



MEMORANDUM

Date: January 2, 2025
To: Luke Schwartz and Adam Fukushima, City of San Luis Obispo
From: Joe Fernandez and Michelle Matson, CCTC
Subject: Higuera Complete Street Project – Madonna Road Class 1 Traffic Operations Evaluation

This memorandum evaluates the operational effects of the Higuera Complete Street project with a future Class I path on the north side of Madonna Road from the US 101 Southbound Ramps to Higuera Street. The Class I path is under consideration as a future alternative to the Class II buffered bike lanes currently included in the Higuera Complete Streets plans. The Class I future alternative would also include an eastbound Class II bike lane.

SUMMARY

The Higuera Complete Street project will enhance pedestrian and bicycle infrastructure in the City of San Luis Obispo along the Higuera Street corridor between Los Osos Valley Road and Marsh Street, on Madonna Road from the US 101 Southbound Ramps to Higuera Street, and on Bridge Street, Corrida Drive, and Woodbridge Street east of Higuera Street with neighborhood greenway improvements. Highlights of the current project include:

- A road diet on Higuera Street between Bridge Street and Margarita Avenue.
- Reconstruction of the northwest corner of Higuera Street/Madonna Road.
- Removal of a westbound through lane at Higuera Street/US 101 Southbound Ramp
- Class II buffered bike lanes on Madonna Road.
- Bicycle signal phases at Higuera Street/Madonna Road and Higuera Street/Los Osos Valley Road.
- Installation of accessible pedestrian signal (APS) push buttons, countdown pedestrian signal heads, leading pedestrian intervals (LPI), and high-visibility signal backplates throughout the corridor where such features do not currently exist.

A future project may include reconstruction of the existing overcrossing to accommodate an eastbound Class II bike lane and a Class I path on the north side of the overcrossing and removing the Class II buffered bike lanes as evaluated in this memorandum.

The Madonna Road intersections with the US 101 Ramps and Higuera Street would operate acceptably at level of service (LOS) D or better with the Higuera Complete Street project and the installation of a Class I path on the north side of the Madonna Road interchange and a southbound bicycle and pedestrian phase at Higuera St/Madonna Road. However, Higuera St/Madonna Road operates at LOS E under Near Term and Cumulative Conditions during both peak hours with a bicycle phase serving the Class I path on the northwest corner. Note that the analysis software reports the worst-case conditions when the bicycle phase is actuated, and cycles without bicycle phase actuation would operate with less delay.

We recommend coordinating data and analysis needs (notably current count data and the evaluation approach for the existing non-standard signal timing) with Caltrans and considering updates to the travel demand forecasts if the City pursues the Class I path.

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TRAFFIC OPERATIONS

Traffic operations were analyzed at the following intersections using the Synchro 11 software package applying the Highway Capacity Manual (HCM) methods and 2022 counts.

- Madonna Road/US 101 Southbound Ramps
- Madonna Road/US 101 Northbound Ramps
- Higuera Street/Madonna Road

Peak hour turning movement forecasts were developed for the Near Term (2030) and Cumulative (2040) conditions analysis using the City’s Travel Demand Model (TDM). The Near Term forecasts include significant approved and pending land use projects such as San Luis Ranch, Avila Ranch, and Froom Ranch, but exclude planned improvements to the US 101/Prado Road interchange, the Prado Bridge Replacement and related intersection improvements at the Higuera Street/Prado Road intersection, or any other major network changes. This is conservative since it assumes all the major approved projects in the City are built and occupied prior to the completion of key improvements along Prado Road which will reduce travel demand along portions of the Higuera Street corridor.

The City’s Circulation Element specifies a performance standard of level of service (LOS) D or better for arterials like South Higuera Street and Madonna Road. The City’s Multimodal Transportation Impact Study Guidelines identify thresholds for local policy consistency, noting that a project may have a significant impact if it causes or exacerbates 95th percentile turning movement queues exceeding available turn pocket capacity and presents a contextually significant safety hazard.

Table 1 summarizes the peak hour auto level of service (LOS) and **Table 2** summarizes the queues at the study intersections under Existing, Near Term, and Cumulative Conditions without the Higuera Complete Street (CS) Project, with the Higuera Complete Street Project and the addition of a Class I path on the overpass, as well as the addition of a bicycle phase for the northwest corner of Higuera Street/Madonna Road. The Synchro output sheets are included in **Attachment A**.

Table 1: Existing, Near Term, and Cumulative Intersection Levels of Service

Existing, Near Term, and Cumulative Intersection Levels of Service																			
Intersection	Peak Hour	Existing		CS w/ w/Bike		Near Term	CS w/ w/Bike		Cumulative	CS w/ w/Bike		LOS ¹	LOS ¹						
		LOS ¹	Phase	LOS ¹	Phase		LOS ¹	Phase		LOS ¹	Phase								
Madonna Rd/US 101 SB	AM	15.4	B	30.5	C	30.5	C	21.5	C	36.2	D	36.2	D	21.9	C	36.9	D	36.9	D
	PM	25.5	C	36.7	D	36.7	D	26.5	C	39.0	D	39.0	D	28.4	C	42.9	D	42.9	D
Madonna Rd/US 101 NB	AM	9.4	A	24.5	C	24.5	C	10.3	B	25.0	C	25.0	C	10.7	B	25.1	C	25.1	C
	PM	21.5	C	28.3	C	28.2	C	25.3	C	33.9	C	33.8	C	26.1	C	34.6	C	34.6	C
Higuera St/Madonna Rd	AM	19.6	B	33.5	C	41.3	D	25.1	C	46.3	D	57.6	E	25.6	C	46.5	D	57.8	E
	PM	25.4	C	42.3	D	50.6	D	32.9	C	51.9	D	60.8	E	33.2	C	52.1	D	60.1	E

1. HCM 6th or HCM 2000 average control delay in seconds per vehicle and level of service (LOS).
 Note: CS = Higuera Complete Street Project. **Unacceptable operations at City intersections shown in bold text.**

Table 2: Existing, Near Term, and Cumulative Intersection Queues

Existing, Near Term, and Cumulative Intersection Queues ¹												
Intersection	Movement	Storage Length ²	Peak Hour	Existing			Near Term			Cumulative		
				No Project	Class I	w/Bike Phase	No Project	Class I	w/Bike Phase	No Project	Class I	w/Bike Phase
Madonna Rd/ US 101 SB	WBL	250 (235)	AM	119	160	160	163	#226	#226	175	#232	#232
			PM	191	#259	#259	m168	m#193	m#193	m159	m167	m167
	WBT	950	AM	109	290	290	138	368	368	153	369	369
			PM	165	421	421	197	#556	#556	m194	m497	m497
NBL	700	AM	162	205	205	197	227	227	256	#300	#300	
		PM	#302	#387	#387	#334	#426	#426	#389	#489	#489	
NBR	240	AM	137	56	56	235	119	119	230	119	119	
		PM	48	30	30	67	32	32	67	32	32	
Madonna Rd/ US 101 NB	EBL	410 & 900	AM	187	137	137	#252	207	207	#252	207	207
			PM	257	156	156	#321	#389	#389	#321	m#375	m#375
	EBT	950	AM	193	56	56	295	73	73	295	72	72
			PM	196	28	28	254	42	42	253	42	42
	WBT	850	AM	231	273	273	306	358	358	332	394	394
PM			#482	474	474	#651	#674	#674	#708	#750	#750	
NBL	170	AM	104	155	155	109	156	156	109	156	156	
		PM	138	179	179	168	218	218	168	218	218	
NBT/R	-	AM	66	58	58	110	133	133	110	133	133	
		PM	45	54	54	46	55	55	46	55	55	
Higuera St/ Madonna Rd	EBL	850	AM	231	278	312	#357	382	426	#357	382	426
			PM	#314	380	418	#408	#484	#535	#408	#484	#535
	EBR	140	AM	33	318	369	125	#749	#860	131	#749	#860
			PM	47	347	#355	61	347	#355	61	347	#355
	NBL	160	AM	124	94	102	181	136	#152	181	136	#152
			PM	207	140	155	#397	#246	#279	#397	#246	#279
NBT	-	AM	72	244	290	110	394	469	110	394	469	
		PM	112	303	390	168	470	603	185	532	681	
SBT	220 (375)	AM	135	171	196	196	243	280	219	271	312	
		PM	196	202	247	240	238	291	#267	263	322	
SBR	330 (375)	AM	106	97	129	172	202	246	172	202	246	
		PM	230	228	288	281	290	356	281	302	348	

1. Queue length that would not be exceeded 95 percent of the time. **Bold** indicates queue length longer than storage or block length. # indicates that 95th percentile volume exceeds capacity, queue may be longer. m indicates volume for 95th percentile queue is metered by upstream signal.

2. Existing storage length (Project storage length) in feet.

Higuera Complete Street with Class I Path Operations

All study locations operate acceptably at LOS D or better with the phasing shown in **Exhibit 1 and 2** for the Class I path. There are no modifications to the existing signal phasing at Madonna Road/US 101 Southbound Ramps and it was assumed bicycles on the Class I path would use the pedestrian phase.

Exhibit 1: Madonna Road/US 101 Northbound Ramps Proposed Signal Phasing with Class I Path

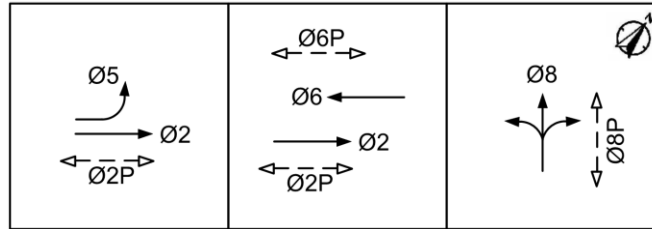
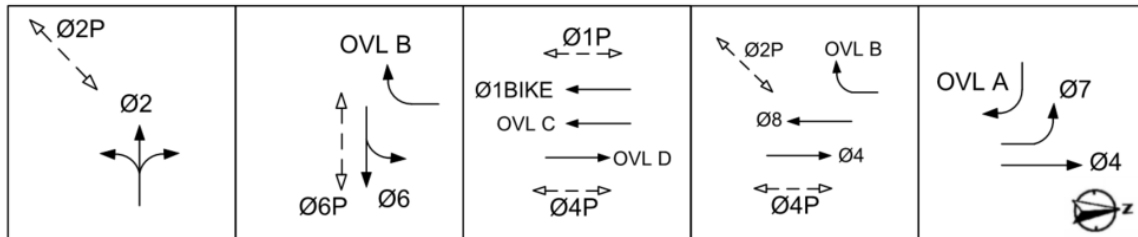


Exhibit 2: Higuera Street/Madonna Road Proposed Higuera Complete Streets Signal Phasing



Note: Phase 2 is the commercial center, Phases 4 and 8 are Higuera Street, and Phase 6 is Madonna Road.

Higuera Street/Madonna Road operates acceptably with the addition of a southbound bicycle and pedestrian phase, restriction of southbound left turns, conversion of a northbound through lane to a left turn lane, LPI, time of day plans, and no RTOR for southbound, eastbound, and northbound. The eastbound right and northbound left turn queues exceed the storage length during one or more peak hours with the project. The northbound queue would also reach Bridge Street during one or more peak hours with the project. Implementation of the project would substantially shorten the forecast northbound left turn queue by adding an additional lane. We recommend installing “KEEP CLEAR ” pavement markings at Bridge Street and extending one of the northbound left turn lanes to Bridge Street.

The existing signal timing on the Madonna Road Overpass is coordinated during the PM peak hour and the cycle length does not accommodate the southbound pedestrian movement at Madonna Road/US 101 Southbound Ramps. The southbound pedestrian flashing don’t walk time continues with eastbound left and northbound right turning vehicles prior to eastbound left turning vehicles which cannot be fully modeled in Synchro. The analysis assumes signal timing updates at the intersections consistent with the CAMUTCD as well as LPI, and no RTOR for the eastbound and westbound Madonna Road phases as well as the Madonna Inn driveway. Note that with the existing signal timing and removal of a westbound through lane at Madonna Road/US 101 Southbound Ramps, the intersection delay would increase by less than one second over the no project conditions.

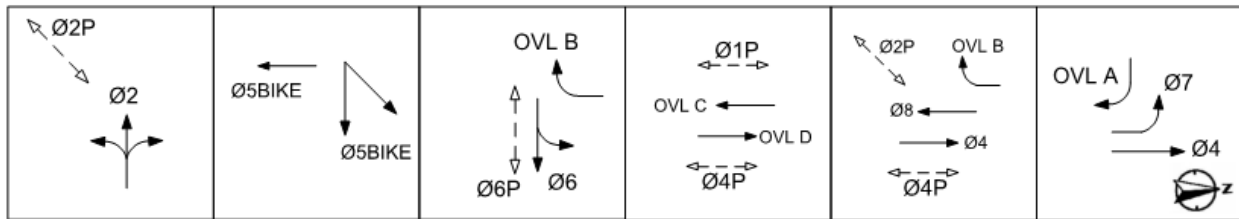
At Madonna Road/US 101 Southbound Ramps, the westbound left turn queue exceeds the storage length during the PM peak hour under Existing Conditions with the project. We recommend the project extend the westbound left turn lane storage to the existing length or longer as feasible. At Madonna Road/US 101 Northbound Ramps, the northbound left turn queue exceeds the storage length during the PM peak hour under

Near Term and Cumulative Conditions with the project. However, the queue can be accommodated in the bay taper and would not likely block the adjacent lane.

Higuera Complete Street with Class I Path and Bicycle Signal Operations

With the proposed phasing shown in **Exhibit 2**, eastbound cyclists using the Class I path at Higuera Street/Madonna Road would need to cross the intersection using multiple phases to travel northbound on Higuera Street. The proposed phasing shown in **Exhibit 3** was used to evaluate the Class I path with a bike phase which would reduce cyclist delay for the eastbound to northbound movement. No additional changes were made to the phasing at the US 101 Ramps.

Exhibit 3: Higuera Street/Madonna Road Proposed Signal Phasing with Class I Path and Bike Phase



The phasing shown on **Exhibit 3** would operate at LOS F during both peak hours under Near Term and Cumulative Conditions with the Class I path and a bicycle phase. In addition, the eastbound right turn queue would reach the US 101 Northbound Ramp intersection during the AM peak hour.

A crosswalk on the north leg of the intersection would also result in AM peak hour queues reaching the Northbound Ramp intersection and LOS E operations during the PM peak hour.

CONCLUSIONS

The Higuera Complete Streets project will substantially improve conditions for cyclists and pedestrians by improving delineation, increasing separation from vehicular traffic, improving traffic signal timing, and implementing a road diet on a portion of the corridor, all measures that have been proven to improve cyclist comfort and reduce frequency and severity of collisions.

A Class I path on the north side of the Madonna Road overpass would further improve conditions for cyclists. We recommend coordinating data and analysis needs (notably current count data and the evaluation approach for the existing non-standard signal timing) with Caltrans and considering updates to the travel demand forecasts if the City pursues the Class I path.

ATTACHMENTS

- A. Synchro Output Sheets

REFERENCES

City of San Luis Obispo. 2014. Circulation Element of the General Plan.
 _____. 2020. Multimodal Transportation Impact Study Guidelines.
 _____. 2021. Active Transportation Plan.
 _____. 2022. Active Transportation Program Higuera Complete Streets Grant Application.