Memo

RE: CUY-490-0.00 TSMO (PID 107408)
To: Kevin Rohde, ODOT District 12
From: Gina Balsamo, Carpenter Marty Transportation
Date: December 17, 2020

A major roadway rehab project is planned for IR-490 in Cleveland, Ohio. Carpenter Marty Transportation (CM) was retained to study and investigate Transportation Systems Management and Operations (TSMO) elements to be integrated into the project for safety improvements. The TSMO program is comprised of an evidence-based process for identifying issues and applying the most effective countermeasures. Below is a summary of the study background, analysis, and possible countermeasures for consideration.

Background

The study area roughly includes IR-490 from IR-90 to east of IR-77. See **Figure 1** for a location map, showing the study area in the Cleveland area. See **Figure 2** for a study area map.

Figure 1 – Location Map

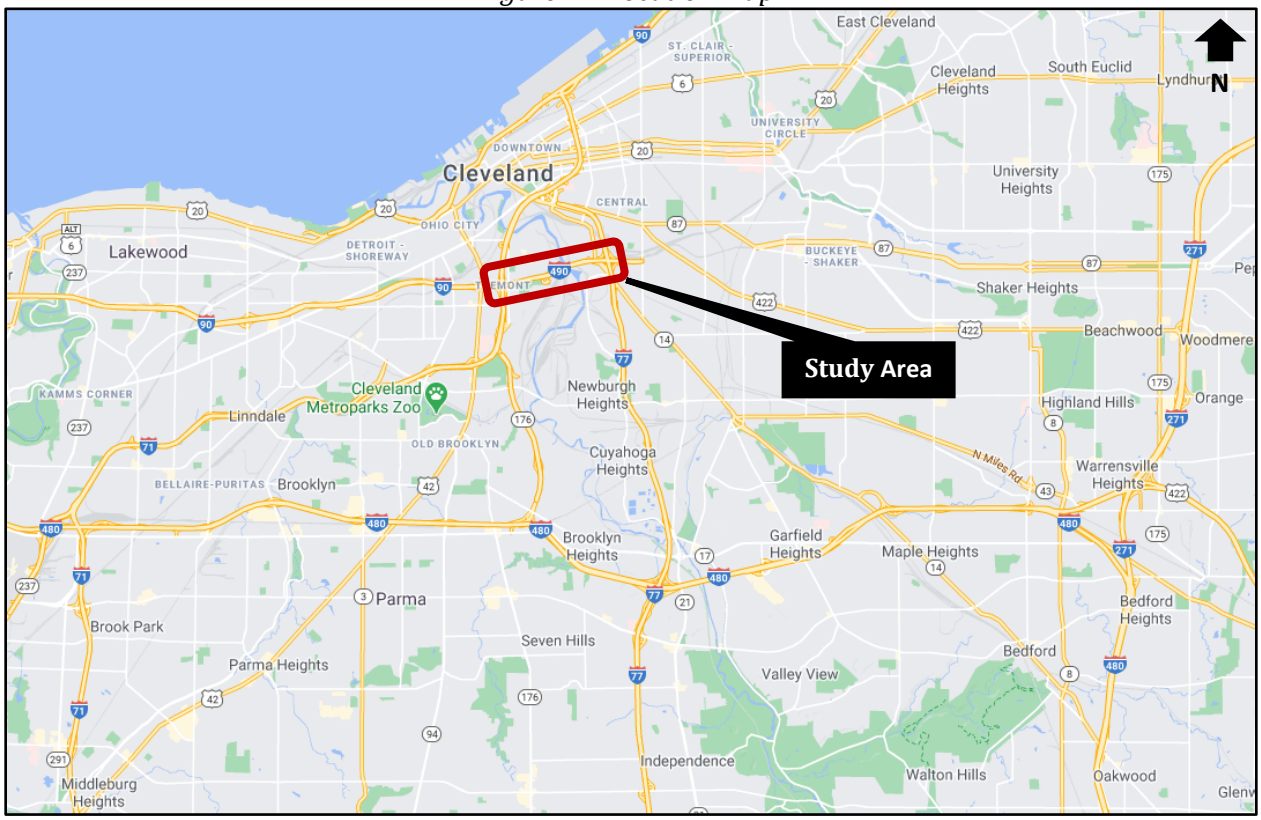

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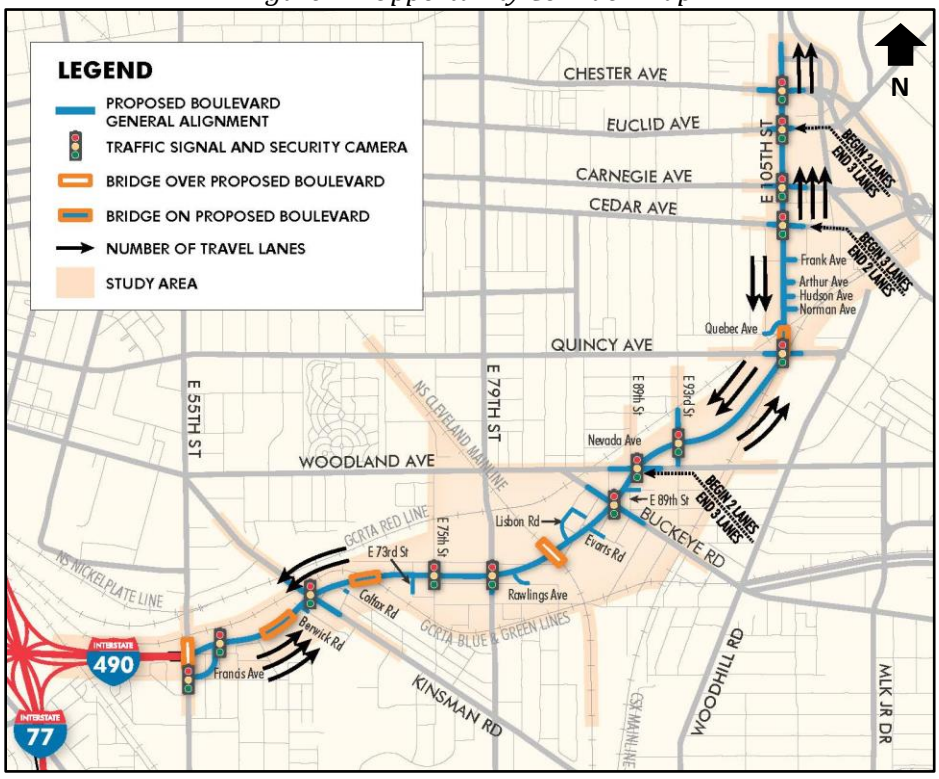
Figure 2 – Study Area Map

Lane configurations for the area have changed several times during the previous years due to nearby construction projects. Additionally, the construction and opening of the Opportunity Corridor Project has and will continue to impact the study area. See **Figure 3** for a map of the project.

Figure 3 – Opportunity Corridor Map



The purpose of the Opportunity Corridor Project is to improve the transportation system and support planned economic development in the areas between IR-490/IR-77 and University Circle in Cleveland. The Opportunity Corridor Project construction started in 2017 and is expected to continue through Fall 2021, when it will be complete and open to traffic. The project could potentially solve traffic issues in the study area and simultaneously make the area more desirable for drivers, drawing more traffic through the study area.

Additionally, speed limit changes are proposed for the area. The proposed changes are shown in **Figure 4**.

Figure 4 - Speed Zone Changes

TOAST Scores

The District provided 2019 Traffic Operations Assessment Systems Tool (TOAST) scores for the study area. TOAST was developed by ODOT to make data-driven decisions and determine operationally sensitive corridors throughout the state. IR-490 has three segments with TOAST scores. See **Table 1** for a summary of the relevant scores. The darker the shade of orange for each score, the worse the route is performing. Note, TOAST scores do not differentiate between eastbound and westbound directions. An explanation of TOAST scores and data categories, category weighting criteria, and TOAST outputs are provided in **Attachment A**.

Table 1 – 2019 TOAST Scores

(Logpoints) Location	Total	Bottlenecks	Travel Time Performance	Safety Performance	Volume Per Lane	Freight Corridors	Incident Clearance	Secondary Crashes
(0-0.92) IR-490 from IR-90 to W. 7th St.	**61.3%**	25	14	0	4.5	8	4.5	5.25
(0.92-1.88) IR-490 from W. 7th St. to IR-77	**56.5%**	25	16	0	4.5	8	0	3
(1.88-2.43) IR-490 from IR-77 to E. 55th St.	**66.0%**	25	12	0	6	8	7.5	7.5

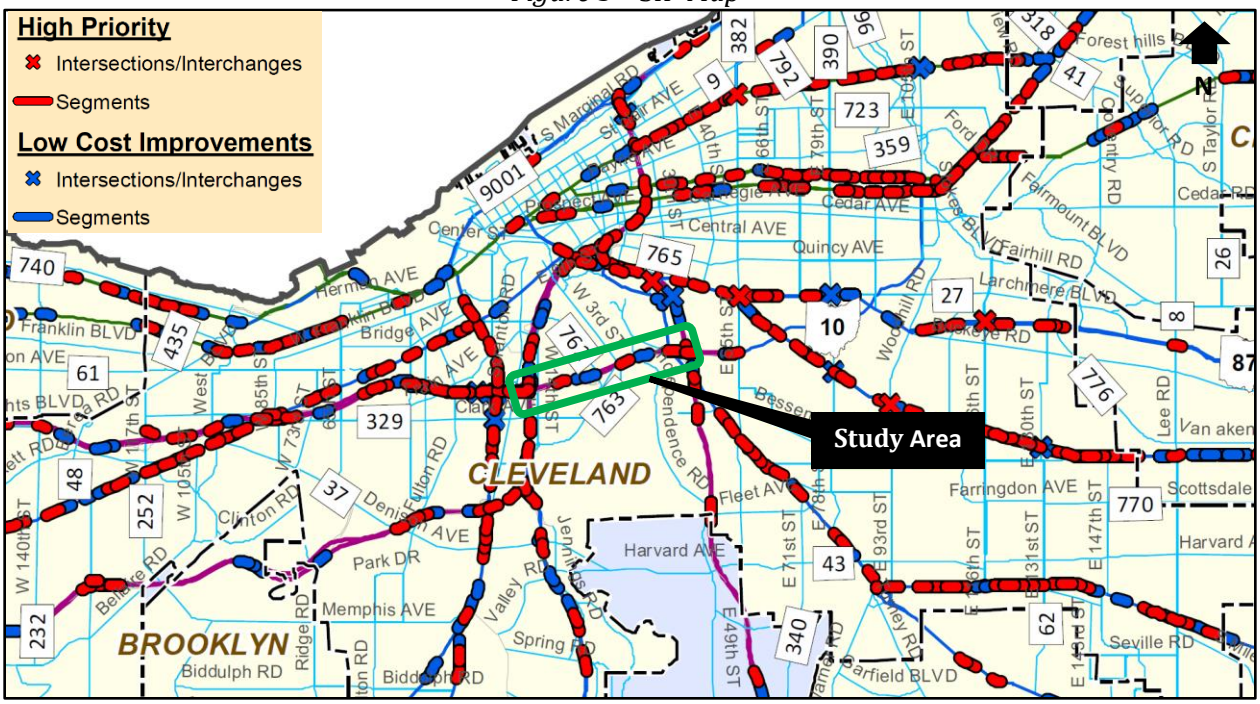
In general, the total score for a route is calculated as a percent based on the score for each category divided by the total possible maximum score. The higher the percent, the better the route is performing; whereas, the lower the percent, the more likely a route is to benefit from the application of TSMO strategies.

The TOAST outputs show undesirable scores for safety performance, volume per lane, incident clearance, and secondary crashes categories throughout the study area. IR-490 from W. 7th Street to IR-77 has the lowest total TOAST score in the study area.

Crash Analysis

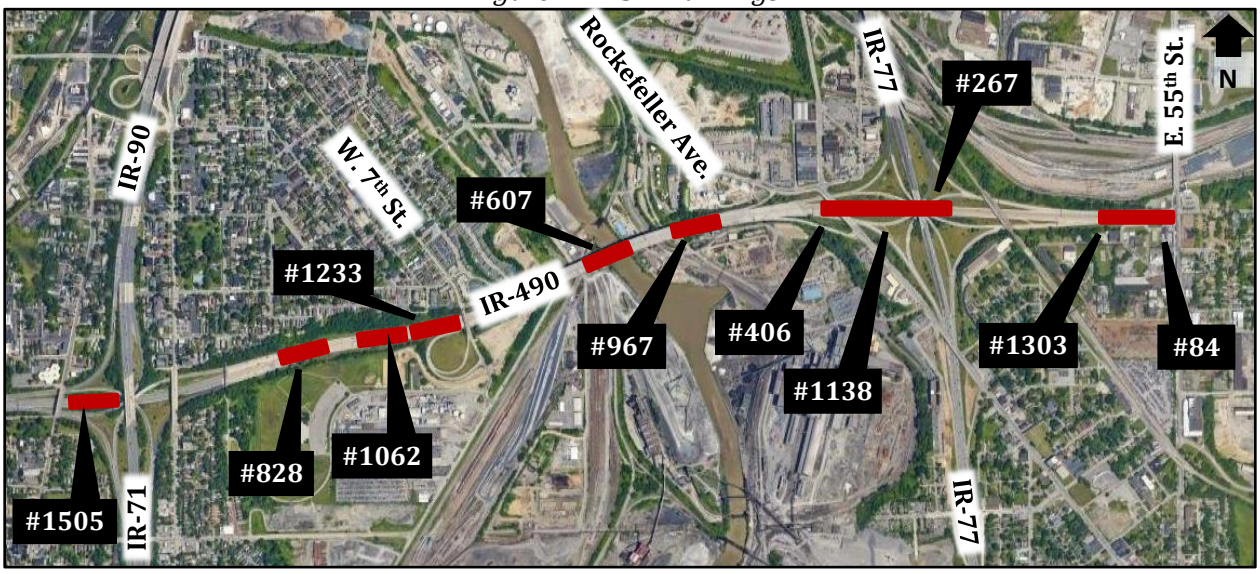
Each year, ODOT flags spot locations and road segments that have higher-than-predicted crash frequencies (including injury and fatality frequencies) based on Highway Safety Manual (HSM) methodologies. The results are illustrated on Safety Integrated Project (SIP) Maps for each county. A zoomed-in view of the State Fiscal Year 2020 SIP Map is provided in **Figure 5**. Multiple high-priority and low-cost improvement segments are identified in the study area.

Figure 5 – SIP Map



Additionally, many segments within the study area are ranked on the ODOT 2018 Highway Safety Improvement Program (HSIP) Urban Freeway Priority List, as shown in **Figure 6**.

Figure 6 – HSIP Rankings



Crash data was obtained from ODOT Transportation Information Mapping System (TIMS) for the study area. The crash query included the entire length of IR-490 as well as the ramps entering and exiting IR-490. Crashes were obtained for three complete years of available data (2017-2019). Data is summarized in **Figures 7-9.**

Figure 7 - Crashes by Direction per Year

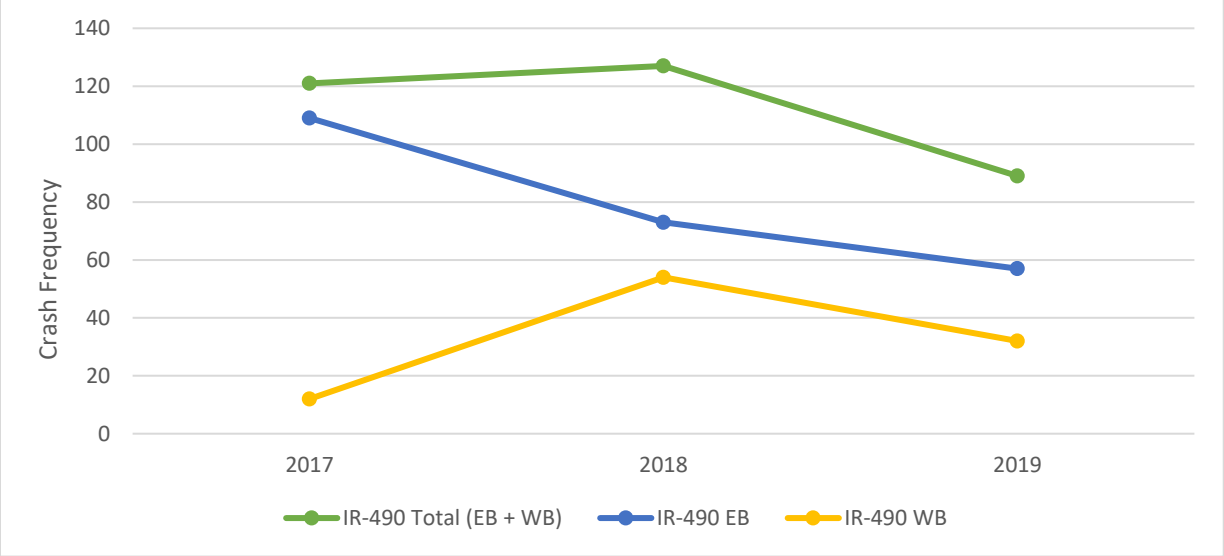


Figure 7 shows there are more eastbound crashes than westbound crashes each year. There was a slight increase in total crashes between 2017 and 2018, specifically in the westbound direction. A significant decrease in crashes was observed between 2018 and 2019.

Figure 8 - Crash Type by Direction

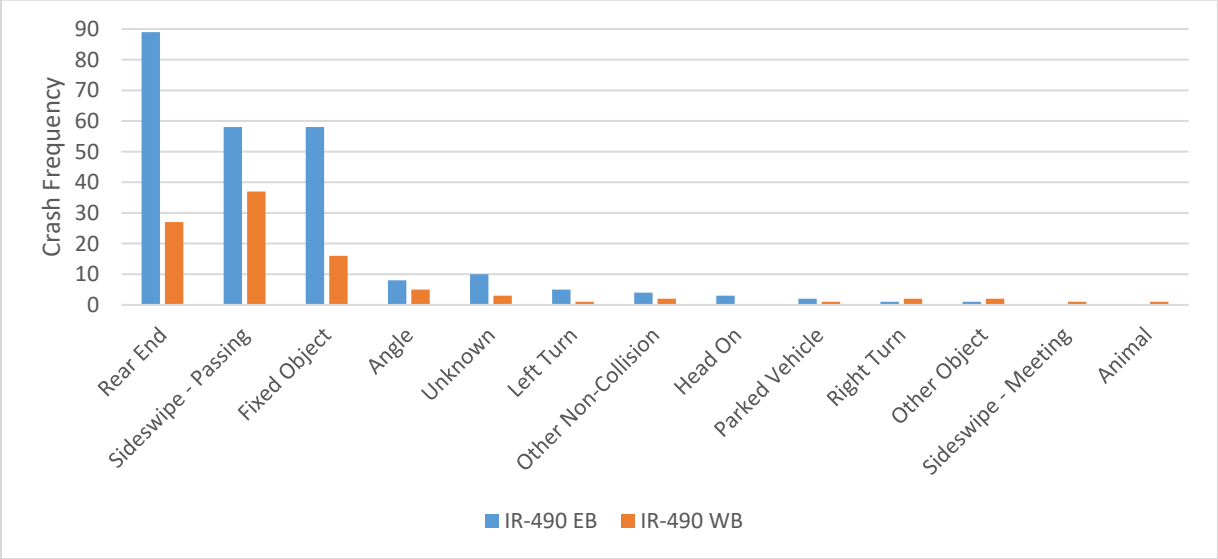


Figure 8 shows the three main crash types are rear end, sideswipe-passing, and fixed object. There are significantly more eastbound rear end crashes than westbound rear end crashes. The primary crash type for the westbound direction is sideswipe-passing crashes.

Figure 9 – Crashes by Time of Day by Direction

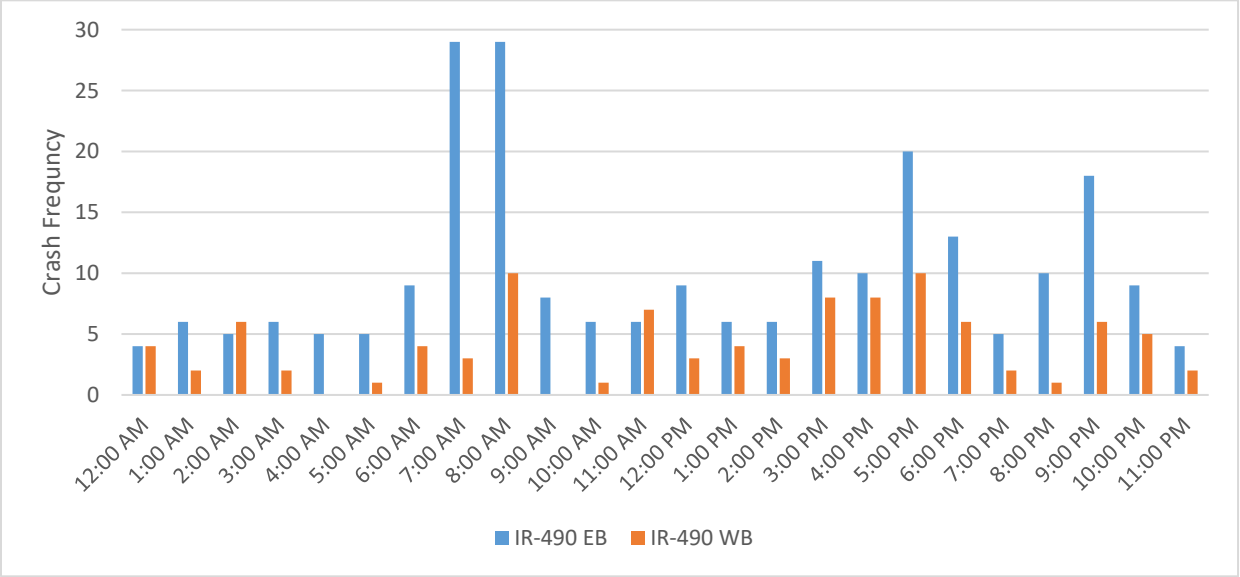


Figure 9 shows the highest peak in EB crashes occurs during the AM peak (7-9 AM). Other less significant peaks in EB crashes occur during the PM peak (5-7 PM) and 9-10 PM. The highest peaks in WB crashes occur during the AM (8-9 AM) and PM (5-6 PM) peaks, with the crash frequencies of each being equal.

Additional crash data statistics can be found in **Attachment B**.

Existing Traffic Volumes & Capacity Analysis

Traffic volumes for the IR-77 NB and SB merges with IR-490 were downloaded from ODOT TIMS. Growth rates were obtained from the ODOT Traffic Forecast Management System (TFMS). Traffic volumes were developed for the 2025 Opening Year and 2045 Design Year, for both AM and PM peak hours. Count data, growth rate outputs, and volume calculations can be found in **Attachment C**. **Figure 10** shows the 2025 AM and PM volumes for the ramps.

Figure 10 - 2025 Volumes

The volumes entering IR-490 WB from IR-77 NB, IR-77 SB, and Opportunity Corridor are all relatively similar during the AM peak hour, ranging from 463-599 vehicles/hour. The volumes entering IR-490 WB from IR-77 NB and IR-77 SB are also relatively similar during the PM peak hour, with 1823 and 1759 vehicles/hour, respectively. However, volumes entering IR-490 WB from Opportunity Corridor are comparably lower during the PM peak at 1027 vehicles/hour.

Capacity analysis was conducted for mainline IR-490 WB and merges from IR-77 NB and SB ramps using Highway Capacity Software (HCS) version 7.8.5. Capacity analysis was conducted for the Opening and Design Year, for both AM and PM peaks. The most recent lane configuration for the area was assumed in the analysis, including a two-lane IR-77 SB ramp, single-lane IR-77 NB ramp, and a single lane from Opportunity Corridor. This is referred to as "Existing Conditions". See **Table 2** and **Table 3** for a summary of the capacity analysis results.

Table 2 – Existing Conditions HCS Segments Results

Location	Analysis Type	2025 AM		2045 AM		2025 PM		2045 PM	
		LOS	D/C	LOS	D/C	LOS	D/C	LOS	D/C
IR-77 SB to IR-490 WB ramp	Basic	A	0.11	A	0.17	C	0.43	D	0.56
IR-77 NB ramp merge with IR-77 SB ramp	Merge	B	0.28	B	0.33	E	0.92	F	1.11
IR-77 NB/SB ramps merge with IR-490 WB	Merge	B	0.29	B	0.40	E	0.50	F	0.77
Rockefeller Ave. to IR-490 WB Merge	Merge	A	0.21	A	0.21	C	0.58	B	0.58
IR-490 WB	Basic	A	0.23	A	0.30	C	0.66	B	0.87

LOS = Level of Service
D/C = Density/Capacity ratio

Table 3 – Existing Conditions HCS Facility Results

Measure of Effectiveness	2025 AM	2045 AM	2025 PM	2045 PM
Facility Length (mile)	1.69	1.69	1.69	1.69
Space Mean Speed (MPH)	59.6	59.4	59.1	57.5
Density (passenger car/mile/lane)	8.7	11.3	25.5	18.9
Travel Time (min)	1.70	1.7	1.70	1.8
LOS	A	B	C	F

The analysis shows noted capacity deficiencies during the PM peak hour, which worsen as traffic volumes grow from 2025 to 2045. The merges between IR-77 NB and SB ramps and IR-490 WB shows the worst LOS in the area.

The lane configuration for the area is planned to be revised, including a single-lane IR-77 SB ramp, single-lane IR-77 NB ramp, and two lanes from Opportunity Corridor. This is referred to as "Planned Future Conditions". See **Table 4** and **Table 5** for a summary of the capacity analysis results. Detailed capacity analysis results are provided in **Attachment D**.

Table 4 – Planned Future Conditions HCS Segments Results

Location	Analysis Type	2025 AM		2045 AM		2025 PM		2045 PM	
		LOS	D/C	LOS	D/C	LOS	D/C	LOS	D/C
IR-490 WB East of IR-77	Basic	A	0.14	A	0.20	B	0.25	C	0.38
IR-77 NB/SB ramps merge with IR-490 WB	Merge	A	0.24	A	0.33	C	0.87	E	1.18
Rockefeller Ave. to IR-490 WB Merge	Merge	A	0.21	B	0.21	C	0.58	D	0.58
IR-490 WB	Basic	A	0.23	A	0.30	C	0.65	D	0.87

LOS = Level of Service
D/C = Density/Capacity ratio

Table 5 – Planned Future Conditions HCS Facility Results

Measure of Effectiveness	2025 AM	2045 AM	2025 PM	2045 PM
Facility Length (mile)	2.00	2.00	2.00	2.00
Space Mean Speed (MPH)	58.9	58.7	59.7	55.9
Density (passenger car/mile/lane)	8.3	10.9	22.2	31.9
Travel Time (min)	2.00	2.00	2.00	2.10
LOS	A	A	C	D

Note, this exercise was conducted as a simple, capacity analysis check. HCS does not fully support analyzing the exact operations of this area. However, the analysis provides enough information to compare the different scenarios. Simulation software, such as TransModeler, could be utilized in the future if additional analysis is determined necessary.

Roadway Geometry Evaluation

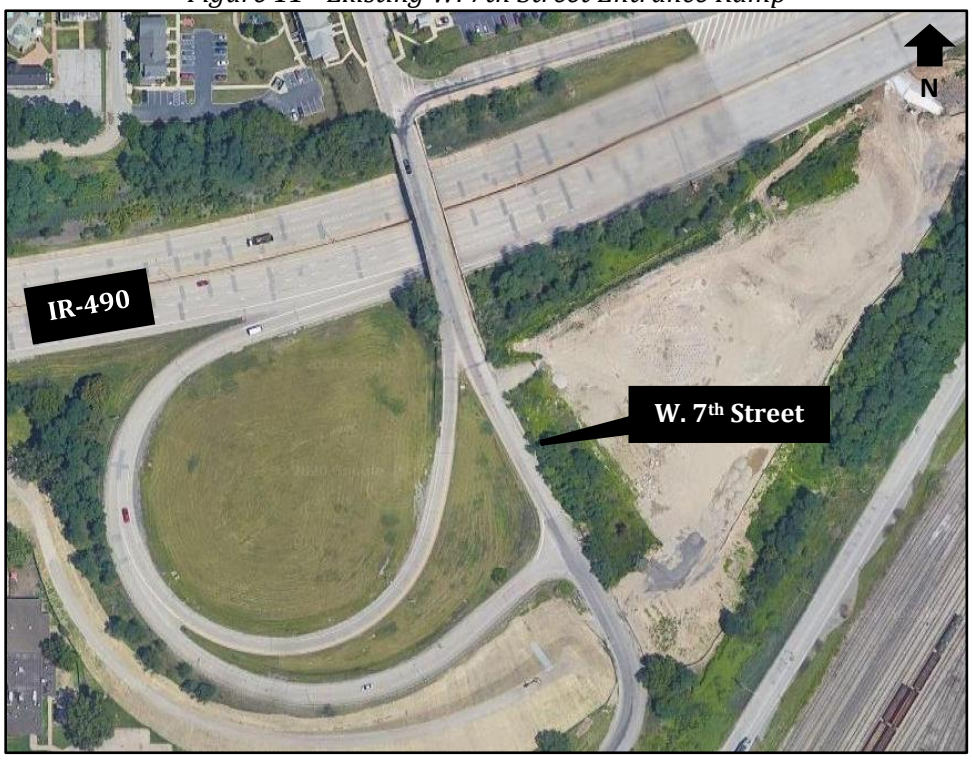
Geometric deficiencies in the study area were investigated to determine necessary improvements. The required vertical clearance over IR-490 for new or reconstructed bridges is 16.5 feet. A 15.5-foot minimum clearance may be used in highly developed urban areas if attainment of 16.5-foot clearance would be unreasonably costly and if there is an alternate freeway route or bypass which provides a minimum 16.5-foot vertical clearance. The minimum clearance is 14.5 feet for an existing bridge to remain.

The existing IR-77 NB ramp to IR-480 WB has planned improvements and detailed design for this project is currently being prepared. This project is planned to improve vertical clearance of the associated bridges.

All bridges over IR-490 have acceptable existing, or planned, vertical clearance except the CUY-490-0205 (1812017) Norfolk Southern railroad bridge. This bridge is 15.1 feet over IR-490 WB and 14.8 feet over IR-490 EB.

Additionally, the geometry of the existing W. 7th Street entrance ramp to IR-490 EB was evaluated. The existing ramp has a tight design with horizontal and vertical curvature. It is assumed high truck volumes are present and the trucks likely have trouble accelerating to mainline freeway speeds due to the geometry. See **Figure 11** for an aerial view of the existing W. 7th Street entrance ramp.

Figure 11 - Existing W. 7th Street Entrance Ramp



Countermeasures

A major roadway rehab project is planned for IR-490. Countermeasures and TSMO elements were evaluated for integration into the project for safety improvements. The listed countermeasures could all be implemented concurrent with the planned major roadway rehab project, or they may be independent solutions to consider for future implementation.

IR-490 Mainline Vertical Clearance

The CUY-490-0205 (1812017) Norfolk Southern railroad bridge does not meet acceptable vertical clearance standards. This bridge is 15.1 feet over IR-490 WB and 14.8 feet over IR-490 EB. It is recommended IR-490 be lowered to obtain the desired 15.5-foot vertical clearance.

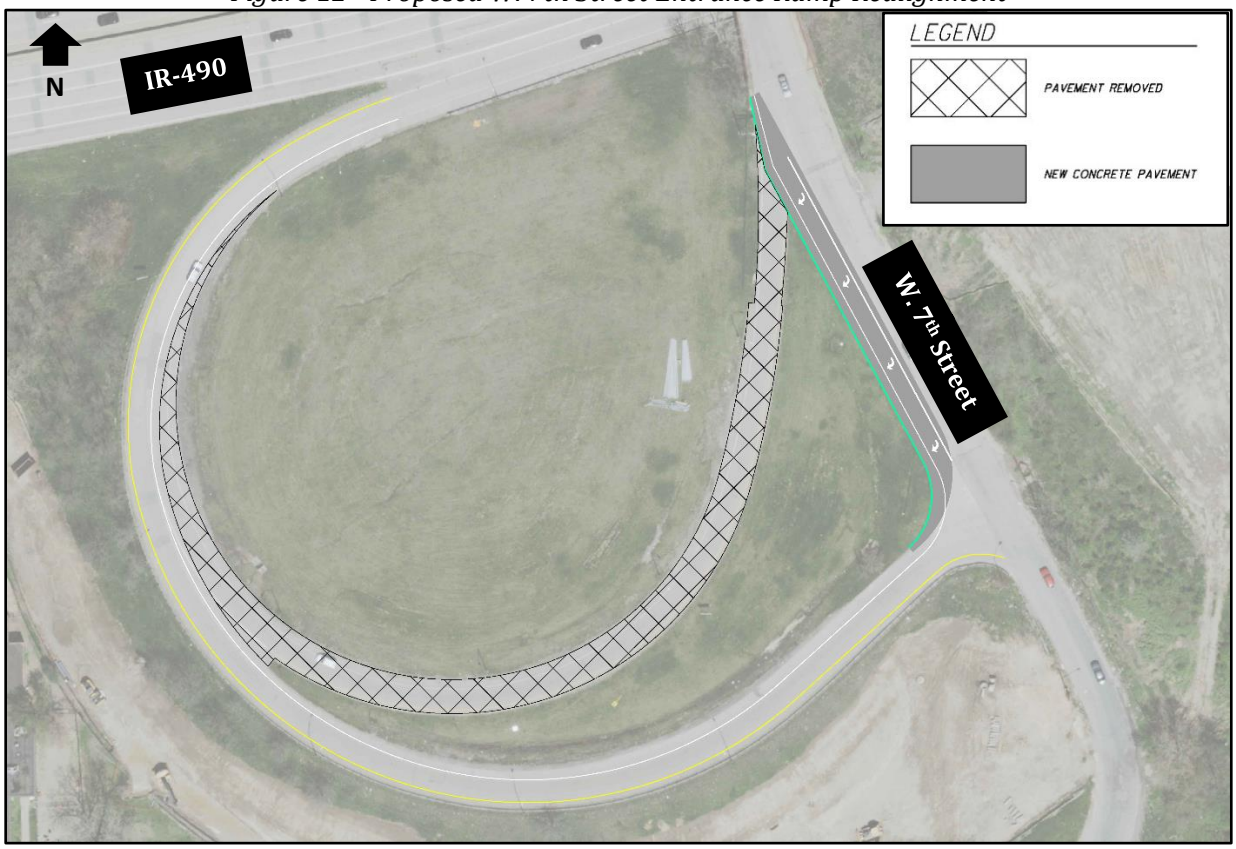
W. 7th Street Entrance Ramp Realignment and Acceleration Lane Extension

Realignment of the existing W. 7th Street entrance ramp is recommended. The southbound W. 7th Street ramp can be consolidated with the northbound W. 7th Street ramp. Southbound W. 7th Street traffic would now make a conventional right turn movement at the existing W. 7th Street northbound entrance ramp intersection. The existing southbound W. 7th Street ramp pavement would be removed. This can be constructed without affecting traffic.

Additionally, the acceleration lane from W. 7th Street to IR-490 is recommended to be extended. The existing ramp merge taper is 40:1 and the acceleration length is 1200 feet per the existing plans, which is substandard. The current standard for a merge taper is 50:1 and acceleration length with an upgrade adjust is 1830 feet. The acceleration lane can be lengthened to meet standards if the inside shoulder is reduced to 3 feet and the outside shoulder next to the ramps is also reduced to 3 feet. A crown shift and barrier upgrade on the bridge may be necessary.

This will allow for greater acceleration through the ramp and higher entry speeds once vehicles reach IR-490 EB. See **Figure 12** for a concept plan of this countermeasure. Larger-scale plan sheets are provided in **Attachment E**.

Figure 12 - Proposed W. 7th Street Entrance Ramp Realignment



IR-77 NB/SB Ramps Dynamic Auxiliary Lanes to IR-490 WB

The most recent lane configuration for the area includes a two-lane IR-77 SB ramp, single-lane IR-77 NB ramp, and a single lane from Opportunity Corridor, all combining into a four-lane IR-490 WB typical section. The lane configuration for the area is planned to be revised, including a single-lane IR-77 SB ramp, single-lane IR-77 NB ramp, and two lanes from Opportunity Corridor.

The volumes entering IR-490 WB from IR-77 NB, IR-77 SB, and Opportunity Corridor are all relatively similar during the AM peak hour. Volumes entering IR-490 WB from Opportunity Corridor are comparably lower during the PM peak. However, the existing lane configuration provides double the capacity for the IR-77 SB ramps compared to the other ramps and the future planned lane configuration provides double the capacity for Opportunity Corridor compared to the IR-77 NB and SB ramps. While traffic volumes are expected to greatly change after Opportunity Corridor construction is complete, additional capacity on the IR-77 NB and SB ramps may be necessary.

Currently, only four lanes can fit on IR-490 WB downstream of the merge. Making IR-77 NB and SB each two-lane ramps could cause issues downstream, as a lane merge would be necessary to bring IR-490 to a four-lane section.

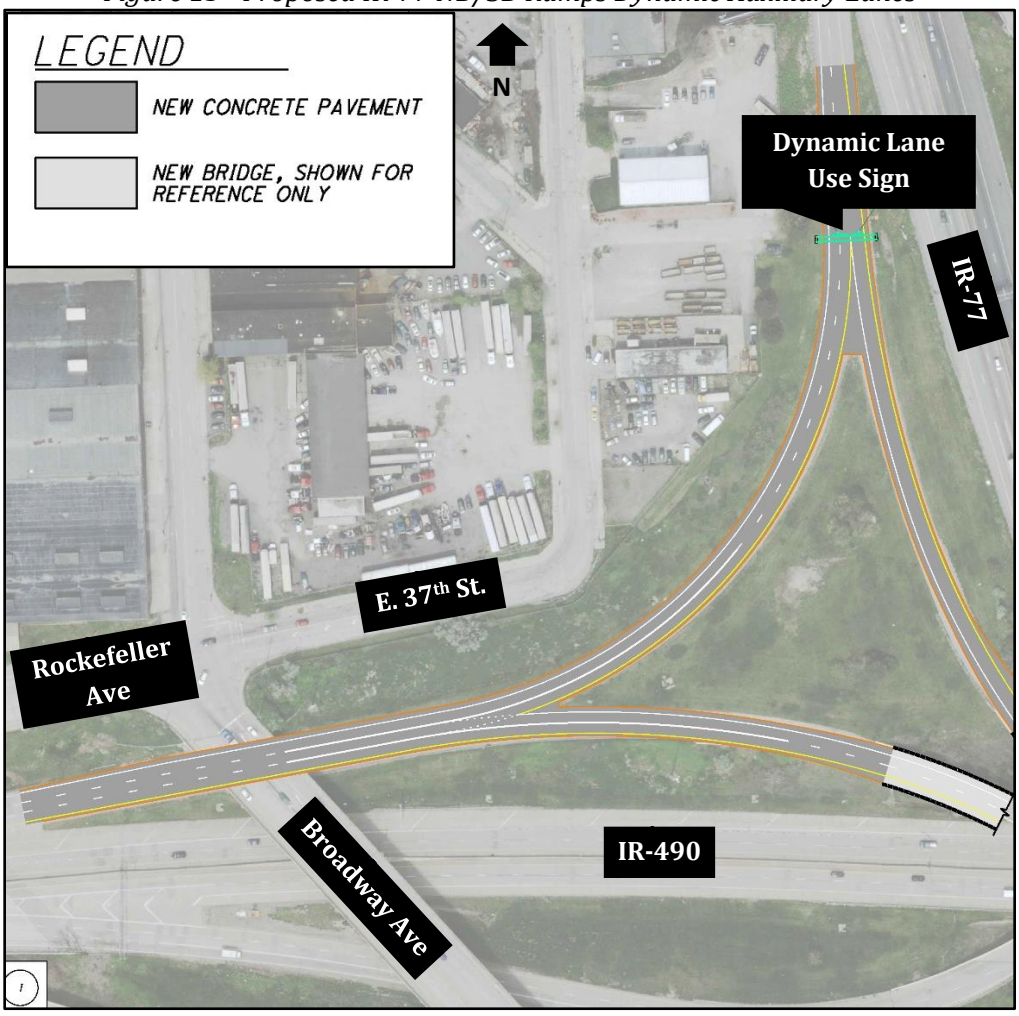
It is recommended dynamic auxiliary lanes be considered for implementation. There may be days, peaks, events, incidents, or situations in which the IR-77 NB ramp may need the two-lane typical section and the IR-77 SB ramp could operate as a single-lane typical section, or vice versa. Dynamic lane use signs could be installed to inform drivers when the second lane is open on the IR-77 SB ramp or NB ramp to IR-490 WB. The second lane would not be open on both ramps simultaneously.

The following design considerations would be necessary to implement this countermeasure:

- IR-77 southbound bridge over the railroads would need to be widened to accommodate a two-lane exit to IR-490
- IR-77 NB to IR-490 WB ramp bridge would need to be widened to accommodate a two-lane ramp, along with additional pavement and retaining wall replacement
- The three-lane entrance ramp from IR-77 NB/SB would have to merge to two-lanes prior to the Rockefeller Avenue entrance ramp to maintain two lanes from Opportunity Corridor
- Bridge widening on IR-490 could be avoided by providing three-foot inside and outside shoulders
- Crown shift on IR-490 bridge
- Barrier upgrades on IR-490 bridge

See **Figure 13** for a concept plan of this countermeasure. Larger-scale plan sheets are provided in **Attachment E**.

Figure 13 - Proposed IR-77 NB/SB Ramps Dynamic Auxiliary Lanes



Capacity analysis of this proposed countermeasure was conducted for comparison with the existing and planned future conditions analysis. The proposed conditions analysis assumes two scenarios:

A. Single-lane IR-77 SB ramp and two-lane IR-77 NB ramp
B. Two-lane IR-77 SB ramp and single-lane IR-77 NB ramp

See **Tables 6-9** for a summary of the capacity analysis results. Detailed capacity analysis results are provided in **Attachment F**.

Table 6 – Proposed Conditions A (Two-Lane Ramp from IR-77 NB) HCS Segments Results

Location	Analysis Type	2025 AM		2045 AM		2025 PM		2045 PM	
		LOS	D/C	LOS	D/C	LOS	D/C	LOS	D/C
IR-77 SB to IR-490 WB ramp	Basic	B	0.22	B	0.34	F	0.85	F	1.30
IR-77 NB ramp merge with IR-77 SB ramp	Merge	A	0.14	A	0.17	F	0.46	F	0.56
IR-77 NB/SB ramps merging from 3-lanes to 2-lanes	Basic	C	0.36	C	0.50	F	1.29	F	1.83
IR-77 NB/SB ramps merge with IR-490 WB	Merge	B	0.14	B	0.20	C	0.25	F	0.38
Rockefeller Ave. to IR-490 WB Merge	Merge	B	0.21	B	0.21	C	0.58	F	0.58
IR-490 WB	Basic	A	0.28	B	0.38	C	0.86	F	1.17

LOS = Level of Service
D/C = Density/Capacity ratio

Table 7 – Proposed Conditions A (Two-Lane Ramp from IR-77 NB) HCS Facility Results

Measure of Effectiveness	2025 AM	2045 AM	2025 PM	2045 PM
Facility Length (mile)	2.69	2.69	2.69	2.69
Space Mean Speed (MPH)	53.4	53.2	42.8	42.2
Density (passenger car/mile/lane)	12.5	17.2	34.0	34.5
Travel Time (min)	3.00	3.00	3.80	3.80
LOS	B	B	F	F

Table 8 – Proposed Conditions B (Two-Lane Ramp from IR-77 SB) HCS Segments Results

Location	Analysis Type	2025 AM		2045 AM		2025 PM		2045 PM	
		LOS	D/C	LOS	D/C	LOS	D/C	LOS	D/C
IR-77 SB to IR-490 WB ramp	Basic	A	0.11	A	0.17	C	0.43	D	0.65
IR-77 NB ramp merge with IR-77 SB ramp	Merge	A	0.28	A	0.33	D	0.92	C	1.11
IR-77 NB/SB ramps merging from 3-lanes to 2-lanes	Basic	B	0.24	B	0.33	E	0.87	F	1.18
IR-77 NB/SB ramps merge with IR-490 WB	Merge	B	0.14	B	0.20	C	0.25	C	0.38
Rockefeller Ave. to IR-490 WB Merge	Merge	A	0.21	B	0.21	C	0.58	B	0.58
IR-490 WB	Basic	A	0.23	A	0.30	C	0.66	C	0.87

LOS = Level of Service
D/C = Density/Capacity ratio

Table 9 – Proposed Conditions B (Two-Lane Ramp from IR-77 SB) HCS Facility Results

Measure of Effectiveness	2025 AM	2045 AM	2025 PM	2045 PM
Facility Length (mile)	2.69	2.69	2.69	2.69
Space Mean Speed (MPH)	54.3	54.1	53.2	52.6
Density (passenger car/mile/lane)	9.4	12.3	29.6	24.4
Travel Time (min)	3.00	3.00	3.00	3.10
LOS	A	B	D	F

The analysis shows noted capacity deficiencies during the PM peak hour, which worsen as traffic volumes grow from 2025 to 2045. Operations in some of the proposed condition scenarios are worse compared to existing and planned future conditions. However, the configuration analyzed in the proposed condition scenarios are not meant to be the permanent configuration. The configuration is dynamic and will operate with the IR-77 NB and SB ramps as two-lane or single-lane configurations, as necessary.

Also note, this exercise was conducted as a simple, capacity analysis check. HCS does not fully support analyzing the exact operations of this area. However, the analysis provides enough information to compare the different scenarios. Simulation software, such as TransModeler, could be utilized in the future if additional analysis is determined necessary.

Variable Speed Limit (VSL) on IR-490 EB from IR-90 to W. 7th Street

VSL signs could be considered for implementation on IR-490 EB from IR-90 to W. 7th Street. This is the highest speed section in the study area, with a posted speed limit of 60 MPH. Daily AM and PM peak eastbound congestion and congestion-related crashes were noted. When the area is congested, the speed limit in the area could be lowered. However, this countermeasure to reduce crashes may resolve itself as the dynamics of the E. 55th Street intersection converts more to an interchange. Consider monitoring this in the future.

This countermeasure was considered for implementation elsewhere in the study area; however, this proposed location is expected to result in the greatest benefit from VSL since it is a high-speed section entering a lower-speed section.

Queue Warning System (QWS)

Queue Warning System (QWS) could be considered for future implementation. QWS informs drivers of the presence of downstream stop-and-go traffic (based on real-time traffic detection) using warning signs and flashing lights. Drivers can anticipate an upcoming situation of emergency braking and slow down, avoid erratic behavior, and reduce congestion-related crashes. QWS would be desirable if the queueing at E. 55th Street continues after construction of Opportunity Corridor is complete. The exact location for the most appropriate installation of QWS would need to be determined. It is possible queues extend outside the IR-490 corridor, so an application outside the study area may be necessary. Relevant excerpts from the Draft TSMO Guidebook are provided in **Attachment G**, which explain each TSMO countermeasure and benefits in further detail.

Cost Estimate

A cost estimate was prepared for the W. 7th Street entrance ramp realignment countermeasure. The estimate assumes the countermeasure would be implemented along with the major roadway rehab project planned for IR-490. The construction cost estimate assumes the following:

- 15 percent engineering design
- 30 percent contingency
- 17.5 percent inflation rate for an estimated 2027 construction year
- Cost for utility relocation is not included

The estimated cost is $321,300**.** The detailed cost estimate is included in **Attachment H.**

Conclusions

The countermeasures listed above should be considered for implementation with the major roadway rehab project planned for IR-490. Additional analysis and further investigations may be necessary to determine the details of each countermeasure implementation. Some countermeasures could be independent solutions to consider as separate projects to be implemented in the future.

If I can help in any way, do not hesitate to contact me at gbalsamo@cmtran.com or 614.656.2429 anytime.

Sincerely,

Gina Balsamo, PE
Project Manager
Carpenter Marty Transportation

Attachment A
TOAST Outputs and Information

Attachment A

CARPENTER MARTY transportation

OHIO DEPARTMENT OF TRANSPORTATION

TOAST

Traffic Operation Assessment Systems Tool

Overview

ODOT's mission is to provide easy movement of people and goods from place to place. In order to continue this mission, Ohio is currently undergoing a shift in focus toward a more operationally centered mindset for our transportation system. Through our new Transportation Systems Management and Operations (TSMO) plan and program, we are working to maximize the efficiency and safety of our current transportation network.

In an effort to make data-driven decisions and determine operationally sensitive corridors throughout the state, we have developed the Traffic Operations Assessment Systems Tool (TOAST).

About the Tool

- Routes are segmented into the State Priority System with breaks at the urban area boundaries, interchange center points, and road functional class changes.
- Multiple Data Categories make up TOAST. For each category, data ranges were normalized into values of 0-10, then multiplied by a weighting factor.
- The total score for a route is calculated as a percent based on the score for each category divided by the total possible maximum score.

In general, the higher the percent, the better the route is performing; whereas, the lower the percent, the more likely a route is to benefit from application of TSMO strategies.

Data Categories

Travel Time Performance

Percent of time motorists can travel at or near (90%) of the reference speed (free-flow/ uncongested speed defined by data provider).

Bottlenecks

A potential bottleneck is detected when speeds on a segment drop to 65% of reference speeds and cause at least a two-minute delay.

Incident Clearance

The time from report of an incident until the entire scene is cleared.

Secondary Crashes

Percent of crashes that occurred as a result of a previous incident.

Volume Per Lane

Calculated based on a weighted average for each segment.

Freight Corridors

Weighted average of percent trucks (avg. daily truck volume ÷ avg. daily total volume).

Safety Performance

A route's potential for safety improvement by density based on its peer group.

Weather Resilience*

Snow & Ice recovery data and route flooding.

Work Zone Delay*

Hours below 35 mph compared to pre-WZ conditions.

Work Zone Crashes*

Ratio of crashes during WZ to pre-WZ conditions.

Signal Timing*

Percentage of vehicle arrivals on green.

* Future TOAST Category

Weighting %	Criteria	Calculated by	Value Range	Range		Normalized Value	Multiplier	Max Score	Use Criteria?	Data Date Ranges
				Min	Max					
25.0%	Bottlenecks	SUM of Top 5 Impact Factors *Impact Factor = Avg duration (minutes) x Avg max length x Number occurances*	0-170,000+	0	15,000	10	2.5	25	☑	2019 Fiscal Year *(7/1/18 - 6/30/19)*
				15,000	18,500	9				
				18,500	22,500	8				
				22,500	30,000	7				
				30,000	35,500	6				
				35,500	50,000	5				
				50,000	65,000	4				
				65,000	86,500	3				
				86,500	122,000	2				
				122,000	170,000	1				
				170,000		0				
20.0%	Travel Time Performance	Score (%) *Real Travel Time/Target Travel Time is ≥ 90% of Reference Speed*	0-100%	0%	66%	0	2.0	20	☑	2019 Fiscal Year *(7/1/18 - 6/30/19)*
				66%	72%	1				
				72%	76%	2				
				76%	80%	3				
				80%	82%	4				
				82%	85%	5				
				85%	88%	6				
				88%	91%	7				
				91%	94%	8				
				94%	98%	9				
				98%	100%	10				
15.0%	Safety Performance	Potential for Safety Improvement by density (PSI_Density) *Crashes per year per mile*	0-85+	0	0	10	1.5	15	☑	2018 Calendar Year *(1/1/18 - 12/31/18)*
				0	0.6	9				
				0.6	1	8				
				1	2.0	7				
				2.0	3.5	6				
				3.5	6	5				
				6	9.0	4				
				9.0	17.0	3				
				17.0	34	2				
				34	85	1				
				85		0				
15.0%	Volume per Lane	Number Vehicles	0 - 30,500+	0	2,200	10	1.5	15	☑	2018 Calendar Year *(1/1/18 - 12/31/18)*
				2,200	2,700	9				
				2,700	3,300	8				
				3,300	3,900	7				
				3,900	4,400	6				
				4,400	5,400	5				
				5,400	6,600	4				
				6,600	9,700	3				
				9,700	15,300	2				
				15,300	30,500	1				
				30,500		0				
10.0%	Freight Corridors	Percent Trucks (%)	0-22%+	0%	3%	10	1.0	10	☑	2018 Calendar Year *(1/1/18 - 12/31/18)*
				3%	6%	9				
				6%	8%	8				
				8%	10%	7				
				10%	12%	6				
				12%	14%	5				
				14%	16%	4				
				16%	18%	3				
				18%	20%	2				
				20%	22%	1				
				22%		0				
7.5%	Incident Clearance	Average Duration (minutes)	0-110+	0	45	10	0.75	7.5	☑	2018 Calendar Year *(1/1/18 - 12/31/18)*
				45	50	9				
				50	60	8				
				60	65	7				
				65	75	6				
				75	80	5				
				80	85	4				
				85	90	3				
				90	100	2				
				100	115	1				
				115		0				
7.5%	Secondary Crashes	Ratio of Secondary Incidents to Total (%)	0-33%+	0%	5%	10	0.75	7.5	☑	2018 Calendar Year *(1/1/18 - 12/31/18)*
				5%	6%	9				
				6%	7%	8				
				7%	8%	7				
				8%	9%	6				
				9%	11%	5				
				11%	13%	4				
				13%	15%	3				
				15%	17%	2				
				17%	23%	1				
				23%		0				
100%							**10**	**100**		

Score	County	Route	Begin Log	Eng Log		Length	Functional Class	Urban/ Rural	# Ellis Projects	Bottlenecks		Travel Time Performance		Safety Performance		Volume Per Lane		Freight Corridors		Incident Clearance		Secondary Crashes	
										Max:	*25*	*Max:*	*20*	*Max:*	*15*	*Max:*	*15*	*Max:*	*10*	*Max:*	*7.5*	*Max:*	*7.5*
										Impact Factor	Score	TTP %	Score	PSI Density	Score	# Veh	Score	% Trucks	Score	Mins	Score	%	Score
61.3%	CUY	490	0	0.92	I-90 to W. 7th	0.92	1	U	0	6568	25	89%	14	150.2	0	7685	4.5	7%	8	74	4.5	7%	5.25
56.5%	CUY	490	0.92	1.88	(90) W. 7th to I-77	0.96	1	U	0	6429	25	92%	16	159.3	0	9653	4.5	7%	8	147	0	12%	3
66.0%	CUY	490	1.88	2.43	(180) I-77 to E. 55th	0.55	1	U	0	4089	25	85%	12	479.3	0	6040	6	7%	8	27	7.5	3%	7.5

Attachment B

Crash Statistics

CARPENTER MARTY transportation

Attachment B

Table 1 below represents a breakdown of the complete crash data for the entire IR-490 study area. A total of 337 crashes were obtained.

Table 1 - Crash Statistics (Complete Data Set)

Crash Year	Number	Percent
2017	121	35.9%
2018	127	37.7%
2019	89	26.4%

Hour of Day	Number	Percent
12:00 AM	8	2.4%
1:00 AM	8	2.4%
2:00 AM	11	3.3%
3:00 AM	8	2.4%
4:00 AM	5	1.5%
5:00 AM	6	1.8%
6:00 AM	13	3.9%
7:00 AM	32	9.5%
8:00 AM	39	11.6%
9:00 AM	8	2.4%
10:00 AM	7	2.1%
11:00 AM	13	3.9%
12:00 PM	12	3.6%
1:00 PM	10	3.0%
2:00 PM	9	2.7%
3:00 PM	19	5.6%
4:00 PM	18	5.3%
5:00 PM	30	8.9%
6:00 PM	19	5.6%
7:00 PM	7	2.1%
8:00 PM	11	3.3%
9:00 PM	24	7.1%
10:00 PM	14	4.2%
11:00 PM	6	1.8%

Crash Severity	Number	Percent
PDO	248	73.6%
Injury Crash	89	26.4%

Crash Type	Number	Percent
Rear End	116	34.4%
Sideswipe – Passing	95	28.2%
Fixed Object	74	22.0%
Angle	13	3.9%
Unknown	13	3.9%
Left Turn	6	1.8%
Other Non-Collision	6	1.8%
Head On	3	0.9%
Parked Vehicle	3	0.9%
Right Turn	3	0.9%
Other Object	3	0.9%
Sideswipe – Meeting	1	0.3%
Animal	1	0.3%

Day of Week	Number	Percent
Sunday	28	8.3%
Monday	47	14.0%
Tuesday	49	14.5%
Wednesday	59	17.5%
Thursday	67	19.9%
Friday	52	15.4%
Saturday	35	10.4%

Road Condition	Number	Percent
Dry	221	65.6%
Wet	85	25.2%
Snow	19	5.6%
Ice	6	1.8%
Other/Unknown	4	1.2%
Water (Standing, Moving)	2	0.6%

Table 2 below represents a breakdown of the crash data associated with IR-490 EB, including entering and exiting ramps. A total of 239 crashes were obtained.

Table 2 - Crash Statistics (IR-490 EB and Ramps Data Set)

Crash Year	Number	Percent
2017	109	45.6%
2018	73	30.5%
2019	57	23.8%

Hour of Day	Number	Percent
12:00 AM	4	1.7%
1:00 AM	6	2.5%
2:00 AM	5	2.1%
3:00 AM	6	2.5%
4:00 AM	5	2.1%
5:00 AM	5	2.1%
6:00 AM	9	3.8%
7:00 AM	29	12.1%
8:00 AM	29	12.1%
9:00 AM	8	3.3%
10:00 AM	6	2.5%
11:00 AM	6	2.5%
12:00 PM	9	3.8%
1:00 PM	6	2.5%
2:00 PM	6	2.5%
3:00 PM	11	4.6%
4:00 PM	10	4.2%
5:00 PM	20	8.4%
6:00 PM	13	5.4%
7:00 PM	5	2.1%
8:00 PM	10	4.2%
9:00 PM	18	7.5%
10:00 PM	9	3.8%
11:00 PM	4	1.7%

Crash Severity	Number	Percent
PDO	172	72.0%
Injury Crash	67	28.0%

Crash Type	Number	Percent
Rear End	89	37.2%
Sideswipe – Passing	58	24.3%
Fixed Object	58	24.3%
Angle	8	3.3%
Unknown	10	4.2%
Left Turn	5	2.1%
Other Non-Collision	4	1.7%
Head On	3	1.3%
Parked Vehicle	2	0.8%
Right Turn	1	0.4%
Other Object	1	0.4%
Sideswipe – Meeting	0	0.0%
Animal	0	0.0%

Day of Week	Number	Percent
Sunday	25	10.5%
Monday	34	14.2%
Tuesday	30	12.6%
Wednesday	40	16.7%
Thursday	43	18.0%
Friday	38	15.9%
Saturday	29	12.1%

Road Condition	Number	Percent
Dry	156	65.3%
Wet	59	24.7%
Snow	15	6.3%
Ice	3	1.3%
Other/Unknown	4	1.7%
Water (Standing, Moving)	2	0.8%

Table 3 below represents a breakdown of the crash data associated with IR-490 WB, including entering and exiting ramps. A total of 98 crashes were obtained.

Table 3 - Crash Statistics (IR-490 WB and Ramps Data Set)

Crash Year	Number	Percent
2017	12	12.2%
2018	54	55.1%
2019	32	32.7%

Hour of Day	Number	Percent
12:00 AM	4	4.1%
1:00 AM	2	2.0%
2:00 AM	6	6.1%
3:00 AM	2	2.0%
4:00 AM	0	0.0%
5:00 AM	1	1.0%
6:00 AM	4	4.1%
7:00 AM	3	3.1%
8:00 AM	10	10.2%
9:00 AM	0	0.0%
10:00 AM	1	1.0%
11:00 AM	7	7.1%
12:00 PM	3	3.1%
1:00 PM	4	4.1%
2:00 PM	3	3.1%
3:00 PM	8	8.2%
4:00 PM	8	8.2%
5:00 PM	10	10.2%
6:00 PM	6	6.1%
7:00 PM	2	2.0%
8:00 PM	1	1.0%
9:00 PM	6	6.1%
10:00 PM	5	5.1%
11:00 PM	2	2.0%

Crash Severity	Number	Percent
PDO	76	77.6%
Injury Crash	22	22.4%

Crash Type	Number	Percent
Rear End	27	27.6%
Sideswipe – Passing	37	37.8%
Fixed Object	16	16.3%
Angle	5	5.1%
Unknown	3	3.1%
Left Turn	1	1.0%
Other Non-Collision	2	2.0%
Head On	0	0.0%
Parked Vehicle	1	1.0%
Right Turn	2	2.0%
Other Object	2	2.0%
Sideswipe – Meeting	1	1.0%
Animal	1	1.0%

Day of Week	Number	Percent
Sunday	3	3.1%
Monday	13	13.3%
Tuesday	19	19.4%
Wednesday	19	19.4%
Thursday	24	24.5%
Friday	14	14.3%
Saturday	6	6.1%

Road Condition	Number	Percent
Dry	65	66.3%
Wet	26	26.5%
Snow	4	4.1%
Ice	3	3.1%
Other/Unknown	0	0.0%
Water (Standing, Moving)	0	0.0%

Table 4 below represents a breakdown of the 2017 crash data for the entire study area. A total of 121 crashes were obtained.

Table 4 - Crash Statistics (2017 Data Set)

Hour of Day	Number	Percent
12:00 AM	2	1.7%
1:00 AM	4	3.3%
2:00 AM	4	3.3%
3:00 AM	2	1.7%
4:00 AM	2	1.7%
5:00 AM	3	2.5%
6:00 AM	2	1.7%
7:00 AM	18	14.9%
8:00 AM	12	9.9%
9:00 AM	3	2.5%
10:00 AM	4	3.3%
11:00 AM	4	3.3%
12:00 PM	5	4.1%
1:00 PM	2	1.7%
2:00 PM	5	4.1%
3:00 PM	3	2.5%
4:00 PM	8	6.6%
5:00 PM	8	6.6%
6:00 PM	10	8.3%
7:00 PM	1	0.8%
8:00 PM	4	3.3%
9:00 PM	9	9.4%
10:00 PM	4	3.3%
11:00 PM	2	1.7%

Crash Severity	Number	Percent
PDO	84	69.4%
Injury Crash	37	30.6%

Crash Type	Number	Percent
Rear End	45	37.2%
Sideswipe – Passing	33	27.3%
Fixed Object	28	23.1%
Angle	5	4.1%
Unknown	4	3.3%
Left Turn	1	0.8%
Other Non-Collision	1	0.8%
Head On	2	1.7%
Parked Vehicle	1	0.8%
Right Turn	0	0.0%
Other Object	1	0.8%
Sideswipe – Meeting	0	0.0%
Animal	0	0.0%

Day of Week	Number	Percent
Sunday	16	13.2%
Monday	20	16.5%
Tuesday	17	14.0%
Wednesday	16	13.2%
Thursday	21	17.4%
Friday	21	17.4%
Saturday	10	8.3%

Road Condition	Number	Percent
Dry	82	67.8%
Wet	34	28.1%
Snow	2	1.7%
Ice	1	0.8%
Other/Unknown	0	0.0%
Water (Standing, Moving)	2	1.7%

Table 5 below represents a breakdown of the 2018 crash data for the entire study area. A total of 127 crashes were obtained.

Table 5 - Crash Statistics (2018 Data Set)

Hour of Day	Number	Percent
12:00 AM	2	1.6%
1:00 AM	3	2.4%
2:00 AM	4	3.1%
3:00 AM	4	3.1%
4:00 AM	2	1.6%
5:00 AM	2	1.6%
6:00 AM	5	3.9%
7:00 AM	8	6.3%
8:00 AM	13	10.2%
9:00 AM	1	0.8%
10:00 AM	3	2.4%
11:00 AM	4	3.1%
12:00 PM	5	3.9%
1:00 PM	7	5.5%
2:00 PM	0	0.0%
3:00 PM	12	9.4%
4:00 PM	4	3.1%
5:00 PM	17	13.4%
6:00 PM	7	5.5%
7:00 PM	5	3.9%
8:00 PM	1	0.8%
9:00 PM	11	8.7%
10:00 PM	5	3.9%
11:00 PM	2	1.6%

Crash Severity	Number	Percent
PDO	101	79.5%
Injury Crash	26	20.5%

Crash Type	Number	Percent
Rear End	45	35.4%
Sideswipe – Passing	33	26.0%
Fixed Object	24	18.9%
Angle	6	4.7%
Unknown	7	5.5%
Left Turn	4	3.1%
Other Non-Collision	3	2.4%
Head On	1	0.8%
Parked Vehicle	0	0.0%
Right Turn	2	1.6%
Other Object	1	0.8%
Sideswipe – Meeting	0	0.0%
Animal	1	0.8%

Day of Week	Number	Percent
Sunday	8	6.3%
Monday	13	10.2%
Tuesday	18	14.2%
Wednesday	27	21.3%
Thursday	27	21.3%
Friday	20	15.7%
Saturday	14	11.0%

Road Condition	Number	Percent
Dry	82	64.6%
Wet	30	23.6%
Snow	9	7.1%
Ice	3	2.4%
Other/Unknown	3	2.4%
Water (Standing, Moving)	0	0.0%

Table 6 below represents a breakdown of the 2019 crash data for the entire study area. A total of 89 crashes were included.

Table 6 - Crash Statistics (2019 Data Set)

Hour of Day	Number	Percent
12:00 AM	4	4.5%
1:00 AM	1	1.1%
2:00 AM	3	3.4%
3:00 AM	2	2.2%
4:00 AM	1	1.1%
5:00 AM	1	1.1%
6:00 AM	6	6.7%
7:00 AM	6	6.7%
8:00 AM	14	15.7%
9:00 AM	4	4.5%
10:00 AM	0	0.0%
11:00 AM	5	5.6%
12:00 PM	2	2.2%
1:00 PM	1	1.1%
2:00 PM	4	4.5%
3:00 PM	4	4.5%
4:00 PM	6	6.7%
5:00 PM	5	5.6%
6:00 PM	2	2.2%
7:00 PM	1	1.1%
8:00 PM	6	6.7%
9:00 PM	4	4.5%
10:00 PM	5	5.6%
11:00 PM	2	2.2%

Crash Severity	Number	Percent
PDO	63	70.8%
Injury Crash	26	29.2%

Crash Type	Number	Percent
Rear End	26	29.2%
Sideswipe – Passing	29	32.6%
Fixed Object	22	24.7%
Angle	2	2.2%
Unknown	2	2.2%
Left Turn	1	1.1%
Other Non-Collision	2	2.2%
Head On	0	0.0%
Parked Vehicle	2	2.2%
Right Turn	1	1.1%
Other Object	1	1.1%
Sideswipe – Meeting	1	1.1%
Animal	0	0.0%

Day of Week	Number	Percent
Sunday	4	4.5%
Monday	14	15.7%
Tuesday	14	15.7%
Wednesday	16	18.0%
Thursday	19	21.3%
Friday	11	12.4%
Saturday	11	12.4%

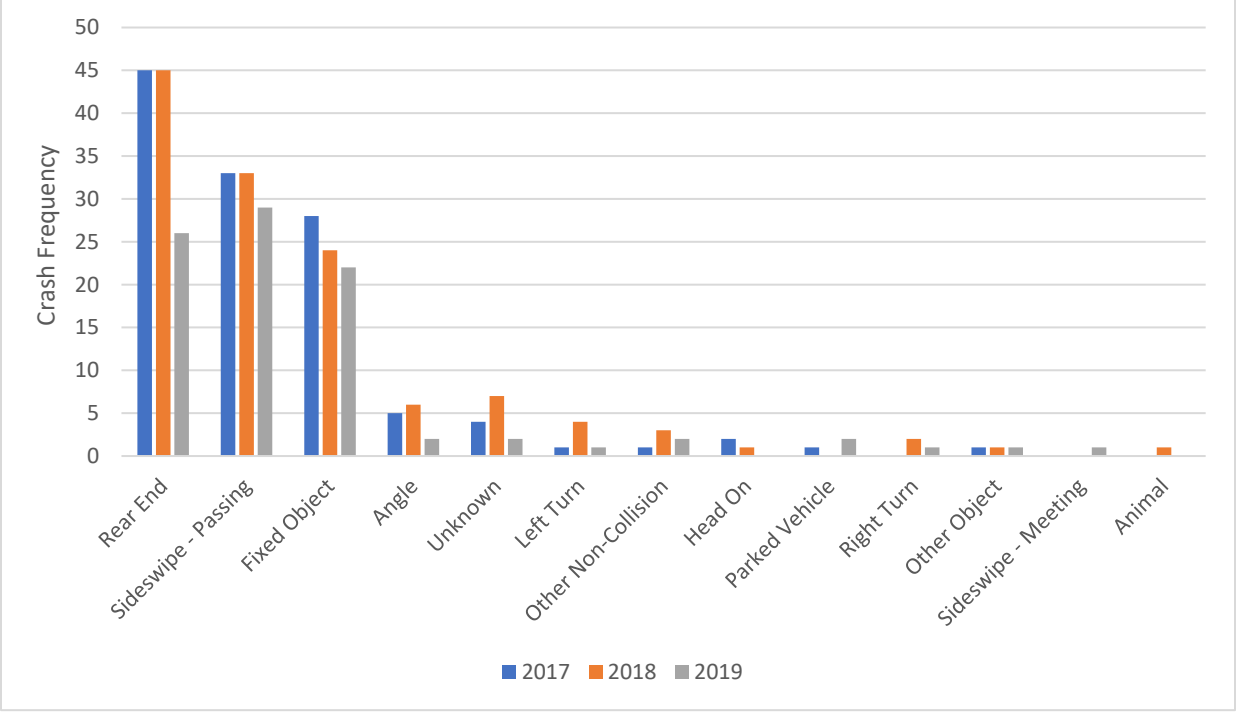
Road Condition	Number	Percent
Dry	57	64.0%
Wet	21	23.6%
Snow	8	9.0%
Ice	2	2.2%
Other/Unknown	1	1.1%
Water (Standing, Moving)	0	0.0%

Table 7 and **Figure 1** below compares crash types across the three years of data.

Table 7 - Crash Type by Year

Crash Type	Percent By Year		
	2017	2018	2019
Rear End	37.2%	35.4%	29.2%
Sideswipe – Passing	27.3%	26.0%	32.6%
Fixed Object	23.1%	18.9%	24.7%
Angle	4.1%	4.7%	2.2%
Unknown	3.3%	5.5%	2.2%
Left Turn	0.8%	3.1%	1.1%
Other Non-Collision	0.8%	2.4%	2.2%
Head On	1.7%	0.8%	0.0%
Parked Vehicle	0.8%	0.0%	2.2%
Right Turn	0.0%	1.6%	1.1%
Other Object	0.8%	0.8%	1.1%
Sideswipe – Meeting	0.0%	0.0%	1.1%
Animal	0.0%	0.8%	0.0%

Figure 1 - Crash Type by Year



Figures 2-3 below further visualize the crash data by year.

Figure 2 - Yearly Comparison of Crashes by Time of Day

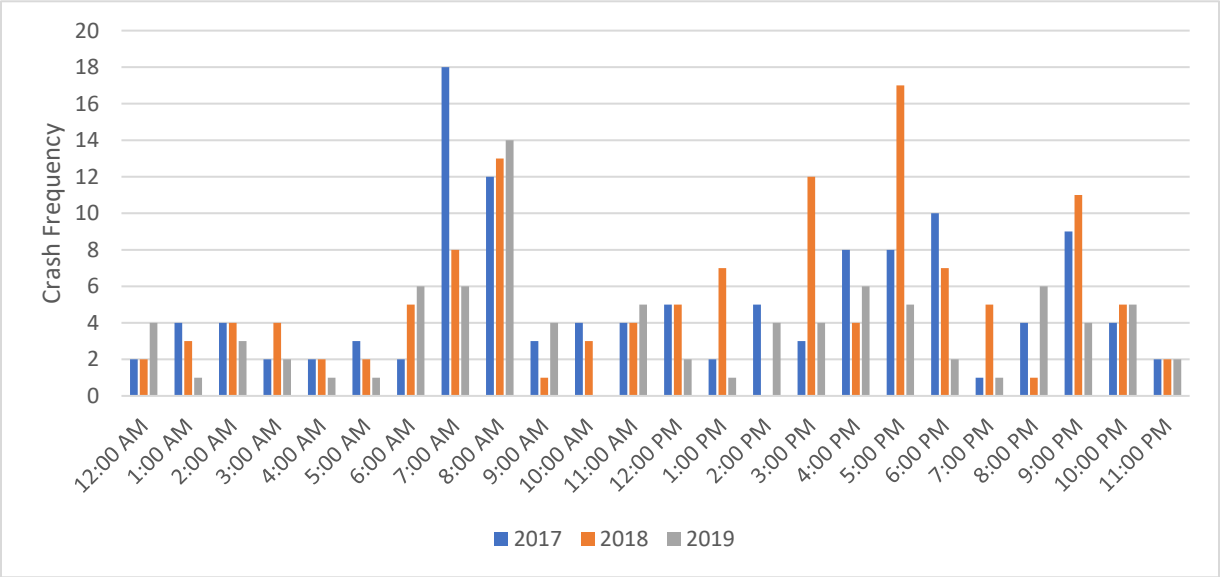
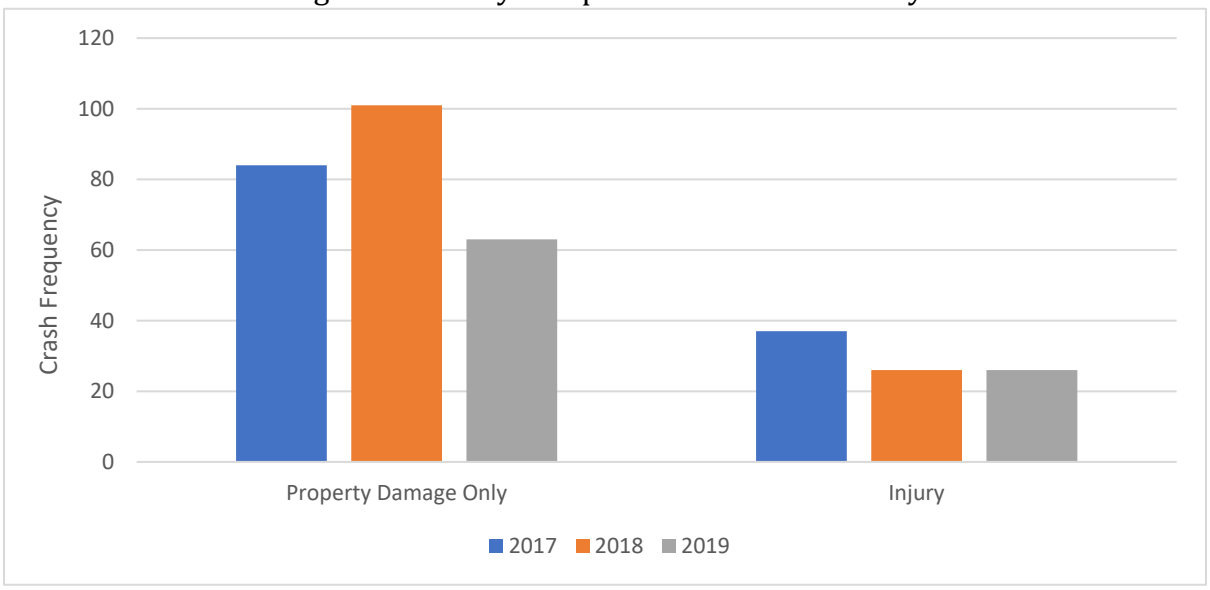


Figure 3 - Yearly Comparison of Crash Severity



Attachment C

Count Data, Growth Rate Outputs, and Volume Calculations

CARPENTER MARTY transportation

Attachment C

Volume Count Report

LOCATION INFO	
Location ID	77518
Type	SPOT
Fnct'l Class	1
Located On	RAMP FROM IR77 NB TO IR490 WB
Direction	RAMP
County	CUYAHOGA
Community	-
MPO ID	
HPMS ID	
Agency	ODOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 12/4/2019
End Date	Thu 12/5/2019
Start Time	10:00:00 AM
End Time	10:00:00 AM
Direction	
Notes	
Station	000775180000
Study	
Speed Limit	
Description	
Sensor Type	Tube Class
Source	
Latitude,Longitude	

INTERVAL:15-MIN

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count
0:00-1:00	35	22	14	16	87
1:00-2:00	16	8	13	8	45
2:00-3:00	9	13	10	6	38
3:00-4:00	14	12	9	10	45
4:00-5:00	17	15	21	25	78
5:00-6:00	27	28	47	49	151
6:00-7:00	56	77	95	109	337
7:00-8:00	118	117	123	115	473
8:00-9:00	100	100	96	98	394
9:00-10:00	104	97	142	128	471
10:00-11:00	101	108	133	127	469
11:00-12:00	108	109	139	132	488
12:00-13:00	113	125	104	141	483
13:00-14:00	148	151	136	150	585
14:00-15:00	192	185	209	239	825
15:00-16:00	279	261	390	347	1,277
16:00-17:00	395	421	440	428	1,684
17:00-18:00	421	421	415	393	1,650
18:00-19:00	320	294	270	183	1,067
19:00-20:00	143	127	107	87	464
20:00-21:00	85	90	79	80	334
21:00-22:00	83	71	59	65	278
22:00-23:00	53	43	47	37	180
23:00-24:00	38	31	22	18	109
Total					12,012
AADT					12,644
AM Peak					11:30-12:30 509
PM Peak					16:15-17:15 1,710

Volume Count Report

LOCATION INFO	
Location ID	75718
Type	SPOT
Fnct'l Class	1
Located On	RAMP FROM IR77 SB TO IR490 WB
Direction	RAMP
County	CUYAHOGA
Community	-
MPO ID	
HPMS ID	
Agency	ODOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 12/4/2019
End Date	Thu 12/5/2019
Start Time	10:00:00 AM
End Time	10:00:00 AM
Direction	
Notes	
Station	
Study	
Speed Limit	
Description	
Sensor Type	Tube Class
Source	
Latitude,Longitude	

INTERVAL:15-MIN

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count
0:00-1:00	17	14	12	15	58
1:00-2:00	14	11	11	4	40
2:00-3:00	4	7	11	7	29
3:00-4:00	9	6	9	4	28
4:00-5:00	9	12	13	9	43
5:00-6:00	13	9	28	25	75
6:00-7:00	23	26	54	53	156
7:00-8:00	45	53	72	76	246
8:00-9:00	71	73	77	71	292
9:00-10:00	60	78	64	67	269
10:00-11:00	61	60	68	63	252
11:00-12:00	82	75	78	89	324
12:00-13:00	105	98	98	98	399
13:00-14:00	100	95	100	119	414
14:00-15:00	146	131	182	158	617
15:00-16:00	187	251	333	309	1,080
16:00-17:00	362	343	392	352	1,449
17:00-18:00	396	311	287	228	1,222
18:00-19:00	178	138	106	102	524
19:00-20:00	74	83	70	88	315
20:00-21:00	59	55	65	61	240
21:00-22:00	47	51	61	34	193
22:00-23:00	47	50	41	23	161
23:00-24:00	15	21	34	21	91
Total					8,517
AADT					8,999
AM Peak					11:45-12:45 390
PM Peak					16:15-17:15 1,483

Volume Count Report

LOCATION INFO	
Location ID	93018
Type	SPOT
Fnct'l Class	1
Located On	TROY LEE JAMES HWY
Loc On Alias	585
Direction	2-WAY
County	Cuyahoga
Community	CLEVELAND
MPO ID	
HPMS ID	
Agency	ODOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Mon 11/5/2018
End Date	Tue 11/6/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	2-WAY
Notes	
Station	0324923
Study	
Speed Limit	
Description	
Sensor Type	Combined Non-Axle Type Counts
Source	
Latitude,Longitude	

INTERVAL:60-MIN	
Time	**Hourly Count**
0:00-1:00	246
1:00-2:00	145
2:00-3:00	127
3:00-4:00	140
4:00-5:00	213
5:00-6:00	431
6:00-7:00	955
7:00-8:00	1,453
8:00-9:00	1,363
9:00-10:00	1,279
10:00-11:00	1,317
11:00-12:00	1,438
12:00-13:00	1,572
13:00-14:00	1,628
14:00-15:00	2,327
15:00-16:00	3,701
16:00-17:00	4,648
17:00-18:00	4,489
18:00-19:00	2,346
19:00-20:00	1,288
20:00-21:00	979
21:00-22:00	763
22:00-23:00	604
23:00-24:00	445
Total	33,897
AADT	33,287
AM Peak	07:00-08:00 1,453
PM Peak	16:00-17:00 4,648

Volume Count Report

LOCATION INFO	
Location ID	75518
Type	SPOT
Fnct'l Class	1
Located On	RAMP FROM IR490 WB TO W 7TH ST
Direction	RAMP
County	CUYAHOGA
Community	-
MPO ID	
HPMS ID	
Agency	ODOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 6/19/2019
End Date	Thu 6/20/2019
Start Time	2:00:00 PM
End Time	2:00:00 PM
Direction	
Notes	
Station	000755180000
Study	
Speed Limit	
Description	
Sensor Type	Tube Class
Source	
Latitude,Longitude	

INTERVAL:15-MIN

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count
0:00-1:00	17	15	16	12	60
1:00-2:00	7	8	9	4	28
2:00-3:00	2	5	3	3	13
3:00-4:00	2	2	5	5	14
4:00-5:00	7	8	6	9	30
5:00-6:00	11	13	15	25	64
6:00-7:00	19	25	30	41	115
7:00-8:00	28	34	38	36	136
8:00-9:00	42	51	51	57	201
9:00-10:00	51	50	59	60	220
10:00-11:00	54	59	54	69	236
11:00-12:00	66	71	80	79	296
12:00-13:00	94	94	99	77	364
13:00-14:00	75	64	47	38	224
14:00-15:00	89	80	66	66	301
15:00-16:00	83	108	81	99	371
16:00-17:00	100	78	104	89	371
17:00-18:00	102	114	104	119	439
18:00-19:00	112	98	79	66	355
19:00-20:00	71	58	84	59	272
20:00-21:00	51	45	48	56	200
21:00-22:00	43	38	45	44	170
22:00-23:00	28	34	33	24	119
23:00-24:00	27	19	27	20	93
Total					4,692
AADT					4,149
AM Peak					11:45-12:45 366
PM Peak					17:15-18:15 449

Volume Count Report

LOCATION INFO	
Location ID	98618
Type	SPOT
Fnct'l Class	1
Located On	RAMP FROM BROADWAY AVE TO IR490 WB
Direction	RAMP
County	CUYAHOGA
Community	-
MPO ID	
HPMS ID	
Agency	ODOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 8/17/2016
End Date	Thu 8/18/2016
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	000986180000
Study	
Speed Limit	
Description	
Sensor Type	Tube Class
Source	
Latitude,Longitude	

INTERVAL:15-MIN

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count
0:00-1:00	35	19	25	14	93
1:00-2:00	21	21	15	14	71
2:00-3:00	15	6	12	13	46
3:00-4:00	26	10	10	8	54
4:00-5:00	7	12	11	17	47
5:00-6:00	49	23	26	35	133
6:00-7:00	37	34	51	67	189
7:00-8:00	90	83	106	104	383
8:00-9:00	88	91	95	75	349
9:00-10:00	84	81	91	86	342
10:00-11:00	88	86	98	101	373
11:00-12:00	91	94	97	94	376
12:00-13:00	110	116	97	122	445
13:00-14:00	97	90	104	111	402
14:00-15:00	119	132	199	184	634
15:00-16:00	226	226	255	259	966
16:00-17:00	242	251	303	272	1,068
17:00-18:00	286	278	254	255	1,073
18:00-19:00	179	137	94	75	485
19:00-20:00	76	81	71	77	305
20:00-21:00	69	85	68	45	267
21:00-22:00	54	68	51	40	213
22:00-23:00	46	33	41	58	178
23:00-24:00	72	46	46	27	191
Total					8,683
AADT					7,902
AM Peak					11:30-12:30 417
PM Peak					16:30-17:30 1,139

TFMS - Segment Forecast Report

Forecast Summary

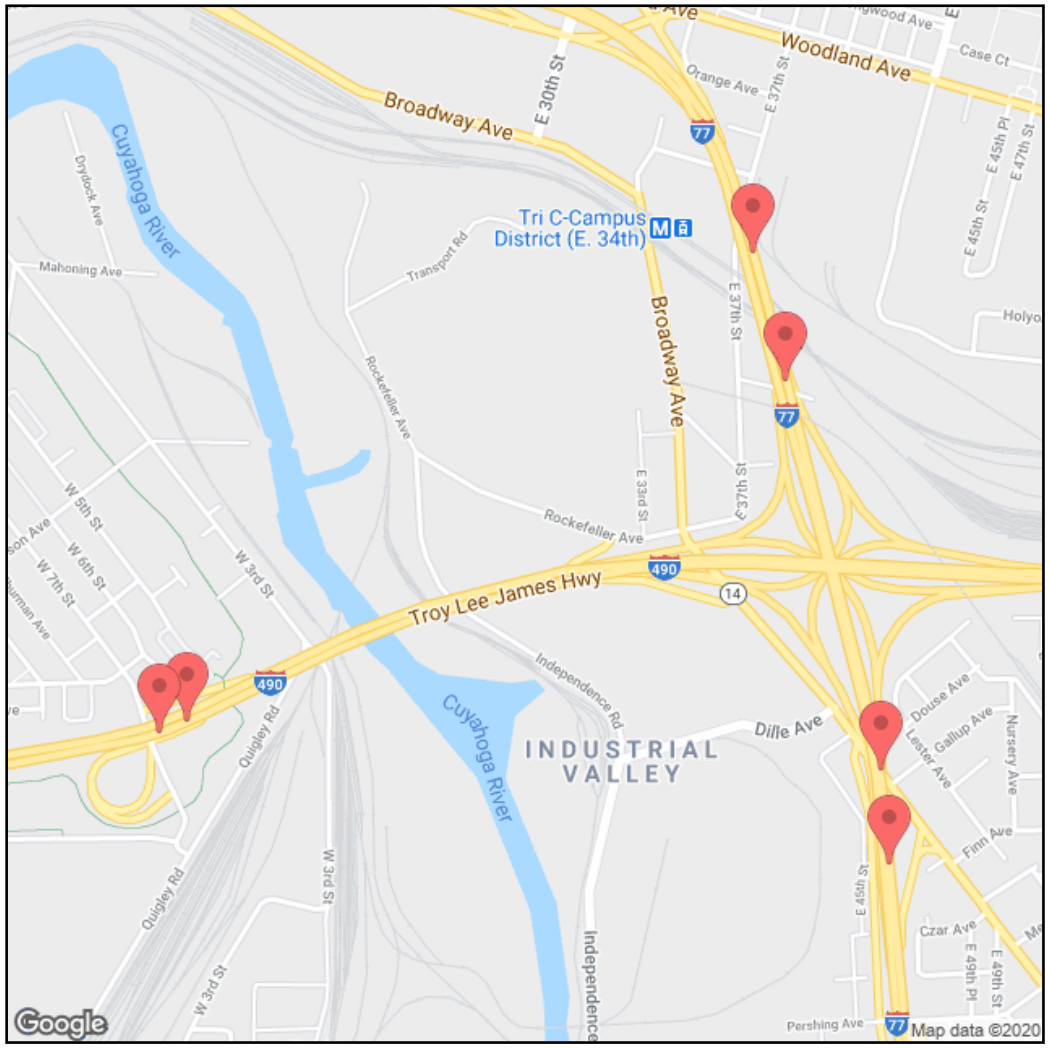
Project ID	Opening Year	Design Year
	2025	2045

Project Description:

*Users of this data need to be aware that there are limitations to the forecasts generated by this product that make it suitable only for roadway design projects which are low risk.

Segment ID	LRS ID	BMP	EMP	Length	2025 AADT	2045 AADT	DHV-30	K%	D%	T24%	TD%
63114396	SCUYIR00077**C	14.680	14.970	0.290	94,500	143,000	14,500	10.0	58.6	7	4
63114395	SCUYIR00077**C	14.610	14.680	0.070	55,000	58,000	5,800	10.0	55.6	11	6
63114388	SCUYIR00077**C	14.080	14.090	0.010	55,000	58,000	7,000	12.0	100.0	11	9
63114387	SCUYIR00077**C	13.840	14.080	0.240	94,000	113,000	11,500	10.0	51.6	5	3
63114949	SCUYIR00490**C	0.960	1.000	0.040	90,500	123,000	11,000	9.0	50.7	8	4
63114948	SCUYIR00490**C	0.920	0.960	0.040	60,500	80,000	7,200	9.0	50.7	8	4

TFMS - Segment Forecast Report



TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114396	SCUYIR00077**C	14.680	14.970

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2040	10.0	7	122,000	Average	3.100	3.000
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
130,800	58.6	4	8,800	Model	5.400	4.000

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114396	SCUYIR00077**C	14.680	14.970

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Regression

Method Number	PA AADT	BC AADT	AADT
2	76,091	4,074	80,165

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
49279	182053	1942	13063	2040

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	0.38	-0.29	0	0	82,297	4,628	81,226	4,501
2	0.06	-0.71	5	5	73,828	3,923	76,091	4,074
3	1.00	0.36	0	0	93,964	5,428	90,928	5,166
4	0.60	-0.15	5	5	84,400	4,618	84,735	4,642
5	0.85	0.36	0	0	91,323	5,421	88,595	5,160
6	0.48	-0.12	5	5	82,225	4,647	82,805	4,668

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114396	SCUYIR00077**C	14.680	14.970

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	-52,950	195,116	-6,867	13,063	6.77	8.21
2	RAT	0.60	149,203	0.41	8,194	4.17	3.37
3	MRAT	1.87	170,526	1.71	10,214	5.40	5.38
4	RAF		182,821		11,638	6.09	6.79

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Model Ratio	6.200	5.400

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
141009	182053	8194	13063	149203	195116

TFMS - Segment Forecast Report

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114396	SCUYIR00077**C	14.680	14.970

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Historical Count

Year	All	Cars	Trucks
2003	80,490	75,100	5,390
2008	73,960	69,100	4,860
2010	77,270	72,400	4,870
2013	75,350	70,601	4,749
2016	87,204	81,708	5,496
2019	79,911	75,116	4,795

TFMS - Segment Forecast Report

Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2045 AADT	DHV30	K %	D %	T24 %	TD %
63114396	SCUYIR00077**C	14.680	14.970	0.290	94,500	143,000	14500	10.0	58.6	7	4

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114395	SCUYIR00077**C	14.610	14.680

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2040	10.0	11	51,000	Average	-0.600	0.000
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
57,000	55.6	6	6,000	Model	4.600	4.000

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114395	SCUYIR00077**C	14.610	14.680

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Regression

Method Number	PA AADT	BC AADT	AADT
1	-28,021	-5,622	-33,643

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
-113799	125560	-14121	8678	2040

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	-7.37	-12.96	0	0	-25,139	-5,309	-28,021	-5,622
2	-7.62	-11.54	4	2	-31,144	-4,349	-30,710	-4,644
3	-8.92	-16.55	0	0	-45,233	-8,263	-44,730	-8,078
4	-8.86	-18.98	4	3	-46,916	-9,996	-44,050	-9,742
5	-8.84	-12.64	0	0	-44,227	-5,233	-43,841	-5,401
6	-7.88	-11.39	4	4	-35,371	-4,497	-33,509	-4,543

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114395	SCUYIR00077**C	14.610	14.680

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	-47,370	134,238	-6,102	8,678	6.93	7.90
2	RAT	0.53	97,074	0.35	5,149	3.79	2.75
3	MRAT	1.78	113,413	1.58	6,442	5.19	4.64
4	RAF		123,826		7,560	6.06	6.27

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Model Ratio	6.200	4.600

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
91925	125560	5149	8678	97074	134238

TFMS - Segment Forecast Report

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114395	SCUYIR00077**C	14.610	14.680

User Name: Chelsea.Cousins

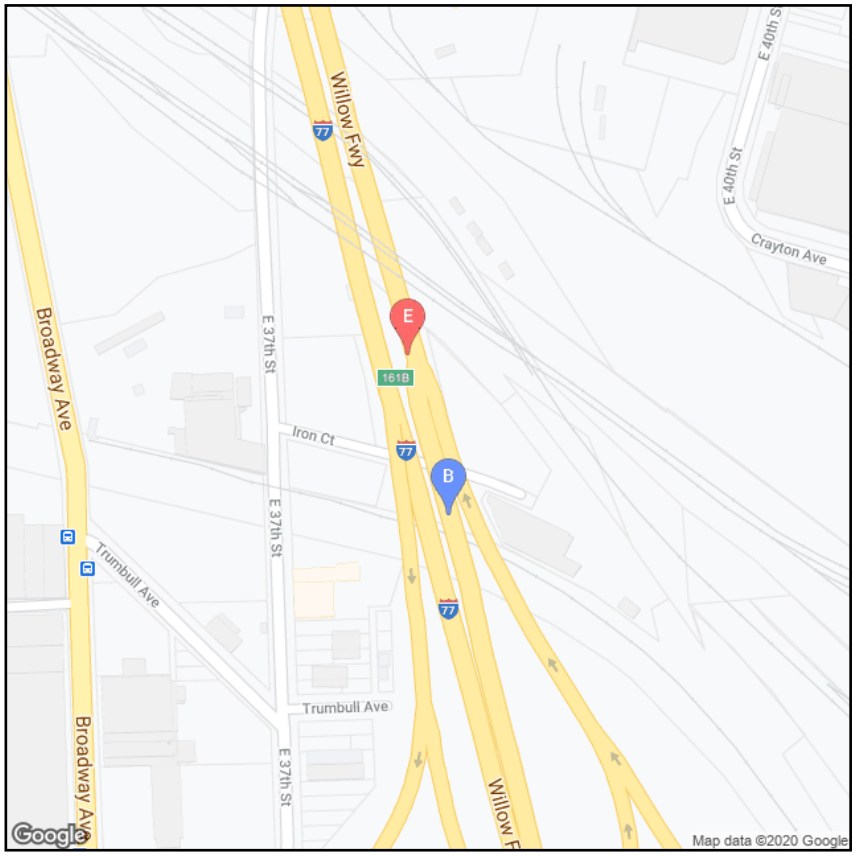
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Historical Count

Year	All	Cars	Trucks
2003	117,620	108,180	9,440
2008	111,040	101,140	9,900
2010	93,110	86,480	6,630
2013	94,980	88,217	6,763
2016	63,063	58,572	4,491
2019	54,397	51,135	3,262

TFMS - Segment Forecast Report



Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2045 AADT	DHV30	K %	D %	T24 %	TD %
63114395	SCUYIR00077**C	14.610	14.680	0.070	55,000	58,000	5800	10.0	55.6	11	6

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114388	SCUYIR00077**C	14.080	14.090

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2040	12.0	10	51,000	Average	-1.900	0.000
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
57,000	100.0	8	6,000	Model	4.000	4.000

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114388	SCUYIR00077**C	14.080	14.090

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Regression

Method Number	PA AADT	BC AADT	AADT
1	-28,021	-5,622	-33,643

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
-113799	91675	-14121	6291	2040

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	-7.37	-12.96	0	0	-25,139	-5,309	-28,021	-5,622
2	-7.62	-11.54	4	2	-31,144	-4,349	-30,710	-4,644
3	-8.92	-16.55	0	0	-45,233	-8,263	-44,730	-8,078
4	-8.86	-18.98	4	3	-46,916	-9,996	-44,050	-9,742
5	-8.84	-12.64	0	0	-44,227	-5,233	-43,841	-5,401
6	-7.88	-11.39	4	4	-35,371	-4,497	-33,509	-4,543

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114388	SCUYIR00077**C	14.080	14.090

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	3,953	93,878	-1,596	6,291	3.39	4.42
2	RAT	1.08	96,971	0.67	5,296	3.77	2.96
3	MRAT	1.78	95,613	1.62	5,678	3.61	3.52
4	RAF		94,745		5,984	3.50	3.97

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Average	3.500	4.000

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
87587	91675	5296	6291	92883	97966

TFMS - Segment Forecast Report

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114388	SCUYIR00077**C	14.080	14.090

User Name: Chelsea.Cousins

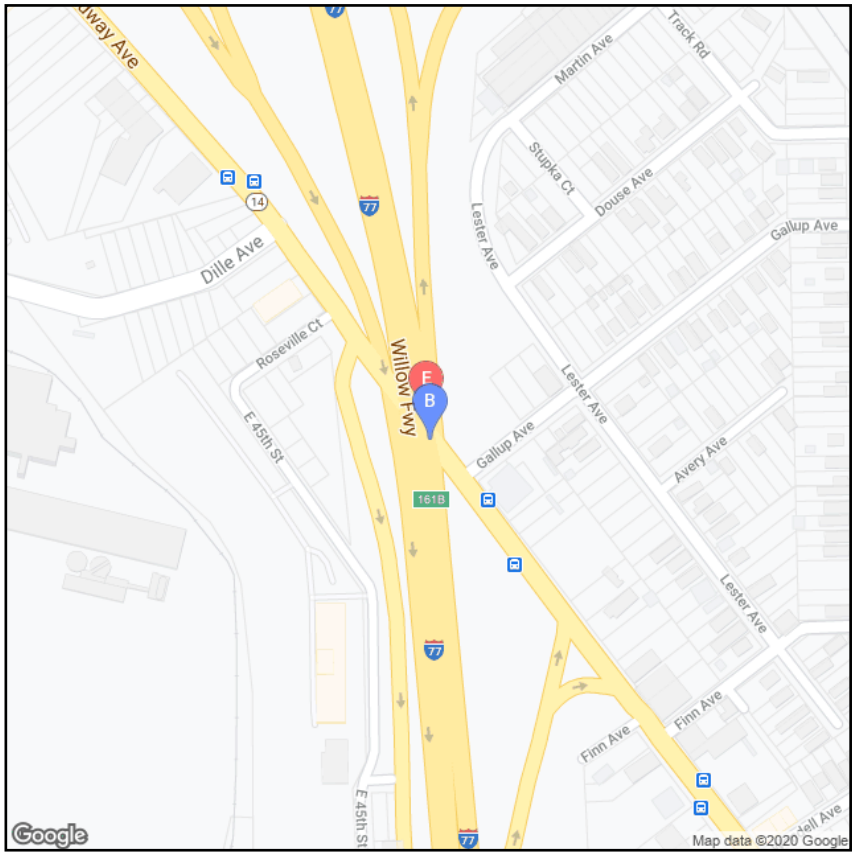
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Historical Count

Year	All	Cars	Trucks
2003	117,620	108,180	9,440
2008	111,040	101,140	9,900
2010	93,110	86,480	6,630
2013	94,980	88,217	6,763
2016	63,063	58,572	4,491
2019	54,397	51,135	3,262

TFMS - Segment Forecast Report



Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2045 AADT	DHV30	K %	D %	T24 %	TD %
63114388	SCUYIR00077**C	14.080	14.090	0.010	55,000	58,000	7000	12.0	100.0	11	9

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114387	SCUYIR00077**C	13.840	14.080

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2040	10.0	5	103,000	Average	1.100	1.100
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
108,300	51.6	3	5,300	Average	-1.100	0.000

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114387	SCUYIR00077**C	13.840	14.080

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Regression

Method Number	PA AADT	BC AADT	AADT
2	46,733	-1,042	45,691

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
26682	166930	-7328	11836	2040

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	-1.99	-5.11	0	0	45,848	305	48,409	-396
2	-2.09	-5.69	3	5	45,041	-761	46,733	-1,042
3	-1.46	-5.62	0	0	57,005	-378	57,686	-964
4	-1.83	-6.42	3	5	50,219	-1,758	51,172	-1,857
5	-0.76	-4.89	0	0	70,860	547	69,927	-147
6	-0.65	-5.65	4	5	72,610	-785	71,968	-994

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114387	SCUYIR00077**C	13.840	14.080

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	-53,818	178,766	-8,051	11,836	4.77	5.82
2	RAT	0.62	144,748	0.40	7,914	3.05	2.31
3	MRAT	1.63	157,923	1.49	9,199	3.73	3.46
4	RAF		168,345		10,518	4.25	4.64

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Model Ratio	4.300	3.500

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
136834	166930	7914	11836	144748	178766

TFMS - Segment Forecast Report

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114387	SCUYIR00077**C	13.840	14.080

User Name: Chelsea.Cousins

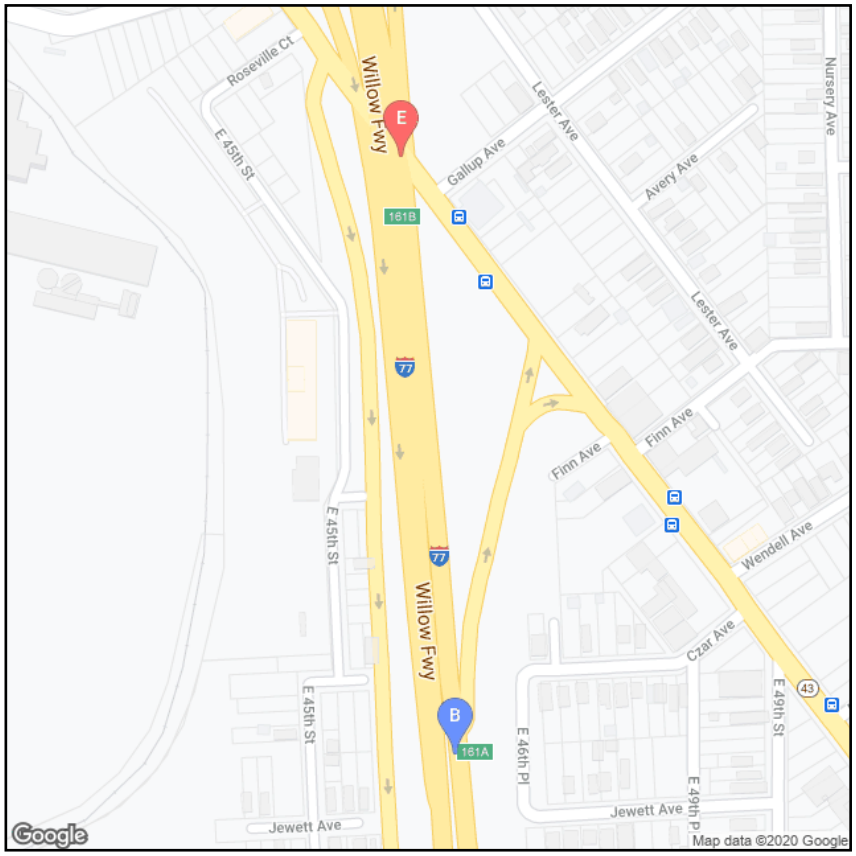
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Historical Count

Year	All	Cars	Trucks
2003	121,020	110,850	10,170
2008	109,640	100,170	9,470
2010	96,390	88,570	7,820
2013	98,140	90,178	7,962
2016	94,242	86,597	7,645
2019	88,687	83,365	5,322

TFMS - Segment Forecast Report



Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2045 AADT	DHV30	K %	D %	T24 %	TD %
63114387	SCUYIR00077**C	13.840	14.080	0.240	94,000	113,000	11500	10.0	51.6	5	3

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114949	SCUYIR00490**C	0.960	1.000

User Name: Chelsea.Cousins
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Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2040	9.0	8	107,000	Model	2.000	2.000
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
115,700	50.7	4	8,700	Model	2.300	2.300

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114949	SCUYIR00490**C	0.960	1.000

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Regression

Method Number	PA AADT	BC AADT	AADT
2	117,267	7,802	125,069

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
77414	138341	5462	10876	2040

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	1.68	1.95	0	0	99,570	7,896	101,491	8,207
2	2.68	1.62	1	2	118,543	7,498	117,267	7,802
3	2.68	3.43	0	0	118,543	10,072	117,267	10,016
4	2.49	3.60	5	3	113,972	10,281	114,307	10,217
5	2.76	3.15	0	0	119,979	9,687	118,536	9,676
6	2.58	3.05	5	4	115,590	9,581	115,743	9,553

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114949	SCUYIR00490**C	0.960	1.000

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	-26,485	118,722	-2,260	8,968	2.20	2.57
2	RAT	0.75	109,358	0.72	8,086	1.66	1.85
3	MRAT	1.35	111,804	1.39	8,333	1.80	2.05
4	RAF		115,263		8,651	2.00	2.31

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Average	2.000	2.300

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
101272	109754	8086	8968	109358	118722

TFMS - Segment Forecast Report

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114949	SCUYIR00490**C	0.960	1.000

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Historical Count

Year	All	Cars	Trucks
2003	63,010	58,660	4,350
2008	58,080	54,520	3,560
2010	61,890	57,660	4,230
2013	67,320	62,719	4,601
2016	78,345	72,991	5,354
2019	80,795	74,978	5,817

TFMS - Segment Forecast Report

Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2045 AADT	DHV30	K %	D %	T24 %	TD %
63114949	SCUYIR00490**C	0.960	1.000	0.040	90,500	123,000	11000	9.0	50.7	8	4

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114948	SCUYIR00490**C	0.920	0.960

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2040	9.0	8	69,000	Average	1.700	1.700
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
74,900	50.7	4	5,900	Model	2.400	2.400

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114948	SCUYIR00490**C	0.920	0.960

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Regression

Method Number	PA AADT	BC AADT	AADT
2	58,326	6,682	65,008

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
3914	114328	1698	9074	2040

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	1.37	3.03	0	0	72,218	6,320	65,662	6,468
2	0.69	3.29	5	3	60,550	6,486	58,326	6,682
3	1.20	2.57	0	0	69,991	5,873	63,747	6,084
4	0.47	3.16	5	3	57,852	6,361	56,022	6,572
5	0.52	1.97	0	0	61,726	5,306	56,516	5,588
6	-0.19	1.48	5	4	49,587	4,956	48,791	5,179

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114948	SCUYIR00490**C	0.920	0.960

User Name: Chelsea.Cousins
10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	-52,422	92,785	-4,128	7,100	3.25	3.79
2	RAT	0.51	74,252	0.49	5,489	1.67	1.85
3	MRAT	1.35	79,092	1.39	5,941	2.08	2.40
4	RAF		85,939		6,520	2.66	3.10

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Model Ratio	2.700	2.400

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
68763	85685	5489	7100	74252	92785

TFMS - Segment Forecast Report

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

TFMS - Segment Forecast Report

Forecast Segment ID	Route	BMP	EMP
63114948	SCUYIR00490**C	0.920	0.960

User Name: Chelsea.Cousins

10/16/2020 9:40:36 AM

Script Import Date	Script Version	Model Version
4/14/2020 5:30:19 PM	2020.001	2020.1900

Historical Count

Year	All	Cars	Trucks
2006	49,166	47,160	2,006
2007	50,126	47,750	2,376
2010	54,330	51,020	3,310
2013	57,490	54,700	2,790
2016	66,258	63,043	3,215
2019	54,858	50,909	3,949

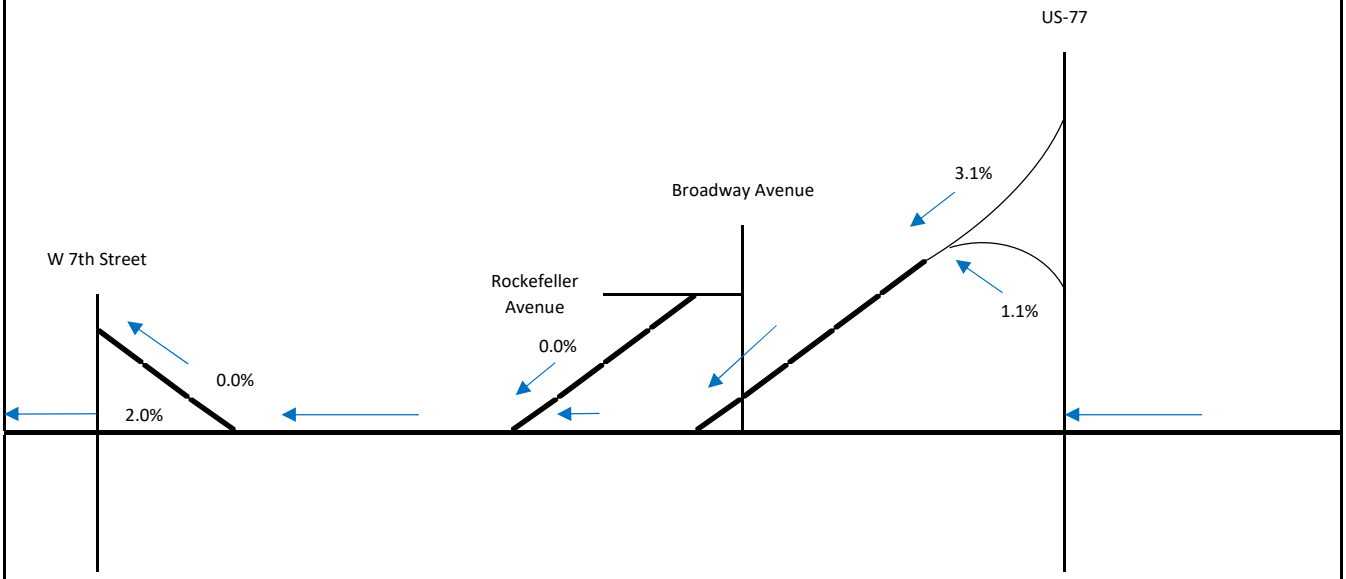
TFMS - Segment Forecast Report

Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2045 AADT	DHV30	K %	D %	T24 %	TD %
63114948	SCUYIR00490**C	0.920	0.960	0.040	60,500	80,000	7200	9.0	50.7	8	4

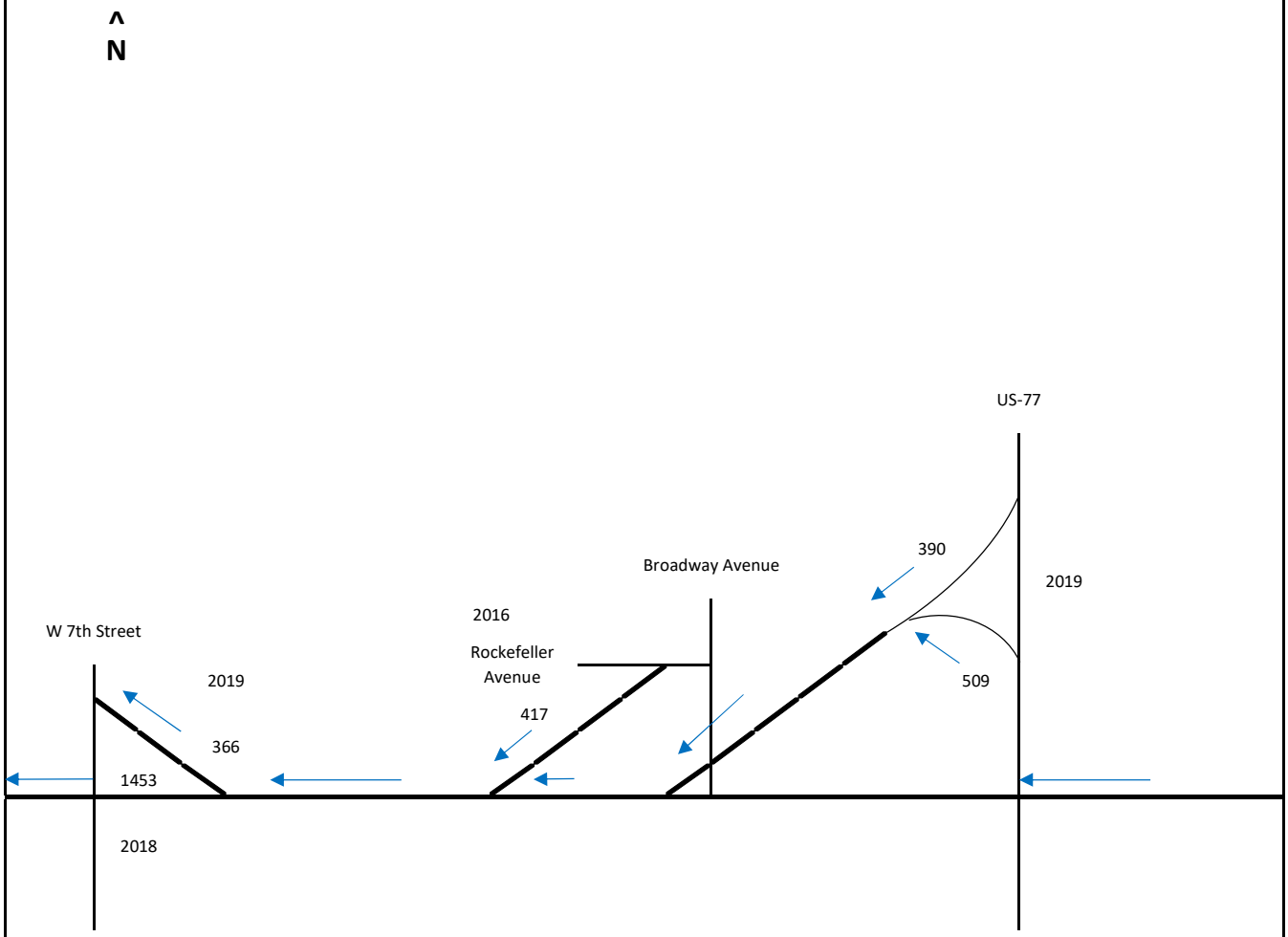
CARPENTER MARTY transportation	Year	Period	Scenario	Plate
			Growth Rates*	

^
N

* Growth rates for IR-490 and IR-77 were taken from the ODOT TFMS database. Gorwth Rates of 0% were assumed for the Rockefeller Avenue and W 7th Street ramps.



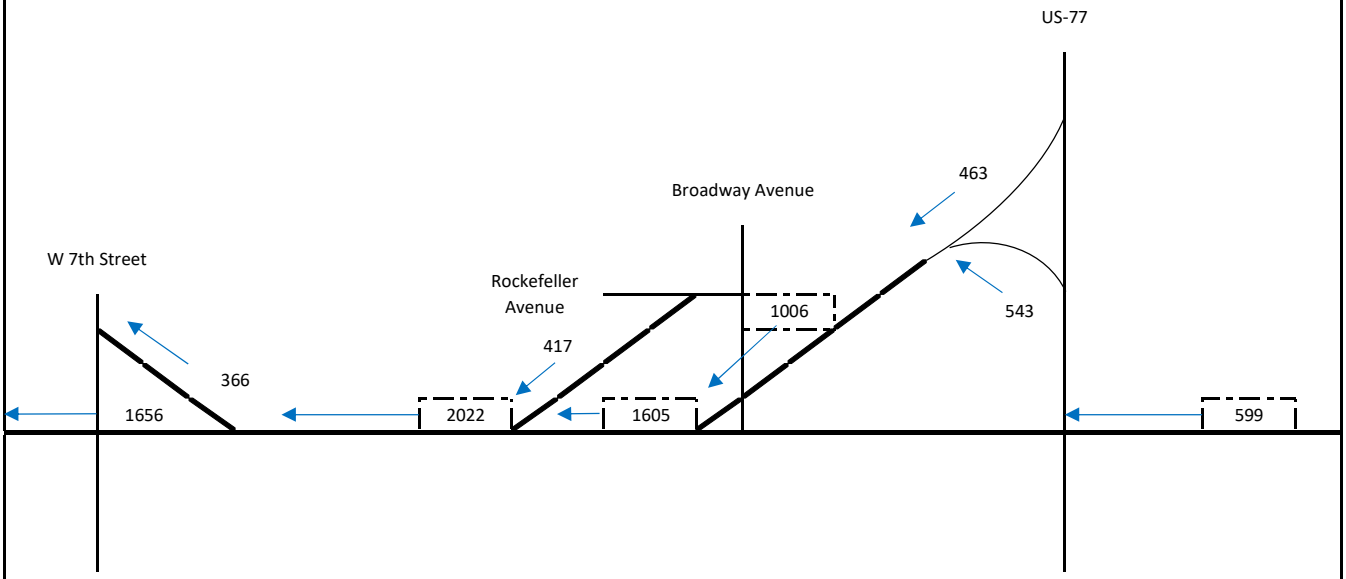
Year	Period	Scenario	Plate
Varies	AM	Count Data	



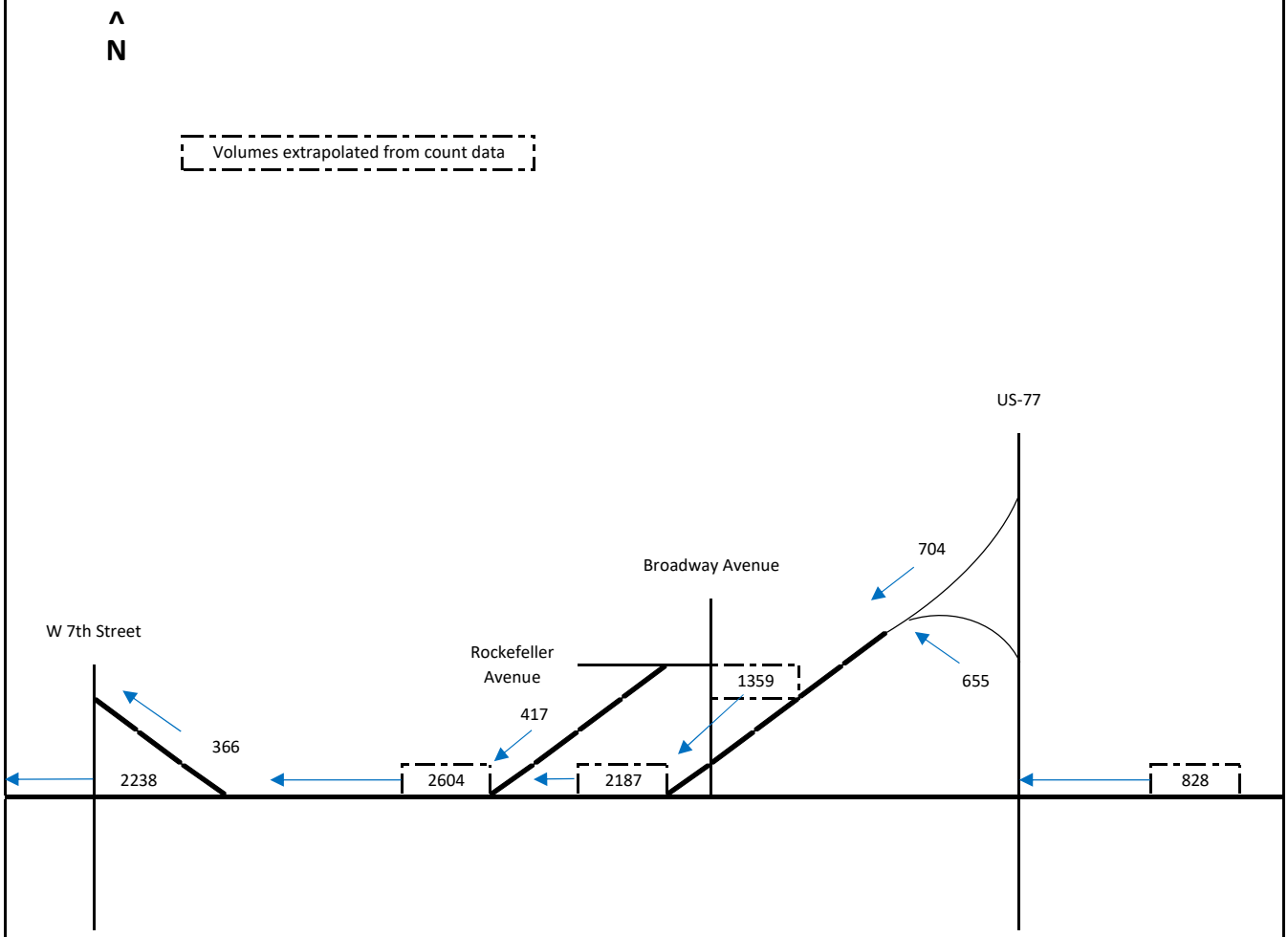
Year	Period	Scenario	Plate
2025	AM	Count Data	

^
N

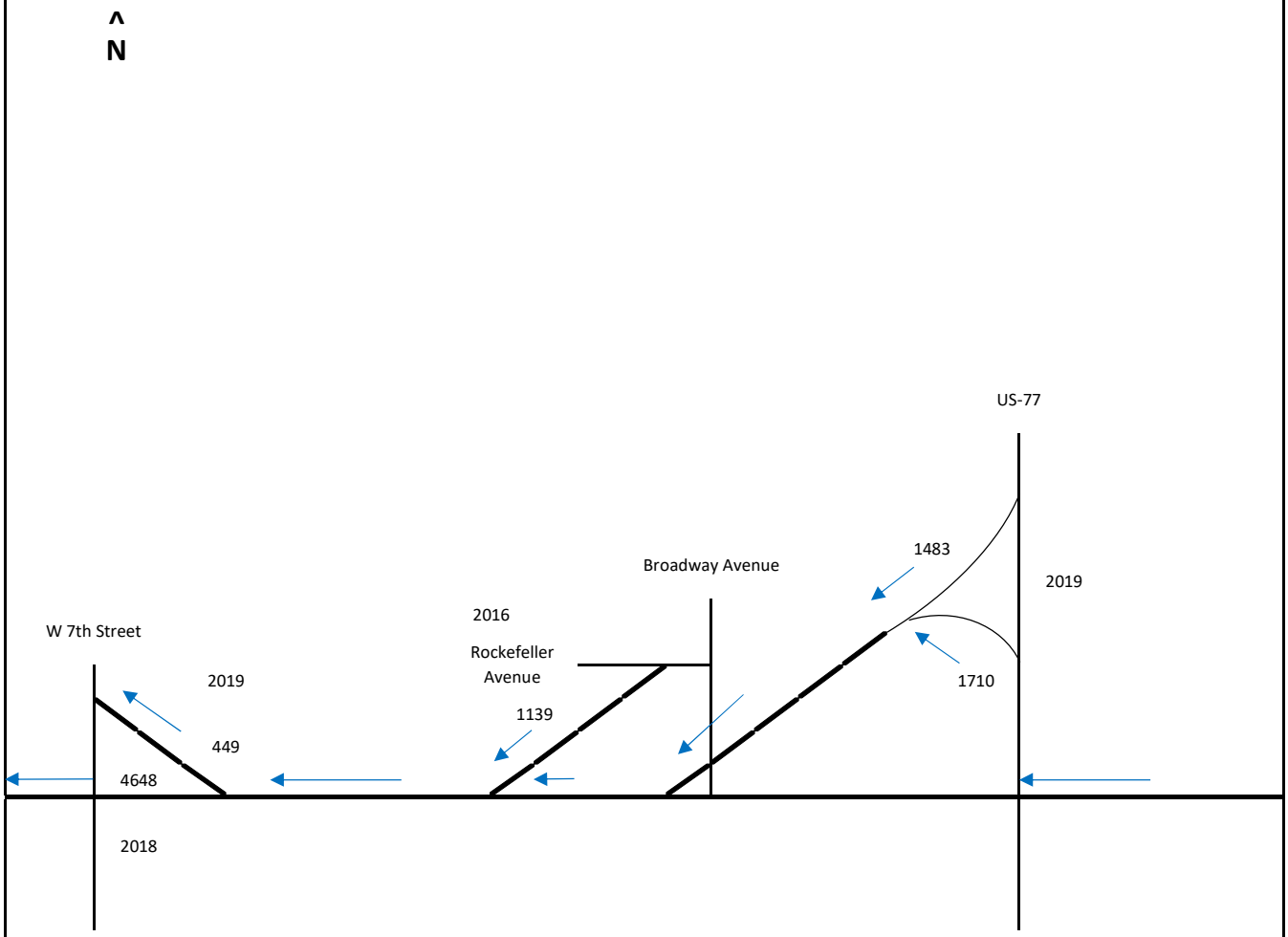
Volumes extrapolated from count data



Year	Period	Scenario	Plate
2045	AM	Count Data	



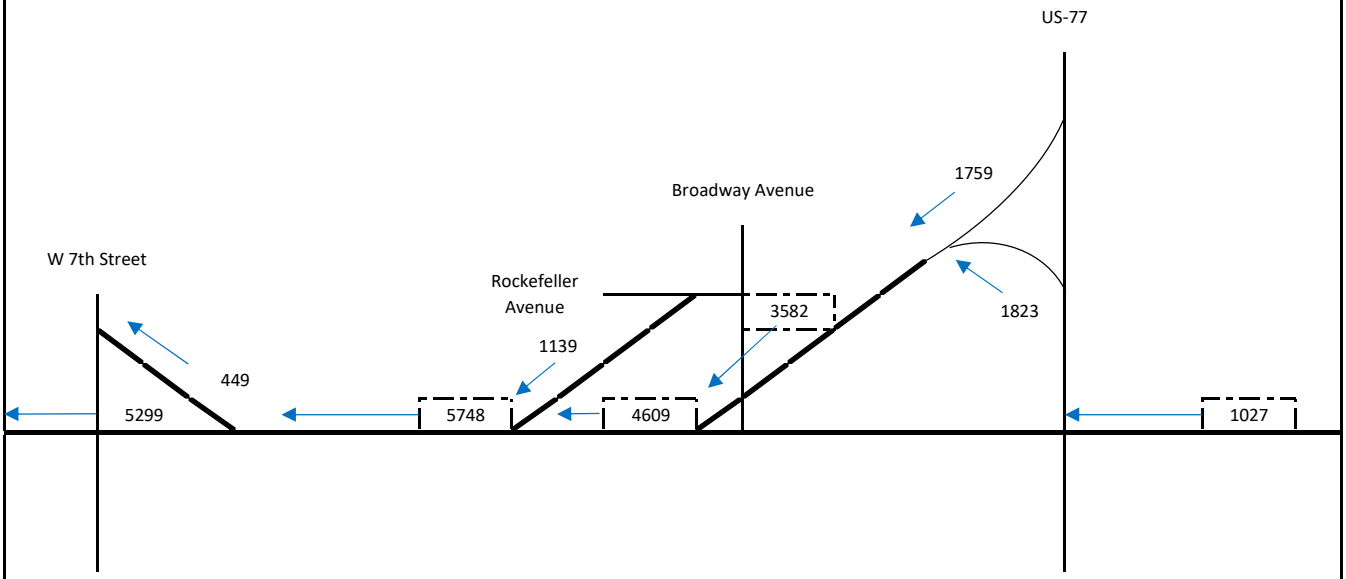
Year	Period	Scenario	Plate
Varies	PM	Count Data	



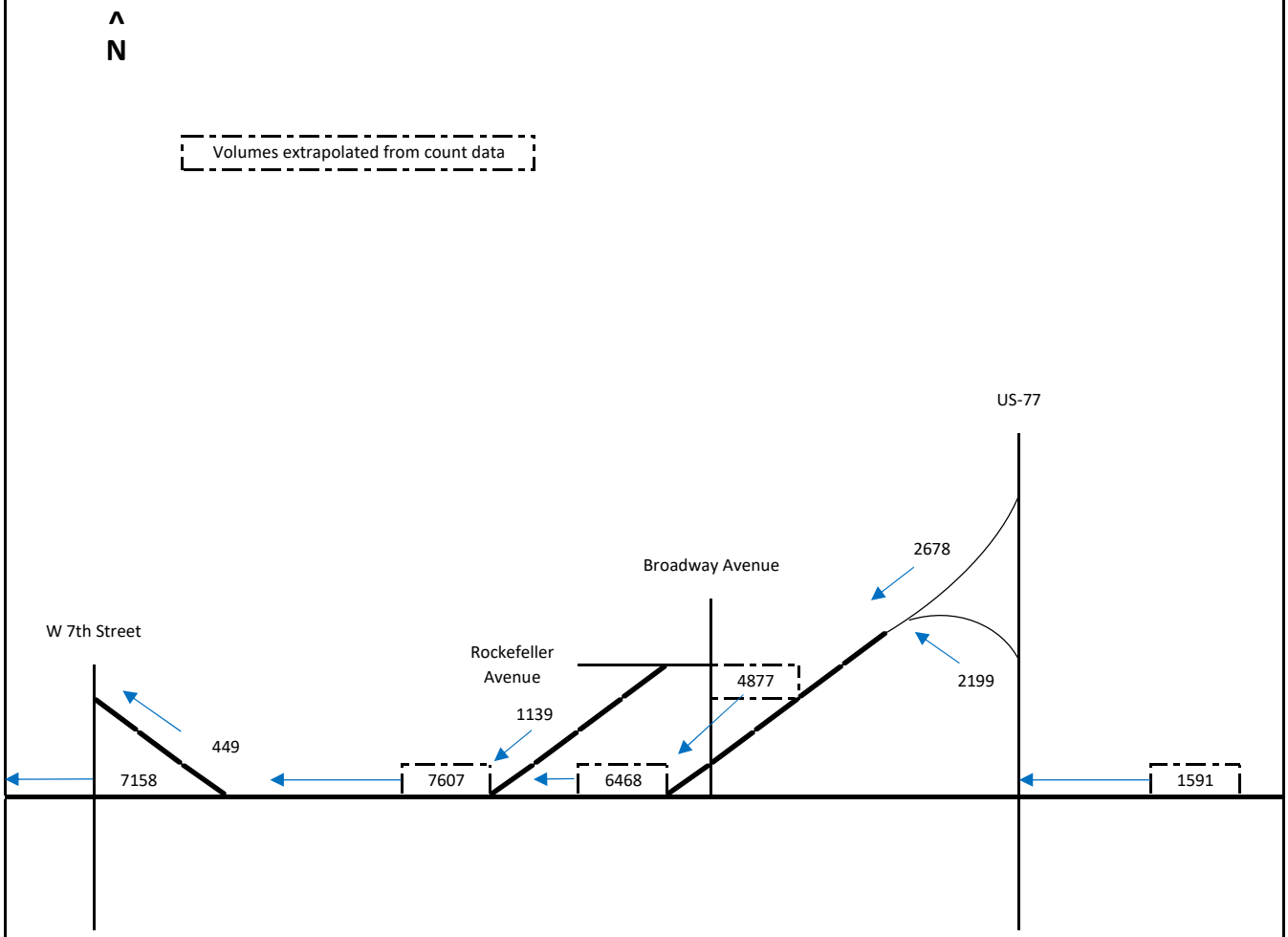
CARPENTER MARTY transportation	Year	Period	Scenario	Plate
	2025	PM	Count Data	

^
N

Volumes extrapolated from count data



Year	Period	Scenario	Plate
2045	PM	Count Data	



Attachment D
Existing Conditions
& Planned Future
Capacity Analysis

CARPENTER MARTY transportation

Attachment D

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	1.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	2
3	Merge	Basic	IR-77 Ramps Merge with IR-490 WB	280	3
4	Merge	Basic	Rockefeller Ave to IR-490 WB Merge	1500	4
5	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	493	4400	0.11	43.2	5.7	A

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1071	578	4400	2100	0.24	0.28	44.6	45.0	11.9	11.9	B

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1707	637	6600	2200	0.26	0.29	44.9	45.0	12.6	12.6	B

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2151	444	9400	2100	0.23	0.21	60.2	65.0	8.3	8.3	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2151	9328	0.23	63.2	8.5	A

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	59.6	8.7	8.7	1.70	A

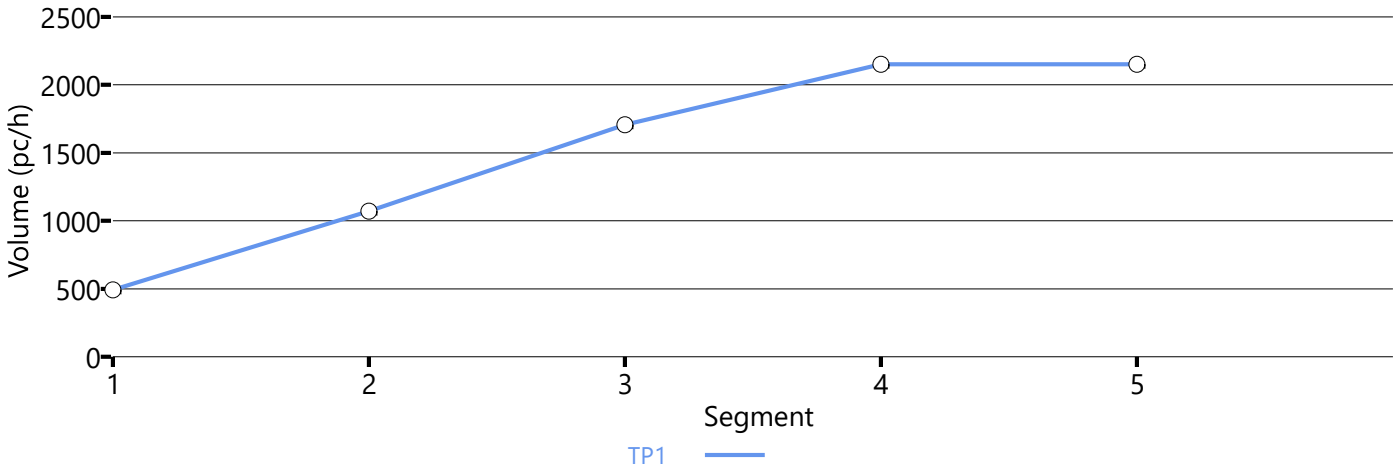
Facility Overall Results

Space Mean Speed, mi/h	59.6	Density, veh/mi/ln	8.7
Average Travel Time, min	1.70	Density, pc/mi/ln	8.7

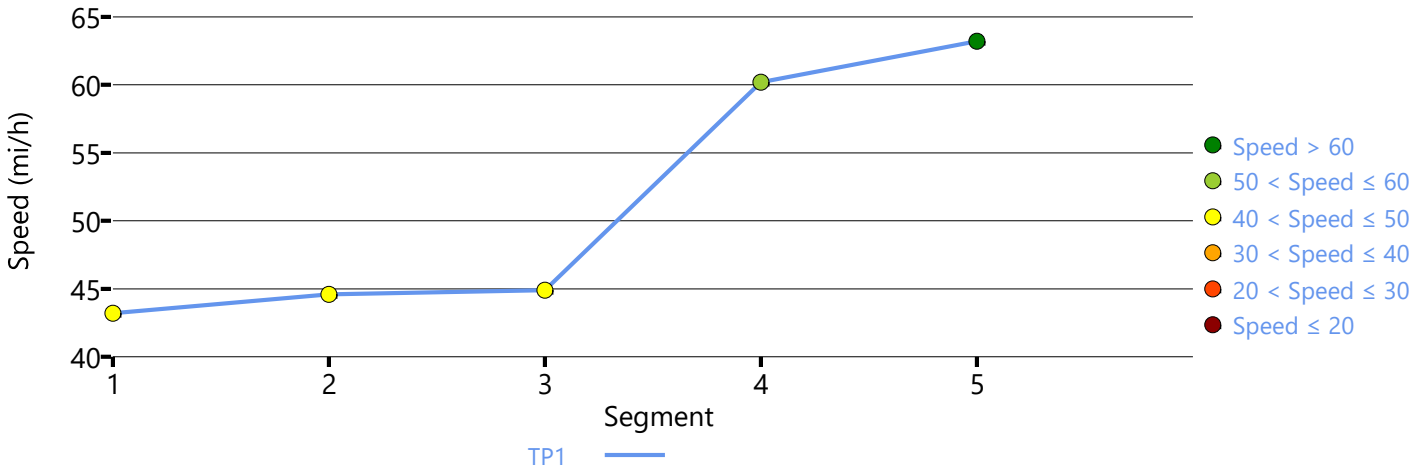
Messages

Comments

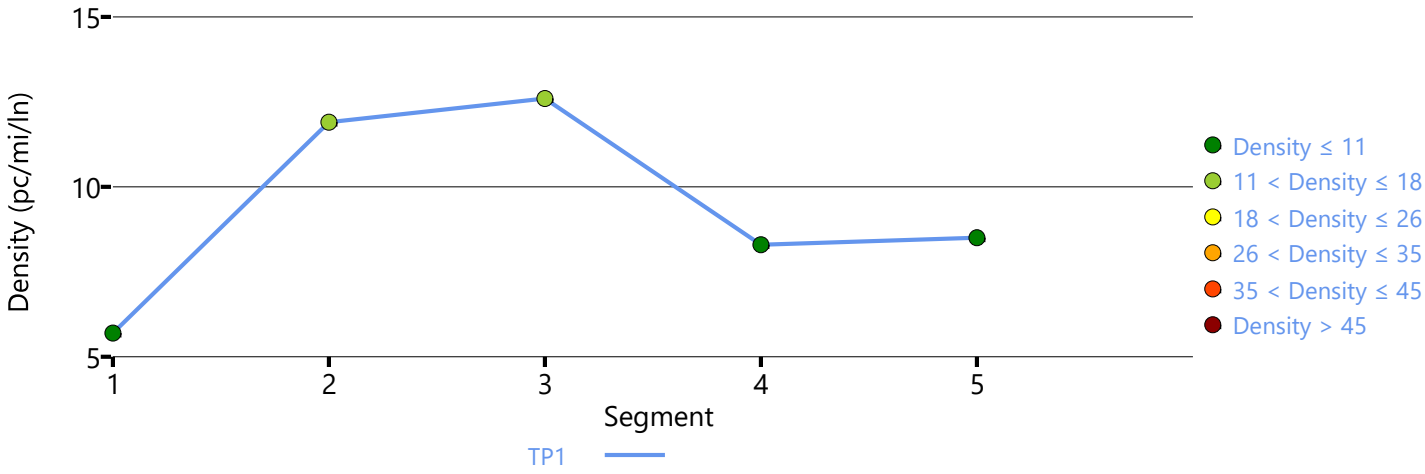
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	463	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	246
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.11
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	5.7
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	463	543
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	493	578
Capacity (c), pc/h	4400	2100
Volume-to-Capacity Ratio (v/c)	0.24	0.28

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 1 and 2 (v12), pc/h	0	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	0	Average Density (D), pc/mi/ln	11.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	11.9

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1006	599
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1070	637
Capacity (c), pc/h	6600	2200
Volume-to-Capacity Ratio (v/c)	0.26	0.29

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 2 and 3 (v23), pc/h	0	Ramp Junction Speed (S), mi/h	44.9
Flow Entering Ramp-Infl. Area (vR23), pc/h	0	Average Density (D), pc/mi/ln	12.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	12.6

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1605	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1707	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.23	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	65.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 1 and 2 (v12), pc/h	0	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	0	Average Density (D), pc/mi/ln	8.3
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	8.3

HCS7 Basic Freeway Report

Project Information

Segment Number	5	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2022	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	538
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.23
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	8.5
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	1.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	2
3	Merge	Basic	IR-77 Ramps Merge with IR-490 WB	280	3
4	Merge	Basic	Rockefeller Ave to IR-490 WB Merge	1500	4
5	Basic	Basic	IR-490	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1871	4400	0.43	43.2	21.7	C

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	3810	1939	4400	2100	0.87	0.92	44.6	45.0	42.3	42.3	E

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4904	1093	6600	2200	0.74	0.50	44.9	45.0	36.3	36.3	E

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	6115	1212	9400	2100	0.65	0.58	60.2	64.8	23.6	23.6	C

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	6115	9328	0.66	63.2	24.2	C

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	59.1	25.5	25.5	1.70	C

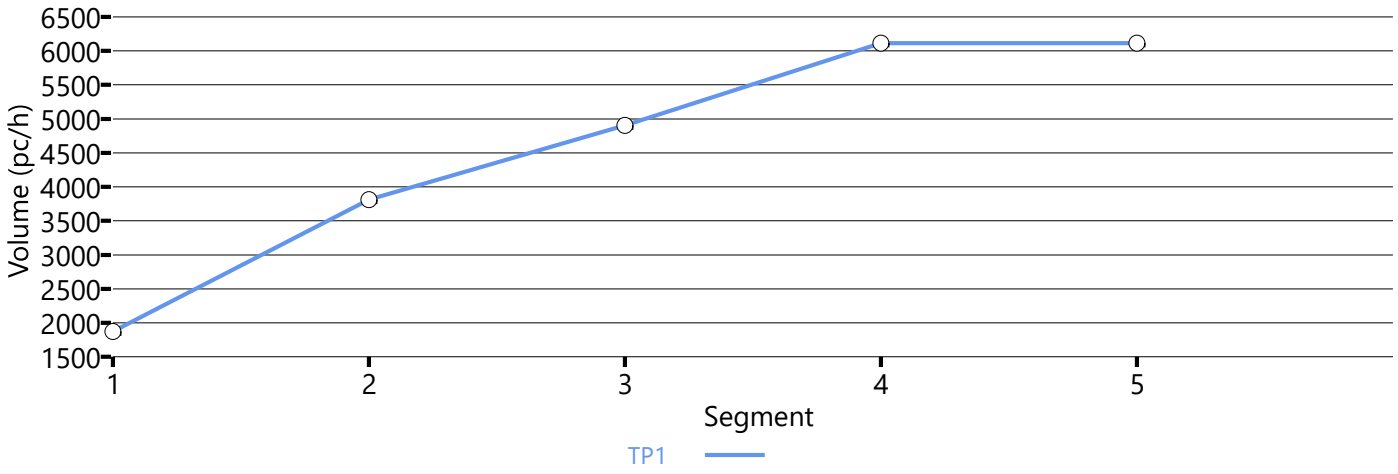
Facility Overall Results

Space Mean Speed, mi/h	59.1	Density, veh/mi/ln	25.5
Average Travel Time, min	1.70	Density, pc/mi/ln	25.5

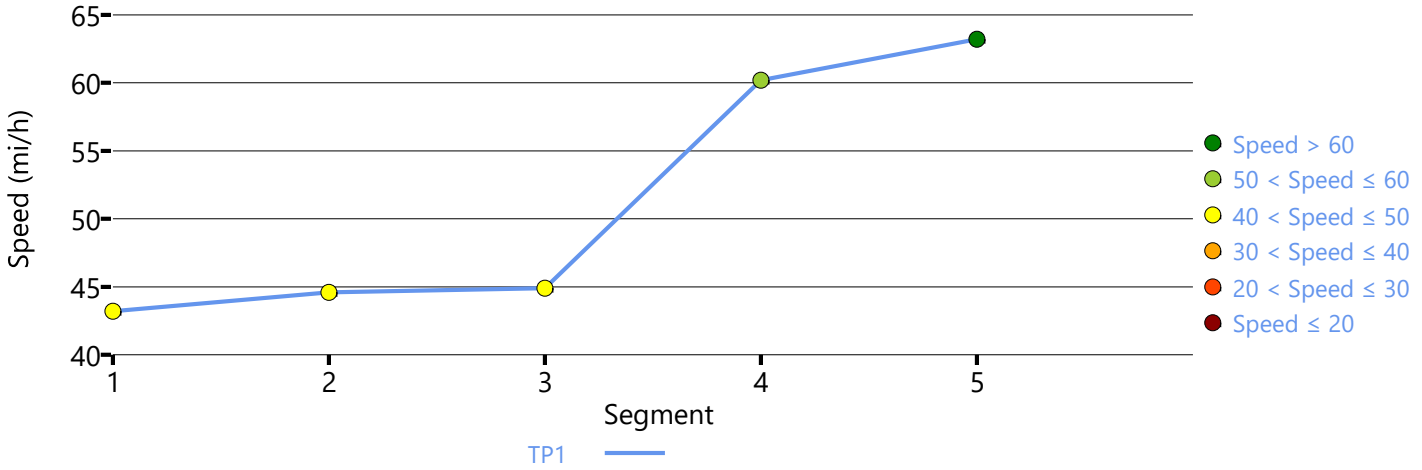
Messages

Comments

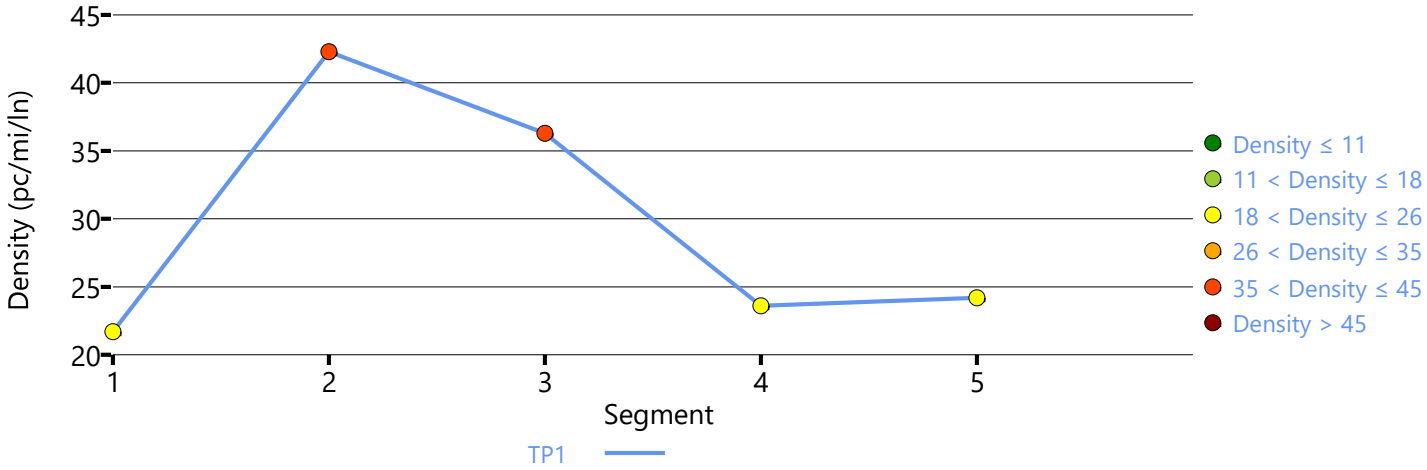
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1759	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	936
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.43
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.7
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1759	1823
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1871	1939
Capacity (c), pc/h	4400	2100
Volume-to-Capacity Ratio (v/c)	0.87	0.92

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 1 and 2 (v12), pc/h	0	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	0	Average Density (D), pc/mi/ln	42.3
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	42.3

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	3582	1027
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	3811	1093
Capacity (c), pc/h	6600	2200
Volume-to-Capacity Ratio (v/c)	0.74	0.50

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 2 and 3 (v23), pc/h	0	Ramp Junction Speed (S), mi/h	44.9
Flow Entering Ramp-Infl. Area (vR23), pc/h	0	Average Density (D), pc/mi/ln	36.3
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	36.3

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	4609	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	4903	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.65	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	64.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 1 and 2 (v12), pc/h	0	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	0	Average Density (D), pc/mi/ln	23.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.6

HCS7 Basic Freeway Report

Project Information

Segment Number	5	Segment Name	IR-490
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	5748	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1529
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.2
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	1.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	2
3	Merge	Basic	IR-77 Ramps Merge with IR-490 WB	280	3
4	Merge	Basic	Rockefeller Ave to IR-490 WB Merge	1500	4
5	Basic	Basic	IR-490	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	749	4400	0.17	43.2	8.7	A

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1446	697	4400	2100	0.33	0.33	44.6	45.0	16.1	16.1	B

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2327	881	6600	2200	0.35	0.40	44.9	45.0	17.2	17.2	B

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2771	444	9400	2100	0.29	0.21	60.2	65.0	10.7	10.7	A

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2770	9328	0.30	63.2	10.9	A

Facility Time Period Results

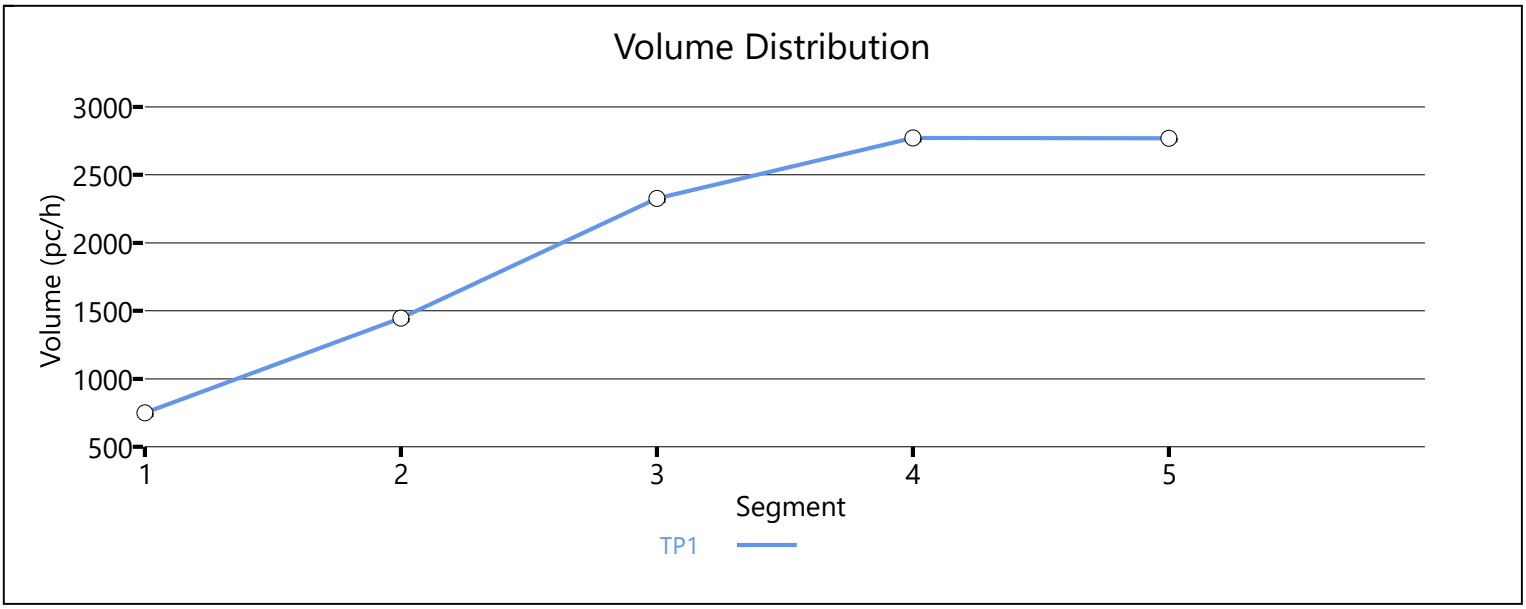
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	59.4	11.3	11.3	1.70	B

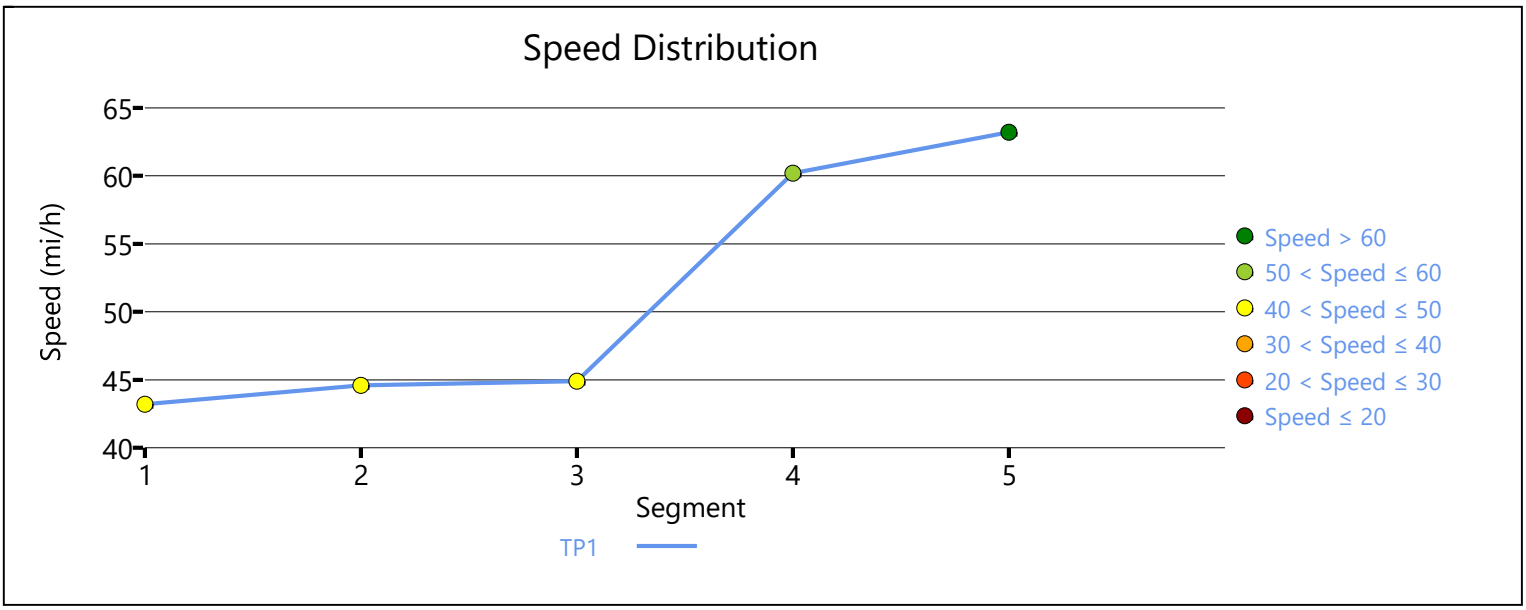
Facility Overall Results

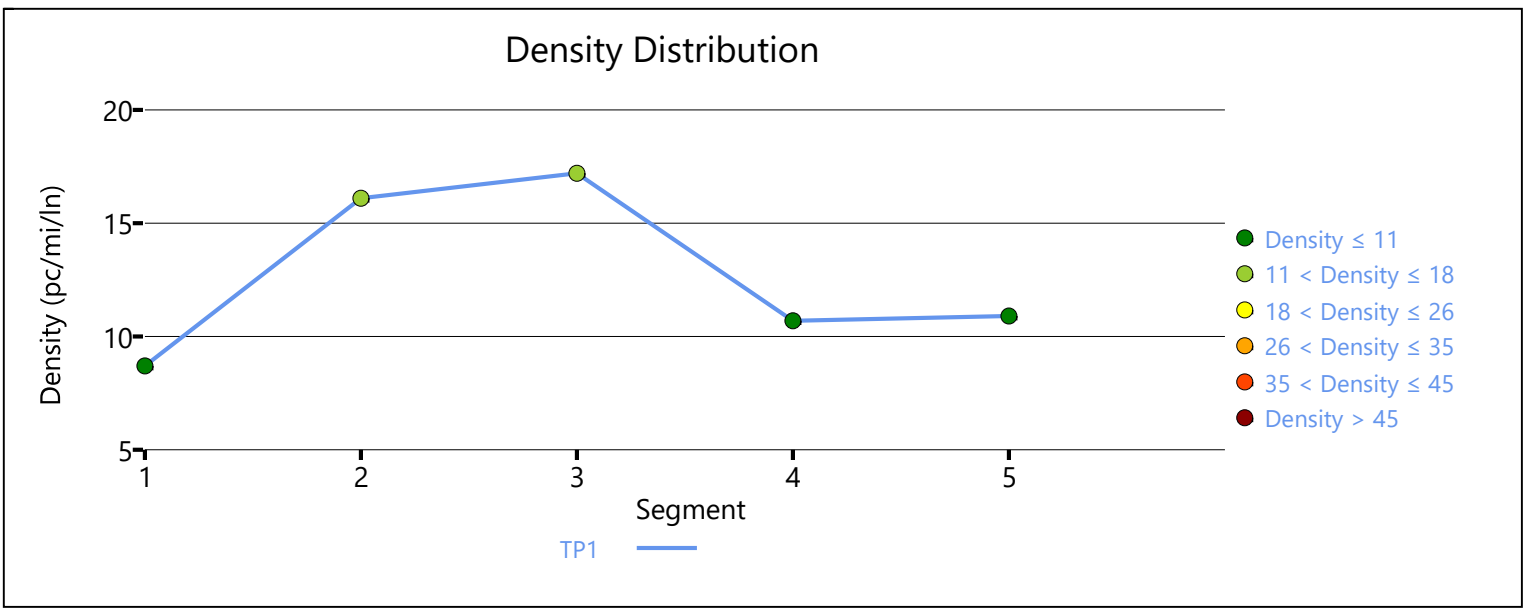
Space Mean Speed, mi/h	59.4	Density, veh/mi/ln	11.3
Average Travel Time, min	1.70	Density, pc/mi/ln	11.3

Messages

Comments







HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	704	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	374
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.17
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	8.7
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	704	655
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	749	697
Capacity (c), pc/h	4400	2100
Volume-to-Capacity Ratio (v/c)	0.33	0.33

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 1 and 2 (v12), pc/h	0	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	0	Average Density (D), pc/mi/ln	16.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.1

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1359	828
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1446	881
Capacity (c), pc/h	6600	2200
Volume-to-Capacity Ratio (v/c)	0.35	0.40

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 2 and 3 (v23), pc/h	0	Ramp Junction Speed (S), mi/h	44.9
Flow Entering Ramp-Infl. Area (vR23), pc/h	0	Average Density (D), pc/mi/ln	17.2
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	17.2

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2187	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	2327	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.29	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	9999.0	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	55.000
Downstream Equilibrium Distance (LEQ), ft	9999.0	Flow Outer Lanes (vOA), pc/h/ln	0
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	65.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	75.0
Flow in Lanes 1 and 2 (v12), pc/h	0	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	0	Average Density (D), pc/mi/ln	10.7
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	10.7

HCS7 Basic Freeway Report

Project Information

Segment Number	5	Segment Name	IR-490
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2604	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	692
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.30
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	10.9
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	5
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	1.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	2
3	Merge	Basic	IR-77 Ramps Merge with IR-490 WB	280	3
4	Merge	Basic	Rockefeller Ave to IR-490 WB Merge	1500	4
5	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2849	4400	0.65	43.2	33.0	D

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	3400	2339	4500	2100	1.18	1.11	44.0	44.0	38.6	38.6	F

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	3789	1693	6750	2200	1.04	0.77	44.0	44.0	28.7	28.7	F

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4067	1212	9400	2100	0.86	0.58	60.0	60.5	16.8	16.8	B

Segment 5: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	4067	9328	0.87	63.2	16.1	B

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	57.5	18.9	18.9	1.80	F

Facility Overall Results

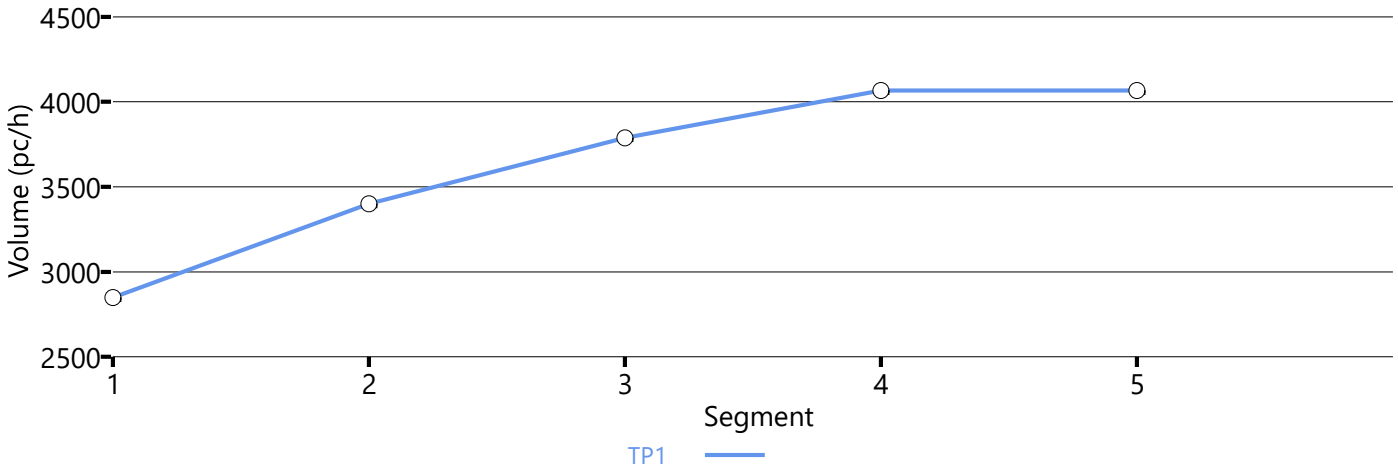
Space Mean Speed, mi/h	57.5	Density, veh/mi/ln	18.9
Average Travel Time, min	1.80	Density, pc/mi/ln	18.9

Messages

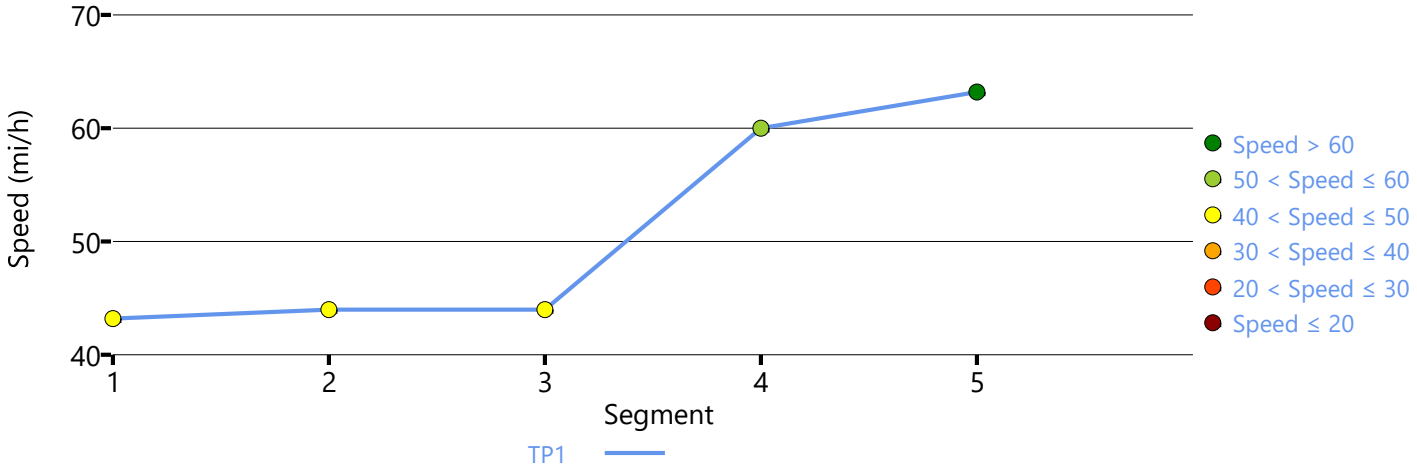
WARNING 1	Oversaturated conditions currently exist in boundary time period 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
WARNING 2	Oversaturated conditions currently exist on segment 3, which is less than 300 feet. Due to time step size, these segments may produce unreliable results. Consider reviewing facility segmentation to resolve this warning.
WARNING 3	Merge capacity is less than merge demand on segment 2.

Comments

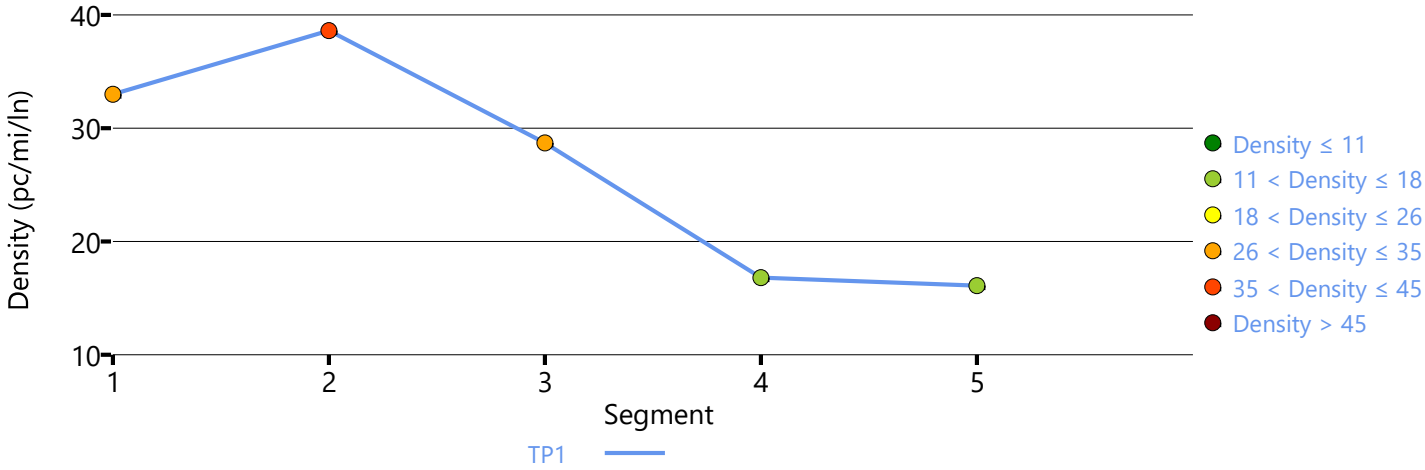
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Existing Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2678	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1425
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.0
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1090
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2678	2199
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	2849	2339
Capacity (c), pc/h	4500	2100
Volume-to-Capacity Ratio (v/c)	0.76	1.11

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	0
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.340
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	-
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	1.000	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 1 and 2 (v12), pc/h	1061	Ramp Junction Speed (S), mi/h	44.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3400	Average Density (D), pc/mi/ln	38.6
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	38.6

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	280
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	4877	1591
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	5188	1693
Capacity (c), pc/h	6750	2200
Volume-to-Capacity Ratio (v/c)	0.56	0.77

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.374
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	723
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.0
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.585	Outer Lanes Freeway Speed (SO), mi/h	44.2
Flow in Lanes 2 and 3 (v23), pc/h	1373	Ramp Junction Speed (S), mi/h	44.0
Flow Entering Ramp-Infl. Area (vR23), pc/h	3066	Average Density (D), pc/mi/ln	28.7
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	28.7

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	6468	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	6881	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.43	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.285
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	857
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	60.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.279	Outer Lanes Freeway Speed (SO), mi/h	63.7
Flow in Lanes 1 and 2 (v12), pc/h	1142	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2354	Average Density (D), pc/mi/ln	16.8
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.8

HCS7 Basic Freeway Report

Project Information

Segment Number	5	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	17:00-17:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	7607	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1017
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.1
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	4
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.00		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-490 WB East of IR-77	3500	2
2	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
3	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
4	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	637	4400	0.14	43.7	7.3	A

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1707	1070	9000	4400	0.19	0.24	44.6	44.5	9.6	6.0	A

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2151	444	9400	2100	0.23	0.21	60.2	59.1	8.7	8.7	A

Segment 4: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2151	9348	0.23	63.7	8.4	A

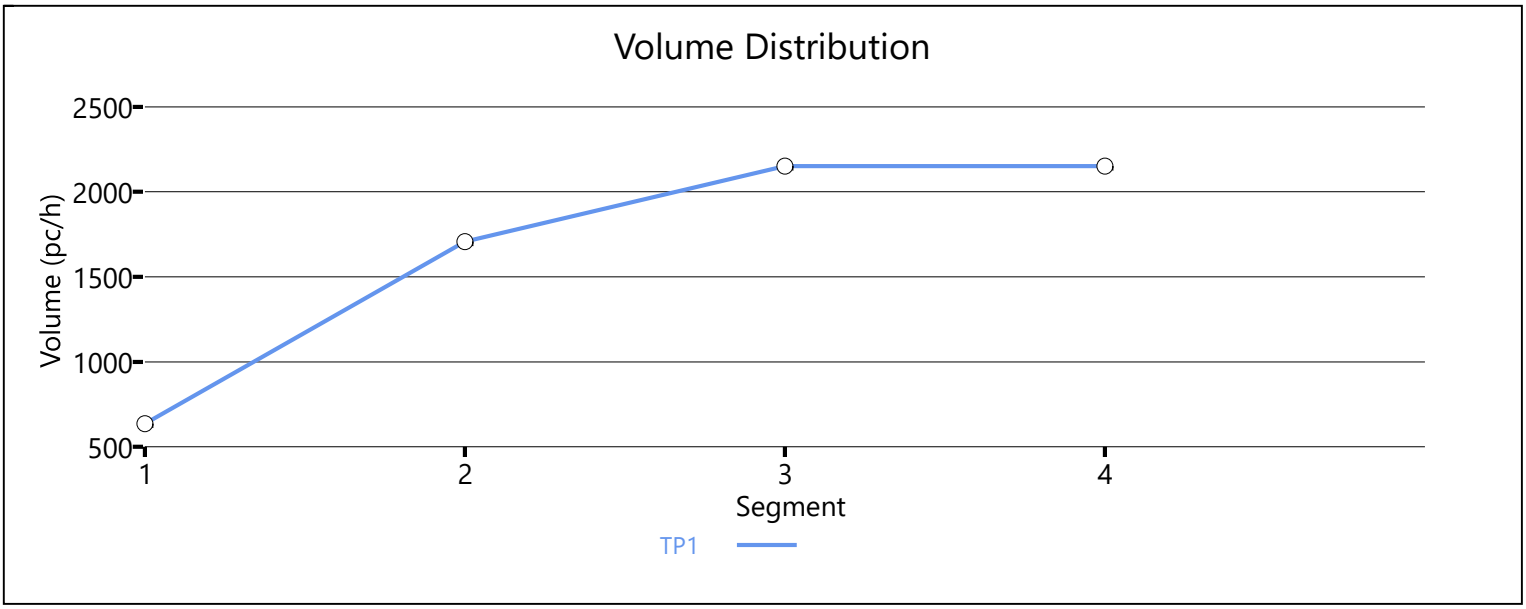
Facility Time Period Results

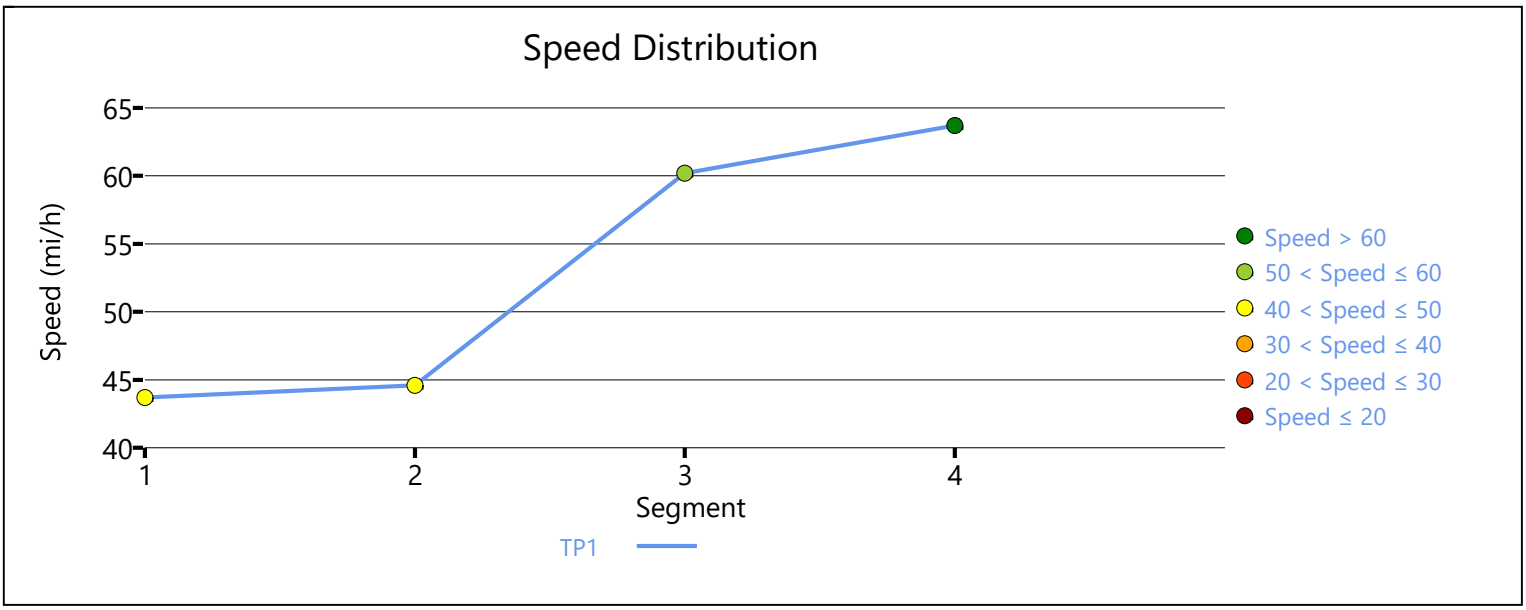
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	58.9	8.3	8.3	2.00	A

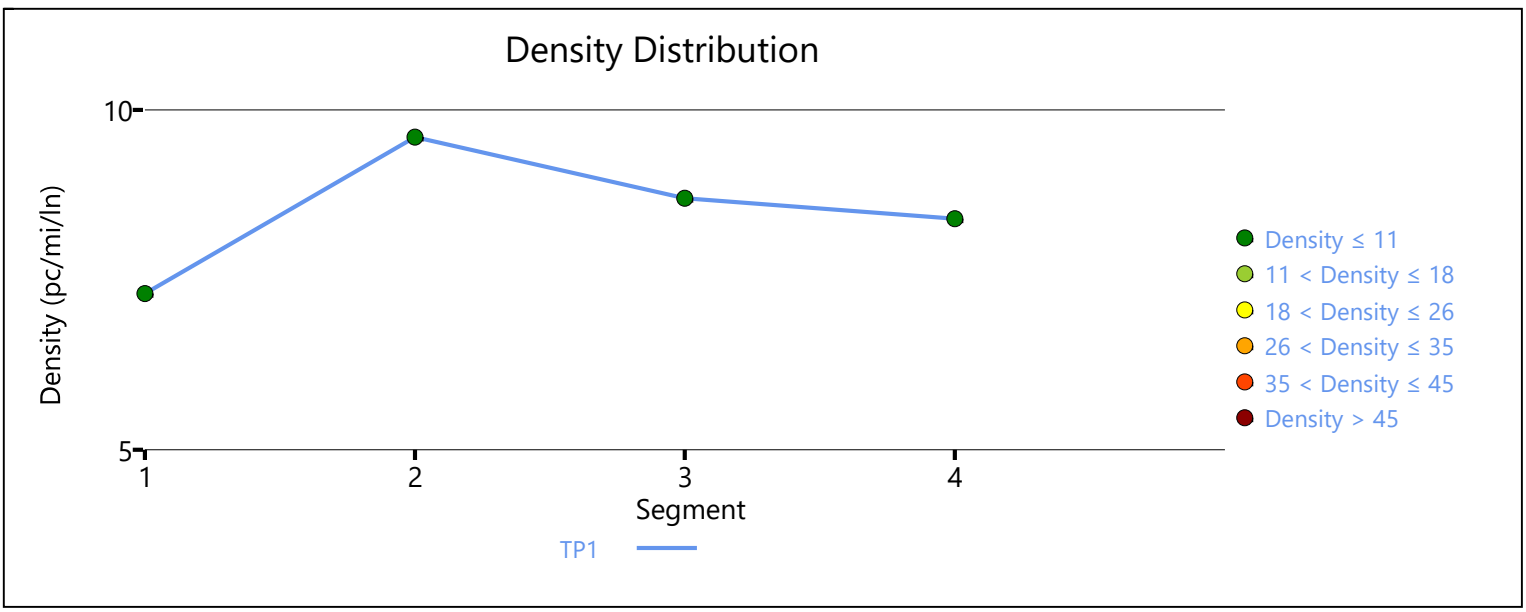
Facility Overall Results			
Space Mean Speed, mi/h	58.9	Density, veh/mi/ln	8.3
Average Travel Time, min	2.00	Density, pc/mi/ln	8.3

Messages	
ERROR 1	Acceleration lane length is longer than the segment length for merge segment 2.

Comments







HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-490 WB East of IR-77
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	3500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	599	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	318
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.14
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	7.3
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.7		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	599	1006
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	637	1070
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.19	0.24

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.171
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	191
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 1 and 2 (v12), pc/h	255	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	1325	Average Density (D), pc/mi/ln	9.6
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	6.0

HCS7 Freeway Merge Report

Project Information

Segment Number	3	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1605	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1707	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.23	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.256
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	512
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.375	Outer Lanes Freeway Speed (SO), mi/h	65.0
Flow in Lanes 1 and 2 (v12), pc/h	683	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1127	Average Density (D), pc/mi/ln	8.7
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	8.7

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2022	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	538
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2337
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2337
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.23
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	8.4
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.7		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	4
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.00		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-490 WB East of IR-77	3500	2
2	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
3	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
4	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1093	4400	0.25	43.7	12.5	B

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4904	3811	9000	4400	0.54	0.87	43.9	43.7	27.9	27.5	C

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	6115	1212	9400	2100	0.65	0.58	59.2	57.2	25.8	24.3	C

Segment 4: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	6115	9348	0.65	63.6	24.0	C

Facility Time Period Results

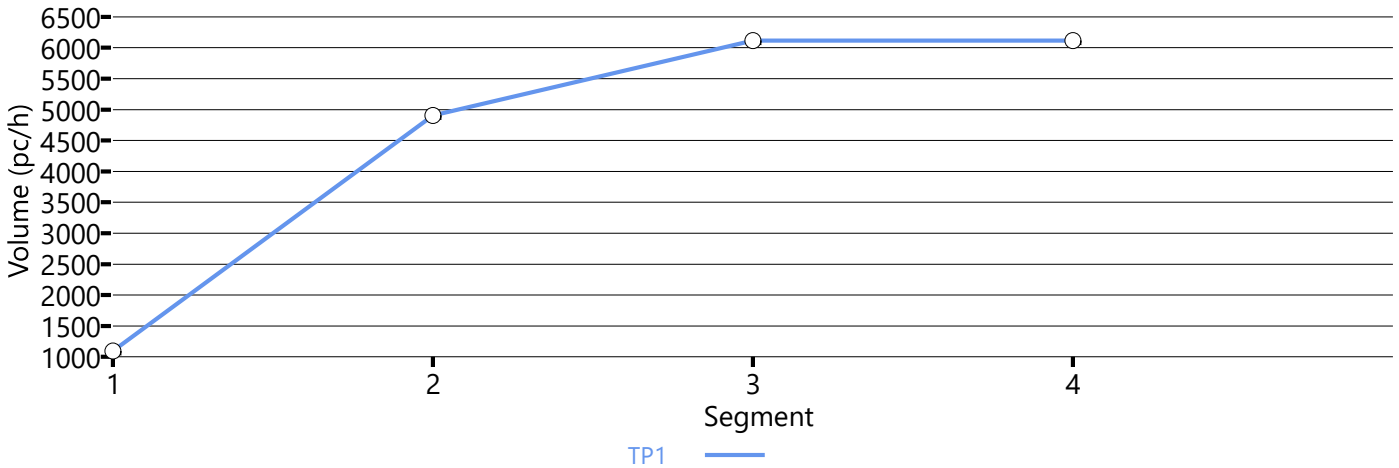
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	59.7	22.2	22.2	2.00	C

Facility Overall Results			
Space Mean Speed, mi/h	59.7	Density, veh/mi/ln	22.2
Average Travel Time, min	2.00	Density, pc/mi/ln	22.2

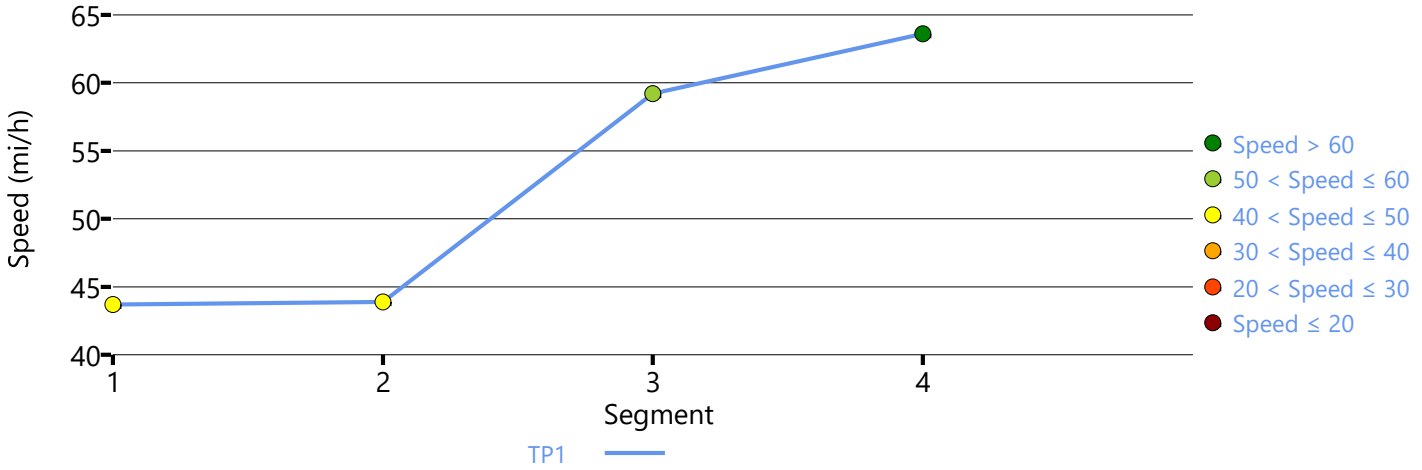
Messages	
ERROR 1	Acceleration lane length is longer than the segment length for merge segment 2.

Comments

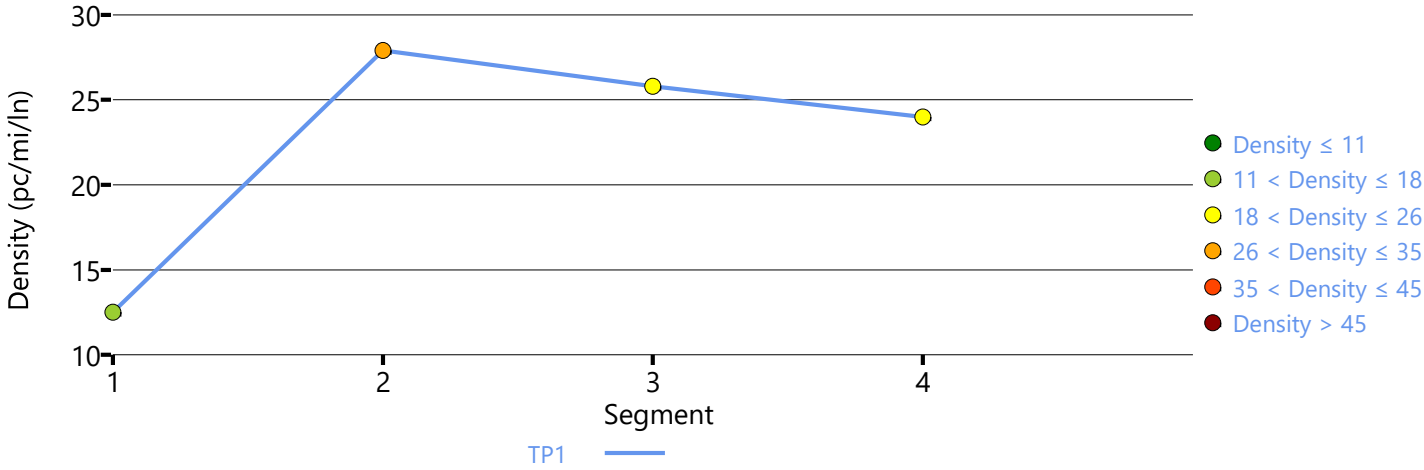
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-490 WB East of IR-77
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	3500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1027	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	546
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.25
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	12.5
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.7		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1027	3582
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1093	3811
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.54	0.87

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.429
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	328
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 1 and 2 (v12), pc/h	437	Ramp Junction Speed (S), mi/h	43.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4248	Average Density (D), pc/mi/ln	27.9
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.5

HCS7 Freeway Merge Report

Project Information

Segment Number	3	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	4609	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	4903	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.65	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.337
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1471
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	57.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.066	Outer Lanes Freeway Speed (SO), mi/h	61.5
Flow in Lanes 1 and 2 (v12), pc/h	1961	Ramp Junction Speed (S), mi/h	59.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	3173	Average Density (D), pc/mi/ln	25.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.3

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	5748	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1529
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2337
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2337
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.0
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.7		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	4
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.00		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-490 WB East of IR-77	3500	2
2	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
3	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
4	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	881	4400	0.20	43.7	10.1	A

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2327	1446	9000	4400	0.26	0.33	44.6	44.5	13.0	9.5	A

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2771	444	9400	2100	0.29	0.21	60.2	59.0	11.2	10.7	B

Segment 4: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2770	9348	0.30	63.7	10.9	A

Facility Time Period Results

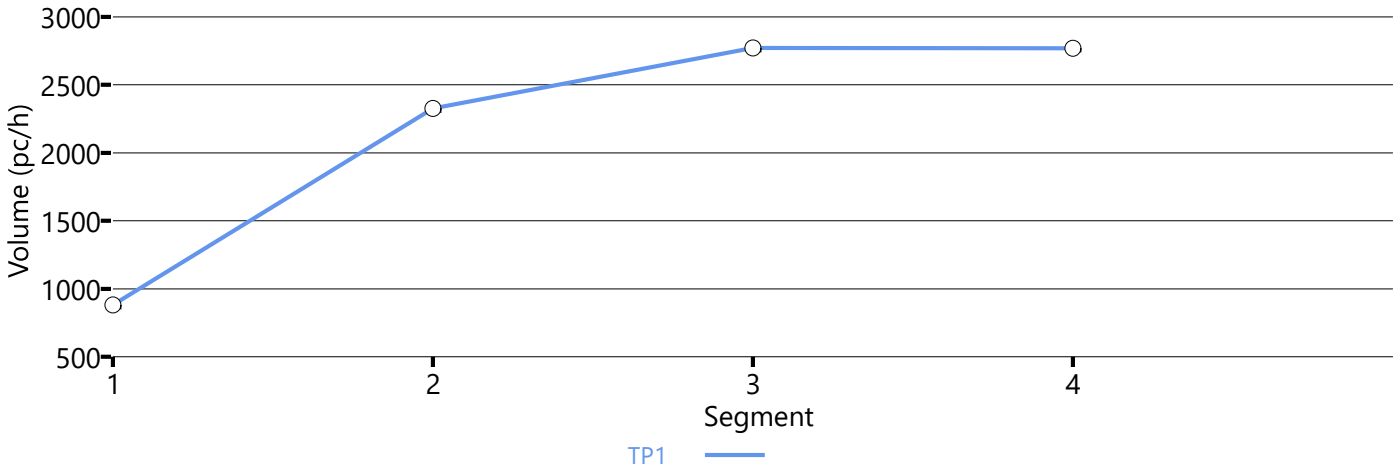
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	58.7	10.9	10.9	2.00	A

Facility Overall Results			
Space Mean Speed, mi/h	58.7	Density, veh/mi/ln	10.9
Average Travel Time, min	2.00	Density, pc/mi/ln	10.9

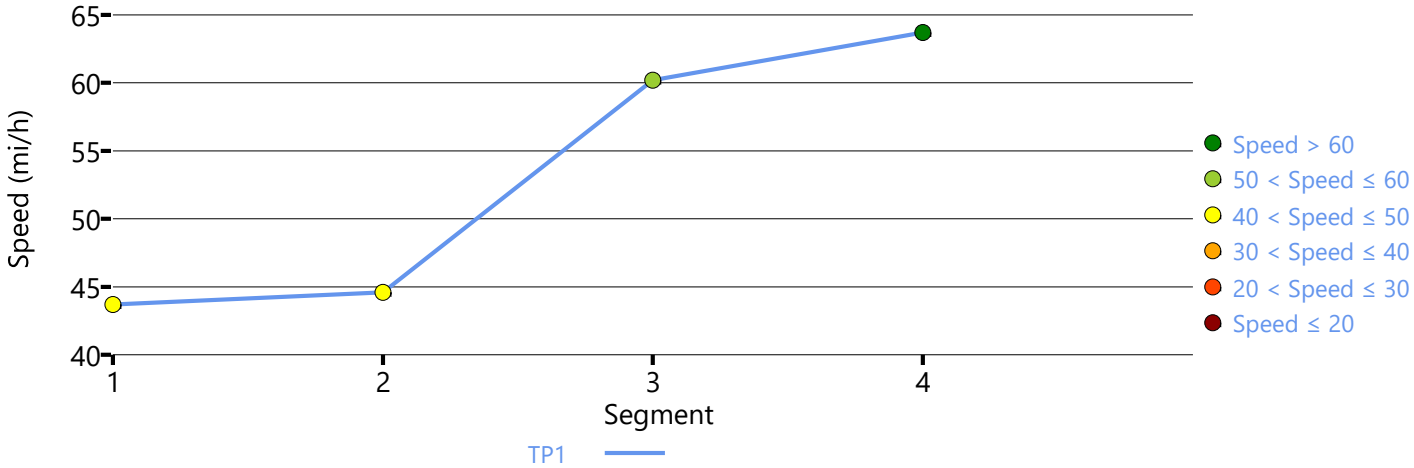
Messages	
ERROR 1	Acceleration lane length is longer than the segment length for merge segment 2.

Comments

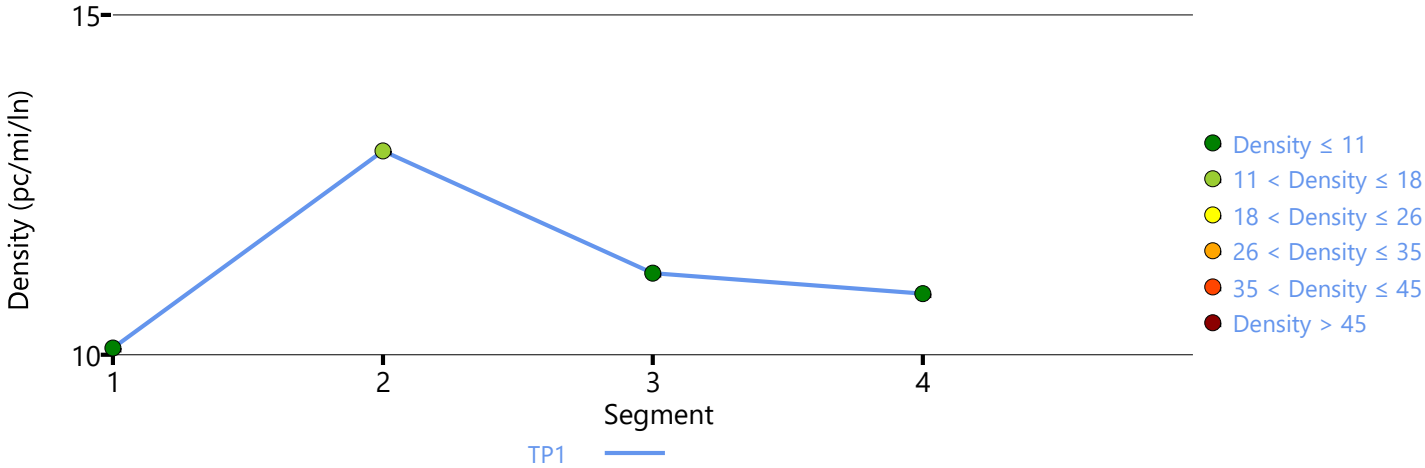
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-490 WB East of IR-77
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	3500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	828	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	440
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.20
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	10.1
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.7		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	828	1359
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	881	1446
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.26	0.33

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.180
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	265
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 1 and 2 (v12), pc/h	352	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR12), pc/h	1798	Average Density (D), pc/mi/ln	13.0
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	9.5

HCS7 Freeway Merge Report

Project Information

Segment Number	3	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2187	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	2327	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.29	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.259
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	698
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.375	Outer Lanes Freeway Speed (SO), mi/h	64.3
Flow in Lanes 1 and 2 (v12), pc/h	931	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1375	Average Density (D), pc/mi/ln	11.2
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	10.7

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2604	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	692
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2337
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2337
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.30
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	10.9
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.7		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	4
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.00		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-490 WB East of IR-77	3500	2
2	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
3	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
4	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1693	4400	0.38	43.7	19.4	C

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	6881	5188	9000	4400	0.76	1.18	41.0	40.4	42.0	39.5	E

Segment 3: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	8093	1212	9400	2100	0.86	0.58	57.0	54.7	35.5	30.5	D

Segment 4: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	8093	9348	0.87	58.8	34.4	D

Facility Time Period Results

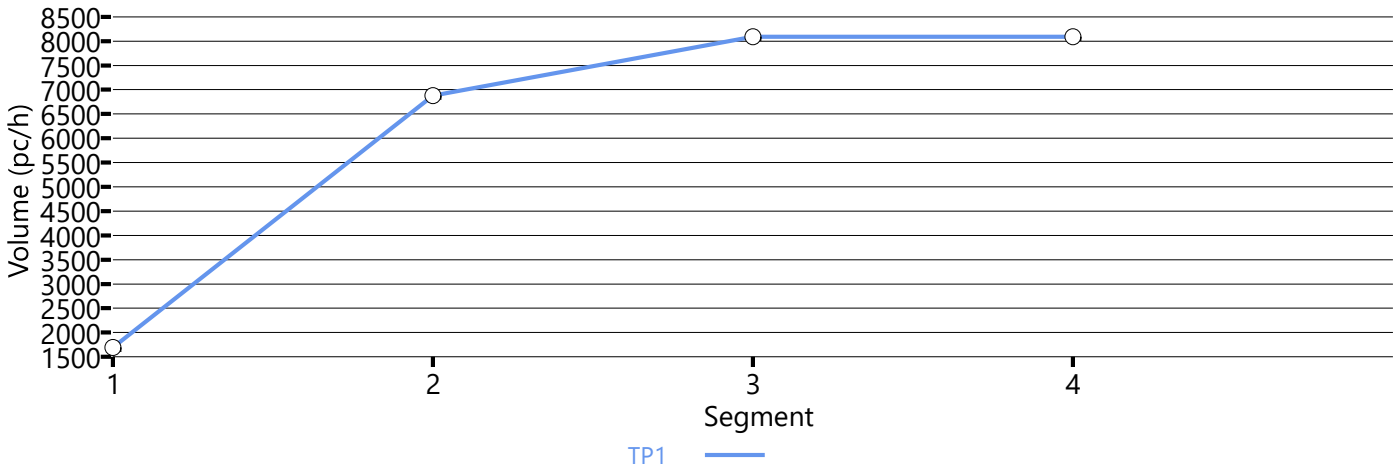
T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	55.9	31.9	31.9	2.10	D

Facility Overall Results			
Space Mean Speed, mi/h	55.9	Density, veh/mi/ln	31.9
Average Travel Time, min	2.10	Density, pc/mi/ln	31.9

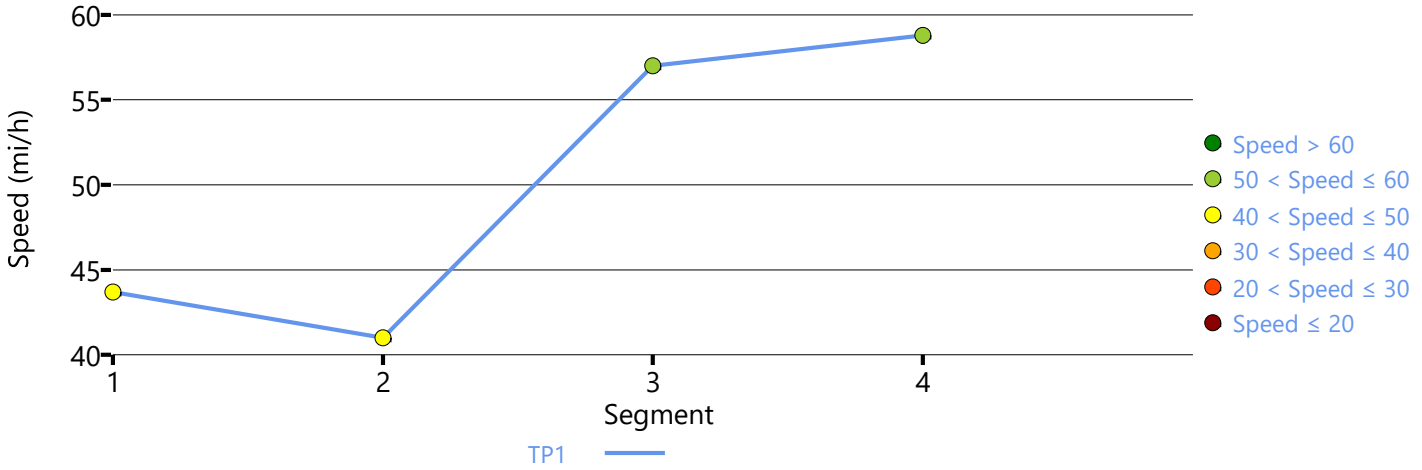
Messages	
ERROR 1	Acceleration lane length is longer than the segment length for merge segment 2.
WARNING 1	Merge capacity is less than merge demand on segment 2.

Comments

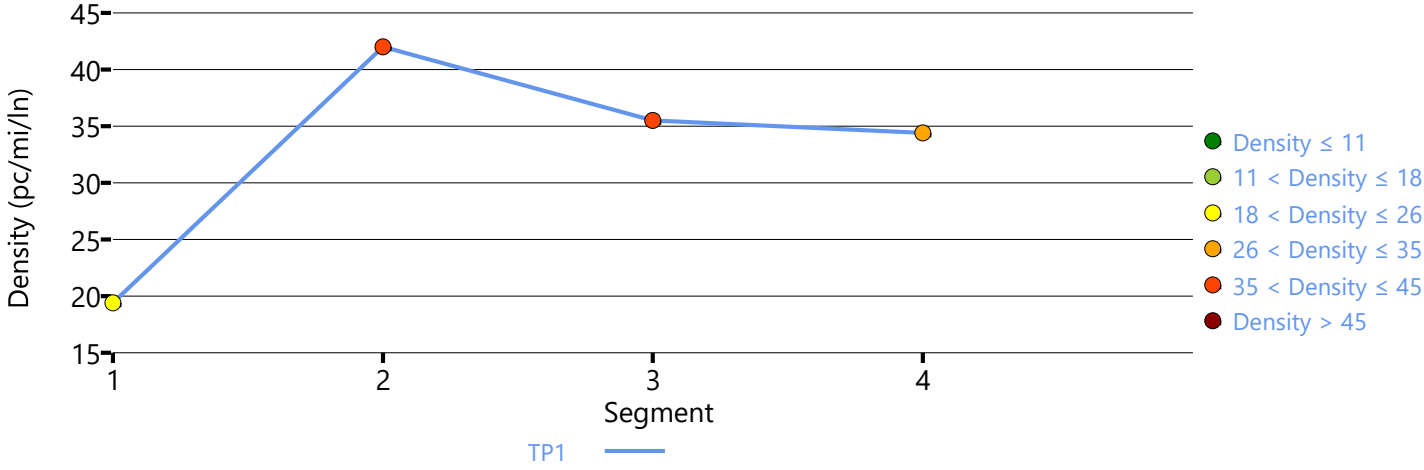
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Planned Future Conditions)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-490 WB East of IR-77
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	3500	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1591	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	846
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.38
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.4
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.7		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1591	4877
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1693	5188
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.76	1.18

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	1.531
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	508
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	40.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 1 and 2 (v12), pc/h	677	Ramp Junction Speed (S), mi/h	41.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	5865	Average Density (D), pc/mi/ln	42.0
Level of Service (LOS)	E	Density in Ramp Influence Area (DR), pc/mi/ln	39.5

HCS7 Freeway Merge Report

Project Information

Segment Number	3	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	6468	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	6881	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.86	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.449
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2065
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	54.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.066	Outer Lanes Freeway Speed (SO), mi/h	59.4
Flow in Lanes 1 and 2 (v12), pc/h	2752	Ramp Junction Speed (S), mi/h	57.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3964	Average Density (D), pc/mi/ln	35.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	30.5

HCS7 Basic Freeway Report

Project Information

Segment Number	4	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.7
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	7607	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2023
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2337
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2337
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	58.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	34.4
Total Ramp Density Adjustment	1.3	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.7		

Attachment E

Concept Plans

CARPENTER MARTY transportation

Attachment E

LEGEND

PAVEMENT REMOVED

NEW CONCRETE PAVEMENT

HORIZONTAL SCALE IN FEET
0 15 30 60

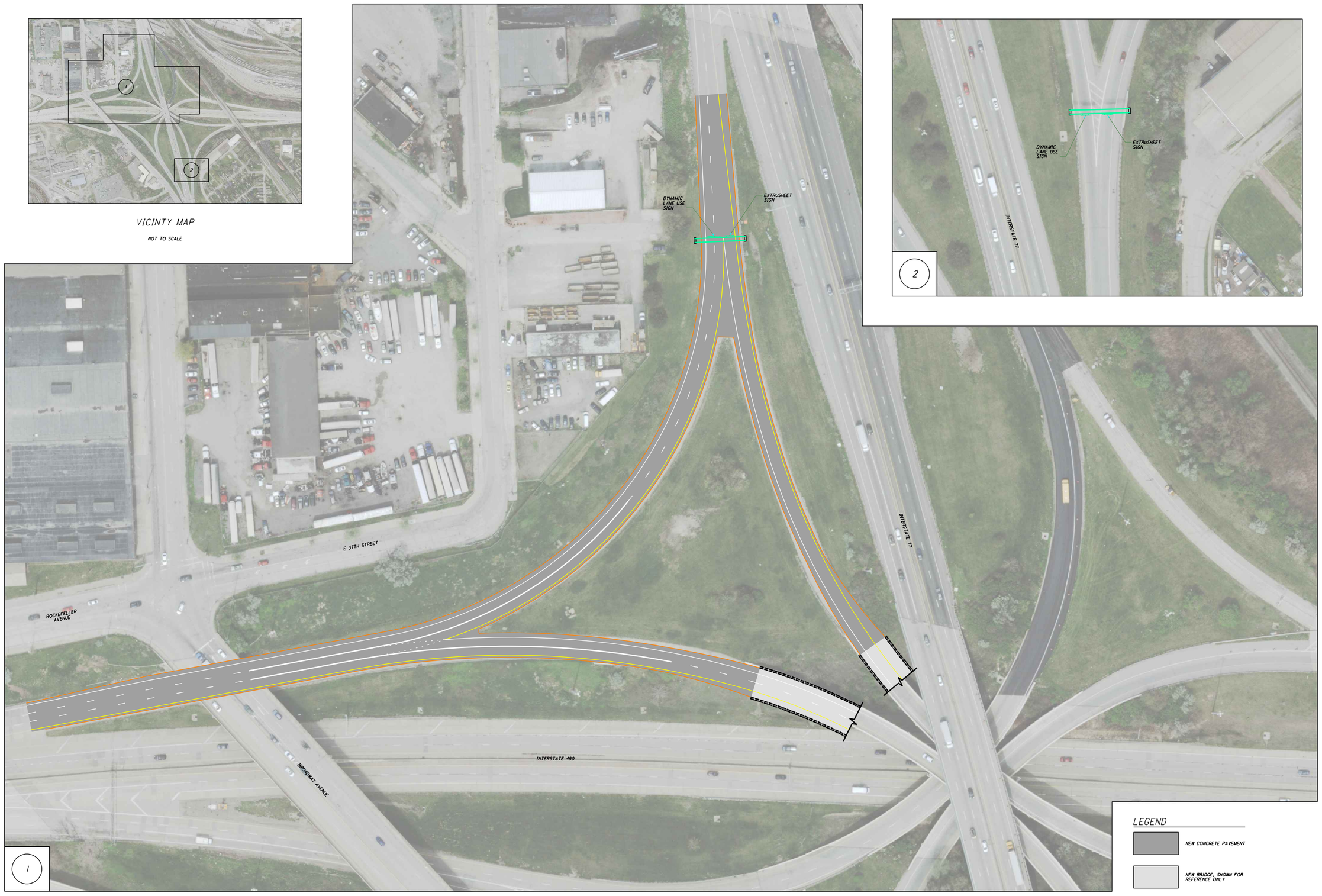
CALCULATED DMG
CHECKED TWG

RAMP REALIGNMENT
WEST 7TH STREET TO I-490 EB

CUY-490-0.00
TSMO

VICINTY MAP

NOT TO SCALE



0 30 60 120
HORIZONTAL SCALE IN FEET

CALCULATED DMG
CHECKED TWG

RAMP IMPROVEMENTS
I-77 TO I-490

CUY-490-0.00
TSMO

Attachment F

Proposed Conditions Capacity Analysis

CARPENTER MARTY transportation

Attachment F

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Merge	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	985	4400	0.22	43.2	11.4	B

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1563	578	6750	4200	0.23	0.14	44.5	44.4	11.7	5.2	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1563	4400	0.36	43.2	18.1	C

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2200	637	9000	4400	0.24	0.14	44.5	44.2	12.4	11.6	B

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2644	444	9400	2100	0.28	0.21	60.2	59.1	10.7	10.3	B

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2644	9328	0.28	63.2	10.5	A

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	53.4	12.5	12.5	3.00	B

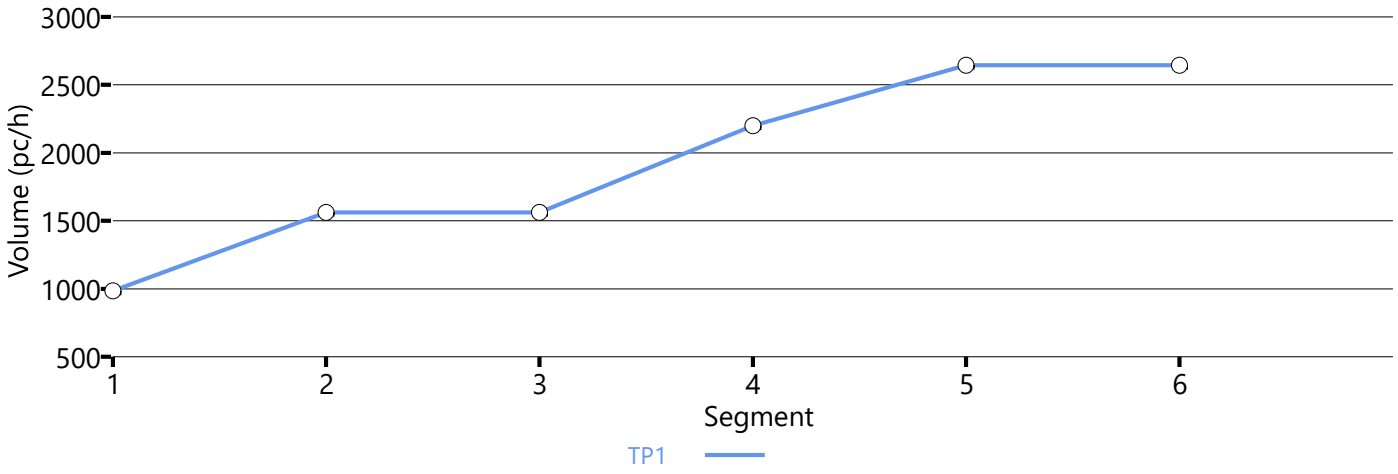
Facility Overall Results

Space Mean Speed, mi/h	53.4	Density, veh/mi/ln	12.5
Average Travel Time, min	3.00	Density, pc/mi/ln	12.5

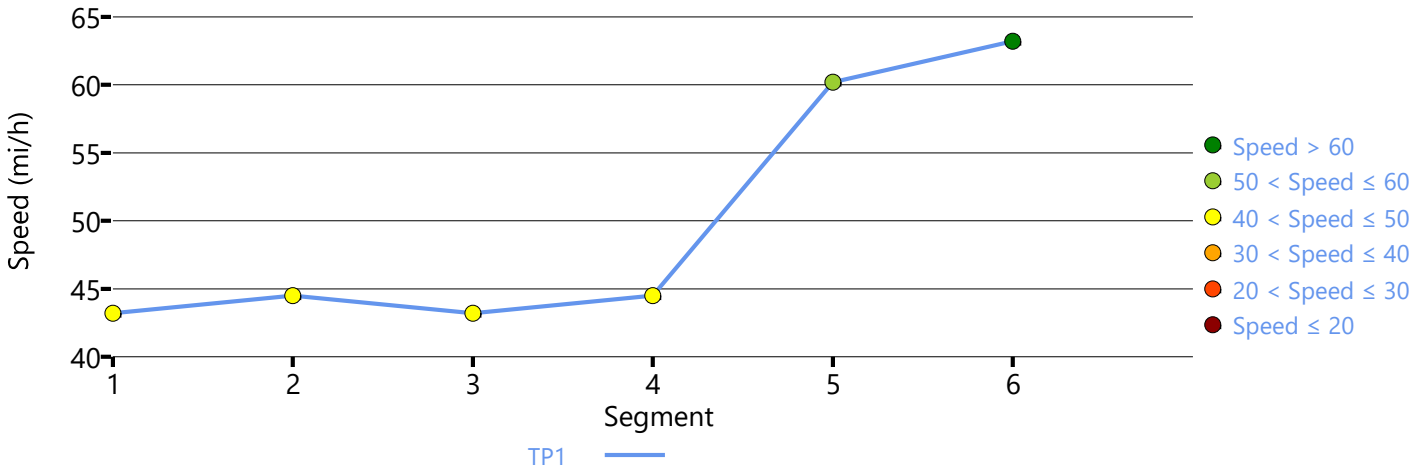
Messages

Comments

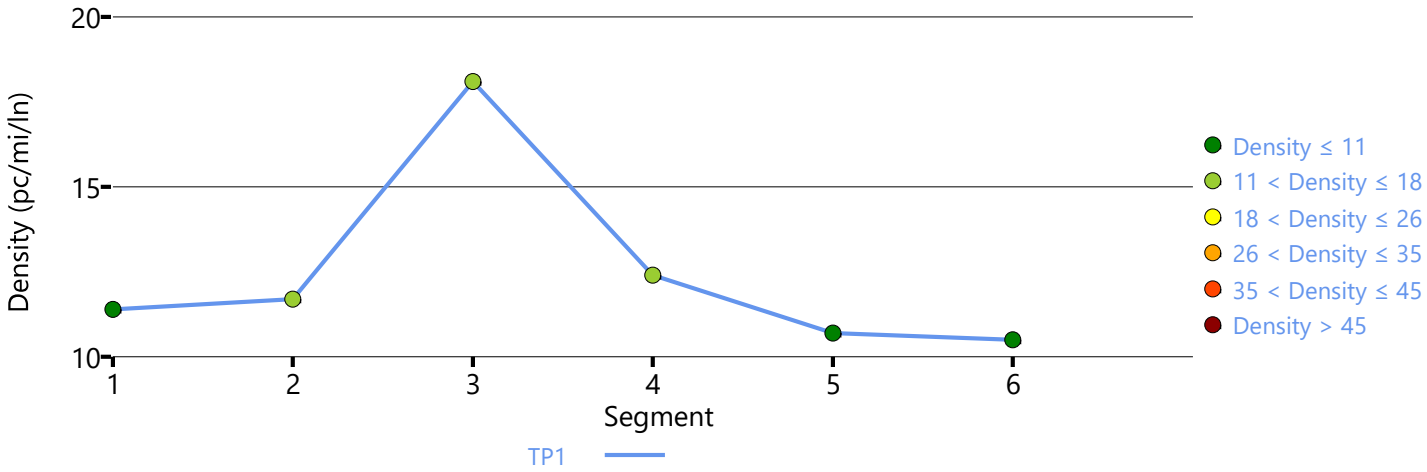
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	926	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	492
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.22
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	11.4
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	2
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	926	543
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	985	578
Capacity (c), pc/h	6750	4200
Volume-to-Capacity Ratio (v/c)	0.23	0.14

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.199
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	372
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.4
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.555	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 2 and 3 (v23), pc/h	613	Ramp Junction Speed (S), mi/h	44.5
Flow Entering Ramp-Infl. Area (vR23), pc/h	1191	Average Density (D), pc/mi/ln	11.7
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	5.2

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1469	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	782
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.36
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.1
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1469	599
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1563	637
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.24	0.14

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.273
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	469
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.2
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 3 and 4 (v34), pc/h	625	Ramp Junction Speed (S), mi/h	44.5
Flow Entering Ramp-Infl. Area (vR34), pc/h	1262	Average Density (D), pc/mi/ln	12.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	11.6

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2068	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	2200	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.28	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.258
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	660
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.375	Outer Lanes Freeway Speed (SO), mi/h	64.4
Flow in Lanes 1 and 2 (v12), pc/h	880	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1324	Average Density (D), pc/mi/ln	10.7
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	10.3

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2485	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	661
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.28
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	10.5
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Merge	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	3521	4400	0.85	23.8	74.0	F

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4097	1939	6750	4200	0.84	0.46	14.7	43.6	93.0	28.5	F

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	4097	4400	1.29	43.0	47.4	F

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4656	1093	9000	4400	0.75	0.25	43.6	44.1	26.7	21.2	C

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4935	1212	9400	2100	0.85	0.58	59.9	58.1	20.5	20.7	C

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	4935	9328	0.86	63.2	19.5	C

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	42.8	34.0	34.0	3.80	F

Facility Overall Results

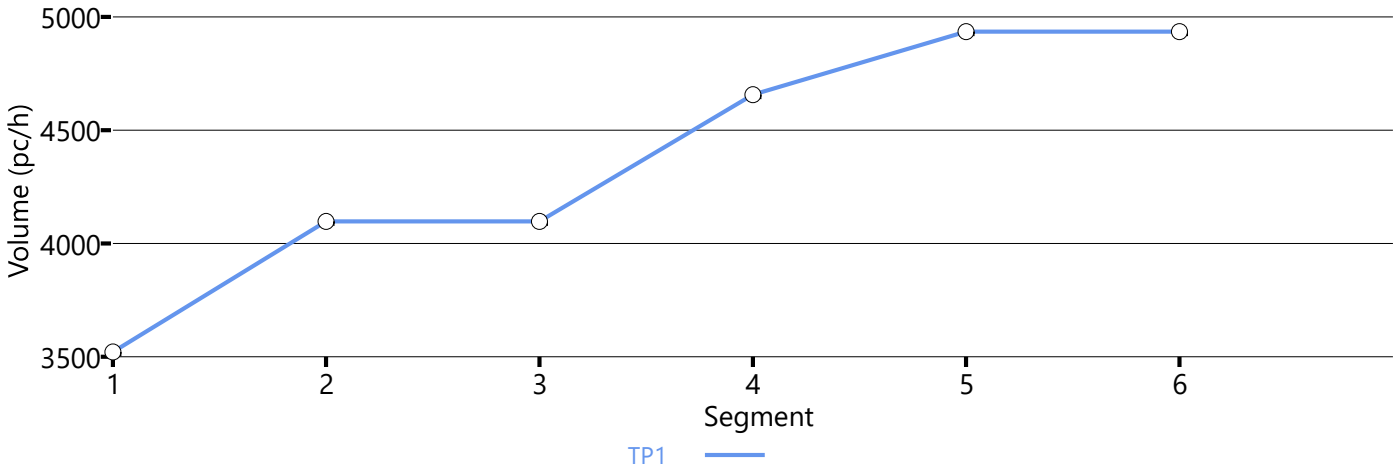
Space Mean Speed, mi/h	42.8	Density, veh/mi/ln	34.0
Average Travel Time, min	3.80	Density, pc/mi/ln	34.0

Messages

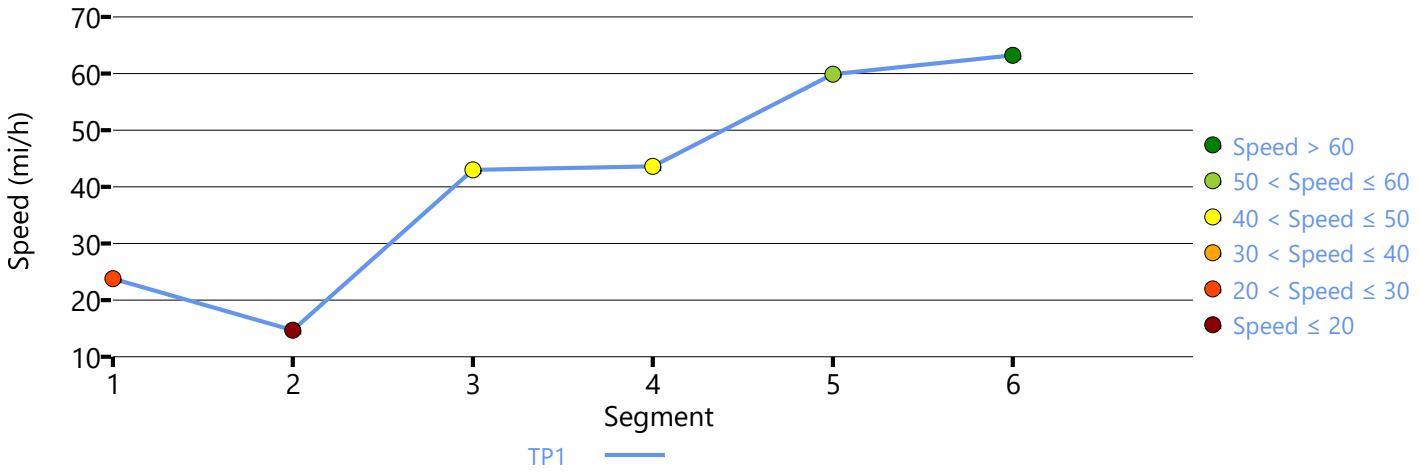
WARNING 1	Oversaturated conditions currently exist in boundary time period 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
WARNING 2	Oversaturated conditions currently exist on segment 4, which is less than 300 feet. Due to time step size, these segments may produce unreliable results. Consider reviewing facility segmentation to resolve this warning.
WARNING 3	Queue extends past the beginning of the facility on time period 1. Consider expanding the length of the facility to account for these vehicles performance and affect on upstream segments.

Comments

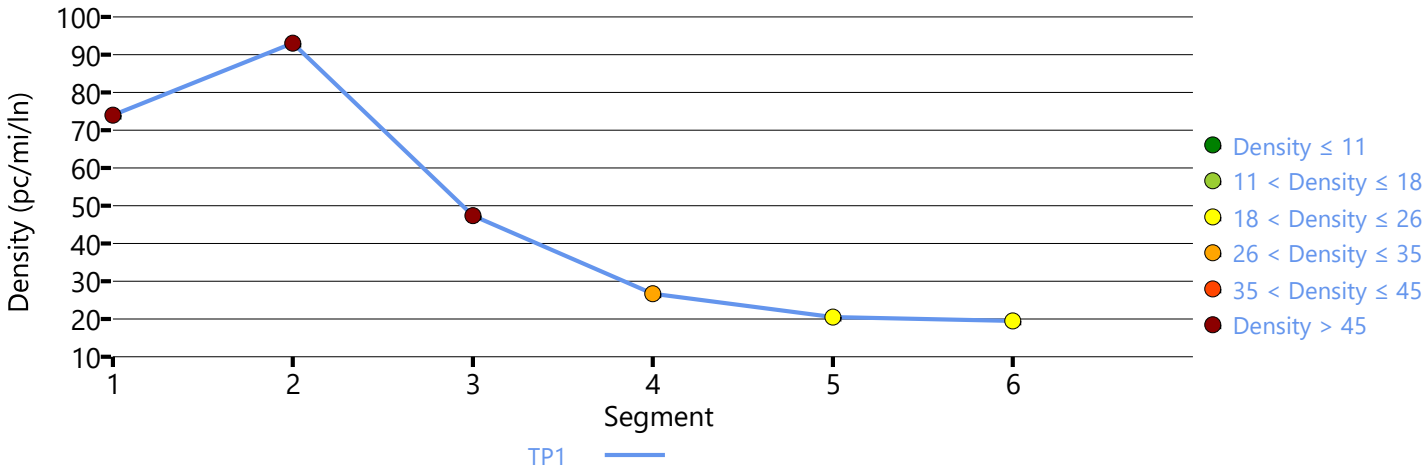
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	3518	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1872
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	23.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	74.0
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	2
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	3518	1823
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	3743	1939
Capacity (c), pc/h	6750	4200
Volume-to-Capacity Ratio (v/c)	0.61	0.46

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.464
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1417
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	43.6
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.555	Outer Lanes Freeway Speed (SO), mi/h	41.7
Flow in Lanes 2 and 3 (v23), pc/h	2326	Ramp Junction Speed (S), mi/h	14.7
Flow Entering Ramp-Infl. Area (vR23), pc/h	4265	Average Density (D), pc/mi/ln	93.0
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	28.5

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	5341	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2049
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	47.4
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	5341	1027
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	5682	1093
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.52	0.25

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.308
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1069
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.1
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	43.0
Flow in Lanes 3 and 4 (v34), pc/h	1425	Ramp Junction Speed (S), mi/h	43.6
Flow Entering Ramp-Infl. Area (vR34), pc/h	2518	Average Density (D), pc/mi/ln	26.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.2

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	6368	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	6774	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.52	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.302
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1117
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	58.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.066	Outer Lanes Freeway Speed (SO), mi/h	62.8
Flow in Lanes 1 and 2 (v12), pc/h	1489	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2701	Average Density (D), pc/mi/ln	20.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.7

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	7507	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1234
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.5
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Merge	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1498	4400	0.34	43.2	17.3	B

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2195	697	6750	4200	0.33	0.17	44.5	44.4	16.4	8.5	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2195	4400	0.50	43.2	25.4	C

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	3076	881	9000	4400	0.34	0.20	44.3	44.2	17.4	15.4	B

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	3520	444	9400	2100	0.37	0.21	60.1	58.9	14.4	13.0	B

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	3519	9328	0.38	63.2	13.9	B

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	53.2	17.2	17.2	3.00	B

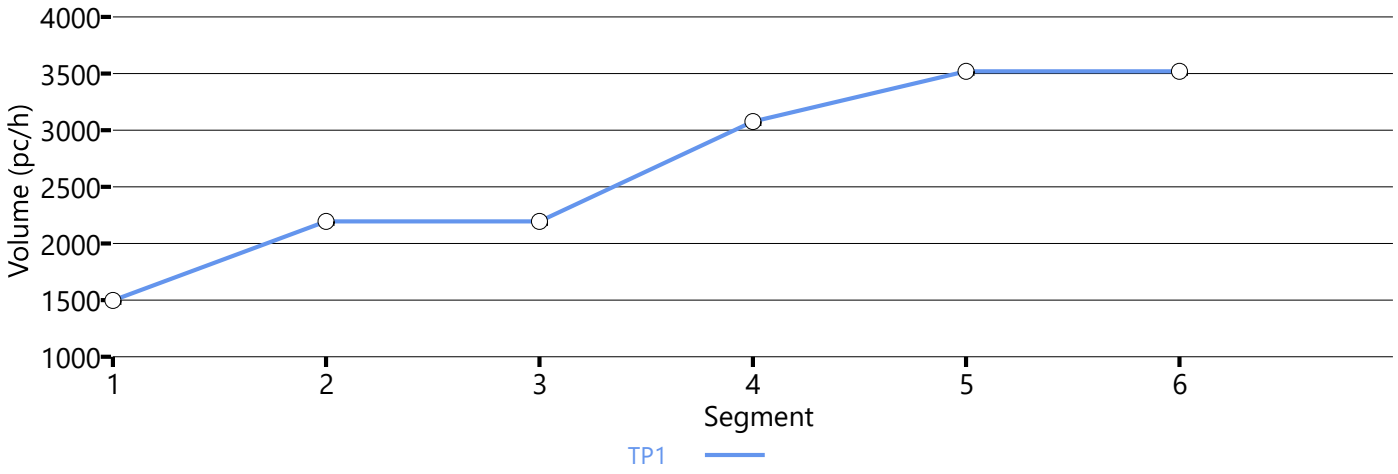
Facility Overall Results

Space Mean Speed, mi/h	53.2	Density, veh/mi/ln	17.2
Average Travel Time, min	3.00	Density, pc/mi/ln	17.2

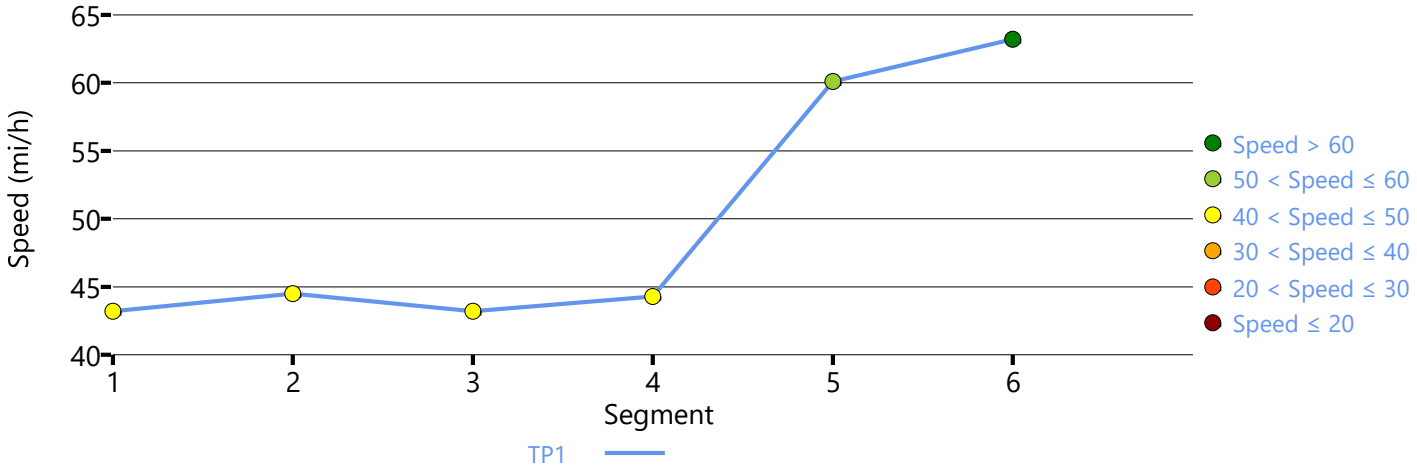
Messages

Comments

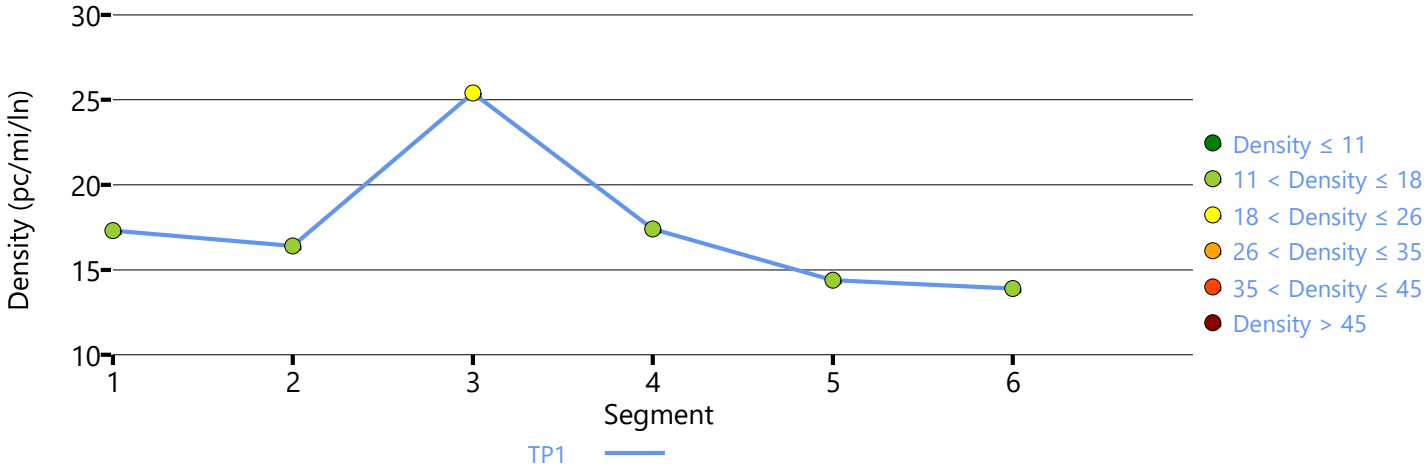
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1408	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	749
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.34
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.3
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	2
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1408	655
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1498	697
Capacity (c), pc/h	6750	4200
Volume-to-Capacity Ratio (v/c)	0.33	0.17

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.206
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	567
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.4
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.555	Outer Lanes Freeway Speed (SO), mi/h	44.8
Flow in Lanes 2 and 3 (v23), pc/h	931	Ramp Junction Speed (S), mi/h	44.5
Flow Entering Ramp-Infl. Area (vR23), pc/h	1628	Average Density (D), pc/mi/ln	16.4
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	8.5

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2063	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1098
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	25.4
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2063	828
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	2195	881
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.34	0.20

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.282
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	659
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.2
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	44.4
Flow in Lanes 3 and 4 (v34), pc/h	878	Ramp Junction Speed (S), mi/h	44.3
Flow Entering Ramp-Infl. Area (vR34), pc/h	1759	Average Density (D), pc/mi/ln	17.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	15.4

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2891	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	3076	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.37	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.264
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	923
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	58.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.375	Outer Lanes Freeway Speed (SO), mi/h	63.5
Flow in Lanes 1 and 2 (v12), pc/h	1230	Ramp Junction Speed (S), mi/h	60.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	1674	Average Density (D), pc/mi/ln	14.4
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.0

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	3308	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	880
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.38
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	13.9
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Merge	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	3511	4400	1.30	23.6	74.3	F

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4097	2339	6750	4200	1.19	0.56	13.7	40.3	99.6	40.9	F

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	4097	4400	1.83	43.0	47.4	F

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4666	1693	9000	4400	1.08	0.38	43.8	44.0	26.6	23.7	F

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4945	1212	9400	2100	1.16	0.58	60.0	58.1	20.6	20.7	F

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	4945	9328	1.17	63.2	19.6	F

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	42.2	34.5	34.5	3.80	F

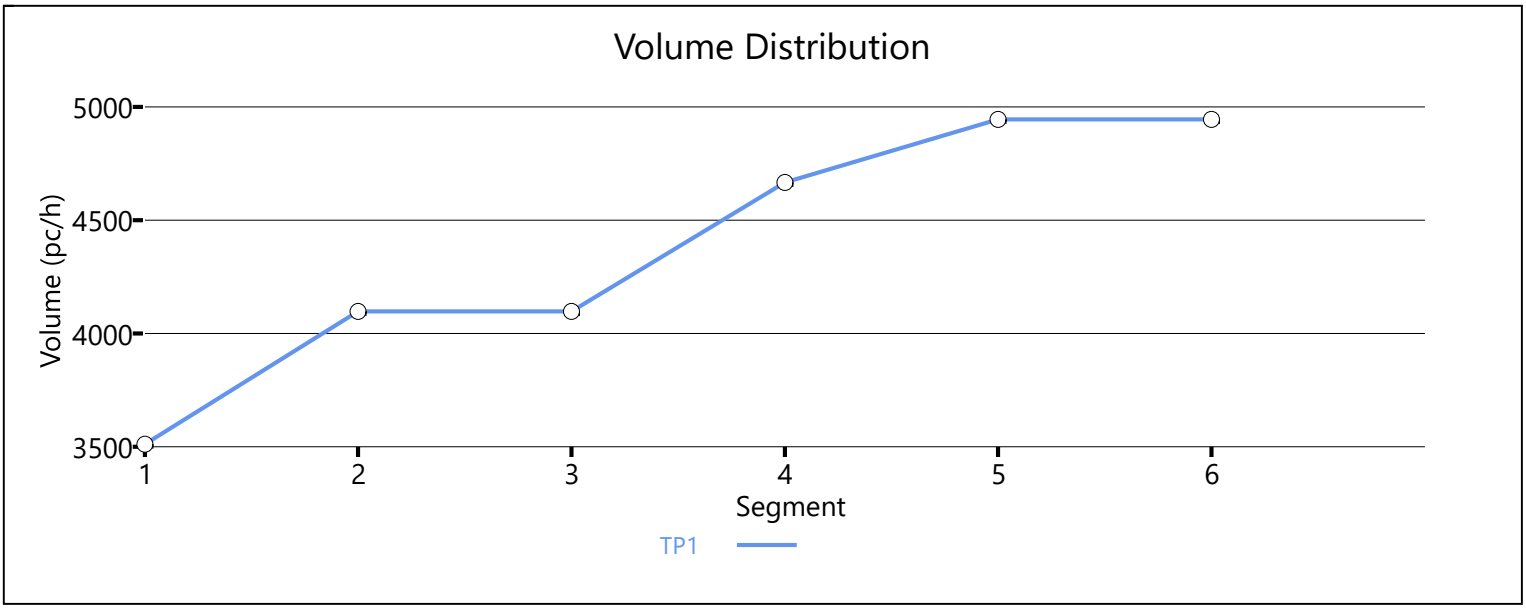
Facility Overall Results

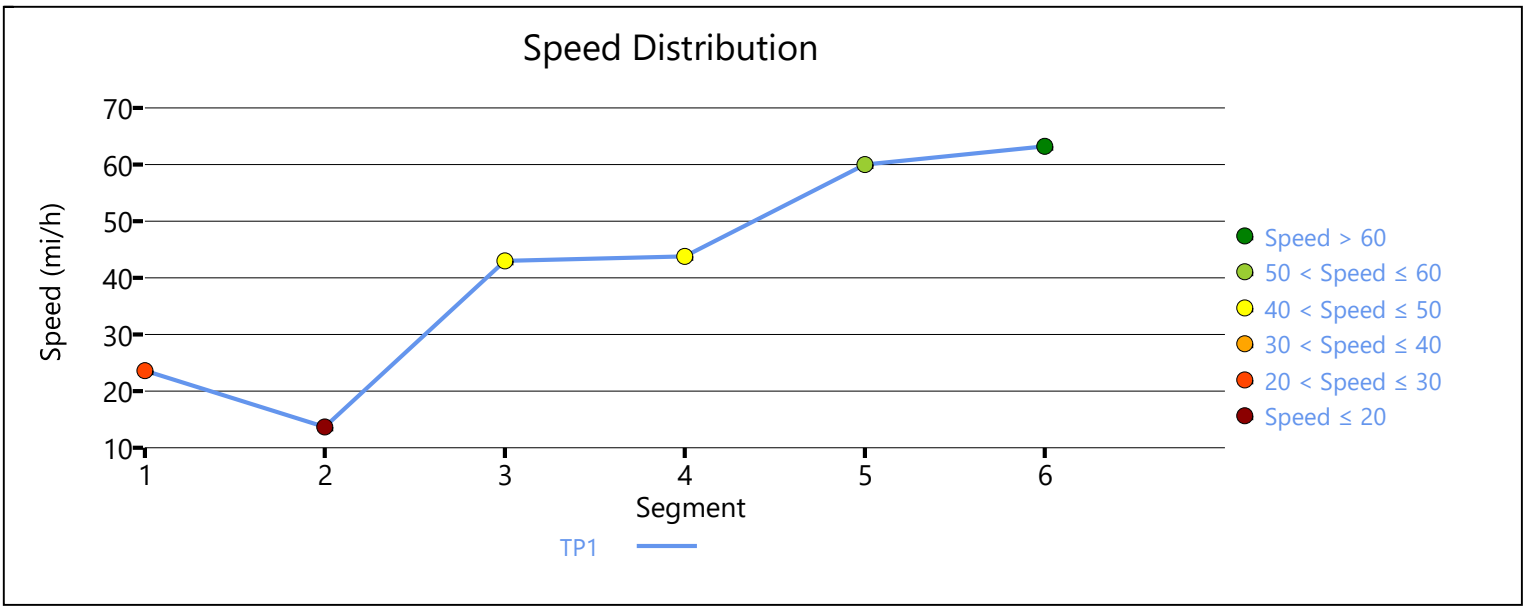
Space Mean Speed, mi/h	42.2	Density, veh/mi/ln	34.5
Average Travel Time, min	3.80	Density, pc/mi/ln	34.5

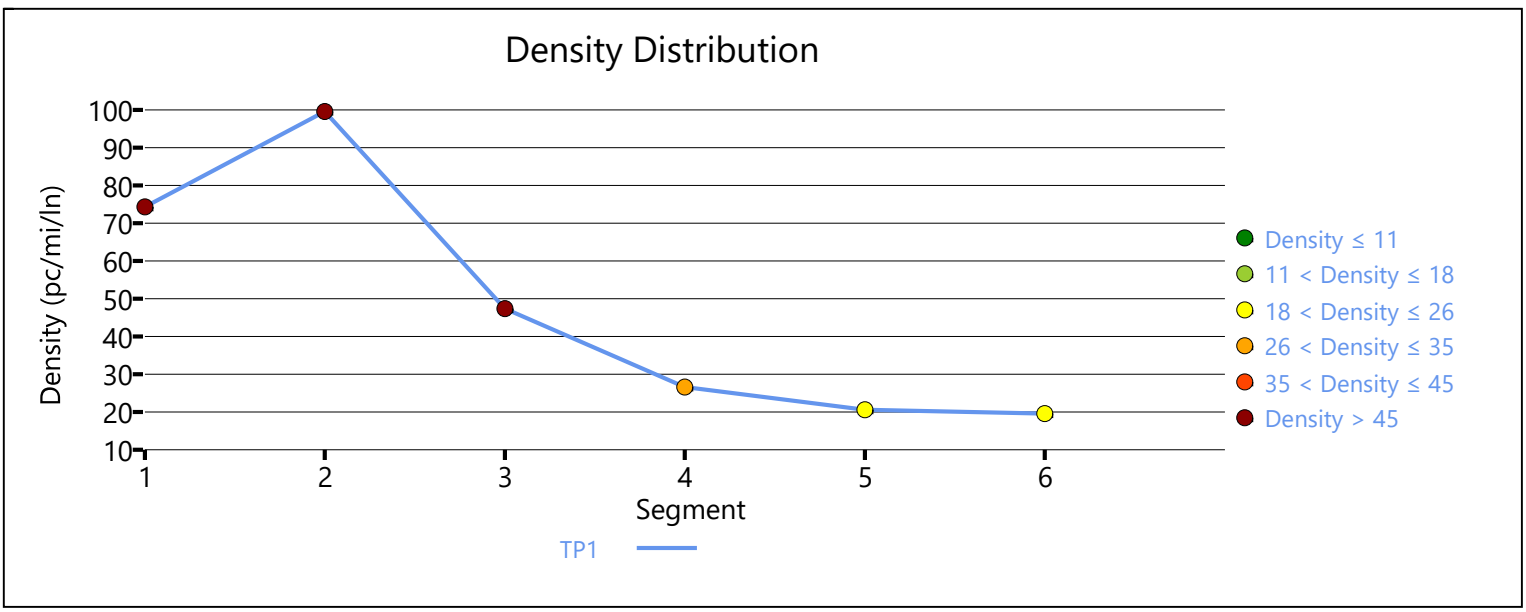
Messages

WARNING 1	Oversaturated conditions currently exist in boundary segment 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
WARNING 2	Oversaturated conditions currently exist in boundary segment 6. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
WARNING 3	Oversaturated conditions currently exist in boundary time period 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
WARNING 4	Oversaturated conditions currently exist on segment 4, which is less than 300 feet. Due to time step size, these segments may produce unreliable results. Consider reviewing facility segmentation to resolve this warning.
WARNING 5	Queue extends past the beginning of the facility on time period 1. Consider expanding the length of the facility to account for these vehicles performance and affect on upstream segments.

Comments







HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition A- NB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	5356	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2849
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.80
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	23.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	74.3
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	2
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	5356	2199
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	5698	2339
Capacity (c), pc/h	6750	4200
Volume-to-Capacity Ratio (v/c)	0.61	0.56

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	1.581
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	2157
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	40.3
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.555	Outer Lanes Freeway Speed (SO), mi/h	39.0
Flow in Lanes 2 and 3 (v23), pc/h	3541	Ramp Junction Speed (S), mi/h	13.7
Flow Entering Ramp-Infl. Area (vR23), pc/h	5880	Average Density (D), pc/mi/ln	99.6
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	40.9

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	7555	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2049
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.93
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	47.4
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	7555	1591
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	8037	1693
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.52	0.38

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.329
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	892
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.0
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	43.6
Flow in Lanes 3 and 4 (v34), pc/h	1189	Ramp Junction Speed (S), mi/h	43.8
Flow Entering Ramp-Infl. Area (vR34), pc/h	2882	Average Density (D), pc/mi/ln	26.6
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	23.7

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	9146	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	9730	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.53	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.302
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1120
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	58.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.066	Outer Lanes Freeway Speed (SO), mi/h	62.8
Flow in Lanes 1 and 2 (v12), pc/h	1493	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2705	Average Density (D), pc/mi/ln	20.6
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	20.7

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	10285	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1236
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.53
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.6
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	493	4400	0.11	43.2	5.7	A

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1071	578	6600	2100	0.16	0.28	44.6	45.0	7.9	7.9	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1070	4400	0.24	43.2	12.4	B

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1707	637	9000	4400	0.19	0.14	44.5	44.2	9.6	10.1	B

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2151	444	9400	2100	0.23	0.21	60.2	59.1	8.7	8.7	A

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2151	9328	0.23	63.2	8.5	A

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	54.3	9.4	9.4	3.00	A

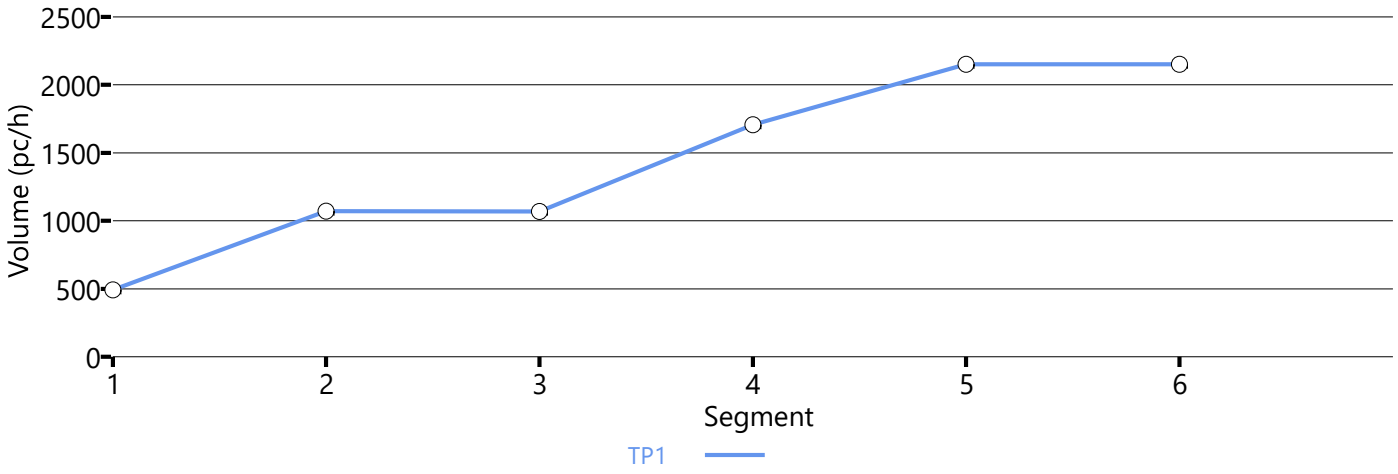
Facility Overall Results

Space Mean Speed, mi/h	54.3	Density, veh/mi/ln	9.4
Average Travel Time, min	3.00	Density, pc/mi/ln	9.4

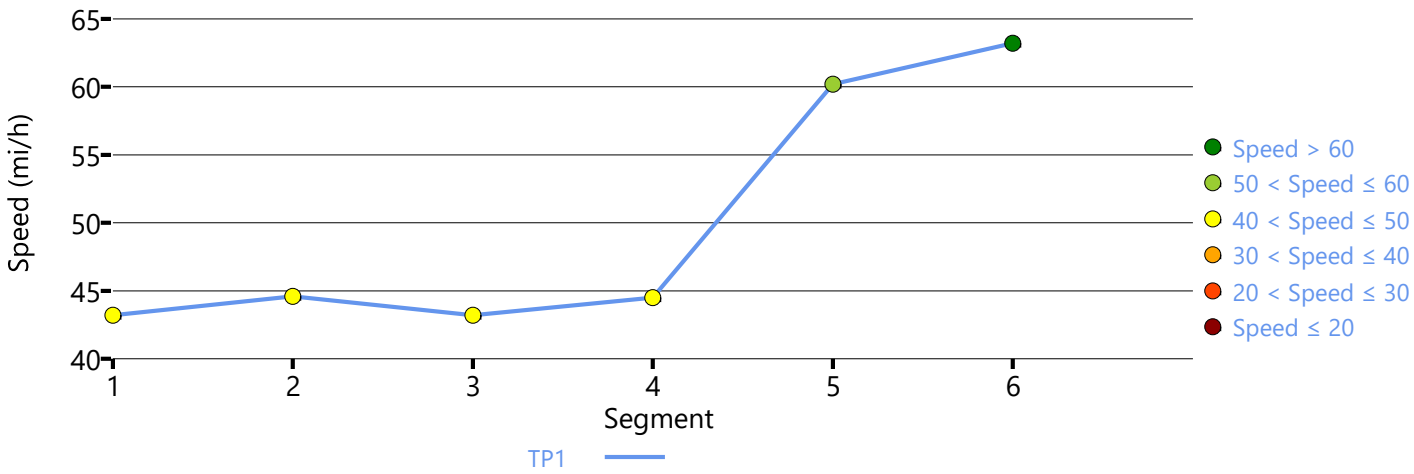
Messages

Comments

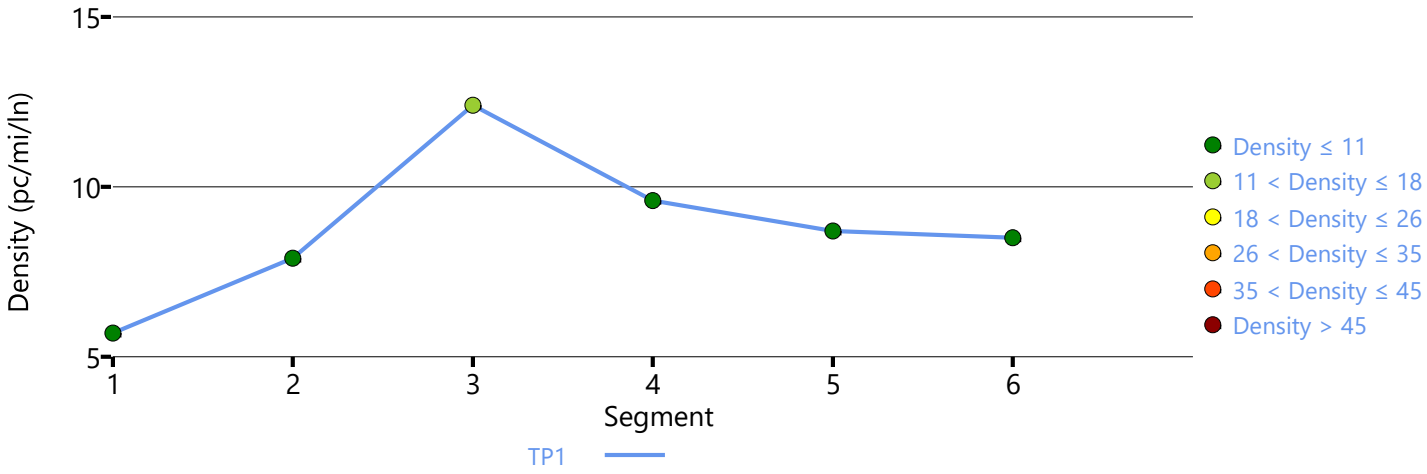
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	463	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	246
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.11
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	5.7
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	463	543
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	493	578
Capacity (c), pc/h	6600	2100
Volume-to-Capacity Ratio (v/c)	0.16	0.28

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.195
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	186
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.555	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 2 and 3 (v23), pc/h	307	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR23), pc/h	885	Average Density (D), pc/mi/ln	7.9
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	7.9

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1006	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	535
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.24
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	12.4
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1006	599
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1070	637
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.19	0.14

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.271
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	321
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.2
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 3 and 4 (v34), pc/h	428	Ramp Junction Speed (S), mi/h	44.5
Flow Entering Ramp-Infl. Area (vR34), pc/h	1065	Average Density (D), pc/mi/ln	9.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	10.1

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1605	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1707	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.23	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.256
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	512
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.375	Outer Lanes Freeway Speed (SO), mi/h	65.0
Flow in Lanes 1 and 2 (v12), pc/h	683	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1127	Average Density (D), pc/mi/ln	8.7
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	8.7

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2022	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	538
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.23
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	8.5
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1871	4400	0.43	43.2	21.7	C

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	3810	1939	6600	2100	0.58	0.92	44.6	45.0	28.2	28.2	D

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	3811	4400	0.87	43.2	44.1	E

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4904	1093	9000	4400	0.54	0.25	43.4	44.1	28.2	21.9	C

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	6115	1212	9400	2100	0.65	0.58	59.2	57.2	25.8	24.3	C

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	6115	9328	0.66	63.2	24.2	C

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	53.2	29.6	29.6	3.00	D

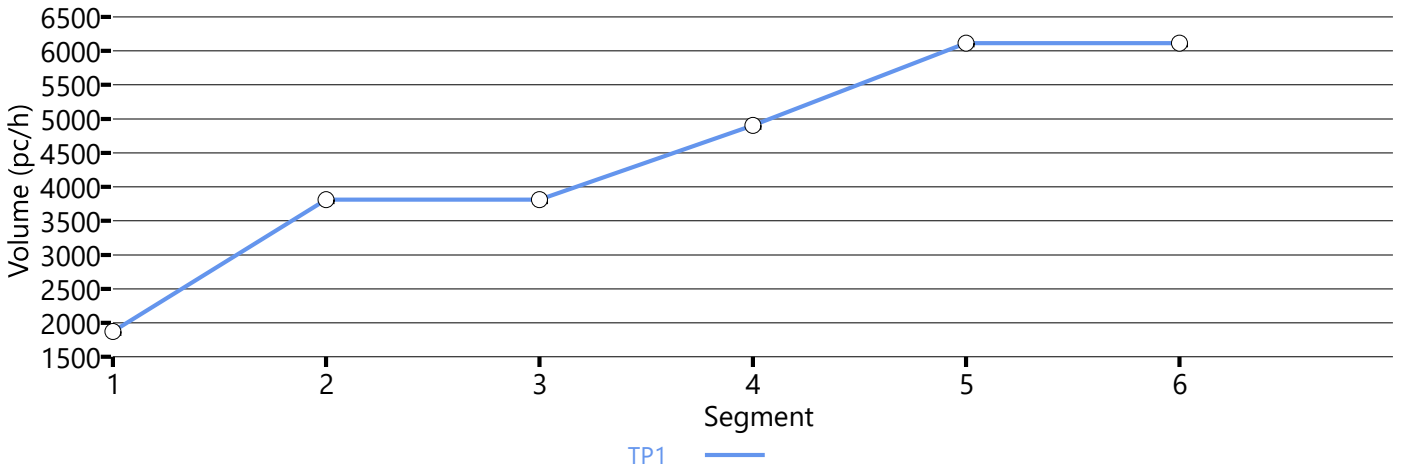
Facility Overall Results

Space Mean Speed, mi/h	53.2	Density, veh/mi/ln	29.6
Average Travel Time, min	3.00	Density, pc/mi/ln	29.6

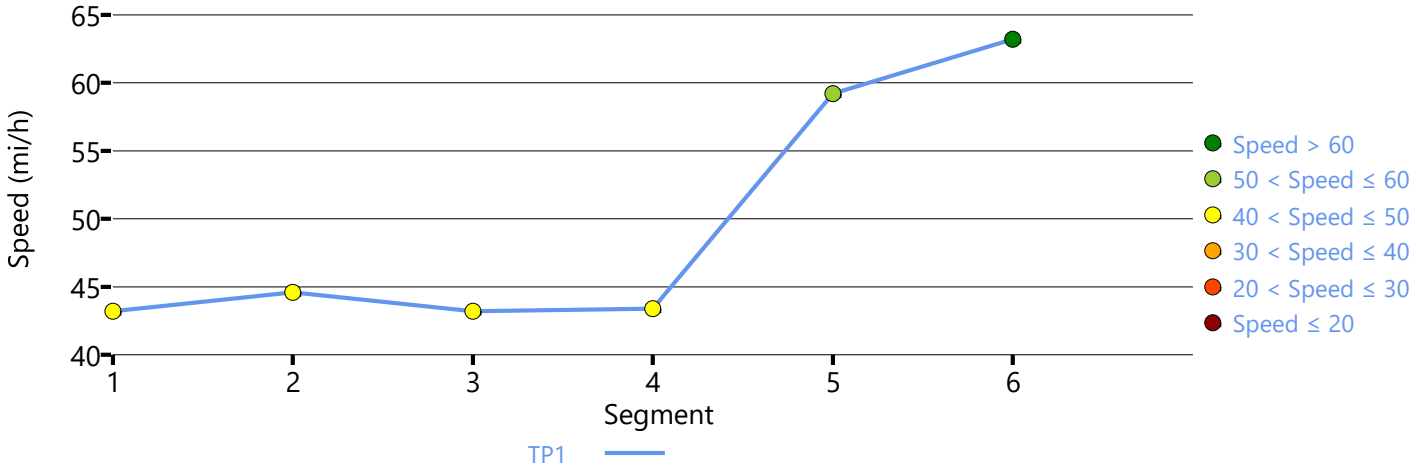
Messages

Comments

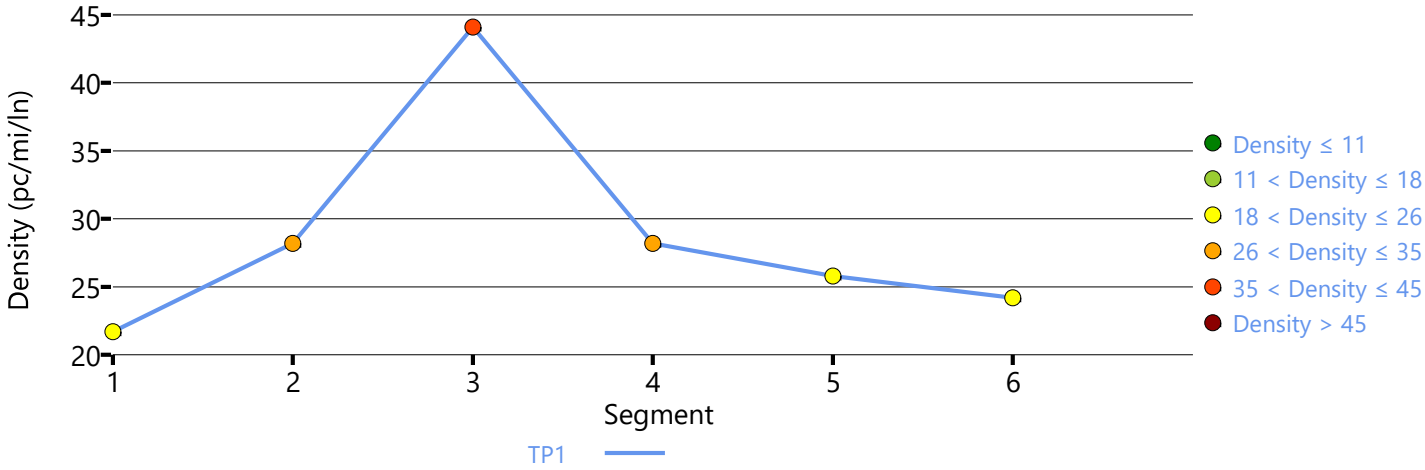
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2025
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1759	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	936
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.43
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	21.7
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1759	1823
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1871	1939
Capacity (c), pc/h	6600	2100
Volume-to-Capacity Ratio (v/c)	0.58	0.92

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.273
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	708
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.555	Outer Lanes Freeway Speed (SO), mi/h	44.3
Flow in Lanes 2 and 3 (v23), pc/h	1163	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR23), pc/h	3102	Average Density (D), pc/mi/ln	28.2
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.2

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	3582	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1906
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	44.1
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	3582	1027
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	3811	1093
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.54	0.25

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.313
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1144
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.1
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	42.7
Flow in Lanes 3 and 4 (v34), pc/h	1524	Ramp Junction Speed (S), mi/h	43.4
Flow Entering Ramp-Infl. Area (vR34), pc/h	2617	Average Density (D), pc/mi/ln	28.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.9

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	4609	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	4903	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.65	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.337
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1471
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	57.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.066	Outer Lanes Freeway Speed (SO), mi/h	61.5
Flow in Lanes 1 and 2 (v12), pc/h	1961	Ramp Junction Speed (S), mi/h	59.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	3173	Average Density (D), pc/mi/ln	25.8
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.3

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	5748	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1529
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.66
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	24.2
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	749	4400	0.17	43.2	8.7	A

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	1446	697	6600	2100	0.22	0.33	44.6	45.0	10.7	10.7	A

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	1446	4400	0.33	43.2	16.7	B

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2327	881	9000	4400	0.26	0.20	44.5	44.2	13.1	13.0	B

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	2771	444	9400	2100	0.29	0.21	60.2	59.0	11.2	10.7	B

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2770	9328	0.30	63.2	10.9	A

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	54.1	12.3	12.3	3.00	B

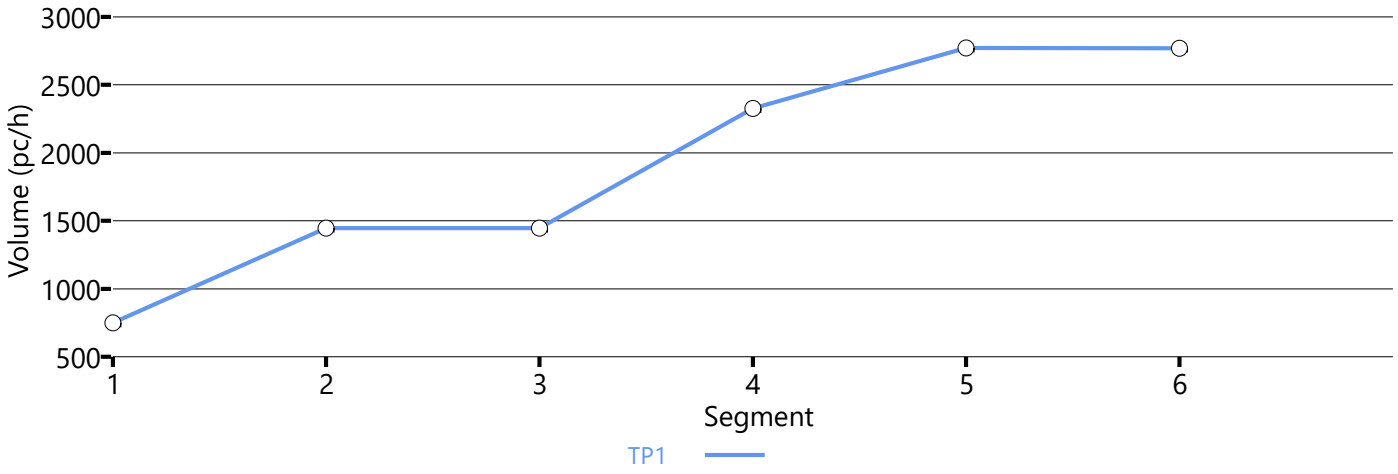
Facility Overall Results

Space Mean Speed, mi/h	54.1	Density, veh/mi/ln	12.3
Average Travel Time, min	3.00	Density, pc/mi/ln	12.3

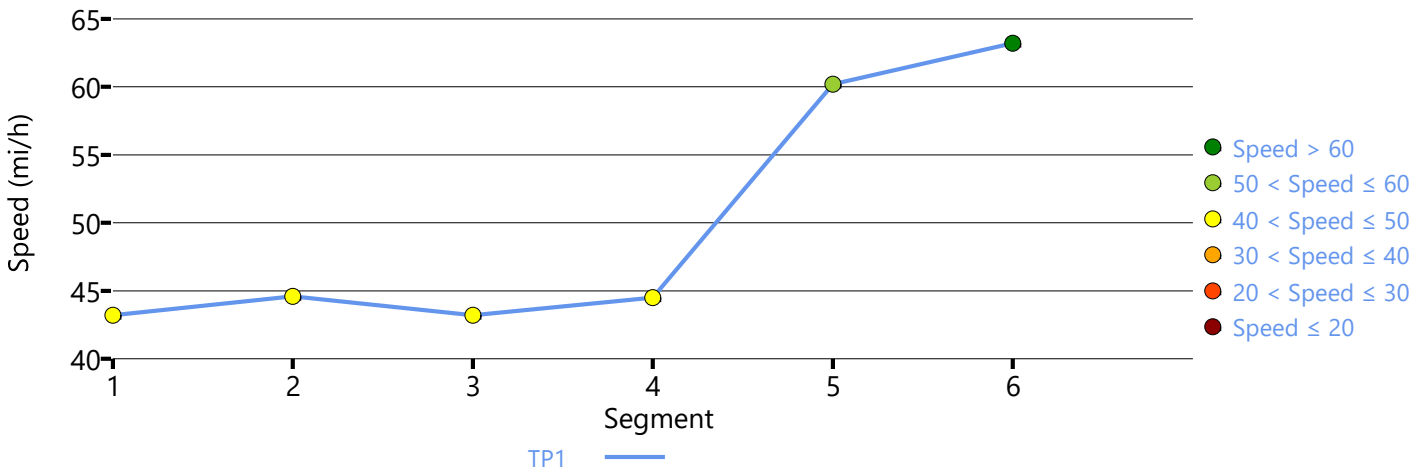
Messages

Comments

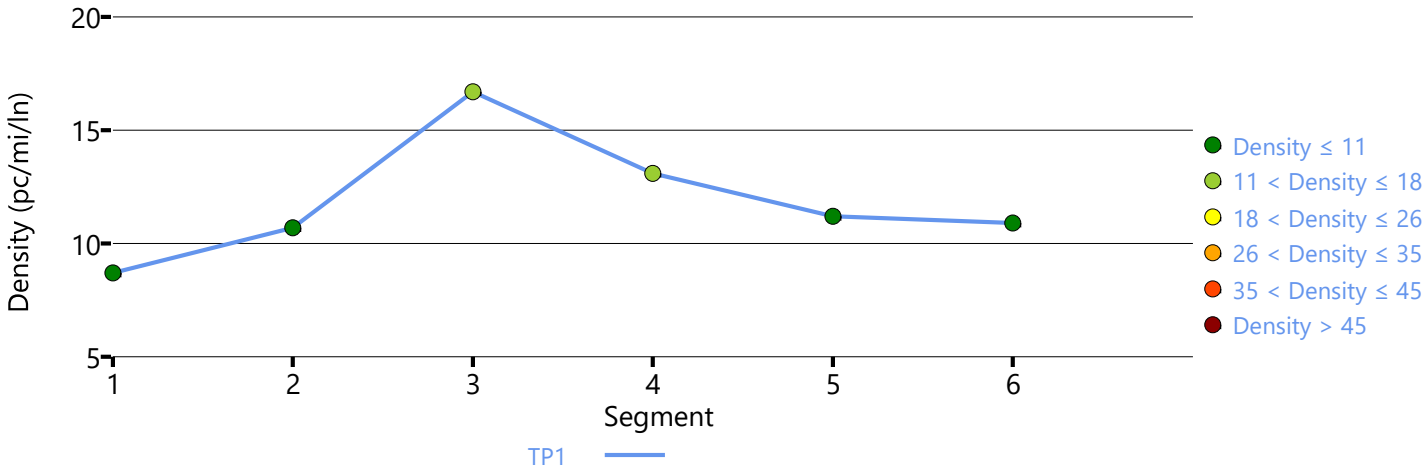
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	AM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	704	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	374
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.17
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	8.7
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	704	655
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	749	697
Capacity (c), pc/h	6600	2100
Volume-to-Capacity Ratio (v/c)	0.22	0.33

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.198
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	283
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	45.0
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.555	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 2 and 3 (v23), pc/h	466	Ramp Junction Speed (S), mi/h	44.6
Flow Entering Ramp-Infl. Area (vR23), pc/h	1163	Average Density (D), pc/mi/ln	10.7
Level of Service (LOS)	A	Density in Ramp Influence Area (DR), pc/mi/ln	10.7

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	1359	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	723
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.33
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.7
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	1359	828
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	1446	881
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.26	0.20

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.276
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	434
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.2
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 3 and 4 (v34), pc/h	578	Ramp Junction Speed (S), mi/h	44.5
Flow Entering Ramp-Infl. Area (vR34), pc/h	1459	Average Density (D), pc/mi/ln	13.1
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	13.0

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2187	417
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	2327	444
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.29	0.21

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.259
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	698
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.375	Outer Lanes Freeway Speed (SO), mi/h	64.3
Flow in Lanes 1 and 2 (v12), pc/h	931	Ramp Junction Speed (S), mi/h	60.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	1375	Average Density (D), pc/mi/ln	11.2
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	10.7

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2604	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	692
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.30
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	10.9
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	A
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

HCS7 Freeway Facilities Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45.0
Queue Discharge Capacity Drop, %	7	Total Segments	6
Total Time Periods	1	Time Period Duration, min	15
Facility Length, mi	2.69		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	IR-77 SB to IR-490 WB Ramp	750	2
2	Merge	Basic	IR-77 NB Ramp Merge with IR-77 SB Ramp	1090	3
3	Basic	Basic	IR-77 Ramps Merge 3-lane to 2-lane	5280	2
4	Merge	Merge	IR-77 Ramps Merge with IR-490 WB	280	4
5	Merge	Merge	Rockefeller Ave to IR-490 WB Merge	1500	4
6	Basic	Basic	IR-490 WB	5280	4

Facility Segment Data

Segment 1: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	2849	4400	0.65	43.2	33.0	D

Segment 2: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	3228	2339	6750	2100	0.79	1.11	44.2	44.2	24.3	24.3	C

Segment 3: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	3228	4400	1.18	43.2	37.4	F

Segment 4: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4428	1693	9000	4400	0.76	0.38	43.9	44.0	25.2	23.0	C

Segment 5: Merge

Time Period	PHF		fHV		Flow Rate (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R	Freeway	Ramp	
1	0.94	0.94	1.000	1.000	4707	1212	9400	2100	0.86	0.58	60.0	58.2	19.5	20.0	B

Segment 6: Basic

Time Period	PHF	fHV	Flow Rate (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	4707	9328	0.87	63.2	18.6	C

Facility Time Period Results

T	Speed, mi/h	Density, pc/mi/ln	Density, veh/mi/ln	Travel Time, min	LOS
1	52.6	24.4	24.4	3.10	F

Facility Overall Results

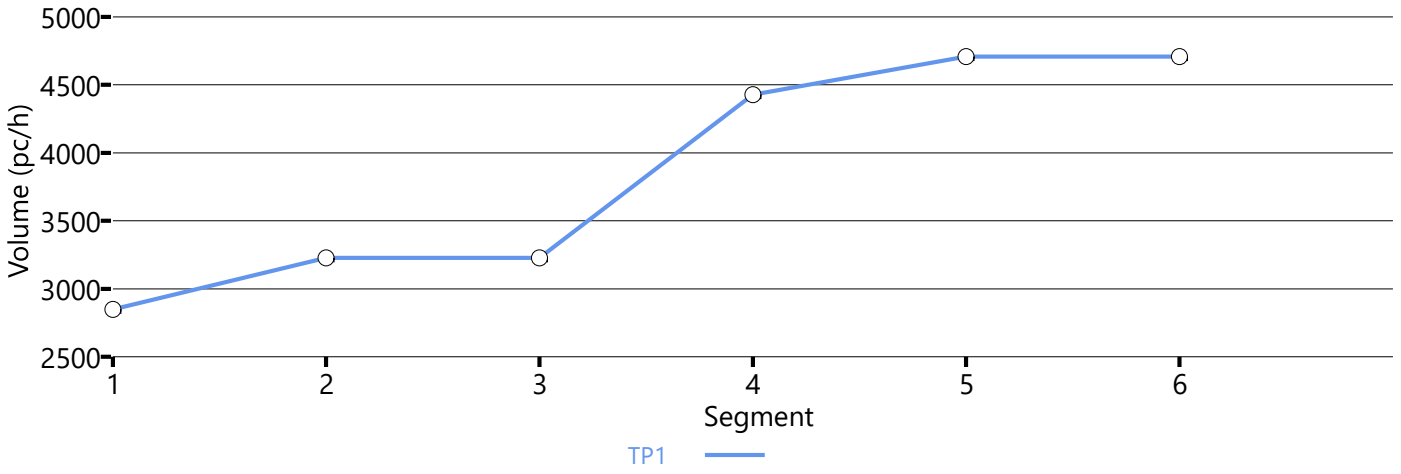
Space Mean Speed, mi/h	52.6	Density, veh/mi/ln	24.4
Average Travel Time, min	3.10	Density, pc/mi/ln	24.4

Messages

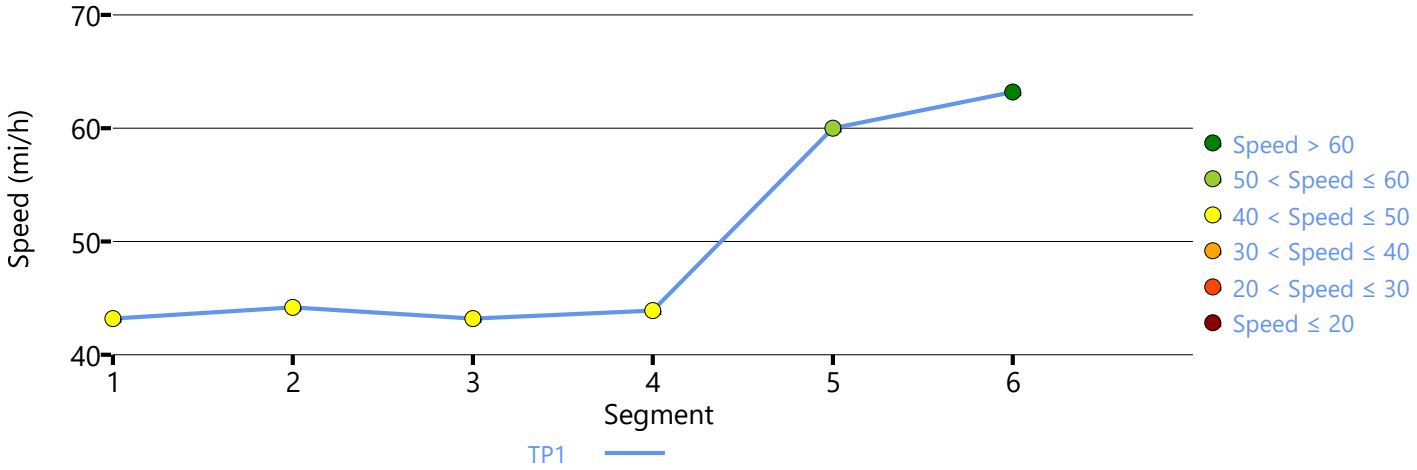
WARNING 1	Oversaturated conditions currently exist in boundary time period 1. Results may not be reliable. Consider expanding analysis in time and/or space to resolve this warning.
WARNING 2	Oversaturated conditions currently exist on segment 4, which is less than 300 feet. Due to time step size, these segments may produce unreliable results. Consider reviewing facility segmentation to resolve this warning.
WARNING 3	Merge capacity is less than merge demand on segment 2.

Comments

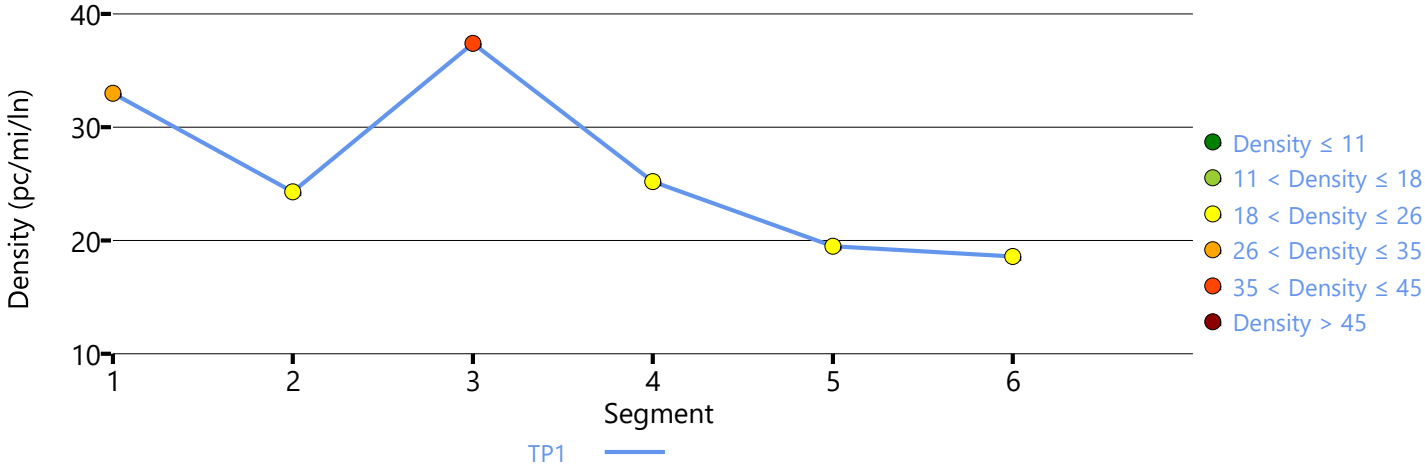
Volume Distribution



Speed Distribution



Density Distribution



HCS7 Basic Freeway Report

Project Information

Analyst	CMC	Date	
Agency	CMTran	Analysis Year	2045
Jurisdiction	ODOT District 12	Time Period Analyzed	PM Peak (Proposed Condition B- SB Ramp with 2 lanes)
Project Description	CUY-490-0.00 TSMO	Unit	United States Customary
Segment Number	1	Segment Name	IR-77 SB to IR-490 WB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	750	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	2678	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1425
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.0
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Basic Freeway Report

Project Information

Segment Number	2	Segment Name	IR-77 NB Ramp Merge with IR-77 SB Ramp
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	3	1
Free-Flow Speed (FFS), mi/h	45.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1090	1090
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	2678	2199
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	2849	2339
Capacity (c), pc/h	6750	2100
Volume-to-Capacity Ratio (v/c)	0.48	1.11

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	1
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.297
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	283
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.2
Prop. Freeway Vehicles in Lane 2 and 3 (PFM)	0.608	Outer Lanes Freeway Speed (SO), mi/h	45.0
Flow in Lanes 2 and 3 (v23), pc/h	606	Ramp Junction Speed (S), mi/h	44.2
Flow Entering Ramp-Infl. Area (vR23), pc/h	2945	Average Density (D), pc/mi/ln	24.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	24.3

HCS7 Basic Freeway Report

Project Information

Segment Number	3	Segment Name	IR-77 Ramps Merge 3-lane to 2-lane
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	2	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	45.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	43.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	4877	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1614
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2200
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.73
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	43.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	37.4
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	43.2		

HCS7 Freeway Merge Report

Project Information

Segment Number	4	Segment Name	IR-77 Ramps Merge with IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	45.0	55.0
Segment Length (L) / Acceleration Length (LA),ft	280	560
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Left

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	4877	1591
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	5188	1693
Capacity (c), pc/h	9000	4400
Volume-to-Capacity Ratio (v/c)	0.49	0.38

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.323
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	821
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	44.0
Prop. Freeway Vehicles in Lane 3 and 4 (PFM)	0.209	Outer Lanes Freeway Speed (SO), mi/h	43.8
Flow in Lanes 3 and 4 (v34), pc/h	1094	Ramp Junction Speed (S), mi/h	43.9
Flow Entering Ramp-Infl. Area (vR34), pc/h	2787	Average Density (D), pc/mi/ln	25.2
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.0

HCS7 Freeway Merge Report

Project Information

Segment Number	5	Segment Name	Rockefeller Ave to IR-490 WB Merge
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA),ft	1500	860
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

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

Demand and Capacity

Demand Volume (Vi)	6468	1139
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	0.00	0.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (fHV)	1.000	1.000
Flow Rate (vi),pc/h	6881	1212
Capacity (c), pc/h	9400	2100
Volume-to-Capacity Ratio (v/c)	0.50	0.58

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (NO)	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (MS)	0.297
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (vOA), pc/h/ln	1049
Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	58.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.066	Outer Lanes Freeway Speed (SO), mi/h	63.0
Flow in Lanes 1 and 2 (v12), pc/h	1398	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2610	Average Density (D), pc/mi/ln	19.5
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	20.0

HCS7 Basic Freeway Report

Project Information

Segment Number	6	Segment Name	IR-490 WB
Time Period Number	1	Segment Analysis Time Period	07:00-07:15

Geometric Data

Number of Lanes, ln	4	Terrain Type	Level
Segment Length (L), ft	5280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.50
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	63.2
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

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

Demand and Capacity

Demand Volume veh/h	7607	Heavy Vehicle Adjustment Factor (f_{HV})	1.000
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1177
Total Trucks, %	0.00	Capacity (c), pc/h/ln	2332
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2332
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.50
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	18.6
Total Ramp Density Adjustment	1.8	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	63.2		

Attachment G
TSMO **Guidebook**
Countermeasure Details

Attachment G

CARPENTER MARTY transportation

Detection Based Driver Warning – Intersection Warning

What it is:

Detection-based driver warning refers to technologies that improve motorist awareness of an inclement condition when that condition is present. This particular strategy subset includes intersection warning systems that detect the presence of a crossing vehicle, usually on a minor approach at an intersection, and notifies motorists on the major approach to be aware of that crossing vehicle. This is typically through a static sign with flashing beacons that activate when the crossing vehicle is detected. These strategies tend to be applied in isolated parts of the network that has a particular crash history type.

Relevant Deployment Conditions:

- Remote intersections with higher crash rates, particularly angle crashes.
- Remote intersections with stop-controlled minor legs and unrestricted major legs.
- Remote intersections with poor sight lines.
- Remote intersections with high average speeds.

Range of Researched Benefits:

Mobility

- No expected mobility benefits.

Safety

- 30% reduction in crashes, 70% reduction in major crash types
- 7% reduction in crashes
- 71% reduction in crashes
- 27% reduction in crashes

Vehicle Operating Costs

- No expected operating cost benefits.

Benefit/Cost Data

- Limited BC Data

Conditions Supporting Success

- Deployment of flashing beacon sufficiently upstream of the intersection to allow for proper warning and response.
- Use of recognizeable signs, preferribly those that are compliant with the MUTCD

Generalized Deployment Costs:

- North Carolina: $21,200 to $28,000 per intersection
- Minnesota DOT: $109,457 per intersection warning systems for post-mounted on all approaches for two-lane major approach included static signs on the major road, blank-out signs on the minor road, micro-loops on the major road, loops or micro-loops on the minor road, controller cabinets, and onsite contractor warranty
- Minnesota DOT: $138,963 per intersection warning systems for post-mounted on all approaches for four-lane major approach
- Missouri DOT: $25,000 to $75,000 for signs posted on either the major or the minor approaches.
- North Carolina: $29,500 to $117,000, depending on extent of deployment on major/minor approaches.
- Minnesota DOT: $50,000 to $125,000, depending on whether major/minor approaches are covered.

Inputs:

- Annual Crash Rate

Basic BCR Calculation Steps:

Annual Benefit = Annual Crash Rate x 10% x $45.64

*BCR = (Annual Benefit * Program Lifespan) / Cost*

Queue Warning System

What it is:

Queue warning's basic principle is to inform travelers of the presence of downstream stop-and-go traffic (based on real-time traffic detection) using warning signs and flashing lights. Drivers can anticipate an upcoming situation of emergency braking and slow down, avoid erratic behavior, and reduce queuing-related collisions. Dynamic message signs (DMS) show a symbol or word when stop-and-go traffic is near. Variable speed limits and lane control signals that provide incident management capabilities can be combined with queue warning. The system can be automated or controlled by a traffic management center operator.

Relevant Deployment Conditions:

- Frequently congested freeways or roads.
- Facilities with frequent queues in predictable locations.
- Facilities with sight distance restricted by vertical grades, horizontal curves, or poor illumination.
- Power must be available to site or able to be installed at cost-effective rate.
- Right of way to install QWS signs and/or overhead sign gantries must be available.
- Communications to TOC must be available.
- CCTV monitoring of the site should be present to monitor system performance.
- Signs should be placed to contain end of queuing fully at site.
- Sensors to support QWS operation must be installed at close spacings. Sensors should be located before and after ramp entrances.

Range of Researched Benefits:

Mobility

- No expected mobility benefits.

Safety

- 44% reduction in crashes
- 22% reduction in crashes, 54% reduction in near misses
- 18% to 45% reduction in crashes
- 14% reduction in crashes (work zones)

Vehicle Operating Costs

- No expected operating cost benefits.

Benefit/Cost Data

- 1.6:1 - 2.4:1

Conditions Supporting Success

- Locations with high rates of secondary crashes, recurring congestion/queuing, and limited sight distances
- Public outreach to familiarize the public with the goals and benefits of the system.
- Lane control signals upstream of lane blockages.
- Frequent analysis (e.g., once per minute) of speed and occupancy data for improved system responsiveness.
- Different types of warnings activated depending on the severity of the congestion ahead.
- Work zones also benefit from queue warning with portable dynamic message sign units placed upstream of expected queue points.

Generalized Deployment Costs:

- Finland: $30 million.
- Scotland: $630,000.
- Virginia: $25,000 at two weigh stations.
- West Virginia: $85,000 for fog warnings.
- Minnesota: $15 million, or $3.75 million per mile, on I-94.
- Florida: $26 million for a mobile warning system.
- California: $2.5 million for reduced visibility warnings.

Inputs:

- Annual Crash Rate

Basic BCR Calculation Steps:

Annual Benefit = Annual Crash Rate x 20% x $45.64

*BCR = (Annual Benefit * Program Lifespan) / Cost*

Variable Speed Limit (VSL)

What it is:

Variable Speed Limits (VSL) are systems that provide flexible speed limits for motorists to drive on the road, as opposed to the traditional fixed speed limit. VSLs allow a road operator to post speed restrictions—regulatory or advisory, depending on local policy—that are based on real-time information that may not be available to the motorists, such as congested conditions ahead, a major incident, or a hazardous environmental condition (e.g. icy road). Most VSL programs use roadside or overhead signage to notify motorists. In the connected-vehicle environment, this information may be transmitted directly into the driver's onboard equipment. Although the technology may be different, the expected benefits are anticipated to be comparable.

Relevant Deployment Conditions:

- Locations with high congestion, large speed differentials, recurrent back of queues, and high crash rates are desirable to offset the high costs associated with the system.
- Locations with recurrent inclement weather, such as icy roads, snow, fog, or other visibility-imparing elements, that would benefit from motorists with reduced speeds are desirable.
- Reliable line power should be available to site or able to be installed at cost-effective rate in order to ensure available operation.
- Right of way to install VSL signs and/or overhead sign gantries must be available.
- Reliable communications to the Traffic Operations Center must be available.
- CCTV monitoring of site should be present to monitor system performance and verify messaging.
- VSL signs should be placed at frequent intervals to help maintain motorist awareness of the changed condition.
- Agency should adopt policy for VSL activation.

Range of Researched Benefits:

Mobility

- 20% reduction in travel time
- 17.6% reduction in travel time
- 2% to 7.6% reduction in travel time
- 15% reduction in delay

Safety

- 8% to 30% reduction in crashes
- 55.7% reduction in personal injury crashes
- 8% to 25% reduction in crashes
- 4.5% to 8% reduction in crashes
- 9% to 35% reduction in crashes
- 18% reduction in crashes

Vehicle Operating Costs

- 5% to 16% reduction in fuel use
- 6.3% reduction in fuel use

Benefit/Cost Data

- B/C Range of 7:1 to 14:1
- B/C Range of 0.6:1 to 1.6:1
- B/C Range of 1.1:1 to 1.9:1

Conditions Supporting Success

- There must be sufficient space on shoulder to permit enforcement officers (if used) to pull over violators.
- Outreach to the judicial system regarding the legal aspects of VSL can strengthen enforcement efforts.
- Public outreach to familiarize the public with the goals and benefits of the system.
- Due to potential driver confusion regarding signage, VSL should be deployed with caution when a dynamic lane management system is in place.
- An accompanying Queue Warning System can contribute to the success of a VSL deployment by justifying the speed limits to drivers.

Generalized Deployment Costs:

- Washington State: $3.2 million per mile on a 3-lane section.
- Washington State: $4 million per mile on a 5-lane section.
- Germany: $1.2 million to $1.7 million per mile.
- United Kingdom: $18 million per mile.
- Michigan: $67,000 per mile for a portable system.
- Virginia: $425,000 per mile.
- Oregon: $560,000 per mile.
- Seattle: $3.6 million per mile on I-5.
- Minnesota: $2.15 million per mile on I-35W.
- Wyoming: $28,000 per mile.

Inputs:

- AADT
- Truck AADT
- % Traffic Present during VSL Activation
- Corridor Length
- Annual Crash Rate

Basic BCR Calculation Steps:

Annual Benefit = ((((AADT - Truck AADT) x $15.29) + (Truck AADT x $29.96)) x (% Traffic Present During VSL Activation) x (Corridor Length / 70) X 17.5% x 365) + (Annual Crash Rate x 10% x $45.64)

*BCR = (Annual Benefit * Program Lifespan) / Cost*

Attachment H
Cost Estimate

CARPENTER MARTY transportation

Attachment H

Roadway Improvements

Item	Description	Quantity	Units	Unit Cost	Total Cost
202	Pavement Removed	2325	SY	$ 11.00	$ 25,575.00
202	Curb Removed	515	FT	$ 10.00	$ 5,150.00
203	Excavation	250	CY	$ 15.00	$ 3,750.00
203	Embankment	1250	CY	$ 10.00	$ 12,500.00
452	Full Depth Pavement (Concrete)	745	SY	$ 70.00	$ 52,150.00
609	Concrete Curb	350	FT	$ 18.00	$ 6,300.00
611	Drainage	1	LUMP	$ 5,000.00	$ 5,000.00
625	Lighting	1	LUMP	$ 1,500.00	$ 1,500.00
630	Signage	1	LUMP	$ 15,000.00	$ 15,000.00
644	Pavement Markings	1	LUMP	$ 1,500.00	$ 1,500.00
			Subtotal		**$ 128,430.00**

Incidentals					
614	Maintenance of Traffic	1	LUMP	$ 25,000.00	$ 25,000.00
619	Field Office	1	LUMP	$ 5,000.00	$ 5,000.00
623	Construction Layout Stakes	1	LUMP	$ 10,000.00	$ 10,000.00
624	Mobilization	1	LUMP	$ 20,000.00	$ 20,000.00
			Incidentals Subtotal		**$ 60,000.00**

Engineering Design (15%)	**$ 28,300.00**
Contingency (30%)	**$ 56,600.00**
Subtotal	**$ 273,400.00**
Inflation (17.5%)**	**$ 47,900.00**
Total	**$ 321,300.00**

Note: Costs for utility relocation are not included

*Inflation based on 2027 Construction