

Final Supplemental Environmental Impact Report 3 for

METRO GOLD LINE

Evaluating Relocation of the
San Dimas Station
Parking Facility

FOOTHILL EXTENSION

Azusa to Montclair (SCH No. 2010121069)

July 2022

APPENDIX A:

ATTACHMENT B –

QUEUING MEMORANDUM



Foothill Gold Line

Metro Gold Line Foothill Extension Construction Authority

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Subject	San Dimas Avenue Crosswalk Traffic Evaluation	Project Name	Metro Gold Line Foothill Extension (Azusa to Montclair)
Attention	Chris Burner, Gold Line Authority	Project No.	680051CH
From	Loren Bloomberg, PE, Jacobs		
Date	June 30, 2022		
Copies to	File		

1. Introduction

The purpose of this memorandum is to document the findings for a traffic evaluation performed for the proposed east-west crosswalk for the proposed Metro Gold Line Foothill Extension (Phase 2B). The proposed crosswalk will connect the proposed Gold Line parking lot (west of San Dimas Avenue and south of the tracks) to the proposed Gold Line Station (east of San Dimas Avenue and south of the tracks). The attachment provides a current location and layout of the proposed crosswalk. The crosswalk will be approximately 55 feet from curb ramp to curb ramp and 12 feet wide.

2. Traffic Data

A traffic evaluation was conducted to capture the potential effects of this crosswalk. The evaluation used the forecasted peak hour (AM and PM) volumes for 2035 Build Alternative with Project Modifications summarized in the latest 2021 Supplemental Environmental Impact Report, Appendix B: Traffic Analysis Technical Memorandum. The entering and exiting volumes for the southern leg at Intersection 38: San Dimas Avenue/Bonita Avenue were used as the northbound (NB) and southbound (SB) volumes. The traffic volumes that would be in conflict with the proposed crosswalk operations are:

- AM peak hour: 362 vehicles per hour (vph) NB and 449 vph SB
- PM peak hour: 684 vph NB and 359 vph SB

3. Crosswalk Analysis

Traffic analysis was performed using Synchro (version 10), which uses integrated methodologies from the latest Highway Capacity Manual (HCM), 6th Edition to evaluate intersection performance. An intersection network was created in Synchro to emulate the interruptions of the NB and SB traffic flows as a result of pedestrian calls at the crosswalk. Due to signal phasing limitations in the HCM methodologies, the integrated Synchro calculations for delay, level of service (LOS), and queueing were reported in the analysis results. The Synchro calculations are consistent with the same traffic engineering principles that are the basis for the HCM methodologies.

The crosswalk was coded as a two-phase signal: one signal phase for the NB and SB traffic movements and one signal phase for the east-west pedestrian movements. For the pedestrian signal phase, a walk time of 5 seconds and a “flash don’t walk” time of 16 seconds were used. The 16 seconds of “flash don’t walk” time was determined from the 55-foot crosswalk distance and a 3.5 feet per second walking speed. With an assumed red time of 1 second, the total pedestrian phase split was coded at 22 seconds (5 seconds walk + 16 seconds flash don’t walk + 1 second red clearance). The remaining cycle length time was allocated to the NB and SB traffic movements. Based on the latest signal timing cycle optimizations of the future Build scenario for the San Dimas Avenue/Bonita Avenue intersection, the cycle lengths were coded as 70 seconds for the AM peak hour and 90 seconds for the PM peak hour.

The traffic analysis included the conservative assumption that one pedestrian call would be placed for each cycle length. This approach was applied to capture the worst-case traffic operations along San Dimas Avenue by setting the cabinet recall mode to “max recall” in both signal phases.

The crosswalk would be integrated to the railroad preemption operations that include upstream signals (queue cutters) to ensure that the queues remain outside of the tracks at all times. The queue cutters are required for the SB movement to make sure that vehicles who would otherwise be stopped in the queues from the crosswalk would not be stopped on the tracks. With queue cutters, it is expected that queues will be limited to the section of San Dimas Avenue north of the tracks.

The product of the traffic analysis was to estimate the delay (in seconds per vehicle) for the NB and SB approach and confirm that the crosswalk operations would not generate excessive queues that could potentially spill back to upstream intersections.

Table 1 is a summary of the results of the traffic analysis for the NB and SB approaches with the implementation of the crosswalk for the worst-case scenario (consistent use of the crosswalk during the peak hours). The detailed Synchro output reports are provided in the attachment.

Table 1. Traffic Operations Summary for San Dimas Avenue Crosswalk

Approach	Approach Delay (seconds per vehicle)	Approach LOS	95 th Percentile Queue (in feet)	Available Storage (in feet)
<i>AM Peak Hour</i>				
San Dimas Avenue (NB)	6.0	A	53	210
San Dimas Avenue (SB)	9.5	A	177	300
<i>PM Peak Hour</i>				
San Dimas Avenue (NB)	6.0	A	83	210
San Dimas Avenue (SB)	6.9	A	136	300

NB = Northbound, SB = Southbound

As summarized in Table 1, the delays for both approaches during the peak hours are minimal and the projected queue lengths are within the available storage upstream of the signals. For comparison, the NB and SB approach delays for the San Dimas Avenue/Bonita Avenue intersection to the north range between 15 and 18 seconds per vehicle (LOS B) in the AM peak hour and between 26 and 27 seconds per vehicle (LOS C) in the PM peak hour. Therefore, the operations at San Dimas Avenue at the crosswalk result in minimal delays compared to the delays experienced at the nearby intersections.

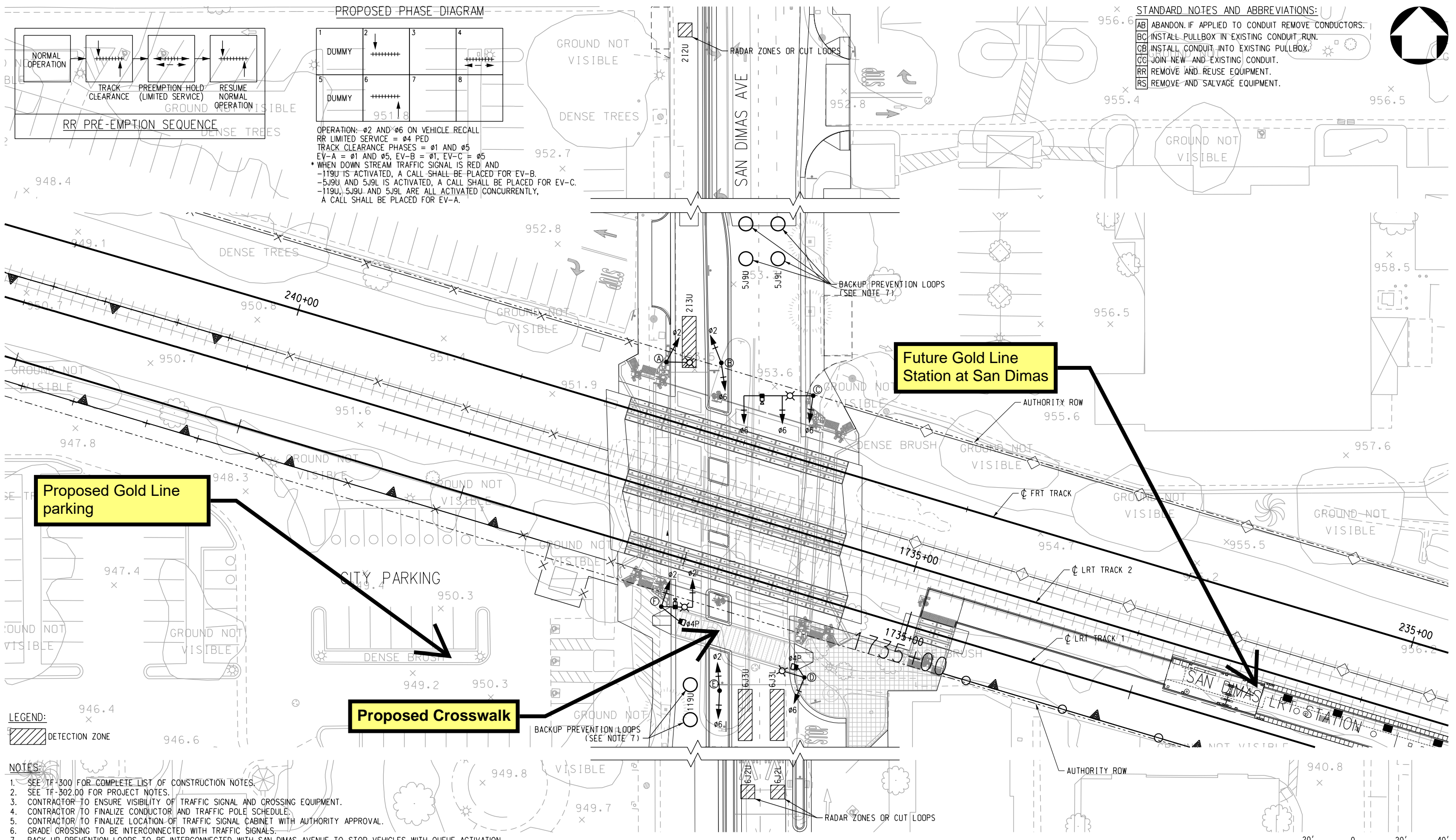
4. Conclusion

The results of the operational and queueing analysis for the NB and SB approaches at San Dimas Avenue indicate that the projected 2035 Build Alternative with Project Modification traffic will not result in a substantial increase in delay and the projected queues are expected to stay within the available storage with the installation of the proposed east-west crosswalk.

Potential enhancements to consider include:

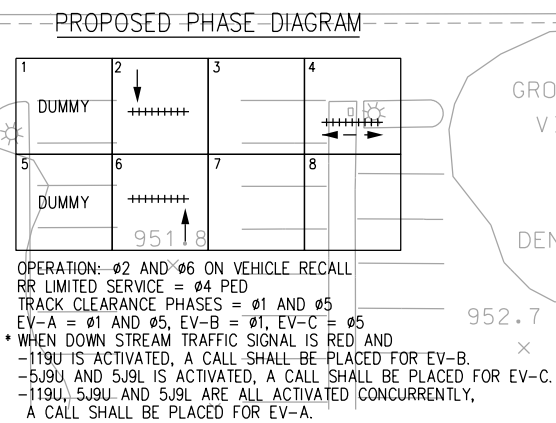
- Synchronization of the crosswalk pedestrian phasing with the east-west phases in at the San Dimas Avenue/Bonita Avenue intersection to minimize queuing from the southbound traffic.
- Synchronization of the crosswalk pedestrian phasing with the railroad preemption operations (“gate down time”) to minimize the overall red time for NB and SB traffic when train events occur simultaneously.

ATTACHMENTS



STANDARD NOTES AND ABBREVIATIONS:

AB	ABANDON. IF APPLIED TO CONDUIT REMOVE CONDUCTORS.
BC	INSTALL PULLBOX IN EXISTING CONDUIT RUN.
CB	INSTALL CONDUIT INTO EXISTING PULLBOX.
CC	JOIN NEW AND EXISTING CONDUIT.
RR	REMOVE AND REUSE EQUIPMENT.
RS	REMOVE AND SALVAGE EQUIPMENT.



Proposed Gold Line parking

Future Gold Line Station at San Dimas

Proposed Crosswalk

LEGEND:
 DETECTION ZONE

- NOTES:
- SEE TF-300 FOR COMPLETE LIST OF CONSTRUCTION NOTES.
 - SEE TF-302.00 FOR PROJECT NOTES.
 - CONTRACTOR TO ENSURE VISIBILITY OF TRAFFIC SIGNAL AND CROSSING EQUIPMENT.
 - CONTRACTOR TO FINALIZE CONDUITOR AND TRAFFIC POLE SCHEDULE.
 - CONTRACTOR TO FINALIZE LOCATION OF TRAFFIC SIGNAL CABINET WITH AUTHORITY APPROVAL.
 - GRADE CROSSING TO BE INTERCONNECTED WITH TRAFFIC SIGNALS.
 - BACK UP PREVENTION LOOPS TO BE INTERCONNECTED WITH SAN DIMAS AVENUE TO STOP VEHICLES WITH QUEUE ACTIVATION.

CPUC APPLICATION NUMBER: A 1804003
 20' 0 20' 40'
 HORIZ. SCALE

REV.	DATE	DESCRIPTION	DES.	ENG.
NOT FOR CONSTRUCTION				

HILL
 Hill International
 406 E. HUNTINGTON, SUITE 202
 MONROVIA, CA 91016 - 3633

METRO GOLD LINE FOOTHILL EXTENSION CONSTRUCTION AUTHORITY
 PHASE 2B ALIGNMENT DESIGN-BUILD PROJECT
 CONTRACT NO. C2002
 EXECUTION VERSION













ADVANCED CONCEPTUAL ENGINEERING
 GLENDORA TO MONTCLAIR
 (POMONA TERMINUS)
 TRAFFIC SIGNALS
 SAN DIMAS AVENUE

DRAWING NO.	TF-321.00
SHEET NO.	

File Name: I:\Phase II\009 Phase 2B Documents\Engineering\Drawings\09-Traffic-Signals-POMTER\C2002_TF-321.00-San_Dimas_Ave-POMTER.dgn
 1/28/2019 8:08:28 PM
 USER: clevinson

Lanes, Volumes, Timings
2002: San Dimas Ave & Crosswalk

05/07/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↑↑			↑	
Traffic Volume (vph)	0	0	0	0	0	0	0	386	0	0	507	0
Future Volume (vph)	0	0	0	0	0	0	0	386	0	0	507	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	1863	0	0	1863	0	0	3539	0	0	1863	0
Flt Permitted												
Satd. Flow (perm)	0	1863	0	0	1863	0	0	3539	0	0	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		256			185			291			451	
Travel Time (s)		5.8			4.2			6.6			10.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	420	0	0	551	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	420	0	0	551	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2			2			2			2	
Detector Template		Thru			Thru			Thru			Thru	
Leading Detector (ft)		100			100			100			100	
Trailing Detector (ft)		0			0			0			0	
Detector 1 Position(ft)		0			0			0			0	
Detector 1 Size(ft)		6			6			6			6	
Detector 1 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0			0.0			0.0	
Detector 1 Queue (s)		0.0			0.0			0.0			0.0	
Detector 1 Delay (s)		0.0			0.0			0.0			0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type												
Protected Phases		8			8			2			6	
Permitted Phases												
Detector Phase		8			8			2			6	
Switch Phase												
Minimum Initial (s)		5.0			5.0			5.0			5.0	

Lanes, Volumes, Timings
 2002: San Dimas Ave & Crosswalk

05/07/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)		22.0			22.0			22.5			22.5	
Total Split (s)		22.0			22.0			48.0			48.0	
Total Split (%)		31.4%			31.4%			68.6%			68.6%	
Maximum Green (s)		19.5			19.5			43.5			43.5	
Yellow Time (s)		2.0			2.0			3.5			3.5	
All-Red Time (s)		0.5			0.5			1.0			1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		2.5			2.5			4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Recall Mode		Max			Max			Max			Max	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)								43.5			43.5	
Actuated g/C Ratio								0.62			0.62	
v/c Ratio								0.19			0.48	
Control Delay								6.0			8.8	
Queue Delay								0.0			0.7	
Total Delay								6.0			9.5	
LOS								A			A	
Approach Delay								6.0			9.5	
Approach LOS								A			A	

Intersection Summary


















Area Type:	Other
Cycle Length:	70
Actuated Cycle Length:	70
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.48
Intersection Signal Delay:	8.0
Intersection LOS:	A
Intersection Capacity Utilization:	30.4%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 2002: San Dimas Ave & Crosswalk



Lanes, Volumes, Timings
2002: San Dimas Ave & Crosswalk

05/07/2021

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (vph)	0	0	0	0	0	0	0	620	0	0	436	0
Future Volume (vph)	0	0	0	0	0	0	0	620	0	0	436	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	0	1863	0	0	1863	0	0	3539	0	0	1863	0
Flt Permitted												
Satd. Flow (perm)	0	1863	0	0	1863	0	0	3539	0	0	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		256			153			280			462	
Travel Time (s)		5.8			3.5			6.4			10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0	0	674	0	0	474	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	674	0	0	474	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors		2			2			2			2	
Detector Template		Thru			Thru			Thru			Thru	
Leading Detector (ft)		100			100			100			100	
Trailing Detector (ft)		0			0			0			0	
Detector 1 Position(ft)		0			0			0			0	
Detector 1 Size(ft)		6			6			6			6	
Detector 1 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)		0.0			0.0			0.0			0.0	
Detector 1 Queue (s)		0.0			0.0			0.0			0.0	
Detector 1 Delay (s)		0.0			0.0			0.0			0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type												
Protected Phases		4			4			2			6	
Permitted Phases												
Detector Phase		4			4			2			6	
Switch Phase												
Minimum Initial (s)		5.0			5.0			5.0			5.0	

Lanes, Volumes, Timings
 2002: San Dimas Ave & Crosswalk

05/07/2021

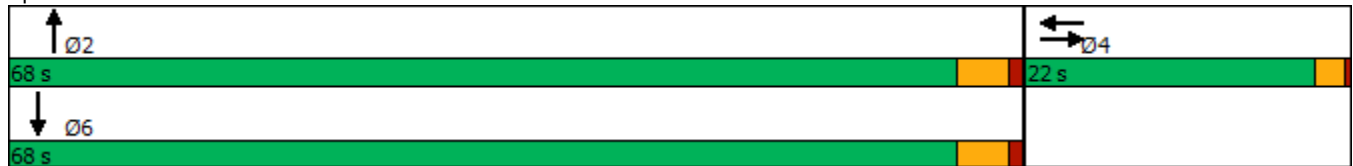


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)		22.0			22.0			22.5			22.5	
Total Split (s)		22.0			22.0			68.0			68.0	
Total Split (%)		24.4%			24.4%			75.6%			75.6%	
Maximum Green (s)		19.5			19.5			63.5			63.5	
Yellow Time (s)		2.0			2.0			3.5			3.5	
All-Red Time (s)		0.5			0.5			1.0			1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		2.5			2.5			4.5			4.5	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Recall Mode		Max			Max			Max			Max	
Walk Time (s)		7.0			7.0			7.0			7.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)								63.5			63.5	
Actuated g/C Ratio								0.71			0.71	
v/c Ratio								0.27			0.36	
Control Delay								5.1			6.2	
Queue Delay								0.9			0.7	
Total Delay								6.0			6.9	
LOS								A			A	
Approach Delay								6.0			6.9	
Approach LOS								A			A	

Intersection Summary

Area Type: Other
 Cycle Length: 90
 Actuated Cycle Length: 90
 Natural Cycle: 45
 Control Type: Actuated-Uncoordinated
 Maximum v/c Ratio: 0.36
 Intersection Signal Delay: 6.4
 Intersection Capacity Utilization 26.7%
 Analysis Period (min) 15
 Intersection LOS: A
 ICU Level of Service A

Splits and Phases: 2002: San Dimas Ave & Crosswalk





Foothill Gold Line

Metro Gold Line Foothill Extension Construction Authority