I-290 Preliminary Engineering and Environmental (Phase 1) Study West of Mannheim Road to Racine Avenue

# **Existing Roadway Operations**

## Addendum #1

Extended Study Area: East of Cicero to Racine Avenue

April 2013

1.0	INT	TRODUCTION 1						
2.0	STU	DY AREA1						
	2.1	Mainline1						
	2.2	Study Area Arterials 3						
2.3	Curr	rent Mitigation Measures						
3.0	PER	FORMANCE MEASURES 5						
	3.1	Volume/Capacity Ratio5						
	3.2	Level of Service						
	3.3	IDOT LOS Policy 6						
4.0	ANA	ALYSIS METHODOLOGY						
	4.1	Mainline Basic Freeway Segments7						
	4.2	Mainline Ramp Junctions7						
	4.3	Mainline Ramp Weaves						
5.0	OPE	RATIONAL ANALYSIS RESULTS						
5.0	OPE 5.1	RATIONAL ANALYSIS RESULTS						
5.0								
5.0		Existing Mainline Operations9						
5.0		Existing Mainline Operations						
5.0		Existing Mainline Operations						
5.0		Existing Mainline Operations						
5.0	5.1	Existing Mainline Operations						
	5.1	Existing Mainline Operations						
	5.1 5.2 FAC	Existing Mainline Operations						
	5.1 5.2 FAC 6.1	Existing Mainline Operations						
	5.1 5.2 FAC 6.1 6.2 6.3	Existing Mainline Operations.95.1.1Mainline Basic Freeway Segments.115.1.2Mainline Ramp Junctions.125.1.3Mainline Ramp Weaves.125.1.4Duration of Congestion.13Study Area Arterial Operations.14TORS AFFECTING OPERATIONS16Basic Freeway Segments16Ramp Junctions and Weaving.16						

#### LIST OF TABLES

Table 2-1 - I-290 Extended Study Area ADT (% Trucks)	3
Table 6-1 – Overall I-290 Mainline Peak Period LOS Summary	9
Table 6-2 - Proportion of I-290 Mainline by LOS (2009)	10
Table 6-3 - I-290 Mainline Average 2010 Travel model Speeds	10
Table 6-4 - I-290 Mainline Basic Freeway Segment LOS	11
Table 6-5 - I-290 Ramp Junction Analysis Summary	12
Table 6-6 - Mainline Weaving Segment LOS	12
Table 6-7 - I-290 Mainline Periods of Congestion (2009)	14
Table 6-8 - 2010 Arterial Peak Period Operations Summary	15
Table 7-1 – I-290 Existing Volumes and Capcity	16

#### LIST OF FIGURES

Figure 2-1 - Study Area Map	1
Figure 2-2 - I-290 Extended Study Area Typical Section	1
Figure 2-3 - I-290 Extended Study Area Lane Diagram	2
Figure 2-4 – Extended Study Area Arterial ADTs (2009)	4
Figure 5-1 - 2010 Arterial Roadway Peak Period Volume to Capacity Ratios	15

#### APPENDICES

Appendix A Arterial v/c Calculations

- Appendix B HCS Analysis Output
  - B-1 Basic Freeway Segments
  - B-2 Ramp Junctions
  - B-3 Weaving Sections
- Appendix C I-290 Count Station Hourly LOS

## 1.0 Introduction

This Technical Memorandum Addendum was prepared in support of the I-290 Preliminary Engineering and Environmental (Phase I) Study Existing Transportation System Performance Report, and documents the existing traffic operations along the Eisenhower Expressway (I-290) from east of Cicero Avenue to Racine Avenue in Cook County, Illinois.

## 2.0 Study Area

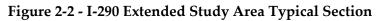
The I-290 Phase I study extended study area (Figure 2-1) is centered along I-290 in Cook County extending approximately 4 miles from east of Cicero Avenue to Racine Avenue.

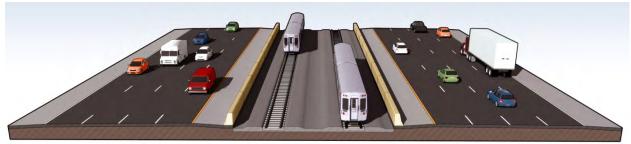


Figure 2-1 - Study Area Map

#### 2.1 Mainline

The I-290 Eisenhower Expressway has remained almost entirely unchanged since its construction over 50 years ago. Interchanges, access ramps, and lane configurations of I-290 from east of Cicero Avenue to Racine Avenue are still in their original design. The I-290 mainline maintains an 8-lane configuration throughout the extended study area with the CTA Blue Line heavy rail transit operating in the median (**Figure 2-2**).





An existing lane diagram in **Figure 2-3** illustrates the existing mainline and ramp lane configurations in the extended study area.

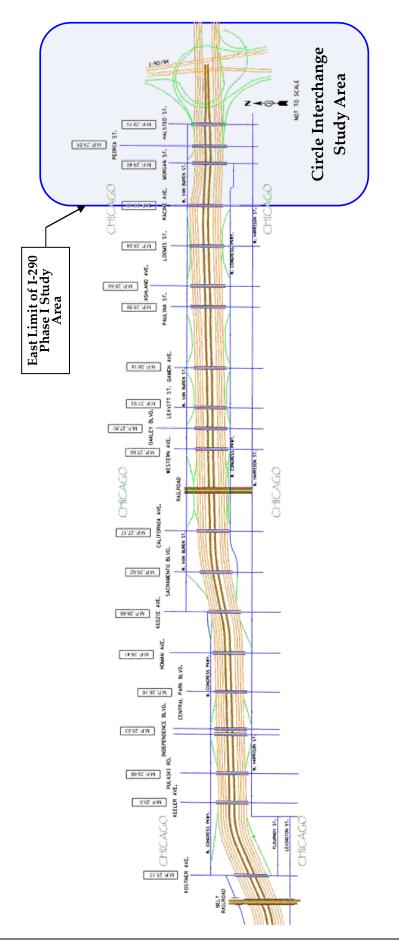


Figure 2-3 - I-290 Extended Study Area Lane Diagram

#### I-290 Preliminary Engineering and Environmental (Phase I) Study APRIL 2013 I-290 ECTM Operations Addendum 2013-April-2.docx

Traffic volumes along I-290 in the extended study area range from 186,300 to 225,700 vehicles per day with truck volumes averaging around 3% (compared to the regional expressway average truck percentage of 10%).

I-290 Location	M.P.	Dis.	# of Lanes				Tru Volu	_
			Lanes	WB	EB	2-Way	2-Way	%
Racine St	19.67							
		0.14	8	103,000	109,600	212,600	6,700	3.2%
Ashland Ave	19.53							
		0.36	8	94,400	98,900	193,300	6,700	3.5%
Paulina St	19.17							
		0.17	8	104,300	110,300	214,600	6,700	3.1%
Damen Ave	19.00							
		0.28	8	98,600	104,100	202,700	6,700	3.3%
Damen Ave	18.72	0.10				004.000	0 = 0 0	0.00(
	40.00	0.12	8	107,500	113,700	221,200	6,700	3.0%
Oakley Blvd	18.60	0.00	-		100.000	040 500	0 700	0.00/
Mastern Arre	40.00	0.38	8	101,900	108,600	210,500	6,700	3.2%
Western Ave	18.22	0.29	8	110,400	100.000	211 200	6 700	2.00/
California Ave	17.93	0.29	0	110,400	100,800	211,200	6,700	3.2%
	17.95	0.50	8	99,900	108,600	208,500	6,700	3.2%
Sacramento Blvd	17.43	0.50	0	33,300	100,000	200,300	0,700	J.Z /0
	17.40	0.17	8	109,200	116,000	225,200	6,700	3.0%
Homan Ave	17.26	0.17	0	100,200	110,000	220,200	0,700	0.070
		0.58	8	101,800	105,900	207,700	6,000	2.9%
Independence Blvd	16.68	0.00		. ,	/		0,000	2.070
		0.32	8	93,800	95,300	189,100	6,000	3.2%
Independence Blvd	16.36							
· ·		0.33	8	103,800	105,100	208,900	6,000	2.9%
Kostner	16.03							
		0.50	8	96,000	90,300	186,300	6,000	3.2%

Table 2-1 - I-290 Extended Study Area ADT (% Trucks)<sup>1</sup>

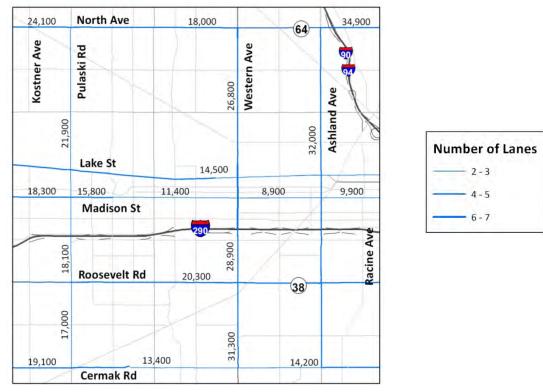
#### 2.2 Study Area Arterials

The primary east-west parallel arterial streets near I-290 are Roosevelt Road to the south and Madison Street to the north. Roosevelt Road, located just over ½ mile to the south of I-290, is a consistent 4-lane street throughout the extended study area section with areas of on-street parking in various locations and averages between 20,100 and 24,400 vehicles per day (vpd). East of Ogden Avenue, there are medians of varying widths located along Roosevelt Road. Throughout this section, there are sections of parallel on-street parking in various locations. Madison Street, which runs parallel to I-290 about ½ mile to the north, varies from a two-lane to four lane configuration in each direction as it travels from east to west. East of Ogden Avenue, there are medians of varying widths. Within the extended study area, there are areas of on-street parallel parking in various locations. Traffic on Madison Street varies from about 8,900 to 18,300 vpd in extended study area. These arterial roads are limited in their capacity to carry additional traffic by the existing number of through lanes, and the operation of signalized intersections along their routes.

<sup>1</sup> 2009 IDOT & CMAP balanced traffic data

Other parallel arterial roads to the north and south of I-290 include Lake Street (approximately 1 mile to the north), North Avenue (approximately 2.4 miles to the north), and Cermak Road (approximately 1.6 miles to the south). The ADT on Lake Street is approximately 14,500 vpd through the extended study area. Along North Avenue, the ADT varies between 18,000 and 24,900 vpd. The ADT on Cermak Road varies between 13,400 and 19,100 vpd.

The principal arterial north-south routes in the extended study area of I-290 are Pulaski Road, Kedzie Avenue, Western Avenue, and Ashland Avenue. Traffic along Pulaski varies from 17,000 to 21,900. Traffic along Kedzie varies from 10,800 to 15,100. Western varies from 26,800 to 31,300 vpd near I-290. Traffic along Ashland varies from 32,000 to 33,600 vpd near I-290.



#### Figure 2-4 – Extended Study Area Arterial ADTs<sup>2</sup> (2009)

#### 2.3 Current Mitigation Measures

To mitigate congestion, the Illinois Department of Transportation (IDOT) has a Congestion Management System (CMS) to monitor and respond to traffic events, including a traffic monitoring control center in Oak Park. Within the I-290 corridor, the CMS strategies relative to traffic operational improvements include ramp metering and traffic surveillance. The existing ramp metering and traffic monitoring equipment have been in service for over two decades. As part of the current plan to maintain traffic flow, IDOT's incident management system includes "Minute Man" patrols to provide prompt response to incidents. Variable message signs installed at various locations along I-290 are instrumental in providing motorists with advance warnings of incidents and maintenance–related lane reductions. Even with these management systems in place, mobility and capacity remains constrained due to the dense urban environment.

### 3.0 Performance Measures

This section defines basic performance measures – volume to capacity (v/c) ratio and level of service (LOS) – used in evaluating roadway operations within the extended study area. IDOT's LOS policy for urban freeways is also described in this section.

#### 3.1 Volume/Capacity Ratio

A measure of how well a roadway segment is functioning is the volume to capacity ratio (v/c ratio). The volume or "v" is the number of vehicles driving on a roadway segment. The capacity portion of the equation "c" is the number of vehicles the subject roadway section can accommodate before a breakdown occurs. If the number of vehicles on a section of highway and the number of vehicles that the highway section can accommodate are the same, the v/c ratio is equal to one. Another way to view this situation is that 100% of the capacity of the roadway has been used. Once capacity is reached (v/c > 1), operations become very unstable and vehicles are operating with the minimum spacing between them in order to maintain uniform flow and vehicle speeds are highly variable. Minor disruptions within the traffic stream such as vehicles entering from ramps, disabled vehicles on the shoulder, crashes, and vehicles being ticketed (off-road) cannot be accommodated. Their occurrence will result in operations that rapidly deteriorate resulting in traffic jams, brief periods of movement and stoppages. The operational conditions of a traffic stream are measured by Level of Service (LOS).

#### 3.2 Level of Service

LOS is a transportation congestion measure that represents the collective factors of speed, travel time, traffic interruption, freedom to maneuver, safety, driver comfort and convenience, and operating volume. LOS procedures from the Transportation Research Board's Highway Capacity Manual (HCM), 2010 were used to evaluate I-290 corridor traffic operations during the morning (A.M.) and evening (P.M.) peak hours. The HCM defines six levels-of-service, ranging from A to F. LOS A represents the best operating conditions and LOS F the worst. Each of these levels represents a range of operating conditions and the driver's perception of these conditions. The HCM defines the operating conditions for each level of service as follows:



**LOS A** indicates primarily free flow operation at average travel speeds. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream.



**LOS B** also indicates free flow speed, although the presence of other vehicles becomes noticeable. Average travel speeds are the same as in LOS A, but drivers have less freedom to maneuver. Minor disruptions to vehicular flow will be easily absorbed



**LOS C**, the influence of traffic density on operations becomes marked. The ability to maneuver within the traffic stream is clearly affected by other vehicles. Travel speeds are affected. Minor disruptions can cause deterioration in service and queues will form behind any major traffic disruption.



**LOS D**, the ability to maneuver is severely restricted due to traffic congestion. Travel speed is reduced by the increasing traffic volume. Only minor disruptions can be absorbed without extensive queues forming and the traffic service deteriorating.



**LOS E** represents operations at capacity and very unstable. Vehicles are operating with the minimum spacing between them in order to maintain uniform flow. Minor disruptions cannot be dissipated and these occurrences will result in operations to deteriorate to LOS F



**LOS F** represents forced or breakdown flow. It occurs either when vehicles arrive at a rate greater than the rate at which they are discharged or when the forecast demand exceeds the computed capacity of a planned facility. LOS F is used to characterize both the point at which the breakdown occurs and/or the operations afterward, i.e., travel speeds are low and vehicles experience brief periods of movement and stoppages. Due to the low traffic speeds and stoppages, the measured volume during breakdown conditions will decrease.

As described above, the performance of a roadway facility is most often described in terms of LOS. It provides a common letter grade rating system, understandable to a broad range of stakeholders. However, LOS is determined based on the primary performance measure for the roadway element being evaluated. For example, the performance of a signalized intersection is measured by the amount of delay. Density is the primary performance measure for evaluating basic freeway segments and ramp junctions. The primary performance measure for evaluating freeway weaving operations is speed.

#### 3.3 IDOT LOS Policy

Although I-290 is referred to as an "expressway", it is functionally classified as a freeway by IDOT. IDOT's LOS policy on freeways, as documented in Chapter 44 of the Bureau of Design and Environment (BDE) Manual, indicates that freeways in urban areas should provide for a LOS C at a minimum; however, a LOS D may be considered for a reconstruction project where existing cross section elements are left in place, with study and justification.<sup>3</sup>

A lower than the desired LOS for a proposed improvement may be justified to minimize impacts to communities and other resources, as well as reduce costs. It may be noted that these level of service criteria/policies (excluding "3R") are applicable to design forecast year traffic volumes 20 years beyond the study phase, and apply to new highway construction or reconstruction projects. Therefore, projected increases in traffic affect the ability of a new or reconstructed highway design to maintain a minimum LOS.

<sup>&</sup>lt;sup>3</sup> IDOT Bureau of Design and Environment Manual, Figure 44-5.C, note 4.

### 4.0 Analysis Methodology

The roadway elements evaluated in the I-290 corridor traffic operations analysis include basic freeway segments, freeway ramp junctions (merge and diverge areas), and weaving sections. This section describes the roadway elements, methodology, and the measures used to analyze their performance.

#### 4.1 Mainline Basic Freeway Segments

Basic freeway segments include the portions of the freeway where flow is not influenced by the merging, diverging, or weaving associated with ramp/freeway connections. The primary factors that affect operations on basic freeway segments include lane widths, lateral clearance, number of lanes, interchange density, heavy vehicles, grades and driver familiarity. The common methodology used for analyzing basic freeway segment operations is described in Chapter 11 of the HCM, 2010. The performance measure used to estimate the LOS for traffic capacity and operations on freeway segments is density in terms of passenger cars per lane per mile. The basic freeway segments within the I-290 study area were evaluated using Highway Capacity Software (HCS) Version 6.1, a computerized version of HCM, 2010. The analysis used IDOT's April 2009 traffic volumes. These volumes were obtained from I-290 automated loop count data from IDOT's Traffic Systems Center (TSC).

#### 4.2 Mainline Ramp Junctions

The analysis associated with operations at ramp junctions with the freeway mainline typically involves the effects of vehicles either merging onto or diverging from the mainline. The analysis evaluates the impacts of the turbulence caused by the merging and diverging operations that occurs specifically in the two lanes adjacent to the merge/diverge point. The methodology used for analyzing freeway ramp junction operations is illustrated in Chapter 13 of the HCM, 2010. The HCM methodology defines an influence area of 1,500 feet for merging and diverging traffic (1,500 feet downstream from ramp if merging and 1,500 feet upstream from ramp if diverging). The LOS and operations at an interchange ramp junction adjacent to the freeway is dependent on the number of lanes on the freeway mainline, the number of lanes on the ramp, the volume of traffic on the mainline, specifically in the two lanes adjacent to the ramp, the volume of traffic entering or exiting at the ramp, the length of the acceleration or deceleration lanes, the side of the mainline that the ramp connects to (right or left), the free-flow speed of the mainline and ramp, and the terrain. The performance measure used to determine the LOS for ramp junctions is density. The existing ramp junctions within the I-290 study area were evaluated using HCS Version 6.1, a computerized version of HCM, 2010. The analysis was performed using April 2009 traffic volumes provided by IDOT's Traffic Systems Center.

#### 4.3 Mainline Ramp Weaves

The HCM defines weaving as the crossing of two or more traffic streams traveling in the same general direction along a significant length of highway without the aid of traffic control devices, with the exception of guide signs. Weaving segments are formed when a merge area is closely followed by a diverge area within 2,500 feet, and the two are joined by an auxiliary lane. Per the HCM, segments longer than 2,500 feet exhibit characteristics similar to a basic freeway segment, and were analyzed as such in this report. For segments longer than 2,500 feet, ramp

junction analysis is used to analyze the operations for the immediate merge and diverge influence areas of the ramps. The methodology used for analyzing freeway weaving segments is described in Chapter 12 of the HCM, 2010. The most critical aspect of operations within a weaving segment is the intense lane changing maneuvers that take place within the confined length of the weaving segment. Factors that influence the operation of the weaving segment include the weaving length, the number of lanes in the weaving segment, the number of vehicles entering and exiting the weave, the freeway traffic, and the weave configuration type. The performance measure that determines LOS within weaving sections is density (passenger cars/mile/lane).

The HCM methodology identifies multiple weaving configurations. The weaving configuration applicable to the I-290 corridor through the extended project area is the one-sided ramp weave. The identifying characteristic of a one-sided ramp weave segment is that all weaving vehicles must make one lane change to complete their maneuver successfully. The weaving segments within the I-290 study area were evaluated using HCS Version 6.1, a computerized version of HCM, 2010. The analysis was performed using April 2009 traffic volumes provided by IDOT's Traffic Systems Center.

#### 5.1 Existing Mainline Operations

Table 5-1 provides a comprehensive overview of the existing A.M. and P.M. peak hour mainline operations for all mainline elements analyzed (basic freeway segments, ramp junctions, and weaving segments) for east and westbound I-290 within the extended study area. As seen in the table, the entire I-290 mainline in the study area is operating at LOS D or worse during the A.M. and P.M. peak periods. This means that the facility is operating near, at, or over capacity with lower travel speeds. The existing traffic operations and LOS analysis for the individual roadway elements (basic freeway segments, ramp junctions, and weaving segments) are described in subsequent sections. The HCS output for this analysis is provided in **Appendix B**.

Eastbound	Analysis Type	2009 LOS		Westbound	Analysis Type	2009 LOS	
		AM	PM			AM	PM
	Segment	E	D		Segment	<b>F</b> *	<b>F</b> *
Kostner Ave On-Ramp	Ramp Jnct.	<b>E</b> *	D	Kostner Ave Off Ramp	Ramp Jnct.	<b>E</b> *	<b>F</b> *
	Segment	<b>F</b> *	Е		Segment	D	<b>F</b> *
Independence Blvd Off-Ramp	Ramp Jnct.	E	Е	Independence Blvd On Ramp	Ramp Jnct.	<b>D</b> *	<b>F</b> *
	Segment	Е	D		Segment	D	<b>F</b> *
Independence Blvd On-Ramp	Ramp Jnct.	D	D	Independence Blvd Off Ramp	Ramp Jnct.	D	<b>F</b> *
Homan Ave On-Ramp	Segment	Е	Е	Homan Ave Off Ramp	Segment	D	<b>F</b> *
Sacramento Blvd Off Ramp	Weave	E	Е	Sacramento Blvd On Ramp	Weave	Е	<b>F</b> *
Sacramento bivu Oli Ramp	Segment	Е	Е	Sacramento Bivo On Ramp	Segment	D	<b>F</b> *
Western Ave Off Ramp	Ramp Jnct.	Е	D	Western Ave On Ramp	Ramp Jnct.	<b>D</b> *	<b>F</b> *
	Segment	Е	D		Segment	D	<b>F</b> *
California Ave On Ramp	Ramp Jnct.	D	D	California Ave Off Ramp	Ramp Jnct.	D	<b>F</b> *
Oskiev Os Dama	Segment	Е	Е	Oshisu Aus Off Deser	Segment	D	<b>F</b> *
Oakley On Ramp	Weave	Е	Е	Oakley Ave Off Ramp	Weave	D	<b>F</b> *
Damen Ave Off Ramp	Segment	Е	F*	Damen Ave On Ramp	Segment	D	<b>F</b> *
Damen Ave On Ramp	Weave	Е	F*	Damen Ave Off Ramp	Weave	D	D
Paulina Ave Off Ramp	Segment	Е	F*	Paulina Ave On Ramp	Segment	D	D
Ashland Ave On Ramp	Weave	Е	Е	Ashland Ave Off Ramp	Weave	Е	Е
Racine Ave Off Ramp				Racine Ave On Ramp			

Table 5-1 – Overall I-290 Mainline Peak Period LOS Summary

Observations and speed information indicate that I-290 through the extended study area operate near, at, or over capacity conditions during AM and PM peak periods through various sections. These sections experience saturated or over saturated conditions resulting in low volumes and speeds which are not well evaluated by HCM 2010. The level of service for those sections are identified by an (\*) and is noted on the HCS output in Appendix B.

Table 5-2 summarizes the proportion of the extended study area that is operating at each level of Service during the peak periods. Overall, the peak period level of service is somewhat evenly distributed across all three levels of service. However, when looking at the directional LOS, 83% (3.3 miles) of westbound I-290 in the PM peak hour (traditional commute) operates at breakdown LOS F conditions. This is due to the 4-lane to 3-lane expressway transition that occurs downstream at Austin Boulevard. For the reverse commute (westbound in the AM peak hour), traffic is generally less congested with 85% of the mainline operating at LOS D. Compared to the westbound operations, eastbound traffic experiences approximately a third of the amount of LOS F conditions. The primary cause of eastbound breakdown conditions is due to the spill back congestion related to the I-290 to I-90/94 system interchange ramps. The remaining 84% of AM and PM eastbound operations operate at LOS E or D.

		EASTE	BOUND			WEST	OVERALL Peak			
LOS	A	М	PI	PM		N	PI	N	OVERALL FEAK	
	Length	%	Length	%	Length	%	Length	%	Length	%
F	2,150	10%	4,447	22%	1,654	8%	17,376	83%	25,627	31%
E	18,498	90%	11,497	56%	1,528	7%	650	3%	32,173	39%
D	0	0%	4,704	23%	17,673	85%	2,829	14%	25,206	30%
С	0	0%	0	0%	0	0%	0	0%	0	0%
В	0	0%	0	0%	0	0%	0	0%	0	0%
Α	0	0%	0	0%	0	0%	0	0%	0	0%
Total	20,648	100%	20,648	100%	20,855	100%	20,855	100%	83,006	100%

Table 5-2 - Proportion of I-290 Mainline by LOS (2009)

Average 2010 peak period speeds were calculated by the travel demand model are presented in **Table 5-3**. For the traditional commute pattern, eastbound travel speeds are estimated at between 8.5 mph and 28.1 mph in the AM period and between 8.6 mph and 31.8 mph in the westbound direction during the PM peak. Average reverse commute speeds are over double the average traditional commute speeds with westbound speeds ranging between 37.2 mph and 53.8 mph in the AM period, and eastbound average speeds ranging between 37.2 mph and 48.7 mph in the PM period.

From	Ta	Longth	Eastbou	nd (mph)	Westbound (mph)	
From	То	Length	AM	PM	AM	PM
Kostner Ave. Entrance	Independence Exit	0.35	19.5	44.0	40.2	22.0
Independence Exit	Independence Entrance	0.41	28.1	51.4	49.6	31.8
Independence Entrance	Homan Entrance	0.51	18.1	45.3	46.0	19.9
Homan Entrance	Sacramento Exit	0.14	10.2	34.6	37.2	10.6
Sacramento Exit	CD Road Exit	0.55	15.5	46.3	47.9	16.8
CD Road Exit	CD Road Entrance	0.25	21.1	48.7	50.7	21.8
CD Road Entrance	Oakley Entrance	0.36	12.8	45.6	47.7	11.7
Oakley Entrance	Damen Exit	0.09	8.5	39.7	44.4	8.6
Damen Exit	Damen Entrance	0.29	18.5	45.8	51.3	16.2
Damen Entrance	Paulina Exit	0.08	12.0	37.2	46.5	8.9
Paulina Exit	Ashland Entrance	0.48	20.8	46.8	53.8	19.4
Ashland Entrance	Racine Exit	0.10	16.4	44.8	52.9	15.3
	Weighted Average Speed	l (mph)->	18.3	45.8	47.9	18.9

Table 5-3 - I-290 Mainline Average 2010 Travel model Speeds

#### 5.1.1 Mainline Basic Freeway Segments

**Table 5-4** summarizes the results of the I-290 mainline basic freeway segment HCS analysis for the A.M. and P.M. peak hours. The results of the basic freeway segment analysis indicate that the traditional commute operations are generally worse than the reverse commute operations, operating almost entirely in LOS D and LOS E. Factors contributing to the sub-standard LOS along basic freeway segments are discussed in Section 6.2.

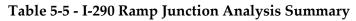
Eastbound	Eastbound Analysis Type 2009 Lo		LOS	Westbound		Analysis Type	2009 LOS	
		AM	PM				AM	PM
Keetner Ave On Damp	Segment	Е	D		Keetner Ave Off Damp	Segment	<b>F</b> *	F*
Kostner Ave On-Ramp	Segment	<b>F</b> *	Е		Kostner Ave Off Ramp	Segment	D	<b>F</b> *
Independence Blvd Off-Ramp	Segment	Е	D		Independence Blvd On Ramp	Segment	D	<b>F</b> *
Independence Blvd On-Ramp	Segment	Е	Е		Independence Blvd Off Ramp	Segment	D	<b>F</b> *
Homan Ave On-Ramp					Homan Ave Off Ramp			
Sacramento Blvd Off Ramp	Segment	Е	Ε		Sacramento Blvd On Ramp	Segment	D	F*
Western Ave Off Ramp	, , , , , , , , , , , , , , , , , , ,				Western Ave On Ramp		_	-
California Ave On Ramp	Segment	E	D		California Ave Off Ramp	Segment	D	<b>F</b> *
Oakley On Ramp	Segment	Ε	E		Oakley Ave Off Ramp	Segment	D	<b>F</b> *
Damen Ave Off Ramp					Damen Ave On Ramp			
Damen Ave On Ramp	Segment	E F'			Damen Ave Off Ramp	Segment	D	<b>F</b> *
Paulina Ave Off Ramp					Paulina Ave On Ramp			
Ashland Ave On Ramp	Segment	Ε	<b>F</b> *		Ashland Ave Off Ramp	Segment	D	D

Table 5-4 - I-290 Mainline Basic Freeway Segment LOS

#### 5.1.2 Mainline Ramp Junctions

The I-290 freeway ramp junction analysis of the A.M. and P.M. peak hours is summarized in **Table 5-5.** The results of the ramp junction analysis indicate that the ramp junction operations associated with traditional commute are generally worse than the reverse commute operations, operating almost entirely in LOS E and LOS F. Factors contributing to the sub-standard operations for ramp junctions are discussed in Section 5.1.2.

Eastbound	Analysis Type	2009	9 LOS		Westbound	Analysis Type	2009 LOS	
		AM	PM				AM	PM
Kostner Ave On-Ramp	Ramp Jnct.	<b>E</b> *	D		Kostner Ave Off Ramp	Ramp Jnct.	<b>E</b> *	<b>F</b> *
Independence Blvd Off-Ramp	Ramp Jnct.	Е	Ε		Independence Blvd On Ramp	Ramp Jnct.	<b>D</b> *	<b>F</b> *
Independence Blvd On-Ramp	Ramp Jnct.	D	D		Independence Blvd Off Ramp	Ramp Jnct.	D	<b>F</b> *
Western Ave Off Ramp	Ramp Jnct.	Е	D		Western Ave On Ramp	Ramp Jnct.	<b>D</b> *	<b>F</b> *
California Ave On Ramp	Ramp Jnct.	D	D		California Ave Off Ramp	Ramp Jnct.	D	<b>F</b> *



#### 5.1.3 Mainline Ramp Weaves

The results of the I-290 corridor weaving section analysis for the A.M. and P.M. peak hours is summarized **Table 5-6.** The weaving sections along I-290 in the expanded study area each include a continuous auxiliary lane connecting single lane on-ramp to a single lane off-ramp.

Eastbound	Analysis Type	2009 LOS		Westbound	Analysis Type	2009 LOS	
		AM	PM			AM	PM
Homan Ave On-Ramp		_	_	Homan Ave Off Ramp		_	-
Sacramento Blvd Off Ramp	Weave	E	Ε	Sacramento Blvd On Ramp	Weave	E	<b>F</b> *
Oakley On Ramp			Ε	Oakley Ave Off Ramp			
Damen Ave Off Ramp	Weave	E		Damen Ave On Ramp	Weave	D	<b>F</b> *
Damen Ave On Ramp				Damen Ave Off Ramp			
Paulina Ave Off Ramp	Weave	E	<b>F</b> *	Paulina Ave On Ramp	Weave	D	D
Ashland Ave On Ramp				Ashland Ave Off Ramp			
Racine Ave Off Ramp	Weave	EE		Racine Ave On Ramp	Weave	E	Ε

Table 5-6 - Mainline Weaving Segment LOS

#### 5.4.1 Eastbound I-290 Weaving Sections

There are four existing weaving sections along eastbound I-290 within the extended study area. They are described here in the direction of travel:

The first eastbound weaving section is between Homan Avenue on-ramp and the Sacramento Boulevard off-ramp. The two ramps are connected by approximately 760 feet of auxiliary lane.

The second eastbound weaving section exists between the Oakley Avenue on-ramp and the Damen Avenue off-ramp. The two ramps are connected by approximately 560 feet of auxiliary lane.

The third eastbound weaving section exists between the Damen Avenue on-ramp and the Paulina Avenue off-ramp. The two ramps are connected by approximately 480 feet of auxiliary lane.

The fourth eastbound weaving section exists between the Ashland Avenue on-ramp and the Racine Avenue off-ramp. The two ramps are connected by approximately 530 feet of auxiliary lane.

#### 5.4.2 Westbound I-290 Weaving Sections

There are four existing weaving sections along westbound I-290 within the extended study area. They are described here in the direction of travel:

The first westbound weaving section exists between the Racine Avenue on-ramp and the Ashland Avenue off-ramp. The two ramps are connected by approximately 650 feet of auxiliary lane.

The second westbound weaving section exists between the Paulina Avenue on-ramp and the Damen Avenue off-ramp. The two ramps are connected by approximately 425 feet of auxiliary lane.

The third westbound weaving section exists between the Damen Avenue on-ramp and the Oakley Avenue off-ramp. The two ramps are connected by approximately 560 feet of auxiliary lane.

The fourth eastbound weaving section is between the Sacramento Boulevard on-ramp and the Homan Avenue off-ramp. The two ramps are connected by approximately 880 feet of auxiliary lane.

#### 5.1.4 Duration of Congestion

To determine the overall periods of congestion beyond the peak hours, the available April 2009 mainline count station traffic volume was analyzed. For the extended study area, data from the count station located nearest the center of the extended study area at Sacramento Avenue was used for both the eastbound and westbound mainline lanes. The LOS for each one-hour time period was calculated at the count station. Calculations were based on equating expressway volumes to a level of service per HCS 2010. The calculations are presented in **Appendix C**, and **Table 5-7** summarizes the results:

	@ Sacramento					
Time of day	East-bound	Westbound				
1:00 AM	Α	Α				
2:00 AM	Α	Α				
3:00 AM	Α	Α				
4:00 AM	Α	Α				
5:00 AM	Α	Α				
6:00:00 AM*	С	В				
7:00:00 AM*	E	<b>D</b> **				
8:00:00 AM*	E	D				
9:00:00 AM*	E	D				
10:00 AM	E	С				
11:00 AM	D	С				
12:00 PM	D	D				
1:00 PM	D	D				
2:00 PM	D	D				
3:00 PM	D	D				
4:00:00 PM*	D	E**				
5:00:00 PM*	D	<b>F</b> **				
6:00:00 PM*	D	<b>F</b> **				
7:00 PM	D	D				
8:00 PM	D	С				
9:00 PM	C C	C C				
10:00 PM	С	С				
11:00 PM	С	С				
12:00 AM	В	В				

Table 5-7 - I-290 Twenty Four Hour LOS (2009)

\* Peak Period, \*\* Observed Operations

Traffic data indicates that the I-290 Eisenhower Expressway experiences congested conditions (LOS D or worse) for up to fourteen hours each weekday for both eastbound and westbound lanes. The most severe congestion occurs in the westbound PM peak period (traditional commute) and is attributed to over 4 miles of congestion due to the I-290 mainline lane drop at Austin Boulevard located over three miles west. Other than this location, the 8-lane section of the extended I-290 project area does not experience the same level breakdown conditions as experienced in the six-lane section of I-290 to the west. In the eastbound direction, the poorest operations occur in the AM peak period (traditional commute) and are attributed to congestion related to the exit ramps at the I-90/94 system interchange.

#### 5.2 Study Area Arterial Operations

Five east-west and three north-south arterials within the extended study area were evaluated; from north to south they are: North Avenue, Lake Street, Madison Street, Roosevelt Road, and Cermak Road, and from east to west: Ashland Avenue, Western Avenue, and Pulaski Road.

To understand the operational performance, the volume to capacity ratio of arterials was examined for the average peak period in 2010. As described earlier in this document, v/c is defined as the ratio of traffic demand flow rate to the roads existing capacity, and is used as a tool to provide conceptual level picture of traffic congestion. For this analysis, the v/c ratios were classified into the following ranges;

Less than 0.50	Uncongested traffic conditions (green)				
0.50 to 0.90	Congested traffic conditions (orange)				
0.90 and over	Very congested conditions (red)				
roliminary Engineering and Environmental (Phase I) Study					

**Figure 5-1** shows the 2010 arterial roadway peak period analysis based on the I-290 travel model results, and **Table 5-8** provides a summary of arterial congestion levels based on length.



Figure 5-1 - 2010 Arterial Roadway Peak Period Volume to Capacity Ratios

In the extended study area, 39% of the east-west arterials and 92% of the north south arterials operate under very congested peak period conditions. All of North Avenue operates under very congested conditions, as does most of Roosevelt Road. **Appendix A** provides a summary of the v/c values calculation table by sub-segment.

		Uncongested		Conge	sted	Very Congested	
Arterial	Length	< 0.	5	from 0.5 t	o 0.89	0.9 & a	bove
		length	%	length	%	Length	%
North Avenue	5.83 mi	0.00 mi	0%	0.00 mi	0%	5.83 mi	100%
Lake Street	5.84 mi	1.00 mi	17%	4.84 mi	83%	0.00 mi	0%
Madison Street	5.61 mi	1.02 mi	18%	4.59 mi	82%	0.00 mi	0%
Roosevelt Road	5.58 mi	0.00 mi	0%	2.03 mi	36%	3.55 mi	64%
Cermak Road	4.05 mi	0.52 mi	13%	2.53 mi	62%	1.00 mi	25%
Total (East-West)	26.91 mi	2.54 mi	9%	13.99 mi	52%	10.38 mi	39%
Pulaski Road	4.06 mi	0.00 mi	0%	0.00 mi	0%	4.06 mi	100%
Western Avenue	4.05 mi	0.00 mi	0%	0.51 mi	13%	3.54 mi	87%
Ashland Avenue	3.99 mi	0.00 mi	0%	0.47 mi	12%	3.52 mi	88%
Total (North-South)	12.10 mi	0.00 mi	0%	0.98 mi	8%	11.12 mi	92%
Overall	39.01 mi	2.54 mi	7%	14.97 mi	38%	21.50 mi	55%

Table 5-8 - 2010 Arterial Peak Period Operations Summary

## 6.0 Factors Affecting Operations

The results of the traffic operations analysis of existing conditions indicate that the majority of roadway elements within the I-290 corridor are operating under congested conditions and deteriorated levels of service. Each of the various elements analyzed have different factors that affect their performance under traffic. This section identifies the primary factors that influence the performance of the major roadway elements analyzed.

#### 6.1 Basic Freeway Segments

A majority of the four lane basic freeway segments along eastbound and westbound I-290 operate at LOS E or worse during both A.M. and P.M. peak hours. This deteriorated LOS may be attributed to the following factors:

- Inadequate capacity for travel demand
- Congestion that backs up due to the westbound lane drop at Austin Boulevard, which is violation of the basic number of lanes principle
- Congested eastbound operations related to the I-90/I-94 interchange/Circle interchange ramp capacity and exit volumes

Demand exceeding the available capacity is the primary factor causing congestion in the corridor. The 8-lane section of I-290 in the extended study on average carries 201,909 vehicles per day. Based on a maximum expected capacity of 180,000 vehicles per day<sup>4</sup>, the mainline operates in excess of 12.2% of its ideal capacity. As a comparison, the 6 lane section of I-290 operates in excess of 37.6% of its ideal capacity (**Table 6-1**).

I-290 Section	ldeal Capacity	2-way ADT Weighted Average by Length	% Over Ideal Capacity
8 Lanes	180,000	201,909	12.2%
6 Lanes	135,000	185,728	37.6%

Table 6-1 – I-290 Existing Volumes and Capcity

Generally, the level of service of the basic freeway segments are affected by the demand volume generally exceeding the maximum expected, or ideal capacity, resulting in less than desirable levels of service D and E. Breakdown level of service F in the basic freeway segments is directly related to congestion spill back from downstream bottleneck conditions in the westbound direction at Austin Boulevard and in the eastbound direction at the I-290 & I-90/94 system interchange ramps.

#### 6.2 Ramp Junctions and Weaving

All of the ramp junctions and each of the identified weaving sections within the 4-lane section of eastbound and westbound I-290, through the extended project area operate at less than the desired LOS C. This lower performance can be attributed to the same factors as the weaving segments:

<sup>&</sup>lt;sup>4</sup> From 2010 Highway Capacity Manual, Exhibit 11-17

- Inadequate capacity for travel demand
- Congestion that backs up due to the westbound lane drop at Austin Boulevard, which is violation of the basic number of lanes principle
- Congested eastbound operations related to the I-90/I-94 interchange/Circle interchange ramp capacity and exit volumes

Generally, the level of service of the ramp junctions and weaving sections are affected by the demand volume generally exceeding the maximum expected capacity, resulting in less than desirable levels of service D and E. Breakdown level of service F in ramp junctions and weaving sections is directly related to congestion spill back from downstream bottleneck conditions in the westbound direction at Austin Boulevard and in the eastbound direction at the I-290 & I-90/94 system interchange ramps.

#### 6.3 Study Area Arterials

Several factors influence the operation along the parallel arterials including:

- Traffic volume: Higher traffic demand results in higher volume to capacity ratios, with congestion beginning when demand approaches the design capacity of a roadway. Breakdown conditions occur when demand exceeds capacity resulting in extremely congested conditions characterized by lower speeds, longer trip times, and longer queues.
- Number of lanes and cross-sections: Providing an adequate number of lanes, including an appropriate number of turn lanes, increases the available capacity on an arterial, allowing it to convey more traffic at lower v/c ratios. The lack of an adequate number of through and turn lanes results in higher volume to capacity ratios and greater congestion.
- The dense urban environment in which these arterials are located, constrain the opportunities to provide capacity improvements to improve operations. Adding through lanes or turn lanes would result in potential impacts to available parking, sidewalks, and buildings.
- Traffic signals: Operations along arterials are impacted by signal density (the number of traffic signals per mile). Service volumes are higher on arterials that have a lower number of traffic signals per mile. A higher number of traffic signals per mile on an arterial will result in lower travel speeds, increases in delay, queuing at intersections, congestion, and greater opportunity for crashes.
- Mainline Congestion: Congested conditions along mainline I-290 may result in the "spillover" traffic being diverted to these arterials. Similar to the mainline operations, the east-west arterials that parallel the 8-lane section of I-290 are generally less congested than compared to the parallel arterials along the six-lane section of I-290 west of Austin Boulevard.

## 7.0 Conclusion

The extended study area and 8-lane section of the I-290 Eisenhower Expressway and adjacent arterial network all experience some congestion, primarily due to demand exceeding the available capacity of the various facilities.

Although congestion in the extended study area can be attributed to the traffic demand in the corridor, two key factors contribute to the particular congestion problems in this section: the eastbound mainline lane imbalance and capacity reduction at Austin Boulevard, and congestion related to the Circle Interchange ramp volume and capacity.

The I-290 Crash Analysis for the extended study area also recognizes these two locations within the extended study area and for operational improvements to address congestion related crashes where they occur with the greatest frequency – in the eastbound direction approaching Racine Avenue, and in the westbound direction from Independence Avenue to Kostner Avenue approaching the lane drop at Austin Boulevard.

Potential operational countermeasures include eliminating the 3 lane bottleneck in the westbound direction to promote more free-flow of traffic and reduce the potential for stop and start traffic that contributes to rear end crashes. In the eastbound direction, the congestion reducing countermeasures associated with the I-290 and I90/94 system interchange are being considered by the Circle Interchange Study.

### List of References

Bureau of Design and Environment Manual, Illinois Department of Transportation, December 2002

A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, 2004

Highway Capacity Manual, Transportation Research Board, 2010

Chicago Metropolitan Agency for Planning, Congestion Management, Performance Management, <u>http://www.cmap.illinois.gov/scans/</u>

Average Daily Traffic map, Illinois Department of Transportation, December 2009, <u>http://www.gettingaroundillinois.com/default.aspx?ql=aadt</u>

# Appendix A

## Arterial Volume to Capacity (v/c) Calculations

Arteria	Il Segment	Len. (mi)	Capacity	AADT 1 hr Vol.	v/c
Seg	North Avenue				
1	Central Ave to Kostner Ave	1.53	2,309	2,380	1.03
6	Kostner to Pulaski	0.52	2,052	2,380	1.16
7	Pulaski to Kedzie	1.00	2,309	2,390	1.04
8	Kedzie to Western	1.02	2,052	2,390	1.16
9	Western to Ashland	1.01	822	2,390	2.91
10	Ashland to Racine	0.75	2,284	2,310	1.01
Seg	Lake Street				
1	Central Ave to Kostner Ave	1.52	2,136	1,120	0.52
6	Kostner to Pulaski	0.50	1,418	870	0.61
7	Pulaski to Kedzie	1.00	1,990	870	0.44
8	Kedzie to Western	1.02	1,697	870	0.51
9	Western to Ashland	0.99	972	870	0.90
10	Ashland to Racine	0.81	1,033	870	0.84
Seg	Madison Street				
1	Central Ave to Kostner Ave	1.53	2,437	1,650	0.68
6	Kostner to Pulaski	0.51	2,437	1,680	0.69
7	Pulaski to Kedzie	1.01	1,635	1,065	0.65
8	Kedzie to Western	1.02	2,159	900	0.42
9	Western to Ashland	1.03	1,560	840	0.54
10	Ashland to Racine	0.51	1,102	840	0.76
Seg	Roosevelt Road	Fixed			
1	Central Ave to Koster Ave	1.53	2,227	1,847	0.83
6	Kostner to Pulaski	0.50	2,437	1,420	0.58
7	Pulaski to Kedzie	1.00	2,228	2,590	1.16
8	Kedzie to Western	1.00	2,106	2,590	1.23
9	Western to Ashland	1.01	2,302	2,590	1.13
10	Ashland to Racine	0.54	2,123	2,590	1.22
Seg	Cermak Road				
1	Kostner to Pulaski	0.52	2,437	2,080	0.85
2	Pulaski to Kedzie	1.01	2,410	1,630	0.68
3	Kedzie to Western	1.00	1,617	1,630	1.01
4	Western to Ashland	1.00	1,769	1,090	0.62
5	Ashland to Racine	0.52	2,991	1,090	0.36

Arteria	l Segment	Len. (mi)	Capacity	AADT 1 hr Vol.	v/c
Seg	Pulaski Road				
1	North to Chicago	0.99	1,093	1,680	1.54
2	Chicago to Lake	0.69	1,033	1,740	1.68
3	Lake to Madison	0.35	1,080	1,740	1.61
4	Madison to Harrison	0.49	1,133	1,740	1.54
5	Harrison to Roosevelt	0.53	1,114	1,790	1.61
6	Roosevelt to Cermak	1.01	1,154	1,580	1.37
Seg	Western Avenue				
1	North to Chicago	1.00	2,052	2,680	1.31
2	Chicago to Lake	0.77	2,022	2,680	1.33
3	Lake to Madison	0.25	2,216	2,680	1.21
4	Madison to Harrison	0.51	3,056	2,680	0.88
5	Harrison to Roosevelt	0.50	2,052	2,420	1.18
6	Roosevelt to Cermak	1.02	2,599	2,890	1.11
Seg	Ashland Avenue				
1	North to Chicago	1.00	2,225	2,720	1.22
2	Chicago to Lake	0.78	2,052	2,720	1.33
3	Lake to Madison	0.24	2,870	2,720	0.95
4	Madison to Harrison	0.47	3,402	2,720	0.80
5	Harrison to Roosevelt	0.50	2,965	2,720	0.92
6	Roosevelt to Cermak	1.00	2,180	2,690	1.23

# Appendix B

**HCS Analysis Output** 

## **B-1**

**Basic Freeway Segments** 

## I - 290 Eastbound Segment Analysis

## **Existing Conditions**

Phone: E-mail: Fax:

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E-mail:			
	Operational And	alysis	
Agency or Company:HDate Performed:7Analysis Time Period:7Freeway/Direction:1From/To:0	-290 EB Licero to Kostn DOT Lxist. 2009	er	
	Flow Inputs an	d Adjustments	
Volume, V Peak-hour factor, PHF		7350 0.95	veh/h
Peak 15-min volume, v15		1934	v
Trucks and buses		10	00
Recreational vehicles		0	Dia
Terrain type:		Level	. 0
Grade		-	
Segment length		- 1 E	mi
Trucks and buses PCE, ET Recreational vehicle PCE,	ГD	1.5 1.2	
Heavy vehicle adjustment,		0.952	
Driver population factor,		1.00	
Flow rate, vp	~P	2031	pc/h/ln
	_Speed Inputs a	nd Adjustments	
To a substitute			C1-
Lane width		-	ft
Right-side lateral cleara	ince	-	ft
Total ramp density, TRD Number of lanes, N		4	ramps/mi
Free-flow speed:		Measured	
FFS or BFFS		55.0	mi/h
Lane width adjustment, fI	W	-	mi/h
Lateral clearance adjust		_	mi/h
TRD adjustment		- -	mi/h
Free-flow speed, FFS		55.0	mi/h
· · ·	LOS and Perfor	mance Measures	
Flow rate, vp		2031	pc/h/ln
Free-flow speed, FFS		55.0 ·	mi/h
Average passenger-car spe	ed, S	53.7	mi/h
Number of lanes, N	r -	4	,
Density, D		37.8	pc/mi/ln
Level of service, LOS		E	<b>-</b>
			,

Phone: E-mail: Fax:

Operational Analysis\_\_\_\_\_ Analyst: RCT Analyst.NotAgency or Company:PBDate Performed:7/31/2012Analysis Time Period:PM Peak HourFreeway/Direction:I-290 EBFrom/To:Cicero to Kostner IDOT Jurisdiction: Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments Volume, V 6860 veh/h 0.95 Peak-hour factor, PHF Peak 15-min volume, v15 1805 v Trucks and buses 9 8 0 Recreational vehicles 8 Terrain type: Level -옹 Grade Segment length \_ mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.957 Driver population factor, fp 1.00 Flow rate, vp 1887 pc/h/ln Speed Inputs and Adjustments Lane width ft Right-side lateral clearance ft -Total ramp density, TRD ramps/mi Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC \_ mi/h TRD adjustment \_ mi/h Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures Flow rate, vp 1887 pc/h/ln 55.0 Free-flow speed, FFS mi/h Average passenger-car speed, S 54.8 mi/h Number of lanes, N 4 34.4 Density, D pc/mi/ln Level of service, LOS D

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:		Fax:	
<b></b>	Operational Ar	alysis	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 EB Kostner to Inde IDOT Exist. 2009 se l Study		
	Flow Inputs ar	nd Adjustments	······································
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen	E, ER t, fHV	7990 0.95 2103 10 0 Level - - 1.5 1.2 0.952	veh/h v % % mi
Driver population facto Flow rate, vp	r, fp	1.00 2208	pc/h/ln
	Speed Inputs a	and Adjustments	
Lane width Right-side lateral clea Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus TRD adjustment Free-flow speed, FFS	fLW tment, fLC	- - 4 Measured 55.0 - - 55.0 cmance Measures	ft ft ramps/mi mi/h mi/h mi/h mi/h
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	2208 55.0 50.9 4 43.4 E	pc/h/ln mi/h mi/h pc/mi/ln

Phone: E-mail: Fax:

Operational Analysis RCT Analyst: Agency or Company: PB Date Performed: 7/31/2012 Analysis Time Period: PM Peak Hour Freeway/Direction: I-290 EB From/To: Kostner to Independence Jurisdiction:IDOTAnalysis Year:Exist. 2009 Description: I-290 Phase 1 Study \_\_\_\_\_Flow Inputs and Adjustments veh/h 7590 Volume, V 0.95 Peak-hour factor, PHF Peak 15-min volume, v15 1997 v Trucks and buses 9 8 0 Recreational vehicles 웅 Terrain type: Level 옹 Grade -Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.957 Driver population factor, fp 1.00 2087 Flow rate, vp pc/h/ln Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft ----Total ramp density, TRD ramps/mi Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS mi/h 55.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h \_ TRD adjustment mi/h 55.0 Free-flow speed, FFS mi/h LOS and Performance Measures Flow rate, vp 2087 pc/h/ln Free-flow speed, FFS 55.0 mi/h Average passenger-car speed, S 53.0 mi/h Number of lanes, N 4 39.4 pc/mi/ln Density, D Level of service, LOS Ε

Phone: E-mail: Fax:

E-mail:				
	_Operational A	nalysis		
Analyst:	RCT			
Agency or Company:	PB			
	7/31/2012			
Analysis Time Period:	AM Peak Hour			
Freeway/Direction:	I-290 EB			
From/To:	Independence (	)ff to On		
Jurisdiction:	IDOT			
Analysis Year: Description: I-290 Phas	Exist. 2009 se 1 Study			
• 		and Adjustments		
Volume, V		7590	veh/h	
Peak-hour factor, PHF		0.95		
Peak 15-min volume, v15		1997	V	
Trucks and buses		10	<del>9</del>	
Recreational vehicles		0	8	
Terrain type:		Level		
Grade		_	8	
Segment length		-	mi	
Trucks and buses PCE, E1	Ľ	1.5		
Recreational vehicle PCH	E, ER	1.2		
Heavy vehicle adjustment	t, fHV	0.952		
Driver population factor	r, fp	1.00		
Flow rate, vp		2097	pc/h/ln	
	Speed Inputs	and Adjustments		
Lane width		_	ft	
Right-side lateral clear	rance	_	ft	
Total ramp density, TRD		-	ramps/mi	
Number of lanes, N		4		
Free-flow speed:		Measured		
FFS or BFFS		55.0	mi/h	
Lane width adjustment, :		-	mi/h	
Lateral clearance adjust	tment, fLC	-	mi/h	
TRD adjustment		-	mi/h	
Free-flow speed, FFS		55.0	mi/h	
	_LOS and Perfo	ormance Measures		
Flow rate, vp		2097	pc/h/ln	
Free-flow speed, FFS		55.0	mi/h	
Average passenger-car s	peed, S	52.8	mi/h	
Number of lanes, N		4		
Density, D		39.7	pc/mi/ln	
Level of service, LOS			1	

#### HCS 2010: Basic Freeway Segments Release 6.1

Phone: E-mail: Fax:

Operational Analysis

0	perational	Analysis	· · · · · · · · · · · · · · · · · · ·
Analyst: RC			
Agency or Company: PB Date Performed: 7/	31/2012		
	Peak Hour		
	290 EB		
	dependence	Off to Op	
	OT		
	ist. 2009		
Description: I-290 Phase			
<u>ـــــــ</u> ـــــــــــــــــــــــــــــ	low Inputs	and Adjustments	
Volume, V		6720	veh/h
Peak-hour factor, PHF		0.95	
Peak 15-min volume, v15		1768	v
Trucks and buses		9	0 <del>1</del> 0
Recreational vehicles		0	0
Terrain type:		Level	
Grade		-	00
Segment length		-	mi
Trucks and buses PCE, ET		1.5	
Recreational vehicle PCE,		1.2	
Heavy vehicle adjustment,		0.957	
Driver population factor,	fp	1.00	
Flow rate, vp		1848	pc/h/ln
S	peed Input	s and Adjustments	
Lane width		-	ft
Right-side lateral clearan	ice	-	ft
Total ramp density, TRD		-	ramps/mi
Number of lanes, N		4	
Free-flow speed:		Measured	_: /1-
FFS or BFFS	т	55.0	mi/h
Lane width adjustment, fLW		_	mi/h
Lateral clearance adjustme	IIL, ILC	_	mi/h mi/h
TRD adjustment		- 55.0	mi/h mi/h
Free-flow speed, FFS			
I	OS and Per	formance Measures	
Flow rate, vp		1848	pc/h/ln
Free-flow speed, FFS		55.0	mi/h
Average passenger-car spee	ed, S	54.9	mi/h
Number of lanes, N		4	
Density, D		33.6	pc/mi/ln
Level of service, LOS		D	

Phone:

Fax:

E-mail: \_\_\_\_\_Operational Analysis\_\_\_\_\_\_ Analyst: RCT Analysi:RefAgency or Company:PBDate Performed:7/31/2012Analysis Time Period:AM Peak HourFreeway/Direction:I-290 EBFrom/To:Independence to HomanJurisdiction:IDOTAnalysis Year:Exist. 2009Description:I\_200 Phase 1 Study Description: I-290 Phase 1 Study Flow Inputs and Adjustments 8020 veh/h Volume, V 0.95 Peak-hour factor, PHF 2111 10 0 Peak 15-min volume, v15 v Trucks and buses 몽 Recreational vehicles 8 Terrain type: Level 웅 Grade -Segment length \_ mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 2216 pc/h/ln \_\_\_\_\_Speed Inputs and Adjustments\_\_\_\_\_ ft Lane width Right-side lateral clearance ---ft Total ramp density, TRD ---ramps/mi Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW mi/h \_ Lateral clearance adjustment, fLC - mi/h TRD adjustment - mi/h Free-flow speed, FFS 55.0 mi/h Lateral clearance adjustment, fLC TRD adjustment Free-flow speed, FFS \_\_\_\_\_LOS and Performance Measures\_\_\_\_\_ 2216 pc/h/ln 55.0 mi/h Flow rate, vp Free-flow speed, FFS

,		,
Average passenger-car speed, S	50.7	mi/h
Number of lanes, N	4	
Density, D	43.7	pc/mi/ln
Level of service, LOS	Е	

Phone: E-mail: Fax:

Operational	Analysis	
Analyst: RCT		
Agency or Company: PB		
Date Performed: 7/31/2012		
Analysis Time Period: PM Peak Hour		
Freeway/Direction: I-290 EB		
From/To: Independence	to Homan	
Jurisdiction: IDOT		
Analysis Year: Exist. 2009		
Description: I-290 Phase 1 Study		
Flow Inputs	and Adjustments	
Volume, V	7370	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1939	v
Trucks and buses	· 9	8
Recreational vehicles	0	8
Terrain type:	Level	
Grade	_	<u>0</u>
Segment length	_	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.957	
Driver population factor, fp	1.00	
Flow rate, vp	2027	pc/h/ln
Speed Input	s and Adjustments	
Lane width	· _	ft
Right-side lateral clearance	_	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	-	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment		mi/h
Free-flow speed, FFS	55.0	mi/h
LOS and Per	formance Measures	
Flow rate, vp	2027	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	53.7	mi/h
Number of lanes, N	4	
namber of famoly n		
Density, D	. 37.7	pc/mi/ln

Phone: E-mail: Fax:

E-mail:		
Operationa	l Analysis	
Analyst: RCT		
Agency or Company: PB		
Date Performed: 7/31/2012		
Date Performed: 7/31/2012 Analysis Time Period: AM Peak Hou	ır	
Freewav/Direction: I-290 EB		
From/To: Sacramento	to Western	
Jurisdiction: IDOT		
Analysis Year: Exist. 2009	)	
Description: I-290 Phase 1 Study		
Flow Input	s and Adjustments	k
Volume, V	7750	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	2039	v
Trucks and buses	10	몽
Recreational vehicles	0	8
Terrain type:	Level	
Grade	_	8
Segment length	_	mi
Trucks and buses PCE, ET	, 1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV		
Driver population factor, fp	1.00	
Flow rate, vp	2141	pc/h/ln
Speed Inpu	its and Adjustments	
Lane width	_	ft
Right-side lateral clearance	_	ft
Total ramp density, TRD	_	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	_	mi/h
Lateral clearance adjustment, fLC	_	mi/h
TRD adjustment	_	mi/h
Free-flow speed, FFS	55.0	mi/h
LOS and Pe	erformance Measures	· · · ·
Flow rate, vp	2141	pc/h/ln
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	52.1	mi/h
Number of lanes, N	4	int / 11
Density, D	41.1	pc/mi/ln
Level of service, LOS	E E	PC/ mr/ 111
TEAST OF SETATCS' TOS	<b>1</b>	

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Operational Analysis\_\_\_\_\_ Analyst: RCT Agency or Company: PB Date Performed: 7/31/2012 Date Felloimed.7/51/2012Analysis Time Period:PM Peak HourFreeway/Direction:I-290 EBFrom/To:Sacramento to Western Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments 7220 veh/h Volume, V 0.95 Peak-hour factor, PHF 1900 v Peak 15-min volume, v15 Trucks and buses 9 웡 0 용 Recreational vehicles Terrain type: Level 8 Grade Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.957 1.00 Driver population factor, fp 1986 pc/h/ln Flow rate, vp \_\_\_\_\_Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft ramps/mi Total ramp density, TRD Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h mi/h TRD adjustment 55.0 Free-flow speed, FFS mi/h LOS and Performance Measures 1986 pc/h/ln Flow rate, vp Free-flow speed, FFS 55.0 mi/h Average passenger-car speed, S 54.1 mi/h Number of lanes, N 4 Density, D 36.7 pc/mi/ln Level of service, LOS E

Fax:

\_\_\_\_\_Operational Analysis\_\_\_\_\_ Analyst: RCT Analyst:RC1Agency or Company:PBDate Performed:7/31/2012Analysis Time Period:AM Peak HourFreeway/Direction:I-290 EBFrom/To:Western to CaliforniaJurisdiction:IDOTAnalysis Year:Exist. 2009Description:I\_200 Phase 1 Study Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h 7250 Volume, V Peak-hour factor, PHF 0.95 1908 Peak 15-min volume, v15 v Trucks and buses 10 울 Recreational vehicles 0 움 Level Terrain type: 뭥 Grade -Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 2003 pc/h/ln \_\_\_\_\_Speed Inputs and Adjustments\_\_\_\_\_ ft Lane width ft Right-side lateral clearance Total ramp density, TRD --ramps/mi Number of lanes, N 4 Free-flow speed: Measured 55.0 mi/h FFS or BFFS Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h mi/h mi/h TRD adjustment Free-flow speed, FFS 55.0 LOS and Performance Measures\_\_\_\_\_ 2003 pc/h/ln Flow rate, vp Free-flow speed, FFS 55.0 mi/h mi/h 54.0 Average passenger-car speed, S Number of lanes, N 4 37.1 Density, D pc/mi/ln E . Level of service, LOS

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\_\_\_\_\_Operational Analysis\_ RCT Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Date Performed: Date Performed: PB 7/31/2012 PM Peak Hour I-290 EB From/To: DOT Analyst: Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments Volume, V 6720 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 1768 v Trucks and buses 9 8 0 Recreational vehicles 응 Terrain type: Level 읗 Grade -Segment length ---mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.957 Driver population factor, fp 1.00 Flow rate, vp 1848 pc/h/ln Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft ---, Total ramp density, TRD ramps/mi Number of lanes, N 4, Free-flow speed: Measured mi/h FFS or BFFS 55.0 Lane width adjustment, fLW mi/h \_ Lateral clearance adjustment, fLC \_ mi/h TRD adjustment mi/h 55.0 mi/h Free-flow speed, FFS LOS and Performance Measures 1848 pc/h/ln Flow rate, vp Free-flow speed, FFS 55.0 mi/h Average passenger-car speed, S 54.9 mi/h Number of lanes, N 4 33.6 pc/mi/ln

Density, D Level of service, LOS

D

Density, D

Level of service, LOS

Fax:

E-mail: \_\_Operational Analysis\_\_\_\_\_ RCT Analyst: Analyst:RCTAgency or Company:PBDate Performed:7/31/2012Analysis Time Period:AM Peak HourFreeway/Direction:I-290 EBFrom/To:California to OakleyJurisdiction:IDOTAnalysis Year:Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments Volume, V 7750 veh/h Peak-hour factor, PHF 0.95 Peak 15-min volume, v15 2039 v 10 Trucks and buses 용 0 Recreational vehicles 몽 Terrain type: Level 웧 -Grade Segment length \_ mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 2141 pc/h/ln Flow rate, vp Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft Total ramp density, TRD ramps/mi Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h TRD adjustment mi/h 55.0 Free-flow speed, FFS mi/h LOS and Performance Measures Flow rate, vp 2141 pc/h/ln Free-flow speed, FFS 55.0 mi/h Average passenger-car speed, S 52.1 mi/h Number of lanes, N 4

41.1

Е

pc/mi/ln

Level of service, LOS

Fax:

\_\_\_\_Operational Analysis\_\_\_\_\_ Analyst:RCTAgency or Company:PBDate Performed:7/31/2012Analysis Time Period:PM Peak HourFreeway/Direction:I-290 EBFrom/To:California to OakleyJurisdiction:IDOTAnalysis Year:Exist. 2009Description:I\_220 Phase 1 Study Analyst: RCT Description: I-290 Phase 1 Study Flow Inputs and Adjustments 7250 veh/h Volume, V 0.95 Peak-hour factor, PHF 1908 v Peak 15-min volume, v15 Trucks and buses 9 . 응 0 옹 Recreational vehicles Level Terrain type: 양. Grade -Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 0.957 Heavy vehicle adjustment, fHV 1.00 Driver population factor, fp 1994 pc/h/ln Flow rate, vp Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft ramps/mi Total ramp density, TRD Number of lanes, N 4 Free-flow speed: Measured 55.0 FFS or BFFS mi/h Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h - mi/h 55.0 mi/h TRD adjustment Free-flow speed, FFS \_\_\_\_\_ LOS and Performance Measures\_\_\_\_\_ 1994 pc/h/ln Flow rate, vp 55.0 Free-flow speed, FFS mi/h 54.1 mi/h Average passenger-car speed, S Number of lanes, N 4 36.9 Density, D pc/mi/ln

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Operational Analysis Analyst: RCT Agency or Company: Date Performed: PB 7/31/2012 Analysis Time Period:AM Peak HourFreeway/Direction:I-290 EBFrom/To:Damen Off to Damen On IDOT Jurisdiction: Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h 7210 Volume, V Peak-hour factor, PHF 0.95 1897 Peak 15-min volume, v15 ν. Trucks and buses 10 8 0 Recreational vehicles 뫙 Terrain type: Level 옹 Grade Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 0.952 Heavy vehicle adjustment, fHV Driver population factor, fp 1.00 pc/h/ln Flow rate, vp 1992 Speed Inputs and Adjustments ft. Lane width Right-side lateral clearance ft Total ramp density, TRD ramps/mi Number of lanes, N 4 Free-flow speed: Measured mi/h FFS or BFFS 55.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h TRD adjustment mi/h Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures 1992 pc/h/ln Flow rate, vp 55.0 Free-flow speed, FFS mi/h Average passenger-car speed, S 54.1mi/h Number of lanes, N 4 36.8 pc/mi/ln Density, D Level of service, LOS Ε

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:		Fax:	
	Operational	Analysis	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Pha	RCT PB 7/31/2012 PM Peak Hour I-290 EB Damen Off to IDOT Exist. 2009 se 1 Study	Damen On	,
	Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15		6920 0.95 1821	veh/h
Trucks and buses Recreational vehicles Terrain type:		9 0 Level	96 96
Grade Segment length	m		۶ mi
Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto	E, ER t, fHV	1.5 1.2 0.957 1.00	
Flow rate, vp		1903	pc/h/ln
•	Speed Input	s and Adjustments	
Lane width Right-side lateral clea Total ramp density, TRD Number of lanes, N Free-flow speed:		- - 4 Measured	ft ft ramps/mi
FFS or BFFS Lane width adjustment,		55.0 -	mi/h mi/h mi/h
Lateral clearance adjus TRD adjustment Free-flow speed, FFS		- 55.0	mi/h mi/h mi/h
		formance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N	peed, S	1903 55.0 54.7 4	pc/h/ln mi/h mi/h
Density, D Level of service, LOS		4 34.8 D	pc/mi/ln

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#### HCS 2010: Basic Freeway Segments Release 6.1

Phone: E-mail: Fax:

Operational Analysis\_\_\_\_\_ RCT Analyst: Date Performed: Agency or Company: PB7/31/2012 Date Periormed.Analysis Time Period:AM Peak HourFreeway/Direction:I-290 EBFrom/To:Paulina to Ashland IDOT Jurisdiction: Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h 7020 Volume, V 0.95 Peak-hour factor, PHF Peak 15-min volume, v15 1847 ν 10 웅 Trucks and buses Recreational vehicles 0 욹 Terrain type: Level 몽 Grade ----Segment length mi 1.5 Trucks and buses PCE, ET Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 1940 pc/h/ln Flow rate, vp Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft ramps/mi Total ramp density, TRD Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h mi/h Lane width adjustment, fLW Lateral clearance adjustment, fLC --mi/h TRD adjustment mi/h Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures\_\_\_\_\_ Flow rate, vp 1940 pc/h/ln 55.0 mi/h

mi/h

pc/mi/ln

Free-flow speed, FFS Average passenger-car speed, S 54.5 Number of lanes, N 4 35.6 Density, D Level of service, LOS Ε

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:		Fax:	
	Operational An	alysis	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 EB Paulina to Ashl IDOT Exist. 2009	and	
	Flow Inputs an	d Adjustments	
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15	5	6990 0.95 1839	veh/h v
Trucks and buses Recreational vehicles Terrain type:		9 0 Level	२ २ २
Grade Segment length Trucks and buses PCE, H Recreational vehicle PC	CE, ER	- 1.5 1.2 0.957	° mi
Heavy vehicle adjustmer Driver population facto Flow rate, vp		1.00 1922	pc/h/ln
	Speed Inputs a	nd Adjustments	
Lane width Right-side lateral clea Total ramp density, TRI Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment,	) flW	- - 4 Measured 55.0	ft ft ramps/mi mi/h mi/h
Lateral clearance adjus TRD adjustment Free-flow speed, FFS		- 55.0	mi/h mi/h mi/h
	LOS and Perfor	mance Measures	· · · · · · · · · · · · · · · · · · ·
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N	speed, S	1922 55.0 54.6 4	pc/h/ln mi/h mi/h
Density, D Level of service, LOS		35.2 E	pc/mi/ln

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\_\_\_\_Operational Analysis\_\_\_\_\_\_

Analyst:	RCT
Agency or Company:	PB
Date Performed:	7/31/2012
Analysis Time Period:	AM Peak Hour
Freeway/Direction:	I-290 EB
From/To:	Racine to I-90/94 Off
Jurisdiction:	IDOT
Analysis Year:	Exist. 2009
Description: I-290 Phas	se 1 Study

\_\_\_\_Flow Inputs and Adjustments\_\_\_\_\_\_

Volume, V	7200	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1895	v
Trucks and buses	10	8
Recreational vehicles	0	010
Terrain type:	Level	
Grade	_	8
Segment length	-	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2	
Heavy vehicle adjustment, fHV	0.952	
Driver population factor, fp	1.00	
Flow rate, vp	1989	pc/h/ln

Speed Inputs and Adjustments

Lane width	_	ft	
Right-side lateral clearance	-	ft	
Total ramp density, TRD	_	ramps/mi	
Number of lanes, N	4		
Free-flow speed:	Measured		
FFS or BFFS	55.0	mi/h	
Lane width adjustment, fLW	-	mi/h	
Lateral clearance adjustment, fLC	-	mi/h	
TRD adjustment	-	mi/h	
Free-flow speed, FFS	55.0	mi/h	

LOS and Performance Measures

Flow rate, vp Free-flow speed, FFS	1989 55.0	pc/h/ln mi/h
Average passenger-car speed, S	54.1	mi/h
Number of lanes, N	4	
Density, D	36.8	pc/mi/ln
Level of service, LOS	E	

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; <b></b> ;	Operational An	alysis		
Analyst:	RCT			
Agency or Company:	PB			
Date Performed:	7/31/2012			
Analysis Time Period:				
Freeway/Direction:	I-290 EB	•		
From/To:	Racine to I-90/	'94 Off		
Jurisdiction:	IDOT			
Analysis Year:				
Description: I-290 Pha				
	Flow Inputs an	nd Adjustments		_
		_		_
Volume, V		7420	veh/h	
Peak-hour factor, PHF		0.95		
Peak 15-min volume, vl5		1953	v	
Trucks and buses		9	9	
Recreational vehicles		0	90 0	
Terrain type:		Level		
Grade		_	8	
Segment length		-	mi	
Trucks and buses PCE, E	T	1.5		
Recreational vehicle PC		1.2		
Heavy vehicle adjustmen	t, fHV	0.957		
Driver population facto		1.00		
Flow rate, vp	· -	2041	pc/h/ln	
	Speed Inputs a	and Adjustments		
Lane width		_	ft	
Right-side lateral clea	rance	_	ft	
-		_	ramps/mi	
Total ramp density, TRE	,	4	rambaymr	
Number of lanes, N Free-flow speed:		Measured		
			mi/h	
FFS or BFFS	ET M	55.0		
Lane width adjustment,		-	mi/h mi/h	
Lateral clearance adjus	sument, ILC	-	mi/h .	
TRD adjustment		-	mi/h	
Free-flow speed, FFS		55.0	mi/h	· ·
<u> </u>	LOS and Perfor	rmance Measures		
Flow rate, vp		2041	pc/h/ln	
Free-flow speed, FFS		55.0	mi/h	
Average passenger-car s	speed, S	53.6	mi/h	
Number of lanes, N		4		
Density, D		38.1	pc/mi/ln	
Level of service, LOS		E	Po,	
POAGT OF BELATCE' TOP				

## I - 290 Westbound Segment Analysis

### **Existing Conditions**

HCS 2010: Basic Freeway Segments Release 6.1

Phone: E-mail:

Density, D

Level of service, LOS

Fax:

Operational Analysis RCT Analyst: Agency or Company: PB Date Performed: 8/6/2012 Date Felloimed:07072012Analysis Time Period:AM Peak HourFreeway/Direction:I-290 WBFrom/To:Ashland to Paulina Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h 5570 Volume, V 0.95 Peak-hour factor, PHF 1466 Peak 15-min volume, v15 v Trucks and buses 10 용 0 Recreational vehicles 뫙 Terrain type: Level 뭉 Grade \_ Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 0.952 Heavy vehicle adjustment, fHV Driver population factor, fp 1.00 1539 pc/h/ln Flow rate, vp Speed Inputs and Adjustments ft Lane width Right-side lateral clearance \_ ft ramps/mi Total ramp density, TRD \_ Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW mi/h \_ mi/h Lateral clearance adjustment, fLC mi/h TRD adjustment 55.0 mi/h Free-flow speed, FFS LOS and Performance Measures\_\_\_\_\_ pc/h/ln 1539 Flow rate, vp mi/h Free-flow speed, FFS 55.0 Average passenger-car speed, S 55.0 mi/h Number of lanes, N 4

28.0

D

pc/mi/ln

Fax:

Operational Analysis\_\_\_\_\_ Analyst: RCT Agency or Company: PB Date Performed: 8/6/2012 Analysis Time Period:PM Peak HourFreeway/Direction:I-290 WBFrom/To:Ashland to Paulina Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments 5720 veh/h Volume, V 0.95 Peak-hour factor, PHF 1505 Peak 15-min volume, v15 v Trucks and buses 10 웅 0 응 Recreational vehicles Terrain type: Level 음 Grade Segment length mi 1.5 Trucks and buses PCE, ET Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 1581 pc/h/ln Flow rate, vp Speed Inputs and Adjustments\_\_\_\_\_ Lane width ft Right-side lateral clearance \_ ft Total ramp density, TRD ramps/mi 4 Number of lanes, N Free-flow speed: Measured 55.0 mi/h FFS or BFFS Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h mi/h TRD adjustment 55.0 Free-flow speed, FFS mi/h LOS and Performance Measures pc/h/ln Flow rate, vp 1581 55.0 Free-flow speed, FFS mi/h Average passenger-car speed, S 55.0 mi/h Number of lanes, N 4 Density, D 28.7 pc/mi/ln Level of service, LOS D

Fax:

\_\_\_\_Operational Analysis\_\_\_\_\_ Analyst:RCTAgency or Company:PBDate Performed:8/6/2012Analysis Time Period:AM Peak HourFreeway/Direction:I-290 WBFrom/To:Damen Off to OnTurisdiction:TDOM Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h 5300 Volume, V 0.95 Peak-hour factor, PHF 1395 Peak 15-min volume, v15 v Trucks and buses 10 움 0 웅 Recreational vehicles Terrain type: Level 용 -Grade Segment length \_ mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 0.952 Heavy vehicle adjustment, fHV 1.00 Driver population factor, fp 1464 pc/h/ln Flow rate, vp Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft ramps/mi Total ramp density, TRD ----Number of lanes, N 4 Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h mi/h TRD adjustment Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures\_\_\_\_\_ pc/h/ln 1464 Flow rate, vp Free-flow speed, FFS 55.0 mi/h 55.0 Average passenger-car speed, S mi/h Number of lanes, N 4 Density, D 26.6 pc/mi/ln Level of service, LOS D

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:		Fax:	
	Operational	Analysis	
Analyst:	RCT		
Agency or Company:	PB		
Date Performed:	8/6/2012		
Analysis Time Period:	PM Peak Hour		
Treeway/Direction:	I-290 WB		
From/To:	Damen Off to (	On	
Jurisdiction:	IDOT		
Analysis Year: Description: I-290 Pha	Exist. 2009		
escription. 1-290 ma	se i study		
	Flow Inputs	and Adjustments	
Volume, V		5850	veh/h
Peak-hour factor, PHF		0.95	
Peak 15-min volume, v15		1539	v
Irucks and buses		10	<b>9</b> 0
Recreational vehicles	ı	0	
Cerrain type:		Level	0
Grade		—	90 The i
Segment length	·Ψ	1.5	mi
Irucks and buses PCE, E Recreational vehicle PC		1.2	
Heavy vehicle adjustmen		0.952	
Driver population facto		1.00	
Flow rate, vp		1616	pc/h/ln
	Speed Inputs	and Adjustments	
Lane width		_	ft
Right-side lateral clea		—	ft
Iotal ramp density, TRD	)	-	ramps/mi
Number of lanes, N		4	
Free-flow speed: FFS or BFFS		Measured	mi/h
Lane width adjustment,	ftM	55.0	mi/h
Lahe width adjustment, Lateral clearance adjus		-	mi/h
TRD adjustment	, emeney 110	_	mi/h
Free-flow speed, FFS		55.0	mi/h
	LOS and Perf	ormance Measures	
Flow rate, vp		1616	pc/h/ln
Free-flow speed, FFS		55.0	mi/h
Average passenger-car s	speed, S	55.0	mi/h
Number of lanes, N		4	
Density, D		29.4	pc/mi/ln
Level of service, LOS		D	

Fax:

	_Operational Ana	alysis	
Applust.	RCT	τ.	
Analyst:	PB		
Agency or Company: Date Performed:	8/6/2012		
Analysis Time Period:			
Freeway/Direction:	I-290 WB		
From/To:	Oakley to Califo	ornia.	
Jurisdiction:	IDOT	JIIIA	
	Exist. 2009		·
Description: I-290 Phas			
	Flow Inputs and	d Adjustments	
Volume, V		5690	veh/h
Peak-hour factor, PHF		0.95	
Peak 15-min volume, v15		1497	v
Trucks and buses		10	- 
Recreational vehicles		0	D
Terrain type:		Level	
Grade ,		_	8
Segment length		_	mi
Trucks and buses PCE, ES	Ľ	1.5	
Recreational vehicle PCI		1.2	
Heavy vehicle adjustment		0.952	
Driver population facto:		1.00	
Flow rate, vp		1572	pc/h/ln
	Speed Inputs a:	nd Adjustments	
Lane width		_	ft
Right-side lateral clea:	rance	_	ft
Total ramp density, TRD		_	ramps/mi
Number of lanes, N		4	-
Free-flow speed:		Measured	
FFS or BFFS		55.0	mi/h
Lane width adjustment,	ELW	-	mi/h
Lateral clearance adjust		-	mi/h
TRD adjustment		-	mi/h
Free-flow speed, FFS		55.0	mi/h
	LOS and Perfor	mance Measures	
Flow rate, vp		1572	pc/h/ln
Free-flow speed, FFS		55.0	mi/h
Average passenger-car s	peed, S	55.0	mi/h
Number of lanes, N	-	4	
			1 1 1-
Density, D		28.6	pc/mi/ln

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Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

E-mail:		Fax:	
, 	Operational Ana	lysis	
Agency or Company: E Date Performed: 8 Analysis Time Period: E Freeway/Direction: 1 From/To: 0 Jurisdiction: 1	CT PB PM Peak Hour -290 WB Dakley to Califo DOT Cxist. 2009 1 Study	ornia	
.a	Flow Inputs and	d Adjustments	
Volume, V Peak-hour factor, PHF		6360 0.95	veh/h
Peak 15-min volume, v15 Trucks and buses Recreational vehicles		1674 10 0	♥ そ そ
Terrain type: Grade Segment length		Level - -	% mi
Trucks and buses PCE, ET Recreational vehicle PCE, Heavy vehicle adjustment, Driver population factor,	, fHV	1.5 1.2 0.952 1.00	
Flow rate, vp		1757	pc/h/ln
<u></u>	_Speed Inputs a	nd Adjustments	· · · · · · · · · · · · · · · · · · ·
Lane width Right-side lateral cleara Total ramp density, TRD Number of lanes, N		nd Adjustments - - 4	ft ft ramps/mi
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS	ance	nd Adjustments - - 4 Measured 55.0 -	ft
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fi Lateral clearance adjustment	ance	- - 4 Measured	ft ramps/mi mi/h
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fl Lateral clearance adjust TRD adjustment Free-flow speed, FFS	LW nent, fLC	- - 4 Measured 55.0 - - 55.0	ft ramps/mi mi/h mi/h mi/h mi/h
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fl Lateral clearance adjustm TRD adjustment Free-flow speed, FFS	LW nent, fLC	- 4 Measured 55.0 - 55.0 mance Measures	ft ramps/mi mi/h mi/h mi/h mi/h
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fl Lateral clearance adjust TRD adjustment Free-flow speed, FFS Flow rate, vp	LW nent, fLC	- - 4 Measured 55.0 - - 55.0 mance Measures 1757	ft ramps/mi mi/h mi/h mi/h mi/h pc/h/ln
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fl Lateral clearance adjust TRD adjustment Free-flow speed, FFS Flow rate, vp Free-flow speed, FFS	LW ment, fLC _LOS and Perfor	- - 4 Measured 55.0 - - 55.0 mance Measures 1757 55.0	ft ramps/mi mi/h mi/h mi/h mi/h mi/h pc/h/ln mi/h
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fl Lateral clearance adjust TRD adjustment Free-flow speed, FFS Flow rate, vp Free-flow speed, FFS Average passenger-car spe	LW ment, fLC _LOS and Perfor	- - 4 Measured 55.0 - - 55.0 mance Measures 1757 55.0 55.0	ft ramps/mi mi/h mi/h mi/h mi/h pc/h/ln
Right-side lateral cleara Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, fl Lateral clearance adjust TRD adjustment Free-flow speed, FFS Flow rate, vp Free-flow speed, FFS	LW ment, fLC _LOS and Perfor	- - 4 Measured 55.0 - - 55.0 mance Measures 1757 55.0	ft ramps/mi mi/h mi/h mi/h mi/h mi/h pc/h/ln mi/h

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Phone: E-mail: ... . . . . . .

Fax:

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E-mail:			
<u></u>	Operational An	alysis	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Ph	RCT PB 8/6/2012 AM Peak Hour I-290 WB California to W IDOT Exist. 2009 ase 1 Study	estern	
	Flow Inputs an	d Adjustments	
Volume, V Peak-hour factor, PHF	5	5210 0.95 1371	veh/h
Peak 15-min volume, vl Trucks and buses Recreational vehicles Terrain type:		10 0 Level	v Po 9
Grade Segment length Trucks and buses PCE,	ЕТ	- - 1.5	۴ mi
Recreational vehicle P Heavy vehicle adjustme Driver population fact	nt, fHV	1.2 0.952 1.00	
Flow rate, vp		1440	pc/h/ln
······	Speed Inputs a	nd Adjustments	
Lane width Right-side lateral cle Total ramp density, TR Number of lanes, N Free-flow speed:		- - 4 Measured	ft ft ramps/mi
FFS or BFFS Lane width adjustment, Lateral clearance adju TRD adjustment		55.0 - - -	mi/h mi/h mi/h mi/h
Free-flow speed, FFS	TOC and Danfar	55.0	mi/h
<u>_</u>	LOS and Perior	mance Measures	
Flow rate, vp Free-flow speed, FFS Average passenger-car Number of lanes, N	speed, S	1440 55.0 55.0 4	pc/h/ln mi/h mi/h
Density, D Level of service, LOS		26.2 D	pc/mi/ln

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Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:	Fax:	
Operational Ar	nalysis	
Analyst: RCT		
Agency or Company: PB		
Date Performed: 8/6/2012		
Analysis Time Period: PM Peak Hour		
Freeway/Direction: I-290 WB		
From/To: California to W	Vestern	
Jurisdiction: IDOT		
Analysis Year: Exist. 2009		
Description: I-290 Phase 1 Study		
Flow Inputs an	nd Adjustments	
	E 0.4 0	
Volume, V	5940	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1563	V 8
Trucks and buses	10 0	** **
Recreational vehicles	Level	6
Terrain type:	Tever	<del>2</del>
Grade	_	
Segment length	- 1 5	mi
Trucks and buses PCE, ET	1.5	
Recreational vehicle PCE, ER	1.2 0.952	
Heavy vehicle adjustment, fHV	1.00	
Driver population factor, fp	1641	pc/h/ln
Flow rate, vp	1041	pe/11/111
Speed Inputs a	and Adjustments	- 10 (m
Lane width	_	ft
Right-side lateral clearance	<del>-</del> .	ft
Total ramp density, TRD	-	ramps/mi
Number of lanes, N	4	
Free-flow speed:	Measured	
FFS or BFFS	55.0	mi/h
Lane width adjustment, fLW	·_	mi/h
Lateral clearance adjustment, fLC	-	mi/h
TRD adjustment	-	mi/h
Free-flow speed, FFS	55.0	mi/h
LOS and Perfo	rmance Measures	
Flow rate up	1641	pc/h/ln
Flow rate, vp	55.0	mi/h
Free-flow speed, FFS	55.0	mi/h
Average passenger-car speed, S	4	111 / 11
Number of lanes, N	4 29.8	pc/mi/ln
Density, D Level of service, LOS	29.0 D	PC/ 111 / 111
HEAGT OT BELATCE, TOP	U	

Number of lanes, N

Level of service, LOS

Density, D

Fax:

Operational Analysis\_\_\_\_\_ Analyst: RCT Agency or Company: Agency or Company: PB Date Performed: 8/6/2012 PB Analysis Time Period: AM Peak Hour Freeway/Direction: I-290 WB From/To: Western to Sacramento Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments 5930 veh/h Volume, V 0.95 Peak-hour factor, PHF Peak 15-min volume, v15 1561 v 10 움 Trucks and buses Recreational vehicles 0 용 Terrain type: Level -Grade 몽 Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 1.00 Driver population factor, fp 1639 pc/h/ln Flow rate, vp Speed Inputs and Adjustments Lane width f+ -ft Right-side lateral clearance ramps/mi Total ramp density, TRD Number of lanes, N 4 Free-flow speed: Measured mi/h FFS or BFFS 55.0 Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC \_ mi/h mi/h TRD adjustment Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures\_\_\_\_ 1639 pc/h/ln Flow rate, vp Free-flow speed, FFS 55.0 mi/h 55.0 mi/h Average passenger-car speed, S

> 4 29.8

D

pc/mi/ln

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:		Fax:	
	Operational	Analysis	
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 WB Western to Sa IDOT Exist. 2009	acramento	
	Flow Inputs	and Adjustments	
Volume, V Peak-hour factor, PHF		6570 0.95	veh/h
Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type:	)	1729 10 0 Level	V २ %
Grade Segment length Trucks and buses PCE, E Recreational vehicle PC		- 1.5 1.2	% mi
Heavy vehicle adjustmer Driver population facto Flow rate, vp	ht, fHV	0.952 1.00 1815	pc/h/ln
	Speed input:	s and Adjustments	
Lane width Right-side lateral clea Total ramp density, TRI Number of lanes, N Free-flow speed: FFS or BFFS	)	- - 4 Measured 55.0	ft ft ramps/mi mi/h
Lane width adjustment, Lateral clearance adjus TRD adjustment Free-flow speed, FFS		- - 55.0	mi/h mi/h mi/h mi/h
	LOS and Per	formance Measures	· · ·
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N	speed, S	1815 55.0 55.0 4	pc/h/ln mi/h mi/h
Density, D Level of service, LOS		33.0 D	pc/mi/ln

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Phone:

Fax:

E-mail: Operational Analysis RCT Analyst: Agency or Company: Agency or Company: PB Date Performed: 8/6/2012 PBAnalysis Time Period:AM Peak HourFreeway/Direction:I-290 WBFrom/To:Homan to Independence Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h Volume, V 6110 0.95 Peak-hour factor, PHF Peak 15-min volume, v15 1608 v 10 옹 Trucks and buses 0 용 Recreational vehicles Level Terrain type: 욹 Grade \_ Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 0.952 Heavy vehicle adjustment, fHV 1.00 Driver population factor, fp pc/h/ln 1688 Flow rate, vp Speed Inputs and Adjustments ft Lane width ft Right-side lateral clearance ramps/mi Total ramp density, TRD Number of lanes, N 4 Measured Free-flow speed: mi/h 55.0 FFS or BFFS mi/h Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h TRD adjustment Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures 1688 pc/h/ln Flow rate, vp Free-flow speed, FFS 55.0 mi/h 55.0 mi/h Average passenger-car speed, S Number of lanes, N 4 30.7 pc/mi/ln Density, D Level of service, LOS D

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method. Phone: Fax: E-mail: Operational Analysis\_\_\_\_\_ RCT Analyst: Agency or Company: PB8/6/2012 Date Performed: Analysis Time Period:PM Peak HourFreeway/Direction:I-290 WBFrom/To:Homan to Independence Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h Volume, V 6630 0.95 Peak-hour factor, PHF 1745 Peak 15-min volume, v15 v 10 몽 Trucks and buses Recreational vehicles 0 웅 Terrain type: Level 움 Grade Segment length mi 1.5 Trucks and buses PCE, ET Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 1832 Flow rate, vp pc/h/ln Speed Inputs and Adjustments ft Lane width ft Right-side lateral clearance ramps/mi Total ramp density, TRD Number of lanes, N 4 Measured Free-flow speed: 55.0 mi/h FFS or BFFS mi/h Lane width adjustment, fLW Lateral clearance adjustment, fLC mi/h mi/h TRD adjustment Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures 1832 pc/h/ln Flow rate, vp 55.0 mi/h Free-flow speed, FFS 55.0 mi/h Average passenger-car speed, S Number of lanes, N 4 33.3 pc/mi/ln Density, D Level of service, LOS D

Fax:

Operational Analysis RCT Analyst: Agency or Company:PBDate Performed:8/6/2012Analysis Time Period:AM Peak HourFreeway/Direction:I-290 WBFrom/To:Independence Off to OnJurisdiction:IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments 5630 veh/h Volume, V 0.95 Peak-hour factor, PHF 1482 v Peak 15-min volume, v15 10 응 Trucks and buses Recreational vehicles 0 8 Terrain type: Level 응 Grade ---Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 Flow rate, vp 1556 pc/h/ln Speed Inputs and Adjustments ft Lane width Right-side lateral clearance ft Total ramp density, TRD ramps/mi 4 Number of lanes, N Free-flow speed: Measured FFS or BFFS 55.0 mi/h Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h TRD adjustment \_ mi/h Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures\_\_\_\_\_ pc/h/ln 1556 Flow rate, vp Free-flow speed, FFS 55.0 mi/h 55.0 mi/h Average passenger-car speed, S Number of lanes, N 4 28.3 pc/mi/ln Density, D Level of service, LOS D

Fax:

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\_\_\_\_Operational Analysis\_\_\_\_\_

Analyst:	RCT
Agency or Company:	PB
Date Performed:	8/6/2012
Analysis Time Period:	PM Peak Hour
Freeway/Direction:	I-290 WB
From/To:	Independence Off to On
Jurisdiction:	IDOT
Analysis Year:	Exist. 2009
Description: I-290 Phas	se 1 Study

#### \_\_\_\_\_Flow Inputs and Adjustments\_\_\_\_\_\_

		•	
Volume, V		6160	veh/h
Peak-hour factor, PHF		0.95	
Peak 15-min volume, v15		1621	v
Trucks and buses		10	8
Recreational vehicles		0	8
Terrain type:		Level	
Grade		-	8
Segment length		-	mi
Trucks and buses PCE, ET		1.5	
Recreational vehicle PCE,	ER	1.2	
Heavy vehicle adjustment,	fHV	0.952	
Driver population factor,		1.00	
Flow rate, vp	-	1702	pc/h/ln
, <u>1</u>			

#### Speed Inputs and Adjustments

Lane width Right-side lateral clearance Total ramp density, TRD Number of lanes, N	- - 4 Measured	ft ft ramps/mi
Free-flow speed: FFS or BFFS Lane width adjustment, fLW Lateral clearance adjustment, fLC TRD adjustment Free-flow speed, FFS	55.0 - - 55.0	mi/h mi/h mi/h mi/h mi/h
LOS and Performan	nce Measures	· · · · · · · · · · · · · · · · · · ·
Flow rate, vp Free-flow speed, FFS Average passenger-car speed, S Number of lanes, N Density, D Level of service, LOS	1702 55.0 55.0 4 30.9 D	pc/h/ln mi/h mi/h pc/mi/ln

Number of lanes, N

Level of service, LOS

Density, D

Fax:

Operational Analysis Analyst: RCT Agency or Company:PBDate Performed:8/6/2012Analysis Time Period:AM Peak HourFreeway/Direction:I-290 WBFrom/To:Independence to KostnerJurisdiction:IDOTAnalysis Year:Exist. 2009 Description: I-290 Phase 1 Study Flow Inputs and Adjustments veh/h Volume, V 6110 0.95 Peak-hour factor, PHF 1608 Peak 15-min volume, v15 v 10 Trucks and buses 옪 Recreational vehicles 0 응 Terrain type: Level ŝ Grade \_ Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fHV 0.952 Driver population factor, fp 1.00 1688 pc/h/ln Flow rate, vp Speed Inputs and Adjustments ft. Lane width -Right-side lateral clearance ft Total ramp density, TRD ramps/mi 4 Number of lanes, N Free-flow speed: Measured 55.0 mi/h FFS or BFFS Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h -- \_ TRD adjustment mi/h Free-flow speed, FFS 55.0 mi/h LOS and Performance Measures\_\_\_\_\_ pc/h/ln 1688 Flow rate, vp mi/h 55.0 Free-flow speed, FFS Average passenger-car speed, S 55.0 mi/h

> 4 30.7

D

pc/mi/ln

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method. Phone: Fax: E-mail: Operational Analysis\_\_\_\_\_ Analyst: RCT Analyst:RefAgency or Company:PBDate Performed:8/6/2012Analysis Time Period:PM Peak HourFreeway/Direction:I-290 WBFrom/To:Independence to KostnerJurisdiction:IDOTAnalysis Year:Exist. 2009Description:I Study Description: I-290 Phase 1 Study \_\_\_\_\_Flow Inputs and Adjustments\_\_\_\_\_ veh/h 6700 Volume, V 0.95 Peak-hour factor, PHF Peak 15-min volume, v15 1763 v 10 용 Trucks and buses 욹 Recreational vehicles 0 Level Terrain type: 웡 Grade Segment length mi Trucks and buses PCE, ET 1.5 Recreational vehicle PCE, ER 1.2 0.952 Heavy vehicle adjustment, fHV Driver population factor, fp 1.00 pc/h/ln 1851 Flow rate, vp Speed Inputs and Adjustments ft Lane width \_ ft Right-side lateral clearance ramps/mi Total ramp density, TRD Number of lanes, N 4 Free-flow speed: Measured 55.0 mi/h FFS or BFFS Lane width adjustment, fLW mi/h Lateral clearance adjustment, fLC mi/h TRD adjustment mi/h 55.0 Free-flow speed, FFS mi/h LOS and Performance Measures\_\_\_\_\_ 1851 pc/h/ln Flow rate, vp Free-flow speed, FFS 55.0 mi/h Average passenger-car speed, S 54.9 mi/h Number of lanes, N 4 33.7 pc/mi/ln Density, D Level of service, LOS D

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:		Fax:		
X	Operational Anal	ysis		
Agency or Company: A	CT PB			
Analysis Time Period: A	/6/2012 M Peak Hour			
From/To: F	-290 WB Costner to Cicerc	,		
	DOT xist. 2009 1 Study			
	Flow Inputs and	Adjustments		
Volume, V		5470	veh/h	
Peak-hour factor, PHF Peak 15-min volume, v15		0.95 1439	17	
Trucks and buses		10	V %	
Recreational vehicles		0	96 96	
Terrain type:		Level	Ū	
Grade		-	8	
Segment length		-	mi '	
Trucks and buses PCE, ET		1.5		
Recreational vehicle PCE,	ER	1.2		
Heavy vehicle adjustment,	fHV	0.952		
Driver population factor,	fp	1.00	4- 4-	
Flow rate, vp		1511	pc/h/ln	
	Speed Inputs and	l Adjustments		
Lane width		-	ft	
Right-side lateral cleara	ance	-	ft	
Total ramp density, TRD		_	ramps/mi	
Number of lanes, N		4		
Free-flow speed:		Measured	mi/h	
FFS or BFFS	TAT	55.0	mi/h	
Lane width adjustment, fi Lateral clearance adjust			mi/h	
TRD adjustment	acite, the	_	mi/h	
Free-flow speed, FFS		55.0	mi/h	
-	LOS and Performa	ance Measures		
		1511	pc/h/ln	
Flow rate we		55.0	mi/h	
Flow rate, vp Free-flow speed FFS		JJ.V	III / II	
Free-flow speed, FFS	eed. S		mi/h	
Free-flow speed, FFS Average passenger-car sp	eed, S	55.0	mi/h	
Free-flow speed, FFS	eed, S		mi/h pc/mi/ln	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Phone: E-mail:		Fax:		
	_Operational Ana	alysis		
Analyst: Agency or Company: Date Performed: Analysis Time Period: Freeway/Direction: From/To: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 WB Kostner to Cice: IDOT Exist. 2009	ro		
u <u>r</u> ,	Flow Inputs and	d Adjustments		
Volume, V Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Segment length Trucks and buses PCE, E Recreational vehicle PC Heavy vehicle adjustmen Driver population facto Flow rate, vp	E, ER t, fHV	6100 0.95 1605 10 0 Level - - 1.5 1.2 0.952 1.00 1686	veh/h v % % mi pc/h/ln	
	Speed Inputs a	nd Adjustments		
Lane width Right-side lateral clea Total ramp density, TRD Number of lanes, N Free-flow speed: FFS or BFFS Lane width adjustment, Lateral clearance adjus TRD adjustment	flw	- - 4 Measured 55.0 -	ft ft ramps/mi mi/h mi/h mi/h mi/h	
Free-flow speed, FFS		55.0	mi/h	
	LOS and Perfor	mance Measures		
Flow rate, vp Free-flow speed, FFS Average passenger-car s Number of lanes, N Density, D Level of service, LOS	peed, S	1686 55.0 55.0 4 30.7 D	pc/h/ln mi/h mi/h pc/mi/ln	

# Appendix B

**HCS Analysis Output** 

## **B-2**

**Ramp Junctions** 

# I - 290 Eastbound Ramp Junction Analysis

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### **Existing Conditions**

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Fax:

	Merge	Analysis	5			
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Phas	I-290 EB Kostner Ave. En IDOT Exist. 2009	ntrance H	Ramp			
	Free	way Data_			· .	
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		4	.0		mph vph	
	On R	amp Data				
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/d	ecel lane	1	.0 0		mph vph ft ft	
	Adjacent Ramp	Data (i:	f on	e exists	)	
Does adjacent ramp exis Volume on adjacent Ramp Position of adjacent Ram Type of adjacent Ramp Distance to adjacent Ram	mp	No			vph ft	
Con	version to pc/h	Under B	ase	Conditio	ns	
Junction Components		Freeway		Ramp		Adjacent Ramp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, E Recreational vehicle PC		7350 0.95 1934 10 0 Level 1.5 1.2	۶ mi	640 0.95 168 10 0 Level 1.5 1.2	% mi	vph v % % % شن

Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	0.952 1.00 8124	0.952 1.00 707		pcph
Estimatic	on of Vl2 Merge	e Areas		
L = EQ	(Equation 13-	6 or 13-7)		
	Using Equation	n 4		
v = v (P) = 12 F FM	1051 pc/h			
Car	oacity Checks_			
v Actual FO	Maximu 9000		LOS F? No	
	c/h (Equat	ion 13-14	or 13-17)	
Is v or v > 2700 pc/h? 3 av34	Yes			
Is v or v > $1.5 v / 2$ 3 av 34 12	Yes			
If yes, $v = 3249$ 12A	(Equation	13-15, 13	-16, 13-18,	or 13-19)
Flow Enter Actual v 8831 12A	ring Merge Inf Max Desirab 4600		a Violation? No	<u></u>
Level of Service	Determination	(if not F	')	
Density, D = 5.475 + 0.00734 v + R $\cdot$ R Level of service for ramp-freeway	12	A	L Contraction of the second seco	pc/mi/ln
Speed	d Estimation			
Intermediate speed variable,	M	= 0.486		
Space mean speed in ramp influence		= 48.7	mph	
Space mean speed in outer lanes,	s 0	= 47.6	mph	
Space mean speed for all vehicles,	•	= 48.1	mph	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS E, which are not adequately evaluated by the Highway Capacity Manual Method.

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Fax:

	Merge	Analysis	8			
Agency/Co.: Date performed: { Analysis time period: } Freeway/Dir of Travel: ; Junction: }	PM Peak Hour I-290 EB Kostner Ave. Er IDOT Exist. 2009	itrance E	amp			
	Free	way Data_				
Type of analysis Number of lanes in freewa Free-flow speed on freewa Volume on freeway			-		mph vph	
	On Ra	amp Data_				
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/de Length of second accel/de		Rig 1 35. 730 560	. O )		mph vph ft ft	
· 	_Adjacent Ramp	Data (ii	E on	e exists	)	
Does adjacent ramp exist Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	p	No			vph ft	
Conv	ersion to pc/h	Under Ba	ase	Conditio	ns	
Junction Components	-	Freeway		Ramp		Adjacent Ramp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade		6860 0.95 1805 9 0 Level	00	730 0.95 192 9 0 Level	망	vph v %
Length Trucks and buses PCE, ET Recreational vehicle PCE		1.5 1.2	mi	1.5 1.2	mi	mi

Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	0.957 1.00 7546	0.957 1.00 803	,	pcph
Estima	ation of V12 M	lerge Areas		
L = EQ	(Equation	13-6 or 13-7	")	
	7 Using Equa	tion 4		
v = v (P) 12 F FM	) <del>-</del> 886 pc	:/h		
	_Capacity Chec	:ks		
V 834 FO		imum 00	LOS F? No	
	0 pc/h (Ec	uation 13-14	l or 13-17)	
Is v or v > 2700 pc/h? 3 av34	Yes	;		
Is v or v > 1.5 v /2 3 av34 12	Yes	5		
If yes, v = 3018 12A	(Equat	ion 13-15, 1	13-16, 13-18,	or 13-19)
Flow E	ntering Merge	Influence A	rea	
Actual v 8349 12A	Max Desi 4600	rable	Violation? No	
Level of Serv	ice Determinat	ion (if not	F)	
Density, D = $5.475 + 0.00734 v$ R Level of service for ramp-free	R 12	2	А	pc/mi/ln
S	peed Estimatio	on		
Intermediate speed variable,		$M_{0} = 0.460$		
Space mean speed in ramp influ	ence area,	S = 49.0	mph	
Space mean speed in outer lane	s,	R = 48.6	mph	
Space mean speed for all vehic	les,	S = 48.8	mph	

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Fax:

	Dive	cge Analysis_			
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 EB Independence H IDOT Exist. 2009	3lvd. Exit Ra	ımp		
	Free	eway Data			
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway	—	Diverg 4 55.0 7990	je	mph vph	
	Off 1	Ramp Data			•
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/	ecel lane	Right 1 35.0 400 215		mph vph ft ft	
	Adjacent Ram	p Data (if or	ne exists	s)	
Does adjacent ramp exis Volume on adjacent ramp Position of adjacent ra Type of adjacent ramp Distance to adjacent ra	mp	No		vph ft	
Con	version to pc/	h Under Base	Conditio	ons	
Junction Components Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, E		Freeway 7990 0.95 2103 10 0 Level 0.00 % 0.00 mi 1.5	_	% Mi	Adjacent Ramp vph vph % % % %

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Heavy vehicle adjust Driver population fa Flow rate, vp		0.952 0.95 1.00 1.00 8831 442	
	Estimation of	V12 Diverge Area	s
	_	ation 13-12 or 13	-13)
Р	CQ = 0.436 Usin	g Equation 8	
v	FD = v + (v - v) P L2 R F R		
	Capacit	y Checks	
v = v Fi F	Actual 8831	Maximum 9000	LOS F? No
v = v - v	8389	9000	No
FOF R V	442	2000	No
R vorv	2365 pc/h	(Equation 13-1	4 or 13-17)
	2700 pc/h?	No	
	1.5 v /2	No	
3 av34 If yes, v = 4100 12A	12	(Equation 13-15,	13-16, 13-18, or 13-19)
v 12	Actual Ma	verge Influence A ax Desirable 100 armination (if not	Violation? No
Density,	D = 4.252 + 0.0		
<i>.</i> .	R	12	D
Level of service for			Idence E
	Speed Est		
Intermediate speed		D = 0.468 S	
Space mean speed in	-	R	mph
Space mean speed in	outer lanes,	S = 55.0	mph
Space mean speed for	r all vehicles,	S = 52.0	mph

Phone: Fax: E-mail: Diverge Analysis RCT Analyst: Agency/Co.: ΡB Date performed: 8/1/2012 Date performed: 8/1/2012 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-290 EB Independence Blvd. Exit Ramp Junction: Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Freeway Data Type of analysis Diverge Number of lanes in freeway 4 Free-flow speed on freeway 55.0 mph 7590 Volume on freeway vph \_\_\_\_\_Off Ramp Data\_\_\_\_ Side of freeway Right 1 Number of lanes in ramp Free-Flow speed on ramp 35.0 mph 870 Volume on ramp vph Length of first accel/decel lane 215 ft Length of second accel/decel lane ft Adjacent Ramp Data (if one exists) Does adjacent ramp exist? No Volume on adjacent ramp vph Position of adjacent ramp Type of adjacent ramp Distance to adjacent ramp ft Conversion to pc/h Under Base Conditions\_\_\_\_\_ Junction Components Freeway Ramp Adjacent Ramp Volume, V (vph) a second second second second 7590 vph 0.95 0.95 Peak-hour factor, PHF 1997 229 Peak 15-min volume, v15 v Trucks and buses 9 9 욹 윊 Recreational vehicles 0 0 Level Terrain type: Level 8 0.00 응 Grade 0.00 응 mi 0.00 0.00 mi mi Length Trucks and buses PCE, ET 1.5 1.5 1.2 Recreational vehicle PCE, ER 1.2

Driver populatio Flow rate, vp	justment, fHV n factor, fP	1.00	).957 L.00 957	pcph
	Estimation of	of V12 Diverge A	Areas	
	EQ	quation 13-12 or ing Equation 8 P = 4180 po FD		
	Capac:	ity Checks		
v = v Fi F	Actual 8349	Maximum 9000	LOS F? No	
	7392	9000	No	·
v R	957	2000	No	
v or v 3 av34	-	(Equation	13-14 or 13-17)	
	> 2700 pc/h?	No		
J 4401				
Is v or v 3 av34	> 1.5 v /2 12	No (Equation 13	15, 13-16, 13-18	, or 13-19)
Is v or v 3 av34 If yes, v = 4	> 1.5 v /2 12 180			, or 13-19)
Is v or v 3 av34 If yes, v = 4 12A v	> 1.5 v /2 12 180 Flow Entering Actual	(Equation 13-		
Is v or v 3 av34 If yes, v = 4 12A	> 1.5 v /2 12 180 Flow Entering Actual	(Equation 13- Diverge Influen Max Desirable 4400	ce Area Violation No	?
Is v or v 3 av34 If yes, v = 4 12A v 12 Density,	> 1.5 v /2 12 180 Flow Entering Actual 4180 Level of Service De D = 4.252 + 0 R	(Equation 13- Diverge Influen Max Desirable 4400 termination (if .0086 v - 0.00 12	ce Area Violation No not F) 9 L = 38.3 D	?
Is v or v 3 av34 If yes, v = 4 12A v 12 Density,	<pre>&gt; 1.5 v /2 12 180 Flow Entering Actual 4180 Level of Service De D = 4.252 + 0 R e for ramp-freeway ju</pre>	(Equation 13- Diverge Influen Max Desirable 4400 termination (if .0086 v - 0.00 12 nction areas of	ce Area Violation No not F) 9 L = 38.3 D	?
Is v or v 3 av34 If yes, v = 4 12A v 12 Density, Level of service	<pre>&gt; 1.5 v /2 12 180 Plow Entering Actual 4180 Level of Service De D = 4.252 + 0 R e for ramp-freeway juSpeed E</pre>	(Equation 13- Diverge Influen Max Desirable 4400 termination (if .0086 v - 0.00 12 nction areas of stimation	ce Area Violation No not F) 9 L = 38.3 D influence E	?
Is v or v 3 av34 If yes, v = 4 12A v 12 Density, Level of service Intermediate spe	<pre>&gt; 1.5 v /2 12 180 Flow Entering Actual 4180 Level of Service De D = 4.252 + 0 R for ramp-freeway ju Speed E eed variable,</pre>	(Equation 13- Diverge Influent Max Desirable 4400 termination (if .0086 v - 0.00 12 nction areas of stimation D = 0 S	ce Area Violation No not F) 9 L = 38.3 D influence E .514	?
Is v or v 3 av34 If yes, v = 4 12A v 12 Density, Level of service Intermediate spe	<pre>&gt; 1.5 v /2 12 180 Plow Entering Actual 4180 Level of Service De D = 4.252 + 0 R e for ramp-freeway juSpeed E</pre>	(Equation 13- Diverge Influent Max Desirable 4400 termination (if .0086 v - 0.00 12 nction areas of stimation D = 0 S	ce Area Violation No not F) 9 L = 38.3 D influence E .514	?
Is v or v 3 av34 If yes, v = 4 12A v 12 Density, Level of service Intermediate spece Space mean speece	<pre>&gt; 1.5 v /2 12 180 Flow Entering Actual 4180 Level of Service De D = 4.252 + 0 R for ramp-freeway ju Speed E eed variable,</pre>	(Equation 13- Diverge Influent Max Desirable 4400 termination (if .0086 v - 0.00 12 nction areas of stimation D = 0 S rea, S = 4	ce Area Violation No not F) 9 L = 38.3 D influence E .514 8.3 mph	?

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Phone: E-mail:	Merge	Fax: Analysis				
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Phas	RCT PB 8/1/2012 AM Peak Hour I-290 EB Independenc Bly IDOT Exist. 2009	-				
	Freew	way Data_				
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway	мау	759	.0 90		mph vph	
	On Ra	amp Data_				<u> </u>
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/de Length of second accel/d		43( 49(	•0 0 0	e exist:	mph vph ft ft	
				e entee.		
Does adjacent ramp exis Volume on adjacent Ramp Position of adjacent Ram Type of adjacent Ramp Distance to adjacent Ram	щЪ				vph ft	
_		1		~ ••••		
Con	version to pc/h	Under Ba	ase	Conditio	ons	
Junction Components		Freeway		Ramp	Ra	djacent amp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length		0.95 1997 10 0 Level	۶ mi	0.95 113 10 0 Level	۶ mi	v v v v v v v v v v v v v v v v v v v v
Trucks and buses PCE, E Recreational vehicle PC		1.5 1.2		1.5 1.2		

Heavy vehicle adjustment, Driver population factor, Flow rate, vp		0.952 1.00 8389	0.952 1.00 475	:	pcph
E	stimation o	of V12 Merge	Areas	•	
L = EQ	(Ec	quation 13-6	or 13-7)		
P = FM	0.158 Us:	ing Equation	4		
v = v 12 F	(P) = 1: FM	329 pc/h			
	_Capac:	ity Checks			
v	Actual 8864	Maximum 9000	LC Nc	DS F?	
FO v  or  v 3  av34	3530 pc/h	(Equati	on 13-14 or	: 13-17)	
Is v or v > 2700 g 3 av34	pc/h?	Yes			
Is v or v > 1.5 v 3 av34	/2 12	Yes			
If yes, v = 3355 12A		(Equation	13-15, 13-1	16, 13-18, or 1	3-19)
F Act 12A	ial 1	g Merge Infl Max Desirabl 4600	e 7	Violation? No	<u></u>
Level of	Service De	termination	(if not F)		. <u> </u>
Density, $D = 5.475 + 0.00$ R Level of service for ramp	R	12	А	-	/mi/lr
	Speed E	stimation	•		
Intermediate speed variab	le,	M	= 0.466		
Space mean speed in ramp	influence a	-	= 48.9	nph	
Space mean speed in outer	lanes,		= 47.2	nph	
Space mean speed for all	vehicles,	v	= 47.9	nph	
			· · · · · · · · · · · · · · · · · · ·		

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1-mall:					
	Merge	e Analysis_		1	
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 EB Independenc Bl IDOT Exist. 2009	.vd. Entran	ICE		
	Free	way Data			
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		Merg 4 55.0 6720	)	mph vph	
	On H	Ramp Data			
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/	ecel lane	Righ 1 35.0 650 490		mph vph ft ft	
	Adjacent Ramp	o Data (if	one exists	5)	
Does adjacent ramp exis Volume on adjacent Ramp Position of adjacent Ra Type of adjacent Ramp Distance to adjacent Ra	mp	No		vph ft	
2	version to pc/h	n Under Bas	se Conditio		
Junction Components	-	Freeway	Ramp		Adjacent Ramp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type:		6720 0.95 1768 9 0 Level	650 0.95 171 9 0 Level		vph vph
Grade Length Trucks and buses PCE, E Recreational vehicle PC			s ni 1.5 1.2	% mi	% mi

Heavy vehicle ad Driver population Flow rate, vp		0.957 1.00 7392	0.957 1.00 715	pcph
	Estimation o	f V12 Merge	Areas	· ·
		uation 13-6	or 13-7)	
	EQ P = 0.128 Usi	ng Equation	4	
	FM v = v (P) = 94 12 F FM	9 pc/h		
	Capaci	ty Checks		
v FO	Actual 8107	Maximum 9000	LOS No	F?
v or v 3 av34	—	(Equatio	n 13-14 or 1	.3-17)
• • • • • •	> 2700 pc/h?	Yes		
		105		
.3 av34 Is v or v 3 av34	> 1.5 v /2 12	Yes		
.3 av34 Is v or v	> 1.5 v /2 12	Yes	3-15, 13-16,	13-18, or 13-19)
$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	> 1.5 v /2 12 956 Flow Entering	Yes (Equation 1 Merge Influ	ence Area	
3 av34 Is v or v 3 av34 If yes, v = 2 12A v	> 1.5 v /2 12 956 Flow Entering Actual M	Yes (Equation 1	ence Area	13-18, or 13-19)
3 av34 Is v or v 3 av34 If yes, v = 2 12A	> 1.5 v /2 12 956 Flow Entering Actual M	Yes (Equation 1 Merge Influ Max Desirable 1600	ence Area Vic No	
3 = av34 Is v or v 3 = av34 If yes, v = 2 12A v 12A Density, D = 5.4	> 1.5 v /2 12 956 Flow Entering Actual M 8107 4 _Level of Service Det 75 + 0.00734 v + 0.0	Yes (Equation 1 Merge Influ Max Desirable 600 cermination ( 0078 v - 0.	ence Area Vic No if not F) 00627 L =	plation?
3 = av34 Is v or v 3 = av34 If yes, v = 2 12A v 12A Density, D = 5.4 R	> 1.5 v /2 12 956 Flow Entering Actual M 8107 4 _Level of Service Det	Yes (Equation 1 Merge Influ Max Desirable 600 cermination ( 0078 v - 0. 12	ence Area Vic No if not F) 00627 L = A	30.7 pc/mi/
3  av34 Is v or v 3  av34 If yes, v = 2 12A v 12A Density, D = 5.4 R	<pre>&gt; 1.5 v /2 12 956 Flow Entering Actual M 8107 4 Level of Service Det 75 + 0.00734 v + 0.0 R for ramp-freeway jun</pre>	Yes (Equation 1 Merge Influ Max Desirable 600 cermination ( 0078 v - 0. 12	ence Area Vic No if not F) 00627 L = A	30.7 pc/mi/
3 av34 Is v or v 3 av34 If yes, v = 2 12A v 12A Density, D = 5.4 R	> 1.5 v /2 12 956 Flow Entering Actual M 8107 4 Level of Service Det 75 + 0.00734 v + 0.0 R for ramp-freeway jun Speed Es	Yes (Equation 1 Merge Influ Max Desirable 600 cermination ( 0078 v - 0. 12 nction areas stimation M =	ence Area Vic No if not F) 00627 L = A	30.7 pc/mi/
3 av34 Is v or v 3 av34 If yes, v = 2 12A v 12A Density, D = 5.4 R Level of service Intermediate spe	> 1.5 v /2 12 956 Flow Entering Actual M 8107 4 Level of Service Det 75 + 0.00734 v + 0.0 R for ramp-freeway jun Speed Es	Yes (Equation 1 Merge Influ Max Desirable 600 cermination ( 0078 v - 0. 12 nction areas stimation M = S cea, S =	ence Area Vic No if not F) 00627 L = A of influence	olation? 30.7 pc/mi/. D
3 av34 Is v or v 3 av34 If yes, v = 2 12A v 12A Density, D = 5.4 R Level of service Intermediate spe Space mean speed	> 1.5 v /2 12 956 Flow Entering Actual M 8107 4 _Level of Service Det 75 + 0.00734 v + 0.0 R for ramp-freeway jun Speed Es ed variable,	Yes (Equation 1 Merge Influ Max Desirable 600 cermination ( 0078 v - 0. 12 nction areas stimation M = S cea, S = R	ence Area Vic No if not F) 00627 L = A of influence 0.440	30.7 pc/mi/

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	Diver	ge Analys	sis_			
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 EB Western Ave. E: IDOT Exist. 2009	xit Ramp				
	Free	way Data_				
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway	—	4	. 0	e ,	mph vph	
	Off R	amp Data				
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/	ecel lane	Rig 1 35 500 230	.0 ) )	e evista	mph vph ft ft	
Does adjacent ramp exis Volume on adjacent ramp Position of adjacent ra Type of adjacent ramp Distance to adjacent ra	t? mp	No		e exists	vph ft	
Con	version to pc/h	Under Ba	ase	Conditio	ons	
Junction Components Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, E Recreational vehicle PC	T	Freeway 7750 0.95 2039 10 0 Level 0.00 0.00 1.5 1.2	% mi	Ramp 500 0.95 132 10 0 Level 0.00 0.00 1.5 1.2	% mi	Adjacent Ramp vph v % % % %

priver population low rate, vp	djustment, fHV on factor, fP	1.00 1	.952 .00 53	pcph
	Estimation o	of V12 Diverge A	reas	<u></u>
	L = (Eq EQ	uation 13-12 or	13-13)	
	P = 0.436 Usi FD	ng Equation 8		
	v = v + (v - v) 12 R F R		/h	
	Capaci	ty Checks		·
v = v Fi F	Actual 8566	Maximum 9000	LOS F? No	
		9000	No	
v	553	2000	No	
R V or V 3 av3		(Equation 1	3-14 or 13-17)	
	> 2700 pc/h?	No		
3 av3 Is v or v	4 > 1.5 v /2	No		
3 av3	4 > 1.5 v /2 4 12	No	5, 13-16, <b>13-</b> 18	, or 13-19)
3 av3 Is v or v 3 av3 If yes, v =	4 > 1.5 v /2 4 4047 Flow Entering I	No (Equation 13-1 Diverge Influenc	e Area	
3 av3 Is v or v 3 av3 If yes, v = 12A v	4 > 1.5 v /2 4 12 4047 Flow Entering D Actual N	No (Equation 13-1 Diverge Influenc		
3 av3 Is v or v 3 av3 If yes, v = 12A	4 > 1.5 v /2 4 12 4047 Flow Entering D Actual N	No (Equation 13-1 Diverge Influenc Max Desirable 4400	e Area Violation No	
3 av3 Is v or v 3 av3 If yes, v = 12A v	4 > 1.5 v /2 4 12 4047 Flow Entering I Actual M 4047 4 Level of Service Det	No (Equation 13-1 Diverge Influenc Max Desirable 4400	e Area Violation No not F)	?
3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density,	4 > 1.5 v /2 4 12 4047 Flow Entering I Actual M 4047 4 Level of Service Det	No (Equation 13-1 Diverge Influenc Max Desirable 4400 cermination (if .0086 v - 0.009 12	e Area Violation No not F) L = 37.0 D	?
3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density,	$ \begin{array}{c} 4 \\ > 1.5 v /2 \\ 4047 \\ \hline Flow Entering D \\ Actual M \\ 4047 \\ \hline Level of Service Det \\ D = 4.252 + 0. \\ R \\ \hline R \\ \hline e for ramp-freeway jurted \\ \end{array} $	No (Equation 13-1 Diverge Influenc Max Desirable 4400 cermination (if .0086 v - 0.009 12	e Area Violation No not F) L = 37.0 D	?
3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density,	$ \begin{array}{cccc}  & & & & & & & & & & & & & & & & & & &$	No (Equation 13-1 Diverge Influenc Max Desirable 4400 cermination (if .0086 v - 0.009 12 nction areas of stimation D = 0.	e Area Violation No not F) L = 37.0 D influence E	?
3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density, Level of servic Intermediate sp	$ \begin{array}{cccc}  & & & & & & & & & & & & & & & & & & &$	No (Equation 13-1 Diverge Influenc Max Desirable 4400 termination (if .0086 v - 0.009 12 nction areas of stimation D = 0. S rea, $S = 48$	e Area Violation No not F) L = 37.0 D influence E 478	?
3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density, Level of servic Intermediate sp Space mean spee	$ \begin{array}{cccc} 4 & > 1.5 & v & /2 \\ 4 & 12 \\ 4047 \\ \hline Flow Entering D \\ Actual & M \\ 4047 & 4 \\ \hline Level of Service Det \\ D = 4.252 + 0. \\ R \\ te for ramp-freeway jur \\ \hline Speed Esternation \\ beed variable, \end{array} $	No (Equation 13-1 Diverge Influenc Max Desirable 4400 cermination (if .0086 v - 0.009 12 nction areas of stimation D = 0. S	e Area Violation No not F) L = 37.0 D influence E 478 .8 mph	?

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	Diver	je Analys	sis_			
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 EB Western Ave. Ex IDOT Exist. 2009	kit Ramp	_			
	Free	way Data_				
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		4	. 0	e	mph vph	·
	Off Ra	amp Data				
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/	ecel lane decel lane	Rig 1 35 500 230	.0 ) )		mph vph ft ft	
	Adjacent Ramp	Data (i:	f on	e exist	s)	u
Does adjacent ramp exis Volume on adjacent ramp Position of adjacent ra Type of adjacent ramp Distance to adjacent ra	mp	No			vph ft	
Con	version to pc/h	Under Ba	ase	Conditi	ons	
Junction Components	_	Freeway		Ramp		Adjacent Ramp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, E Recreational vehicle PC	Т	7220 0.95 1900 9 0 Level 0.00 0.00 1.5 1.2	% mi	500 0.95 132 9 0 Level 0.00 0.00 1.5 1.2	% mi	vph v % % % شi

		0.957 0	.957	
Heavy vehicle ad	djustment, IHV			
Driver populatio			.00	
Flow rate, vp		7942 5	50	pcph
	Estimation	of V12 Diverge A:	reas	
		-		
	EQ	Equation 13-12 or	13-13)	
	P = 0.436 Us FD	sing Equation 8		
	$\mathbf{v} = \mathbf{v} + (\mathbf{v} - \mathbf{v})$ 12 R F R		/h	•
	Capac	city Checks		
	Actual	Maximum	LOS F?	
$\mathbf{v} = \mathbf{v}$	7942	9000	No	
Fi F v = v - v		9000	No	
v	R 550	2000	No	
R vorv	-	h (Equation 1	3-14 or 13-17)	
	> 2700 pc/h?	No		
Is v or v 3 av3 Is v or v	> 2700 pc/h? 4 > 1.5 v /2	No		
Is v or v 3 av3 Is v or v 3 av3	> 2700 pc/h? 4 > 1.5 v /2 4 12	No	5, 13-16, 13-18	, or 13-19)
Is v or v 3 av3 Is v or v 3 av3	> 2700 pc/h? 4 > 1.5 v /2 4 12	No	5, 13-16, 13-18	, or 13-19)
Is v or v 3 av3 Is v or v 3 av3 If yes, v =	> 2700 pc/h? 4 > 1.5 v /2 4 12 3773 Flow Entering	No (Equation 13-1 Diverge Influenc	e Area	, or 13-19)
Is v or v 3 av3 Is v or v 3 av3 If yes, v =	> 2700 pc/h? 4 > 1.5 v /2 4 12 3773 Flow Entering Actual	No (Equation 13-1 Diverge Influenc Max Desirable	e Area Violation	
Is v or v $3  ext{av3}$ Is v or v $3  ext{av3}$ If yes, v = 12A v	> 2700 pc/h? 4 > 1.5 v /2 4 12 3773 Flow Entering	No (Equation 13-1 Diverge Influenc	e Area	
Is v or v $3  ext{av3}$ Is v or v $3  ext{av3}$ If yes, v = 12A	> 2700 pc/h? 4 > 1.5 v /2 4 12 3773 Flow Entering Actual	No (Equation 13-1 Diverge Influenc Max Desirable 4400	e Area Violation No	
Is v or v $3  ext{av3}$ Is v or v $3  ext{av3}$ If yes, v = 12A v	> 2700 pc/h? 4 > 1.5 v /2 4 12 3773 Flow Entering Actual 3773 Level of Service D	No (Equation 13-1 Diverge Influenc Max Desirable 4400	e Area Violation No not F)	?
Is v or v 3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density,	<pre>&gt; 2700 pc/h? 4 &gt; 1.5 v /2 4</pre>	No (Equation 13-1 Diverge Influenc Max Desirable 4400 etermination (if 0.0086 v - 0.009 12	No No No L = 34.6 D	?
Is v or v 3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density,	<pre>&gt; 2700 pc/h? 4 &gt; 1.5 v /2 4</pre>	No (Equation 13-1 Diverge Influenc Max Desirable 4400 etermination (if 0.0086 v - 0.009 12 unction areas of	No No No L = 34.6 D	?
Is v or v 3 av3 Is v or v 3 av3 If yes, v = 12A V Density, Level of servic	<pre>&gt; 2700 pc/h? 4 &gt; 1.5 v /2 4</pre>	No (Equation 13-1 Diverge Influenc Max Desirable 4400 etermination (if 0.0086 v - 0.009 12 unction areas of Estimation	e Area Violation No not F) L = 34.6 D influence D	?
Is v or v 3 av3 Is v or v 3 av3 If yes, v = 12A v Level of servic	<pre>&gt; 2700 pc/h? 4 &gt; 1.5 v /2 4</pre>	No (Equation 13-1 Diverge Influenc Max Desirable 4400 etermination (if 0.0086 v - 0.009 12 unction areas of Estimation D = 0.	e Area Violation No not F) L = 34.6 D influence D	?
Is v or v 3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density, Level of servic Intermediate sp	<pre>&gt; 2700 pc/h? 4 &gt; 1.5 v /2 4</pre>	No (Equation 13-1 Diverge Influenc Max Desirable 4400 etermination (if 0.0086 v - 0.009 12 unction areas of Estimation D = 0. s area, S = 48	violation No No No L = 34.6 D influence D	?
Is v or v 3 av3 Is v or v 3 av3 If yes, v = 12A v 12 Density, Level of servic Intermediate sp Space mean spee	<pre>&gt; 2700 pc/h? 4 &gt; 1.5 v /2 4</pre>	No (Equation 13-1 Diverge Influenc Max Desirable 4400 etermination (if 0.0086 v - 0.009 12 unction areas of Estimation D = 0. S	Pe Area Violation No not F) L = 34.6 D influence D 478 8.8 mph	?

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HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: E-mail: Fax:

Merge Analysis RCT Analyst: Agency/Co.: PBDate performed: 8/1/2012 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-290 EB Junction: California Ave. Entrance Ramp Jurisdiction: IDOT • Jurisdiction:IDOTAnalysis Year:Exist. 2009 Description: I-290 Phase 1 Study Freeway Data\_\_\_ Merge Type of analysis Number of lanes in freeway 4 55.0 7250 Free-flow speed on freeway mph vph Volume on freeway \_\_\_\_On Ramp Data Side of freeway Right Number of lanes in ramp 1 35.0 Free-flow speed on ramp mph 500 vph Volume on ramp ft Length of first accel/decel lane 400 ft Length of second accel/decel lane Adjacent Ramp Data (if one exists) Does adjacent ramp exist? No Volume on adjacent Ramp vph Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp ft Conversion to pc/h Under Base Conditions\_\_\_\_ Adjacent Junction Components Freeway Ramp Ramp Peak-hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1908 132 ν 10 10 응 Trucks and buses 0 0 읗 Recreational vehicles Level Level Terrain type: 90 ŝ 응 Grade mi mi mi Length Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2

Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	0.952 1.00 8013	0.952 1.00 553		pcph
Estima	tion of V12 Merge	Areas		
L = EQ P = 0.149	(Equation 13-6 Using Equation		•	
· FM	= 1191 pc/h			
	Capacity Checks			
v 8566 FO			LOS F? No	
	.pc/h (Equati	on 13-14	or 13-17)	
1s v or v > 2700 pc/h?	Yes			
_	100			
3 av34 Is v or v > 1.5 v /2	Yes			
3 av34		13-15, 13	-16, 13-18,	or 13-19)
3 av34 Is v or v > 1.5 v /2 3 av34 12 If yes, v = 3205 12A Flow Er Actual v 8566 12A	Yes (Equation ntering Merge Infl Max Desirabl 4600	uence Are e	a Violation? No	or 13-19)
3 av34 Is v or v > 1.5 v /2 3 av34 12 If yes, v = 3205 12A Flow Er Actual v 8566 12A	Yes (Equation ntering Merge Infl Max Desirabl	uence Are e	a Violation? No	or 13-19)
3 av34 Is v or v > 1.5 v /2 3 av34 12 If yes, v = 3205 12A Flow Er Actual v 8566 12A Level of Servi Density, D = 5.475 + 0.00734 v	Yes (Equation ntering Merge Infl Max Desirabl 4600 ice Determination + 0.0078 v - 0 12	uence Are e (if not F ).00627 L A	a Violation? No ) = 32.0	
3 av34 Is v or v > 1.5 v /2 3 av34 12 If yes, v = 3205 12A Flow En Actual v 8566 12A Level of Servi Density, D = 5.475 + 0.00734 v R Level of service for ramp-freev	Yes (Equation ntering Merge Infl Max Desirabl 4600 ice Determination + 0.0078 v - 0 12	uence Are e (if not F ).00627 L A	a Violation? No ) = 32.0	
3 av34 Is v or v > 1.5 v /2 3 av34 12 If yes, v = 3205 12A Flow En Actual v 8566 12A Level of Servi Density, D = 5.475 + 0.00734 v R Level of service for ramp-freev	Yes (Equation ntering Merge Infl Max Desirabl 4600 ice Determination + 0.0078 v - 0 12 way junction areas peed Estimation M	uence Are e (if not F ).00627 L A	a Violation? No ) = 32.0	
3 av34 Is v or v > 1.5 v /2 3 av34 12 If yes, v = 3205 12A Flow Er Actual v 8566 12A Level of Servi Density, D = 5.475 + 0.00734 v R Level of service for ramp-freev Sp	Yes (Equation ntering Merge Infl Max Desirabl 4600 ice Determination + 0.0078 v - 0 12 way junction areas peed Estimation M Sence area, S	uence Are e (if not F ).00627 L A s of influ	a Violation? No ) = 32.0	
3 av34 Is v or v > 1.5 v /2 3 av34 12 If yes, v = 3205 12A Flow Er Actual v 8566 12A Level of Servi Density, D = 5.475 + 0.00734 v R Level of service for ramp-freev Sp Intermediate speed variable,	Yes (Equation ntering Merge Infl Max Desirabl 4600 ice Determination + 0.0078 v - 0 12 way junction areas peed Estimation M Sence area, S R	uence Are e (if not F ).00627 L A s of influ = 0.460	a Violation? No ) = 32.0 ence D	

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	Merge	a Analysi	s				
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	PM Peak Hour I-290 EB California Ave IDOT Exist. 2009	e. Entran	.ce R	атр			
	Free	eway Data	L				
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		4 55	rge .0 20		mph vph		·
	On H	Ramp Data	L				
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/o Length of second accel/	ecel lane	1 35	5.0 80		mph vph ft ft		
	Adjacent Ram	p Data (i	f on	e exist	s)		
Does adjacent ramp exis Volume on adjacent Ramp Position of adjacent Ra Type of adjacent Ramp Distance to adjacent Ra	amp	No	)	·	vph ft		
Cor	nversion to pc/h	h Under E	Base	Conditi	ons		
Junction Components	L	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v19 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, H Recreational vehicle PC	5 5 5	6720 0.95 1768 9 0 Level 1.5 1.2	% mi	530 0.95 139 9 0 Level 1.5 1.2	° mi	 -	ए १ १

Heavy vehicle adj Driver population Flow rate, vp		0.957 1.00 7392	0.957 1.00 583	pcph
	Estimatio	n of V12 Merge A	reas	
		(Equation 13-6 or	r 13-7)	
	EQ P = 0.145 FM	Using Equation	4	
	v = v (P) = 12 F FM	1071 pc/h		
	Сар	acity Checks	aug	
V	Actua1 7975	Maximum 9000	LOS F? No	
FO vorv 3 av34		/h (Equation	13-14 or 13-3	17)
	> 2700 pc/h?	Yes		
	-			
3 av34 Is v or v	> 1.5 v /2	Yes		
3 av34	> 1.5 v /2 12		-15, 13-16, 1	3-18, or 13-19)
$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	> 1.5 v /2 12 95 <u>6</u> Flow Enter Actual 7975	(Equation 13 ting Merge Influe Max Desirable 4600	nce Area Viola No	
3  av34 Is v or v $3  av34$ If yes, v = 29 $12A$ v $12A$	> 1.5 v /2 12 956 Flow Enter Actual 7975 Level of Service	(Equation 13) Fing Merge Influe: Max Desirable 4600 Determination (i	nce Area Viola No f not F)	tion?
3  av34 Is v or v 3  av34 If yes, v = 29 12A v 12A Density, D = 5.4 R	> 1.5 v /2 12 95.6 Flow Enter Actual 7975 _Level of Service 75 + 0.00734 v + R	(Equation 13 Ting Merge Influe: Max Desirable 4600 Determination (i 0.0078 v - 0.0 12	nce Area Viola No f not F) 0627 L = A	tion? 30.3 pc/mi/lr
3  av34 Is v or v 3  av34 If yes, v = 29 12A v 12A Density, D = 5.4 R	<pre>&gt; 1.5 v /2 12 956Flow Enter Actual 7975 _Level of Service 75 + 0.00734 v + R for ramp-freeway</pre>	(Equation 13) Fing Merge Influe: Max Desirable 4600 Determination (i 0.0078 v - 0.0 12 junction areas o	nce Area Viola No f not F) 0627 L = A	tion? 30.3 pc/mi/lr
3  av34 Is v or v 3  av34 If yes, v = 29 12A v 12A Density, D = 5.4 R Level of service	<pre>&gt; 1.5 v /2 12 95.6 Flow Enter Actual 7975 Level of Service 75 + 0.00734 v + for ramp-freeway Speed</pre>	(Equation 13 Max Desirable 4600 Determination (i 0.0078 v - 0.0 12 junction areas o end Estimation	nce Area Viola No f not F) 0627 L = A f influence	tion? 30.3 pc/mi/lr
3  av34 Is v or v 3  av34 If yes, v = 29 12A v 12A Density, D = 5.4 R	<pre>&gt; 1.5 v /2 12 95.6 Flow Enter Actual 7975 Level of Service 75 + 0.00734 v + for ramp-freeway Speed</pre>	(Equation 13 Max Desirable 4600 Determination (i 0.0078 v - 0.0 12 junction areas o end Estimation	nce Area Viola No f not F) 0627 L = A	tion? 30.3 pc/mi/lr
3  av34 Is v or v 3  av34 If yes, v = 29 12A v 12A Density, D = 5.4 R Level of service Intermediate spece	<pre>&gt; 1.5 v /2 12 95.6 Flow Enter Actual 7975 Level of Service 75 + 0.00734 v + for ramp-freeway Speed</pre>	<pre>(Equation 13) fing Merge Influe:    Max Desirable    4600 Determination (i    0.0078 v - 0.0         12    junction areas o d Estimation M =    S</pre>	nce Area Viola No f not F) 0627 L = A f influence	tion? 30.3 pc/mi/lr
3  av34 Is v or v 3  av34 If yes, v = 29 12A v 12A Density, D = 5.4 R Level of service Intermediate spece	<pre>&gt; 1.5 v /2 12 956 Flow Enter Actual 7975 _Level of Service 75 + 0.00734 v + for ramp-freeway Speed ed variable, in ramp influence</pre>	<pre>(Equation 13) fing Merge Influe: Max Desirable 4600 Determination (i 0.0078 v - 0.0 12 junction areas o d Estimation M = Searea, S = R</pre>	nce Area Viola No f not F) 0627 L = A f influence 0.427	tion? 30.3 pc/mi/lr

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## I - 290 Westbound Ramp Junction Analysis

**Existing Conditions** 

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Phone: E-mail: Fax:

	Dive	rge Analys	sis			
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Phas	RCT PB 8/7/2012 AM Peak Hour I-290 WB California Ave IDOT Exist. 2009		_			
·	Free	eway Data_				
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		4	.0	e	mph vph	
	Off ]	Ramp Data <sub>.</sub>				
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/d	ecel lane decel lane	1 35 480 265	.0 0 5	0.0415	mph vph ft ft	
Does adjacent ramp exis	Adjacent Ram	p Data (1) No	r on	e exist:	5)	
Volume on adjacent ramp Position of adjacent ram Type of adjacent ramp					vph	
Distance to adjacent ra	qm				ft	
Con	version to pc/	h Under B	ase	Conditio	ons	
Junction Components		Freeway		Ramp		Adjacent Ramp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, E Recreational vehicle PC	T	5690 0.95 1497 10 0 Level 0.00 0.00 1.5 1.2	% mi	480 0.95 126 10 0 Level 0.00 0.00 1.5 1.2	% mi	vph v % % شا

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	adjustment, fHV Ion factor, fP	1.00	0.952 1.00 531	pcph
	Estimation	n of V12 Diverge .	Areas	
		Equation 13-12 of	r 13-13)	
	EQ P = 0.436 U FD	Jsing Equation 8		
	$\mathbf{v} = \mathbf{v} + (\mathbf{v} - \mathbf{v})$ 12 R F F		c/h	
	Capa	acity Checks		
v = v	Actual 6289	Maximum 9000	LOS F? No	
Fi F V = V - V		9000	No	
FO F V	531	2000	No	
R vorv		/h (Equation	13-14 or 13 <b>-</b> 17)	
Is vorv	34 > 2700 pc/h?	No		
	> 1.5 v /2	No		
Is vorv	> 1.5 v /2 34 12		15, 13-16, 13-18	3, or 13-19)
Is v or v 3 av If yes, v = 12A v	> 1.5 v /2 34 12 3041			
Is v or v 3 av If yes, v = 12A	> 1.5 v /2 34 12 3041 Flow Entering Actual	(Equation 13- g Diverge Influen Max Desirable 4400	ce Area Violatior No	
Is v or v 3 av: If yes, v = 12A v 12	> 1.5 v /2 34 12 3041 Flow Entering Actual 3041 Level of Service P D = 4.252 +	(Equation 13- g Diverge Influen Max Desirable 4400 Determination (if 0.0086 v - 0.00	ce Area Violation No not F) 9 L = 28.0+	1?
Is v or v 3 av: If yes, v = 12A v 12 Density,	> 1.5 v /2 34 12 3041 Flow Entering Actual 3041 Level of Service 1	(Equation 13- g Diverge Influen Max Desirable 4400 Determination (if 0.0086 v - 0.00 12	ce Area Violation No not F) 9 L = 28.04 D	1?
Is v or v 3 av: If yes, v = 12A v 12 Density,	<pre>&gt; 1.5 v /2 34 12 3041Flow Entering Actual 3041Level of Service I D = 4.252 + R ce for ramp-freeway ;</pre>	(Equation 13- g Diverge Influen Max Desirable 4400 Determination (if 0.0086 v - 0.00 12	ce Area Violation No not F) 9 L = 28.04 D	1?
Is v or v 3 av: If yes, v = 12A v 12 Density, Level of servi	<pre>&gt; 1.5 v /2 34 12 3041Flow Entering Actual 3041Level of Service I D = 4.252 + R ce for ramp-freeway ;</pre>	(Equation 13- g Diverge Influen Max Desirable 4400 Determination (if 0.0086 v - 0.00 12 junction areas of Estimation D = 0	ce Area Violation No not F) 9 L = 28.04 D influence D	1?
Is v or v 3 av: If yes, v = 12A v 12 Density, Level of servity Intermediate s	<pre>&gt; 1.5 v /2 34 12 3041Flow Entering Actual 3041Level of Service I         D = 4.252 +         R ce for ramp-freeway :Speed</pre>	(Equation 13- g Diverge Influen Max Desirable 4400 Determination (if 0.0086 v - 0.00 12 junction areas of Estimation D = 0 S area, S = 4	ce Area Violation No not F) 9 L = 28.04 D influence D	1?
Is v or v 3 av: If yes, v = 12A v 12 Density, Level of servi Intermediate s Space mean spe	<pre>&gt; 1.5 v /2 34 12 3041Flow Entering Actual 3041Level of Service P D = 4.252 + R ce for ramp-freewaySpeed peed variable,</pre>	(Equation 13- g Diverge Influen Max Desirable 4400 Determination (if 0.0086 v - 0.00 12 junction areas of Estimation D = 0 S	ce Area Violation No not F) 9 L = 28.04 D influence D .476 8.8 mph	1?

<u>.</u>

Heavy vehicle adj Driver population Flow rate, vp		0.985 1.00 6795	0.985 1.00 449		pcph
	Estimation	of V12 Diverg	e Areas_		
		quation 13-12	or 13-1	.3)	
	EQ P = 0.436 Us FD	ing Equation	8		
	v = v + (v - v) 12 R F R		pc/h		
	Capac	ity Checks			
v = v Fi F	Actual 6795	Maximum 9000		LOS F? No	
v = v - v	6346	9000		No	
FO F R V	449	2000		No	
R v or v 3 av34		n (Equatio	n 13-14	or 13-17)	
Is v or v	> 2700 pc/h?	No			
	> 1.5 v /2	No			
3 av34 If yes, v = 32 12A		(Equation 1	3-15, 13	3-16, 13-18,	or 13-19)
	Flow Entering				
v	Actual 3216	Max Desirable 4400	<u>.</u>	Violation? No	
. 12	Level of Service De	etermination (	if not 1	E)	
Density,		).0086 v - 0.		= 29.5	pc/mi/ln
Level of service	R for ramp-freeway ju	12 Inction areas	D of influ	lence D	
	Speed B	Stimation			
Intermediate spee	ed variable,		0.468		
Space mean speed	in ramp influence a	•	48.9	mph	
Space mean speed	in outer lanes,	-	57.3	mph	
Space mean speed	for all vehicles,	0 S =	≖ 53 <b>.</b> 0	mph	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

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Merge	Analysis			
Analyst:RCTAgency/Co.:PBDate performed:8/7/2012Analysis time period:AM Peak HourFreeway/Dir of Travel:I-290 WBJunction:Western Ave. EnJurisdiction:IDOTAnalysis Year:Exist. 2009Description:I-290 Phase 1 Study	ntrance Ramp			
Free	way Data			
Type of analysis Number of lanes in freeway Free-flow speed on freeway Volume on freeway	Merge 4 55.0 5210		mph vph	
On R	amp Data			
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/decel lane Length of second accel/decel lane	Right 1 35.0 720 375		mph vph ft ft	
Adjacent Ramp	Data (if one	e exists	)	
Does adjacent ramp exist? Volume on adjacent Ramp Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp	No		vph ft	
Conversion to pc/h	Under Base	Conditio	ns	
Junction Components Volume, V (vph) Peak-hour factor, PHF	Freeway 5210 0.95	Ramp 720 0.95		Adjacent Ramp vph
Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type:	1371 10 0 Level	189 10 0 Level		V % %
Grade Length Trucks and buses PCE, ET Recreational vehicle PCE, ER	ی پ ش ا ا ا ا ا ا	1.5 1.2	° mi	۶ mi

Flow rate, vp	1.00 . 5758	1.00 796	pcph
Estimation of	E V12 Merge A	reas	
L = (Equ EQ	ation 13-6 o	r 13-7)	
	ng Equation	4	
v = v (P) = 681 12 F FM	L, pc/h		
Capaci	cy Checks		
Actual v 6554 FO	Maximum 9000	LOS No	F?
	(Equation	13-14 or 1	13-17)
Is v or v > 2700 pc/h? 3 av34	No		
Is v or v > 1.5 v /2 3 av34 12	Yes		
If yes, v = 2303 12A	(Equation 13	3-15, 13-16	, 13-18, or 13-19)
	Merge Influe ax Desirable 600		olation?
Level of Service Det	ermination (i	f not F)	
Density, D = $5.475 + 0.00734 v + 0.0$ R R Level of service for ramp-freeway jun	12	A	
Speed Es	timation		
Intermediate speed variable,	M = S	0.381	
Space mean speed in ramp influence ar	_	50.0 mp	h
Space mean speed in outer lanes,	S =	50.6 mp	h
Space mean speed for all vehicles,	S =	50.3 mp	h

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS D, which are not adequately evaluated by the Highway Capacity Manual Method.

Recreational vehicle PCE, ER

Fax:

\_\_\_\_\_Merge Analysis\_\_\_\_\_ RCT Analyst: Agency/Co.: PBAgency/Co.: PB Date performed: 8/7/2012 Analysis time period: PM Peak Hour Freeway/Dir of Travel: I-290 WB Junction: Western Ave. Entrance Ramp Jurisdiction: IDOT Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Freeway Data Merge Type of analysis Number of lanes in freeway 4 mph 55.0 5940 Free-flow speed on freeway vph Volume on freeway \_\_\_\_On Ramp Data\_\_\_\_\_ Side of freeway Right Number of lanes in ramp 1 35.0 mph Free-flow speed on ramp Volume on ramp 630 vph Length of first accel/decel lane ft 375 Length of second accel/decel lane ft Adjacent Ramp Data (if one exists) Does adjacent ramp exist? NO Volume on adjacent Ramp vph Position of adjacent Ramp Type of adjacent Ramp Distance to adjacent Ramp ft Conversion to pc/h Under Base Conditions Adjacent Junction Components Freeway Ramp Ramp 630 vph 5940 Volume, V (vph) Peak-hour factor, PHF 0.95 166 0.95 0.95 Peak 15-min volume, v15 1563 v 3 0 3 Trucks and buses 응 0 v Level Level % 응 Recreational vehicles Terrain type: · 8 응 Grade mi mi mi Length Trucks and buses PCE, ET 1.5 1.5

1.2

1.2

Heavy vehicle adjustme Driver population fact Flow rate, vp		0.985 1.00 6346	0.985 1.00 673		pcph
	Estimation of	of V12 Merge	Areas		
L = EQ	- (Ec	quation 13-6	or 13-7)		
P = FM	= 0.134 Usi	ing Equation	4		
	= v (P) = 84 F FM	48 pc/h			
	Capac:	ity Checks			
V	Actual 7019	Maximum 9000		LOS F? No	
FO v or v 3 av34	2749 pc/h	(Equatio	on 13-14	or 13-17)	
	700 pc/h?	Yes	-		
	.5 v /2 12	Yes			
If yes, v = 2538 12A	12	(Equation 1	.3-15, 13	-16, 13-18,	or 13-19)
v 12A Leve	Actual	g Merge Influ Max Desirable 4600 termination (	2	Violation? No	
Density, D = 5.475 + R Level of service for	0.00734 v + 0. R	0078 <del>v</del> - 0. 12	00627 L A	= 27.9	pc/mi/ln
		stimation		· · · • • • • • • • • • • • • • • • • •	
Intermediate speed va	riable,	M = S	= 0.391		
Space mean speed in r	amp influence a	-	= 49.9	mph	
Space mean speed in o	uter lanes,		= 49.9	mph	
Space mean speed for	all vehicles,	0	= 49.9	mph	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

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Phone: Fax: E-mail: \_\_\_\_\_Diverge Analysis\_\_\_\_\_\_ RCT Analyst: Agency/Co.: ΡB Agency/Co.: Date performed: 8/7/2012 Analysis time period: AM Peak Hour Freeway/Dir of Travel: I-290 WB Independence Blvd. Exit Ramp IDOT Junction: Jurisdiction: Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Freeway Data\_\_\_\_\_ Type of analysis Diverge Number of lanes in freeway 4 55.0 6110 mph vph Free-flow speed on freeway Volume on freeway \_\_\_\_\_Off Ramp Data\_\_\_\_\_ Side of freeway Right Number of lanes in ramp 1 35.0 Free-Flow speed on ramp mph 480 vph Volume on ramp ft Length of first accel/decel lane 150 Length of second accel/decel lane ft Adjacent Ramp Data (if one exists)\_\_\_\_\_ Does adjacent ramp exist? No Volume on adjacent ramp vph Position of adjacent ramp Type of adjacent ramp ft Distance to adjacent ramp Conversion to pc/h Under Base Conditions\_\_\_\_\_ Freeway Ramp Adjacent Junction Components Ramp vph v 480 6110 Volume, V (vph) Peak-hour factor, PHF 0.95 0.95 1608 126 Peak 15-min volume, v15 v 10 10 Trucks and buses 읗 0 0 웡 Recreational vehicles Level Level Terrain type: 0.00 % 0.00 0.00 mi 0.00 응 Grade 8 mi mi Length Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2

Heavy vehicle adjustment, Driver population factor, Flow rate, vp		0.952 1.00 6753	0.952 1.00 531		pcph
•	Estimation of	E V12 Diverge	Areas		
L = EQ	(Equ	uation 13-12 d	or 13-13)		
	0.436 Usir	ng Equation	8		
	+ (v - v ) E F R	P = 3244 j FD	pc/h		
	Capacit	ty Checks			
v = v Fi F	Actual 6753	Maximum 9000	LC NC	DS F?	
	6222	9000	NO	D	
v R	531	2000	NG	<b>o</b> .	
v or v 3 av34	1754 pc/h	(Equation	13-14 o:	r 13-17)	
Is v or v > 2700 3 av34	pc/h?	No			
Is v or v $> 1.5$ v 3 av34		No			
If yes, $v = 3244$ 12A	12	(Equation 13	-15, 13-3	16, 13-18,	or 13-19)
		iverge Influe			
v 324		ax Desirable 400		Violation? No	
12 Level of	Service Dete	ermination (i	f not F)		
		0086 v - 0.0	_	= 30.8	pc/mi/ln
Evel of service for ramp	•	12 ction areas o	D f influe	nce D	
	Speed Es	timation			
Intermediate speed variab	ole,		0.476		
Space mean speed in ramp	influence ar		48.8	mph	
Space mean speed in outer	: lanes,	R S =	57.4	mph	
		0			

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

Phone: E-mail: Fax:

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	Diver	ge Analys	is_			
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 WB Independence B IDOT Exist. 2009	lvd. Exit	: Ra:	du.		
	Free	way Data_				
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		4 55.	verg 0 30		mph vph	
<u></u>	Off R	amp Data_				
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/	ecel lane	Rig 1 35. 470 150	. 0 )		mph vph ft ft	
	Adjacent Ramp	Data (if	: on	e exist:	s)	
Does adjacent ramp exis Volume on adjacent ramp Position of adjacent ra Type of adjacent ramp Distance to adjacent ra	gm	No			vph ft	
Cor	version to pc/h	Under Ba	ase	Conditio	ons	
Junction Components Volume, V (vph)		Freeway 6630		Ramp 470		Adjacent Ramp vph
Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, F Recreational vehicle PC	T	0.95 1745 3 0 Level 0.00 0.00 1.5 1.2	۶ mi	0.95 124 3 0 Level 0.00 0.00 1.5 1.2	% mi	vpn v % % % mi

Heavy vehicle adjustment, Driver population factor, Flow rate, vp		0.985 1.00 7084	0.985 1.00 502		pcph
I	Estimation	of V12 Diver	ge Areas_		
L = EQ	(E	quation 13-12	2 or 13-1	.3)	
P = FD	0.436 Us	ing Equation	8		
v = v 12 R		P = 3372 FD	pc/h		
	Capac	ity Checks			
v = v Fi F	Actual 7084	Maximum 9000		LOS F? No	
v = v - v	6582	9000		No	
FO F R V	502	2000		No	
R vorv 3 av34	1856 pc/h	(Equati	on 13-14	or 13-17)	
$\begin{array}{cccc} \text{Is } v & \text{or } v & > 2700 \\ & 3 & av34 \end{array}$	pc/h?	No			
Is v or v > 1.5 v	/2 12	No			
If yes, v = 3372 12A	12	(Equation	13-15, 13	3-16, 13-18,	or 13-19)
		Diverge Infl			
v 337		Max Desirabl 4400	e	Violation? No	
Level of	Service De	etermination	(if not )	F)	
Density, D		).0086 v - 0 12	.009 L	= 31.9	pc/mi/ln
Level of service for ramp			2	uence D	
	Speed E	stimation			
Intermediate speed variab	ole,		= 0.473		
Space mean speed in ramp	influence a	_	= 48.8	mph	
Space mean speed in outer	lanes,		= 57.0	mph	
Space mean speed for all	vehicles,	0 S	= 52.8	mph	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

	Merge	Analysis			. =.
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 WB Independence B IDOT Exist. 2009	lvd. Entranc	e		·
	Free	way Data			
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway	-	Merge 4 55.0 5630		mph vph	
	On R	amp Data			
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/	ecel lane	Right 1 35.0 480 630		mph vph ft ft	
Does adjacent ramp exis Volume on adjacent Ramp Position of adjacent Ra Type of adjacent Ramp Distance to adjacent Ra	mp	Data (if or	ne exists	) vph ft	
-	version to pc/h	Under Base	Conditic	ns	
Junction Components Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type:		Freeway 5630 0.95 1482 10 0 Level	Ramp 480 0.95 126 10 0 Level		Adjacent Ramp vph v % %
Grade Grade Length Trucks and buses PCE, E Recreational vehicle PC		1.5 1.2	1.5 1.2	% mi	% mi

Heavy vehicle adjustment, fHV Driver population factor, fP Flow rate, vp	0.952 1.00 6223	0.952 1.00 531		pcph
Estimatic	on of V12 Merge	Areas		
L = C + EQ	(Equation 13-6	or 13-7)		
	Using Equation	4		
v = v (P) = 12 F FM	942 pc/h			
Car	pacity Checks			
Actual v 6754 FO	Maximum 9000		LOS F? No	
	c/h (Equati	on 13-14	or 13-17)	
Is v or v > 2700 pc/h? 3 av34	No			
Is v or v > 1.5 v /2 3 av34 12	Yes			
If yes, v = 2489 12A	(Equation	13-15, 13	-16, 13-18,	or 13-19)
Actual v 6754 12A	ring Merge Infl Max Desirabl 4600	-e	Violation? No	
Level of Service				
Density, D = $5.475 + 0.00734 v + R R$ Level of service for ramp-freeway	12	A	7	pc/mi/ln
Spee	d Estimation			
Intermediate speed variable,	M S	= 0.357		
Space mean speed in ramp influenc		= 50.4	mph	
Space mean speed in outer lanes,		= 50.1	mph	
Space mean speed for all vehicles	, S	= 50.2	mph	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS D, which are not adequately evaluated by the Highway Capacity Manual Method.

	Mero	ge Analysis			
Analysis time period: Freeway/Dir of Travel:	I-290 WB Independence IDOT Exist. 2009	Blvd. Entr	ance		
<b>-</b> /	Fre	eeway Data_			
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway	_	Mer 4 55. 616	0	mph vph	
	On	Ramp Data_			- · · · · · · · · · · · · · · · · · · ·
Side of freeway Number of lanes in ramp Free-flow speed on ramp Volume on ramp Length of first accel/d Length of second accel/	ecel lane	Rig 1 35. 540 630	0	mph vph ft ft	
	Adjacent Ram	mp Data (if	one exist	s)	
Does adjacent ramp exis Volume on adjacent Ramp Position of adjacent Ra Type of adjacent Ramp Distance to adjacent Ra	mp	No		vph ft	
Con	version to pc	/h Under Ba	se Conditi	ons	
Junction Components	-	Freeway	Ramp		Adjacent Ramp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, E Recreational vehicle PC	т	6160 0.95 1621 3 0 Level 1.5 1.2	540 0.95 142 3 0 Level % mi 1.5 1.2	۶ mi	vph v % % mi

Heavy vehicle adju Driver population Flow rate, vp		0.985 1.00 6581	0.985 1.00 577		pcph
	Estimation	of V12 Merge	Areas		
		Equation 13-6	or 13-7)		
	EQ P = 0.146 Us FM	sing Equation	4		
	v = v (P) = 9 $12 F FM$	959 pc/h			
	Сарас	city Checks			
V FO	Actual 7158	Maximum 9000		LOS F? No	
v  or  v 3 av34	2811 pc/1	h (Equati	on 13-14	or 13-17)	
Is v or v 3 av34	> 2700 pc/h?	Yes			
Is v or v 3 av34	> 1.5 v /2 12	Yes			
If yes, v = 263 12A		(Equation	13-15, 13	-16, 13-18,	or 13-19)
		ng Merge Infl			
<b>v</b> 12A	Actual 7158	Max Desirabl 4600	e	Violation? No	
	evel of Service D	etermination	(if not F	')	· · · · · ·
Density, D = 5.475 R Level of service f	R	12	A		pc/mi/lr
	Speed	Estimation			
Intermediate speed	variable,	м	= 0.373		
Space mean speed i	n ramp influence	area, S R	<b>=</b> 50.1	mph	
Space mean speed i	n outer lanes,	S 0	= 49.7	mph	
Space mean speed f	for all vehicles,		= 49.9	mph	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Fax:

	Diver	ge Analy	sis_				<u></u>
Analyst: Agency/Co.: Date performed: Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction: Analysis Year: Description: I-290 Pha	I-290 WB Kostner Ave. E IDOT Exist. 2009	xit Ramp					
	Free	way Data					
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		4 55	verg .0 10		mph vph		
	Off R	amp Data					
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/o Length of second accel/	decel lane /decel lane	1 35 64 26	ght .0 0 7		mph vph ft ft		
	Adjacent Ramp	) Data (1	t on	e exists	5)		<b>_</b>
Does adjacent ramp exis Volume on adjacent ramp Position of adjacent ra Type of adjacent ramp	, Ç	No			vph		
Distance to adjacent ra	amp				ft		
Cor	nversion to pc/h	n Under E	ase	Conditio	ons		<b>,</b>
Junction Components		Freeway	,	Ramp		Adjacent Ramp	
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, vl Trucks and buses Recreational vehicles Terrain type:	5	6110 0.95 1608 10 0 Level		640 0.95 168 10 0 Level			vph v % %
Grade Length Trucks and buses PCE, I Recreational vehicle PG		0.00 0.00 1.5 1.2	% mi	0.00 0.00 1.5 1.2	% mi		ł ni

river population f low rate, vp	stment, fHV factor, fP	0.952 1.00 6753	0.952 1.00 707	pcph
	Estimatior	n of V12 Diverge	e Areas	
	L = (	(Equation 13-12	or 13-13)	
	P = 0.436 U FD	Jsing Equation	8	
	v = v + (v - v 12 R F F		pc/h	
	Capa	acity Checks		
v = v	Actual 6753	Maximum 9000	LOS No	F?
$ \begin{array}{cccc} Fi & F \\ v &= v - v \\ FO & F & F \end{array} $	6046	9000	No	
FO F R V	707	2000	No	
R v or v 3 av34	1705 pc,	/h (Equation	n 13-14 or 1	3-17)
(svorv >	> 2700 pc/h?	No		
3 av34				
ls vorv >		No		
	12		3-15, 13-16,	13-18, or 13-19)
(s v or v ) 3 av34 (f yes, v = 3343	12 3 Flow Entering	(Equation 13 g Diverge Influe	ence Area	
ls v or v > 3 av34 If yes, v = 3343 12A v	12 3	(Equation 13 g Diverge Influe	ence Area	13-18, or 13-19) lation?
ls v or v > 3 av34 If yes, v = 3343 12A v 12	12 3 Flow Entering Actual	(Equation 13 g Diverge Influe Max Desirable 4400	ence Area Vio No	
ls v or v > 3 av34 If yes, v = 3343 12A v 12	12 3 Flow Enterine Actual 3343 evel of Service	(Equation 13 g Diverge Influe Max Desirable 4400 Determination (3 0.0086 v - 0.0	ence Area Vio No if not F) 009 L =	lation?
ls v or v > 3 av34 If yes, v = 3343 12A v 12 Le	12 3 Flow Enterine Actual 3343 evel of Service D = 4.252 + R	(Equation 13 g Diverge Influe Max Desirable 4400 Determination (1 0.0086 v - 0.0 12	ence Area Vio No if not F) D09 L = D	lation? 30.6 pc/mi/ln
<pre>(s v or v &gt; 2) 3 av34 (f yes, v = 3343 12A v 12 v 12 Le Density,</pre>	12 3 Flow Entering Actual 3343 evel of Service D = 4.252 + R or ramp-freeway	(Equation 13 g Diverge Influe Max Desirable 4400 Determination (1 0.0086 v - 0.0 12	ence Area Vio No if not F) D09 L = D	lation? 30.6 pc/mi/ln
<pre>(s v or v &gt; 2) 3 av34 (f yes, v = 3343 12A v 12 v 12 Le Density,</pre>	12 3 Flow Enterine Actual 3343 evel of Service D = 4.252 + R or ramp-freeway Speed	(Equation 13 g Diverge Influe Max Desirable 4400 Determination (3 0.0086 v - 0.0 12 junction areas o Estimation D =	ence Area Vio No if not F) D09 L = D	lation? 30.6 pc/mi/ln
Is v or v > 3 av34 If yes, v = 3343 12A v 12 Level of service for	12 3 Flow Enterine Actual 3343 evel of Service D = 4.252 + R or ramp-freeway Speed variable,	<pre>(Equation 13) g Diverge Influe Max Desirable 4400 Determination (1) 0.0086 v - 0.0 12 junction areas Estimation D = S area, S =</pre>	ence Area Vio No if not F) 009 L = D of influence	lation? 30.6 pc/mi/ln D
Is v or v > 3 av34 If yes, v = 3343 12A v 12 Level of service for Intermediate speed	12 3 Flow Entering Actual 3343 evel of Service D = 4.252 + R or ramp-freeway Speed variable, n ramp influence	<pre>(Equation 13) g Diverge Influe Max Desirable 4400 Determination (1) 0.0086 v - 0.0 12 junction areas Estimation D = S area, S = R</pre>	ence Area Vio No if not F) 009 L = D of influence 0.492	lation? 30.6 pc/mi/ln D

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS E, which are not adequately evaluated by the Highway Capacity Manual Method.

HCS 2010: Freeway Merge and Diverge Segments Release 6.1

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Phone: E-mail:

	Diver	ge Analys	sis_			
Analysis time period: Freeway/Dir of Travel: Junction: Jurisdiction:	I-290 WB Kostner Ave. E: IDOT Exist. 2009	xit Ramp				
	Free	way Data				
Type of analysis Number of lanes in free Free-flow speed on free Volume on freeway		4 55	verg .0 D0		mph vph	
	Off Ra	amp Data				
Side of freeway Number of lanes in ramp Free-Flow speed on ramp Volume on ramp Length of first accel/o Length of second accel/	) lecel lane 'decel lane	1 35 60 26	7		mph vph ft ft	
Does adjacent ramp exis Volume on adjacent ramp Position of adjacent ra Type of adjacent ramp	<b>)</b>	No		e exists	v	
Distance to adjacent ra	qmp				ft	
Cor	nversion to pc/h	Under B	ase	Conditio	ns	<del>_</del>
Junction Components		Freeway		Ramp		Adjacent Ramp
Volume, V (vph) Peak-hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Terrain type: Grade Length Trucks and buses PCE, H Recreational vehicle PC	ST	6700 0.95 1763 3 0 Level 0.00 0.00 1.5 1.2	% mi	600 0.95 158 3 0 Level 0.00 0.00 1.5 1.2	% mi	vph v % % mi

Heavy vehicle adj Driver population Flow rate, vp		0.985 1.00 7158	0.985 1.00 641		pcph
<u> </u>	Estimation o	f V12 Diverge	e Areas		
	L = (Eq EQ	uation 13-12	or 13-13	)	
		ng Equation	8		
	v = v + (v - v) 12 R F R		pc/h		
	Capaci	ty Checks			
v = v	Actual 7158	Maximum 9000		IOS F? Io	
$ \begin{array}{cccc} Fi & F \\ v &= v - v \\ Fi & F \\ v &= v - v \end{array} $	6517	9000	N	ю	
FO F R V R	641	2000	N	ю	
v or v 3 av34	-	(Equation	n 13-14 c	or 13-17)	
	> 2700 pc/h?	No			
	> 1.5 v /2 12	No			
If yes, v = 34 12A		(Equation 13	3-15, 13-	-16, 13-18,	or 13-19)
v 12	Flow Entering I Actual N 3482 4	Max Desirable 1400		Violation? No	
	Level of Service Det				
Density,	D = 4.252 + 0. R	12	D		pc/mi/ln
Level of service	for ramp-freeway jur		of influe	ence D	
	Speed Es	stimation			
Intermediate spee	ed variable,	D = S	0.486		
Space mean speed	in ramp influence an	cea, S = R	48.7	mph	
Space mean speed	in outer lanes,	S = 0	57.1	mph	
Space mean speed	for all vehicles,	S =	52.7	mph	

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

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# Appendix B

**HCS Analysis Output** 

## **B-3**

**Weaving Sections** 

# I - 290 Eastbound Weaving Analysis

### **Existing Conditions**

HCS 2010: Freeway Weaving Release 6.1 Fax:

Phone: E-mail:

DateB/2/2012Analysis Time Period:AM Peak HourPreeway/Dir of Travel:I-290 EBNeaving Location:Homan Ent. to SacramenAnalysis Year:Exist. 2009Description:I-290 Phase 1 Study		
Agency/Co.:PBDate Performed:8/2/2012Analysis Time Period:M Peak HourFreeway/Dir of Travel:I-290 EBWeaving Location:Homan Ent. to SacramenAnalysis Year:Exist. 2009Description:I-290 Phase 1 Study		
Analysis Time Period: AM Peak Hour Freeway/Dir of Travel: I-290 EB Homan Ent. to Sacramen Analysis Year: Exist. 2009 Description: I-290 Phase 1 Study Inputs Segment Type Freeway Weaving configuration One-Side Number of lanes, N 5 Weaving segment length, LS 758 Freeway free-flow speed, FFS 55 Minimum segment speed, SMIN 15 Freeway maximum capacity, cIFL 2250 Terrain type Level Grade 0.00 Length 0.00 Conversion to pc/h Under Base Con Volume Compon VeF VRF Volume, V 7467 290 Peak hour factor, PHF 0.95 0.95 Peak l5-min volume, v15 1965 76 Trucks and buses 10 10 Recreational vehicles 0 0 Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 Heavy vehicle adjustment, fP 1.00 1.00 Flow rate, v 8253 321 Volume ratio, VR 0.102 Configuration Characteristi Number of maneuver lanes, NWL 2 Interchange density, ID 1.00 Minimum RF lane changes, LCRF 1 Minimum RR lane changes, LCMIN 940 Weaving lane changes, LCMIN 940 Weaving lane change, LCNW 1148		
Freeway/Dir of Travel:       I-290 EB         Weaving Location:       Homan Ent. to Sacramen Analysis Year:         Description:       Exist. 2009         Description:       Inputs         Segment Type       Freeway         Weaving configuration       One-Side         Number of lanes, N       5         Weaving segment length, LS       758         Freeway free-flow speed, FFS       55         Minimum segment speed, SMIN       15         Freeway maximum capacity, cIFL       2250         Terrain type       Level         Grade       0.00		
Weaving Location:Homan Ent. to Sacramen Exist. 2009Analysis Year:Exist. 2009Description:I-290 Phase 1 StudyInputsInputsSegment TypeFreewayWeaving configurationOne-SideNumber of lanes, N5Weaving segment length, LS758Freeway free-flow speed, FFS55Minimum segment speed, SMIN15Freeway maximum capacity, cIFL2250Terrain typeLevelGrade0.00		
Analysis Year:       Exist. 2009         Description:       I-290 Phase 1 Study         Inputs       Inputs         Segment Type       Freeway         Weaving configuration       One-Side         Number of lanes, N       5         Weaving segment length, LS       758         Freeway free-flow speed, FFS       55         Minimum segment speed, SMIN       15         Freeway maximum capacity, cIFL       2250         Terrain type       Level         Grade       0.00         Length       0.00         Conversion to pc/h Under Base Con       Volume Compon         Volume, V       7467       290         Peak hour factor, PHF       0.95       0.95         Peak hour factor, PHF       0.95       0.95         Recreational vehicles       0       0         Trucks and buses       10       10         Recreational vehicle PCE, ER       1.2       1.2         Heavy vehicle adjustment, fP       0.00       1.00         Flow rate, v       8253       321         Volume ratio, VR       0.102       0.102         Minimum RF lane changes, LCRF       1       1.00         Minimum RF lane changes, L		
Description:       I-290 Phase 1 Study         Inputs       Inputs         Segment Type       Freeway         Weaving configuration       One-Side         Number of lanes, N       5         Weaving segment length, LS       758         Freeway free-flow speed, FFS       55         Minimum segment speed, SMIN       15         Freeway maximum capacity, CIFL       2250         Terrain type       Level         Grade       0.00         Length       0.00         Conversion to pc/h Under Base Con       Volume Compon         Volume, V       7467       290         Peak hour factor, PHF       0.95       0.95         Peak hour factor, PHF       0.95       0.95         Peak hour factor, PHF       0.952       0.952         Prucks and buses       10       10         Recreational vehicles       0       0         Trucks and buses PCE, ET       1.5       1.5         Recreational vehicle PCE, ER       1.2       1.2         Driver population adjustment, fP       1.00       1.00         Flow rate, v       8253       321         Volume ratio, VR       0.102       2         Intercha	to Ex.	
InputsSegment TypeFreewayWeaving configurationOne-SideNumber of lanes, N5Weaving segment length, LS758Freeway free-flow speed, FFS55Minimum segment speed, SMIN15Freeway maximum capacity, cIFL2250Terrain typeLevelGrade0.00		
Segment Type Freeway Freeway One-Side Veaving configuration One-Side Vumber of lanes, N 5 Veaving segment length, LS 758 Freeway free-flow speed, FFS 55 Minimum segment speed, SMIN 15 Freeway maximum capacity, CIFL 2250 Ferrain type Level 0.00 Length 0.00 Conversion to pc/h Under Base Con Volume Compon VFF VRF Volume, V 7467 290 Peak hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1965 76 Trucks and buses 10 10 Recreational vehicles 0 0 Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 Heavy vehicle adjustment, fP 1.00 1.00 Flow rate, v 8253 321 Volume ratio, VR 0.102 Configuration Characteristi Number of maneuver lanes, NWL 2 Interchange density, ID 1.00 Minimum RF lane changes, LCRF 1 Minimum RR lane changes, LCRR 1 Minimum RR lane changes, LCRN 940 Weaving lane changes, LCMIN 940 Weaving lane changes, LCMIN 940 Weaving lane changes, LCNW 1148		
Weaving configuration One-Side Number of lanes, N 5 Weaving segment length, LS 758 Freeway free-flow speed, FFS 55 Minimum segment speed, SMIN 15 Freeway maximum capacity, cIFL 2250 Terrain type Level Grade 0.00 Length 0.00 Conversion to pc/h Under Base Con Volume Compon VFF VRF Volume, V 7467 290 Peak hour factor, PHF 0.95 0.95 Peak l5-min volume, vl5 1965 76 Trucks and buses 10 10 Recreational vehicles 0 0 Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 Heavy vehicle adjustment, fP 1.00 1.00 Flow rate, v 8253 321 Volume ratio, VR 0.102 Configuration Characteristi Number of maneuver lanes, NWL 2 Interchange density, ID 1.00 Minimum RF lane changes, LCRF 1 Minimum RR lane changes, LCRR 1303 Non-weaving lane changes, LCMIN 940 Weaving lane changes, LCMIN 940 Weaving lane changes, LCNW 1148		
Weaving configurationOne-SideNumber of lanes, N5Weaving segment length, LS758Freeway free-flow speed, FFS55Minimum segment speed, SMIN15Freeway maximum capacity, cIFL2250Ierrain typeLevelGrade0.00Length0.00		
Weaving segment length, LS 758 Freeway free-flow speed, FFS 55 Minimum segment speed, SMIN 15 Freeway maximum capacity, cIFL 2250 Terrain type Level Grade 0.00 Length 0.00 Conversion to pc/h Under Base Con Volume Compon VFF VRF Volume, V 7467 290 Peak hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1965 76 Trucks and buses 10 10 Recreational vehicles 0 0 0 Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population adjustment, fP 1.00 1.00 Flow rate, v 8253 321 Volume ratio, VR 0.102 Configuration Characteristi Number of maneuver lanes, NWL 2 Interchange density, ID 1.00 Minimum RF lane changes, LCRF 1 Minimum RR lane changes, LCRN 940 Weaving lane changes, LCMN 940 Weaving lane changes, LCMN 940 Weaving lane changes, LCMN 940 Non-weaving vehicle index, INW 626 Non-weaving lane change, LCNW 1148	d .	
Freewayfree-flow speed, FFS55Minimum segment speed, SMIN15Freeway maximum capacity, cIFL2250Terrain typeLevelGrade0.00Length0.00	ln	
Minimum segment speed, SMIN 15 Freeway maximum capacity, cIFL 2250 Terrain type Level Grade 0.00 Length 0.00 Conversion to pc/h Under Base Con Volume Compon VFF VRF Volume, V 7467 290 Peak hour factor, PHF 0.95 0.95 Peak 15-min volume, v15 1965 76 Trucks and buses 10 10 Recreational vehicles 0 0 Trucks and buses PCE, ET 1.5 1.5 Recreational vehicle PCE, ER 1.2 1.2 Heavy vehicle adjustment, fHV 0.952 0.952 Driver population adjustment, fP 1.00 1.00 Flow rate, v 8253 321 Volume ratio, VR 0.102 Configuration Characteristi Number of maneuver lanes, NWL 2 Interchange density, ID 1.00 Minimum RF lane changes, LCRF 1 Minimum RR lane changes, LCRR 1 Minimum RR lane changes, LCRN 940 Weaving lane changes, LCMN 940 Weaving lane changes, LCMN 940 Neaving lane changes, LCNN 1303 Non-weaving vehicle index, INW 626 Non-weaving lane change, LCNW 1148	ft	
Freeway maximum capacity, cIFL2250Ierrain typeLevelGrade0.00Length0.00	mi/h	
Terrain typeLevelGrade0.00Length0.00Conversion to pc/h Under Base Con Volume ComponVolume, V7467Peak hour factor, PHF0.95Peak 15-min volume, v151965Trucks and buses10Recreational vehicles0Trucks and buses PCE, ET1.5Recreational vehicle PCE, ER1.2Heavy vehicle adjustment, fHV0.952Driver population adjustment, fP1.00Flow rate, v8253Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR1303Minimum weaving lane changes, LCMIN940Weaving lane changes, LCNW1148	mi/h	
Grade0.00Length0.00Conversion to pc/h Under Base Con Volume Compon VFFVRFVRFVolume, V7467Peak hour factor, PHF0.95Peak hour factor, PHF0.95Peak l5-min volume, v151965Trucks and buses10Recreational vehicles0O0Trucks and buses PCE, ET1.5Recreational vehicle PCE, ER1.2Heavy vehicle adjustment, fHV0.952Driver population adjustment, fP1.00Flow rate, v8253Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR940Weaving lane changes, LCRN940Weaving lane changes, LCNN940Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	pc/h/ln	
Grade0.00Length0.00Conversion to pc/h Under Base Con Volume Compon VFFConversion to pc/h Under Base Con Volume Compon VFFVolume, V7467Peak hour factor, PHF0.95Peak 15-min volume, v151965Trucks and buses10Recreational vehicles0O0Trucks and buses PCE, ET1.5Recreational vehicle PCE, ER1.2Heavy vehicle adjustment, fHV0.952Driver population adjustment, fP1.00Flow rate, v8253Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR940Weaving lane changes, LCMIN940Weaving lane changes, LCNW1148		
Conversion to pc/h Under Base Con Volume Compon VFFVolume, V7467290Peak hour factor, PHF0.950.95Peak 15-min volume, v15196576Trucks and buses1010Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCFR1Minimum RR lane changes, LCRR940Weaving lane changes, LCMIN940Weaving lane changes, LCNW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	90	
VolumeVolume Compon VFFVolume, V7467290Peak hour factor, PHF0.950.95Peak 15-min volume, v15196576Trucks and buses1010Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR940Weaving lane changes, LCRN940Weaving lane changes, LCNIN940Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	mi	
VolumeVolume Compon VFFVolume, V7467290Peak hour factor, PHF0.950.95Peak 15-min volume, v15196576Trucks and buses1010Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR940Weaving lane changes, LCMIN940Weaving lane changes, LCNW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	ditions	
Volume, V7467290Peak hour factor, PHF0.950.95Peak 15-min volume, v15196576Trucks and buses1010Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102	lents	
Peak hour factor, PHF0.950.95Peak 15-min volume, v15196576Trucks and buses1010Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102	VFR VRR	
Peak 15-min volume, v15196576Trucks and buses1010Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR1Minimum RR lane changes, LCRR940Weaving lane changes, LCMIN940Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	560 0 veh/h	
Trucks and buses1010Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR1Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	0.95 0.95	
Recreational vehicles00Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR1Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	147 0	
Trucks and buses PCE, ET1.51.5Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR1Minimum RR lane changes, LCRR940Weaving lane changes, LCMIN940Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148		8
Recreational vehicle PCE, ER1.21.2Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR1Minimum RR lane changes, LCRR940Weaving lane changes, LCMIN940Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148		응
Heavy vehicle adjustment, fHV0.9520.952Driver population adjustment, fP1.001.00Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum RR lane changes, LCRR1Minimum weaving lane changes, LCRR940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148		
Driver population adjustment, fP 1.00 1.00 Flow rate, v 8253 321 Volume ratio, VR 0.102 Configuration Characteristi Number of maneuver lanes, NWL 2 Interchange density, ID 1.00 Minimum RF lane changes, LCRF 1 Minimum FR lane changes, LCFR 1 Minimum RR lane changes, LCRR Minimum weaving lane changes, LCMIN 940 Weaving lane changes, LCMIN 940 Non-weaving vehicle index, INW 626 Non-weaving lane change, LCNW 1148		
Flow rate, v8253321Volume ratio, VR0.102Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum FR lane changes, LCRR1Minimum RR lane changes, LCRR940Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148		
Volume ratio, VR0.102Configuration CharacteristicNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum FR lane changes, LCFR1Minimum RR lane changes, LCRR1Minimum weaving lane changes, LCRN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	1.00 1.00	
Configuration CharacteristiNumber of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum FR lane changes, LCFR1Minimum RR lane changes, LCRR1Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	619 0 pc/h	
Number of maneuver lanes, NWL2Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum FR lane changes, LCFR1Minimum RR lane changes, LCRR940Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148		
Interchange density, ID1.00Minimum RF lane changes, LCRF1Minimum FR lane changes, LCFR1Minimum RR lane changes, LCRR940Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	.cs	
Minimum RF lane changes, LCRF1Minimum FR lane changes, LCFR1Minimum RR lane changes, LCRR940Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	ln	
Minimum FR lane changes, LCFR1Minimum RR lane changes, LCRR940Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	int/mi	
Minimum RR lane changes, LCRR940Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	lc/pc	
Minimum weaving lane changes, LCMIN940Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	lc/pc	
Weaving lane changes, LCW1303Non-weaving vehicle index, INW626Non-weaving lane change, LCNW1148	lc/pc	
Non-weaving vehicle index, INW 626 Non-weaving lane change, LCNW 1148	lc/h	
Non-weaving lane change, LCNW 1148	lc/h	
Non-weaving lane change, LCNW 1148		
	lc/h	
Total lane changes, LCALL 2451	lc/h	
Weaving and Non-Weaving Speed	ls	

Average weaving speed, SW Average non-weaving speed		40.5 39.4	mi/h mi/h	
Weaving Segment Weaving segment speed, S Weaving segment density, Level of service, LOS		Level of Se 39.5 46.5 E		acity
Weaving segment v/c ratio Weaving segment flow rate Weaving segment capacity,	e, v	0.903 9193 9695	pc/h veh/h	
L: If limit reached, see not	imitations on We	eaving Segmen	ts	·····
Weaving length (ft)	Minimum 300	Maximum 3561 Maximum	Actual 758 Analyzed	Note a,b
Density-based capacty,		2250	2036	C .

cIWL (pc/h/ln) Maximum Analyzed v/c ratio 1.00 0.903

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

d

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

Phone: E-mail:	10: Freewa		ix:		
	Operationa	al Anal	ysis		- 1 <u>6</u>
Agency/Co.: Date Performed: Analysis Time Period: Freeway/Dir of Travel: Weaving Location: Analysis Year:	RCT PB 8/2/2012 PM Peak Ho I-290 EB Homan Ent Exist. 20 I-290 Pha	. to Sa 09		Ex.	
·	Inpu	ts			
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIFL		Or 5 75 55	reeway he-Sided 58 5 5 250	ln ft mi/h mi/h pc/h/	ln
Terrain type Grade Length		0.	evel .00 .00	१ mi	
Conversion					
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v	fP	FF 6680	1.00	VFR 690 0.95 182 9 0 1.5 1.2 0.957 1.00	1.000 1.00
Volume ratio, VR			0.155		
Confi Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum-RR-lane changes, LCRR		2 1.0 1 1	00	ln int/mi lc/pc lc/pc	
Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, INW Non-weaving lane change, LCNW	4	17: 55 96:	7	lc/h lc/h lc/h lc/h	
Total lane changes, LCALL					

Average weaving speed, S	N	39.8	mi/h		
Average non-weaving speed	d, SNW	36.9	mi/h		
Weaving Segment	Speed Density	Level of Se	arvice and Car	acity	
	Speed, Density	37.3	mi/h	acrey	
Weaving segment speed, S	_		•		
Weaving segment density,	D	46.6	pc/mi/ln		
Level of service, LOS		Ε			
Weaving segment v/c ration	0	0.872			
Weaving segment flow rat		8701	pc/h		
Weaving segment capacity		9545	veh/h		
weaving segment capacity	, ("	2040	VEII/ II		
_					
	imitations on W	leaving Segmer	nts		
If limit reached, see no	te.				
	Minimum	Maximum	Actual	Note	
Weaving length (ft)	300	4086	758	a,b	
2 2		Maximum	Analyzed		
Density-based capacty,		2250	1995	с	
cIWL (pc/h/ln)					
CIND (PC/11/11)		Maximum	Analyzed		
			-	-1	
v/c ratio		1.00	0.872	d	

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

HCS 203 Phone: E-mail:	10: Freew		ving Rele x:	ease 6.1	
	Operation	al Anal	ysis		
Agency/Co.: Date Performed: Analysis Time Period: Freeway/Dir of Travel: Neaving Location: Analysis Year:	RCT PB 8/2/2012 AM Peak H I-290 EB Oakley En Exist. 20 I-290 Pha	nt. to I 109			
	Inpu	its			· •#
Segment Type Neaving configuration Number of lanes, N Neaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIFL		Or 5 55 55	reeway he-Sided 57 5 250	ln ft mi/h mi/h pc/h/1	ln
Ferrain type Grade Length		0	evel .00 .00	% mi	
Conversion	to pc/h (				
	-		Componei		
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v		/FF 6780 0.95 1784 10 0 1.5 1.2 0.952 1.00 7494	VRF 430 0.95 113 10 0 1.5 1.2 0.952 1.00 475	VFR 970 0.95 255 10 0 1.5 1.2 0.952 1.00 1072	VRR 0 veh/h 0.95 0 0 % 1.5 1.2 1.000 1.00 0 pc/h
Volume ratio, VR			0.171		
	guration		teristic		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR		2 1.0 1 1	00	ln int/mi lc/pc lc/pc lc/pc	• • • • • •
Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, INW Non-weaving lane change, LCNW Total lane changes, LCALL		15 18 41 88 27	19 7	lc/h lc/h lc/h lc/h	
Weaving intensity factor, W	g and Non-		g Speeds <sub>.</sub> 786		

Weaving intensity factor, W

l

Average weaving speed, SW	37.4	mi/h	
Average non-weaving speed, SNW	35.2	mi/h	
Weaving Segment Speed, Densit	ry, Level of Se		acity
Weaving segment speed, S	35.5	mi/h	
Weaving segment density, D	50.9	pc/mi/ln	
Level of service, LOS	E		
Weaving segment v/c ratio	0.919		
Weaving segment flow rate, v	9041 ·	pc/h	
Weaving segment capacity, cW	9371	veh/h	
Limitations on	Weaving Segme:	nts	
If limit reached, see note.			
If limit reached, see note.			
li limit reached, see note. Minimum	Maximum	Actual	Note
	Maximum 4243	Actual 557	Note a,b
Minimum		557	
Minimum Weaving length (ft) 300	4243		
Minimum Weaving length (ft) 300 Density-based capacty,	4243 Maximum	557 Analyzed	a,b
Minimum Weaving length (ft) 300	4243 Maximum	557 Analyzed 1968	a,b
Minimum Weaving length (ft) 300 Density-based capacty,	4243 Maximum 2250	557 Analyzed	a,b

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

Phone: E-mail:			ax:			
	_Operation	nal Anal	lysis			
Analyst:	RCT					
Agency/Co.:	PB					
Date Performed:	8/2/2012					
	PM Peak H	lour				
	I-290 EB					
Weaving Location:	Oakley En	nt. to I	Damen Ex	-		
Analysis Year:	Exist. 20		/(41.1.2			
Description:	I-290 Pha		cudy			
	Inpu	uts				
Segment Type			reeway			
Weaving configuration		_	ne-Sided			
Number of lanes, N		5		ln		
Weaving segment length, LS			57	ft mi/h		
Freeway free-flow speed, FFS		55		mi/h mi/h		
Minimum segment speed, SMIN	-		5 250	mi/h		
Freeway maximum capacity, cIFI	L	<i>L L</i>	250	pc/h/I	ln	
Terrain type			evel			
Grade			.00	8		
Length		0	.00	mi		
Conversion	+~ nc/h '	Under B	-se Cond	itions		
	to porn .		Componer			
	•	VFF	VRF	VFR	VRR	
Volume, V		6530		720		veh/h
Peak hour factor, PHF		6530 0.95			0.95	/en/ n
Peak l5-min volume, v15		0.95 1718	0.95 103	0.95 189	0.95	
Trucks and buses		9	9	189	0	0,
		9 0		9		90 90
Recreational vehicles			0		0	б
Trucks and buses PCE, ET		1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER		1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV		0.957	0.957	0.957	1.000	
Driver population adjustment, Flow rate, v	τŀ	1.00 7183	1.00 429	1.00 792	1.00 0	pc/h
Volume ratio, VR		1100	429 0.145	176	v	pe, n
		-				
Conf: Number of maneuver lanes, NWL	iguration	Charact 2	ceristic	s ln		
Interchange density, ID		2 1.(	<u>^</u>	int/mi		
		1.0	JU			
Minimum RF lane changes, LCRF		1 1		lc/pc		
Minimum FR lane changes, LCFR		_		lc/pc		
Minimum.RR_lanechanges, LCRR				ТСЛ рс		
Minimum weaving lane changes,	LCMIN	122		lc/h		
Weaving lane changes, LCW		149	93	lc/h		
Non-weaving vehicle index, INK	N	400	0			
Non-weaving lane change, LCNW		819		lc/h		
			12	lc/h		

HCS 2010: Freeway Weaving Release 6.1

Weaving intensity factor, W

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Average weaving speed, SW		38.6	mi/h	
Average non-weaving speed	, SNW	38.1	mi/h	
Weaving Segment	Speed, Density,	Level of Se	ervice and Cap	acity
Weaving segment speed, S		38.2	mi/h	
Weaving segment density,	D	44.0	pc/mi/ln	
Level of service, LOS		E		
Weaving segment v/c ratio		0.845		
Weaving segment flow rate	, V	8404	pc/h	
Weaving segment capacity,	cW	9512	veh/h	
	mitations on We	eaving Segmen	its	
If limit reached, see not	e.			
	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	3985	557	a,b
		Maximum	Analyzed	
Density-based capacty,		2250	1988	С

 Density-based capacty,
 2250
 1988
 c

 cIWL (pc/h/ln)
 Maximum
 Analyzed

 v/c ratio
 1.00
 0.845
 d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

Chapter 13, "Freeway Merge and Diverge Segments." c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

	Operati	onal Anal	vsis				
Analyst:	RCT PB						
Agency/Co.: Date Performed:	8/2/201	<b>o</b>					
Analysis Time Period:	AM Peak						
Freeway/Dir of Travel:	I-290 E						
Neaving Location:		nt. to Pa	ulina Ex	ζ.			
	Exist.						
Description:	I-290 P	hase 1 St	udy				
-	Τ×	nut o	_				
	111	puts					
Segment Type			reeway ne-Sided				
Weaving configuration Number of lanes, N			le-sided	ln			
Weaving segment length, LS			30	ft			
Freeway free-flow speed, FFS			5	mi/h			
Minimum segment speed, SMIN			5	mi/h			
Freeway maximum capacity, cIF	Ĺ	22	250	pc/h/	ln		
Terrain type		Le	evel				
Grade			.00	010			
Length		0	.00	mi			
Conversion	to pc/h	Under Ba	ase Cond:	itions			
			Componer				
		VFF	VRF	VFR	VRR		
Volume, V		6610	410	600		veh/h	
Peak hour factor, PHF		0.95 1739	0.95	0.95	0.95		
Peak 15-min volume, v15 Trucks and buses		10	108	10	0 0	몽	
Recreational vehicles		0	0	0	0	응	
Trucks and buses PCE, ET		1.5	1.5	1.5	1.5	Ĵ	
Recreational vehicle PCE, ER		1.2	1.2	1.2	1.2		
Heavy vehicle adjustment, fHV		0.952	0.952	0.952	1.000		
Driver population adjustment,		1.00	1.00	1.00	1.00		
Flow rate, v		7306	453	663	0	pc/h	
Volume ratio, VR			0.133				
Conf	iguratic	n Charac	teristic	S			
Number of maneuver lanes, NWL	-	2		ln			
Interchange density, ID		1.0	00	int/mi			
Minimum RF lane changes, LCRF		1		lc/pc			
Minimum FR lane changes, LCFR		1.		lc/pc			
Minimum RR lane changes, LCRR				lc/pc			
Minimum weaving lane changes,	LCMIN	11		lc/h			
Weaving lane changes, LCW		13		lc/h			
Non-weaving vehicle index, IN		35		1 - /1			
Non-weaving lane change, LCNW Total lane changes, LCALL		80)		lc/h lc/h			
TOTAL LADA CDADGAGE LCALL		21	чю	lc/h			

Average weaving speed, SW		38.0	mi/h	
Average non-weaving speed	, SNW	38.9	mi/h	
5 5 1				
Weaving Segment	Speed, Density,	Level of Ser	vice and Capa	acity
Weaving segment speed, S		38.8	mi/h	
Weaving segment density,	D	43.5	pc/mi/ln	
Level of service, LOS		Е		
Weaving segment v/c ratio		0.846		
Weaving segment flow rate	, V	8422	pc/h	
Weaving segment capacity,		9486	veh/h	
5 5 1 1,				
Тi	mitations on We	eaving Segment	s	
If limit reached, see not				
II IIMIC ICached, bee not	<b>.</b>			
	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	3858	480	a,b
		Maximum	Analyzed	-,-
			1	

. ..

 Density-based capacty,
 2250
 1992
 c

 cIWL (pc/h/ln)
 Maximum
 Analyzed

 v/c ratio
 1.00
 0.846
 d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

Chapter 13, "Freeway Merge and Diverge Segments." c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

	Onematic	م_ر م_1 »_∽				
	_Operatio	nal Anal	Lysis			
malyst:	RCT					
gency/Co.:	PB					
Date Performed:	8/2/2012					
nalysis Time Period:	PM Peak	Hour				
reeway/Dir of Travel:	I-290 EB					
leaving Location:	Damen En		aulina Ez	Χ.		
nalysis Year:	Exist. 2					
Description:	I-290 Ph	ase 1 St	tudy			
	Inp	outs				<u>.</u>
egment Type		F	reeway			
Neaving configuration		O	ne-Sided			
Number of lanes, N		5		ln		
Neaving segment length, LS			80	ft		
Freeway free-flow speed, FFS		55		mi/h		
inimum segment speed, SMIN		1		mi/h		
Freeway maximum capacity, cIF	L	22	250	pc/h/	ln	
ferrain type		L	evel			
Grade		0	.00	뭥		
Length		0	.00	mi		
Conversion	to pc/h		ase Cond Compone:			
Conversion	to pc/h		ase Cond Compone VRF		VRR	- <b>19</b>
Conversion	to pc/h	Volume	Compone	nts 🗌		eh/h
	to pc/h	Volume VFF	Compone: VRF	nts VFR		eh/h
Volume, V Peak hour factor, PHF Peak 15-min volume, v15	to pc/h	Volume VFF 6390 0.95 1682	Compone: VRF 600 0.95 158	nts VFR 530 0.95 139	0 ve 0.95 0	
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses	to pc/h	Volume VFF 6390 0.95 1682 9	Compone: VRF 600 0.95 158 9	nts VFR 530 0.95 139 9	0 ve 0.95 0 0	99 99
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles	to pc/h	Volume VFF 6390 0.95 1682 9 0	Compone: VRF 600 0.95 158 9 0	nts VFR 530 0.95 139 9 0	0 ve 0.95 0 0	
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET	to pc/h	Volume VFF 6390 0.95 1682 9 0 1.5	Compone: VRF 600 0.95 158 9 0 1.5	nts VFR 530 0.95 139 9 0 1.5	0 ve 0.95 0 0 0 . 1.5	99 99
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER		Volume VFF 6390 0.95 1682 9 0 1.5 1.2	Compone VRF 600 0.95 158 9 0 1.5 1.2	nts VFR 530 0.95 139 9 0 1.5 1.2	0 ve 0.95 0 0 1.5 1.2	9
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV	,	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957	0 ve 0.95 0 0 1.5 1.2 1.000	9
Volume, V Reak hour factor, PHF Reak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHW Driver population adjustment,	,	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00	0 ve 0.95 0 0 1.5 1.2 1.000 1.00	00 00
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Prucks and buses Recreational vehicles Prucks and buses PCE, ET Recreational vehicle PCE, ER Reavy vehicle adjustment, fHV Priver population adjustment,	,	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957	0 ve 0.95 0 0 1.5 1.2 1.000 1.00	9
Yolume, V Peak hour factor, PHF Peak 15-min volume, v15 Prucks and buses Recreational vehicles Prucks and buses PCE, ET Recreational vehicle PCE, ER Reavy vehicle adjustment, fHV Priver population adjustment, Flow rate, v	,	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00	0 ve 0.95 0 0 1.5 1.2 1.000 1.00	00 00
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR	, fP Tiguratior	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583	0 ve 0.95 0 0 1.5 1.2 1.000 1.00	00 00
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR Conf Number of maneuver lanes, NWI	, fP Tiguratior	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 Charac 2	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s ln	0 ve 0.95 0 0 1.5 1.2 1.000 1.00 0 F	90 90 90
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR Conf Number of maneuver lanes, NWI Interchange density, ID	fP figuration	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 Charac 2 1.	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s ln int/mi	0 ve 0.95 0 0 1.5 1.2 1.000 1.00 0 F	90 90 90
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Irucks and buses Recreational vehicles Irucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR <u>Conf</u> Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRE	fP	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 Charac 2 1. 1	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s int/mi lc/pc	0 ve 0.95 0 0 1.5 1.2 1.000 1.00 0 F	00 00
Yolume, V Peak hour factor, PHF Peak 15-min volume, v15 Prucks and buses Recreational vehicles Prucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Priver population adjustment, Flow rate, v Yolume ratio, VR Conf Number of maneuver lanes, NWI Interchange density, ID Ainimum RF lane changes, LCFF	fP	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 A Charac 2 1. 1 1	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s 	0 ve 0.95 0 0 . 1.5 1.2 1.000 1.00 0 p	۶ ۶ bc/h
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR <u>Conf</u> Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRE Minimum FR lane changes, LCFE	fP	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 A Charac 2 1. 1 1	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s 	0 ve 0.95 0 0 . 1.5 1.2 1.000 1.00 0 p	۶ ۶ bc/h
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR Conf Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRE Minimum RR lane changes, LCRE	fP	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 A Charac 2 1. 1 1	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s 	0 ve 0.95 0 0 . 1.5 1.2 1.000 1.00 0 p	% % bc/h
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR <u>Conf</u> Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRE Minimum FR lane changes, LCFF	fP	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 A Charac 2 1. 1 1	Compones VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic 00	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s 	0 ve 0.95 0 0 . 1.5 1.2 1.000 1.00 0 p	°€ % bc/h
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR Conf Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRE Minimum FR lane changes, LCRE Minimum weaving lane changes, Weaving lane changes, LCW	fP figuration LCMIN	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 A Charac 2 1. 1 1	Compone VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic 00	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s 	0 ve 0.95 0 0 . 1.5 1.2 1.000 1.00 0 p	°€ % bc/h
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR Conf Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRF Minimum RR lane changes, LCRF Minimum RR lane changes, LCRF	fP iguration LCMIN	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 A Charac 2 1. 1 1 1 1 2 14 33	Compone VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic 00	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s 	0 ve 0.95 0 0 . 1.5 1.2 1.000 1.00 0 p	° १ bc∕h
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Frucks and buses Recreational vehicles Frucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR Conf Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRE Minimum FR lane changes, LCRE Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, IN	fP iguration LCMIN	Volume VFF 6390 0.95 1682 9 0 1.5 1.2 0.957 1.00 7029 A Charac 2 1. 1 1 1 1 2 14 33 74	Compone VRF 600 0.95 158 9 0 1.5 1.2 0.957 1.00 660 0.150 teristic 00 43 71 7	nts VFR 530 0.95 139 9 0 1.5 1.2 0.957 1.00 583 s 	0 ve 0.95 0 0 . 1.5 1.2 1.000 1.00 0 p	° १ bc∕h

### HCS 2010: Freeway Weaving Release 6.1

Average weaving speed, S Average non-weaving speed		37.8 38.1	mi/h mi/h	
Weaving Segment	Speed, Densit	y, Level of Se	ervice and Cap	Dacity
Weaving segment speed, S	-	38.1	mi/h	
Weaving segment density,	D	43.5	pc/mi/ln	
Level of service, LOS		E		
Weaving segment v/c ratio	с С	0.836		
Weaving segment flow rate	e, v	8272	pc/h	
Weaving segment capacity	, CW	9464	veh/h	
If limit reached, see no	imitations on te. Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4034	480	a,b
			Analyzed	,
Density-based capacty, cIWL (pc/h/ln)		2250	1978	с
·• · · · · · · · · · · · · · · · · · ·		Maximum	Analyzed	
v/c ratio		1.00	0.836	d
Notes:				
<ul> <li>In weaving segments make only necessary</li> </ul>		00 ft, weaving	g vehicles are	e assumed to

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

HCS	2010:	Freeway	Weaving	Release	6.1
			Fax:		

Phone: E-mail:

	Operational A	analysis			
Analyst: Agency/Co.: Date Performed: Analysis Time Period: Freeway/Dir of Travel: Weaving Location: Analysis Year: Description:	RCT PB 8/2/2012 AM Peak Hour I-290 EB Ashland Ent. Exist. 2009 I-290 Phase I		Ex.		
	Inputs				
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIF	Ŀ	Freeway One-Sided 5 530 55 15 2250	ln ft mi/h mi/h pc/h/1	ln	
Terrain type Grade Length		Level 0.00 0.00	۶ mi		
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR	VFF 6610 0.99 1739 10 0 1.5 1.2 0.99 fP 1.00 7300	ume Compone VRF 590 50.95 155 10 0 1.5 1.2 52 0.952 0 1.00 6 652 0.131 racteristic	nts VFR 410 0.95 108 10 0 1.5 1.2 0.952 1.00 453	VRR 0 0.95 0 0 1.5 1.2 1.000 1.00 0	veh/h % % pc/h
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, IN Non-weaving lane change, LCNW	LCMIN	2 1.00 1 1 1105 1362 387 829	ln int/mi lc/pc lc/pc lc/pc lc/h lc/h lc/h		
Total lane changes, LCALL	g and Non-Wear	2191 ving Speeds 0.693	lc/h		

Average weaving speed, SW	38.6	mi/h
Average non-weaving speed, SNW	39.0	mi/h
incluye non weating opeou, one		
Weaving Segment Speed, Density,	Level of Ser	vice and Capacity
Weaving segment speed, S	38.9	mi/h
Weaving segment density, D	43.2	pc/mi/ln
Level of service, LOS	E	-
Weaving segment v/c ratio	0.843	
Weaving segment flow rate, v	8411	pc/h
Weaving segment capacity, cW	9505	veh/h
Limitations on We	aving Segment:	S
If limit reached, see note.		
,		

. ..

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	3847	530	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2250	1996	С
-		Maximum	Analyzed	
v/c ratio		1.00	0.843	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- Chapter 13, "Freeway Merge and Diverge Segments." c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 20 Phone: E-mail:	010: Freeway	Weaving Rel Fax:	ease 6.1
	_Operational	Analysis	
Analyst: Agency/Co.: Date Performed: Analysis Time Period: Freeway/Dir of Travel: Weaving Location: Analysis Year: Description:	Exist. 2009 I-290 Phase	. to Racine l Study	Ex.
	Inputs		
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIF Terrain type	L	Freeway One-Sided 5 530 55 15 2250 Level	ln ft mi/h mi/h pc/h/ln
Grade Length		0.00 0.00	% mi
Conversion		ler Base Cond lume Compone ' VRF	
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v	65 0. 17 9 0 1. 1. 0. fP 1.	910 910 95 0.95 913 239 9 0	480 0 veh/h 0.95 0.95 126 0 9 0 % 0 0 % 1.5 1.5 1.2 1.2
Volume ratio, VR		0.176	
Conf	iguration Ch	aracteristic	S
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR		2 1.00 1 1	ln int/mi lc/pc lc/pc lc/pc
Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, IN Non-weaving lane change, LCNW Total lane changes, LCALL	W	1529 1786 380 799 2585	lc/h lc/h lc/h lc/h
Weavin Weaving intensity factor, W	g and Non-We	eaving Speeds 0.789	s

Average weaving speed, SW Average non-weaving speed, SNW	37.4 35.6	mi/h mi/h
incarge non nearing speed, enn		
Weaving Segment Speed, Density,	Level of Ser	vice and Capacity
Weaving segment speed, S	35.9	mi/h
Weaving segment density, D	48.4	pc/mi/ln
Level of service, LOS	E	
Weaving segment v/c ratio	0.886	
Weaving segment flow rate, v	8690	pc/h
Weaving segment capacity, cW	9388	veh/h
Limitations on We	aving Segment	s

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4292 Maximum	530 Analyzed	a,b
Density-based capacty, cIWL (pc/h/ln)		2250	1962	С
		Maximum	Analyzed	
v/c ratio		1.00	0.886	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of 'Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

### I - 290 Westbound Weaving Analysis

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### **Existing Conditions**

HCS 2010: Fr Phone: E-mail:	-	ing Rele ix:	ease 6.1	
Operat	cional Anal	Lysis		
Freeway/Dir of Travel: I-290 Weaving Location: Racine Analysis Year: Exist	ak Hour WB e Ent. to A		Ex.	
	Inputs			
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIFL	Or 5 5 1	50	ln ft mi/h mi/h pc/h/1	ln
Terrain type Grade Length	0	evel .00 .00	% mi	
Conversion to pc				· · · · · · · · · · · · · · · · · · ·
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	VFF 4830	Compone VRF 740 0.95 195 10 0 1.5 1.2 0.952 1.00 818	nts VFR 900 0.95 237 10 0 1.5 1.2 0.952 1.00 995	VRR 0 veh/h 0.95 0 0 % 1.5 1.2 1.000 1.00 0 pc/h
Volume ratio, VR		0.254		
Configurat Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR	ion Charac 2 1. 1 1		ln int/mi lc/pc lc/pc lc/pc	
Minimum weaving lane changes, LCMIN Weaving lane changes, LCW Non-weaving vehicle index, INW Non-weaving lane change, LCNW Total lane changes, LCALL	21 34 48	13 31 7 9 20	lc/h lc/h lc/h lc/h	
Weaving and	Non-Weavin	g Speeds 679	·	<u></u>

Weaving intensity factor, W

1

Average weaving speed, SW	38.8	mi/h
Average non-weaving speed, SNW	35.1	mi/h
	- • - •	
Weaving Segment Speed, Density,	Level of Serv	ice and Capacity
Weaving segment speed, S	36.0	mi/h
Weaving segment density, D	39.8	pc/mi/ln
Level of service, LOS	E	
Weaving segment v/c ratio	0.755	
Weaving segment flow rate, v	7151	pc/h
Weaving segment capacity, cW	9016	veh/h

Limitations on Weaving Segments

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	5091	650	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2250	1910	С
•		Maximum	Analyzed	
v/c ratio		1.00	0.755	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

	Operation	al Anal	vsis			
	_operation		y515			
Analyst:	RCT					
Agency/Co.:	PB					
Date Performed:	8/7/2012					
	PM Peak H	Iour				
<b>4</b> ·	I-290 ₩B					
······································	Racine En		shland E	lx.		
<b>1</b>	Exist. 20					
Description:	I-290 Pha	ise 1 St	udy			
	Inpu	its				
Segment Type			eeway e-Sided			
Weaving configuration			le-sided			
Number of lanes, N		5 65	0	ln ft		
Weaving segment length, LS		55		ni/h		
Freeway free-flow speed, FFS			,	mi/h		
Minimum segment speed, SMIN Freeway maximum capacity, cIF1	r.		:50	pc/h/1	In	
recovery measurement capacity, ciri	-	~~~~		P.C., 11, 1		
Terrain type			vel			
Grade			00	용		
Length	•	0.	00	mi		
Conversion	to pc/h l	Jnder Ba	ise Condi	tions		
	-	Volume	Componer	nts —		
	7			VFR	VRR	
Volume, V				500		
Peak hour factor, PHF				0.95		
Peak 15-min volume, v15				132		
Trucks and buses		10	10	•	0 %	
Recreational vehicles		0	0	0	0 %	
Trucks and buses PCE, ET		1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER		1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV		0.952	0.952			
Driver population adjustment,	Γ₽	1.00 5427	1.00 895	1.00 553	1.00 0 pc/h	
Flow rate, v		5427	090	222	o perm	
Volume ratio, VR			0.211			
	iguration	_	ceristics			
Number of maneuver lanes, NWL		2		ln		
Interchange density, ID		1.(	0	int/mi		
Minimum RF lane changes, LCRF		1		lc/pc		
Minimum FR lane changes, LCFR		1		lc/pc		
Minimum RR lane changes, LCRR				·-·⊥c/pc-·		
Minimum weaving lane changes,	LCMIN	144	18	lc/h		
Weaving lane changes, LCW		176	56	lc/h		
Non-weaving vehicle index, IN	W	350	3			
Non-weaving lane change, LCNW		501	7	lc/h		
Hold Wood ang _ and onengo, _ one		22		lc/h		

Average weaving speed, SW	39.9	mi/h	
Average non-weaving speed, SNW	38.0	mi/h	
Weaving Segment Speed, Density	, Level of Se	ervice and Capa	acity
Weaving segment speed, S	38.4	mi/h	
Weaving segment density, D	35.8	pc/mi/ln	
Level of service, LOS	E		
Weaving segment v/c ratio	0.707		
Weaving segment flow rate, v	6875	pc/h	
Weaving segment capacity, CW	9257	veh/h	
Limitations on W	∛eaving Segme	nts	
If limit reached, see note.			<u>12</u> ,
Minimum	Maximum	Actual	Note
Weaving length (ft) 300	4645	650	a,b
······································	Maximum	Analyzed	

Density-based capacty, cIWL (pc/h/ln)	2250	1944	с	
	Maximum	Analyzed		
v/c ratio	1.00	0.707	d	

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

-mail:						
	Operational	Anal	ysis			
Analyst:	RCT					
<b>1</b>	PB					
	8/7/2012					
Analysis Time Period:	AM Peak Hour	r				
	I-290 WB					
	Paulina Ent	. to	Damen Ex	κ.		
Analysis Year:	Exist. 2009					
Description:	I-290 Phase	1 St	udy			
	Inputs					
		(				. <u></u> .
Segment Type			eeway e-Sided			
Weaving configuration		0n 5	e-stred	ln		
Number of lanes, N			5	ft		
Weaving segment length, LS Freeway free-flow speed, FFS		42 55		ni/h		
Minimum segment speed, SMIN				mi/h		
Freeway maximum capacity, cIFI	L		50	pc/h/l	n	
				L		
Terrain type Grade			vel 00	8		
Length			00	~ mi		
-						
Conversion	to pc/h Unde		se Cond: Componer			
	VFF		VRF	VFR	VRR	
Volume, V			450	720	0	veh/h
Peak hour factor, PHF	0.	95	0.95	0.95	0.93	
Peak 15-min volume, v15	12		118	189	0	
Trucks and buses	10		10	10	0	Dio Co
Recreational vehicles	0		0	0	0	₽jo
Trucks and buses PCE, ET	1.	5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.	2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.	952	0.952	0.952	1.00	00
Driver population adjustment,	fP 1.	00	1.00	1.00	1.00	C
Flow rate, v	53	61	497	796	0	pc/h
Volume ratio, VR			0.194			
		aract	eristic:	s		
Conf	iguration Ch					
	iguration Ch	2		ln		
Number of maneuver lanes, NWL	iguration Ch		0	ln int/mi		
Number of maneuver lanes, NWL Interchange density, ID	iguration Ch	2	00			
Number of maneuver lanes, NWL	iguration Ch	2 1.(	00	int/mi		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF	iguration Ch	2 1.( 1	00	int/mi lc/pc		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR	-	2 1.( 1 1	93	int/mi lc/pc lc/pc		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR	-	2 1.( 1 1	93	int/mi lc/pc lc/pc lc/pc		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR Minimum weaving lane changes,	LCMIN	2 1.( 1 1	93 93	int/mi lc/pc lc/pc lc/pc lc/h		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR Minimum weaving lane changes, Weaving lane changes, LCW	LCMIN	2 1.0 1 1 129 148	)3 }3 }	int/mi lc/pc lc/pc lc/pc lc/h		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, INW	LCMIN	2 1.0 1 1 129 148 228	)3 33 3	int/mi lc/pc lc/pc lc/pc lc/h lc/h		

Average weaving speed, S	W	38.2	mi/h		
Average non-weaving spee		39.3	mi/h		
				• •	
Weaving Segment	Speed, Densi	ty, Level of S	ervice and Cap	bacity	
Weaving segment speed, S		39.1	mi/h		
Weaving segment density,	D	34.0	pc/mi/ln		
Level of service, LOS		D	-		
Weaving segment v/c rati	0	0.686			
Weaving segment flow rat		6654	pc/h	•	
Weaving segment capacity	-	9238	veh/h		
<b>y y i i</b>					
I	imitations or	n Weaving Segme	nts		
If limit reached, see no	te.				
	Minimum	Maximum	Actual	Note	
Weaving length (ft)	300	4478	425	a,b	
		Maximum	Analyzed		
Density-based capacty,		2250	1940	С	

cIWL (pc/h/ln) Maximum Analyzed v/c ratio 1.00 0.686

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

d

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

Analyst:	_Operat:				
		ional Ana	alysis		
Agency/Co.: Date Performed: Analysis Time Period: Freeway/Dir of Travel: Weaving Location: Analysis Year: Description:	Exist.	k Hour WB a Ent. to	o Damen E Study	x.	ſ
	I	nputs			
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIF	Ľ	-	Freeway Dne-Sided 5 425 55 15 2250	l ft mi/h mi/h pc/h/2	ln
Terrain type Grade Length			Level 0.00 0.00	% mi	
Conversion	to pc/				
		Volum VFF	e Compone VRF	ents VFR	VRR
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v		5330 0.95 1403 10 0 1.5 1.2 0.952 1.00 5891	520 0.95 137 10 0 1.5 1.2	390 0.95 103 10 0 1.5 1.2 0.952 1.00 431	0 veh/h 0.95 0 % 1.5 1.2 1.000 1.00 0 pc/h
Volume ratio, VR			0.146		
Conf Number of maneuver lanes, NWI Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCRF Minimum RR lane changes, LCRF	- - -	2	.00	ln int/mi lc/pc lc/pc lc/pc	
Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, IN Non-weaving lane change, LCNW Total lane changes, LCALL Weavin	1M	1 2 4 1	006 196 50 81 677	lc/h lc/h lc/h lc/h	

Weaving intensity factor, W

Average weaving speed, SW	39.0 mi/h	
Average non-weaving speed, SNW	41.1 mi/h	
Weaving Segment Speed, Den	nsity, Level of Service and Capacity	
Weaving segment speed, S	40.8 mi/h	_
Weaving segment density, D	33.8 pc/mi/ln	
Level of service, LOS	D	
Weaving segment v/c ratio	0.698	
Weaving segment flow rate, v	6897 pc/h	
Weaving segment capacity, cW	9414 veh/h	
Limitations	on Weaving Segments	

If limit reached, see note.

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	,3990	425	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2250	1977	С
		Maximum	Analyzed	
v/c ratio		1.00	0.698	d

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

Phone: E-mail:		Fax:		
(	Operational A	nalysis		
Agency/Co.: Date Performed: Analysis Time Period: Freeway/Dir of Travel: Weaving Location: Analysis Year:	RCT PB 8/7/2012 AM Peak Hour I-290 WB Damen Ent. to Exist. 2009 I-290 Phase 1		۲.	
	Inputs	<del></del>		
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIFL		Freeway One-Sideo 5 560 55 15 2250	l ln ft mi/h mi/h pc/h/l	-n -
Ierrain type Grade Length		Level 0.00 0.00	۶ mi	
Conversion Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, Flow rate, v Volume ratio, VR	VFF 5000 0.95 1310 10 0 1.5 1.2 0.95	me Compone VRF 690 0.95 182 10 0 1.5 1.2 2 0.952 1.00	ents VFR 300 0.95 79 10 0 1.5 1.2 0.952 1.00	VRR 0 veh/h 0.95 0 0 % 1.5 1.2 1.000 1.00 0 pc/h
Confi	guration Chai	acteristi	cs	
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR		2 1.00 1 1	ln int/mi lc/pc lc/pc lc/pc	
Minimum weaving lane changes, Weaving lane changes, LCW Non-weaving vehicle index, INW Non-weaving lane change, LCNW Total lane changes, LCALL		1095 1369 309 479 1848	lc/h lc/h lc/h lc/h	
-	g and Non-Weav			

•

Average weaving speed, SW		40.3	mi/h	
Average non-weaving speed	, SNW	40.8	mi/h	
Weaving Segment	Speed, Densit	y, Level of Se	ervice and Cap	acity
Weaving segment speed, S	-	40.7	mi/h	
Weaving segment density,	D	32.5	pc/mi/ln	
Level of service, LOS		D	-	
Weaving segment v/c ratio		0.671		
Weaving segment flow rate	, V	6621	pc/h	
Weaving segment capacity,		9395	_ veh/h	
Li	mitations on	Weaving Segmen	nts	
If limit reached, see not	e.			
	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4185	560	_a,b
		Maximum	Analyzed	•
Density-based capacty,		2250	1973	С
cIWL (pc/h/ln)				
		Maximum	Analyzed	
v/c ratio		1.00	0.671	d
Notes:				
- The second and commonts a	herter than 3	00 ft woowin	a mobiclos are	accumed to

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

d. Volumes exceed the weaving segment capacity. The level of service is F.

HCS 2010: Fro E-mail:	eeway Weavi Fax	-	ase 6.1	
Operat	ional Analy	ysis		
Analysis Year:Exist.Description:I-290	k Hour WB Ent. to Oal	-		
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIFL			ln ft mi/h mi/h pc/h/]	Ln
Terrain type Grade Length	Le <sup>.</sup> 0.		% Mi	
Conversion to pc/	Volume	Componer	nts –	
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, fP Flow rate, v	5570 0.95		0.95 74 10 0 1.5 1.2 0.952	VRR 0 veh/h 0.95 0 0 % 1.5 1.2 1.000 1.00 0 pc/h
Volume ratio, VR		0.161		
Configurati Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR	on Charact 2 1.0 1 1		In int/mi lc/pc lc/pc lc/pc	
Minimum weaving lane changes, LCMIN Weaving lane changes, LCW Non-weaving vehicle index, INW Non-weaving lane change, LCNW Total lane changes, LCALL	118 145 345 609 206	6	lc/h lc/h lc/h lc/h	
Weaving and N Weaving intensity factor, W	Non-Weaving 0.6			

Average weaving speed, SW	1	39.5	mi/h	
Average non-weaving speed	I, SNW	39.4	mi/h	
Weaving Segment	Speed, Densi	ty, Level of Se	ervice and Cap	Dacity
Weaving segment speed, S		39.5	mi/h	
Weaving segment density,	D	37.2	pc/mi/ln	
Level of service, LOS		E	-	
Weaving segment v/c ratio	)	0.743		
Weaving segment flow rate		7338	pc/h	
Weaving segment capacity,		9410	veh/h	
Li If limit reached, see not		ı Weaving Segmer	nts	
	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4142	560	a,b
5 5 7 7	<b>1</b>	Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2250	1976	с
· · · · · · · · ·		Maximum	Analyzed	
v/c ratio		1.00	0.743	d

Notes:

In weaving segments shorter than 300 ft, weaving vehicles are assumed to a. make only necessary lane changes.

Weaving segments longer than the calculated maximum length should be b. treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

The density-based capacity exceeds the capacity of a basic freeway segment, с. under equivalent ideal conditions.

Volumes exceed the weaving segment capacity. The level of service is F. d.

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

Op	eratio	nal Anal	lysis				
Analyst: RC	m						
Analyst: RC Agency/Co.: PB							
	7/2012						
	Peak						
-	290 WE	•					
	cramen	to Ent.	to Homan	n Ex.			
	ist. 2						
Description: I-	290 Ph	ase 1 St	cudy				
``	Inp	outs					
Seqment Type	"		reeway				
Weaving configuration			he-Sided				
Number of lanes, N		5		ln			
Weaving segment length, LS			78	ft			
Freeway free-flow speed, FFS		5	5	mi/h			
Minimum segment speed, SMIN		1	5	mi/h			
Freeway maximum capacity, cIFL		. 2:	250	pc/h/l	Ln		
Terrain type		L	evel				
Grade			.00	5			
Length		0	.00	mi			
Conversion to	pc/h	Under Ba	ase Cond	itions			
			Compone				
_		VFF	VRF	VFR	VRR		
Volume, V		5500		430		veh/h	
Peak hour factor, PHF			0.95 161	0.95			
Peak 15-min volume, vl5 Trucks and buses		1447 10	10	113 10	0 0	0,0	
Recreational vehicles		0	0	0	0	olo lo	
Trucks and buses PCE, ET		1.5	1.5	1.5	1.5	0	
Recreational vehicle PCE, ER		1.2	1.2	1.2	1.2		
Heavy vehicle adjustment, fHV		0.952	0.952	0.952	1.000		
Driver population adjustment, fF		1.00	1.00	1.00	1.00		
Flow rate, v		6079	674	475	0	pc/h	
Volume ratio, VR			0.159				
Configu	ratior		teristic	s			
Number of maneuver lanes, NWL		2	0.0	ln			
Interchange density, ID		1.	00	int/mi			
Minimum RF lane changes, LCRF		1 1		lc/pc			
Minimum FR lane changes, LCFR		T		lc/pc			
Minimum RR lane changes, LCRR				lc/pc			
Minimum weaving lane changes, LC	MIN	11		lc/h			
Weaving lane changes, LCW		15		lc/h			
Non-weaving vehicle index, INW		53					
Non-weaving lane change, LCNW		76		lc/h			
Total lane changes, LCALL		23	22	lc/h			

Average weaving speed, SW	41.9	mi/h		
Average non-weaving speed, SNW	39.8	mi/h		
Weaving Segment Speed	d, Density, Level of	Service and Ca	pacity	
Weaving segment speed, S	40.1	mi/h		
Weaving segment density, D	36.0	pc/mi/ln		
Level of service, LOS	E	-		
Weaving segment v/c ratio	0.722			
Weaving segment flow rate, v	7228	pc/h		
Weaving segment capacity, cW	9533	veh/h		
Limitat If limit reached, see note.	ions on Weaving Seg	ments	<u></u>	
If limit reached, see note.	ions on Weaving Seg	ments Actual	Note	
If limit reached, see note. Mini			Note a,b	
If limit reached, see note. Mini	imum Maximum	Actual	=	
If limit reached, see note. Min: Weaving length (ft) Density-based capacty,	imum Maximum 300 4121	Actual 878	=	
If limit reached, see note. Mini Weaving length (ft)	imum Maximum 300 4121 Maximum	Actual 878 Analyzed	a,b	

Notes:

a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.

b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."

c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.

HCS 2010 Phone: E-mail:	): Freeway Wea H	ving Rele ax:	ase 6.1	
Or	perational Ana	lysis		
Analysis Time Period:PhFreeway/Dir of Travel:I-Weaving Location:SaAnalysis Year:Ex			n Ex.	
	Inputs			
Segment Type Weaving configuration Number of lanes, N Weaving segment length, LS Freeway free-flow speed, FFS Minimum segment speed, SMIN Freeway maximum capacity, cIFL		Treeway Dne-Sided 78 55 15 2250	ln ft mi/h mi/h pc/h/]	.n
Terrain type Grade Length	1	Level ).00 ).00	१ mi	
Conversion to	pc/h Under 1			
	Volum VFF	e Componer VRF	nts VFR	VRR
Volume, V Peak hour factor, PHF Peak 15-min volume, v15 Trucks and buses Recreational vehicles Trucks and buses PCE, ET Recreational vehicle PCE, ER Heavy vehicle adjustment, fHV Driver population adjustment, f Flow rate, v	6070 0.95 1597 10 0 1.5 1.2 0.952	560 0.95 147 10 0 1.5 1.2 0.952 1.00 619	500	0 veh/h 0.95 0 0 % 1.5 1.2 1.000 1.00 0 pc/h
Volume ratio, VR		0.149		
	uration Chara	cteristic		
Number of maneuver lanes, NWL Interchange density, ID Minimum RF lane changes, LCRF Minimum FR lane changes, LCFR Minimum RR lane changes, LCRR	2 1 1 1	.00	ln int/mi lc/pc lc/pc lc/pc	
Minimum weaving lane changes, L Weaving lane changes, LCW Non-weaving vehicle index, INW Non-weaving lane change, LCNW Total lane changes, LCALL	1 5 8	172 580 39 95 475	lc/h lc/h lc/h lc/h	• •
Weaving Weaving intensity factor, W	and Non-Weavi 0	ng Speeds 512 <sup>.</sup>		

Average weaving speed, SW	41.5	mı/h
Average non-weaving speed, SNW	39.0	mi/h
Weaving Segment Speed, Density,	Level of Serv	vice and Capacity
Weaving segment speed, S	39.3	mi/h
Weaving segment density, D	40.1	pc/mi/ln
Level of service, LOS	E	
Weaving segment v/c ratio	0.784	
Weaving segment flow rate, v	7881	pc/h
Weaving segment capacity, cW	9571	veh/h
Meaving Segment Capacity, en	<b>JOT</b>	V G11/ 11
Tiwitationa on Ma		
Limitations on We	aving Segments	ö
If limit reached, see note.		

. . /1

	Minimum	Maximum	Actual	Note
Weaving length (ft)	300	4019	878	a,b
		Maximum	Analyzed	
Density-based capacty, cIWL (pc/h/ln)		2250	2010	с
-		Maximum	Analyzed	
v/c ratio		1.00	0.784	d

Notes:

- a. In weaving segments shorter than 300 ft, weaving vehicles are assumed to make only necessary lane changes.
- b. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments."
- c. The density-based capacity exceeds the capacity of a basic freeway segment, under equivalent ideal conditions.
- d. Volumes exceed the weaving segment capacity. The level of service is F.

Speed and volume conditions occuring in the field indicate over-saturated conditions indicative of LOS F, which are not adequately evaluated by the Highway Capacity Manual Method.

# Appendix C I-290 Count Station Hourly LOS Mainline Periods of Congestion

SACR4LCS	<b>April 2009</b> Loop Count Data			
Time	3-Day Ave. Volume	LOS Calc.	Over- saturated LOS	LOS
01:00	1326	A		Α
02:00	838	Α		Α
03:00	723	Α		Α
04:00	762	Α		Α
05:00	1273	A		Α
06:00*	4157	С		С
07:00*	7438	E		E
08:00*	7563	E		E
09:00*	7617	E		E
10:00	7199	E		E
11:00	6219	D		D
12:00	5786	D		D
13:00	5759	D		D
14:00	5794	D		D
15:00	6086	D		D
16:00*	6061	D		D
17:00*	6235	D		D
18:00*	6647	D		D
19:00	6604	D		D
20:00	5346	D		D
21:00	4210	С		С
22:00	4264	С		С
23:00	3604	С		С
00:00	2494	В		В
Total	114,005			

I-290	Eastbound
-------	-----------

3-lane Segment		4-1	ane Segm	ent	
LOS*		<u>Volumes</u>	LOS*		Volumes
А	<	1644	А	<	2192
В	<	2689	В	<	3585
С	<	3883	С	<	5178
D	<	5194	D	<	6926
Е	<	6109	Е	<	8145
F	>=	6109	F	>=	8145
	Interchang	h = 12' ulder Clearand ge Density: 1 p e-flow Speed: { 5	er mile		

SOURCE: HCS 2010 Freeways Version 6.1

\* Peak Period

\*\* LOS observed data - CMAP Congestion Scan

I:\6.0 - Project Deliverables\6.2-Environmental Documents\6.2.7 Existing Conditions Report\Technical Memoranda\4 - ECTM - Existing Roadway Operations\I290 Existing Hourly LOS 2013 Jan 29 Operations Cic to Sac.xlsx

SACR4LCS	<b>April 2009</b> Loop Count Data			
Time	3-Day Ave. Volume	LOS Calc.	Over- saturated LOS	LOS
01:00	1640	A		Α
02:00	1119	A		Α
03:00	745	Α		Α
04:00	755	Α		Α
05:00	1206	Α		Α
06:00*	2731	В		В
07:00*	5104	С	<b>D</b> **	D
08:00*	6325	D		D
09:00*	5491	D		D
10:00	4907	С		С
11:00	5060	С		С
12:00	5298	D		D
13:00	5749	D		D
14:00	6098	D		D
15:00	6701	D		D
16:00*	6140	D	E**	D
17:00*	5807	D	F**	D
18:00*	6427	D	F**	D
19:00	6211	D		D
20:00	5147	С		С
21:00	4665	С		С
22:00	4740	С		С
23:00	4909	С		С
00:00	3193	В		В
Total	106,167			

3-lane Segment			4-I	4-lane Segment		
LOS*		Volumes	LOS*		Volumes	
А	<	1644	А	<	2192	
В	<	2689	В	<	3585	
С	<	3883	С	<	5178	
D	<	5194	D	<	6926	
Е	<	6109	Е	<	8145	
F	>=	6109	F	>=	8145	
	Interchan	h = 12' ulder Clearanc ge Density: 1 p s-flow Speed: 5 5	er mile			

SOURCE: HCS 2010 Freeways Version 6.1

\* Peak Period

I-290 Westbound

\*\* LOS observed data - CMAP Congestion Scan

I:\6.0 - Project Deliverables\6.2-Environmental Documents\6.2.7 Existing Conditions Report\Technical Memoranda\4 - ECTM - Existing Roadway Operations\I290 Existing Hourly LOS 2013 Jan 29 Operations Cic to Sac.xlsx