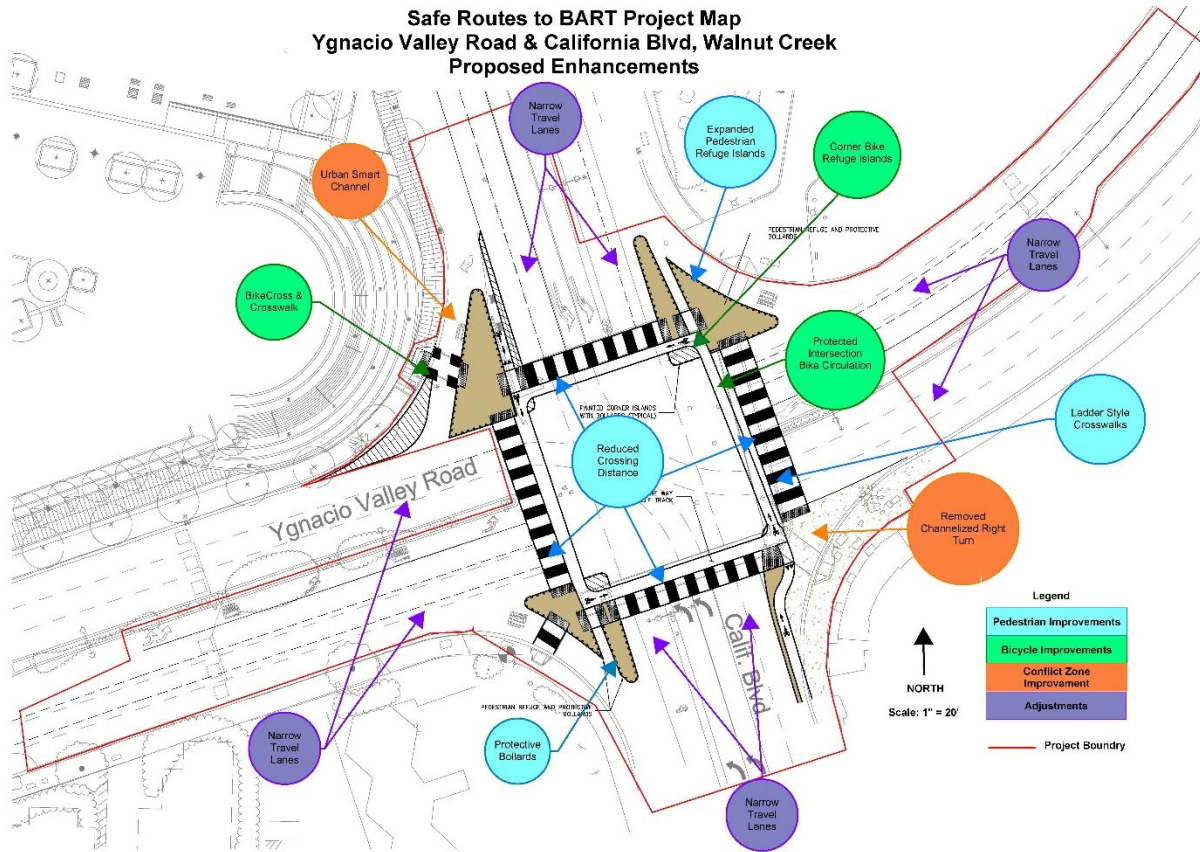




Figure 8: Safe Routes 2 BART - Intersection Detail



Source: City of Walnut Creek, 2021