

**Date:** May 12, 2023

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**Subject:** **Project Traffic Analysis Memorandum**  
**SR 528 and Dallas Boulevard Interchange PD&E Study (Project # 528-307)**

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## 1.0 Overview

### 1.1 Background

In Summer 2022, the Central Florida Expressway Authority (CFX) initiated a Project Development and Environment (PD&E) study for the SR 528 and Dallas Boulevard interchange. SR 528 currently intersects with Dallas Boulevard forming a partial interchange, serving movements to and from the west only. It was constructed in standard diamond configuration and has not been substantially modified since its opening. The interchange is located within a projected high growth area of eastern Orange County. It is anticipated that future traffic demand at this location will further exceed the design capacities as development in the area continues to intensify. Therefore, the current SR 528 and Dallas Boulevard interchange PD&E study is evaluating addition of ramps to/from east and improving the ramp terminal intersections. Addition of ramps to/from the east will provide more efficient access points to better serve trips originating or ending in the Wedgefield residential area, as well as other planned developments along SR 528 near the interchange of Dallas Boulevard. **Figure 1.1** is a map of the Dallas Boulevard interchange location in the regional context.

This Project Traffic Analysis Memorandum is prepared to support the PD&E study. It provides existing conditions data, future traffic forecasts, and operational analysis results for the 2022 existing, 2030 opening and 2050 design year conditions. Historical crash data analysis is also included.

### 1.2 Analysis Area of Influence

The analysis Area of Influence (AOI) for the proposed interchange is depicted on **Figure 1.2**. It includes the following existing facilities:

- SR 528 mainline segments from Innovation Way to SR 520 and interchanges at:
  - Innovation Way – ramps to/from east only
  - Dallas Boulevard
  - SR 520
- Dallas Boulevard intersections at:
  - SR 528 Eastbound Off-ramp
  - SR 528 Westbound On-ramp
  - Starry Street

For Build conditions, the analysis also included a full interchange at SR 528 and Dallas Boulevard with four ramps serving all movements.

**Figure 1.1  
Project Location**

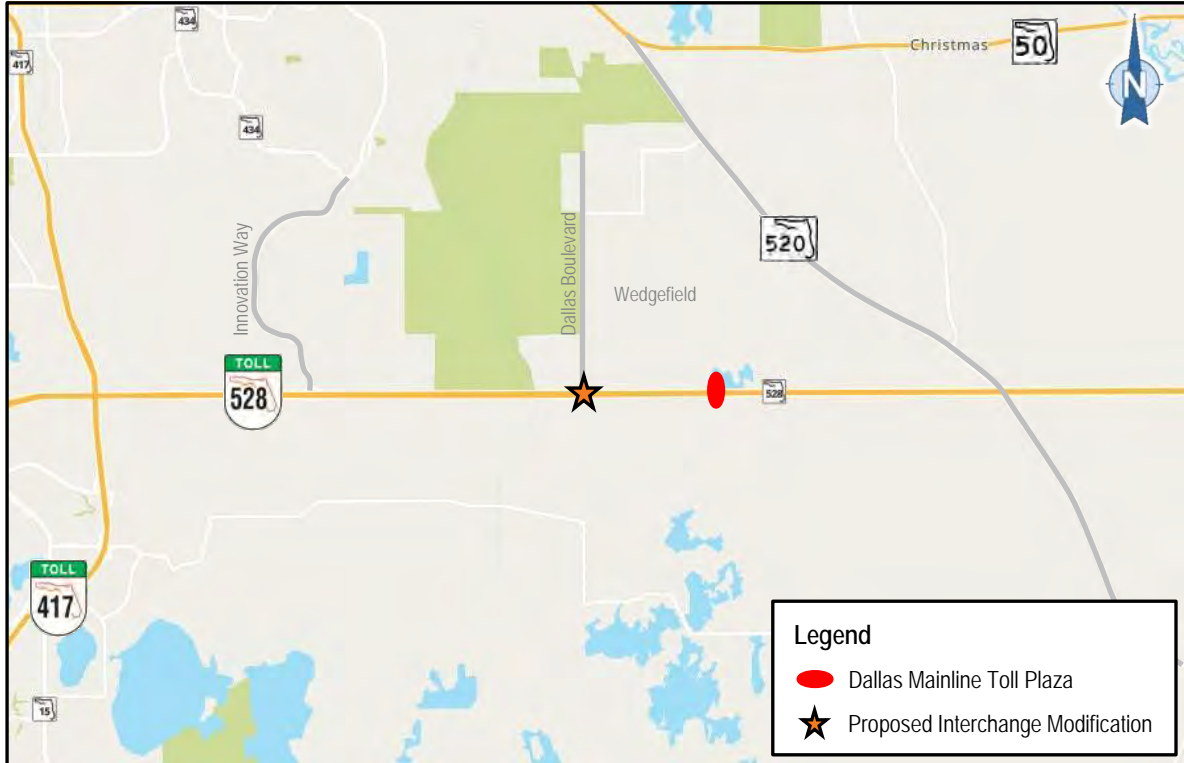
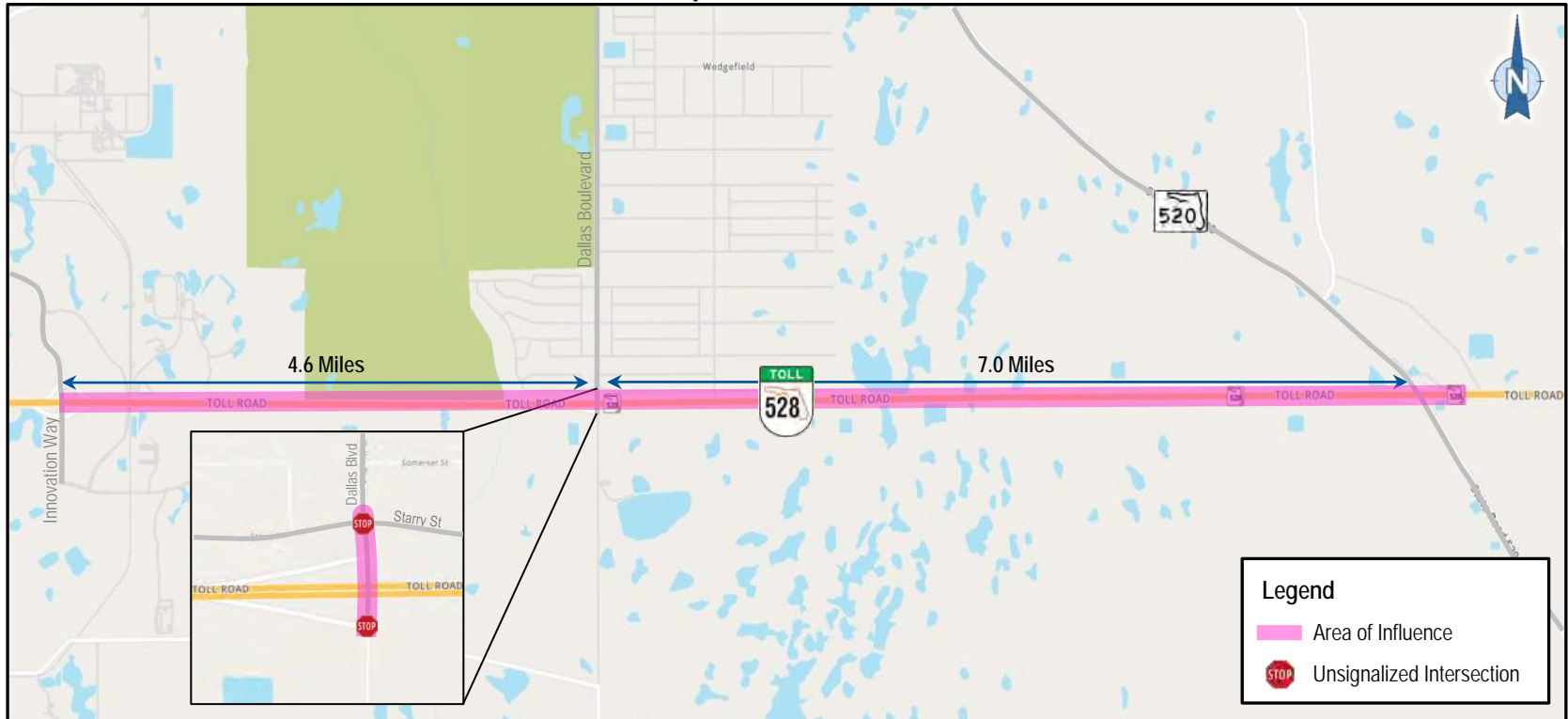


Figure 1.2  
Analysis Area of Influence



### 1.3 Operational Analysis Methodology

The analysis documented in this memorandum was conducted for the 2022 existing, 2030 opening and 2050 design years. Freeway segments (basic and merge/diverge) analysis was based on the capacity targets published in the 2020 Florida Department of Transportation (FDOT) Quality and Level of Service (LOS) Handbook. The FDOT targets were adjusted for local conditions such as speed, truck proportion and Peak Hour Factor (PHF).

The Highway Capacity Software (HCS) Version 7.9.6 was used to identify LOS along freeway segments. The analysis was based on the FDOT Traffic Analysis Handbook and followed the Highway Capacity Manual (HCM) 6th Edition methodologies. The HCM estimates LOS based on density – a function of flow rate (volumes) and travel speed – for uninterrupted flow facilities such as basic freeway/Collector-Distributor (C-D) roadway segments, merge and diverge segments, and freeway/C-D roadway weaving segments. Density is measured in passenger cars per mile per lane (pcpmpl). The HCM 6th Edition LOS and density thresholds for freeway segments are listed in **Table 1.1**.

**Table 1.1**  
**Freeway Segments HCM 6th Edition LOS Criteria**

LOS	Basic (HCM Exhibit 12-15)	Merge and Diverge (HCM Exhibit 14-3)
A	≤11	≤10
B	>11–18	>10–20
C	>18–26	>20–28
D	>26–35	>28–35
E	>35–45	>35
F	Demand exceeds capacity or density > 45	Demand exceeds capacity

Since the default capacity in the HCS is high, it was adjusted to a realistic level using the FDOT capacity target that was modified for local conditions. Tests were conducted using the following parameters and assumptions for SR 528 to determine a factor for adjusting capacity and speed:

- SR 528 Future Free-Flow Speed (FFS) = 75 mph
- SR 528 Design Hour Truck (DHT) percentage = 3%
- Lane width = 12 feet
- Right shoulder clearance = 6 feet
- Driver Population = Mostly Familiar
- Weather Type = Non-Severe Weather
- Incident Type = No Incident
- Demand Adjustment Factor = 1.00

A capacity and speed adjustment factor of 0.980 was determined.

For freeway merge and diverge areas, the HCM methodology also includes a capacity check for the influence area and the upstream or downstream ramp roadway. Capacity is dependent upon FFS and number of lanes. HCM capacity targets for ramp roadways are shown in **Table 1.2**. Similar to freeway segments capacities, the HCM ramp roadway capacities were also adjusted for local conditions.

**Table 1.2**  
**Signalized Intersection HCM 6th Edition Level of Service Criteria**

Ramp FFS	Single-Lane Ramps	Two-Lane Ramps
<b>(HCM Exhibit 14-12)</b>		
>50	2,200	4,400
>40–50	2,100	4,200
>30–40	2,000	4,000
≥20–30	1,900	3,800
<20	1,800	3,600

Intersections were evaluated using Synchro Version 11, based on the HCM 6th Edition LOS and the delay targets presented in **Tables 1.3** and **1.4**. Unlike the HCM, Synchro has additional procedures for estimating control delay, such as estimation of right turn on red and queue delay associated with starvation and spillback. Thus, Synchro is expected to yield more accurate results than HCM because of these additional refinements.

**Table 1.3**  
**Signalized Intersection HCM 6th Edition Level of Service Criteria**

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio*	
	≤1.0	>1.0
<b>(HCM Exhibit 19-8)</b>		
≤10	A	F
>10–20	B	F
>20–35	C	F
>35–55	D	F
>55–80	E	F
>80	F	F

\*For approach-based and intersection wide assessments, LOS is defined solely by control delay.

**Table 1.4**  
**Unsignalized Intersection HCM 6th Edition Level of Service Criteria**

Control Delay (s/veh)	LOS by Volume-to-Capacity Ratio	
	≤1.0	>1.0
<b>(HCM Exhibit 20-2)</b>		
0–10	A	F
>10–15	B	F
>15–25	C	F
>25–35	D	F
>35–50	E	F
>50	F	F

The LOS criteria apply to each lane on a given approach and to each approach on the minor street.  
 LOS is not calculated for major-street approaches or for the intersection as a whole.

Queue lengths were estimated using SimTraffic, the microsimulation companion of Synchro, to better account for vehicle interactions. SimTraffic analysis was based on a 30-minute seeding period and two hours of simulation.

## 2.0 Existing Conditions

### 2.1 Roadway Facilities

**SR 528** is an east-west, limited-access tolled facility that begins at Interstate 4 (I-4) to the west and ends at US 1 to the east in Cocoa. This facility is owned and maintained by the Florida's Turnpike Enterprise (FTE), CFX and FDOT District 5. The section within the project limits is owned and operated by CFX. SR 528 provides a crucial connection for residents and visitors traveling to the International Drive attractions, Orlando International Airport, the east coast beaches, and Cape Canaveral. It also connects the John F. Kennedy Space Center and the aerospace industry with greater Orlando.

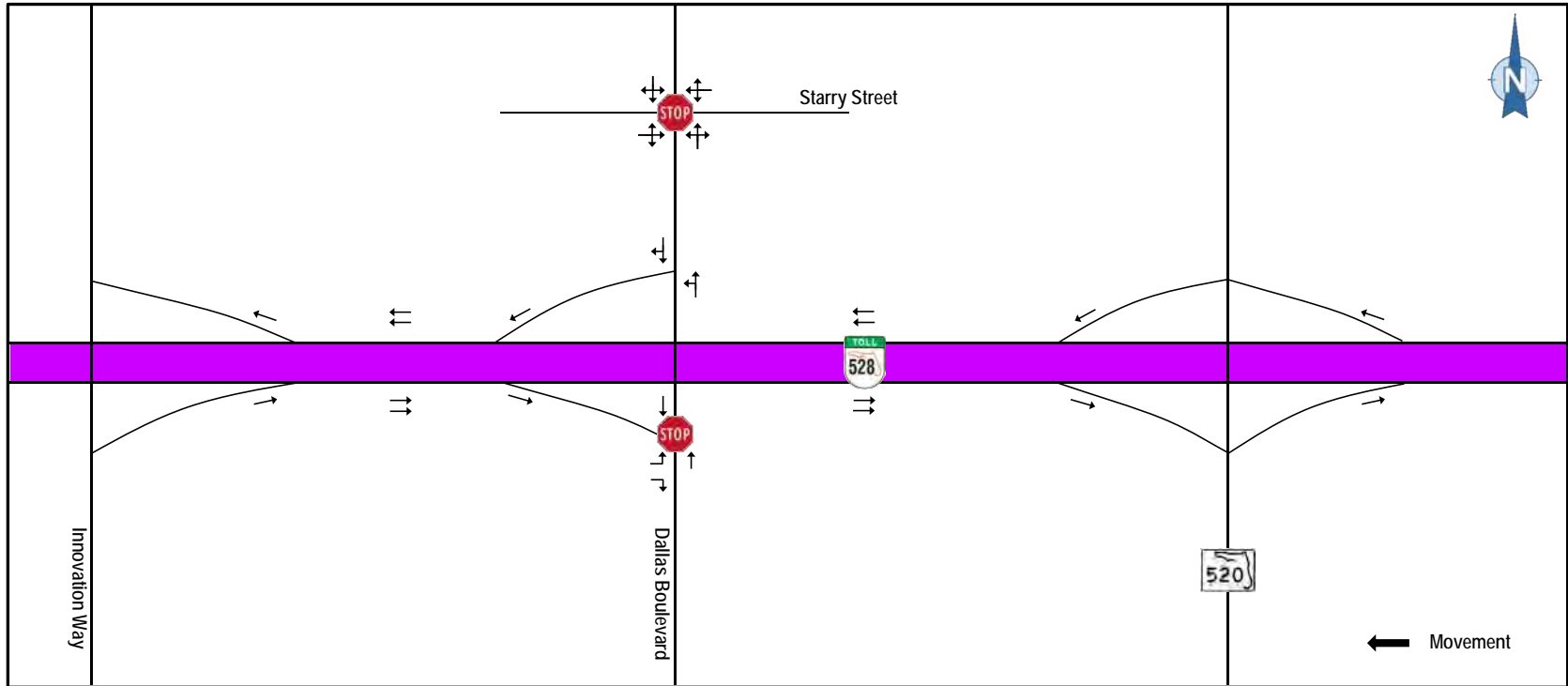
The existing typical section of SR 528 is a four-lane divided roadway with a median width of 40 feet within the study limits. Both the eastbound and westbound directions consist of two 12-foot-wide travel lanes, a 4-foot-wide inside shoulder, and 10-foot-wide outside shoulder. The posted speed limit within the study area is 70 mph. SR 528 forms a diamond interchange including a loop ramp with Innovation Way, a partial diamond interchange with Dallas Boulevard and a diamond interchange with SR 520.

**Dallas Boulevard** is a north-south, two-lane undivided major collector which serves the Wedgefield residential area. It has a direct access to SR 528 at Milepost (MP) 24, forming a partial interchange with unsignalized ramp terminal intersections that provide access to/from the west only. There is an adjacent closely spaced unsignalized intersection along Dallas Boulevard at Starry Street. The posted speed limit within the study area is 40 mph.

**Starry Street** is an east-west, two-lane undivided road that serves residential land uses. It forms a four-legged, all-way stop-controlled intersection with Dallas Boulevard. The posted speed limit is 30 mph within the study area.

The existing conditions lane geometry within the AOI is depicted on **Figure 2.1**. Lane geometry information was obtained from high resolution aerial maps and field reviews.

Figure 2.1  
2022 (Existing) Intersection Lane Geometry and Control





## 2.2 Data Collection

Traffic data collection for the project included 48-hour directional counts at two locations and 4-hour intersection counts at three locations. The count locations are listed in **Tables 2.1** and **2.2**. All the counts were conducted in December 2022. Traffic volumes for SR 528 at the Dallas mainline plaza and tolled ramps at Innovation Way and Dallas Boulevard were obtained from transaction data for 2022. Traffic data for the SR 520 tolled ramps was obtained from FTE’s transaction data and non-tolled ramps from roadway sensor data for 2022. Supplemental traffic data was obtained from the 2021 CFX Traffic Data and Statistics Manual and the FDOT Florida Traffic Online (FTO) web application for verification purposes. All data collection was conducted in accordance with the procedures from the latest edition of the FDOT Manual on Uniform Traffic Studies, FDOT Manual Number 750-020-007.

**Table 2.1  
2-Day Bi-directional Hose Counts**

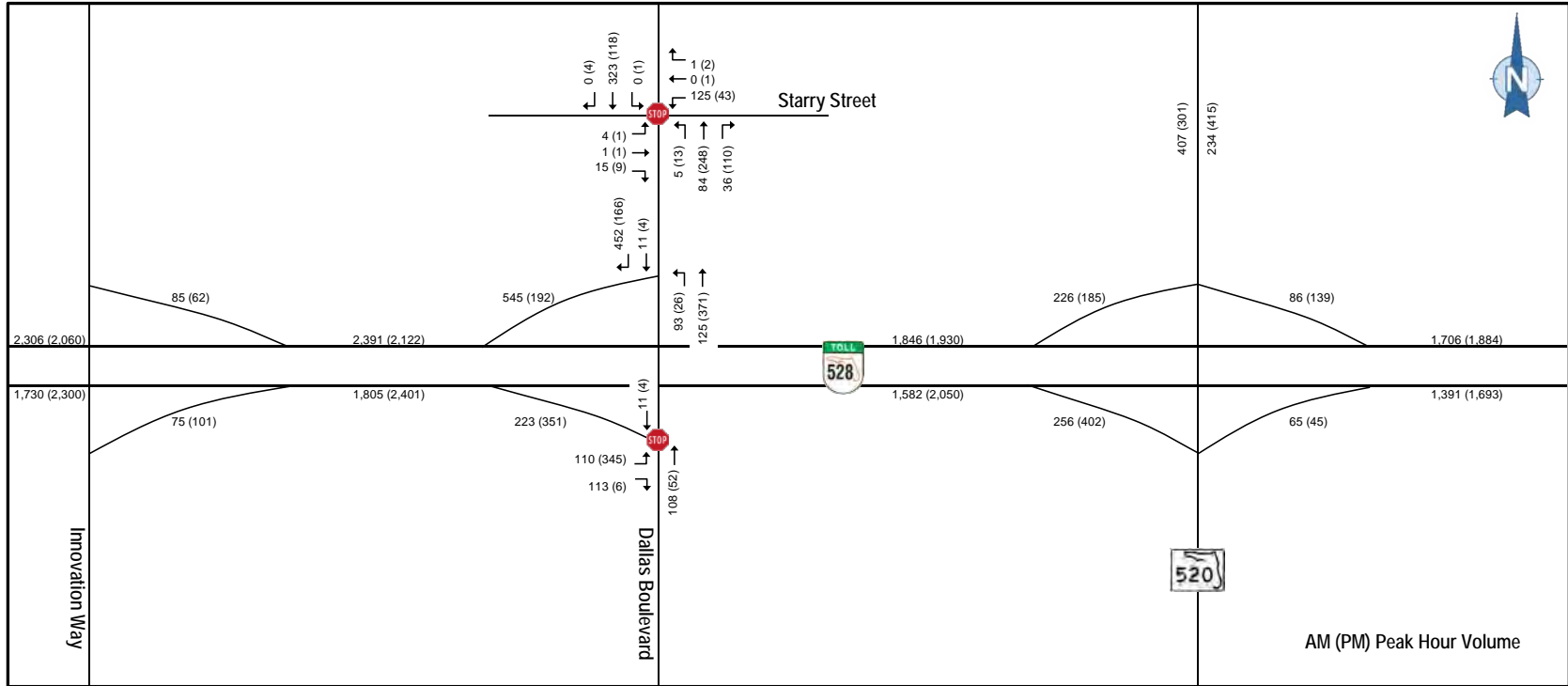
Count #	Roadway	Count Location	Count Date
1	Dallas Boulevard	North of Starry Street	12/6-7/2022
2	SR 520	North of SR 528	12/6-7/2022

**Table 2.2  
Intersection Counts**

Count #	Intersection Control	Count Location	Count Date
1	Unsignalized	Dallas Boulevard at SR 528 Eastbound Off-Ramp	12/6/2022
2	Unsignalized	Dallas Boulevard at SR 528 Westbound On-Ramp	12/6/2022
3	Unsignalized	Dallas Boulevard at Starry Street	12/6/2022

The AM and PM peak hour volumes were calculated using data for the four highest consecutive 15-minute periods in the morning and evening at each count location. Seasonal and axle adjustment factors were applied to the data where applicable. The data were then aggregated and balanced to ensure continuity of flow and consistency. **Figure 2.2** shows the final 2022 existing year peak hour volumes in the AM and PM conditions within the AOI.

**Figure 2.2**  
**2022 (Existing) AM and PM Peak Hour Intersection Volumes**



## 2.3 Existing Traffic Operations

This section provides a summary of traffic performance results for existing conditions. Detailed output reports and analysis files are provided in **Appendix A**.

### 2.3.1 Freeway Segments Analysis

The section of SR 528 within the AOI was evaluated using HCS software Version 7.9.6. As shown in **Table 2.3**, the segments currently operate at an acceptable LOS C or better during both the AM and PM peak hours.

**Table 2.3**  
**2022 Existing AM and PM Peak Hour Freeway Segment LOS/Density (pcpmpl)**

Segment	Segment Type	Lanes	Volume (vph)		LOS/Density	
			AM	PM	AM	PM
<b>SR 528 Eastbound</b>						
Upstream of Innovation Way on-ramp	Basic	2	1,730	2,300	B/13	B/17
Innovation Way on-ramp to Dallas Boulevard off-ramp	Merge	2	1,805	2,401	B/15	C/20
Innovation Way on-ramp to Dallas Boulevard off-ramp	Basic	2	1,805	2,401	B/13	B/18
Innovation Way on-ramp to Dallas Boulevard off-ramp	Diverge	2	1,805	2,401	B/14	B/19
Dallas Boulevard off-ramp to SR 520 off-ramp	Basic	2	1,582	2,050	B/12	B/15
Dallas Boulevard off-ramp to SR 520 off-ramp	Diverge	2	1,582	2,050	B/17	C/21
SR 520 off-ramp to on-ramp	Basic	2	1,326	1,648	A/10	B/12
Downstream of SR 520 on-ramp	Merge	2	1,391	1,693	B/15	B/17
Downstream of SR 520 on-ramp	Basic	2	1,391	1,693	A/10	B/13
<b>SR 528 Westbound</b>						
Upstream of SR 520 off-ramp	Basic	2	1,706	1,884	B/13	B/14
Upstream of SR 520 off-ramp	Diverge	2	1,706	1,884	B/18	B/20
SR 520 off-ramp to on-ramp	Basic	2	1,620	1,745	B/12	B/13
SR 520 on-ramp to Dallas Boulevard on-ramp	Merge	2	1,846	1,930	B/17	B/18
SR 520 on-ramp to Dallas Boulevard on-ramp	Basic	2	1,846	1,930	B/14	B/14
Dallas Boulevard on-ramp to Innovation Way off-ramp	Merge	2	2,391	2,122	C/20	B/18
Dallas Boulevard on-ramp to Innovation Way off-ramp	Basic	2	2,391	2,122	B/18	B/16
Dallas Boulevard on-ramp to Innovation Way off-ramp	Diverge	2	2,391	2,122	C/24	C/22
Downstream of Innovation Way off-ramp	Basic	2	2,306	2,060	B/17	B/15

### 2.3.2 Ramp Roadways Analysis

The analysis for ramp roadways was based on LOS E (capacity) targets from the HCM 6th Edition and adjusted for local conditions. Capacity on the ramp roadways was assessed by comparing it with existing demand. The ramp Volume-to-Capacity (V/C) analysis is summarized in **Table 2.4**. The results show that the ramps within the AOI have a V/C ratio of 0.3 or less in year 2022.

**Table 2.4**  
**2022 Existing AM and PM Peak Hour Ramp Capacity Analysis**

Interchange	Ramp	Lanes	Volume (vph)		Capacity (vph)	V/C	
			AM	PM		AM	PM
Innovation Way	Westbound off-ramp	1	85	62	1,850	0.0	0.0
	Eastbound on-ramp	1	75	101	1,850	0.0	0.1
Dallas Boulevard	Westbound on-ramp	1	545	192	1,850	0.3	0.1
	Eastbound off-ramp	1	223	351	1,850	0.1	0.2
SR 520	Westbound on-ramp	1	226	185	1,850	0.1	0.1
	Eastbound off-ramp	1	256	402	1,850	0.1	0.2
	Westbound off-ramp	1	86	139	1,850	0.0	0.1
	Eastbound on-ramp	1	65	45	1,850	0.0	0.0

### 2.3.3 Intersections Analysis

The intersection LOS and delay was evaluated using the Synchro software, Version 11. Queue lengths were estimated using SimTraffic. The analysis results for the 2022 AM and PM peak hours are summarized in **Table 2.5**. Detailed Synchro/SimTraffic output reports are provided in **Appendix A**. The results show that all movements are currently operating at an acceptable LOS B or better in both the AM and PM peak hours.

**Table 2.5  
2022 Existing AM and PM Peak Hour Intersection LOS/Delay (sec)**

Intersection	Approach	Movement	LOS	Delay (Seconds)	Maximum Queue Length (Feet)*	Available Storage Length (Feet)
			AM (PM)	AM (PM)	AM (PM)	
Dallas Boulevard and SR 528 Eastbound Ramp (Unsignalized)	Eastbound	Left	A (B)	9.3 (11.1)	66 (109)	-
		Through	-	-	-	-
		Right	A (B)	9.3 (11.1)	-	720
	Westbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Northbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	-	-
		Right	-	-	-	-
	Southbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	-	-
		Right	-	-	-	-
<b>Overall Intersection</b>			<b>A (B)</b>	<b>9.3 (11.1)</b>	<b>-</b>	<b>-</b>
Dallas Boulevard and SR 528 Westbound Ramp (Unsignalized)	Eastbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Westbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Northbound	Left	A (A)	0.5 (0.2)	38 (3)	-
		Through	A (A)	3.4 (0.6)	38 (3)	-
		Right	-	-	-	-
	Southbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	-	-
		Right	A (A)	0.0 (0.0)	-	-
<b>Overall Intersection</b>			<b>A (A)</b>	<b>3.4 (0.6)</b>	<b>-</b>	<b>-</b>
Dallas Boulevard and Starry Street (Unsignalized)	Eastbound	Left	A (A)	8.0 (7.8)	42 (38)	-
		Through	A (A)	8.0 (7.8)	42 (38)	-
		Right	A (A)	8.0 (7.8)	42 (38)	-
	Westbound	Left	A (A)	9.6 (8.7)	87 (62)	-
		Through	A (A)	0.0 (8.7)	87 (62)	-
		Right	A (A)	9.6 (8.7)	87 (62)	-
	Northbound	Left	A (B)	8.6 (10.5)	66 (90)	-
		Through	A (B)	8.6 (10.5)	66 (90)	-
		Right	A (B)	8.6 (10.5)	66 (90)	-
	Southbound	Left	A (A)	0.0 (8.4)	105 (68)	-
		Through	B (A)	11.1 (8.4)	105 (68)	-
		Right	A (A)	0.0 (8.4)	105 (68)	-
<b>Overall Intersection</b>			<b>B (B)</b>	<b>11.1 (10.5)</b>	<b>-</b>	<b>-</b>

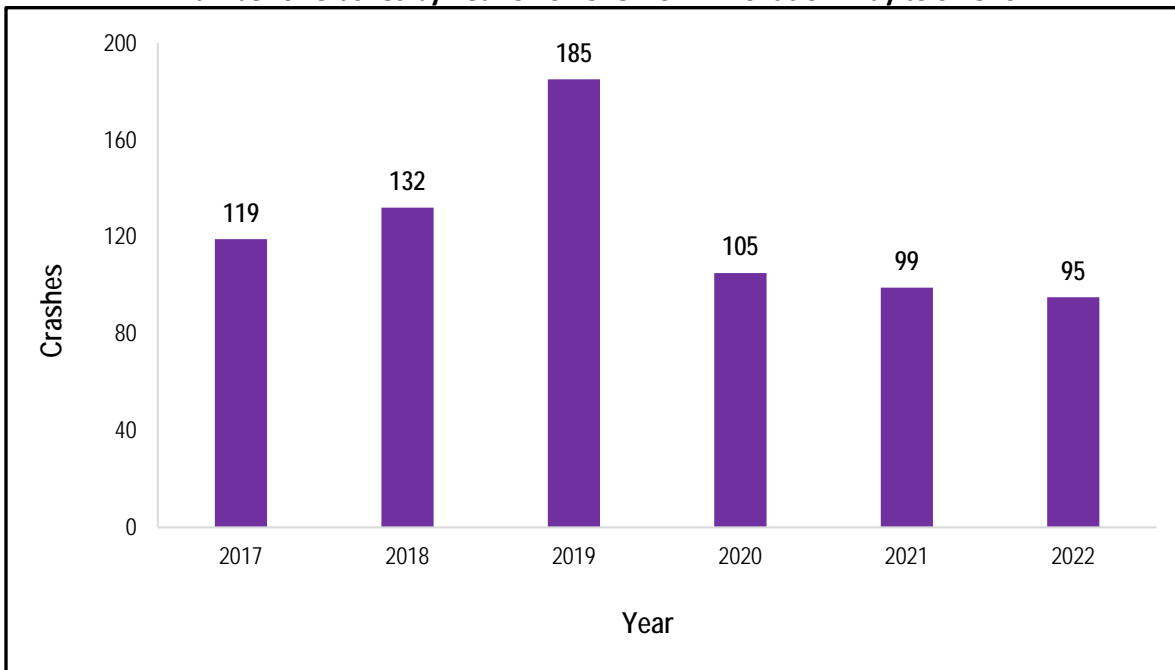
\*SimTraffic maximum queue length

## 2.4 Existing Conditions Safety

Crash data for SR 528 mainline and intersections along Dallas Boulevard were processed from 2017 through 2022 from the Signal Four Analytics tool, the FDOT’s official crash data repository. The data was reviewed for accuracy and updated where applicable.

A total of 735 crashes were reported on SR 528 between Innovation Way and SR 520 from 2017 to 2022. There was an increase in the number of crashes from 2017 to 2019 and a reduction from 2020 to 2022, as shown on **Figure 2.3**. The reduction in crashes in 2020 is attributed to COVID-19 impacts which reduced traffic, especially along SR 528 that has a high proportion of tourist traffic. A review of historical data showed that traffic in 2021 was still lower than in 2019 in this section of SR 528. Nevertheless, on average, 123 crashes were reported per year from 2017 to 2022. A review of the hourly crash distribution showed that approximately 24 percent of the crashes occurred between 3 PM and 7 PM. The data indicated that crashes predominantly occurred in the westbound direction.

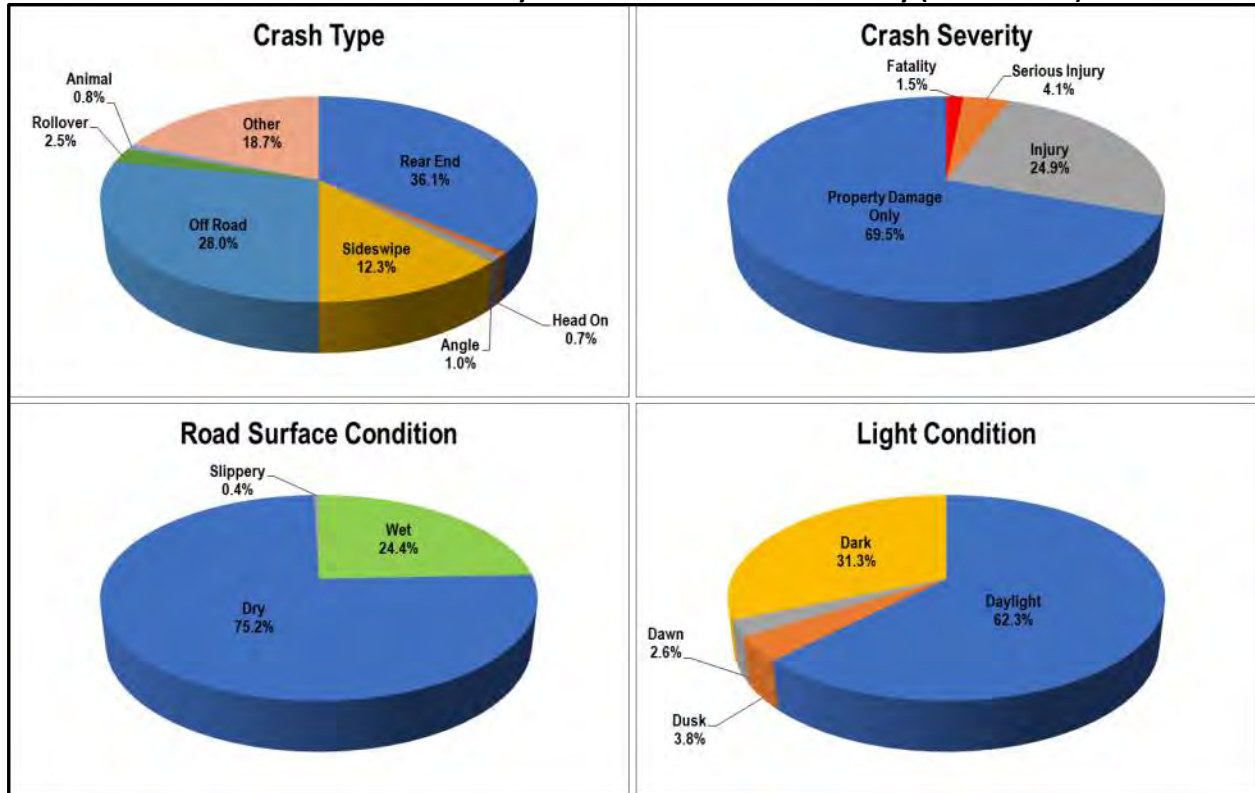
**Figure 2.3**  
Number of Crashes by Year on SR 528 from Innovation Way to SR 520



**Figure 2.4** summarizes the SR 528 crashes by type, severity, road surface and light conditions. The data showed that the most common types of reported crashes were rear end (36.1 percent), followed by run-off-road (28.0 percent) crashes. A review of the crash reports showed that the contributing factors for rear end and run-off-road crashes were speeding, following too closely and driving while fatigued. Overall, the majority of crashes occurred on dry pavement and during the day. Most of the crashes resulted in property damage only (69.5 percent) but there were a few serious injuries (4.1 percent) and 11 fatalities (1.5 percent). The 11 fatalities reported were mainly due to run-off-road crashes and occurred at night on dry pavement.

Figure 2.4

SR 528 from Innovation Way to SR 520 Crash Data Summary (2017 – 2022)



Thirteen crashes occurred along Dallas Boulevard within the study limits during the study period from 2017 to 2022: eight at the SR 528 eastbound ramp terminal, two at the SR 528 westbound ramp terminal and three at the Starry Street intersection. Crash analysis at the Dallas Boulevard intersections included a 250-foot influence area. The analysis showed that most of the crashes reported at the intersections were run-off-road, resulted in property damage only and occurred on dry pavement during the day, as illustrated on **Figures 2.5** through **2.7**. A review of the crash reports indicated that all run-off-road crashes involved a single vehicle colliding with a fixed object. There was one fatality at the SR 528 westbound ramp terminal, resulting from a run-off-road crash that occurred on dry pavement at night.

Figure 2.5

Dallas Boulevard and SR 528 Eastbound Ramp Intersection Crash Data Summary (2017 – 2022)

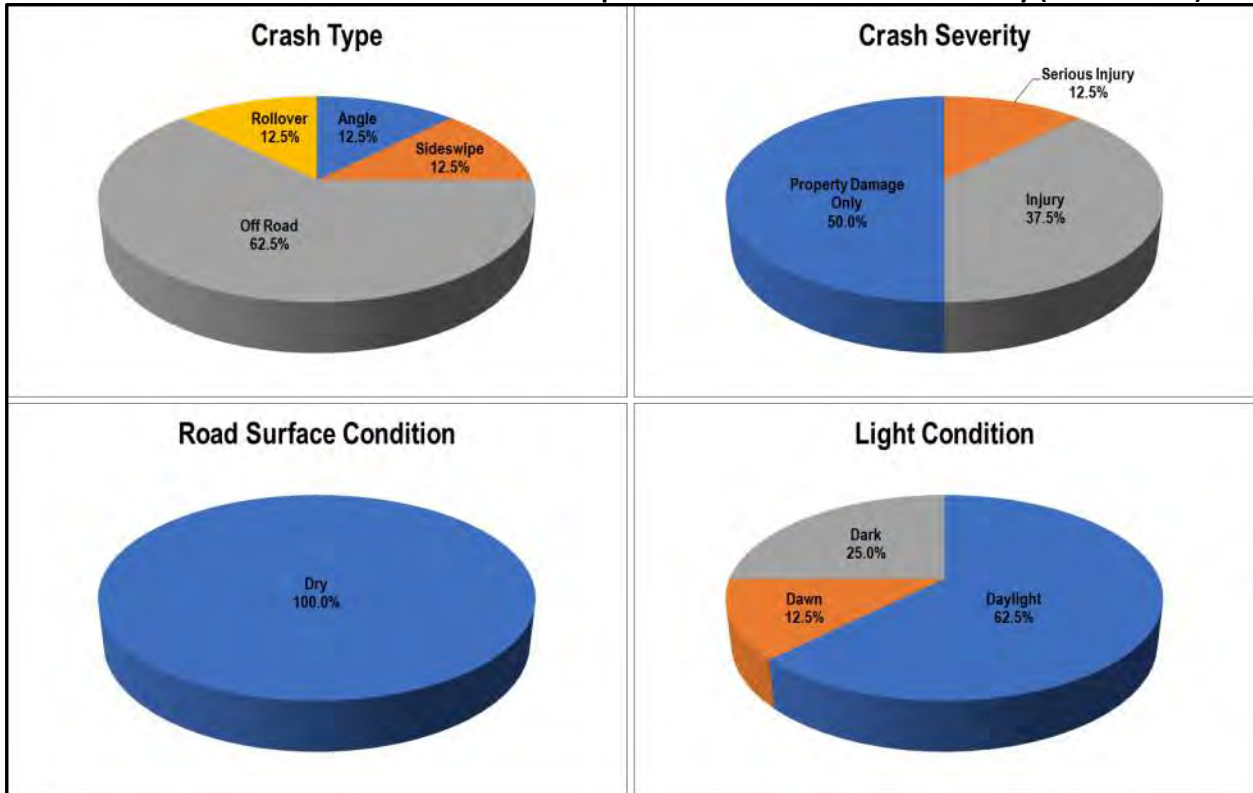


Figure 2.6

Dallas Boulevard and SR 528 Westbound Ramp Intersection Crash Data Summary (2017 – 2022)

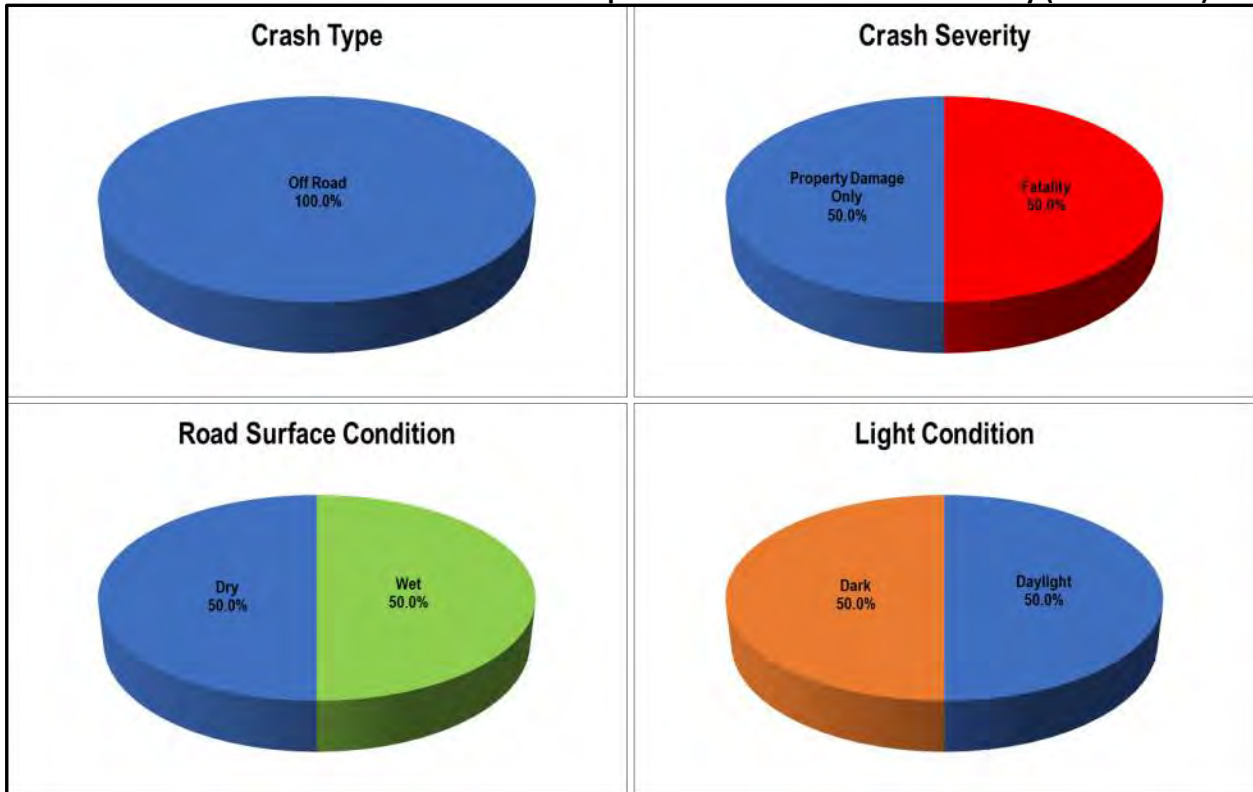
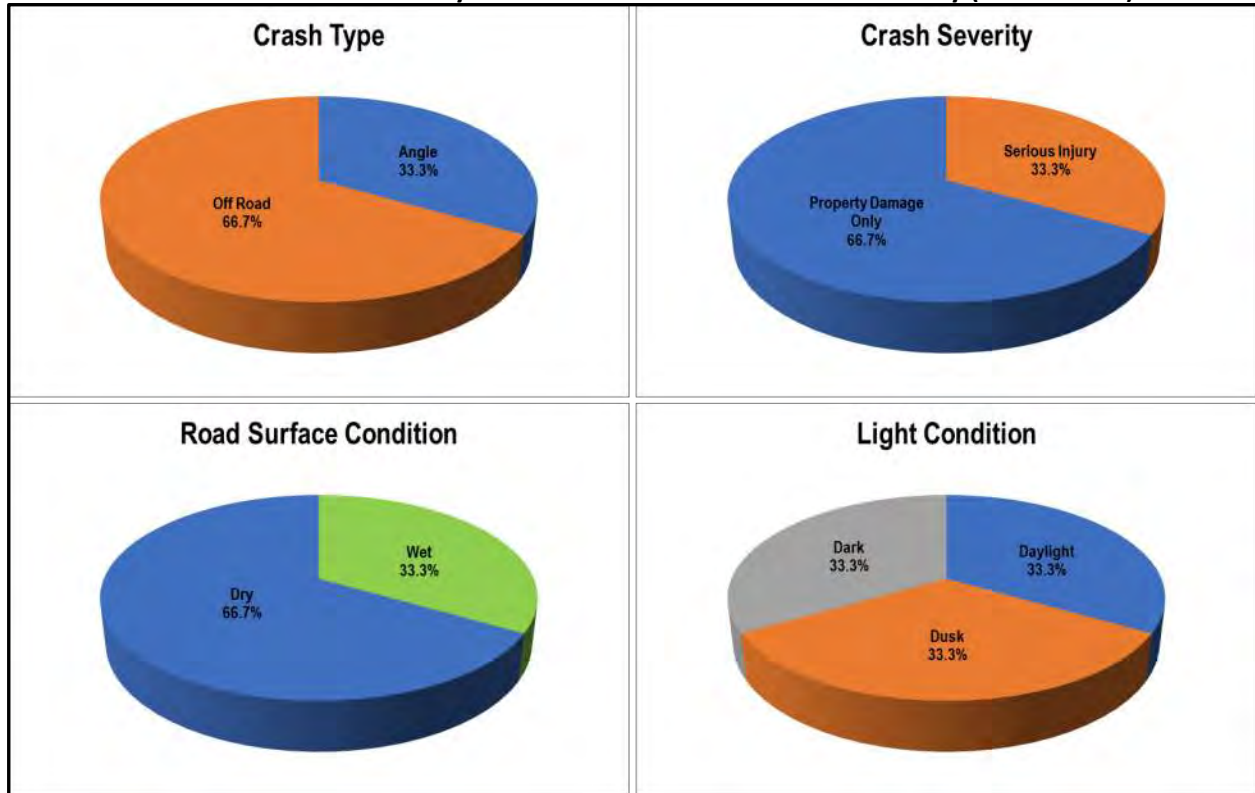




Figure 2.7

Dallas Boulevard and Starry Street Intersection Crash Data Summary (2017 – 2022)



Actual crash rates were computed and compared with average crash rates for similar facilities within Orange County to assess the safety condition within the study area. Critical crash rates and safety ratios were also estimated. Crash rates for the SR 528 mainline were estimated as crashes per Million Vehicle Miles Travelled (MVMT) and for the Dallas Boulevard intersections as crashes per Million Entering Vehicles (MEV). The critical crash rate is based on the average crash rate for a similar facility adjusted by vehicle exposure and a probability constant. The safety ratio represents the actual crash rate divided by the critical crash rate. If a segment or intersection has an actual crash rate higher than the critical crash rate (i.e., safety ratio > 1.0), it may have a safety deficiency. As shown in **Table 2.6**, the highest safety ratio is 0.70, indicating that this is not necessarily a high crash location.

**Table 2.6  
Crash Rates and Safety Ratios for 2017 through 2022**

Description	Total Crashes	Actual Crash Rate	Average Crash Rate*	Critical Crash Rate	Safety Ratio
<b>SR 528 Mainline</b>					
Innovation Way to SR 520	735	0.53	0.63	0.75	0.70
<b>Dallas Boulevard Intersections</b>					
SR 528 Eastbound Ramp	8	0.85	0.34	1.73	0.49
SR 528 Westbound Ramp	2	0.16	0.34	1.52	0.11
Starry Street	3	0.20	0.32	1.34	0.15

\* FDOT CAR Orange County, 5-year Average Crash Rate

Freeway: Toll Road Urban

Intersection: Urban 2-3Ln 2 Way Undivided

Crash Rate:

Freeway: Crashes per Million Vehicle Miles Travelled (MVMT)

Intersection: Crashes per Million Entering Vehicles (MEV)

### 3.0 Future Conditions

#### 3.1 Future Annual Average Daily Traffic (AADT)

The CFX Osceola/Brevard County Connector (OBCC) project-specific travel demand model was used as the starting point in projecting future Annual Average Daily Traffic (AADT) for this study. The model was initially prepared for the OBCC Concept, Feasibility & Mobility study and it was originally based on the FDOT District 5 Central Florida Regional Planning Model, version 6.1. The OBCC project-specific model had been validated for 2015 base year and the horizon year was 2045. For the current study, the model was updated to improve distribution and assignment of trips around the Dallas Boulevard and SR 520 interchanges. The traffic analysis zone structure, socioeconomic data and highway network were updated. Model runs were conducted for year 2045 for the No Build alternative with the existing partial interchange at Dallas Boulevard and Build with the proposed full interchange. The Peak Season Weekday Average Daily Traffic (PSWADT) from the model was converted to AADT by applying a Model Output Calibration Factor (MOCF) of 0.98.

The 2045 No Build AADT was adjusted using historical and future master plan growth rates developed for CFX's long range planning. For the ramps to/from east at the SR 520 interchange, reference was made to the FTE's 2022 Traffic Trends Report. To develop the final 2045 No Build AADT profile, additional adjustments were made to balance volumes and ensure continuity of flow. The final 2045 No Build AADT profile was generally used as the basis for developing the Build profile.

Based on the highway network, future land use and initial model output, it was expected that the proposed Dallas Boulevard ramps to/from east would divert traffic from SR 520 and induce new trips due to planned future developments in the area. Proportions for diverted trips were initially estimated using select link analysis from the model. To enhance volume development for the Build alternative, StreetLight origin-destination data was also analyzed to estimate the proportion of trips that would potentially be diverted from the SR 520 interchange ramps to/from east. Final proportions for diverted trips were estimated by comparing the StreetLight data to the select link analysis output, and engineering judgement was applied to ensure reasonableness. These proportions for diverted traffic were applied to the final 2045 No Build AADT profile to develop the Build AADT profile. Further, induced trips were estimated based on the model output and comparison with other ramp volumes in the area to develop the final 2045 Build AADT profile. Since the opening and design years for the project were 2030 and 2050, AADT for these two years was developed through interpolation and extrapolation.

#### 3.2 Traffic Factors

The future traffic factors for this study are presented in **Table 3.1**. The Design Hour Factor (K) is the proportion of the Annual Average Daily Traffic (AADT) that occurs during the design hour. The Directional Distribution Factor (D) is the proportion of traffic traveling in the peak direction during the design hour. The K and D factors represent the traffic demand a roadway is typically designed to accommodate.

For future conditions analysis, this study used the standard K factor for the SR 528 and arterials. Consistent with FDOT, CFX has developed standard K factors for use in planning and design applications, based on the FDOT Project Traffic Forecasting Handbook. The D factors were originally calculated using count data and adjusted where applicable based on future projections to account for anticipated changes in land use and traffic patterns.

Existing conditions truck factors were generally maintained for future conditions analysis. The daily truck ( $T_{24}$ ) factors were obtained from the Florida Traffic Online web application for Telemetered Traffic Monitoring Site (TTMS) 75-9960, located on the SR 528 mainline, west of SR 520, Portable Traffic Monitoring Site (PTMS) 75-2341/2, located at the Dallas mainline toll plaza, and PTMS 75-8220, located on Dallas Boulevard, north of SR 528. The Design Hour Truck (DHT) factor is the proportion of trucks within the peak hour and is assumed to be half of the  $T_{24}$  proportion rounded to the nearest whole number for this study. A PHF of 0.95 was assumed for future conditions.

**Table 3.1**  
**Future Traffic Factors**

Segment	Traffic Factors			
	K	D	$T_{24}$	DHT
<b>Freeway Mainline</b>				
SR 528	10.0%	52.0%	6.4%	3.0%
<b>SR 528 Ramps</b>				
<b>Innovation Way</b>				
Eastbound On-ramp and Westbound Off-ramp	11.1%	56.4%	6.4%	3.0%
<b>Dallas Boulevard</b>				
Eastbound Off-ramp and Westbound On-ramp	11.0%	67.8%	6.4%	3.0%
Eastbound On-ramp and Westbound Off-ramp	9.4%	67.3%	6.4%	3.0%
<b>SR 520</b>				
Eastbound Off-ramp and Westbound On-ramp	9.5%	61.2%	6.4%	3.0%
Eastbound On-ramp and Westbound Off-ramp	9.5%	65.4%	6.4%	3.0%
<b>Arterials</b>				
Dallas Boulevard	9.0%	72.6%	4.1%	2.0%
Starry Street	9.0%	59.5%	4.1%	2.0%

### 3.3 Future Directional Design Hour Volumes (DDHV)

Directional Design Hour Volumes (DDHV) for the No Build and Build alternatives for the SR 528 mainline and ramps were generated by applying the K and D traffic factors presented in **Table 3.1** to the final AADT profiles. Adjustments were then made to balance the DDHV to ensure continuity of flow and for reasonableness where applicable. The final SR 528 mainline and ramps AADT and the corresponding DDHV for years 2030 and 2050 are provided in **Tables 3.2** and **3.3** for the No Build and Build conditions, respectively. The bold values represent the mainline volumes, and the non-bold values represent ramp volumes. The data shows that traffic would be diverted from the SR 520 ramps to/from the east of SR 528 to the proposed Dallas Boulevard ramps to/from east and new trips would be induced.

Future year turn movement volumes for the Dallas Boulevard intersections at SR 528 ramp terminals and Starry Street were developed using the projected ramp DDHV. Turn proportions were estimated using peak period data from the model and adjusted based on anticipated changes in land use and traffic patterns where applicable. The projected 2030 and 2050 design hour volumes are presented in **Figures 3.1** through **3.4** for the No Build and Build conditions.

**Table 3.2  
No Build Traffic Forecasts**

Location	SR 528			2030					2050				
				AADT	AM - DDHV		PM - DDHV		AADT	AM - DDHV		PM - DDHV	
					EB	WB	EB	WB		EB	WB	EB	WB
Innovation Way				75,500	3,460	4,250	4,140	3,460	110,800	5,080	6,150	6,070	5,080
	X		X	2,400	110	150	150	110	3,500	170	220	220	170
				<b>77,900</b>	<b>3,570</b>	<b>4,400</b>	<b>4,290</b>	<b>3,570</b>	<b>114,300</b>	<b>5,250</b>	<b>6,370</b>	<b>6,290</b>	<b>5,250</b>
Dallas Boulevard	X		X	7,500	260	670	560	260	11,000	390	900	820	390
Dallas Mainline Toll Plaza				70,400	3,310	3,730	3,730	3,310	103,300	4,860	5,470	5,470	4,860
SR 520				9,600	560	360	560	360	14,100	820	520	820	520
	X		X	3,900	240	130	130	240	6,900	430	220	220	430
				<b>64,700</b>	<b>2,990</b>	<b>3,500</b>	<b>3,300</b>	<b>3,190</b>	<b>96,100</b>	<b>4,470</b>	<b>5,170</b>	<b>4,870</b>	<b>4,770</b>

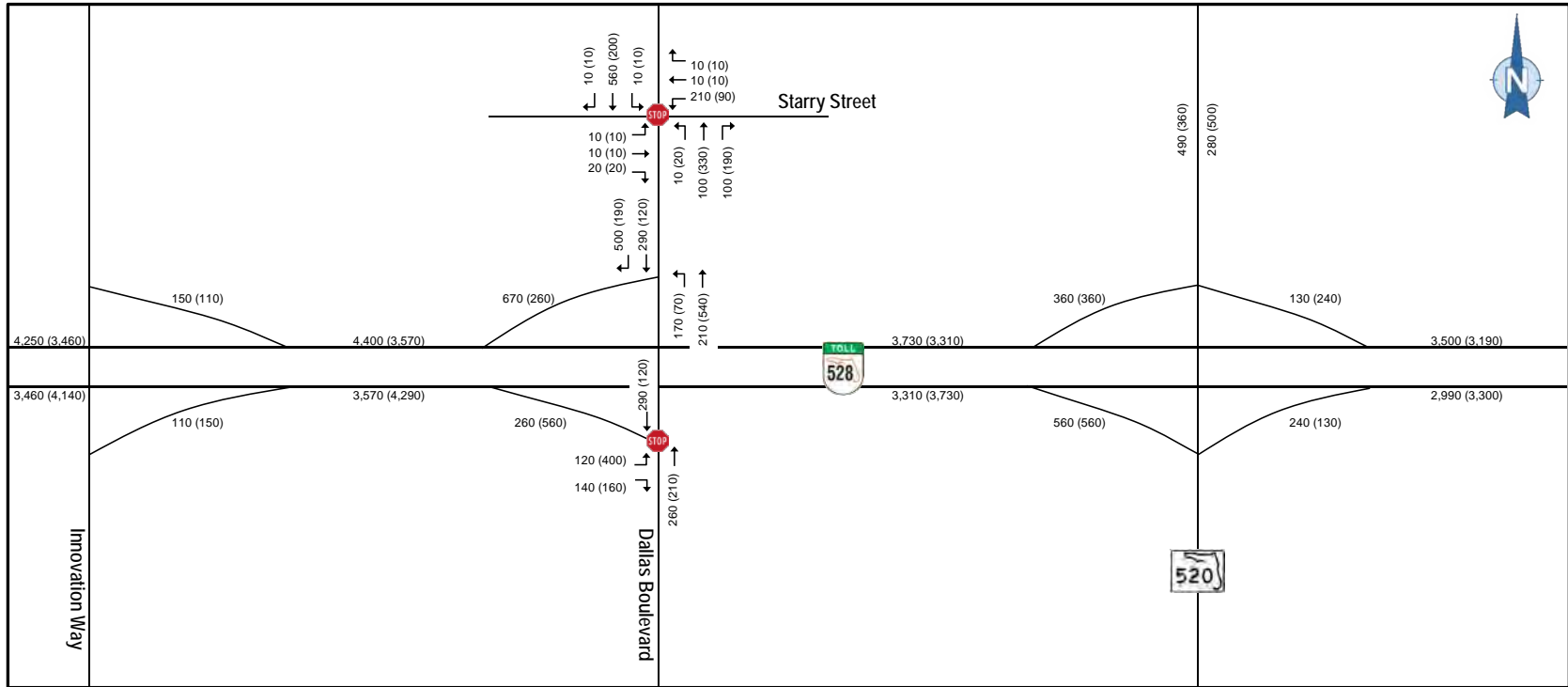
Values in purple indicate peak hour directional volumes

**Table 3.3  
Build Traffic Forecasts**

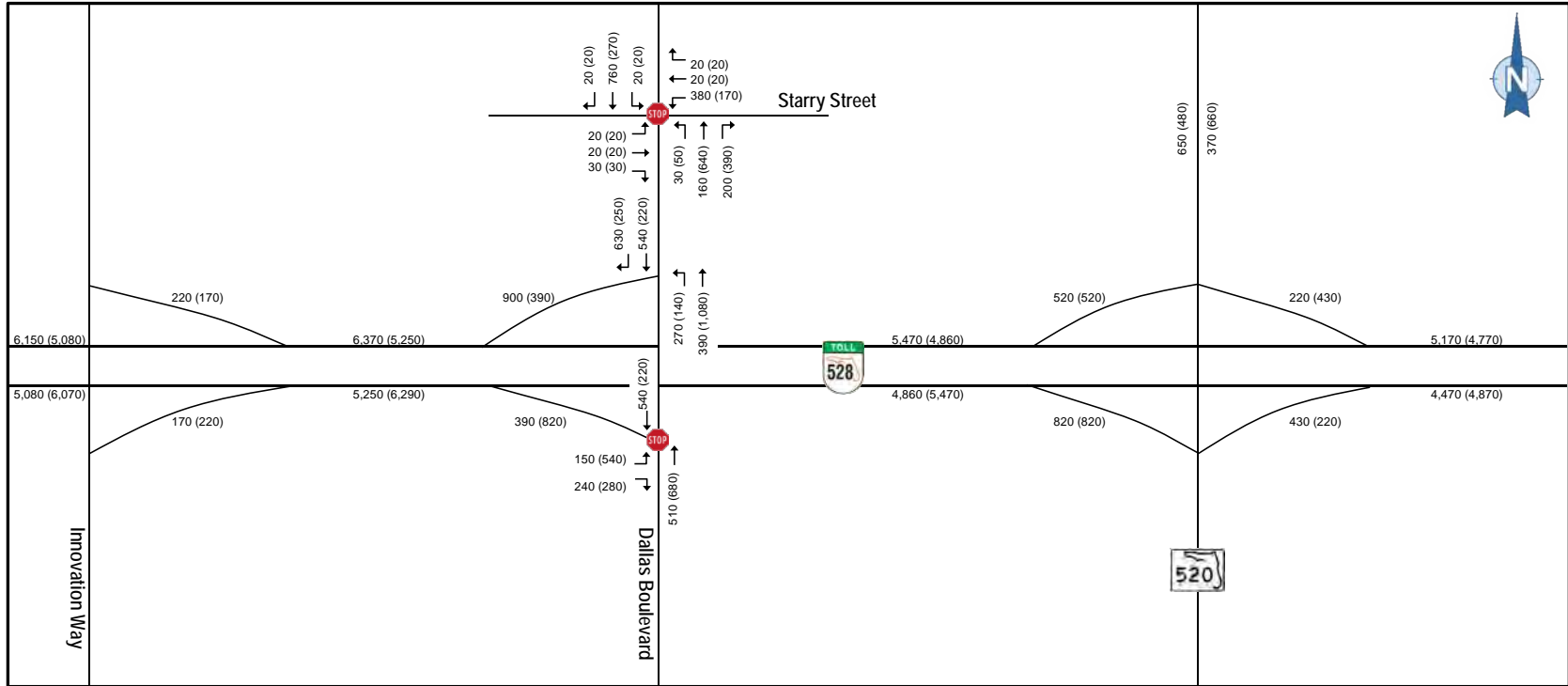
Location	SR 528			2030					2050				
				AADT	AM - DDHV		PM - DDHV		AADT	AM - DDHV		PM - DDHV	
					EB	WB	EB	WB		EB	WB	EB	WB
Innovation Way				75,500	3,460	4,250	4,140	3,460	110,800	5,080	6,150	6,070	5,080
		X	X	2,400	110	150	150	110	3,500	170	220	220	170
				<b>77,900</b>	<b>3,570</b>	<b>4,400</b>	<b>4,290</b>	<b>3,570</b>	<b>114,300</b>	<b>5,250</b>	<b>6,370</b>	<b>6,290</b>	<b>5,250</b>
Dallas Boulevard		X	X	7,500	260	670	560	260	11,000	390	900	820	390
				2,900	160	120	100	180	5,200	330	160	160	330
				<b>73,300</b>	<b>3,470</b>	<b>3,850</b>	<b>3,830</b>	<b>3,490</b>	<b>108,500</b>	<b>5,190</b>	<b>5,630</b>	<b>5,630</b>	<b>5,190</b>
Dallas Mainline Toll Plaza				9,600	560	360	560	360	14,100	820	520	820	520
		X	X	3,100	190	100	100	190	5,500	340	180	180	340
				<b>66,800</b>	<b>3,100</b>	<b>3,590</b>	<b>3,370</b>	<b>3,320</b>	<b>99,900</b>	<b>4,710</b>	<b>5,290</b>	<b>4,990</b>	<b>5,010</b>

Values in purple indicate peak hour directional volumes

**Figure 3.1**  
**2030 AM (PM) No Build DDHV**

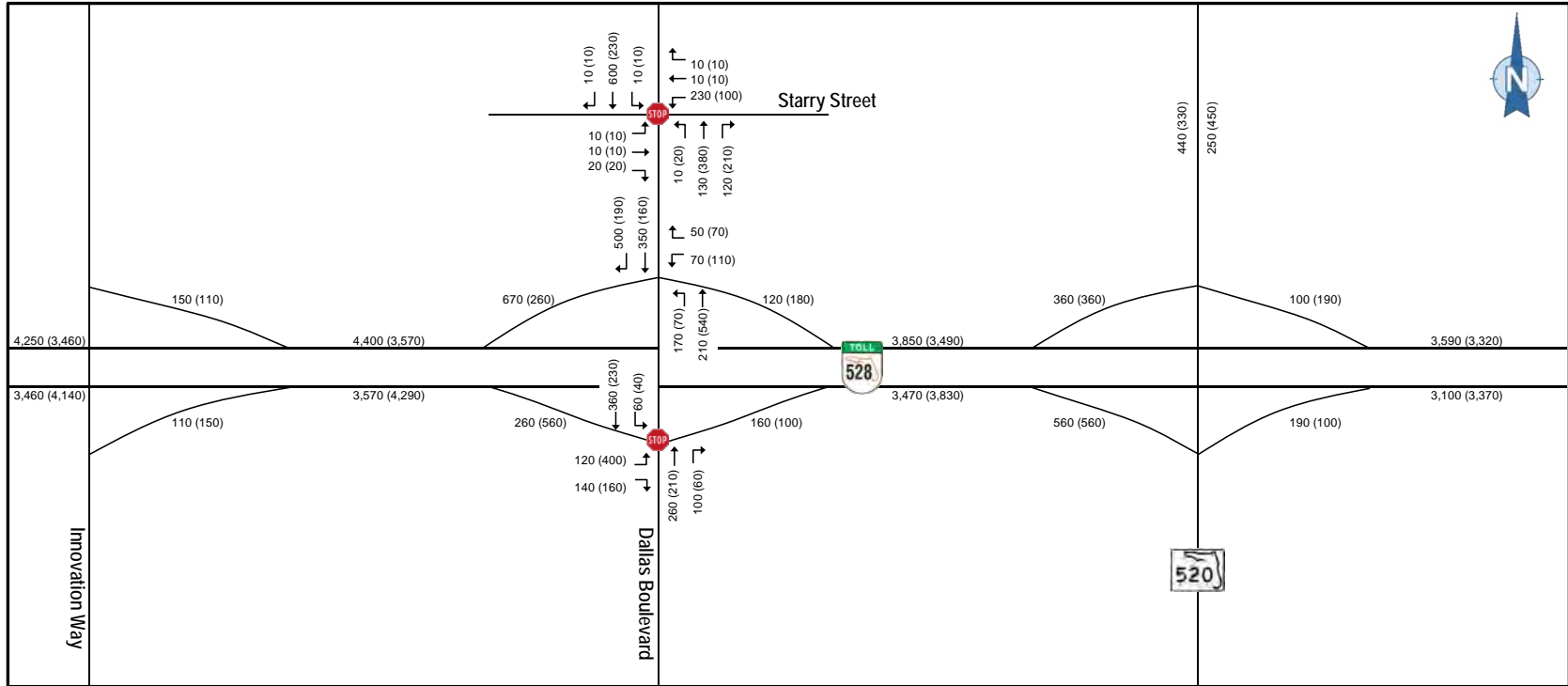


**Figure 3.2**  
**2050 AM (PM) No Build DDHV**

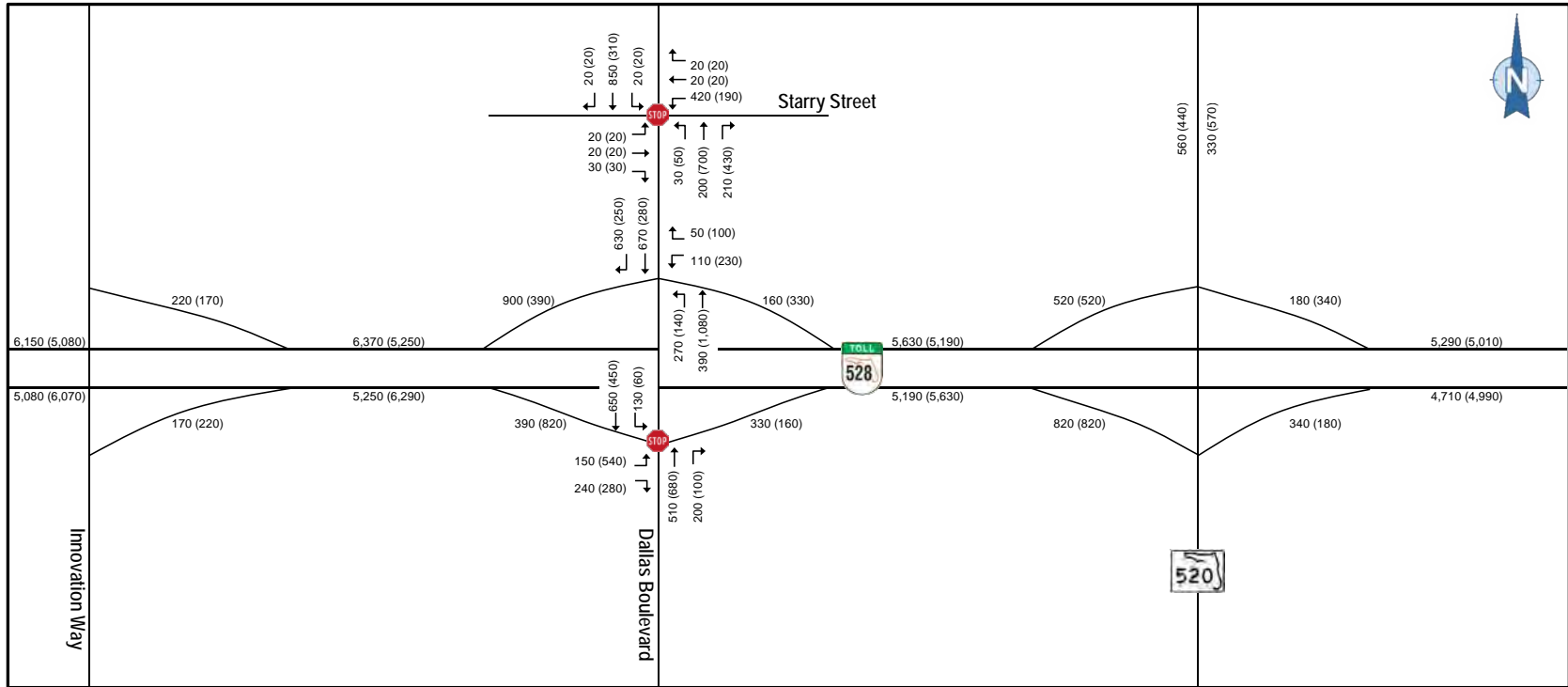




**Figure 3.3**  
**2030 AM (PM) Build DDHV**



**Figure 3.4**  
**2050 AM (PM) Build DDHV**


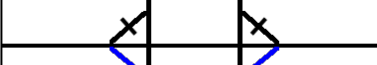

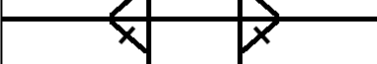


### 3.4 Lane Requirements for Freeway Mainline and Ramps

Future lane requirements were evaluated to provide an estimated timeline for the onset of capacity deficiencies along the SR 528 mainline and ramp roadways for the No Build and Build alternatives. Freeway mainline LOS targets were based on the FDOT’s Quality and LOS Handbook. Capacity analysis for ramp roadways was based on HCM targets. The FDOT and HCM targets were adjusted for local conditions such as speed, truck proportion and PHF.

The lane requirements analysis for the SR 528 mainline and ramps is summarized in **Table 3.4**. The analysis for the mainline segments was based on LOS D constraints. The analysis for ramp roadways was based on LOS E (capacity) target. The analysis shows that the SR 528 mainline will require three lanes per direction from Innovation Way to SR 520 either before or just after year 2030. This is consistent with the planned widening of the SR 528 mainline to three lanes per direction in this area, that is yet to be programmed. The results also show that the segment of SR 528 from Innovation Way to Dallas Boulevard will require four lanes per direction by year 2045. Finally, the analysis does not show a need to widen the existing single lane ramps. Detailed color-coded lane requirements analysis is presented in **Tables 3.5** and **3.6**. The lane requirements evaluation was followed by detailed analysis to confirm future operations and refine the proposed lane geometry where applicable, as documented in the sections that follow.

**Table 3.4  
Lanes Requirements Summary – Number of Lanes per Direction**

Location	SR 528		2022 Existing Number of Lanes	Lane Needs (Year) LOS D/E	
				No Build	Build
Innovation Way			1	n/a	n/a
			2	3 (<2030), 4 (2045)	3 (<2030), 4 (2045)
Dallas Boulevard			1	n/a	n/a
			n/a	n/a	1
Dallas Mainline Toll Plaza			2	3 (2032)	3 (2031)
SR 520			1	n/a	n/a
			1	n/a	n/a

Year of need based on mainline LOS D Maximum Service Volume/Ramp Capacity (LOS E)

n/a - not applicable or no additional lane needs

< Before

**Table 3.5  
No Build Mainline (LOS D) and Ramp Capacity (LOS E) Lane Requirements**

DDHV - Worst Case AM or PM Design Hour																								
Location	SR 528			Opening	Interpolated																			Design
				2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Innovation Way				150	150	160	160	170	170	170	180	180	190	190	190	200	200	200	210	210	210	210	220	220
				4,400	4,500	4,600	4,700	4,800	4,900	4,990	5,090	5,190	5,290	5,390	5,490	5,590	5,680	5,780	5,880	5,980	6,080	6,170	6,270	6,370
Dallas Boulevard				670	680	690	710	720	730	740	750	770	780	790	800	810	820	830	850	860	870	880	890	900
				3,730	3,820	3,900	3,990	4,080	4,170	4,250	4,340	4,430	4,510	4,600	4,690	4,770	4,860	4,950	5,040	5,120	5,210	5,300	5,380	5,470
Dallas Mainline Toll Plaza				560	570	590	600	610	630	640	650	660	680	690	700	720	730	740	760	770	780	790	810	820
				240	250	260	270	280	290	300	310	320	330	340	350	360	370	380	390	390	400	410	420	430

Freeway Inputs	
Truck % (t <sub>r</sub> )	3.0%
Free Flow Speed (mph)	75
Peak Hour Factor (PHF)	0.95

Freeway LOS Targets	
Lanes	LOS D
2	3,860
3	5,790
4	7,720
5	9,650
6	11,580

Ramp Capacity	
Lanes	LOS E
1	1,850
2	3,700
3	5,550

Speed - 40 to 50 MPH



**Table 3.6  
Build Mainline (LOS D) and Ramp Capacity (LOS E) Lane Requirements**

DDHV - Worst Case AM or PM Design Hour																								
Location	SR 528			Opening	Interpolated																			Design
				2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Innovation Way				150	150	160	160	170	170	170	180	180	190	190	190	200	200	200	210	210	210	210	220	220
				4,400	4,500	4,600	4,700	4,800	4,900	4,990	5,090	5,190	5,290	5,390	5,490	5,590	5,680	5,780	5,880	5,980	6,080	6,170	6,270	6,370
Dallas Boulevard				670	680	690	710	720	730	740	750	770	780	790	800	810	820	830	850	860	870	880	890	900
				180	190	200	200	210	220	230	240	240	250	260	270	270	280	290	300	300	310	320	320	330
Dallas Mainline Toll Plaza				3,850	3,940	4,030	4,120	4,210	4,300	4,380	4,470	4,560	4,650	4,740	4,830	4,920	5,010	5,100	5,190	5,270	5,360	5,450	5,540	5,630
SR 520				560	570	590	600	610	630	640	650	660	680	690	700	720	730	740	760	770	780	790	810	820
				190	200	210	210	220	230	240	250	250	260	270	280	280	290	300	310	310	320	330	330	330

Freeway Inputs	
Truck % (t <sub>r</sub> )	3.0%
Free Flow Speed (mph)	75
Peak Hour Factor (PHF)	0.95

Freeway LOS Targets	
Lanes	LOS D
2	3,860
3	5,790
4	7,720
5	9,650
6	11,580

Ramp Capacity	
Lanes	LOS E
1	1,850
2	3,700
3	5,550

Speed - 40 to 50 MPH

### 3.5 Freeway Segments Analysis

The future freeway segment analysis considered the planned widening of the SR 528 mainline to three lanes per direction from Innovation Way to SR 520, for both No Build and Build interchange conditions. The 2030 opening year HCS output for the SR 528 mainline segments within the AOI is summarized in **Tables 3.7** and **3.8** for the No Build and Build alternatives, respectively. Detailed output reports and analysis files are provided in **Appendix B**. The results show that the freeway segments are expected to operate at an acceptable LOS D or better in the both the 2030 No Build and Build conditions.

**Table 3.7  
2030 No Build AM and PM Design Hour Freeway Segment LOS/Density (pcpmp)**

Segment	Segment Type	Lanes	Volume (vph)		LOS/Density	
			AM	PM	AM	PM
<b>SR 528 Eastbound</b>						
Upstream of Innovation Way on-ramp	Basic	3	3,460	4,140	B/17	C/21
Innovation Way on-ramp to Dallas Boulevard off-ramp	Merge	3	3,570	4,290	B/18	C/22
Innovation Way on-ramp to Dallas Boulevard off-ramp	Basic	3	3,570	4,290	B/18	C/22
Innovation Way on-ramp to Dallas Boulevard off-ramp	Diverge	3	3,570	4,290	B/19	C/24
Dallas Boulevard off-ramp to SR 520 off-ramp	Basic	3	3,310	3,730	B/16	C/19
Dallas Boulevard off-ramp to SR 520 off-ramp	Diverge	3	3,310	3,730	C/24	C/26
SR 520 off-ramp to on-ramp	Basic	3	2,750	3,170	B/14	B/16
Downstream of SR 520 on-ramp	Merge	3	2,990	3,300	B/19	B/20
Downstream of SR 520 on-ramp	Basic	3	2,990	3,300	B/15	B/16
<b>SR 528 Westbound</b>						
Upstream of SR 520 off-ramp	Basic	3	3,500	3,190	B/17	B/16
Upstream of SR 520 off-ramp	Diverge	3	3,500	3,190	C/24	C/23
SR 520 off-ramp to on-ramp	Basic	3	3,370	2,950	B/17	B/15
SR 520 on-ramp to Dallas Boulevard on-ramp	Merge	3	3,730	3,310	C/21	B/19
SR 520 on-ramp to Dallas Boulevard on-ramp	Basic	3	3,730	3,310	C/19	B/16
Dallas Boulevard on-ramp to Innovation Way off-ramp	Merge	3	4,400	3,570	C/25	B/19
Dallas Boulevard on-ramp to Innovation Way off-ramp	Basic	3	4,400	3,570	C/23	B/18
Dallas Boulevard on-ramp to Innovation Way off-ramp	Diverge	3	4,400	3,570	D/28	C/24
Downstream of Innovation Way off-ramp	Basic	3	4,250	3,460	C/22	B/17

**Table 3.8  
2030 Build AM and PM Design Hour Freeway Segment LOS/Density (pcpmpl)**

Segment	Segment Type	Lanes	Volume (vph)		LOS/Density	
			AM	PM	AM	PM
<b>SR 528 Eastbound</b>						
Upstream of Innovation Way on-ramp	Basic	3	3,460	4,140	B/17	C/21
Innovation Way on-ramp to Dallas Boulevard off-ramp	Merge	3	3,570	4,290	B/18	C/22
Innovation Way on-ramp to Dallas Boulevard off-ramp	Basic	3	3,570	4,290	B/18	C/22
Innovation Way on-ramp to Dallas Boulevard off-ramp	Diverge	3	3,570	4,290	B/19	C/24
Dallas Boulevard off-ramp to on-ramp	Basic	3	3,310	3,730	B/16	C/19
Dallas Boulevard on-ramp to SR 520 off-ramp	Merge	3	3,470	3,830	C/21	C/22
Dallas Boulevard on-ramp to SR 520 off-ramp	Basic	3	3,470	3,830	B/17	C/19
Dallas Boulevard on-ramp to SR 520 off-ramp	Diverge	3	3,470	3,830	C/25	C/27
SR 520 off-ramp to on-ramp	Basic	3	2,910	3,270	B/14	B/16
Downstream of SR 520 on-ramp	Merge	3	3,100	3,370	B/19	C/20
Downstream of SR 520 on-ramp	Basic	3	3,100	3,370	B/15	B/17
<b>SR 528 Westbound</b>						
Upstream of SR 520 off-ramp	Basic	3	3,590	3,320	B/18	B/16
Upstream of SR 520 off-ramp	Diverge	3	3,590	3,320	C/25	C/23
SR 520 off-ramp to on-ramp	Basic	3	3,490	3,130	B/17	B/15
SR 520 on-ramp to Dallas Boulevard off-ramp	Merge	3	3,850	3,490	C/22	C/20
SR 520 on-ramp to Dallas Boulevard off-ramp	Basic	3	3,850	3,490	C/19	B/17
SR 520 on-ramp to Dallas Boulevard off-ramp	Diverge	3	3,850	3,490	C/26	C/24
Dallas Boulevard off-ramp to on-ramp	Basic	3	3,730	3,310	C/19	B/16
Dallas Boulevard on-ramp to Innovation Way off-ramp	Merge	3	4,400	3,570	C/25	B/19
Dallas Boulevard on-ramp to Innovation Way off-ramp	Basic	3	4,400	3,570	C/23	B/18
Dallas Boulevard on-ramp to Innovation Way off-ramp	Diverge	3	4,400	3,570	D/28	C/24
Downstream of Innovation Way off-ramp	Basic	3	4,250	3,460	C/22	B/17

For the 2050 design year, the mainline segments analysis is summarized in **Tables 3.9** and **3.10** for the No Build and Build alternatives, respectively. The results show that most of the freeway segments along SR 528 are expected to operate at an acceptable LOS D or better but the section between Innovation Way and Dallas Boulevard is expected to operate at LOS E in both No Build and Build conditions. Future lane requirement analysis indicated that this section will need four lanes in each direction by year 2045.

**Table 3.9  
2050 No Build AM and PM Design Hour Freeway Segment LOS/Density (pcpmp)**

Segment	Segment Type	Lanes	Volume (vph)		LOS/Density	
			AM	PM	AM	PM
<b>SR 528 Eastbound</b>						
Upstream of Innovation Way on-ramp	Basic	3	5,080	6,070	D/28	<b>E/39</b>
Innovation Way on-ramp to Dallas Boulevard off-ramp	Merge	3	5,250	6,290	C/27	D/33
Innovation Way on-ramp to Dallas Boulevard off-ramp	Basic	3	5,250	6,290	D/30	<b>E/42</b>
Innovation Way on-ramp to Dallas Boulevard off-ramp	Diverge	3	5,250	6,290	C/28	D/33
Dallas Boulevard off-ramp to SR 520 off-ramp	Basic	3	4,860	5,470	D/26	D/32
Dallas Boulevard off-ramp to SR 520 off-ramp	Diverge	3	4,860	5,470	D/32	D/35
SR 520 off-ramp to on-ramp	Basic	3	4,040	4,650	C/21	C/25
Downstream of SR 520 on-ramp	Merge	3	4,470	4,870	C/27	C/28
Downstream of SR 520 on-ramp	Basic	3	4,470	4,870	C/23	D/26
<b>SR 528 Westbound</b>						
Upstream of SR 520 off-ramp	Basic	3	5,170	4,770	D/29	C/26
Upstream of SR 520 off-ramp	Diverge	3	5,170	4,770	D/32	D/31
SR 520 off-ramp to on-ramp	Basic	3	4,950	4,340	D/27	C/22
SR 520 on-ramp to Dallas Boulevard on-ramp	Merge	3	5,470	4,860	D/31	C/28
SR 520 on-ramp to Dallas Boulevard on-ramp	Basic	3	5,470	4,860	D/32	D/26
Dallas Boulevard on-ramp to Innovation Way off-ramp	Merge	3	6,370	5,250	<b>E/35</b>	D/28
Dallas Boulevard on-ramp to Innovation Way off-ramp	Basic	3	6,370	5,250	<b>E/43</b>	D/30
Dallas Boulevard on-ramp to Innovation Way off-ramp	Diverge	3	6,370	5,250	<b>E/38</b>	D/32
Downstream of Innovation Way off-ramp	Basic	3	6,150	5,080	<b>E/40</b>	D/28



**Table 3.10**  
**2050 Build AM and PM Design Hour Freeway Segment LOS/Density (pcpmpl)**

Segment	Segment Type	Lanes	Volume (vph)		LOS/Density	
			AM	PM	AM	PM
<b>SR 528 Eastbound</b>						
Upstream of Innovation Way on-ramp	Basic	3	5,080	6,070	D/28	<b>E/39</b>
Innovation Way on-ramp to Dallas Boulevard off-ramp	Merge	3	5,250	6,290	C/27	D/33
Innovation Way on-ramp to Dallas Boulevard off-ramp	Basic	3	5,250	6,290	D/30	<b>E/42</b>
Innovation Way on-ramp to Dallas Boulevard off-ramp	Diverge	3	5,250	6,290	C/28	D/33
Dallas Boulevard off-ramp to on-ramp	Basic	3	4,860	5,470	D/26	D/32
Dallas Boulevard on-ramp to SR 520 off-ramp	Merge	3	5,190	5,630	D/30	D/32
Dallas Boulevard on-ramp to SR 520 off-ramp	Basic	3	5,190	5,630	D/29	D/33
Dallas Boulevard on-ramp to SR 520 off-ramp	Diverge	3	5,190	5,630	D/33	<b>E/35</b>
SR 520 off-ramp to on-ramp	Basic	3	4,370	4,810	C/23	C/26
Downstream of SR 520 on-ramp	Merge	3	4,710	4,990	C/28	D/28
Downstream of SR 520 on-ramp	Basic	3	4,710	4,990	C/25	D/27
<b>SR 528 Westbound</b>						
Upstream of SR 520 off-ramp	Basic	3	5,290	5,010	D/30	D/27
Upstream of SR 520 off-ramp	Diverge	3	5,290	5,010	D/33	D/32
SR 520 off-ramp to on-ramp	Basic	3	5,110	4,670	D/28	C/25
SR 520 on-ramp to Dallas Boulevard off-ramp	Merge	3	5,630	5,190	D/31	D/29
SR 520 on-ramp to Dallas Boulevard off-ramp	Basic	3	5,630	5,190	D/33	D/29
SR 520 on-ramp to Dallas Boulevard off-ramp	Diverge	3	5,630	5,190	D/34	D/33
Dallas Boulevard off-ramp to on-ramp	Basic	3	5,470	4,860	D/32	D/26
Dallas Boulevard on-ramp to Innovation Way off-ramp	Merge	3	6,370	5,250	<b>E/35</b>	D/28
Dallas Boulevard on-ramp to Innovation Way off-ramp	Basic	3	6,370	5,250	<b>E/43</b>	D/30
Dallas Boulevard on-ramp to Innovation Way off-ramp	Diverge	3	6,370	5,250	<b>E/38</b>	D/32
Downstream of Innovation Way off-ramp	Basic	3	6,150	5,080	<b>E/40</b>	D/28

### 3.6 Ramp Roadways Analysis

**Tables 3.11** and **3.12** summarize ramp roadway capacity evaluation for the No Build and Build conditions, respectively. The results show that the ramps within the AOI are expected to have a V/C ratio of 0.4 or less in 2030 and 0.5 or less in 2050 for both No Build and Build conditions, indicating that the ramps are expected to have a considerable amount of unused capacity in the future.

**Table 3.11  
No Build AM and PM Design Hour Ramp Capacity Analysis**

Interchange	Ramp	Lanes	Volume (vph)		Capacity (vph)	V/C	
			AM	PM		AM	PM
<b>2030 No Build</b>							
Innovation Way	Westbound off-ramp	1	150	110	1,850	0.1	0.1
	Eastbound on-ramp	1	110	150	1,850	0.1	0.1
Dallas Boulevard	Westbound on-ramp	1	670	260	1,850	0.4	0.1
	Eastbound off-ramp	1	260	560	1,850	0.1	0.3
SR 520	Westbound on-ramp	1	360	360	1,850	0.2	0.2
	Eastbound off-ramp	1	560	560	1,850	0.3	0.3
	Westbound off-ramp	1	130	240	1,850	0.1	0.1
	Eastbound on-ramp	1	240	130	1,850	0.1	0.1
<b>2050 No Build</b>							
Innovation Way	Westbound off-ramp	1	220	170	1,850	0.1	0.1
	Eastbound on-ramp	1	170	220	1,850	0.1	0.1
Dallas Boulevard	Westbound on-ramp	1	900	390	1,850	0.5	0.2
	Eastbound off-ramp	1	390	820	1,850	0.2	0.4
SR 520	Westbound on-ramp	1	520	520	1,850	0.3	0.3
	Eastbound off-ramp	1	820	820	1,850	0.4	0.4
	Westbound off-ramp	1	220	430	1,850	0.1	0.2
	Eastbound on-ramp	1	430	220	1,850	0.2	0.1

**Table 3.12  
Build AM and PM Design Hour Ramp Capacity Analysis**

Interchange	Ramp	Lanes	Volume (vph)		Capacity (vph)	V/C	
			AM	PM		AM	PM
<b>2030 Build</b>							
Innovation Way	Westbound off-ramp	1	150	110	1,850	0.1	0.1
	Eastbound on-ramp	1	110	150	1,850	0.1	0.1
Dallas Boulevard	Westbound on-ramp	1	670	260	1,850	0.4	0.1
	Eastbound off-ramp	1	260	560	1,850	0.1	0.3
	Westbound off-ramp	1	120	180	1,850	0.1	0.1
	Eastbound on-ramp	1	160	100	1,850	0.1	0.1
SR 520	Westbound on-ramp	1	360	360	1,850	0.2	0.2
	Eastbound off-ramp	1	560	560	1,850	0.3	0.3
	Westbound off-ramp	1	100	190	1,850	0.1	0.1
	Eastbound on-ramp	1	190	100	1,850	0.1	0.1
<b>2050 Build</b>							
Innovation Way	Westbound off-ramp	1	220	170	1,850	0.1	0.1
	Eastbound on-ramp	1	170	220	1,850	0.1	0.1
Dallas Boulevard	Westbound on-ramp	1	900	390	1,850	0.5	0.2
	Eastbound off-ramp	1	390	820	1,850	0.2	0.4
	Westbound off-ramp	1	160	330	1,850	0.1	0.2
	Eastbound on-ramp	1	330	160	1,850	0.2	0.1
SR 520	Westbound on-ramp	1	520	520	1,850	0.3	0.3
	Eastbound off-ramp	1	820	820	1,850	0.4	0.4
	Westbound off-ramp	1	180	340	1,850	0.1	0.2
	Eastbound on-ramp	1	340	180	1,850	0.2	0.1

### 3.7 Intersections Analysis

#### 3.7.1 Interchange Analysis Alternatives

The proposed modification is to add ramps to/from east at the SR 528 and Dallas Boulevard interchange which currently serves trips to/from the west only. Two configurations for the interchange (roundabout and signalized) were proposed during the feasibility study for the project and carried forward for evaluation in the current PD&E study. **Figures 3.5** and **3.6** show the preliminary conceptual layouts of the two alternatives developed during the feasibility study.

It was determined during the PD&E study that, even with the proposed full interchange, Dallas Boulevard would remain a two-lane roadway until demand triggers a need for widening. The year of need for widening Dallas Boulevard will depend on the pace at which development occurs in the region.

Information obtained during the PD&E study indicated that most of the planned development in the area will occur beyond year 2050. Therefore, the analysis for the PD&E study was conducted to determine lane geometry requirements for the full interchange with a two-lane typical section for Dallas Boulevard. This scenario was deemed the interim configuration for both alternatives for the interchange.

**Figure 3.5**  
**Preliminary Layout of Proposed Roundabout Interchange Alternative**



**Figure 3.6**  
**Preliminary Layout of Proposed Signalized Interchange Alternative**



### 3.7.2 No Build Intersections Conditions

Future No Build intersections operational analysis was conducted using the 2030 and 2050 design hour volumes on **Figures 3.1** and **3.2**, to verify operations in the opening and design years. The No Build analysis at the ramp terminal and Starry Street intersections assumed the existing conditions lane geometry presented on **Figure 2.2**. The intersection LOS and delay was evaluated using the Synchro software, Version 11. Queue lengths were estimated using SimTraffic. The analysis results for the 2030 and 2050 peak hour No Build conditions are presented in **Tables 3.13** and **3.14**. Detailed Synchro/SimTraffic output reports are provided in **Appendix B**.

The results in **Table 3.13** show that all movements are expected to operate at an acceptable LOS C or better at the Dallas Boulevard and SR 528 ramp terminal intersections in 2030 No Build conditions. The southbound movements at the Dallas Boulevard and Starry Street intersection would operate at LOS E in the AM peak hour. All other movements are expected to operate at LOS C or better in 2030 at the Starry Street intersection.

**Table 3.13**  
**2030 AM (PM) No Build Design Hour Intersection LOS/Delay (sec)**

Intersection	Approach	Movement	LOS	Delay (Seconds)	Maximum Queue Length (Feet)*	Available Storage Length (Feet)
			AM (PM)	AM (PM)	AM (PM)	
Dallas Boulevard and SR 528 Eastbound Ramp (Unsignalized)	Eastbound	Left	B (C)	13.0 (17.2)	85 (217)	-
		Through	-	-	-	-
		Right	B (C)	13.0 (17.2)	47 (44)	720
	Westbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Northbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	-	-
		Right	-	-	-	-
	Southbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	-	-
		Right	-	-	-	-
<b>Overall Intersection</b>			<b>B (C)</b>	<b>13.0 (17.2)</b>	-	-
Dallas Boulevard and SR 528 Westbound Ramp (Unsignalized)	Eastbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Westbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Northbound	Left	A (A)	1.4 (0.6)	176 (100)	-
		Through	A (A)	4.5 (1.4)	176 (100)	-
		Right	-	-	-	-
	Southbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	20 (3)	-
		Right	A (A)	0.0 (0.0)	20 (3)	-
<b>Overall Intersection</b>			<b>A (A)</b>	<b>4.5 (1.4)</b>	-	-
Dallas Boulevard and Starry Street (Unsignalized)	Eastbound	Left	B (A)	10.1 (9.3)	54 (52)	-
		Through	B (A)	10.1 (9.3)	54 (52)	-
		Right	B (A)	10.1 (9.3)	54 (52)	-
	Westbound	Left	B (B)	14.1 (10.5)	103 (72)	-
		Through	B (B)	14.1 (10.5)	103 (72)	-
		Right	B (B)	14.1 (10.5)	103 (72)	-
	Northbound	Left	B (C)	11.4 (18.2)	96 (102)	-
		Through	B (C)	11.4 (18.2)	96 (102)	-
		Right	B (C)	11.4 (18.2)	96 (102)	-
	Southbound	Left	E (B)	35.7 (10.6)	252 (92)	-
		Through	E (B)	35.7 (10.6)	252 (92)	-
		Right	E (B)	35.7 (10.6)	252 (92)	-
<b>Overall Intersection</b>			<b>E (C)</b>	<b>35.7 (18.2)</b>	-	-

\*SimTraffic maximum queue length

**Table 3.14  
2050 AM (PM) No Build Design Hour Intersection LOS/Delay (sec)**

Intersection	Approach	Movement	LOS	Delay (Seconds)	Maximum Queue Length (Feet)*	Available Storage Length (Feet)
			AM (PM)	AM (PM)	AM (PM)	
Dallas Boulevard and SR 528 Eastbound Ramp (Unsignalized)	Eastbound	Left	D (F)	29.5 (558.5)	227 (1,622)	-
		Through	-	-	-	-
		Right	D (F)	29.5 (558.5)	107 (820)	720
	Westbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Northbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	105 (0)	-
		Right	-	-	-	-
	Southbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	-	-
		Right	-	-	-	-
<b>Overall Intersection</b>			<b>D (F)</b>	<b>29.5 (558.5)</b>	<b>-</b>	<b>-</b>
Dallas Boulevard and SR 528 Westbound Ramp (Unsignalized)	Eastbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Westbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Northbound	Left	A (A)	3.7 (2.7)	532 (392)	-
		Through	A (A)	6.3 (3.3)	532 (392)	-
		Right	-	-	-	-
	Southbound	Left	-	-	-	-
		Through	A (A)	0.0 (0.0)	77 (3)	-
		Right	A (A)	0.0 (0.0)	-	-
<b>Overall Intersection</b>			<b>A (A)</b>	<b>6.3 (3.3)</b>	<b>-</b>	<b>-</b>
Dallas Boulevard and Starry Street (Unsignalized)	Eastbound	Left	B (B)	13.5 (11.3)	77 (62)	-
		Through	B (B)	13.5 (11.3)	77 (62)	-
		Right	B (B)	13.5 (11.3)	77 (62)	-
	Westbound	Left	E (B)	46.5 (14.7)	273 (103)	-
		Through	E (B)	46.5 (14.7)	273 (103)	-
		Right	E (B)	46.5 (14.7)	273 (103)	-
	Northbound	Left	D (F)	31.7 (338.7)	215 (260)	-
		Through	D (F)	31.7 (338.7)	215 (260)	-
		Right	D (F)	31.7 (338.7)	215 (260)	-
	Southbound	Left	F (C)	319.8 (16.0)	1,304 (121)	-
		Through	F (C)	319.8 (16.0)	1,304 (121)	-
		Right	F (C)	319.8 (16.0)	1,304 (121)	-
<b>Overall Intersection</b>			<b>F (F)</b>	<b>319.8 (338.7)</b>	<b>-</b>	<b>-</b>

\*SimTraffic maximum queue length

In the 2050 design year No Build conditions (**Table 3.14**), most of the movements are expected to operate at LOS D or better at the Dallas Boulevard and SR 528 ramp terminal intersections, except for the eastbound left and right turns at the SR 528 eastbound off-ramp which are anticipated to operate at an unacceptable LOS F in the PM peak hour. The results show very long delays and queues extending along the full length of the ramp and onto the freeway mainline. This is mainly due to lack of capacity at the off-ramp, along Dallas Boulevard and at the adjacent intersection at Starry Street which is within close proximity. The westbound movements at the Dallas Boulevard and Starry Street intersection would operate at LOS E and the southbound movements would operate at an unacceptable LOS F in the AM peak hour. In the PM, most of the movements are expected to operate at LOS C or better, except for the northbound movements which are anticipated to operate at LOS F. Northbound queues at the Starry Street intersection would extend upstream to the interchange ramp terminals, compounding the backups along the eastbound off-ramp and mainline.

### **3.7.3 Build Intersections Conditions - Interim**

Future intersections operational analysis for the Build interchange conditions was primarily conducted to determine interim lane geometry requirements for the roundabout and signalized alternatives, assuming a two-lane typical section for Dallas Boulevard (interim), as discussed in **Section 3.7.1**. In addition, the interim configurations also assumed that the All-Way-Stop Control at the Starry Street intersection with Dallas Boulevard would be maintained until a need for signaling and/or adding turn lanes is established, after the interchange is open to traffic. The roundabout alternative was evaluated using the SIDRA software, Version 9, whereas, the signalized intersection alternative was evaluated using the Synchro software, Version 11. The analysis was based on the 2030 and 2050 design hour volumes presented in **Figures 3.3** and **3.4** and the results are presented in **Tables 3.15** through **3.18**. The proposed lane geometry for the interim conditions is graphically depicted on **Figures 3.7** and **3.8**, that also shows the proposed storage lengths for the turn bays. For the signalized intersection, queue lengths were estimated using SimTraffic. Detailed SIDRA and Synchro/SimTraffic reports are provided in **Appendix B**.

The interim Build results in **Tables 3.15** and **3.16** show that all movements at the proposed Dallas Boulevard and SR 528 full interchange ramp terminals are expected to operate at LOS A in 2030 for the roundabout alternative, and an acceptable LOS C or better for the signalized intersection alternative. The overall LOS is A for the roundabout alternative and B for the signalized intersection. The results also show that most of the movements at the unsignalized intersection of Dallas Boulevard and Starry Street are expected to operate at an acceptable LOS D or better in 2030 peak hours, even with single lane approaches shared by all movements (left/through/right). The only exception is the southbound approach which is reported with a LOS F in 2030 AM and is not expected to impact the interchange. When the interchange is open to traffic, operations will need to be monitored at the Starry Street intersection and data collected after traffic stabilizes to evaluate when signalization and/or addition of turn lanes will be required.



**Table 3.15**  
**2030 AM (PM) Build Design Hour Intersection LOS/Delay (sec)**  
**Roundabout Interchange Alternative – Interim**

Intersection	Approach	Movement	LOS	Delay (Seconds)	Maximum Queue Length (Feet)*
			AM (PM)	AM (PM)	AM (PM)
Dallas Boulevard and SR 528 Eastbound Ramps (Roundabout)	Eastbound	Left	A (A)	5.2 (7.5)	14 (52)
		Through	-	-	-
		Right	A (A)	5.1 (4.6)	15 (16)
	Westbound	Left	-	-	-
		Through	-	-	-
		Right	-	-	-
	Northbound	Left	-	-	-
		Through	A (A)	6.6 (8.2)	48 (42)
		Right	A (A)	6.6 (8.2)	48 (42)
	Southbound	Left	A (A)	5.6 (4.4)	0 (0)
		Through	A (A)	5.6 (4.4)	0 (0)
		Right	-	-	-
<b>Overall Intersection</b>			<b>A (A)</b>	<b>5.8 (6.5)</b>	<b>-</b>
Dallas Boulevard and SR 528 Westbound Ramps (Roundabout)	Eastbound	Left	-	-	-
		Through	-	-	-
		Right	-	-	-
	Westbound	Left	A (A)	4.4 (6.3)	7 (15)
		Through	-	-	-
		Right	A (A)	3.6 (5.3)	5 (9)
	Northbound	Left	A (A)	5.3 (7.4)	0 (0)
		Through	A (A)	5.3 (7.4)	0 (0)
		Right	-	-	-
	Southbound	Left	-	-	-
		Through	A (A)	6.6 (4.3)	42 (15)
		Right	A (A)	0.0 (0.0)	0 (0)
<b>Overall Intersection</b>			<b>A (A)</b>	<b>3.5 (5.5)</b>	<b>-</b>
Dallas Boulevard and Starry Street (Unsignalized)	Eastbound	Left	B (A)	10.8 (9.7)	56 (47)
		Through	B (A)	10.8 (9.7)	56 (47)
		Right	B (A)	10.8 (9.7)	56 (47)
	Westbound	Left	C (B)	16.2 (11.1)	137 (71)
		Through	C (B)	16.2 (11.1)	137 (71)
		Right	C (B)	16.2 (11.1)	137 (71)
	Northbound	Left	B (D)	13.6 (26.3)	91 (226)
		Through	B (D)	13.6 (26.3)	91 (226)
		Right	B (D)	13.6 (26.3)	91 (226)
	Southbound	Left	F (B)	59.1 (11.6)	334 (108)
		Through	F (B)	59.1 (11.6)	334 (108)
		Right	F (B)	59.1 (11.6)	334 (108)
<b>Overall Intersection</b>			<b>F (D)</b>	<b>59.1 (26.3)</b>	<b>-</b>

\*SimTraffic maximum queue length reported for the Starry Street intersection

**Table 3.16**  
**2030 AM (PM) Build Design Hour Intersection LOS/Delay (sec)**  
**Signalized Interchange Alternative – Interim**

Intersection	Approach	Movement	LOS	Delay (Seconds)	Maximum Queue Length (Feet)*
			AM (PM)	AM (PM)	AM (PM)
Dallas Boulevard and SR 528 Ramps (Signalized)	Eastbound	Left	C (C)	26.6 (21.8)	127 (248)
		Through	-	-	-
		Right	A (A)	8.0 (4.0)	61 (58)
	Westbound	Left	C (B)	23.9 (14.6)	92 (111)
		Through	-	-	-
		Right	A (A)	0.8 (1.6)	6 (83)
	Northbound	Left	A (B)	7.0 (12.5)	117 (80)
		Through	A (B)	8.5 (19.4)	125 (149)
		Right	A (B)	8.5 (19.4)	125 (149)
	Southbound	Left	A (B)	6.5 (12.2)	60 (63)
		Through	C (C)	22.7 (23.6)	172 (108)
		Right	A (A)	6.0 (6.7)	0 (0)
	<b>Overall Intersection</b>			<b>B (B)</b>	<b>11.8 (15.0)</b>
Dallas Boulevard and Starry Street (Unsignalized)	Eastbound	Left	B (A)	10.8 (9.7)	56 (47)
		Through	B (A)	10.8 (9.7)	56 (47)
		Right	B (A)	10.8 (9.7)	56 (47)
	Westbound	Left	C (B)	16.2 (11.1)	137 (71)
		Through	C (B)	16.2 (11.1)	137 (71)
		Right	C (B)	16.2 (11.1)	137 (71)
	Northbound	Left	B (D)	13.6 (26.3)	91 (226)
		Through	B (D)	13.6 (26.3)	91 (226)
		Right	B (D)	13.6 (26.3)	91 (226)
	Southbound	Left	F (B)	59.1 (11.6)	334 (108)
		Through	F (B)	59.1 (11.6)	334 (108)
		Right	F (B)	59.1 (11.6)	334 (108)
	<b>Overall Intersection</b>			<b>F (D)</b>	<b>59.1 (26.3)</b>

\*SimTraffic maximum queue length

**Table 3.17**  
**2050 AM (PM) Build Design Hour Intersection LOS/Delay (sec)**  
**Roundabout Interchange Alternative – Interim**

Intersection	Approach	Movement	LOS	Delay (Seconds)	Maximum Queue Length (Feet)*	Proposed # of Turn Lanes/ Storage Length (Feet)
			AM (PM)	AM (PM)	AM (PM)	
Dallas Boulevard and SR 528 Eastbound Ramps (Roundabout)	Eastbound	Left	A (C)	8.5 (15.9)	24 (181)	-
		Through	-	-	-	-
		Right	A (A)	9.1 (7.6)	39 (38)	1/700'
	Westbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Northbound	Left	-	-	-	-
		Through	C (F)	17.4 (113.2)	356 (1,476)	-
		Right	C (F)	17.4 (113.2)	356 (1,476)	-
	Southbound	Left	A (A)	9.7 (6.4)	0 (0)	-
		Through	A (A)	9.7 (6.4)	0 (0)	-
		Right	-	-	-	-
<b>Overall Intersection</b>			<b>B (E)</b>	<b>12.4 (48.5)</b>	-	-
Dallas Boulevard and SR 528 Westbound Ramps (Roundabout)	Eastbound	Left	-	-	-	-
		Through	-	-	-	-
		Right	-	-	-	-
	Westbound	Left	A (C)	6.6 (22.2)	15 (75)	-
		Through	-	-	-	-
		Right	A (B)	4.3 (10.6)	5 (20)	1/400'
	Northbound	Left	A (D)	8.0 (31.6)	0 (0)	-
		Through	A (D)	8.0 (31.6)	0 (0)	-
		Right	-	-	-	-
	Southbound	Left	-	-	-	-
		Through	C (A)	17.0 (6.8)	283 (35)	-
		Right	A (A)	0.0 (0.0)	0 (0)	1/300'
<b>Overall Intersection</b>			<b>A (C)</b>	<b>8.3 (22.4)</b>	-	-
Dallas Boulevard and Starry Street (Signalized)	Eastbound	Left	C (C)	31.2 (28.4)	124 (122)	-
		Through	C (C)	31.2 (28.4)	124 (122)	-
		Right	C (C)	31.2 (28.4)	124 (122)	-
	Westbound	Left	F (D)	181.9 (51.2)	1,035 (250)	-
		Through	F (D)	181.9 (51.2)	1,035 (250)	-
		Right	F (D)	181.9 (51.2)	1,035 (250)	-
	Northbound	Left	B (F)	14.8 (165.6)	795 (1,023)	-
		Through	B (F)	14.8 (165.6)	795 (1,023)	-
		Right	B (F)	14.8 (165.6)	795 (1,023)	-
	Southbound	Left	D (B)	46.2 (14.3)	1,304 (734)	-
		Through	D (B)	46.2 (14.3)	1,304 (734)	-
		Right	D (B)	46.2 (14.3)	1,304 (734)	-
<b>Overall Intersection</b>			<b>E (F)</b>	<b>71.7 (117.1)</b>	-	-

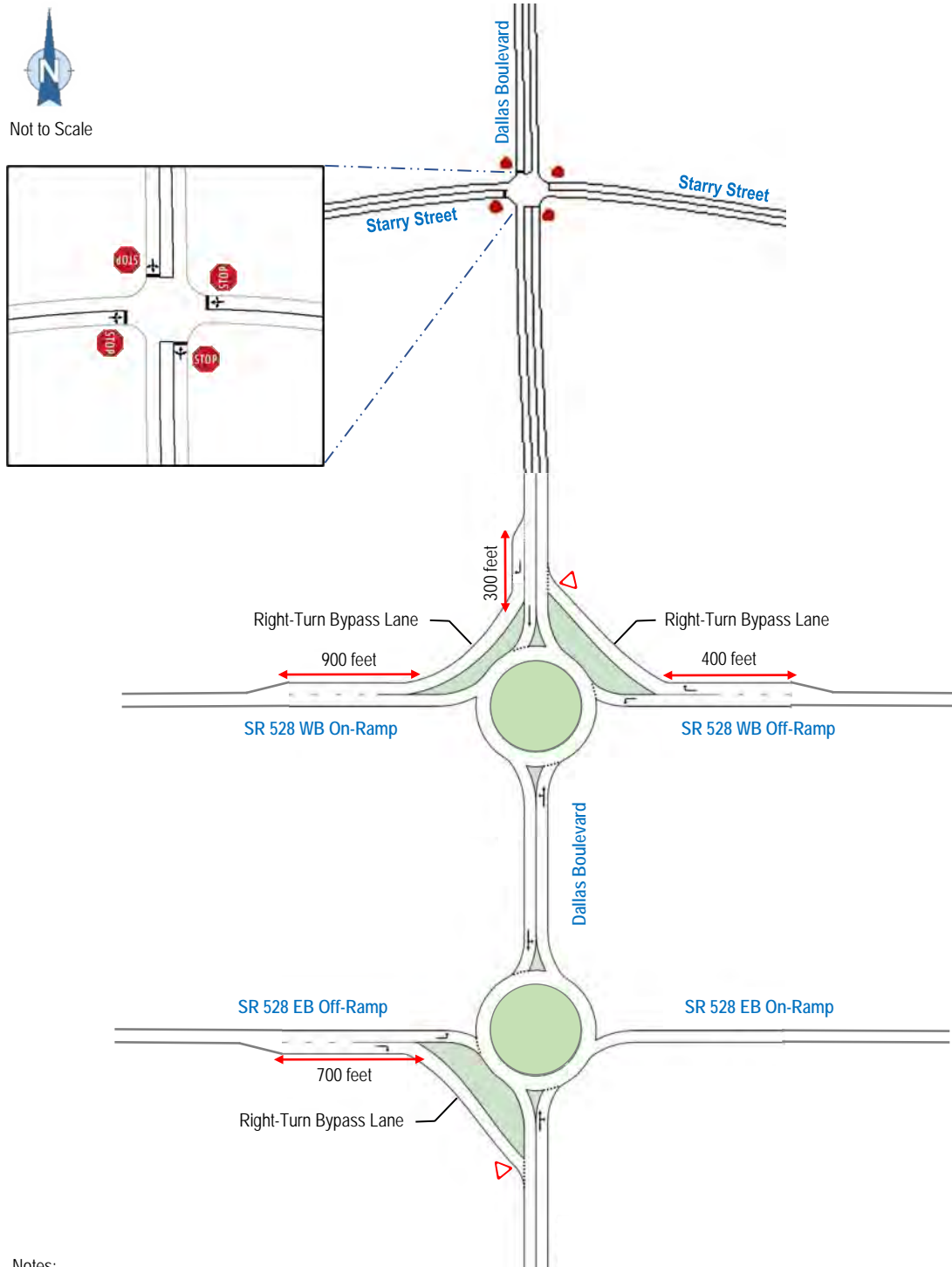
Right-turn bypass lanes are proposed to ensure the turn lanes are not blocked by left or through movement queue.

**Table 3.18**  
**2050 AM (PM) Build Design Hour Intersection LOS/Delay (sec)**  
**Signalized Interchange Alternative – Interim**

Intersection	Approach	Movement	LOS	Delay (Seconds)	Maximum Queue Length (Feet)*	Proposed # of Turn Lanes/ Storage Length (Feet)
			AM (PM)	AM (PM)	AM (PM)	
Dallas Boulevard and SR 528 Ramps (Signalized)	Eastbound	Left	D (D)	37.8 (52.0)	210 (1,872)	-
		Through	-	-	-	-
		Right	A (A)	9.1 (4.5)	136 (800)	1/700'
	Westbound	Left	C (C)	34.4 (24.4)	142 (211)	-
		Through	-	-	-	-
		Right	A (A)	0.9 (4.2)	22 (120)	1/375'
	Northbound	Left	B (B)	12.6 (13.0)	246 (400)	1/350'
		Through	B (E)	14.4 (66.0)	438 (1,270)	-
		Right	B (E)	14.4 (66.0)	438 (1,270)	-
	Southbound	Left	A (B)	7.3 (13.8)	118 (100)	1/400'
		Through	C (C)	29.7 (25.5)	289 (243)	-
		Right	A (A)	4.9 (5.0)	0 (0)	1/400'
	<b>Overall Intersection</b>			<b>B (D)</b>	<b>16.2 (35.4)</b>	-
Dallas Boulevard and Starry Street (Signalized)	Eastbound	Left	C (C)	31.2 (28.4)	124 (122)	-
		Through	C (C)	31.2 (28.4)	124 (122)	-
		Right	C (C)	31.2 (28.4)	124 (122)	-
	Westbound	Left	F (D)	<b>181.9 (51.2)</b>	1,035 (250)	-
		Through	F (D)	<b>181.9 (51.2)</b>	1,035 (250)	-
		Right	F (D)	<b>181.9 (51.2)</b>	1,035 (250)	-
	Northbound	Left	B (F)	14.8 ( <b>165.6</b> )	795 (1,023)	-
		Through	B (F)	14.8 ( <b>165.6</b> )	795 (1,023)	-
		Right	B (F)	14.8 ( <b>165.6</b> )	795 (1,023)	-
	Southbound	Left	D (B)	46.2 (14.3)	1,304 (734)	-
		Through	D (B)	46.2 (14.3)	1,304 (734)	-
		Right	D (B)	46.2 (14.3)	1,304 (734)	-
	<b>Overall Intersection</b>			<b>E (F)</b>	<b>71.7 (117.1)</b>	-

\*SimTraffic maximum queue length

**Figure 3.7**  
**Proposed Lane Geometry and Storage Lengths for**  
**Roundabout Interchange Alternative – Interim**



**Notes:**

Lane tapers not included in storage lengths

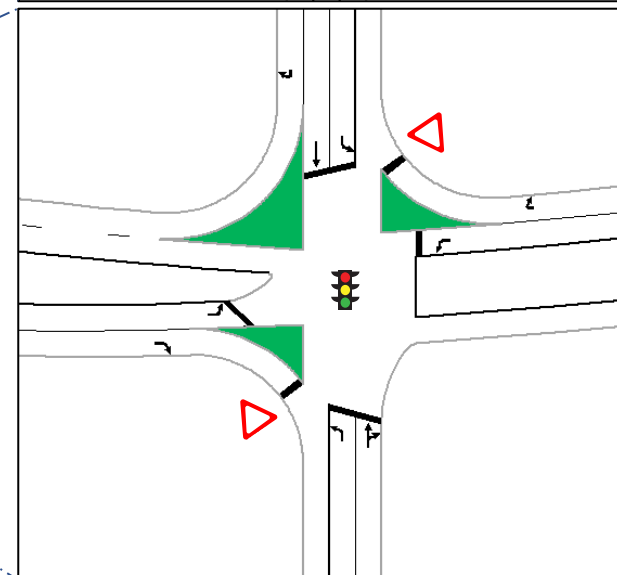
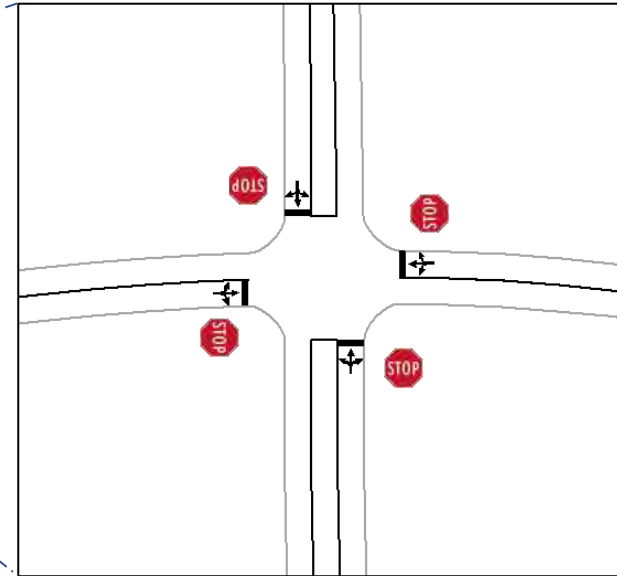
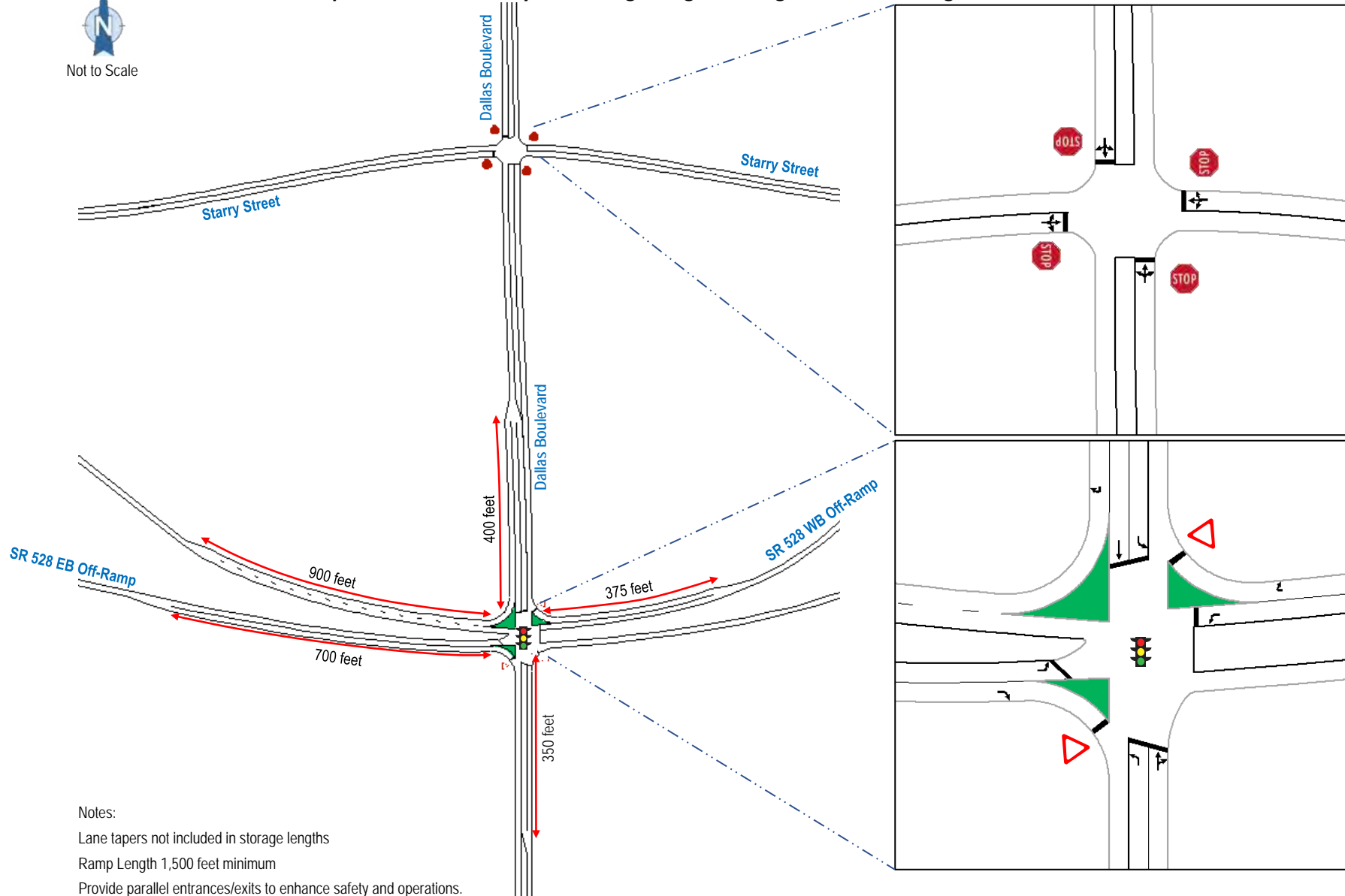
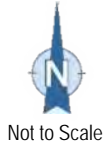
Ramp Length 1,500 feet minimum

Provide parallel entrances/exits to enhance safety and operations.

Schematic provided for illustration purposes only, design to be based on guidelines. E.g., adjust roundabout shape and bypass channelization appropriately.

**Figure 3.8**

**Proposed Lane Geometry and Storage Lengths for Signalized Interchange Alternative – Interim**



Notes:

Lane tapers not included in storage lengths

Ramp Length 1,500 feet minimum

Provide parallel entrances/exits to enhance safety and operations.

Schematic provided for illustration purposes only, design to be based on guidelines.

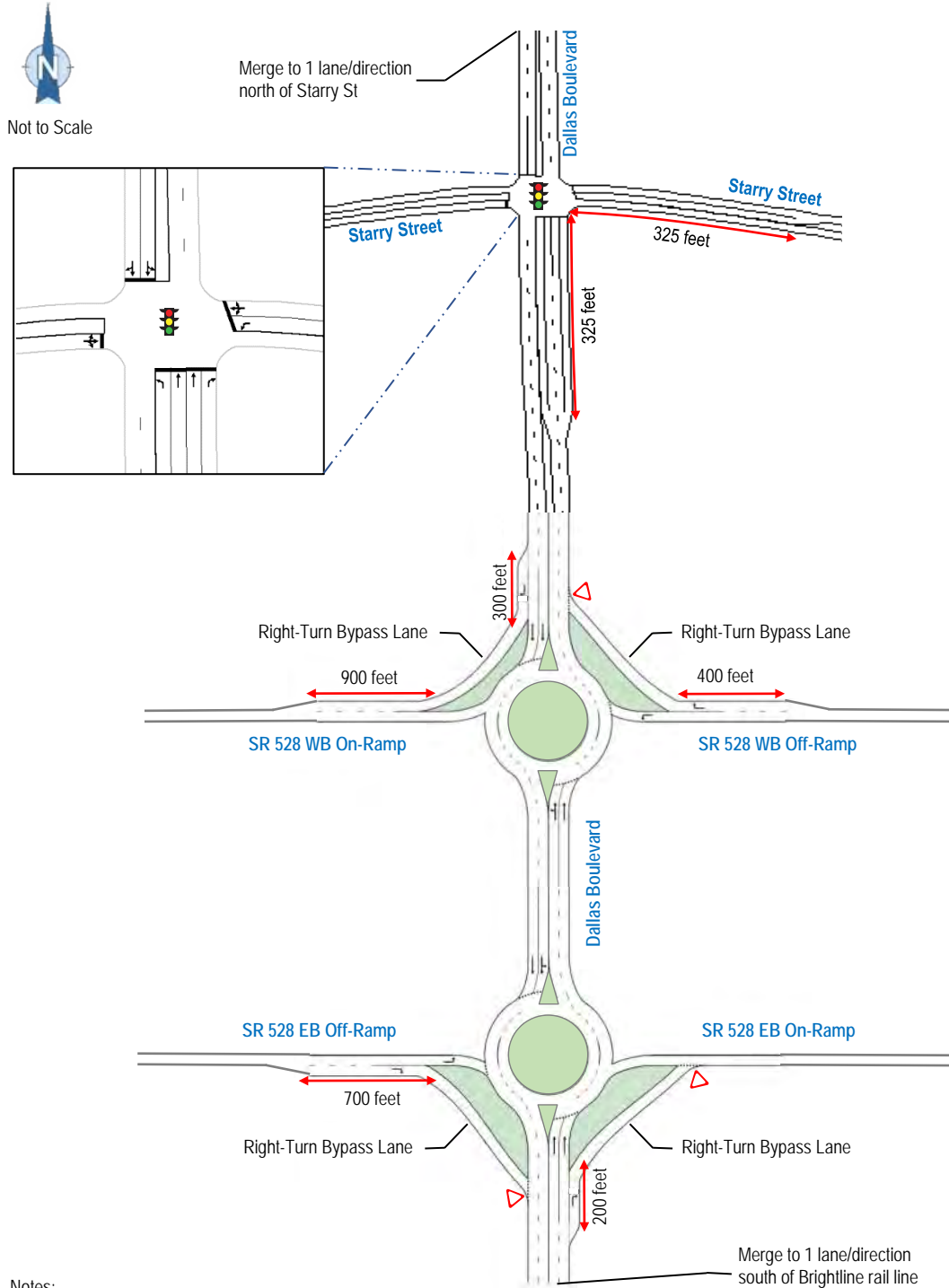
In the 2050 design year interim Build conditions (**Tables 3.17** and **3.18**), most of the movements are expected to operate at an acceptable LOS D or better at the proposed Dallas Boulevard and SR 528 interchange ramp terminals for both the roundabout and signalized intersection alternatives, except for the northbound through and right turns at the SR 528 eastbound ramps terminal in the PM. These movements are anticipated to operate at an unacceptable LOS F for the roundabout alternative and E for the signalized intersection in the interim conditions, indicating that additional capacity improvements will be required along Dallas Boulevard. The year of need for the four-lane widening of Dallas Boulevard and an ultimate interchange configuration will depend on the pace at which development occurs in the region. Information obtained during the PD&E study indicated that most of the planned development in the area will occur beyond year 2050. The interim interchange operations will need to be monitored as development occurs to determine when the ultimate configurations will need to be implemented.

Signalization of the Dallas Boulevard and Starry Street intersection was assumed in the 2050 intersection analysis since signalization will be warranted by then. The results show that most of the movements are expected to operate at LOS D or better, except for the westbound movements in the AM and northbound movements in the PM which are anticipated to operate at LOS F. Turn lane improvements can be added to the intersection when a signal is warranted.

#### ***Build Conditions - Ultimate***

Preliminary analysis was conducted to determine lane geometry for an ultimate configuration when Dallas Boulevard is widened to four lanes. Based on the initial analysis, the lane geometry presented in **Figures 3.9** and **3.10** was developed. However, further evaluation will need to be conducted to refine the ultimate intersections lane geometry as development occurs in the area and a need for widening Dallas Boulevard is determined.

**Figure 3.9**  
**Proposed Lane Geometry and Storage Lengths for**  
**Roundabout Interchange Alternative – Ultimate**



**Notes:**

Lane tapers not included in storage lengths

Ramp Length 1,500 feet minimum

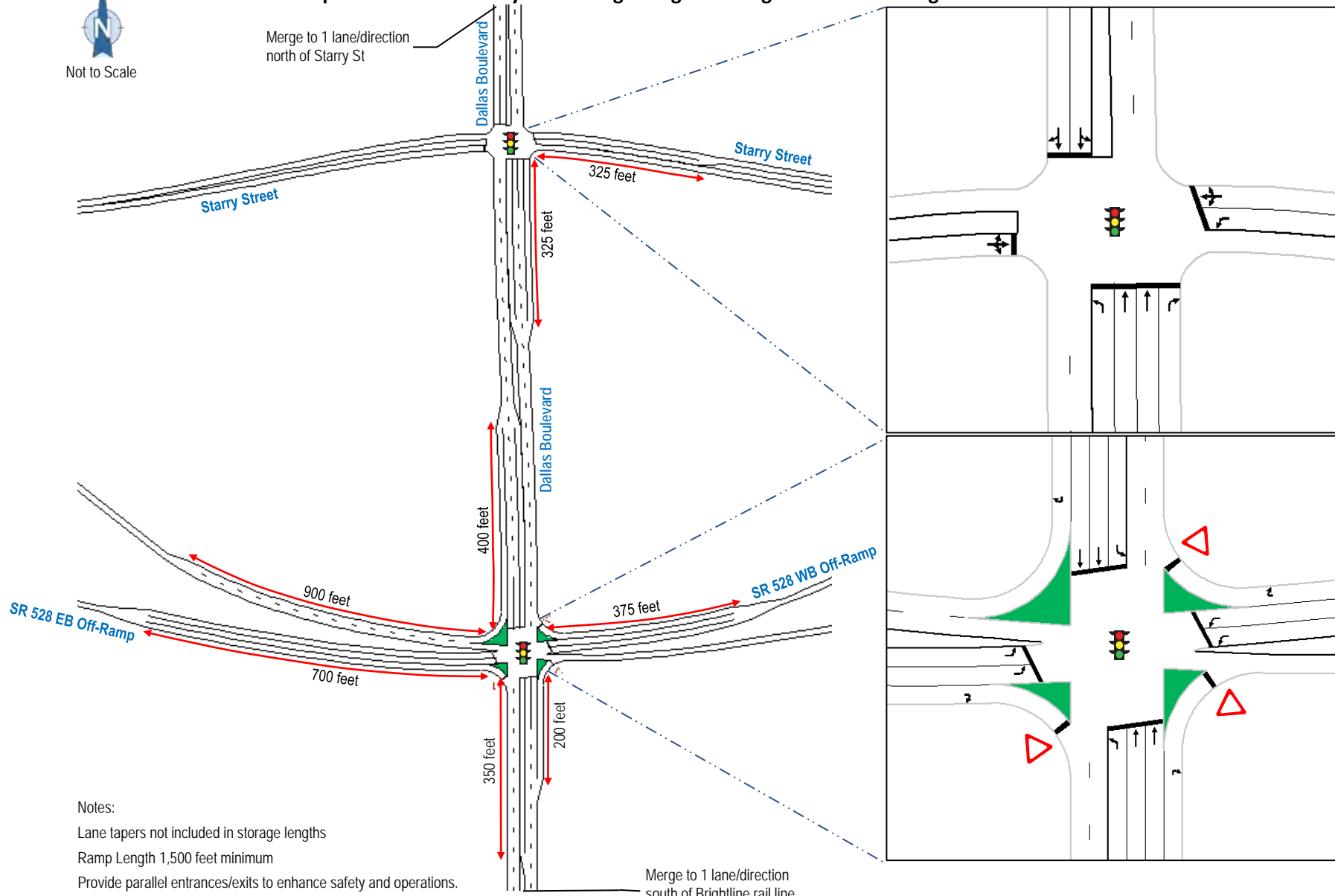
Provide parallel entrances/exits to enhance safety and operations.

Schematic provided for illustration purposes only, design to be based on guidelines. E.g., adjust roundabout shape and bypass channelization appropriately.



**Figure 3.10**

**Proposed Lane Geometry and Storage Lengths for Signalized Interchange Alternative – Ultimate**



Notes:  
 Lane tapers not included in storage lengths  
 Ramp Length 1,500 feet minimum  
 Provide parallel entrances/exits to enhance safety and operations.  
 Schematic provided for illustration purposes only, design to be based on guidelines.

## 4.0 Conclusion

The SR 528 and Dallas Boulevard interchange PD&E study is evaluating addition of ramps to/from east and improving the ramp terminal intersections. Addition of ramps to and from the east will provide more efficient access points to better serve trips originating or ending in the Wedgefield residential area, as well as other planned developments along SR 528 near the interchange of Dallas Boulevard. The analysis showed that traffic would be diverted from the SR 520 ramps to/from the east of SR 528 to the proposed Dallas Boulevard ramps and new trips would be induced due to planned future developments in the area.

Two configurations for the interchange (roundabout and signalized) were proposed during the feasibility study for the project and carried forward for evaluation in the PD&E study. It was determined during the PD&E study that, even with the proposed full interchange, Dallas Boulevard would remain a two-lane roadway until demand triggers a need for widening. Therefore, the analysis was conducted to determine interim lane geometry requirements for the full interchange with a two-lane typical section for Dallas Boulevard. Both the roundabout and signalized interchange alternatives are expected to operate acceptably in the interim conditions. The existing All-Way-Stop Control at the Dallas Boulevard and Starry Street intersection is not expected to impact the interchange by the 2030 opening year, based on traffic projections. However, when the interchange is open to traffic, operations will need to be monitored at the Starry Street intersection and data collected after traffic stabilizes to evaluate when signalization and/or addition of turn lanes will be required.

The year of need for the four-lane widening of Dallas Boulevard and an ultimate interchange configuration will depend on the pace at which development occurs in the region. Information obtained during the PD&E study indicated that most of the planned development in the area will occur beyond year 2050. The interim interchange operations will need to be monitored as development occurs to determine when the ultimate configurations will need to be implemented. Preliminary analysis was conducted to determine lane geometry for an ultimate configuration when Dallas Boulevard is widened to four lanes. Both the roundabout and signalized interchange alternatives are expected to operate acceptably in the long term with the proposed ultimate lane geometry. However, further evaluation will need to be conducted to refine the ultimate intersections lane geometry as development occurs in the area and a need for widening Dallas Boulevard is determined.

# Appendices



## Appendix A

### Existing Conditions Analysis:

- HCS Reports
- Synchro/SimTraffic Reports



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1730	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	938
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.40
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	12.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1730	75
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1875	81
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.42	0.04

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.268
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	65.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	1875	Ramp Junction Speed (S), mi/h	65.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	1956	Average Density (D), pc/mi/ln	15.0
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	15.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1805	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	978
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	13.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1805	223
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1957	242
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.42	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.331
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	1957	Ramp Junction Speed (S), mi/h	63.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	15.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.7



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1582	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	858
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.36
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	11.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1582	256
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1715	278
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.36	0.14

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.335
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	62.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	1715	Ramp Junction Speed (S), mi/h	62.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	13.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1326	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	718
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.31
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	9.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1326	65
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1437	70
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.32	0.03

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.304
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	1437	Ramp Junction Speed (S), mi/h	63.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	1507	Average Density (D), pc/mi/ln	11.8
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	14.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1391	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	754
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.32
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	10.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1706	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	924
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.39
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	12.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1706	86
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1849	93
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.39	0.05

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.318
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	1849	Ramp Junction Speed (S), mi/h	63.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	14.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1620	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	878
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.37
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	11.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1620	226
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1756	245
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.43	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.293
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	1756	Ramp Junction Speed (S), mi/h	64.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	2001	Average Density (D), pc/mi/ln	15.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.0

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1846	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1000
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.43
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	13.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1846	545
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2001	591
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.29

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.300
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	2001	Ramp Junction Speed (S), mi/h	64.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2592	Average Density (D), pc/mi/ln	20.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2391	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1296
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2391	85
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2592	92
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.04

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.318
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	2592	Ramp Junction Speed (S), mi/h	63.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	20.4
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing AM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2306	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1250
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2300	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1246
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2300	101
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2493	109
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.05

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.294
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	2493	Ramp Junction Speed (S), mi/h	64.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	2602	Average Density (D), pc/mi/ln	20.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.1



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2401	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1302
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	18.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2401	351
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2603	381
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.19

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.344
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	62.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	2603	Ramp Junction Speed (S), mi/h	62.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	20.8
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2050	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1111
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.4
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	15.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2050	402
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2222	436
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.47	0.21

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.349
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	62.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	2222	Ramp Junction Speed (S), mi/h	62.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	17.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1648	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	894
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.38
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	12.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1648	45
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1787	49
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.39	0.02

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.311
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	1787	Ramp Junction Speed (S), mi/h	63.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	1836	Average Density (D), pc/mi/ln	14.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.4

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1693	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	918
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.39
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	12.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1884	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1021
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.43
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	13.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/24/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1884	139
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2042	151
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.43	0.07

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.323
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	2042	Ramp Junction Speed (S), mi/h	63.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	16.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.7

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1745	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	946
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.40
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	12.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1745	185
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	1892	201
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.44	0.10

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.296
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	1892	Ramp Junction Speed (S), mi/h	64.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	2093	Average Density (D), pc/mi/ln	16.3
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	1930	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1046
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	14.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	1930	192
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2092	208
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.49	0.10

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.287
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	73.5
Flow in Lanes 1 and 2 (v12), pc/h	2092	Ramp Junction Speed (S), mi/h	64.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2300	Average Density (D), pc/mi/ln	17.8
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2122	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1150
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	15.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/18/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2122	62
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2300	67
Capacity (c), pc/h	4704	2058
Volume-to-Capacity Ratio (v/c)	0.49	0.03

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.316
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	80.6
Flow in Lanes 1 and 2 (v12), pc/h	2300	Ramp Junction Speed (S), mi/h	63.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	18.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/17/2023
Agency	CDM Smith	Analysis Year	2022
Jurisdiction	Orange County	Time Analyzed	Existing PM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2060	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1116
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.4
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	15.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		





Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	110	113	0	108	11	0
Future Volume (vph)	110	113	0	108	11	0
Satd. Flow (prot)	1770	1583	0	1863	1863	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1583	0	1863	1863	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	116	119	0	114	12	0
Sign Control	Stop		Free		Free	

**Intersection Summary**

















Control Type: Unsignalized

Intersection Capacity Utilization 18.4% ICU Level of Service A

Analysis Period (min) 15



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕	↕	
Traffic Volume (vph)	0	0	93	125	11	452
Future Volume (vph)	0	0	93	125	11	452
Satd. Flow (prot)	0	0	0	1824	1617	0
Flt Permitted				0.979		
Satd. Flow (perm)	0	0	0	1824	1617	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	237	503	0
Sign Control	Stop			Free	Free	
<b>Intersection Summary</b>						
Control Type: Unsignalized						
Intersection Capacity Utilization 46.9%			ICU Level of Service A			
Analysis Period (min) 15						

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	1	15	125	0	1	5	84	36	0	323	0
Future Volume (vph)	4	1	15	125	0	1	5	84	36	0	323	0
Satd. Flow (prot)	0	1656	0	0	1773	0	0	1787	0	0	1863	0
Flt Permitted		0.991			0.953			0.998				
Satd. Flow (perm)	0	1656	0	0	1773	0	0	1787	0	0	1863	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	21	0	0	137	0	0	135	0	0	351	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 37.3% ICU Level of Service A												
Analysis Period (min) 15												

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:30	6:30	6:30	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	1620	1663	1558	1560	1649	1589	1682
Vehs Exited	1617	1668	1558	1570	1648	1599	1688
Starting Vehs	25	26	19	26	22	22	21
Ending Vehs	28	21	19	16	23	12	15
Travel Distance (mi)	1229	1264	1182	1184	1246	1205	1270
Travel Time (hr)	39.1	40.2	37.4	37.7	39.6	38.1	40.6
Total Delay (hr)	5.6	5.7	5.2	5.4	5.6	5.3	5.8
Total Stops	1453	1473	1380	1371	1432	1364	1482
Fuel Used (gal)	51.8	54.3	50.2	51.1	53.6	51.9	54.7

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	1627	1596	1606	1615
Vehs Exited	1631	1602	1597	1617
Starting Vehs	20	23	12	20
Ending Vehs	16	17	21	16
Travel Distance (mi)	1230	1211	1205	1223
Travel Time (hr)	39.3	38.5	38.1	38.9
Total Delay (hr)	5.7	5.4	5.4	5.5
Total Stops	1445	1420	1395	1422
Fuel Used (gal)	52.6	51.8	51.3	52.3

Interval #0 Information Seeding

Start Time	6:30
End Time	7:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	1620	1663	1558	1560	1649	1589	1682
Vehs Exited	1617	1668	1558	1570	1648	1599	1688
Starting Vehs	25	26	19	26	22	22	21
Ending Vehs	28	21	19	16	23	12	15
Travel Distance (mi)	1229	1264	1182	1184	1246	1205	1270
Travel Time (hr)	39.1	40.2	37.4	37.7	39.6	38.1	40.6
Total Delay (hr)	5.6	5.7	5.2	5.4	5.6	5.3	5.8
Total Stops	1453	1473	1380	1371	1432	1364	1482
Fuel Used (gal)	51.8	54.3	50.2	51.1	53.6	51.9	54.7

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	1627	1596	1606	1615
Vehs Exited	1631	1602	1597	1617
Starting Vehs	20	23	12	20
Ending Vehs	16	17	21	16
Travel Distance (mi)	1230	1211	1205	1223
Travel Time (hr)	39.3	38.5	38.1	38.9
Total Delay (hr)	5.7	5.4	5.4	5.5
Total Stops	1445	1420	1395	1422
Fuel Used (gal)	52.6	51.8	51.3	52.3

**Intersection: 1: SR 528 EB Ramps & Dallas Boulevard**

Movement	EB
Directions Served	L
Maximum Queue (ft)	66
Average Queue (ft)	29
95th Queue (ft)	47
Link Distance (ft)	1607
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 2: Dallas Boulevard & SR 528 WB Ramps**

Movement	NB
Directions Served	LT
Maximum Queue (ft)	38
Average Queue (ft)	2
95th Queue (ft)	14
Link Distance (ft)	569
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 3: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	42	87	66	105
Average Queue (ft)	15	38	33	53
95th Queue (ft)	40	62	48	80
Link Distance (ft)	972	978	253	1246
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 0
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Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	345	6	0	52	4	0
Future Volume (vph)	345	6	0	52	4	0
Satd. Flow (prot)	1770	1583	0	1863	1863	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1583	0	1863	1863	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	363	6	0	55	4	0
Sign Control	Stop		Free		Free	

**Intersection Summary**

Control Type: Unsignalized

Intersection Capacity Utilization 29.1% ICU Level of Service A

Analysis Period (min) 15



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕	↕	
Traffic Volume (vph)	0	0	26	371	4	166
Future Volume (vph)	0	0	26	371	4	166
Satd. Flow (prot)	0	0	0	1857	1617	0
Flt Permitted				0.997		
Satd. Flow (perm)	0	0	0	1857	1617	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	431	184	0
Sign Control	Stop			Free	Free	

















**Intersection Summary**

Control Type: Unsignalized

Intersection Capacity Utilization 38.1% ICU Level of Service A

Analysis Period (min) 15



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	1	9	43	1	2	13	248	110	1	118	4
Future Volume (vph)	1	1	9	43	1	2	13	248	110	1	118	4
Satd. Flow (prot)	0	1646	0	0	1770	0	0	1785	0	0	1855	0
Flt Permitted		0.996			0.955			0.998				
Satd. Flow (perm)	0	1646	0	0	1770	0	0	1785	0	0	1855	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	12	0	0	50	0	0	404	0	0	133	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 44.5% ICU Level of Service A												
Analysis Period (min) 15												

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:30	4:30	4:30	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	1122	1180	1214	1169	1119	1216	1206
Vehs Exited	1125	1182	1218	1174	1116	1225	1210
Starting Vehs	19	17	16	18	15	19	15
Ending Vehs	16	15	12	13	18	10	11
Travel Distance (mi)	901	960	980	945	901	983	976
Travel Time (hr)	28.7	30.9	31.6	30.2	28.8	31.4	31.1
Total Delay (hr)	4.9	5.6	5.7	5.3	4.9	5.6	5.6
Total Stops	1690	1849	1858	1788	1706	1856	1839
Fuel Used (gal)	35.2	37.8	38.2	37.3	35.3	38.8	38.0

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	1176	1192	1212	1182
Vehs Exited	1180	1191	1206	1183
Starting Vehs	17	18	13	16
Ending Vehs	13	19	19	13
Travel Distance (mi)	950	956	977	953
Travel Time (hr)	30.4	30.5	31.2	30.5
Total Delay (hr)	5.3	5.3	5.6	5.4
Total Stops	1782	1799	1859	1803
Fuel Used (gal)	37.4	38.1	38.2	37.4

Interval #0 Information Seeding

Start Time	4:30
End Time	5:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	1122	1180	1214	1169	1119	1216	1206
Vehs Exited	1125	1182	1218	1174	1116	1225	1210
Starting Vehs	19	17	16	18	15	19	15
Ending Vehs	16	15	12	13	18	10	11
Travel Distance (mi)	901	960	980	945	901	983	976
Travel Time (hr)	28.7	30.9	31.6	30.2	28.8	31.4	31.1
Total Delay (hr)	4.9	5.6	5.7	5.3	4.9	5.6	5.6
Total Stops	1690	1849	1858	1788	1706	1856	1839
Fuel Used (gal)	35.2	37.8	38.2	37.3	35.3	38.8	38.0

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	1176	1192	1212	1182
Vehs Exited	1180	1191	1206	1183
Starting Vehs	17	18	13	16
Ending Vehs	13	19	19	13
Travel Distance (mi)	950	956	977	953
Travel Time (hr)	30.4	30.5	31.2	30.5
Total Delay (hr)	5.3	5.3	5.6	5.4
Total Stops	1782	1799	1859	1803
Fuel Used (gal)	37.4	38.1	38.2	37.4

**Intersection: 1: SR 528 EB Ramps & Dallas Boulevard**

Movement	EB
Directions Served	L
Maximum Queue (ft)	109
Average Queue (ft)	50
95th Queue (ft)	80
Link Distance (ft)	1607
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 2: Dallas Boulevard & SR 528 WB Ramps**

Movement	NB
Directions Served	LT
Maximum Queue (ft)	3
Average Queue (ft)	0
95th Queue (ft)	3
Link Distance (ft)	569
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

**Intersection: 3: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	38	62	90	68
Average Queue (ft)	8	25	41	34
95th Queue (ft)	31	48	65	52
Link Distance (ft)	972	978	253	1246
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 0
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## Appendix B

### Future Conditions Analysis:

- HCS Reports
- SIDRA Reports
- Synchro/SimTraffic Reports



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3460	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1250
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3460	110
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3751	119
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.06

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.283
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1489
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	69.9
Flow in Lanes 1 and 2 (v12), pc/h	2262	Ramp Junction Speed (S), mi/h	66.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2381	Average Density (D), pc/mi/ln	19.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.4

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3570	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1290
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3570	260
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3870	282
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.14

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.335
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1256
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	62.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.650	Outer Lanes Freeway Speed (SO), mi/h	79.6
Flow in Lanes 1 and 2 (v12), pc/h	2614	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3310	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1196
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3310	560
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3588	607
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.51	0.29

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.364
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1067
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	62.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.642	Outer Lanes Freeway Speed (SO), mi/h	80.4
Flow in Lanes 1 and 2 (v12), pc/h	2521	Ramp Junction Speed (S), mi/h	66.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	18.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2750	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	994
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.42
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	13.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2750	240
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	2981	260
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.46	0.13

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	771.1	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.316
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	1228
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	70.9
Flow in Lanes 1 and 2 (v12), pc/h	1753	Ramp Junction Speed (S), mi/h	66.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2013	Average Density (D), pc/mi/ln	16.3
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.7

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2990	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1080
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	14.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3500	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1265
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3500	130
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3794	141
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.54	0.07

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.322
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1246
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	63.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.659	Outer Lanes Freeway Speed (SO), mi/h	79.7
Flow in Lanes 1 and 2 (v12), pc/h	2548	Ramp Junction Speed (S), mi/h	68.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	18.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.1



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3370	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1218
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3370	360
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3653	390
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.57	0.19

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1053.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.315
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1479
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	2174	Ramp Junction Speed (S), mi/h	65.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	2564	Average Density (D), pc/mi/ln	20.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.4

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3730	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1348
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	18.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3730	670
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4044	726
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.68	0.35

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.340
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1614
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	62.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	69.5
Flow in Lanes 1 and 2 (v12), pc/h	2430	Ramp Junction Speed (S), mi/h	64.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	3156	Average Density (D), pc/mi/ln	24.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.7

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4400	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1590
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	69.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	22.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4400	150
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4770	163
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.68	0.08

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.324
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1691
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.633	Outer Lanes Freeway Speed (SO), mi/h	77.9
Flow in Lanes 1 and 2 (v12), pc/h	3079	Ramp Junction Speed (S), mi/h	67.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	23.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4250	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1536
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	70.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	21.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4140	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1496
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	70.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	21.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4140	150
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4488	163
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.66	0.08

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.310
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1782
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	68.9
Flow in Lanes 1 and 2 (v12), pc/h	2706	Ramp Junction Speed (S), mi/h	65.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	2869	Average Density (D), pc/mi/ln	23.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4290	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1550
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	70.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	22.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4290	560
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4651	607
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.66	0.29

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.364
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1553
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	62.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.616	Outer Lanes Freeway Speed (SO), mi/h	78.5
Flow in Lanes 1 and 2 (v12), pc/h	3098	Ramp Junction Speed (S), mi/h	66.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	23.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3730	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1348
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	18.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3730	560
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4044	607
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.57	0.29

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.364
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1268
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	62.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.631	Outer Lanes Freeway Speed (SO), mi/h	79.6
Flow in Lanes 1 and 2 (v12), pc/h	2776	Ramp Junction Speed (S), mi/h	66.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	20.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.0

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3170	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1146
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	15.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3170	130
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3437	141
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.51	0.07

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	843.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.320
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	1416
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	70.2
Flow in Lanes 1 and 2 (v12), pc/h	2021	Ramp Junction Speed (S), mi/h	65.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2162	Average Density (D), pc/mi/ln	18.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.9

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3300	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1192
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3190	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1153
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.49
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	15.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3190	240
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3458	260
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.49	0.13

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.333
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1081
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	63.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.662	Outer Lanes Freeway Speed (SO), mi/h	80.3
Flow in Lanes 1 and 2 (v12), pc/h	2377	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	17.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2950	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1066
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	14.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2950	360
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3198	390
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.51	0.19

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	956.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.303
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1295
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	70.6
Flow in Lanes 1 and 2 (v12), pc/h	1903	Ramp Junction Speed (S), mi/h	66.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	2293	Average Density (D), pc/mi/ln	18.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3310	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1196
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3310	260
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3588	282
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.14

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.293
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1432
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	70.1
Flow in Lanes 1 and 2 (v12), pc/h	2156	Ramp Junction Speed (S), mi/h	66.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	2438	Average Density (D), pc/mi/ln	19.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3570	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1290
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3570	110
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3870	119
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.06

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.320
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1283
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.658	Outer Lanes Freeway Speed (SO), mi/h	79.5
Flow in Lanes 1 and 2 (v12), pc/h	2587	Ramp Junction Speed (S), mi/h	68.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	19.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.1



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3460	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1250
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5080	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1836
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	65.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	28.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5080	170
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5507	184
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.09

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.371
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2186
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	67.4
Flow in Lanes 1 and 2 (v12), pc/h	3321	Ramp Junction Speed (S), mi/h	63.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	3505	Average Density (D), pc/mi/ln	29.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1897
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	29.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5250	390
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5691	423
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.21

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.348
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2118
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	62.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.598	Outer Lanes Freeway Speed (SO), mi/h	76.3
Flow in Lanes 1 and 2 (v12), pc/h	3573	Ramp Junction Speed (S), mi/h	67.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4860	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1756
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.75
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	67.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	26.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4860	820
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5269	889
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.75	0.43

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1809
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.587	Outer Lanes Freeway Speed (SO), mi/h	77.5
Flow in Lanes 1 and 2 (v12), pc/h	3460	Ramp Junction Speed (S), mi/h	66.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	26.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4040	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1460
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.62
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	71.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	20.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4040	430
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4380	466
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.69	0.23

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1114.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.368
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	1805
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	68.8
Flow in Lanes 1 and 2 (v12), pc/h	2575	Ramp Junction Speed (S), mi/h	64.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3041	Average Density (D), pc/mi/ln	25.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4470	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1615
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	69.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	23.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5170	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1868
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.79
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	28.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5170	220
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5605	238
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.79	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.331
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2098
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	63.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.609	Outer Lanes Freeway Speed (SO), mi/h	76.3
Flow in Lanes 1 and 2 (v12), pc/h	3507	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	27.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4950	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1789
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	66.4
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	26.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4950	520
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5366	564
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.84	0.27

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1457.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.432
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2173
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	67.5
Flow in Lanes 1 and 2 (v12), pc/h	3193	Ramp Junction Speed (S), mi/h	62.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	3757	Average Density (D), pc/mi/ln	31.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5470	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1977
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	62.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	31.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5470	900
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5930	976
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.98	0.47

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.614
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2366
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	66.6
Flow in Lanes 1 and 2 (v12), pc/h	3564	Ramp Junction Speed (S), mi/h	57.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4540	Average Density (D), pc/mi/ln	39.8
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.3



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6370	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2302
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.98
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	53.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	42.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	6370	220
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6906	238
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.98	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.331
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2700
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.576	Outer Lanes Freeway Speed (SO), mi/h	74.0
Flow in Lanes 1 and 2 (v12), pc/h	4206	Ramp Junction Speed (S), mi/h	67.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.4
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	38.0

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build AM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6150	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2222
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	56.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	39.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6070	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2193
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	57.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	38.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	6070	220
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6580	238
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.97	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.503
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2612
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	57.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	65.1
Flow in Lanes 1 and 2 (v12), pc/h	3968	Ramp Junction Speed (S), mi/h	60.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	4206	Average Density (D), pc/mi/ln	37.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6290	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2273
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.97
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	54.7
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	41.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	6290	820
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6819	889
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.97	0.43

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2674
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.549	Outer Lanes Freeway Speed (SO), mi/h	74.1
Flow in Lanes 1 and 2 (v12), pc/h	4145	Ramp Junction Speed (S), mi/h	65.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5470	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1977
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	62.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	31.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard off-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5470	820
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5930	889
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.84	0.43

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2163
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.571	Outer Lanes Freeway Speed (SO), mi/h	76.1
Flow in Lanes 1 and 2 (v12), pc/h	3767	Ramp Junction Speed (S), mi/h	65.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	30.0
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4650	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1680
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.71
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	68.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	24.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4650	220
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5041	238
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.75	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1207.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.382
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	2077
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	67.8
Flow in Lanes 1 and 2 (v12), pc/h	2964	Ramp Junction Speed (S), mi/h	63.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	3202	Average Density (D), pc/mi/ln	27.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	28.0

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4870	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1760
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.75
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	66.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	26.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4770	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1724
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.73
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	67.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	25.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4770	430
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5171	466
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.73	0.23

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.352
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1840
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	62.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.609	Outer Lanes Freeway Speed (SO), mi/h	77.4
Flow in Lanes 1 and 2 (v12), pc/h	3331	Ramp Junction Speed (S), mi/h	67.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	25.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4340	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1568
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	69.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	22.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4340	520
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4705	564
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.75	0.27

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1316.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.377
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1906
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	68.4
Flow in Lanes 1 and 2 (v12), pc/h	2799	Ramp Junction Speed (S), mi/h	63.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	3363	Average Density (D), pc/mi/ln	27.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.5



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4860	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1756
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.75
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	67.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	26.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4860	390
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5269	423
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.21

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2102
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	67.7
Flow in Lanes 1 and 2 (v12), pc/h	3167	Ramp Junction Speed (S), mi/h	63.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	3590	Average Density (D), pc/mi/ln	29.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1897
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	29.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5250	170
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5691	184
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.09

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.326
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2153
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.609	Outer Lanes Freeway Speed (SO), mi/h	76.1
Flow in Lanes 1 and 2 (v12), pc/h	3538	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	1/26/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	No Build PM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5080	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1836
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	65.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	28.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3460	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1250
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3460	110
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3751	119
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.06

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.283
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1489
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	69.9
Flow in Lanes 1 and 2 (v12), pc/h	2262	Ramp Junction Speed (S), mi/h	66.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2381	Average Density (D), pc/mi/ln	19.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	18.4

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3570	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1290
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3570	260
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3870	282
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.14

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.335
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1256
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	62.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.650	Outer Lanes Freeway Speed (SO), mi/h	79.6
Flow in Lanes 1 and 2 (v12), pc/h	2614	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3310	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1196
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3310	160
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3588	173
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.53	0.08

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	882.3	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.325
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1478
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	2110	Ramp Junction Speed (S), mi/h	65.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	2283	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3470	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1254
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3470	560
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3762	607
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.53	0.29

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.364
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1142
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	62.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.638	Outer Lanes Freeway Speed (SO), mi/h	80.1
Flow in Lanes 1 and 2 (v12), pc/h	2620	Ramp Junction Speed (S), mi/h	66.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	18.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	2910	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1052
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	14.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	2910	190
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3155	206
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.48	0.10

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	796.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.317
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	1300
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	70.6
Flow in Lanes 1 and 2 (v12), pc/h	1855	Ramp Junction Speed (S), mi/h	66.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	2061	Average Density (D), pc/mi/ln	16.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3100	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1120
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.4
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	15.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3590	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1297
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3590	100
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3892	108
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.05

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.319
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1294
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	63.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.658	Outer Lanes Freeway Speed (SO), mi/h	79.5
Flow in Lanes 1 and 2 (v12), pc/h	2598	Ramp Junction Speed (S), mi/h	68.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3490	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1261
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3490	360
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3783	390
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.59	0.19

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1081.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.319
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1532
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	69.8
Flow in Lanes 1 and 2 (v12), pc/h	2251	Ramp Junction Speed (S), mi/h	65.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	2641	Average Density (D), pc/mi/ln	21.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.0

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3850	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1391
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.59
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	71.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	19.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3850	120
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4174	130
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.59	0.06

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.321
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1415
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	63.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.650	Outer Lanes Freeway Speed (SO), mi/h	79.0
Flow in Lanes 1 and 2 (v12), pc/h	2759	Ramp Junction Speed (S), mi/h	67.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	20.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	25.9

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3730	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1348
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	18.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3730	670
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4044	726
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.68	0.35

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1291.4	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.340
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1614
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	62.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	69.5
Flow in Lanes 1 and 2 (v12), pc/h	2430	Ramp Junction Speed (S), mi/h	64.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	3156	Average Density (D), pc/mi/ln	24.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.7



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4400	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1590
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.68
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	69.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	22.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4400	150
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4770	163
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.68	0.08

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.324
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1691
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.633	Outer Lanes Freeway Speed (SO), mi/h	77.9
Flow in Lanes 1 and 2 (v12), pc/h	3079	Ramp Junction Speed (S), mi/h	67.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	23.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4250	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1536
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	70.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	21.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4140	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1496
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	70.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	21.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4140	150
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4488	163
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.66	0.08

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.310
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1782
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	68.9
Flow in Lanes 1 and 2 (v12), pc/h	2706	Ramp Junction Speed (S), mi/h	65.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	2869	Average Density (D), pc/mi/ln	23.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4290	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1550
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	70.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	22.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4290	560
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4651	607
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.66	0.29

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.364
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1553
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	62.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.616	Outer Lanes Freeway Speed (SO), mi/h	78.5
Flow in Lanes 1 and 2 (v12), pc/h	3098	Ramp Junction Speed (S), mi/h	66.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	23.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3730	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1348
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	18.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3730	100
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4044	108
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.59	0.05

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	966.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.333
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1666
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	69.3
Flow in Lanes 1 and 2 (v12), pc/h	2378	Ramp Junction Speed (S), mi/h	65.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	2486	Average Density (D), pc/mi/ln	21.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.4

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3830	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1384
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.59
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	71.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	19.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3830	560
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4152	607
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.59	0.29

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.364
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1319
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	62.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.628	Outer Lanes Freeway Speed (SO), mi/h	79.4
Flow in Lanes 1 and 2 (v12), pc/h	2833	Ramp Junction Speed (S), mi/h	66.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	20.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3270	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1182
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3270	100
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3545	108
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.52	0.05

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	859.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.322
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	1461
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	2084	Ramp Junction Speed (S), mi/h	65.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2192	Average Density (D), pc/mi/ln	18.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3370	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1218
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3320	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1200
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3320	190
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3599	206
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.51	0.10

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.328
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1150
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	63.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.661	Outer Lanes Freeway Speed (SO), mi/h	80.0
Flow in Lanes 1 and 2 (v12), pc/h	2449	Ramp Junction Speed (S), mi/h	67.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	17.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.2



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3130	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1131
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	15.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3130	360
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3393	390
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.54	0.19

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	998.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.308
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1374
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	63.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	70.4
Flow in Lanes 1 and 2 (v12), pc/h	2019	Ramp Junction Speed (S), mi/h	66.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2409	Average Density (D), pc/mi/ln	19.1
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3490	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1261
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.54
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3490	180
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3783	195
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.54	0.09

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.327
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1234
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	63.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.656	Outer Lanes Freeway Speed (SO), mi/h	79.7
Flow in Lanes 1 and 2 (v12), pc/h	2549	Ramp Junction Speed (S), mi/h	67.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	18.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3310	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1196
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.51
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	73.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	16.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3310	260
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3588	282
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.14

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1098.8	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.293
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1432
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	70.1
Flow in Lanes 1 and 2 (v12), pc/h	2156	Ramp Junction Speed (S), mi/h	66.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	2438	Average Density (D), pc/mi/ln	19.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3570	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1290
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.55
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.6
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	3570	110
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	3870	119
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.55	0.06

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.320
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1283
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.658	Outer Lanes Freeway Speed (SO), mi/h	79.5
Flow in Lanes 1 and 2 (v12), pc/h	2587	Ramp Junction Speed (S), mi/h	68.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	19.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.1



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2030
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	3460	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1250
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	72.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	17.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5080	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1836
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	65.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	28.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5080	170
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5507	184
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.09

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.371
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2186
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	67.4
Flow in Lanes 1 and 2 (v12), pc/h	3321	Ramp Junction Speed (S), mi/h	63.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	3505	Average Density (D), pc/mi/ln	29.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.1

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1897
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	29.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5250	390
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5691	423
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.21

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.348
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2118
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	62.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.598	Outer Lanes Freeway Speed (SO), mi/h	76.3
Flow in Lanes 1 and 2 (v12), pc/h	3573	Ramp Junction Speed (S), mi/h	67.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4860	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1756
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.75
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	67.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	26.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4860	330
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5269	358
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.80	0.17

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1281.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.410
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2171
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	60.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	67.5
Flow in Lanes 1 and 2 (v12), pc/h	3098	Ramp Junction Speed (S), mi/h	63.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	3456	Average Density (D), pc/mi/ln	29.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	29.9

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5190	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1875
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.7
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	29.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5190	820
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5626	889
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.80	0.43

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1999
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.578	Outer Lanes Freeway Speed (SO), mi/h	76.7
Flow in Lanes 1 and 2 (v12), pc/h	3627	Ramp Junction Speed (S), mi/h	65.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	33.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4370	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1579
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.67
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	69.7
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	22.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4370	340
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	4737	369
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.72	0.18

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1170.2	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.378
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	1952
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	68.3
Flow in Lanes 1 and 2 (v12), pc/h	2785	Ramp Junction Speed (S), mi/h	64.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3154	Average Density (D), pc/mi/ln	26.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4710	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1702
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.72
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	67.9
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	25.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5290	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1912
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	29.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5290	180
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5735	195
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.09

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.327
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2172
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	63.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.608	Outer Lanes Freeway Speed (SO), mi/h	76.1
Flow in Lanes 1 and 2 (v12), pc/h	3563	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5110	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1847
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.79
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	65.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	28.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5110	520
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5540	564
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.87	0.27

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1494.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.450
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2244
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	67.2
Flow in Lanes 1 and 2 (v12), pc/h	3296	Ramp Junction Speed (S), mi/h	62.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3860	Average Density (D), pc/mi/ln	32.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.4



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5630	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2034
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.86
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	61.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	33.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5630	160
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6103	173
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.86	0.08

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.325
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2378
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	63.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.599	Outer Lanes Freeway Speed (SO), mi/h	75.3
Flow in Lanes 1 and 2 (v12), pc/h	3725	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	30.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	34.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5470	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1977
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	62.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	31.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5470	900
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5930	976
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.98	0.47

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1748.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.614
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2366
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	66.6
Flow in Lanes 1 and 2 (v12), pc/h	3564	Ramp Junction Speed (S), mi/h	57.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4540	Average Density (D), pc/mi/ln	39.8
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.3

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6370	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2302
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.98
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	53.8
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	42.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), In	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	6370	220
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6906	238
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.98	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.331
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2700
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.576	Outer Lanes Freeway Speed (SO), mi/h	74.0
Flow in Lanes 1 and 2 (v12), pc/h	4206	Ramp Junction Speed (S), mi/h	67.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.4
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	38.0

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build AM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6150	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2222
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.94
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	56.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	39.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Upstream of Innovation Way on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6070	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2193
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	57.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	38.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	908
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	6070	220
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6580	238
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.97	0.12

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.503
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2612
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	57.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.603	Outer Lanes Freeway Speed (SO), mi/h	65.1
Flow in Lanes 1 and 2 (v12), pc/h	3968	Ramp Junction Speed (S), mi/h	60.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	4206	Average Density (D), pc/mi/ln	37.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	6290	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2273
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.97
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	54.7
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	41.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Innovation Way on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	6290	820
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6819	889
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.97	0.43

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2674
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.549	Outer Lanes Freeway Speed (SO), mi/h	74.1
Flow in Lanes 1 and 2 (v12), pc/h	4145	Ramp Junction Speed (S), mi/h	65.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	34.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.5

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5470	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1977
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	62.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	31.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5470	160
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5930	173
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.86	0.08

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1383.5	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.438
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2443
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	66.1
Flow in Lanes 1 and 2 (v12), pc/h	3487	Ramp Junction Speed (S), mi/h	62.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	3660	Average Density (D), pc/mi/ln	32.8
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.6

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5630	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	2034
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.86
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	61.2
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	33.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5630	820
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	6103	889
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.86	0.43

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2258
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.567	Outer Lanes Freeway Speed (SO), mi/h	75.7
Flow in Lanes 1 and 2 (v12), pc/h	3845	Ramp Junction Speed (S), mi/h	65.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	30.9
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	35.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4810	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1738
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	67.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	25.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	390
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4810	180
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5214	195
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.77	0.09

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1235.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.388
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (VOA), pc/h/ln	2148
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.588	Outer Lanes Freeway Speed (SO), mi/h	67.6
Flow in Lanes 1 and 2 (v12), pc/h	3066	Ramp Junction Speed (S), mi/h	63.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	3261	Average Density (D), pc/mi/ln	28.3
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.4

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Downstream of SR 520 on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4990	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1803
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	66.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	27.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5010	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1810
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.77
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	66.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	27.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Upstream of SR 520 off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5010	340
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5431	369
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.77	0.18

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (Ds)	0.343
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1989
Distance to Downstream Ramp (LDOWN), ft	2091	Off-Ramp Influence Area Speed (SR), mi/h	62.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.607	Outer Lanes Freeway Speed (SO), mi/h	76.8
Flow in Lanes 1 and 2 (v12), pc/h	3442	Ramp Junction Speed (S), mi/h	67.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	26.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	31.8

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4670	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1688
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.72
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	68.1
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	24.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	640
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4670	520
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5063	564
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.80	0.27

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1392.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2091	Speed Index (MS)	0.404
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2051
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	60.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.595	Outer Lanes Freeway Speed (SO), mi/h	67.9
Flow in Lanes 1 and 2 (v12), pc/h	3012	Ramp Junction Speed (S), mi/h	63.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	3576	Average Density (D), pc/mi/ln	29.7
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	29.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5190	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1875
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.7
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	29.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	SR 520 on-ramp to Dallas Boulevard off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	230
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5190	330
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5626	358
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.80	0.17

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.342
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2091
Distance to Downstream Ramp (LDOWN), ft	2519	Off-Ramp Influence Area Speed (SR), mi/h	62.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.603	Outer Lanes Freeway Speed (SO), mi/h	76.4
Flow in Lanes 1 and 2 (v12), pc/h	3535	Ramp Junction Speed (S), mi/h	67.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	27.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.6



# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/8/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard off-ramp to on-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, In	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	4860	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1756
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.75
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	67.0
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	26.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Merge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	825
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	4860	390
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5269	423
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.21

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	1488.7	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	2519	Speed Index (MS)	0.390
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2102
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	61.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.601	Outer Lanes Freeway Speed (SO), mi/h	67.7
Flow in Lanes 1 and 2 (v12), pc/h	3167	Ramp Junction Speed (S), mi/h	63.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	3590	Average Density (D), pc/mi/ln	29.9
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5250	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1897
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (ET)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	64.3
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	29.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		

# HCS7 Freeway Diverge Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Dallas Boulevard on-ramp to Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	75.0	45.0
Segment Length (L) / Deceleration Length (LA),ft	1500	270
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

## Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Final Speed Adjustment Factor (SAF)	0.980	0.980
Final Capacity Adjustment Factor (CAF)	0.980	0.980
Demand Adjustment Factor (DAF)	1.000	1.000

## Demand and Capacity

Demand Volume (Vi)	5250	170
Peak Hour Factor (PHF)	0.95	0.95
Total Trucks, %	3.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	0.971	0.971
Flow Rate (vi),pc/h	5691	184
Capacity (c), pc/h	7056	2058
Volume-to-Capacity Ratio (v/c)	0.81	0.09

## Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (DS)	0.326
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2153
Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	63.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.609	Outer Lanes Freeway Speed (SO), mi/h	76.1
Flow in Lanes 1 and 2 (v12), pc/h	3538	Ramp Junction Speed (S), mi/h	67.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	32.2

# HCS7 Basic Freeway Report

## Project Information

Analyst	CDM Smith	Date	2/13/2023
Agency	CDM Smith	Analysis Year	2050
Jurisdiction	Orange County	Time Analyzed	Build PM Peak
Project Description	Downstream of Innovation Way off-ramp	Units	U.S. Customary

## Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	75.0
Right-Side Lateral Clearance, ft	-		

## Adjustment Factors

Driver Population	Mostly Familiar	Final Speed Adjustment Factor (SAF)	0.980
Weather Type	Non-Severe Weather	Final Capacity Adjustment Factor (CAF)	0.980
Incident Type	No Incident	Demand Adjustment Factor (DAF)	1.000

## Demand and Capacity

Demand Volume veh/h	5080	Heavy Vehicle Adjustment Factor (fhv)	0.971
Peak Hour Factor	0.95	Flow Rate (Vp), pc/h/ln	1836
Total Trucks, %	3.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (cadj), pc/h/ln	2352
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (Et)	2.00		

## Speed and Density

Lane Width Adjustment (fLW)	-	Average Speed (S), mi/h	65.5
Right-Side Lateral Clearance Adj. (fRLC)	-	Density (D), pc/mi/ln	28.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFSadj), mi/h	73.5		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	120	140	0	260	290	0
Future Volume (vph)	120	140	0	260	290	0
Satd. Flow (prot)	1770	1583	0	1863	1863	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1583	0	1863	1863	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	126	147	0	274	305	0
Sign Control	Stop		Free		Free	

**Intersection Summary**

















Control Type: Unsignalized

Intersection Capacity Utilization 30.6% ICU Level of Service A

Analysis Period (min) 15



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕	↕	
Traffic Volume (vph)	0	0	170	210	290	500
Future Volume (vph)	0	0	170	210	290	500
Satd. Flow (prot)	0	0	0	1822	1704	0
Flt Permitted				0.978		
Satd. Flow (perm)	0	0	0	1822	1704	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	400	831	0
Sign Control	Stop			Free	Free	
<b>Intersection Summary</b>						
Control Type: Unsignalized						
Intersection Capacity Utilization 73.1%				ICU Level of Service D		
Analysis Period (min) 15						

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	10	20	210	10	10	10	100	100	10	560	10
Future Volume (vph)	10	10	20	210	10	10	10	100	100	10	560	10
Satd. Flow (prot)	0	1717	0	0	1772	0	0	1740	0	0	1857	0
Flt Permitted		0.987			0.957			0.998			0.999	
Satd. Flow (perm)	0	1717	0	0	1772	0	0	1740	0	0	1857	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	43	0	0	243	0	0	221	0	0	611	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 59.5% ICU Level of Service B												
Analysis Period (min) 15												



Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:30	6:30	6:30	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	2743	2825	2747	2665	2747	2765	2813
Vehs Exited	2749	2833	2741	2667	2765	2757	2829
Starting Vehs	39	41	27	36	53	29	42
Ending Vehs	33	33	33	34	35	37	26
Travel Distance (mi)	1969	2032	1975	1910	1974	1978	2029
Travel Time (hr)	68.1	69.8	67.2	65.6	67.8	68.0	70.4
Total Delay (hr)	14.3	14.6	13.4	13.4	13.8	14.2	15.1
Total Stops	2758	2841	2713	2607	2720	2764	2838
Fuel Used (gal)	79.9	82.8	80.1	78.0	80.2	80.2	83.0

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	2799	2738	2831	2767
Vehs Exited	2818	2735	2825	2772
Starting Vehs	45	36	34	36
Ending Vehs	26	39	40	32
Travel Distance (mi)	2016	1967	2026	1988
Travel Time (hr)	70.0	67.6	69.8	68.4
Total Delay (hr)	14.7	13.8	14.6	14.2
Total Stops	2765	2751	2797	2755
Fuel Used (gal)	82.1	80.4	81.9	80.9

Interval #0 Information Seeding

Start Time	6:30
End Time	7:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	2743	2825	2747	2665	2747	2765	2813
Vehs Exited	2749	2833	2741	2667	2765	2757	2829
Starting Vehs	39	41	27	36	53	29	42
Ending Vehs	33	33	33	34	35	37	26
Travel Distance (mi)	1969	2032	1975	1910	1974	1978	2029
Travel Time (hr)	68.1	69.8	67.2	65.6	67.8	68.0	70.4
Total Delay (hr)	14.3	14.6	13.4	13.4	13.8	14.2	15.1
Total Stops	2758	2841	2713	2607	2720	2764	2838
Fuel Used (gal)	79.9	82.8	80.1	78.0	80.2	80.2	83.0

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	2799	2738	2831	2767
Vehs Exited	2818	2735	2825	2772
Starting Vehs	45	36	34	36
Ending Vehs	26	39	40	32
Travel Distance (mi)	2016	1967	2026	1988
Travel Time (hr)	70.0	67.6	69.8	68.4
Total Delay (hr)	14.7	13.8	14.6	14.2
Total Stops	2765	2751	2797	2755
Fuel Used (gal)	82.1	80.4	81.9	80.9

**Intersection: 1: SR 528 EB Ramps & Dallas Boulevard**

Movement	EB	EB
Directions Served	L	R
Maximum Queue (ft)	85	47
Average Queue (ft)	37	2
95th Queue (ft)	64	18
Link Distance (ft)	1607	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	720	
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 2: Dallas Boulevard & SR 528 WB Ramps**

Movement	NB	SB
Directions Served	LT	TR
Maximum Queue (ft)	176	20
Average Queue (ft)	58	1
95th Queue (ft)	118	8
Link Distance (ft)	569	253
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 3: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	54	103	96	252
Average Queue (ft)	24	53	45	102
95th Queue (ft)	48	83	71	174
Link Distance (ft)	972	978	253	1246
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 0
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Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	400	160	0	210	120	0
Future Volume (vph)	400	160	0	210	120	0
Satd. Flow (prot)	1770	1583	0	1863	1863	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1583	0	1863	1863	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	421	168	0	221	126	0
Sign Control	Stop		Free		Free	

**Intersection Summary**

















Control Type: Unsignalized

Intersection Capacity Utilization 39.9% ICU Level of Service A

Analysis Period (min) 15



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕	↕	
Traffic Volume (vph)	0	0	70	540	120	190
Future Volume (vph)	0	0	70	540	120	190
Satd. Flow (prot)	0	0	0	1852	1708	0
Flt Permitted				0.994		
Satd. Flow (perm)	0	0	0	1852	1708	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	642	326	0
Sign Control	Stop			Free	Free	
<b>Intersection Summary</b>						
Control Type: Unsignalized						
Intersection Capacity Utilization 56.9%				ICU Level of Service B		
Analysis Period (min) 15						

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	10	20	90	10	10	20	330	190	10	200	10
Future Volume (vph)	10	10	20	90	10	10	20	330	190	10	200	10
Satd. Flow (prot)	0	1717	0	0	1767	0	0	1770	0	0	1848	0
Flt Permitted		0.987			0.961			0.998			0.998	
Satd. Flow (perm)	0	1717	0	0	1767	0	0	1770	0	0	1848	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	43	0	0	117	0	0	568	0	0	233	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 55.8% ICU Level of Service B												
Analysis Period (min) 15												

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:30	4:30	4:30	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	2244	2322	2231	2304	2268	2302	2294
Vehs Exited	2236	2324	2233	2301	2258	2299	2291
Starting Vehs	24	28	28	26	19	21	25
Ending Vehs	32	26	26	29	29	24	28
Travel Distance (mi)	1667	1732	1650	1715	1691	1711	1710
Travel Time (hr)	55.1	57.7	54.1	57.1	56.4	56.2	56.4
Total Delay (hr)	10.7	11.8	10.2	11.6	11.4	10.7	11.1
Total Stops	2656	2759	2628	2741	2699	2689	2690
Fuel Used (gal)	62.7	65.3	62.4	64.5	63.8	64.2	64.4

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	2285	2317	2391	2295
Vehs Exited	2266	2328	2392	2294
Starting Vehs	27	35	23	23
Ending Vehs	46	24	22	26
Travel Distance (mi)	1690	1728	1777	1707
Travel Time (hr)	56.6	57.5	58.9	56.6
Total Delay (hr)	11.6	11.6	11.9	11.3
Total Stops	2753	2792	2824	2722
Fuel Used (gal)	63.4	65.4	66.7	64.3

Interval #0 Information Seeding

Start Time	4:30
End Time	5:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	2244	2322	2231	2304	2268	2302	2294
Vehs Exited	2236	2324	2233	2301	2258	2299	2291
Starting Vehs	24	28	28	26	19	21	25
Ending Vehs	32	26	26	29	29	24	28
Travel Distance (mi)	1667	1732	1650	1715	1691	1711	1710
Travel Time (hr)	55.1	57.7	54.1	57.1	56.4	56.2	56.4
Total Delay (hr)	10.7	11.8	10.2	11.6	11.4	10.7	11.1
Total Stops	2656	2759	2628	2741	2699	2689	2690
Fuel Used (gal)	62.7	65.3	62.4	64.5	63.8	64.2	64.4

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	2285	2317	2391	2295
Vehs Exited	2266	2328	2392	2294
Starting Vehs	27	35	23	23
Ending Vehs	46	24	22	26
Travel Distance (mi)	1690	1728	1777	1707
Travel Time (hr)	56.6	57.5	58.9	56.6
Total Delay (hr)	11.6	11.6	11.9	11.3
Total Stops	2753	2792	2824	2722
Fuel Used (gal)	63.4	65.4	66.7	64.3



**Intersection: 1: SR 528 EB Ramps & Dallas Boulevard**

Movement	EB	EB
Directions Served	L	R
Maximum Queue (ft)	217	44
Average Queue (ft)	85	1
95th Queue (ft)	150	15
Link Distance (ft)	1607	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		720
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 2: Dallas Boulevard & SR 528 WB Ramps**

Movement	NB	SB
Directions Served	LT	TR
Maximum Queue (ft)	100	3
Average Queue (ft)	13	0
95th Queue (ft)	51	2
Link Distance (ft)	569	253
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 3: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	52	72	102	92
Average Queue (ft)	23	36	59	45
95th Queue (ft)	47	56	85	70
Link Distance (ft)	972	978	253	1246
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 0
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Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	150	240	0	510	540	0
Future Volume (vph)	150	240	0	510	540	0
Satd. Flow (prot)	1770	1583	0	1863	1863	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1583	0	1863	1863	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	158	253	0	537	568	0
Sign Control	Stop		Free		Free	

**Intersection Summary**

















Control Type: Unsignalized

Intersection Capacity Utilization 49.9% ICU Level of Service A

Analysis Period (min) 15



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕	↕	
Traffic Volume (vph)	0	0	270	390	540	630
Future Volume (vph)	0	0	270	390	540	630
Satd. Flow (prot)	0	0	0	1825	1727	0
Flt Permitted				0.980		
Satd. Flow (perm)	0	0	0	1825	1727	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	695	1231	0
Sign Control	Stop			Free	Free	
<b>Intersection Summary</b>						
Control Type: Unsignalized						
Intersection Capacity Utilization 109.1%				ICU Level of Service H		
Analysis Period (min) 15						

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	20	30	380	20	20	30	160	200	20	760	20
Future Volume (vph)	20	20	30	380	20	20	30	160	200	20	760	20
Satd. Flow (prot)	0	1730	0	0	1772	0	0	1727	0	0	1855	0
Flt Permitted		0.986			0.957			0.996			0.999	
Satd. Flow (perm)	0	1730	0	0	1772	0	0	1727	0	0	1855	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	74	0	0	442	0	0	411	0	0	842	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 82.9% ICU Level of Service E												
Analysis Period (min) 15												

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:30	6:30	6:30	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	4052	4134	4091	4104	4035	4079	4142
Vehs Exited	4066	4124	4107	4097	4043	4070	4136
Starting Vehs	110	97	115	103	110	97	90
Ending Vehs	96	107	99	110	102	106	96
Travel Distance (mi)	2852	2904	2891	2877	2840	2838	2911
Travel Time (hr)	524.4	572.7	548.7	531.7	527.3	487.2	506.3
Total Delay (hr)	446.2	493.1	469.4	452.6	449.2	409.3	426.2
Total Stops	3490	3640	3610	3687	3296	3373	3681
Fuel Used (gal)	209.1	222.6	215.8	211.7	209.3	199.4	207.8

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	4103	4088	4167	4099
Vehs Exited	4110	4094	4166	4100
Starting Vehs	103	114	95	101
Ending Vehs	96	108	96	102
Travel Distance (mi)	2887	2862	2927	2879
Travel Time (hr)	512.7	586.1	526.7	532.4
Total Delay (hr)	433.6	507.4	446.5	453.3
Total Stops	3474	3525	3451	3523
Fuel Used (gal)	207.6	223.7	211.9	211.9

Interval #0 Information Seeding

Start Time	6:30
End Time	7:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	4052	4134	4091	4104	4035	4079	4142
Vehs Exited	4066	4124	4107	4097	4043	4070	4136
Starting Vehs	110	97	115	103	110	97	90
Ending Vehs	96	107	99	110	102	106	96
Travel Distance (mi)	2852	2904	2891	2877	2840	2838	2911
Travel Time (hr)	524.4	572.7	548.7	531.7	527.3	487.2	506.3
Total Delay (hr)	446.2	493.1	469.4	452.6	449.2	409.3	426.2
Total Stops	3490	3640	3610	3687	3296	3373	3681
Fuel Used (gal)	209.1	222.6	215.8	211.7	209.3	199.4	207.8

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	4103	4088	4167	4099
Vehs Exited	4110	4094	4166	4100
Starting Vehs	103	114	95	101
Ending Vehs	96	108	96	102
Travel Distance (mi)	2887	2862	2927	2879
Travel Time (hr)	512.7	586.1	526.7	532.4
Total Delay (hr)	433.6	507.4	446.5	453.3
Total Stops	3474	3525	3451	3523
Fuel Used (gal)	207.6	223.7	211.9	211.9

**Intersection: 1: SR 528 EB Ramps & Dallas Boulevard**

Movement	EB	EB	NB
Directions Served	L	R	T
Maximum Queue (ft)	227	107	105
Average Queue (ft)	71	19	5
95th Queue (ft)	161	64	70
Link Distance (ft)	1607		1254
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)		720	
Storage Blk Time (%)			
Queuing Penalty (veh)			

**Intersection: 2: Dallas Boulevard & SR 528 WB Ramps**

Movement	NB	SB
Directions Served	LT	TR
Maximum Queue (ft)	532	77
Average Queue (ft)	218	14
95th Queue (ft)	432	50
Link Distance (ft)	569	253
Upstream Blk Time (%)	0	
Queuing Penalty (veh)	2	
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 3: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	77	273	215	1304
Average Queue (ft)	32	106	94	1269
95th Queue (ft)	57	195	157	1290
Link Distance (ft)	972	978	253	1246
Upstream Blk Time (%)			0	100
Queuing Penalty (veh)			0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 2
------------------------------



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	540	280	0	680	220	0
Future Volume (vph)	540	280	0	680	220	0
Satd. Flow (prot)	1770	1583	0	1863	1863	0
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1583	0	1863	1863	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%		0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	568	295	0	716	232	0
Sign Control	Stop		Free		Free	

**Intersection Summary**

Control Type: Unsignalized

Intersection Capacity Utilization 72.4% ICU Level of Service C

Analysis Period (min) 15





















Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations				↕	↕	
Traffic Volume (vph)	0	0	140	1080	220	250
Future Volume (vph)	0	0	140	1080	220	250
Satd. Flow (prot)	0	0	0	1852	1729	0
Flt Permitted				0.994		
Satd. Flow (perm)	0	0	0	1852	1729	0
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						
Mid-Block Traffic (%)	0%			0%	0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1284	495	0
Sign Control	Stop			Free	Free	

**Intersection Summary**

Control Type: Unsignalized

Intersection Capacity Utilization 98.1% ICU Level of Service F

Analysis Period (min) 15

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	20	30	170	20	20	50	640	390	20	270	20
Future Volume (vph)	20	20	30	170	20	20	50	640	390	20	270	20
Satd. Flow (prot)	0	1730	0	0	1767	0	0	1768	0	0	1840	0
Flt Permitted		0.986			0.961			0.998			0.997	
Satd. Flow (perm)	0	1730	0	0	1767	0	0	1768	0	0	1840	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	74	0	0	221	0	0	1138	0	0	326	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 97.5% ICU Level of Service F												
Analysis Period (min) 15												

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:30	4:30	4:30	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	3328	3408	3415	3410	3431	3468	3453
Vehs Exited	3351	3419	3426	3415	3430	3463	3445
Starting Vehs	167	157	150	150	146	143	137
Ending Vehs	144	146	139	145	147	148	145
Travel Distance (mi)	2349	2384	2396	2378	2414	2421	2421
Travel Time (hr)	1067.1	1260.2	1188.5	1077.3	1190.5	1106.9	1125.7
Total Delay (hr)	1003.8	1195.8	1124.0	1013.3	1125.7	1041.6	1060.5
Total Stops	4193	4291	4895	4635	4161	4652	4274
Fuel Used (gal)	311.7	356.6	340.4	314.3	341.4	322.6	327.5

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	3442	3396	3508	3428
Vehs Exited	3427	3397	3481	3425
Starting Vehs	139	151	131	148
Ending Vehs	154	150	158	147
Travel Distance (mi)	2387	2354	2439	2394
Travel Time (hr)	1195.3	1322.2	1243.9	1177.8
Total Delay (hr)	1131.1	1258.9	1178.2	1113.3
Total Stops	4842	4919	4590	4545
Fuel Used (gal)	341.1	368.3	354.1	337.8

Interval #0 Information Seeding

Start Time	4:30
End Time	5:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	3328	3408	3415	3410	3431	3468	3453
Vehs Exited	3351	3419	3426	3415	3430	3463	3445
Starting Vehs	167	157	150	150	146	143	137
Ending Vehs	144	146	139	145	147	148	145
Travel Distance (mi)	2349	2384	2396	2378	2414	2421	2421
Travel Time (hr)	1067.1	1260.2	1188.5	1077.3	1190.5	1106.9	1125.7
Total Delay (hr)	1003.8	1195.8	1124.0	1013.3	1125.7	1041.6	1060.5
Total Stops	4193	4291	4895	4635	4161	4652	4274
Fuel Used (gal)	311.7	356.6	340.4	314.3	341.4	322.6	327.5

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	3442	3396	3508	3428
Vehs Exited	3427	3397	3481	3425
Starting Vehs	139	151	131	148
Ending Vehs	154	150	158	147
Travel Distance (mi)	2387	2354	2439	2394
Travel Time (hr)	1195.3	1322.2	1243.9	1177.8
Total Delay (hr)	1131.1	1258.9	1178.2	1113.3
Total Stops	4842	4919	4590	4545
Fuel Used (gal)	341.1	368.3	354.1	337.8

**Intersection: 1: SR 528 EB Ramps & Dallas Boulevard**

Movement	EB	EB
Directions Served	L	R
Maximum Queue (ft)	1622	820
Average Queue (ft)	1616	802
95th Queue (ft)	1622	998
Link Distance (ft)	1607	
Upstream Blk Time (%)	46	
Queuing Penalty (veh)	376	
Storage Bay Dist (ft)		720
Storage Blk Time (%)	100	
Queuing Penalty (veh)	280	

**Intersection: 2: Dallas Boulevard & SR 528 WB Ramps**

Movement	NB	SB
Directions Served	LT	TR
Maximum Queue (ft)	392	3
Average Queue (ft)	133	0
95th Queue (ft)	295	3
Link Distance (ft)	569	253
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 3: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	62	103	260	121
Average Queue (ft)	31	50	211	57
95th Queue (ft)	53	79	293	91
Link Distance (ft)	972	978	253	1246
Upstream Blk Time (%)			2	
Queuing Penalty (veh)			17	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 673

# MOVEMENT SUMMARY

**Site: 1 [Dallas Boulevard at SR 528 EB Ramps (Site Folder: 2030 AM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2030 AM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
8	T1	260	2.0	274	2.0	0.341	6.6	LOS A	1.9	47.7	0.43	0.30	0.43	21.3
18	R2	100	2.0	105	2.0	0.341	6.6	LOS A	1.9	47.7	0.43	0.30	0.43	31.0
Approach		360	2.0	379	2.0	0.341	6.6	LOS A	1.9	47.7	0.43	0.30	0.43	24.7
North: Dallas Boulevard														
7	L2	60	2.0	63	2.0	0.327	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	36.7
4	T1	360	2.0	379	2.0	0.327	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	34.2
Approach		420	2.0	442	2.0	0.327	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	34.7
West: SR 528 EB Off-Ramp														
5	L2	120	2.0	126	2.0	0.137	5.2	LOS A	0.5	13.7	0.48	0.41	0.48	26.8
12	R2	140	2.0	147	2.0	0.150	5.1	LOS A	0.6	15.4	0.46	0.37	0.46	32.1
Approach		260	2.0	274	2.0	0.150	5.1	LOS A	0.6	15.4	0.47	0.39	0.47	29.5
All Vehicles		1040	2.0	1095	2.0	0.341	5.8	LOS A	1.9	47.7	0.27	0.20	0.27	29.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.  
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).  
 Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).  
 Roundabout Capacity Model: US HCM 6.  
 Delay Model: HCM Delay Formula (Geometric Delay is not included).  
 Queue Model: HCM Queue Formula.  
 Gap-Acceptance Capacity: Traditional M1.  
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# MOVEMENT SUMMARY

**Site: 2 [Dallas Boulevard at SR 528 WB Ramps (Site Folder: 2030 AM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2030 AM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
3	L2	170	2.0	179	2.0	0.296	5.3	LOS A	0.0	0.0	0.00	0.00	0.00	35.0
8	T1	210	2.0	221	2.0	0.296	5.3	LOS A	0.0	0.0	0.00	0.00	0.00	31.9
Approach		380	2.0	400	2.0	0.296	5.3	LOS A	0.0	0.0	0.00	0.00	0.00	33.6
East: SR 528 WB Off-Ramp														
1	L2	70	2.0	74	2.0	0.077	4.4	LOS A	0.3	7.4	0.44	0.34	0.44	27.2
16	R2	50	2.0	53	2.0	0.046	3.6	LOS A	0.2	4.5	0.32	0.19	0.32	33.2
Approach		120	2.0	126	2.0	0.077	4.1	LOS A	0.3	7.4	0.39	0.28	0.39	29.5
North: Dallas Boulevard														
4	T1	350	2.0	368	2.0	0.335	6.6	LOS A	1.7	42.2	0.45	0.34	0.45	25.0
14	R2	500	2.0	526	2.0	0.321	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.0
Approach		850	2.0	895	2.0	0.335	2.7	LOS A	1.7	42.2	0.19	0.14	0.19	32.2
All Vehicles		1350	2.0	1421	2.0	0.335	3.5	LOS A	1.7	42.2	0.15	0.11	0.15	32.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

Delay Model: HCM Delay Formula (Geometric Delay is not included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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South: Dallas Boulevard

This approach does not have any continuous lanes

North: Dallas Boulevard

This approach does not have any continuous lanes

West: SR 528 EB Off-Ramp

This approach does not have any continuous lanes

Midblock Effective Detection Zone Length = 7 ft

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	v/c	mph	Delay sec	sec	Length ft	ft	sec	sec	Ratio %	Ratio % veh/mi	pc/mi	Method)	
South: Dallas Boulevard													
This approach does not have any continuous lanes													
East: SR 528 WB Off-Ramp													
This approach does not have any continuous lanes													
North: Dallas Boulevard													
Lane 2	0.321	39.9	0.0	6.84	399.8	17.4	0.69	6.15	4.3	10.1	13.2	13.4	LOS B

Midblock Effective Detection Zone Length = 7 ft

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# MOVEMENT SUMMARY

**Site: 1 [Dallas Boulevard at SR 528 EB Ramps (Site Folder: 2030 PM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2050 PM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
8	T1	210	2.0	221	2.0	0.340	8.2	LOS A	1.6	41.6	0.61	0.58	0.61	20.5
18	R2	60	2.0	63	2.0	0.340	8.2	LOS A	1.6	41.6	0.61	0.58	0.61	30.0
Approach		270	2.0	284	2.0	0.340	8.2	LOS A	1.6	41.6	0.61	0.58	0.61	23.2
North: Dallas Boulevard														
7	L2	40	2.0	42	2.0	0.210	4.4	LOS A	0.0	0.0	0.00	0.00	0.00	36.6
4	T1	230	2.0	242	2.0	0.210	4.4	LOS A	0.0	0.0	0.00	0.00	0.00	34.2
Approach		270	2.0	284	2.0	0.210	4.4	LOS A	0.0	0.0	0.00	0.00	0.00	34.7
West: SR 528 EB Off-Ramp														
5	L2	400	2.0	421	2.0	0.394	7.5	LOS A	2.0	52.0	0.50	0.40	0.50	25.7
12	R2	160	2.0	168	2.0	0.151	4.6	LOS A	0.6	16.1	0.37	0.25	0.37	32.4
Approach		560	2.0	589	2.0	0.394	6.7	LOS A	2.0	52.0	0.47	0.36	0.47	27.4
All Vehicles		1100	2.0	1158	2.0	0.394	6.5	LOS A	2.0	52.0	0.39	0.33	0.39	27.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

Delay Model: HCM Delay Formula (Geometric Delay is not included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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# MOVEMENT SUMMARY

**Site: 2 [Dallas Boulevard at SR 528 WB Ramps (Site Folder: 2030 PM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2050 PM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
3	L2	70	2.0	74	2.0	0.475	7.4	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
8	T1	540	2.0	568	2.0	0.475	7.4	LOS A	0.0	0.0	0.00	0.00	0.00	34.4
Approach		610	2.0	642	2.0	0.475	7.4	LOS A	0.0	0.0	0.00	0.00	0.00	34.9
East: SR 528 WB Off-Ramp														
1	L2	110	2.0	116	2.0	0.151	6.3	LOS A	0.6	14.6	0.56	0.54	0.56	26.3
16	R2	70	2.0	74	2.0	0.090	5.3	LOS A	0.3	8.5	0.52	0.46	0.52	32.0
Approach		180	2.0	189	2.0	0.151	5.9	LOS A	0.6	14.6	0.55	0.51	0.55	28.3
North: Dallas Boulevard														
4	T1	160	2.0	168	2.0	0.144	4.3	LOS A	0.6	15.4	0.33	0.20	0.33	26.9
14	R2	190	2.0	200	2.0	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.0
Approach		350	2.0	368	2.0	0.144	2.0	LOS A	0.6	15.4	0.15	0.09	0.15	32.7
All Vehicles		1140	2.0	1200	2.0	0.475	5.5	LOS A	0.6	15.4	0.13	0.11	0.13	32.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

Delay Model: HCM Delay Formula (Geometric Delay is not included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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South: Dallas Boulevard

This approach does not have any continuous lanes

North: Dallas Boulevard

This approach does not have any continuous lanes

West: SR 528 EB Off-Ramp

This approach does not have any continuous lanes

Midblock Effective Detection Zone Length = 7 ft

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	v/c	mph	Delay sec	sec	Length ft	ft	sec	sec	Ratio %	Ratio %	veh/mi	pc/mi	Method)
South: Dallas Boulevard													
This approach does not have any continuous lanes													
East: SR 528 WB Off-Ramp													
This approach does not have any continuous lanes													
North: Dallas Boulevard													
Lane 2	0.122	40.0	0.0	18.00	1054.8	17.4	0.69	17.31	1.6	3.8	5.0	5.1	LOS A

Midblock Effective Detection Zone Length = 7 ft

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# MOVEMENT SUMMARY

**Site: 1 [Dallas Boulevard at SR 528 EB Ramps (Site Folder: 2050 AM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2050 AM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
8	T1	510	2.0	537	2.0	0.751	17.4	LOS C	14.0	355.6	0.86	1.07	1.56	16.4
18	R2	200	2.0	211	2.0	0.751	17.4	LOS C	14.0	355.6	0.86	1.07	1.56	25.5
Approach		710	2.0	747	2.0	0.751	17.4	LOS C	14.0	355.6	0.86	1.07	1.56	19.5
North: Dallas Boulevard														
7	L2	130	2.0	137	2.0	0.607	9.7	LOS A	0.0	0.0	0.00	0.00	0.00	36.5
4	T1	650	2.0	684	2.0	0.607	9.7	LOS A	0.0	0.0	0.00	0.00	0.00	34.0
Approach		780	2.0	821	2.0	0.607	9.7	LOS A	0.0	0.0	0.00	0.00	0.00	34.6
West: SR 528 EB Off-Ramp														
5	L2	150	2.0	158	2.0	0.243	8.5	LOS A	0.9	23.8	0.64	0.64	0.64	25.2
12	R2	240	2.0	253	2.0	0.342	9.1	LOS A	1.5	38.8	0.65	0.67	0.71	29.6
Approach		390	2.0	411	2.0	0.342	8.9	LOS A	1.5	38.8	0.64	0.66	0.68	27.8
All Vehicles		1880	2.0	1979	2.0	0.751	12.4	LOS B	14.0	355.6	0.46	0.54	0.73	25.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

Delay Model: HCM Delay Formula (Geometric Delay is not included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# MOVEMENT SUMMARY

**Site: 2 [Dallas Boulevard at SR 528 WB Ramps (Site Folder: 2050 AM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2050 AM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
3	L2	270	2.0	284	2.0	0.514	8.0	LOS A	0.0	0.0	0.00	0.00	0.00	35.2
8	T1	390	2.0	411	2.0	0.514	8.0	LOS A	0.0	0.0	0.00	0.00	0.00	32.2
Approach		660	2.0	695	2.0	0.514	8.0	LOS A	0.0	0.0	0.00	0.00	0.00	33.8
East: SR 528 WB Off-Ramp														
1	L2	110	2.0	116	2.0	0.159	6.6	LOS A	0.6	15.3	0.58	0.58	0.58	26.1
16	R2	50	2.0	53	2.0	0.055	4.3	LOS A	0.2	5.3	0.44	0.33	0.44	32.7
Approach		160	2.0	168	2.0	0.159	5.9	LOS A	0.6	15.3	0.54	0.50	0.54	27.9
North: Dallas Boulevard														
4	T1	670	2.0	705	2.0	0.734	17.0	LOS C	11.1	282.8	0.84	1.12	1.61	18.7
14	R2	630	2.0	663	2.0	0.404	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	35.9
Approach		1300	2.0	1368	2.0	0.734	8.8	LOS A	11.1	282.8	0.43	0.58	0.83	27.1
All Vehicles		2120	2.0	2232	2.0	0.734	8.3	LOS A	11.1	282.8	0.30	0.39	0.55	28.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

Delay Model: HCM Delay Formula (Geometric Delay is not included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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# QUEUE ANALYSIS

**Site: 1 [Dallas Boulevard at SR 528 EB Ramps (Site Folder: 2050 AM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2050 AM Build  
 Site Category: (None)  
 Roundabout

Lane Queues (Distance)															
Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (ft)	Back of Queue (ft)		Queue at Start of Green (ft)		Cycle Average Queue (ft)		Queue Storage Ratio		Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
					Av.	95%	Av.	95%	Av.	95%	Av.	95%			
South: Dallas Boulevard															
Lane 1		0.751	1.000	47.1	143.1	355.6	NA	NA	91.6	166.1	0.22	0.54	0.0	NA	NA
Approach		0.751			143.1	355.6	NA	NA	91.6	166.1	0.22	0.54			
North: Dallas Boulevard															
Lane 1		0.607	1.000	0.0	0.0	0.0	NA	NA	56.3	102.1	0.00	0.00	0.0	NA	NA
Approach		0.607			0.0	0.0	NA	NA	56.3	102.1	0.00	0.00			
West: SR 528 EB Off-Ramp															
Lane 1		0.243	1.000	0.0	9.6	23.8	NA	NA	9.5	17.2	0.01	0.02	0.0	NA	NA
Lane 2		0.342	1.000	0.9	15.6	38.8	NA	NA	16.2	29.5	0.02	0.06	0.0	NA	NA
Approach		0.342			15.6	38.8	NA	NA	16.2	29.5	0.02	0.06			
Intersection		0.751			143.1	355.6	NA	NA	91.6	166.1	0.22	0.54			

Queue Model: HCM Queue Formula.  
 Gap-Acceptance Capacity: Traditional M1.

Lane Queues (Vehicles)															
Lane Number	Contin. Lane	Deg. Satn v/c	Prog. Factor (Queue)	Overflow Queue (veh)	Back of Queue (veh)		Queue at Start of Green (veh)		Cycle Average Queue (veh)		Queue Storage Ratio		Prob. Block. %	Prob. SL Ov. %	Ov. Lane No.
					Av.	95%	Av.	95%	Av.	95%	Av.	95%			
South: Dallas Boulevard															
Lane 1		0.751	1.000	1.9	5.6	14.0	NA	NA	3.6	6.5	0.22	0.54	0.0	NA	NA
Approach		0.751			5.6	14.0	NA	NA	3.6	6.5	0.22	0.54			
North: Dallas Boulevard															
Lane 1		0.607	1.000	0.0	0.0	0.0	NA	NA	2.2	4.0	0.00	0.00	0.0	NA	NA
Approach		0.607			0.0	0.0	NA	NA	2.2	4.0	0.00	0.00			
West: SR 528 EB Off-Ramp															
Lane 1		0.243	1.000	0.0	0.4	0.9	NA	NA	0.4	0.7	0.01	0.02	0.0	NA	NA
Lane 2		0.342	1.000	0.0	0.6	1.5	NA	NA	0.6	1.2	0.02	0.06	0.0	NA	NA
Approach		0.342			0.6	1.5	NA	NA	0.6	1.2	0.02	0.06			
Intersection		0.751			5.6	14.0	NA	NA	3.6	6.5	0.22	0.54			

Queue Model: HCM Queue Formula.  
 Gap-Acceptance Capacity: Traditional M1.

Continuous Lane Performance												
Lane Number	Deg. Satn v/c	Unint. Speed mph	Unint. Travel Delay sec	Hdwy Spacing sec	Aver. Vehicle Length ft	Occup. Time sec	Space Time sec	Space Occup. Ratio %	Time Occup. Ratio %	Density veh/mi pc/mi	LOS (Density Method)	

South: Dallas Boulevard

This approach does not have any continuous lanes

North: Dallas Boulevard

This approach does not have any continuous lanes

West: SR 528 EB Off-Ramp

This approach does not have any continuous lanes

Midblock Effective Detection Zone Length = 7 ft

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	v/c	mph	Delay sec	sec	Length ft	ft	sec	sec	Ratio %	Ratio % veh/mi	pc/mi	Method)	
South: Dallas Boulevard													
This approach does not have any continuous lanes													
East: SR 528 WB Off-Ramp													
This approach does not have any continuous lanes													
North: Dallas Boulevard													
Lane 2	0.404	39.8	0.1	5.43	316.8	17.4	0.69	4.74	5.5	12.7	16.7	16.9	LOS B

Midblock Effective Detection Zone Length = 7 ft

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# MOVEMENT SUMMARY

**Site: 1 [Dallas Boulevard at SR 528 EB Ramps (Site Folder: 2050 PM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2050 PM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
8	T1	680	2.0	716	2.0	1.171	113.2	LOS F	58.1	1475.9	1.00	3.21	7.47	5.4
18	R2	100	2.0	105	2.0	1.171	113.2	LOS F	58.1	1475.9	1.00	3.21	7.47	10.0
Approach		780	2.0	821	2.0	1.171	113.2	LOS F	58.1	1475.9	1.00	3.21	7.47	6.0
North: Dallas Boulevard														
7	L2	60	2.0	63	2.0	0.397	6.4	LOS A	0.0	0.0	0.00	0.00	0.00	36.8
4	T1	450	2.0	474	2.0	0.397	6.4	LOS A	0.0	0.0	0.00	0.00	0.00	34.4
Approach		510	2.0	537	2.0	0.397	6.4	LOS A	0.0	0.0	0.00	0.00	0.00	34.8
West: SR 528 EB Off-Ramp														
5	L2	540	2.0	568	2.0	0.672	15.9	LOS C	7.1	180.5	0.80	1.05	1.47	22.3
12	R2	280	2.0	295	2.0	0.329	7.6	LOS A	1.5	37.7	0.57	0.54	0.57	30.5
Approach		820	2.0	863	2.0	0.672	13.1	LOS B	7.1	180.5	0.72	0.87	1.17	24.7
All Vehicles		2110	2.0	2221	2.0	1.171	48.5	LOS E	58.1	1475.9	0.65	1.53	3.21	13.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.  
 LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).  
 Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).  
 Roundabout Capacity Model: US HCM 6.  
 Delay Model: HCM Delay Formula (Geometric Delay is not included).  
 Queue Model: HCM Queue Formula.  
 Gap-Acceptance Capacity: Traditional M1.  
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



# MOVEMENT SUMMARY

**Site: 2 [Dallas Boulevard at SR 528 WB Ramps (Site Folder: 2050 PM Build)]**

SR 528 & Dallas Boulevard Interchange PD&E Study  
 2050 PM Build  
 Site Category: (None)  
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[ Total veh/h ]	[ HV % ]	[ Total veh/h ]	[ HV % ]				[ Veh. veh ]	[ Dist ft ]				
South: Dallas Boulevard														
3	L2	140	2.0	147	2.0	0.949	31.6	LOS D	0.0	0.0	0.00	0.00	0.00	36.8
8	T1	1080	2.0	1137	2.0	0.949	31.6	LOS D	0.0	0.0	0.00	0.00	0.00	34.4
Approach		1220	2.0	1284	2.0	0.949	31.6	LOS D	0.0	0.0	0.00	0.00	0.00	34.9
East: SR 528 WB Off-Ramp														
1	L2	230	2.0	242	2.0	0.573	22.2	LOS C	3.0	74.9	0.84	1.00	1.43	20.3
16	R2	100	2.0	105	2.0	0.217	10.6	LOS B	0.8	19.6	0.70	0.70	0.70	28.8
Approach		330	2.0	347	2.0	0.573	18.7	LOS C	3.0	74.9	0.80	0.91	1.21	22.4
North: Dallas Boulevard														
4	T1	280	2.0	295	2.0	0.304	6.8	LOS A	1.4	35.2	0.52	0.46	0.52	24.8
14	R2	250	2.0	263	2.0	0.160	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	36.0
Approach		530	2.0	558	2.0	0.304	3.6	LOS A	1.4	35.2	0.28	0.24	0.28	30.9
All Vehicles		2080	2.0	2189	2.0	0.949	22.4	LOS C	3.0	74.9	0.20	0.21	0.26	30.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).  
 Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

Delay Model: HCM Delay Formula (Geometric Delay is not included).

Queue Model: HCM Queue Formula.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.



South: Dallas Boulevard

This approach does not have any continuous lanes

North: Dallas Boulevard

This approach does not have any continuous lanes

West: SR 528 EB Off-Ramp

This approach does not have any continuous lanes

Midblock Effective Detection Zone Length = 7 ft

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	v/c	mph	Delay sec	sec	Length ft	ft	sec	sec	Ratio %	Ratio % veh/mi	pc/mi	Method)	
South: Dallas Boulevard													
This approach does not have any continuous lanes													
East: SR 528 WB Off-Ramp													
This approach does not have any continuous lanes													
North: Dallas Boulevard													
Lane 2	0.160	39.9	0.0	13.68	801.3	17.4	0.69	12.99	2.2	5.0	6.6	6.7	LOS A

Midblock Effective Detection Zone Length = 7 ft

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SR 528 & Dallas Boulevard Interchange PD&E Study  
 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard

2030 AM Build Interim

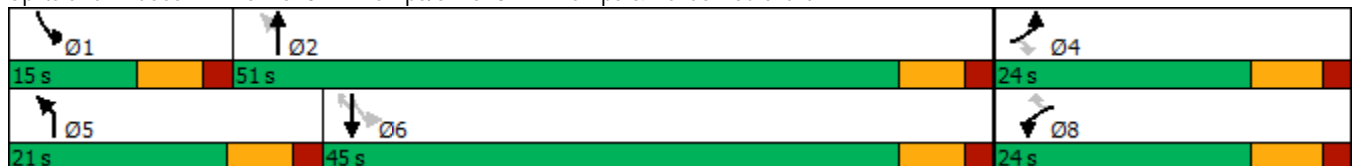


















Lane Group	EBL	EBR	WBL	WBR2	NBL	NBT	NBR	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	120	140	70	50	170	90	100	60	290	500
Future Volume (vph)	120	140	70	50	170	90	100	60	290	500
Satd. Flow (prot)	1770	1583	1770	1583	1770	1716	0	1770	1863	1583
Flt Permitted	0.950		0.950		0.398			0.632		
Satd. Flow (perm)	1770	1583	1770	1583	741	1716	0	1177	1863	1583
Satd. Flow (RTOR)		147		119		88				526
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)						0%			0%	
Shared Lane Traffic (%)										
Lane Group Flow (vph)	126	147	74	53	179	200	0	63	305	526
Turn Type	Prot	Perm	Prot	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	4		8		5	2		1	6	
Permitted Phases		4		8	2			6		6
Total Split (s)	24.0	24.0	24.0	24.0	21.0	51.0		15.0	45.0	45.0
Total Lost Time (s)	6.8	6.8	6.8	6.8	6.4	6.4		6.4	6.4	6.4
Act Effect Green (s)	9.9	9.9	9.9	9.9	30.5	24.3		23.8	15.6	15.6
Actuated g/C Ratio	0.18	0.18	0.18	0.18	0.55	0.44		0.43	0.28	0.28
v/c Ratio	0.40	0.37	0.24	0.14	0.30	0.25		0.11	0.59	0.64
Control Delay	26.6	8.0	23.9	0.8	7.0	8.5		6.5	22.7	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	26.6	8.0	23.9	0.8	7.0	8.5		6.5	22.7	6.0
LOS	C	A	C	A	A	A		A	C	A
Approach Delay						7.8			11.7	
Approach LOS						A			B	

Intersection Summary

Cycle Length: 90  
 Actuated Cycle Length: 55.7  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.64  
 Intersection Signal Delay: 11.8  
 Intersection LOS: B  
 Intersection Capacity Utilization 51.0%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	10	20	230	10	10	10	130	120	10	600	10
Future Volume (vph)	10	10	20	230	10	10	10	130	120	10	600	10
Satd. Flow (prot)	0	1717	0	0	1770	0	0	1744	0	0	1857	0
Flt Permitted		0.987			0.956			0.998			0.999	
Satd. Flow (perm)	0	1717	0	0	1770	0	0	1744	0	0	1857	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	43	0	0	264	0	0	274	0	0	654	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 63.2% ICU Level of Service B												
Analysis Period (min) 15												

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:30	6:30	6:30	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	3319	3316	3316	3258	3248	3253	3232
Vehs Exited	3327	3303	3318	3243	3250	3257	3240
Starting Vehs	59	43	51	44	44	40	53
Ending Vehs	51	56	49	59	42	36	45
Travel Distance (mi)	2663	2676	2682	2621	2623	2618	2602
Travel Time (hr)	91.9	92.9	92.7	89.5	90.6	90.3	89.0
Total Delay (hr)	22.8	23.5	23.1	21.6	22.6	22.5	21.5
Total Stops	3600	3576	3559	3431	3521	3520	3492
Fuel Used (gal)	112.4	114.1	112.6	111.1	110.2	110.5	110.2

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	3319	3230	3414	3290
Vehs Exited	3323	3230	3407	3289
Starting Vehs	49	40	49	43
Ending Vehs	45	40	56	47
Travel Distance (mi)	2680	2615	2754	2653
Travel Time (hr)	92.5	88.9	94.7	91.3
Total Delay (hr)	23.0	21.3	23.4	22.5
Total Stops	3590	3413	3695	3538
Fuel Used (gal)	113.0	110.8	116.3	112.1

Interval #0 Information Seeding

Start Time	6:30
End Time	7:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	



**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	3319	3316	3316	3258	3248	3253	3232
Vehs Exited	3327	3303	3318	3243	3250	3257	3240
Starting Vehs	59	43	51	44	44	40	53
Ending Vehs	51	56	49	59	42	36	45
Travel Distance (mi)	2663	2676	2682	2621	2623	2618	2602
Travel Time (hr)	91.9	92.9	92.7	89.5	90.6	90.3	89.0
Total Delay (hr)	22.8	23.5	23.1	21.6	22.6	22.5	21.5
Total Stops	3600	3576	3559	3431	3521	3520	3492
Fuel Used (gal)	112.4	114.1	112.6	111.1	110.2	110.5	110.2

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	3319	3230	3414	3290
Vehs Exited	3323	3230	3407	3289
Starting Vehs	49	40	49	43
Ending Vehs	45	40	56	47
Travel Distance (mi)	2680	2615	2754	2653
Travel Time (hr)	92.5	88.9	94.7	91.3
Total Delay (hr)	23.0	21.3	23.4	22.5
Total Stops	3590	3413	3695	3538
Fuel Used (gal)	113.0	110.8	116.3	112.1

**Intersection: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard**

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	R	L	>	L	TR	L	T
Maximum Queue (ft)	127	61	92	6	117	125	60	172
Average Queue (ft)	47	5	34	0	48	35	22	77
95th Queue (ft)	91	30	71	4	86	85	48	132
Link Distance (ft)	1856		1266			1210		947
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		700		375	350		400	
Storage Blk Time (%)								
Queuing Penalty (veh)								

**Intersection: 2: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	56	137	91	334
Average Queue (ft)	24	57	48	131
95th Queue (ft)	48	94	74	239
Link Distance (ft)	965	975	947	1246
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 0
------------------------------

SR 528 & Dallas Boulevard Interchange PD&E Study  
 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard

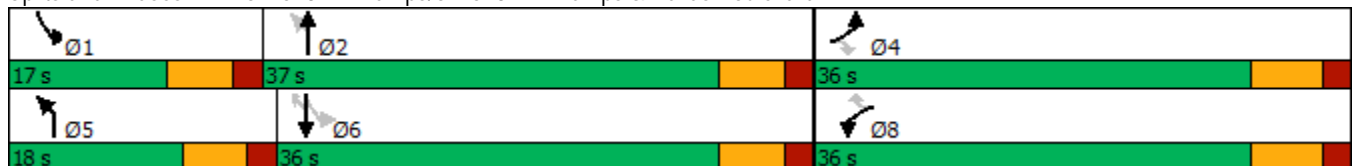
2030 PM Build Interim

















Lane Group	EBL	EBR	WBL	WBR2	NBL	NBT	NBR	SBL	SBT	SBR2	
Lane Configurations											
Traffic Volume (vph)	400	160	110	70	70	140	60	40	120	190	
Future Volume (vph)	400	160	110	70	70	140	60	40	120	190	
Satd. Flow (prot)	1770	1583	1770	1583	1770	1779	0	1770	1863	1583	
Flt Permitted	0.950		0.950		0.603			0.626			
Satd. Flow (perm)	1770	1583	1770	1583	1123	1779	0	1166	1863	1583	
Satd. Flow (RTOR)		168		119		26				200	
Confl. Peds. (#/hr)											
Confl. Bikes (#/hr)											
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	
Parking (#/hr)											
Mid-Block Traffic (%)						0%					
Shared Lane Traffic (%)											
Lane Group Flow (vph)	421	168	116	74	74	210	0	42	126	200	
Turn Type	Prot	Perm	Prot	Perm	pm+pt	NA		pm+pt	NA	Perm	
Protected Phases	4		8		5	2		1	6		
Permitted Phases		4		8	2			6		6	
Total Split (s)	36.0	36.0	36.0	36.0	18.0	37.0		17.0	36.0	36.0	
Total Lost Time (s)	6.8	6.8	6.8	6.8	6.4	6.4		6.4	6.4	6.4	
Act Effect Green (s)	19.3	19.3	19.3	19.3	18.2	15.6		16.6	12.6	12.6	
Actuated g/C Ratio	0.36	0.36	0.36	0.36	0.34	0.29		0.31	0.23	0.23	
v/c Ratio	0.66	0.25	0.18	0.12	0.15	0.39		0.09	0.29	0.38	
Control Delay	21.8	4.0	14.6	1.6	12.5	19.4		12.2	23.6	6.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	
Total Delay	21.8	4.0	14.6	1.6	12.5	19.4		12.2	23.6	6.7	
LOS	C	A	B	A	B	B		B	C	A	
Approach Delay						17.6					
Approach LOS						B					

Intersection Summary

Cycle Length: 90  
 Actuated Cycle Length: 53.8  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.66  
 Intersection Signal Delay: 15.0  
 Intersection LOS: B  
 Intersection Capacity Utilization 56.2%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	10	20	100	10	10	20	380	210	10	230	10
Future Volume (vph)	10	10	20	100	10	10	20	380	210	10	230	10
Satd. Flow (prot)	0	1717	0	0	1767	0	0	1774	0	0	1848	0
Flt Permitted		0.987			0.960			0.998			0.998	
Satd. Flow (perm)	0	1717	0	0	1767	0	0	1774	0	0	1848	0
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	43	0	0	127	0	0	642	0	0	264	0
Sign Control		Stop			Stop			Stop			Stop	
<b>Intersection Summary</b>												
Control Type: Unsignalized												
Intersection Capacity Utilization 60.7% ICU Level of Service B												
Analysis Period (min) 15												

Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:30	4:30	4:30	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	2860	2833	2865	2723	2729	2910	2892
Vehs Exited	2865	2834	2852	2720	2753	2886	2894
Starting Vehs	41	39	42	38	60	26	39
Ending Vehs	36	38	55	41	36	50	37
Travel Distance (mi)	2343	2318	2335	2227	2232	2367	2364
Travel Time (hr)	81.5	79.3	80.2	75.4	75.4	81.2	81.4
Total Delay (hr)	21.0	19.6	20.0	18.0	17.9	20.2	20.2
Total Stops	3492	3428	3479	3268	3244	3480	3503
Fuel Used (gal)	91.1	90.7	89.4	87.1	86.7	92.0	91.3

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	2912	2798	2863	2839
Vehs Exited	2904	2802	2848	2837
Starting Vehs	44	37	35	38
Ending Vehs	52	33	50	43
Travel Distance (mi)	2389	2284	2340	2320
Travel Time (hr)	82.6	77.9	79.6	79.4
Total Delay (hr)	20.9	18.9	19.5	19.6
Total Stops	3485	3420	3406	3420
Fuel Used (gal)	91.3	87.8	91.8	89.9

Interval #0 Information Seeding

Start Time	4:30
End Time	5:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	2860	2833	2865	2723	2729	2910	2892
Vehs Exited	2865	2834	2852	2720	2753	2886	2894
Starting Vehs	41	39	42	38	60	26	39
Ending Vehs	36	38	55	41	36	50	37
Travel Distance (mi)	2343	2318	2335	2227	2232	2367	2364
Travel Time (hr)	81.5	79.3	80.2	75.4	75.4	81.2	81.4
Total Delay (hr)	21.0	19.6	20.0	18.0	17.9	20.2	20.2
Total Stops	3492	3428	3479	3268	3244	3480	3503
Fuel Used (gal)	91.1	90.7	89.4	87.1	86.7	92.0	91.3

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	2912	2798	2863	2839
Vehs Exited	2904	2802	2848	2837
Starting Vehs	44	37	35	38
Ending Vehs	52	33	50	43
Travel Distance (mi)	2389	2284	2340	2320
Travel Time (hr)	82.6	77.9	79.6	79.4
Total Delay (hr)	20.9	18.9	19.5	19.6
Total Stops	3485	3420	3406	3420
Fuel Used (gal)	91.3	87.8	91.8	89.9

**Intersection: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard**

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	R	L	>	L	TR	L	T
Maximum Queue (ft)	248	58	111	83	80	149	63	108
Average Queue (ft)	120	5	41	2	29	60	20	41
95th Queue (ft)	196	29	81	25	60	115	47	81
Link Distance (ft)	1856		1266			1210		947
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		700		375	350		400	
Storage Blk Time (%)								
Queuing Penalty (veh)								

**Intersection: 2: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	47	71	226	108
Average Queue (ft)	22	39	98	49
95th Queue (ft)	46	61	164	77
Link Distance (ft)	965	975	947	1246
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 0
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SR 528 & Dallas Boulevard Interchange PD&E Study  
 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard

2050 AM Build Interim

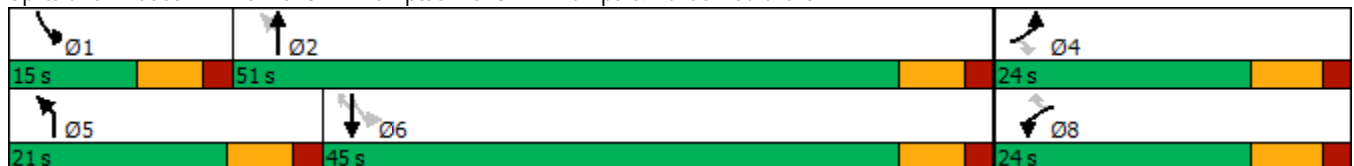


Lane Group	EBL	EBR	WBL	WBR2	NBL	NBT	NBR	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	150	240	110	50	270	240	200	130	540	630
Future Volume (vph)	150	240	110	50	270	240	200	130	540	630
Satd. Flow (prot)	1770	1583	1770	1583	1770	1736	0	1770	1863	1583
Flt Permitted	0.950		0.950		0.195			0.490		
Satd. Flow (perm)	1770	1583	1770	1583	363	1736	0	913	1863	1583
Satd. Flow (RTOR)		253		119		66				663
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)						0%			0%	
Shared Lane Traffic (%)										
Lane Group Flow (vph)	158	253	116	53	284	464	0	137	568	663
Turn Type	Prot	Perm	Prot	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	4		8		5	2		1	6	
Permitted Phases		4		8	2			6		6
Total Split (s)	24.0	24.0	24.0	24.0	21.0	51.0		15.0	45.0	45.0
Total Lost Time (s)	6.8	6.8	6.8	6.8	6.4	6.4		6.4	6.4	6.4
Act Effect Green (s)	12.1	12.1	12.1	12.1	46.2	36.1		36.4	27.9	27.9
Actuated g/C Ratio	0.17	0.17	0.17	0.17	0.63	0.49		0.50	0.38	0.38
v/c Ratio	0.54	0.53	0.40	0.15	0.60	0.52		0.25	0.80	0.65
Control Delay	37.8	9.1	34.4	0.9	12.6	14.4		7.3	29.7	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	37.8	9.1	34.4	0.9	12.6	14.4		7.3	29.7	4.9
LOS	D	A	C	A	B	B		A	C	A
Approach Delay						13.7			15.5	
Approach LOS						B			B	

Intersection Summary

Cycle Length: 90  
 Actuated Cycle Length: 73.1  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.80  
 Intersection Signal Delay: 16.2  
 Intersection LOS: B  
 Intersection Capacity Utilization 68.0%  
 ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard



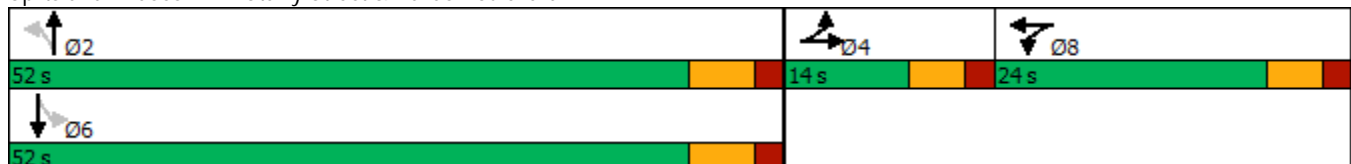


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	20	30	420	20	20	30	200	210	20	850	20
Future Volume (vph)	20	20	30	420	20	20	30	200	210	20	850	20
Satd. Flow (prot)	0	1730	0	0	1770	0	0	1738	0	0	1855	0
Flt Permitted		0.986			0.956			0.910			0.985	
Satd. Flow (perm)	0	1730	0	0	1770	0	0	1587	0	0	1829	0
Satd. Flow (RTOR)		32			2			74			2	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	74	0	0	484	0	0	464	0	0	937	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Total Split (s)	14.0	14.0		24.0	24.0		52.0	52.0		52.0	52.0	
Total Lost Time (s)		5.7			5.7			6.4			6.4	
Act Effct Green (s)		8.2			18.4			45.8			45.8	
Actuated g/C Ratio		0.09			0.21			0.53			0.53	
v/c Ratio		0.39			1.29			0.53			0.97	
Control Delay		31.2			181.9			14.8			46.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		31.2			181.9			14.8			46.2	
LOS		C			F			B			D	
Approach Delay		31.2			181.9			14.8			46.2	
Approach LOS		C			F			B			D	

**Intersection Summary**

Cycle Length: 90  
 Actuated Cycle Length: 87.1  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.29  
 Intersection Signal Delay: 71.7  
 Intersection LOS: E  
 Intersection Capacity Utilization 93.6%  
 ICU Level of Service F  
 Analysis Period (min) 15

Splits and Phases: 2: Starry Street & Dallas Boulevard



Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	6:30	6:30	6:30	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	5139	5143	5203	5124	5211	5251	5225
Vehs Exited	5164	5138	5163	5142	5191	5202	5244
Starting Vehs	161	150	118	166	125	102	173
Ending Vehs	136	155	158	148	145	151	154
Travel Distance (mi)	4023	4002	4041	4011	4059	4089	4092
Travel Time (hr)	602.5	742.9	384.6	438.0	497.6	509.3	517.7
Total Delay (hr)	498.0	639.0	279.9	334.1	392.4	403.0	411.7
Total Stops	5954	5982	5737	6370	6151	5908	6506
Fuel Used (gal)	273.8	304.3	222.7	236.1	250.3	252.9	256.0

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	6:30	6:30	6:30	6:30
End Time	9:00	9:00	9:00	9:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	5155	5214	5220	5187
Vehs Exited	5120	5219	5205	5179
Starting Vehs	132	154	142	141
Ending Vehs	167	149	157	153
Travel Distance (mi)	4014	4080	4074	4048
Travel Time (hr)	513.7	339.2	583.6	512.9
Total Delay (hr)	409.7	233.4	478.1	407.9
Total Stops	6369	6391	6228	6158
Fuel Used (gal)	252.5	214.8	271.8	253.5

Interval #0 Information Seeding

Start Time	6:30
End Time	7:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	5139	5143	5203	5124	5211	5251	5225
Vehs Exited	5164	5138	5163	5142	5191	5202	5244
Starting Vehs	161	150	118	166	125	102	173
Ending Vehs	136	155	158	148	145	151	154
Travel Distance (mi)	4023	4002	4041	4011	4059	4089	4092
Travel Time (hr)	602.5	742.9	384.6	438.0	497.6	509.3	517.7
Total Delay (hr)	498.0	639.0	279.9	334.1	392.4	403.0	411.7
Total Stops	5954	5982	5737	6370	6151	5908	6506
Fuel Used (gal)	273.8	304.3	222.7	236.1	250.3	252.9	256.0

**Interval #1 Information Recording**

Start Time	7:00
End Time	9:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	5155	5214	5220	5187
Vehs Exited	5120	5219	5205	5179
Starting Vehs	132	154	142	141
Ending Vehs	167	149	157	153
Travel Distance (mi)	4014	4080	4074	4048
Travel Time (hr)	513.7	339.2	583.6	512.9
Total Delay (hr)	409.7	233.4	478.1	407.9
Total Stops	6369	6391	6228	6158
Fuel Used (gal)	252.5	214.8	271.8	253.5

**Intersection: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard**

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	R	L	>	L	TR	L	T
Maximum Queue (ft)	210	136	142	22	246	438	118	289
Average Queue (ft)	77	41	58	0	90	134	43	160
95th Queue (ft)	148	100	107	9	171	293	82	257
Link Distance (ft)	1856		1266			1210		947
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		700		375	350		400	
Storage Blk Time (%)						1		
Queuing Penalty (veh)						2		

**Intersection: 2: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	124	1035	795	1304
Average Queue (ft)	48	994	293	1102
95th Queue (ft)	94	1024	665	1624
Link Distance (ft)	965	975	947	1246
Upstream Blk Time (%)		96	1	56
Queuing Penalty (veh)		0	4	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

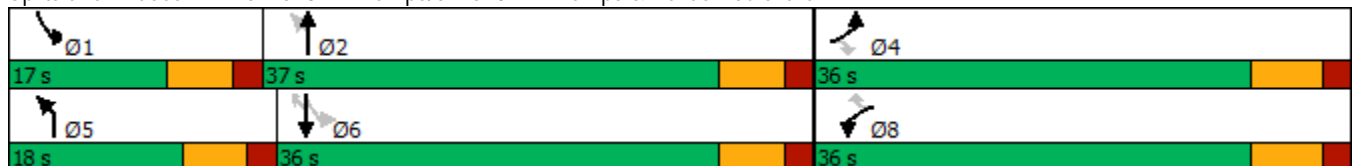
Zone wide Queuing Penalty: 7
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Lane Group	EBL	EBR	WBL	WBR2	NBL	NBT	NBR	SBL	SBT	SBR2
Lane Configurations										
Traffic Volume (vph)	540	280	230	100	140	540	100	60	220	250
Future Volume (vph)	540	280	230	100	140	540	100	60	220	250
Satd. Flow (prot)	1770	1583	1770	1583	1770	1820	0	1770	1863	1583
Flt Permitted	0.950		0.950		0.506			0.145		
Satd. Flow (perm)	1770	1583	1770	1583	943	1820	0	270	1863	1583
Satd. Flow (RTOR)		295		119		11				263
Confl. Peds. (#/hr)										
Confl. Bikes (#/hr)										
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										
Mid-Block Traffic (%)						0%			0%	
Shared Lane Traffic (%)										
Lane Group Flow (vph)	568	295	242	105	147	673	0	63	232	263
Turn Type	Prot	Perm	Prot	Perm	pm+pt	NA		pm+pt	NA	Perm
Protected Phases	4		8		5	2		1	6	
Permitted Phases		4		8	2			6		6
Total Split (s)	36.0	36.0	36.0	36.0	18.0	37.0		17.0	36.0	36.0
Total Lost Time (s)	6.8	6.8	6.8	6.8	6.4	6.4		6.4	6.4	6.4
Act Effect Green (s)	29.3	29.3	29.3	29.3	38.4	30.8		34.3	26.1	26.1
Actuated g/C Ratio	0.35	0.35	0.35	0.35	0.45	0.36		0.41	0.31	0.31
v/c Ratio	0.93	0.40	0.40	0.17	0.28	1.01		0.25	0.40	0.39
Control Delay	52.0	4.5	24.4	4.2	13.0	66.0		13.8	25.5	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	52.0	4.5	24.4	4.2	13.0	66.0		13.8	25.5	5.0
LOS	D	A	C	A	B	E		B	C	A
Approach Delay						56.5			14.5	
Approach LOS						E			B	

**Intersection Summary**

Cycle Length: 90  
 Actuated Cycle Length: 84.6  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.01  
 Intersection Signal Delay: 35.4  
 Intersection LOS: D  
 Intersection Capacity Utilization 87.4%  
 ICU Level of Service E  
 Analysis Period (min) 15

**Splits and Phases: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard**



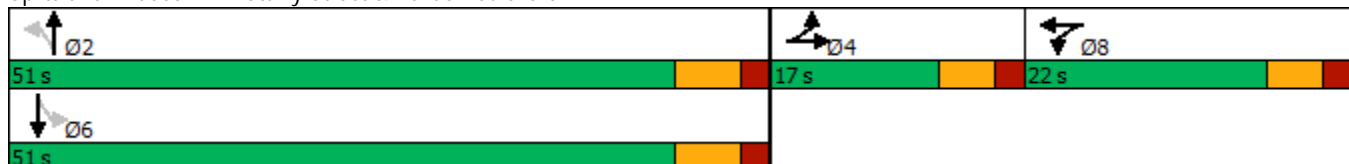


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	20	20	30	190	20	20	50	700	430	20	310	20
Future Volume (vph)	20	20	30	190	20	20	50	700	430	20	310	20
Satd. Flow (prot)	0	1730	0	0	1767	0	0	1768	0	0	1842	0
Flt Permitted		0.986			0.960			0.968			0.910	
Satd. Flow (perm)	0	1730	0	0	1767	0	0	1715	0	0	1682	0
Satd. Flow (RTOR)		32			5			45			5	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	74	0	0	242	0	0	1243	0	0	368	0
Turn Type	Split	NA		Split	NA		Perm	NA		Perm	NA	
Protected Phases	4	4		8	8			2			6	
Permitted Phases							2			6		
Total Split (s)	17.0	17.0		22.0	22.0		51.0	51.0		51.0	51.0	
Total Lost Time (s)		5.7			5.7			6.4			6.4	
Act Effct Green (s)		8.9			14.7			45.8			45.8	
Actuated g/C Ratio		0.11			0.18			0.55			0.55	
v/c Ratio		0.35			0.78			1.30			0.40	
Control Delay		28.4			51.2			165.6			14.3	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		28.4			51.2			165.6			14.3	
LOS		C			D			F			B	
Approach Delay		28.4			51.2			165.6			14.3	
Approach LOS		C			D			F			B	

**Intersection Summary**

Cycle Length: 90  
 Actuated Cycle Length: 84  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.30  
 Intersection Signal Delay: 117.1  
 Intersection LOS: F  
 Intersection Capacity Utilization 108.8%  
 ICU Level of Service G  
 Analysis Period (min) 15

Splits and Phases: 2: Starry Street & Dallas Boulevard



Summary of All Intervals

Run Number	1	2	3	4	5	6	7
Start Time	4:30	4:30	4:30	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150	150	150	150
Time Recorded (min)	120	120	120	120	120	120	120
# of Intervals	2	2	2	2	2	2	2
# of Recorded Intervals	1	1	1	1	1	1	1
Vehs Entered	4277	4316	4389	4381	4330	4449	4273
Vehs Exited	4299	4329	4333	4309	4312	4409	4273
Starting Vehs	248	240	168	164	211	184	246
Ending Vehs	226	227	224	236	229	224	246
Travel Distance (mi)	3350	3390	3395	3362	3350	3459	3355
Travel Time (hr)	1497.5	1546.4	965.2	1083.2	1172.3	1228.2	1582.2
Total Delay (hr)	1410.7	1458.5	877.4	996.2	1085.1	1138.3	1495.1
Total Stops	6569	6955	7285	7260	7001	6997	6608
Fuel Used (gal)	442.4	454.1	321.2	347.6	367.5	383.4	461.6

Summary of All Intervals

Run Number	8	9	10	Avg
Start Time	4:30	4:30	4:30	4:30
End Time	7:00	7:00	7:00	7:00
Total Time (min)	150	150	150	150
Time Recorded (min)	120	120	120	120
# of Intervals	2	2	2	2
# of Recorded Intervals	1	1	1	1
Vehs Entered	4301	4232	4404	4336
Vehs Exited	4248	4167	4374	4304
Starting Vehs	188	200	204	203
Ending Vehs	241	265	234	234
Travel Distance (mi)	3325	3271	3423	3368
Travel Time (hr)	1469.4	1560.4	1230.6	1333.5
Total Delay (hr)	1383.0	1475.7	1141.7	1246.2
Total Stops	7014	6527	6911	6912
Fuel Used (gal)	435.3	454.8	384.1	405.2

Interval #0 Information Seeding

Start Time	4:30
End Time	5:00
Total Time (min)	30
Volumes adjusted by Growth Factors.	
No data recorded this interval.	

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	1	2	3	4	5	6	7
Vehs Entered	4277	4316	4389	4381	4330	4449	4273
Vehs Exited	4299	4329	4333	4309	4312	4409	4273
Starting Vehs	248	240	168	164	211	184	246
Ending Vehs	226	227	224	236	229	224	246
Travel Distance (mi)	3350	3390	3395	3362	3350	3459	3355
Travel Time (hr)	1497.5	1546.4	965.2	1083.2	1172.3	1228.2	1582.2
Total Delay (hr)	1410.7	1458.5	877.4	996.2	1085.1	1138.3	1495.1
Total Stops	6569	6955	7285	7260	7001	6997	6608
Fuel Used (gal)	442.4	454.1	321.2	347.6	367.5	383.4	461.6

**Interval #1 Information Recording**

Start Time	5:00
End Time	7:00
Total Time (min)	120

Volumes adjusted by Growth Factors.

Run Number	8	9	10	Avg
Vehs Entered	4301	4232	4404	4336
Vehs Exited	4248	4167	4374	4304
Starting Vehs	188	200	204	203
Ending Vehs	241	265	234	234
Travel Distance (mi)	3325	3271	3423	3368
Travel Time (hr)	1469.4	1560.4	1230.6	1333.5
Total Delay (hr)	1383.0	1475.7	1141.7	1246.2
Total Stops	7014	6527	6911	6912
Fuel Used (gal)	435.3	454.8	384.1	405.2



**Intersection: 1: SR 528 EB Ramps/SR 528 WB Ramps & Dallas Boulevard**

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	R	L	>	L	TR	L	T
Maximum Queue (ft)	1872	800	211	120	400	1270	100	243
Average Queue (ft)	1823	775	98	11	335	1232	32	90
95th Queue (ft)	2134	1000	166	57	564	1253	68	178
Link Distance (ft)	1856		1266			1210		947
Upstream Blk Time (%)	32					96		
Queuing Penalty (veh)	263					0		
Storage Bay Dist (ft)		700		375	350		400	
Storage Blk Time (%)	93				0	82		
Queuing Penalty (veh)	261				0	115		

**Intersection: 2: Starry Street & Dallas Boulevard**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	122	250	1023	734
Average Queue (ft)	45	127	955	214
95th Queue (ft)	85	209	1048	507
Link Distance (ft)	965	975	947	1246
Upstream Blk Time (%)			12	
Queuing Penalty (veh)			141	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 781