City/County Association of Governments of San Mateo County

State Highway System Congestion and Safety Assessment Update 2019

Background

This report is intended to assess the existing 2019 conditions of the current state highway system network in San Mateo County for congestion and safety. The various performance measures used are detailed in the following sections along with how they should be interpreted with regard to the associated elements considered and their meaning.

Transportation Performance Measures for 2019 in San Mateo County

Determining a Methodology

The method used in this analysis initially evolved from the transportation related work performed by the Metropolitan Transportation Commission (MTC) that is updated annually and referred to as part of Vital Signs, which is an innovative monitoring initiative that tracks trends related to transportation, land and people, the economy and the environment for the nine-county San Francisco Bay Area. In reviewing this large-scale document for the region, the various performance measures were assessed to determine a sub-set that would have application to the goals of C/CAG for the CTP. The first initiative taken was to determine the level of detail needed for the CTP application. MTC focuses more on the big picture of things while a more detailed view is needed for the CTP. Therefore, it was determined to define the segmentation based on the availability of operations data. INRIX provides measured speed data to MTC through a contract for the 511 program. This data is then made available to MTC members for free for planning purposes. INRIX utilizes traffic message channel (TMC) segments as the basis for defining road sections on which to report speed. TMC location codes were originally conceived of as points on the road network, typically assigned at significant decision points, interchanges or intersections for the purpose of describing locations of traffic incidents in an unambiguous format, independent of map vendor. INRIX reports traffic flow data by considering the road segments implied by the distance between consecutive TMC location codes, referred to as TMC Segments. In order to leverage the Congestion Management Process (CMP) work completed by C/CAG, it was decided to make use of the dataset used for the latest update for the 2019 CMP. The period reflected in that analysis was for Tuesdays, Wednesdays, and Thursdays (as typically applied for traffic analysis to avoid Mondays and Fridays that may reflect transitional traffic patterns closer to the weekends) between March – May 2015.

A short-list of performance measures was identified for application in San Mateo County that could be updated for a more detailed analysis using available data sources. These performance measures included Total Delay, % of Free-flow speed, and Travel Time Reliability. For Delay, MTC focuses on Congestion Delay which measures only delay when speeds drop below 35 mph. This is the threshold where the freeways begin to operate inefficiently. Given C/CAG is evaluating all state roadways within the County, the threshold of 35 mph does not necessarily apply to non-controlled access facilities like state routes that have signals or rural routes. Therefore, it was determined to use Total Delay as measured below free-flow speed rather than a pre-determined threshold of 35 mph.

Free-flow speed is the unconstrained speed of traffic during off-peak periods taking into account normal friction of each corridor including ramps, signals, driveways, etc. Free-flow speed is specific to each corridor measured down to the segment level since each area will have unique performance characteristics. Another performance measure used is % free-flow. This is one in the same range of total delay, but one all drivers can easily relate. This places all roadways in the same range of each other no matter the speed limit or operating characteristics, which makes it easier to compare performance across the network.

In addition to total delay and free-flow speed, a performance measure that is important to drivers is consistency of travel time. Within the transportation industry, this is referred to as travel time reliability. It is a function of the variability of travel time from day to day throughout a period of time. This relates to the unpredictability of traffic conditions, thus variability as compared to everyday delays or bottlenecks.

Crash frequency is another performance measure of interest to the county and to drivers. On the surface, crashes want to be minimized for the safety of the community, but they also contribute to non-recurring delays and many times to secondary crashes and problems. The crash frequency on the system network was evaluated and crash rates were evaluated using the volumes of the respective roadways.

Defining Performance Measures

The performance measure results are summarized for the AM and PM peak periods. For the purpose of the analysis, the supporting figures and tables are based on the worst hour of the respective periods. For the AM peak, that was found to be 8-9 am and for the PM peak, it was 5-6 pm. The represented thresholds in each legend were determined based on the distribution of the results. Each category includes approximately the same percentage of the resulting segments.

Total Delay, as opposed to Congested Delay primarily reported by MTC, accounts for delay compared to free-flow speed measured and reported by INRIX. FHWA defines free-flow speed as the measured average speed when there are no constraints placed on a driver by other vehicles on the road. When free- flow speed is measured varies by corridor and segment based on the conditions in the area. It is given that the longer a segment is, the more apt it is to accumulate delay. With that in mind, the units of measure for Total Delay are divided by the segment length which results in a delay value at a unit length level. The delay is further factored by the respective model volume that experienced the measured delay. The resulting units are Vehicle – Hours of Delay per mile (VHD / mile). The source of the volumes for the analysis is the C/CAG – VTA Travel Demand Model for the 2019 year. The results for Total Delay over the region are illustrated in **Figures 1 and 2** for the AM and PM Peak Period, respectively.

Another performance measure reported for use in the CTP is the % free-flow speed. The State Highway System Congestion and Safety Assessment includes the evaluation of all state roadways in the County. As such, this includes freeways (controlled access facilities) and local state routes that have driveways, traffic signals, and in some instances, stop signs on the rural routes. Therefore, it is more appropriate to compare average speeds to measured free-flow speed instead of average speed to the posted speed limit. Posted speed limit on the local state routes are difficult to maintain given the frequency of driveways, traffic signals, and the quality of the signal timing. Therefore, in order to highlight the conditions due to volume (congestion) and lessen the implications due to traffic signal timing (delay), this assessment compares to free-flow. In this context, speed limits are seen as maximum values vs. averages given the impact of traffic signals, driveways, friction along the corridor, etc. This is especially true along non-control access facilities. The results for % free-flow over the region are illustrated in **Figures 3 and 4** for the AM and PM Peak Period, respectively.

A more specific travel time reliability performance measure is referred to as the Buffer Index. Buffer Index in literal terms is the percent of time a driver must add to the average travel time for their trip in order to arrive on time to the destination 95% of the time over a month. A buffer index value of 25% indicates a driver would need to add 25% additional travel time over the average trip time (for an average 40 min trip, the driver would need to add 10 extra minutes) given the variability of the drive time over a typical month. The results for the region are illustrated in **Figures 5 and 6** for the AM and PM Peak Period, respectively.

There are two ways to study crash history. One is frequency and the other is rate compared to volume. If one looks at purely frequency, it results in highlighting those areas that have the most accidents, but most times that corresponds with those areas with the most volume. As one would expect, statistically, the more cars that go through and area with points of conflict, the chances are, the more crashes will happen. This approach will tend to miss those areas that have higher than the normal crashes on a relative basis when considering the number of cars that travel through the area. The other contributing factor for accidents is the length of segment being considered. Therefore, in order to baseline the calculation, the standard units for accident rate is the # accidents / million-vehicle-mile. This results in a common comparison between areas of differing exposure or volume and accounts for areas of differing lengths or segments. The results for the 3-year between 2016-2018 calendar years using the states accident database for the county that reflects all reported accidents for all law enforcement agencies in San Mateo County are illustrated in **Figures 7 and 8** for the crash frequency per mile and the crash rate compared to volume and segment length, respectively.

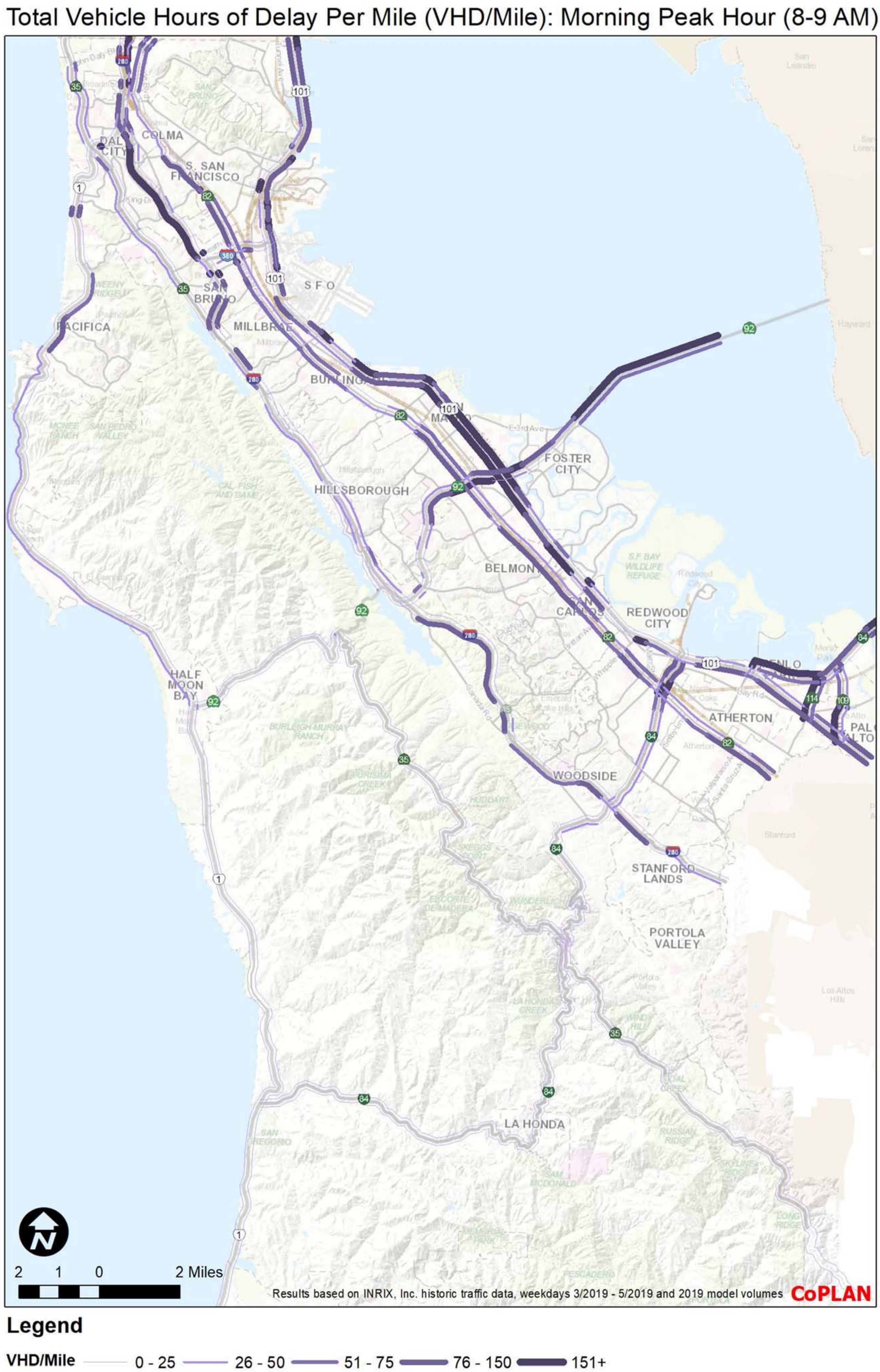


Figure 1: Total Vehicle Hours of Delay per Mile (AM Peak Period 8-9 AM)

Total Vehicle Hours of Delay Per Mile (VHD/Mile): Evening Peak Hour (5-6 PM)

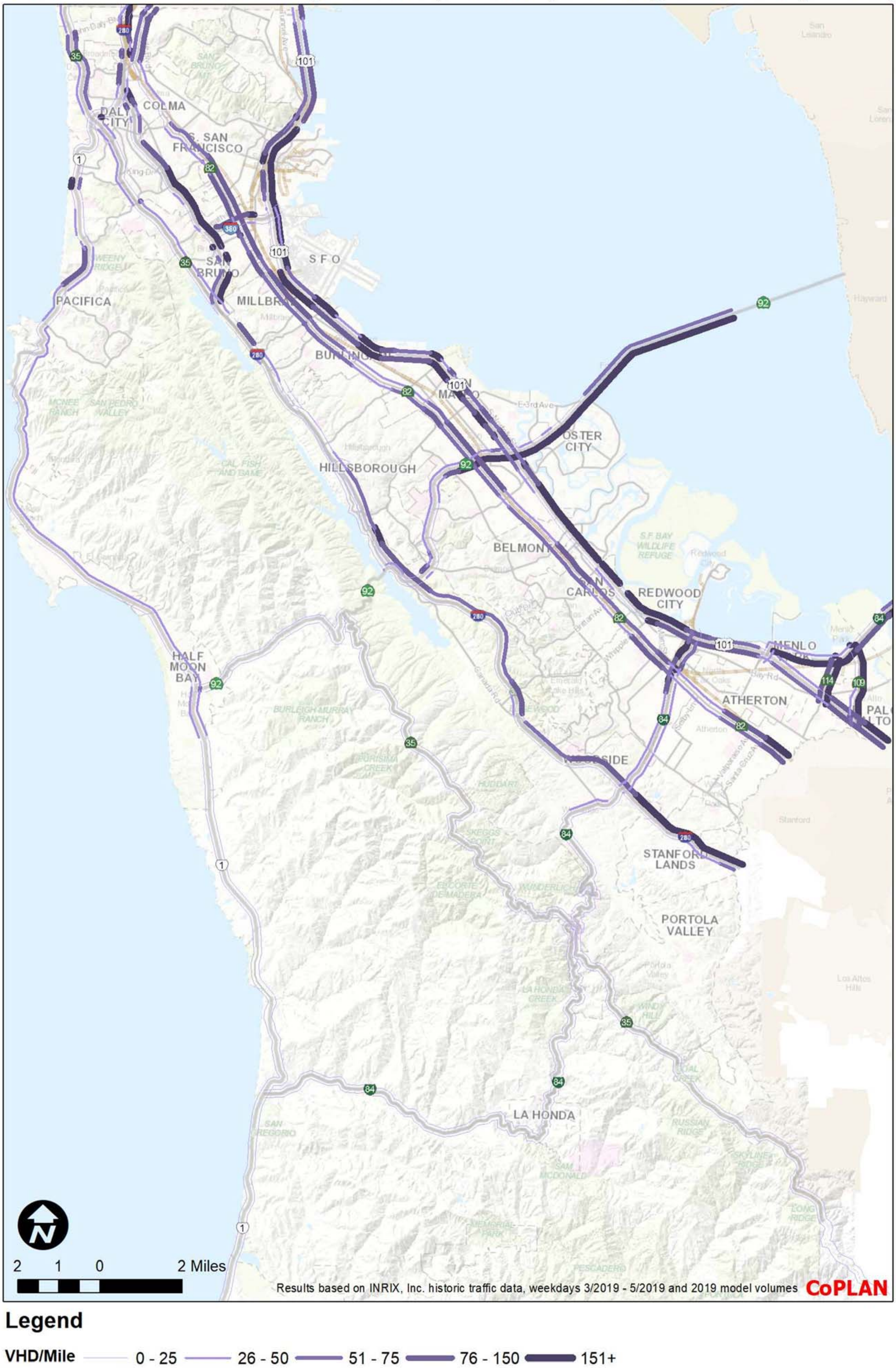


Figure 2: Total Vehicle Hours of Delay per Mile (PM Peak Period 5-6 PM)

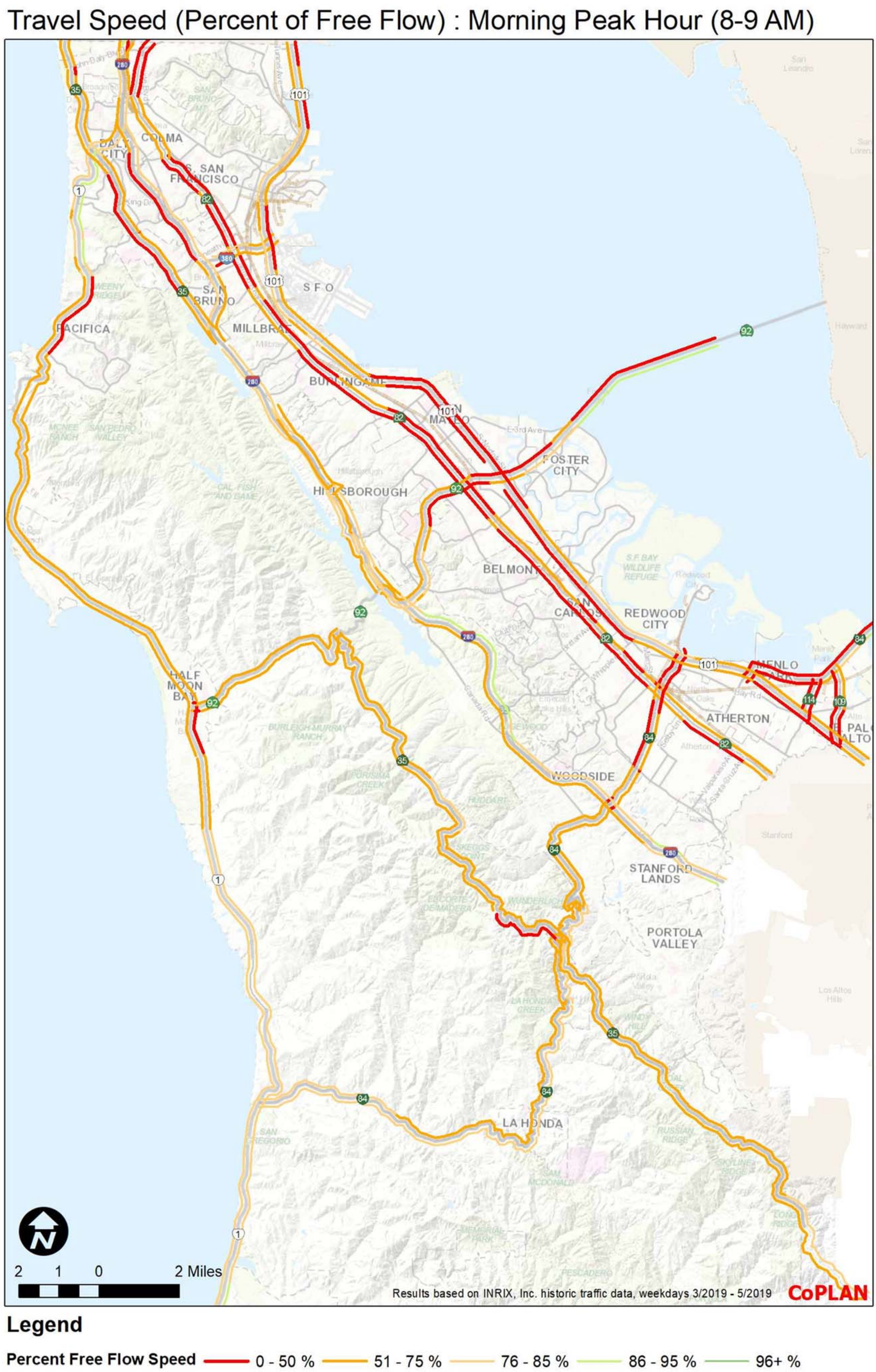


Figure 3: Percent of Free Flow Speed (AM Peak Period 8-9 AM)

Travel Speed (Percent of Free Flow) : Evening Peak Hour (5-6 PM)

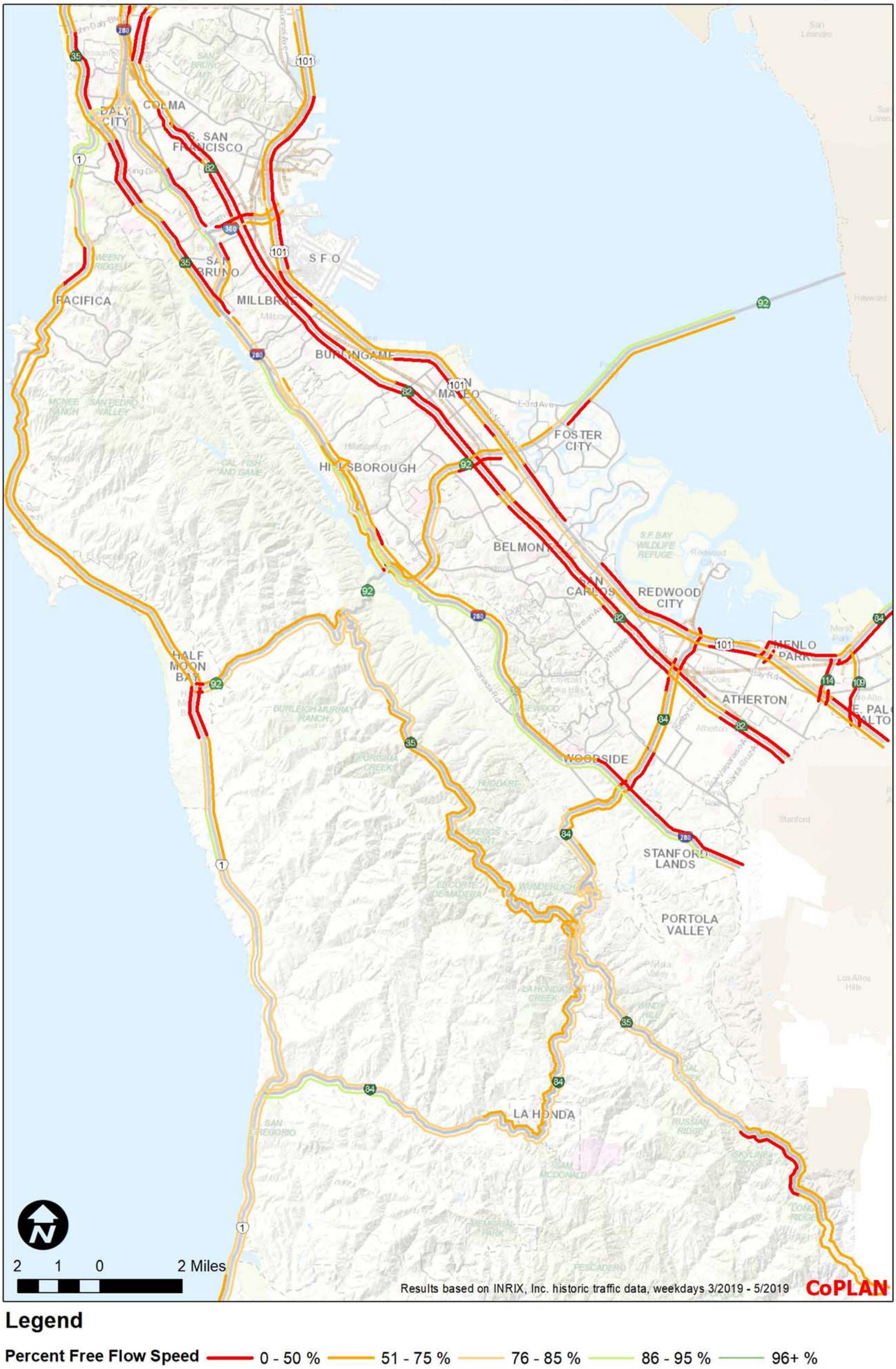


Figure 4: Percent of Free Flow Speed (PM Peak Period 5-6 PM)

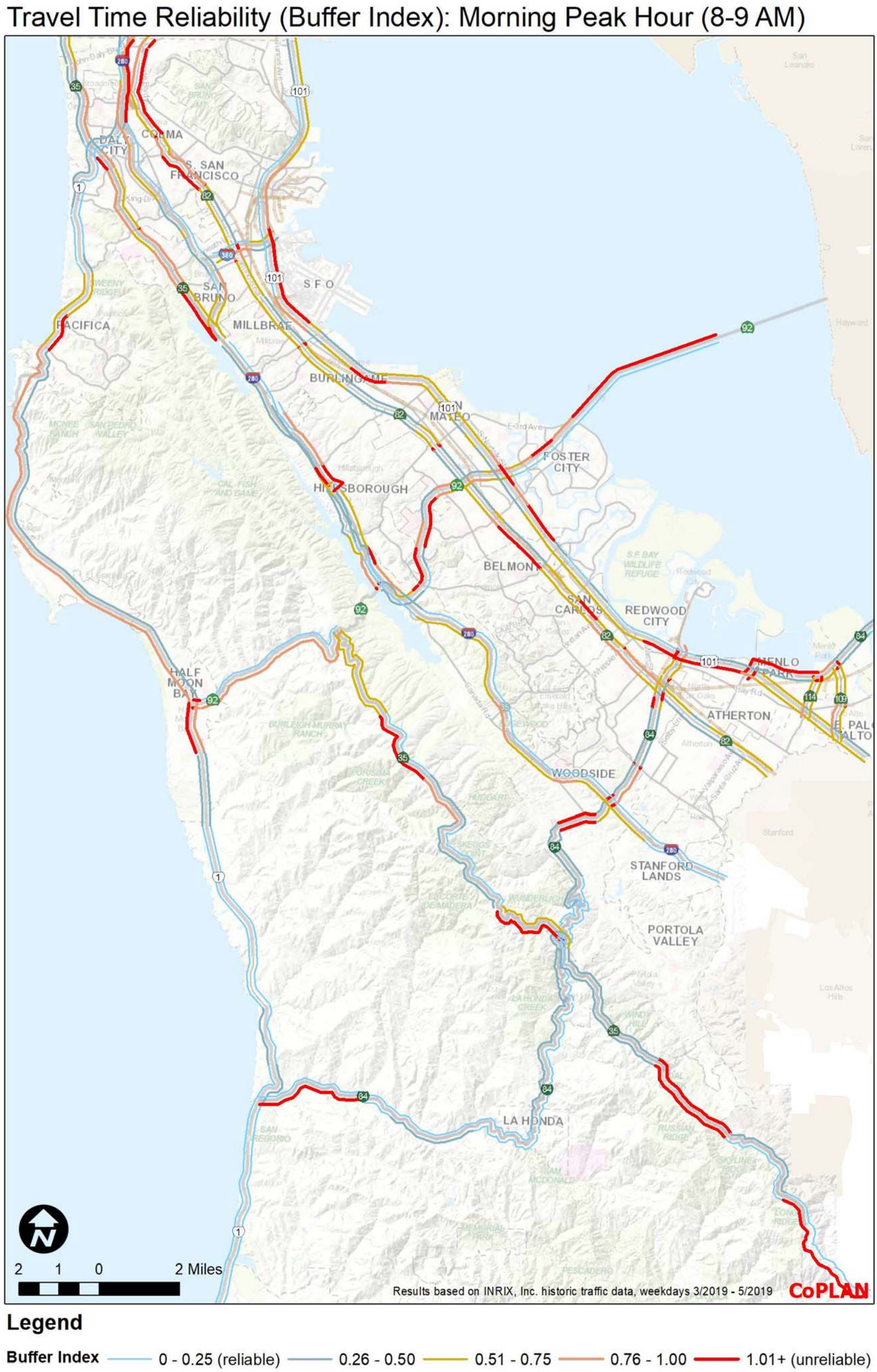
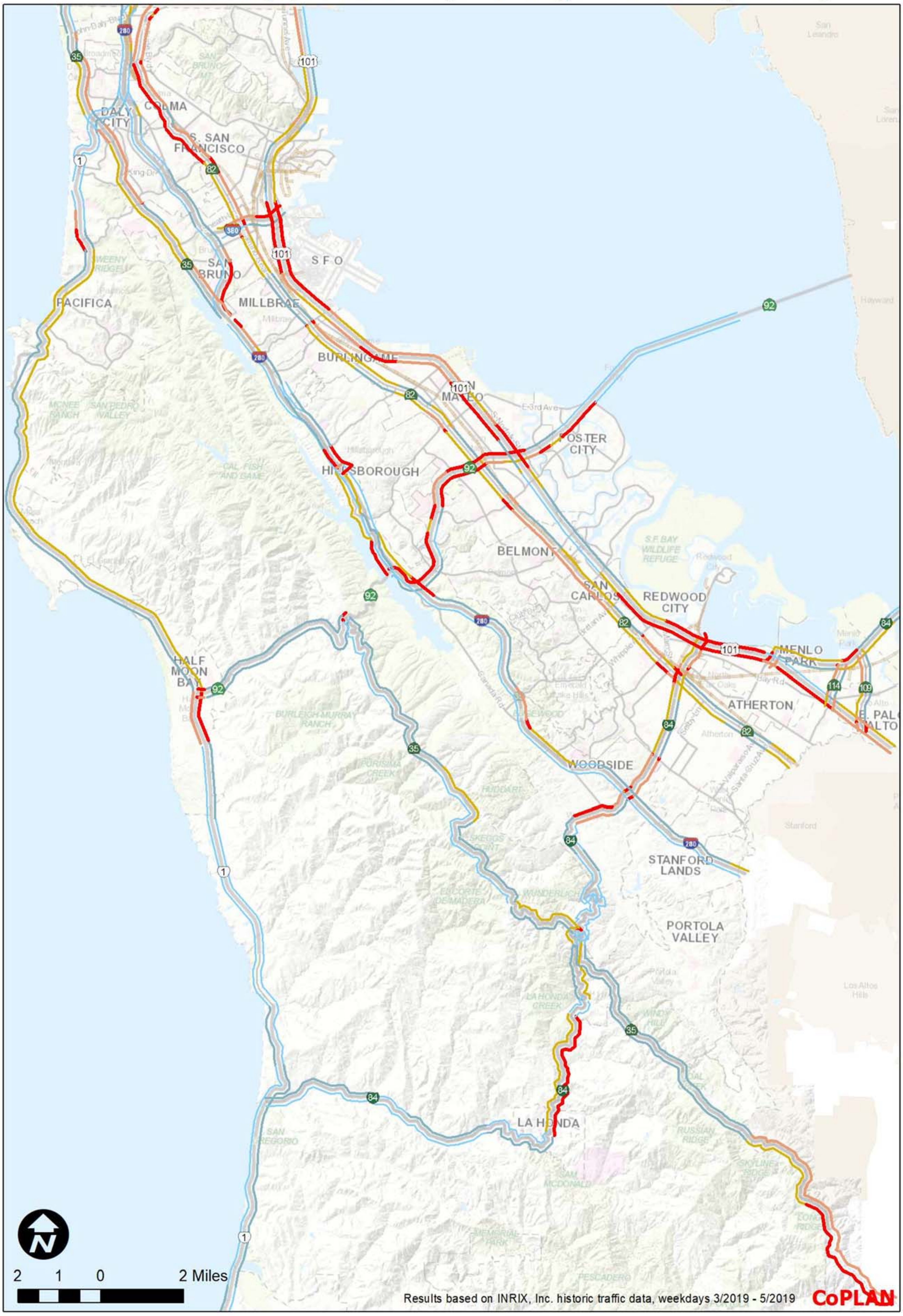


Figure 5: Travel Time Reliability (Buffer Index for AM Peak Period 8-9 AM)

Travel Time Reliability (Buffer Index): Evening Peak Hour (5-6 PM)



Legend

Buffer Index — 0 - 0.25 (reliable) — 0.26 - 0.50 — 0.51 - 0.75 — 0.76 - 1.00 — 1.01+ (unreliable)

Figure 6: Travel Time Reliability (Buffer Index for PM Peak Period 5-6 PM)

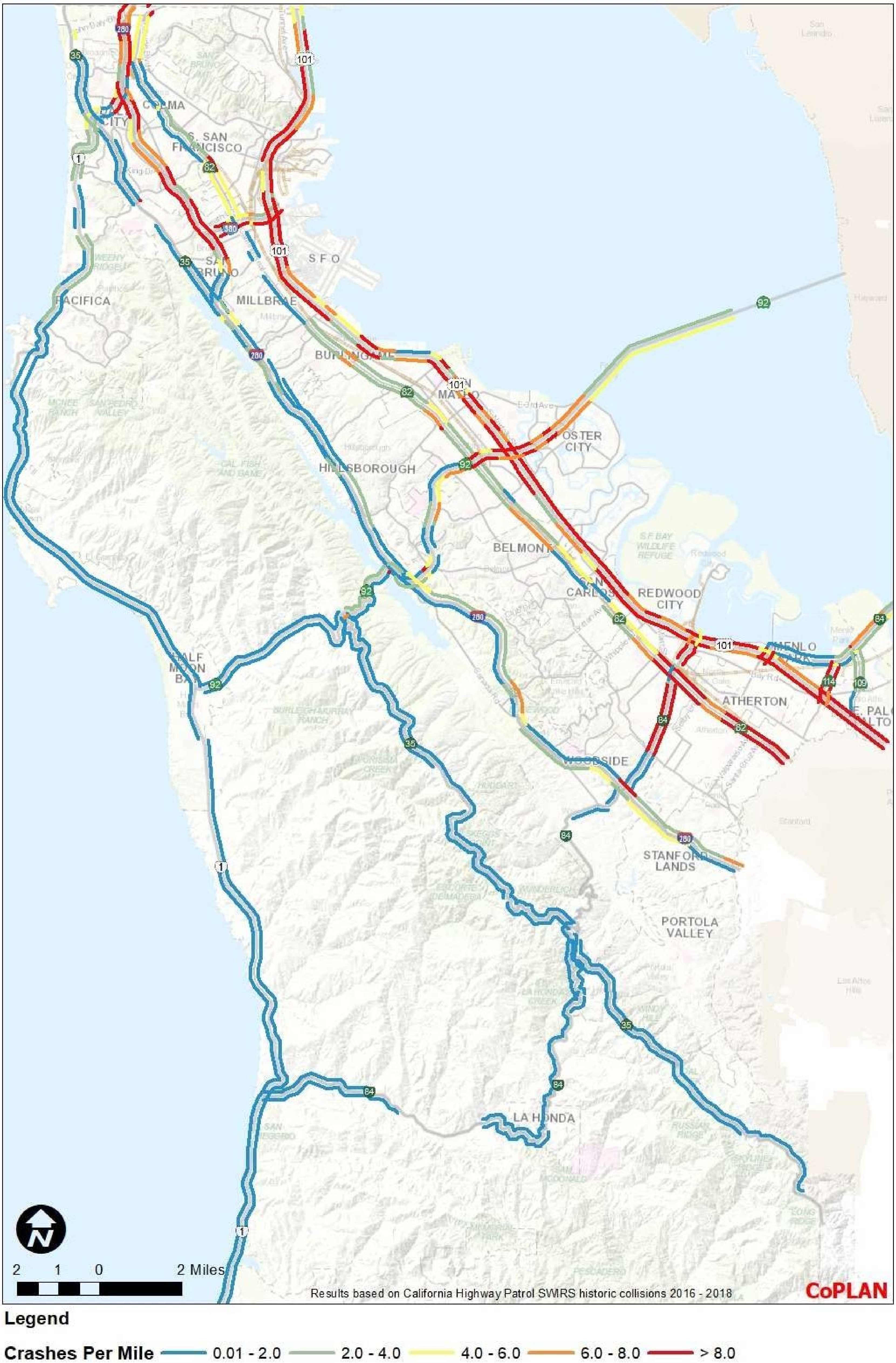
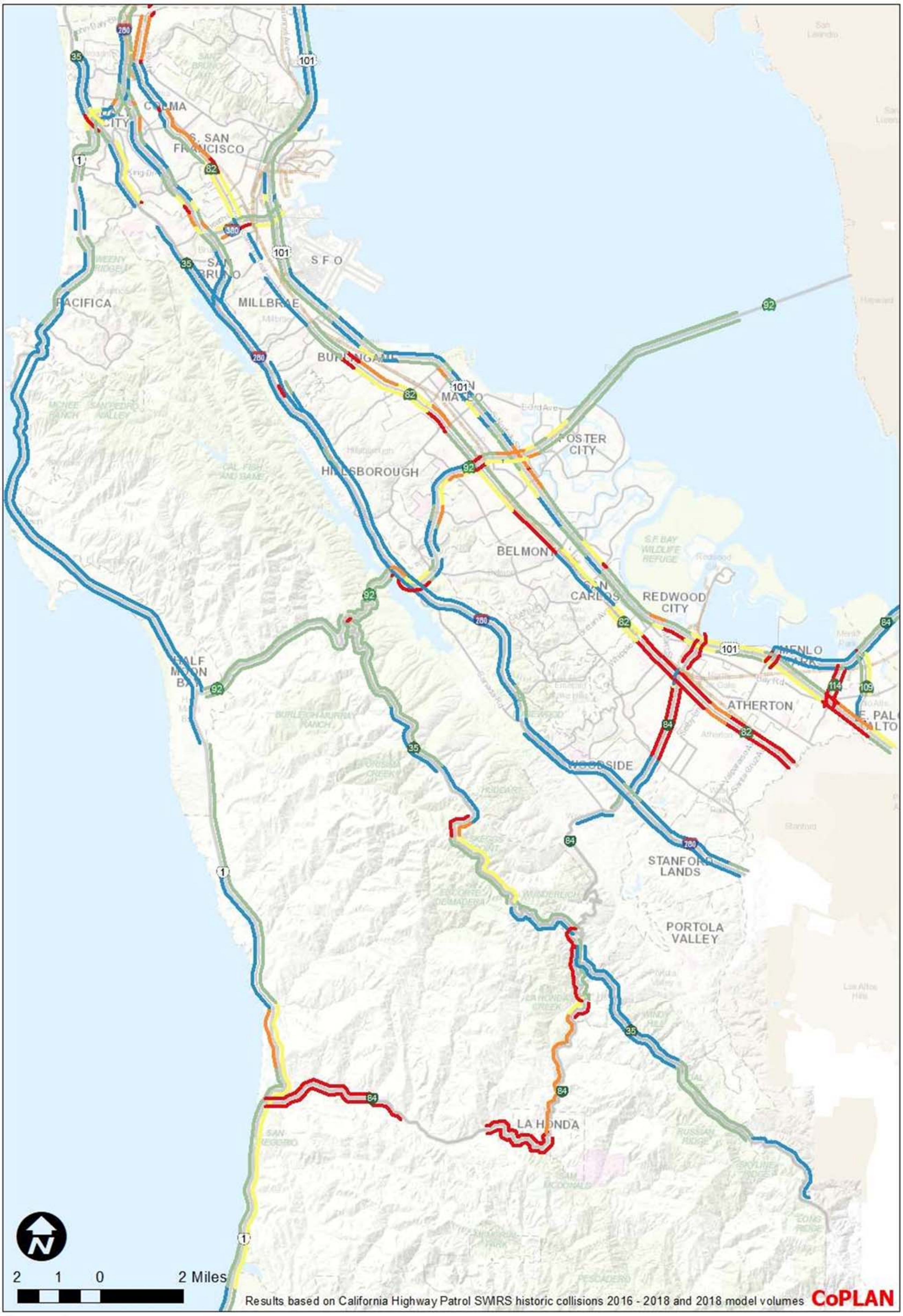


Figure 7: Crashes Per Mile (2016-2018)



Legend

Crashes Per Millon VMT — 0.01 - 0.25 — 0.25 - 0.50 — 0.50 - 0.75 — 0.75 - 1.00 — > 1.00

Figure 8: Crashes Per Million Vehicle Miles Traveled (2016 – 2018)

State Highway System Congestion and Safety Assessment in San Mateo County

The assessment of the State Highway System Congestion and Safety in San Mateo County is based on data from the countywide travel demand model and INRIX travel speeds for 2019.

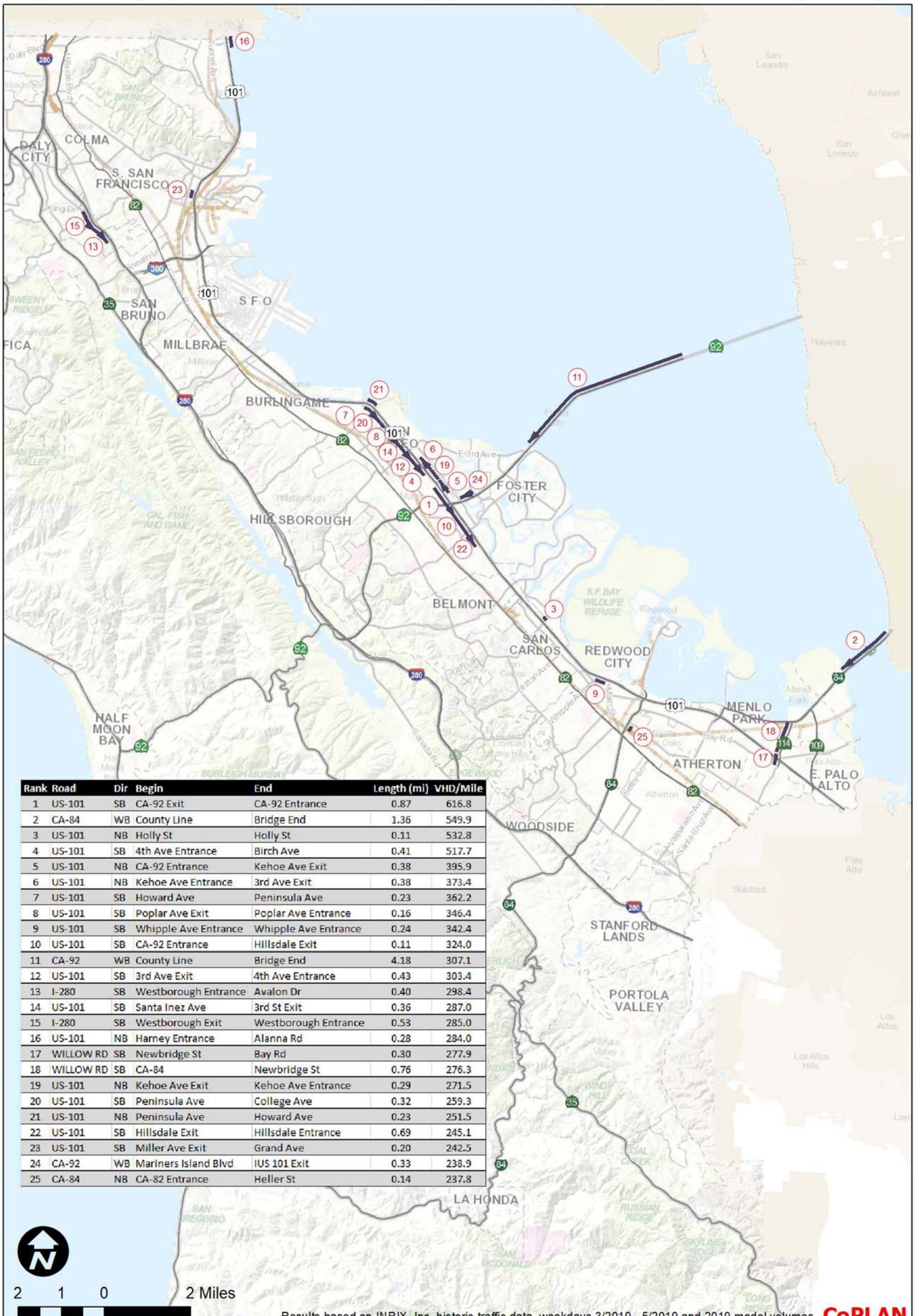
Figures 9 and 10 highlight the worst performing 25 segments based on the Total Delay performance measure for the AM and PM peak hours, respectively. For the AM peak hour, 14 (compared to 18 in 2015) of the worst 25 segments are in close proximity to the US 101 and SR 92 interchange. In the southbound direction, the segments include the length from Howard to Peninsula while the northbound side is similarly high on the list from the SR 92 entrance ramp to the Kehoe exit. During the PM period, US 101 and SR 92 each occupy 3 of the top 6 spots given the high total delays in these segments northbound US 101 between Skyway and Marine and the US 101 entrance ramp to SR 92 over to Metro Center eastbound on SR 92. Together, these 6 segments contribute over 7,650 vehicle-hours of delay / mile during the PM peak hour or 81% of the Total Delay for the worst 10 segments. The worst segment was the short segment between the Holly ramps of which it contributed to 48% of the total delay for the top 10 combined.

Based on % Free Flow, the corresponding figures for the AM and PM peak hour are illustrated on **Figures 11 and 12**, respectively. In contrast to Total Delay, during the AM peak hour, based on % Free Flow, there is a mix of roads within the top 10 with SR 84 being represented the most at 3 times. During the PM peak period, SR 92 occupies the top 3 spots starting at US 101 to Mariners Island. Having an average speed between 12-13% of free flow produces a large amount of delay. These performance measure results mean that the average speed on these segments are between 8-9 mph.

When considering travel time reliability, or inconsistency of travel time, once again, the variability of travel times produces much variability on the AM lists top 10 ranging from just over 3 to 1.7 on the worst 25 list for the AM peak hour as shown on **Figure 13**. SR 92 holds down six of the top 10 spots during the PM peak period as included in **Figure 14.** These segments for TTR are eastbound near SR 82 and westbound near I-280. For the PM peak period, Skyline between Bunker Hill and SR 92 comes to the top of the worst segments for this performance measure given the resulting Buffer Index of 4.34. This value means that a driver must allow an additional 434% of the average travel time (essentially quadrupling the average travel time) for this segment in order to cover the variance 95% of the time.

Crash history contributes not only to the safety status of the roadway network, but also to the driver delays and congestion. When studying the crash results for the most recent complete calendar years from 2016-2018, the results vary across the network for controlled access and surface streets. US 101 holds down five of the top 10 spots based on crashes per mile in **Figure 15,** while the lower volume rural western section of SR 84 claims the top 7 spots when considering crashes per million vehicle miles as shown in **Figure 16**.

Worst 25 Segments based on Total Delay (VHD/Mile) : Morning Peak Hour (8-9 AM)



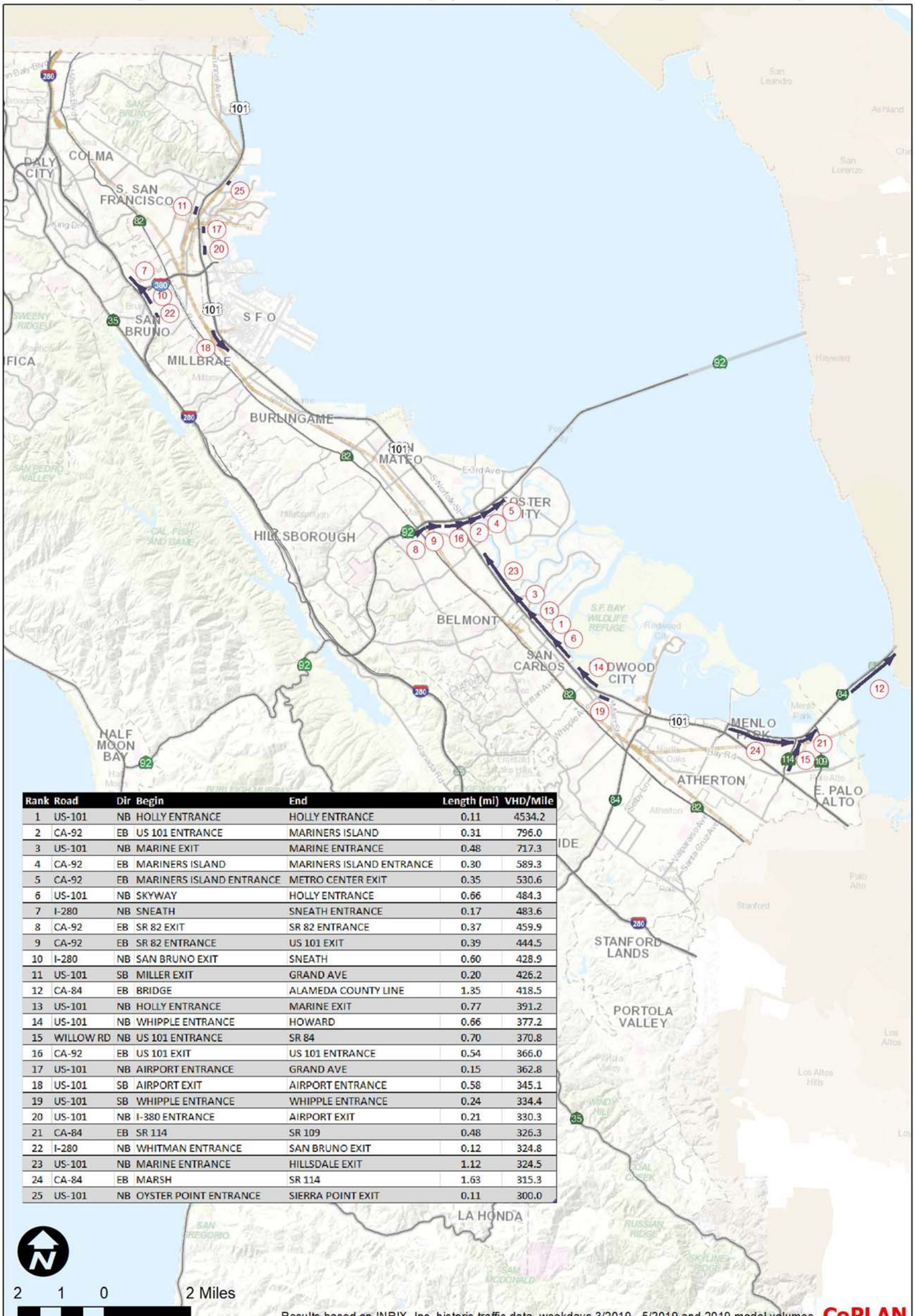
Rank	Road	Dir	Begin	End	Length (mi)	VHD/Mile
1	US-101	SB	CA-92 Exit	CA-92 Entrance	0.87	616.8
2	CA-84	WB	County Line	Bridge End	1.36	549.9
3	US-101	NB	Holly St	Holly St	0.11	532.8
4	US-101	SB	4th Ave Entrance	Birch Ave	0.41	517.7
5	US-101	NB	CA-92 Entrance	Kehoe Ave Exit	0.38	395.9
6	US-101	NB	Kehoe Ave Entrance	3rd Ave Exit	0.38	373.4
7	US-101	SB	Howard Ave	Peninsula Ave	0.23	362.2
8	US-101	SB	Poplar Ave Exit	Poplar Ave Entrance	0.16	346.4
9	US-101	SB	Whipple Ave Entrance	Whipple Ave Entrance	0.24	342.4
10	US-101	SB	CA-92 Entrance	Hillsdale Exit	0.11	324.0
11	CA-92	WB	County Line	Bridge End	4.18	307.1
12	US-101	SB	3rd Ave Exit	4th Ave Entrance	0.43	303.4
13	I-280	SB	Westborough Entrance	Avalon Dr	0.40	298.4
14	US-101	SB	Santa Inez Ave	3rd St Exit	0.36	287.0
15	I-280	SB	Westborough Exit	Westborough Entrance	0.53	285.0
16	US-101	NB	Harney Entrance	Alanna Rd	0.28	284.0
17	WILLOW RD	SB	Newbridge St	Bay Rd	0.30	277.9
18	WILLOW RD	SB	CA-84	Newbridge St	0.76	276.3
19	US-101	NB	Kehoe Ave Exit	Kehoe Ave Entrance	0.29	271.5
20	US-101	SB	Peninsula Ave	College Ave	0.32	259.3
21	US-101	NB	Peninsula Ave	Howard Ave	0.23	251.5
22	US-101	SB	Hillsdale Exit	Hillsdale Entrance	0.69	245.1
23	US-101	SB	Miller Ave Exit	Grand Ave	0.20	242.5
24	CA-92	WB	Mariners Island Blvd	IUS 101 Exit	0.33	238.9
25	CA-84	NB	CA-82 Entrance	Heller St	0.14	237.8

Legend

Worst 25 Segments based on Total Delay Per Mile (8-9 AM)

Figure 9: Worst 25 Segments based on Total Delay (VHD / mile for AM Peak Period 8-9 AM)

Worst 25 Segments based on Total Delay (VHD/Mile) : Evening Peak Hour (5-6 PM)



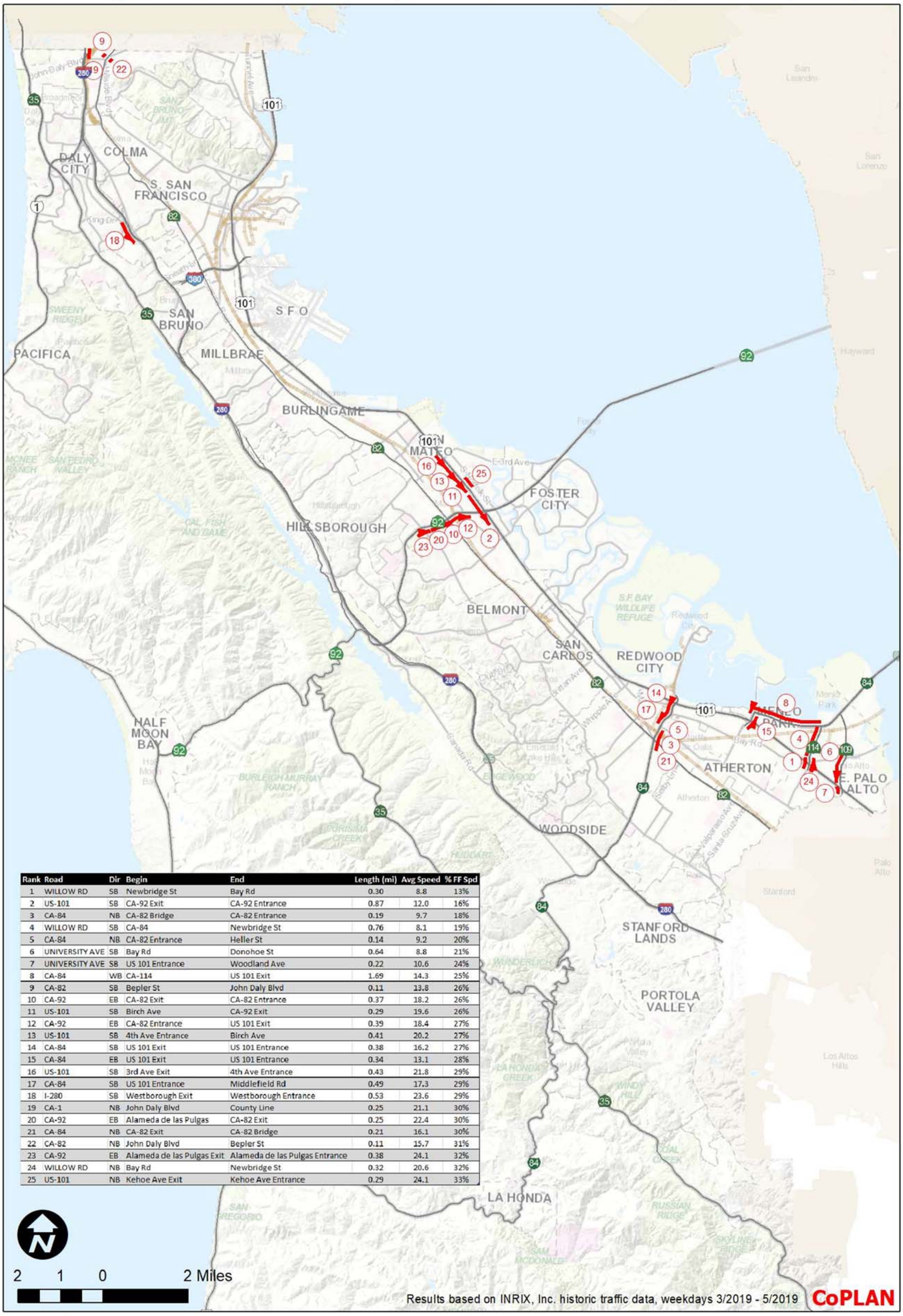
Rank	Road	Dir	Begin	End	Length (mi)	VHD/Mile
1	US-101	NB	HOLLY ENTRANCE	HOLLY ENTRANCE	0.11	4534.2
2	CA-92	EB	US 101 ENTRANCE	MARINERS ISLAND	0.31	796.0
3	US-101	NB	MARINE EXIT	MARINE ENTRANCE	0.48	717.3
4	CA-92	EB	MARINERS ISLAND	MARINERS ISLAND ENTRANCE	0.30	589.3
5	CA-92	EB	MARINERS ISLAND ENTRANCE	METRO CENTER EXIT	0.35	530.6
6	US-101	NB	SKYWAY	HOLLY ENTRANCE	0.66	484.3
7	I-280	NB	SNEATH	SNEATH ENTRANCE	0.17	483.6
8	CA-92	EB	SR 82 EXIT	SR 82 ENTRANCE	0.37	459.9
9	CA-92	EB	SR 82 ENTRANCE	US 101 EXIT	0.39	444.5
10	I-280	NB	SAN BRUNO EXIT	SNEATH	0.60	428.9
11	US-101	SB	MILLER EXIT	GRAND AVE	0.20	426.2
12	CA-84	EB	BRIDGE	ALAMEDA COUNTY LINE	1.35	418.5
13	US-101	NB	HOLLY ENTRANCE	MARINE EXIT	0.77	391.2
14	US-101	NB	WHIPPLE ENTRANCE	HOWARD	0.66	377.2
15	WILLOW RD	NB	US 101 ENTRANCE	SR 84	0.70	370.8
16	CA-92	EB	US 101 EXIT	US 101 ENTRANCE	0.54	366.0
17	US-101	NB	AIRPORT ENTRANCE	GRAND AVE	0.15	362.8
18	US-101	SB	AIRPORT EXIT	AIRPORT ENTRANCE	0.58	345.1
19	US-101	SB	WHIPPLE ENTRANCE	WHIPPLE ENTRANCE	0.24	334.4
20	US-101	NB	I-380 ENTRANCE	AIRPORT EXIT	0.21	330.3
21	CA-84	EB	SR 114	SR 109	0.48	326.3
22	I-280	NB	WHITMAN ENTRANCE	SAN BRUNO EXIT	0.12	324.8
23	US-101	NB	MARINE ENTRANCE	HILLSDALE EXIT	1.12	324.5
24	CA-84	EB	MARSH	SR 114	1.63	315.3
25	US-101	NB	OYSTER POINT ENTRANCE	SIERRA POINT EXIT	0.11	300.0

Legend

Worst 25 Segments based on Total Delay Per Mile (5-6 PM)

Figure 10: Worst 25 Segments based on Total Delay (VHD / mile for PM Peak Period 5-6 PM)

Worst 25 Segments based on Travel Speed (Percent of Free Flow) : Morning Peak Hour (8-9 AM)



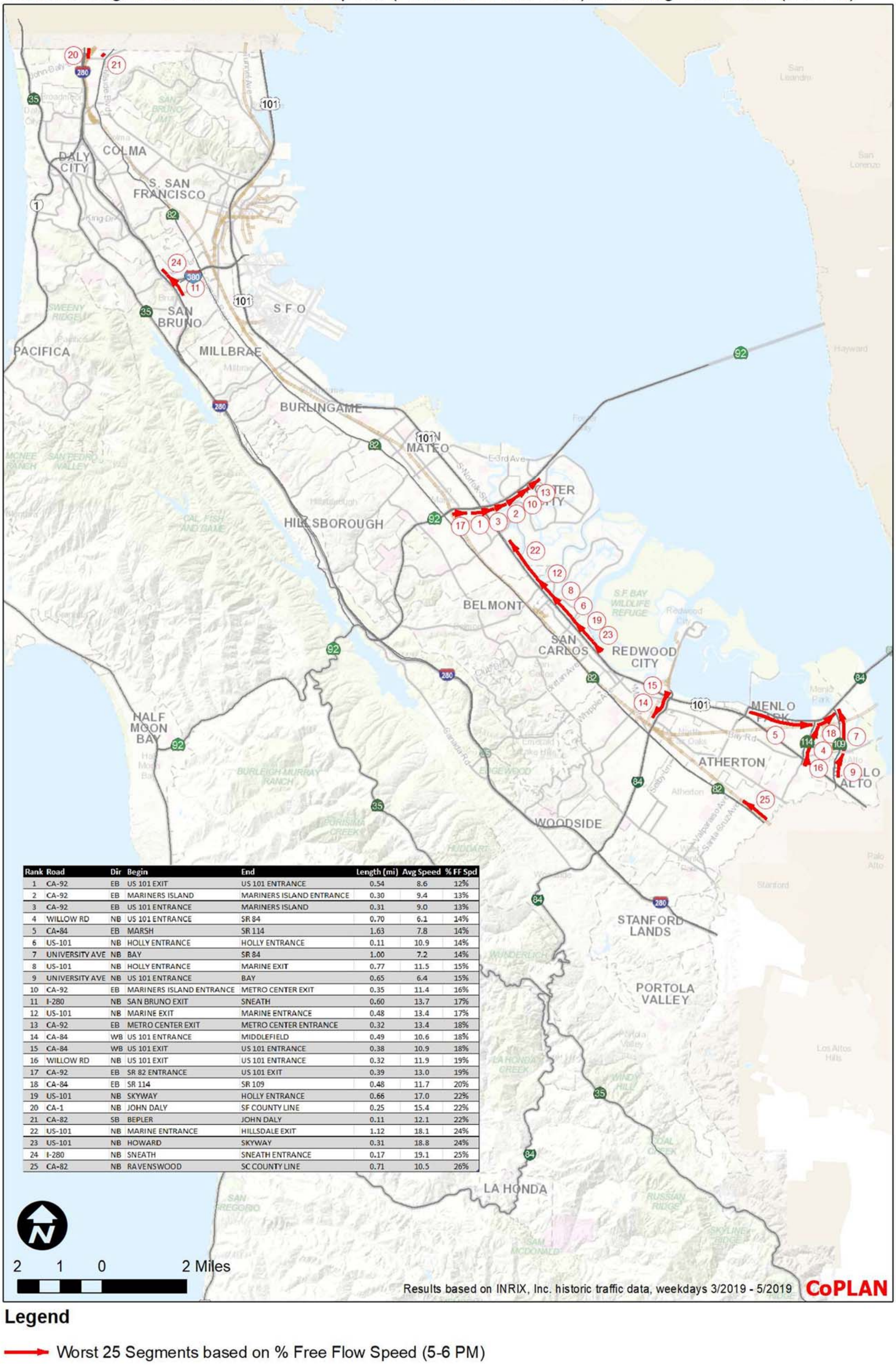
Rank	Road	Dir	Begin	End	Length (mi)	Avg Speed	% FF Spd
1	WILLOW RD	SB	Newbridge St	Bay Rd	0.30	8.8	13%
2	US-101	SB	CA-92 Exit	CA-92 Entrance	0.87	12.0	16%
3	CA-84	NB	CA-82 Bridge	CA-82 Entrance	0.19	9.7	18%
4	WILLOW RD	SB	CA-84	Newbridge St	0.76	8.1	19%
5	CA-84	NB	CA-82 Entrance	Heller St	0.14	9.2	20%
6	UNIVERSITY AVE	SB	Bay Rd	Donohoe St	0.64	8.8	21%
7	UNIVERSITY AVE	SB	US 101 Entrance	Woodland Ave	0.22	10.6	24%
8	CA-84	WB	CA-114	US 101 Exit	1.69	14.3	25%
9	CA-82	SB	Bepler St	John Daly Blvd	0.11	13.8	26%
10	CA-92	EB	CA-82 Exit	CA-82 Entrance	0.37	18.2	26%
11	US-101	SB	Birch Ave	CA-92 Exit	0.29	19.6	26%
12	CA-92	EB	CA-82 Entrance	US 101 Exit	0.39	18.4	27%
13	US-101	SB	4th Ave Entrance	Birch Ave	0.41	20.2	27%
14	CA-84	SB	US 101 Exit	US 101 Entrance	0.38	16.2	27%
15	CA-84	EB	US 101 Exit	US 101 Entrance	0.34	13.1	28%
16	US-101	SB	3rd Ave Exit	4th Ave Entrance	0.43	21.8	29%
17	CA-84	SB	US 101 Entrance	Middlefield Rd	0.49	17.3	29%
18	I-280	SB	Westborough Exit	Westborough Entrance	0.53	23.6	29%
19	CA-1	NB	John Daly Blvd	County Line	0.25	21.1	30%
20	CA-92	EB	Alameda de las Pulgas	CA-82 Exit	0.25	22.4	30%
21	CA-84	NB	CA-82 Exit	CA-82 Bridge	0.21	16.1	30%
22	CA-82	NB	John Daly Blvd	Bepler St	0.11	15.7	31%
23	CA-92	EB	Alameda de las Pulgas Exit	Alameda de las Pulgas Entrance	0.38	24.1	32%
24	WILLOW RD	NB	Bay Rd	Newbridge St	0.32	20.6	32%
25	US-101	NB	Kehoe Ave Exit	Kehoe Ave Entrance	0.29	24.1	33%

Legend

Worst 25 Segments based on % Free Flow Speed (8-9 AM)

Figure 11: Worst 25 Segments based on Travel Speed (% of Free Flow for AM Peak Period 8-9 AM)

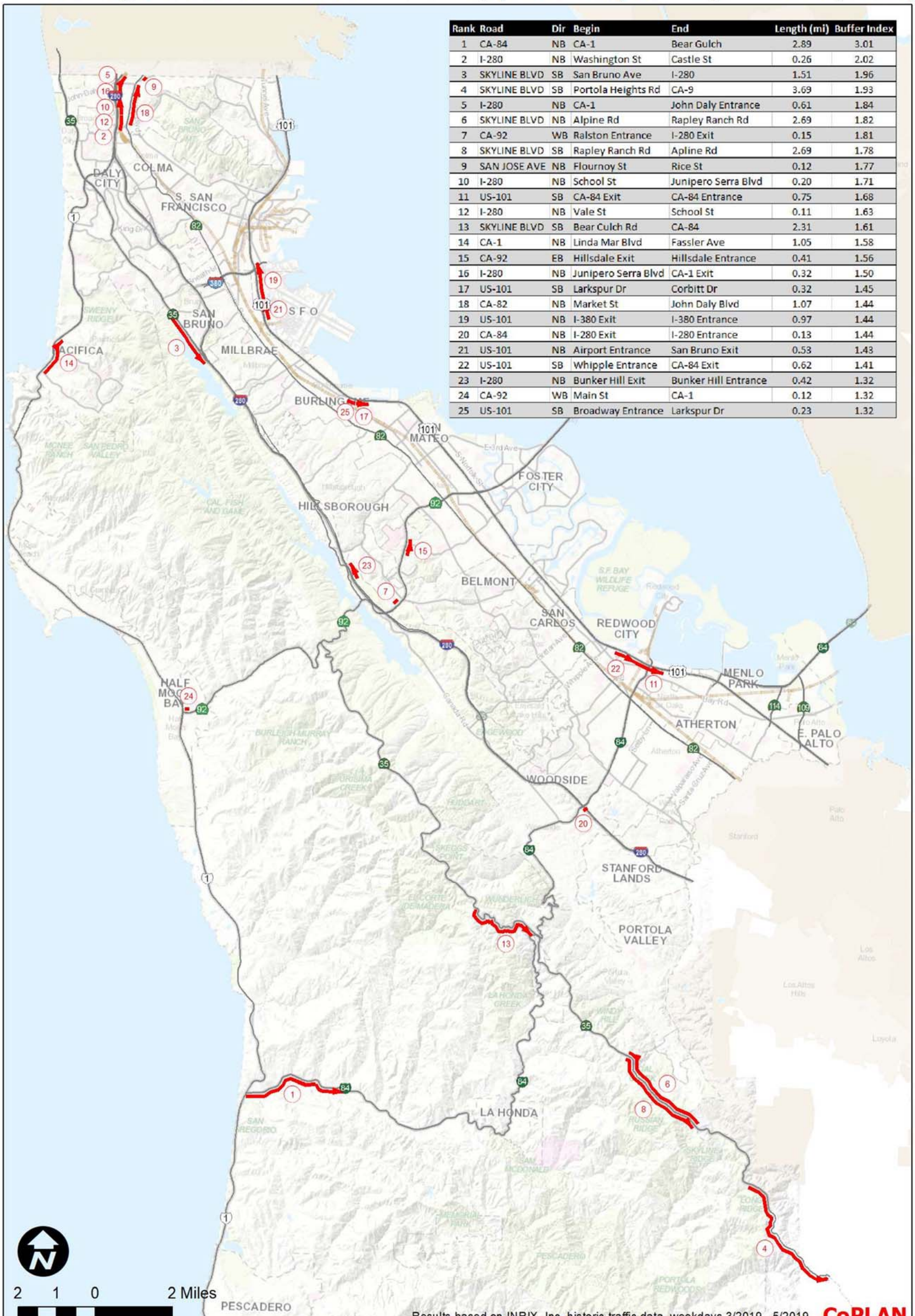
Worst 25 Segments based on Travel Speed (Percent of Free Flow) : Evening Peak Hour (5-6 PM)



Rank	Road	Dir	Begin	End	Length (mi)	Avg Speed	% FF Spd
1	CA-92	EB	US 101 EXIT	US 101 ENTRANCE	0.54	8.6	12%
2	CA-92	EB	MARINERS ISLAND	MARINERS ISLAND ENTRANCE	0.30	9.4	13%
3	CA-92	EB	US 101 ENTRANCE	MARINERS ISLAND	0.31	9.0	13%
4	WILLOW RD	NB	US 101 ENTRANCE	SR 84	0.70	6.1	14%
5	CA-84	EB	MARSH	SR 114	1.63	7.8	14%
6	US-101	NB	HOLLY ENTRANCE	HOLLY ENTRANCE	0.11	10.9	14%
7	UNIVERSITY AVE	NB	BAY	SR 84	1.00	7.2	14%
8	US-101	NB	HOLLY ENTRANCE	MARINE EXIT	0.77	11.5	15%
9	UNIVERSITY AVE	NB	US 101 ENTRANCE	BAY	0.65	6.4	15%
10	CA-92	EB	MARINERS ISLAND ENTRANCE	METRO CENTER EXIT	0.35	11.4	16%
11	I-280	NB	SAN BRUNO EXIT	SNEATH	0.60	13.7	17%
12	US-101	NB	MARINE EXIT	MARINE ENTRANCE	0.48	13.4	17%
13	CA-92	EB	METRO CENTER EXIT	METRO CENTER ENTRANCE	0.32	13.4	18%
14	CA-84	WB	US 101 ENTRANCE	MIDDLEFIELD	0.49	10.6	18%
15	CA-84	WB	US 101 EXIT	US 101 ENTRANCE	0.38	10.9	18%
16	WILLOW RD	NB	US 101 EXIT	US 101 ENTRANCE	0.32	11.9	19%
17	CA-92	EB	SR 82 ENTRANCE	US 101 EXIT	0.39	13.0	19%
18	CA-84	EB	SR 114	SR 109	0.48	11.7	20%
19	US-101	NB	SKYWAY	HOLLY ENTRANCE	0.66	17.0	22%
20	CA-1	NB	JOHN DALY	SF COUNTY LINE	0.25	15.4	22%
21	CA-82	SB	BEPLER	JOHN DALY	0.11	12.1	22%
22	US-101	NB	MARINE ENTRANCE	HILLSDALE EXIT	1.12	18.1	24%
23	US-101	NB	HOWARD	SKYWAY	0.31	18.8	24%
24	I-280	NB	SNEATH	SNEATH ENTRANCE	0.17	19.1	25%
25	CA-82	NB	RAVENSWOOD	SC COUNTY LINE	0.71	10.5	26%

Figure 12: Worst 25 Segments based on Travel Speed (% of Free Flow for PM Peak Period 5-6 PM)

Worst 25 Segments based onTravel Time Reliability (Buffer Index) : Morning Peak Hour (8-9 AM)



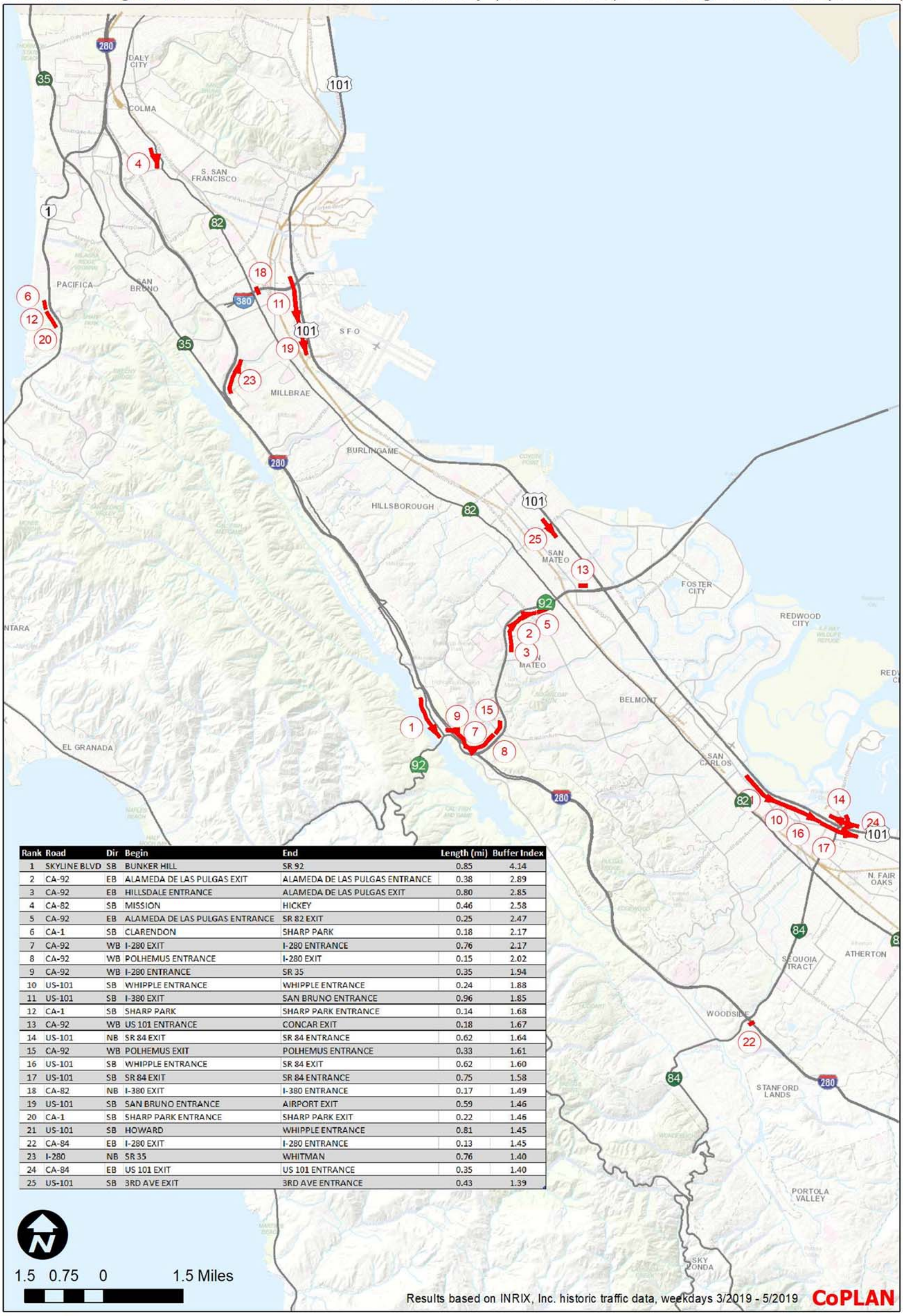
Rank	Road	Dir	Begin	End	Length (mi)	Buffer Index
1	CA-84	NB	CA-1	Bear Gulch	2.89	3.01
2	I-280	NB	Washington St	Castle St	0.26	2.02
3	SKYLINE BLVD	SB	San Bruno Ave	I-280	1.51	1.96
4	SKYLINE BLVD	SB	Portola Heights Rd	CA-9	3.69	1.93
5	I-280	NB	CA-1	John Daly Entrance	0.61	1.84
6	SKYLINE BLVD	NB	Alpine Rd	Rapley Ranch Rd	2.69	1.82
7	CA-92	WB	Ralston Entrance	I-280 Exit	0.15	1.81
8	SKYLINE BLVD	SB	Rapley Ranch Rd	Apline Rd	2.69	1.78
9	SAN JOSE AVE	NB	Flournoy St	Rice St	0.12	1.77
10	I-280	NB	School St	Junipero Serra Blvd	0.20	1.71
11	US-101	SB	CA-84 Exit	CA-84 Entrance	0.75	1.68
12	I-280	NB	Vale St	School St	0.11	1.63
13	SKYLINE BLVD	SB	Bear Culch Rd	CA-84	2.31	1.61
14	CA-1	NB	Linda Mar Blvd	Fassler Ave	1.05	1.58
15	CA-92	EB	Hillsdale Exit	Hillsdale Entrance	0.41	1.56
16	I-280	NB	Junipero Serra Blvd	CA-1 Exit	0.32	1.50
17	US-101	SB	Larkspur Dr	Corbitt Dr	0.32	1.45
18	CA-82	NB	Market St	John Daly Blvd	1.07	1.44
19	US-101	NB	I-380 Exit	I-380 Entrance	0.97	1.44
20	CA-84	NB	I-280 Exit	I-280 Entrance	0.13	1.44
21	US-101	NB	Airport Entrance	San Bruno Exit	0.53	1.43
22	US-101	SB	Whipple Entrance	CA-84 Exit	0.62	1.41
23	I-280	NB	Bunker Hill Exit	Bunker Hill Entrance	0.42	1.32
24	CA-92	WB	Main St	CA-1	0.12	1.32
25	US-101	SB	Broadway Entrance	Larkspur Dr	0.23	1.32

Legend

Worst 25 Segments based on Travel Time Reliability (Buffer Index) (8-9 AM)

Figure 13: Worst 25 Segments based on Travel Time Reliability (Buffer Index for AM Peak Period 8-9 AM)

Worst 25 Segments based onTravel Time Reliability (Buffer Index) : Evening Peak Hour (5-6 PM)



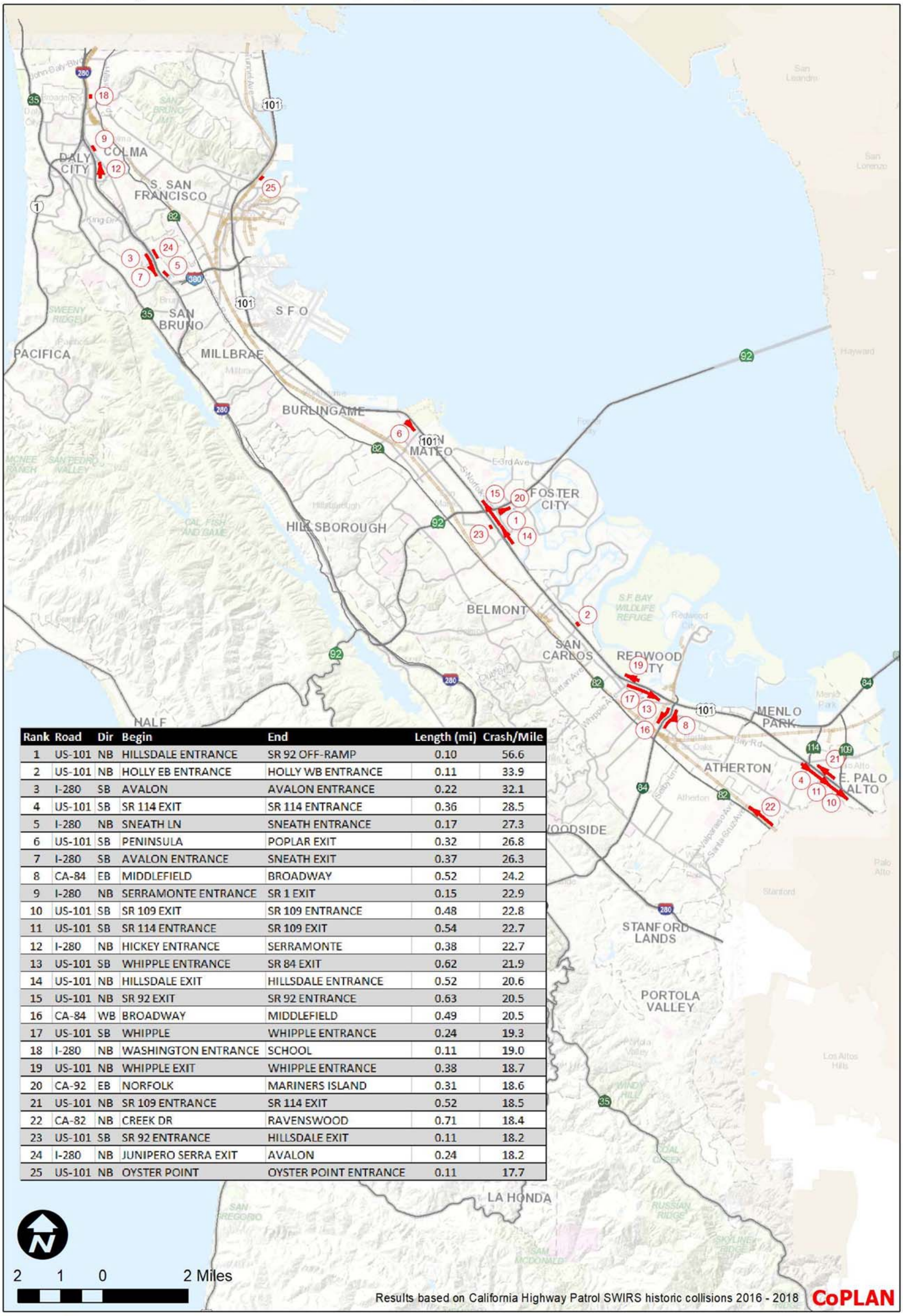
Rank	Road	Dir	Begin	End	Length (mi)	Buffer Index
1	SKYLINE BLVD	SB	BUNKER HILL	SR 92	0.85	4.14
2	CA-92	EB	ALAMEDA DE LAS PULGAS EXIT	ALAMEDA DE LAS PULGAS ENTRANCE	0.38	2.89
3	CA-92	EB	HILLSDALE ENTRANCE	ALAMEDA DE LAS PULGAS EXIT	0.80	2.85
4	CA-82	SB	MISSION	HICKEY	0.46	2.58
5	CA-92	EB	ALAMEDA DE LAS PULGAS ENTRANCE	SR 82 EXIT	0.25	2.47
6	CA-1	SB	CLARENDON	SHARP PARK	0.18	2.17
7	CA-92	WB	I-280 EXIT	I-280 ENTRANCE	0.76	2.17
8	CA-92	WB	POLHEMUS ENTRANCE	I-280 EXIT	0.15	2.02
9	CA-92	WB	I-280 ENTRANCE	SR 35	0.35	1.94
10	US-101	SB	WHIPPLE ENTRANCE	WHIPPLE ENTRANCE	0.24	1.88
11	US-101	SB	I-380 EXIT	SAN BRUNO ENTRANCE	0.96	1.85
12	CA-1	SB	SHARP PARK	SHARP PARK ENTRANCE	0.14	1.68
13	CA-92	WB	US 101 ENTRANCE	CONCAR EXIT	0.18	1.67
14	US-101	NB	SR 84 EXIT	SR 84 ENTRANCE	0.62	1.64
15	CA-92	WB	POLHEMUS EXIT	POLHEMUS ENTRANCE	0.33	1.61
16	US-101	SB	WHIPPLE ENTRANCE	SR 84 EXIT	0.62	1.60
17	US-101	SB	SR 84 EXIT	SR 84 ENTRANCE	0.75	1.58
18	CA-82	NB	I-380 EXIT	I-380 ENTRANCE	0.17	1.49
19	US-101	SB	SAN BRUNO ENTRANCE	AIRPORT EXIT	0.59	1.46
20	CA-1	SB	SHARP PARK ENTRANCE	SHARP PARK EXIT	0.22	1.46
21	US-101	SB	HOWARD	WHIPPLE ENTRANCE	0.81	1.45
22	CA-84	EB	I-280 EXIT	I-280 ENTRANCE	0.13	1.45
23	I-280	NB	SR 35	WHITMAN	0.76	1.40
24	CA-84	EB	US 101 EXIT	US 101 ENTRANCE	0.35	1.40
25	US-101	SB	3RD AVE EXIT	3RD AVE ENTRANCE	0.43	1.39

Legend

Worst 25 Segments based on Travel Time Reliability (Buffer Index) (5-6 PM)

Figure 14: Worst 25 Segments based on Travel Time Reliability (Buffer Index for PM Peak Period 5-6 PM)

Worst 25 Segments based on Crashes per Mile



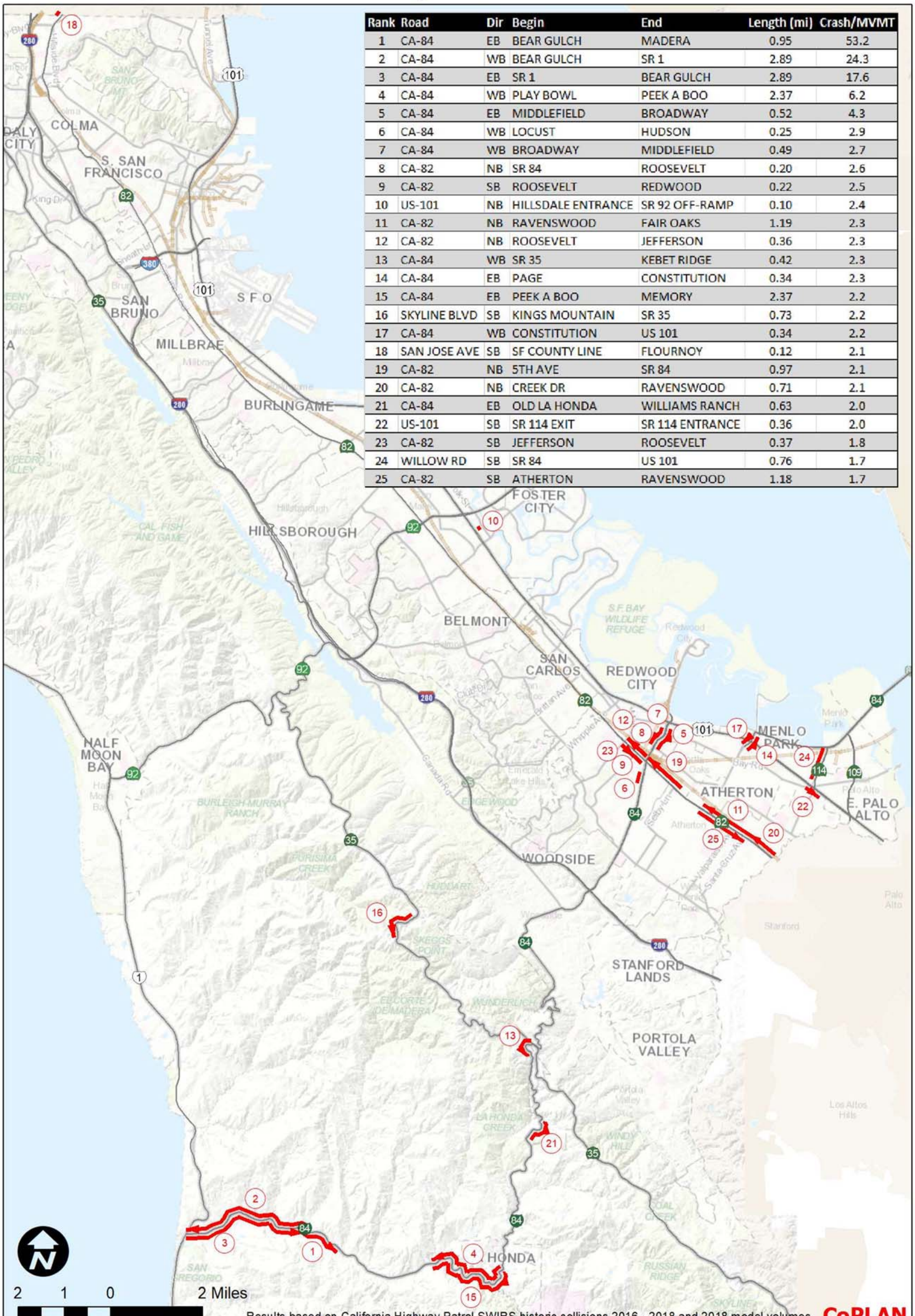
Rank	Road	Dir	Begin	End	Length (mi)	Crash/Mile
1	US-101	NB	HILLSDALE ENTRANCE	SR 92 OFF-RAMP	0.10	56.6
2	US-101	NB	HOLLY EB ENTRANCE	HOLLY WB ENTRANCE	0.11	33.9
3	I-280	SB	AVALON	AVALON ENTRANCE	0.22	32.1
4	US-101	SB	SR 114 EXIT	SR 114 ENTRANCE	0.36	28.5
5	I-280	NB	SNEATH LN	SNEATH ENTRANCE	0.17	27.3
6	US-101	SB	PENINSULA	POPLAR EXIT	0.32	26.8
7	I-280	SB	AVALON ENTRANCE	SNEATH EXIT	0.37	26.3
8	CA-84	EB	MIDDLEFIELD	BROADWAY	0.52	24.2
9	I-280	NB	SERRAMONTE ENTRANCE	SR 1 EXIT	0.15	22.9
10	US-101	SB	SR 109 EXIT	SR 109 ENTRANCE	0.48	22.8
11	US-101	SB	SR 114 ENTRANCE	SR 109 EXIT	0.54	22.7
12	I-280	NB	HICKEY ENTRANCE	SERRAMONTE	0.38	22.7
13	US-101	SB	WHIPPLE ENTRANCE	SR 84 EXIT	0.62	21.9
14	US-101	NB	HILLSDALE EXIT	HILLSDALE ENTRANCE	0.52	20.6
15	US-101	NB	SR 92 EXIT	SR 92 ENTRANCE	0.63	20.5
16	CA-84	WB	BROADWAY	MIDDLEFIELD	0.49	20.5
17	US-101	SB	WHIPPLE	WHIPPLE ENTRANCE	0.24	19.3
18	I-280	NB	WASHINGTON ENTRANCE	SCHOOL	0.11	19.0
19	US-101	NB	WHIPPLE EXIT	WHIPPLE ENTRANCE	0.38	18.7
20	CA-92	EB	NORFOLK	MARINERS ISLAND	0.31	18.6
21	US-101	NB	SR 109 ENTRANCE	SR 114 EXIT	0.52	18.5
22	CA-82	NB	CREEK DR	RAVENSWOOD	0.71	18.4
23	US-101	SB	SR 92 ENTRANCE	HILLSDALE EXIT	0.11	18.2
24	I-280	NB	JUNIPERO SERRA EXIT	AVALON	0.24	18.2
25	US-101	NB	OYSTER POINT	OYSTER POINT ENTRANCE	0.11	17.7

Legend

Worst 25 Segments based on Crashes Per Mile

Figure 15: Worst 25 Segments based on Crashes Per Mile 2016-2018

Worst 25 Segments based on Crashes per Million Vehicle Miles Traveled



Rank	Road	Dir	Begin	End	Length (mi)	Crash/MVMT
1	CA-84	EB	BEAR GULCH	MADERA	0.95	53.2
2	CA-84	WB	BEAR GULCH	SR 1	2.89	24.3
3	CA-84	EB	SR 1	BEAR GULCH	2.89	17.6
4	CA-84	WB	PLAY BOWL	PEEK A BOO	2.37	6.2
5	CA-84	EB	MIDDLEFIELD	BROADWAY	0.52	4.3
6	CA-84	WB	LOCUST	HUDSON	0.25	2.9
7	CA-84	WB	BROADWAY	MIDDLEFIELD	0.49	2.7
8	CA-82	NB	SR 84	ROOSEVELT	0.20	2.6
9	CA-82	SB	ROOSEVELT	REDWOOD	0.22	2.5
10	US-101	NB	HILLSDALE ENTRANCE	SR 92 OFF-RAMP	0.10	2.4
11	CA-82	NB	RAVENSWOOD	FAIR OAKS	1.19	2.3
12	CA-82	NB	ROOSEVELT	JEFFERSON	0.36	2.3
13	CA-84	WB	SR 35	KEBET RIDGE	0.42	2.3
14	CA-84	EB	PAGE	CONSTITUTION	0.34	2.3
15	CA-84	EB	PEEK A BOO	MEMORY	2.37	2.2
16	SKYLINE BLVD	SB	KINGS MOUNTAIN	SR 35	0.73	2.2
17	CA-84	WB	CONSTITUTION	US 101	0.34	2.2
18	SAN JOSE AVE	SB	SF COUNTY LINE	FLOURNOY	0.12	2.1
19	CA-82	NB	5TH AVE	SR 84	0.97	2.1
20	CA-82	NB	CREEK DR	RAVENSWOOD	0.71	2.1
21	CA-84	EB	OLD LA HONDA	WILLIAMS RANCH	0.63	2.0
22	US-101	SB	SR 114 EXIT	SR 114 ENTRANCE	0.36	2.0
23	CA-82	SB	JEFFERSON	ROOSEVELT	0.37	1.8
24	WILLOW RD	SB	SR 84	US 101	0.76	1.7
25	CA-82	SB	ATHERTON	RAVENSWOOD	1.18	1.7

Legend

Worst 25 Segments based on Crashes Per Million VMT

Figure 16: Worst 25 Segments based on Crashes Per Million VMT 2016-2018

Performance Measure Trending

The initial Supplement to San Mateo CTP 2040 State Highway System Congestion and Safety Assessment was based on data collected in 2015. With this update in 2019, a comparison can be made between the various performance measures to determine if there are trends that can be identified. Those trends can be in areas that have seen network improvements in the 4 years since the original study that may results in reduced delays and variability, while other areas will show lower speeds due to increasing development and traffic volumes. The following figures make those comparisons between each performance measure and for each peak period. In general, there is a downward trend in comparison with 2015.

Figures 17 and 18 show the results of the comparisons with the 2015 study. As one would expect, the most common trend is downward with slower speeds in the expected areas and corridors. Most segments are “red” which indicates the delays have increase by 60% or more. This performance measure factors in not only delays but volumes, so that can also mean that delays have not changed but volumes have gone up, so the resulting vehicle hours of delay is higher since more vehicles are experiencing the delay. US 101 is one of the few corridors where there are areas that show less degradation or even some improvement.

Figures 19 and 20 highlight the differences compared to 2015 for Travel Speed or % of Free Flow speed. In these results, it is apparent that the magnitude of slower speeds (most in the range of 20% - 60% slower) are less than the delays highlighted in **Figures 17 and 18**. That can support the theory that speeds have reduced somewhat but the vehicle hours of delay are substantially higher due to increase volumes.

Figures 21 and 22 illustrate the differences in Travel Time Reliability compared with 2015. That portrays the variability in travel time throughout the time period. It appears that a large percentage of the corridors have degraded in results. That means there is even high variability in travel times than there were in 2015. That increase results in wider ranges in the amount of time it takes to get to your destination which leads to having to leave earlier to get to work in order to arrive on-time.

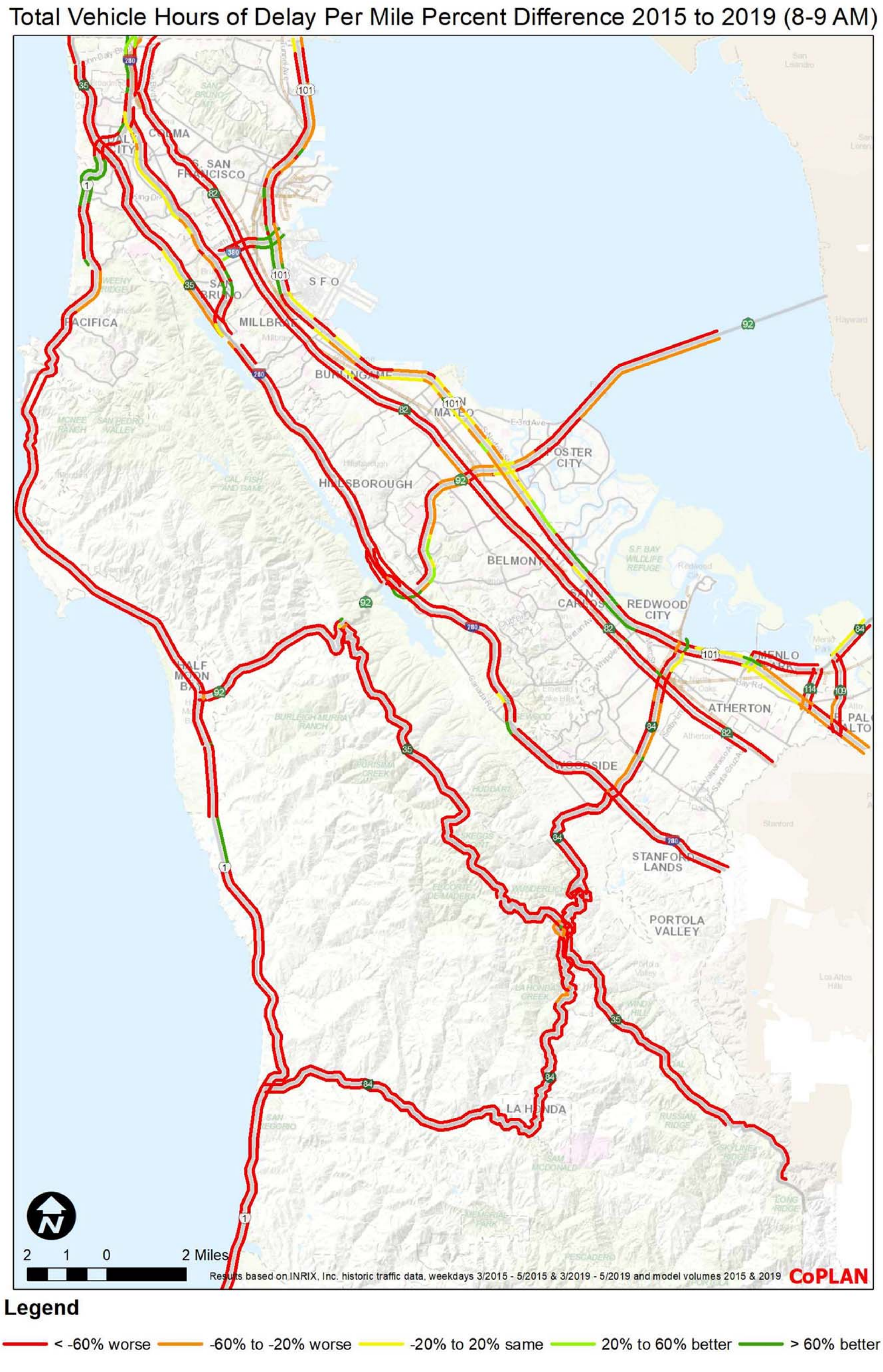


Figure 17: Total Vehicle Hours of Delay Per Mile % Difference 2015 – 2019 (8-9 AM)

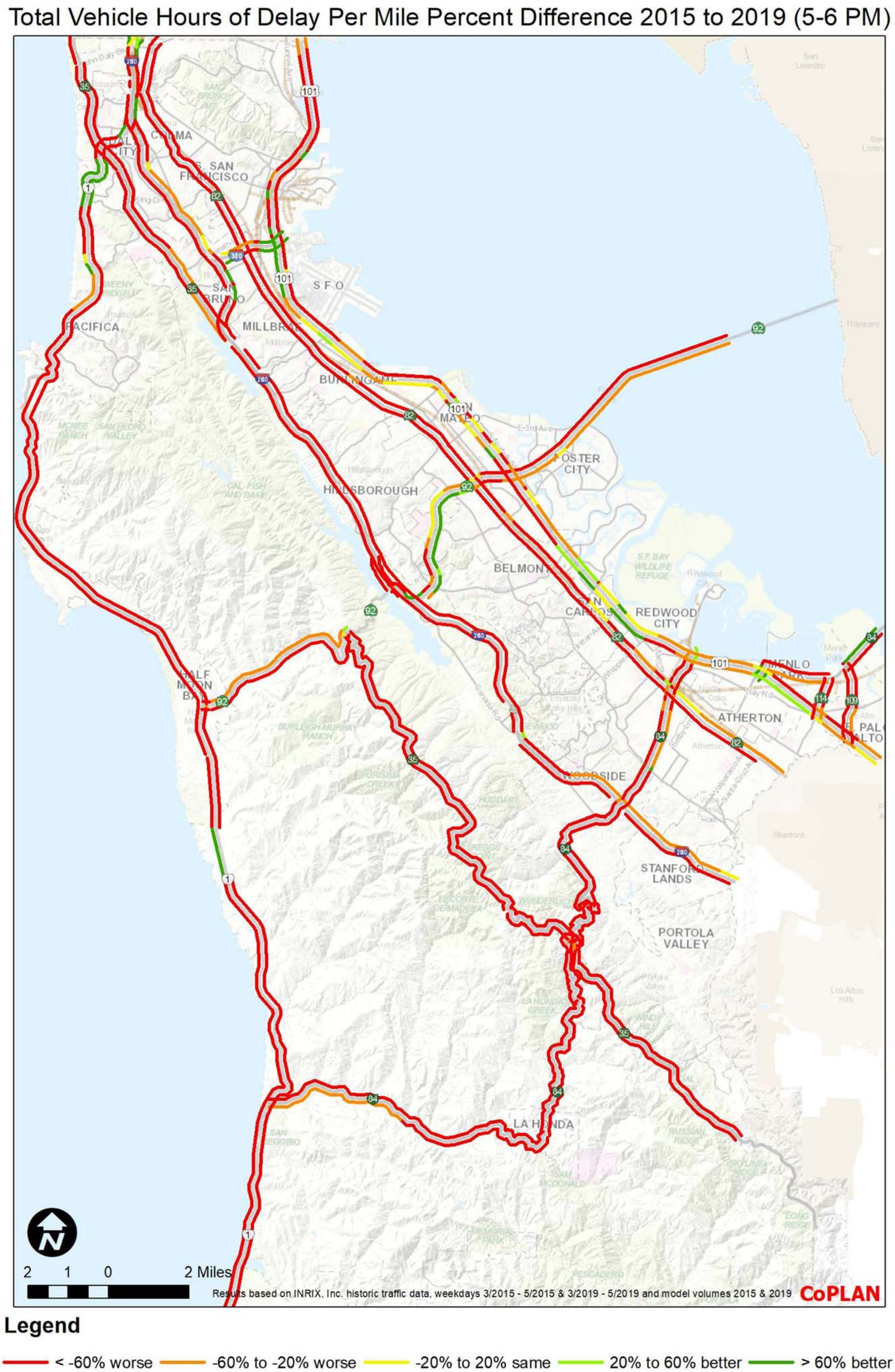
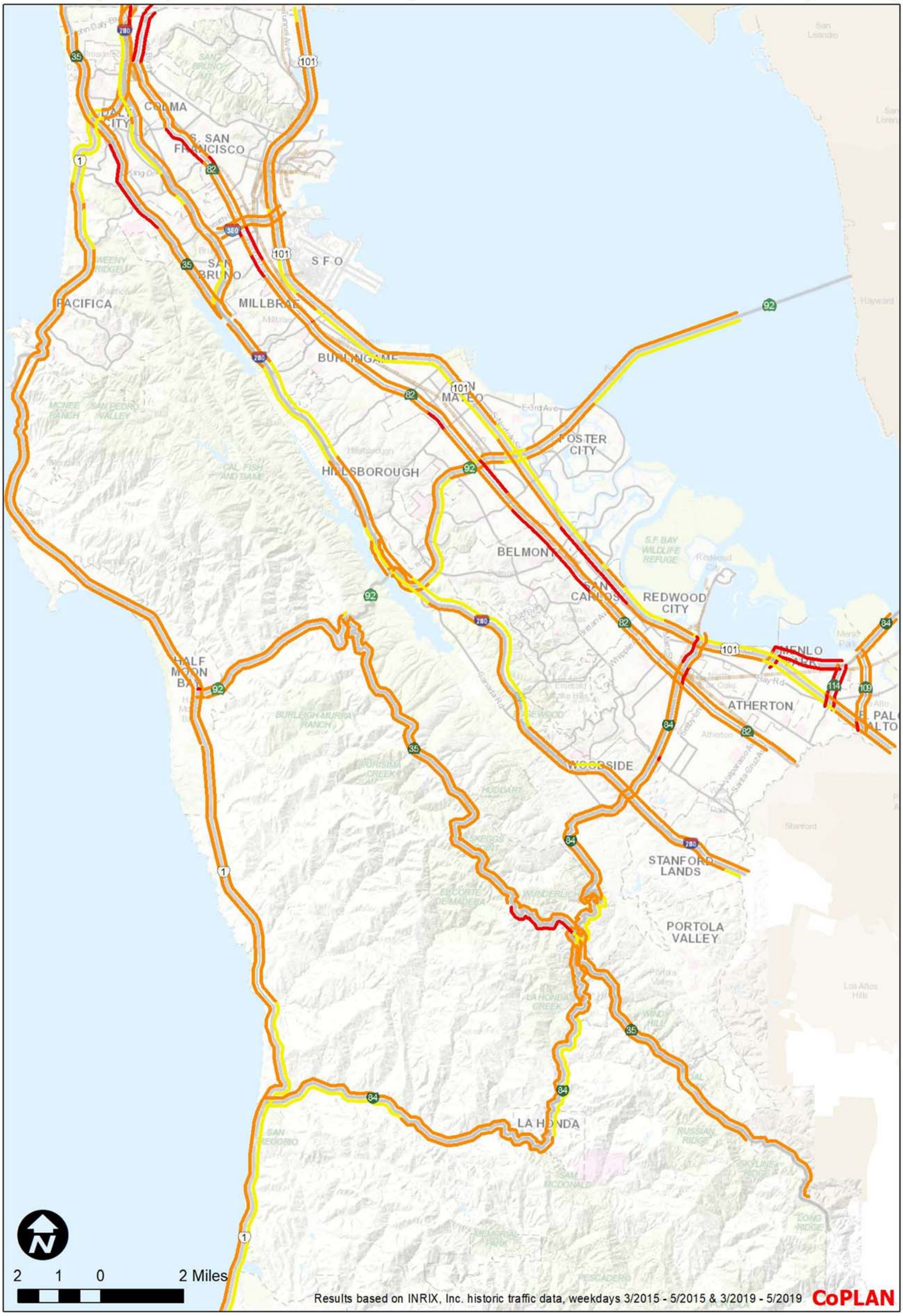


Figure 18: Total Vehicle Hours of Delay Per Mile % Difference 2015 – 2019 (5-6 PM)

Travel Speed (Percent of Free Flow) Percent Difference 2015 to 2019 (8-9 AM)

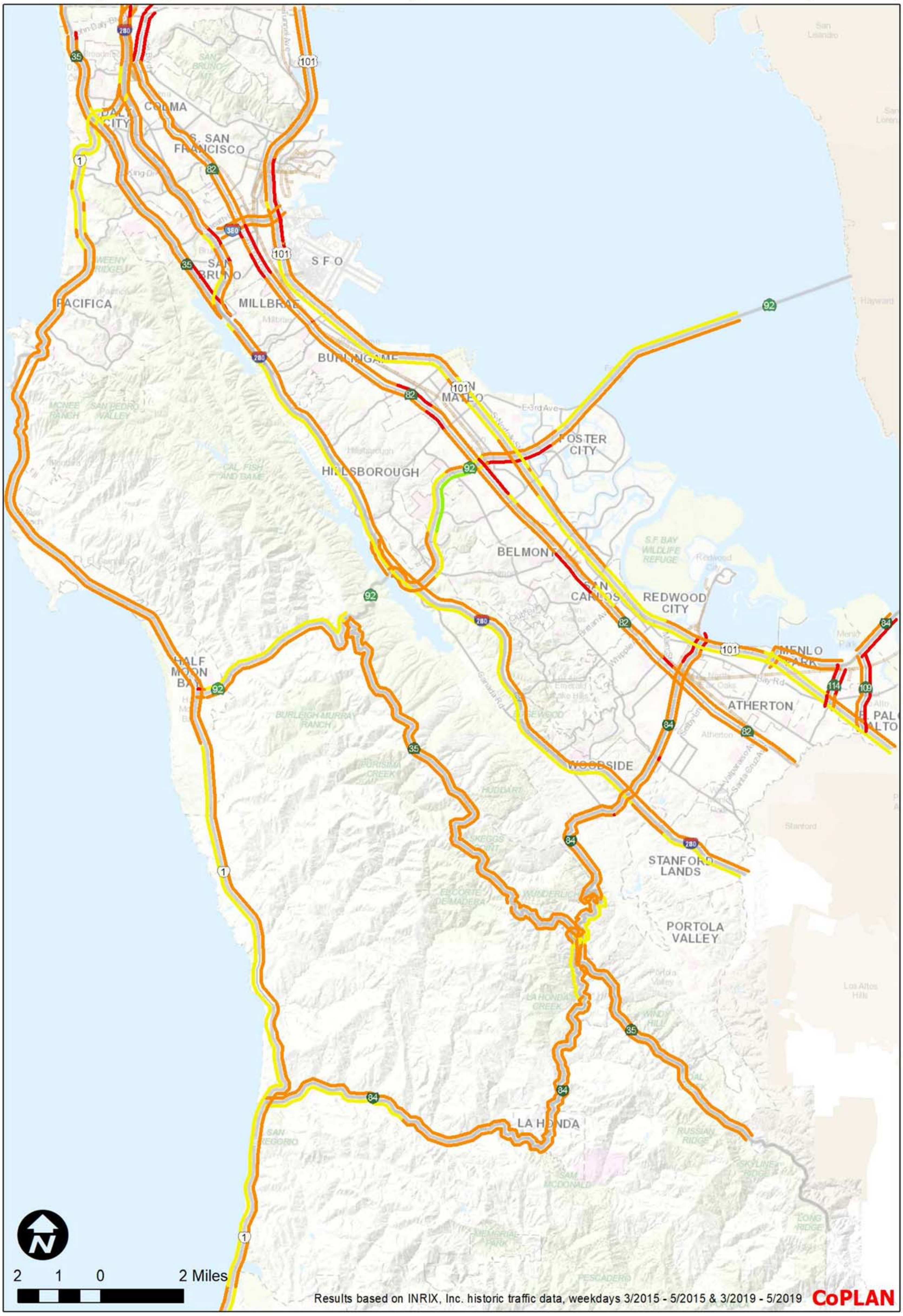


Legend

< -60% worse; -60% to -20% worse; -20% to 20% same; 20% to 60% better; > 60% better

Figure 19: Travel Speed (% of Free Flow) % Difference 2015 – 2019 (8-9 AM)

Travel Speed (Percent of Free Flow) Percent Difference 2015 to 2019 (5-6 PM)

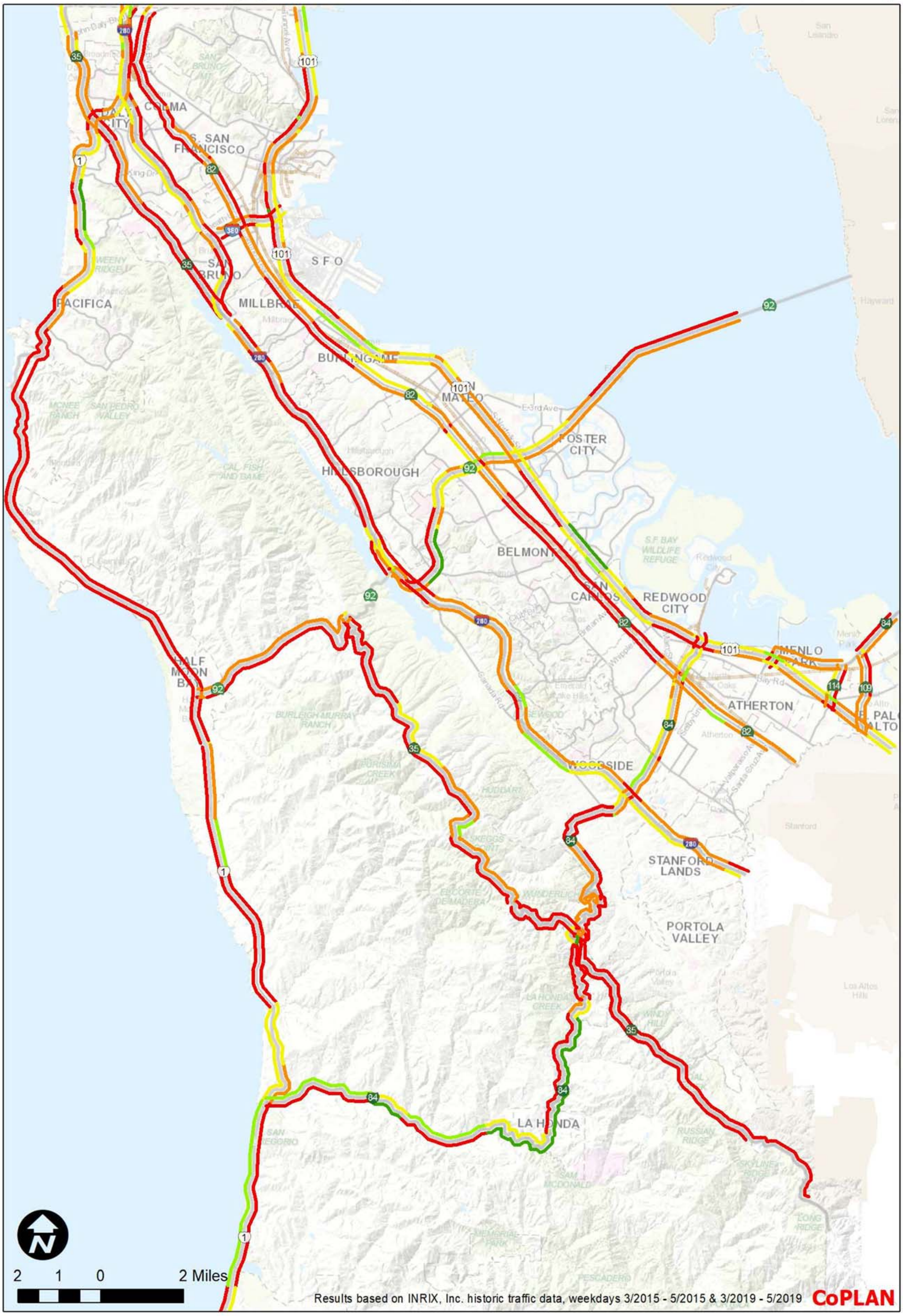


Legend

< -60% worse | -60% to -20% worse | -20% to 20% same | 20% to 60% better | > 60% better

Figure 20: Travel Speed (% of Free Flow) % Difference 2015 – 2019 (5-6 PM)

Travel Time Reliability (Buffer Index) Percent Difference 2015 to 2019 (8-9 AM)

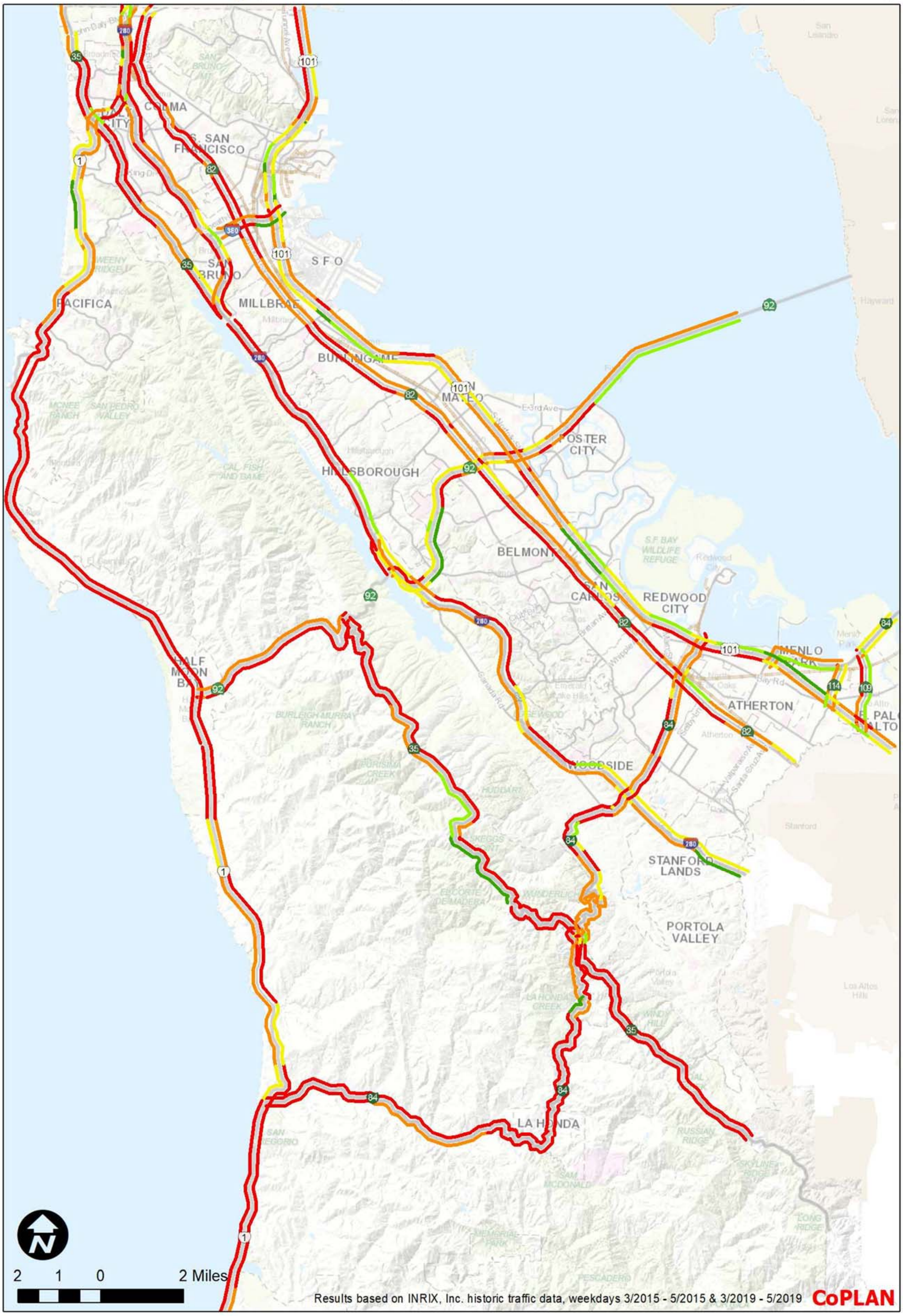


Legend

< -60% worse | -60% to -20% worse | -20% to 20% same | 20% to 60% better | > 60% better

Figure 21: Travel Time Reliability (Buffer Index) % Difference 2015 – 2019 (8-9 AM)

Travel Time Reliability (Buffer Index) Percent Difference 2015 to 2019 (5-6 PM)



Legend

< -60% worse | -60% to -20% worse | -20% to 20% same | 20% to 60% better | > 60% better

Figure 22: Travel Time Reliability (Buffer Index) % Difference 2015 – 2019 (5-6 PM)