

# Preliminary TCM Substitution Technical Analysis

## 1. Introduction

Metro is considering substitution of Project LAE0332: Long Beach Park and Ride Lot Facility at 3rd St. and Pacific Ave. with the following four projects, which are not in the 2015 FTIP; (1) Old Town Calabasas Park and Ride Facility by the City of Calabasas, (2) Vincent Community Bikeway Access by the County of Los Angeles, (3) West Athens and West Carson Community Bikeways by the County of Los Angeles, and (4) Arcadia Bike Facility Improvement project by the City of Arcadia.

### 1-1 Project to be deleted

#### **Long Beach Park and Ride Lot Facility at 3rd St. and Pacific Ave**

The Long Beach Park & Ride Lot project proposed at 3rd Street and Pacific Avenue south of the Metro Blue Line Pacific station would provide approximately 400 parking spaces for Metro Blue Line users. However, the project has been requested to be cancelled by the City of Long Beach due to lack of funding.

### 1-2 Projects to be used as substitution

#### **Santa Clarita Park and Ride Facility:**

The project proposes the construction of a Park and Ride lot that will have approximately 150 parking spaces at State Route 14 and Newhall Avenue. The routes that will be served are Commuter Express Routes that go to Century City, Downtown Los Angeles, Warner Center and North Hollywood. In addition, this lot will serve carpools and vanpools.

#### **Old Town Calabasas Park and Ride Facility:**

The City of Calabasas proposes a Park & Ride lot project in Old town Calabasas to purchase and construct a Park and Ride Lot with 72 parking spaces. The proposed Park and Ride Lot is located 1,000 feet from the Mulholland Highway/Valley Circle on-ramp to the US 101 and through being 700 feet from a stop for Metro's Line 161 and will allow residents of the City of Calabasas to park their vehicles and conveniently take public transportation/ vanpool/carpool to work or other activities throughout Los Angeles County.

#### **Vincent Community Bikeway Access:**

The project is located in the unincorporated Vincent community and the Cities of Azusa and West Covina. The scope of work includes installation of Class I bike path (2.01 miles) along the Big Dalton Wash between Irwindale Avenue and Lark Ellen Avenue, and between Arrow Highway and Citrus Avenue. Two Class II bike lanes (1.08 miles) are proposed along Irwindale Avenue between the Class I bike path and existing bikeways on Sunset Avenue and along Badillo Street between Irwindale Avenue and Orange Avenue to connect to the existing bike lane along Badillo Street and Ramona Boulevard.

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## Athens and West Carson Community Bikeways:

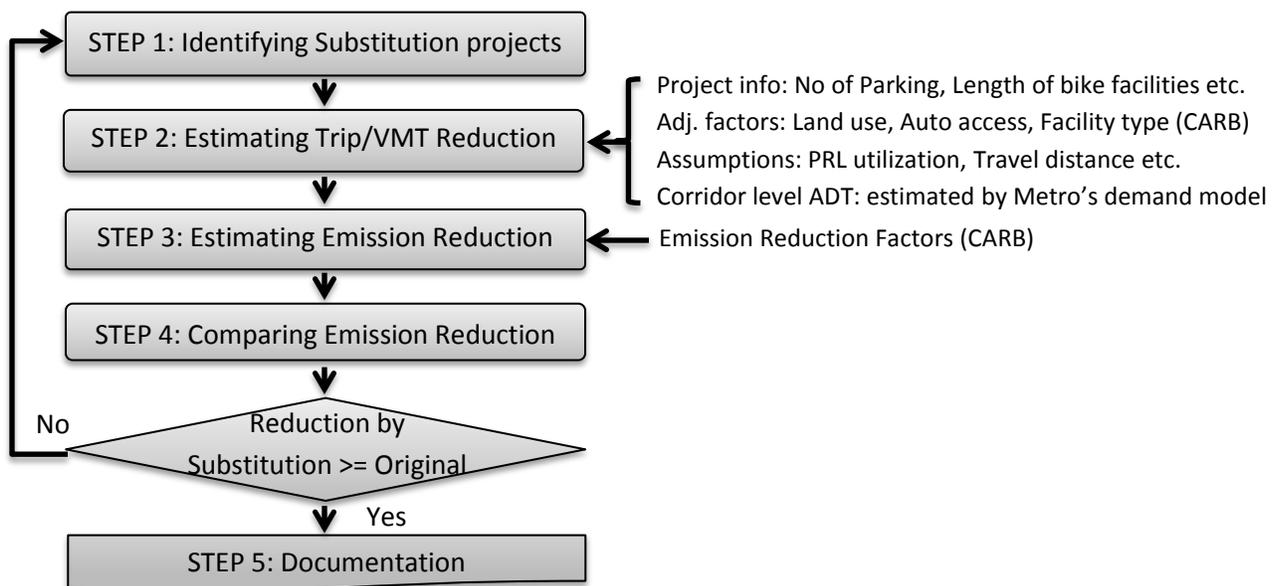
The Athens and West Carson Community Bikeways project will design and construct Class II bike lanes on Normandie Avenue between Imperial Hwy and El Segundo Boulevard (1 mile), 120<sup>th</sup> Street between Western Avenue and Vermont Avenue (1 mile), Lomita Boulevard between Frampton Avenue and Vermont Avenue (0.48 miles), and Carson Street between Normandie Avenue and Vermont Avenue (0.51 miles).

## 2. Methodology

In order to verify that these projects have similar air quality benefits and thus can be substituted for one another, we conducted an air quality benefits analysis based on the “Methods to Find the Cost-Effectiveness of Funding Air Quality Projects For Evaluating Motor Vehicle Registration Fee Projects and Congestion Mitigation and Air Quality Improvement (CMAQ) Projects” published by the California Air Resources Board (ARB) in May 2005 (validated in 2013), as well as 2013 Emission Factor Tables (also by ARB).

This was conducted through a five step process; (1) Identifying potential substitution projects (2) Estimating the Vehicle Miles Travelled (VMT) reduction and trip reduction for commute trips based on the number of parking spaces and parking lot utilization ratio (for PRL projects) and length of bike facilities and ADT (for bicycle facility projects) (3) Estimating air emission reduction by multiplying number of trips/VMTs and air emission factors (4) Comparing air quality benefits of original project with the substitution projects, then (5) Documenting the results. Figure below presents the air emission reduction benefits estimation process.

Figure 2-1 Air Emission Reduction Benefits Analysis Process



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## 2-1 Formulas, Input Values, and Assumption for Park & Ride Lot Projects

Provision of park and ride lots (PRL) would promote the use of public transit (if the PRL is located near transit stops) or encourage the formation of vanpools and carpools. The emission reduction benefits from PRLs come from the reduction of auto trips by transit, vanpool, or carpool services after adjusting for the increase in emissions associated with the vanpool/carpool vehicle itself and auto access trips to and from PRL.

### Formulas

$$\text{Annual Auto Trip Reduced} = [(D) * (R) * (A)] * [1 - (AA)] \quad \text{trips/year}$$

$$\text{Annual Auto VMT Reduced} = [(D) * (R) * (A)] * [(L) - (AA) * (LL)] \quad \text{miles/year}$$

$$\begin{aligned} \text{Annual Emission Reductions (ROG, NOx, and PM10)} = \quad & \text{lbs/year} \\ & [( \text{Annual Auto Trips Reduced} ) * (\text{Auto Trip End Factor}) \\ & + ( \text{Annual Auto VMT Reduced} ) * (\text{Auto VMT Factor}) \\ & - ( \text{Van VMT} ) * (\text{Van VMT Factor}) ] / 454 \end{aligned}$$

$$\text{Ridership (R)} = (\text{Parking Spaces}) * (\text{Lot Utilization}) * (2 \text{ commute trips/day})$$

$$\text{Van VMT} = [(R)/5] * (L) * (D)$$

(Assume 5 passenger per Vanpool)

### Note

- Parking is the number of parking spaces for a new parking lot or the number of added spaces to an existing lot.
- Lot Utilization is the estimated lot utilization rate from monitored data OR use 0.75 as a default.
- The default for Adjustment (AA) for Auto Access to and from rail service is 0.5.
- The default for Adjustment (AA) for Auto Access to and from vanpool/shuttle should be 0.9 instead of 0.5.

Table 2-1 Input Values for Park & Ride Lot Projects (CARB – May, 2013)

Inputs	Default	Units	Comments
<b>For the Vanpool</b>			
Days (D)	250	days (of operation)/year	Suggested defaults are weekday vanpools - 250 days
Ridership (R)		total trips (riders)/day	One-way trips by riders (or number of boardings) per day
Annual Van/Shuttle VMT (Van VMT)		annual miles	
<b>For Auto Travel Reduced</b>			
Adjustment (A) on Auto Trips: Portion of riders who did NOT previously use transit or vanpools.	0.3 (for vanpool) 0.3 (for rail)		The default (0.83) is for long-distance, commuter vanpool service. For new rail feeders, use 0.3 for the adjustment factor A.
Auto Trip Length (L)	25 (for vanpool) 8 (for rail)	miles one direction/trip	Suggested default for vanpools is 35 mile. 25 miles is used in this report

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Inputs	Default	Units	Comments
<b>For Auto Travel Added to Access Vanpool/Shuttle</b>			
Adjustment ( <b>AA</b> ) for Auto Access to and from PRL	0.75 (for Vanpool) 0.5 (for rail)		Enter the percentage of riders who drive to the vanpool service. The default (0.75) is for long-distance vanpools. For rail feeders, use 0.5.
Trip Length ( <b>LL</b> ) for Auto Access to and from vanpool/shuttle	5 (for vanpool) 2 (for rail)	miles one direction/trip	The default (5 mi) is for long-distance van pools. For rail feeders, use 2 mi.

Table 2-2 Total Average Auto Emission Factor (CARB – May, 2013)

Project Life	Grams per Commute Trip End			
	ROG	CO	NOx	PM2.5
1~5 years (2011~2015)	0.764	6.046	0.303	0.006
6~10 years (2011~2020)	0.614	4.083	0.233	0.004
16~20 years (2014~2035)	0.462	3.593	0.162	0.004
Project Life	Grams per Vehicle Mile			
	ROG	CO	NOx	PM2.5
1~5 years (2014~2017)	0.191	2.239	0.217	0.087
6~10 years (2014~2023)	0.153	1.783	0.172	0.087
16~20 years (2014~2035)	0.119	1.356	0.13	0.087

## 2-2 Formulas, Input Values, and Assumption for Bicycle Facility Projects

Bicycle and pedestrian projects/programs include a wide range of investments and strategies to facilitate and encourage non-motorized travel from bike path, bike share program to pedestrian urban design enhancements. Among these various strategies this report only includes bike path (Class I) and bike lane (Class II).

### Formulas

$$\text{Annual Auto Trip Reduced} = (D) * (ADT) * (A + C) \quad \text{trips/year}$$

$$\text{Annual Auto VMT Reduced} = (\text{Auto Trips}) * (L) \quad \text{miles/year}$$

$$\text{Annual Emission Reductions (ROG, NOx, and PM10)} = \quad \text{lbs/year}$$

$$\begin{aligned} & [(\text{Annual Auto Trips Reduced}) * (\text{Auto Trip End Factor}) \\ & + (\text{Annual Auto VMT Reduced}) * (\text{Auto VMT Factor})] / 454 \\ & - (\text{Van VMT}) * (\text{Van VMT Factor}) / 454 \end{aligned}$$

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Table 2-3 Input Values for Bicycle Facility Projects (CARB – May, 2013)

Inputs	Default	Units	Comments
Days (D)	200	days (of operation)/year	Consider local climate in number of days used.
Average Length (L) of bicycle trips	1.8	Miles per trip in one direction	Default is based on the National Personal Transportation Survey
Annual Average Daily Traffic (ADT)		Trips per day	Two-direction traffic volumes on roadway parallel to bike project. MAXIMUM IS 30,000.
Adjustment (A) on ADT for auto trips replaced by bike trips from the bike facility.	0.002		See Table I-3 Adjustment Factors table
Credit (C) for Activity Centers near the project.	0.0005		See Table I-4 Activity Centers table

Table 2-4 Adjustment Factors on ADT (CARB – May, 2013)

Bike Facility Class	Annual Average Daily Traffic (ADT)	Length of Bike Project (one direction)	Adjustment Factors for Cities with POP. > 250,000 and non-university towns < 250,000	Adjustment Factors for University Towns with POP. < 250,000
Class I (bike path) & Class II (bike lane)	ADT ≤ 12,000 vehicles a day	≤ 1 mile	0.0019	0.0104
		>1 & ≤ 2 miles	0.0029	0.0155
		> 2 miles	0.0038	0.0207
Class I (bike path) & Class II (bike lane)	12,000 < ADT ≤ 24,000 vehicles per day	≤ 1 mile	0.0014	0.0073
		>1 & ≤ 2 miles	0.002	0.0109
		> 2 miles	0.0027	0.0145
Class II bike lane	24,000 < ADT ≤ 30,000 vehicles per day	≤ 1 mile	0.001	0.0052
		>1 & ≤ 2 miles	0.0014	0.0078
		> 2 miles	0.0019	0.0104

Table 2-5 Activity Center Credits (CARB – May, 2013)

Number of activity centers*	Credit (C) Within 1/2 mile	Credit (C) Within 1/4 mile
Three (3)	0.0005	0.001
More than 3 but less than 7	0.001	0.002
7 or more	0.0015	0.003

- Types of Activity Centers: Bank, church, hospital or HMO, light rail station (park & ride), office park, post office, public library, shopping area or grocery store, university or junior college
- The number of activity centers within 1/4 mile and/or 1/2 mile from the project corridor was provided by project sponsors

### 3. Air Quality Benefits Equivalency

The methodologies and input data discussed in Chapter 2 were used to estimate emissions reductions for the Long Beach Park & Ride Facility project and the four substitution projects to demonstrate that the substitute measures have equivalent or greater emissions reductions than the control measure to be replaced.

#### 3-1 Emission Reduction by Original Project

Table 3-1 presents the air quality benefits, in units of “lbs per year” associated with the control measure (400 park and ride spaces at the Long Beach Park & Ride facility) for three horizon years: 2016, 2023, and 2035.

Table 3-1 Air emission reduction by original project (lbs)

Annual Emission Reduction	ROG	CO	NOx	PM2.5
<b>2016</b>	170.6	1,855.4	165.8	60.7
<b>2023</b>	153.5	1,618.2	147.1	68.1
<b>2035</b>	140.8	1,493.7	131.1	80.8

#### 3-2 Emission Reduction by Substitution Projects

Table 3-2 presents the air quality benefits, in units of “lbs per year” associated with substitution measures (222 park and ride spaces at the Santa Clarita Park & Ride facility and the Old town Calabasas Park & Ride facility and 6.09 miles of Class I and Class II bike facilities in the County of Los Angeles) for three horizon years: 2016, 2023, and 2035.

Table 3-2 Air emission reduction by substitute projects (lbs)

Annual Emission Reduction	ROG	CO	NOx	PM2.5
<b>2016</b>	272.1	2,674.6	209.1	63.4
<b>2023</b>	249.5	2,340.5	196.1	78.2
<b>2035</b>	218.1	2,183.1	176.3	99.1

#### 3-3 Summary of Results

The results clearly indicate that the proposed substitution projects - Santa Clarita Park & Ride facility, Old town Calabasas Park & Ride facility, Vincent Community Bikeway, and Athens and West Carson Community Bikeway – will have higher air quality benefits as compared to the Long Beach Park & Ride facility project. The net air quality benefits of the substitute projects as compared to the Long Beach Park & Ride facility project are summarized in Table 3-3.

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Table 3-3 Comparison: Substitution - Original (lbs)

<b>Annual Emission Reduction</b>	<b>ROG</b>	<b>CO</b>	<b>NOx</b>	<b>PM2.5</b>
<b>2016</b>	101.5	819.3	43.4	2.7
<b>2023</b>	96.0	722.4	49.0	10.1
<b>2035</b>	77.3	689.4	45.2	18.3

A-1 Original Project:

**Long Beach Park & Ride Facility**

Year	TRIP REDUCTION	VMT REDUCTION
2016	22,507	315,101
2023	25,271	353,797
2035	30,010	420,134

**INPUT VALUES**

Total Space	400	
Average Daily Utilization		
2016	75%	
2023	84%	
2035	100%	
Turnover	1	
Percent Effectiveness		
Adjustment on Auto trips replaced by PRL	30%	
Adjustment for Auto Access	50%	
Vehicle Trips (In/Out)	2	
Avg. Commute Distance	8	
Avg. Travel Distance to PRL	2	
Reduction Days/Year	250	

**Annual TRIP Reduction**

2016	<b>22,507</b>	
2023	<b>25,271</b>	
2035	<b>30,010</b>	

**Annual VMT reduction**

2016	<b>315,101</b>	
2023	<b>353,797</b>	
2035	<b>420,134</b>	

**Annual Factor**

Days in a Year	365	
Weeks in a Year	52	
Slow Days in a Week	2.21	
Negligible Days		115
Trip Reduction Days/Year		250

\*Urban Park & Ride Lot utilization rate in opening year estimated as 75%.

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## A-2 Substitution Projects

### Santa Clarita Park & Ride Facility

Year	TRIP REDUCTION	VMT REDUCTION
2016	2,345	181,166
2023	2,949	227,888
2035	3,986	307,982

#### INPUT VALUES

Total Space	150	
Average Daily Utilization*		
2016	50%	
2023	63%	
2035	85%	
Turnover	1	
Percent Effectiveness	0	
Adjustment on Auto trips replaced by PRL	25%	
Adjustment for Auto Access	75%	
Vehicle Trips (In/Out)	2	
Avg. Commute Distance	25	
Avg. Travel Distance to PRL	5	
Reduction Days/Year	250	

#### Annual TRIP Reduction

2016	2,345	
2023	2,949	
2035	3,986	

#### Annual VMT reduction

2016	199,283	
2023	250,676	
2035	338,780	

#### Annual VAN VMT (assuming 11 passengers Van)

2016	18,117	
2023	22,789	
2035	30,798	

#### Annual Factor

Days in a Year	365	
Weeks in a Year	52	
Slow Days in a Week	2.21	
Negligible Days		115
Trip Reduction Days/Year		250

\*Suburban Park & Ride Lot utilization rate in opening year estimated as 50%.

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## Old Town Calabasas Park & Ride Facility

Year	TRIP REDUCTION	VMT REDUCTION
2016	1,125	86,960
2023	1,416	109,386
2035	1,913	147,831

### **INPUT VALUES**

Total Space	72	
Average Daily Utilization		
2016	50%	
2023	63%	
2035	85%	
Turnover	1	
Percent Effectiveness	0	
Adjustment on Auto trips replaced by PRL	25%	
Adjustment for Auto Access	75%	
Vehicle Trips (In/Out)	2	
Avg. Commute Distance	25	
Avg. Travel Distance to PRL	5	
Reduction Days/Year	250	

### **Annual TRIP Reduction**

2016	1,125	
2023	1,416	
2035	1,913	

### **Annual VMT reduction**

2016	95,656	
2023	120,325	
2035	162,615	

### **Annual VAN VMT (assuming 11 passengers Van)**

2016	8,696	
2023	10,939	
2035	14,783	

### **Annual Factor**

Days in a Year	365	
Weeks in a Year	52	
Slow Days in a Week	2.21	
Negligible Days		115
Trip Reduction Days/Year		250

\*Suburban Park & Ride Lot utilization rate in opening year estimated as 50%.

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## Vincent Community Bikeway Access

Year	TRIP REDUCTION	VMT REDUCTION
2016	32,993	26,216
2023	33,053	26,553
2035	33,156	27,132

<b>INPUT VALUES</b>						
Street	Irwindale Ave.	Big Dalton Wash	Big Dalton Wash	Badillo St.		
Limits	340ft n/o Cypress St. and 650ft s/o Badillo St.	Irwindale Ave. and Lark Ellen Ave.	Arrow Highway and Citrus Ave.	Orange Ave. and Irwindale Ave.		
Length (mile)	0.64	1.01	1.00	0.44		3.09
Class/Type	Class II	Class I	Class I	Class II		
Average Daily Traffic (ADT)*						
	2016	17,538	10,039	24,842	11,737	64,156
	2023	17,407	9,785	26,807	10,936	64,935
	2035	17,182	9,349	30,175	9,564	66,270
Adjustment Factors						
Class I & II Bike Path	0.0014	0.0029	0.0010	0.0019		
Activity Center Credit	0.0010	0.0010	0.0010	0.0010		
Avg. Length of Bike Trip	1.8	1.8	1.8	1.8		
Reduction Days/Year	200	200	200	200		
<b>Annual TRIP Reduction</b>						
	<b>2016</b>	8,418	7,831	9,937	6,808	32,993
	<b>2023</b>	8,355	7,632	10,723	6,343	33,053
	<b>2035</b>	8,248	7,292	12,070	5,547	33,156
<b>Annual VMT reduction</b>						
	<b>2016</b>	5,368	7,934	9,910	3,004	26,216
	<b>2023</b>	5,328	7,733	10,694	2,799	26,553
	<b>2035</b>	5,259	7,388	12,037	2,448	27,132
<b>Annual Factor</b>						
Days in a Year		365				
Weeks in a Year		52				
Slow Days in a Week		3.17				
Negligible Days			165			
Trip Reduction Days/Year			200			

\*Estimated by LA Metro demand estimation model (2015)

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## Athens and West Carson Community Bikeways

Year	TRIP REDUCTION	VMT REDUCTION
2016	43,803	30,768
2023	46,296	33,406
2035	42,874	30,223

<b>INPUT VALUES</b>						
Street	Normandie Ave.	Lomita Blvd.	Carson St.	120th St.		
Limits	Imperial Hwy and El Segundo Blvd.	Frampton Ave. and Vermont Ave.	Normandie Ave. and Vermont Ave.	Western Ave. and Vermont Ave.		
Length (mile)	1.00	0.48	0.51	0.99		2.99
Class/Type	Class II	Class II	Class II w Diet	Class II		
Average Daily Traffic (ADT)*						
2016	23,396	38,506	25,695	11,884		99,480
2023	23,627	38,099	25,410	11,579		98,715
2035	24,025	37,402	24,920	11,058		97,404
Adjustment Factors						
Class I & II Bike Path	0.0014	0.0010	0.0010	0.0019		
Activity Center Credit	0.0010	0.0010	0.0010	0.0010		
Avg. Length of Bike Trip	1.8	1.8	1.8	1.8		
Reduction Days/Year	200	200	200	200		
<b>Annual TRIP Reduction</b>						
2016	11,230	15,402	10,278	6,893		43,803
2023	14,176	15,240	10,164	6,716		46,296
2035	11,532	14,961	9,968	6,414		42,874
<b>Annual VMT reduction</b>						
2016	11,246	7,389	5,283	6,851		30,768
2023	14,196	7,311	5,224	6,675		33,406
2035	11,548	7,177	5,123	6,375		30,223
<b>Annual Factor</b>						
Days in a Year	365					
Weeks in a Year	52					
Slow Days in a Week	3.17					
Negligible Days		165				
Trip Reduction Days/Year		200				

\*Estimated by LA Metro demand estimation model (2015)