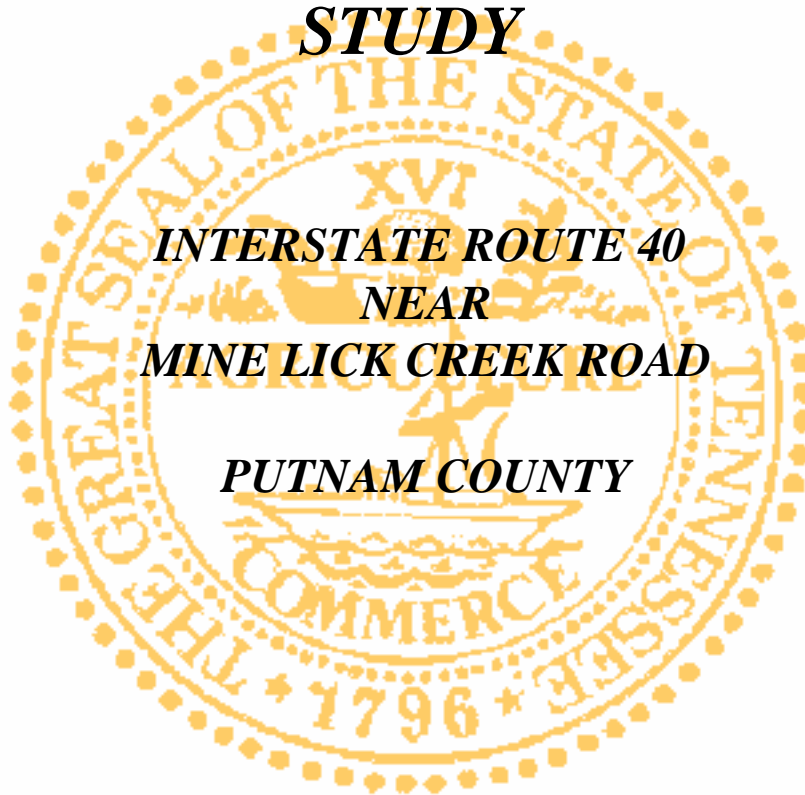


INTERCHANGE JUSTIFICATION STUDY



***INTERSTATE ROUTE 40
NEAR
MINE LICK CREEK ROAD
PUTNAM COUNTY***

***PREPARED BY
NEEL-SCHAFFER, INC.***

***FOR
THE TENNESSEE DEPARTMENT OF
TRANSPORTATION***

AUGUST 2000

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CHAPTER 1

INTRODUCTION

A. Purpose of Study

The purpose of this study is to determine the feasibility of providing access to Interstate 40 at Mine Lick Creek Road just west of the City of Cookeville in Putnam County (see Figure 1).

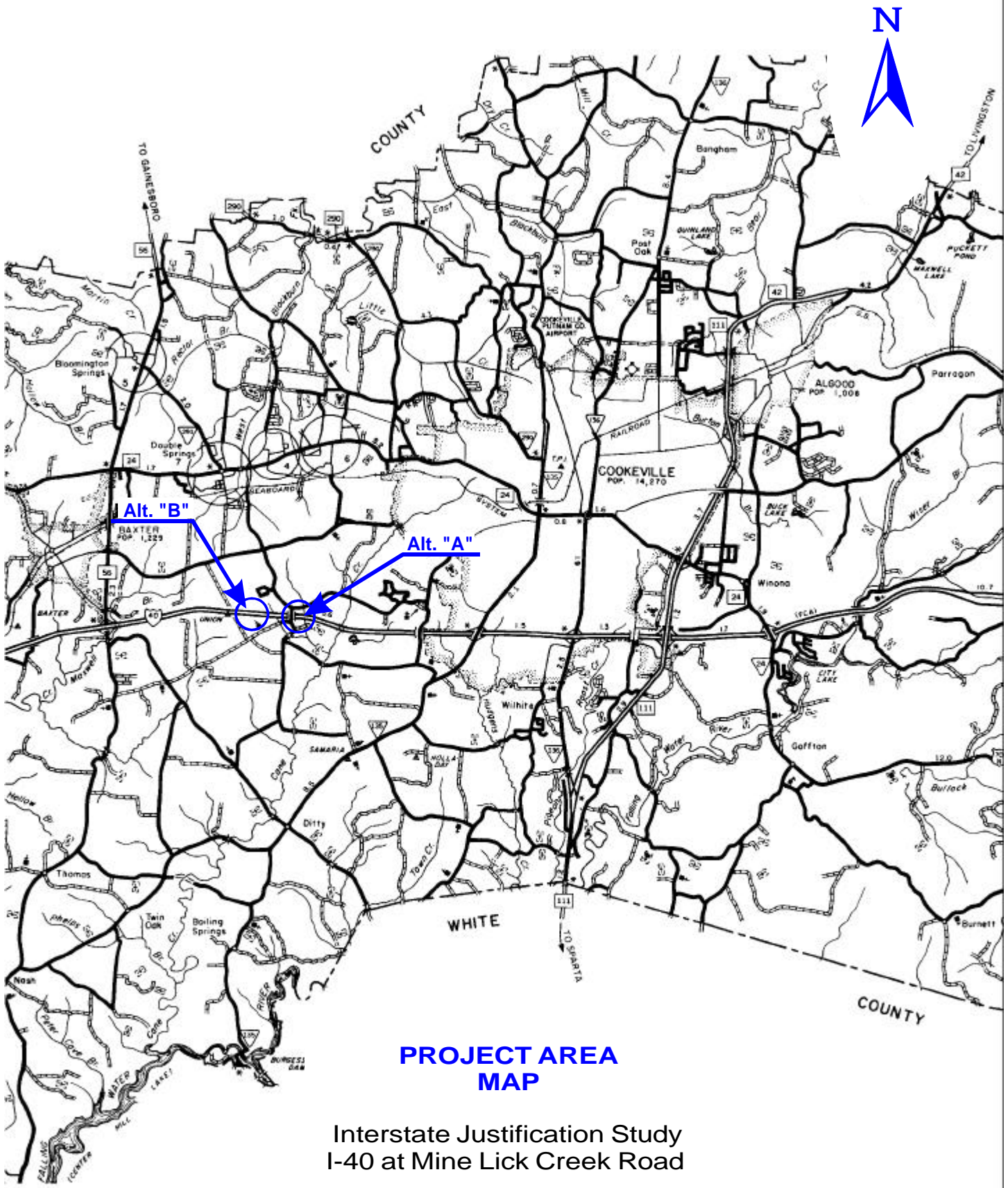
This report will consider current and future needs of the area, and analyze traffic operational features for access points at this location. Estimated costs for the proposed interchange will be prepared, functional plans will be developed and preliminary environmental concerns for the proposed project will be identified.

Preparation of a justification study for this proposed new access to Interstate 40 was initiated at the request of Mayor Charles T. Womack, City of Cookeville.

B. Description of Project Location

Two alternate locations have been investigated for this proposed interchange site (See Figure 2). Alternate "A" is located at the existing Mine Lick Creek Road separation and is approximately 2.80 miles east of the State Route 56 (Baxter Road) interchange and 2.82 miles west of the State Route 135 (Burgess Falls Road) interchange. Alternate "B" is located approximately 0.57 miles west of existing Mine Lick Creek Road. This site will be approximately 2.23 miles east of the SR-56 interchange and 3.39 miles west of the State Route 135 interchange.

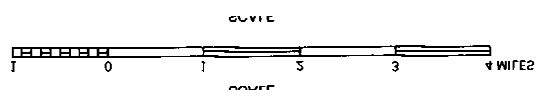
Interstate 40 consists of a four-lane, controlled access facility with a depressed median through the proposed interchange area. Mine Lick Creek Road is a two-lane non-access controlled facility on the County's Local Road System. The existing route has a 20' surface width within the proposed interchange area, 5' shoulders and approximately 80' of right-of-way.

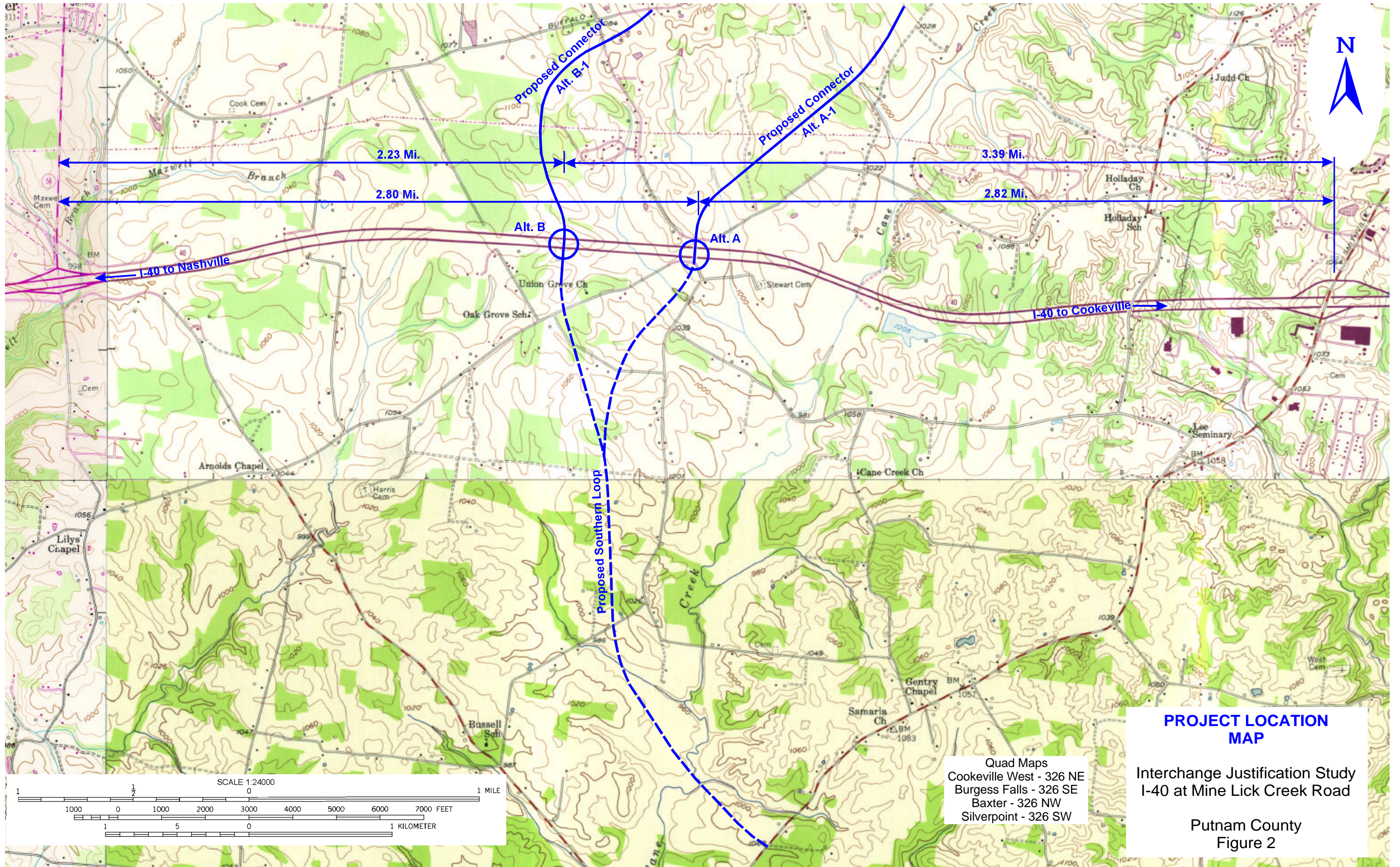


**PROJECT AREA
MAP**

Interstate Justification Study
I-40 at Mine Lick Creek Road

Putnam County
Figure 1





PROJECT LOCATION MAP

Interchange Justification Study
I-40 at Mine Lick Creek Road

Quad Maps
Cookeville West - 326 NE
Burgess Falls - 326 SE
Baxter - 326 NW
Silverpoint - 326 SW

Putnam County
Figure 2

C. Relationship to Other Transportation Improvement Plans & Classifications

Planning is currently underway for the location and construction of a segment of Appalachian Corridor “J” north of Cookeville, which would extend from existing State Route 111 (APD “J”) to State Route 56. Also proposed as part of the Cookeville Transportation Plan is a “Northern Loop” extending from Interstate 40 near the proposed Mine Lick Creek Road Interchange. This route would ultimately provide access to the Appalachia Route north of Cookeville. Other future roadway improvement plans within the Cookeville area call for the construction of a proposed “Southern Loop” that would be located in White and Putnam Counties. This southern proposal would connect State Route 111, south, to Interstate 40 at the proposed Mine Lick Road Interchange and would serve several purposes including providing access from the Putnam County – White County Regional Airport to Interstate 40, west. All of these future improvements are included in the Cookeville Area’s Long Range Transportation Plan.

Interstate 40 is classified as a Rural Interstate on the National Highway System. Mine Lick Creek Road is classified as a Local Road on the Putnam County Road System. However, the proposed inter-connector north of I-40 and the proposed “Southern Loop” south of I-40, when constructed, will connect with the proposed interchange at I-40 and Mine Lick Creek Road, and will be classified as arterial routes serving the Cookeville area.

Within the proposed interchange area, Interstate 40 is a high-speed, fully access controlled highway facility in a rural setting. Both the proposed northern “Inter-connector” and the “Southern Loop” are proposed as rural multi-lane partially access controlled roadways. For these reasons, bicycle and pedestrian facilities are not being considered as a part of the proposed project development.

A site for a Park-and-Ride lot is not being considered as a part of the proposed interchange project. However, the feasibility of park-and-ride facilities should be included in planning studies for both the north and south connectors serving this proposed interchange, and if determined feasible, site locations should be investigated at that time.

CHAPTER 2

PRELIMINARY PLANNING DATA

A. Land Use

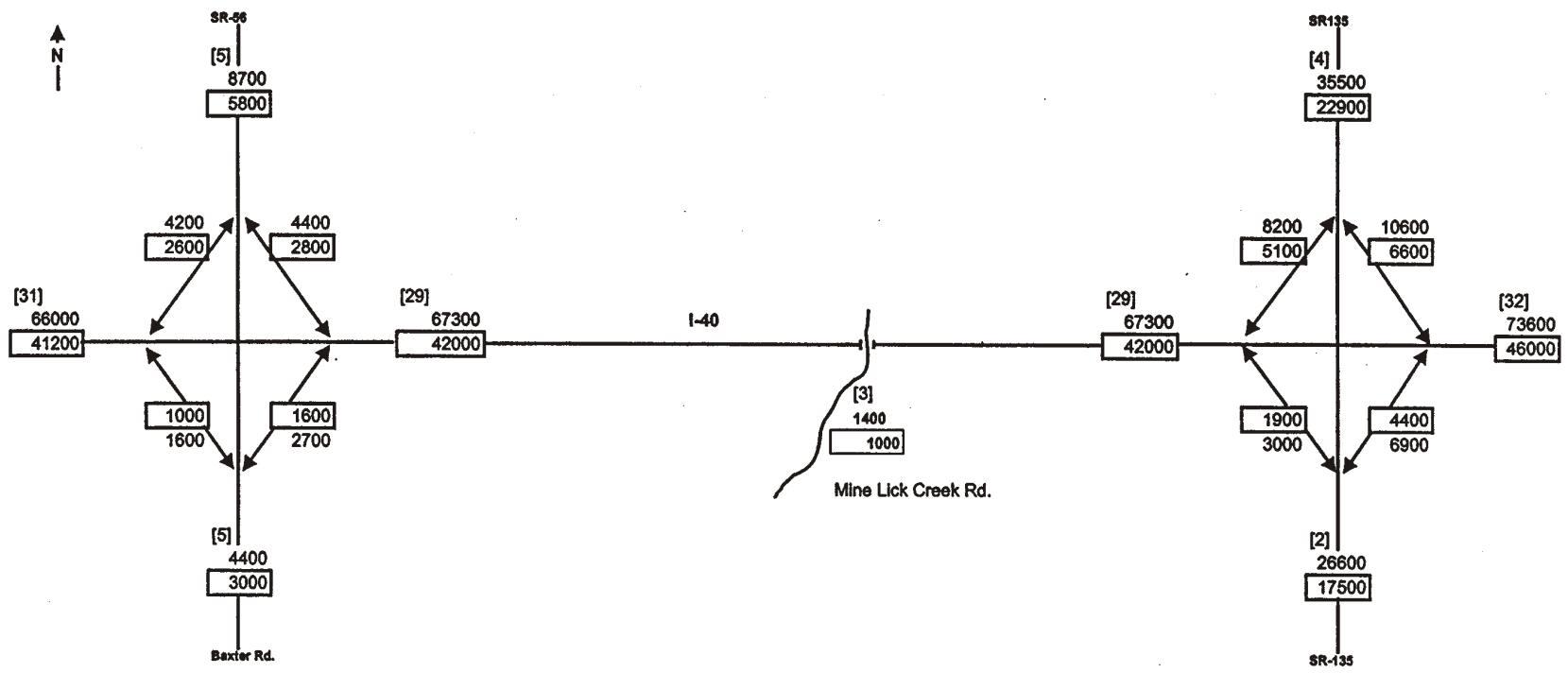
The proposed interchange is located west of the Cookeville City Limits in Putnam County. Land use in the immediate vicinity of both proposed interchange locations is primarily rural with open agricultural (pastureland) and scattered residential development. Heavier residential development occurs to the north and east of the proposed sites. Two unnamed streams cross Interstate 40 in the immediate area of the existing Mine Lick Creek Road separation structures. One is located approximately 750' west of Mine Lick Creek Road, while the other is located approximately 400' east of this road. Both of these streams utilize box culverts in crossing I-40. Cane Creek also crosses I-40 approximately 0.74 miles east of Mine Lick Creek Road. Parallel structures, each having a length of 96', span this stream and an adjacent county road.

B. Traffic Served

The Tennessee Department of Transportation (TDOT) furnished traffic data for this study effort. Traffic provided for the existing system shows 2004 ADT volumes of 42,000 on Interstate 40 between the SR-56 (Baxter Road) Interchange and the SR-135 (Burgess Falls Road) Interchange. Design year (2024) volumes on this section are expected to reach 67,300 vehicles per day. Traffic on existing Mine Lick Creek Road shows a daily volume of 1,000 vehicles in the base year (2004) and 1,400 by the 2024 design year. These volumes are shown in Figure 3.

With the proposed interchange in place and the proposed Appalachian Route along with the connectors north and south of I-40 considered as a part of the system, 2004 traffic volumes on Interstate 40 are expected to be 41,700 west of, and 43,000 east of the proposed interchange site. Traffic volumes on Mine Lick Creek Road ("Southern Loop") south of I-40 will increase to 6,300 by 2004 and 9,600 by the year 2024. Traffic on Mine Lick Creek Road (proposed Interconnector) to the north is expected to be 8,600 in 2004 and 12,900 by the 2024 design year (see Figure 4).

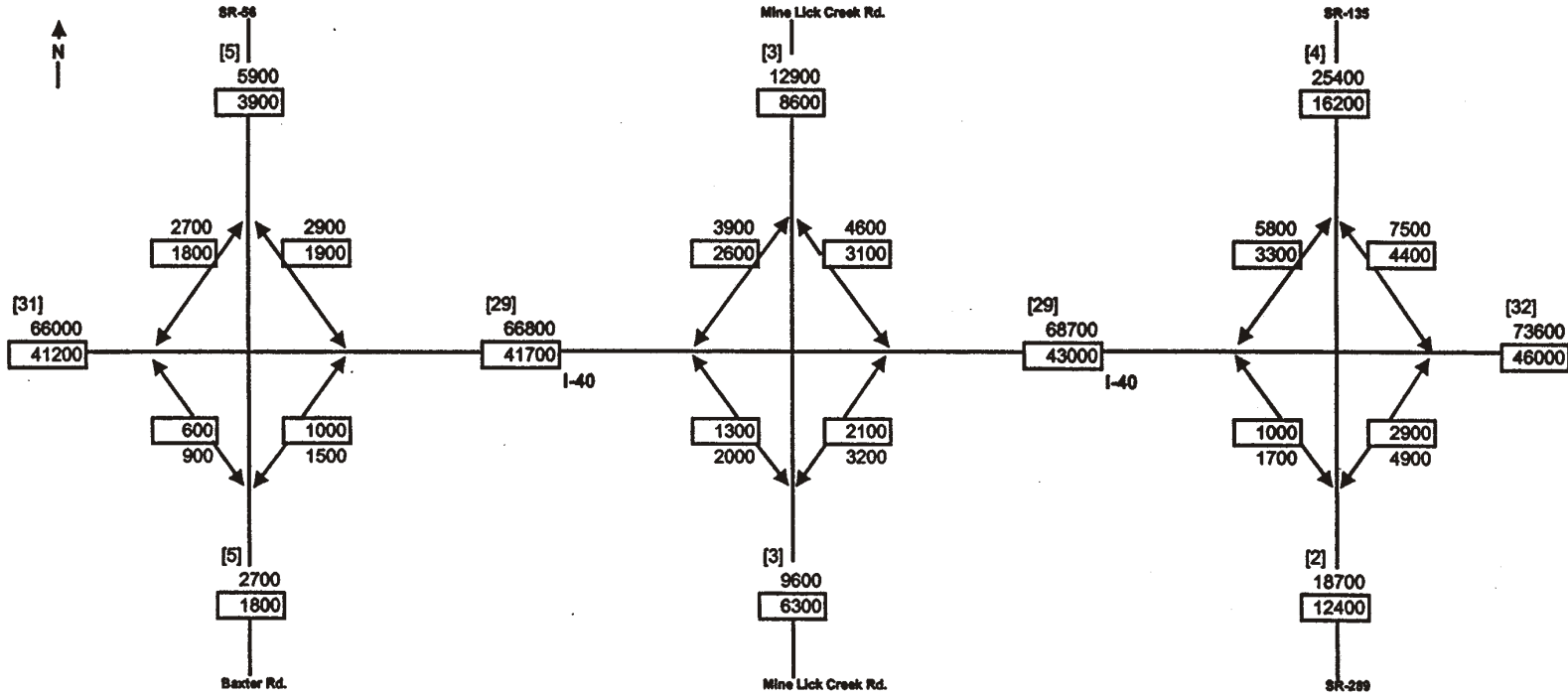
Present and projected ADT volumes, along with Design Hour Volumes (DHV) are also shown in the Appendix.



**ADT
EXISTING SYSTEM**
County Putnam
City Cookeville
Date 3/31/00

LEGEND 000- 2004
000- 2024
[0] Truck %
Initials MK

Figure 3



ADT
**PROPOSED SYSTEM
 WITH "J" CORRIDOR**
 County Putnam
 City Cookeville
 Date 3/31/00

Legend [000-] 2004
 [000-] 2024
 [0]- Truck %
 Initials MK

Figure 4

C. Proposed Improvement

Based on the analysis conducted for this project, it is proposed that a modified cloverleaf type interchange be constructed at the Mine Lick Creek Road location. An I-40 eastbound to Mine Lick Creek Road northbound loop ramp would be located in the southeast quadrant of the interchange. This proposal would eliminate left turns associated with these movements and improve the overall operation of the interchange. It is also proposed that additional right-of-way be acquired in order to provide additional loop ramps as needed in the future. This ramp configuration is applicable to both alternatives.

In investigating Alternate “A”, the existing Mine Lick Creek Road bridge over I-40 is to be replaced with a new structure just east of the current facility. Local roads north and south of I-40 will require extensive relocation to accommodate the new interchange ramps. Also, access will be provided within the proposed right-of-way to a cemetery otherwise unaffected by this alternative. One residence located in the northwest quadrant and one residence located in the southwest quadrant will be acquired with implementation of the proposed interchange.

Alternate “B” is proposed to be constructed on new location approximately 0.57 miles west of the existing Mine Lick Creek Road bridge. In constructing this proposal, one residence and one small outbuilding would be removed. No existing roads would require relocation.

Access control is proposed to be extended for a distance of 300’ from the ramp terminals in both the north and south direction. As a part of the analysis undertaken, it was assumed that a new connector road north to the proposed Appalachian Route “J” would become a reality prior to or concurrent with the interchange construction. It should also be noted that future completion of a proposed “southern loop” from I-40 south to SR-111 would be required prior to reaching projected design year traffic volumes.

As stated above, after an evaluation of the proposed interchange site, which included a field review and meetings with TDOT’s Planning and Design offices and FHWA Division Office personnel, it was agreed that a modified cloverleaf type interchange would provide the required level of traffic service and should be recommended for this location.

Specific recommendations for the proposed modified cloverleaf interchange scheme are discussed below and are shown on the attached functional plans.

1. Parallel interchange structures will be constructed across I-40 for either alternative. These new structures will each have sufficient width for 2 @ 12’ traffic lanes and 12’ shoulders.
2. The I-40 westbound off-ramp will have a single left-turn lane onto the proposed connector. This connector will have single left turn lanes for the northbound to westbound and the southbound to eastbound movements.

3. The relocation of adjacent local roads is proposed so that access control along the connector can be extended a minimum of 300' beyond ramp terminals (Alternate "A" only).
4. Initially, the connector route is proposed to be extended approximately 800' south of the eastbound ramp terminals in order to provide local access at existing Mine Lick Creek Road. Future construction of the "southern loop" connector would utilize this segment in connecting to the interchange (Alternate "B" only).
5. Signals will be required on the proposed connector at the westbound ramp terminal intersections north of the interstate.
6. Due to the distance between the proposed and existing interchanges, no auxiliary lanes along I-40 are proposed. Capacity analyses were performed for the proposed ramps without these lanes and no operational deficiencies have been noted.

CHAPTER 3

ENGINEERING INVESTIGATIONS

A. Traffic Operations

An analysis was conducted to determine what impacts the proposed interchange would have on the interstate system. The traffic operation analyses contained in the appendix include basic freeway segments, ramps, and ramp intersections with the proposed connector routes. These analyses are applicable for both Alternate “A” and Alternate “B”.

Without the proposed interchange, the analysis shows the existing interstate highway between the SR-135 (Burgess Falls Road) interchange and the SR-56 (Baxter Road) interchange operating at a Level of Service (LOS) “C” in the westbound lanes during the AM and PM Peaks with base year (2004) traffic. The eastbound lanes, through this same area, are also operating at a LOS “C” during both peak periods. Using projected design year (2024) traffic, these eastbound and westbound lanes are expected to operate at a LOS “D” and “E” during respective AM and PM peaks.

Capacity analyses were also conducted on the effects to the proposed interchange and the immediate I-40 system with the completion of the Appalachian Corridor “J”. Under these conditions during the base year, all mainline sections in both directions will be characterized by a LOS “C”. During the design year, westbound lanes west of the proposed interchange will operate at a LOS “D” during both peak periods; eastbound lanes in this area will experience a LOS “E” during the peak hours.

East of the Mine Lick Creek Road interchange, westbound lanes are predicted to operate during 2024 at a LOS “D” during the AM Peak and a LOS “E” through the PM Peak hours with the “J” Corridor considered. Eastbound lanes east of the proposed interchange will operate at a LOS “E” throughout the peak hours of travel in 2024.

Considering the “J” Corridor, the unsignalized intersection of the eastbound I-40 ramps with Mine Lick Creek Road is expected to operate at a LOS “A” through the 2004 base year during both peaks. This intersection will experience a LOS “A” during the AM Peak and a LOS “B” during the PM Peak of the 2024 design year. The signalized westbound ramp intersection will experience a LOS “B” during the 2004 AM Peak, the 2004 PM Peak, and the 2024 AM Peak, and a LOS “C” during the 2024 PM Peak.

Under these adjusted traffic volumes, all ramps at the proposed interchange have a minimum 20-year service life. The westbound on and off-ramps will operate in the base year with a LOS “B” during both peaks and in the design year with a LOS “C” in the AM Peak and LOS “D” during the PM Peak hours. The eastbound on-ramp will operate with a LOS “C” in the AM Peak and a LOS “B” in the PM Peak of 2004 and with a LOS “D” during all peak hours in the 2024 design year. The eastbound off-ramp to south Mine Lick Creek Road will operate during the base year with a LOS “B” in the AM and “C” in the PM Peak. During this same year,

the loop ramp to north Mine Lick Creek Road will experience a LOS “B” during both peak periods. Both eastbound off-ramps will operate at a LOS “D” during all peak hours of the 2024 design year.

Traffic volumes and level of service analyses for both base year volumes (2004) and design year volumes (2024) are presented in the Appendix.

B. Cost

The total estimated cost for the modified cloverleaf interchange given as Alternate “A” is \$12,201,000.00 and is detailed on Page 15 of this report. The total estimated cost for the modified cloverleaf interchange given as Alternate “B” is \$8,717,000.00 and is detailed on Page 16 of this report. Worksheets used in developing these cost estimates are contained in the Appendix of this report.

C. Environmental Concerns

The area in the vicinity of the interchange consists of primarily residential/agricultural properties. Two residences are expected to be acquired for the construction of the proposed Alternate “A” interchange; one residence is expected to be acquired for the construction of proposed Alternate “B”. No National Register listed properties or other cultural resource areas were identified during preliminary reviews. Two small, unnamed streams will be affected by construction of either proposed alternative. Special considerations will be necessary to minimize impacts to these streams.

D. Access Analysis

This study has been undertaken in accordance with the Federal Highway Administration’s (FHWA) policy for granting new or modified interstate access. The FHWA policy, as described in FHWA Docket No. 89-23, “Additional Interchanges to the Interstate System” (Federal Register 55, No. 204, October 22, 1990), is provided in the following paragraphs along with comments for consideration.

It is in the national interest to maintain the Interstate System to provide the highest level of service in terms of safety and mobility. Adequate control of access is critical to providing such service. Therefore, new or revised access points to the existing Interstate System will be considered for approval only if:

- 1. The existing interchanges and/or local roads and streets in the corridor can neither provide the necessary access nor be improved to satisfactorily accommodate the design year traffic demands while at the same time providing the access intended by the proposal.*

The City of Cookeville is a fast growing city located adjacent to Interstate 40 in Putnam County. The City has a certified population of 22,216 and a projected 2020 population of 36,337. The State's Transportation Improvement Program proposes the construction of Appalachian Corridor "J" north of the city. Cookeville's Major Thoroughfare Plan proposes the construction of an "Inter-connector" from this Appalachia Route to Interstate 40 and a "Southern Loop" connecting SR-111, south with Interstate 40 west of the city. TDOT has previously completed a Feasibility Study for the "Inter-connector Route" north and west of Cookeville.

Implementation of these proposed roadway projects, along with the proposed new I-40 interchange, will provide improved transportation access and enhance continued development of business and industry within this area of Cookeville and Putnam County.

2. *All reasonable alternatives for design options, location and transportation system management type improvements (such as ramp metering, mass transit, and HOV facilities) have been assessed and provided for if currently justified, or provisions are included for accommodating such facilities if a future need is identified.*

As previously discussed in this study, alternate locations were investigated for the proposed interchange. These alternates were reviewed and evaluated in field investigations and meetings with representatives from TDOT's Planning and Design Divisions.

Public transit services are not currently available in the Cookeville area. However, small private transit operators provide limited commuter service from Cookeville to Nashville. HOV facilities are not warranted through this area of I-40. The feasibility of and location for possible park-and-ride sites should be investigated during development of future planning studies conducted for the proposed connector routes to serve the new interstate access point. The possibility of a rail corridor is currently being discussed that could result in future commuter train service for the Cookeville area to both Nashville and Knoxville.

3. *The proposed access point does not have a significant adverse impact on the safety and operation of the Interstate facility based on analysis of current and future traffic. The operational analysis for existing conditions shall, particularly in urbanized areas, include an analysis of sections of Interstate to and including at least the first adjacent existing or proposed interchange on either side. Crossroads and other roads and streets shall be included in the analysis to the extent necessary to assure their ability to collect and distribute traffic to and from the interchange with new or revised access points.*

An operational analysis of current and future traffic was made for sections of the interstate, all ramps, and ramp termini within the limits of the interchange area. The adjacent existing interchange (Baxter Road) west of the proposed site is 2.23± miles west and outside the influence of weaving. The adjacent interchange east of the proposed site

is Burgess falls Road which is located 3.39± miles east and is also outside the influence of weaving.

The investigations and analyses conducted for this proposed interchange assumed that the proposed connector road from I-40 north to the Appalachia Route would be implemented prior to or concurrently with the interchange construction. The proposed “Southern Loop” was also considered as a part of the system in the analyses conducted. These connector roads were also assumed to be constructed to standards that would provide an acceptable level of service for projected design year traffic volumes.

4. The proposed access connects to a public road only and will provide for all turning movements. Less than “full interchanges” for special purpose access for transit vehicles, for HOV’s or into park and ride lots may be considered on a case-by-case basis. The proposed access will be designed to meet or exceed current standards for Federal-Aid projects on the Interstate system.

The proposed interchange is a modified cloverleaf type interchange and will provide for all traffic movements. The recommended interchange design will meet or exceed all American Association of State Highway and Transportation Officials (AASHTO) criteria.

5. The proposal considers and is consistent with local and regional land use and transportation plans. Prior to final approval, all requests for new or revised access must be consistent with the metropolitan and/or statewide transportation plan, as appropriate, the applicable provisions of 23 CFR part 450 and the transportation conformity requirements of 40 CFR parts 51 and 93.

The proposed interchange is consistent with the Cookeville Long Range Transportation Plan and with Statewide Transportation Plans.

6. In areas where the potential exists for future multiple interchange additions all requests for new or revised access are supported by a comprehensive Interstate network study with recommendations that address all proposed and desired access within the context of a long term plan.

Implementation of the interchange at Mine Lick Creek Road will place five interstate interchanges within a distance of approximately 7.25 miles to serve the City of Cookeville and the adjacent area of Putnam County. This results in an average interchange spacing of 1.45± miles. No additional interchanges are either planned or proposed for the Cookeville area.

7. The request for a new or revised access generated by new or expanded development demonstrates appropriate coordination between the development and related or otherwise required transportation system improvements.

The primary objectives of the proposed interchange are to provide safe and adequate interstate access for traffic volumes projected to be generated by implementation of the proposed Appalachia Route, the “Inter-connector” and the “Southern Loop” around the north and west sides of Cookeville. Also, the proposed interchange will provide improved access to an area that is targeted for future expansion and development by the City. The interchange facility proposed in this study will meet these objectives.

8. *The request for new or revised access contains information relative to the planning requirements and the status of the environmental processing of the proposal.*

Construction of the proposed Alternate “A” interchange scheme would require the acquisition of two residences and several outbuildings associated with these properties. Acquisition of some acreage now being used for farming (pastureland) operations would also be required. Construction is not expected to impact any environmentally sensitive areas but will necessitate crossing two unnamed streams.

Construction of the proposed Alternate “B” interchange scheme would require the acquisition of one existing residence. Acquisition of some acreage now being used for farming (pastureland) operations as well as one small outbuilding would also be required. Construction of Alternate “B” would require crossing two unnamed streams but is not expected to impact any environmentally sensitive areas.

COST DATA SHEET

Project Total

PROJECT: Mine Lick Creek Road Interchange (Alt. "A")

LENGTH: 4.57 mi. CROSS-SECTION: variable

Right-of-Way

Land, Improvements and Damages (48.10± Acres).....	\$	596,000.00
Incidentals (9 Tracts).....	\$	23,000.00
Relocation Payments: (2 Residences).....	\$	26,000.00
(0 Business)		
(0 Non-Profits)		
TOTAL RIGHT-OF-WAY COST	\$	645,000.00

Utility Relocation

Reimbursable.....	\$	16,000.00
Non-Reimbursable.....	\$	385,000.00
TOTAL ADJUSTMENT COST	\$	401,000.00

Construction

Clearing and Grubbing.....	\$	114,000.00
Earthwork.....	\$	1,367,000.00
Pavement Removal.....	\$	84,000.00
Drainage (Includes Erosion Control).....	\$	1,470,000.00
Structures.....	\$	1,620,000.00
Railroad Crossing or Separation.....	\$	-
Paving.....	\$	3,036,000.00
Retaining Walls.....	\$	-
Maintenance of Traffic.....	\$	75,000.00
Topsoil.....	\$	44,000.00
Seeding.....	\$	32,000.00
Sodding.....	\$	33,000.00
Signing.....	\$	81,000.00
Lighting.....	\$	-
Signalization	\$	45,000.00
Fence.....	\$	97,000.00
Guardrail.....	\$	113,000.00
Rip Rap or Slope Protection.....	\$	-
Other Construction Items (8.5%).....	\$	698,000.00
Mobilization.....	\$	386,000.00
10% Engineering and Contingencies.....	\$	930,000.00
TOTAL CONSTRUCTION COST	\$	10,225,000.00

Preliminary Engineering (10%)..... \$ 930,000.00

TOTAL SECTION COST..... \$ **\$12,201,000.00**

COST DATA SHEET

Project Total

PROJECT: Mine Lick Creek Road Interchange (Alt. "B")

LENGTH: 3.31 mi. CROSS-SECTION: variable

Right-of-Way

Land, Improvements and Damages (50.10± Acres).....	\$	365,000.00
Incidentals (10 Tracts).....	\$	25,000.00
Relocation Payments: (0 Residences).....	\$	13,000.00
(0 Business)		
(0 Non-Profits)		
TOTAL RIGHT-OF-WAY COST	\$	403,000.00

Utility Relocation

Reimbursable.....	\$	8,000.00
Non-Reimbursable.....	\$	-
TOTAL ADJUSTMENT COST	\$	8,000.00

Construction

Clearing and Grubbing.....	\$	120,000.00
Earthwork.....	\$	1,414,000.00
Pavement Removal.....	\$	21,000.00
Drainage (Includes Erosion Control).....	\$	500,000.00
Structures.....	\$	1,452,000.00
Railroad Crossing or Separation.....	\$	-
Paving.....	\$	2,123,000.00
Retaining Walls.....	\$	-
Maintenance of Traffic.....	\$	65,000.00
Topsoil.....	\$	41,000.00
Seeding.....	\$	29,000.00
Sodding.....	\$	31,000.00
Signing.....	\$	78,000.00
Lighting.....	\$	-
Signalization	\$	45,000.00
Fence.....	\$	100,000.00
Guardrail.....	\$	89,000.00
Rip Rap or Slope Protection.....	\$	
Other Construction Items (8.5%).....	\$	519,000.00
Mobilization.....	\$	295,000.00
10% Engineering and Contingencies.....	\$	692,000.00
TOTAL CONSTRUCTION COST	\$	7,614,000.00

Preliminary Engineering (10%)..... \$ 692,000.00

TOTAL SECTION COST..... \$ **\$8,717,000.00**

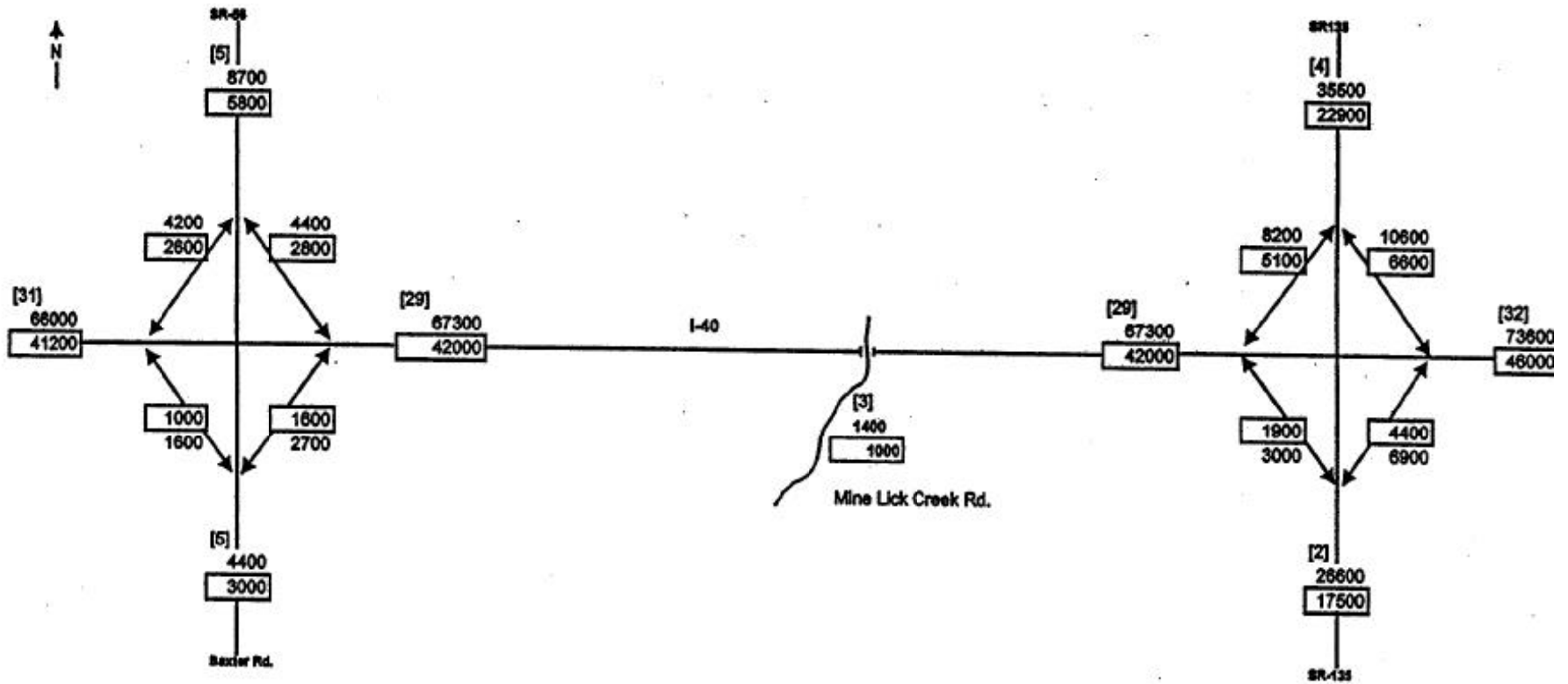
CHAPTER 4

SUMMARY AND CONCLUSIONS

The preceding study was conducted to evaluate current and future traffic operations on Interstate 40 within the proposed interchange area and determine the effects of additional interstate access at this location. The analysis indicates that the proposed modified cloverleaf interchange at either recommended location is in conformity with transportation plans of the area and will meet established objectives of the study.

Appendix

Traffic Projections

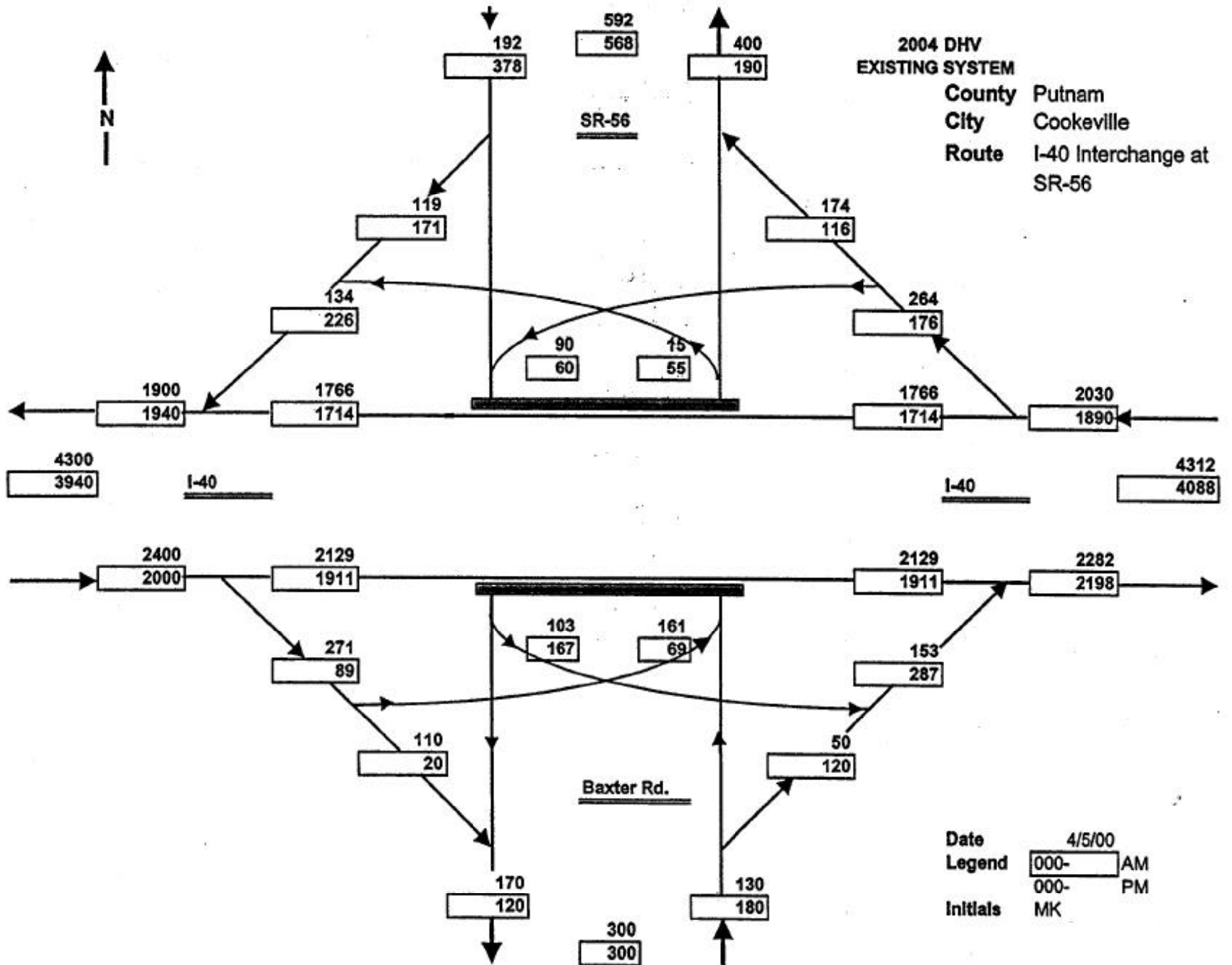


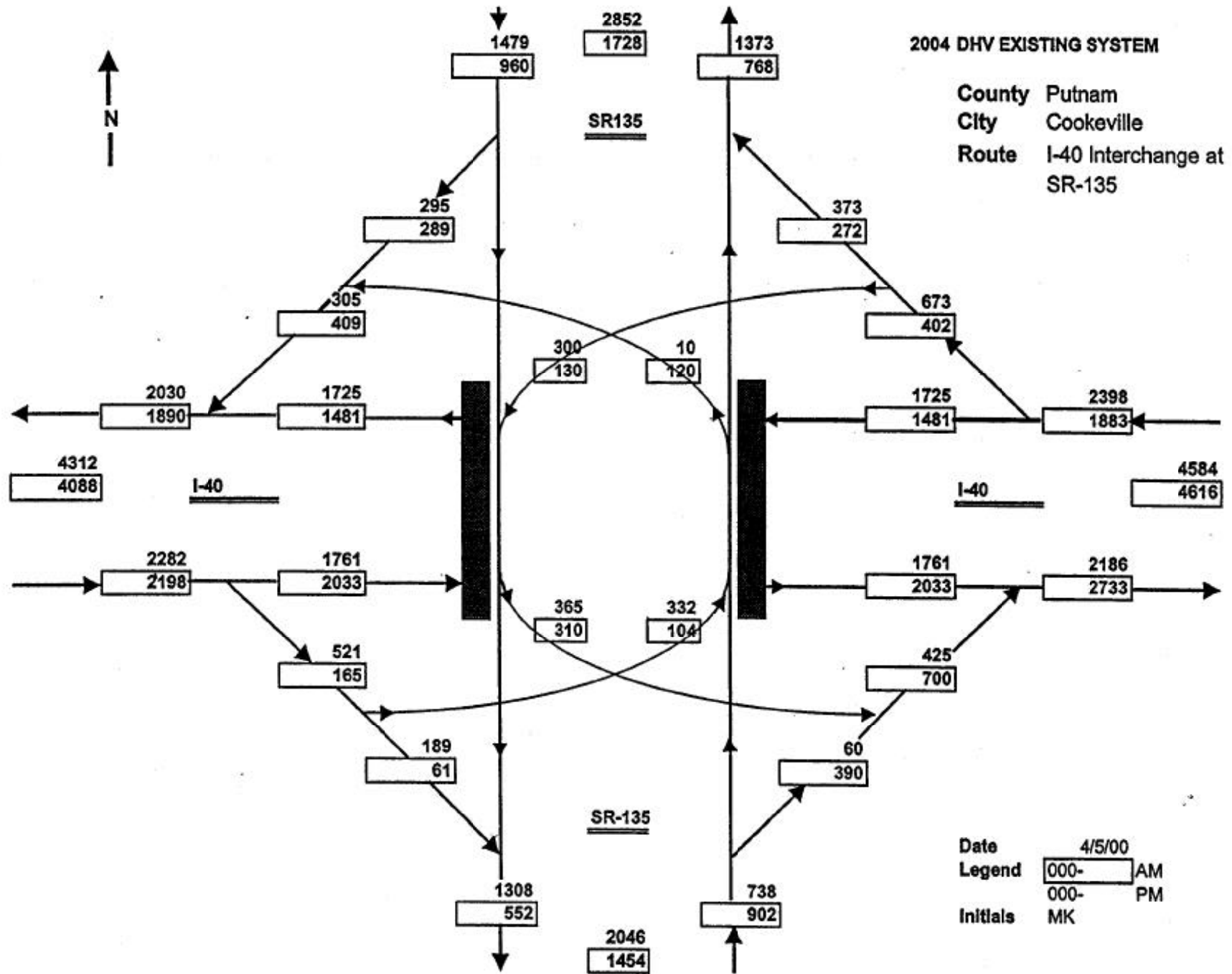
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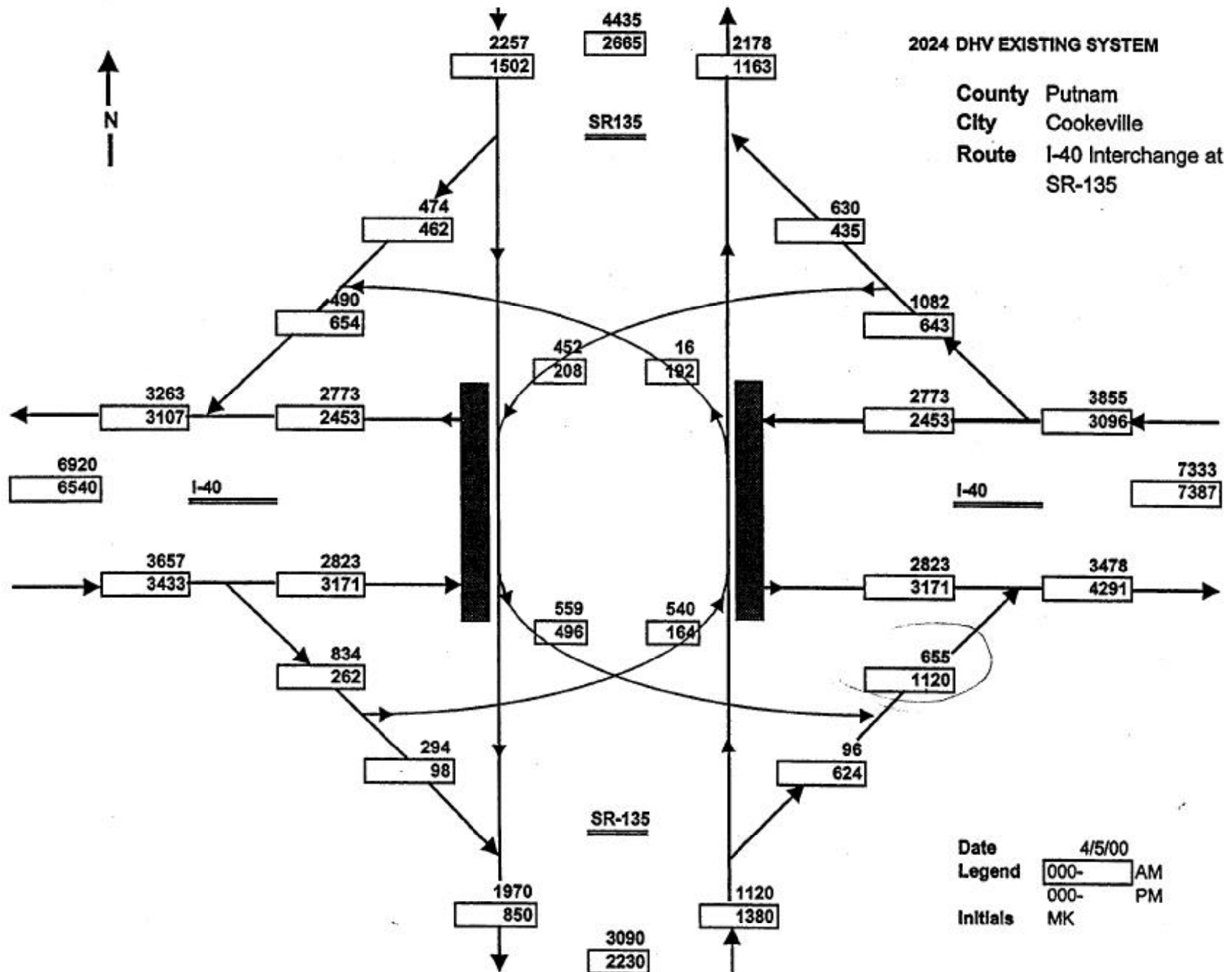
County Putnam
City Cookeville

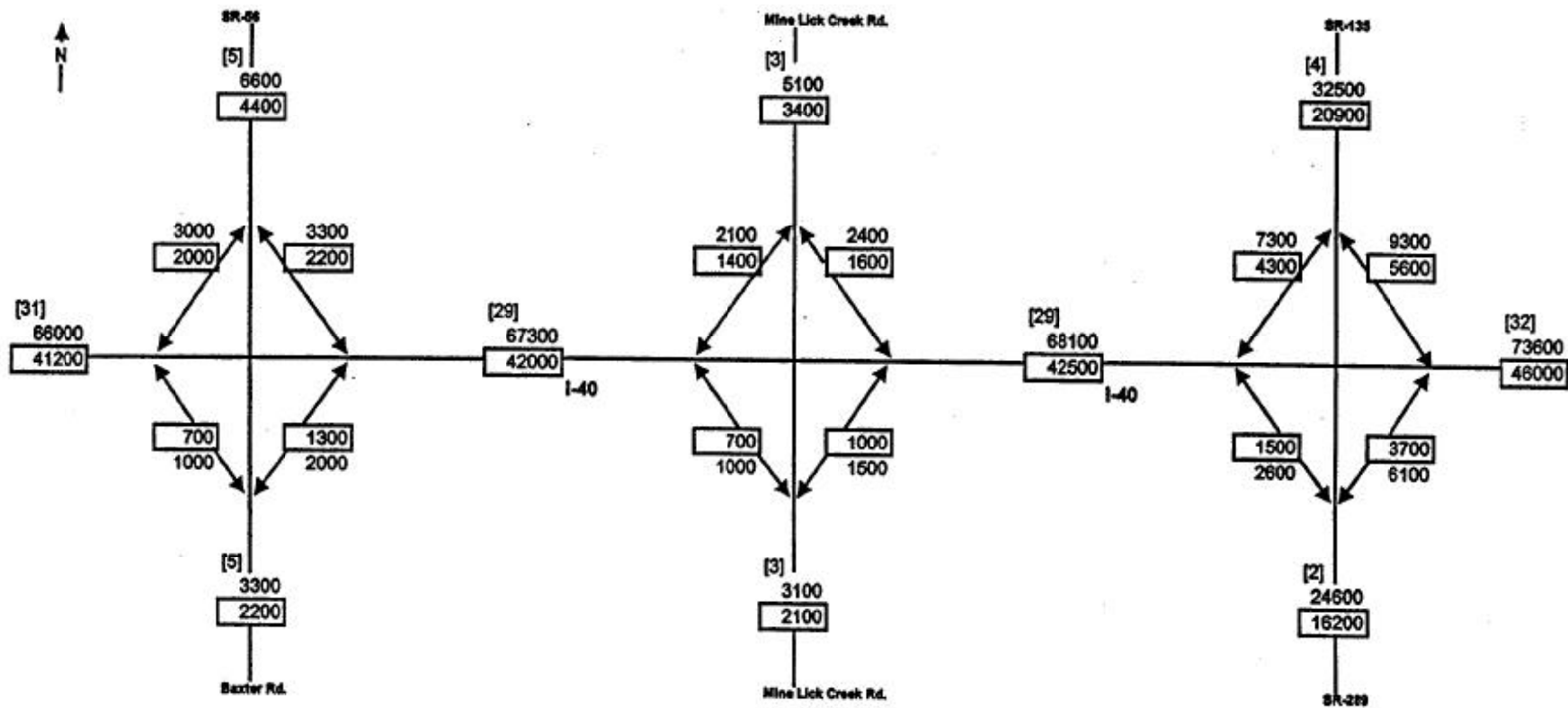
Date 3/31/00

LEGEND 000- 2004
000- 2024
 [0] Truck %
 Initials MK





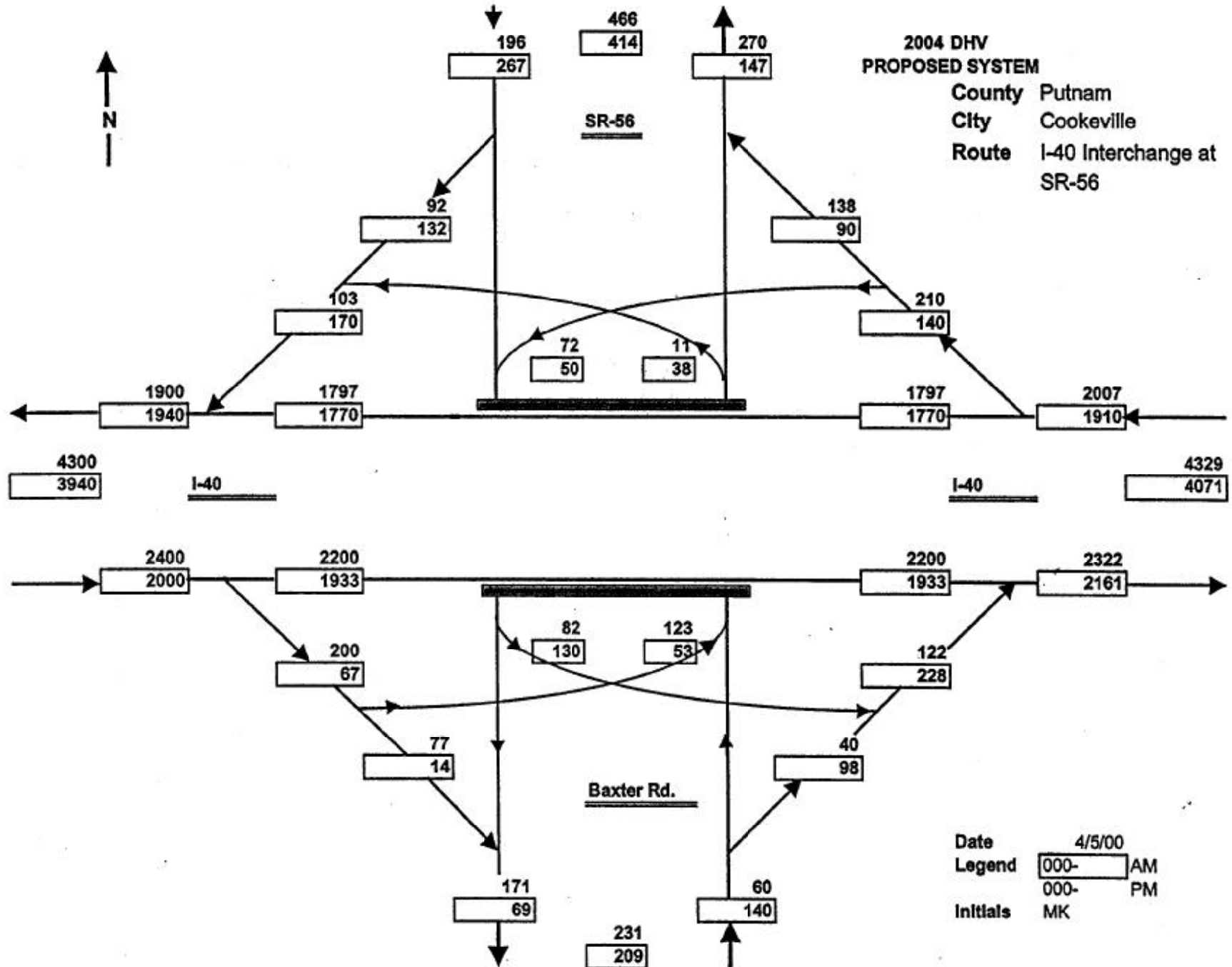


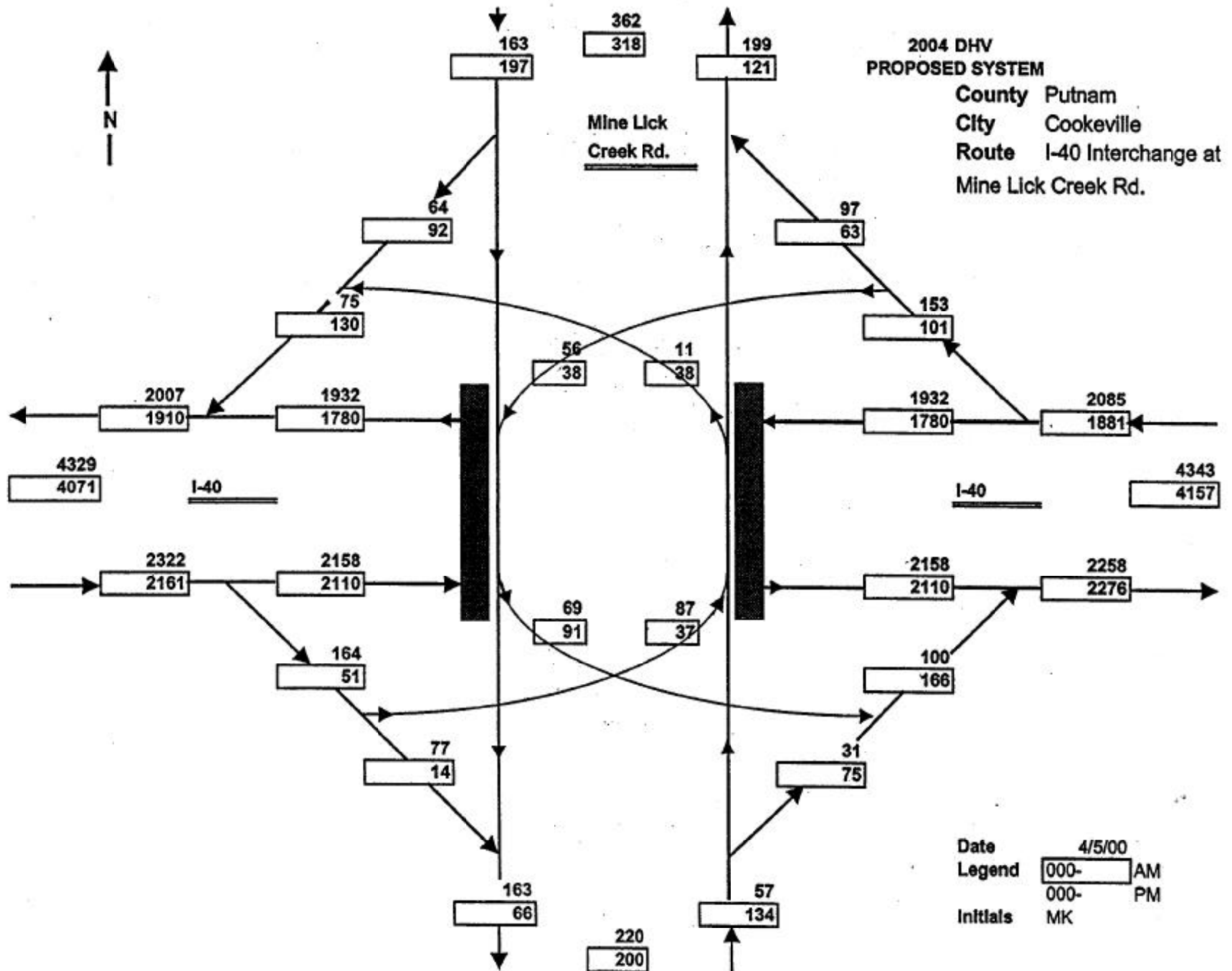


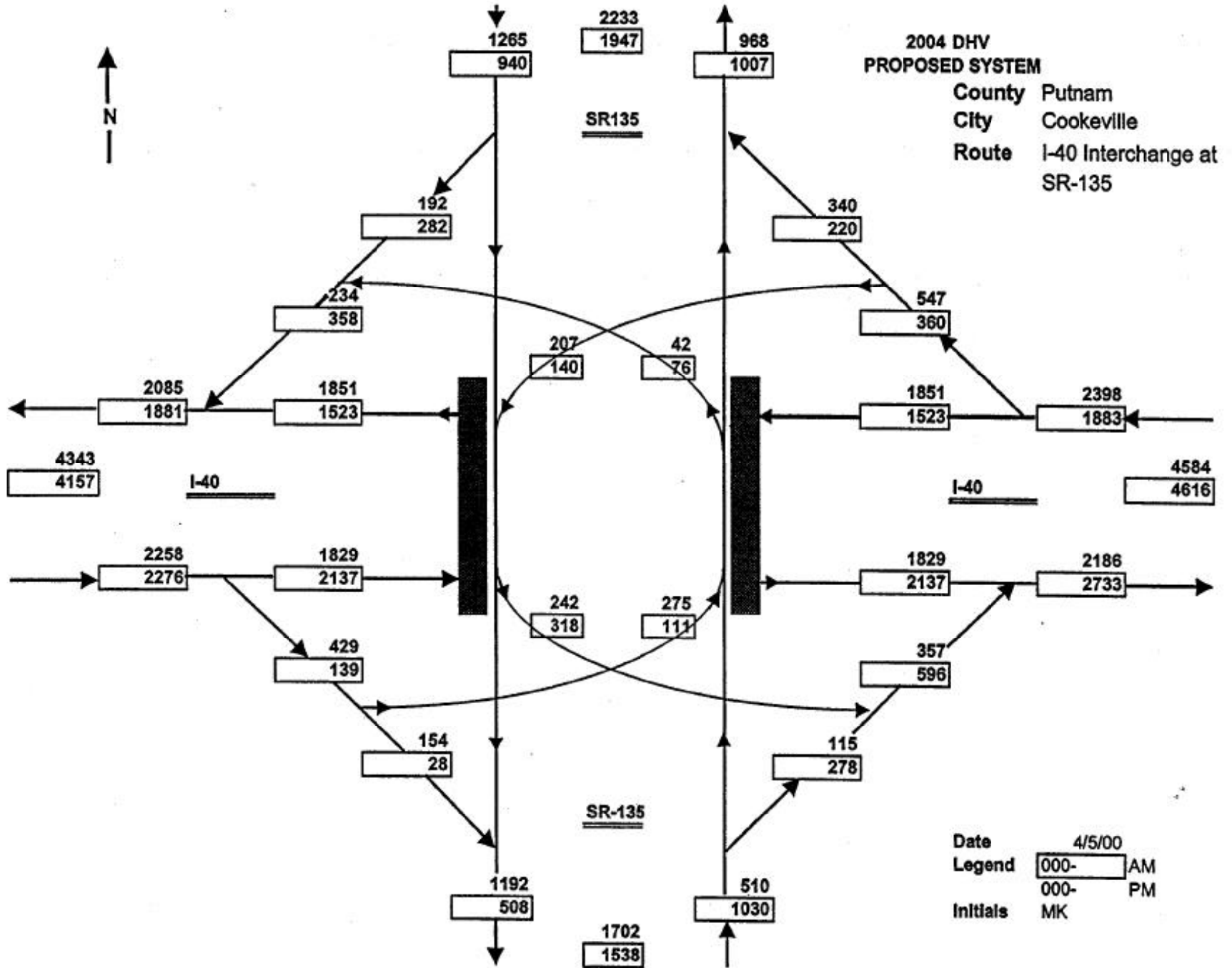
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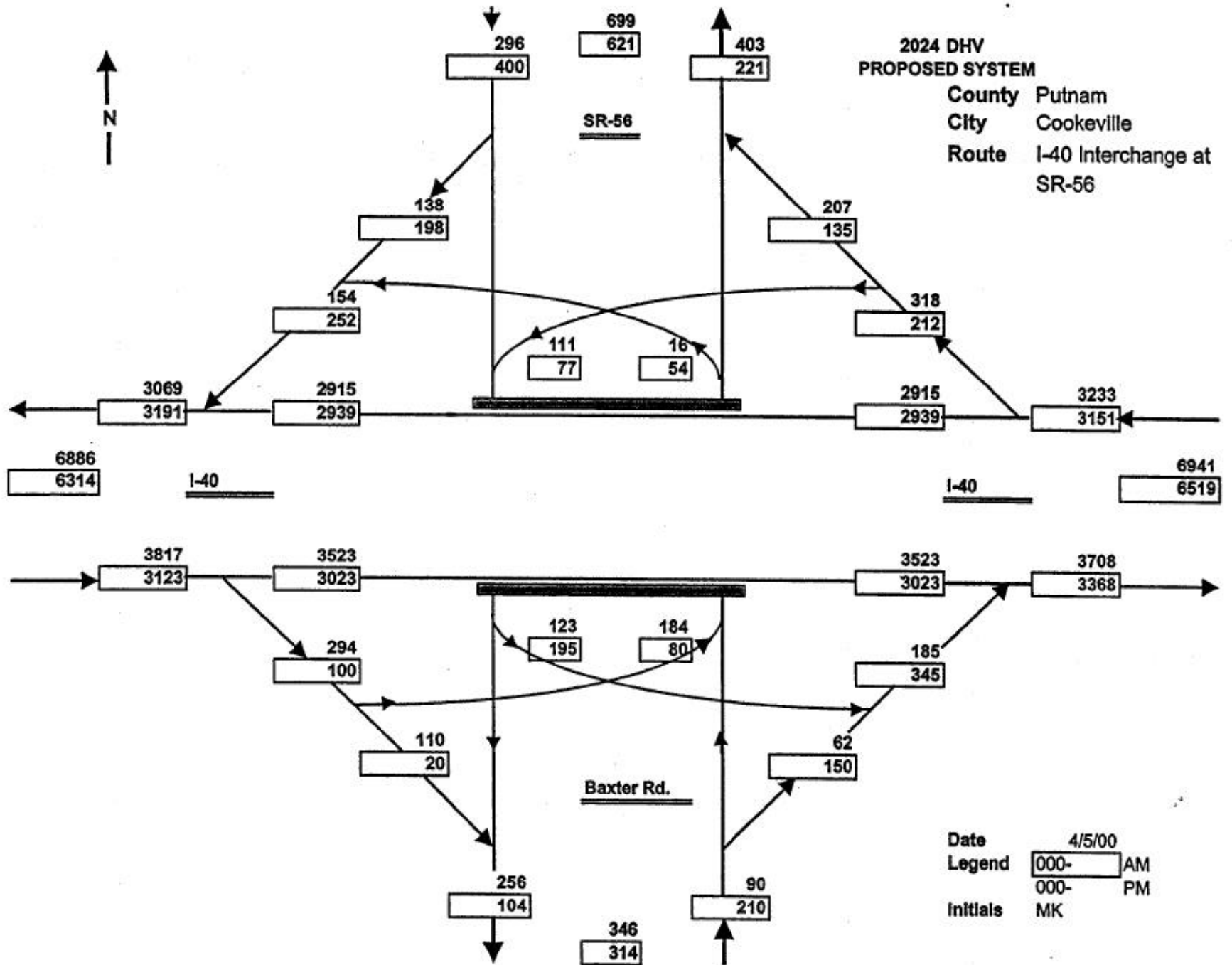
County Putnam
City Cookeville
Date 3/31/00

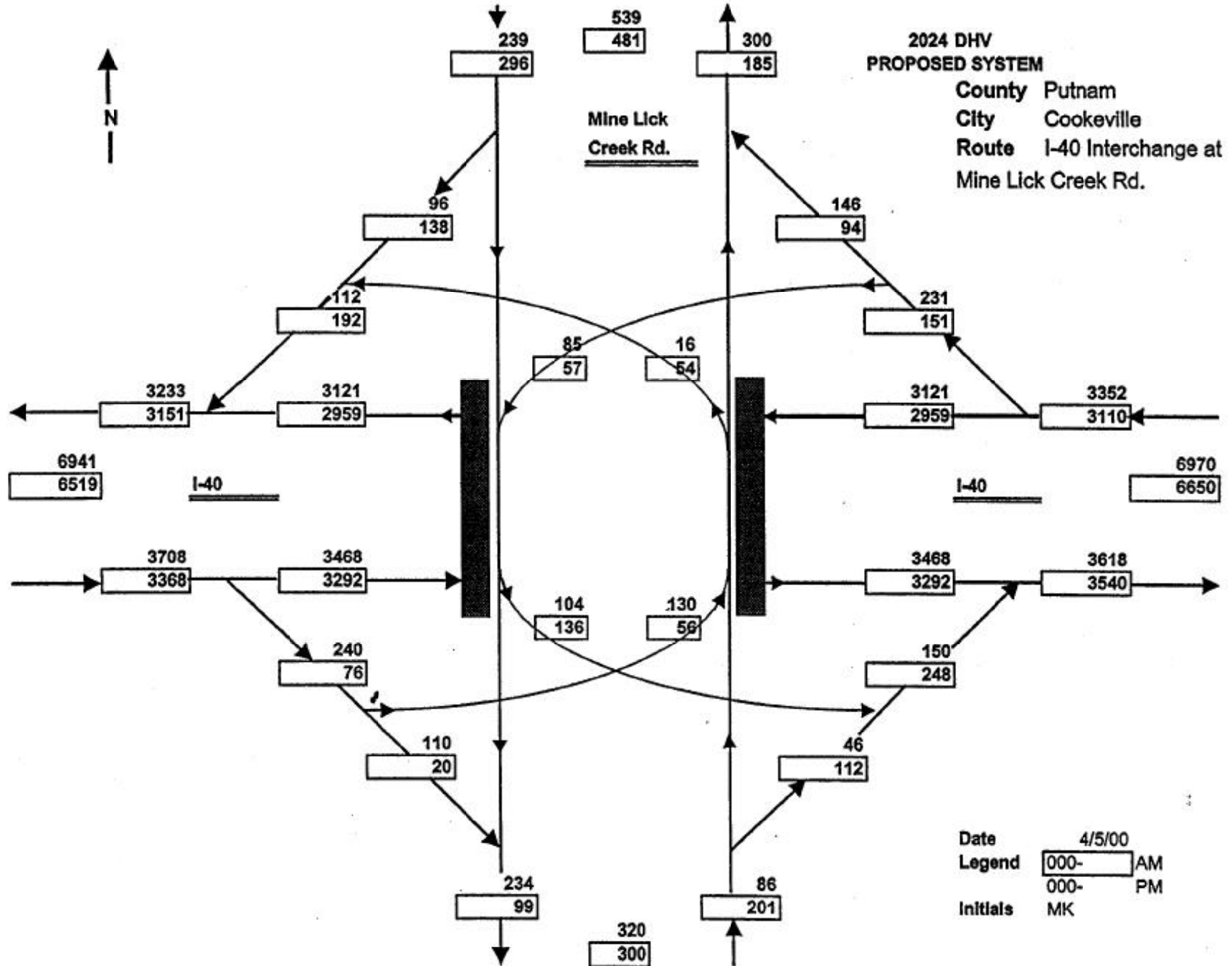
Legend 000- 2004
000- 2024
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Initials MK

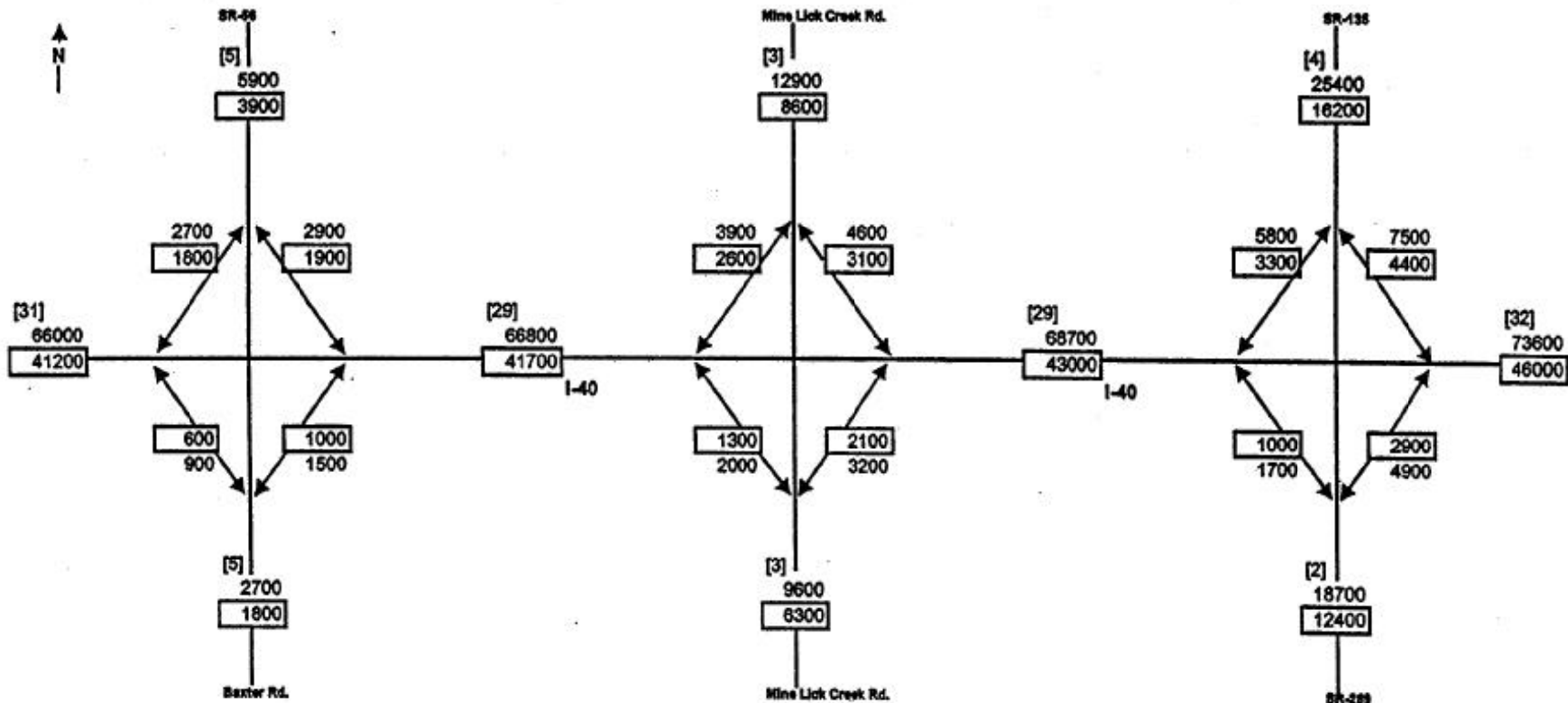






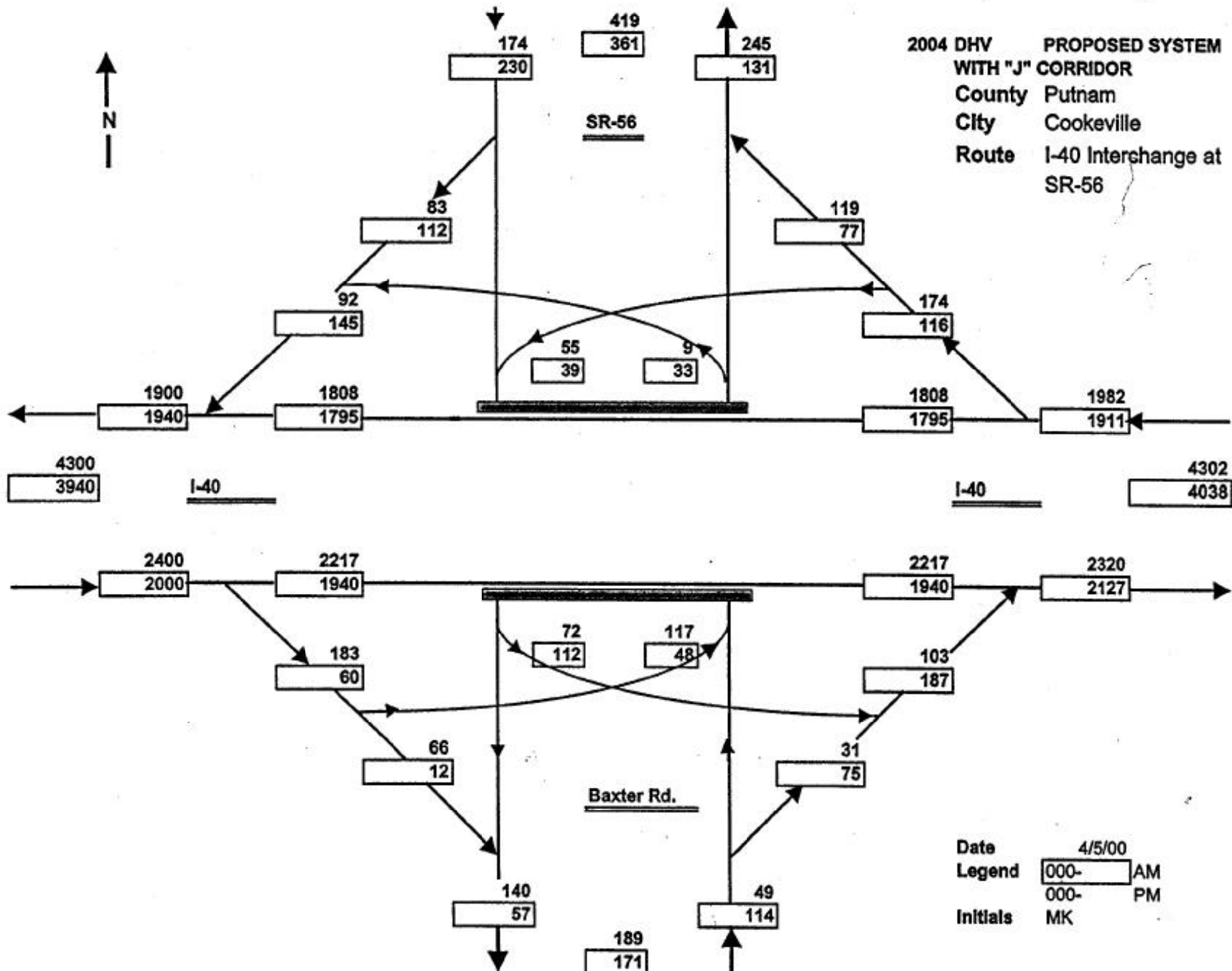


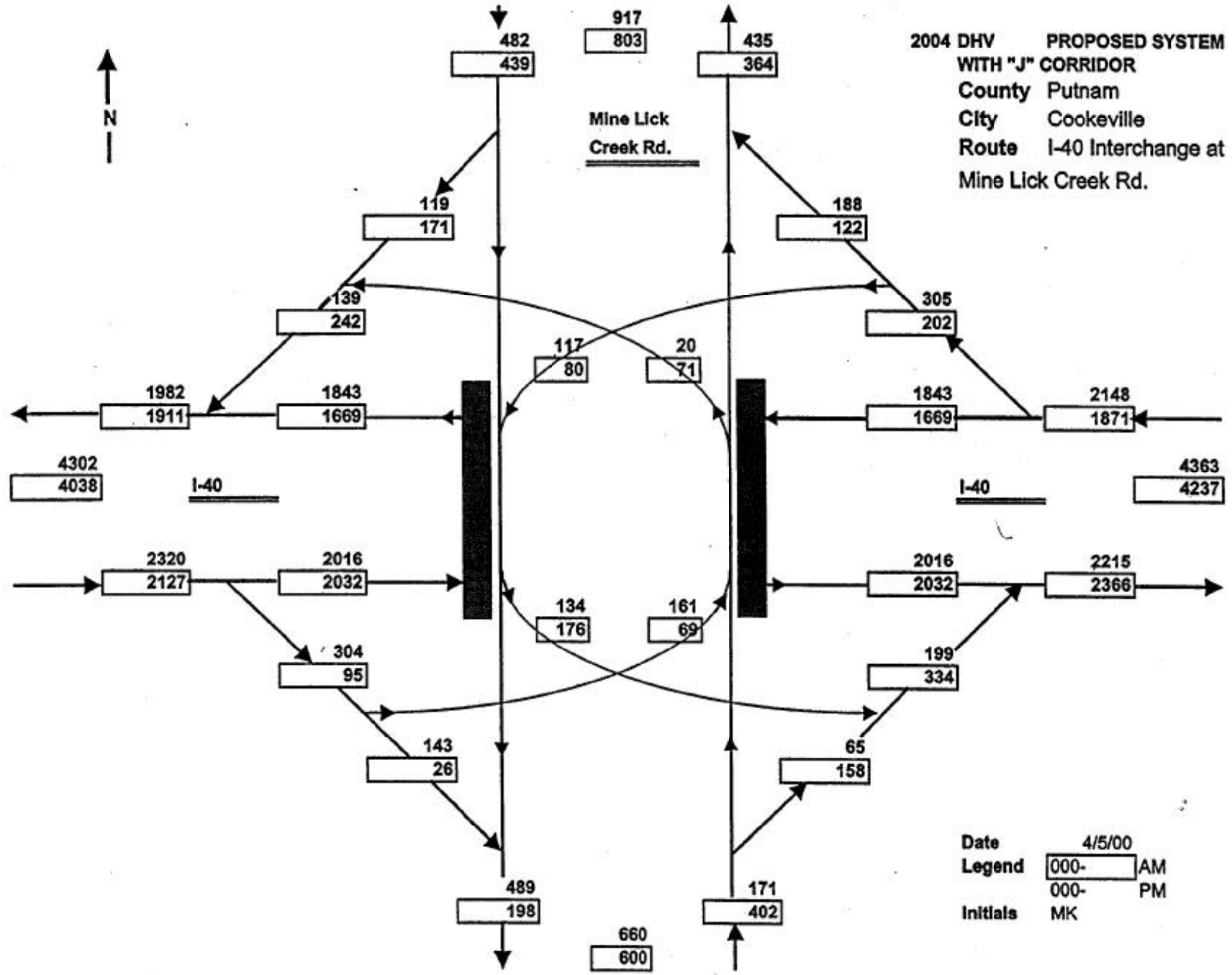


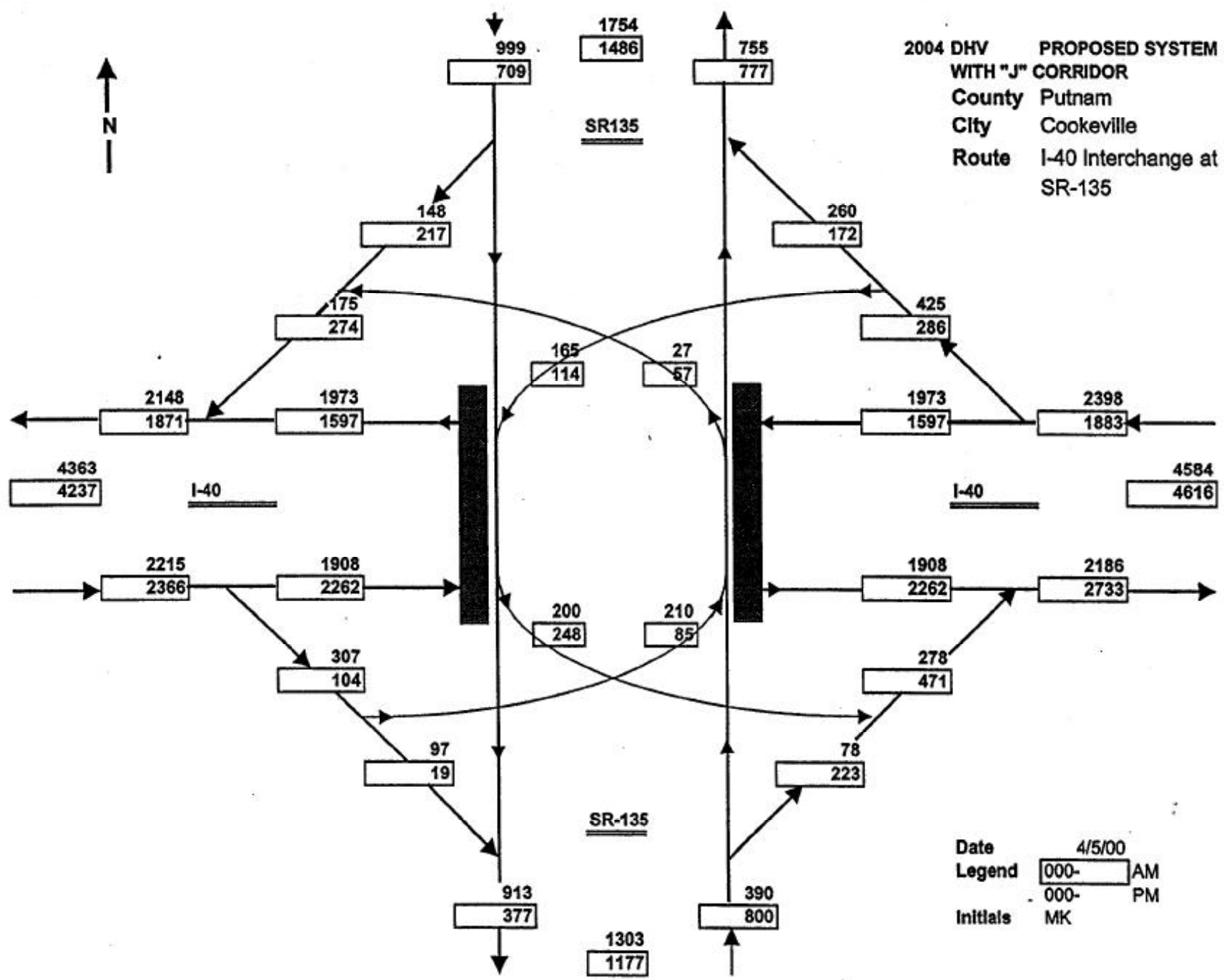


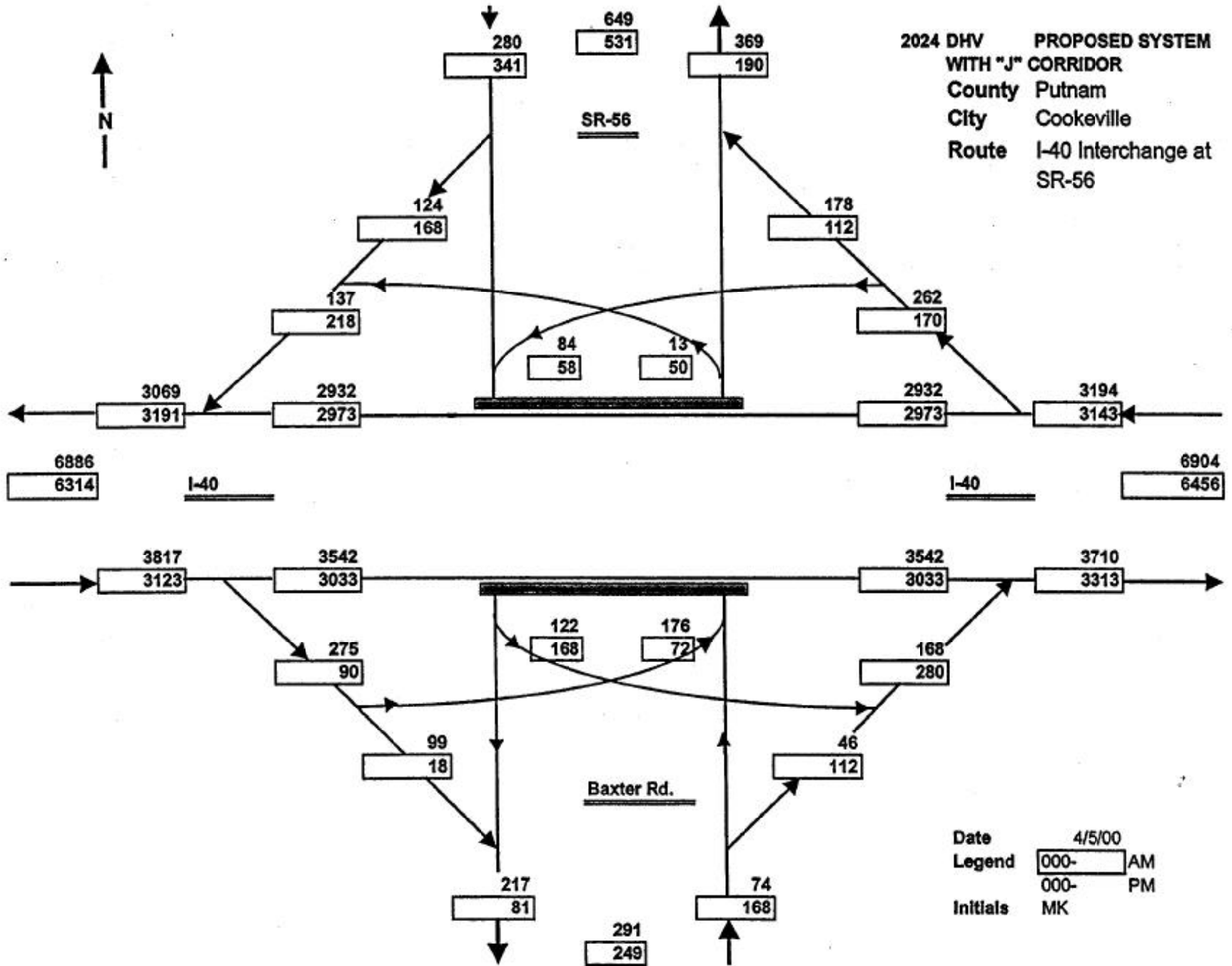
ADT
**PROPOSED SYSTEM
 WITH "J" CORRIDOR**
 County Putnam
 City Cookeville
 Date 3/31/00

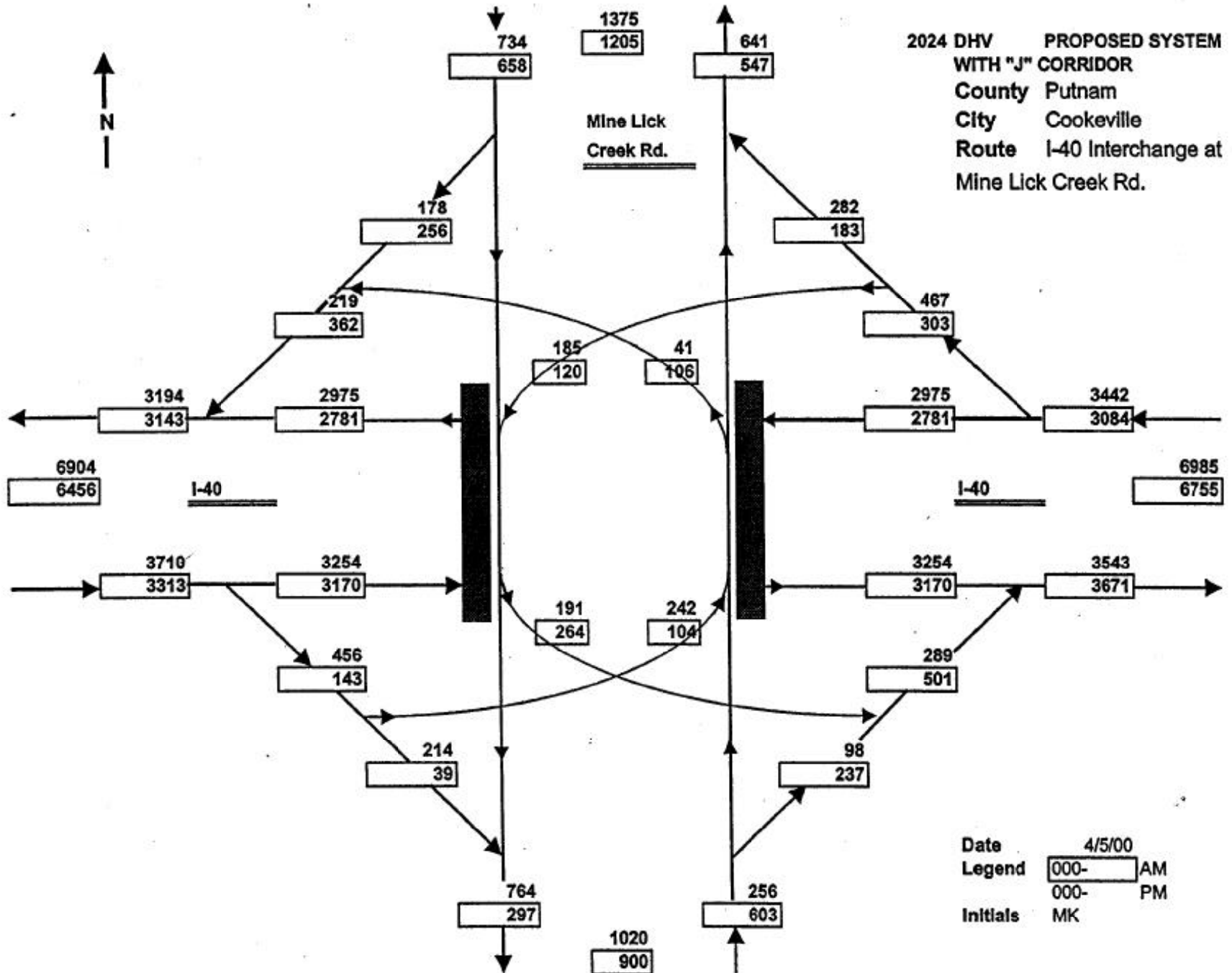
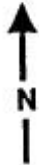
Legend 000- 2004
000- 2024
 [0]- Truck %
 Initials MK

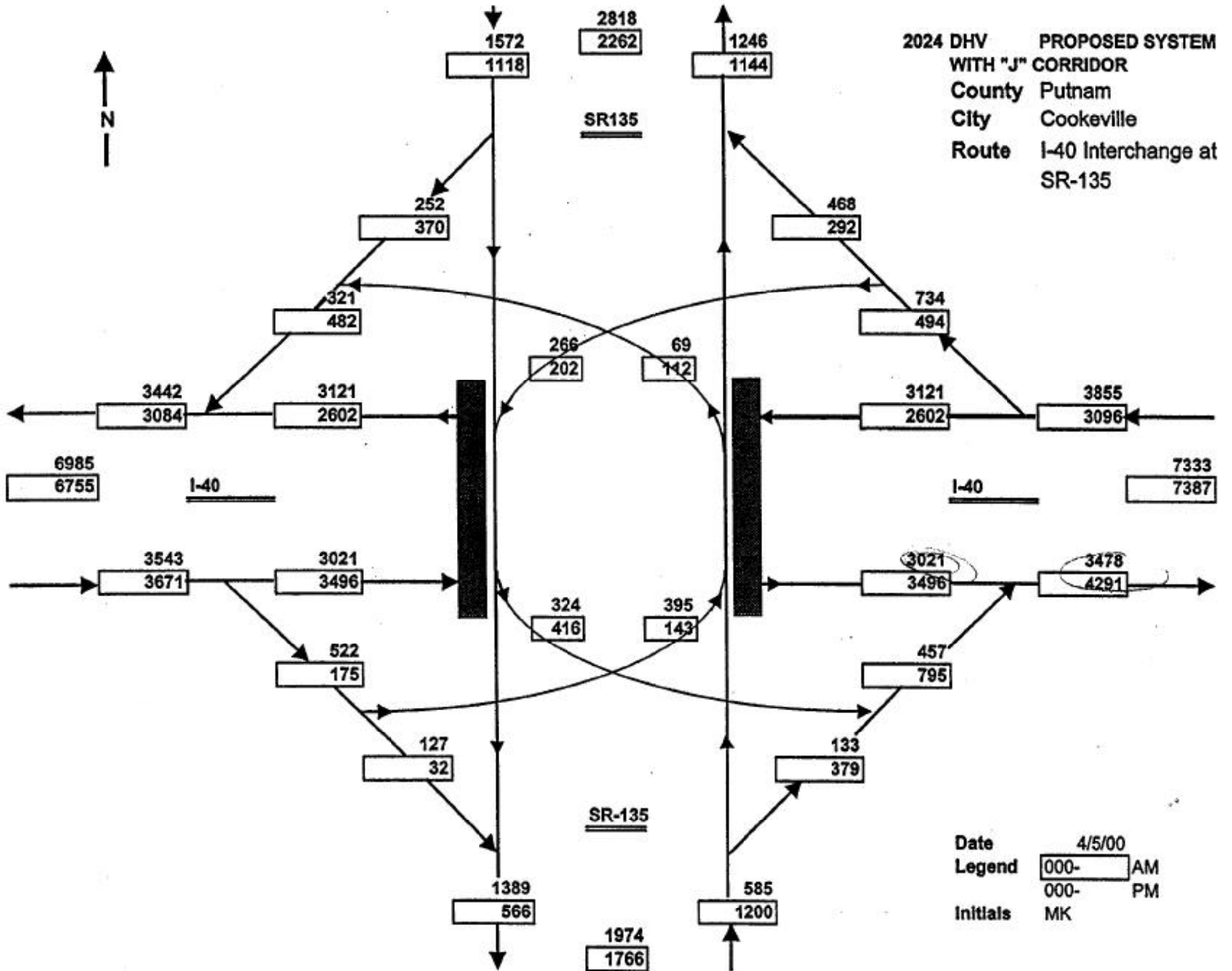












Level of Service Summaries

**MINE LICK CREEK ROAD INTERSECTIONS
LEVEL OF SERVICE SUMMARY
(PROPOSED CONDITIONS ONLY)**

	Analysis Year	<u>East I-40 Ramps</u>		<u>West I-40 Ramps</u>	
		AM Peak	PM Peak	AM Peak	PM Peak
Base Year Analysis	2004	A	A	B	B
Design Year Analysis	2024	A	B	B	C
Level of Service "D" Service Life		20 yrs		20 yrs	
Level of Service "E" Service Life		20 yrs		20 yrs	

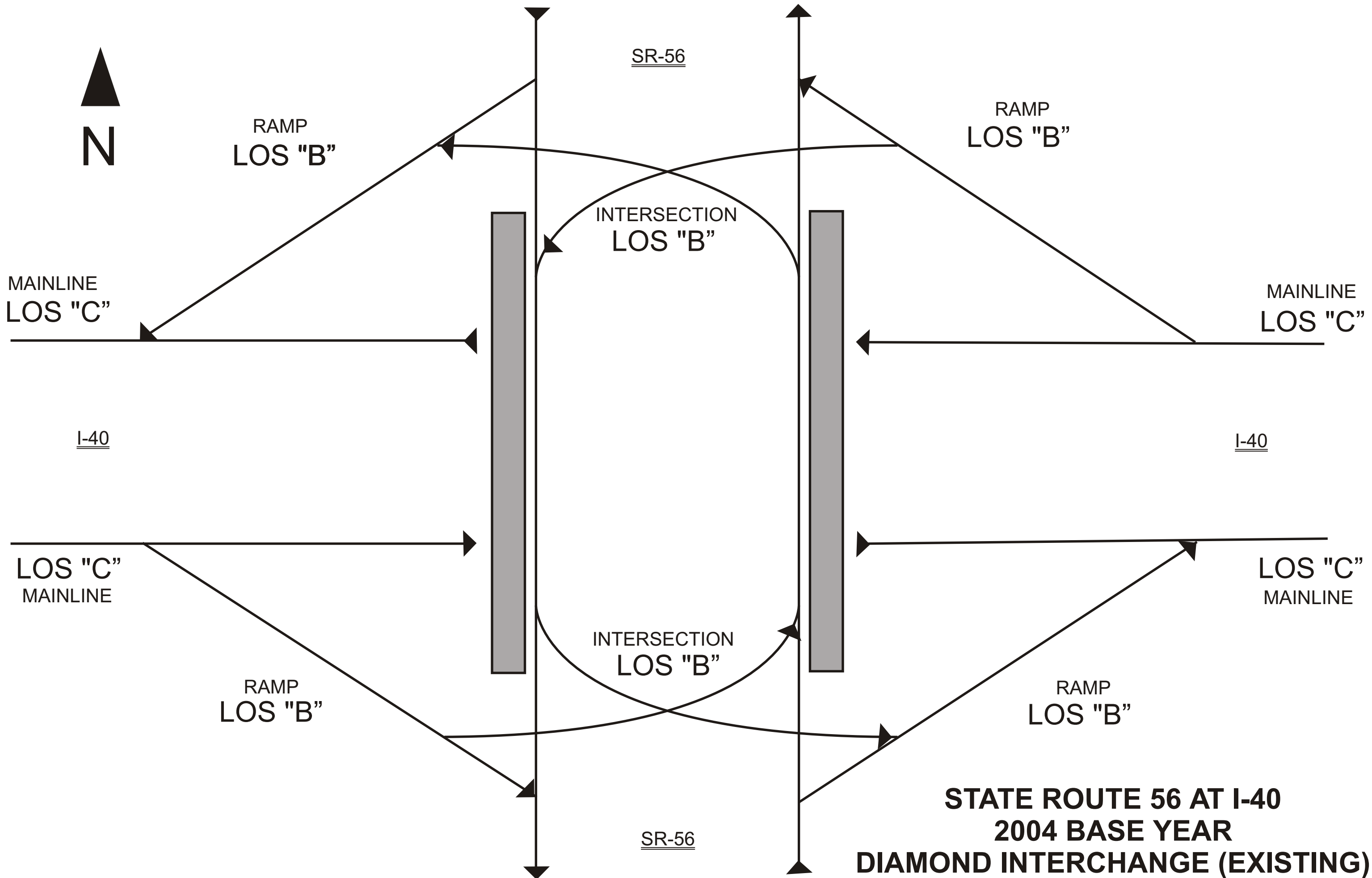
**I-40 MAINLINE
LEVEL OF SERVICE SUMMARY**

		Analysis Year	EB West of Mine Lick Creek Rd.		WB West of Mine Lick Creek Rd.		EB East of Mine Lick Creek Rd.		WB East of Mine Lick Creek Rd.	
			AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Existing Geometrics	2 lanes EB/2 lanes WB	2004	C	C	C	C	C	C	C	C
	2 lanes EB/2 lanes WB	2024	D	E	D	E	D	E	D	E
Level of Service "D" Service Life			14 yrs		19 yrs		14 yrs		19 yrs	
Level of Service "E" Service Life			20 yrs		20 yrs		20 yrs		20 yrs	
Proposed Geometrics	Non-Weaving	2004	C	C	C	C	C	C	C	C
	Non-Weaving	2024	E	E	D	D	E	E	D	E
Level of Service "D" Service Life			12 yrs		20 yrs		13 yrs		17 yrs	
Level of Service "E" Service Life			20 yrs		20 yrs		20 yrs		20 yrs	

**I-40 RAMPS (PROPOSED CONDITIONS ONLY)
LEVEL OF SERVICE SUMMARY**

	Analysis Year	S. Mine Lick Creek Rd. <u>EB Off Ramp</u>		N. Mine Lick Creek Rd. <u>EB Loop Off Ramp</u>		Mine Lick Creek Rd. <u>EB On Ramp</u>		Mine Lick Creek Rd. <u>WB Off Ramp</u>		Mine Lick Creek Rd. <u>WB On Ramp</u>	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
		Modified Cloverleaf Interchange	2004	B	C	B	B	C	B	B	B
2024	D		D	D	D	D	D	C	D	C	D
Level of Service "D" Service Life		20 yrs		20 yrs		20 yrs		20 yrs		20 yrs	
Level of Service "E" Service Life		20 yrs		20 yrs		20 yrs		20 yrs		20 yrs	

Existing Conditions Analysis
State Route 56 (Baxter Road)
At Interstate 40



SR-56

RAMP
LOS "B"

RAMP
LOS "B"

INTERSECTION
LOS "B"

MAINLINE
LOS "C"

MAINLINE
LOS "C"

I-40

I-40

LOS "C"
MAINLINE

LOS "C"
MAINLINE

RAMP
LOS "B"

RAMP
LOS "B"

INTERSECTION
LOS "B"

SR-56

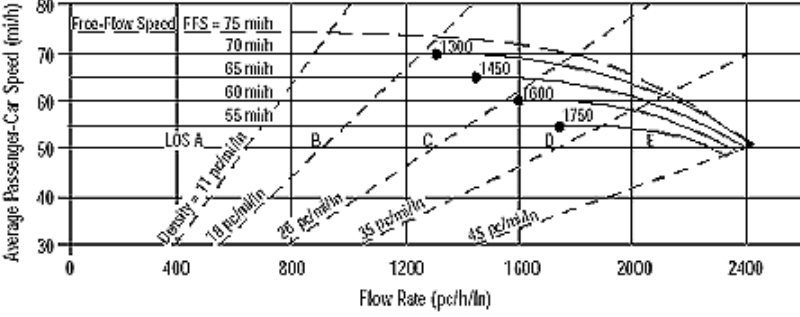
**STATE ROUTE 56 AT I-40
2004 BASE YEAR
DIAMOND INTERCHANGE (EXISTING)
AM PEAK**

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	<i>JH</i>			Intersection	<i>EB RAMPS @ SR-56 (EXISTING)</i>			
Agency/Co.				Jurisdiction				
Date Performed	<i>4/5/00</i>			Analysis Year				
Analysis Time Period	<i>AM 2004</i>							
Project Description								
East/West Street:				North/South Street:				
Intersection Orientation: <i>North-South</i>				Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	60	120	167	100	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	63	126	175	105	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street	Westbound			Eastbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	69	0	20		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	72	0	21		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		3			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT					LR	
v (vph)		175					93	
C (m) (vph)		1367					471	
v/c		0.13					0.20	
95% queue length		0.44					0.73	
Control Delay		8.0					14.5	
LOS		A					B	
Approach Delay	--	--					14.5	
Approach LOS	--	--					B	

>

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	<i>JH</i>			Intersection	<i>WB RAMPS @ SR-56 (EXISTING)</i>			
Agency/Co.				Jurisdiction				
Date Performed	<i>4/5/00</i>			Analysis Year				
Analysis Time Period	<i>AM 2004</i>							
Project Description								
East/West Street:				North/South Street:				
Intersection Orientation: <i>North-South</i>				Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	<i>55</i>	<i>74</i>	<i>0</i>	<i>0</i>	<i>207</i>	<i>171</i>		
Peak-Hour Factor, PHF	<i>0.95</i>	<i>0.95</i>	<i>1.00</i>	<i>1.00</i>	<i>0.95</i>	<i>0.95</i>		
Hourly Flow Rate, HFR	<i>57</i>	<i>77</i>	<i>0</i>	<i>0</i>	<i>217</i>	<i>0</i>		
Percent Heavy Vehicles	<i>5</i>	<i>--</i>	<i>--</i>	<i>0</i>	<i>--</i>	<i>--</i>		
Median Type	<i>Undivided</i>							
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>0</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>0</i>		
Configuration	<i>LT</i>				<i>T</i>			
Upstream Signal		<i>0</i>			<i>0</i>			
Minor Street	Westbound			Eastbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	<i>60</i>	<i>0</i>	<i>116</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Peak-Hour Factor, PHF	<i>0.95</i>	<i>1.00</i>	<i>0.95</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>		
Hourly Flow Rate, HFR	<i>63</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Percent Heavy Vehicles	<i>5</i>	<i>0</i>	<i>5</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Percent Grade (%)	<i>0</i>			<i>0</i>				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		<i>0</i>			<i>3</i>			
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>1</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Configuration	<i>L</i>							
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>		<i>L</i>					
v (vph)	<i>57</i>		<i>63</i>					
C (m) (vph)	<i>1335</i>		<i>569</i>					
v/c	<i>0.04</i>		<i>0.11</i>					
95% queue length	<i>0.13</i>		<i>0.37</i>					
Control Delay	<i>7.8</i>		<i>12.1</i>					
LOS	<i>A</i>		<i>B</i>					
Approach Delay	<i>--</i>	<i>--</i>	<i>12.1</i>					
Approach LOS	<i>--</i>	<i>--</i>	<i>B</i>					

>

BASIC FREEWAY SEGMENTS WORKSHEET																								
 <p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 18 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Design points are marked: A (1300, 70), B (1450, 65), C (1600, 60), D (1750, 55), and E (2400, 50). A free-flow speed of 75 mi/h is indicated at the top left.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>			Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																						
Operational (LOS)	FFS, N, v_p	LOS, S, D																						
Design (N)	FFS, LOS, v_p	N, S, D																						
Design (v_p)	FFS, LOS, N	v_p , S, D																						
Planning (LOS)	FFS, N, AADT	LOS, S, D																						
Planning (N)	FFS, LOS, AADT	N, S, D																						
Planning (v_p)	FFS, LOS, N	v_p , S, D																						
General Information		Site Information																						
Analyst	JH	Highway/Direction of Travel	EB I-40																					
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																					
Date Performed	5/1/00	Jurisdiction	EXISTING																					
Analysis Time Period	AM PEAK	Analysis Year	2004																					
Project Description																								
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																								
Flow Inputs																								
Volume, V	2000 veh/h	Peak-Hour Factor, PHF	0.95																					
AADT	veh/day	%Trucks and Buses, P_T	25																					
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																					
Peak-Hr Direction Prop, D		General Terrain:	Level																					
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																					
Driver type adjustment	1.00	Up/Down %	0.00																					
Calculate Flow Adjustments																								
f_p	1.00	E_R	1.2																					
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																					
Speed Inputs		Calc Speed Adj and FFS																						
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																					
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																					
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																					
Number of Lanes, N	2	f_N	4.5 mi/h																					
FFS (measured)		FFS	63.0 mi/h																					
Base free-flow Speed, BFFS	70.0 mi/h																							
LOS and Performance Measures		Design (N)																						
Operational (LOS)		Design (N)																						
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1199 pc/h/ln	Design LOS																						
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																						
$D = v_p / S$	19.0 pc/mi/ln	S																						
LOS	C	$D = v_p / S$																						
		Required Number of Lanes, N																						
Glossary		Factor Location																						
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																					
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																					
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																					
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																					
DDHV - Directional design hour volume																								

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Regions A through F are marked, corresponding to different levels of service (LOS). A table in the top right corner lists applications and their input/output parameters.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2198 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1318 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	20.9 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
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Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1940 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1163 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	18.5 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																								
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows five Level of Service (LOS) curves: LOS A (top), LOS B, LOS C, LOS D, and LOS E (bottom). Dashed lines represent density values: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Specific flow rate points are marked: 1300, 1450, 1600, and 1750. A legend table is provided to the right of the graph.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D			
Application	Input	Output																						
Operational (LOS)	FFS, N, v_p	LOS, S, D																						
Design (N)	FFS, LOS, v_p	N, S, D																						
Design (v_p)	FFS, LOS, N	v_p , S, D																						
Planning (LOS)	FFS, N, AADT	LOS, S, D																						
Planning (N)	FFS, LOS, AADT	N, S, D																						
Planning (v_p)	FFS, LOS, N	v_p , S, D																						
General Information		Site Information																						
Analyst	JH	Highway/Direction of Travel	WB I-40																					
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																					
Date Performed	5/1/00	Jurisdiction	EXISTING																					
Analysis Time Period	AM PEAK	Analysis Year	2004																					
Project Description																								
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																								
Flow Inputs																								
Volume, V	1890 veh/h	Peak-Hour Factor, PHF	0.95																					
AADT	veh/day	%Trucks and Buses, P_T	25																					
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																					
Peak-Hr Direction Prop, D		General Terrain:	Level																					
DDHV = AADT x K x D	veh/h	Grade	Length																					
Driver type adjustment	1.00	Up/Down %	0.00																					
Calculate Flow Adjustments																								
f_p	1.00	E_R	1.2																					
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																					
Speed Inputs		Calc Speed Adj and FFS																						
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																					
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																					
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																					
Number of Lanes, N	2	f_N	4.5 mi/h																					
FFS (measured)		FFS	63.0 mi/h																					
Base free-flow Speed, BFFS	70.0 mi/h																							
LOS and Performance Measures		Design (N)																						
Operational (LOS)		Design (N)																						
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1133 pc/h/ln	Design LOS																						
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																						
$D = v_p / S$	18.0 pc/mi/ln	S																						
LOS	B	$D = v_p / S$																						
		Required Number of Lanes, N																						
Glossary		Factor Location																						
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																					
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																					
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																					
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																					
DDHV - Directional design hour volume																								

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2000	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	89	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	287	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2000	89	287	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	526	23	76	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2398	94	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2398	4800	No
v 12		4400	No
$v = v - v$ FO F R	2304	4800	No
v R	94	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.436$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.8$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-56 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1911	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	287	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	89	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1911	287	89	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	503	76	23	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2291	302	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2593	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.303

Space mean speed in ramp influence area, $S_R =$ mph

Space mean speed in outer lanes, $S_0 =$ N/A mph

Space mean speed for all vehicles, S = 61.5 mph

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1890	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	176	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	226	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1890	176	226	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	497	46	59	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2266	185	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	2266	4800	No
Fi F			
v		4400	No
12			
$v = v - v$	2081	4800	No
FO F R			
v	185	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.445$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.5$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-56 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1714	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	226	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	176	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1714	226	176	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	451	59	46	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2055	238	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2293	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

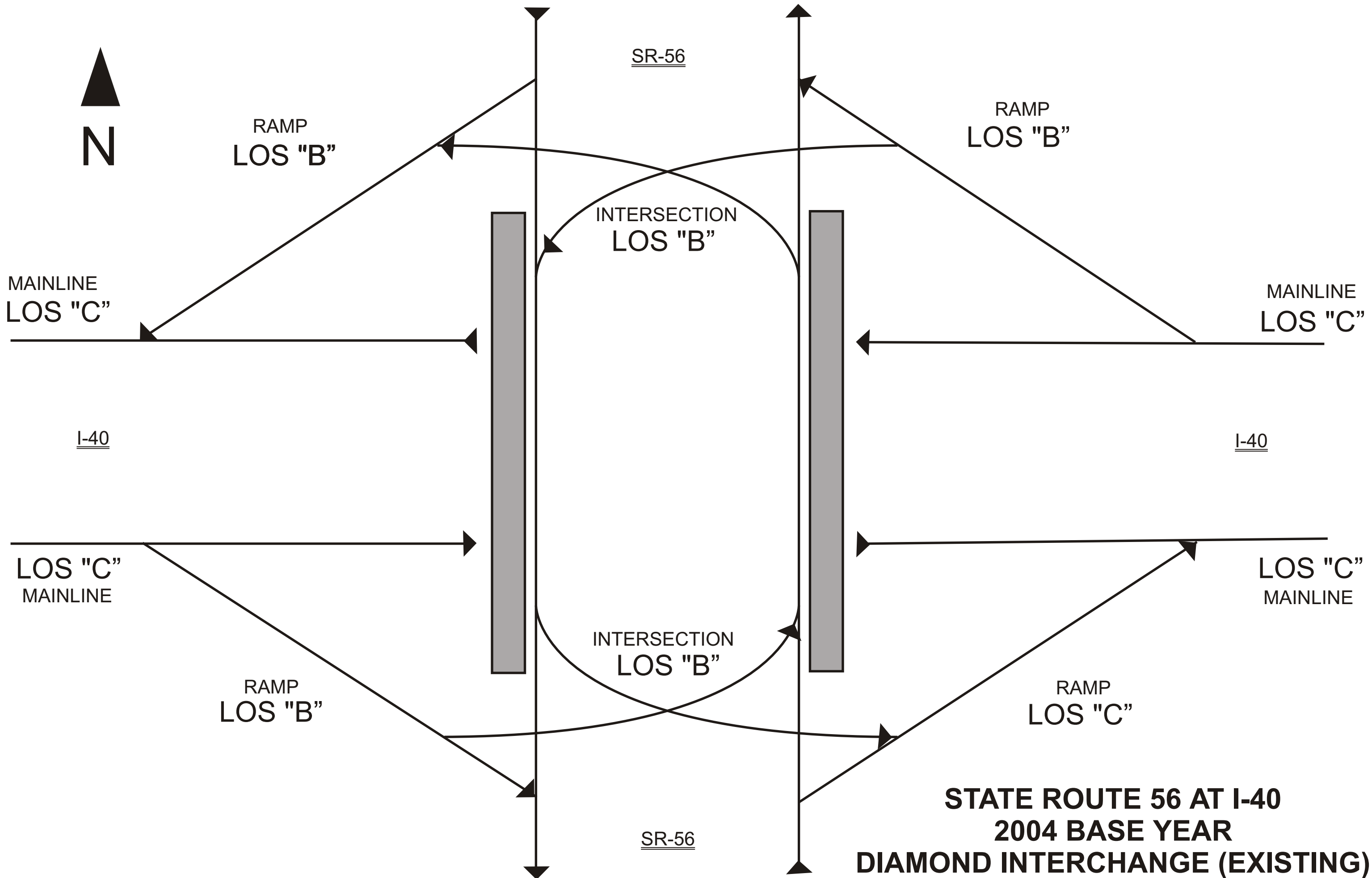
Speed Estimation

Intermediate speed variable, M = 0.290

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.9 mph



SR-56

RAMP
LOS "B"

RAMP
LOS "B"

MAINLINE
LOS "C"

MAINLINE
LOS "C"

INTERSECTION
LOS "B"

I-40

I-40

LOS "C"
MAINLINE

LOS "C"
MAINLINE

INTERSECTION
LOS "B"

RAMP
LOS "B"

RAMP
LOS "C"

**STATE ROUTE 56 AT I-40
2004 BASE YEAR
DIAMOND INTERCHANGE (EXISTING)
PM PEAK**

SR-56

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB RAMPS @ SR-56 (EXISTING)</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>PM 2004</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	<i>0</i>	<i>20</i>	<i>50</i>	<i>103</i>	<i>60</i>	<i>0</i>		
Peak-Hour Factor, PHF	<i>1.00</i>	<i>0.95</i>	<i>0.95</i>	<i>0.95</i>	<i>0.95</i>	<i>1.00</i>		
Hourly Flow Rate, HFR	<i>0</i>	<i>21</i>	<i>52</i>	<i>108</i>	<i>63</i>	<i>0</i>		
Percent Heavy Vehicles	<i>0</i>	<i>--</i>	<i>--</i>	<i>5</i>	<i>--</i>	<i>--</i>		
Median Type	<i>Undivided</i>							
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>0</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>0</i>		
Configuration			<i>TR</i>	<i>LT</i>				
Upstream Signal		<i>0</i>			<i>0</i>			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	<i>0</i>	<i>0</i>	<i>0</i>	<i>161</i>	<i>0</i>	<i>110</i>		
Peak-Hour Factor, PHF	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>0.95</i>	<i>1.00</i>	<i>0.95</i>		
Hourly Flow Rate, HFR	<i>0</i>	<i>0</i>	<i>0</i>	<i>169</i>	<i>0</i>	<i>115</i>		
Percent Heavy Vehicles	<i>0</i>	<i>0</i>	<i>0</i>	<i>5</i>	<i>0</i>	<i>5</i>		
Percent Grade (%)	<i>0</i>			<i>0</i>				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		<i>3</i>			<i>0</i>			
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Configuration					<i>LR</i>			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		<i>LT</i>					<i>LR</i>	
v (vph)		<i>108</i>					<i>284</i>	
C (m) (vph)		<i>1508</i>					<i>727</i>	
v/c		<i>0.07</i>					<i>0.39</i>	
95% queue length		<i>0.23</i>					<i>1.86</i>	
Control Delay		<i>7.6</i>					<i>13.1</i>	
LOS		<i>A</i>					<i>B</i>	
Approach Delay	<i>--</i>	<i>--</i>				<i>13.1</i>		
Approach LOS	<i>--</i>	<i>--</i>				<i>B</i>		

>

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Version 4.1c

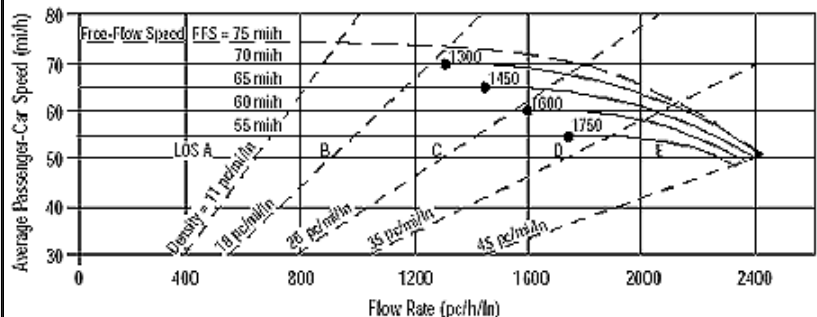
TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>WB RAMPS @ SR-56 (EXISTING)</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>PM 2004</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	15	385	0	0	73	119		
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95		
Hourly Flow Rate, HFR	15	405	0	0	76	0		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0				0	
Lanes	0	1	0	0	1	0		
Configuration	<i>LT</i>				<i>T</i>			
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	90	0	174	0	0	0		
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR	94	0	0	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)	0			0				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		0			3			
RT Channelized			0				0	
Lanes	1	0	0	0	0	0		
Configuration	<i>L</i>							
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>		<i>L</i>					
v (vph)	15		94					
C (m) (vph)	1504		512					
v/c	0.01		0.18					
95% queue length	0.03		0.67					
Control Delay	7.4		13.6					
LOS	<i>A</i>		<i>B</i>					
Approach Delay	--	--	13.6					
Approach LOS	--	--	<i>B</i>					

>

HCS2000™

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Version 4.1c

BASIC FREEWAY SEGMENTS WORKSHEET																						
 <p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Design points are marked: A (1300, 70), B (1450, 65), C (1600, 60), D (1750, 55), and E (2400, 50). A free-flow speed of 75 mi/h is indicated at the top left.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2400 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1439 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	22.8 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
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Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2282 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1368 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	21.7 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
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Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1900 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1139 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	18.1 pc/mi/ln	S	mi/h																			
LOS	C	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2400	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	271	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	153	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2400	271	153	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	632	71	40	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2877	285	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	2877	4800	No
Fi F			
v		4400	No
12			
$v = v - v$	2592	4800	No
FO F R			
v	285	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = -$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.454$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.3$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-56 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2129	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	153	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	271	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2129	153	271	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	560	40	71	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2553	161	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	2714	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.310

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.3 mph

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2030	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	264	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	134	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	2030	264	134	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	534	69	35	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2434	278	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2434	4800	No
v 12		4400	No
$v = v - v$ FO F R	2156	4800	No
v R	278	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.453$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.3$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-56 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1766	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	134	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	264	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1766	134	264	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	465	35	69	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2117	141	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2258	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

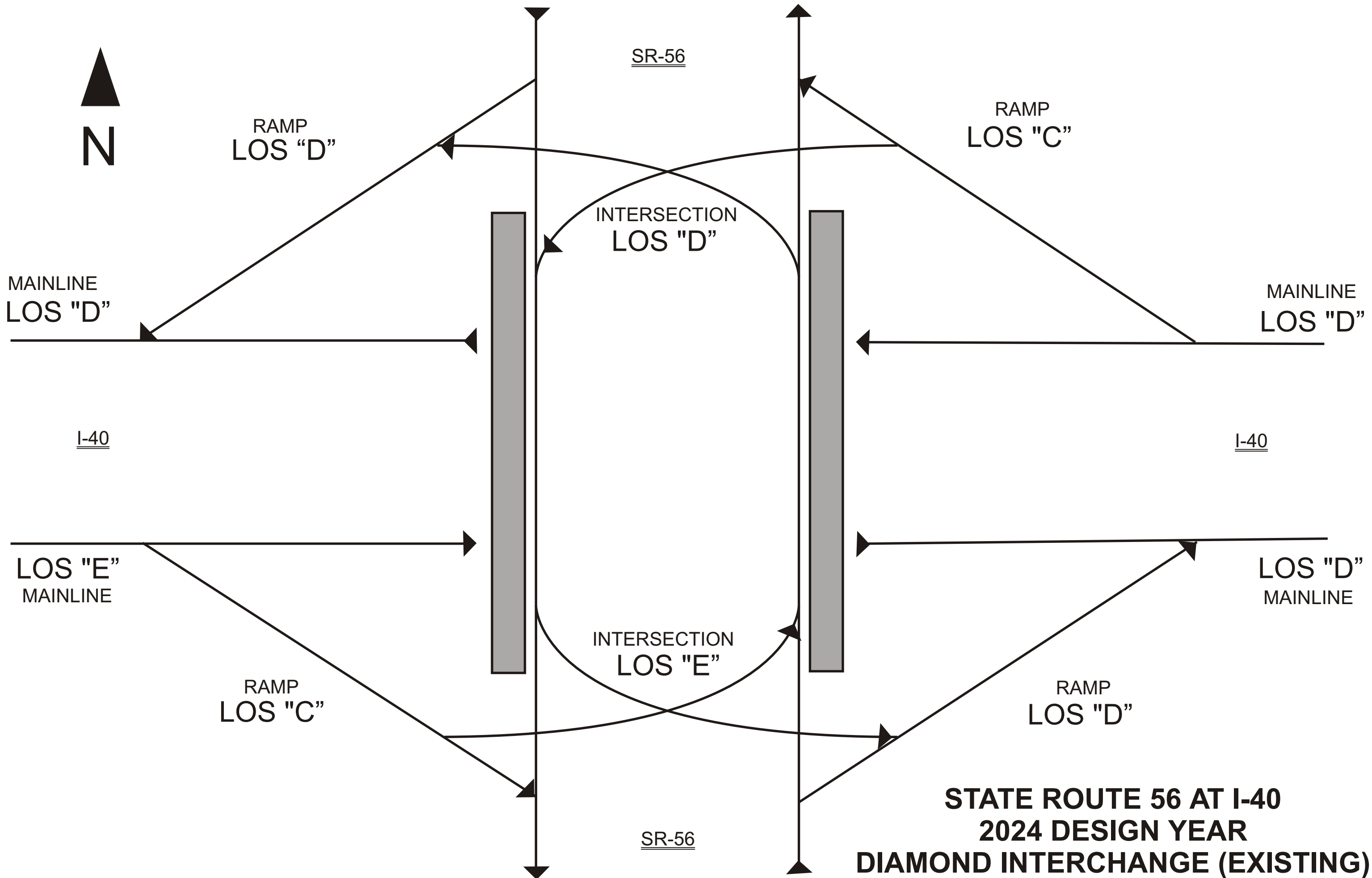
Speed Estimation

Intermediate speed variable, M = 0.288

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.9 mph



SR-56

RAMP
LOS "D"

RAMP
LOS "C"

INTERSECTION
LOS "D"

MAINLINE
LOS "D"

MAINLINE
LOS "D"

I-40

I-40

LOS "E"
MAINLINE

LOS "D"
MAINLINE

RAMP
LOS "C"

RAMP
LOS "D"

INTERSECTION
LOS "E"

**STATE ROUTE 56 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE (EXISTING)
AM PEAK**

SR-56

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB RAMPS @ SR-56 (EXISTING)</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>AM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	<i>0</i>	<i>105</i>	<i>205</i>	<i>250</i>	<i>179</i>	<i>0</i>		
Peak-Hour Factor, PHF	<i>1.00</i>	<i>0.95</i>	<i>0.95</i>	<i>0.95</i>	<i>0.95</i>	<i>1.00</i>		
Hourly Flow Rate, HFR	<i>0</i>	<i>110</i>	<i>215</i>	<i>263</i>	<i>188</i>	<i>0</i>		
Percent Heavy Vehicles	<i>0</i>	<i>--</i>	<i>--</i>	<i>5</i>	<i>--</i>	<i>--</i>		
Median Type	<i>Undivided</i>							
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>0</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>0</i>		
Configuration			<i>TR</i>	<i>LT</i>				
Upstream Signal		<i>0</i>			<i>0</i>			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	<i>0</i>	<i>0</i>	<i>0</i>	<i>144</i>	<i>0</i>	<i>31</i>		
Peak-Hour Factor, PHF	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>0.95</i>	<i>1.00</i>	<i>0.95</i>		
Hourly Flow Rate, HFR	<i>0</i>	<i>0</i>	<i>0</i>	<i>151</i>	<i>0</i>	<i>32</i>		
Percent Heavy Vehicles	<i>0</i>	<i>0</i>	<i>0</i>	<i>5</i>	<i>0</i>	<i>5</i>		
Percent Grade (%)	<i>0</i>			<i>0</i>				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		<i>3</i>			<i>0</i>			
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Configuration					<i>LR</i>			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		<i>LT</i>					<i>LR</i>	
v (vph)		<i>263</i>					<i>183</i>	
C (m) (vph)		<i>1218</i>					<i>262</i>	
v/c		<i>0.22</i>					<i>0.70</i>	
95% queue length		<i>0.82</i>					<i>4.71</i>	
Control Delay		<i>8.8</i>					<i>45.4</i>	
LOS		<i>A</i>					<i>E</i>	
Approach Delay	<i>--</i>	<i>--</i>				<i>45.4</i>		
Approach LOS	<i>--</i>	<i>--</i>				<i>E</i>		

>

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Version 4.1c

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>WB RAMPS @ SR-56 (EXISTING)</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>AM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	96	214	0	0	334	270		
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95		
Hourly Flow Rate, HFR	101	225	0	0	351	0		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0				0	
Lanes	0	1	0	0	1	0		
Configuration	<i>LT</i>				<i>T</i>			
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	95	0	187	0	0	0		
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR	100	0	0	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)	0			0				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		0			3			
RT Channelized			0				0	
Lanes	1	0	0	0	0	0		
Configuration	<i>L</i>							
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>		<i>L</i>					
v (vph)	101		100					
C (m) (vph)	1191		330					
v/c	0.08		0.30					
95% queue length	0.28		1.25					
Control Delay	8.3		20.6					
LOS	<i>A</i>		<i>C</i>					
Approach Delay	--	--	20.6					
Approach LOS	--	--	<i>C</i>					

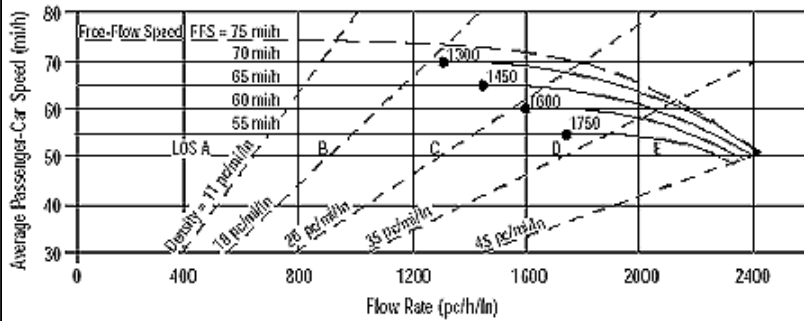
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Version 4.1c

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	EB I-40
From/To	EAST OF SR-56
Jurisdiction	EXISTING
Analysis Year	2024

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	3123 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1872 pc/h/ln
S	61.7 mi/h
$D = v_p / S$	30.4 pc/mi/ln
LOS	D

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

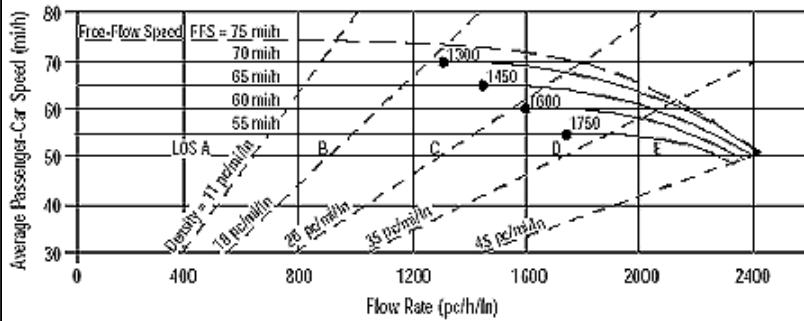
Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	EB I-40
From/To	WEST OF SR-56
Jurisdiction	EXISTING
Analysis Year	2024

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	3433 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2058 pc/h/ln
S	59.1 mi/h
$D = v_p / S$	34.8 pc/mi/ln
LOS	D

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3191 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1913 pc/h/ln	Design LOS																				
S	61.2 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	31.2 pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3107 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1863 pc/h/ln	Design LOS																				
S	61.7 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	30.2 pc/mi/ln	S	mi/h																			
LOS	D	$D = v_p / S$	pc/mi/ln																			
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3123	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	145	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	455	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3123	145	455	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	822	38	120	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3744	153	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3744	4800	No
v 12		4400	No
$v = v - v$ FO F R	3591	4800	No
v R	153	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.442$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.6$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-56 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2978	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	455	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	145	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2978	455	145	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	784	120	38	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3570	479	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v \left(\frac{P}{12 F FM} \right) =$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v FO	4049	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{12} - 0.00627 \frac{L}{A} =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.475

Space mean speed in ramp influence area, $S =$ mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 56.7 mph

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3107	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	282	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	366	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3107	282	366	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	818	74	96	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3725	297	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3725	4800	No
Fi F			
v		4400	No
12			
$v = v - v$	3428	4800	No
FO F R			
v	297	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.455$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.3$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-56 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2825	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	366	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	282	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2825	366	282	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	743	96	74	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3387	385	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)
EQ
P = Using Equation 0
FM
 $v = v(P) =$ pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3772	4800	No
FO			
v		4600	Yes
R12			

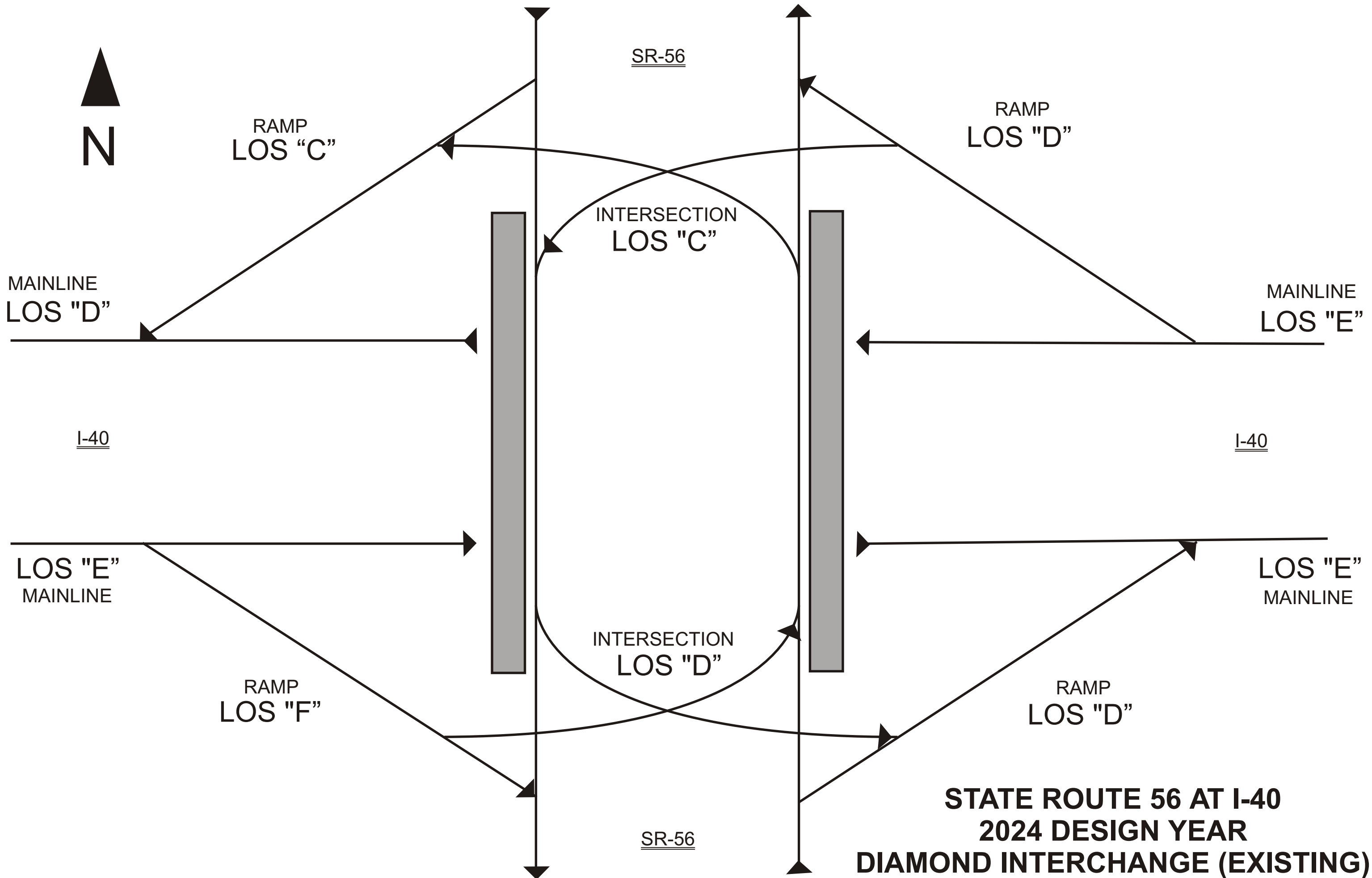
Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, $M = 0.421$
S
Space mean speed in ramp influence area, $S =$ mph
R
Space mean speed in outer lanes, $S = N/A$ mph
0
Space mean speed for all vehicles, $S = 58.2$ mph



**STATE ROUTE 56 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE (EXISTING)
PM PEAK**

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB RAMPS @ SR-56 (EXISTING)</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>PM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	<i>0</i>	<i>90</i>	<i>90</i>	<i>185</i>	<i>11</i>	<i>0</i>		
Peak-Hour Factor, PHF	<i>1.00</i>	<i>0.95</i>	<i>0.95</i>	<i>0.95</i>	<i>0.95</i>	<i>1.00</i>		
Hourly Flow Rate, HFR	<i>0</i>	<i>94</i>	<i>94</i>	<i>194</i>	<i>11</i>	<i>0</i>		
Percent Heavy Vehicles	<i>0</i>	--	--	<i>5</i>	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>0</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>0</i>		
Configuration			<i>TR</i>	<i>LT</i>				
Upstream Signal		<i>0</i>			<i>0</i>			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	<i>0</i>	<i>0</i>	<i>0</i>	<i>266</i>	<i>0</i>	<i>169</i>		
Peak-Hour Factor, PHF	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>0.95</i>	<i>1.00</i>	<i>0.95</i>		
Hourly Flow Rate, HFR	<i>0</i>	<i>0</i>	<i>0</i>	<i>280</i>	<i>0</i>	<i>177</i>		
Percent Heavy Vehicles	<i>0</i>	<i>0</i>	<i>0</i>	<i>5</i>	<i>0</i>	<i>5</i>		
Percent Grade (%)	<i>0</i>			<i>0</i>				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		<i>3</i>			<i>0</i>			
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Configuration					<i>LR</i>			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		<i>LT</i>					<i>LR</i>	
v (vph)		<i>194</i>					<i>457</i>	
C (m) (vph)		<i>1368</i>					<i>556</i>	
v/c		<i>0.14</i>					<i>0.82</i>	
95% queue length		<i>0.49</i>					<i>8.29</i>	
Control Delay		<i>8.1</i>					<i>34.7</i>	
LOS		<i>A</i>					<i>D</i>	
Approach Delay	--	--				<i>34.7</i>		
Approach LOS	--	--				<i>D</i>		

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TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>WB RAMPS @ SR-56 (EXISTING)</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>PM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	<i>24</i>	<i>332</i>	<i>0</i>	<i>0</i>	<i>46</i>	<i>190</i>		
Peak-Hour Factor, PHF	<i>0.95</i>	<i>0.95</i>	<i>1.00</i>	<i>1.00</i>	<i>0.95</i>	<i>0.95</i>		
Hourly Flow Rate, HFR	<i>25</i>	<i>349</i>	<i>0</i>	<i>0</i>	<i>48</i>	<i>0</i>		
Percent Heavy Vehicles	<i>5</i>	--	--	<i>0</i>	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			<i>0</i>				<i>0</i>	
Lanes	<i>0</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>0</i>		
Configuration	<i>LT</i>				<i>T</i>			
Upstream Signal		<i>0</i>			<i>0</i>			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	<i>150</i>	<i>0</i>	<i>258</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Peak-Hour Factor, PHF	<i>0.95</i>	<i>1.00</i>	<i>0.95</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>		
Hourly Flow Rate, HFR	<i>157</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Percent Heavy Vehicles	<i>5</i>	<i>0</i>	<i>5</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Percent Grade (%)	<i>0</i>			<i>0</i>				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		<i>0</i>			<i>3</i>			
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>1</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Configuration	<i>L</i>							
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>		<i>L</i>					
v (vph)	<i>25</i>		<i>157</i>					
C (m) (vph)	<i>1540</i>		<i>555</i>					
v/c	<i>0.02</i>		<i>0.28</i>					
95% queue length	<i>0.05</i>		<i>1.16</i>					
Control Delay	<i>7.4</i>		<i>14.0</i>					
LOS	<i>A</i>		<i>B</i>					
Approach Delay	--	--	<i>14.0</i>					
Approach LOS	--	--	<i>B</i>					

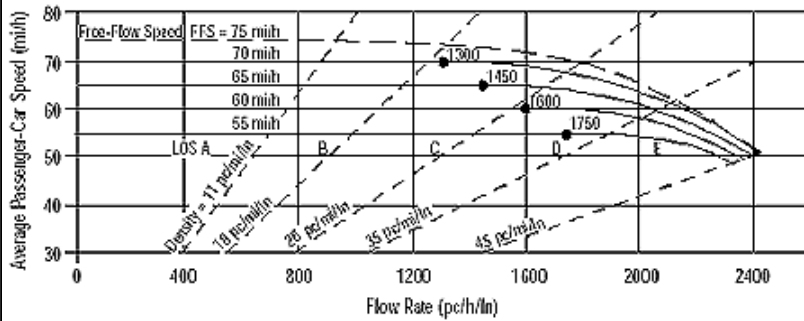
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Version 4.1c

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	PM PEAK

Site Information

Highway/Direction of Travel	EB I-40
From/To	EAST OF SR-56
Jurisdiction	EXISTING
Analysis Year	2024

Project Description

<input checked="" type="checkbox"/> Oper.(LOS)	<input type="checkbox"/> Des.(N)	<input type="checkbox"/> Planning Data
--	----------------------------------	--

Flow Inputs

Volume, V	3657 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade	Length
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2192 pc/h/ln
S	56.0 mi/h
$D = v_p / S$	39.1 pc/mi/ln
LOS	E

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

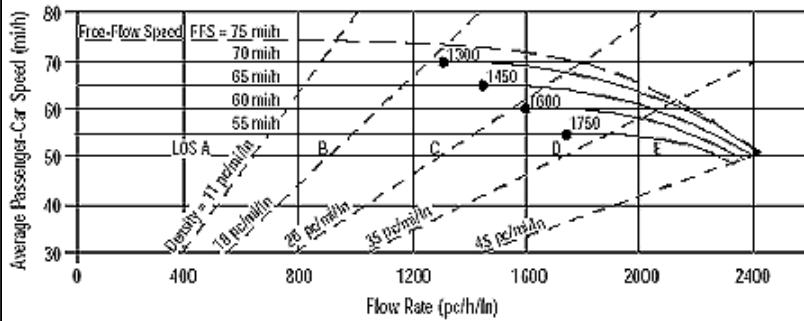
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves labeled with densities: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Data points are plotted at (1300, 70), (1450, 65), (1600, 60), and (1750, 55). A horizontal line for LOS A is shown at approximately 55 mi/h.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3657 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2192 pc/h/ln	Design LOS																				
S	56.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	39.1 pc/mi/ln	S	mi/h																			
LOS	E	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	PM PEAK

Site Information

Highway/Direction of Travel	WB I-40
From/To	WEST OF SR-56
Jurisdiction	EXISTING
Analysis Year	2024

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	3069 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1840	pc/h/ln
S	61.9	mi/h
$D = v_p / S$	29.7	pc/mi/ln
LOS	D	

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

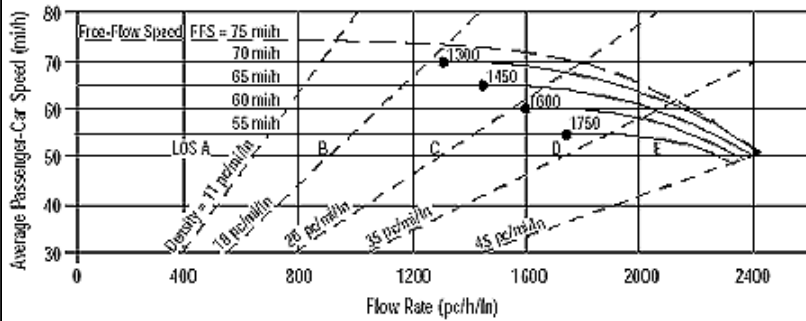
Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	PM PEAK

Site Information

Highway/Direction of Travel	WB I-40
From/To	EAST OF SR-56
Jurisdiction	EXISTING
Analysis Year	2024

Project Description

<input checked="" type="checkbox"/> Oper.(LOS)	<input type="checkbox"/> Des.(N)	<input type="checkbox"/> Planning Data
--	----------------------------------	--

Flow Inputs

Volume, V	3263 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade	Length
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1956 pc/h/ln
S	60.7 mi/h
$D = v_p / S$	32.2 pc/mi/ln
LOS	D

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3817	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	435	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	275	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3817	435	275	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1004	114	72	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4576	458	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	4576	4800	No
Fi F			
v		4400	Yes
12			
$v = v - v$	4118	4800	No
FO F R			
v	458	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $D = 0.469$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.9$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-56 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3382	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	275	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	435	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3382	275	435	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	890	72	114	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4055	289	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	4344	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.551

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 54.6 mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-56 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3263	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	408	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	214	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3263	408	214	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	859	107	56	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3912	429	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3912	4800	No
v 12		4400	No
$v = v - v$ FO F R	3483	4800	No
v R	429	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.467$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.9$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-56 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2855	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	214	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	408	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2855	214	408	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	751	56	107	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3423	225	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3648	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

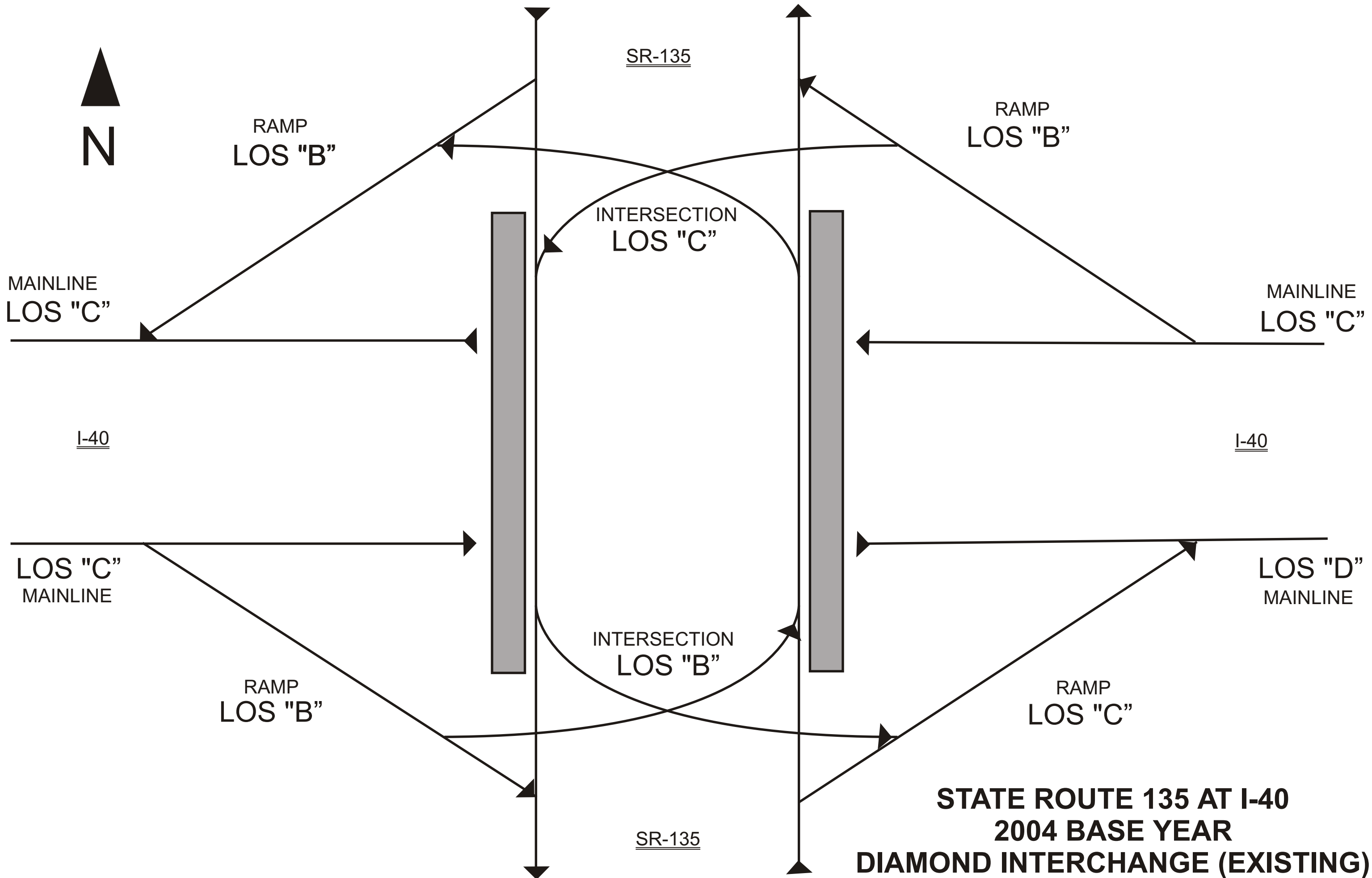
Intermediate speed variable, M = 0.401

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 58.8 mph

Existing Conditions Analysis
State Route 135 (Burgess Falls Road)
At Interstate 40



SR-135

RAMP
LOS "B"

RAMP
LOS "B"

MAINLINE
LOS "C"

MAINLINE
LOS "C"

INTERSECTION
LOS "C"

I-40

I-40

LOS "C"
MAINLINE

LOS "D"
MAINLINE

INTERSECTION
LOS "B"

RAMP
LOS "B"

RAMP
LOS "C"

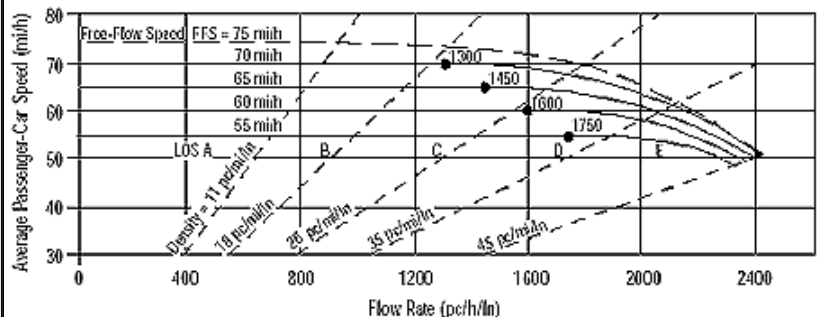
**STATE ROUTE 135 AT I-40
2004 BASE YEAR
DIAMOND INTERCHANGE (EXISTING)
AM PEAK**

SR-135

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>AM PEAK 2004 (EXISTING)</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N ₁	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	104		61					512	390	310	491	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, I ₁	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q _b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		15	0			0		98			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N _m												
Buses stopping, N _B	0		0					0	0	0	0	
Min. time for pedestrians, G _p												
Phasing	EB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, T = 0.25									Cycle Length, C = 90.0			
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	109		48					539	307	326	517	
Lane group capacity, c	487		436					718	1132	470	1127	
v/c ratio, X	0.22		0.11					0.75	0.27	0.69	0.46	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d ₁	25.0		24.2					23.7	4.3	12.4	9.5	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d ₂	1.1		0.5					7.1	0.6	8.2	1.3	
Initial queue delay, d ₃												
Control delay	26.1		24.7					30.8	4.9	20.6	10.8	
Lane group LOS	C		C					C	A	C	B	
Approach delay	25.7						21.4			14.6		
Approach LOS	C						C			B		
Intersection delay	18.7						Intersection LOS			B		

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>AM PEAK 2004 (EXISTING)</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				130		272	120	496			671	289
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		68				0		72
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, $T = 0.25$									Cycle Length, $C = 90.0$			
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				137		215	126	522			706	228
Lane group capacity, c				487		436	285	718			1127	1568
v/c ratio, X				0.28		0.49	0.44	0.73			0.63	0.15
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d_1				25.5		27.2	20.3	23.4			11.0	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				1.4		3.9	4.9	6.3			2.6	0.2
Initial queue delay, d_3												
Control delay				26.9		31.1	25.2	29.8			13.7	0.2
Lane group LOS				C		C	C	C			B	A
Approach delay				29.5			28.9			10.4		
Approach LOS				C			C			B		
Intersection delay	20.1						Intersection LOS			C		

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h is labeled 'Free-Flow Speed'. Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points are plotted at (1300, 70), (1450, 65), (1600, 60), and (1750, 55). Vertical lines indicate LOS A (400-800), B (800-1200), C (1200-1600), D (1600-2000), and E (2000-2400).</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2733 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1638 pc/h/ln	Design LOS																				
S	62.9 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	26.0+ pc/mi/ln	S	mi/h																			
LOS	D	$D = v_p / S$	pc/mi/ln																			
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1883 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1129 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	17.9 pc/mi/ln	S	mi/h																			
LOS	B	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2198	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	165	vph	
Length of first accel/decel lane	850	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	700	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	2198	165	700	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	578	43	184	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2626	174	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2626	4800	No
v 12		4400	No
$v = v - v$ FO F R	2452	4800	No
v R	174	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.444$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.6$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-135 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2033	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	700	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	165	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2033	700	165	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	535	184	43	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2437	737	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3174	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.365

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 59.8 mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
 Nashville, TN 37215

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1883	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	402	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	409	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1883	402	409	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	496	106	108	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2250	423	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	2250	4800	No
Fi F			
v		4400	No
12			
$v = v - v$	1827	4800	No
FO F R			
v	423	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.466$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.0$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-135 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1481	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	409	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	402	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1481	409	402	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	390	108	106	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	1776	431	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2207	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

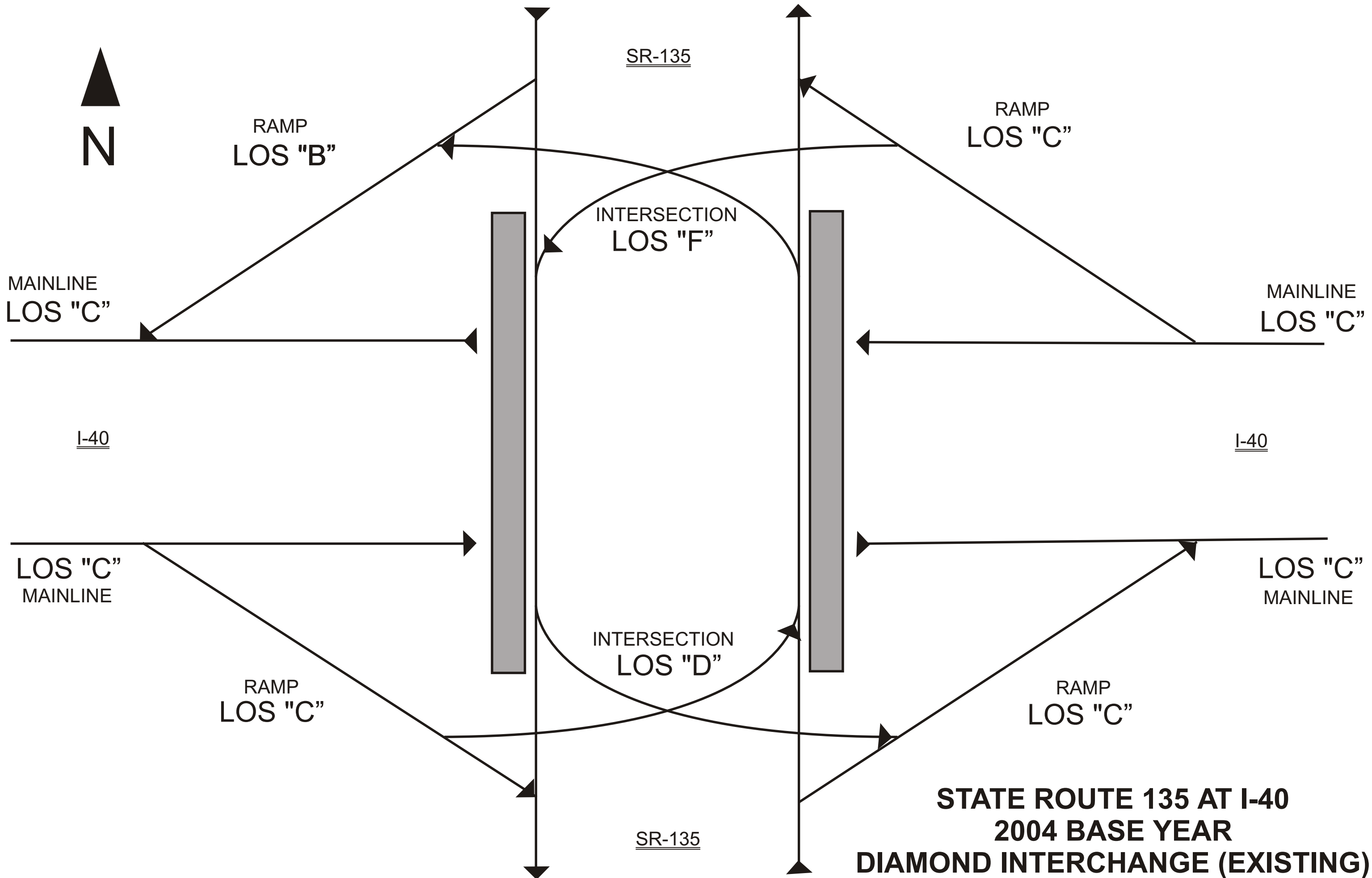
Speed Estimation

Intermediate speed variable, M = 0.286

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 62.0 mph



SR-135

RAMP
LOS "B"

RAMP
LOS "C"

INTERSECTION
LOS "F"

MAINLINE
LOS "C"

MAINLINE
LOS "C"

I-40

I-40

LOS "C"
MAINLINE

LOS "C"
MAINLINE

RAMP
LOS "C"

RAMP
LOS "C"

INTERSECTION
LOS "D"

SR-135

**STATE ROUTE 135 AT I-40
2004 BASE YEAR
DIAMOND INTERCHANGE (EXISTING)
PM PEAK**

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>PM PEAK 2004 (EXISTING)</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	332		189					678	60	365	943	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, l_1	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, l	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q_b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		47	0			0		15			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0		0					0	0	0	0	
Min. time for pedestrians, G_p												
Phasing	EB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, $T = 0.25$								Cycle Length, $C = 90.0$				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	349		149					714	47	384	993	
Lane group capacity, c	487		436					718	1132	402	1127	
v/c ratio, X	0.72		0.34					0.99	0.04	0.96	0.88	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d_1	29.3		25.9					27.4	3.6	23.0	14.7	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d_2	8.7		2.1					32.3	0.1	34.9	10.0	
Initial queue delay, d_3												
Control delay	38.1		28.1					59.7	3.6	58.0	24.7	
Lane group LOS	D		C					E	A	E	C	
Approach delay	35.1						56.2			34.0		
Approach LOS	D						E			C		
Intersection delay	40.6						Intersection LOS			D		

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>PM PEAK 2004 (EXISTING)</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N ₁	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				300		373	10	1000			1184	295
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I ₁				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q _b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		93				0		74
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N _m												
Buses stopping, N _B				0		0	0	0			0	0
Min. time for pedestrians, G _p												
Phasing	WB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, T = 0.25								Cycle Length, C = 90.0				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				316		295	11	1053			1246	233
Lane group capacity, c				487		436	171	718			1127	1568
v/c ratio, X				0.65		0.68	0.06	1.47			1.11	0.15
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d ₁				28.6		28.9	17.2	27.5			17.5	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d ₂				6.6		8.2	0.7	217.6			60.6	0.2
Initial queue delay, d ₃												
Control delay				35.2		37.1	18.0	245.1			78.1	0.2
Lane group LOS				D		D	B	F			E	A
Approach delay				36.1			242.7			65.8		
Approach LOS				D			F			E		
Intersection delay	119.8						Intersection LOS			F		

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS)		<input type="checkbox"/> Des.(N)																				
<input type="checkbox"/> Des.(N)		<input type="checkbox"/> Planning Data																				
Flow Inputs																						
Volume, V	2186 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1310 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	20.8 pc/mi/ln	S	mi/h																			
LOS	C	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, 1750, and 2400 pc/h/ln respectively. The Level of Service (LOS) is determined by these flow rates: LOS A (1300-1450), LOS B (1450-1600), LOS C (1600-1750), LOS D (1750-2400), and LOS E (2400+).</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper. (LOS) <input type="checkbox"/> Des. (N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2398 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1438 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	22.8 pc/mi/ln	S	mi/h																			
LOS	C	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2282	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	521	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	425	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	2282	521	425	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	601	137	112	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2726	548	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2726	4800	No
v 12		4400	No
$v = v - v$ FO F R	2178	4800	No
v R	548	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.477$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.6$ mph

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 Nashville, TN 37215

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 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-135 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1761	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	425	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	521	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1761	425	521	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	463	112	137	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2111	447	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	2558	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.322

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.0 mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2398	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	673	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	305	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2398	673	305	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	631	177	80	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2865	708	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

v = v	Actual	Maximum	LOS F?
Fi F	2865	4800	No
v		4400	No
12			
v = v - v	2157	4800	No
FO F R			
v	708	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.492$

Space mean speed in ramp influence area, $S = 56$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.2$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

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 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-135 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1725	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	305	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	673	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1725	305	673	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	454	80	177	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2068	321	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2389	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

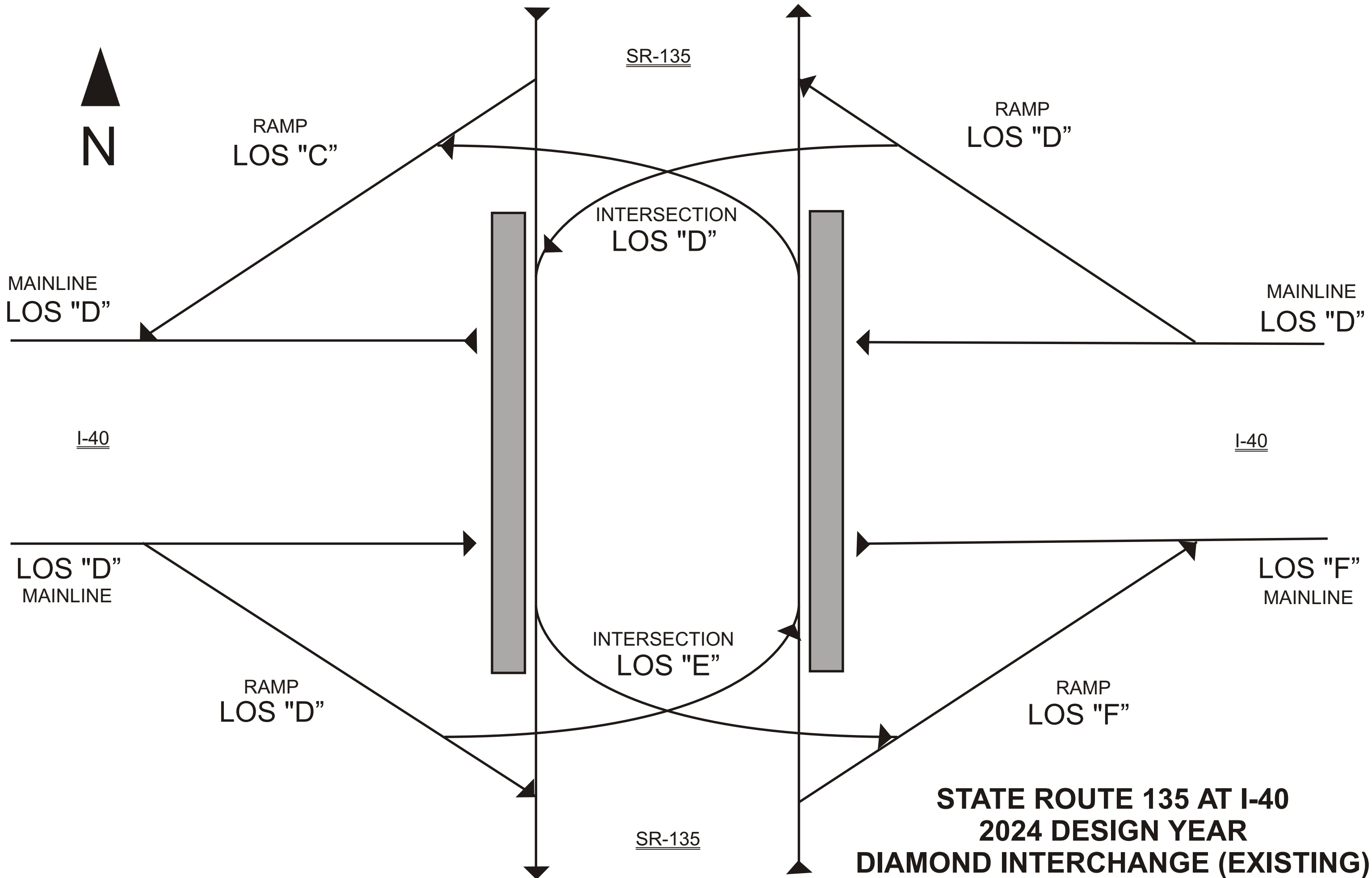
Speed Estimation

Intermediate speed variable, M = 0.294

Space mean speed in ramp influence area, $S_R =$ mph

Space mean speed in outer lanes, $S_0 =$ N/A mph

Space mean speed for all vehicles, S = 61.8 mph



SR-135



RAMP
LOS "C"

RAMP
LOS "D"

INTERSECTION
LOS "D"

MAINLINE
LOS "D"

MAINLINE
LOS "D"

I-40

I-40

LOS "D"
MAINLINE

LOS "F"
MAINLINE

RAMP
LOS "D"

RAMP
LOS "F"

INTERSECTION
LOS "E"

**STATE ROUTE 135 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE (EXISTING)
AM PEAK**

SR-135

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>AM PEAK 2024 (EXISTING)</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	164		98					756	624	496	752	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, l_1	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q_b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		25	0			0		156			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0		0					0	0	0	0	
Min. time for pedestrians, G_p												
Phasing	EB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, T = 0.25									Cycle Length, C = 90.0			
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	173		77					796	493	522	792	
Lane group capacity, c	487		436					718	1132	377	1127	
v/c ratio, X	0.36		0.18					1.11	0.44	1.38	0.70	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d_1	26.0		24.7					27.5	5.1	26.7	11.9	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d_2	2.0		0.9					67.4	1.2	188.8	3.7	
Initial queue delay, d_3												
Control delay	28.1		25.6					94.9	6.3	215.5	15.6	
Lane group LOS	C		C					F	A	F	B	
Approach delay	27.3						61.0			95.0		
Approach LOS	C						E			F		
Intersection delay	73.7						Intersection LOS			E		

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>AM PEAK 2024 (EXISTING)</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				208		435	192	728			1040	462
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		109				0		116
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, T = 0.25									Cycle Length, C = 90.0			
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				219		343	202	766			1095	364
Lane group capacity, c				487		436	198	718			1127	1568
v/c ratio, X				0.45		0.79	1.02	1.07			0.97	0.23
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d_1				26.8		30.0	27.5	27.5			16.8	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				3.0		13.4	69.3	52.9			20.8	0.3
Initial queue delay, d_3												
Control delay				29.8		43.4	96.8	80.4			37.6	0.3
Lane group LOS				C		D	F	F			D	A
Approach delay				38.1			83.8			28.3		
Approach LOS				D			F			C		
Intersection delay	48.1						Intersection LOS			D		

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	4291 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2572 pc/h/ln	Design LOS																				
S	mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	pc/mi/ln	S																				
LOS	F	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Regions A through F are marked, corresponding to different levels of service (LOS). A table in the top right corner lists applications and their input/output parameters.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3096 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1856 pc/h/ln	Design LOS																				
S	61.8 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	30.0 pc/mi/ln	S	mi/h																			
LOS	D	$D = v_p / S$	pc/mi/ln																			
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3433	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	262	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	1120	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3433	262	1120	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	903	69	295	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4102	276	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4102	4800	No
v 12		4400	No
$v = v - v$ FO F R	3826	4800	No
v R	276	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.453$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.3$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-135 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3171	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	1120	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	262	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3171	1120	262	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	834	295	69	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3802	1179	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) = \text{pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	4981	4800	Yes
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = \text{pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.840

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 46.5 mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3096	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	643	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	654	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	3096	643	654	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	815	169	172	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3699	677	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3699	4800	No
v 12		4400	No
$v = v - v$ FO F R	3022	4800	No
v R	677	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.489$

Space mean speed in ramp influence area, $S = 56$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.3$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-135 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2453	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	654	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	643	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2453	654	643	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	646	172	169	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2941	688	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v \left(\frac{P}{F} \right) =$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3629	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{12} - 0.00627 \frac{L}{A} =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

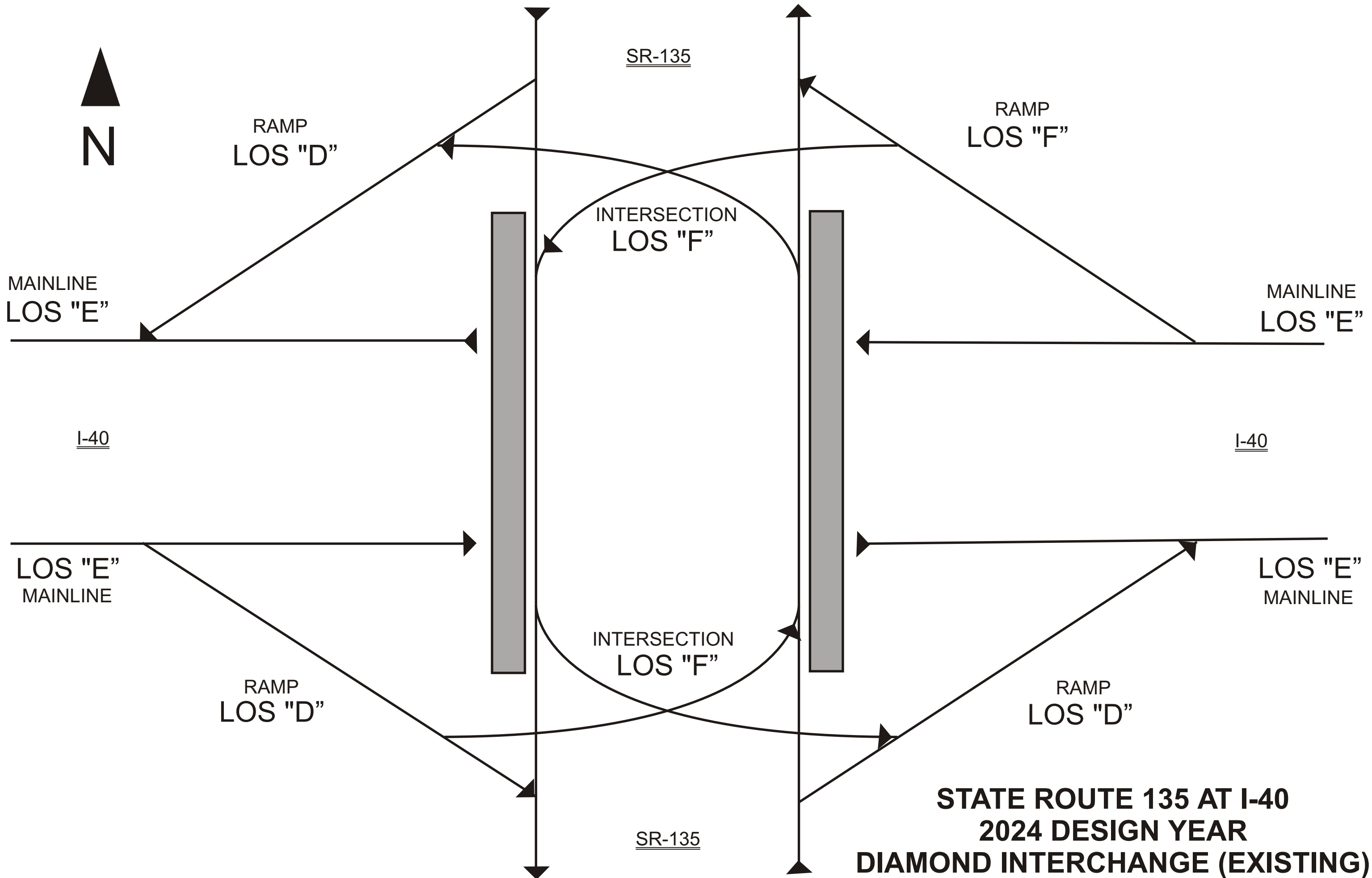
Speed Estimation

Intermediate speed variable, M = 0.398

Space mean speed in ramp influence area, $S =$ mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 58.9 mph



SR-135

RAMP
LOS "D"

RAMP
LOS "F"

MAINLINE
LOS "E"

MAINLINE
LOS "E"

INTERSECTION
LOS "F"

I-40

I-40

LOS "E"
MAINLINE

LOS "E"
MAINLINE

INTERSECTION
LOS "F"

RAMP
LOS "D"

RAMP
LOS "D"

**STATE ROUTE 135 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE (EXISTING)
PM PEAK**

SR-135

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>PM PEAK 2024 (EXISTING)</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	540		294					1024	96	559	1411	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, l_1	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q_b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		74	0			0		24			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0		0					0	0	0	0	
Min. time for pedestrians, G_p												
Phasing	EB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, T = 0.25									Cycle Length, C = 90.0			
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	568		232					1078	76	588	1485	
Lane group capacity, c	487		436					718	1132	374	1127	
v/c ratio, X	1.17		0.53					1.50	0.07	1.57	1.32	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d_1	32.5		27.5					27.5	3.6	27.8	17.5	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d_2	95.2		4.6					232.9	0.1	270.1	149.3	
Initial queue delay, d_3												
Control delay	127.7		32.1					260.4	3.8	297.9	166.8	
Lane group LOS	F		C					F	A	F	F	
Approach delay	100.0						243.5			204.0		
Approach LOS	F						F			F		
Intersection delay	194.6						Intersection LOS			F		

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>PM PEAK 2024 (EXISTING)</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N ₁	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				452		630	16	1548			1783	474
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I ₁				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q _b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		158				0		119
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N _m												
Buses stopping, N _B				0		0	0	0			0	0
Min. time for pedestrians, G _p												
Phasing	WB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, T = 0.25								Cycle Length, C = 90.0				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				476		497	17	1629			1877	374
Lane group capacity, c				487		436	82	718			1127	1568
v/c ratio, X				0.98		1.14	0.21	2.27			1.67	0.24
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d ₁				32.2		32.5	18.3	27.5			17.5	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d ₂				35.6		87.2	5.7	575.4			303.4	0.4
Initial queue delay, d ₃												
Control delay				67.8		119.7	23.9	602.9			320.9	0.4
Lane group LOS				E		F	C	F			F	A
Approach delay				94.3			596.9			267.7		
Approach LOS				F			F			F		
Intersection delay	344.3						Intersection LOS			F		

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 20 pc/mi/h, 25 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Regions A through F are marked, corresponding to different levels of service (LOS). A table in the top right corner lists applications and their input/output parameters.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS)		<input type="checkbox"/> Des.(N)																				
<input type="checkbox"/> Des.(N)		<input type="checkbox"/> Planning Data																				
Flow Inputs																						
Volume, V	3478 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2085 pc/h/ln	Design LOS																				
S	58.5 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	35.6 pc/mi/ln	S	mi/h																			
LOS	E	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/1/00	Jurisdiction	EXISTING																			
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3855 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2311 pc/h/ln	Design LOS																				
S	52.4 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	44.1 pc/mi/ln	S	mi/h																			
LOS	E	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3657	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	834	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	655	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	3657	834	655	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	962	219	172	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4369	878	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4369	4800	No
v 12		4400	No
$v = v - v$ FO F R	3491	4800	No
v R	878	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.507$

Space mean speed in ramp influence area, $S = 56$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 55.8$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-135 TO EB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2823	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	655	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	834	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2823	655	834	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	743	172	219	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3385	689	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	4074	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.501

Space mean speed in ramp influence area, $S =$ mph

Space mean speed in outer lanes, $S =$ N/A mph

Space mean speed for all vehicles, $S = 56.0$ mph

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-135 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3855	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	1082	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	460	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3855	1082	460	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1014	285	121	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4606	1139	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4606	4800	No
v 12		4400	Yes
$v = v - v$ FO F R	3467	4800	No
v R	1139	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $D = 0.531$

Space mean speed in ramp influence area, $S = 55$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 55.1$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-135 TO WB I-40 (EXISTING)
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2773	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	490	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	1082	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2773	490	1082	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	730	129	285	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3325	516	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3841	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

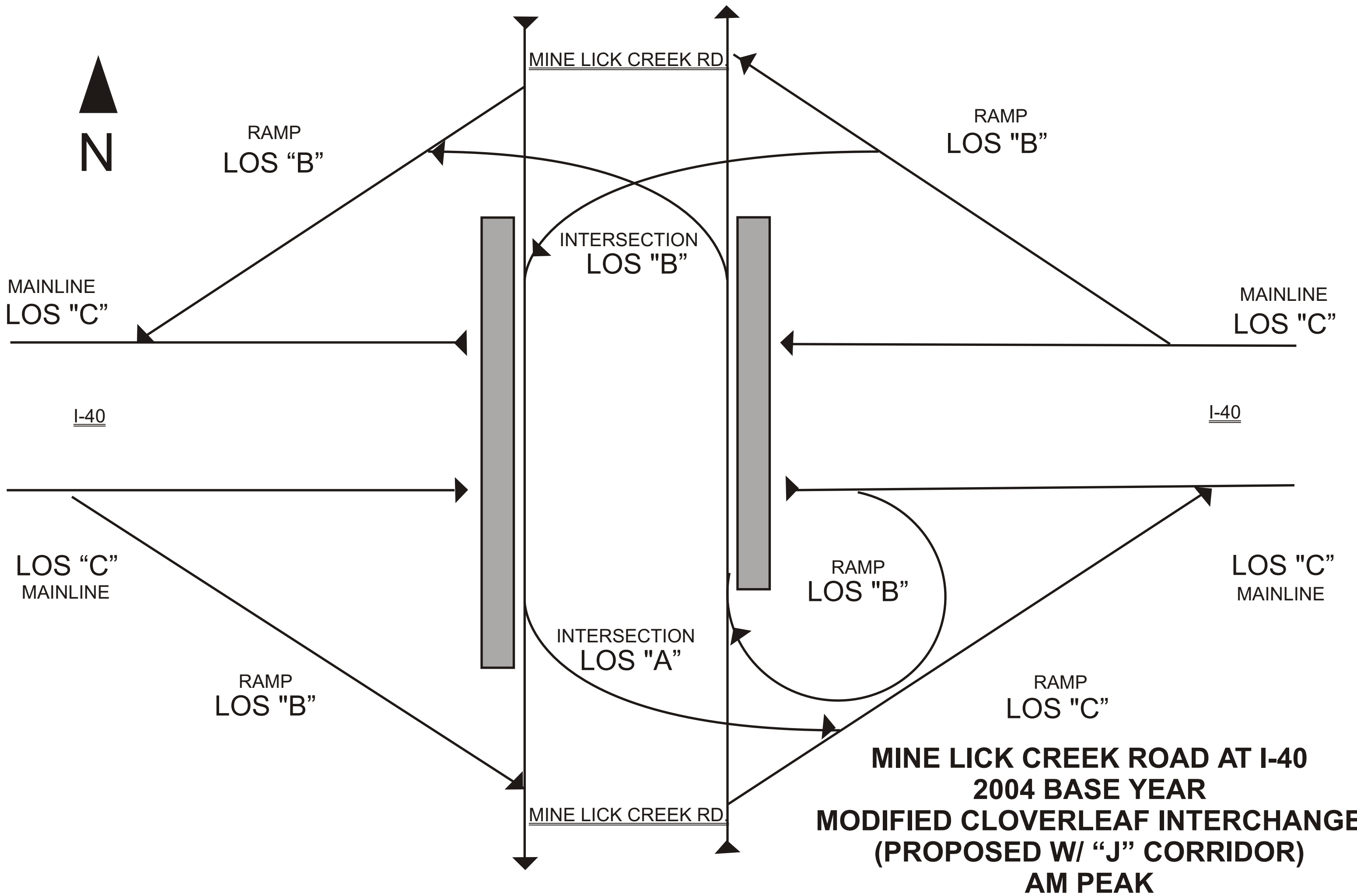
Intermediate speed variable, M = 0.433

Space mean speed in ramp influence area, $S =$ mph

Space mean speed in outer lanes, $S =$ N/A mph

Space mean speed for all vehicles, $S = 57.9$ mph

Modified Cloverleaf Interchange Analysis
Alternates A and B
Mine Lick Creek Road at Interstate 40



TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB I-40 LOOP RAMP (W/ "J")</i>		
Agency/Co.					Jurisdiction			
Date Performed					Analysis Year			
Analysis Time Period	<i>AM 2004</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	244	158	176	172	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	256	166	185	181	0		
Percent Heavy Vehicles	0	--	--	3	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0				0	
Lanes	0	2	1	1	2	0		
Configuration		T	R	L	T			
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	0	0	26		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	0	0	27		
Percent Heavy Vehicles	0	0	0	0	0	3		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	1		
Configuration						R		
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L						R
v (vph)		185						27
C (m) (vph)		1127						947
v/c		0.16						0.03
95% queue length		0.59						0.09
Control Delay		8.8						8.9
LOS		A						A
Approach Delay	--	--				8.9		
Approach LOS	--	--				A		

>

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/1/00</i> Time Period <i>AM PEAK 2004</i>						Intersection <i>WB I-40 @ MINE LICK CREEK RD</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	2	0	0	2	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				80		122	71	242			268	171
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		31				0		43
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08				
Timing	G = 25.0	G =	G =	G =	G = 20.0	G = 30.0	G =	G =				
	Y = 5	Y =	Y =	Y =	Y = 5	Y = 5	Y =	Y =				
Duration of Analysis, T = 0.25						Cycle Length, C = 90.0						
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				84		96	75	255			282	135
Lane group capacity, c				487		436	740	2142			1168	523
v/c ratio, X				0.17		0.22	0.10	0.12			0.24	0.26
Total green ratio, g/C				0.28		0.28	0.61	0.61			0.33	0.33
Uniform delay, d_1				24.7		25.0	7.3	7.3			21.8	21.9
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	1.000
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				0.8		1.2	0.3	0.1			0.5	1.2
Initial queue delay, d_3												
Control delay				25.4		26.2	7.6	7.5			22.2	23.1
Lane group LOS				C		C	A	A			C	C
Approach delay				25.8			7.5			22.5		
Approach LOS				C			A			C		
Intersection delay	17.8						Intersection LOS			B		

BASIC FREEWAY SEGMENTS WORKSHEET																						
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Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB																			
Agency or Company		From/To	WEST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2127 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1271 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	20.2 pc/mi/ln	S	mi/h																			
LOS	C	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																								
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several curves representing different density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points are marked at flow rates of 1300, 1450, 1600, and 1750. A horizontal line for LOS A is shown at approximately 55 mi/h. A legend table is provided to the right of the graph.</p> <table border="1" style="float: right; margin-left: 20px;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D			
Application	Input	Output																						
Operational (LOS)	FFS, N, v_p	LOS, S, D																						
Design (N)	FFS, LOS, v_p	N, S, D																						
Design (v_p)	FFS, LOS, N	v_p , S, D																						
Planning (LOS)	FFS, N, AADT	LOS, S, D																						
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Planning (v_p)	FFS, LOS, N	v_p , S, D																						
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Analyst	JH	Highway/Direction of Travel	EB																					
Agency or Company		From/To	EAST OF MINE LICK CREEK RD																					
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Analysis Time Period	AM PEAK	Analysis Year	2004																					
Project Description																								
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																								
Flow Inputs																								
Volume, V	2366 veh/h	Peak-Hour Factor, PHF	0.95																					
AADT	veh/day	%Trucks and Buses, P_T	25																					
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																					
Peak-Hr Direction Prop, D		General Terrain:	Level																					
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																					
Driver type adjustment	1.00	Up/Down %	0.00																					
Calculate Flow Adjustments																								
f_p	1.00	E_R	1.2																					
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																					
Speed Inputs		Calc Speed Adj and FFS																						
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																					
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																					
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																					
Number of Lanes, N	2	f_N	4.5 mi/h																					
FFS (measured)	mi/h	FFS	63.0 mi/h																					
Base free-flow Speed, BFFS	70.0 mi/h																							
LOS and Performance Measures		Design (N)																						
Operational (LOS)		Design (N)																						
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1413 pc/h/ln	Design LOS																						
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ pc/h																						
$D = v_p / S$	22.4 pc/mi/ln	S mi/h																						
LOS	C	$D = v_p / S$ pc/mi/ln																						
		Required Number of Lanes, N																						
Glossary		Factor Location																						
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																					
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																					
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																					
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<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, 1750, and 2400 pc/h/ln respectively. The Level of Service (LOS) is determined by these flow rates: LOS A (1300-1450), LOS B (1450-1600), LOS C (1600-1750), LOS D (1750-2400), and LOS E (2400+).</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
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Operational (LOS)	FFS, N, v_p	LOS, S, D																				
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Design (v_p)	FFS, LOS, N	v_p , S, D																				
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Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1911 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
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LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1142 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	18.1 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
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Design (v _p)	FFS, LOS, N	v _p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
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<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1871 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P _T	25																			
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Lane Width	12.0 ft	f _{LW}	0.0 mi/h																			
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LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	1118 pc/h/ln	Design LOS																				
S	63.0 mi/h	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	pc/h																			
D = v _p / S	17.7 pc/mi/ln	S	mi/h																			
LOS	B	D = v _p / S	pc/mi/ln																			
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E _R - Exhibits 23-8, 23-10	f _{LW} - Exhibit 23-4																			
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DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM 2004 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO NB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2101	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	69	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	334	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2101	69	334	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	553	18	88	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2510	73	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2510	4800	No
v 12		4400	No
$v = v - v$ FO F R	2437	4800	No
v R	73	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.435$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.8$ mph

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM 2004 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO SB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2127	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	26	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	69	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	Off		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2127	26	69	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	560	7	18	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2541	27	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2541	4800	No
v 12		4400	No
$v = v - v$ FO F R	2514	4800	No
v R	27	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.430$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.9$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
 Nashville, TN 37215

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 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: MINE LICK CREEK RD TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2032	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	334	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	95	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2032	334	95	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	535	88	25	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2428	352	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2780	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.314

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.2 mph

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: WB I-40 TO MINE LICK CREEK RD
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1871	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	202	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	242	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1871	202	242	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	492	53	64	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2235	213	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	2235	4800	No
Fi F			
v		4400	No
12			
$v = v - v$	2022	4800	No
FO F R			
v	213	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.447$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.5$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: MINE LICK CREEK RD TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1669	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	242	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	202	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1669	242	202	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	439	64	53	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	1994	255	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2249	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

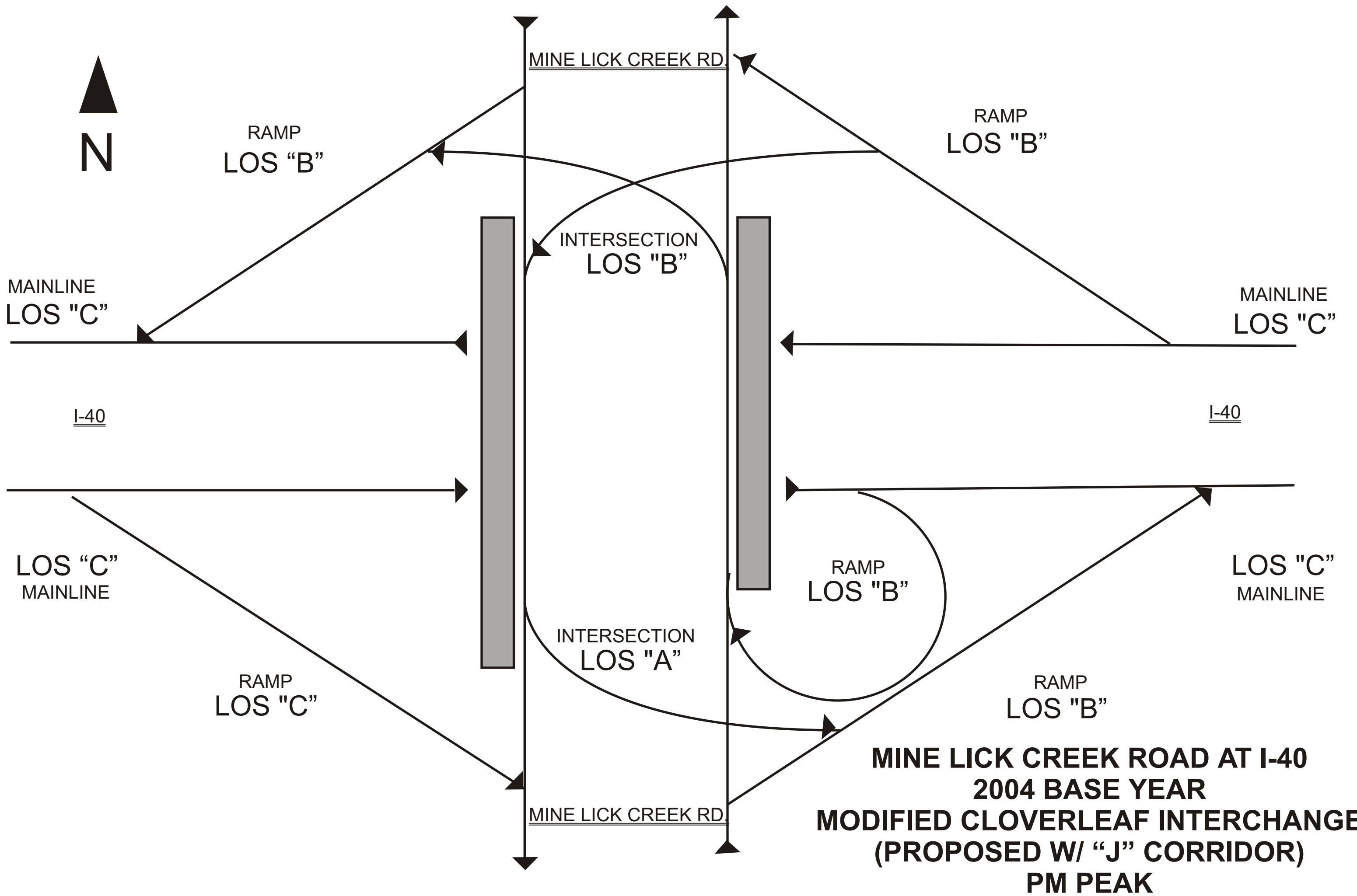
Speed Estimation

Intermediate speed variable, M = 0.288

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.9 mph



**MINE LICK CREEK ROAD AT I-40
2004 BASE YEAR
MODIFIED CLOVERLEAF INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
PM PEAK**

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB I-40 LOOP RAMP (W/ "J")</i>		
Agency/Co.					Jurisdiction			
Date Performed					Analysis Year			
Analysis Time Period	<i>PM 2004</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	106	65	134	346	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	111	68	141	364	0		
Percent Heavy Vehicles	0	--	--	3	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0			0		
Lanes	0	2	1	1	2	0		
Configuration		T	R	L	T			
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	0	0	26		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	0	0	27		
Percent Heavy Vehicles	0	0	0	0	0	3		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	1		
Configuration						R		
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L						R
v (vph)		141						27
C (m) (vph)		1387						826
v/c		0.10						0.03
95% queue length		0.34						0.10
Control Delay		7.9						9.5
LOS		A						A
Approach Delay	--	--				9.5		
Approach LOS	--	--				A		

>

HCS2000™

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Version 4.1c

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/1/00</i> Time Period <i>PM PEAK 2004</i>						Intersection <i>WB I-40 @ MINE LICK CREEK RD</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	2	0	0	2	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				117		188	20	247			363	119
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		47				0		30
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only		02	03	04	NB Only		NS Perm	07	08		
Timing	$G = 25.0$		$G =$	$G =$	$G =$	$G = 20.0$		$G = 30.0$	$G =$	$G =$		
	$Y = 5$		$Y =$	$Y =$	$Y =$	$Y = 5$		$Y = 5$	$Y =$	$Y =$		
Duration of Analysis, $T = 0.25$								Cycle Length, $C = 90.0$				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				123		148	21	260			382	94
Lane group capacity, c				487		436	685	2142			1168	523
v/c ratio, X				0.25		0.34	0.03	0.12			0.33	0.18
Total green ratio, g/C				0.28		0.28	0.61	0.61			0.33	0.33
Uniform delay, d_1				25.2		25.9	7.2	7.4			22.4	21.3
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	1.000
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				1.2		2.1	0.1	0.1			0.7	0.8
Initial queue delay, d_3												
Control delay				26.5		28.0	7.3	7.5			23.2	22.0
Lane group LOS				C		C	A	A			C	C
Approach delay				27.3			7.5			23.0		
Approach LOS				C			A			C		
Intersection delay	19.9						Intersection LOS			B		

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows five Level of Service (LOS) curves: LOS A (75 mi/h), LOS B (70 mi/h), LOS C (65 mi/h), LOS D (60 mi/h), and LOS E (55 mi/h). Density curves are also shown: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Data points are plotted at (1300, 70), (1450, 65), (1600, 60), and (1750, 55).</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB																			
Agency or Company		From/To	WEST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2320 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1386 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	22.0 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB																			
Agency or Company		From/To	EAST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2215 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1323 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	21.0 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB																			
Agency or Company		From/To	WEST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1982 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1184 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	18.8 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB																			
Agency or Company		From/To	EAST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2148 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1283 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	20.4 pc/mi/ln	S	mi/h																			
LOS	C	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM 2004 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO NB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2177	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	161	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	199	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	2177	161	199	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	573	42	52	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2601	169	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2601	4800	No
v 12		4400	No
$v = v - v$ FO F R	2432	4800	No
v R	169	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.443$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.6$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM 2004 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO SB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2320	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	143	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	161	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	Off		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2320	143	161	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	611	38	42	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2772	151	pcph

Estimation of V12 Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)

EQ

$P =$ Using Equation 0

FD

$v = v + (v - v) P =$ pc/h

$12 \quad R \quad F \quad R \quad FD$

Capacity Checks

$v = v$	Actual	Maximum	LOS F?
$F_i \quad F$	2772	4800	No
v		4400	No
12			
$v = v - v$	2621	4800	No
$FO \quad F \quad R$			
v	151	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{12} - 0.009 \frac{L}{D} =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.442$

Space mean speed in ramp influence area, $S = 58$ mph

Space mean speed in outer lanes, $S = N/A$ mph

Space mean speed for all vehicles, $S = 57.6$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 Neel-Schaffer, Inc.
 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: MINE LICK CREEK RD TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2016	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	199	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	304	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2016	199	304	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	531	52	80	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2409	209	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2618	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.304

Space mean speed in ramp influence area, $S_R =$ mph

Space mean speed in outer lanes, $S_0 =$ N/A mph

Space mean speed for all vehicles, S = 61.5 mph

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: WB I-40 TO MINE LICK CREEK RD
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2148	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	305	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	139	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	2148	305	139	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	565	80	37	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2566	321	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	2566	4800	No
Fi F			
v		4400	No
12			
$v = v - v$	2245	4800	No
FO F R			
v	321	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.457$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.2$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: MINE LICK CREEK RD TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1843	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	139	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	305	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1843	139	305	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	485	37	80	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2202	146	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2348	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =$ pc/mi/ln

R R 12 A

Level of service for ramp-freeway junction areas of influence

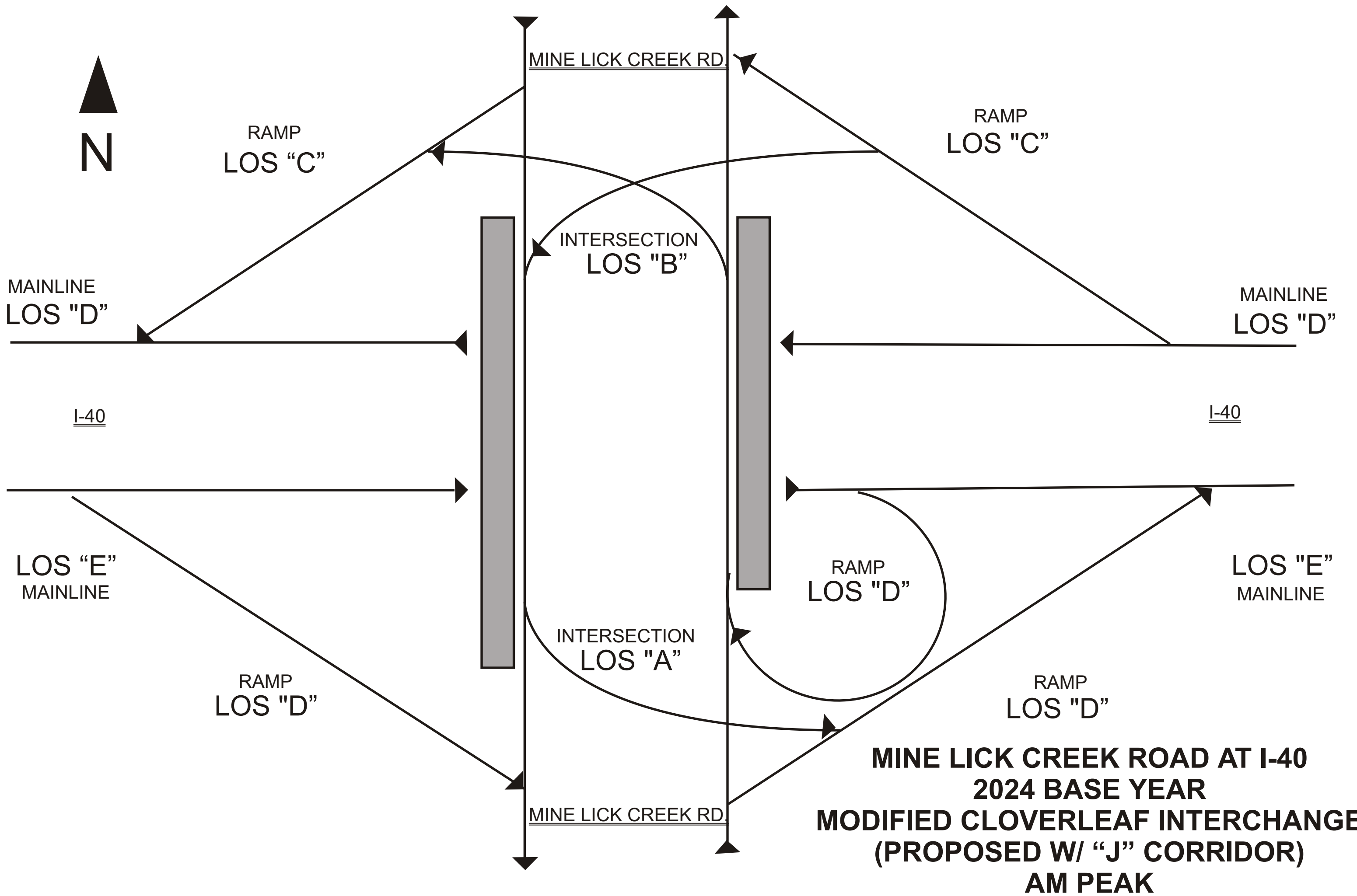
Speed Estimation

Intermediate speed variable, M = 0.292

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.8 mph

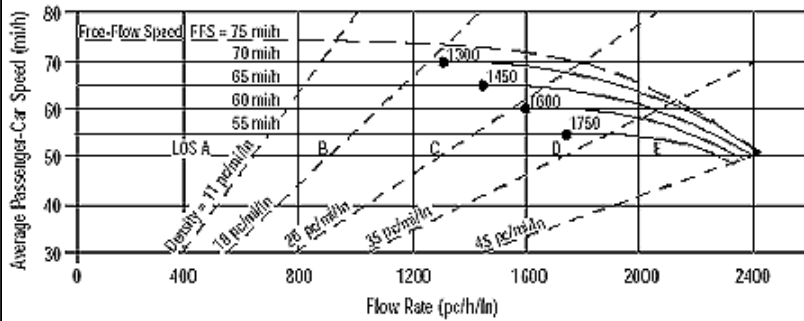


TWO-WAY STOP CONTROL SUMMARY									
General Information					Site Information				
Analyst	<i>JH</i>				Intersection	<i>EB I-40 LOOP RAMP (W/ "J")</i>			
Agency/Co.					Jurisdiction				
Date Performed					Analysis Year				
Analysis Time Period	<i>AM 2024</i>								
Project Description									
East/West Street:					North/South Street:				
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>				
Vehicle Volumes and Adjustments									
Major Street		Northbound			Southbound				
Movement	1	2	3	4	5	6			
	L	T	R	L	T	R			
Volume	0	366	237	264	258	0			
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00			
Hourly Flow Rate, HFR	0	385	249	277	271	0			
Percent Heavy Vehicles	0	--	--	3	--	--			
Median Type	<i>Undivided</i>								
RT Channelized			0			0			
Lanes	0	2	1	1	2	0			
Configuration		T	R	L	T				
Upstream Signal		0			0				
Minor Street		Westbound			Eastbound				
Movement	7	8	9	10	11	12			
	L	T	R	L	T	R			
Volume	0	0	0	0	0	39			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	0.95			
Hourly Flow Rate, HFR	0	0	0	0	0	41			
Percent Heavy Vehicles	0	0	0	0	0	3			
Percent Grade (%)	0			0					
Flared Approach		N			N				
Storage		0			0				
RT Channelized			0			0			
Lanes	0	0	0	0	0	1			
Configuration						R			
Delay, Queue Length, and Level of Service									
Approach	NB	SB	Westbound			Eastbound			
Movement	1	4	7	8	9	10	11	12	
Lane Configuration		L						R	
v (vph)		277						41	
C (m) (vph)		938						885	
v/c		0.30						0.05	
95% queue length		1.24						0.15	
Control Delay		10.4						9.3	
LOS		B						A	
Approach Delay	--	--				9.3			
Approach LOS	--	--				A			

>

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/1/00</i> Time Period <i>AM PEAK 2024</i>						Intersection <i>WB I-40 @ MINE LICK CREEK RD</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	2	0	0	2	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				120		183	106	364			402	256
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		46				0		64
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only		02	03	04	NB Only		NS Perm	07	08		
Timing	$G = 25.0$		$G =$	$G =$	$G =$	$G = 20.0$		$G = 30.0$	$G =$	$G =$		
	$Y = 5$		$Y =$	$Y =$	$Y =$	$Y = 5$		$Y = 5$	$Y =$	$Y =$		
Duration of Analysis, $T = 0.25$								Cycle Length, $C = 90.0$				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				126		144	112	383			423	202
Lane group capacity, c				487		436	664	2142			1168	523
v/c ratio, X				0.26		0.33	0.17	0.18			0.36	0.39
Total green ratio, g/C				0.28		0.28	0.61	0.61			0.33	0.33
Uniform delay, d_1				25.3		25.8	7.7	7.6			22.7	23.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	1.000
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				1.3		2.0	0.5	0.2			0.9	2.1
Initial queue delay, d_3												
Control delay				26.6		27.9	8.3	7.8			23.6	25.1
Lane group LOS				C		C	A	A			C	C
Approach delay				27.3			7.9			24.1		
Approach LOS				C			A			C		
Intersection delay	19.0						Intersection LOS			B		

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	
Date Performed	5/1/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	EB
From/To	WEST OF MINE LICK CREEK RD
Jurisdiction	
Analysis Year	2024

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	3313 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	5
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade	Length
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1979	pc/h/ln
S	60.4	mi/h
$D = v_p / S$	32.8	pc/mi/ln
LOS	D	

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

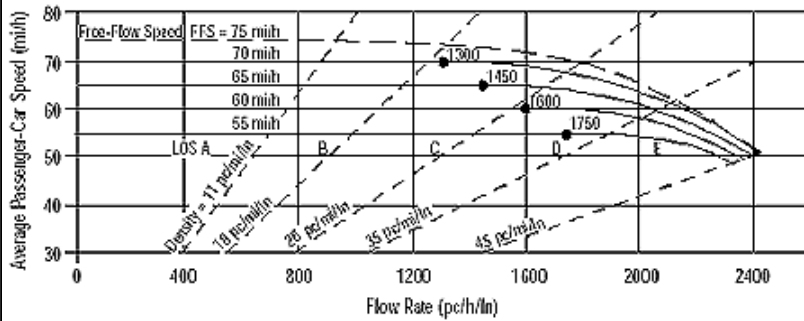
Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	
Date Performed	5/1/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	EB
From/To	EAST OF MINE LICK CREEK RD
Jurisdiction	
Analysis Year	2024

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	3671 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	5
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2193	pc/h/ln
S	56.0	mi/h
$D = v_p / S$	39.1	pc/mi/ln
LOS	E	

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, 1750, and 2400 pc/h/ln respectively. The Level of Service (LOS) is indicated as A, B, C, D, and E for these points.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB																			
Agency or Company		From/To	WEST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3143 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1878 pc/h/ln	Design LOS																				
S	61.6 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	30.5 pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
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Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB																			
Agency or Company		From/To	EAST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3084 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1842 pc/h/ln	Design LOS																				
S	61.9 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	29.7 pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

Jeff Hammond
 Neel-Schaffer, Inc.
 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM 2024 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO NB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3274	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	104	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	501	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3274	104	501	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	862	27	132	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3912	109	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3912	4800	No
v 12		4400	No
$v = v - v$ FO F R	3803	4800	No
v R	109	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.438$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.7$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM 2024 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO SB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3313	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	39	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	104	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	Off		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3313	39	104	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	872	10	27	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3958	41	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3958	4800	No
v 12		4400	No
$v = v - v$ FO F R	3917	4800	No
v R	41	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.432$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.9$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: MINE LICK CREEK RD TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3170	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	501	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	143	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	3170	501	143	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	834	132	38	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3787	527	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v \left(\frac{P}{F} \right) =$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v FO	4314	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.542

Space mean speed in ramp influence area, $S =$ mph

Space mean speed in outer lanes, $S =$ N/A mph

Space mean speed for all vehicles, $S = 54.8$ mph

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: WB I-40 TO MINE LICK CREEK RD
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3084	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	303	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	303	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3084	303	303	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	812	80	80	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3685	319	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3685	4800	No
Fi F			
v		4400	No
12			
$v = v - v$	3366	4800	No
FO F R			
v	319	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.457$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.2$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: MINE LICK CREEK RD TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2781	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	362	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	303	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2781	362	303	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	732	95	80	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3323	381	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3704	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

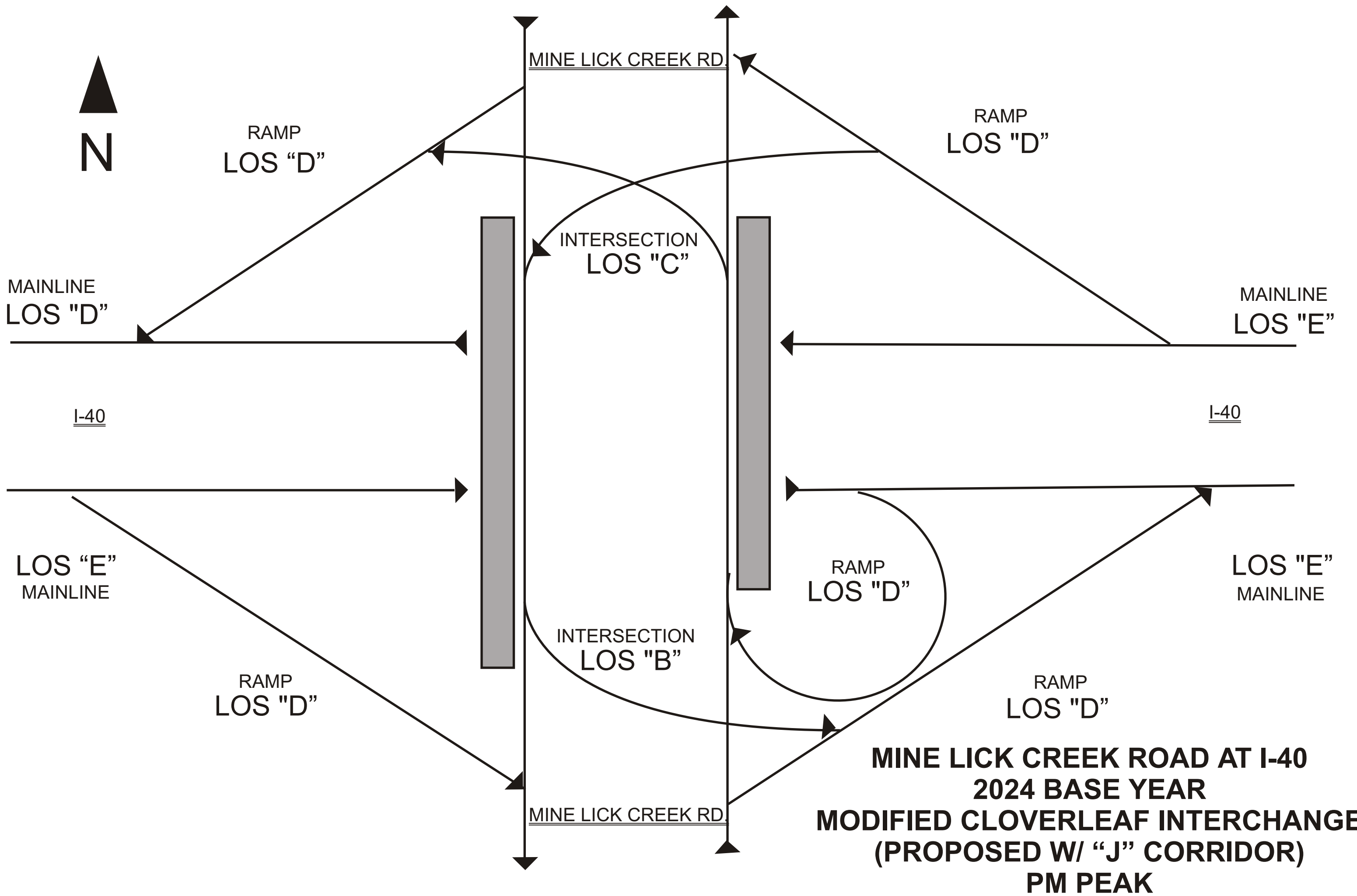
Speed Estimation

Intermediate speed variable, M = 0.409

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 58.5 mph



**MINE LICK CREEK ROAD AT I-40
2024 BASE YEAR
MODIFIED CLOVERLEAF INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
PM PEAK**

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB I-40 LOOP RAMP (W/ "J")</i>		
Agency/Co.					Jurisdiction			
Date Performed					Analysis Year			
Analysis Time Period	<i>PM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	158	98	191	550	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	166	103	201	578	0		
Percent Heavy Vehicles	0	--	--	3	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0			0		
Lanes	0	2	1	1	2	0		
Configuration		T	R	L	T			
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	0	0	214		
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	0	0	225		
Percent Heavy Vehicles	0	0	0	0	0	3		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	1		
Configuration						R		
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L						R
v (vph)		201						225
C (m) (vph)		1284						705
v/c		0.16						0.32
95% queue length		0.55						1.37
Control Delay		8.3						12.5
LOS		A						B
Approach Delay	--	--				12.5		
Approach LOS	--	--				B		

>

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Version 4.1c

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/1/00</i> Time Period <i>PM PEAK 2024</i>						Intersection <i>WB I-40 @ MINE LICK CREEK RD</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	2	0	0	2	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				185		282	41	359			556	178
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		71				0		45
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08				
Timing	G = 25.0	G =	G =	G =	G = 20.0	G = 30.0	G =	G =				
	Y = 5	Y =	Y =	Y =	Y = 5	Y = 5	Y =	Y =				
Duration of Analysis, T = 0.25						Cycle Length, C = 90.0						
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				195		222	43	378			585	140
Lane group capacity, c				487		436	589	2142			1168	523
v/c ratio, X				0.40		0.51	0.07	0.18			0.50	0.27
Total green ratio, g/C				0.28		0.28	0.61	0.61			0.33	0.33
Uniform delay, d_1				26.4		27.3	7.9	7.6			24.0	22.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	1.000
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				2.4		4.2	0.2	0.2			1.5	1.3
Initial queue delay, d_3												
Control delay				28.9		31.5	8.1	7.8			25.5	23.2
Lane group LOS				C		C	A	A			C	C
Approach delay				30.3			7.8			25.1		
Approach LOS				C			A			C		
Intersection delay	21.8						Intersection LOS			C		

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB																			
Agency or Company		From/To	WEST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3710 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2216 pc/h/ln	Design LOS																				
S	55.4 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	40.0 pc/mi/ln	S																				
LOS	E	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several dashed curves representing different flow rates: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Points A through F are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, and 1750 pc/h/ln. A legend for 'Free-Flow Speed' lists values: 75 mi/h, 70 mi/h, 65 mi/h, 60 mi/h, and 55 mi/h. A 'LOS A' label is also present.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB																			
Agency or Company		From/To	EAST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3543 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2116 pc/h/ln	Design LOS																				
S	57.9 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	36.6 pc/mi/ln	S	mi/h																			
LOS	E	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Points are marked at flow rates of 1300, 1450, 1600, and 1750. Regions A through F are delineated by dashed lines representing different levels of service (LOS).</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB																			
Agency or Company		From/To	WEST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3194 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1908 pc/h/ln	Design LOS																				
S	61.3 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	31.1 pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points are plotted at flow rates of 1300, 1450, 1600, and 1750 pc/h/ln, corresponding to different Levels of Service (LOS) A through E.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB																			
Agency or Company		From/To	EAST OF MINE LICK CREEK RD																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3442 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	5																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.881																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2056 pc/h/ln	Design LOS																				
S	59.1 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	34.8 pc/mi/ln	S	mi/h																			
LOS	D	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM 2024 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO NB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3496	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	242	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	289	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3496	242	289	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	920	64	76	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4177	255	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4177	4800	No
v 12		4400	No
$v = v - v$ FO F R	3922	4800	No
v R	255	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{12} - 0.009 \frac{L}{D} =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.451$

Space mean speed in ramp influence area, $S = 57$ mph

Space mean speed in outer lanes, $S = N/A$ mph

Space mean speed for all vehicles, $S = 57.4$ mph

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM 2024 (W/ LOOP W/ "J")
 Freeway/dir or travel: EB I-40 TO SB MINE LICK CREEK
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3710	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	214	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	242	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	Off		
Distance to adjacent ramp	1000	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	3710	214	242	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	976	56	64	v
Trucks and buses	23	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.889	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4393	225	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

v = v	Actual	Maximum	LOS F?
Fi F	4393	4800	No
v		4400	No
12			
v = v - v	4168	4800	No
FO F R			
v	225	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.448$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.4$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: MINE LICK CREEK RD TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3254	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	289	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	456	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3254	289	456	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	856	76	120	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3888	304	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	4192	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.509

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 55.7 mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: WB I-40 TO MINE LICK CREEK RD
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3442	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	467	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	219	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	3442	467	219	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	906	123	58	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4112	492	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4112	4800	No
v 12		4400	No
$v = v - v$ FO F R	3620	4800	No
v R	492	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.472$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.8$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

Jeff Hammond
 Neel-Schaffer, Inc.
 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: MINE LICK CREEK RD TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2975	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	219	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	467	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2975	219	467	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	783	58	123	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3554	231	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3785	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =$ pc/mi/ln

R R 12 A

Level of service for ramp-freeway junction areas of influence

Speed Estimation

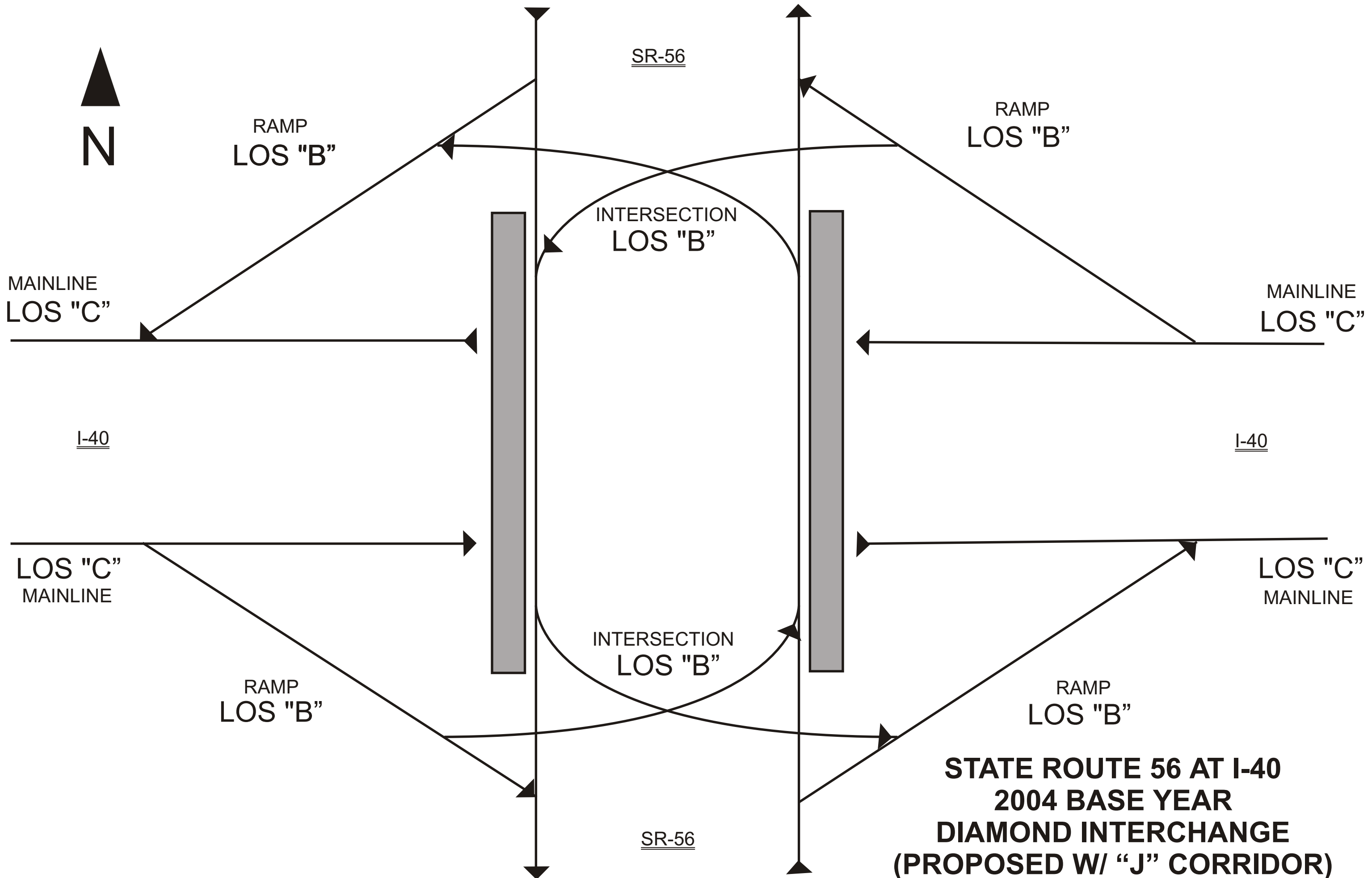
Intermediate speed variable, M = 0.423

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 58.2 mph

Proposed Conditions Analysis
State Route 56 (Baxter Road)
At Interstate 40



**STATE ROUTE 56 AT I-40
 2004 BASE YEAR
 DIAMOND INTERCHANGE
 (PROPOSED W/ "J" CORRIDOR)
 AM PEAK**

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB RAMPS @ SR-56</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>AM 2004</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	39	75	112	45	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	41	78	117	47	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	48	0	12		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	50	0	12		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		3			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT					LR	
v (vph)		117					62	
C (m) (vph)		1451					633	
v/c		0.08					0.10	
95% queue length		0.26					0.32	
Control Delay		7.7					11.3	
LOS		A					B	
Approach Delay	--	--					11.3	
Approach LOS	--	--					B	

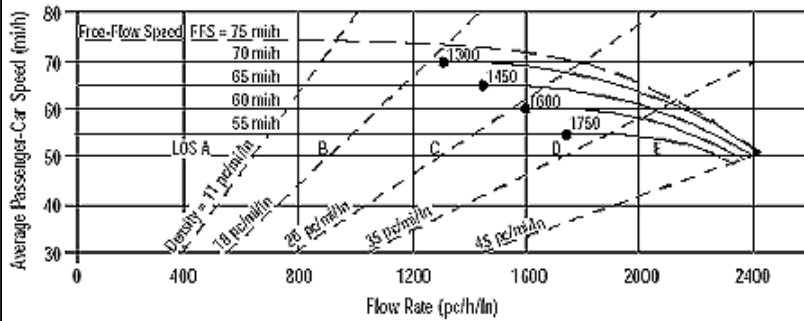
>

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>WB RAMPS @ SR-56</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>AM 2004</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	33	54	0	0	118	112		
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95		
Hourly Flow Rate, HFR	34	56	0	0	124	0		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0				0	
Lanes	0	1	0	0	1	0		
Configuration	<i>LT</i>				<i>T</i>			
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	39	0	77	0	0	0		
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR	41	0	0	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)	0			0				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		0			3			
RT Channelized			0				0	
Lanes	1	0	0	0	0	0		
Configuration	<i>L</i>							
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>		<i>L</i>					
v (vph)	34		41					
C (m) (vph)	1444		717					
v/c	0.02		0.06					
95% queue length	0.07		0.18					
Control Delay	7.6		10.3					
LOS	<i>A</i>		<i>B</i>					
Approach Delay	--	--	10.3					
Approach LOS	--	--	<i>B</i>					

>

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows five Level of Service (LOS) curves: LOS A (top), LOS B, LOS C, LOS D, and LOS E (bottom). Dashed lines represent density levels: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Specific flow rate points are marked: 1300, 1450, 1600, and 1750. A legend table is located to the right of the graph.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2000 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1199 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	19.0 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	EB I-40
From/To	EAST OF SR-56
Jurisdiction	
Analysis Year	2004

Project Description

- Oper.(LOS) Des.(N) Planning Data

Flow Inputs

Volume, V	2127 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade	Length
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1275	pc/h/ln
S	63.0	mi/h
$D = v_p / S$	20.2	pc/mi/ln
LOS	C	

Design (N)

Design (N)		
Design LOS		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$		pc/h
S		mi/h
$D = v_p / S$		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Regions A through F are marked, corresponding to different levels of service (LOS). A table of Free-Flow Speed (FFS) values is provided: 75 mi/h, 70 mi/h, 65 mi/h, 60 mi/h, and 55 mi/h.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1940 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1163 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	18.5 pc/mi/ln	S	mi/h																			
LOS	C	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1911 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1146 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	18.2 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2000	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	60	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	187	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2000	60	187	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	526	16	49	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2398	63	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2398	4800	No
v 12		4400	No
$v = v - v$ FO F R	2335	4800	No
v R	63	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.434$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.9$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
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 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-56 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1940	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	187	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	60	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1940	187	60	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	511	49	16	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2326	197	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2523	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.300

Space mean speed in ramp influence area, $S_R =$ mph

Space mean speed in outer lanes, $S_0 =$ N/A mph

Space mean speed for all vehicles, S = 61.6 mph

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1911	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	116	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	145	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	1911	116	145	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	503	31	38	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2291	122	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2291	4800	No
v 12		4400	No
$v = v - v$ FO F R	2169	4800	No
v R	122	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.439$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.7$ mph

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 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-56 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1795	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	145	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	116	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1795	145	116	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	472	38	31	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2152	153	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2305	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =$ pc/mi/ln

R R 12 A

Level of service for ramp-freeway junction areas of influence

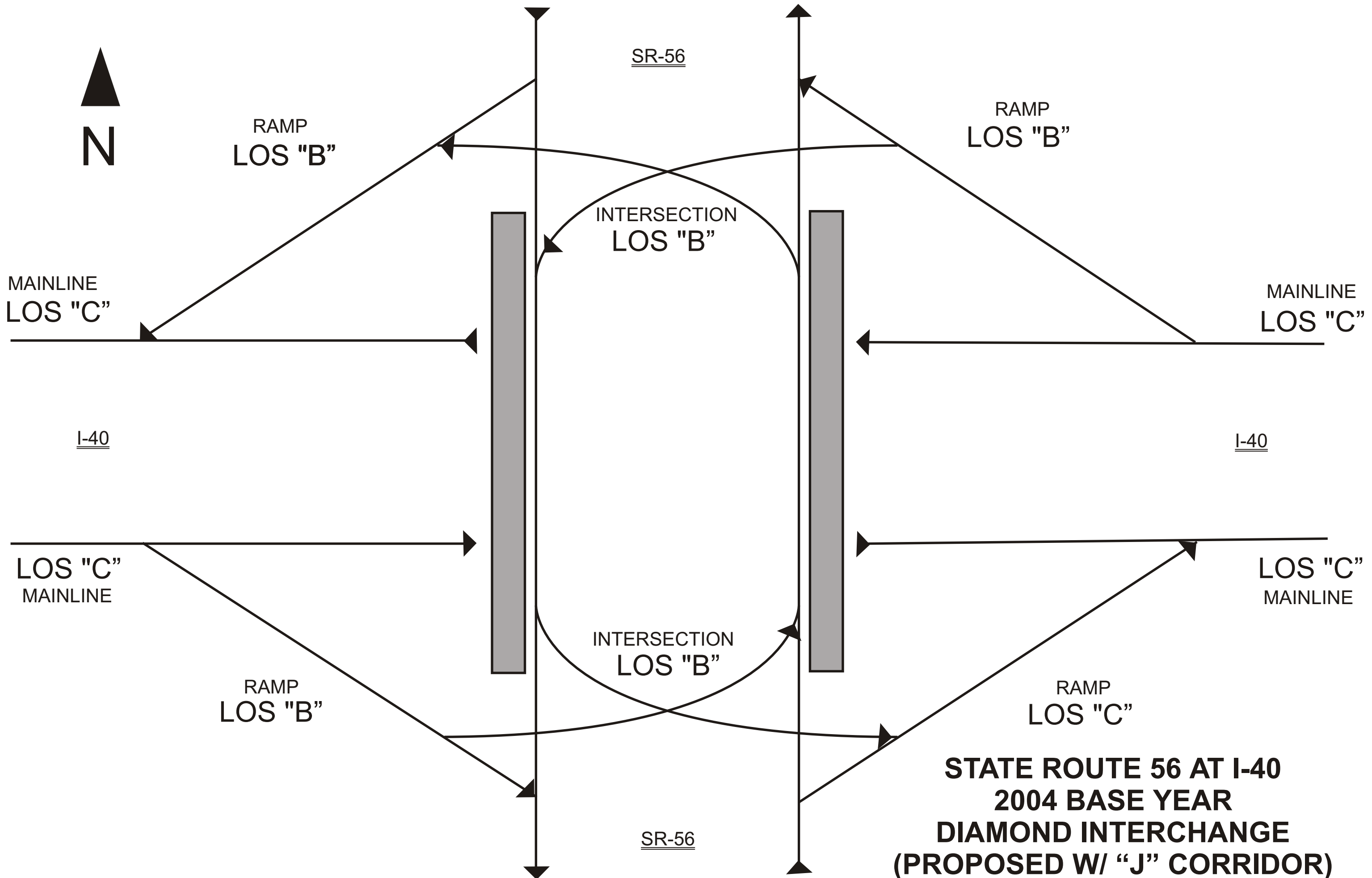
Speed Estimation

Intermediate speed variable, M = 0.290

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.9 mph



SR-56

RAMP
LOS "B"

RAMP
LOS "B"

MAINLINE
LOS "C"

MAINLINE
LOS "C"

INTERSECTION
LOS "B"

I-40

I-40

LOS "C"
MAINLINE

LOS "C"
MAINLINE

INTERSECTION
LOS "B"

RAMP
LOS "B"

RAMP
LOS "C"

**STATE ROUTE 56 AT I-40
2004 BASE YEAR
DIAMOND INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
PM PEAK**

SR-56

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB RAMPS @ SR-56</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>PM 2004</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	18	31	72	74	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	18	32	75	77	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	117	0	66		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	123	0	69		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		3			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT					LR	
v (vph)		75					192	
C (m) (vph)		1537					768	
v/c		0.05					0.25	
95% queue length		0.15					0.99	
Control Delay		7.5					11.2	
LOS		A					B	
Approach Delay	--	--					11.2	
Approach LOS	--	--					B	

>

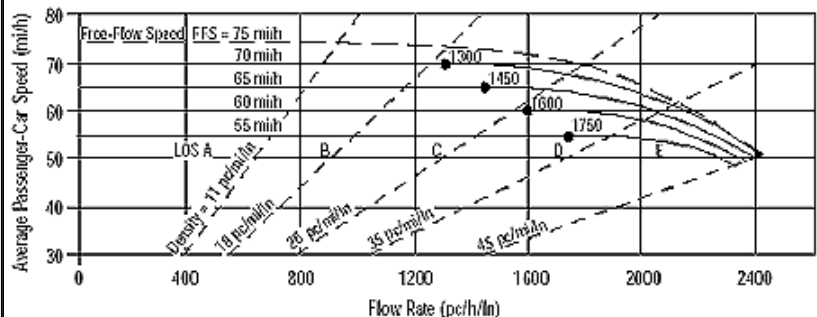
TWO-WAY STOP CONTROL SUMMARY									
General Information					Site Information				
Analyst	JH				Intersection	WB RAMPS @ SR-56			
Agency/Co.					Jurisdiction				
Date Performed	4/5/00				Analysis Year				
Analysis Time Period	PM 2004								
Project Description									
East/West Street:					North/South Street:				
Intersection Orientation: North-South					Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments									
Major Street		Northbound			Southbound				
Movement	1	2	3	4	5	6			
	L	T	R	L	T	R			
Volume	9	126	0	0	91	83			
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95			
Hourly Flow Rate, HFR	9	132	0	0	95	0			
Percent Heavy Vehicles	5	--	--	0	--	--			
Median Type	Undivided								
RT Channelized			0					0	
Lanes	0	1	0	0	1	0			
Configuration	LT				T				
Upstream Signal		0			0				
Minor Street		Westbound			Eastbound				
Movement	7	8	9	10	11	12			
	L	T	R	L	T	R			
Volume	39	0	77	0	0	0			
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00			
Hourly Flow Rate, HFR	41	0	0	0	0	0			
Percent Heavy Vehicles	5	0	5	0	0	0			
Percent Grade (%)	0			0					
Flared Approach		N			N				
Storage		0			3				
RT Channelized			0					0	
Lanes	1	0	0	0	0	0			
Configuration	L								
Delay, Queue Length, and Level of Service									
Approach	NB	SB	Westbound			Eastbound			
Movement	1	4	7	8	9	10	11	12	
Lane Configuration	LT		L						
v (vph)	9		41						
C (m) (vph)	1480		733						
v/c	0.01		0.06						
95% queue length	0.02		0.18						
Control Delay	7.4		10.2						
LOS	A		B						
Approach Delay	--	--	10.2						
Approach LOS	--	--	B						

>

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Version 4.1c

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2400 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1439 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	22.8 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2320 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1391 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	22.1 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several curves representing different traffic conditions: <ul style="list-style-type: none"> Free-Flow Speed: FFS = 75 mi/h Curves for 70, 65, 60, and 55 mi/h. Density curves: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph. </p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1900 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1139 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	18.1 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows five Level of Service (LOS) regions: LOS A (v_p > 65), LOS B (55 < v_p < 65), LOS C (45 < v_p < 55), LOS D (35 < v_p < 45), and LOS E (v_p < 35). Dashed lines represent density curves: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Data points are plotted at (1300, 70), (1450, 65), (1600, 60), and (1750, 55).</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v _p	LOS, S, D	Design (N)	FFS, LOS, v _p	N, S, D	Design (v _p)	FFS, LOS, N	v _p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v _p)	FFS, LOS, N	v _p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v _p	LOS, S, D																				
Design (N)	FFS, LOS, v _p	N, S, D																				
Design (v _p)	FFS, LOS, N	v _p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v _p)	FFS, LOS, N	v _p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1982 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P _T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P _R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f _p	1.00	E _R	1.2																			
E _T	1.5	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f _{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f _{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f _{ID}	2.5 mi/h																			
Number of Lanes, N	2	f _N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	1188 pc/h/ln	Design LOS																				
S	63.0 mi/h	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)																				
D = v _p / S	18.9 pc/mi/ln	S																				
LOS	C	D = v _p / S																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E _R - Exhibits 23-8, 23-10	f _{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E _T - Exhibits 23-8, 23-10, 23-11	f _{LC} - Exhibit 23-5																			
v _p - Flow rate	FFS - Free-flow speed	f _p - Page 23-12	f _N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v _p - Exhibits 23-2, 23-3	f _{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2400	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	183	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	103	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2400	183	103	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	632	48	27	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2877	193	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2877	4800	No
v 12		4400	No
$v = v - v$ FO F R	2684	4800	No
v R	193	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.445$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.5$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-56 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2217	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	103	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	183	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2217	103	183	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	583	27	48	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2658	108	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2766	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.313

Space mean speed in ramp influence area, $S_R =$ mph

Space mean speed in outer lanes, $S_0 =$ N/A mph

Space mean speed for all vehicles, S = 61.2 mph

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1982	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	174	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	92	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1982	174	92	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	522	46	24	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2376	183	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2376	4800	No
v 12		4400	No
$v = v - v$ FO F R	2193	4800	No
v R	183	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.444$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.6$ mph

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 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-56 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1808	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	92	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	174	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1808	92	174	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	476	24	46	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2168	97	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2265	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

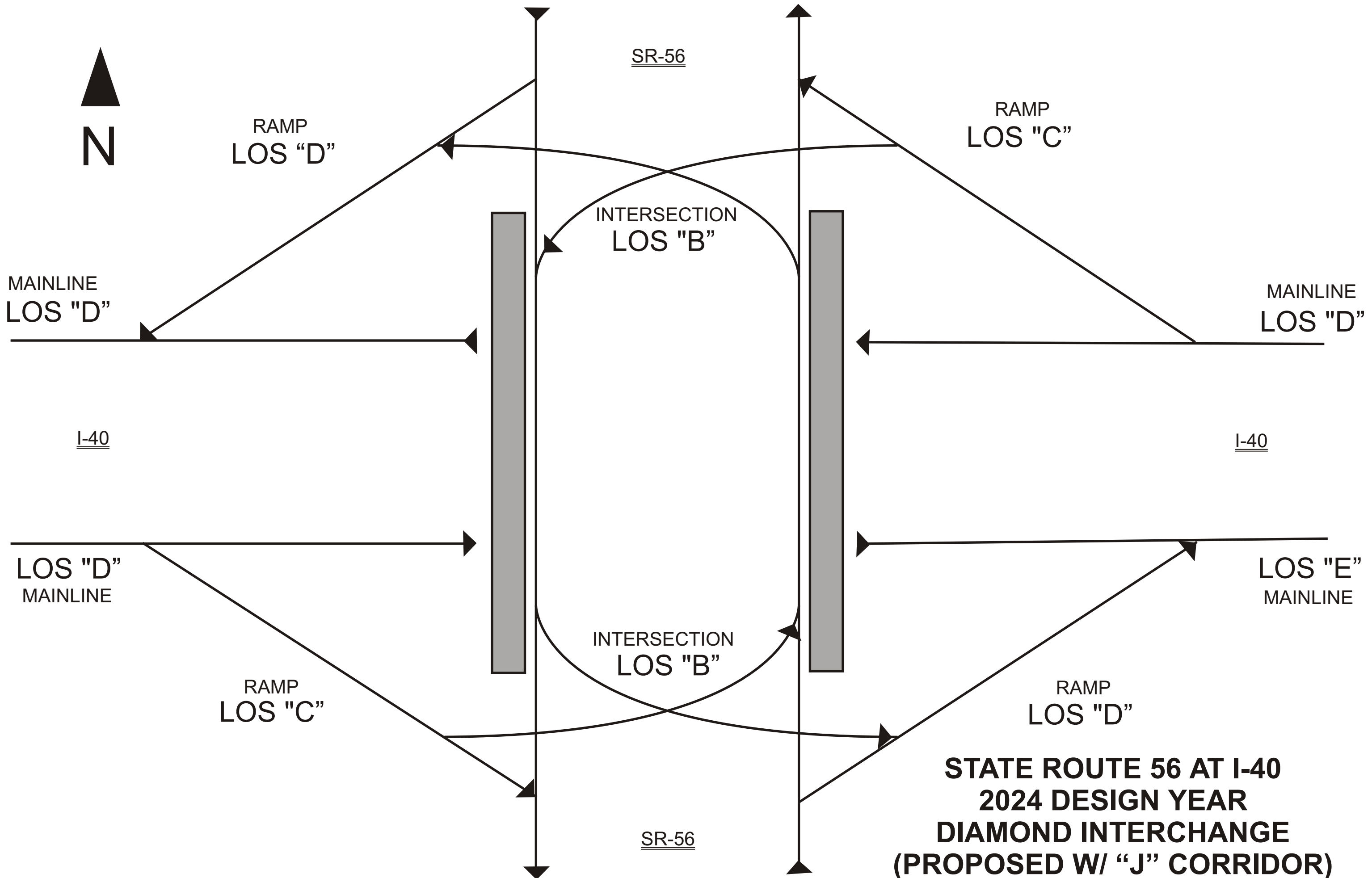
Speed Estimation

Intermediate speed variable, M = 0.289

Space mean speed in ramp influence area, $S_R =$ mph

Space mean speed in outer lanes, $S_0 =$ N/A mph

Space mean speed for all vehicles, S = 61.9 mph



SR-56

RAMP
LOS "D"

RAMP
LOS "C"

INTERSECTION
LOS "B"

MAINLINE
LOS "D"

MAINLINE
LOS "D"

I-40

I-40

LOS "D"
MAINLINE

LOS "E"
MAINLINE

INTERSECTION
LOS "B"

RAMP
LOS "C"

RAMP
LOS "D"

**STATE ROUTE 56 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
AM PEAK**

SR-56

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB RAMPS @ SR-56</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>AM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	56	112	168	63	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	58	117	176	66	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	72	0	18		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	75	0	18		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		3			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT					LR	
v (vph)		176					93	
C (m) (vph)		1383					491	
v/c		0.13					0.19	
95% queue length		0.44					0.69	
Control Delay		8.0					14.0	
LOS		A					B	
Approach Delay	--	--				14.0		
Approach LOS	--	--				B		

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Version 4.1c

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>WB RAMPS @ SR-56</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>AM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	<i>50</i>	<i>78</i>	<i>0</i>	<i>0</i>	<i>173</i>	<i>168</i>		
Peak-Hour Factor, PHF	<i>0.95</i>	<i>0.95</i>	<i>1.00</i>	<i>1.00</i>	<i>0.95</i>	<i>0.95</i>		
Hourly Flow Rate, HFR	<i>52</i>	<i>82</i>	<i>0</i>	<i>0</i>	<i>182</i>	<i>0</i>		
Percent Heavy Vehicles	<i>5</i>	--	--	<i>0</i>	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			<i>0</i>				<i>0</i>	
Lanes	<i>0</i>	<i>1</i>	<i>0</i>	<i>0</i>	<i>1</i>	<i>0</i>		
Configuration	<i>LT</i>				<i>T</i>			
Upstream Signal		<i>0</i>			<i>0</i>			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	<i>58</i>	<i>0</i>	<i>112</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Peak-Hour Factor, PHF	<i>0.95</i>	<i>1.00</i>	<i>0.95</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>		
Hourly Flow Rate, HFR	<i>61</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Percent Heavy Vehicles	<i>5</i>	<i>0</i>	<i>5</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Percent Grade (%)	<i>0</i>			<i>0</i>				
Flared Approach		<i>N</i>			<i>N</i>			
Storage		<i>0</i>			<i>3</i>			
RT Channelized			<i>0</i>			<i>0</i>		
Lanes	<i>1</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>		
Configuration	<i>L</i>							
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>		<i>L</i>					
v (vph)	<i>52</i>		<i>61</i>					
C (m) (vph)	<i>1375</i>		<i>602</i>					
v/c	<i>0.04</i>		<i>0.10</i>					
95% queue length	<i>0.12</i>		<i>0.34</i>					
Control Delay	<i>7.7</i>		<i>11.7</i>					
LOS	<i>A</i>		<i>B</i>					
Approach Delay	--	--	<i>11.7</i>					
Approach LOS	--	--	<i>B</i>					

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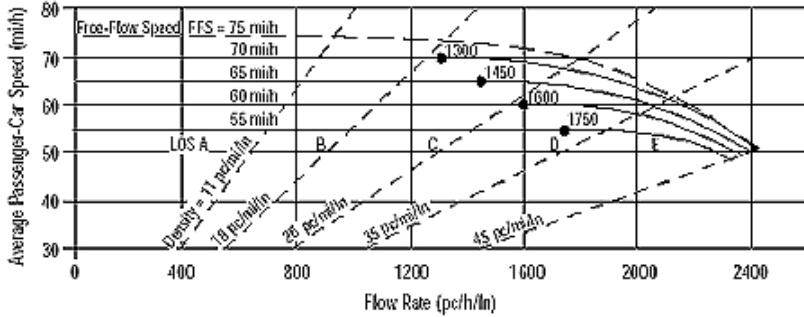
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Version 4.1c

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows five Level of Service (LOS) curves: LOS A (55 mi/h), LOS B (60 mi/h), LOS C (65 mi/h), LOS D (70 mi/h), and LOS E (75 mi/h). Dashed lines represent density curves: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Data points are plotted at flow rates of 1300, 1450, 1600, and 1750 pc/h/ln.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3123 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1872 pc/h/ln	Design LOS																				
S	61.7 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	30.4 pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	EB I-40
From/To	EAST OF SR-56
Jurisdiction	
Analysis Year	2024

Project Description

Oper.(LOS) Des.(N) Planning Data

Flow Inputs

Volume, V	3313 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade	Length
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1986	pc/h/ln
S	60.3	mi/h
$D = v_p / S$	33.0	pc/mi/ln
LOS	D	

Design (N)

Design (N)		
Design LOS		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$		pc/h
S		mi/h
$D = v_p / S$		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, 1750, and 2400 pc/h/ln respectively. The Level of Service (LOS) is indicated as A, B, C, D, and E for these flow rates.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3191 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1913 pc/h/ln	Design LOS																				
S	61.2 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	31.2 pc/mi/ln	S	mi/h																			
LOS	D	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3143 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1884 pc/h/ln	Design LOS																				
S	61.5 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	30.6 pc/mi/ln	S	mi/h																			
LOS	D	$D = v_p / S$	pc/mi/ln																			
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
 Nashville, TN 37215

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3123	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	90	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	280	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3123	90	280	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	822	24	74	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3744	95	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3744	4800	No
v 12		4400	No
$v = v - v$ FO F R	3649	4800	No
v R	95	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.437$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.8$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
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Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-56 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3033	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	280	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	90	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3033	280	90	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	798	74	24	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3636	295	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3931	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.450

Space mean speed in ramp influence area, $S =$ mph

Space mean speed in outer lanes, $S =$ N/A mph

Space mean speed for all vehicles, $S = 57.4$ mph

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3143	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	170	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	218	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	3143	170	218	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	827	45	57	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3768	179	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3768	4800	No
v 12		4400	No
$v = v - v$ FO F R	3589	4800	No
v R	179	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.444$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.6$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-56 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2973	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	218	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	170	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2973	218	170	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	782	57	45	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3564	229	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3793	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

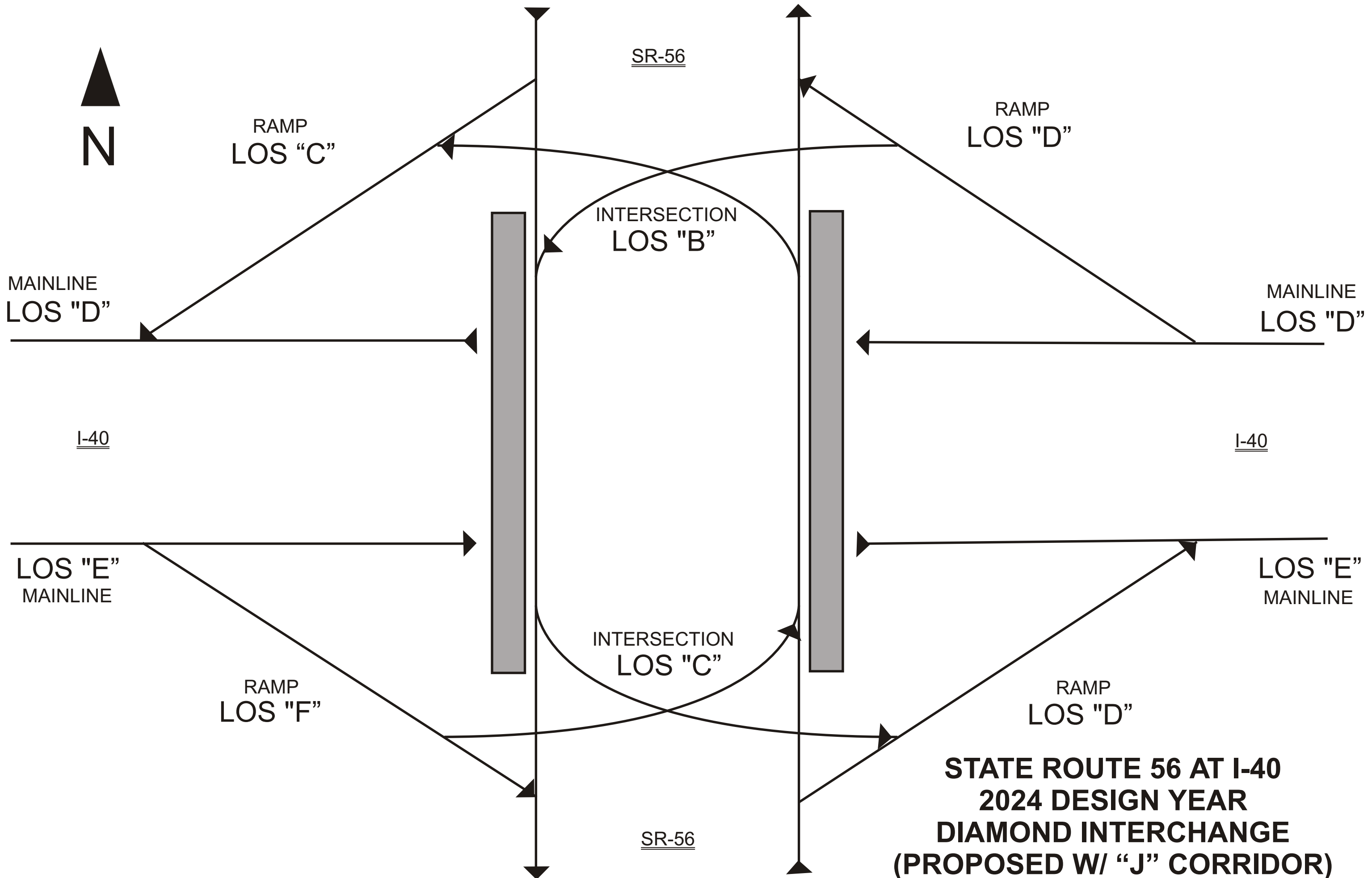
Speed Estimation

Intermediate speed variable, M = 0.424

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 58.1 mph



**STATE ROUTE 56 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
PM PEAK**

TWO-WAY STOP CONTROL SUMMARY								
General Information					Site Information			
Analyst	<i>JH</i>				Intersection	<i>EB RAMPS @ SR-56</i>		
Agency/Co.					Jurisdiction			
Date Performed	<i>4/5/00</i>				Analysis Year			
Analysis Time Period	<i>PM 2024</i>							
Project Description								
East/West Street:					North/South Street:			
Intersection Orientation: <i>North-South</i>					Study Period (hrs): <i>0.25</i>			
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume	0	28	46	122	118	0		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR	0	29	48	128	124	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	<i>Undivided</i>							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street		Westbound			Eastbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume	0	0	0	176	0	99		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR	0	0	0	185	0	104		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		3			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT					LR	
v (vph)		128					289	
C (m) (vph)		1503					621	
v/c		0.09					0.47	
95% queue length		0.28					2.47	
Control Delay		7.6					15.7	
LOS		A					C	
Approach Delay	--	--					15.7	
Approach LOS	--	--					C	

>

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TWO-WAY STOP CONTROL SUMMARY									
General Information					Site Information				
Analyst	JH				Intersection	WB RAMPS @ SR-56			
Agency/Co.					Jurisdiction				
Date Performed	4/5/00				Analysis Year				
Analysis Time Period	PM 2024								
Project Description									
East/West Street:					North/South Street:				
Intersection Orientation: North-South					Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments									
Major Street		Northbound			Southbound				
Movement	1	2	3	4	5	6			
	L	T	R	L	T	R			
Volume	13	191	0	0	156	124			
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95			
Hourly Flow Rate, HFR	13	201	0	0	164	0			
Percent Heavy Vehicles	5	--	--	0	--	--			
Median Type	Undivided								
RT Channelized			0				0		
Lanes	0	1	0	0	1	0			
Configuration	LT				T				
Upstream Signal		0			0				
Minor Street		Westbound			Eastbound				
Movement	7	8	9	10	11	12			
	L	T	R	L	T	R			
Volume	84	0	178	0	0	0			
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00			
Hourly Flow Rate, HFR	88	0	0	0	0	0			
Percent Heavy Vehicles	5	0	5	0	0	0			
Percent Grade (%)	0			0					
Flared Approach		N			N				
Storage		0			3				
RT Channelized			0			0			
Lanes	1	0	0	0	0	0			
Configuration	L								
Delay, Queue Length, and Level of Service									
Approach	NB	SB	Westbound			Eastbound			
Movement	1	4	7	8	9	10	11	12	
Lane Configuration	LT		L						
v (vph)	13		88						
C (m) (vph)	1396		601						
v/c	0.01		0.15						
95% queue length	0.03		0.51						
Control Delay	7.6		12.0						
LOS	A		B						
Approach Delay	--	--	12.0						
Approach LOS	--	--	B						

>

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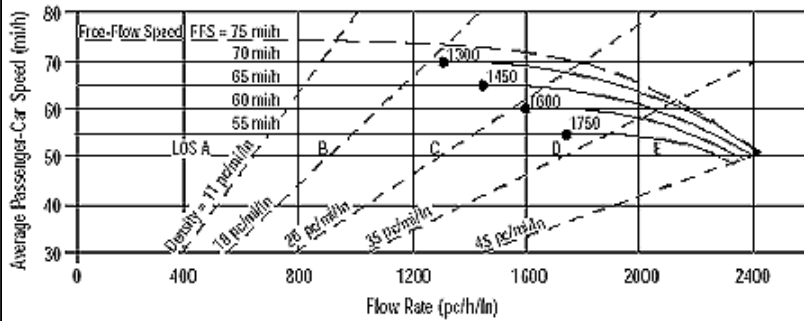
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Version 4.1c

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h is labeled 'Free-Flow Speed'. Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points are plotted at flow rates of 1300, 1450, 1600, and 1750. Vertical lines indicate Level of Service (LOS) A through E.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3817 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2288 pc/h/ln	Design LOS																				
S	53.2 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	43.0 pc/mi/ln	S	mi/h																			
LOS	E	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3710 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2224 pc/h/ln	Design LOS																				
S	55.2 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ pc/h																				
$D = v_p / S$	40.3 pc/mi/ln	S mi/h																				
LOS	E	$D = v_p / S$ pc/mi/ln																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/1/00
Analysis Time Period	PM PEAK

Site Information

Highway/Direction of Travel	WB I-40
From/To	WEST OF SR-56
Jurisdiction	
Analysis Year	2024

Project Description

<input checked="" type="checkbox"/> Oper.(LOS)	<input type="checkbox"/> Des.(N)	<input type="checkbox"/> Planning Data
--	----------------------------------	--

Flow Inputs

Volume, V	3069 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1840	pc/h/ln
S	61.9	mi/h
$D = v_p / S$	29.7	pc/mi/ln
LOS	D	

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, 1750, and 2400 pc/h/ln respectively. The Level of Service (LOS) is indicated as A, B, C, D, and E for these flow rates.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-56																			
Date Performed	5/1/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3194 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1915 pc/h/ln	Design LOS																				
S	61.2 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	31.3 pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3817	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	275	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	168	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	3817	275	168	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1004	72	44	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4576	289	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	4576	4800	No
Fi F			
v		4400	Yes
12			
$v = v - v$	4287	4800	No
FO F R			
v	289	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $D = 0.454$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.3$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-56 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3542	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	168	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	275	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3542	168	275	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	932	44	72	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4247	177	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	4424	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.576

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 53.9 mph

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-56
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3194	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	262	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	137	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	3194	262	137	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	841	69	36	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3829	276	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3829	4800	No
v 12		4400	No
$v = v - v$ FO F R	3553	4800	No
v R	276	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.453$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.3$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/1/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-56 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2932	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	137	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	262	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2932	137	262	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	772	36	69	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3515	144	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3659	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

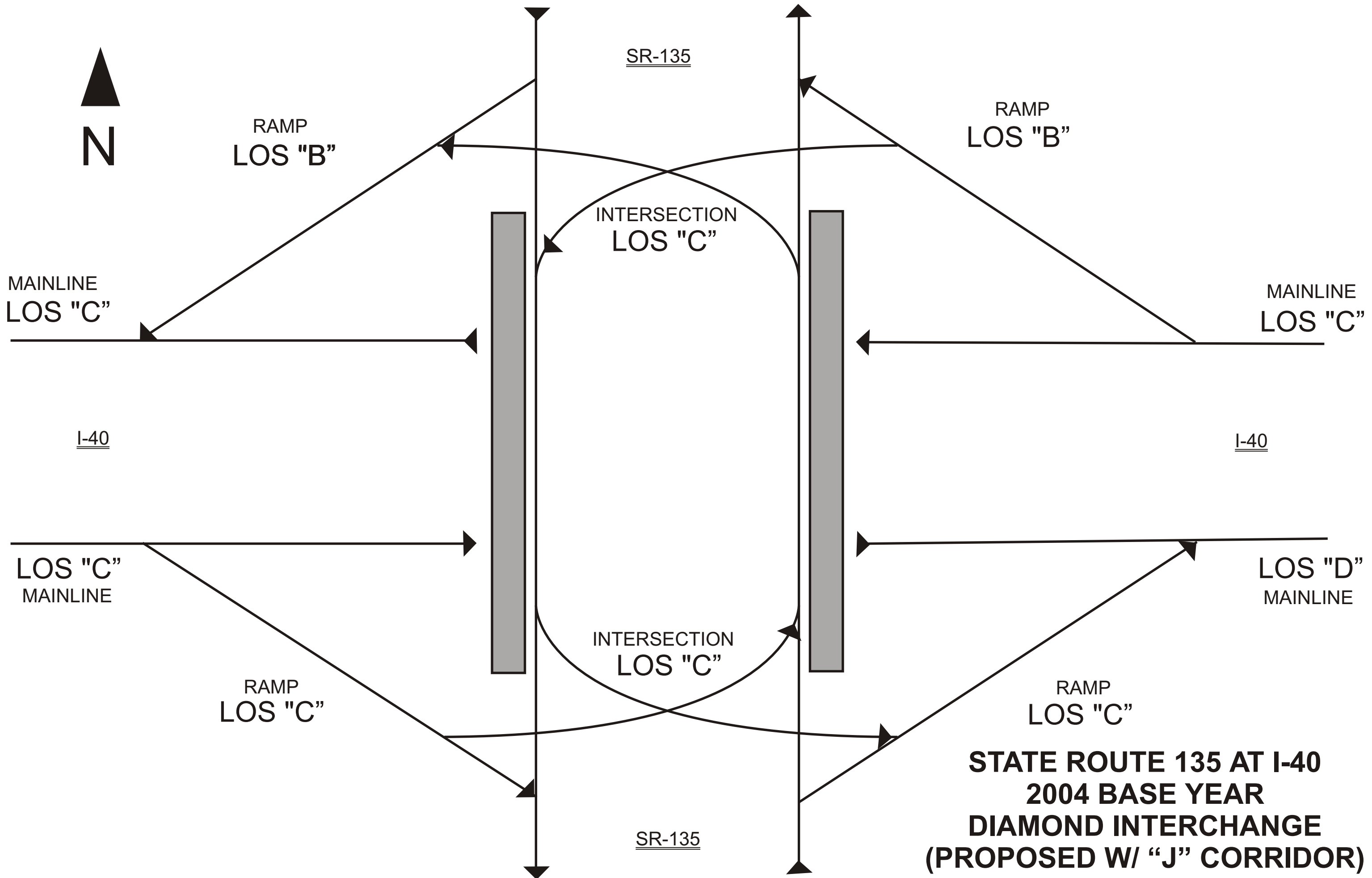
Intermediate speed variable, M = 0.402

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 58.7 mph

Proposed Conditions Analysis
State Route 135 (Burgess Falls Road)
At Interstate 40



SR-135

RAMP
LOS "B"

RAMP
LOS "B"

INTERSECTION
LOS "C"

MAINLINE
LOS "C"

MAINLINE
LOS "C"

I-40

I-40

LOS "C"
MAINLINE

LOS "D"
MAINLINE

INTERSECTION
LOS "C"

RAMP
LOS "C"

RAMP
LOS "C"

SR-135

**STATE ROUTE 135 AT I-40
2004 BASE YEAR
DIAMOND INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
AM PEAK**

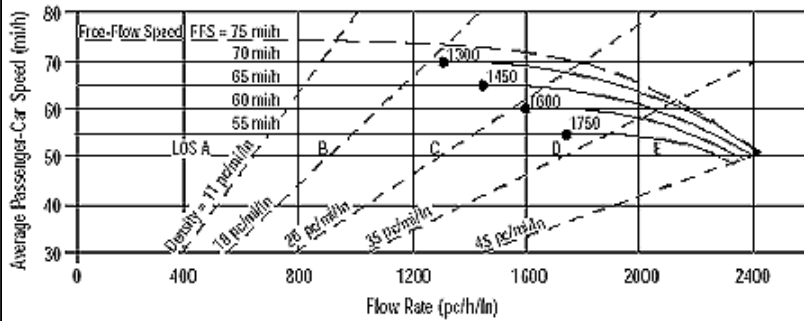
HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>AM PEAK 2004</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	85		19					577	223	248	358	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, I_1	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q_b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		5	0			0		56			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0		0					0	0	0	0	
Min. time for pedestrians, G_p												
Phasing	EB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, $T = 0.25$								Cycle Length, $C = 90.0$				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	89		15					607	176	261	377	
Lane group capacity, c	487		436					718	1132	441	1127	
v/c ratio, X	0.18		0.03					0.85	0.16	0.59	0.33	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d_1	24.7		23.7					25.0	3.9	12.5	8.6	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d_2	0.8		0.1					11.7	0.3	5.7	0.8	
Initial queue delay, d_3												
Control delay	25.6		23.8					36.8	4.2	18.2	9.4	
Lane group LOS	C		C					D	A	B	A	
Approach delay	25.3						29.4			13.0		
Approach LOS	C						C			B		
Intersection delay	22.3						Intersection LOS			C		

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i>						
Agency or Co. <i>COOKEVILLE</i>						Area Type <i>All other areas</i>						
Date Performed <i>5/2/00</i>						Jurisdiction						
Time Period <i>AM PEAK 2004</i>						Analysis Year <i>2-3828-05</i>						
						Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				114		172	57	605			492	217
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		43				0		54
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, $T = 0.25$								Cycle Length, $C = 90.0$				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				120		136	60	637			518	172
Lane group capacity, c				487		436	339	718			1127	1568
v/c ratio, X				0.25		0.31	0.18	0.89			0.46	0.11
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d_1				25.2		25.7	18.0	25.7			9.5	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				1.2		1.9	1.1	15.2			1.4	0.1
Initial queue delay, d_3												
Control delay				26.4		27.6	19.2	40.8			10.8	0.1
Lane group LOS				C		C	B	D			B	A
Approach delay				27.0			39.0			8.2		
Approach LOS				C			D			A		
Intersection delay	24.2						Intersection LOS			C		

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Points are marked at flow rates of 1300, 1450, 1600, and 1750. Regions A through F are delineated by dashed lines.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2366 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1418 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	22.5 pc/mi/ln	S	mi/h																			
LOS	C	$D = v_p / S$	pc/mi/ln																			
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, 1750, and 2400 pc/h/ln respectively. The Level of Service (LOS) is indicated as A, B, C, D, and E for these points.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2733 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1638 pc/h/ln	Design LOS																				
S	62.9 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	26.0+ pc/mi/ln	S	mi/h																			
LOS	D	$D = v_p / S$	pc/mi/ln																			
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/2/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	WB I-40
From/To	WEST OF SR-135
Jurisdiction	
Analysis Year	2004

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	1871 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1122 pc/h/ln
S	63.0 mi/h
$D = v_p / S$	17.8 pc/mi/ln
LOS	B

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows five Level of Service (LOS) curves: LOS A (top), LOS B, LOS C, LOS D, and LOS E (bottom). Dashed lines represent constant densities: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Data points are plotted at flow rates of 1300, 1450, 1600, and 1750 pc/h/ln, corresponding to speeds of approximately 70, 65, 60, and 55 mi/h respectively.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	1883 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade	Length																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1129 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	17.9 pc/mi/ln	S																				
LOS	B	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2366	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	104	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	471	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	2366	104	471	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	623	27	124	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2827	109	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2827	4800	No
v 12		4400	No
$v = v - v$ FO F R	2718	4800	No
v R	109	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.438$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.7$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-135 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2262	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	471	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	104	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2262	471	104	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	595	124	27	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2712	496	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)
EQ
P = Using Equation 0
FM
 $v = v (P) =$ pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3208	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =$ pc/mi/ln
R R 12 A

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable,	M = 0.368
Space mean speed in ramp influence area,	S = mph
Space mean speed in outer lanes,	S = N/A mph
Space mean speed for all vehicles,	S = 59.7 mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1883	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	286	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	274	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1883	286	274	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	496	75	72	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2258	301	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

v = v	Actual	Maximum	LOS F?
Fi F	2258	4800	No
v		4400	No
12			
v = v - v	1957	4800	No
FO F R			
v	301	2000	No
R			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.455$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.3$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2004
 Freeway/dir or travel: SR-135 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1597	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	278	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	286	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1597	278	286	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	420	73	75	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	1915	293	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	2208	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

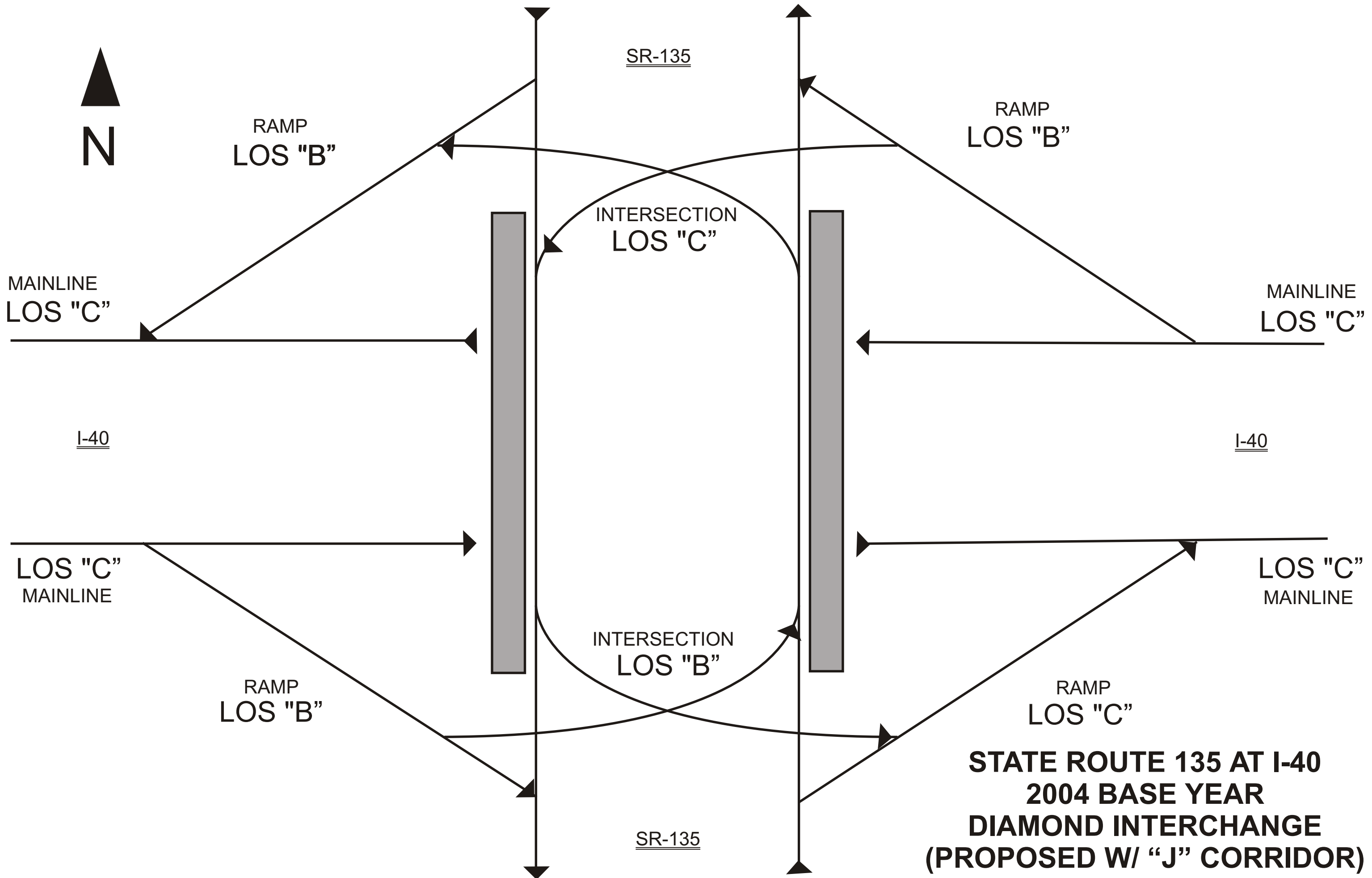
Speed Estimation

Intermediate speed variable, M = 0.286

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 62.0 mph



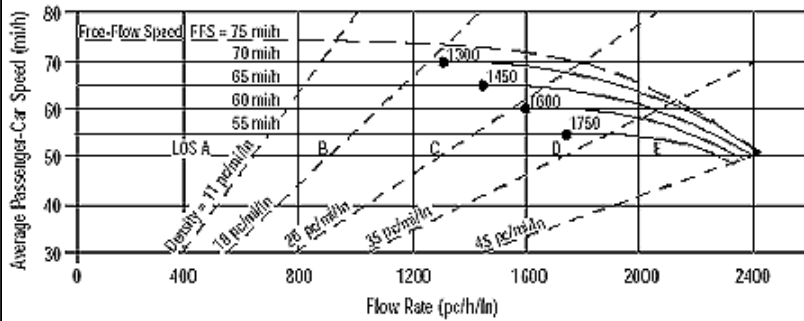
**STATE ROUTE 135 AT I-40
 2004 BASE YEAR
 DIAMOND INTERCHANGE
 (PROPOSED W/ "J" CORRIDOR)
 PM PEAK**

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>PM PEAK 2004</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N ₁	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	210		97					312	78	200	816	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, I ₁	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q _b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		24	0			0		20			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N _m												
Buses stopping, N _B	0		0					0	0	0	0	
Min. time for pedestrians, G _p												
Phasing	EB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, T = 0.25								Cycle Length, C = 90.0				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	221		77					328	61	211	859	
Lane group capacity, c	487		436					718	1132	585	1127	
v/c ratio, X	0.45		0.18					0.46	0.05	0.36	0.76	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d ₁	26.9		24.7					20.4	3.6	9.2	12.7	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d ₂	3.0		0.9					2.1	0.1	1.7	4.9	
Initial queue delay, d ₃												
Control delay	29.9		25.6					22.5	3.7	10.9	17.6	
Lane group LOS	C		C					C	A	B	B	
Approach delay	28.8						19.6			16.3		
Approach LOS	C						B			B		
Intersection delay	19.1						Intersection LOS			B		

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>PM PEAK 2004</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N ₁	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				165		260	27	495			851	148
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I ₁				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q _b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		65				0		37
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N _m												
Buses stopping, N _B				0		0	0	0			0	0
Min. time for pedestrians, G _p												
Phasing	WB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, T = 0.25								Cycle Length, C = 90.0				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				174		205	28	521			896	117
Lane group capacity, c				487		436	238	718			1127	1568
v/c ratio, X				0.36		0.47	0.12	0.73			0.80	0.07
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d ₁				26.1		27.0	17.6	23.4			13.2	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d ₂				2.0		3.6	1.0	6.3			5.8	0.1
Initial queue delay, d ₃												
Control delay				28.1		30.6	18.6	29.7			19.1	0.1
Lane group LOS				C		C	B	C			B	A
Approach delay				29.5			29.2			16.9		
Approach LOS				C			C			B		
Intersection delay	22.8						Intersection LOS			C		

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves: 11 pc/mi/h, 16 pc/mi/h, 26 pc/mi/h, 35 pc/mi/h, and 45 pc/mi/h. Regions A through F are marked, corresponding to different levels of service (LOS). A table in the top right corner lists applications and their input/output parameters.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Application</th> <th>Input</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2215 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1328 pc/h/ln	Design LOS																				
S	63.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	21.1 pc/mi/ln	S																				
LOS	C	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/2/00
Analysis Time Period	PM PEAK

Site Information

Highway/Direction of Travel	EB I-40
From/To	EAST OF SR-135
Jurisdiction	
Analysis Year	2004

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	2186 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade	Length
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1310	pc/h/ln
S	63.0	mi/h
$D = v_p / S$	20.8	pc/mi/ln
LOS	C	

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

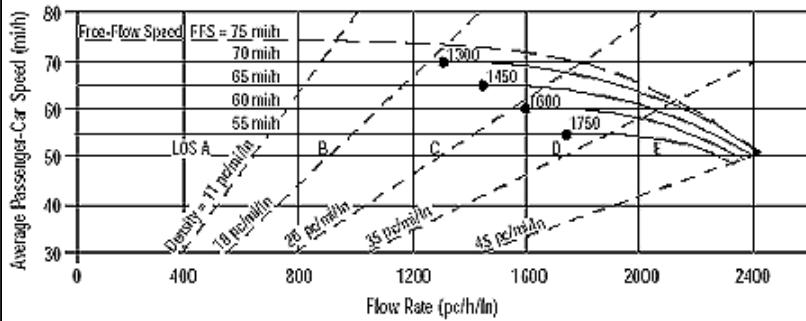
Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/2/00
Analysis Time Period	PM PEAK

Site Information

Highway/Direction of Travel	WB I-40
From/To	WEST OF SR-135
Jurisdiction	
Analysis Year	2004

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	2148 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1288	pc/h/ln
S	63.0	mi/h
$D = v_p / S$	20.4	pc/mi/ln
LOS	C	

Design (N)

Design (N)		
Design LOS		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$		pc/h
S		mi/h
$D = v_p / S$		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points A, B, C, D, and E are marked on the graph, corresponding to flow rates of 1300, 1450, 1600, 1750, and 2400 pc/h/ln respectively. The Level of Service (LOS) is determined as follows: LOS A (v_p > 65 mi/h), LOS B (60 < v_p < 65 mi/h), LOS C (55 < v_p < 60 mi/h), LOS D (50 < v_p < 55 mi/h), and LOS E (v_p < 50 mi/h).</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v _p	LOS, S, D	Design (N)	FFS, LOS, v _p	N, S, D	Design (v _p)	FFS, LOS, N	v _p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v _p)	FFS, LOS, N	v _p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v _p	LOS, S, D																				
Design (N)	FFS, LOS, v _p	N, S, D																				
Design (v _p)	FFS, LOS, N	v _p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v _p)	FFS, LOS, N	v _p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2004																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	2398 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P _T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P _R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f _p	1.00	E _R	1.2																			
E _T	1.5	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f _{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f _{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f _{ID}	2.5 mi/h																			
Number of Lanes, N	2	f _N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	1438 pc/h/ln	Design LOS																				
S	63.0 mi/h	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)																				
D = v _p / S	22.8 pc/mi/ln	S																				
LOS	C	D = v _p / S																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E _R - Exhibits 23-8, 23-10	f _{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E _T - Exhibits 23-8, 23-10, 23-11	f _{LC} - Exhibit 23-5																			
v _p - Flow rate	FFS - Free-flow speed	f _p - Page 23-12	f _N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v _p - Exhibits 23-2, 23-3	f _{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: EB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2215	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	307	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	278	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2215	307	278	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	583	81	73	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2646	323	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2646	4800	No
v 12		4400	No
$v = v - v$ FO F R	2323	4800	No
v R	323	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.457$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.2$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-135 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1908	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	278	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	307	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1908	278	307	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	502	73	81	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2288	293	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) = \text{pc/h}$
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	2581	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = \text{pc/mi/ln}$

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.324

Space mean speed in ramp influence area, $S_R = \text{mph}$

Space mean speed in outer lanes, $S_0 = \text{N/A mph}$

Space mean speed for all vehicles, S = 60.9 mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: WB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2398	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	425	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	175	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2398	425	175	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	631	112	46	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2875	447	pcph

Estimation of V12 Diverge Areas

$L = 0.00$ (Equation 25-8 or 25-9)

EQ

$P =$ Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	2875	4800	No
v 12		4400	No
$v = v - v$ FO F R	2428	4800	No
v R	447	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = -$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, $D = 0.468$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.9$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

Jeff Hammond
 Neel-Schaffer, Inc.
 4205 Hillsboro Road
 Nashville, TN 37215

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 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2004
 Freeway/dir or travel: SR-135 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	1973	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	175	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	425	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	1973	175	425	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	519	46	112	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	2366	184	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	2550	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

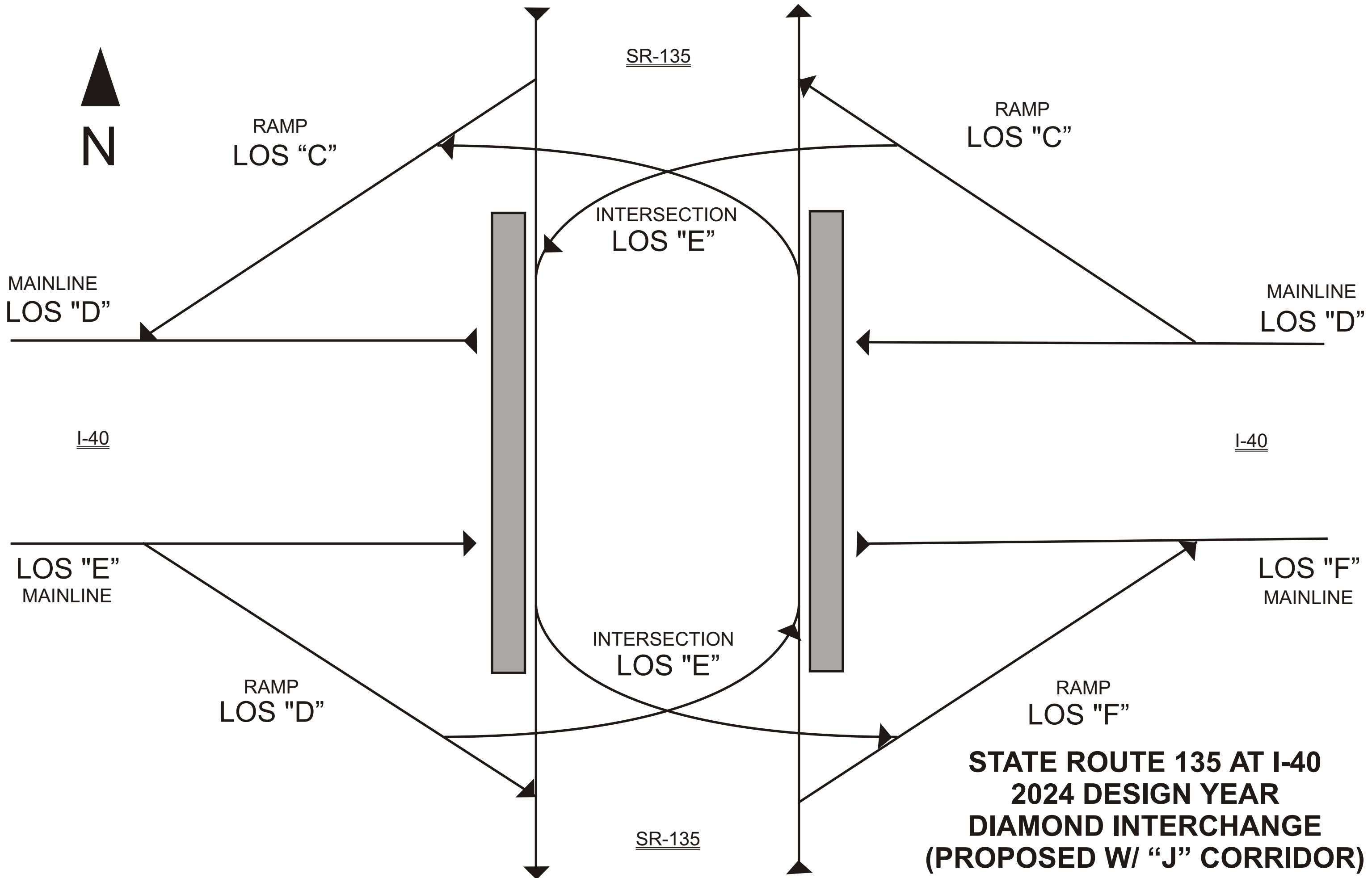
Speed Estimation

Intermediate speed variable, M = 0.301

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 61.6 mph



SR-135

RAMP
LOS "C"

RAMP
LOS "C"

INTERSECTION
LOS "E"

MAINLINE
LOS "D"

MAINLINE
LOS "D"

I-40

I-40

LOS "E"
MAINLINE

LOS "F"
MAINLINE

INTERSECTION
LOS "E"

RAMP
LOS "D"

RAMP
LOS "F"

SR-135

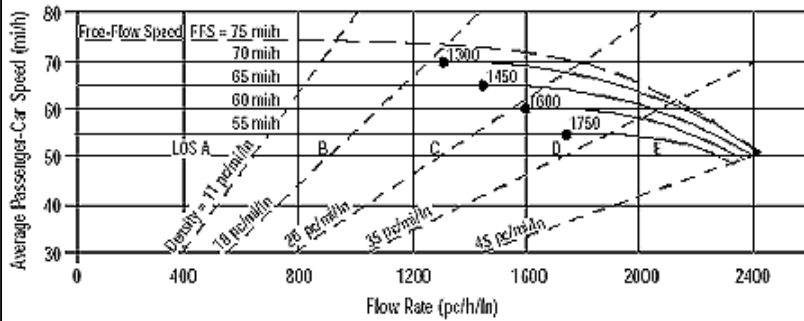
**STATE ROUTE 135 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
AM PEAK**

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>AM PEAK 2024</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	143		32					821	379	416	534	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, l_1	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q_b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		8	0			0		95			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B	0		0					0	0	0	0	
Min. time for pedestrians, G_p												
Phasing	EB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, T = 0.25									Cycle Length, C = 90.0			
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	151		25					864	299	438	562	
Lane group capacity, c	487		436					718	1132	374	1127	
v/c ratio, X	0.31		0.06					1.20	0.26	1.17	0.50	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d_1	25.7		23.9					27.5	4.3	27.2	9.8	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d_2	1.7		0.3					104.5	0.6	101.9	1.6	
Initial queue delay, d_3												
Control delay	27.3		24.1					132.0	4.9	129.1	11.4	
Lane group LOS	C		C					F	A	F	B	
Approach delay	26.9						99.3			62.9		
Approach LOS	C						F			E		
Intersection delay	78.3						Intersection LOS			E		

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>AM PEAK 2024</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				202		292	112	852			748	370
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I_1				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q_b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		73				0		93
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B				0		0	0	0			0	0
Min. time for pedestrians, G_p												
Phasing	WB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, T = 0.25									Cycle Length, C = 90.0			
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				213		231	118	897			787	292
Lane group capacity, c				487		436	264	718			1127	1568
v/c ratio, X				0.44		0.53	0.45	1.25			0.70	0.19
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d_1				26.7		27.5	20.3	27.5			11.9	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d_2				2.8		4.6	5.4	123.6			3.6	0.3
Initial queue delay, d_3												
Control delay				29.6		32.1	25.7	151.1			15.5	0.3
Lane group LOS				C		C	C	F			B	A
Approach delay				30.9			136.5			11.4		
Approach LOS				C			F			B		
Intersection delay	64.8						Intersection LOS			E		

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3671 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2201 pc/h/ln	Design LOS																				
S	55.8 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	39.4 pc/mi/ln	S																				
LOS	E	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/2/00
Analysis Time Period	AM PEAK

Site Information

Highway/Direction of Travel	EB I-40
From/To	EAST OF SR-135
Jurisdiction	
Analysis Year	2024

Project Description

- Oper.(LOS)
 Des.(N)
 Planning Data

Flow Inputs

Volume, V	4291 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2572 pc/h/ln
S	mi/h
$D = v_p / S$	pc/mi/ln
LOS	F

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). A horizontal line at 75 mi/h represents the Free-Flow Speed (FFS). Dashed lines represent density levels: 11 pc/mi/ln, 18 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, and 45 pc/mi/ln. Points are plotted at flow rates of 1300, 1450, 1600, and 1750 pc/h/ln, which correspond to Levels of Service (LOS) A, B, C, D, and E respectively.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	AM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3084 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1849 pc/h/ln	Design LOS																				
S	61.9 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	29.9 pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																								
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several curves representing different traffic conditions: <ul style="list-style-type: none"> Free-Flow Speed: FFS = 75 mi/h 70 mi/h 65 mi/h 60 mi/h 55 mi/h LOS A Density curves: 11 pc/mi/ln, 16 pc/mi/ln, 26 pc/mi/ln, 35 pc/mi/ln, 45 pc/mi/ln Flow rate points: 1300, 1450, 1600, 1750 Regions B, C, D, E are marked on the graph. </p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>			Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																						
Operational (LOS)	FFS, N, v_p	LOS, S, D																						
Design (N)	FFS, LOS, v_p	N, S, D																						
Design (v_p)	FFS, LOS, N	v_p , S, D																						
Planning (LOS)	FFS, N, AADT	LOS, S, D																						
Planning (N)	FFS, LOS, AADT	N, S, D																						
Planning (v_p)	FFS, LOS, N	v_p , S, D																						
General Information		Site Information																						
Analyst	JH	Highway/Direction of Travel	WB I-40																					
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																					
Date Performed	5/2/00	Jurisdiction																						
Analysis Time Period	AM PEAK	Analysis Year	2024																					
Project Description																								
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																								
Flow Inputs																								
Volume, V	3096 veh/h	Peak-Hour Factor, PHF	0.95																					
AADT	veh/day	%Trucks and Buses, P_T	25																					
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																					
Peak-Hr Direction Prop, D		General Terrain:	Level																					
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																					
Driver type adjustment	1.00	Up/Down %	0.00																					
Calculate Flow Adjustments																								
f_p	1.00	E_R	1.2																					
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																					
Speed Inputs		Calc Speed Adj and FFS																						
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																					
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																					
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																					
Number of Lanes, N	2	f_N	4.5 mi/h																					
FFS (measured)		FFS	63.0 mi/h																					
Base free-flow Speed, BFFS	70.0 mi/h																							
LOS and Performance Measures		Design (N)																						
Operational (LOS)		Design (N)																						
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	1856 pc/h/ln	Design LOS																						
S	61.8 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																					
$D = v_p / S$	30.0 pc/mi/ln	S	mi/h																					
LOS	D	$D = v_p / S$	pc/mi/ln																					
Glossary		Factor Location																						
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																					
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																					
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																					
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																					
DDHV - Directional design hour volume																								

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3671	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	175	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	795	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	3671	175	795	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	966	46	209	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4386	184	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4386	4800	No
v 12		4400	No
$v = v - v$ FO F R	4202	4800	No
v R	184	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.445$

Space mean speed in ramp influence area, $S = 58$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 57.6$ mph

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-135 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3496	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	795	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	175	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3496	795	175	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	920	209	46	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4192	837	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5029	4800	Yes
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, M = 0.868

Space mean speed in ramp influence area, S = mph

Space mean speed in outer lanes, S = N/A mph

Space mean speed for all vehicles, S = 45.7 mph

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Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3096	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	494	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	482	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
		Ramp		
Volume, V (vph)	3096	494	482	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	815	130	127	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3712	520	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	3712	4800	No
v 12		4400	No
$v = v - v$ FO F R	3192	4800	No
v R	520	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{12} - 0.009 \frac{L}{D} =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, $D = 0.475$

Space mean speed in ramp influence area, $S = 57$ mph

Space mean speed in outer lanes, $S = N/A$ mph

Space mean speed for all vehicles, $S = 56.7$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: AM PEAK 2024
 Freeway/dir or travel: SR-135 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	2602	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	482	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	494	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	2602	482	494	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	685	127	130	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3120	507	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)

EQ

P = Using Equation 0

FM

$v = v(P) =$ pc/h

12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3627	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

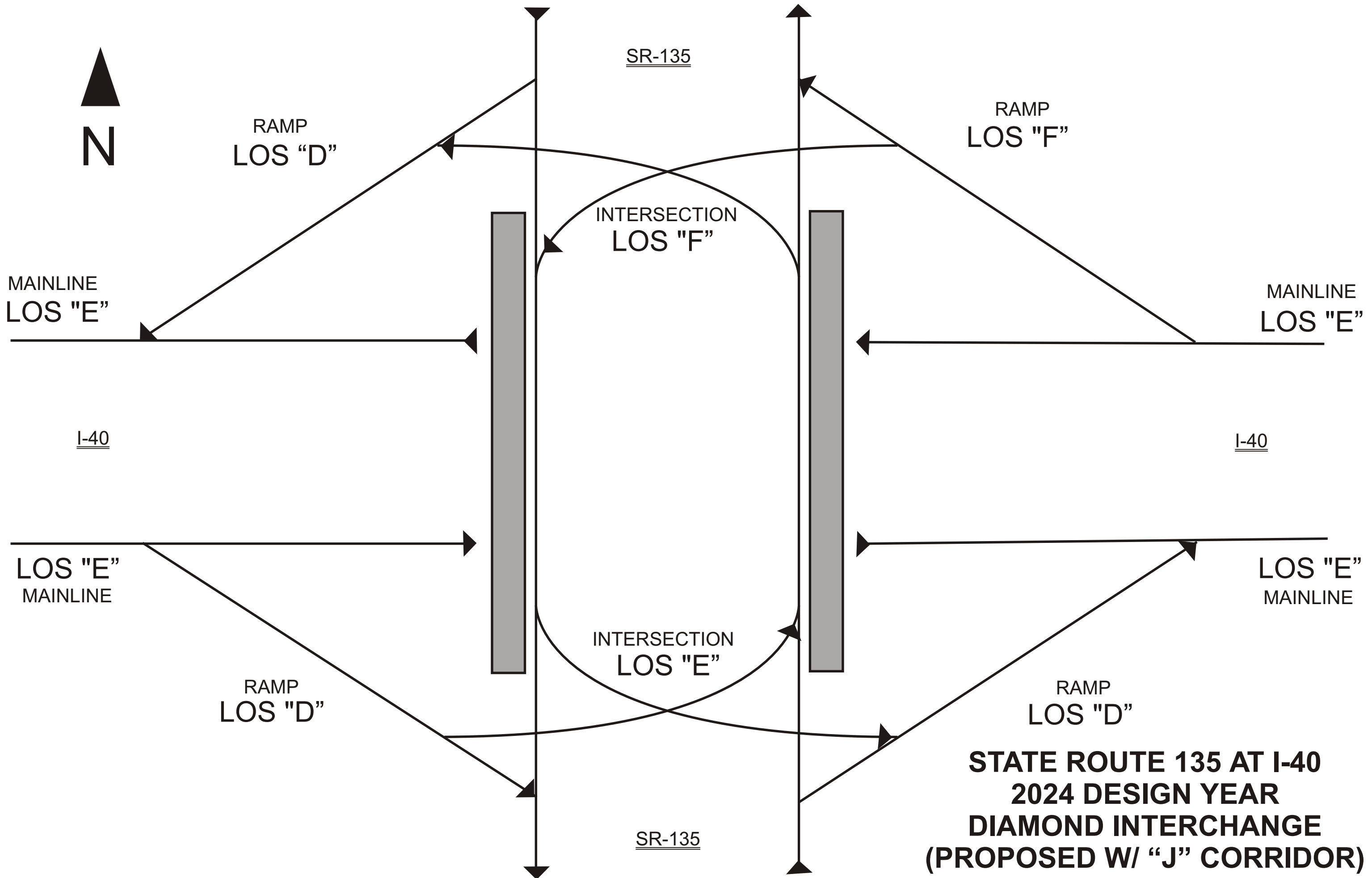
Speed Estimation

Intermediate speed variable, M = 0.398

Space mean speed in ramp influence area, $S_R =$ mph

Space mean speed in outer lanes, $S_0 =$ N/A mph

Space mean speed for all vehicles, S = 58.9 mph



SR-135

RAMP
LOS "D"

RAMP
LOS "F"

MAINLINE
LOS "E"

MAINLINE
LOS "E"

INTERSECTION
LOS "F"

I-40

I-40

LOS "E"
MAINLINE

LOS "E"
MAINLINE

INTERSECTION
LOS "E"

RAMP
LOS "D"

RAMP
LOS "D"

SR-135

**STATE ROUTE 135 AT I-40
2024 DESIGN YEAR
DIAMOND INTERCHANGE
(PROPOSED W/ "J" CORRIDOR)
PM PEAK**

HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>PM PEAK 2024</i>						Intersection <i>I-40 EB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N ₁	1	0	1	0	0	0	0	1	1	1	1	0
Lane group	L		R					T	R	L	T	
Volume, V (vph)	395		127					452	133	324	1262	
% Heavy vehicles, %HV	3		3					3	3	3	3	
Peak-hour factor, PHF	0.95		0.95					0.95	0.95	0.95	0.95	
Pretimed (P) or actuated (A)	P		P					P	P	P	P	
Start-up lost time, I ₁	2.0		2.0					2.0	2.0	2.0	2.0	
Extension of effective green, e	2.0		2.0					2.0	2.0	2.0	2.0	
Arrival type, AT	3		3					3	3	3	3	
Unit extension, UE	3.0		3.0					3.0	3.0	3.0	3.0	
Filtering/metering, I	1.000	1.000	1.000					1.000	1.000	1.000	1.000	
Initial unmet demand, Q _b	0.0		0.0					0.0	0.0	0.0	0.0	
Ped / Bike / RTOR volumes	0		32	0			0		33			
Lane width	12.0		12.0					12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N _m												
Buses stopping, N _B	0		0					0	0	0	0	
Min. time for pedestrians, G _p												
Phasing	EB Only		02	03		04	SB Only		NS Perm		07	08
Timing	G = 25.0		G =	G =		G =	G = 15.0		G = 35.0		G =	G =
	Y = 5		Y =	Y =		Y =	Y = 5		Y = 5		Y =	Y =
Duration of Analysis, T = 0.25								Cycle Length, C = 90.0				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v	416		100					476	105	341	1328	
Lane group capacity, c	487		436					718	1132	500	1127	
v/c ratio, X	0.85		0.23					0.66	0.09	0.68	1.18	
Total green ratio, g/C	0.28		0.28					0.39	0.72	0.61	0.61	
Uniform delay, d ₁	30.8		25.1					22.6	3.7	11.8	17.5	
Progression factor, PF	1.000		1.000					1.000	1.000	1.000	1.000	
Delay calibration, k	0.50		0.50					0.50	0.50	0.50	0.50	
Incremental delay, d ₂	17.2		1.2					4.8	0.2	7.3	89.7	
Initial queue delay, d ₃												
Control delay	47.9		26.3					27.4	3.9	19.1	107.2	
Lane group LOS	D		C					C	A	B	F	
Approach delay	43.7						23.2			89.2		
Approach LOS	D						C			F		
Intersection delay	66.9						Intersection LOS			E		

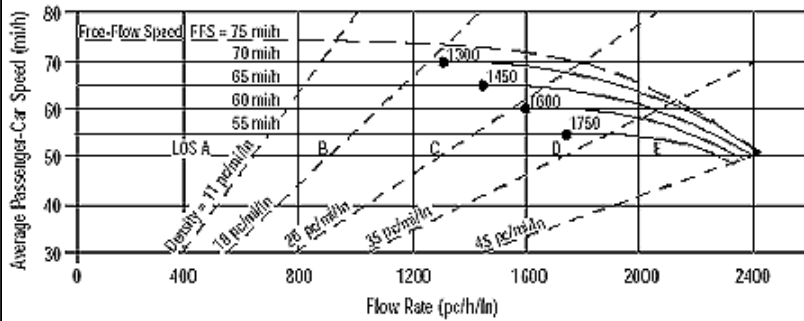
HCS2000™ DETAILED REPORT												
General Information						Site Information						
Analyst <i>JH</i> Agency or Co. <i>COOKEVILLE</i> Date Performed <i>5/2/00</i> Time Period <i>PM PEAK 2024</i>						Intersection <i>I-40 WB RAMPS @ SR-135</i> Area Type <i>All other areas</i> Jurisdiction Analysis Year <i>2-3828-05</i> Project ID						
Volume and Timing Input												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N ₁	0	0	0	1	0	1	1	1	0	0	1	1
Lane group				L		R	L	T			T	R
Volume, V (vph)				266		468	69	778			1320	252
% Heavy vehicles, %HV				3		3	3	3			3	3
Peak-hour factor, PHF				0.95		0.95	0.95	0.95			0.95	0.95
Pretimed (P) or actuated (A)				P		P	P	P			P	P
Start-up lost time, I ₁				2.0		2.0	2.0	2.0			2.0	2.0
Extension of effective green, e				2.0		2.0	2.0	2.0			2.0	2.0
Arrival type, AT				3		3	3	3			3	3
Unit extension, UE				3.0		3.0	3.0	3.0			3.0	3.0
Filtering/metering, I				1.000	1.000	1.000	1.000	1.000			1.000	1.000
Initial unmet demand, Q _b				0.0		0.0	0.0	0.0			0.0	0.0
Ped / Bike / RTOR volumes	0			0		117				0		63
Lane width				12.0		12.0	12.0	12.0			12.0	12.0
Parking / Grade / Parking	N		N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N _m												
Buses stopping, N _B				0		0	0	0			0	0
Min. time for pedestrians, G _p												
Phasing	WB Only		02	03	04	SB Only		NS Perm		07	08	
Timing	G = 25.0		G =	G =	G =	G = 15.0		G = 35.0		G =	G =	
	Y = 5		Y =	Y =	Y =	Y = 5		Y = 5		Y =	Y =	
Duration of Analysis, T = 0.25								Cycle Length, C = 90.0				
Lane Group Capacity, Control Delay, and LOS Determination												
	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v				280		369	73	819			1389	199
Lane group capacity, c				487		436	140	718			1127	1568
v/c ratio, X				0.57		0.85	0.52	1.14			1.23	0.13
Total green ratio, g/C				0.28		0.28	0.39	0.39			0.61	1.00
Uniform delay, d ₁				27.9		30.7	21.1	27.5			17.5	0.0
Progression factor, PF				1.000		1.000	1.000	1.000			1.000	0.950
Delay calibration, k				0.50		0.50	0.50	0.50			0.50	0.50
Incremental delay, d ₂				4.9		18.0	13.2	79.5			112.5	0.2
Initial queue delay, d ₃												
Control delay				32.8		48.7	34.3	107.0			130.0	0.2
Lane group LOS				C		D	C	F			F	A
Approach delay				41.9			101.0			113.7		
Approach LOS				D			F			F		
Intersection delay	95.2						Intersection LOS			F		

BASIC FREEWAY SEGMENTS WORKSHEET																						
<p>The graph plots Average Passenger-Car Speed (mi/h) on the y-axis (30 to 80) against Flow Rate (pc/h/ln) on the x-axis (0 to 2400). It shows several density curves for different speeds: 75, 70, 65, 60, 55, 50, 45, 40, 35, 30, 25, 20, 15, 10, 5, and 0. Data points are plotted at (1300, 70), (1450, 65), (1600, 60), and (1750, 55). A horizontal line for LOS A is shown at approximately 55 mi/h.</p>	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3543 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)		FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2124 pc/h/ln	Design LOS																				
S	57.7 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h																			
$D = v_p / S$	36.8 pc/mi/ln	S	mi/h																			
LOS	E	$D = v_p / S$	pc/mi/ln																			
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	EB I-40																			
Agency or Company	COOKEVILLE	From/To	EAST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3478 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2085 pc/h/ln	Design LOS																				
S	58.5 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	35.6 pc/mi/ln	S																				
LOS	E	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET																						
	<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Application</th> <th style="text-align: left;">Input</th> <th style="text-align: left;">Output</th> </tr> </thead> <tbody> <tr> <td>Operational (LOS)</td> <td>FFS, N, v_p</td> <td>LOS, S, D</td> </tr> <tr> <td>Design (N)</td> <td>FFS, LOS, v_p</td> <td>N, S, D</td> </tr> <tr> <td>Design (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> <tr> <td>Planning (LOS)</td> <td>FFS, N, AADT</td> <td>LOS, S, D</td> </tr> <tr> <td>Planning (N)</td> <td>FFS, LOS, AADT</td> <td>N, S, D</td> </tr> <tr> <td>Planning (v_p)</td> <td>FFS, LOS, N</td> <td>v_p, S, D</td> </tr> </tbody> </table>	Application	Input	Output	Operational (LOS)	FFS, N, v_p	LOS, S, D	Design (N)	FFS, LOS, v_p	N, S, D	Design (v_p)	FFS, LOS, N	v_p , S, D	Planning (LOS)	FFS, N, AADT	LOS, S, D	Planning (N)	FFS, LOS, AADT	N, S, D	Planning (v_p)	FFS, LOS, N	v_p , S, D
Application	Input	Output																				
Operational (LOS)	FFS, N, v_p	LOS, S, D																				
Design (N)	FFS, LOS, v_p	N, S, D																				
Design (v_p)	FFS, LOS, N	v_p , S, D																				
Planning (LOS)	FFS, N, AADT	LOS, S, D																				
Planning (N)	FFS, LOS, AADT	N, S, D																				
Planning (v_p)	FFS, LOS, N	v_p , S, D																				
General Information		Site Information																				
Analyst	JH	Highway/Direction of Travel	WB I-40																			
Agency or Company	COOKEVILLE	From/To	WEST OF SR-135																			
Date Performed	5/2/00	Jurisdiction																				
Analysis Time Period	PM PEAK	Analysis Year	2024																			
Project Description																						
<input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data																						
Flow Inputs																						
Volume, V	3442 veh/h	Peak-Hour Factor, PHF	0.95																			
AADT	veh/day	%Trucks and Buses, P_T	25																			
Peak-Hr Prop. of AADT, K		%RVs, P_R	7																			
Peak-Hr Direction Prop, D		General Terrain:	Level																			
DDHV = AADT x K x D	veh/h	Grade Length	0.00mi																			
Driver type adjustment	1.00	Up/Down %	0.00																			
Calculate Flow Adjustments																						
f_p	1.00	E_R	1.2																			
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878																			
Speed Inputs		Calc Speed Adj and FFS																				
Lane Width	12.0 ft	f_{LW}	0.0 mi/h																			
Rt-Shoulder Lat. Clearance	6.0 ft	f_{LC}	0.0 mi/h																			
Interchange Density	1.00 l/mi	f_{ID}	2.5 mi/h																			
Number of Lanes, N	2	f_N	4.5 mi/h																			
FFS (measured)	mi/h	FFS	63.0 mi/h																			
Base free-flow Speed, BFFS	70.0 mi/h																					
LOS and Performance Measures		Design (N)																				
Operational (LOS)		Design (N)																				
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2063 pc/h/ln	Design LOS																				
S	59.0 mi/h	$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$																				
$D = v_p / S$	35.0- pc/mi/ln	S																				
LOS	D	$D = v_p / S$																				
		Required Number of Lanes, N																				
Glossary		Factor Location																				
N - Number of lanes	S - Speed	E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4																			
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5																			
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6																			
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7																			
DDHV - Directional design hour volume																						

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p , S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p , S, D

General Information

Analyst	JH
Agency or Company	COOKEVILLE
Date Performed	5/2/00
Analysis Time Period	PM PEAK

Site Information

Highway/Direction of Travel	WB I-40
From/To	EAST OF SR-135
Jurisdiction	
Analysis Year	2024

Project Description

<input checked="" type="checkbox"/> Oper.(LOS)	<input type="checkbox"/> Des.(N)	<input type="checkbox"/> Planning Data
--	----------------------------------	--

Flow Inputs

Volume, V	3855 veh/h	Peak-Hour Factor, PHF	0.95
AADT	veh/day	%Trucks and Buses, P_T	25
Peak-Hr Prop. of AADT, K		%RVs, P_R	7
Peak-Hr Direction Prop, D		General Terrain:	Level
DDHV = AADT x K x D	veh/h	Grade	Length
Driver type adjustment	1.00	Up/Down %	0.00

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	0.878

Speed Inputs

Lane Width	12.0	ft
Rt-Shoulder Lat. Clearance	6.0	ft
Interchange Density	1.00	l/mi
Number of Lanes, N	2	
FFS (measured)		mi/h
Base free-flow Speed, BFFS	70.0	mi/h

Calc Speed Adj and FFS

f_{LW}	0.0	mi/h
f_{LC}	0.0	mi/h
f_{ID}	2.5	mi/h
f_N	4.5	mi/h
FFS	63.0	mi/h

LOS and Performance Measures

Operational (LOS)		
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	2311	pc/h/ln
S	52.4	mi/h
$D = v_p / S$	44.1	pc/mi/ln
LOS	E	

Design (N)

Design (N)	
Design LOS	
$v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$	pc/h
S	mi/h
$D = v_p / S$	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: EB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3543	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	522	vph	
Length of first accel/decel lane	800	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	457	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
	Ramp			
Volume, V (vph)	3543	522	457	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	932	137	120	v
Trucks and buses	25	0	0	%
Recreational vehicles	5	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.881	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4233	549	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4233	4800	No
v 12		4400	No
$v = v - v$ FO F R	3684	4800	No
v R	549	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L =$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, $D = 0.477$

Space mean speed in ramp influence area, $S = 57$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.6$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-135 TO EB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3021	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	457	vph	
Length of first accel/decel lane	700	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	522	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3021	457	522	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	795	120	137	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3622	481	pcph

Estimation of V12 Merge Areas

$L = 0.00$ (Equation 25-2 or 25-3)
 EQ
 $P =$ Using Equation 0
 FM
 $v = v (P) =$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v FO	4103	4800	No
v R12		4600	Yes

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L =$ pc/mi/ln
 R R 12 A

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, $M = 0.508$
 S
 Space mean speed in ramp influence area, $S =$ mph
 R
 Space mean speed in outer lanes, $S = N/A$ mph
 0
 Space mean speed for all vehicles, $S = 55.8$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

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 E-mail: jhammond@neel-schaffer.com

Diverge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: WB I-40 TO SR-135
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Diverge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3855	vph	

Off Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-Flow speed on ramp	35.0	mph	
Volume on ramp	734	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent ramp	321	vph	
Position of adjacent ramp	Downstream		
Type of adjacent ramp	On		
Distance to adjacent ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3855	734	321	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1014	193	84	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	0.00 %	0.00 %	0.00 %	%
Length	0.00 mi	0.00 mi	0.00 mi	mi
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	4622	773	pcph

Estimation of V12 Diverge Areas

L = 0.00 (Equation 25-8 or 25-9)

EQ

P = Using Equation 0

FD

$v = v + (v - v) P =$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$ Fi F	4622	4800	No
v 12		4400	Yes
$v = v - v$ FO F R	3849	4800	No
v R	773	2000	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = +$ pc/mi/ln
 R 12 D

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable, $D = 0.498$

Space mean speed in ramp influence area, $S = 56$ mph
 R

Space mean speed in outer lanes, $S = N/A$ mph
 0

Space mean speed for all vehicles, $S = 56.1$ mph

HCS2000: Ramps and Ramp Junctions Release 4.1c

Jeff Hammond
 Neel-Schaffer, Inc.
 4205 Hillsboro Road
 Nashville, TN 37215

Phone: (615) 383-8420 Fax: (615) 383-9984
 E-mail: jhammond@neel-schaffer.com

Merge Analysis

Analyst: JH
 Agency/Co.:
 Date performed: 5/2/00
 Analysis time period: PM PEAK 2024
 Freeway/dir or travel: SR-135 TO WB I-40
 Junction:
 Jurisdiction:
 Analysis Year:
 Description:

Freeway Data

Type of analysis	Merge		
Number of lanes in freeway	2		
Free-flow speed on freeway	70.0	mph	
Volume on freeway	3121	vph	

On Ramp Data

Side of freeway	Right		
Number of lanes in ramp	1		
Free-flow speed on ramp	35.0	mph	
Volume on ramp	321	vph	
Length of first accel/decel lane	1000	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	734	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1500	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent	
Volume, V (vph)	3121	321	734	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	821	84	193	v
Trucks and buses	25	0	0	%
Recreational vehicles	7	0	0	%
Terrain type:	Level	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		

Recreational vehicle PCE, ER	1.2	1.2	1.2
Heavy vehicle adjustment, fHV	0.878	1.000	
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3742	338	pcph

Estimation of V12 Merge Areas

L = 0.00 (Equation 25-2 or 25-3)
EQ
P = Using Equation 0
FM
 $v = v(P) =$ pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	4080	4800	No
FO			
v		4600	Yes
R12			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A =$ pc/mi/ln

Level of service for ramp-freeway junction areas of influence

Speed Estimation

Intermediate speed variable, $M = 0.482$
S
Space mean speed in ramp influence area, $S =$ mph
R
Space mean speed in outer lanes, $S = N/A$ mph
0
Space mean speed for all vehicles, $S = 56.5$ mph

Modified Cloverleaf Interchange Cost
Estimates
Alternates A and B
(with worksheets)

Project: Mine Lick Creek Interchange Alt "A"

Length: 4.57 mi.

Cross Section:

Variable

Right-of-Way

Land, Improvements and Damages (Acres)) 48.1	\$596,000.00
Incidentals (9 Tracts)		\$23,000.00
Relocation Payments (Residentials)	2	\$26,000.00
(Businesses)	0	
(Non-Profit)	0	
Total Right-of-Way Cost		\$645,000.00

Utility Relocation

Reimbursable.....		\$16,000.00
Non-Reimbursable.....		\$385,000.00
Total Adjustment Cost.....		\$401,000.00

Construction Cost

Clearing and Grubbing.....		\$114,000.00
Earthwork.....		\$1,367,000.00
Pavement Removal.....		\$84,000.00
Drainage.....		\$1,470,000.00
Major Items	\$1,156,000.00	
Other Drainage	\$94,000.00	
Erosion Control	\$220,000.00	
Structures.....		\$1,620,000.00
Railroad Crossing or Separation Structure.....		\$0.00
Paving.....		\$3,036,000.00
Retaining Walls.....		\$0.00
Maintenance of Traffic		\$75,000.00
Topsoil.....		\$44,000.00
Seeding.....		\$32,000.00
Sodding.....		\$33,000.00
Signing.....		\$81,000.00
Signalization.....		\$45,000.00
Fence.....		\$97,000.00
Guardrail.....		\$113,000.00
Rip-Rap or Slope Protection.....		\$0.00
Other Const. Items (8.5%).....		\$698,000.00
Sub-Total Construction.....		\$8,909,000.00
Mobilization.....		\$386,000.00
Sub-Total Construction.....		\$9,295,000.00
10% Engineering and Contingencies.....		\$930,000.00

Total Construction Cost..... \$10,225,000.00

Preliminary Engineering (10%)..... \$930,000.00

TOTAL PROJECT COST..... \$12,201,000.00

Cost Estimate Worksheet

Route: Mine Lick Interchang

Section: "A"

From:

To:

Length (Mi) 4.57 (Ft.) 24130

1. Clearing and Grubbing						
Acreage	63.33	X Cost/Acre	\$1,800.00			\$114,000.00
2. Earthwork						
Average Cut/Fill	5					
Type of Excavation	Unc.					
Yardage Factor = C.Y.	24.41	X Length	38902.00	X Percentage	0.60	
Subtotal for Earthwork	569759	X Unit Price	\$2.40			\$1,367,420.86
						\$1,367,000.00
3. Pavement Removal						
No. of Roads	1	X Length	16781	X unit price	\$5.00	\$84,000.00
4. Drainage						
Catch Basins	6	X \$2,000				\$12,000.00
Pipe 18"		Length	5835	X unit price	\$25.00	\$145,875.00
Pipe 24"		Length	3500	X unit price	\$30.00	\$105,000.00
Pipe 30"		Length	2334	X unit price	\$35.00	\$81,690.00
Culverts; L	0	X Width	0	X unit price	\$45.00	\$0.00
L	345	X Width	48	X unit price	\$45.00	\$745,200.00
L	0	X Width	0	X unit price	\$45.00	\$0.00
Paved Ditches; L	11670	X unit price	\$15.00			\$61,267.50
Side Drains; No.	10	X 36'	X unit price	\$15.00		\$5,400.00
Other Drainage	(1.5% of Constr.)					\$94,161.49
Erosion Control	(3.5% of Constr.)					\$219,710.14
Subtotal for Drainage						\$1,470,000.00
5. Structures						
(Removal) L	378	X Width	30	X unit price	\$9.50	\$107,730.00
(New) L	378	X Width	80	X unit price	\$50.00	\$1,512,000.00
(New) L	0	X Width	0	X unit price	\$50.00	\$0.00
(Widen) L	0	X Width	24	X unit price	\$45.00	\$0.00
+(\$100 x Length	0	X 2				\$0.00
Major Structures: Length			0			\$0.00
Major Structures: Length			0			\$0.00
Subtotal for Structures						\$1,620,000.00
6. Railroad Crossing:						
Surface: Length	0	X Unit Price	\$780.00			\$0.00
Length	0	X Unit Price	\$0.00			\$0.00
CWT or MD: No.	0	X Unit Price	\$12,000.00			\$0.00
Signals: No.	0	X Unit Price	\$72,000.00			\$0.00
No.	0	X Unit Price	\$0.00			\$0.00
Signing: No.	0	X Unit Price	\$200.00			\$0.00
Separation Structure						
L	0	X Width	0	X unit price	\$45.00	\$0.00
Run-around= \$200/ft. + \$50,000 for relocation of communication equipment						\$0.00
Subtotal for Railroad Crossing						\$0.00
7. Paving						
Mainline= L (ft.)	38902	X unit price	\$78.00			\$3,034,356.00
Sideroads= No.	0	X Length	200	X unit price	\$45.00	\$0.00
Overlay(L)	0	X unit price	\$60.00			\$0.00
Sidewalk(sq ft)	0	X unit price	\$3.00			\$0.00
Driveways= No.	3	X Avg. Length	20.00	X unit price	\$30.00	\$1,800.00
Subtotal for Paving						\$3,036,000.00
8. Retaining Walls						
Sq. Ft.	0	X unit price	\$30.00			\$0.00
Subtotal for Retaining Walls						\$0.00
9. Maintenance of Traffic						
New Location	\$15,000.00					
Existing Location	\$60,000.00					
Detour	\$0.00					
Subtotal for Maintenance of Traffic						\$75,000.00

10. Topsoil							
Avg. Fill	5						
Factor	0.283	X Length	15561	X unit price*2	\$3.00	\$26,422.58	
Avg. Cut	5						
Factor	0.191	X Length	15561	X unit price*2	\$3.00	\$17,832.91	
Subtotal for Topsoil							\$44,000.00
11. Seeding							
Avg. Fill	5						
Factor	0.030	X Length	19451	X unit price*2	\$16.00	\$18,672.96	
Avg. Cut	5						
Factor	0.021	X Length	19451	X unit price*2	\$16.00	\$13,071.07	
Subtotal for Seeding							\$32,000.00
12. Sodding							
Avg. Fill	5						
Factor	3.389	X Length	973	X unit price*2	\$3.00	\$19,784.98	
Avg. Cut	5						
Factor	2.333	X Length	973	X unit price*2	\$3.00	\$13,620.05	
Subtotal for Sodding							\$33,000.00
13. Signing							
L (Mi.)	2.00	X Cost/Mile		\$3,000.00		\$6,000.00	
No. Int.	2	X Cost/Int.		\$5,000.00		\$10,000.00	
Interchange	1	X unit price		\$65,000.00		\$65,000.00	
Subtotal for Signing							\$81,000.00
14. Signalization							
No. + signals	0	X unit price		\$75,000.00		\$0.00	
No. T signals	1	X unit price		\$45,000.00		\$45,000.00	
Subtotal for Signalization							\$45,000.00
15. Fence							
L (ft.)	1745	X 2 X u/p		\$5.00		\$17,450.00	
No. int.	2	X cost/int.		\$40,000.00		\$80,000.00	
Subtotal for Fence							\$97,000.00
16. Guardrail							
L (ft.)	9725	X unit price		\$10.00		\$97,250.00	
# end treatments	16	X unit price		\$1,000.00		\$16,000.00	
Subtotal for Guardrail							\$113,000.00
17. Rip/Rap Slope Protection							
L (ft.)	0	X slope dist.	20	X 0.074			
X 2 tons X unit price/ton		\$14.00					\$0.00
18. Subtotal for Items #1 - #17							\$8,211,000.00
19. Other Const. Items (Line #18 X 8.5%)							\$698,000.00
20. Sub-Total for Construction (18 + 19)							\$8,909,000.00
21. Mobilization							
0 to 1 million (5%)							
1 to 5 million \$50,000 + 4.5% in excess of 1 million							\$386,000.00
5 to 10 million \$230,000 + 4.0% in excess of 5 million							
10 to 20 million \$430,000 + 3.5% in excess of 10 million							
over 20 million \$780,000 + 3.0% in excess of 20 million							
Subtotal for Mobilization							

Project: Mine Lick Creek Interchange Alt "B"

Length: 3.31 mi.

Cross Section: variable

Right-of-Way

Land, Improvements and Damages (Acres)) 50.1	\$365,000.00
Incidentals (10 Tracts)		\$25,000.00
Relocation Payments (Residentials)	1	\$13,000.00
(Businesses)	0	
(Non-Profit)	0	
Total Right-of-Way Cost		\$403,000.00

Utility Relocation

Reimbursable.....	\$8,000.00
Non-Reimbursable.....	\$0.00
Total Adjustment Cost.....	\$8,000.00

Construction Cost

Clearing and Grubbing.....	\$120,000.00
Earthwork.....	\$1,414,000.00
Pavement Removal.....	\$21,000.00
Drainage.....	\$500,000.00
Major Items	\$278,000.00
Other Drainage	\$67,000.00
Erosion Control	\$155,000.00
Structures.....	\$1,452,000.00
Railroad Crossing or Separation Structure.....	\$0.00
Paving.....	\$2,123,000.00
Retaining Walls.....	\$0.00
Maintenance of Traffic	\$65,000.00
Topsoil.....	\$41,000.00
Seeding.....	\$29,000.00
Sodding.....	\$31,000.00
Signing.....	\$78,000.00
Signalization.....	\$45,000.00
Fence.....	\$100,000.00
Guardrail.....	\$89,000.00
Rip-Rap or Slope Protection.....	\$0.00
Other Const. Items (8.5%).....	\$519,000.00
Sub-Total Construction.....	\$6,627,000.00
Mobilization.....	\$295,000.00
Sub-Total Construction.....	\$6,922,000.00
10% Engineering and Contingencies.....	\$692,000.00
Total Construction Cost.....	\$7,614,000.00
Preliminary Engineering (10%).....	\$692,000.00
TOTAL PROJECT COST.....	\$8,717,000.00

Cost Estimate Worksheet

Route: Mine Lick Interchang

Section: "B"

From:

To:

Length (Mi) 3.31 (Ft.) 17477

1. Clearing and Grubbing						
Acreage	66.77	X Cost/Acre	\$1,800.00			\$120,000.00
2. Earthwork						
Average Cut/Fill	7					
Type of Excavation	Unc.					
Yardage Factor = C.Y.	38.43	X Length	25556.00	X Percentage	0.60	
Subtotal for Earthwork	589270	X Unit Price	\$2.40			\$1,414,248.60
						\$1,414,000.00
3. Pavement Removal						
No. of Roads	1	X Length	4190	X unit price	\$5.00	\$21,000.00
4. Drainage						
Catch Basins	6	X \$2,000				\$12,000.00
Pipe 18"		Length	3833	X unit price	\$25.00	\$95,825.00
Pipe 24"		Length	2300	X unit price	\$30.00	\$69,000.00
Pipe 30"		Length	1533	X unit price	\$35.00	\$53,655.00
Culverts; L	0	X Width	0	X unit price	\$45.00	\$0.00
L	2	X Width	48	X unit price	\$45.00	\$4,320.00
L	0	X Width	0	X unit price	\$45.00	\$0.00
Paved Ditches; L	7667	X unit price	\$15.00			\$40,251.75
Side Drains; No.	6	X 36'	X unit price	\$15.00		\$3,240.00
Other Drainage	(1.5% of Constr.)					\$66,514.38
Erosion Control	(3.5% of Constr.)					\$155,200.21
Subtotal for Drainage						\$500,000.00
5. Structures						
(New) L	363	X Width	80	X unit price	\$50.00	\$1,452,000.00
(New) L	0	X Width	0	X unit price	\$50.00	\$0.00
(New) L	0	X Width	0	X unit price	\$50.00	\$0.00
(Widen) L	0	X Width	24	X unit price	\$45.00	\$0.00
+(\$100 x Length	0	X 2				\$0.00
Major Structures: Length			0			\$0.00
Major Structures: Length			0			\$0.00
Subtotal for Structures						\$1,452,000.00
6. Railroad Crossing:						
Surface: Length	0	X Unit Price	\$780.00			\$0.00
Length	0	X Unit Price	\$0.00			\$0.00
CWT or MD: No.	0	X Unit Price	\$12,000.00			\$0.00
Signals: No.	0	X Unit Price	\$72,000.00			\$0.00
No.	0	X Unit Price	\$0.00			\$0.00
Signing: No.	0	X Unit Price	\$200.00			\$0.00
Separation Structure						
L	0	X Width	0	X unit price	\$45.00	\$0.00
Run-around= \$200/ft. + \$50,000 for relocation of communication equipment						\$0.00
Subtotal for Railroad Crossing						\$0.00
7. Paving						
Mainline= L (ft.)	25556	X unit price	\$83.00			\$2,121,148.00
Sideroads= No.	0	X Length	200	X unit price	\$45.00	\$0.00
Overlay(L)	0	X unit price	\$60.00			\$0.00
Sidewalk(sq ft)	0	X unit price	\$3.00			\$0.00
Driveways= No.	3	X Avg. Length	20.00	X unit price	\$30.00	\$1,800.00
Subtotal for Paving						\$2,123,000.00
8. Retaining Walls						
Sq. Ft.	0	X unit price	\$30.00			\$0.00
Subtotal for Retaining Walls						\$0.00
9. Maintenance of Traffic						
New Location	\$5,000.00					
Existing Location	\$60,000.00					
Detour	\$0.00					
Subtotal for Maintenance of Traffic						\$65,000.00

10. Topsoil							
Avg. Fill	7						
Factor	0.396	X Length	10222	X unit price*2	\$3.00	\$24,287.47	
Avg. Cut	7						
Factor	0.268	X Length	10222	X unit price*2	\$3.00	\$16,436.98	
Subtotal for Topsoil							\$41,000.00
11. Seeding							
Avg. Fill	7						
Factor	0.043	X Length	12778	X unit price*2	\$16.00	\$17,582.53	
Avg. Cut	7						
Factor	0.029	X Length	12778	X unit price*2	\$16.00	\$11,857.98	
Subtotal for Seeding							\$29,000.00
12. Sodding							
Avg. Fill	7						
Factor	4.745	X Length	640	X unit price*2	\$3.00	\$18,220.80	
Avg. Cut	7						
Factor	3.222	X Length	640	X unit price*2	\$3.00	\$12,372.48	
Subtotal for Sodding							\$31,000.00
13. Signing							
L (Mi.)	1.00	X Cost/Mile		\$3,000.00		\$3,000.00	
No. Int.	2	X Cost/Int.		\$5,000.00		\$10,000.00	
Interchange	1	X unit price		\$65,000.00		\$65,000.00	
Subtotal for Signing							\$78,000.00
14. Signalization							
No. + signals	0	X unit price		\$75,000.00		\$0.00	
No. T signals	1	X unit price		\$45,000.00		\$45,000.00	
Subtotal for Signalization							\$45,000.00
15. Fence							
L (ft.)	1985	X 2 X u/p		\$5.00		\$19,850.00	
No. int.	2	X cost/int.		\$40,000.00		\$80,000.00	
Subtotal for Fence							\$100,000.00
16. Guardrail							
L (ft.)	7667	X unit price		\$10.00		\$76,670.00	
# end treatments	12	X unit price		\$1,000.00		\$12,000.00	
Subtotal for Guardrail							\$89,000.00
17. Rip/Rap Slope Protection							
L (ft.)	0	X slope dist.	20	X 0.074			
X 2 tons X unit price/ton		\$14.00					\$0.00
18. Subtotal for Items #1 - #17							\$6,108,000.00
19. Other Const. Items (Line #18 X 8.5%)							\$519,000.00
20. Sub-Total for Construction (18 + 19)							\$6,627,000.00
21. Mobilization							
0 to 1 million (5%)							
1 to 5 million \$50,000 + 4.5% in excess of 1 million							\$295,000.00
5 to 10 million \$230,000 + 4.0% in excess of 5 million							
10 to 20 million \$430,000 + 3.5% in excess of 10 million							
over 20 million \$780,000 + 3.0% in excess of 20 million							
Subtotal for Mobilization							

Functional Drawings

Index of Sheets

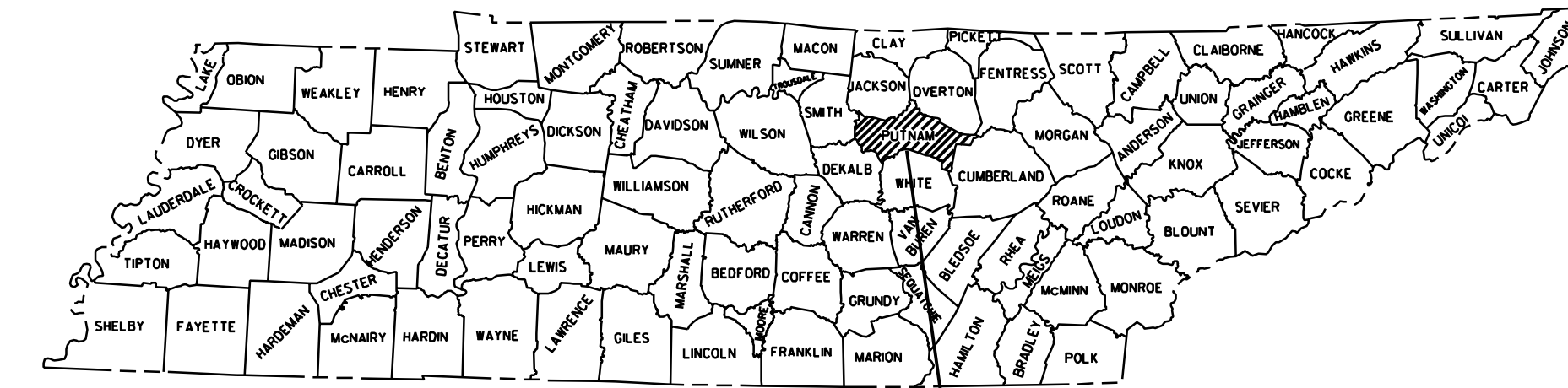
SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	TYPICAL SECTIONS
3A, 4A, 5A, 6A	PROPOSED LAYOUTS (ALT. "A")
3B, 4B, 5B, 6B	PROPOSED LAYOUTS (ALT. "B")

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION BUREAU OF PLANNING AND DEVELOPMENT

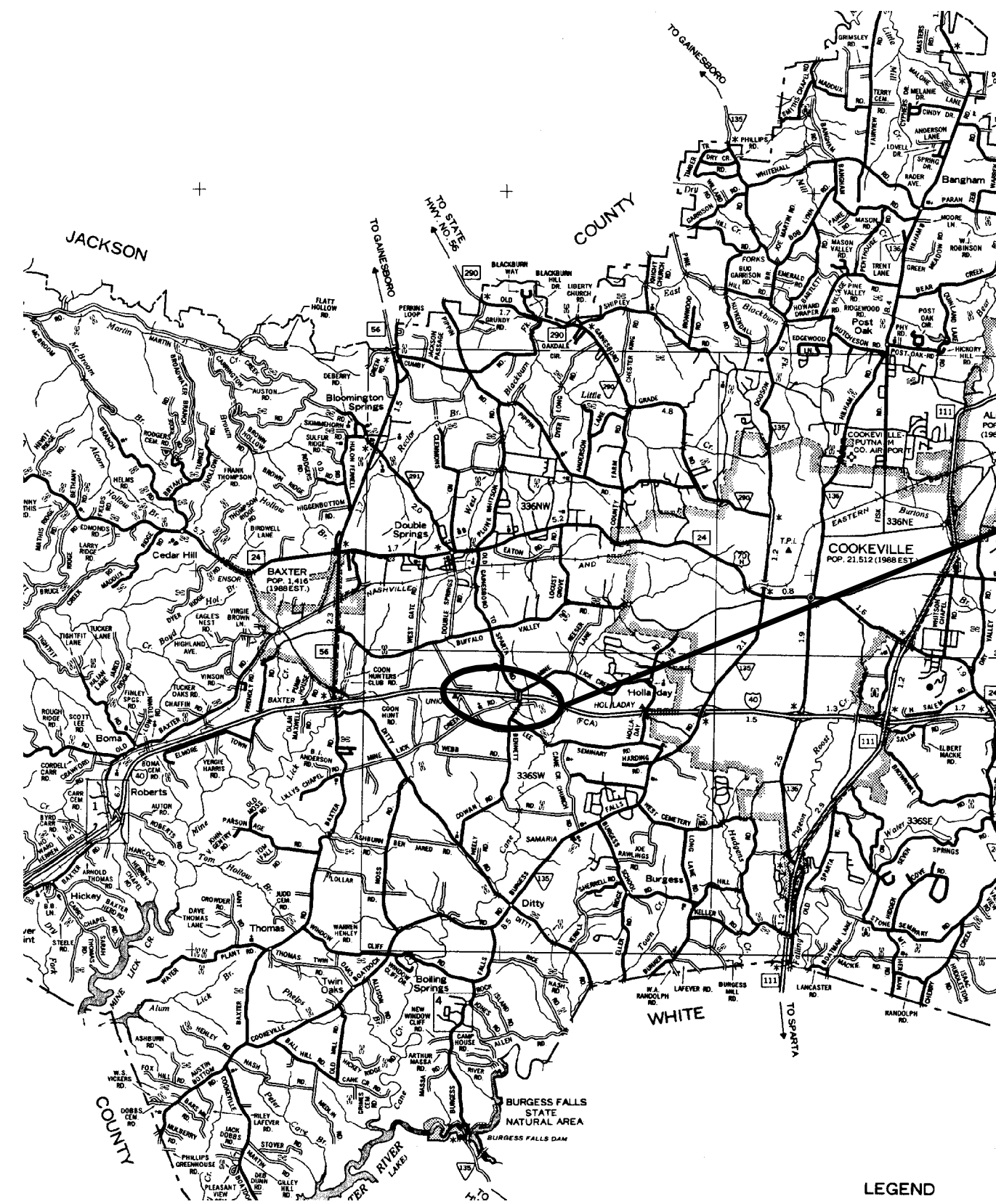
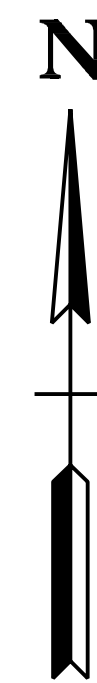
TENN.	YEAR	SHEET NO.
	2000	1
FED. AID PROJ. NO.		
STATE PROJ. NO.		

PUTNAM COUNTY INTERCHANGE JUSTIFICATION STUDY MINE LICK CREEK ROAD AT INTERSTATE 40

STATE HIGHWAY NO. 265 F.A.H.S. NO. N/A



PROJECT LOCATION



PROJECT LOCATION

N. T. S.

SPECIAL NOTES

PROPOSALS MAY BE REJECTED BY THE COMMISSIONER IF ANY OF THE UNIT PRICES CONTAINED THEREIN ARE OBVIOUSLY UNBALANCED, EITHER EXCESSIVE OR BELOW THE REASONABLE COST ANALYSTS VALUE.

THIS PROJECT TO BE CONSTRUCTED UNDER THE STANDARD SPECIFICATIONS OF THE TENNESSEE DEPARTMENT OF TRANSPORTATION DATED MARCH 1, 1995 AND ADDITIONAL SPECIFICATIONS AND SPECIAL PROVISIONS CONTAINED IN THE PLANS AND IN THE PROPOSAL CONTRACT

TDOT CIVIL ENGINEERING MANAGER 1 _____
 DESIGNED BY NEEL-SCHAFFER, INC.
 DESIGNER _____ CHECKED BY _____
 P.E. NO. _____

APPROVED: _____
 DESIGN DIVISION

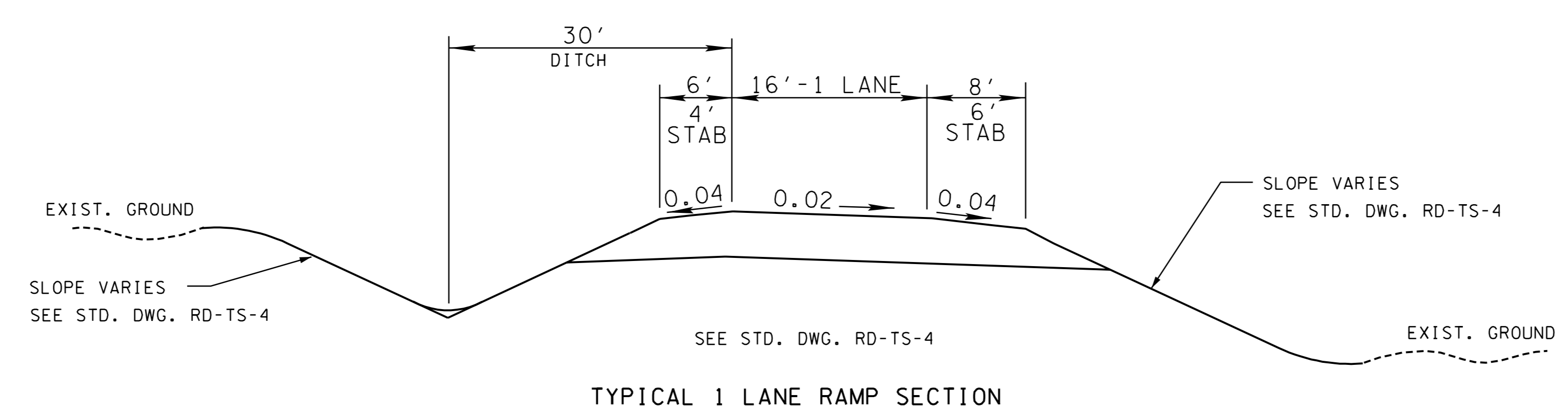
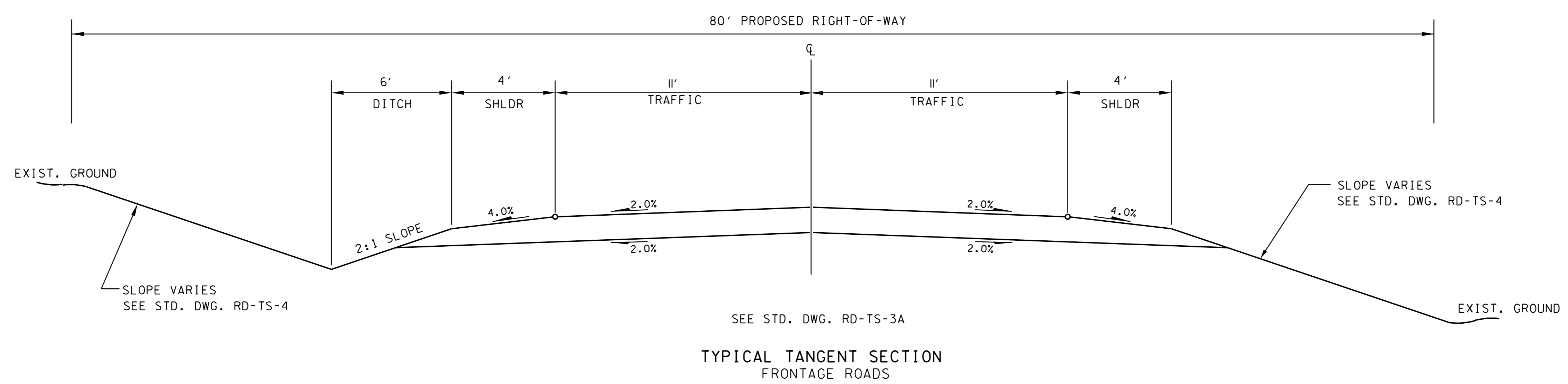
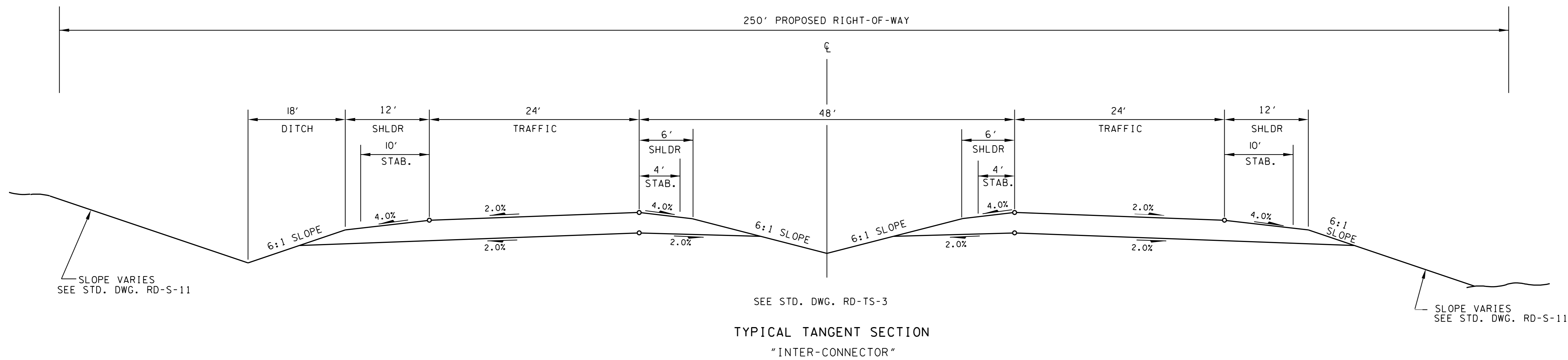
DATE: _____

APPROVED: _____
 COMMISSIONER

U.S. DEPARTMENT OF TRANSPORTATION
 FEDERAL HIGHWAY ADMINISTRATION

APPROVED: _____
 DIVISION ADMINISTRATOR DATE

TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		2

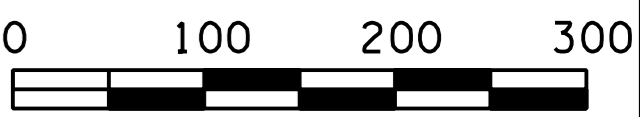


NOT TO SCALE

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

PUTNAM COUNTY
INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD

TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		3A

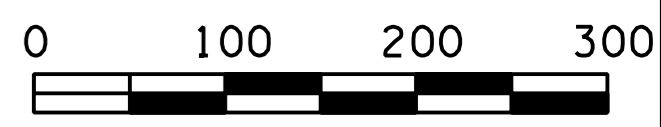


STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD.

ALTERNATE "A"

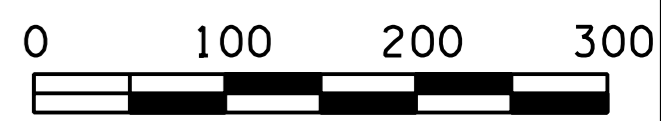
TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		4A



STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

**INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD.
ALTERNATE "A"**

TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		5A

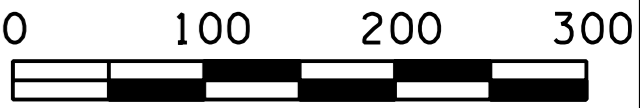


STATE OF TENNESSEE
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INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD.

ALTERNATE "A"

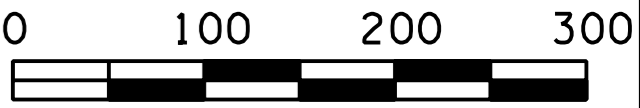
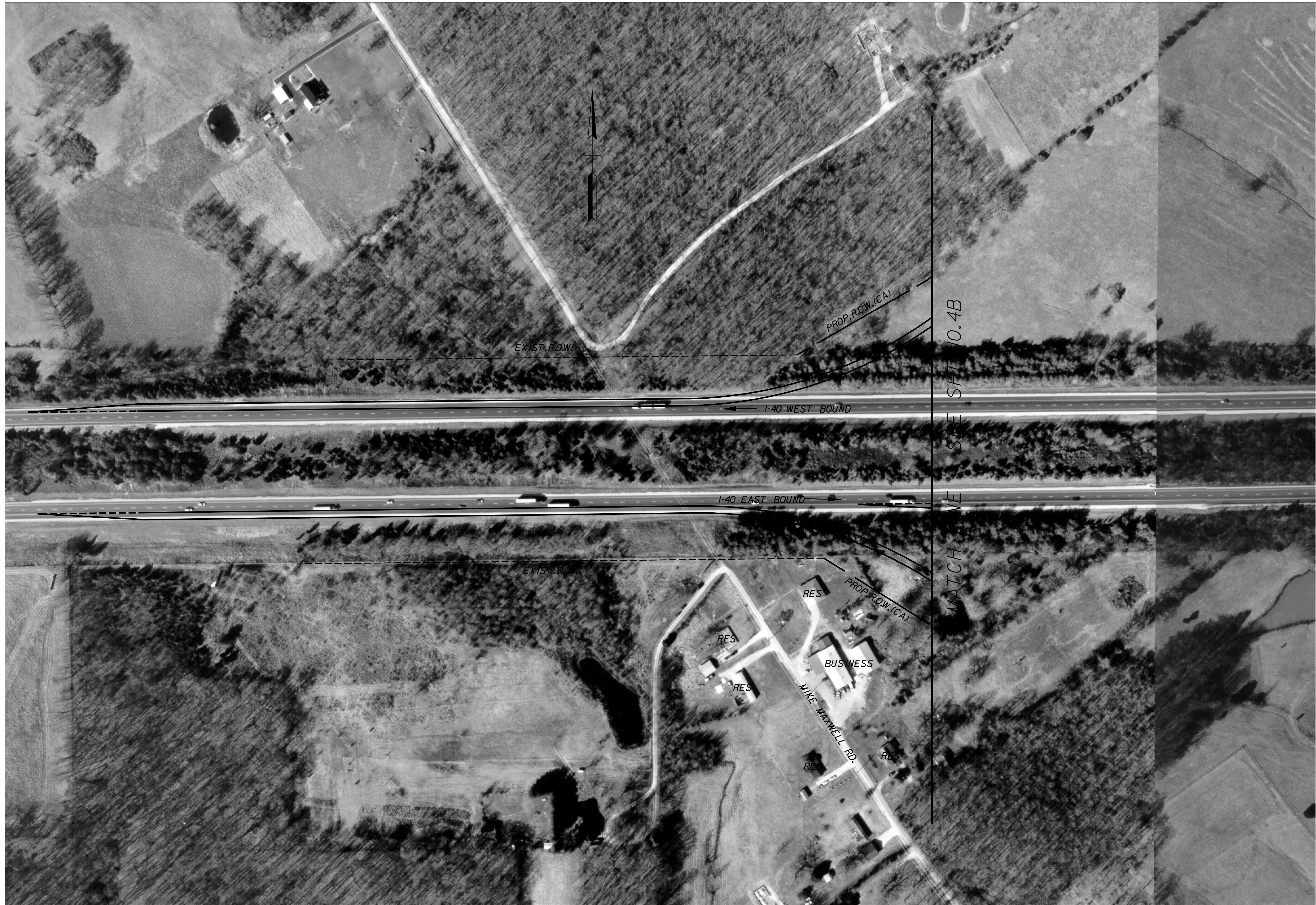
TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		6A



STATE OF TENNESSEE
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**INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD.
ALTERNATE "A"**

TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		3B



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INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD
ALTERNATE "B"

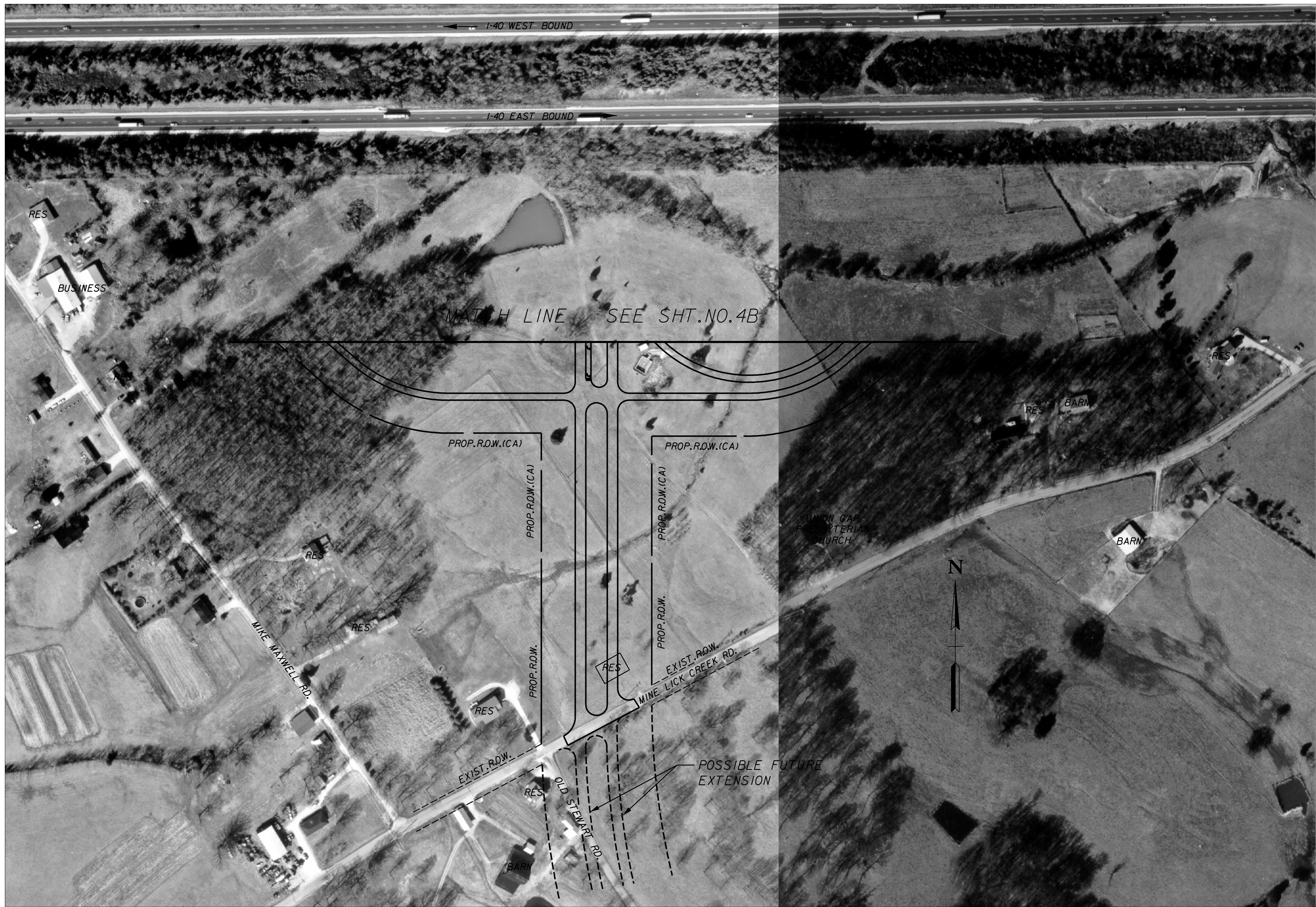
TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		5B



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INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD
ALTERNATE "B"

TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		6B



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INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD
ALTERNATE "B"