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MONTEREY PARK ORANGE ONTARIO SAN DIEGO

Date: October 26, 2020

To: Reata Kulcsar – City of Carson

From: Stephen Bise, P.E. – KOA Corporation

Subject: **Carson Citywide Bike Lane Traffic Assessment**
HSIPL-5403(025) & HSIPL-5403(026)

INTRODUCTION

The City was awarded two grants through the Highway Safety Improvement Program (HSIP) to install bike lanes along several major arterial roadways throughout the City. The proposed bike improvements are identified in the City's Bike Master Plan. In order to provide sufficient room for bike lanes, select segments require a roadway reconfiguration (removal of travel lane(s)). KOA Corporation (KOA) is pleased to submit this technical memorandum to present level of service analysis and findings to support the City's effort along these segments:

- Figueroa Street
  - Between Lomita Boulevard and 223rd Street
  - Between Del Amo Boulevard and Victoria Street
- Carson Street
  - Between Alameda Street and Santa Fe Avenue
- Avalon Boulevard
  - Between Carson Street and I-405 South Ramp
- Central Avenue
  - Between Artesia Boulevard and Walnut Street

Methodology

Analysis was conducted using historical ADT counts provided by the City of Carson and/or the City of Carson's General Plan. The historical ADT counts ranged from 2013-2018, therefore a 0.25% growth factor was included for each year up to the current year (2020). The ADT was adjusted to account for Truck Traffic volume with a factor of 21% of total ADT. Using the 21% truck traffic volume, 3 factors were considered to adjust the ADT volume using the multipliers shown below:

1. 2 axle trucks: 24.8% of total truck traffic volume with 1.5 PCE (Passenger Car Equivalent)
2. 3 axle trucks: 20.3% of total truck traffic volume with 2 PCE (Passenger Car Equivalent)
3. 4+ axle trucks: 54.9% of total truck traffic volume with 3 PCE (Passenger Car Equivalent)

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The following formulas were used to calculate the adjusted ADT for each segment:

ADTT (truck percentage) = ADT x 21% = ADTT

PCE (21% of trucks) = ADTT x [(.248 x 1.5) + (.203 x 2) + (.549 x 3)] = PCE

Total ADT = ADT – ADTT + PCE

The following two different methods were used to analyze the level of service of the segment based on ADT and lanes/classification of the roadway. The City has directed KOA that a roadway reconfiguration is feasible at segments with a LOS of "C" or better. If the segment has a LOS "D" or worse, a roadway reconfiguration is not feasible.

SCAG Model Validation Methodology

This methodology determines the LOS based on the volume capacity ratio. The SCAG model uses 24 hours in the Average daily capacity formula. Per the City's direction on 10/14/2020, KOA was directed to use 12 hours in the Average daily capacity formula. The adjusted ADT was used as the volume, and the capacity was determine as follows:

1. Define the roadway type
2. Used the hourly capacity to calculate the average daily capacity (ADC)
    - ADC = hourly capacity x **12 hours** x # of thru-lanes in the segment

The City of Carson's General plan provided the hourly capacity for different roadway classifications (see Table 1 below):

Table 1: Roadway Capacities

Facility Type	Hourly Capacity (veh./lane/hour)
Two way major arterial	750
Two way secondary arterial	750
Collector and local streets	750

The ADT & ADC were used to calculate volume/capacity (v/c) ratio. These ratios were compared the v/c ratio to the City of Carson's General Plan thresholds (see Table 2 below).

Table 2: City of Carson General Plan Level of Service Thresholds		
Level of Service	**Definition**	**Volume to Capacity Ratio (v/c)**
A	Excellent operation. All approaches to the intersection appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation.	0-0.60
B	Very good operation. Many drivers begin to feel somewhat restricted within platoons of vehicles. This represents stable flow. An approach to an intersection may occasionally be fully utilized and traffic queues start to form.	0.61-0.70
C	Good operation. Occasionally backups may develop behind turning vehicles. Most drivers feel somewhat restricted.	0.71-0.80
D	Fair operation. There are no long-standing traffic queues. This level is typically associated with design practice for peak periods.	0.81-0.90
E	Poor operation. Some long standing vehicular queues develop on critical approaches.	0.91-1.00
F	Forced flow. Represents jammed conditions. Backups from locations downstream or on the cross street may restrict or prevent movements of vehicles out of the intersection approach lanes; therefore, volumes carried are not predictable. Potential for stop and go type traffic flow.	Over 1.01
Source:	Highway Capacity Manual, Special Report 209, Transportation Research Board, Washington D.C., 2000 and Interim Materials on Highway Capacity, NCHRP Circular 212, 1982.	

Table 3 below shows the results from SCAG's model validation while using the City of Carson's General Plan parameters.

Table 3: ADT/LOS Analysis											
Street	**Between**	**And**	**Adjusted ADT (Truck %)**	**Existing Lane Geometry**	**Exist. Capacity**	**Exist. v/c**	**Exist. LOS***	**Proposed Lane Geometry**	**Prop. Capacity**	**Prop. v/c**	**Prop. LOS***
Figueroa St	Lomita Blvd	Sepulveda	13,706	4D	36000	0.38	A	2D	18000	0.76	C
Figueroa St	Sepulveda	223rd St	13,679	4D	36000	0.38	A	2D	18000	0.76	C
Figueroa St	Del Amo Blvd	I-405	16,215	4D	36000	0.45	A	2D	18000	0.90	D
Figueroa St	I-405	Victoria St	18,025	4D	36000	0.50	A	2D	18000	1.00	E
Carson St	Alameda St	Santa Fe	14,051	4U	36000	0.39	A	2D	18000	0.78	C
Avalon Blvd	Carson St	213th St	38,422	6D	54000	0.71	C	4D	36000	1.07	F
Avalon Blvd	213th St	I-405	39,292	6D	54000	0.73	C	4D	36000	1.09	F
Central Ave	Artesia Blvd	Walnut St	30,590	5D	45000	0.68	B	4D	36000	0.85	D

***Assumptions based off City of Carson Transportation Plan**

****Two-way-left-turn lane assumed to classify the roadway as divided**

D = Divided, U = Undivided

Exhibit No. 4

City of Santa Ana's Methodology

The City Santa Ana's methodology is simply looking up the LOS based on classification of roadway and lane geometry. The City General Plan include parameters for various roadway classifications and their corresponding levels of service. These parameters are shown in table 4 below.

Table 4: Average Daily Traffic Volumes and Corresponding Levels of Service

Roadway Classification	Lanes/ Configuration	Maximum Volume				
		LOS A	LOS B	LOS C	LOS D	LOS E
Major Arterial	8 Lanes Divided	45,000	52,500	60,000	67,500	75,000
Major Arterial	6 Lanes Divided	33,900	39,400	45,000	50,600	56,300
	5 Lanes Divided	28,200	32,850	37,500	42,200	46,900
Primary Arterial	4 Lanes Divided	22,500	26,300	30,000	33,800	37,500
Secondary Arterial	4 lanes Undivided	15,000	17,500	20,000	22,500	25,000
	2 Lanes Divided	11,250	13,150	15,000	16,900	18,750
Collector Street	2 Lanes Undivided	7,500	8,800	10,000	11,300	12,500
Residential Street	Undivided	1,000	1,200	1,500	2,000	2,500

Using the adjusted ADT data, we compared the existing and proposed lane geometry to determine the LOS of each segment. Our findings can be found in Table 5 below.

Table 5: ADT/LOS Analysis

Street	Between	And	Existing Lane Geometry	Adjusted ADT	Existing LOS*	Proposed Lane Geometry	Proposed LOS*
Figueroa St	Lomita Blvd	Sepulveda Blvd	4D	13,706	A	2D	C
Figueroa St	Sepulveda Blvd	223rd St	4D	13,679	A	2D	C
Figueroa St	Del Amo Blvd	I-405	4D	16,215	A	2D	D
Figueroa St	I-405	Victoria St	4D	18,025	A	2D	E
Carson St	Alameda St	Santa Fe Ave	4U	14,051	A	2D**	C
Avalon Blvd	Carson St	213th St	6D	38,422	B	4D	F
Avalon Blvd	213th St	I-405	6D	39,292	B	4D	F
Central Ave	Artesia Blvd	Walnut St	5D	30,590	B	4D	D

***Assumptions based off City of Carson's General Plan**

****Two Way left turn lane assumed to classify the roadway as divided**

D = Divided, U = Undivided

Exhibit No. 4

Conclusion

Per the City's direction, a roadway reconfiguration (lane reduction) is acceptable for the segments with a proposed LOS of C or better. Reconfiguration for segments with a proposed LOS D or worse was deemed not acceptable.

Based on the methodologies used and the direction provided by the City, roadway reconfiguration (lane reduction) is feasible along the following roadway segments:

- Figueroa Street from Lomita Boulevard to Sepulveda Boulevard
- Figueroa Street from Sepulveda Boulevard to 223rd Street
- Carson Street from Alameda Street to Santa Fe Avenue