

# Appendix U: SR 78-Traffic Sensitivity Analysis

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To: San Diego Association of Governments and Caltrans District 11

From: North County Comprehensive Multimodal Corridor Plan (CMCP) Project Team

Date: October 2022

Subject: North County Comprehensive Multimodal Corridor Plan (CMCP) – Sensitivity Analysis

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## Overview

The North County Comprehensive Multimodal Corridor Plan (CMCP) will identify integrated transportation solutions that enhance the way people travel throughout North County.

This appendix provides information on how connective/automated vehicles (CAV) may influence the general operational of SR 78 into the future—including the possibility of dedicating lanes for HOV or CAV fleets. The analysis was utilized to understand how the different segments (and lane configurations) of the highway could accommodate the demand into the future.

## Preliminary Conclusions

- Future capacity of the State Highway System will be dependent on both the market (i.e., personal vehicle user) acceptance and utilization of CAV fleets **and** the highway operations system’s ability to increase lane capacity thresholds (i.e., personal vehicles per hour per lane) due to CAV capabilities.
- A 25% fleet conversion to CAV by 2035 could:
  - Provide an estimated 3-5% increase in capacity for a HOV/CAV lane
  - Accommodate 2035 SR 78 demand between San Marcos and Oceanside through 2035 with or without an HOV/managed lane
- A 50% fleet conversion to CAV by 2050 would:
  - Provide an estimated 10-12% increase in capacity for a dedicated HOV/CAV lane(s)
  - Accommodate 2050 SR 78 demand between San Marcos and Oceanside through 2035 with or without an HOV/managed lane
- Additional analysis is recommended to understand how Transportation System Management and Operations strategies (e.g., lane assignment/management) can maximize the potential efficiencies and lane capacity improvement from CAV technologies

# METHODOLOGY

The SR 78 Sensitivity Analysis Spreadsheet is designed to be used as a tool to assess vehicle volumes of SR 78 with varying lane alternatives and fleet mixes for the years 2016, 2025, 2035, and 2050.

The spreadsheet was developed using three inputs to develop “vehicle distributions” between the different types of facilities along SR 78:

1. Fleet Mix Percentages
  - a. High Occupancy Vehicle (HOV)
  - b. Single Occupancy Vehicle (SOV)
  - c. CAV
  - d. Transit/Freight
2. Lane Configuration Alternatives by Direction of Travel (i.e., eastbound, westbound)
  - a. HOV Lanes
  - b. General Purpose Lanes
  - c. HOV + CAV Lanes
3. Transportation Demand Volumes (from SANDAG Regional Planning Model) By Segment
  - a. Western Segment – Interstate 5 to Vista Village Dr
  - b. Middle Segment – Vista Village Dr to San Marcos Blvd
  - c. Eastern Segments – San Marcos Blvd to Interstate 15

## CAV Fleet Mix Percentages

As CAV increase their share of the fleet on the roadways (i.e., market penetration), there is the opportunity for increasing the flow (and potentially speed) of vehicles through the state highway system. Two CAV market penetration (25% and 50%) was used for potential analysis; full market penetration (100%) was estimated but not utilized in the sensitivity analysis.

The spreadsheet was developed to allow for fixed and adjustable fleet percentages to assess how changes in SOV/HOV/CAV influence capacity of the roadway.

## Lane Types and Capacities

Lane Type	Est. Capacity
General Purpose (2 or more lanes) (includes transit/freight)	2400
CAV Lane (25% Fleet) +	2470
CAV Lane (50% Fleet)	2690
CAV Lane (100% Fleet)	3270
HOV Lane	1700

## Traffic Volumes

Data inputs included the fleet mix percentage per year and the lane alternatives per direction of flow. Counts that were sourced from GIS were also captured and separated by:

- The SR 78 segment (Eastern, Middle, Western)
- The direction of flow (eastbound or westbound)
- The year (2016, 2025, 2035, 2050)
- Time (AM peak or PM peak)

## Developing Distributions

Using the inputs, a distribution that demonstrated projected capacity was calculated. The distribution was grouped by year, segment, direction of flow, and time of travel. These distributions were then compared with the estimated needed capacity to see if the projected conditions would be able to meet demand.

# Distribution and Estimated Results

## Eastern Segment – AM Peak

Table 1: Existing/Estimated Eastbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1287	See SOV	0	n/a	452	See SOV	6280	Yes
<b>2025</b>	1300	Yes	317	See SOV	463	See SOV	5359	Yes
<b>2035</b>	973	See CV_AV	2563	No	534	See SOV	5386	Yes
<b>2050</b>	1009	Yes	3253	No	540	See SOV	5498	No

Table 2: Fleet Adjusted Eastbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1319	See SOV	0	n/a	440	See SOV	6280	Yes
<b>2025</b>	1268	Yes	317	See SOV	507	See SOV	5073	Yes
<b>2035</b>	1590	See CV_AV	3180	No	534	See SOV	3180	Yes
<b>2050</b>	1627	Yes	3260	Yes	540	See SOV	1620	Yes

Table 3: Existing/Estimated Westbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1256	See SOV	0	n/a	441	See SOV	6128	Yes
<b>2025</b>	1312	Yes	320	See SOV	467	See SOV	5408	Yes
<b>2035</b>	1018	See CV_AV	2681	No	559	See SOV	5635	Yes
<b>2050</b>	1034	Yes	3335	No	554	See SOV	5637	No

Table 4: Fleet Adjusted Westbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1287	See SOV	0	n/a	429	See SOV	6128	Yes
<b>2025</b>	1280	Yes	320	See SOV	512	See SOV	5120	Yes
<b>2035</b>	1663	See CV_AV	3326	No	559	See SOV	3326	Yes
<b>2050</b>	1668	Yes	3342	No	554	See SOV	1661	Yes

## Eastern Segment – PM Peak

Table 5: Existing/Estimated Eastbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1507	See SOV	0	n/a	529	Y	7352	No
<b>2025</b>	1533	Yes	374	See SOV	546	Y	6318	Yes
<b>2035</b>	1189	See CV_AV	3131	No	653	Y	6580	Yes
<b>2050</b>	1211	Yes	3908	No	649	Y	6604	No

Table 6: Fleet Adjusted Eastbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1544	See SOV	0	n/a	515	Y	7352	No
<b>2025</b>	1495	Yes	374	See SOV	598	Y	5981	Yes
<b>2035</b>	1942	See CV_AV	3884	No	653	Y	3884	Yes
<b>2050</b>	1954	No	3915	No	649	Y	1946	Yes

Table 7: Existing/Estimated Westbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1518	See SOV	0	n/a	533	Y	7406	See SOV
<b>2025</b>	1580	Yes	385	See SOV	563	Y	6512	See SOV
<b>2035</b>	1156	See CV_AV	3045	No	635	Y	6400	No
<b>2050</b>	1192	Yes	3845	No	638	Y	6499	No

Table 8: Fleet Adjusted Westbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1555	See SOV	0	n/a	518	Y	7406	No
<b>2025</b>	1541	Yes	385	See SOV	617	Y	6165	Yes
<b>2035</b>	1889	See CV_AV	3778	No	635	Y	3778	Yes
<b>2050</b>	1923	No	3853	No	638	Y	1915	Yes

## Middle Segment – AM Peak

Table 9: Existing/Estimated Eastbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1178	See SOV	0	n/a	414	See SOV	5745	Yes
<b>2025</b>	1211	See SOV	295	See SOV	431	See SOV	6203	Yes
<b>2035</b>	914	See CV_AV	2406	Yes	502	See SOV	5057	No
<b>2050</b>	949	Yes	3062	Yes	508	See SOV	5174	No

Table 10: Fleet Adjusted Eastbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1206	See SOV	0	n/a	402	See SOV	5745	Yes
<b>2025</b>	1181	See SOV	295	See SOV	473	See SOV	5907	Yes
<b>2035</b>	1493	See CV_AV	2985	No	502	See SOV	2985	Yes
<b>2050</b>	1531	Yes	3068	Yes	508	See SOV	1525	Yes

Table 11: Existing/Estimated Westbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1043	See SOV	0	n/a	366	See SOV	5089	Yes
<b>2025</b>	1067	See SOV	260	See SOV	380	See SOV	5467	Yes
<b>2035</b>	813	See CV_AV	2140	Yes	446	See SOV	4498	Yes
<b>2050</b>	847	Yes	2734	Yes	454	See SOV	4620	No

Table 12: Fleet Adjusted Westbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
<b>2016</b>	1069	See SOV	0	n/a	356	See SOV	5089	Yes
<b>2025</b>	1041	See SOV	260	See SOV	417	See SOV	5207	Yes
<b>2035</b>	1328	See CV_AV	2656	No	446	See SOV	2656	Yes
<b>2050</b>	1367	Yes	2739	Yes	454	See SOV	1361	Yes

## Middle Segment – PM Peak

Table 13: Existing/Estimated Eastbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	1234	See SOV	0	n/a	433	Yes	6021	Yes
2025	1258	See SOV	307	See SOV	448	Yes	6444	Yes
2035	989	See CV_AV	2604	No	543	Yes	5473	No
2050	1012	Yes	3264	Yes	542	Yes	5516	No

Table 14: Fleet Adjusted Eastbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	1264	See SOV	0	n/a	421	See SOV	6021	Yes
2025	1227	See SOV	307	See SOV	491	See SOV	6137	Yes
2035	1615	See CV_AV	3231	Yes	543	See SOV	3231	Yes
2050	1632	Yes	3270	Yes	542	See SOV	1625	Yes

Table 15: Existing/Estimated Westbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	1399	See SOV	0	n/a	491	Yes	6823	Yes
2025	1471	See SOV	359	See SOV	524	Yes	7532	No
2035	1098	See CV_AV	2891	No	603	Yes	6076	No
2050	1115	Yes	3597	Yes	597	Yes	6079	No

Table 16: Fleet Adjusted Westbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	Yes	1433	See SOV	0	n/a	478	See SOV	6823
2025	Yes	1435	See SOV	359	See SOV	574	See SOV	7173
2035	Yes	1793	See CV_AV	3587	No	603	See SOV	3587
2050	Yes	1799	No	3604	Yes	597	See SOV	1791

## Western Segment – AM Peak

Table 17: Existing/Estimated Eastbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	855	See SOV	0	n/a	300	See SOV	4168	Yes
2025	850	See SOV	207	See SOV	303	See SOV	1360	Yes
2035	662	See CV_AV	1743	Yes	363	See SOV	3664	Yes
2050	708	See SOV	2284	Yes	379	See SOV	4568	Yes

Table 18: Fleet Adjusted Eastbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	875	See SOV	0	n/a	292	See SOV	3001	Yes
2025	829	See SOV	207	See SOV	332	See SOV	2778	Yes
2035	1081	See CV_AV	2163	Yes	363	See SOV	1799	Yes
2050	1142	See SOV	2288	Yes	379	See SOV	758	Yes

Table 19: Existing/Estimated Westbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	963	See SOV	0	n/a	338	See SOV	4698	Yes
2025	1030	See SOV	251	See SOV	367	See SOV	5275	Yes
2035	791	See CV_AV	2085	Yes	435	See SOV	4381	Yes
2050	848	See SOV	2734	No	454	See SOV	5469	Yes

Table 20: Fleet Adjusted Westbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	986	See SOV	0	n/a	329	See SOV	4698	Yes
2025	1005	See SOV	251	See SOV	402	See SOV	5023	Yes
2035	1293	See CV_AV	2586	No	435	See SOV	2586	Yes
2050	1367	See SOV	2740	Yes	454	See SOV	2729	Yes



## Western Segment – PM Peak

Table 21: Existing/Estimated Eastbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	1151	See SOV	0	n/a	404	See SOV	5615	Yes
2025	1217	See SOV	297	See SOV	433	See SOV	6231	Yes
2035	917	See CV_AV	2415	Yes	503	See SOV	5075	Yes
2050	974	See SOV	3143	No	522	See SOV	6286	Yes

Table 22: Fleet Adjusted Eastbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	1179	See SOV	0	n/a	393	See SOV	5615	Yes
2025	1123	See SOV	281	See SOV	449	See SOV	5615	Yes
2035	1498	See CV_AV	2996	No	503	See SOV	2996	Yes
2050	1571	See SOV	3149	No	522	See SOV	3136	Yes

Table 23: Existing/Estimated Westbound

Existing and Estimated Volume by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	1026	See SOV	0	n/a	360	See SOV	5005	Yes
2025	1016	See SOV	248	See SOV	362	See SOV	5204	Yes
2035	786	See CV_AV	2070	Yes	431	See SOV	4350	Yes
2050	822	See SOV	2650	Yes	440	See SOV	5301	Yes

Table 24: Fleet Adjusted Westbound

Adjusted Percentage Applied by Year	HOV	Satisfies?	SOV with CV/AV	Satisfies?	Transit/Freight	Satisfies?	SOV/GP	Satisfies?
2016	1051	See SOV	0	n/a	350	See SOV	5005	Yes
2025	991	See SOV	248	See SOV	396	See SOV	4956	Yes
2035	1284	See CV_AV	2568	No	431	See SOV	2568	Yes
2050	1325	See SOV	2656	Yes	440	See SOV	2645	Yes