Memo

Date:	Thursday, October 25, 2018
Project:	South Mountain Freeway
To:	Kurt Watzek, HDR
From:	Ed Liebsch, HDR
Subject:	Air Quality Assessment for 32nd Street Traffic Interchange FEIS Re-evaluation #9

Introduction

The purpose of this memorandum is to provide a re-evaluation of air quality requirements that were addressed in the 2015 South Mountain Freeway (SMF), Interstate 10 (I-10, Papago Freeway) to I-10 (Maricopa Freeway) Final Environmental Impact Statement (FEIS) and Record of Decision (ROD), based on the proposed project to add the 32nd Street Traffic Interchange (TI) to the SMF (see Figures 1 and 2). Table 1 provides a listing of those air quality requirements, and a summary of conclusions for each requirement for this re-evaluation, the basis for which are discussed in more detail below Table 1.

Table 1. Proposed 32nd Street Traffic Interchange: Re-evaluation of SMF Air Quality Requirements

Air Quality Requirement	Conclusions of 32nd Street TI Re-evaluation
Regional emissions (under Transportation Conformity) of ozone precursors	The proposed TI project would tend to reduce regional emissions because of improved traffic operations at intersections vs. without the TI. The project is included in an approved RTP and TIP with regional conformity analysis, as amended and approved by FHWA on July 17, 2018. The latest State Transportation Improvement Program (STIP) amendment #36 was approved by FHWA and the Federal Transit Administration on August 18, 2018. Therefore, Transportation Conformity regional emissions requirements have been satisfied.
Particulate matter 10 micrometers or less in diameter (PM_{10})hot-spots	The TI project is not a “project of air quality concern” per 40 CFR 93.123(b) based on evaluation of a current traffic analysis, current project air quality criteria, and interagency

Air Quality Requirement	Conclusions of 32nd Street TI Re-evaluation
(under Transportation Conformity)	consultation. Therefore, additional PM_{10} hot-spot analysis is not required under Transportation Conformity rules.
Carbon monoxide (CO) hot-spots (under Transportation Conformity)	The TI project effects on CO would be less than for other interchanges previously analyzed for the FEIS because of lower intersection traffic levels, and the project would not create Level of Service (LOS) "D" or worse intersections. Therefore, CO hot-spot analysis is not required under Transportation Conformity rules.
Mobile Source Air Toxics (MSATs) per FHWA Policy	The TI project would not measurably change regional or study area MSAT emissions vs. no-action because there would be minimal changes in vehicle miles travelled (VMT). No additional analysis is warranted under current FHWA policy.
Construction emissions & General Conformity	The TI project construction would not include any stream crossings subject to USACE approval under General Conformity air quality rules (40 CFR 93, Subpart B).

For the purposes of this discussion, "no action" case represents the implementation of the SMF without addition of the proposed TI at 32nd Street.

The project area compliance status with respect to National Ambient Air Quality Standards (NAAQS) has not changed since approval of the ROD in March 5, 2015 for the SMF. The only new NAAQS implemented since that time is the 2015 ozone NAAQS of 70 parts per billion (ppb). The project area is still a "moderate" nonattainment area for the prior 2008 ozone NAAQS of 75 ppb. Effective August 3, 2018, The U.S. Environmental Protection Agency (USEPA) designated the Phoenix-Mesa area (including the project area of the proposed 32nd Street TI) as a "marginal" nonattainment area for the 2015 ozone NAAQS. Thus the area is designated nonattainment for both the 2008 and 2015 ozone NAAQS. The project area is still a maintenance area for the carbon monoxide (CO) NAAQS and a "serious" nonattainment area for the 24-hour NAAQs for particulate matter 10 micrometers or less in diameter (PM_{10}).

Figure 1. South Mountain Freeway Location Map

Figure 2. Proposed 32nd Street Traffic Interchange

Regional Emissions

Under Transportation Conformity rules, regional emissions due to transportation plans, programs and projects must not interfere with approved plans to bring a nonattainment area into attainment with NAAQS, and must not interfere with plans to maintain compliance with NAAQs in maintenance areas.

By adding the proposed TI to the SMF at 32nd Street, there would be somewhat better access to and from addresses near 32nd Street, thus tending to shorten trips that would otherwise need to use the 24th and 40th Street interchanges that are already included in the approved SMF, or other routes. The proposed project to place a TI at 32nd Street would tend to lessen congestion vs. no-action and would have minimal effects on regional VMT. Both of these improvements will likely tend to reduce regional air pollutant emissions associated with highway vehicle traffic.

Transportation Conformity requirements in 40 CFR 93, Subpart A, with respect to regional emissions budgets, are assumed to be met if the proposed project is included in a conforming (approved) regional transportation plan (RTP) and transportation improvement program (TIP). The project is included in an approved RTP and TIP (July 17, 2018), and the latest STIP amendment #36 was approved by FHWA and the Federal Transit Administration on August 18, 2018.

PM_{10} Hot-Spots

A Project of Air Quality Concern Questionnaire (POAQCQ) was prepared (see Attachment A) to assess the proposed project in relation to project types in 40 CFR 93.123(b) requiring a quantitative analysis of local particulate emissions (hot spots) in nonattainment or maintenance areas: the SMF is located within the Phoenix PM-10 Nonattainment Area for PM_{10}. Project types that have been specifically defined to cause local air quality concerns include:

- Projects on new highways that have more than 125,000 annual average daily traffic (AADT) and 8 percent or more of the AADT is diesel truck traffic
- Expansion of a highway that affects a congested intersection that operates (or will operate, for a new intersection) at a Level-of-Service (LOS) of D, E, or F and that expansion has a significant increase in the number of diesel trucks
- Projects in areas or affecting sites that are identified in an applicable PM_{10} implementation plan as sites of violation or possible violation

Traffic projections for 2040 for the road network within the study area were obtained from the Maricopa Association of Governments (MAG) Regional Travel Demand Model. The traffic data indicates there will be no significant increase in the percentage of diesel trucks as a result of the TI project. The highest traffic volumes projected on the freeway mainline in the area, just east of 40th Street, without the TI is 135,998 vehicles per day, including 23,339 diesel trucks, and with the TI is 139,910 vehicles per day, including 23,374 diesel trucks, a diesel truck increase of 0.1 percent. The new TI would provide access to an almost exclusively residential area with very few commercial, industrial, or other land use activities that typically attract commercial truck traffic.

A traffic report (see Attachment B) was prepared by HDR dated July 16, 2018 that modeled the 32nd Street TI intersections for LOS as well as the nearby TIs at 40th and 24th Streets. The results indicate that all of the intersections would operate at a LOS of C or better, with or without the 32nd Street TI.

The PM_{10} implementation plan revision issued by MAG (*2012 Five Percent Plan for the Maricopa County Nonattainment Area) was* approved by the USEPA on May 30, 2014. This implementation plan does not identify the 32nd Street area or interchanges in general, as sites of existing or potential violation. Additionally, the PM_{10} hot-spot analyses for the SMF FEIS involved traffic interchanges with much higher total and diesel vehicle traffic levels. The north and south intersections for the 32nd Street traffic interchange have volumes of total traffic and diesel vehicle traffic less than the 40th Street signalized intersection previously analyzed for PM_{10} hot spot in the FEIS. Therefore, the prior analyses conducted for transportation conformity and NEPA purposes in the FEIS demonstrate that the proposed 32nd Street traffic interchange would not cause or contribute to violations of the PM_{10} NAAQS. It is clear from the prior analyses that the proposed 32nd Street traffic interchange is not a site of violation or potential violation of the PM_{10} NAAQS.

Based on the 2040 traffic data and analysis, the proposed 32nd Street TI is not a Project of Air Quality Concern and will not require a PM_{10} hot-spot analysis. Interagency consultation with the EPA, ADEQ, MAG and Maricopa County Air Quality Department was completed on October 9, 2018 in accordance with 40 CFR 93.105. The USEPA concurred that the project is not a project of air quality concern (see Attachment A).

CO Hot-Spots

Transportation Conformity rules require hot-spot analysis for CO (or equivalent/approved screening analysis) for roadway project in NAAQS nonattainment or maintenance areas

where the project would affect an intersection with a LOS of “D” or worse, or would change the LOS to “D” or worse as a result of project implementation.

The traffic report prepared by HDR for this project, dated July 16, 2018 (Attachment B), shows that LOS would be “C” or better at the two adjacent TI locations (40th and 24th Streets) if there is no action. Including the proposed TI, the report documents that the intersections at the 40th and 24th Street TIs and at 32nd Street TI would be LOS “C” or better. Therefore, no hot-spot analysis for CO is required under Transportation Conformity rules. Note that CO hot-spot analysis was completed under the 2015 FEIS for other, busier intersections along the SMF, and no adverse air quality impacts were found in those analyses.

Mobile Source Air Toxics (MSATs)

A quantitative analysis of MSAT emissions was performed as part of the 2015 FEIS for the SMF. That analysis concluded that traffic-related MSAT emissions in the project study area in 2035, for the preferred alternative for SMF implementation, would be less than 1 percent higher than for the no-action alternative. It also concluded that MSAT emissions for project implementation would be significantly lower than baseline (2012) emissions.

The Federal Highway Administration (FHWA) has updated their MSAT analysis policy/guidance since the 2015 FEIS. The current policy dated October 16, 2016, updated the prior policy from December 2012, by incorporating emissions estimates that take into account three additional USEPA rules to control motor vehicle emissions, using the latest version of the Motor Vehicle Emissions Simulator (MOVES 2014a) software. The latest updated policy shows that, consistent with the earlier policy and MOVES projections, MSAT emissions will drop dramatically in the coming decades, even with substantial increases in VMT.

Implementation of the proposed 32nd Street TI project would not affect the MSAT conclusions from the 2015 FEIS with respect to the SMF project, in light of the latest FHWA guidance. In addition, the proposed 32nd Street TI would have little effect on MSAT emissions, as the project would cause minimal changes in regional VMT and congestion. Based on this finding, there is no need for additional quantitative MSAT emissions analysis for the proposed 32nd Street TI project.

Construction Emissions & General Conformity

The SMF project was subject to a General Conformity emissions analysis, due to the need for US Army Corps of Engineers (USACE) approval for dry stream bed crossings to be constructed at various points along the SMF corridor. For the prior analysis, only emissions associated with the construction of crossings themselves were estimated, for comparison with the General Conformity *de minimis* emissions thresholds provided under 40 CFR 93, Subpart B. The prior analysis showed that the construction emissions for these crossings would be below the *de minimis* emissions thresholds, and therefore, no mitigation of such emissions was necessary for General Conformity purposes.

The proposal to add the 32nd Street TI to the SMF would not include any stream crossings subject to USACE approval. Thus, the General Conformity requirements of 40 CFR 93, Subpart B do not apply to this TI project.

Attachment A

Project of Air Quality Concern Questionnaire

and

Interagency Consultation E-mails

Project Level PM Quantitative Hot-Spot Analysis – Project of Air Quality Concern Questionnaire

Project Setting and Description

The Arizona Department of Transportation (ADOT) is the sponsor of the construction and operation of the South Mountain Freeway. The freeway will constitute a section of the Regional Freeway and Highway System, the Loop 202, which is also referred to as State Route (SR) 202L. The project is in the southwestern portion of the Phoenix metropolitan area in Maricopa County, Arizona (see map below). The approximately 22-mile-long freeway will be constructed as an eight-lane divided, access-controlled facility, with four travel lanes in each direction. Three lanes will be for general purpose use and one lane will be dedicated to high-occupancy vehicle use.

South Mountain Freeway
Federal-aid Project Number: NH-202-D(ADY)
ADOT Project Number: 202L MA 054 H5764 01D (H8827 01C)

Figure 1

Project Location Map

Not to scale

June 5, 2018

During the third tier of the alternatives development and screening process for the environmental impact statement (EIS), which occurred between 2001 and 2005, the project team evaluated where traffic interchanges with arterial streets should be located (see page 3-12 of the Final EIS). In the beginning, interchanges were located at all major arterial streets, generally spaced at 1-mile or greater intervals along the arterial street grid. This included an interchange at 32nd Street. During the screening process, ADOT worked with local agencies and the Citizens Advisory Team (CAT) to evaluate each interchange location. During the evaluation for 32nd Street, the City of Phoenix and CAT recommended that ADOT remove the traffic interchange from further consideration because of undesirable residential displacements (over 100 homes) and the proximity of the ramp intersections to a nearby high school. At the time (in 2006), the City of Phoenix conducted a traffic circulation study to evaluate the impacts of the proposed freeway without a 32nd Street traffic interchange on the local street system. The City of Phoenix study found that the freeway would have no adverse effects on the local street system.

Based on this information, an interchange at 32nd Street was not included in the Draft EIS and Final EIS. During the public comment period for each document, ADOT and the Federal Highway Administration received comments questioning the decision to eliminate the interchange from consideration. The response from ADOT and the Federal Highway Administration referred to the justification considered at the time (regarding the potential residential and high school impacts) in coordination with the City and with support from the CAT.

After the Record of Decision was issued, and prior to the initiation of project construction, ADOT and its contractor participated in a public input meeting for the South Mountain Freeway in Ahwatukee Foothills Village. At the 2016 meeting, the community, including City Council members and State representatives, expressed an interest in reconsidering the need for a traffic interchange at 32nd Street. The concerns raised by the community included the fear that traffic would increase substantially on Liberty Lane and Lakewood Parkway (both minor collector streets) because vehicles currently using 32nd Street would need to get to 24th or 40th Streets to access the new freeway. This additional traffic would pass directly by a number of local schools.

Based on the request from the community, City, and elected officials, ADOT decided to conduct an EIS reevaluation for the addition of an interchange at 32nd Street.

The purpose of the 32nd Street traffic interchange is to improve access to and mobility within Ahwatukee Foothills Village. Benefits of this traffic interchange would include:

- maintaining current trip distributions by providing access to the freeway from all of the north-to-south arterial streets that currently connect to Pecos Road
- reducing traffic volumes on the adjacent interchanges at 40th and 24th Streets as compared to a no-build alternative
- providing a nearer access point, compared to the no-build alternative, in the event of emergency for the many local schools in the 32nd Street area

The design presented in the Final EIS/Record of Decision included a grade-separated bridge for the freeway over 32nd Street (see Figure 3-25 on page 3-47 of the Final EIS). This bridge has remained in the plans through the development of the final design. As such, the addition of the traffic interchange at 32nd Street primarily requires the addition of on- and off-ramps from the freeway to 32nd Street and the addition of auxiliary lanes between the adjacent ramps at 40th and 24th Streets. Other ancillary items associated

with a traffic interchange—lighting, striping, signals, and minor crossroad improvements—would also be included.

This questionnaire was prepared to address air quality issues related to the proposed 32nd Street traffic interchange. In this questionnaire, the "Build scenario" refers to the condition in which the 32nd Street traffic interchange is constructed as part of the larger 22-mile freeway project. The "No Build scenario" refers to the condition in which the larger 22-mile freeway project is constructed, but no ramps nor a connection to 32nd Street are included.

The proposed project is located in the Maricopa County (Phoenix) Non-Attainment Area for particulates 10 microns in diameter or less (PM_{10}). The Maricopa Association of Governments (MAG) issued the *2012 Five Percent Plan for the Maricopa County Nonattainment Area*, and the Arizona Department of Environmental Quality (ADEQ) submitted it to the US Environmental Protection Agency (EPA) on May 25, 2012. EPA approved this State Implementation Plan revision on May 30, 2014.

The following agencies would be included in interagency consultation and would provide input to the Project of Air Quality Concern Questionnaire: EPA, ADEQ, MAG, and the Maricopa County Air Quality Department.

Project Assessment

The following questionnaire is used to compare the proposed project with a list of project types in 40 Code of Federal Regulations (CFR) 93.123(b) requiring a quantitative analysis of local particulate emissions (hot spots) in nonattainment or maintenance areas, which include:

i) New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles;
ii) Projects affecting intersections that are at Level-of-Service D, E, or F with a significant number of diesel vehicles, or those that will change to Level-of-Service D, E, or F because of an increase in traffic volumes from a significant number of diesel vehicles related to the project;
iii) New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;
iv) Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and
v) Projects in or affecting locations, areas, or categories of sites which are identified in the PM_{10} or $PM_{2.5}$ applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

If the project matches one of the project types listed in 40 CFR 123(b)(1) above, it is considered a project of local air quality concern and the hot-spot demonstration must be based on quantitative analysis methods in accordance with 40 CFR 93.116(a) and the consultation requirements of 40 CFR 93.105(c)(1)(i). If the project does not require a PM hot-spot analysis, a qualitative assessment will be developed that demonstrates that the project will not contribute to any new localized carbon monoxide (CO) or PM violations, increase the frequency or severity of any existing CO or PM violations, or delay the timely attainment of any National Ambient Air Quality Standards (NAAQS) or any required emission reductions or milestones in a CO, PM_{10}, and $PM_{2.5}$ nonattainment or maintenance area.

On March 10, 2006, EPA published *PM2.5 and PM10 Hot-Spot Analyses in Project-Level Transportation Conformity Determinations for the New PM2.5 and Existing PM10 National Ambient Air Quality Standards; Final Rule,* describing the types of projects that would be considered a project of air quality concern and that require a hot-spot analysis (71 *Federal Register* 12468–12511). Specifically, on page 12491, EPA provided the following clarification: "Some examples of *projects of air quality concern* that would be covered by § 93.123(b)(1)(i) and (ii) are: A project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic (AADT) and 8% or more of such AADT is diesel truck traffic;" ... "Expansion of an existing highway or other facility that affects a congested intersection (operated at Level-of-Service D, E, or F) that has a significant increase in the number of diesel trucks …" These examples will be used as the baseline for determining whether the project is a project of air quality concern.

New Highway Capacity

Is this a New highway project that has a significant number of diesel vehicles?

Example: total traffic volumes ≥125,000 annual average daily traffic (AADT) and truck volumes ≥10,000 diesel trucks per day (8% of total traffic).

NO – The project being considered is a service traffic interchange, not a new highway or freeway corridor.

Expanded Highway Capacity

Is this an expanded highway projects that have a significant increase in the number of diesel vehicles?

Example: the build scenario of the expanded highway or expressway causes a significant increase in the number of diesel trucks compared with the no-build scenario, truck volumes > 8% of the total traffic.

NO – No significant increase in the percentage of diesel trucks in the design year (2040) would occur between the Build and No Build scenarios. The highest traffic volumes on the freeway main line within the study area are located just east of 40th Street. At this location, the 2040 daily traffic projection for the Build scenario is 139,910 vehicles per day (vpd); this includes 23,370 diesel trucks (15,440 heavy trucks and 7,930 medium trucks). As a conservative estimate, it is assumed that ALL medium and heavy trucks are diesel trucks, which would represent 16.7% of total traffic under this alternative. With the Build scenario, the total number of vehicles is projected to increase by 3,912 vpd, but trucks increase by only 35 vpd (see Table 1). The new interchange would provide access to an almost exclusively residential area with very few commercial, industrial, or other land use activities that typically attract commercial truck traffic. Thus, no substantial increase in the overall truck or diesel truck volumes would occur in the Build scenario compared with the No Build scenario.

Table 1. Traffic Data for SR 202L east of 40th Street

Parameter	2040 No Build	2040 Build	Difference between Build and No Build	% Difference between Build and No Build
Average daily traffic volumes	135,998	139,910	3,912	3%
Diesel truck volume (medium and heavy)	23,339	23,374	35	0.1%
% Diesel trucks (medium and heavy)	17%	17%	0	0%

Projects with Congested Intersections

Is this a project that affects a congested intersection (LOS D or greater) that has a significant number of diesel trucks, OR will change LOS to D or greater because of increase traffic volumes for significant number of diesel trucks related to the project?

NO – This project will not affect an existing congested intersection that has a significant number of diesel trucks.

Two signalized intersections are proposed for the 32nd Street traffic interchange: one on the northern side of the South Mountain Freeway and one on the southern side. The LOS projections for these two intersections (HDR Traffic Report, Draft, July 16, 2018) and for the adjacent traffic interchanges at 40th and 24th Streets are tabulated in Tables 2 and 3 for the No Build and Build scenarios, respectively, for the 2040 design year. Because the LOS values are “C” or better for all intersections under both the No Build and Build scenarios, no quantitative PM_{10} hot-spot analysis is required.

Table 2. Level of Service for No Build Scenario in 2040

Interchange	Intersection	AM peak hour		PM peak hour	
		Delay (seconds)	LOS	Delay (seconds)	LOS
40th Street	South	35	C	32	C
	North	18	B	20	C
24th Street	South	29	C	34	C
	North	24	C	27	C

Table 3. Level of Service for Build Scenario in 2040

Interchange	Intersection	AM peak hour		PM peak hour	
		Delay (seconds)	LOS	Delay (seconds)	LOS
40th Street	South	29	C	25	C
	North	15	B	25	C
32nd Street	South	30	C	29	C
	North	13	B	12	B
24th Street	South	25	C	15	B
	North	13	B	16	B

New Bus and Rail Terminals

Does the project involve construction of a new bus or intermodal terminal that accommodates a significant number of diesel vehicles?

NO – These facilities are not included in the project.

Expanded Bus and Rail Terminals

Does the project involve an existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses (or trains) increases by 50% or more, as measured by arrivals?

NO – These facilities are not included in the project.

Projects Affecting PM Sites of Violation or Possible Violation

Does the project affect locations, areas or categories of sites that are identified in the PM_{10} or $PM_{2.5}$ applicable plan or implementation plan submissions, as appropriate, as sites of violation or potential violation?

NO – The 2012 Five Percent Plan describes the PM_{10} emission inventory for the nonattainment area, which includes on-road emissions from paved road dust resuspension, unpaved roads, road construction, exhaust, and brake and tire wear. The implementation plan does not identify traffic intersections as sites of violation or possible violation. The plan emphasizes controlling fugitive dust from previously disturbed lots or undeveloped areas where the ground has been or is being disturbed. An area with a substantial area of land use fitting this category is in southwestern Phoenix, along the Salt River.

Ambient PM_{10} monitors that have shown excessive levels/exceedances in recent years are located near the Salt River in southwestern Phoenix, at West 43rd Avenue (#6 on Attachment 1) and at the Durango Complex (#8 on Attachment 1). The EIS for the South Mountain Freeway included a quantitative PM_{10} hot-spot analysis for an intersection near the Salt River, at Broadway Road. The new traffic interchange at 32nd Street would be near the far eastern end of the freeway corridor, far from the Salt River, in an area where much of the land is developed and stabilized, or is active and inactive agricultural fields and undisturbed desert. The 2012 Five Percent Plan does not

explicitly or implicitly identify the area of the 32nd Street traffic interchange, or traffic interchange sites in general, as areas of existing or possible violation.

In addition, the prior quantitative PM_{10} hot-spot analyses for the South Mountain Freeway Final EIS involved traffic interchanges with much higher total and diesel vehicle traffic levels. Table 4 provides a comparison of the traffic projections for the 32nd Street traffic interchange and the other interchange locations previously analyzed. The north and south intersections for the 32nd Street traffic interchange have volumes of total traffic and diesel vehicle traffic less than both of the signalized intersections previously analyzed for PM_{10} hot spots in the Final EIS. Therefore, the prior analyses conducted for transportation conformity and National Environmental Policy Act purposes in the Final EIS demonstrate that the proposed 32nd Street traffic interchange would not cause or contribute to violations of the PM_{10} NAAQS. It is clear from the prior analyses that the proposed 32nd Street traffic interchange is not a site of violation or potential violation of the PM_{10} NAAQS.

Table 4. Comparison of 2040 Traffic Projections for Proposed 32nd Street Traffic Interchange Signalized Intersections and the Intersections Analyzed in the South Mountain Freeway Final EIS

Signalized Intersection Location	Total Annual Average Daily Traffic Approach Volume	Diesel Vehicle Annual Average Daily Traffic Approach Volume
32nd Street Traffic Interchange – North	14,750	430
32nd Street Traffic Interchange – South	7,230	230
40th Street Traffic Interchange – North	25,190	1,850
40th Street Traffic Interchange – South	21,450	1,630
Broadway Road – East	35,160	3,210
Broadway Road – West	34,120	2,720

POAQC Determination

This project is not a Project of Air Quality Concern. The expanded highway access that would result from the proposed changes would not increase the total truck traffic under the 2040 Build scenario compared with the 2040 No Build scenario and would not create a condition with LOS D or worse with significant truck/diesel vehicle traffic. No substantial increase in the overall diesel truck volumes would occur in the 2040 Build condition compared with the 2040 No Build condition.

The project has been modeled to determine whether congested intersections exist in the project area. The project, when modeled for LOS in the 2040 Build scenario, does not show any decrease in LOS at either the 40th or 24th Street traffic interchanges, and all intersections at the 32nd Street traffic interchange would have an LOS C or better and would not significantly increase the number of trucks in the project area. The intersections would not create an air quality concern for the project. The project would improve traffic circulation and LOS, which would result in improved air quality and traffic flow.

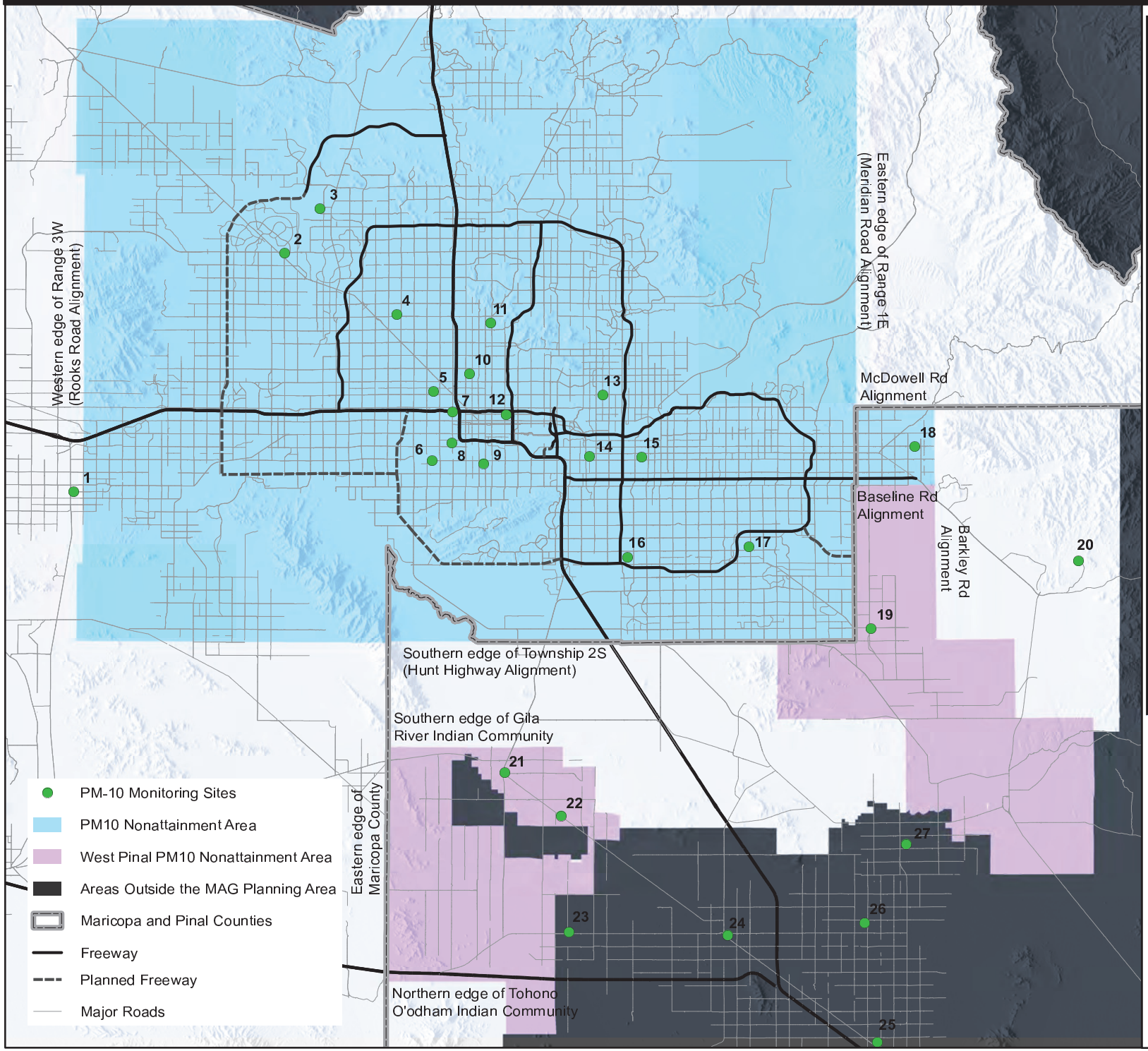
Therefore, ADOT is presenting this project for interagency consultation in accordance with 40 CFR 93.105, as a Project that is NOT of Air Quality Concern and thereby will not require a PM_{10} hot-spot analysis. While this project does not require a hot-spot analysis, other conformity provisions apply and will be addressed in the project clearance.

Interagency Consultation Results

On September 24th, 2018 ADOT provided a copy of this questionnaire, to the following consultation parties, EPA, MAG, Arizona Department of Environmental Quality (ADEQ), and Maricopa County Air Quality Department (MCAQD), as the State and local air agencies in Maricopa County. There were no objections to the project determination and on October 9th, 2018 ADOT concluded Interagency Consultation by notifying interested parties that this project will proceed as a project that does not require a quantitative PM10 hot-spot analysis under 40CFR 93.123(b).

PM-10 Nonattainment Area Boundary Map with Monitor Locations for Maricopa and Pinal Counties, Arizona

MARICOPA ASSOCIATION of GOVERNMENTS



#	Monitor Name
1	Buckeye
2	Dysart
3	Zuni Hills
4	Glendale
5	West Phoenix
6	West 43rd Avenue
7	Greenwood
8	Durango Complex
9	South Phoenix
10	JLG Supersite
11	North Phoenix
12	Central Phoenix
13	South Scottsdale
14	Tempe
15	Mesa
16	West Chandler
17	Higley
18	Apache Junction Fire Station
19	Combs School
20	Queen Valley
21	(City of) Maricopa County Complex
22	Cowtown Road
23	Stanfield County Complex
24	Casa Grande Downtown
25	Eloy County Complex
26	Pinal County Housing Complex
27	Coolidge Maintenance Yard

N

0 10

Miles

While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.

Source: U.S. Environmental Protection Agency

Date: October 2013

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Attachment A:

Interagency Consultation Emails

From:	Beverly Chenausky
To:	"Lindy Bauer"; "Jerry Wamsley"; "Johanna Kuspert - AQDX"; "ADEQ Conformity"
Cc:	"Clifton Meek"; "Karina O"Conner"; ADOTAirNoise; Farhana Jesmin; "Watzek, Kurt"; Aryan Lirange
Subject:	RE: Interagency Consultation SR 202L (South Mountain Freeway) 32nd Street Traffic Interchange H5764 H8827
Date:	Tuesday, October 9, 2018 3:42:11 PM
Attachments:	image001.png

As there are not objections to the project determination presented, interagency consultation is complete with the project identified as a project that does not require a quantitative hot-spot analysis as listed under 40 CFR 93.123(b).

Thank you,
Beverly

From: Beverly Chenausky
Sent: Monday, September 24, 2018 3:18 PM
To: 'Lindy Bauer'; 'Jerry Wamsley'; 'Johanna Kuspert - AQDX'; 'ADEQ Conformity'
Cc: 'Clifton Meek'; 'Karina O'Conner'; ADOTAirNoise; Farhana Jesmin; 'Watzek, Kurt'
Subject: Interagency Consultation SR 202L (South Mountain Freeway) 32nd Street Traffic Interchange H5764 H8827

To Interested Parties:
ADOT is presenting the following project, **SR 202L (South Mountain Freeway) 32nd Street Traffic Interchange,** for interagency consultation per 40 CFR 93.105 as a potential project that is not a project of Air Quality Concern and thereby will not require a PM10 hot-spot analysis. If through interagency consultation it is determined that this project will not require a hot-spot analysis, other conformity provisions apply and will be addressed in the air quality section of the environmental clearance. ADOT is requesting responses to the attached questionnaire within **10 business days**; a non-response will be interpreted as concurrence that the project is not a project of air quality concern and does not require a hot-spot analysis. If any consulted party believes this project should be treated as a project of air quality concern that requires a Quantitative PM hot-spot analysis, please document the appropriate section under 40 CFR 93.123 (b) that applies to the project and describe why the project should be treated as a project of air quality concern.

Beverly T. Chenausky
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Environmental Planning

From: Wamsley, Jerry
To: Beverly Chenausky
Cc: OConnor, Karina; Lee, Anita
Subject: RE: Interagency Consultation SR 202L (South Mountain Freeway) 32nd Street Traffic Interchange H5764 H8827
Date: Thursday, October 4, 2018 12:18:08 PM
Attachments: image001.png

Hello Beverly,

Thank you for the opportunity to the review the Arizona Department of Transportation's (ADOT) Project of Air Quality Concern (POAQC) Questionnaire for the SR-202L 32nd Street Traffic Interchange project within the City of Phoenix, dated September 24, 2018.

We concur that this project is not a project of air quality concern and does not require a particulate matter hot-spot analysis.

Sincerely,
Jerry Wamsley

From: Beverly Chenausky [mailto:BChenausky@azdot.gov]
Sent: Monday, September 24, 2018 3:18 PM
To: 'Lindy Bauer' <LBauer@azmag.gov>; Wamsley, Jerry <Wamsley.Jerry@epa.gov>; 'Johanna Kuspert - AQDX' <JKuspert@mail.maricopa.gov>; 'ADEQ Conformity' <Transportationconformity@azdeq.gov>
Cc: meek, clifton <meek.clifton@epa.gov>; OConnor, Karina <OConnor.Karina@epa.gov>; ADOTAirNoise <AdotAirNoise@azdot.gov>; Farhana Jesmin <FJesmin@azdot.gov>; 'Watzek, Kurt' <Kurt.Watzek@hdrinc.com>
Subject: Interagency Consultation SR 202L (South Mountain Freeway) 32nd Street Traffic Interchange H5764 H8827

To Interested Parties:
ADOT is presenting the following project, **SR 202L (South Mountain Freeway) 32nd Street Traffic Interchange,** for interagency consultation per 40 CFR 93.105 as a potential project that is not a project of Air Quality Concern and thereby will not require a PM10 hot-spot analysis. If through interagency consultation it is determined that this project will not require a hot-spot analysis, other conformity provisions apply and will be addressed in the air quality section of the environmental clearance. ADOT is requesting responses to the attached questionnaire within **10 business days**; a non-response will be interpreted as concurrence that the project is not a project of air quality concern and does not require a hot-spot analysis. If any consulted party believes this project should be treated as a project of air quality concern that requires a Quantitative PM hot-spot analysis, please document the appropriate section under 40 CFR 93.123 (b) that applies to the project and describe why the project should be treated as a project of air quality concern.

Attachment B

Traffic Study

for

32nd Street Traffic Interchange

South Mountain Freeway

Traffic Study in support of Reevaluation of the FEIS/ROD for 32nd Street traffic interchange

Phoenix, Arizona
July 20, 2018

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Appendix A. – MAG model traffic projections, Build and No-Build scenario, 2040

Appendix B. – HCS Analysis Reports

Appendix C. – Synchro Analysis Reports

1 Project Description

ADOT is the sponsor of the construction and operation of the South Mountain Freeway. The freeway will constitute a section of the Regional Freeway and Highway System, the Loop 202 (also referred to as State Route 202L). The project is in the southwestern portion of the Phoenix metropolitan area in Maricopa County, Arizona (see Figure 1). The approximately 22-mile-long freeway will be constructed as an eight-lane divided, access-controlled facility, with four travel lanes in each direction. Three lanes will be for general purpose use and one lane will be dedicated to high-occupancy vehicle use.

The Final Environmental Impact Statement (FEIS) was released to the public in September, 2014, and the Record of Decision (ROD) for the project was approved on March 5, 2015. Based on coordination with the City of Phoenix, elected officials, and the public after the ROD, ADOT is conducting a Reevaluation of the FEIS/ROD to evaluate the impacts associated with adding a new traffic interchange at 32nd Street.

The purpose of this report is to analyze traffic conditions for the Build (with the proposed interchange) and No-Build (without the proposed interchange) scenarios in the design year, 2040. The analysis also includes a comparison of the predicted traffic patterns with and without the proposed TI.

Figure 1 – Study Location Map

2 Traffic Analysis Methodology

The design year for the traffic analysis was assumed to be 2040. The opening year for the traffic analysis was assumed to be 2020. The methodology used for the traffic analysis of freeway operations as well as for the signalized intersections is based on the Transportation Research Board's *Highway Capacity Manual* (HCM, 2010). The study area for the traffic analysis included the area between 24th Street and 40th Street and from the freeway to Chandler Boulevard.

2.1 TRAFFIC DATA COLLECTION

The traffic projections for 2040 for the road network within the study area were obtained from the Maricopa Association of Governments (MAG) Regional Travel Demand Model (see Figure 2).

The MAG traffic projections are provided in multiple periods: morning 3-hour (6-9 AM); midday 5-hour (9AM-2PM); evening 4-hour (2-6 PM); and overnight 12-hour (6 PM-6 AM). The sum of all of the periods represent the daily or 24-hour traffic volume. The traffic projections are also provided by vehicle class, including heavy and medium trucks. The focus of the analysis is on the morning (AM) and evening (PM) peak hour. To calculate the AM peak hour volume, the AM period volumes are divided by a factor of 2.72. PM period volumes are divided by 3.74 to calculate PM peak-hour volumes. The raw traffic projections in 2040 for the freeway main line, ramps, and ramp intersections are presented in Appendix A.

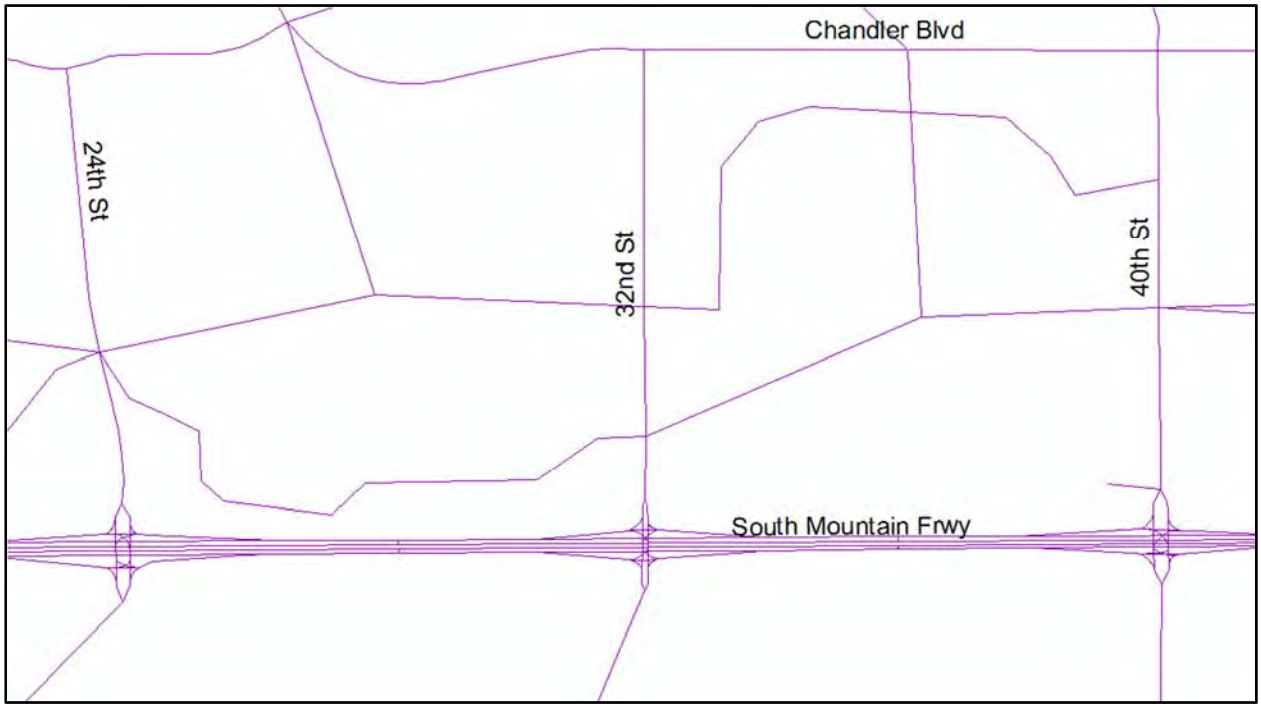


Figure 2 – MAG model road network within study area

2.2 TRAFFIC ANALYSIS TOOLS

2.2.1 Freeway Main Line: HCS Analysis

Highway Capacity Software (HCS 7.0) was used to perform the traffic analysis of the freeway mainline. As described in HCM, the freeway traffic operational analysis introduces the Level of Service (LOS) concept. LOS is described by letters from A to F, with each letter describing different traffic flow and roadway characteristics, similar to a classroom grade. For instance, LOS A stands for free flow condition with almost no delays, while LOS F stands for worst conditions, with unacceptable congestion, long queues and delays.

Table 1 illustrates the Level of Service concept based on flow condition.

Table 1 – Highway Capacity Manual level of service criteria for freeway segments

Level of Service	Density range (passenger cars/mile/lane)		
	Basic	Weaving	Merge & Diverge
A	≤ 11	≤ 10	≤ 10
B	>11-18	>10-20	>10-20
C	>18-26	>20-28	>20-28
D	>26-35	>28-35	>28-35
E	>35-45	>35	>35
F	> 45	Demand exceeds capacity	Demand exceeds capacity

For analysis purpose, the freeway is split into following segments:

- Basic freeway segments: These are all the segments that lie outside of the weaving or ramp junction influence areas. These generally occur between successive off and on-ramps.
- Ramp junctions: The ramp junction is an area where a ramp enters or exits a freeway main line.
- Weaving segment: These are formed when an auxiliary lane is used to connect adjacent on and off ramps spaced less than 1.5 miles apart. A lane change of at least 1 lane is required for the traffic to either enter or leave the freeway main line.

HCS analysis was conducted for both the AM and PM peak hours. Inputs that were used in the analysis include:

- Peak hour factor – 0.94
- Truck percentage on main line – 10%
- Truck percentage on ramps – 2%

- Freeway free flow speeds
  - Main line – 70 mph
  - Ramp – 45 mph

2.2.2 Traffic Interchanges: Synchro Analysis

The traffic analysis at the ramp intersections was performed using Synchro 9 software. Synchro is widely used for evaluating traffic delays and congestions based on traffic volumes, road geometry, and signal timings. It provides the outputs as LOS in terms of delay. Table 2 presents the level of service thresholds used in the analysis.

Table 2 – Highway Capacity Manual level of service criteria for signalized intersections

Level of service	Average control delay (seconds per vehicle)
A	≤ 10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	> 80

Synchro analysis is performed for both AM and PM peak hours. Major inputs are traffic volumes, lane geometry, signal control, signal timing, and phasing. The signal cycle length and phasing is optimized during the analysis. The results include the delay and LOS for individual lane groups as well as for entire signalized intersection.

3 TRAFFIC DATA & ANALYSIS RESULTS

This section presents the data that was used in the traffic analysis as well as the operational analysis results from HSC and Synchro.

3.1 FREEWAY ANALYSIS

The data presented includes section ID, section name, segment type, direction, length, number of lanes, time period, and traffic volume. The LOS results are provided along with the data, so that the results can be easily interpreted. Detailed HCS reports are provided in Appendix B.

The analysis for the No-Build scenario are presented in Tables 3 and 4. The analysis for the Build scenario are presented in Tables 5 and 6. Notable observations from the freeway analysis include:

1. For the No-Build scenario, there are two segments with LOS E, but the majority of the segments in both directions are LOS D or better.
2. For the Build scenario, there are three segments with LOS E, but most segments in both directions are LOS D or better.
3. Overall there is little or no change in the anticipated freeway operations with or without the proposed 32nd Street traffic interchange.

Table 3 – Freeway level of service, westbound, 2040, No-Build

Section ID	Section	Freeway segment type	Freeway direction	Length (feet)	Time period	Level of service (LOS)	Data input (2040 peak hour volumes)					
							Number of lanes	Mainline volume	Weaving lanes	Peak hour volume	On-ramp volume	Off-ramp volume
1	Off-ramp @ 40th St	Diverge	WB	1500	AM	C	3	3,390				465
					PM	D		5,845				795
2	Mainline on 40th St	Basic	WB	2700	AM	B	3	2,925				
					PM	D		5,055				
3	On-ramp @ 40th St	Merge	WB	1500	AM	C	3	3,210			290	
					PM	F		5,815			760	
4	Mainline on 32nd St	Basic	WB	4900	AM	B	3	3,210				
					PM	E		5,815				
5	Off-ramp @ 24th St	Diverge	WB	1500	AM	B	3	3,210				415
					PM	D		5,815				700
6	Mainline on 24th St	Basic	WB	2900	AM	B	3	2,825				
					PM	D		5,120				
7	On-ramp @ 24th St	Merge	WB	1500	AM	B	3	2,880			55	
					PM	D		5,300			185	

Table 4 – Freeway level of service, eastbound, 2040, No-Build

Section ID	Section	Freeway segment type	Freeway direction	Length (feet)	Time period	Level of service (LOS)	Data input (2040 peak hour volumes)					
							Number of lanes	Mainline volume	Weaving lanes	Peak hour volume	On-ramp volume	Off-ramp volume
1	On ramp @ 40th St	Merge	EB	1500	AM	E	3	5,295			755	
					PM	D		4,245			755	
2	Mainline on 40th St	Basic	EB	2500	AM	D	3	4,545				
					PM	C		3,495				
3	Off ramp @ 40th St	Diverge	EB	1500	AM	D	3	5,245				705
					PM	C		3,930				435
4	Mainline on 32nd St	Basic	EB	4900	AM	D	3	5,245				
					PM	C		3,930				
5	On ramp @ 24th St	Merge	EB	1500	AM	D	3	5,245			590	
					PM	C		3,930			515	
6	Mainline on 24th St	Basic	EB	2900	AM	D	3	4,655				
					PM	C		3,425				
7	Off ramp @ 24th St	Diverge	EB	1500	AM	C	3	4,845				190
					PM	C		3,485				60

Table 5 – Freeway level of service, westbound, 2040, Build

Section ID	Section	Freeway segment type	Freeway direction	Length (feet)	Time period	Level of service (LOS)	Data input (2040 peak hour volumes)					
							Number of lanes	Mainline volume	Weaving lanes	Peak hour volume	On-ramp volume	Off-ramp volume
1	Off ramp @ 40th St	Diverge	WB	800	AM	C	3	3,495				450
					PM	D		5,965				700
2	Mainline @ 40th St	Basic	WB	3600	AM	B	3	3,050				
					PM	D		5,270				
3	Between 32nd & 40th St	Weave	WB	Ls=1300	AM	B	4	3,355	2		285	270
					PM	E		5,920			675	495
4	Mainline @ 32nd St	Basic	WB	3900	AM	B	3	3,090				
					PM	E		5,425				
5	Between 24th & 32nd St	Weave	WB	Ls=1400	AM	B	4	3,165	2		80	320
					PM	E		5,735			315	675
6	Mainline @ 24th St	Basic	WB	3500	AM	B	3	2,875				
					PM	D		5,110				
7	On ramp @ 24nd St	Merge	WB	1400	AM	B	3	2,925			50	
					PM	D		5,315			205	

Table 6 – Freeway level of service, eastbound, 2040, Build

Section ID	Section	Freeway segment type	Freeway direction	Length (feet)	Time period	Level of service (LOS)	Data input (2040 peak hour volumes)					
							Number of lanes	Mainline volume	Weaving lanes	Peak hour volume	On- ramp volume	Off-ramp volume
1	On ramp @ 40th St	Merge	EB	1400	AM	D	3	5,410			590	
					PM	C		4,335			665	
2	Mainline @ 40th St	Basic	EB	3600	AM	D	3	4,820				
					PM	C		3,675				
3	Between 32nd & 40th St	Weave	EB	Ls=1300	AM	D	4	5,385	2		425	580
					PM	C		4,045			350	370
4	Mainline @ 32nd St	Basic	EB	3900	AM	D	3	4,965				
					PM	C		3,695				
5	Between 24th & 32nd St	Weave	EB	Ls=1400	AM	D	4	5,225	2		580	260
					PM	C		3,870			440	175
6	Mainline @ 24th St	Basic	EB	3500	AM	D	3	4,680				
					PM	C		3,465				
7	Off ramp @ 24nd St	Diverge	EB	800	AM	C	3	4,865				190
					PM	C		3,515				55

3.2 INTERSECTION ANALYSIS

This section presents the turning movement volumes at the ramp intersections and the associated LOS for the No-Build and Build scenarios. The turning movements for the No-Build scenario are presented in Figures 3 and 4 for AM peak hour and PM peak hour, respectively. The turning movements for the Build scenario are presented in Figures 5 and 6 for AM peak hour and PM peak hour, respectively. Detailed Synchro reports are provided in Appendix C.

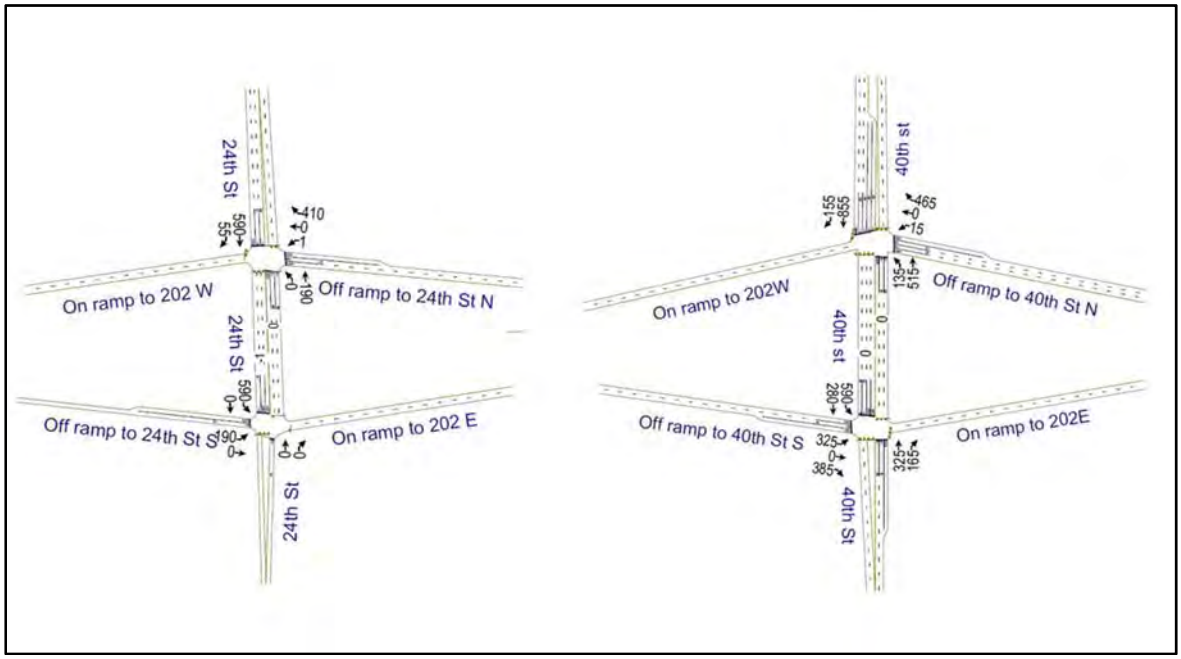


Figure 3 – Turning movements, AM peak hour, No-Build

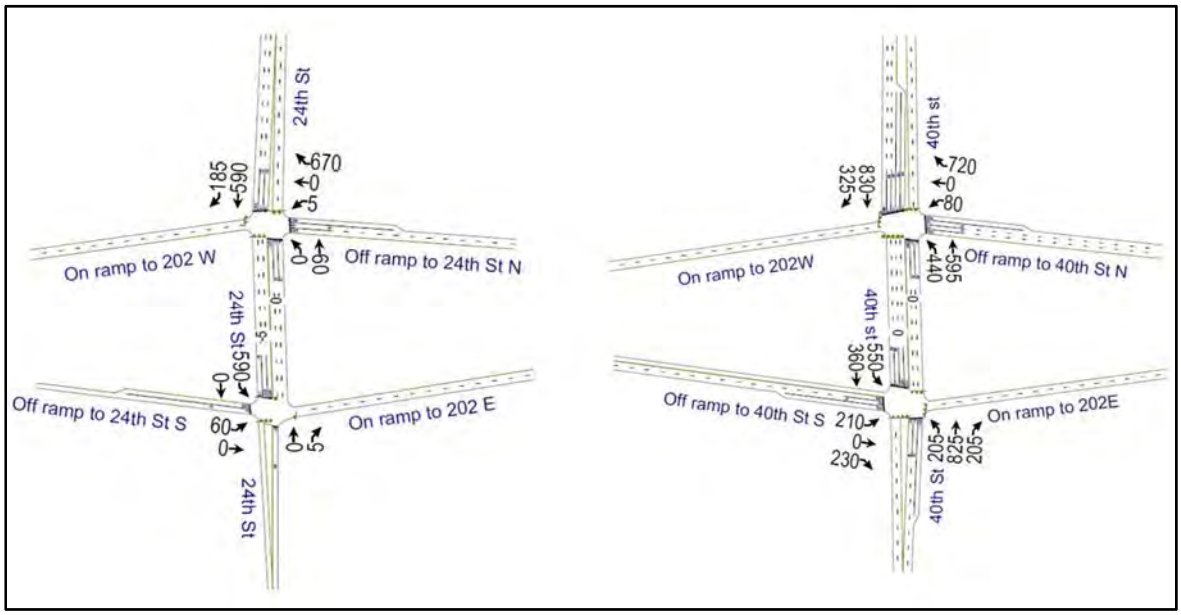


Figure 4 – Turning movements, PM peak hour, No-Build

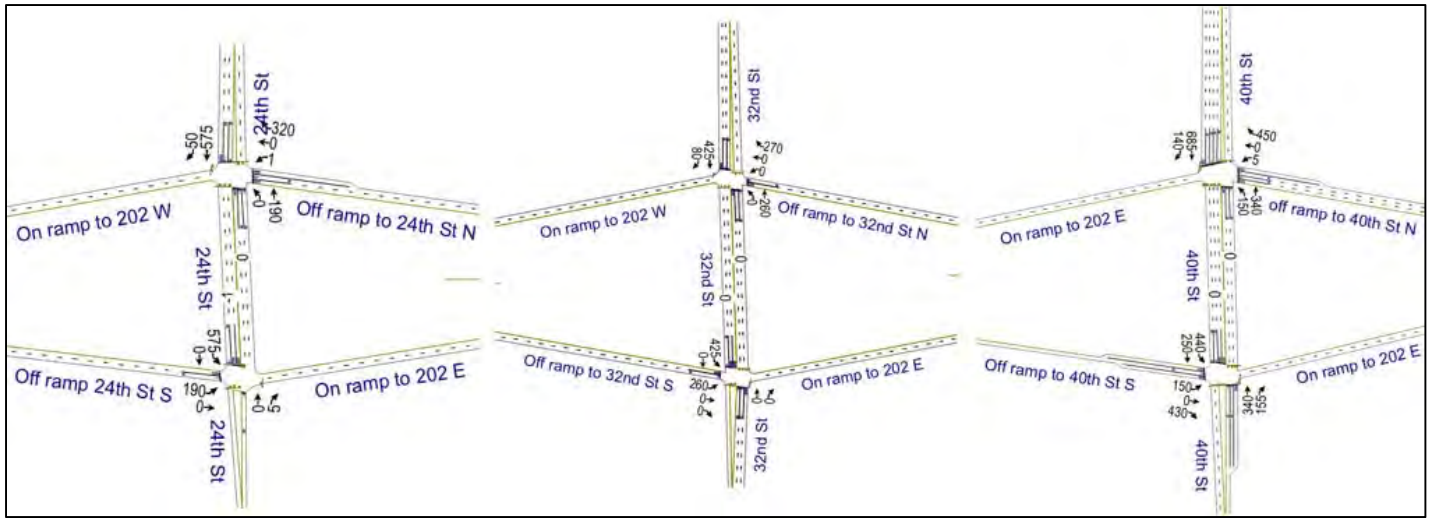


Figure 5 – Turning movements, AM peak hour, Build

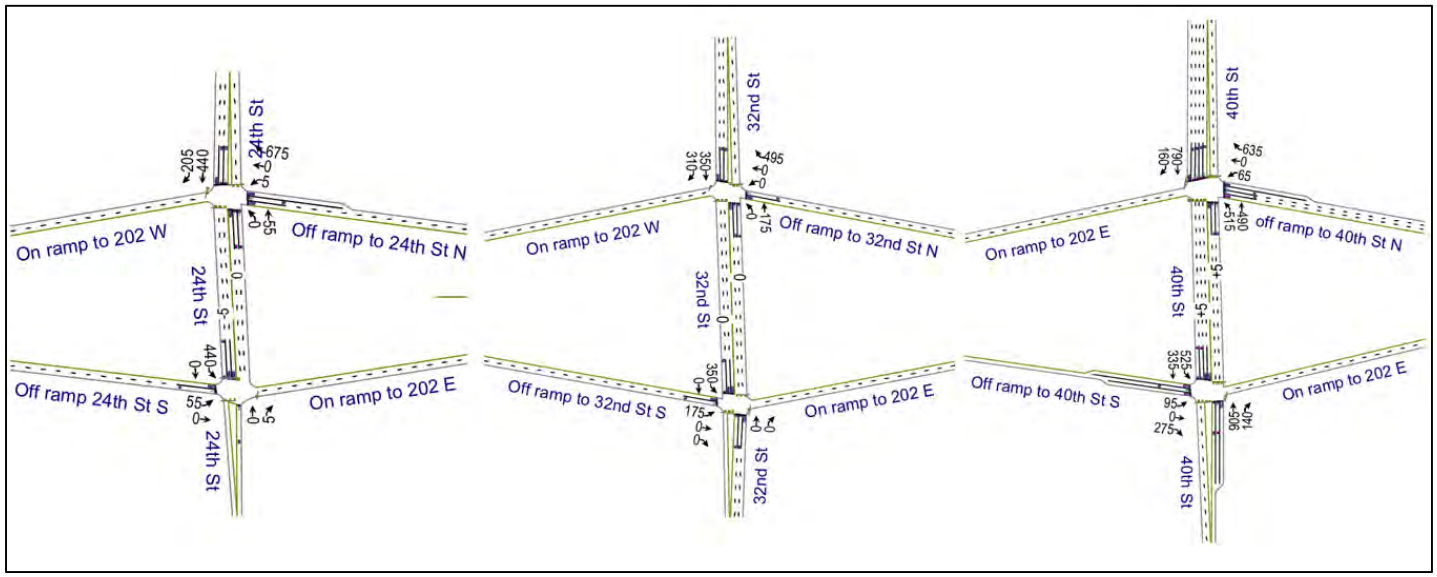


Figure 6 – Turning movements, PM peak hour, Build

The results of the analysis for the No-Build and Build scenario are presented in Tables 7 and 8, respectively.

Table 7 – Intersection level of service, No-Build

Interchange	Intersection	AM peak hour		PM peak hour	
		Delay (seconds)	LOS	Delay (seconds)	LOS
40th Street	South	33	C	33	C
	North	18	B	22	C
24th Street	South	18	B	23	C
	North	27	C	31	C

Table 8 – Intersection level of service, Build

Interchange	Intersection	AM peak hour		PM peak hour	
		Delay (seconds)	LOS	Delay (seconds)	LOS
40th Street	South	20	B	22	C
	North	14	B	22	C
32nd Street	South	30	C	29	C
	North	12	B	12	B
24th Street	South	25	C	15	B
	North	13	B	16	B

Notable observations from the intersection analysis include:

1. The level of service of all of the intersections, regardless of scenario, is C or better in 2040.

2. Overall the intersection operations at the 40th Street interchange and the 24th Street interchange improve with the Build scenario. This is especially evident in the 15 second per vehicle delay improvement at the north intersection at the 24th Street interchange during the PM peak hour

4 ADDITIONAL ANALYSIS IN SUPPORT OF REEVALUATION

4.1 COMPARISON TO TRAFFIC PROJECTIONS USED IN FEIS/ROD

The traffic analysis presented in the FEIS and ROD was for the design year of 2035, based on the MAG travel demand model output from 2013. This traffic study is presenting information for design year of 2040 based on the MAG travel demand model output from 2018. This section presents a comparison between the two models for the purpose of supporting technical analyses in the Reevaluation of the FEIS/ROD.

The comparison was completed by overlaying the two model networks and comparing the 24-hour traffic volumes in a geographic information system (GIS) platform. The links are color coded to show those roads with a greater than 10 percent change (negative or positive). If there was less than a 10-percent change, the change was assumed to be negligible. The results of the comparison are presented for all vehicles, heavy trucks, and medium trucks in Figures 7, 8, and 9, respectively. Notable observations include:

1. On the freeway main-line and ramps, the change in projected traffic is less than 10 percent (plus or minus) when considering all vehicles combined and heavy trucks individually. A greater than 10 percent reduction in medium trucks is projected between the 2035 and 2040 models.

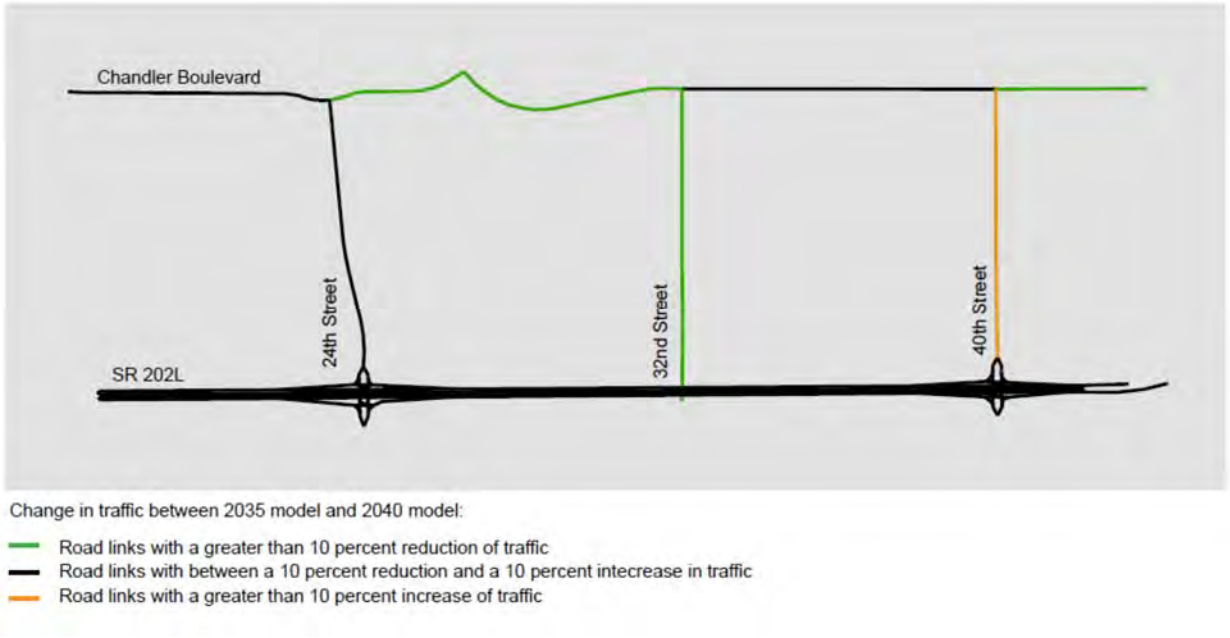


Figure 7 – MAG model comparison, 2035 and 2040, No-Build, All vehicles

Figure 8 – MAG model comparison, 2035 and 2040, No-Build, Heavy trucks

Figure 9 – MAG model comparison, 2035 and 2040, No-Build, Medium trucks

Appendix A. – MAG model traffic projections, Build and No-Build scenario, 2040

2040 MAG Projections - Peak hour and 24-hour
With and Without 32nd Street Traffic Interchange

Peak Hour Conversion Factors	Freeway and Ramp
AM - 3Hr (6am - 9am)	2.72
PM - 4Hr (2pm - 6pm)	3.74

Notes: H = heavy trucks; M = medium trucks; AM = morning; PM = evening; GP = general purpose lanes; HOV = high-occupancy vehicle lane;

westbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	52760	52312	1%
H	8506	8618	-1%
M	3307	3295	0%
AM	2921	2878	2%
H	475	475	0%
M	256	256	0%
PM	5314	5297	0%
H	571	573	0%
M	320	321	0%

westbound on-ramp

	Build	No Build	
24 hr	1830	1761	4%
H	57	55	4%
M	60	59	2%
AM	49	53	-8%
H	0	0	0%
M	1	1	0%
PM	205	181	13%
H	5	4	19%
M	6	6	14%

westbound off-ramp

	Build	No Build	
24 hr	7294	8443	-14%
H	43	50	-14%
M	122	148	-18%
AM	317	411	-23%
H	3	3	-13%
M	8	10	-19%
PM	673	700	-4%
H	3	3	0%
M	9	10	-8%

westbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	57944	58905	-2%
H	8492	8613	-1%
M	3366	3383	-1%
AM	3165	3210	-1%
H	478	478	0%
M	263	265	-1%
PM	5734	5811	-1%
H	569	571	0%
M	323	325	-1%

westbound on-ramp

	Build	No Build
24 hr	2065	
H	43	
M	68	
AM	77	
H	1	
M	2	
PM	311	
H	8	
M	12	

westbound off-ramp

	Build	No Build
24 hr	5296	
H	24	
M	78	
AM	266	
H	1	
M	5	
PM	493	
H	2	
M	6	

westbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	61175	58905	4%
H	8474	8613	-2%
M	3376	3383	0%
AM	3354	3210	4%
H	478	478	0%
M	266	265	0%
PM	5916	5811	2%
H	562	571	-2%
M	316	325	-3%

westbound on-ramp

	Build	No Build	
24 hr	7363	7693	-4%
H	115	146	-21%
M	182	232	-22%
AM	284	286	-1%
H	7	8	-10%
M	13	15	-12%
PM	671	760	-12%
H	3	9	-62%
M	9	18	-51%

westbound off-ramp

	Build	No Build	
24 hr	7885	8644	-9%
H	93	98	-5%
M	195	213	-8%
AM	446	465	-4%
H	6	6	0%
M	14	15	-8%
PM	696	794	-12%
H	5	6	-9%
M	14	15	-9%

westbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	61724	59857	3%
H	8450	8564	-1%
M	3391	3365	1%
AM	3495	3389	3%
H	476	476	0%
M	266	264	1%
PM	5964	5845	2%
H	564	568	-1%
M	321	322	0%

westbound SR 202L (HOV)

	Build	No Build
24 hr	9454	9194
H	1242	1138
M	583	588
AM	139	114
H	0	0
M	0	0
PM	455	423
H	0	0
M	0	0

eastbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	49000	48316	1%
H	5135	5110	0%
M	3219	3208	0%
AM	4865	4841	1%
H	328	328	0%
M	301	301	0%
PM	3515	3481	1%
H	329	329	0%
M	277	277	0%

eastbound off-ramp

	Build	No Build	
24 hr	1592	1448	10%
H	49	39	26%
M	54	48	13%
AM	188	187	0%
H	5	5	0%
M	6	6	6%
PM	53	57	-8%
H	0	0	0%
M	1	1	0%

eastbound on-ramp

	Build	No Build	
24 hr	6833	7780	-12%
H	39	44	-11%
M	112	132	-15%
AM	577	590	-2%
H	2	2	0%
M	7	8	-10%
PM	440	513	-14%
H	3	3	-9%
M	9	10	-16%

eastbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	53954	54572	-1%
H	5124	5115	0%
M	3274	3291	-1%
AM	5221	5243	0%
H	325	326	0%
M	303	303	0%
PM	3867	3928	-2%
H	331	332	0%
M	285	286	0%

eastbound off-ramp

	Build	No Build
24 hr	2044	
H	46	
M	73	
AM	258	
H	7	
M	10	
PM	174	
H	5	
M	8	

eastbound on-ramp

	Build	No Build
24 hr	5175	
H	24	
M	80	
AM	423	
H	1	
M	5	
PM	349	
H	1	
M	6	

eastbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	57085	54572	5%
H	5102	5115	0%
M	3281	3291	0%
AM	5385	5243	3%
H	321	326	-2%
M	298	303	-2%
PM	4042	3928	3%
H	328	332	-1%
M	282	286	-1%

eastbound off-ramp

	Build	No Build	
24 hr	6747	7221	-7%
H	100	141	-29%
M	155	217	-29%
AM	577	702	-18%
H	3	9	-64%
M	8	16	-52%
PM	367	435	-16%
H	4	8	-55%
M	9	16	-45%

eastbound on-ramp

	Build	No Build	
24 hr	9275	10793	-14%
H	101	114	-11%
M	221	253	-13%
AM	590	751	-21%
H	6	6	-12%
M	14	16	-14%
PM	661	751	-12%
H	7	7	-11%
M	17	20	-11%

eastbound SR 202L (GP lanes only)

	Build	No Build	
24 hr	59631	58144	3%
H	5102	5088	0%
M	3347	3327	1%
AM	5410	5292	2%
H	322	323	0%
M	304	303	0%
PM	4333	4243	2%
H	331	331	0%
M	291	289	1%

eastbound SR 202L (HOV)

	Build	No Build
24 hr	9101	8803
H	646	661
M	613	608
AM	333	303
H	0	0
M	0	0
PM	292	253
H	0	0
M	0	0

SR 202L (both directions+HOV)

	Build	No Build	
24 hr	120315	118625	1%
H	15529	15527	0%
M	7722	7699	0%
AM	8258	8136	2%
H	803	803	0%
M	557	557	0%
PM	9576	9455	1%
H	900	902	0%
M	598	598	0%

SR 202L (both directions+HOV)

	Build	No Build	
24 hr	130453	131474	-1%
H	15504	15527	0%
M	7836	7870	0%
AM	8858	8871	0%
H	803	804	0%
M	566	568	0%
PM	10349	10415	-1%
H	900	903	0%
M	607	611	-1%

SR 202L (both directions+HOV)

	Build	No Build	
24 hr	136815	131474	4%
H	15464	15527	0%
M	7853	7870	0%
AM	9211	8871	4%
H	799	804	-1%
M	564	568	-1%
PM	10705	10415	3%
H	890	903	-1%
M	599	611	-2%

SR 202L (both directions+HOV)

	Build	No Build	
24 hr	139910	135998	3%
H	15440	15451	0%
M	7934	7888	1%
AM	9376	9099	3%
H	799	799	0%
M	570	567	1%
PM	11044	10765	3%
H	895	899	0%
M	612	611	0%

2040 MAG Projections - Peak hour
With and Without 32nd Street Traffic Interchange
Notes: H = heavy trucks; M = medium trucks; AM = morning; PM = evening;

Peak Hour Conversion Factors	Freeway and Ramp
AM - 3Hr (6am - 9am)	2.72
PM - 4Hr (2pm - 6pm)	3.74

	Build	No Build	Build	No Build
24 hr	1830	1761	6808	7756
H	57	55	39	44
M	60	59	109	129
AM	49	53	575	588
H	0	0	2	2
M	1	1	7	8
PM	205	181	438	511
H	5	4	3	3
M	6	6	9	10

24th Street

N

	24 hr	H	M	AM	H	M	PM	H	M
Build	7267	43	119	316	3	8	671	3	9
No Build	8416	50	145	409	3	10	698	3	9
Build	0	0	0	0	0	0	0	0	0
No Build	0	0	0	0	0	0	0	0	0
Build	27	0	3	1	0	0	2	0	0
No Build	27	0	3	1	0	0	2	0	0

	Build	No Build	Build	No Build
24 hr	0	0	1595	1451
H	0	0	49	39
M	0	0	54	48
AM	0	0	188	187
H	0	0	5	5
M	0	0	6	6
PM	0	0	53	58
H	0	0	0	0
M	0	0	1	1

North intersection; total approach volume

	Build	No Build
24 hr	**17527**	**19411**
H	**188**	**188**
M	**345**	**384**
AM	**1129**	**1239**
H	**10**	**10**
M	**22**	**25**
PM	**1370**	**1451**
H	**11**	**10**
M	**25**	**27**

South intersection; total approach volume

	Build	No Build
24 hr	**8457**	**9261**
H	**88**	**83**
M	**469**	**183**
AM	**766**	**779**
H	**7**	**7**
M	**13**	**14**
PM	**495**	**573**
H	**3**	**3**
M	**10**	**12**

	Build	No Build	Build	No Build
24 hr	30	30	6805	7753
H	0	0	39	44
M	3	3	409	129
AM	1	2	575	588
H	0	0	2	2
M	0	0	7	8
PM	3	2	438	511
H	0	0	3	3
M	0	0	9	10

	24 hr	H	M	AM	H	M	PM	H	M
Build	1592	49	54	188	5	6	53	0	1
No Build	1448	39	48	187	5	6	57	0	1
Build	0	0	0	0	0	0	0	0	0
No Build	0	0	0	0	0	0	0	0	0
Build	0	0	0	0	0	0	0	0	0
No Build	0	0	0	0	0	0	0	0	0

	Build	No Build	Build	No Build
24 hr	3	3	27	27
H	0	0	0	0
M	0	0	3	3
AM	0	0	2	2
H	0	0	0	0
M	0	0	0	0
PM	0	0	2	2
H	0	0	0	0
M	0	0	0	0

2040 MAG Projections - Peak hour
With and Without 32nd Street Traffic Interchange
Notes: H = heavy trucks; M = medium trucks; AM = morning; PM = evening;

Peak Hour Conversion Factors	Freeway and Ramp
AM - 3Hr (6am - 9am)	2.72
PM - 4Hr (2pm - 6pm)	3.74

N

32nd Street

	Build		Build	
24 hr	2062		5172	
H	41		23	
M	67		78	
AM	77		422	
H	1		1	
M	2		5	
PM	310		349	
H	8		1	
M	12		6	

	24 hr	H	M	AM	H	M	PM	H	M
Build	5293	23	76	266	1	5	493	1	6
Build	0	0	0	0	0	0	0	0	0
Build	3	0	2	0	0	0	0	0	0

	Build		Build	
24 hr	3		2041	
H	2		44	
M	1		71	
AM	0		6	
H	0		9	
M	0		258	
PM	0		174	
H	0		5	
M	0		8	

North intersection; total approach volume

	Build
24 hr	**14574**
H	**133**
M	**295**
AM	**772**
H	**13**
M	**270**
PM	**1326**
H	**15**
M	**31**

South intersection; total approach volume

	Build
24 hr	**7225**
H	**71**
M	**155**
AM	**681**
H	**8**
M	**14**
PM	**524**
H	**6**
M	**13**

	Build		Build	
24 hr	3		5172	
H	0		23	
M	2		78	
AM	0		422	
H	0		1	
M	0		5	
PM	0		349	
H	0		1	
M	0		6	

	24 hr	H	M	AM	H	M	PM	H	M
Build	2041	44	71	258	6	9	174	5	8
Build	0	0	0	0	0	0	0	0	0
Build	3	2	1	0	0	0	0	0	0

	Build		Build	
24 hr	3		3	
H	2		0	
M	1		2	
AM	0		0	
H	0		0	
M	0		0	
PM	0		0	
H	0		0	
M	0		0	

2040 MAG Projections - Peak hour
With and Without 32nd Street Traffic Interchange
Notes: H = heavy trucks; M = medium trucks; AM = morning; PM = evening;

Peak Hour Conversion Factors	
AM - 3Hr (6am - 9am)	2.72
PM - 4Hr (2pm - 6pm)	3.74

	Build	No Build	Build	No Build
24 hr	2469	3268	10297	11523
H	77	108	85	84
M	96	148	177	200
AM	138	155	685	851
H	5	6	4	5
M	8	10	11	13
PM	159	321	790	826
H	1	7	6	6
M	2	11	14	15

40th Street

N

	24 hr	H	M	AM	H	M	PM	H	M
Build	7643	92	195	446	6	14	632	5	13
No Build	8349	97	211	465	6	15	716	6	15
Build	0	0	0	0	0	0	0	0	0
No Build	0	0	0	0	0	0	0	0	0
Build	243	0	1	0	0	0	64	0	0
No Build	294	1	2	0	0	0	78	0	1

	Build	No Build	Build	No Build
24 hr	4893	4425	6602	2781
H	39	38	78	43
M	86	84	99	59
AM	147	132	339	510
H	2	2	2	8
M	6	6	4	13
PM	511	439	488	595
H	2	2	2	7
M	6	6	5	12

North intersection; total approach volume

	Build	No Build
24 hr	**32147**	**30640**
H	**371**	**371**
M	**654**	**704**
AM	**1755**	**2112**
H	**19**	**27**
M	**42**	**55**
PM	**2644**	**2976**
H	**17**	**28**
M	**41**	**60**

South intersection; total approach volume

	Build	No Build
24 hr	**29166**	**30910**
H	**259**	**308**
M	**490**	**582**
AM	**1750**	**2039**
H	**12**	**19**
M	**29**	**40**
PM	**2265**	**2368**
H	**14**	**19**
M	**34**	**44**

	Build	No Build	Build	No Build
24 hr	3856	4138	6684	7680
H	7	7	79	87
M	10	11	168	191
AM	247	265	438	586
H	0	0	4	5
M	1	1	10	12
PM	333	357	522	547
H	1	1	5	6
M	1	1	14	14

	24 hr	H	M	AM	H	M	PM	H	M
Build	2206	67	81	150	1	3	95	2	3
No Build	3235	107	144	321	7	11	209	6	11
Build	0	0	0	0	0	0	0	0	0
No Build	0	0	0	0	0	0	0	0	0
Build	4540	34	74	427	2	5	272	2	5
No Build	3988	33	73	381	2	5	226	2	5

	Build	No Build	Build	No Build
24 hr	9289	8755	2591	3114
H	50	48	22	26
M	104	101	53	62
AM	336	321	151	165
H	3	3	1	1
M	7	7	4	4
PM	904	825	139	203
H	3	3	1	2
M	7	7	3	5

Appendix B. – HCS Analysis Reports

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202- AT 24th St - EB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3425	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1336
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	69.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.1
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	AM
Project Description	Loop 202- AT 32th St - EB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	5245	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2046
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.85
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.2
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202- AT 32th St - EB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3930	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1533
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.64
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	68.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	22.3
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	AM
Project Description	Loop 202- AT 40th St - EB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	4545	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1773
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.74
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	66.2
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	26.8
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202- AT 40th St - EB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3495	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1363
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	69.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.6
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	AM
Project Description	Loop 202- AT 24th St - WB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	2825	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1102
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.46
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	70.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	15.7
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202- AT 24th St - WB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	5120	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1997
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.9
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	AM
Project Description	Loop 202- AT 32nd St - WB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3210	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1252
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.52
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	70.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.9
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202- AT 32nd St - WB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	5815	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2268
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.95
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	56.8
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	39.9
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2018
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 at 40th St - WB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	2925	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1141
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	70.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.3
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202- AT 40th St - WB - No Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	5055	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1972
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.82
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	63.1
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.3
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - At 24th St - EB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	4680	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1826
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	65.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	27.9
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 24th St - EB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3465	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1352
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	69.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	19.4
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - At 32nd St - EB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	4965	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1937
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
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	30.4
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 32nd St - EB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3695	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1441
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.60
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	69.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.8
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - At 40th St - EB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	4820	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1880
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	64.6
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	29.1
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 40th St - EB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3675	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1434
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.60
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	69.4
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	20.7
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - At 24th St - WB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	2875	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1122
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.47
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	70.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	16.0
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 24th St - WB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	5110	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1993
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.83
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	62.7
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	31.8
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - At 32nd St - WB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3090	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1205
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
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	70.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.2
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 32nd St - WB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	5425	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2116
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.88
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	60.3
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	35.1
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - At 40th St - WB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	3050	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	1190
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
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	70.0
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	17.0
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Basic Freeway Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 40th St - WB - Build		

Geometric Data

Number of Lanes, ln	3	Terrain Type	Level
Segment Length (L), ft	-	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	70.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	70.0
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	5270	Heavy Vehicle Adjustment Factor (f_{HV})	0.909
Peak Hour Factor	0.94	Flow Rate (V_p), pc/h/ln	2056
Total Trucks, %	10.00	Capacity (c), pc/h/ln	2400
Single-Unit Trucks (SUT), %	-	Adjusted Cpacity (c_{adj}), pc/h/ln	2400
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.86
Passenger Car Equivalent (E_T)	2.000		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	61.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	33.4
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	70.0		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - At 24th St-EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	4845	190
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	5670	206
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.79	0.10

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	3446.6	Density in Ramp Influence Area (D_R), pc/mi/ln	27.4
Distance to Upstream Ramp (L_{UP}), ft	2800	Speed Index (D_S)	0.317
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (V_{OA}), pc/h/ln	2136
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	61.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.609	Outer Lanes Freeway Speed (S_O), mi/h	72.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	3534	Ramp Junction Speed (S), mi/h	64.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	29.1
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 24th St-EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	3485	60
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	4079	65
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.03

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	3495.4	Density in Ramp Influence Area (D_R), pc/mi/ln	21.0
Distance to Upstream Ramp (L_{UP}), ft	2800	Speed Index (D_S)	0.304
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1293
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	61.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.678	Outer Lanes Freeway Speed (S_O), mi/h	75.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	2786	Ramp Junction Speed (S), mi/h	65.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	20.8
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	AM
Project Description	Loop 202 - At 40th St-EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	600
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 (V_i), veh/h	5245	705
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6138	765
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.85	0.36

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	5318.7	Density in Ramp Influence Area (D_R), pc/mi/ln	31.8
Distance to Upstream Ramp (L_{UP}), ft	2800	Speed Index (D_S)	0.367
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (V_{OA}), pc/h/ln	2305
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	59.7
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.571	Outer Lanes Freeway Speed (S_O), mi/h	71.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	3833	Ramp Junction Speed (S), mi/h	63.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	32.1
Level of Service (LOS)	D		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - At 40th St-EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	3930	435
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	4599	472
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.64	0.22

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	5814.2	Density in Ramp Influence Area (D_R), pc/mi/ln	23.2
Distance to Upstream Ramp (L_{UP}), ft	2800	Speed Index (D_S)	0.340
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1556
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	60.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.623	Outer Lanes Freeway Speed (S_O), mi/h	74.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	3043	Ramp Junction Speed (S), mi/h	64.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	23.7
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	AM
Project Description	Loop 202 - At 24th St-WB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	3210	415
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	3757	450
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.52	0.21

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	484.4	Density in Ramp Influence Area (D_R), pc/mi/ln	19.3
Distance to Upstream Ramp (L_{UP}), ft	2900	Speed Index (D_S)	0.338
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1174
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	60.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.645	Outer Lanes Freeway Speed (S_O), mi/h	76.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	2583	Ramp Junction Speed (S), mi/h	64.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	19.4
Level of Service (LOS)	B		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202 - At 24th St-WB-No Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	5815	700
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6805	760
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.95	0.36

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	1182.6	Density in Ramp Influence Area (D_R), pc/mi/ln	32.4
Distance to Upstream Ramp (L_{UP}), ft	2900	Speed Index (D_S)	0.366
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2690
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	59.8
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.555	Outer Lanes Freeway Speed (S_O), mi/h	70.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	4115	Ramp Junction Speed (S), mi/h	63.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	35.7
Level of Service (LOS)	D		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	AM
Project Description	Loop 202 - At 40th St-WB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	3390	465
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	3967	505
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.55	0.24

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	2540.6	Density in Ramp Influence Area (D_R), pc/mi/ln	20.4
Distance to Upstream Ramp (L_{UP}), ft	2650	Speed Index (D_S)	0.343
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (V_{OA}), pc/h/ln	1253
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	60.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.638	Outer Lanes Freeway Speed (S_O), mi/h	75.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	2714	Ramp Junction Speed (S), mi/h	64.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	20.5
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT-MAG	Time Period Analyzed	PM
Project Description	Loop 202 - At 40th St-WB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	5845	795
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6841	863
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.95	0.41

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	5067.0	Density in Ramp Influence Area (D_R), pc/mi/ln	32.7
Distance to Upstream Ramp (L_{UP}), ft	2650	Speed Index (D_S)	0.376
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2696
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	59.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.549	Outer Lanes Freeway Speed (S_O), mi/h	70.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	4145	Ramp Junction Speed (S), mi/h	63.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	36.0
Level of Service (LOS)	D		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - @ 24th St - EB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	800
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

	Freeway	Ramp
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

	Freeway	Ramp
Demand Volume (V_i), veh/h	4865	190
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	5694	206
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.79	0.10

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	3378.1	Density in Ramp Influence Area (D_R), pc/mi/ln	27.5
Distance to Upstream Ramp (L_{UP}), ft	3500	Speed Index (D_S)	0.317
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2151
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	61.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.608	Outer Lanes Freeway Speed (S_O), mi/h	72.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	3543	Ramp Junction Speed (S), mi/h	64.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	29.2
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - @ 24th St - EB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	3515	55
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	4114	60
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.03

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	2964.4	Density in Ramp Influence Area (D_R), pc/mi/ln	20.4
Distance to Upstream Ramp (L_{UP}), ft	3500	Speed Index (D_S)	0.303
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1403
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	61.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.654	Outer Lanes Freeway Speed (S_O), mi/h	75.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	2711	Ramp Junction Speed (S), mi/h	65.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	20.9
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - @ 40th St - WB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	3495	450
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	4090	488
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.23

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	2416.4	Density in Ramp Influence Area (D_R), pc/mi/ln	20.9
Distance to Upstream Ramp (L_{UP}), ft	3600	Speed Index (D_S)	0.342
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (V_{OA}), pc/h/ln	1315
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	60.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.635	Outer Lanes Freeway Speed (S_O), mi/h	75.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	2775	Ramp Junction Speed (S), mi/h	64.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	21.1
Level of Service (LOS)	C		

HCS7 Freeway Diverge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - @ 40th St - WB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Deceleration Length (L_D), 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 (V_i), veh/h	5965	700
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6981	760
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.97	0.36

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	4214.2	Density in Ramp Influence Area (D_R), pc/mi/ln	33.9
Distance to Upstream Ramp (L_{UP}), ft	3600	Speed Index (D_S)	0.366
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700
Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	59.8
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FO})	0.551	Outer Lanes Freeway Speed (S_O), mi/h	70.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	4281	Ramp Junction Speed (S), mi/h	63.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	36.7
Level of Service (LOS)	D		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - AT 24th St - EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1100
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 (V_i), veh/h	5245	590
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6138	640
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.94	0.30

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	32.5
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.531
Downstream Equilibrium Distance (L_{EQ}), ft	907.0	Flow Outer Lanes (v_{OA}), pc/h/ln	2406
Distance to Downstream Ramp (L_{DOWN}), ft	2800	On-Ramp Influence Area Speed (S_R), mi/h	55.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.608	Outer Lanes Freeway Speed (S_O), mi/h	62.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3732	Ramp Junction Speed (S), mi/h	57.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4372	Average Density (D), pc/mi/ln	39.2
Level of Service (LOS)	D		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - AT 24th St - EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1100
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 (V_i), veh/h	3930	515
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	4599	559
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.72	0.27

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	24.6
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.334
Downstream Equilibrium Distance (L_{EQ}), ft	286.4	Flow Outer Lanes (v_{OA}), pc/h/ln	1803
Distance to Downstream Ramp (L_{DOWN}), ft	2800	On-Ramp Influence Area Speed (S_R), mi/h	60.6
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.608	Outer Lanes Freeway Speed (S_O), mi/h	65.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	2796	Ramp Junction Speed (S), mi/h	62.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3355	Average Density (D), pc/mi/ln	27.6
Level of Service (LOS)	C		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - AT 40th St - EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1100
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 (V_i), veh/h	5295	755
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6197	820
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.97	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	35.1
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.659
Downstream Equilibrium Distance (L_{EQ}), ft	3365.6	Flow Outer Lanes (v_{OA}), pc/h/ln	2299
Distance to Downstream Ramp (L_{DOWN}), ft	2500	On-Ramp Influence Area Speed (S_R), mi/h	51.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.629	Outer Lanes Freeway Speed (S_O), mi/h	63.5
Flow in Lanes 1 and 2 (v_{12}), pc/h	3898	Ramp Junction Speed (S), mi/h	54.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4718	Average Density (D), pc/mi/ln	42.6
Level of Service (LOS)	E		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - AT 40th St - EB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1100
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 (V_i), veh/h	4245	755
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	4968	820
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.80	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	28.2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.404
Downstream Equilibrium Distance (L_{EQ}), ft	2076.6	Flow Outer Lanes (v_{OA}), pc/h/ln	1947
Distance to Downstream Ramp (L_{DOWN}), ft	2500	On-Ramp Influence Area Speed (S_R), mi/h	58.7
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.608	Outer Lanes Freeway Speed (S_O), mi/h	64.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3021	Ramp Junction Speed (S), mi/h	60.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3841	Average Density (D), pc/mi/ln	31.8
Level of Service (LOS)	D		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 at 24th St -WB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1100
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 (V_i), veh/h	2880	55
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	3371	60
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.48	0.03

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	15.1
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.254
Downstream Equilibrium Distance (L_{EQ}), ft	1981.2	Flow Outer Lanes (v_{OA}), pc/h/ln	1321
Distance to Downstream Ramp (L_{DOWN}), ft	2900	On-Ramp Influence Area Speed (S_R), mi/h	62.9
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.608	Outer Lanes Freeway Speed (S_O), mi/h	67.0
Flow in Lanes 1 and 2 (v_{12}), pc/h	2050	Ramp Junction Speed (S), mi/h	64.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2110	Average Density (D), pc/mi/ln	17.8
Level of Service (LOS)	B		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 at 24th St -WB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1100
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 (V_i), veh/h	5300	185
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6203	201
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.89	0.10

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	30.0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.442
Downstream Equilibrium Distance (L_{EQ}), ft	3341.7	Flow Outer Lanes (v_{OA}), pc/h/ln	2370
Distance to Downstream Ramp (L_{DOWN}), ft	2900	On-Ramp Influence Area Speed (S_R), mi/h	57.6
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.618	Outer Lanes Freeway Speed (S_O), mi/h	63.0
Flow in Lanes 1 and 2 (v_{12}), pc/h	3833	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4034	Average Density (D), pc/mi/ln	35.9
Level of Service (LOS)	D		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 at 40th St -WB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), 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 (V_i), veh/h	3210	290
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	3757	315
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.57	0.15

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	20.4
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.300
Downstream Equilibrium Distance (L_{EQ}), ft	2584.9	Flow Outer Lanes (v_{OA}), pc/h/ln	1503
Distance to Downstream Ramp (L_{DOWN}), ft	2650	On-Ramp Influence Area Speed (S_R), mi/h	61.6
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.600	Outer Lanes Freeway Speed (S_O), mi/h	66.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	2254	Ramp Junction Speed (S), mi/h	63.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2569	Average Density (D), pc/mi/ln	21.4
Level of Service (LOS)	C		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/6/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 at 40th St -WB-No build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1100
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 (V_i), veh/h	5815	760
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6805	825
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	1.06	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	38.4
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	-
Downstream Equilibrium Distance (L_{EQ}), ft	3795.3	Flow Outer Lanes (v_{OA}), pc/h/ln	2491
Distance to Downstream Ramp (L_{DOWN}), ft	2650	On-Ramp Influence Area Speed (S_R), mi/h	45.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.634	Outer Lanes Freeway Speed (S_O), mi/h	62.3
Flow in Lanes 1 and 2 (v_{12}), pc/h	4314	Ramp Junction Speed (S), mi/h	-
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	5139	Average Density (D), pc/mi/ln	-
Level of Service (LOS)	F		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - @40th St - EB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Side	Freeway	Right

Adjustment Factors

	Freeway	Ramp
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

	Freeway	Ramp
Demand Volume (V_i), veh/h	5410	590
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6331	640
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.97	0.30

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	31.9
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.563
Downstream Equilibrium Distance (L_{EQ}), ft	2426.2	Flow Outer Lanes (v_{OA}), pc/h/ln	2425
Distance to Downstream Ramp (L_{DOWN}), ft	3600	On-Ramp Influence Area Speed (S_R), mi/h	54.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.617	Outer Lanes Freeway Speed (S_O), mi/h	62.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	3906	Ramp Junction Speed (S), mi/h	56.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4546	Average Density (D), pc/mi/ln	40.8
Level of Service (LOS)	D		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - @40th St - EB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1400
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 (V_i), veh/h	4335	665
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	5073	722
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.80	0.34

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	26.5
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.379
Downstream Equilibrium Distance (L_{EQ}), ft	1547.8	Flow Outer Lanes (v_{OA}), pc/h/ln	1943
Distance to Downstream Ramp (L_{DOWN}), ft	3600	On-Ramp Influence Area Speed (S_R), mi/h	59.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.617	Outer Lanes Freeway Speed (S_O), mi/h	64.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3130	Ramp Junction Speed (S), mi/h	61.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3852	Average Density (D), pc/mi/ln	31.6
Level of Service (LOS)	C		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - @24th St - WB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1400
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 (V_i), veh/h	2925	50
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	3423	54
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.48	0.03

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	13.6
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.229
Downstream Equilibrium Distance (L_{EQ}), ft	1338.6	Flow Outer Lanes (v_{OA}), pc/h/ln	1311
Distance to Downstream Ramp (L_{DOWN}), ft	3500	On-Ramp Influence Area Speed (S_R), mi/h	63.6
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.617	Outer Lanes Freeway Speed (S_O), mi/h	67.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	2112	Ramp Junction Speed (S), mi/h	64.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2166	Average Density (D), pc/mi/ln	17.9
Level of Service (LOS)	B		

HCS7 Freeway Merge Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - @24th St - WB - Build		

Geometric Data

	Freeway	Ramp
Number of Lanes (N)	3	1
Free-Flow Speed (FFS), mi/h	70.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1400
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 (V_i), veh/h	5315	205
Peak Hour Factor (PHF)	0.94	0.94
Total Trucks, %	10.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980
Flow Rate (v_i), pc/h	6220	223
Capacity (c), pc/h	7200	2100
Volume-to-Capacity Ratio (v/c)	0.89	0.11

Speed and Density

Upstream Equilibrium Distance (L_{EO}), ft	-	Density in Ramp Influence Area (D_R), pc/mi/ln	28.3
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.421
Downstream Equilibrium Distance (L_{EQ}), ft	2823.6	Flow Outer Lanes (V_{OA}), pc/h/ln	2382
Distance to Downstream Ramp (L_{DOWN}), ft	3500	On-Ramp Influence Area Speed (S_R), mi/h	58.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.617	Outer Lanes Freeway Speed (S_O), mi/h	63.0
Flow in Lanes 1 and 2 (v_{12}), pc/h	3838	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4061	Average Density (D), pc/mi/ln	35.9
Level of Service (LOS)	D		

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - Between 24th & 32nd St - EB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Short Length (L_S), ft	1400	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	5225	580	0	260
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	6115	630	0	282

Weaving Flow Rate (v_w), pc/h	912	Freeway Max Capacity (c_{FL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	6115	Density-Based Capacity (c_{IWL}), pc/h/ln	2214
Total Flow Rate (v), pc/h	7027	Demand Flow-Based Capacity (c_{IW}), pc/h	18462
Volume Ratio (VR)	0.130	Weaving Segment Capacity (c_w), veh/h	8050
Minimum Lane Change Rate (LC_{MIN}), lc/h	912	Adjusted Weaving Area Capacity, pc/h	8767
Maximum Weaving Length (L_{MAX}), ft	3833	Volume-to-Capacity Ratio (v/c)	0.80

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	685	Average Weaving Speed (S_W), mi/h	55.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1248	Average Non-Weaving Speed (S_{NW}), mi/h	55.0
Weaving Lane Change Rate (LC_W), lc/h	1243	Average Speed (S), mi/h	55.1
Total Lane Change Rate (LC_{All}), lc/h	2491	Density (D), pc/mi/ln	31.9
Weaving Intensity Factor (W)	0.356	Level of Service (LOS)	D

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - Between 24th & 32nd St - EB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Short Length (L_S), ft	1400	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	3870	440	0	175
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	4529	478	0	190

Weaving Flow Rate (v_w), pc/h	668	Freeway Max Capacity (c_{FL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	4529	Density-Based Capacity (c_{IWL}), pc/h/ln	2215
Total Flow Rate (v), pc/h	5197	Demand Flow-Based Capacity (c_{IW}), pc/h	18605
Volume Ratio (VR)	0.129	Weaving Segment Capacity (c_w), veh/h	8054
Minimum Lane Change Rate (LC_{MIN}), lc/h	668	Adjusted Weaving Area Capacity, pc/h	8773
Maximum Weaving Length (L_{MAX}), ft	3823	Volume-to-Capacity Ratio (v/c)	0.59

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	507	Average Weaving Speed (S_W), mi/h	57.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	921	Average Non-Weaving Speed (S_{NW}), mi/h	59.0
Weaving Lane Change Rate (LC_W), lc/h	999	Average Speed (S), mi/h	58.8
Total Lane Change Rate (LC_{All}), lc/h	1920	Density (D), pc/mi/ln	22.1
Weaving Intensity Factor (W)	0.290	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - Between 32nd & 40th St - EB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Short Length (L_s), ft	1300	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	5385	425	0	580
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	6302	461	0	630

Weaving Flow Rate (v_w), pc/h	1091	Freeway Max Capacity (c_{FL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	6302	Density-Based Capacity (c_{IWL}), pc/h/ln	2193
Total Flow Rate (v), pc/h	7393	Demand Flow-Based Capacity (c_{IW}), pc/h	16216
Volume Ratio (VR)	0.148	Weaving Segment Capacity (c_w), veh/h	7974
Minimum Lane Change Rate (LC_{MIN}), lc/h	1091	Adjusted Weaving Area Capacity, pc/h	8672
Maximum Weaving Length (L_{MAX}), ft	4011	Volume-to-Capacity Ratio (v/c)	0.85

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	655	Average Weaving Speed (S_W), mi/h	54.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1232	Average Non-Weaving Speed (S_{NW}), mi/h	53.3
Weaving Lane Change Rate (LC_W), lc/h	1407	Average Speed (S), mi/h	53.5
Total Lane Change Rate (LC_{All}), lc/h	2639	Density (D), pc/mi/ln	34.5
Weaving Intensity Factor (W)	0.395	Level of Service (LOS)	D

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - Between 32nd & 40th St - EB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Short Length (L_s), ft	1300	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	4045	350	0	370
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	4734	380	0	402

Weaving Flow Rate (v_w), pc/h	782	Freeway Max Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	4734	Density-Based Capacity (c_{IWL}), pc/h/ln	2197
Total Flow Rate (v), pc/h	5516	Demand Flow-Based Capacity (c_{IW}), pc/h	16901
Volume Ratio (VR)	0.142	Weaving Segment Capacity (c_W), veh/h	7988
Minimum Lane Change Rate (LC_{MIN}), lc/h	782	Adjusted Weaving Area Capacity, pc/h	8692
Maximum Weaving Length (L_{MAX}), ft	3952	Volume-to-Capacity Ratio (v/c)	0.63

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	492	Average Weaving Speed (S_W), mi/h	56.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	909	Average Non-Weaving Speed (S_{NW}), mi/h	57.8
Weaving Lane Change Rate (LC_W), lc/h	1098	Average Speed (S), mi/h	57.6
Total Lane Change Rate (LC_{All}), lc/h	2007	Density (D), pc/mi/ln	23.9
Weaving Intensity Factor (W)	0.318	Level of Service (LOS)	C

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - Between 24th & 32nd St - WB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Short Length (L_s), ft	1400	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	3165	80	0	320
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	3704	87	0	347

Weaving Flow Rate (v_w), pc/h	434	Freeway Max Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	3704	Density-Based Capacity (c_{IWL}), pc/h/ln	2233
Total Flow Rate (v), pc/h	4138	Demand Flow-Based Capacity (c_{IW}), pc/h	22857
Volume Ratio (VR)	0.105	Weaving Segment Capacity (c_W), veh/h	8119
Minimum Lane Change Rate (LC_{MIN}), lc/h	434	Adjusted Weaving Area Capacity, pc/h	8859
Maximum Weaving Length (L_{MAX}), ft	3588	Volume-to-Capacity Ratio (v/c)	0.47

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	415	Average Weaving Speed (S_W), mi/h	59.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	751	Average Non-Weaving Speed (S_{NW}), mi/h	61.9
Weaving Lane Change Rate (LC_W), lc/h	765	Average Speed (S), mi/h	61.6
Total Lane Change Rate (LC_{All}), lc/h	1516	Density (D), pc/mi/ln	16.8
Weaving Intensity Factor (W)	0.241	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - Between 24th & 32nd St - WB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Short Length (L_S), ft	1400	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	5735	315	0	675
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	6712	342	0	733

Weaving Flow Rate (v_w), pc/h	1075	Freeway Max Capacity (c_{FL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	6712	Density-Based Capacity (c_{IWL}), pc/h/ln	2208
Total Flow Rate (v), pc/h	7787	Demand Flow-Based Capacity (c_W), pc/h	17391
Volume Ratio (VR)	0.138	Weaving Segment Capacity (c_w), veh/h	8028
Minimum Lane Change Rate (LC_{MIN}), lc/h	1075	Adjusted Weaving Area Capacity, pc/h	8738
Maximum Weaving Length (L_{MAX}), ft	3912	Volume-to-Capacity Ratio (v/c)	0.89

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	752	Average Weaving Speed (S_W), mi/h	54.6
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1371	Average Non-Weaving Speed (S_{NW}), mi/h	52.9
Weaving Lane Change Rate (LC_W), lc/h	1406	Average Speed (S), mi/h	53.1
Total Lane Change Rate (LC_{All}), lc/h	2777	Density (D), pc/mi/ln	36.7
Weaving Intensity Factor (W)	0.388	Level of Service (LOS)	E

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	AM
Project Description	Loop 202 - Between 32nd & 40Th St - WB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Highway/CD Roadway
Short Length (L_S), ft	1300	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	3355	285	0	270
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	3926	309	0	293

Weaving Flow Rate (v_w), pc/h	602	Freeway Max Capacity (c_{IFL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	3926	Density-Based Capacity (c_{IWL}), pc/h/ln	2204
Total Flow Rate (v), pc/h	4528	Demand Flow-Based Capacity (c_W), pc/h	18045
Volume Ratio (VR)	0.133	Weaving Segment Capacity (c_w), veh/h	8014
Minimum Lane Change Rate (LC_{MIN}), lc/h	602	Adjusted Weaving Area Capacity, pc/h	8724
Maximum Weaving Length (L_{MAX}), ft	3863	Volume-to-Capacity Ratio (v/c)	0.52

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	408	Average Weaving Speed (S_W), mi/h	58.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	743	Average Non-Weaving Speed (S_{NW}), mi/h	60.2
Weaving Lane Change Rate (LC_W), lc/h	918	Average Speed (S), mi/h	59.9
Total Lane Change Rate (LC_{All}), lc/h	1661	Density (D), pc/mi/ln	18.9
Weaving Intensity Factor (W)	0.274	Level of Service (LOS)	B

HCS7 Freeway Weaving Report

Project Information

Analyst	GSR	Date	6/8/2018
Agency	HDR	Analysis Year	2040
Jurisdiction	ADOT	Time Period Analyzed	PM
Project Description	Loop 202 - Between 32nd & 40th St - WB - Build		

Geometric Data

Number of Lanes (N), ln	4	Segment Type	Freeway
Short Length (L_S), ft	1300	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.80	Cross Weaving Managed Lane	No

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

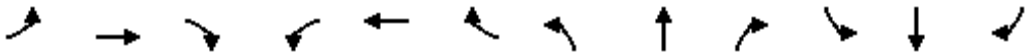
	FF	RF	RR	FR
Demand Volume (V_i), veh/h	5920	675	0	495
Peak Hour Factor (PHF)	0.94	0.94	0.94	0.94
Total Trucks, %	10.00	2.00	0.00	2.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.909	0.980	1.000	0.980
Flow Rate (v_i), pc/h	6928	733	0	537

Weaving Flow Rate (v_w), pc/h	1270	Freeway Max Capacity (c_{FL}), pc/h/ln	2400
Non-Weaving Flow Rate (v_{NW}), pc/h	6928	Density-Based Capacity (c_{IWL}), pc/h/ln	2187
Total Flow Rate (v), pc/h	8198	Demand Flow-Based Capacity (c_{IW}), pc/h	15484
Volume Ratio (VR)	0.155	Weaving Segment Capacity (c_W), veh/h	7952
Minimum Lane Change Rate (LC_{MIN}), lc/h	1270	Adjusted Weaving Area Capacity, pc/h	8643
Maximum Weaving Length (L_{MAX}), ft	4081	Volume-to-Capacity Ratio (v/c)	0.95

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	721	Average Weaving Speed (S_W), mi/h	53.4
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	1361	Average Non-Weaving Speed (S_{NW}), mi/h	51.0
Weaving Lane Change Rate (LC_W), lc/h	1586	Average Speed (S), mi/h	51.4
Total Lane Change Rate (LC_{All}), lc/h	2947	Density (D), pc/mi/ln	39.9
Weaving Intensity Factor (W)	0.431	Level of Service (LOS)	E

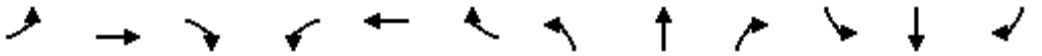
Appendix C. – Synchro Analysis Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	0	0	0	0	0	0	0	0	590	0	0
Future Volume (vph)	190	0	0	0	0	0	0	0	0	590	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5								4.5		
Lane Util. Factor	0.95	0.95								0.97		
Frt	1.00	1.00								1.00		
Flt Protected	0.95	0.95								0.95		
Satd. Flow (prot)	1513	1513								3090		
Flt Permitted	0.95	0.95								0.95		
Satd. Flow (perm)	1513	1513								3090		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	207	0	0	0	0	0	0	0	0	641	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	103	104	0	0	0	0	0	0	0	641	0	0
Turn Type	Perm	NA								Prot		
Protected Phases		4						6		2	6	
Permitted Phases	4											
Actuated Green, G (s)	11.5	11.5								29.4		
Effective Green, g (s)	11.5	11.5								29.4		
Actuated g/C Ratio	0.13	0.13								0.33		
Clearance Time (s)	4.5	4.5								4.5		
Vehicle Extension (s)	3.0	3.0								3.0		
Lane Grp Cap (vph)	193	193								1009		
v/s Ratio Prot										c0.21		
v/s Ratio Perm	0.07	0.07										
v/c Ratio	0.53	0.54								0.64		
Uniform Delay, d1	36.7	36.8								25.7		
Progression Factor	1.00	1.00								0.37		
Incremental Delay, d2	2.8	2.9								1.1		
Delay (s)	39.6	39.6								10.7		
Level of Service	D	D								B		
Approach Delay (s)		39.6			0.0			0.0			10.7	
Approach LOS		D			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	17.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

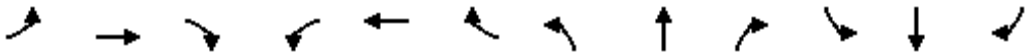
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	1	0	410	0	190	0	0	590	55
Future Volume (vph)	0	0	0	1	0	410	0	190	0	0	590	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Lane Util. Factor				0.95	0.91	0.95		0.95			0.95	1.00
Frt				1.00	0.85	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539			3539	1583
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1	0	446	0	207	0	0	641	60
RTOR Reduction (vph)	0	0	0	0	208	208	0	0	0	0	0	40
Lane Group Flow (vph)	0	0	0	1	15	15	0	207	0	0	641	20
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			6			2	
Permitted Phases				8		8	6					2
Actuated Green, G (s)				6.2	6.2	6.2		24.9			29.4	29.4
Effective Green, g (s)				6.2	6.2	6.2		24.9			29.4	29.4
Actuated g/C Ratio				0.07	0.07	0.07		0.28			0.33	0.33
Clearance Time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				115	99	103		979			1156	517
v/s Ratio Prot								c0.06			c0.18	
v/s Ratio Perm				0.00	0.01	0.01						0.01
v/c Ratio				0.01	0.16	0.15		0.21			0.55	0.04
Uniform Delay, d1				39.0	39.4	39.4		25.0			24.9	20.7
Progression Factor				1.00	1.00	1.00		0.24			1.00	1.00
Incremental Delay, d2				0.0	0.7	0.7		0.5			0.6	0.0
Delay (s)				39.1	40.2	40.1		6.6			25.5	20.7
Level of Service				D	D	D		A			C	C
Approach Delay (s)		0.0			40.1			6.6			25.1	
Approach LOS		A			D			A			C	

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

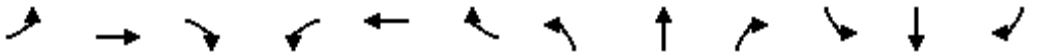
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	325	0	385	0	0	0	0	325	165	595	270	0
Future Volume (vph)	325	0	385	0	0	0	0	325	165	595	270	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Util. Factor	0.95	0.91	0.95					0.95	1.00	0.97	0.95	
Frt	1.00	0.90	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.98	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1500	1504					3539	1583	3433	3539	
Flt Permitted	0.95	0.98	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1500	1504					3539	1583	3433	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	353	0	418	0	0	0	0	353	179	647	293	0
RTOR Reduction (vph)	0	98	191	0	0	0	0	0	111	0	0	0
Lane Group Flow (vph)	268	158	56	0	0	0	0	353	68	647	293	0
Turn Type	custom	NA	Perm					NA	Perm	Prot	NA	
Protected Phases	8	8						6		5	2	
Permitted Phases	8		8						6			
Actuated Green, G (s)	20.4	20.4	20.4					34.0	34.0	22.1	48.0	
Effective Green, g (s)	20.4	20.4	20.4					34.0	34.0	22.1	48.0	
Actuated g/C Ratio	0.23	0.23	0.23					0.38	0.38	0.25	0.53	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	381	340	340					1336	598	842	1887	
v/s Ratio Prot	c0.16	0.11						c0.10		c0.19	0.08	
v/s Ratio Perm			0.04						0.04			
v/c Ratio	0.70	0.46	0.16					0.26	0.11	0.77	0.16	
Uniform Delay, d1	32.0	30.1	28.0					19.4	18.2	31.6	10.7	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.67	0.63	
Incremental Delay, d2	5.8	1.0	0.2					0.5	0.4	4.2	0.2	
Delay (s)	37.8	31.1	28.2					19.8	18.6	56.9	6.9	
Level of Service	D	C	C					B	B	E	A	
Approach Delay (s)		32.5			0.0			19.4			41.3	
Approach LOS		C			A			B			D	

Intersection Summary			
HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



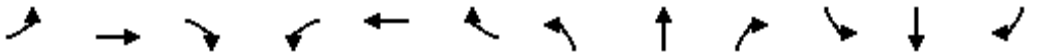
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	10	0	465	135	515	0	0	855	155
Future Volume (vph)	0	0	0	10	0	465	135	515	0	0	855	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor				0.91	0.86	0.91	1.00	0.95			0.86	1.00
Frt				1.00	0.85	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1610	2725	1441	1770	3539			6408	1583
Flt Permitted				0.95	1.00	1.00	0.28	1.00			1.00	1.00
Satd. Flow (perm)				1610	2725	1441	520	3539			6408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	11	0	505	147	560	0	0	929	168
RTOR Reduction (vph)	0	0	0	0	196	195	0	0	0	0	0	78
Lane Group Flow (vph)	0	0	0	10	58	57	147	560	0	0	929	90
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					4		1	6			2	
Permitted Phases				4		4	6					2
Actuated Green, G (s)				20.4	20.4	20.4	42.1	34.0			48.0	48.0
Effective Green, g (s)				20.4	20.4	20.4	42.1	34.0			48.0	48.0
Actuated g/C Ratio				0.23	0.23	0.23	0.47	0.38			0.53	0.53
Clearance Time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				364	617	326	355	1336			3417	844
v/s Ratio Prot							c0.04	c0.16			c0.14	
v/s Ratio Perm				0.01	0.02	c0.04	0.16					0.06
v/c Ratio				0.03	0.09	0.18	0.41	0.42			0.27	0.11
Uniform Delay, d1				27.1	27.5	28.0	13.9	20.7			11.5	10.4
Progression Factor				1.00	1.00	1.00	1.19	1.10			1.00	1.00
Incremental Delay, d2				0.0	0.1	0.3	0.7	0.9			0.2	0.3
Delay (s)				27.1	27.6	28.3	17.2	23.6			11.7	10.6
Level of Service				C	C	C	B	C			B	B
Approach Delay (s)		0.0			27.9			22.3			11.5	
Approach LOS		A			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
1: 24th St & Off ramp to 24th St S/On ramp to 202 E

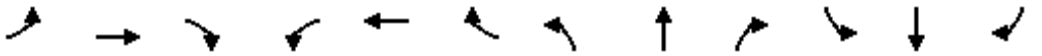
06/18/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	60	0	0	0	0	0	0	0	5	590	0	0
Future Volume (vph)	60	0	0	0	0	0	0	0	5	590	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5						4.5		4.5		
Lane Util. Factor	0.95	0.95						1.00		0.97		
Frt	1.00	1.00						0.86		1.00		
Flt Protected	0.95	0.95						1.00		0.95		
Satd. Flow (prot)	1513	1513						1450		3090		
Flt Permitted	0.95	0.95						1.00		0.95		
Satd. Flow (perm)	1513	1513						1450		3090		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	0	0	0	0	0	0	0	5	641	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	32	33	0	0	0	0	0	2	0	641	0	0
Turn Type	Perm	NA						NA		Prot		
Protected Phases		4						6		2	6	
Permitted Phases	4											
Actuated Green, G (s)	5.2	5.2						31.0		25.6		
Effective Green, g (s)	5.2	5.2						31.0		25.6		
Actuated g/C Ratio	0.06	0.06						0.34		0.28		
Clearance Time (s)	4.5	4.5						4.5		4.5		
Vehicle Extension (s)	3.0	3.0						3.0		3.0		
Lane Grp Cap (vph)	87	87						499		878		
v/s Ratio Prot								c0.00		c0.21		
v/s Ratio Perm	0.02	0.02										
v/c Ratio	0.37	0.38						0.00		0.73		
Uniform Delay, d1	40.8	40.8						19.4		29.1		
Progression Factor	1.00	1.00						1.00		0.65		
Incremental Delay, d2	2.6	2.8						0.0		2.4		
Delay (s)	43.4	43.6						19.4		21.2		
Level of Service	D	D						B		C		
Approach Delay (s)		43.5			0.0			19.4			21.2	
Approach LOS		D			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	39.3%	ICU Level of Service	A
Analysis Period (min)	15		

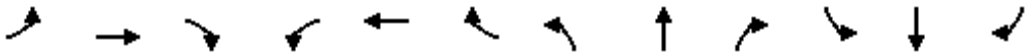
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	5	0	670	0	60	0	0	590	185
Future Volume (vph)	0	0	0	5	0	670	0	60	0	0	590	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Lane Util. Factor				0.95	0.91	0.95		0.95			0.95	1.00
Frt				1.00	0.85	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539			3539	1583
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	5	0	728	0	65	0	0	641	201
RTOR Reduction (vph)	0	0	0	0	323	323	0	0	0	0	0	144
Lane Group Flow (vph)	0	0	0	4	42	41	0	65	0	0	641	57
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			6			2	
Permitted Phases				8		8	6					2
Actuated Green, G (s)				10.2	10.2	10.2		31.0			25.6	25.6
Effective Green, g (s)				10.2	10.2	10.2		31.0			25.6	25.6
Actuated g/C Ratio				0.11	0.11	0.11		0.34			0.28	0.28
Clearance Time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				190	163	170		1218			1006	450
v/s Ratio Prot								c0.02			c0.18	
v/s Ratio Perm				0.00	0.03	0.03						0.04
v/c Ratio				0.02	0.26	0.24		0.05			0.64	0.13
Uniform Delay, d1				35.5	36.4	36.4		19.7			28.1	23.9
Progression Factor				1.00	1.00	1.00		0.12			1.00	1.00
Incremental Delay, d2				0.0	0.8	0.7		0.1			1.3	0.1
Delay (s)				35.5	37.3	37.1		2.5			29.5	24.0
Level of Service				D	D	D		A			C	C
Approach Delay (s)		0.0			37.2			2.5			28.2	
Approach LOS		A			D			A			C	

Intersection Summary			
HCM 2000 Control Delay	31.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	39.3%	ICU Level of Service	A
Analysis Period (min)	15		

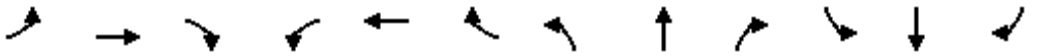
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	0	230	0	0	0	205	825	205	550	360	0
Future Volume (vph)	210	0	230	0	0	0	205	825	205	550	360	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Util. Factor	0.95	0.91	0.95					0.95	1.00	0.97	0.95	
Frt	1.00	0.91	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.98	1.00					0.99	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1510	1504					3504	1583	3433	3539	
Flt Permitted	0.95	0.98	1.00					0.77	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1510	1504					2708	1583	3433	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	228	0	250	0	0	0	223	897	223	598	391	0
RTOR Reduction (vph)	0	105	125	0	0	0	0	0	124	0	0	0
Lane Group Flow (vph)	166	55	27	0	0	0	0	1120	99	598	391	0
Turn Type	custom	NA	Perm				Perm	NA	Perm	Prot	NA	
Protected Phases	8	8						6		5	2	
Permitted Phases	8		8				6		6			
Actuated Green, G (s)	15.7	15.7	15.7					39.8	39.8	21.0	41.3	
Effective Green, g (s)	15.7	15.7	15.7					39.8	39.8	21.0	41.3	
Actuated g/C Ratio	0.17	0.17	0.17					0.44	0.44	0.23	0.46	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	293	263	262					1197	700	801	1624	
v/s Ratio Prot	c0.10	0.04								c0.17	0.11	
v/s Ratio Perm			0.02					c0.41	0.06			
v/c Ratio	0.57	0.21	0.10					0.94	0.14	0.75	0.24	
Uniform Delay, d1	34.0	31.8	31.2					23.9	14.9	32.0	14.8	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.31	0.66	
Incremental Delay, d2	2.5	0.4	0.2					14.6	0.4	3.7	0.3	
Delay (s)	36.5	32.2	31.4					38.4	15.4	45.7	10.1	
Level of Service	D	C	C					D	B	D	B	
Approach Delay (s)		33.5			0.0			34.6			31.7	
Approach LOS		C			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		

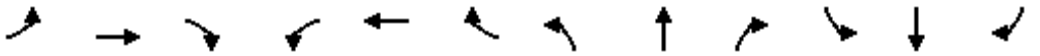
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	80	0	720	440	595	0	0	830	325
Future Volume (vph)	0	0	0	80	0	720	440	595	0	0	830	325
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor				0.91	0.86	0.91	1.00	0.95			0.86	1.00
Frt				1.00	0.85	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1610	2731	1441	1770	3539			6408	1583
Flt Permitted				0.95	1.00	1.00	0.27	1.00			1.00	1.00
Satd. Flow (perm)				1610	2731	1441	505	3539			6408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	87	0	783	478	647	0	0	902	353
RTOR Reduction (vph)	0	0	0	0	324	323	0	0	0	0	0	191
Lane Group Flow (vph)	0	0	0	78	77	68	478	647	0	0	902	162
Turn Type				custom	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				4	4		1	6			2	
Permitted Phases				4		4	6					2
Actuated Green, G (s)				15.7	15.7	15.7	59.3	39.8			41.3	41.3
Effective Green, g (s)				15.7	15.7	15.7	59.3	39.8			41.3	41.3
Actuated g/C Ratio				0.17	0.17	0.17	0.66	0.44			0.46	0.46
Clearance Time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				280	476	251	606	1565			2940	726
v/s Ratio Prot				c0.05	0.03		c0.17	0.18			0.14	
v/s Ratio Perm						0.05	c0.35					0.10
v/c Ratio				0.28	0.16	0.27	0.79	0.41			0.31	0.22
Uniform Delay, d1				32.2	31.6	32.2	7.4	17.1			15.3	14.7
Progression Factor				1.00	1.00	1.00	2.07	1.31			1.00	1.00
Incremental Delay, d2				0.5	0.2	0.6	3.8	0.4			0.3	0.7
Delay (s)				32.8	31.7	32.8	19.3	22.8			15.6	15.4
Level of Service				C	C	C	B	C			B	B
Approach Delay (s)		0.0			32.3			21.3			15.5	
Approach LOS		A			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

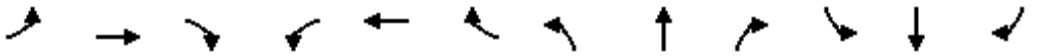
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	190	0	0	0	0	0	0	0	5	575	0	0
Future Volume (vph)	190	0	0	0	0	0	0	0	5	575	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5						4.5		4.5		
Lane Util. Factor	0.95	0.95						1.00		0.97		
Frt	1.00	1.00						0.86		1.00		
Flt Protected	0.95	0.95						1.00		0.95		
Satd. Flow (prot)	1681	1681						1611		3433		
Flt Permitted	0.95	0.95						1.00		0.95		
Satd. Flow (perm)	1681	1681						1611		3433		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	207	0	0	0	0	0	0	0	5	625	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	103	104	0	0	0	0	0	2	0	625	0	0
Turn Type	Perm	NA						NA		Prot		
Protected Phases		4						6		5	2	
Permitted Phases	4											
Actuated Green, G (s)	9.6	9.6						28.9		18.0		
Effective Green, g (s)	9.6	9.6						28.9		18.0		
Actuated g/C Ratio	0.14	0.14						0.41		0.26		
Clearance Time (s)	4.5	4.5						4.5		4.5		
Vehicle Extension (s)	3.0	3.0						3.0		3.0		
Lane Grp Cap (vph)	230	230						665		882		
v/s Ratio Prot								c0.00		c0.18		
v/s Ratio Perm	0.06	0.06										
v/c Ratio	0.45	0.45						0.00		0.71		
Uniform Delay, d1	27.8	27.8						12.1		23.6		
Progression Factor	1.00	1.00						1.00		0.90		
Incremental Delay, d2	1.4	1.4						0.0		2.6		
Delay (s)	29.2	29.2						12.1		23.8		
Level of Service	C	C						B		C		
Approach Delay (s)		29.2			0.0			12.1			23.8	
Approach LOS		C			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	25.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

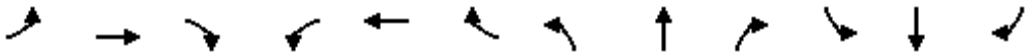
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	1	0	320	0	190	0	0	575	50
Future Volume (vph)	0	0	0	1	0	320	0	190	0	0	575	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Lane Util. Factor				0.95	0.91	0.95		0.95			0.95	1.00
Frt				1.00	0.85	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539			3539	1583
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1	0	348	0	207	0	0	625	54
RTOR Reduction (vph)	0	0	0	0	150	150	0	0	0	0	0	14
Lane Group Flow (vph)	0	0	0	1	24	24	0	207	0	0	625	40
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			6			2	
Permitted Phases				8		8	6					2
Actuated Green, G (s)				9.6	9.6	9.6		28.9			51.4	51.4
Effective Green, g (s)				9.6	9.6	9.6		28.9			51.4	51.4
Actuated g/C Ratio				0.14	0.14	0.14		0.41			0.73	0.73
Clearance Time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				230	197	206		1461			2598	1162
v/s Ratio Prot								0.06			c0.18	
v/s Ratio Perm				0.00	0.02	0.02						0.03
v/c Ratio				0.00	0.12	0.12		0.14			0.24	0.03
Uniform Delay, d1				26.1	26.5	26.5		12.8			3.0	2.5
Progression Factor				1.00	1.00	1.00		1.83			1.00	1.00
Incremental Delay, d2				0.0	0.3	0.3		0.2			0.2	0.1
Delay (s)				26.1	26.8	26.7		23.7			3.2	2.6
Level of Service				C	C	C		C			A	A
Approach Delay (s)		0.0			26.8			23.7			3.2	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

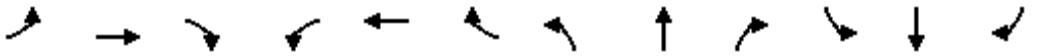
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	260	0	0	0	0	0	0	0	0	425	0	0
Future Volume (vph)	260	0	0	0	0	0	0	0	0	425	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5									4.5		
Lane Util. Factor	1.00									0.97		
Frt	1.00									1.00		
Flt Protected	0.95									0.95		
Satd. Flow (prot)	1770									3433		
Flt Permitted	0.95									0.95		
Satd. Flow (perm)	1770									3433		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	283	0	0	0	0	0	0	0	0	462	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	283	0	0	0	0	0	0	0	0	462	0	0
Turn Type	Perm								Perm	Prot		
Protected Phases		8						6		5	2	
Permitted Phases	8								6			
Actuated Green, G (s)	14.7									13.0		
Effective Green, g (s)	14.7									13.0		
Actuated g/C Ratio	0.24									0.22		
Clearance Time (s)	4.5									4.5		
Vehicle Extension (s)	3.0									3.0		
Lane Grp Cap (vph)	433									743		
v/s Ratio Prot										c0.13		
v/s Ratio Perm	c0.16											
v/c Ratio	0.65									0.62		
Uniform Delay, d1	20.4									21.3		
Progression Factor	1.00									1.69		
Incremental Delay, d2	3.5									1.6		
Delay (s)	23.9									37.7		
Level of Service	C									D		
Approach Delay (s)		23.9			0.0			0.0			37.7	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	32.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

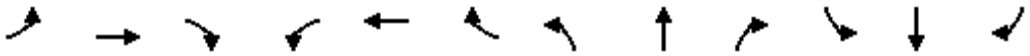
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	270	0	260	0	0	425	80
Future Volume (vph)	0	0	0	0	0	270	0	260	0	0	425	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.5			4.5			4.5	4.5
Lane Util. Factor					1.00			0.95			0.95	1.00
Frt					0.85			1.00			1.00	0.85
Flt Protected					1.00			1.00			1.00	1.00
Satd. Flow (prot)					1583			3539			3539	1583
Flt Permitted					1.00			1.00			1.00	1.00
Satd. Flow (perm)					1583			3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	293	0	283	0	0	462	87
RTOR Reduction (vph)	0	0	0	0	221	0	0	0	0	0	0	34
Lane Group Flow (vph)	0	0	0	0	72	0	0	283	0	0	462	53
Turn Type				Perm	NA		Perm	NA			NA	Perm
Protected Phases					4			6			2	
Permitted Phases				4			6					2
Actuated Green, G (s)					14.7			18.8			36.3	36.3
Effective Green, g (s)					14.7			18.8			36.3	36.3
Actuated g/C Ratio					0.24			0.31			0.60	0.60
Clearance Time (s)					4.5			4.5			4.5	4.5
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					387			1108			2141	957
v/s Ratio Prot					c0.05			c0.08			c0.13	
v/s Ratio Perm												0.03
v/c Ratio					0.19			0.26			0.22	0.06
Uniform Delay, d1					17.9			15.4			5.4	4.8
Progression Factor					1.00			1.24			1.00	1.00
Incremental Delay, d2					0.2			0.5			0.2	0.1
Delay (s)					18.1			19.5			5.6	5.0
Level of Service					B			B			A	A
Approach Delay (s)		0.0			18.1			19.5			5.5	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

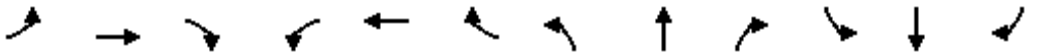
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	150	0	430	0	0	0	0	340	155	440	250	0
Future Volume (vph)	150	0	430	0	0	0	0	340	155	440	250	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Util. Factor	0.95	0.91	0.95					0.95	1.00	0.97	0.95	
Frt	1.00	0.86	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1453	1504					3539	1583	3433	3539	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1453	1504					3539	1583	3433	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	163	0	467	0	0	0	0	370	168	478	272	0
RTOR Reduction (vph)	0	180	195	0	0	0	0	0	105	0	0	0
Lane Group Flow (vph)	147	60	48	0	0	0	0	370	63	478	272	0
Turn Type	Split	NA	Perm					NA	Perm	Prot	NA	
Protected Phases	8	8						6		5	2	
Permitted Phases			8						6			
Actuated Green, G (s)	11.9	11.9	11.9					22.5	22.5	12.1	28.6	
Effective Green, g (s)	11.9	11.9	11.9					22.5	22.5	12.1	28.6	
Actuated g/C Ratio	0.20	0.20	0.20					0.38	0.38	0.20	0.48	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	333	288	298					1327	593	692	1686	
v/s Ratio Prot	c0.09	0.04						c0.10		c0.14	0.08	
v/s Ratio Perm			0.03						0.04			
v/c Ratio	0.44	0.21	0.16					0.28	0.11	0.69	0.16	
Uniform Delay, d1	21.1	20.1	19.9					13.1	12.2	22.2	8.9	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.43	0.58	
Incremental Delay, d2	0.9	0.4	0.3					0.5	0.4	2.9	0.2	
Delay (s)	22.1	20.5	20.2					13.6	12.6	34.8	5.4	
Level of Service	C	C	C					B	B	C	A	
Approach Delay (s)		20.7			0.0			13.3			24.1	
Approach LOS		C			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	20.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

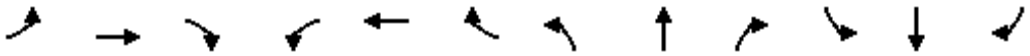
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	5	0	450	150	340	0	0	685	140
Future Volume (vph)	0	0	0	5	0	450	150	340	0	0	685	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor				0.91	0.86	0.91	1.00	0.95			0.86	1.00
Frt				1.00	0.85	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1610	2725	1441	1770	3539			6408	1583
Flt Permitted				0.95	1.00	1.00	0.34	1.00			1.00	1.00
Satd. Flow (perm)				1610	2725	1441	636	3539			6408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	5	0	489	163	370	0	0	745	152
RTOR Reduction (vph)	0	0	0	0	197	196	0	0	0	0	0	80
Lane Group Flow (vph)	0	0	0	4	49	48	163	370	0	0	745	72
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					4		1	6			2	
Permitted Phases				4		4	6					2
Actuated Green, G (s)				11.9	11.9	11.9	28.5	22.5			28.6	28.6
Effective Green, g (s)				11.9	11.9	11.9	28.5	22.5			28.6	28.6
Actuated g/C Ratio				0.20	0.20	0.20	0.48	0.38			0.48	0.48
Clearance Time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				319	540	285	415	1327			3054	754
v/s Ratio Prot							c0.04	0.10			c0.12	
v/s Ratio Perm				0.00	0.02	c0.03	c0.15					0.05
v/c Ratio				0.01	0.09	0.17	0.39	0.28			0.24	0.10
Uniform Delay, d1				19.3	19.6	20.0	9.1	13.1			9.3	8.6
Progression Factor				1.00	1.00	1.00	1.84	1.05			1.00	1.00
Incremental Delay, d2				0.0	0.1	0.3	0.6	0.5			0.2	0.3
Delay (s)				19.3	19.7	20.2	17.3	14.3			9.5	8.9
Level of Service				B	B	C	B	B			A	A
Approach Delay (s)		0.0			20.0			15.2			9.4	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

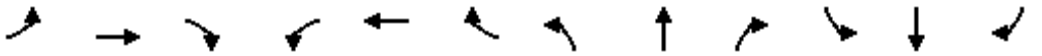
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	0	0	0	0	0	0	0	5	440	0	0
Future Volume (vph)	55	0	0	0	0	0	0	0	5	440	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5						4.5		4.5		
Lane Util. Factor	0.95	0.95						1.00		0.97		
Frt	1.00	1.00						0.86		1.00		
Flt Protected	0.95	0.95						1.00		0.95		
Satd. Flow (prot)	1681	1681						1611		3433		
Flt Permitted	0.95	0.95						1.00		0.95		
Satd. Flow (perm)	1681	1681						1611		3433		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	0	0	0	0	0	0	0	5	478	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	4	0	0	0	0
Lane Group Flow (vph)	30	30	0	0	0	0	0	1	0	478	0	0
Turn Type	Perm	NA						NA		Prot		
Protected Phases		4						6		5	2	
Permitted Phases	4											
Actuated Green, G (s)	10.4	10.4						18.7		27.4		
Effective Green, g (s)	10.4	10.4						18.7		27.4		
Actuated g/C Ratio	0.15	0.15						0.27		0.39		
Clearance Time (s)	4.5	4.5						4.5		4.5		
Vehicle Extension (s)	3.0	3.0						3.0		3.0		
Lane Grp Cap (vph)	249	249						430		1343		
v/s Ratio Prot								c0.00		c0.14		
v/s Ratio Perm	c0.02	0.02										
v/c Ratio	0.12	0.12						0.00		0.36		
Uniform Delay, d1	25.8	25.8						18.8		15.1		
Progression Factor	1.00	1.00						1.00		0.88		
Incremental Delay, d2	0.2	0.2						0.0		0.7		
Delay (s)	26.1	26.1						18.8		14.0		
Level of Service	C	C						B		B		
Approach Delay (s)		26.1			0.0			18.8			14.0	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.20		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		

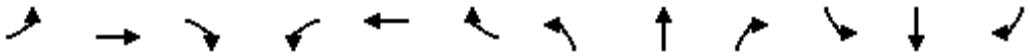
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	5	0	675	0	55	0	0	440	205
Future Volume (vph)	0	0	0	5	0	675	0	55	0	0	440	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Lane Util. Factor				0.95	0.91	0.95		0.95			0.95	1.00
Frt				1.00	0.85	0.85		1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539			3539	1583
Flt Permitted				0.95	1.00	1.00		1.00			1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	5	0	734	0	60	0	0	478	223
RTOR Reduction (vph)	0	0	0	0	312	312	0	0	0	0	0	62
Lane Group Flow (vph)	0	0	0	4	56	55	0	60	0	0	478	161
Turn Type				Perm	NA	Perm	Perm	NA			NA	Perm
Protected Phases					8			6			2	
Permitted Phases				8		8	6					2
Actuated Green, G (s)				10.4	10.4	10.4		18.7			50.6	50.6
Effective Green, g (s)				10.4	10.4	10.4		18.7			50.6	50.6
Actuated g/C Ratio				0.15	0.15	0.15		0.27			0.72	0.72
Clearance Time (s)				4.5	4.5	4.5		4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				249	214	223		945			2558	1144
v/s Ratio Prot								0.02			c0.14	
v/s Ratio Perm				0.00	0.04	0.04						0.10
v/c Ratio				0.02	0.26	0.24		0.06			0.19	0.14
Uniform Delay, d1				25.4	26.4	26.3		19.1			3.1	3.0
Progression Factor				1.00	1.00	1.00		1.78			1.00	1.00
Incremental Delay, d2				0.0	0.6	0.6		0.1			0.2	0.3
Delay (s)				25.5	27.0	26.9		34.1			3.3	3.3
Level of Service				C	C	C		C			A	A
Approach Delay (s)		0.0			27.0			34.1			3.3	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.22		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		

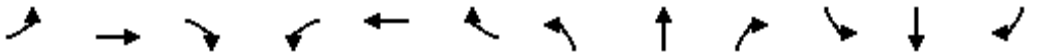
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	175	0	0	0	0	0	0	0	0	350	0	0
Future Volume (vph)	175	0	0	0	0	0	0	0	0	350	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5									4.5		
Lane Util. Factor	1.00									0.97		
Frt	1.00									1.00		
Flt Protected	0.95									0.95		
Satd. Flow (prot)	1770									3433		
Flt Permitted	0.95									0.95		
Satd. Flow (perm)	1770									3433		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	190	0	0	0	0	0	0	0	0	380	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	190	0	0	0	0	0	0	0	0	380	0	0
Turn Type	Perm								Perm	Prot		
Protected Phases		8						6		5	2	
Permitted Phases	8								6			
Actuated Green, G (s)	11.8									11.8		
Effective Green, g (s)	11.8									11.8		
Actuated g/C Ratio	0.20									0.20		
Clearance Time (s)	4.5									4.5		
Vehicle Extension (s)	3.0									3.0		
Lane Grp Cap (vph)	348									675		
v/s Ratio Prot										c0.11		
v/s Ratio Perm	c0.11											
v/c Ratio	0.55									0.56		
Uniform Delay, d1	21.7									21.8		
Progression Factor	1.00									1.65		
Incremental Delay, d2	1.8									1.1		
Delay (s)	23.4									37.1		
Level of Service	C									D		
Approach Delay (s)		23.4			0.0			0.0			37.1	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		

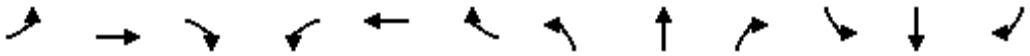
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	495	0	175	0	0	350	310
Future Volume (vph)	0	0	0	0	0	495	0	175	0	0	350	310
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					4.5			4.5			4.5	4.5
Lane Util. Factor					1.00			0.95			0.95	1.00
Frt					0.85			1.00			1.00	0.85
Flt Protected					1.00			1.00			1.00	1.00
Satd. Flow (prot)					1583			3539			3539	1583
Flt Permitted					1.00			1.00			1.00	1.00
Satd. Flow (perm)					1583			3539			3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	538	0	190	0	0	380	337
RTOR Reduction (vph)	0	0	0	0	432	0	0	0	0	0	0	117
Lane Group Flow (vph)	0	0	0	0	106	0	0	190	0	0	380	220
Turn Type				Perm	NA		Perm	NA			NA	Perm
Protected Phases					4			6			2	
Permitted Phases				4			6					2
Actuated Green, G (s)					11.8			22.9			39.2	39.2
Effective Green, g (s)					11.8			22.9			39.2	39.2
Actuated g/C Ratio					0.20			0.38			0.65	0.65
Clearance Time (s)					4.5			4.5			4.5	4.5
Vehicle Extension (s)					3.0			3.0			3.0	3.0
Lane Grp Cap (vph)					311			1350			2312	1034
v/s Ratio Prot					c0.07			0.05			0.11	
v/s Ratio Perm												c0.14
v/c Ratio					0.34			0.14			0.16	0.21
Uniform Delay, d1					20.7			12.1			4.0	4.2
Progression Factor					1.00			1.32			1.00	1.00
Incremental Delay, d2					0.7			0.2			0.2	0.5
Delay (s)					21.4			16.2			4.2	4.7
Level of Service					C			B			A	A
Approach Delay (s)		0.0			21.4			16.2			4.4	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		

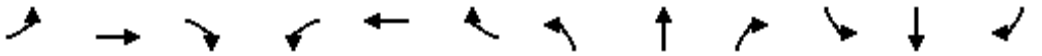
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	0	275	0	0	0	0	905	140	525	335	0
Future Volume (vph)	95	0	275	0	0	0	0	905	140	525	335	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Util. Factor	0.95	0.91	0.95					0.95	1.00	0.97	0.95	
Frt	1.00	0.86	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1452	1504					3539	1583	3433	3539	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1452	1504					3539	1583	3433	3539	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	0	299	0	0	0	0	984	152	571	364	0
RTOR Reduction (vph)	0	132	128	0	0	0	0	0	87	0	0	0
Lane Group Flow (vph)	93	25	24	0	0	0	0	984	65	571	364	0
Turn Type	Perm	NA	Perm					NA	Perm	Prot	NA	
Protected Phases		8						6		5	2	
Permitted Phases	8		8						6			
Actuated Green, G (s)	11.0	11.0	11.0					30.0	30.0	15.5	24.8	
Effective Green, g (s)	11.0	11.0	11.0					30.0	30.0	15.5	24.8	
Actuated g/C Ratio	0.16	0.16	0.16					0.43	0.43	0.22	0.35	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	264	228	236					1516	678	760	1253	
v/s Ratio Prot								c0.28		c0.17	0.10	
v/s Ratio Perm	c0.06	0.02	0.02						0.04			
v/c Ratio	0.35	0.11	0.10					0.65	0.10	0.75	0.29	
Uniform Delay, d1	26.3	25.3	25.3					15.8	11.9	25.5	16.3	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.12	0.99	
Incremental Delay, d2	0.8	0.2	0.2					2.2	0.3	4.0	0.6	
Delay (s)	27.1	25.5	25.5					18.0	12.2	32.6	16.7	
Level of Service	C	C	C					B	B	C	B	
Approach Delay (s)		25.9			0.0			17.2			26.4	
Approach LOS		C			A			B			C	

Intersection Summary			
HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	65	0	635	515	490	0	0	790	160
Future Volume (vph)	0	0	0	65	0	635	515	490	0	0	790	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Lane Util. Factor				0.91	0.86	0.91	1.00	0.95			0.86	1.00
Frt				1.00	0.85	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)				1610	2730	1441	1770	3539			6408	1583
Flt Permitted				0.95	1.00	1.00	0.23	1.00			1.00	1.00
Satd. Flow (perm)				1610	2730	1441	422	3539			6408	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	71	0	690	560	533	0	0	859	174
RTOR Reduction (vph)	0	0	0	0	291	291	0	0	0	0	0	112
Lane Group Flow (vph)	0	0	0	64	61	54	560	533	0	0	859	62
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					4		1	6			2	
Permitted Phases				4		4	6					2
Actuated Green, G (s)				11.0	11.0	11.0	50.0	30.0			24.8	24.8
Effective Green, g (s)				11.0	11.0	11.0	50.0	30.0			24.8	24.8
Actuated g/C Ratio				0.16	0.16	0.16	0.71	0.43			0.35	0.35
Clearance Time (s)				4.5	4.5	4.5	4.5	4.5			4.5	4.5
Vehicle Extension (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				253	429	226	700	1516			2270	560
v/s Ratio Prot							c0.24	0.15			0.13	
v/s Ratio Perm				c0.04	0.02	0.04	c0.33					0.04
v/c Ratio				0.25	0.14	0.24	0.80	0.35			0.38	0.11
Uniform Delay, d1				25.9	25.4	25.8	10.0	13.5			16.9	15.2
Progression Factor				1.00	1.00	1.00	2.77	1.01			1.00	1.00
Incremental Delay, d2				0.5	0.2	0.6	5.3	0.5			0.5	0.4
Delay (s)				26.4	25.6	26.4	33.1	14.1			17.3	15.6
Level of Service				C	C	C	C	B			B	B
Approach Delay (s)		0.0			26.0			23.8			17.0	
Approach LOS		A			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group