ADDENDUM TO THE INTERCHANGE JUSTIFICATION STUDY

Interstate 40
at
Mine Lick Creek Road
Putnam County

PREPARED BY
RPM TRANSPORTATION CONSULTANTS, LLC

FOR
THE TENNESSEE DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION

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CHAPTER 1

INTRODUCTION

A. Purpose of Addendum

The purpose of this addendum is to update the information provided in the Interchange Justification Study (IJS) for Interstate 40 (I-40) at Mine Lick Creek Road just west of the City of Cookeville in Putnam County (see Figure 1).

An Interchange Justification Study was developed by TDOT in August 2000 for this location and was subsequently approved by FHWA. Since that time, some changes have occurred in both the existing conditions and in the planned conditions of the proposed interchange location. Specifically these are:

- Selection of an alternative Appalachian Route "J"
- Planning for a new 367-acre business park at the interchange location

These two changes have initiated the development of this addendum to the previously approved IJS. Major aspects of the previous justification study including planned future northern and southern routes connecting State Route (SR) 111 in White County, south of I-40 to SR 24 (US 70N) north of I-40 remain valid and are therefore not addressed in detail in this addendum. One exception is that, while still considered a part of the interchange proposal, the proposed northern connector from I-40 to SR 24 may not be constructed concurrently with the interchange due to funding considerations. This will be addressed further within this addendum.

The updated conditions and plans in the area have been deemed significant enough to warrant updated traffic projections. These updated traffic projections have, in turn, resulted in some modification to the geometrics of the interchange configuration. These traffic and geometric updates are addressed in this addendum.

This addendum considers changes in the current and future needs of the area, and re-analyzes traffic operational features for the approved I-40 access point at Mine Lick Creek Road. Estimated costs for the proposed interchange have been updated and functional plans have been modified.

B. Description of Project Location

For the purposes of this addendum, only one location has been investigated for this proposed interchange site[1] (See Figure 2). Alternate "A" is located at the existing Mine Lick Creek Road overpass and is approximately 2.80 miles east of the State Route (SR) 56 (Baxter Road)

[1] The 2000 IJS investigated a second site, Alternate "B", located approximately 0.57 miles west of existing Mine Lick Creek Road. Both alternatives were found to meet the objectives of the study. Subsequent discussions with the City of Cookeville concerning other road and development plans in the area have resulted in Alternate "A" being selected as the preferred location.

interchange and 2.82 miles west of the SR 135 (Burgess Falls Road/S. Willow Avenue) interchange.

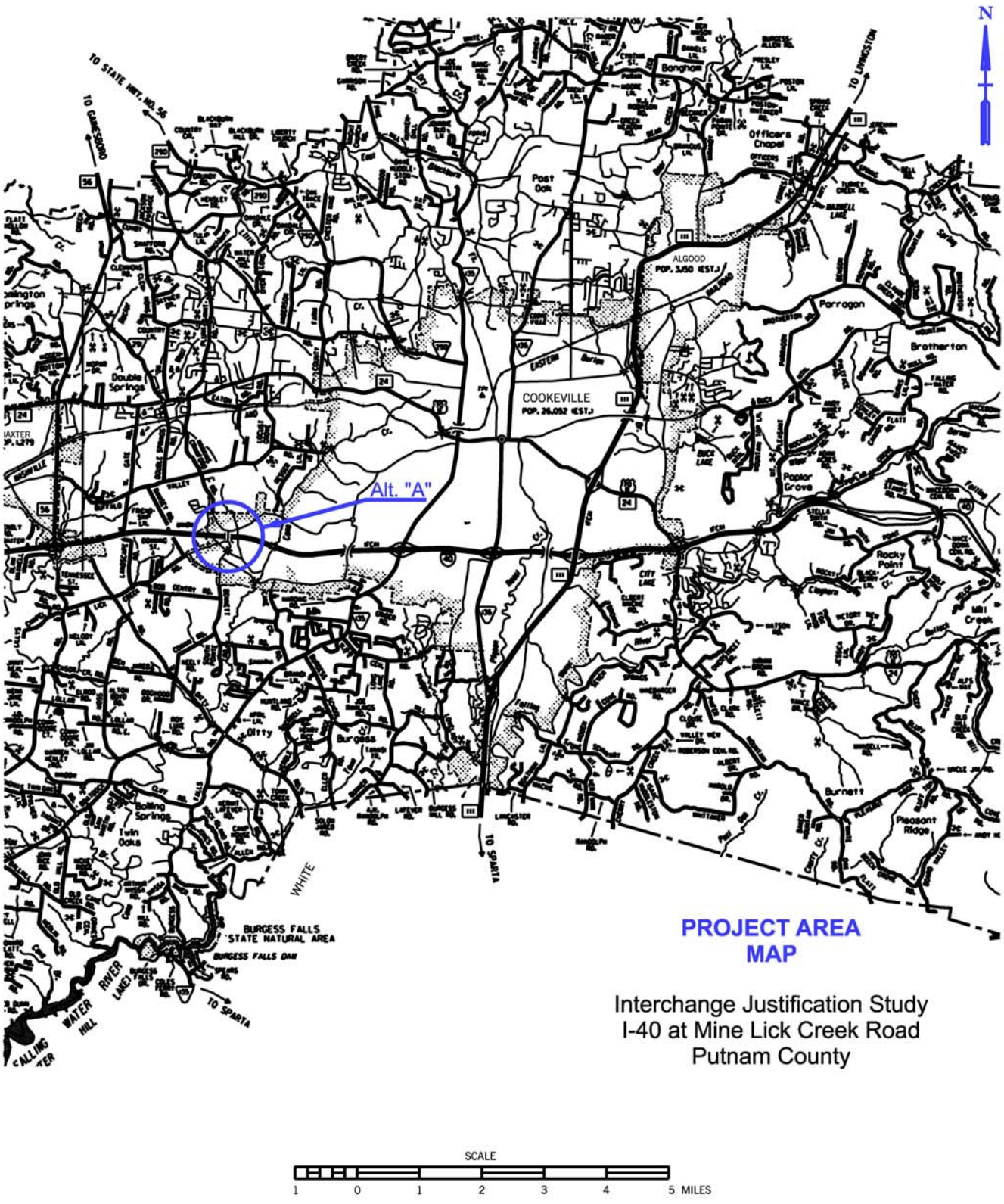


Figure 1. Project Area Map

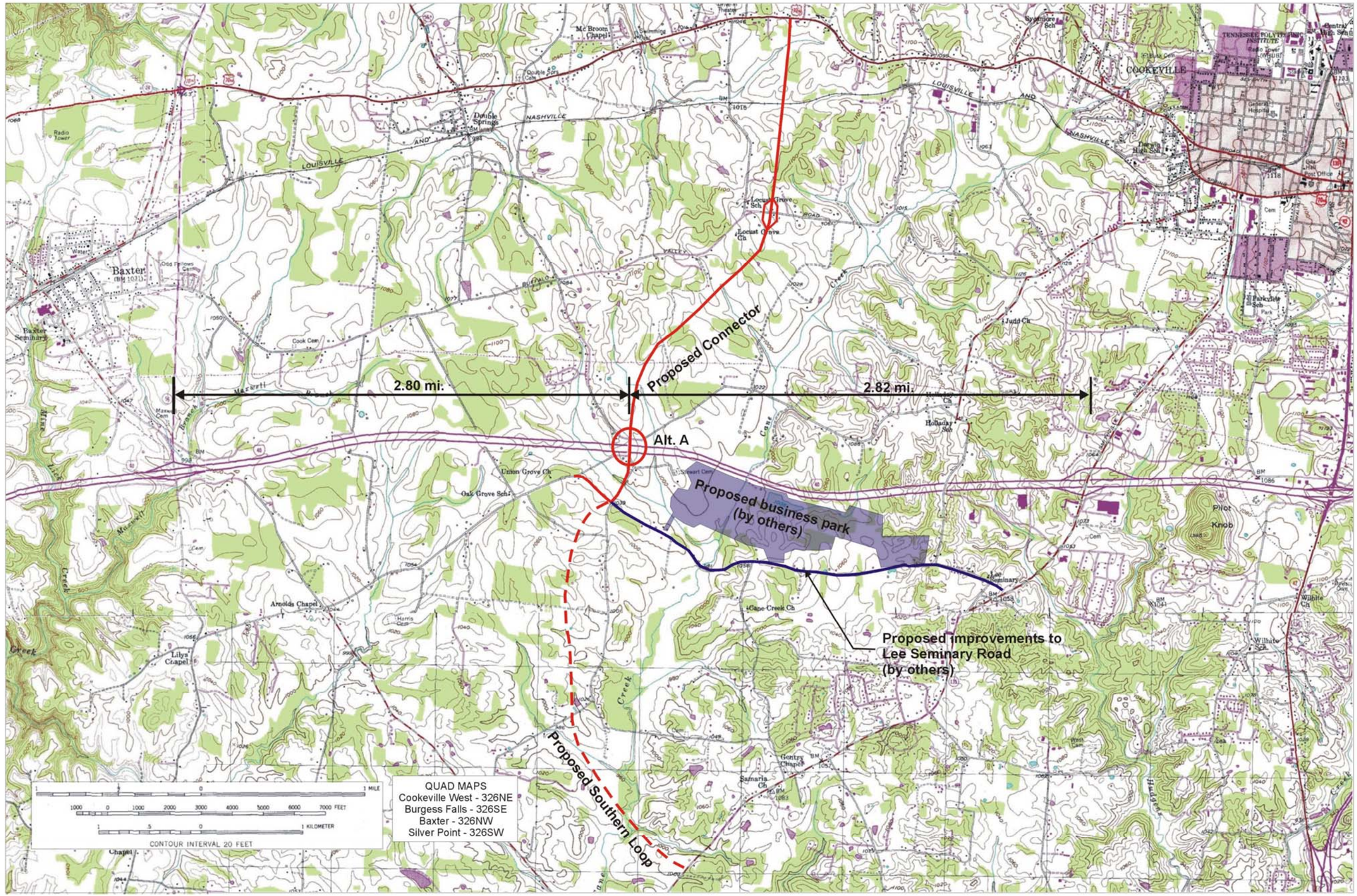


Figure 2. Project Location Map

C. Relationship to Other Transportation Improvement Plans & Classifications

In the 2000 IJS, it was assumed that a connector would be constructed north from the proposed interchange to a proposed Appalachian Route "J" alignment on the north side of Cookeville. Since then, an alternative route for Corridor "J" has been selected east of the interchange location and out of range of a connection with I-40 via the Mine Lick Creek Road interchange.

While this northern connector is no longer planned to be extended to Corridor "J", this road is still planned to be extended from the proposed interchange to SR 24 (US 70N), as shown in Figure 3. This northern roadway extension remains in the Cookeville Major Street Plan.

Aside from the selection of an alternate Corridor "J" alignment, the other change to the 2000 IJS is the proposed Highlands Business Park to be constructed just east of the proposed interchange location, and bordered by I-40 to the north, Holladay Road to the east, Lee Seminary Road to the south, and Mine Lick Creek Road to the west. This business park is a joint effort by the City of Cookeville and Putnam County and is being planned to take advantage of regional economic development opportunities. The location of this proposed business park has been determined in part by the location of the Alternate "A" interchange in the previously approved Interchange Justification Study. The business park is 367-acres in size and is expected to generate over 20,000 new vehicle trips in this area per day[2].

The construction of the Mine Lick Creek Road interchange is currently programmed in the 2008-2011 State Transportation Improvement Program (STIP). The STIP includes programming of right-of-way and construction of the interchange as STIP ID# 71015. The northern connector is currently not included in the STIP.

[2] Data from "Traffic Analysis for Gould Drive Extension Environmental Assessment". Barge Waggoner Sumner & Cannon, Inc. October 2008. The traffic study used a combination of land uses to estimate that over 30,000 new trips per day would be generated. However, a review of the data shows that the traffic was likely overestimated (For example: The average size of a business park per ITE Trip Generation data is 28 acres. The Highlands Business Park has 250 acres of developable area. Using trip generation data for a site almost 10 times the average size of the site from which data were collected yields higher than expected traffic volumes.) Data from the traffic study were reduced by 30% to obtain just over 21,000 new daily trips to the site.

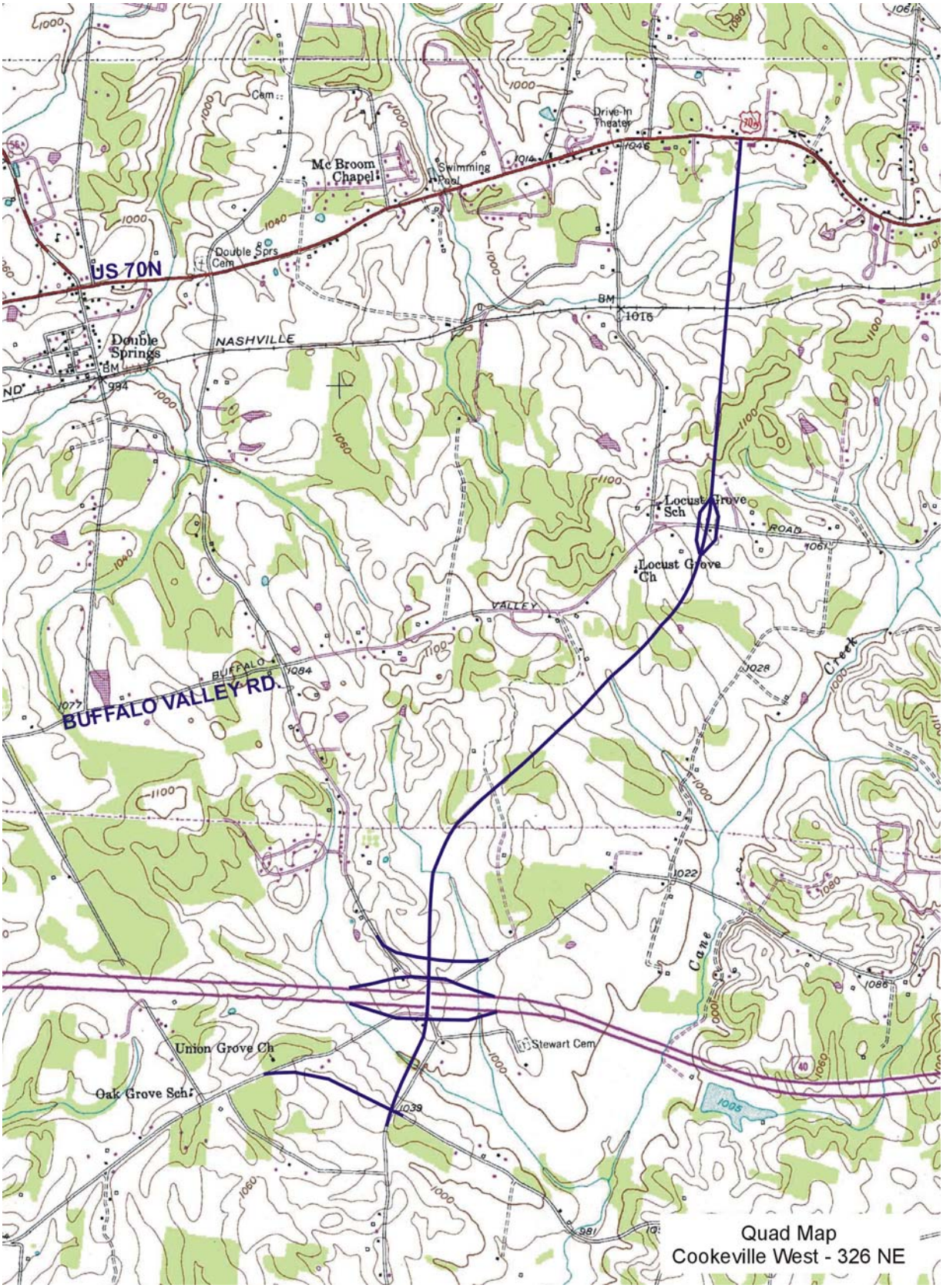


Figure 3. Proposed Alignment of North-South Connector (Not to scale)
(*Source: TDOT APR, 2000*)

CHAPTER 2

CHANGES IN PRELIMINARY PLANNING DATA

A. Land Use

Land use at the proposed interchange location has changed very little since completion of the 2000 IJS. One difference is that this area is now included within the City Limits of Cookeville. This has had no significant impact on the land use of the area.

With the development of the proposed Highlands Business Park in this area, the surrounding land use, particularly south of I-40 will change. Land use in the business park area will convert from agricultural and low-density residential to a mixture of office, general commercial, light industrial, and manufacturing uses.

B. Updated Traffic Projections

Updates to traffic data for this addendum were developed by RPM Transportation Consultants (RPM) and approved by The Tennessee Department of Transportation (TDOT). The traffic projections used in this analysis include new trips that will be generated by the Highland Business Park located just east of the proposed interchange location[3]. Traffic developed for the existing system shows 2013 AADT volumes of 52,500 on I-40 between the SR 56 (Baxter Road) interchange and the SR 135 (Burgess Falls Road/S. Willow Avenue) interchange. Design year (2033) volumes on this section are expected to reach 71,500 vehicles per day. Traffic on existing Mine Lick Creek Road shows a daily volume of 7,100 vehicles in the base year (2013) and 7,600 by the 2033 design year. These volumes are shown in Figure 4.

With the proposed interchange in place, 2013 Annual Average Daily Traffic (AADT) volumes on I-40 are expected to be 55,000 vehicles west of, and 59,000 vehicles east of the proposed interchange site. These volumes are expected to increase by 2033 to 73,000 vehicles and 77,500 vehicles, respectively. Daily traffic volumes on Mine Lick Creek Road will be heavily influenced by the business park construction and will increase to 29,500 vehicles by the year 2033 south of I-40 and 13,500 vehicles north of I-40 (see Figure 5).

Projected AADT volumes, along with Design Hour Volumes (DHV) are shown in the Appendix.

[3] Traffic projections from the Barge Waggoner Sumner & Cannon study were used to account for the impacts of the business park.

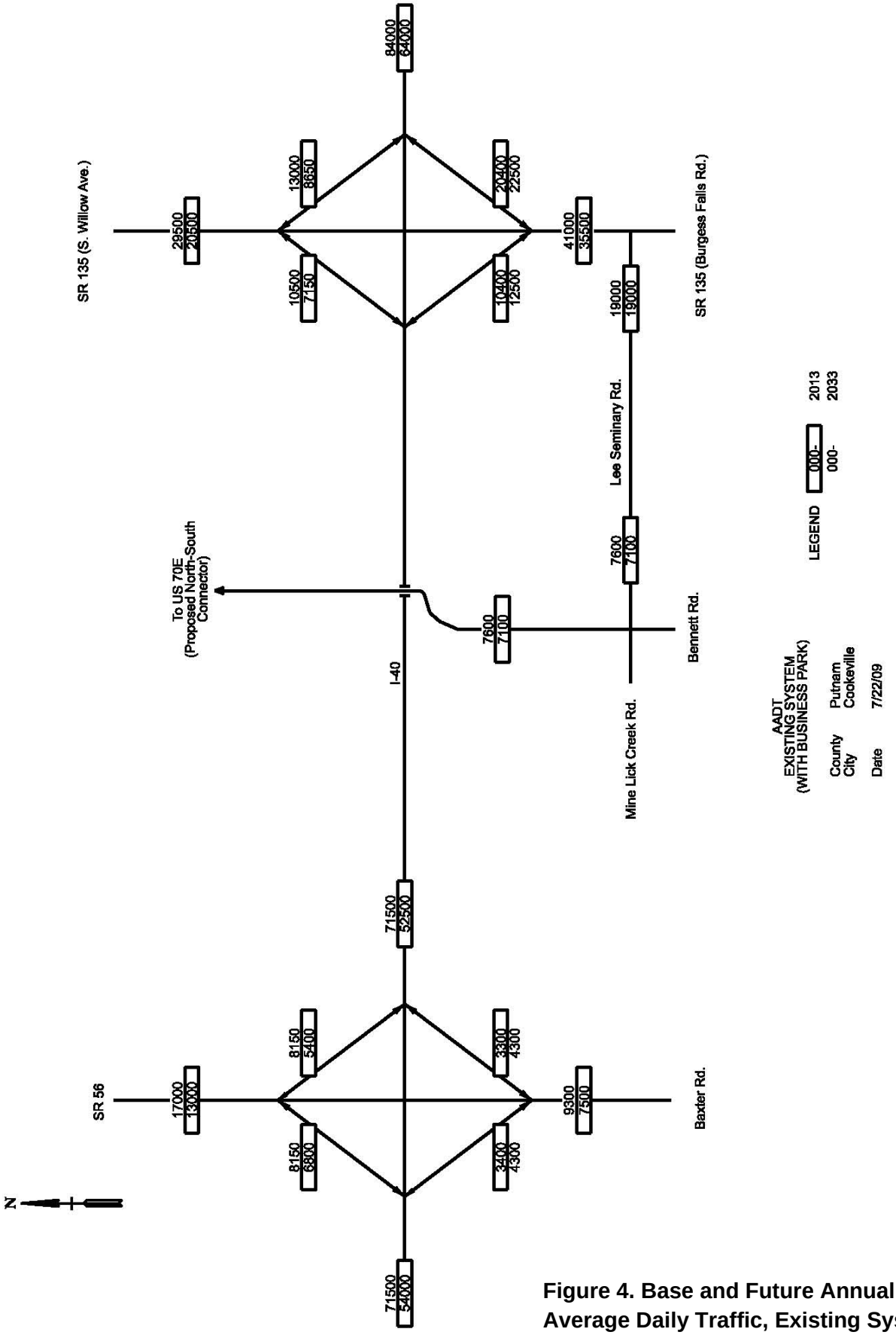


Figure 4. Base and Future Annual Average Daily Traffic, Existing System

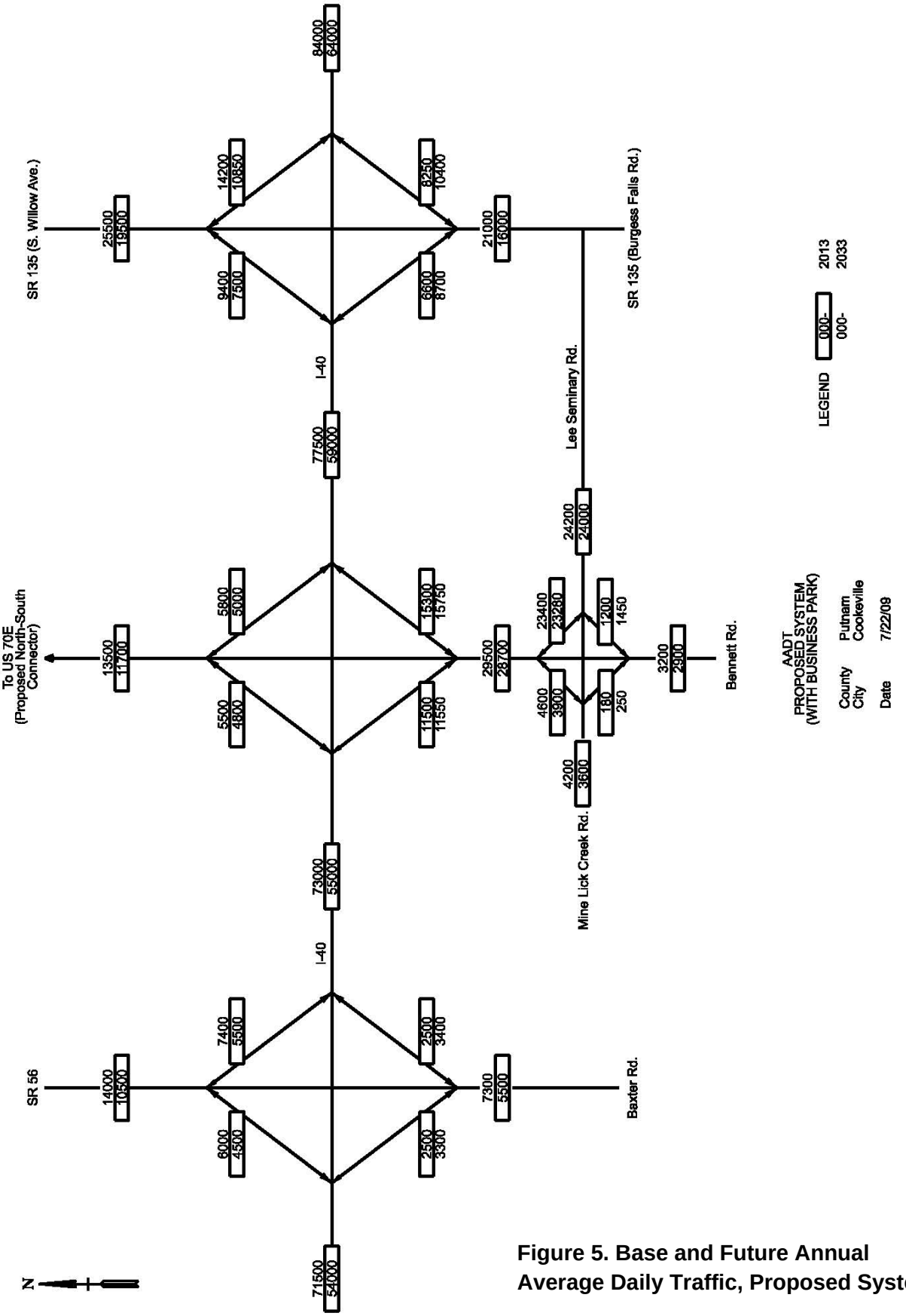


Figure 5. Base and Future Annual Average Daily Traffic, Proposed System

C. Modifications in Proposed Improvements

Based on the analysis conducted for this addendum, it is proposed that the interchange configuration be changed from a partial cloverleaf to a typical diamond-type interchange at the Mine Lick Creek Road (Alternate "A") location. The scale of the diamond interchange is the most fitting for this setting – currently rural but with the potential for significant growth originating from the proposed Highland Business Park and associated development. The diamond as proposed will include single lane on and off ramps. The intersections of the ramp terminals and Mine Lick Creek Road will be constructed in accordance with AASHTO guidelines with the following lane configurations:

Intersection of westbound I-40 ramps and Mine Lick Creek Road

- Two westbound left turn lanes (minimum 400 feet each of storage)
- One westbound right turn lane (minimum 300 feet of storage)
- Two southbound through lanes
- One southbound right turn lane (minimum 200 feet of storage)
- Two northbound through lanes
- Two northbound left turn lanes (minimum 400 feet each of storage)
- The westbound on ramp will be constructed with two lanes for approximately 550 feet, then will taper to a single lane ramp before merging onto I-40

Intersection of eastbound I-40 ramps and Mine Lick Creek Road

- One eastbound left turn lane (minimum 400 feet of storage)
- Two eastbound right turn lanes (minimum 400 feet each of storage)
- Two southbound through lanes
- One southbound left turn lane (minimum 200 feet of storage)
- Two northbound through lanes
- Two northbound right turn lanes (minimum 250 feet each of storage)
- The eastbound on ramp will be constructed with two lanes for approximately 550 feet, then will taper to a single lane ramp before merging onto I-40

These ramp intersection configurations will accommodate future year projections, but can also be expanded if needed in the future. These expansions could include ramp widening and additional turn lanes at the ramp terminal intersections.

After an evaluation of the proposed interchange site, coordinated local and regional plans, and operational requirements, it is proposed that a typical diamond-type interchange will provide the required level of traffic service and should be planned for this location.

Specific recommendations for the proposed diamond interchange layout are discussed below and are shown on the attached functional plans.

1. Two six-lane interchange structures will be constructed over I-40 for the cross-street. These new structures will have sufficient width for 4 @ 12' traffic lanes, a 24 foot wide median including turn lanes, and 12' outside shoulders. These structures will be approximately 140 feet long and in basically the same location as the existing structures over I-40.

2. The proposed lane configuration for each turning movement is as follows:

- Intersection of I-40 westbound ramps and Mine Lick Creek Road
    - Two northbound left turn lanes, two northbound through lanes
    - Two southbound through lanes, one southbound right turn lane

    - Two westbound left turn lanes, one westbound right turn lane
- Intersection of I-40 eastbound ramps and Mine Lick Creek Road
    - Two northbound through lanes, two northbound right turn lanes
    - One southbound left turn lane, two southbound through lanes
    - One eastbound left turn lane, two eastbound right turn lanes

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.

4. Traffic signals will be required on the proposed connector at both the westbound ramp terminal intersection north of the interstate and the eastbound ramp terminal intersection south of the interstate.

5. 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.

Several related projects exist that may not have a significant operational impact on the proposed interchange, but that would ensure a cohesive network of public roads in this area. These related projects, which should be constructed prior to or concurrently with the proposed Mine Lick Creek Road interchange, are as follow:

- Realign approximately 0.38 miles of Mine Lick Creek Road southwest of the proposed interchange to align with the existing intersection of Lee Seminary Road and Bennett Road.
- Improve Lee Seminary Road from Bennett Road to SR 135 (Burgess Falls Road). Because the Highlands Business Park is expected to generate over 20,000 new trips per day and because Lee Seminary Road will serve as the exclusive route to access the business park, improvements to Lee Seminary Road will be required. The planning and design of these improvements are being completed by the City of Cookeville and Putnam County.
- Realign 0.50± miles of Hawkins Crawford Road and Mine Lick Creek Road north of I-40 to create a continuous east-west route north of the proposed interchange. The intersection of this realigned road with the proposed interchange cross-street should be at least 300 feet north of the westbound I-40 ramp terminals. North of the intersection of Mine Lick Creek Road/Hawkins Crawford Road and the interchange cross-street, the North-South Connector will be fully access controlled.
- Construct the proposed North-South Connector from I-40 to SR 24 (US 70N). As detailed in the Advance Planning Report completed by TDOT in 2000, this 2.87± mile roadway would be a four lane access controlled divided highway with a minimum 250 foot right-of-way. Programming and funding considerations for a project of this magnitude may require its construction to follow after the interchange project. If so, the cross street should be constructed at least to the intersection of Mine Lick Creek Road and Hawkins Crawford Road.

CHAPTER 3

ENGINEERING INVESTIGATIONS

A. Traffic Operations

An update to the interchange 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 and without the proposed I-40 interchange at Mine Lick Creek Road.

Without the proposed interchange, the analysis shows the westbound lanes of the existing interstate highway between the SR 135 (Burgess Falls Road/S. Willow Avenue) interchange and the SR 56 (Baxter Road) interchange operating at a Level of Service (LOS) B during the AM peak and LOS C during the PM peak with base year (2013) traffic. The eastbound lanes, through this same area, will operate at a LOS C during the AM peak and LOS B during the PM peak. Using projected design year (2033) traffic, the westbound lanes are expected to operate at a LOS C during both peak periods. The eastbound lanes will operate with a LOS D during the AM peak and LOS C during the PM peak.

Capacity analyses were also conducted assuming the completion of the proposed Mine Lick Creek Road interchange. Under these conditions during the base year, all mainline sections in both directions will be characterized by a LOS C or better. During the design year, all mainline sections in both directions will be characterized by a LOS D or better.

Analysis of the proposed interchange shows the signalized intersection of the eastbound I-40 ramps with Mine Lick Creek Road is expected to operate at a LOS C during the AM peak and LOS B during the PM peak through base and design years. The signalized westbound ramp intersection will experience a LOS C during the AM Peak and a LOS B during the PM peak through base and design years.

Overall, the construction of the Mine Lick Creek Road interchange will substantially mitigate the traffic impacts of the proposed business park on the interstate system. Without the proposed interchange at Mine Lick Creek Road, most of the business park traffic will utilize the SR 135 interchange. This will increase delays and worsen operations at the SR 135 interchange and on SR 135, particularly south of I-40. With the proposed interchange at Mine Lick Creek Road, traffic volumes will be heavier on the mainline segment of I-40 between SR 135 and Mine Lick Creek Road, but traffic volumes using the SR 135 interchange will not be substantially increased over baseline conditions.

Under the projected traffic volumes, all ramps at the proposed interchange have a minimum 20-year service life. Table 1 summarizes the results of the operational analysis. Traffic volumes and level of service analyses for both base year volumes (2013) and design year volumes (2033) are presented in the Appendix.

Analysis Point	Analysis Type	LOS							
		2013 Existing System		2013 Proposed System		2033 Existing System		2033 Proposed System	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
I-40 Mainline									
Eastbound Mainline I-40, west of SR 56	Freeway	C	B	C	B	D	C	D	C
Eastbound Mainline I-40, between SR 56 interchange ramps	Freeway	B	B	C	B	C	C	C	C
Eastbound Mainline I-40, SR 56 to Mine Lick Creek Rd	Freeway	C	B	C	B	D	C	D	C
Eastbound Mainline I-40, between Mine Lick Creek Rd interchange ramps	Freeway	--	--	B	B	--	--	C	C
Eastbound Mainline I-40, Mine Lick Creek Rd to SR 135	Freeway	C	B	B	C	D	C	C	D
Eastbound Mainline I-40, between SR 135 interchange ramps	Freeway	B	B	B	C	C	B	C	D
Eastbound Mainline I-40, east of SR 135	Freeway	B	C	B	C	C	D	C	D
Westbound Mainline I-40, east of SR 135	Freeway	C	B	C	B	D	C	D	C
Westbound Mainline I-40, between SR 135 interchange ramps	Freeway	A	A	C	B	B	B	D	C
Westbound Mainline I-40, SR 135 to Mine Lick Creek Rd	Freeway	B	C	C	B	C	C	D	C
Westbound Mainline I-40, between Mine Lick Creek Rd interchange ramps	Freeway	--	--	B	B	--	--	B	B
Westbound Mainline I-40, Mine Lick Creek Rd to SR 56	Freeway	B	C	B	C	C	C	C	C
Westbound Mainline I-40, between SR 56 interchange ramps	Freeway	B	B	B	B	B	C	B	C
Westbound Mainline I-40, west of SR 56	Freeway	B	C	B	C	C	C	C	C
SR 56 Interchange at I-40									
Eastbound off ramp to SR 56	Ramp Diverge	C	C	C	C	D	D	D	D
Eastbound on ramp from SR 56	Ramp Merge	C	B	C	B	D	C	D	C
Westbound off ramp to SR 56	Ramp Diverge	B	C	B	C	C	D	C	D
Westbound on ramp from SR 56	Ramp Merge	B	B	B	B	C	C	C	C
Eastbound ramps and SR 56 intersection	Unsignalized Intersection	F	F	E	C	F	F	F	F
Westbound ramps and SR 56 intersection	Unsignalized Intersection	C	C	B	B	E	F	C	C
Mainline SR 56, south of eastbound ramps	Two-Lane Highway	C	C	C	B	D	C	C	C
Mainline SR 56, between interchange ramps	Two-Lane Highway	D	C	C	C	D	D	D	C
Mainline SR 56, north of westbound ramps	Two-Lane Highway	D	D	D	C	D	D	D	D

Table 1. Operational Analysis Summary (1 of 2)

Analysis Point	Analysis Type	LOS							
		2013 Existing System		2013 Proposed System		2033 Existing System		2033 Proposed System	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Mine Lick Creek Road interchange at I-40									
Eastbound off ramp to Mine Lick Creek Rd	Ramp Diverge	--	--	C	C	--	--	D	C
Eastbound on ramp from Mine Lick Creek Rd	Ramp Merge	--	--	B	C	--	--	C	D
Westbound off ramp to Mine Lick Creek Rd	Ramp Diverge	--	--	C	C	--	--	D	C
Westbound on ramp from Mine Lick Creek Rd	Ramp Merge	--	--	B	C	--	--	C	C
Eastbound ramps and Mine Lick Creek Rd intersection	Signalized Intersection	--	--	C	B	--	--	C	B
Westbound ramps and Mine Lick Creek Rd intersection	Signalized Intersection	--	--	C	B	--	--	C	B
Mainline southbound Mine Lick Creek Rd, south of eastbound ramps	Multi-Lane Highway	--	--	D	A	--	--	D	A
Mainline northbound Mine Lick Creek Rd, south of eastbound ramps	Multi-Lane Highway	--	--	A	C	--	--	C	A
Mainline southbound Mine Lick Creek Rd, between interchange ramps	Multi-Lane Highway	--	--	C	A	--	--	C	A
Mainline northbound Mine Lick Creek Rd, between interchange ramps	Multi-Lane Highway	--	--	A	B	--	--	A	B
Mainline southbound Mine Lick Creek Rd, north of westbound ramps	Multi-Lane Highway	--	--	A	A	--	--	A	A
Mainline northbound Mine Lick Creek Rd, north of westbound ramps	Multi-Lane Highway	--	--	A	A	--	--	A	A
SR 135 Interchange at I-40									
Eastbound off ramp to SR 135	Ramp Diverge	C	B	C	C	D	C	D	D
Eastbound on ramp from SR 135	Ramp Merge	B	C	B	C	C	D	C	D
Westbound off ramp to SR 135	Ramp Diverge	D	C	D	C	E	C	E	C
Westbound on ramp from SR 135	Ramp Merge	B	B	C	B	C	C	D	C
Eastbound ramps and SR 135 intersection	Signalized Intersection	E	F	C	C	F	F	D	B
Westbound ramps and SR 135 intersection	Signalized Intersection	F	F	D	F	F	F	F	B
Mainline southbound SR 135, south of eastbound ramps	Multi-Lane Highway	D	B	A	A	D	B	A	B
Mainline northbound SR 135, south of eastbound ramps	Multi-Lane Highway	B	D	B	A	C	D	B	B
Mainline southbound SR 135, between interchange ramps	Multi-Lane Highway	C	B	A	B	C	C	B	B
Mainline northbound SR 135, between interchange ramps	Multi-Lane Highway	B	B	B	A	C	C	B	B
Mainline southbound SR 135, north of westbound ramps	Multi-Lane Highway	A	B	A	B	B	C	A	B
Mainline northbound SR 135, north of westbound ramps	Multi-Lane Highway	B	B	B	A	C	B	C	B

Table 1. Operational Analysis Summary (2 of 2)

As mentioned previously, the construction of the northern connector from I-40 to SR 24 is not currently in the STIP; consequently, this project may not be constructed concurrently with the interchange. Between the time that the interchange is constructed and the time that the northern connector is constructed, the rural roads in the vicinity of the interchange location north of I-40 may be expected to experience increased traffic volumes. This aspect of traffic operations and impacts was investigated as part of this addendum.

It was assumed that, if the northern connector is not constructed concurrently with the interchange, it would be constructed by the year 2018, five years after the assumed base year of the previous analyses. With the northern connector, base year AADT estimates for its use are 11,700 vehicles per day. While a significant reduction of this traffic is expected if the northern connector is not constructed concurrently, the proposed interchange would still introduce improved access to this rural area. This, in turn, may introduce some new land uses into the area, resulting in additional traffic demands.

These considerations result in a 2018 projected traffic volume north of I-40 of approximately 4,900 vehicles per day assuming the northern connector is not constructed concurrently with the interchange. This traffic volume would disperse throughout the area, primarily on Mine Lick Creek Road, Hawkins-Crawford Road, and Buffalo Valley Road. The most significant impacts will occur on Mine Lick Creek Road and Hawkins-Crawford Road near the interchange location.

Both of these roads are typical two-lane rural roadways with 10 foot wide lanes and one foot wide paved shoulders. An AADT volume of 4,900 vehicles will not exceed the capacity for these two lane roads (the HCS methods yield a peak hour LOS C for these roads carrying this daily volume of traffic).

B. Cost Update

The total estimated cost for the diamond-type interchange given as Alternate "A" is $13,588,000 and is detailed at the end of this chapter. Worksheets used in developing these cost estimates are contained in the Appendix of this report.

C. Environmental Concerns

No concerns beyond those specified in the IJS were found.

D. Access Analysis Update

Both the approved IJS and this addendum have 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. Comments are only provided where modifications discussed in this addendum alter TDOT's response to these FHWA policy provisions.

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.

In addition to the previous justification, the publicly owned Highlands Business Park has been planned in conjunction with the proposed interchange at Mine Lick Creek Road. This facility is projected to generate over 20,000 trips per day. Traffic analyses assuming that the business park is constructed with the existing transportation network (no new interchange) show that several movements of both the SR 56 interchange and the SR 135 interchange will experience significant delay. Also, using the existing network, the business park site is located approximately 4.9 miles from the SR 56 interchange and approximately 2.6 miles from the SR 135 interchange. These distances result in less than desirable access for this type of development.

Implementation of the proposed new I-40 interchange will provide improved transportation access in keeping with local immediate and long-range planning efforts that improvement of existing roadways cannot. Local leaders believe that this, in turn, will 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.

In the approved study for this proposed I-40 access point, 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 and FHWA's Division Office. Since that time, local planning efforts have anticipated and been based on the proposal named Alternate "A" in the previous study and this addendum.

Given the capacity and operational needs of the proposed interchange, it is proposed that a standard diamond interchange design configuration be utilized. This is in keeping with local planning objectives to avoid other interchange forms which require more land for construction. Other interchange forms (urban tight diamond, single-point urban, etc.) were considered, but were not found to be appropriate for this location, given the additional cost and operational needs. These alternative design options were therefore not given further study.

Ramp metering and other ITS applications should be considered for this area in the future. These applications may improve operations at the existing interchanges at SR 56 and at SR 135 under projected conditions. However, by themselves, ITS applications will not provide reasonable access to the proposed North-South connector from I-40 to SR 24 nor will they provide appropriate access to the planned business park location. Nothing proposed in this addendum will preclude ITS applications from being implemented in the future.

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 updated operational analysis of current and future traffic was made for mainline sections of the interstate, all ramps, and ramp termini within the limits of the interchange area. The proposed interchange will have no significant adverse affect on the interstate mainline and will improve operation of the adjacent interchanges.

If the northern connector is not constructed concurrently with the interchange, the possibility exists of significantly increased traffic volumes on existing local roads north of I-40. These impacts have been investigated and projected traffic volumes were found to remain well within the capacity constraints of these roads. The improved and existing local road network will allow the collection and distribution of traffic to and from the proposed interchange.

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 typical diamond-type interchange and will provide for all traffic movements. All roads in this area are public roads. 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 remains consistent with the adopted Cookeville Major Street Plan (a component of the Cookeville Comprehensive Future Land Use Plan) and with statewide transportation planning objectives. Local development plans by the City of Cookeville and Putnam County for the municipal Highlands Business Park have also been prepared in anticipation of the proposed I-40 access at Mine Lick Creek Road. Resolutions in support of the proposed I-40 access and its consistency with local planning objectives are included in Chapter 4 of this addendum.

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.

No changes to this policy point are introduced by this addendum.

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.

One new objective of the proposed interchange is to provide safe and adequate interstate access for traffic generated by the City and County planned Highland Business Park. The viability of this public venture is likely to be significantly hindered without the proposed interstate access. The interchange facility proposed in this study will meet the objectives of this planned development.

The traffic study prepared separately for this business park assumed that the interchange would provide the major point of access to the development. Other roadway improvements, such as the improvement to Lee Seminary Road from Bennett Road to SR 135, will require local commitment for construction prior to or concurrent with construction of the interchange. The planning and design of these improvements are being completed by TDOT, the City of Cookeville, and Putnam County. Resolutions in support of the proposed I-40 access and related street network improvements are included in Chapter 4 of this addendum.

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.

No changes to this policy point are introduced by this addendum.

Project: I-40 Interchange at Mine Lick Creek Rd
Length: N/A Cross Section: Variable

Right-of-Way			
Land, Improvements and Damages (Acres)	54.0±		$588,000.00
Incidentals (8 Tracts)			$26,000.00
Relocation Payments (Residentials)		1	$13,000.00
(Businesses)		0	
(Non-Profit)		0	
Total Right-of-Way Cost			$627,000.00
Utility Relocation			
Reimbursable			$17,000.00
Non-Reimbursable			$200,000.00
Total Adjustment Cost			$217,000.00
Construction Cost			
Clearing and Grubbing			$108,000.00
Earthwork			$1,492,000.00
Pavement Removal			$97,000.00
Drainage			$1,843,000.00
Major Items	$1,507,000.00		
Other Drainage	$101,000.00		
Erosion Control	$235,000.00		
Structures			$1,800,000.00
Railroad Crossing or Separation Structure			$0.00
Paving			$2,537,000.00
Retaining Walls			$0.00
Maintenance of Traffic			$110,000.00
Topsoil			$48,000.00
Seeding			$31,000.00
Sodding			$51,000.00
Signing			$114,000.00
Signalization			$224,000.00
Fence			$221,000.00
Guardrail			$180,000.00
Rip-Rap or Slope Protection			$0.00
Other Const. Items (15%)			$1,328,000.00
Sub-Total Construction			$10,184,000.00
Mobilization			$436,000.00
Sub-Total Construction			$10,620,000.00
10% Engineering and Contingencies			$1,062,000.00
Total Construction Cost			$11,682,000.00
Preliminary Engineering (10%)			$1,062,000.00
TOTAL PROJECT COST			$13,588,000.00

CHAPTER 4

SUMMARY AND CONCLUSIONS

This addendum addresses changes to the proposed I-40 access at Mine Lick Creek Road in Putnam County. This location for a new access was originally approved by the FHWA in 2000. The initiation of this addendum is twofold:

1. A connection to Appalachian Route "J" is no longer a consideration for this interchange due to the selection of a route east of Cookeville. However, the connection north to SR 24 (US 70N) remains a part of this interchange proposal.
2. A municipal development project, the Highlands Business Park, is expected to bring significant new traffic to this area and has been planned in anticipation of this interstate access.

The preceding addendum was conducted to re-evaluate current and future traffic operations on I-40 within the proposed interchange area. The analysis indicates that a diamond-type interchange at the existing Mine Lick Creek Road overpass location will meet established transportation objectives of the area.

Specific recommendations for the proposed diamond interchange layout are as follow.

1. Two six-lane interchange structures will be constructed over I-40 for the cross-street. These new structures will have sufficient width for 4 @ 12' traffic lanes, a 24 foot wide median including turn lanes, and 12' outside shoulders. These structures will be approximately 140 feet long and in basically the same location as the existing structures over I-40.

2. The proposed lane configuration for each turning movement is as follows:
- Intersection of I-40 westbound ramps and Mine Lick Creek Road
    - Two northbound left turn lanes, two northbound through lanes
    - Two southbound through lanes, one southbound right turn lane
    - Two westbound left turn lanes, one westbound right turn lane
- Intersection of I-40 eastbound ramps and Mine Lick Creek Road
    - Two northbound through lanes, two northbound right turn lanes
    - One southbound left turn lane, two southbound through lanes
    - One eastbound left turn lane, two eastbound right turn lanes

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.

4. Traffic signals will be required on the proposed connector at both the westbound ramp terminal intersection north of the interstate and the eastbound ramp terminal intersection south of the interstate.

5. 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.

Several related projects exist that may not have a significant operational impact on the proposed interchange, but that would ensure a cohesive network of public roads in this area.

These related projects, which should be constructed prior to or concurrently with the proposed Mine Lick Creek Road interchange, are as follow:

- Realign approximately 0.38 miles of Mine Lick Creek Road southwest of the proposed interchange to align with the existing intersection of Lee Seminary Road and Bennett Road.
- Improve Lee Seminary Road from Bennett Road to SR 135 (Burgess Falls Road). Because the Highlands Business Park is expected to generate over 20,000 new trips per day and because Lee Seminary Road will serve as the exclusive route to access the business park, improvements to Lee Seminary Road will be required. The planning and design of these improvements are being completed by the City of Cookeville and Putnam County.
- Realign 0.50± miles of Hawkins Crawford Road and Mine Lick Creek Road north of I-40 to create a continuous east-west route north of the proposed interchange. The intersection of this realigned road with the proposed interchange cross-street should be at least 300 feet north of the westbound I-40 ramp terminals. North of the intersection of Mine Lick Creek Road/Hawkins Crawford Road and the interchange cross-street, the North-South Connector will be fully access controlled.
- Construct the proposed North-South Connector from I-40 to SR 24 (US 70N). As detailed in the Advance Planning Report completed by TDOT in 2000, this 2.87± mile roadway would be a four lane access controlled divided highway with a minimum 250 foot right-of-way. Programming and funding considerations for a project of this magnitude may require its construction to follow after the interchange project. If so, the cross street should be constructed at least to the intersection of Mine Lick Creek Road and Hawkins Crawford Road.

A. Local Commitment

Attached and made a part of this Interchange Justification Study addendum are official resolutions from both the City of Cookeville and Putnam County demonstrating support for the proposed I-40 interstate access at Mine Lick Creek Road.

COOKEVILLE
TENNESSEE

Office of the City Manager

#24971

February 17, 2010

Gerald F. Nicely, Commissioner
State of Tennessee
Department of Transportation
Suite 700, James K. Polk Building
Nashville, TN 37243-0349

RE: I-40 Interchange at Mine Lick Creek Road
PIN: 101577.00 Putnam County

Dear Commissioner Nicely:

Enclosed please find resolutions adopted by the Cookeville City Council and the Putnam County Commission officially pledging the commitment of the city and county to partner with TDOT to fund the cost of the northern connector road. These resolutions, along with the letter dated January 28, 2010, signed by County Executive Kim Blaylock and myself, should serve as additional assurance to TDOT and FHWA that both governing bodies are willing to step up to the plate, if necessary, to see the completion of the interchange and the northern connector.

Thank you for your continued support of this project. I'm sure you have been as frustrated as we have with the many problems we've encountered over the years.

Sincerely,

Jim Shipley
City Manager

cc: Cookeville City Council
State Senator Charlotte Burks
State Representative Henry Fincher
George Halford, President Cookeville Chamber of Commerce
Kim Blaylock, Putnam County Executive

enclosures

45 E. Broad Street *Cookeville, Tennessee 38501* *931-520-5241*

STATE OF TENNESSEE)
COUNTY OF PUTNAM)
CITY OF COOKEVILLE)

I, CATHY MCCLAIN, City Clerk, being the legal custodian of Ordinances and Codes of Cookeville, Tennessee, and as such do further certify that the attached hereto is a true and exact copy of Resolution Number R10-02-02 adopted by the City Council on FEBRUARY 15, 2010.

Witness my official signature and official seal of said Municipality this 17TH day of FEBRUARY, 2010.

City Clerk

S
E
A
L

RESOLUTION

A RESOLUTION SUPPORTING THE 5TH INTERCHANGE AT MINE LICK CREEK ROAD AND COMMITTING TO CONSTRUCT A CONNECTOR ROAD FROM SAID INTERCHANGE NORTH TO HIGHWAY 70

RESOLUTION NO. R10-02-02
REQUESTED BY: JIM SHIPLEY
PREPARED BY: JIM SHIPLEY
APPROVED AS TO FORM & CORRECTNESS:

(City Attorney)

ADOPTED: 2-15-10

MINUTE BOOK _____ **PAGE** _____

WHEREAS, the Tennessee Department of Transportation plans to construct an interchange on Interstate 40 at Mine Lick Creek Road (referred to herein as the 5th interchange); and

WHEREAS, the Tennessee Department of Transportation believes that the Federal Highway Administration may require that the new interchange connect north to Highway 70; and

WHEREAS, Putnam County and the City of Cookeville have invested approximately $20 million in a Business Park to secure a future for economic development in our region; and

WHEREAS, Putnam County is the job center for the entire Upper Cumberland Region, and currently there is double digit unemployment in all fourteen counties; and

WHEREAS, the completion of the fifth interchange at Mine Lick Creek is critical to the success of the Business Park.

NOW, THEREFORE, BE IT RESOLVED, that if a local road connecting the interchange to State Highway 70 is required by the Federal Highway Administration, Putnam County and the City of Cookeville will partner with the Tennessee Department of Transportation to fund the cost of building the connector road.

Adopted this the 15th day of February, 2010.

(Mayor)

ATTEST:

(City Clerk)

WAYNE NABORS
COUNTY CLERK - PUTNAM COUNTY

CERTIFICATION

STATE OF TENNESSEE)
)
COUNTY OF PUTNAM)

I, WAYNE NABORS, duly elected County Clerk in and for said County and State, do hereby certify that the attached and foregoing is a true, correct and complete copy of:

RESOLUTION OF THE GOVERNING BODY OF PUTNAM COUNTY, TENNESSEE, SUPPORTING POTENTIAL REQUIREMENTS OF THE FIFTH INTERCHANGE

As was presented, approved and adopted by the Putnam County Board of Commissioners at the February 16, 2010 regular monthly meeting, as the same appears of record and on file of which records and files I am present and legal custodian.

WITNESS my hand and official seal of office on this the 17th **day of** February, **20** 10.

COUNTY CLERK

P. O. BOX 220 • COOKEVILLE, TN 38503 • (931) 526-7106 • FAX (931) 372-8201

COPY

RESOLUTION SUPPORTING POTENTIAL REQUIREMENTS OF THE FIFTH INTERCHANGE

WHEREAS, the Tennessee Department of Transportation plans to construct an interchange on Interstate 40 at Mine Lick Creek Road (referred to herein as the 5th interchange); and,

WHEREAS, the Tennessee Department of Transportation believes that the Federal Highway Administration may require that the new interchange connect north to Highway 70; and,

WHEREAS, Putnam County and the City of Cookeville have invested approximately $20 million in a Business Park to secure a future for economic development in our region; and,

WHEREAS, Putnam County is the job center for the entire Upper Cumberland Region, and currently there is double digit unemployment in all fourteen counties; and,

WHEREAS, the completion of the fifth interchange at Mine Lick Creek is critical to the success of the Business Park.

NOW THEREFORE BE IT RESOLVED, that if a local road connecting the interchange to State Highway 70 is required by the Federal Highway Administration, Putnam County and the City of Cookeville will partner with the Tennessee Department of Transportation to fund the cost of building the connector road.

Adopted this the 16TH day of FEBRUARY, 2010

Chairman, Putnam County Commission
JIM MARTIN

ATTEST:

(County Clerk)
WAYNE NABORS

COUNTY CLERK XVI AGRICULTURE COMMERCE PUTNAM COUNTY, TN

COOKEVILLE
TENNESSEE

Office of the City Manager
P.O. Box 998
Cookeville, TN 38503
931-520-5240

Kim BLAYLOCK
COUNTY EXECUTIVE
300 E. Spring St. - Rm. 8 Cookeville, TN 38501 (931) 526-2161 Ph. 528-1300 Fax

January 28, 2010

Gerald F. Nicely, Commissioner
State of Tennessee
Department of Transportation
Suite 700, James K. Polk Building
Nashville, TN 37243-0349

RE: I-40 Interchange at Mine Lick Creek Road
PIN: 101577.00 Putnam County

Dear Commissioner Nicely:

We are in receipt of your letter dated 1/13/10, and thank you for the update on this important project. As you know, the City of Cookeville and Putnam County have expended significant funding for a long term commitment to the citizens of this community to develop and grow the area for current and future generations. In a long line of events that began in 1998, we have worked diligently to move this project along. The proposed access points for this interchange have been considered operationally acceptable and were initially approved by the FHWA in 2000.

A dual purpose Certificate of Public Purpose and Necessity was granted in 2009, for the development of the Highlands Business Park to promote economic growth and create jobs for the residents of this region, which was the impetus for requesting the interchange. The City of Cookeville has confirmed its intent to utilize post rescission level STP funds in the amount of $1,123,861.78 to improve Lee Seminary Road to serve as an entrance to the Highlands Business Park. The Park itself represents a $20 million commitment by these two governments. The City of Cookeville expects the Lee Seminary Road project and preliminary road and infrastructure work on the park to be bid in the spring of this year.

The road that we are building through the new Highlands Business Park will connect the interchange to State Highway 135, and we feel that this will satisfy the connectivity requirement by the FHWA. However, if other road requirements become apparent, we as City Manager and County Executive will do what is necessary to fund and satisfy your requirements. We also want to officially request to be a participant in your Local Interstate Connector (LIC) program and want to maximize potential for the multiple projects you indicate may be eligible.

With double digit unemployment in every county in the Upper Cumberland, we cannot stress enough the importance of the Business Park to the whole region, and the critical part the interchange project plays in making the Park a success. We are sending this letter to meet TDOT's deadline of 1/29/2010. However, we would like to request another meeting of City, County, State and Federal officials in the future to further discuss the project, and its progress.

Sincerely,

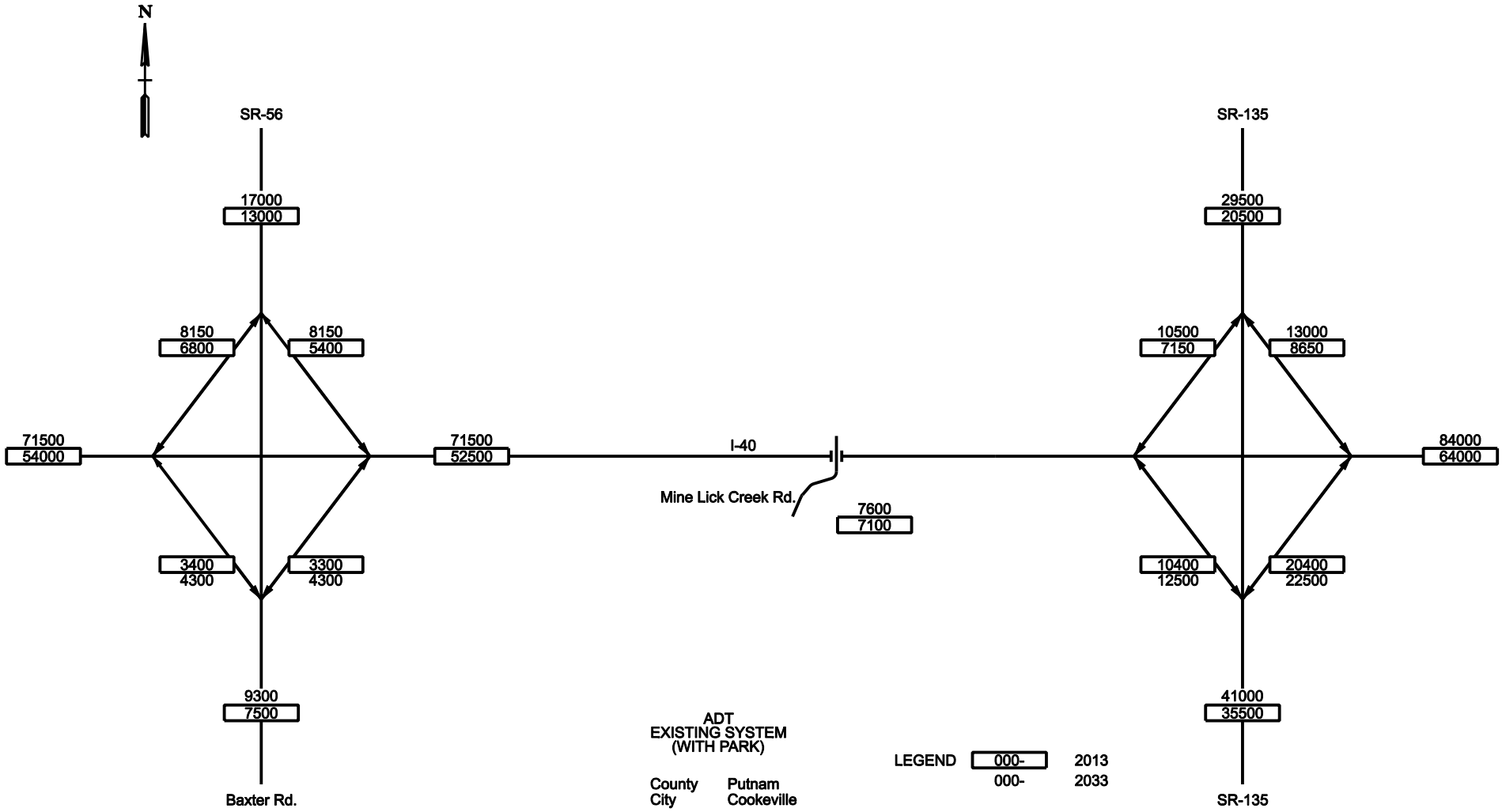
Jim Shipley
City Manager

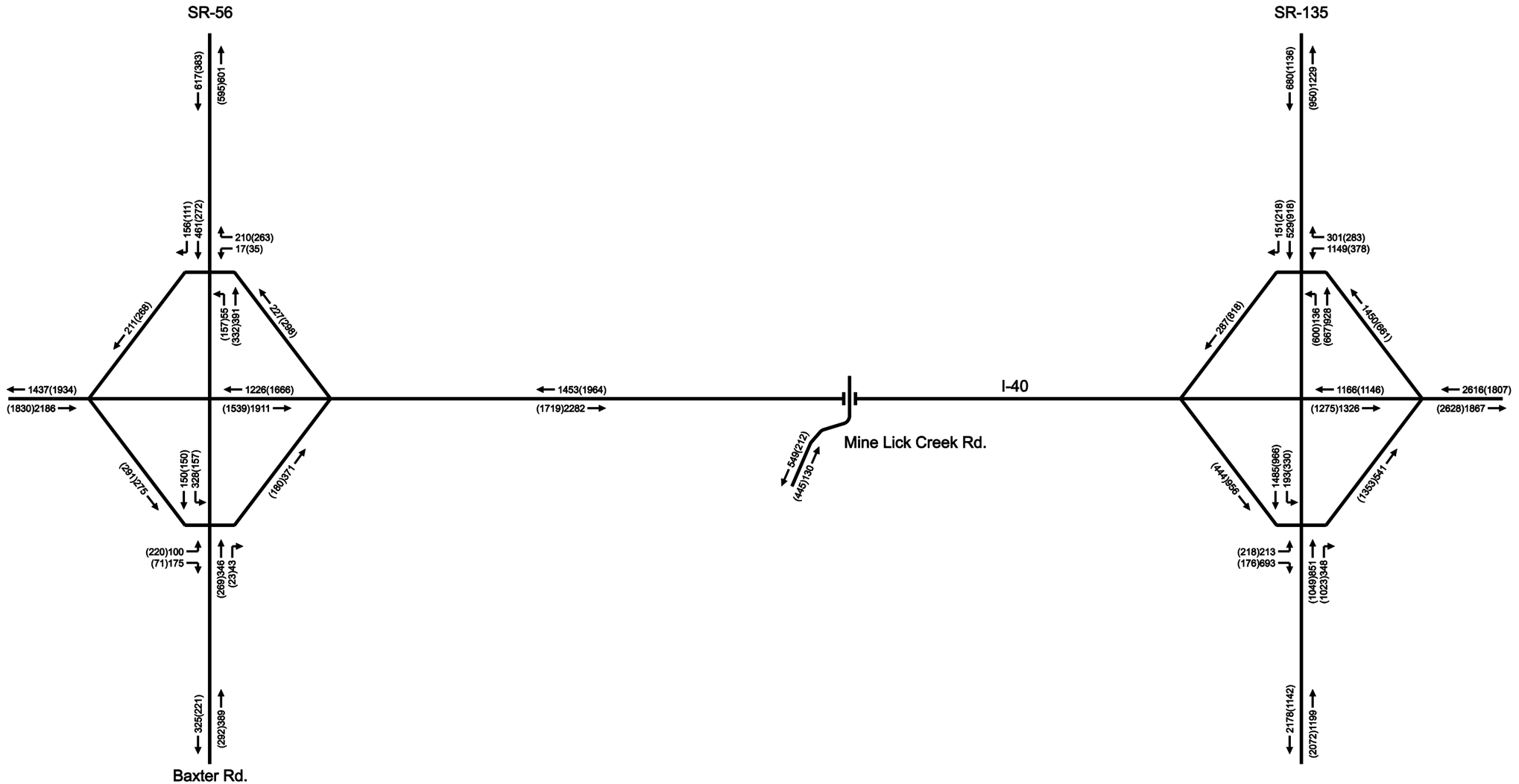
Kim Blaylock
County Executive

cc: Mr. Paul Degges, Chief Engineer
Mr. Bob Brown, Region 2 Director

APPENDIX

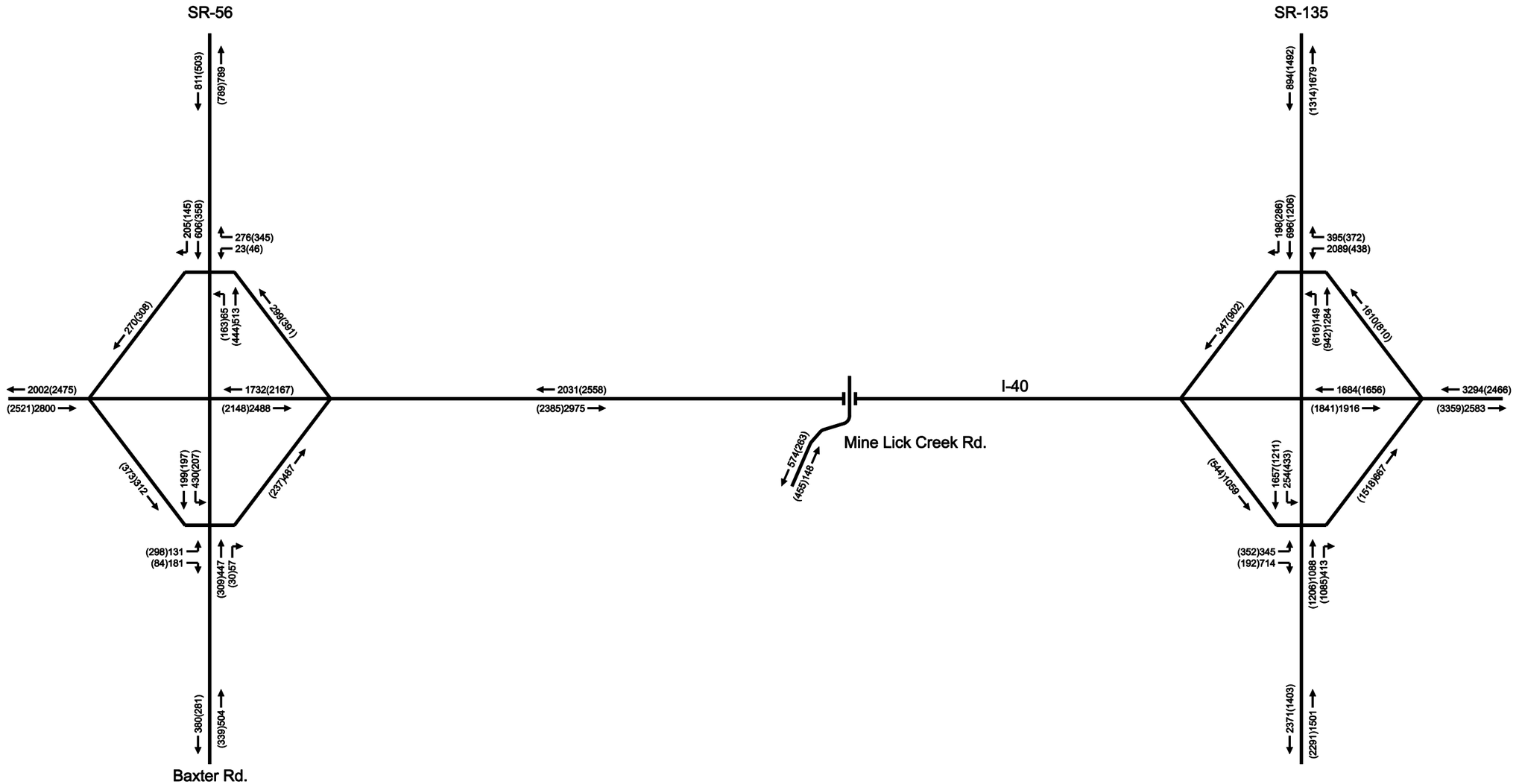
TRAFFIC PROJECTIONS


N
SR-56
17000
13000
8150
6800
8150
5400
71500
54000
71500
52500
3400
4300
3300
4300
9300
7500
Baxter Rd.
I-40
Mine Lick Creek Rd.
7600
7100
SR-135
29500
20500
10500
7150
13000
8650
84000
64000
10400
12500
20400
22500
41000
35500
SR-135
ADT
EXISTING SYSTEM
(WITH PARK)
County Putnam
City Cookeville
Date 5/12/09
LEGEND 000- 2013
000- 2033



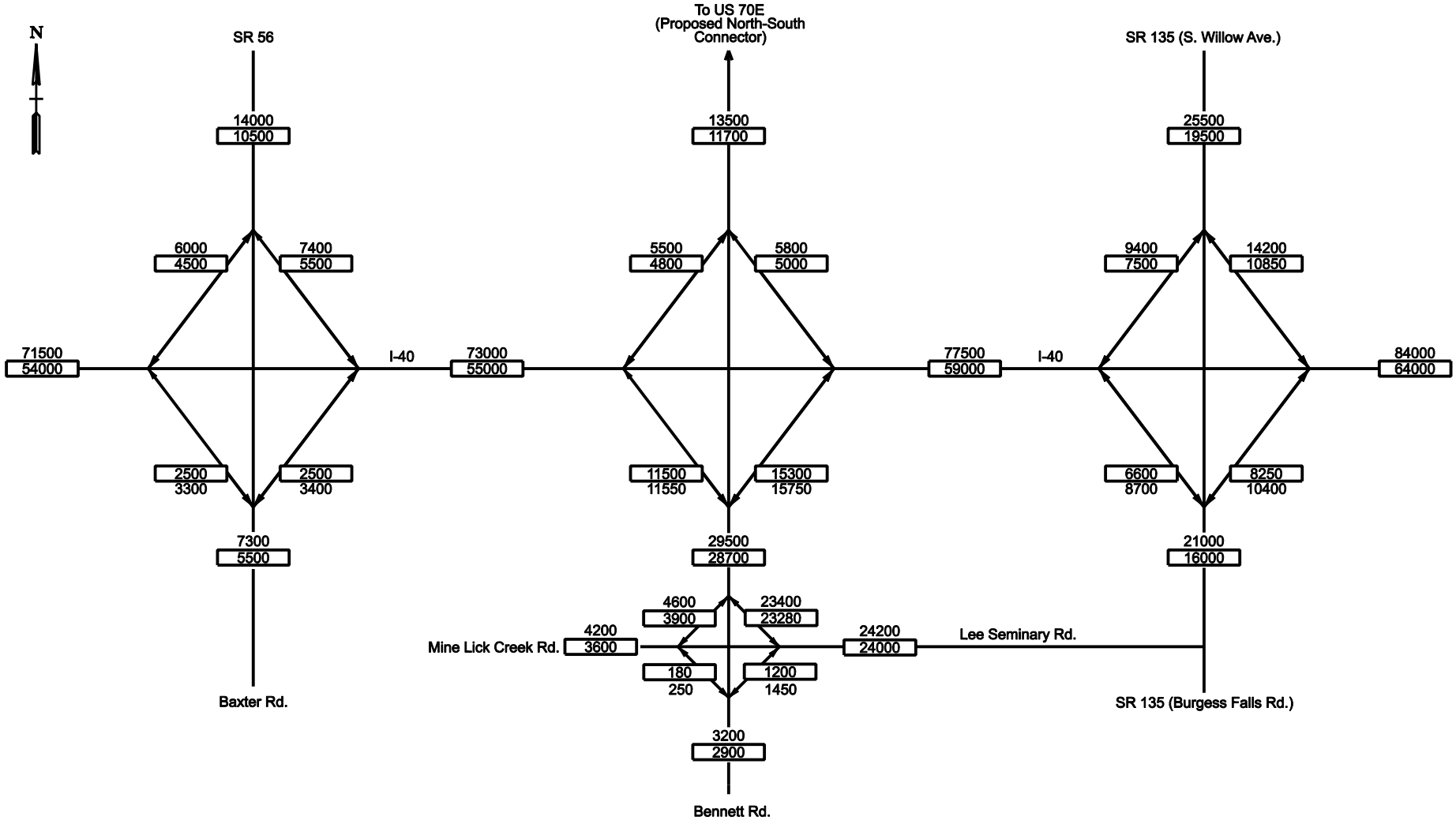
XXX - AM Peak Hour Traffic Volumes
(XXX) - PM Peak Hour Traffic Volumes

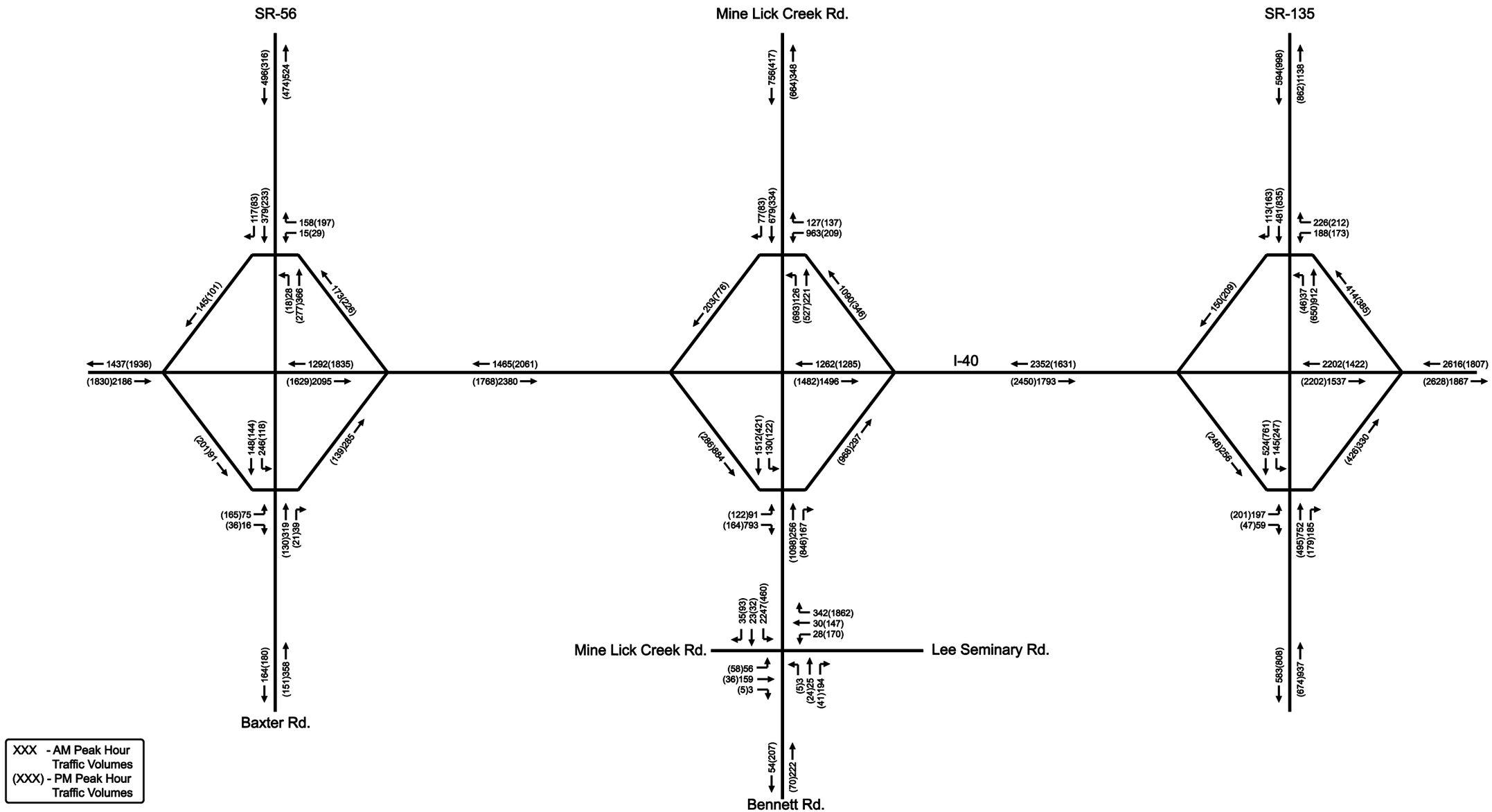
2013 Existing System (with Business Park)
(Not to Scale)



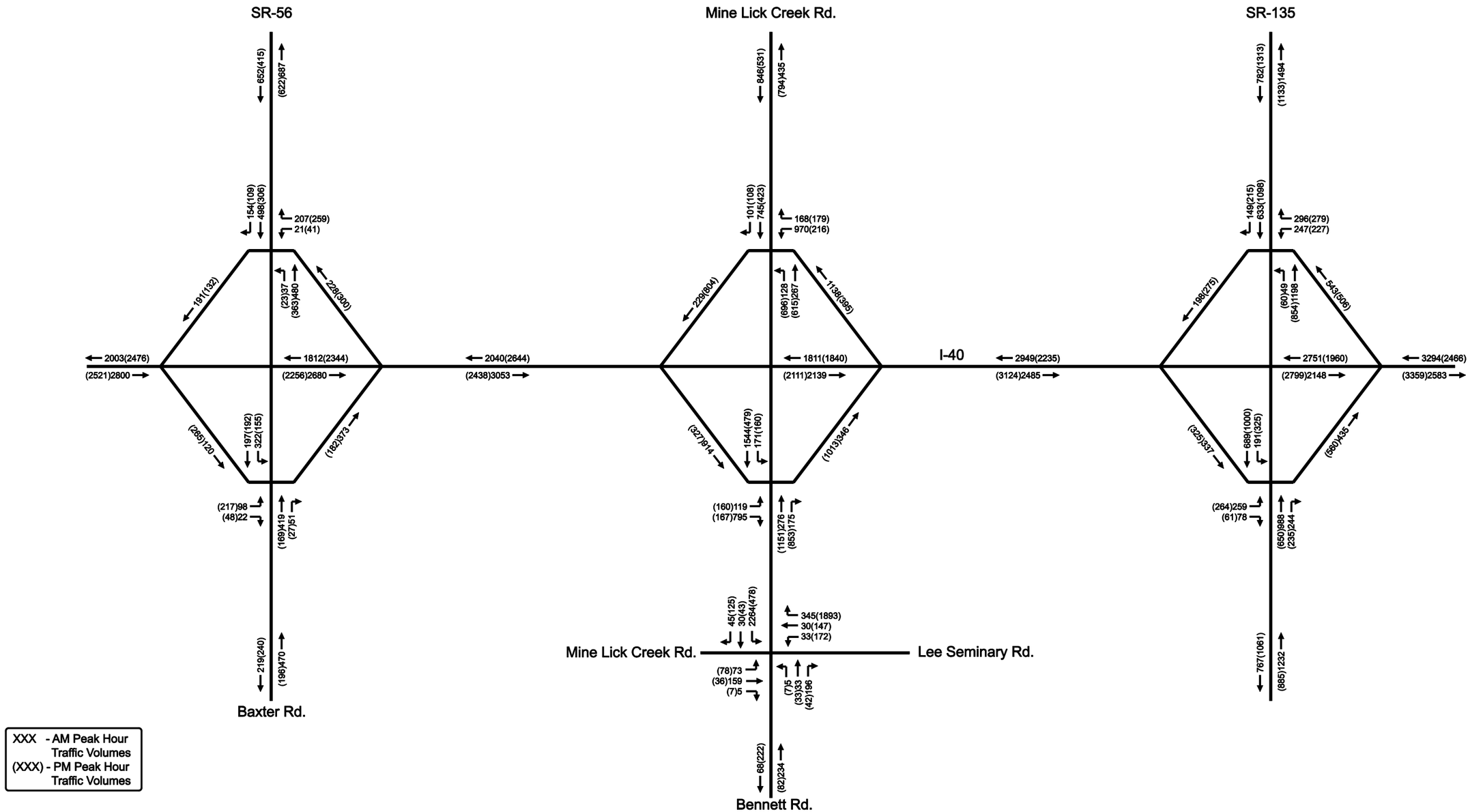
XXX - AM Peak Hour Traffic Volumes
(XXX) - PM Peak Hour Traffic Volumes

2033 Existing System (with Business Park)
(Not to Scale)


N
SR 56
To US 70E
(Proposed North-South
Connector)
SR 135 (S. Willow Ave.)
14000
10500
13500
11700
25500
19500
6000
4500
7400
5500
5500
4800
5800
5000
9400
7500
14200
10850
71500
54000
I-40
73000
55000
77500
59000
I-40
84000
64000
2500
3300
2500
3400
11500
11550
15300
15750
6600
8700
8250
10400
7300
5500
29500
28700
21000
16000
4600
3900
23400
23280
4200
3600
Mine Lick Creek Rd.
24200
24000
Lee Seminary Rd.
180
250
1200
1450
Baxter Rd.
SR 135 (Burgess Falls Rd.)
3200
2900
Bennett Rd.
ADT
PROPOSED SYSTEM
(WITH BUSINESS PARK)
County Putnam
City Cookeville
Date 7/22/09
LEGEND 000- 2013
000- 2033



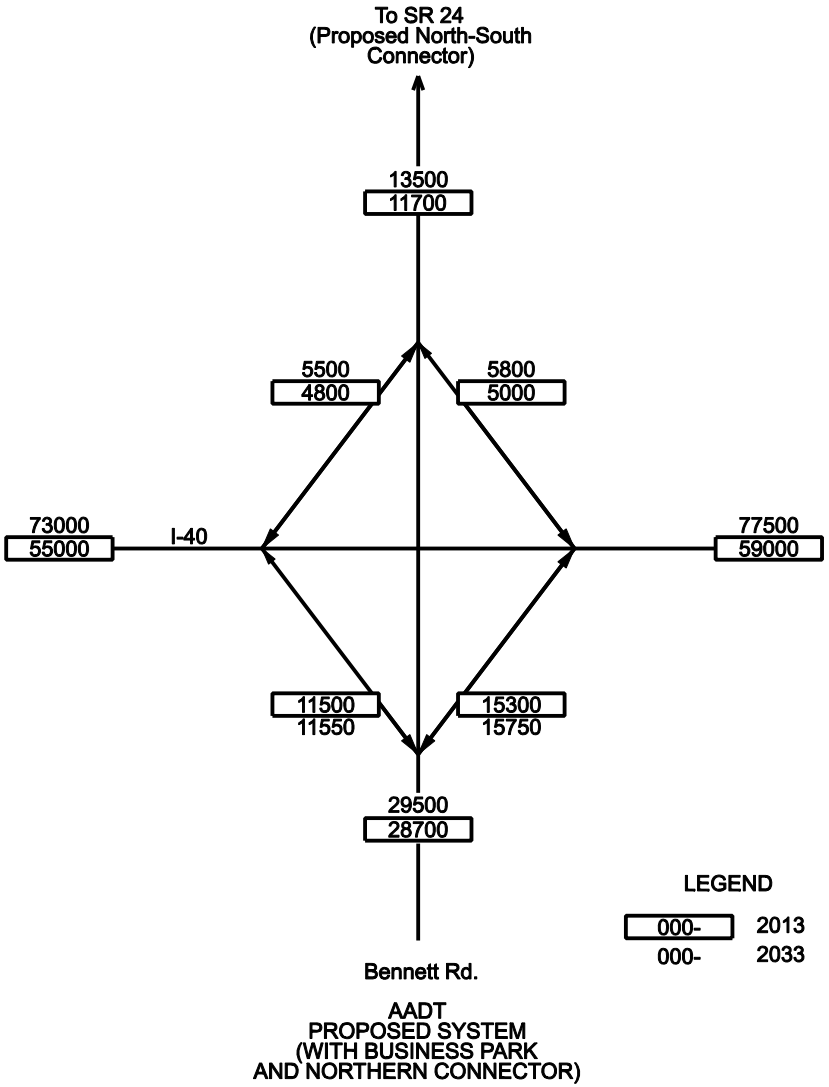
2013 Proposed System (with Business Park)
(Not to Scale)



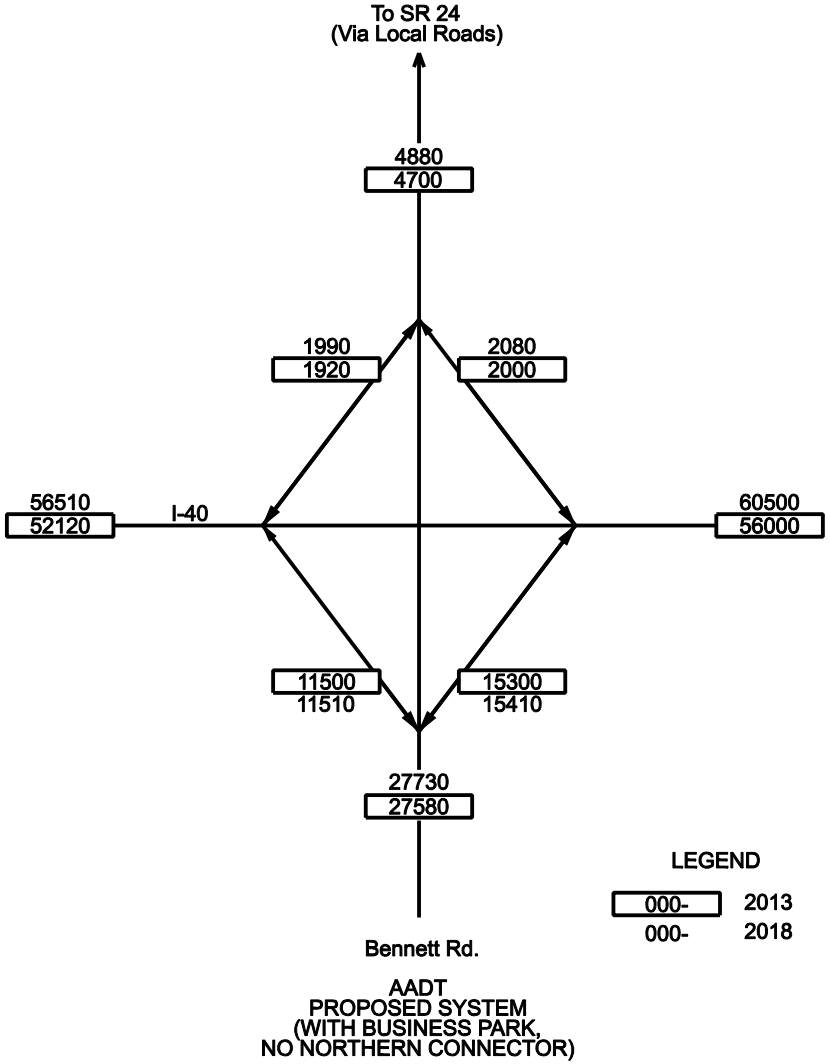
XXX - AM Peak Hour Traffic Volumes
(XXX) - PM Peak Hour Traffic Volumes

2033 Proposed System (with Business Park)
(Not to Scale)

AADT
PROPOSED SYSTEM
(COMPARISON WITH AND WITHOUT NORTHERN CONNECTOR)

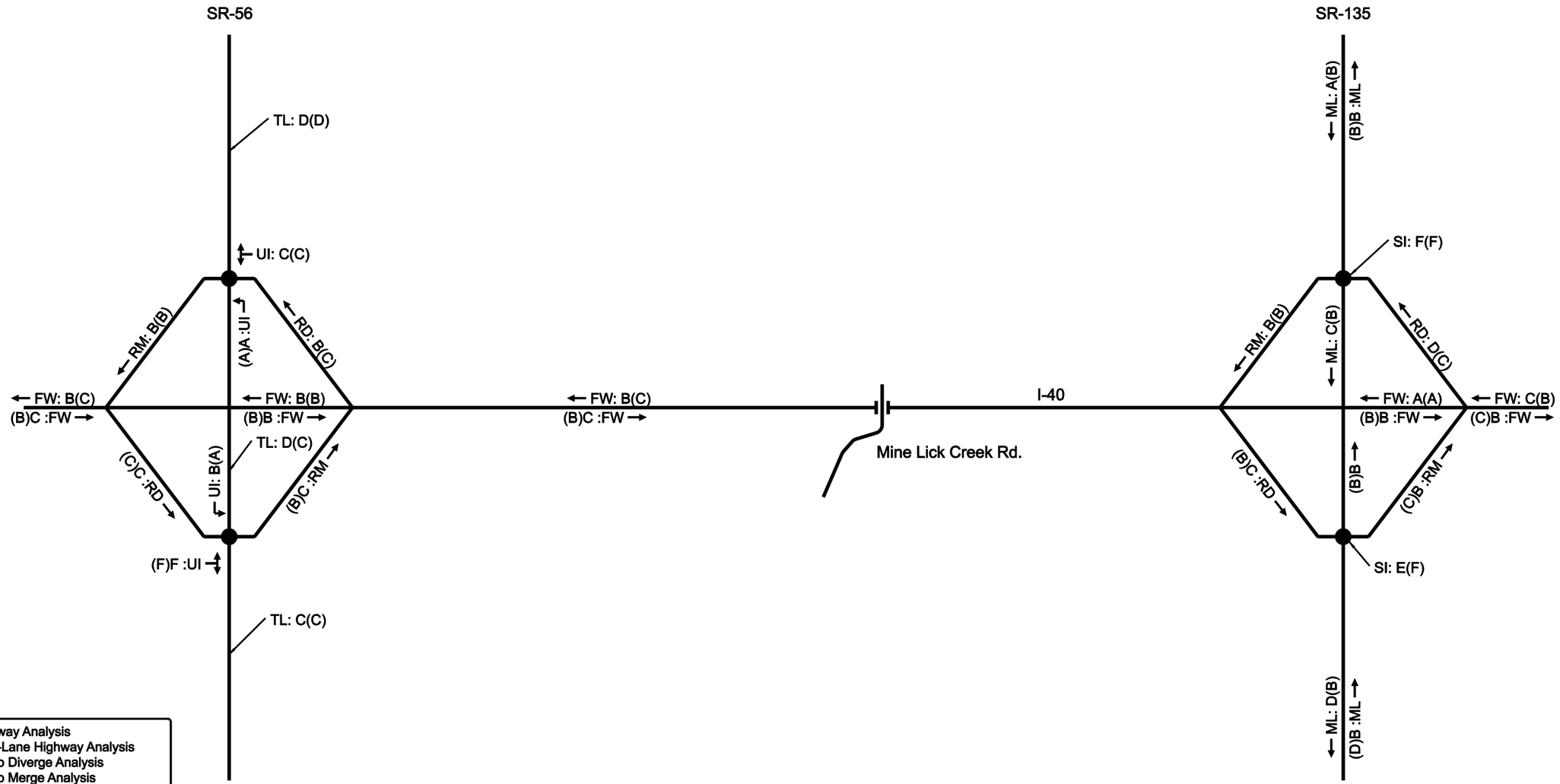


AADT
PROPOSED SYSTEM
(WITH BUSINESS PARK
AND NORTHERN CONNECTOR)

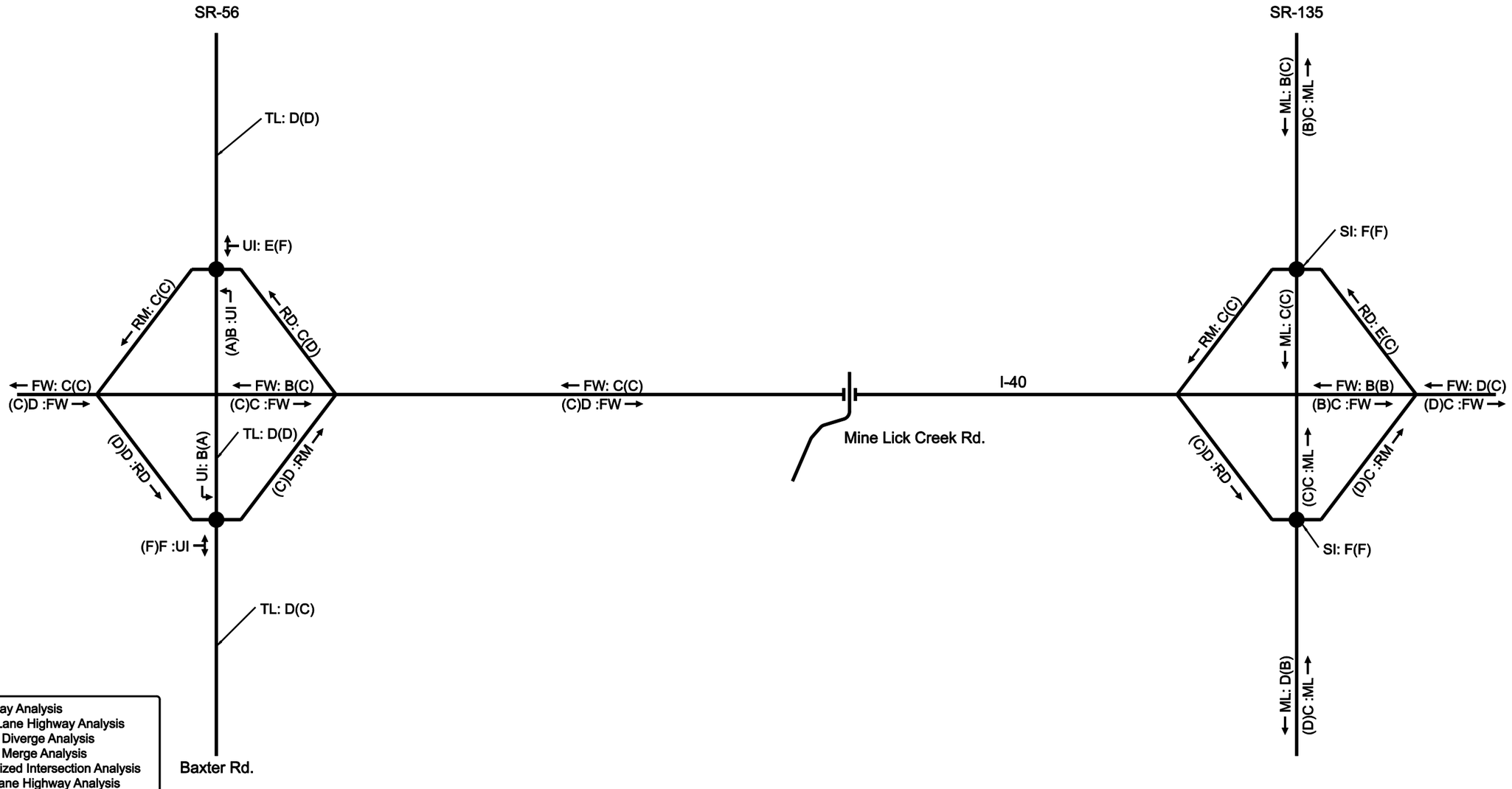


AADT
PROPOSED SYSTEM
(WITH BUSINESS PARK,
NO NORTHERN CONNECTOR)

LEVEL OF SERVICE ANALYSIS
EXISTING SYSTEM



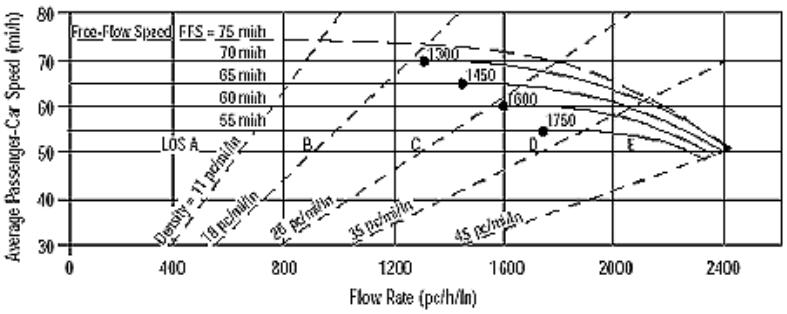
2013 Existing System (with Business Park) Levels of Service
(Not to Scale)



2033 Existing System (with Business Park) Levels of Service
(Not to Scale)

BASE YEAR 2013
INTERSTATE 40 MAINLINE

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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2186*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1348*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*20.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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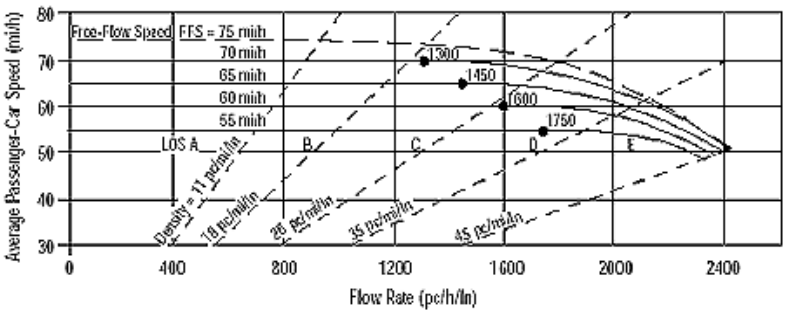
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1911*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1178*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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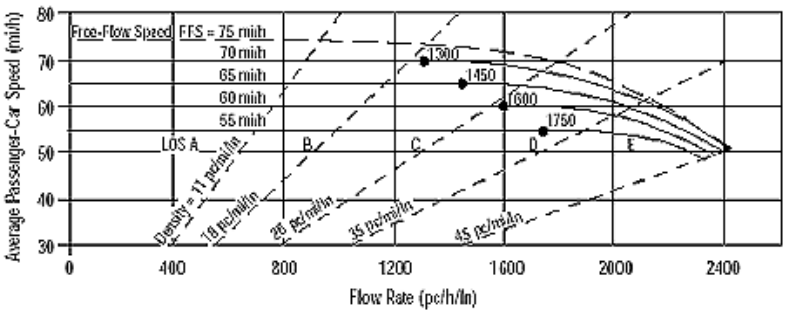
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-135 & SR-56*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2282*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	l/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1407*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*21.5*	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 - Exhibits23-8, 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			

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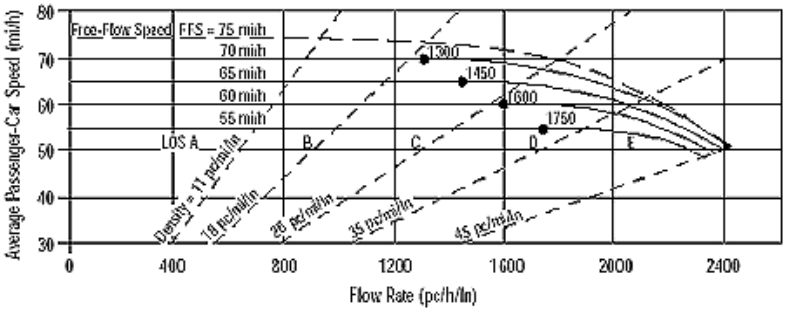
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1326*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*818*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*12.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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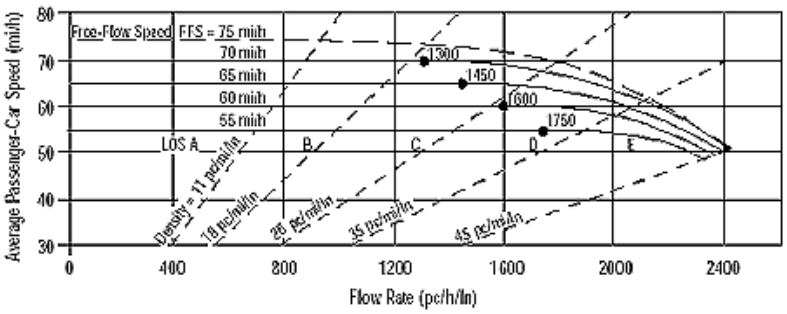
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1867*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1151*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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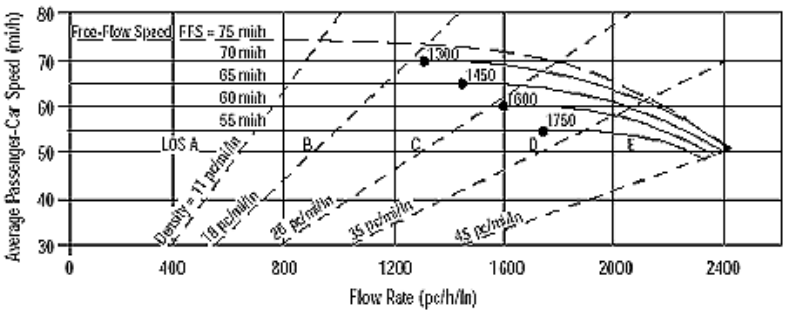
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Approaching SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2616*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1613*	pc/h/ln
S	*65.3*	mi/h
D = v_p / S	*24.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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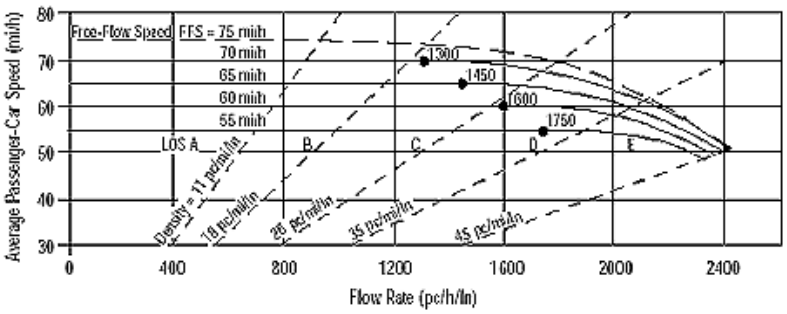

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1166*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*719*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*11.0*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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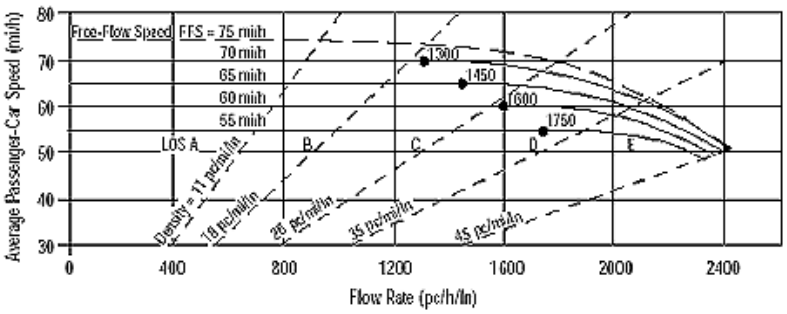
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 & SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1453*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*896*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*13.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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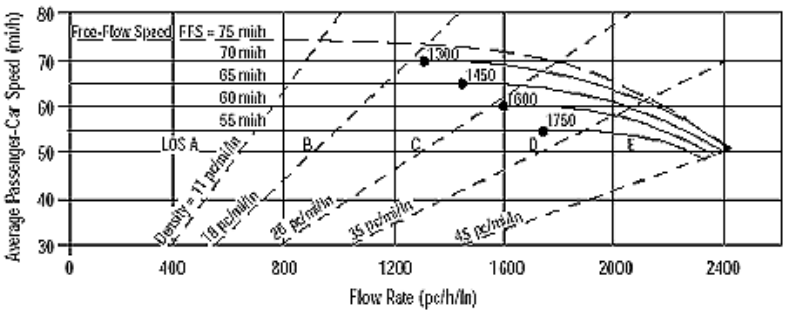
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1226*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*756*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*11.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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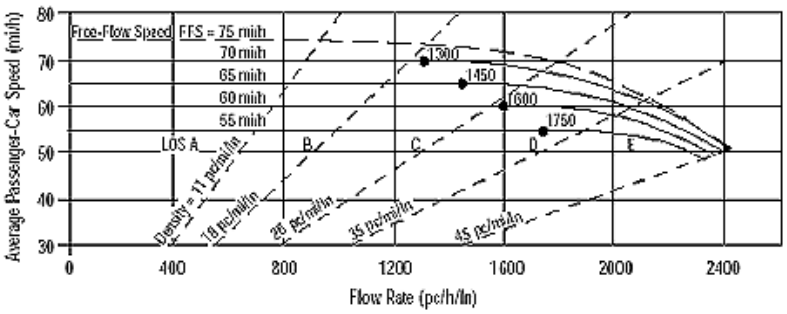
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*West of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1437*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*886*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*13.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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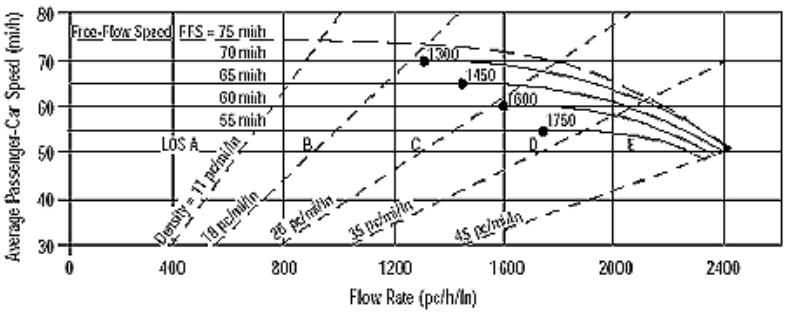
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1830*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1129*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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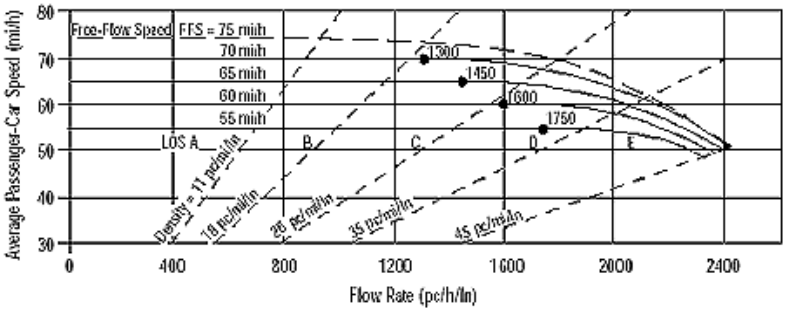
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1539*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*949*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*14.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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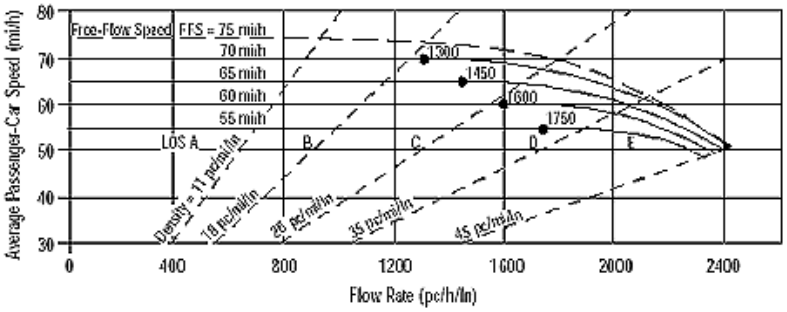
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-135 & SR-56*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*1719*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1060*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*16.2*	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 - Exhibits23-8, 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			

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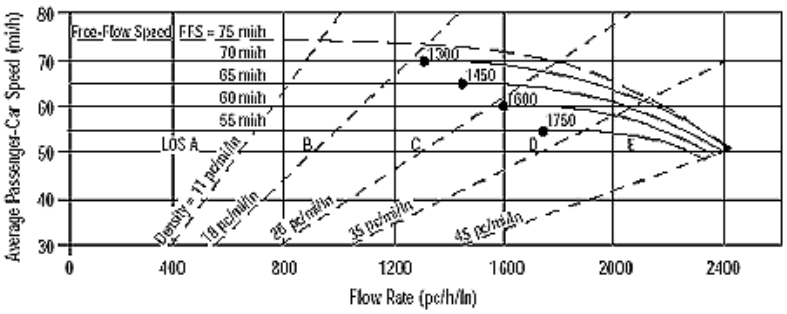
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1275*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*786*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*12.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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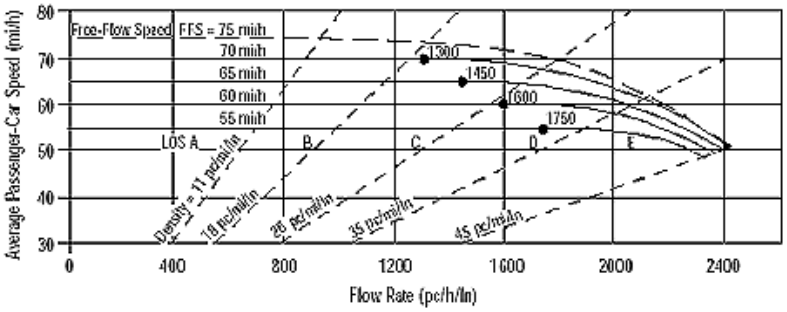
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2628*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1621*	pc/h/ln
S	*65.3*	mi/h
D = v_p / S	*24.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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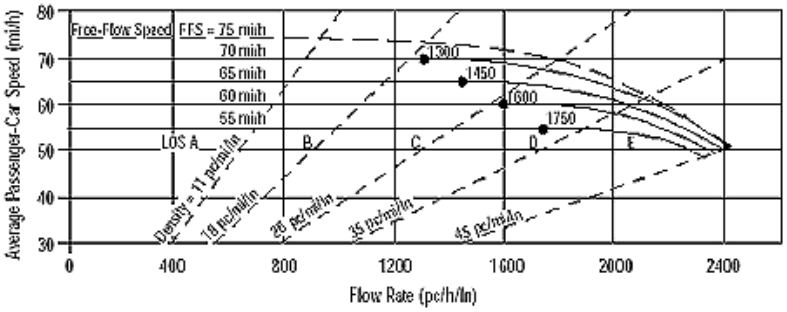
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1807*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1114*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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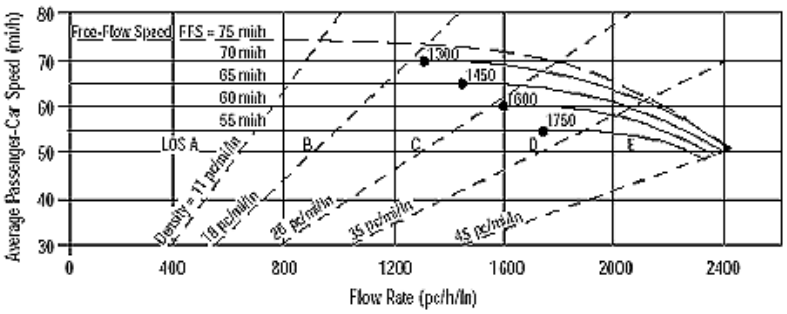
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1146*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*707*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*10.8*	pc/mi/ln
LOS	*A*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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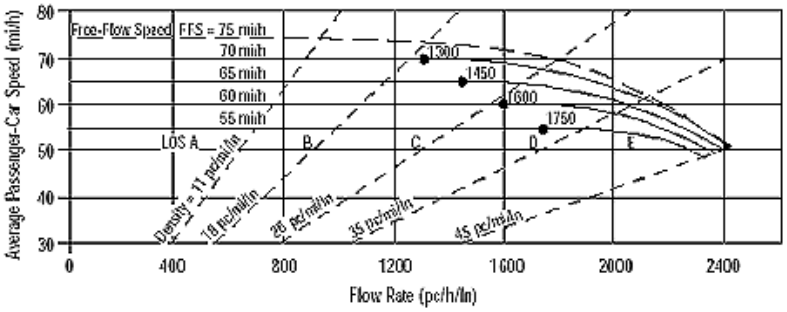
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 & SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1964*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1211*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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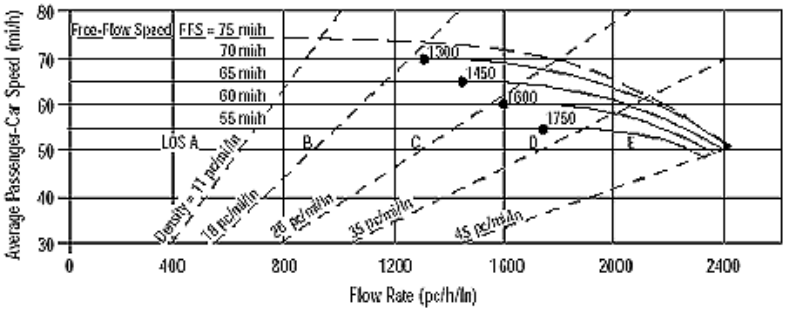
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1666*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1027*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*15.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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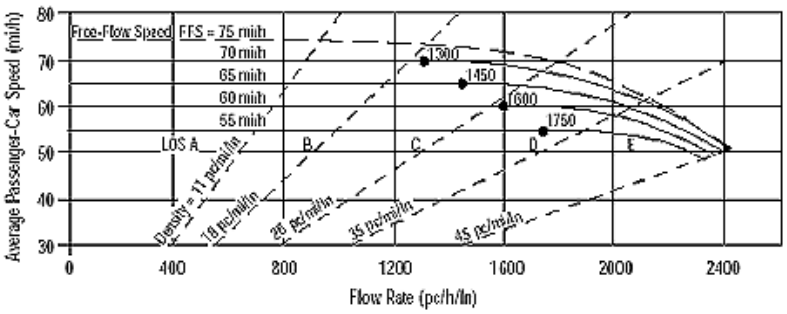
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*West of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1934*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1193*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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BASE YEAR 2013
INTERSTATE 40 AT STATE ROUTE 56 (BAXTER ROAD)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2186	0.90	Level	22	0	0.901	1.00	2696
Ramp	275	0.90	Level	22	0	0.901	1.00	339
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2696 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2696	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2357	Exhibit 25-14	4800	No
V_R	339	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2696	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 24.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.459 (Exhibit 25-19)

S_R= 57.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1911	0.90	Level	22	0	0.901	1.00	2357
Ramp	371	0.90	Level	22	0	0.901	1.00	458
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2357 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2815	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2815	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.338 (Exibit 25-19)
S_R= 60.5 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 60.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1453	0.90	Level	22	0	0.901	1.00	1792
Ramp	227	0.90	Level	22	0	0.901	1.00	280
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 1792 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1792	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1512	Exhibit 25-14	4800	No
V_R	280	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1792	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 16.3 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.453 (Exhibit 25-19)

S_R= 57.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1226	0.90	Level	22	0	0.901	1.00	1512
Ramp	211	0.90	Level	22	0	0.901	1.00	260
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1512 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1772	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1772	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 14.9 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.297 (Exibit 25-19)

S_R= 61.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Existing w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*346*	*43*	*328*	*150*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*384*	*47*	*364*	*166*	*0*
Percent Heavy Vehicles	*0*	--	--	*22*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*100*		*175*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*111*	*0*	*194*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*364*					*305*	
C (m) (veh/h)		*1030*					*241*	
v/c		*0.35*					*1.27*	
95% queue length		*1.61*					*15.42*	
Control Delay (s/veh)		*10.4*					*189.6*	
LOS		*B*					*F*	
Approach Delay (s/veh)	--	--				*189.6*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Existing w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*55*	*391*			*461*	*156*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*61*	*434*	*0*	*0*	*512*	*173*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*17*		*210*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*18*	*0*	*233*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*61*			*251*				
C (m) (veh/h)	*822*			*566*				
v/c	*0.07*			*0.44*				
95% queue length	*0.24*			*2.26*				
Control Delay (s/veh)	*9.7*			*16.3*				
LOS	*A*			*C*				
Approach Delay (s/veh)	--	--	*16.3*					
Approach LOS	--	--	*C*					

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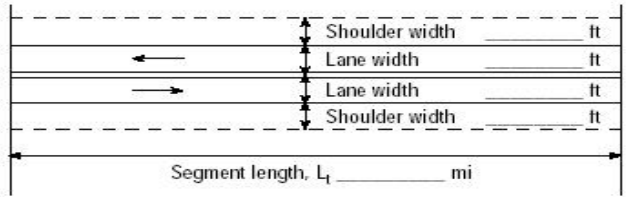
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1218* veh/h
Directional split	*51 / 49*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1357*
v_p * highest directional split proportion[2] (pc/h)	*692*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.0*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*39.8*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*1.000*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1353*
v_p * highest directional split proportion[2] (pc/h)	*690*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*69.6*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*6.3*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*75.9*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.42*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*338*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1218*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*8.5*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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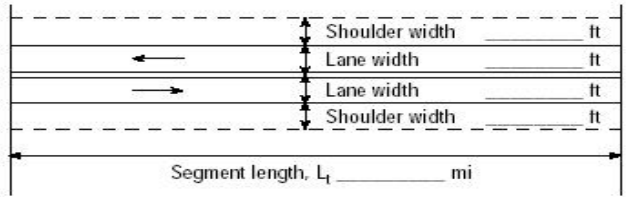
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*924* veh/h
Directional split	*52 / 48*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1033*
v_p * highest directional split proportion[2] (pc/h)	*537*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*2.5*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*34.1*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1030*
v_p * highest directional split proportion[2] (pc/h)	*536*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*59.6*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*12.4*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*72.0*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.32*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*26*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*92*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*0.8*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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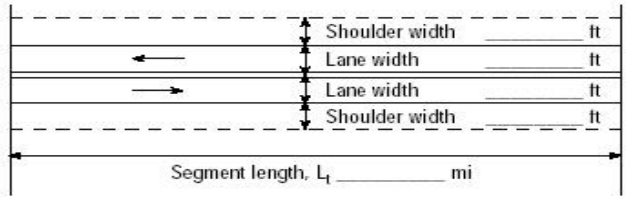
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*714* veh/h
Directional split	*54 / 46*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*798*
v_p * highest directional split proportion[2] (pc/h)	*431*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*3.0*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*32.1*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*796*
v_p * highest directional split proportion[2] (pc/h)	*430*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*50.3*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*15.1*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*65.4*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.25*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*119*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*428*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*3.7*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1830	0.90	Level	22	0	0.901	1.00	2257
Ramp	291	0.90	Level	22	0	0.901	1.00	359
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2257 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2257	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1898	Exhibit 25-14	4800	No
V_R	359	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2257	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 20.7 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.460 (Exhibit 25-19)

S_R= 57.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1539	0.90	Level	22	0	0.901	1.00	1898
Ramp	180	0.90	Level	22	0	0.901	1.00	222
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1898 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2120	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2120	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 17.6 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.305 (Exibit 25-19)

S_R= 61.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1964	0.90	Level	22	0	0.901	1.00	2422
Ramp	298	0.90	Level	22	0	0.901	1.00	368
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2422 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2422	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2054	Exhibit 25-14	4800	No
V_R	368	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2422	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 21.8 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.461 (Exhibit 25-19)

S_R= 57.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1666	0.90	Level	22	0	0.901	1.00	2055
Ramp	268	0.90	Level	22	0	0.901	1.00	331
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2055 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2386	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2386	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.7 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.316 (Exibit 25-19)
S_R= 61.1 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 61.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Existing w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*269*	*23*	*157*	*150*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*298*	*25*	*174*	*166*	*0*
Percent Heavy Vehicles	*0*	--	--	*22*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*220*		*71*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*244*	*0*	*78*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*174*					*322*	
C (m) (veh/h)		*1132*					*326*	
v/c		*0.15*					*0.99*	
95% queue length		*0.54*					*10.74*	
Control Delay (s/veh)		*8.8*					*83.4*	
LOS		*A*					*F*	
Approach Delay (s/veh)	--	--				*83.4*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Existing w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*157*	*332*			*272*	*111*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*174*	*368*	*0*	*0*	*302*	*123*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*35*		*263*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*38*	*0*	*292*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*174*			*330*				
C (m) (veh/h)	*1035*			*606*				
v/c	*0.17*			*0.54*				
95% queue length	*0.60*			*3.28*				
Control Delay (s/veh)	*9.2*			*17.8*				
LOS	*A*			*C*				
Approach Delay (s/veh)	--	--	*17.8*					
Approach LOS	--	--	*C*					

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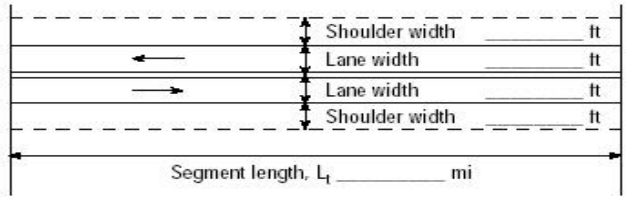
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*978* veh/h
Directional split	*61 / 39*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1093*
v_p * highest directional split proportion[2] (pc/h)	*667*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.5*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*41.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1090*
v_p * highest directional split proportion[2] (pc/h)	*665*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*61.6*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*8.5*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*70.1*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.34*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*272*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*978*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*6.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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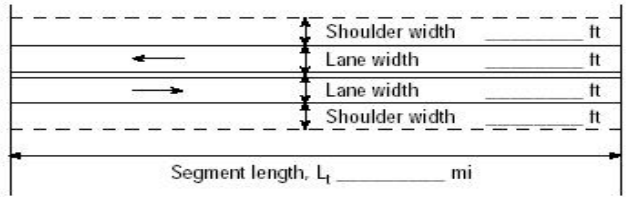
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*796* veh/h
Directional split	*61 / 39*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*890*
v_p * highest directional split proportion[2] (pc/h)	*543*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*2.8*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*34.9*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*887*
v_p * highest directional split proportion[2] (pc/h)	*541*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*54.1*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*13.5*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*67.7*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.28*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*22*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*80*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*0.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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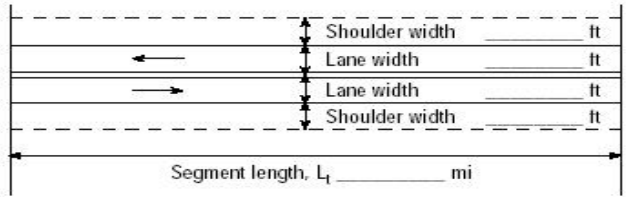
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*513* veh/h
Directional split	*57 / 43*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.979*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*582*
v_p * highest directional split proportion[2] (pc/h)	*332*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*4.0*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*32.8*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*572*
v_p * highest directional split proportion[2] (pc/h)	*326*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*39.5*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*21.0*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*60.5*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.18*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*86*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*308*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*2.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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BASE YEAR 2013
INTERSTATE 40 AT STATE ROUTE 135 (S. WILLOW AVENUE)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2282	0.90	Level	22	0	0.901	1.00	2814
Ramp	956	0.90	Level	22	0	0.901	1.00	1179
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2814 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2814	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1635	Exhibit 25-14	4800	No
V_R	1179	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2814	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 25.8 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.534 (Exhibit 25-19)

S_R= 55.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 55.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1326	0.90	Level	22	0	0.901	1.00	1635
Ramp	541	0.90	Level	22	0	0.901	1.00	667
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 1635 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2302	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2302	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.6 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.321 (Exibit 25-19)
S_R= 61.0 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 61.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2616	0.90	Level	22	0	0.901	1.00	3226
Ramp	1450	0.90	Level	22	0	0.901	1.00	1788
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3226 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3226	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1438	Exhibit 25-14	4800	No
V_R	1788	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3226	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 29.5 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.589 (Exhibit 25-19)

S_R= 53.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1166	0.90	Level	22	0	0.901	1.00	1438
Ramp	287	0.90	Level	22	0	0.901	1.00	354
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 1438 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1792	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1792	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 15.3 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.300 (Exibit 25-19)
S_R= 61.6 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 61.6 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*213*		*693*					*851*	*348*	*193*	*1485*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *50.6*	G = *0.0*	G = *0.0*	G = *0.0*	G = *11.8*	G = *52.6*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* | Cycle Length, C = *130.0*

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	*237*		*770*					*1333*		*214*	*1650*	
Lane Group Capacity, c	*669*		*599*					*1333*		*212*	*1839*	
v/c Ratio, X	*0.35*		*1.29*					*1.00*		*1.01*	*0.90*	
Total Green Ratio, g/C	*0.39*		*0.39*					*0.40*		*0.53*	*0.53*	
Uniform Delay, d_1	*28.1*		*39.7*					*38.7*		*40.5*	*27.1*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*		*0.50*					*0.50*		*0.50*	*0.42*	
Incremental Delay, d_2	*0.3*		*140.8*					*24.7*		*64.3*	*6.3*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*28.5*		*180.5*					*63.4*		*104.8*	*33.4*	
Lane Group LOS	*C*		*F*					*E*		*F*	*C*	
Approach Delay	*144.7*						*63.4*			*41.6*		
Approach LOS	*F*						*E*			*D*		
Intersection Delay	*73.2*			X_C = *1.14*			Intersection LOS			*E*		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*AM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*1149*			*136*	*928*			*529*	*151*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *76.2*	G = *0.0*	G = *0.0*	G = *0.0*	G = *6.4*	G = *32.4*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *130.0*

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				*1277*			*151*	*1031*			*756*	
Lane Group Capacity, c				*1008*			*141*	*1161*			*830*	
v/c Ratio, X				*1.27*			*1.07*	*0.89*			*0.91*	
Total Green Ratio, g/C				*0.59*			*0.34*	*0.34*			*0.25*	
Uniform Delay, d_1				*26.9*			*48.6*	*40.8*			*47.4*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.50*			*0.50*	*0.41*			*0.43*	
Incremental Delay, d_2				*128.0*			*96.0*	*8.7*			*14.1*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*154.9*			*144.6*	*49.4*			*61.5*	
Lane Group LOS				*F*			*F*	*D*			*E*	
Approach Delay				*154.9*			*61.6*			*61.5*		
Approach LOS				*F*			*E*			*E*		
Intersection Delay	*98.6*			X_C = *1.23*			Intersection LOS			*F*		

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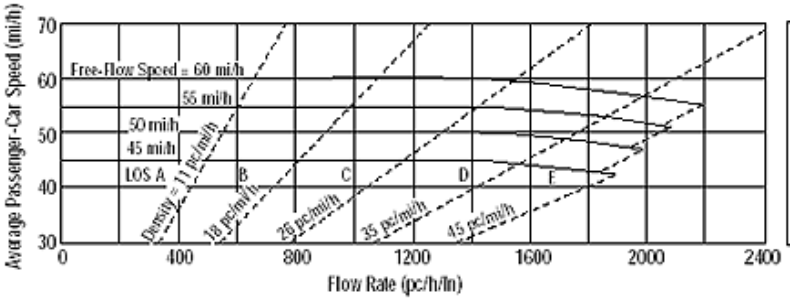
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	680	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	387
Speed, S (mi/h)	45.0
D (pc/mi/ln)	8.6
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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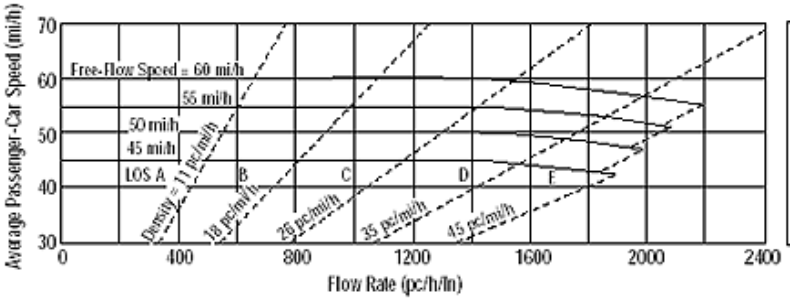
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1229	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	699
Speed, S (mi/h)	45.0
D (pc/mi/ln)	15.5
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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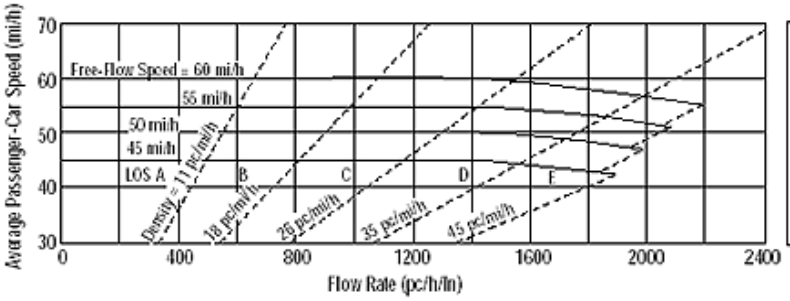
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1678	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	955
Speed, S (mi/h)	45.0
D (pc/mi/ln)	21.2
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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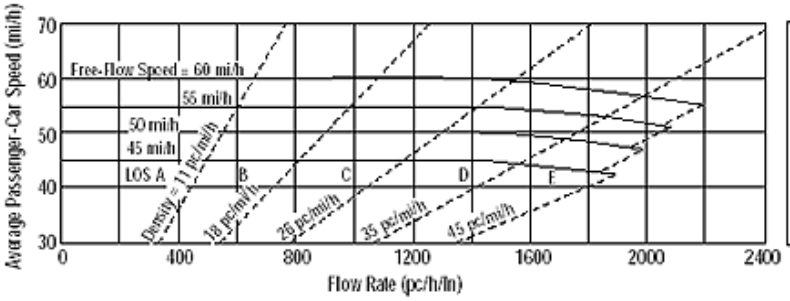
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1064	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	605
Speed, S (mi/h)	45.0
D (pc/mi/ln)	13.4
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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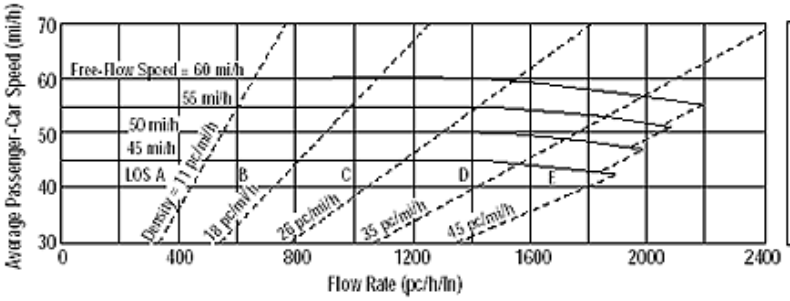
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	2178	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1240
Speed, S (mi/h)	45.0
D (pc/mi/ln)	27.6
LOS	D

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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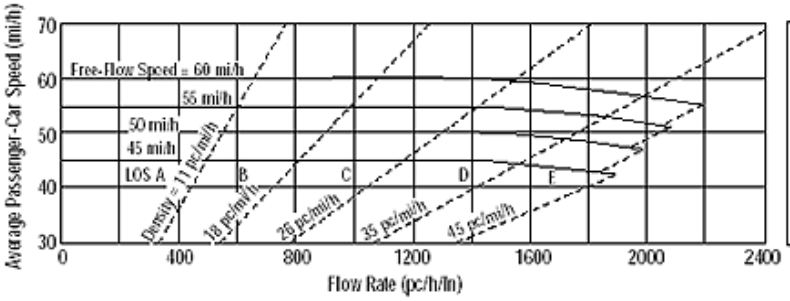
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1199	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	682
Speed, S (mi/h)	45.0
D (pc/mi/ln)	15.2
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1719	0.90	Level	22	0	0.901	1.00	2120
Ramp	444	0.90	Level	22	0	0.901	1.00	548
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2120 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2120	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1572	Exhibit 25-14	4800	No
V_R	548	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2120	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 19.9 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.477 (Exhibit 25-19)

S_R= 56.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1275	0.90	Level	22	0	0.901	1.00	1573
Ramp	1353	0.90	Level	22	0	0.901	1.00	1669
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 1573 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3242	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3242	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.382 (Exibit 25-19)
S_R= 59.3 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 59.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1807	0.90	Level	22	0	0.901	1.00	2229
Ramp	661	0.90	Level	22	0	0.901	1.00	815
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2229 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2229	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1414	Exhibit 25-14	4800	No
V_R	815	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2229	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 20.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.501 (Exhibit 25-19)

S_R= 56.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1146	0.90	Level	22	0	0.901	1.00	1413
Ramp	818	0.90	Level	22	0	0.901	1.00	1009
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1413 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2422	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2422	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.0 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.321 (Exibit 25-19)

S_R= 61.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*218*		*176*					*1049*	*1023*	*330*	*966*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *13.6*	G = *0.0*	G = *0.0*	G = *0.0*	G = *17.7*	G = *93.7*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *140.0*

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	*242*		*196*					*2303*		*367*	*1073*	
Lane Group Capacity, c	*167*		*149*					*2135*		*268*	*2864*	
v/c Ratio, X	*1.45*		*1.32*					*1.08*		*1.37*	*0.37*	
Total Green Ratio, g/C	*0.10*		*0.10*					*0.67*		*0.83*	*0.83*	
Uniform Delay, d_1	*63.2*		*63.2*					*23.1*		*53.8*	*2.9*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.50*		*0.50*					*0.50*		*0.50*	*0.11*	
Incremental Delay, d_2	*232.3*		*181.4*					*44.6*		*188.2*	*0.1*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*295.5*		*244.6*					*67.7*		*242.0*	*3.0*	
Lane Group LOS	*F*		*F*					*E*		*F*	*A*	
Approach Delay	*272.7*						*67.7*			*63.9*		
Approach LOS	*F*						*E*			*E*		
Intersection Delay	*87.9*			X_C = *2.50*			Intersection LOS			*F*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*PM Peak Hour*	Analysis Year	*2013 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*378*			*600*	*667*			*918*	*218*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *23.1*	G = *0.0*	G = *0.0*	G = *0.0*	G = *28.2*	G = *33.7*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *100.0*

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				*420*			*667*	*741*			*1262*	
Lane Group Capacity, c				*397*			*557*	*2305*			*1128*	
v/c Ratio, X				*1.06*			*1.20*	*0.32*			*1.12*	
Total Green Ratio, g/C				*0.23*			*0.67*	*0.67*			*0.34*	
Uniform Delay, d_1				*38.5*			*14.2*	*7.0*			*33.1*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.50*			*0.50*	*0.11*			*0.50*	
Incremental Delay, d_2				*61.3*			*105.4*	*0.1*			*65.7*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*99.7*			*119.6*	*7.1*			*98.8*	
Lane Group LOS				*F*			*F*	*A*			*F*	
Approach Delay				*99.7*			*60.4*			*98.8*		
Approach LOS				*F*			*E*			*F*		
Intersection Delay	*81.4*			X_C = *1.67*			Intersection LOS			*F*		

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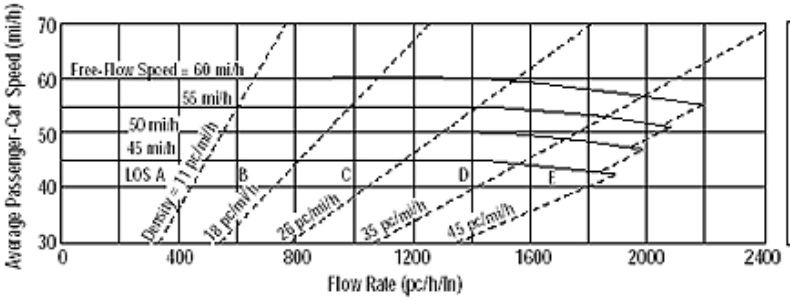
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1136	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	646
Speed, S (mi/h)	45.0
D (pc/mi/ln)	14.4
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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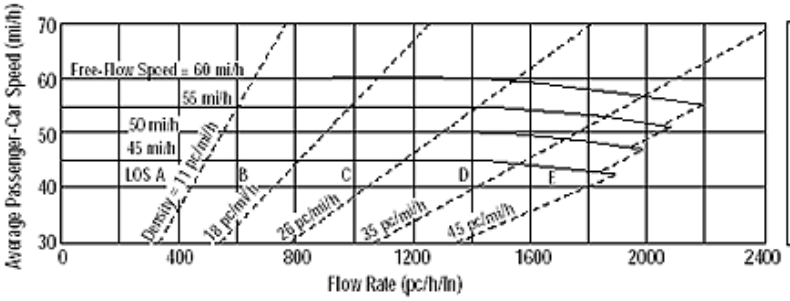
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	950	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	540
Speed, S (mi/h)	45.0
D (pc/mi/ln)	12.0
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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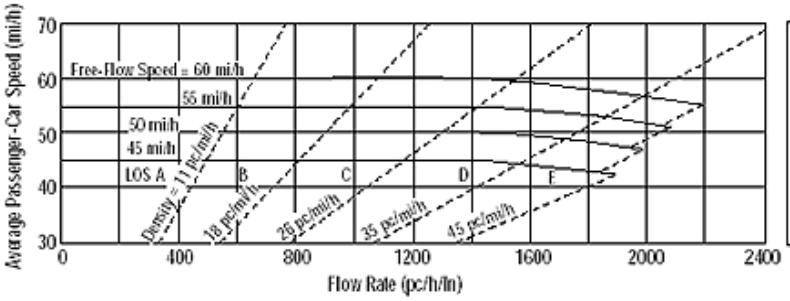
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1296	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	738
Speed, S (mi/h)	45.0
D (pc/mi/ln)	16.4
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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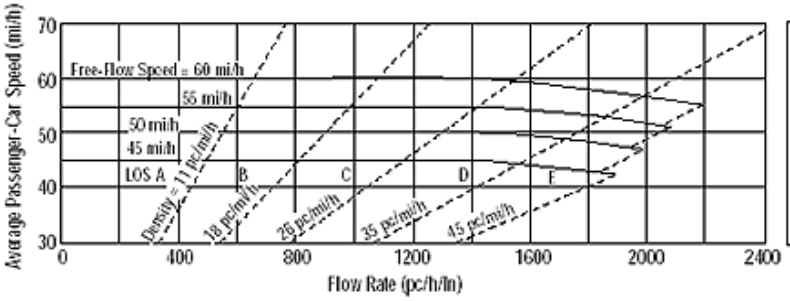
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1267	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	721
Speed, S (mi/h)	45.0
D (pc/mi/ln)	16.0
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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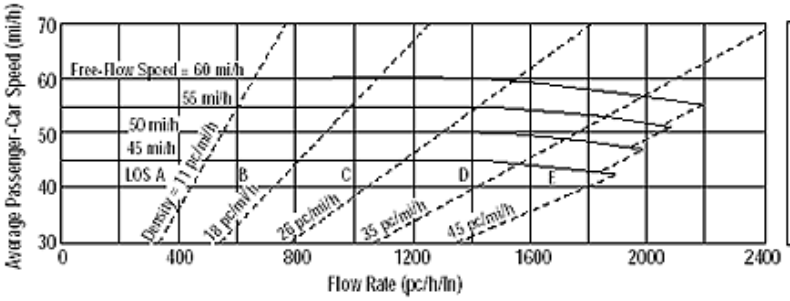
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1142	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	650
Speed, S (mi/h)	45.0
D (pc/mi/ln)	14.4
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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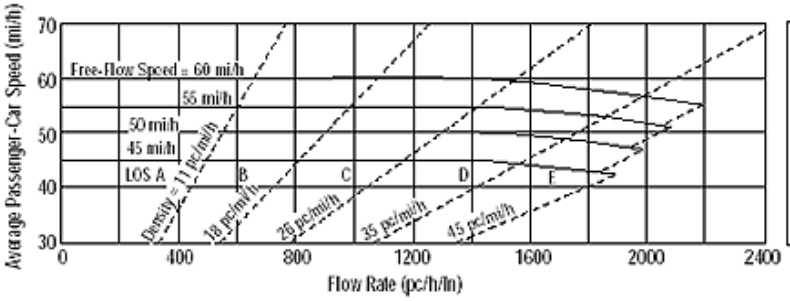
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	2072	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1179
Speed, S (mi/h)	45.0
D (pc/mi/ln)	26.2
LOS	D

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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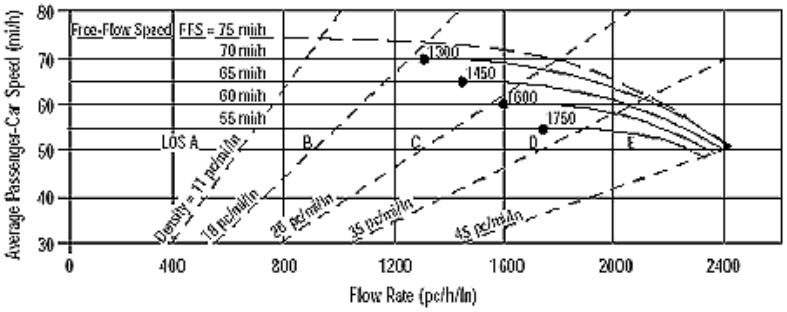
FUTURE YEAR 2033
INTERSTATE 40 MAINLINE

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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2800*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1727*	pc/h/ln
S	*64.8*	mi/h
D = v_p / S	*26.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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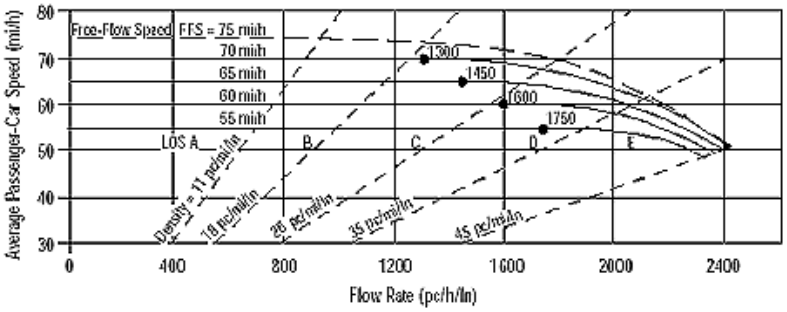
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2488*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1534*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*23.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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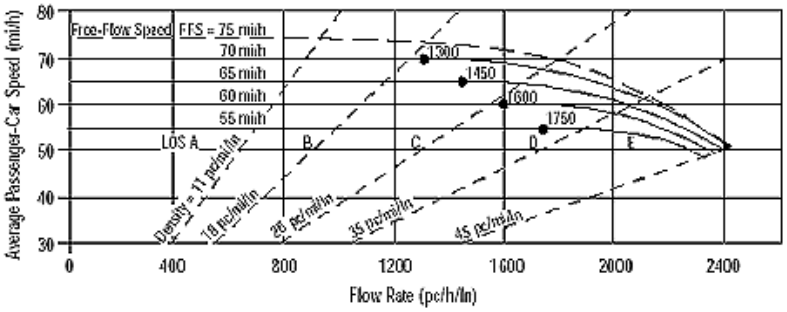
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 & SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2975*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1835*	pc/h/ln
S	*64.0*	mi/h
D = v_p / S	*28.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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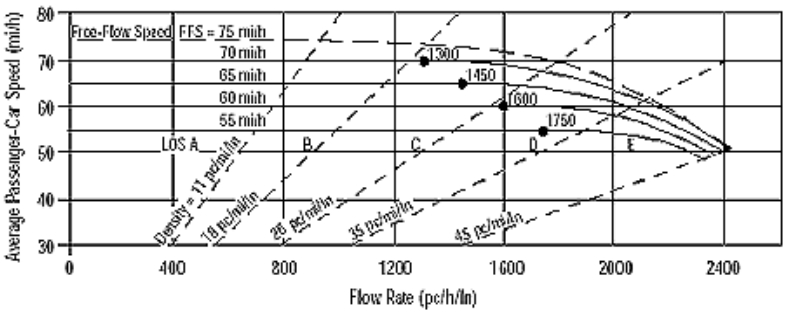
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1916*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1182*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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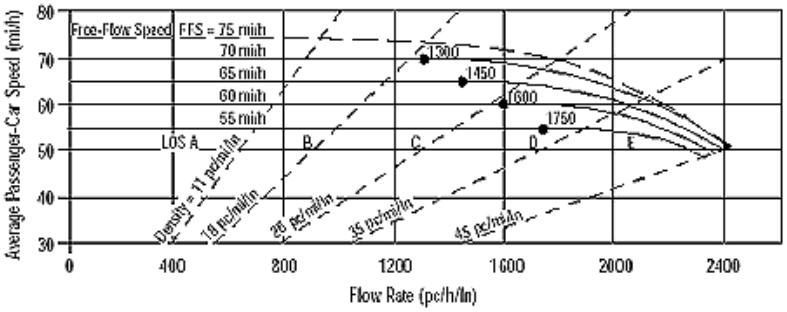
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2583*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1593*	pc/h/ln
S	*65.4*	mi/h
D = v_p / S	*24.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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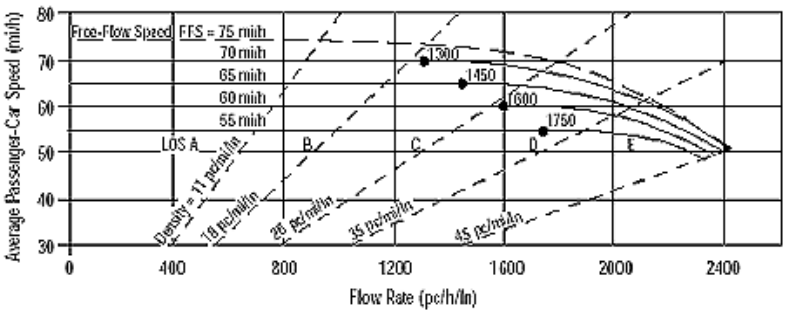
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3294*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2031*	pc/h/ln
S	*61.2*	mi/h
D = v_p / S	*33.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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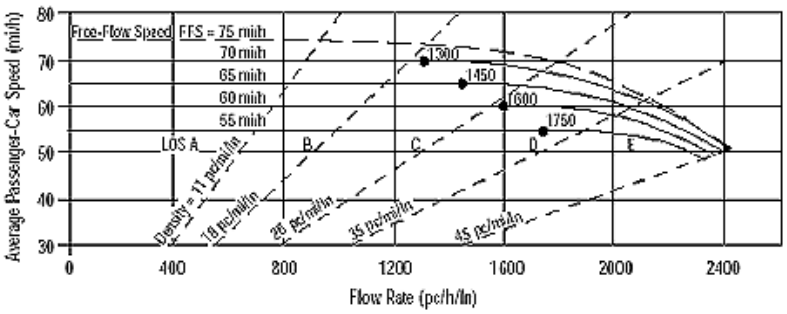
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1684*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1038*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*15.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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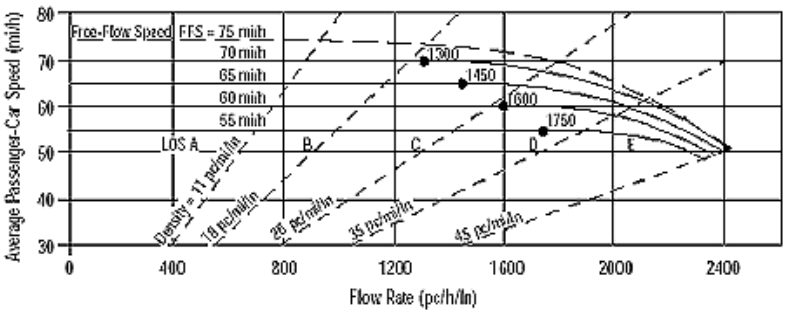
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 & SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2031*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1252*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*19.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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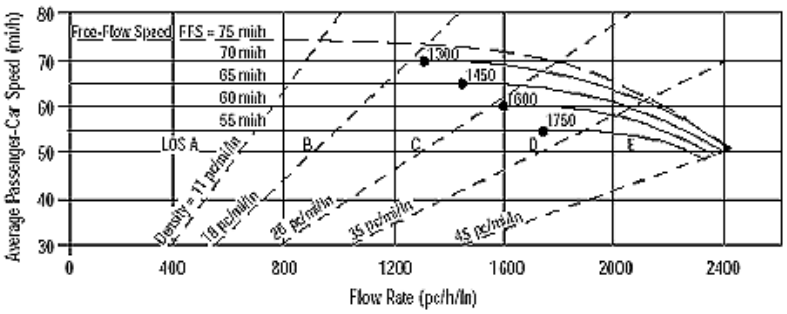
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1732*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1068*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*16.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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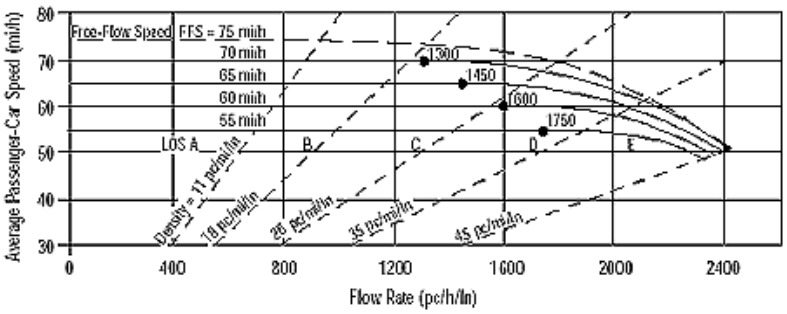
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*West of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2002*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1235*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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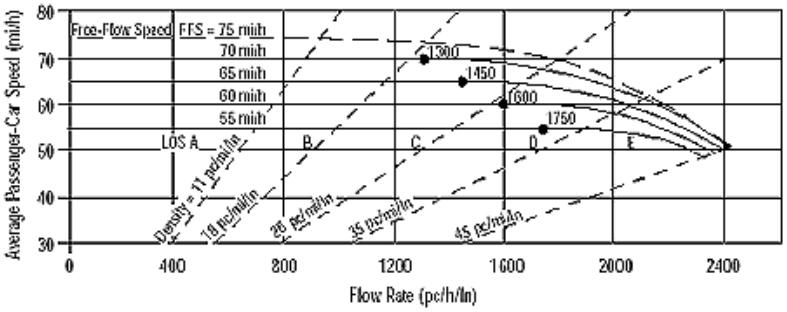
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*west of SR-56*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2521*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1555*	pc/h/ln	Design LOS	
S	*65.4*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*23.8*	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 - Exhibits23-8, 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			

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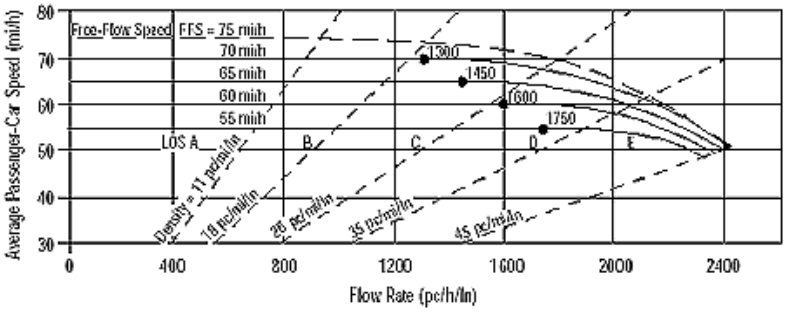
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2148*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1325*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*20.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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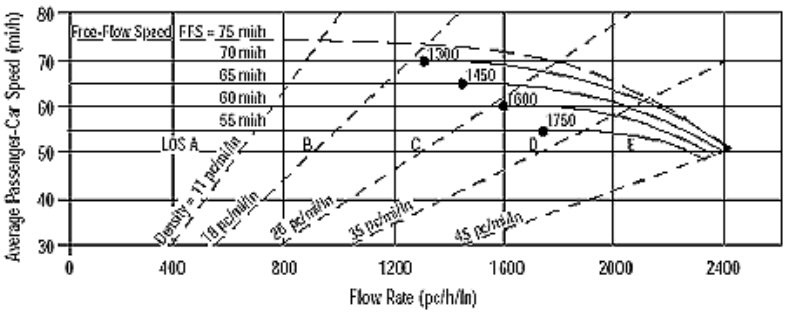
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 & SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2385*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1471*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*22.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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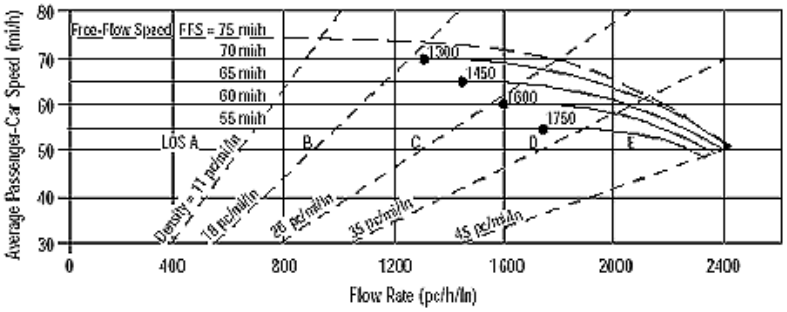
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1841*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1135*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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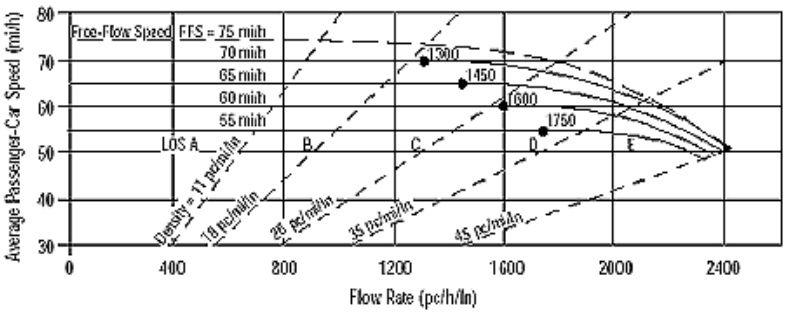
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3359*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2071*	pc/h/ln
S	*60.5*	mi/h
D = v_p / S	*34.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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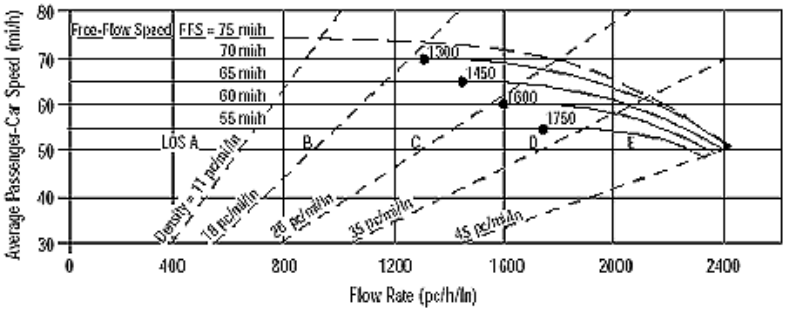
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2466*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1521*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*23.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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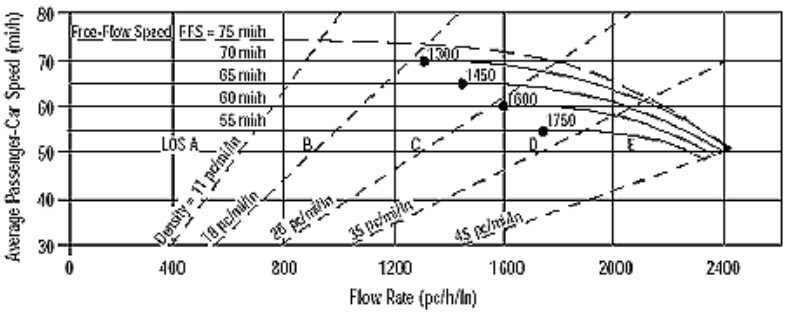
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1656*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1021*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*15.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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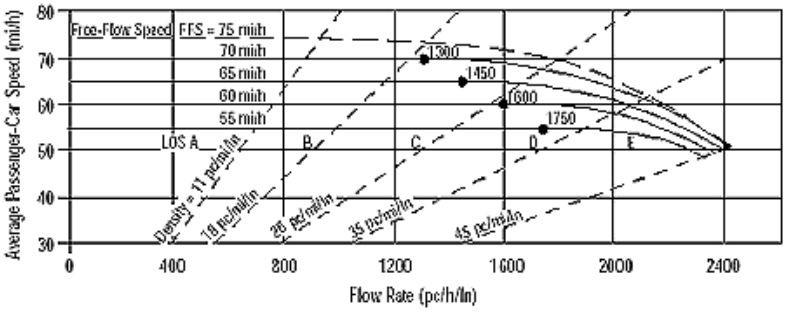
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 & SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2558*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1577*	pc/h/ln
S	*65.4*	mi/h
D = v_p / S	*24.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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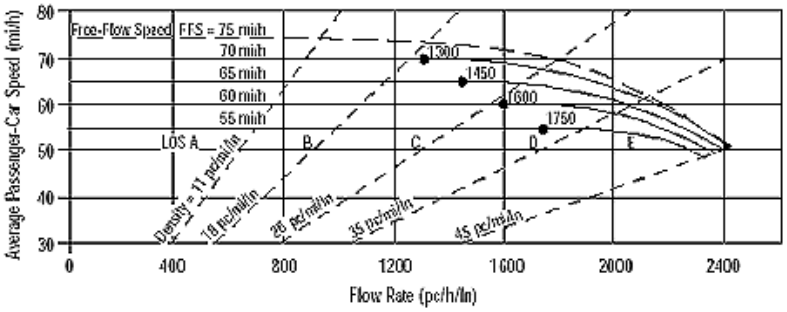
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2167*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1336*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*20.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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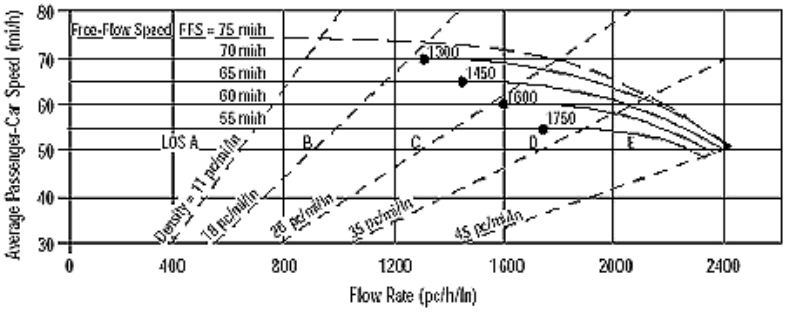
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*West of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Existing w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2475*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1526*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*23.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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FUTURE YEAR 2033
INTERSTATE 40 AT STATE ROUTE 56 (BAXTER ROAD)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp: ☐ Yes ☐ On ☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2800	0.90	Level	22	0	0.901	1.00	3453
Ramp	312	0.90	Level	22	0	0.901	1.00	385
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3453 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3453	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	3068	Exhibit 25-14	4800	No
V_R	385	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3453	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 31.0 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.463 (Exhibit 25-19)

S_R= 57.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2488	0.90	Level	22	0	0.901	1.00	3069
Ramp	487	0.90	Level	22	0	0.901	1.00	601
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 3069 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3670	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3670	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 29.5 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.426 (Exibit 25-19)

S_R= 58.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 58.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2031	0.90	Level	22	0	0.901	1.00	2505
Ramp	299	0.90	Level	22	0	0.901	1.00	369
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2505 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2505	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2136	Exhibit 25-14	4800	No
V_R	369	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2505	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 22.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.461 (Exhibit 25-19)

S_R= 57.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1732	0.90	Level	22	0	0.901	1.00	2136
Ramp	270	0.90	Level	22	0	0.901	1.00	333
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2136 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2469	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2469	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.3 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.320 (Exibit 25-19)

S_R= 61.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Existing w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*447*	*57*	*430*	*199*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*496*	*63*	*477*	*221*	*0*
Percent Heavy Vehicles	*0*	--	--	*22*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*131*		*181*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*145*	*0*	*201*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*477*					*346*	
C (m) (veh/h)		*919*					*95*	
v/c		*0.52*					*3.64*	
95% queue length		*3.07*					*35.07*	
Control Delay (s/veh)		*13.1*					*1282*	
LOS		*B*					*F*	
Approach Delay (s/veh)	--	--				*1282*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Existing w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*65*	*513*			*606*	*205*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*72*	*570*	*0*	*0*	*673*	*227*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*23*		*276*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*25*	*0*	*306*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*72*			*331*				
C (m) (veh/h)	*678*			*431*				
v/c	*0.11*			*0.77*				
95% queue length	*0.35*			*6.52*				
Control Delay (s/veh)	*10.9*			*36.1*				
LOS	*B*			*E*				
Approach Delay (s/veh)	--	--	*36.1*					
Approach LOS	--	--	*E*					

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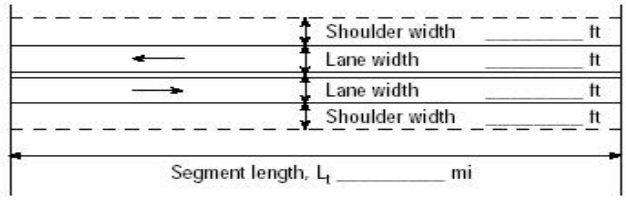
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1600* veh/h
Directional split	*51 / 49*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1783*
v_p * highest directional split proportion[2] (pc/h)	*909*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*0.8*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*36.8*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1778*
v_p * highest directional split proportion[2] (pc/h)	*907*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*79.0*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*4.1*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*83.2*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.56*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*444*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1600*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*12.1*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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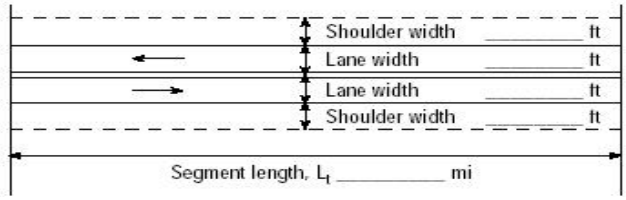
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1207* veh/h
Directional split	*52 / 48*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1345*
v_p * highest directional split proportion[2] (pc/h)	*699*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.8*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*32.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*1.000*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1341*
v_p * highest directional split proportion[2] (pc/h)	*697*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*69.2*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*8.7*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*77.9*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.42*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*34*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*121*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*1.1*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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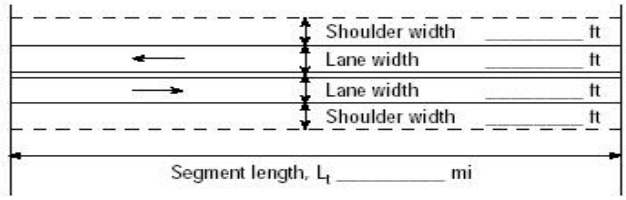
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*884* veh/h
Directional split	*57 / 43*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*988*
v_p * highest directional split proportion[2] (pc/h)	*563*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*2.6*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*31.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*985*
v_p * highest directional split proportion[2] (pc/h)	*561*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*57.9*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*12.6*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*70.6*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.31*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*147*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*530*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*4.7*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2521	0.90	Level	22	0	0.901	1.00	3109
Ramp	373	0.90	Level	22	0	0.901	1.00	460
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3109 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3109	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2649	Exhibit 25-14	4800	No
V_R	460	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3109	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 28.0 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.469 (Exhibit 25-19)

S_R= 56.9 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2148	0.90	Level	22	0	0.901	1.00	2649
Ramp	237	0.90	Level	22	0	0.901	1.00	292
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2649 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2941	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2941	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.0 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.347 (Exibit 25-19)

S_R= 60.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2558	0.90	Level	22	0	0.901	1.00	3155
Ramp	391	0.90	Level	22	0	0.901	1.00	482
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3155 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3155	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2673	Exhibit 25-14	4800	No
V_R	482	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3155	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 28.1 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.471 (Exhibit 25-19)

S_R= 56.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.8 mph (Exhibit 25-15)

HCS+™ Version 5.21 Generated: 5/29/2009 4:22 PM

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2167	0.90	Level	22	0	0.901	1.00	2673
Ramp	308	0.90	Level	22	0	0.901	1.00	380
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2673 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3053	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3053	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.356 (Exibit 25-19)

S_R= 60.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Existing w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*309*	*30*	*207*	*197*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*343*	*33*	*230*	*218*	*0*
Percent Heavy Vehicles	*0*	--	--	*22*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*298*		*84*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*331*	*0*	*93*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*230*					*424*	
C (m) (veh/h)		*1081*					*222*	
v/c		*0.21*					*1.91*	
95% queue length		*0.80*					*30.47*	
Control Delay (s/veh)		*9.2*					*462.3*	
LOS		*A*					*F*	
Approach Delay (s/veh)	--	--				*462.3*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Existing w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*163*	*444*			*358*	*145*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*181*	*493*	*0*	*0*	*397*	*161*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*46*		*345*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*51*	*0*	*383*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*181*			*434*				
C (m) (veh/h)	*920*			*442*				
v/c	*0.20*			*0.98*				
95% queue length	*0.73*			*12.27*				
Control Delay (s/veh)	*9.9*			*69.2*				
LOS	*A*			*F*				
Approach Delay (s/veh)	--	--	*69.2*					
Approach LOS	--	--	*F*					

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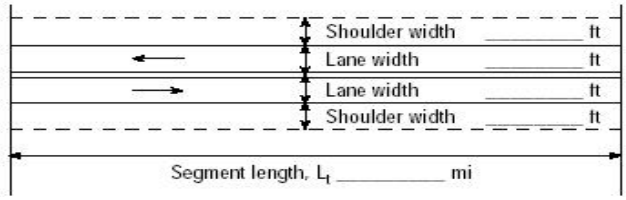
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1292* veh/h
Directional split	*61 / 39*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1440*
v_p * highest directional split proportion[2] (pc/h)	*878*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.0*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*39.3*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1436*
v_p * highest directional split proportion[2] (pc/h)	*876*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*71.7*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*5.7*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*77.4*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.45*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*359*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1292*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*9.1*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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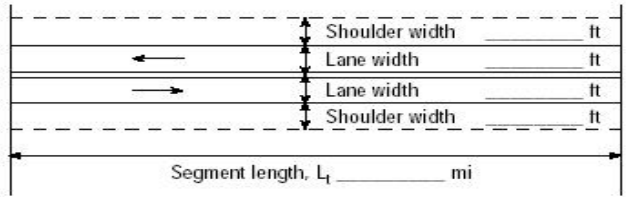
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1011* veh/h
Directional split	*60 / 40*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1130*
v_p * highest directional split proportion[2] (pc/h)	*678*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*2.3*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*33.6*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1127*
v_p * highest directional split proportion[2] (pc/h)	*676*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*62.9*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*11.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*73.8*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.35*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*28*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*101*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*0.8*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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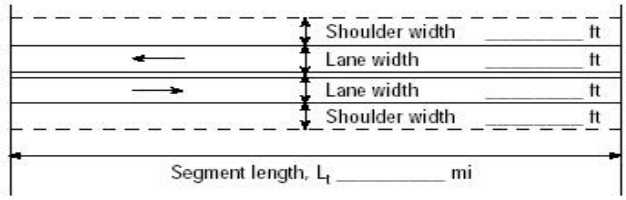
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*620* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*693*
v_p * highest directional split proportion[2] (pc/h)	*381*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*3.5*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*32.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*691*
v_p * highest directional split proportion[2] (pc/h)	*380*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*45.5*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*18.0*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*63.5*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.22*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*103*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*372*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*3.2*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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FUTURE YEAR 2033
INTERSTATE 40 AT STATE ROUTE 135 (S. WILLOW AVENUE)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2975	0.90	Level	22	0	0.901	1.00	3669
Ramp	1059	0.90	Level	22	0	0.901	1.00	1306
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3669 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3669	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2363	Exhibit 25-14	4800	No
V_R	1306	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3669	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 33.2 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.546 (Exhibit 25-19)

S_R= 54.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 54.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1916	0.90	Level	22	0	0.901	1.00	2363
Ramp	667	0.90	Level	22	0	0.901	1.00	823
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2363 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3186	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3186	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.376 (Exibit 25-19)

S_R= 59.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 59.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3294	0.90	Level	22	0	0.901	1.00	4063
Ramp	1610	0.90	Level	22	0	0.901	1.00	1986
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 4063 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4063	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2077	Exhibit 25-14	4800	No
V_R	1986	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4063	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 36.7 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.607 (Exhibit 25-19)

S_R= 53.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1684	0.90	Level	22	0	0.901	1.00	2077
Ramp	347	0.90	Level	22	0	0.901	1.00	428
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2077 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2505	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2505	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.325 (Exibit 25-19)

S_R= 60.9 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*345*		*714*					*1088*	*413*	*254*	*1657*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *50.6*	G = *0.0*	G = *0.0*	G = *0.0*	G = *11.8*	G = *52.6*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* | Cycle Length, C = *130.0*

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	*383*		*793*					*1668*		*282*	*1841*	
Lane Group Capacity, c	*669*		*599*					*1336*		*212*	*1839*	
v/c Ratio, X	*0.57*		*1.32*					*1.25*		*1.33*	*1.00*	
Total Green Ratio, g/C	*0.39*		*0.39*					*0.40*		*0.53*	*0.53*	
Uniform Delay, d_1	*31.2*		*39.7*					*38.7*		*41.1*	*30.3*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.17*		*0.50*					*0.50*		*0.50*	*0.50*	
Incremental Delay, d_2	*1.2*		*157.1*					*118.2*		*177.3*	*21.2*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*32.4*		*196.8*					*156.9*		*218.3*	*51.5*	
Lane Group LOS	*C*		*F*					*F*		*F*	*D*	
Approach Delay	*143.3*						*156.9*			*73.7*		
Approach LOS	*F*						*F*			*E*		
Intersection Delay	*118.1*			X_C = *1.74*			Intersection LOS			*F*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*AM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*2089*			*149*	*1284*			*696*	*198*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *76.2*	G = *0.0*	G = *0.0*	G = *0.0*	G = *6.4*	G = *32.4*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *130.0*

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				*2321*			*166*	*1427*			*993*	
Lane Group Capacity, c				*1008*			*141*	*1161*			*830*	
v/c Ratio, X				*2.30*			*1.18*	*1.23*			*1.20*	
Total Green Ratio, g/C				*0.59*			*0.34*	*0.34*			*0.25*	
Uniform Delay, d_1				*26.9*			*39.2*	*43.1*			*48.8*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.50*			*0.50*	*0.50*			*0.50*	
Incremental Delay, d_2				*589.3*			*131.3*	*110.8*			*100.0*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*616.2*			*170.5*	*153.9*			*148.8*	
Lane Group LOS				*F*			*F*	*F*			*F*	
Approach Delay				*616.2*			*155.7*			*148.8*		
Approach LOS				*F*			*F*			*F*		
Intersection Delay	*372.1*			X_C = *1.97*			Intersection LOS			*F*		

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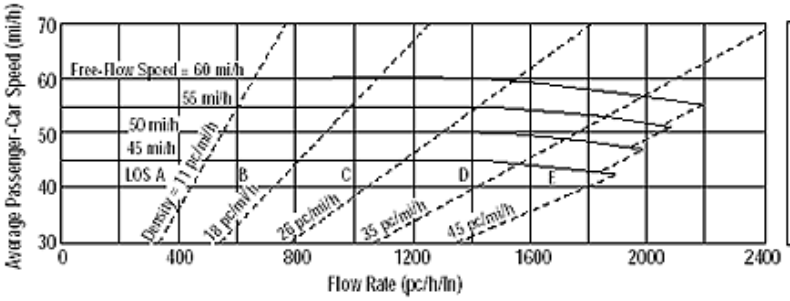
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	894	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	509
Speed, S (mi/h)	45.0
D (pc/mi/ln)	11.3
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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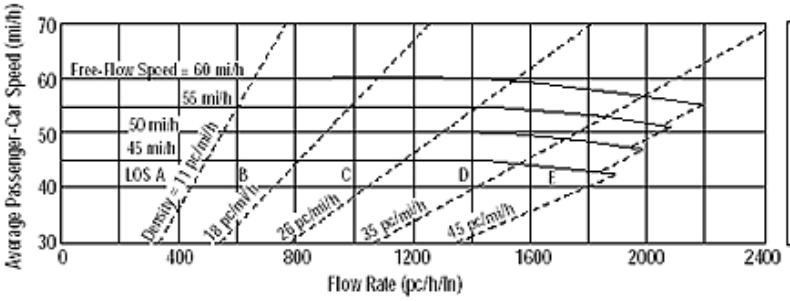
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1679	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	956
Speed, S (mi/h)	45.0
D (pc/mi/ln)	21.2
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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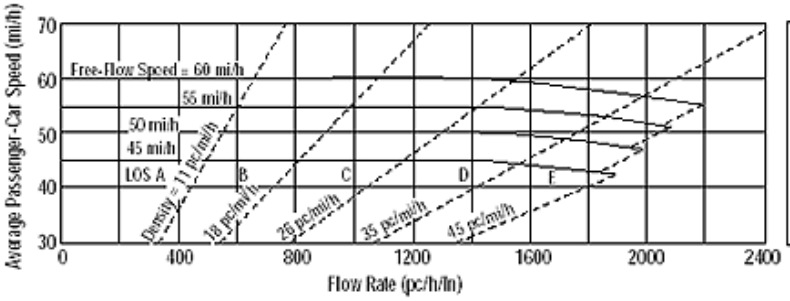
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1911	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1088
Speed, S (mi/h)	45.0
D (pc/mi/ln)	24.2
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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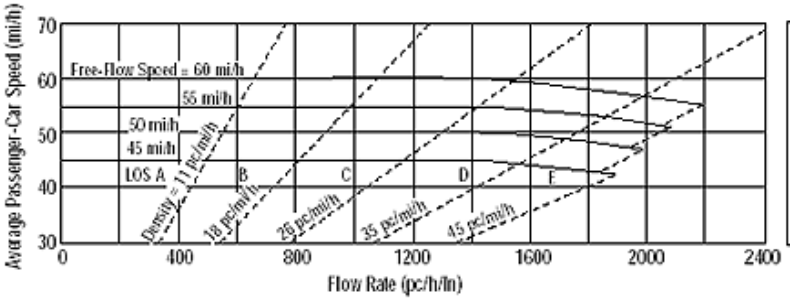
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1433	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	816
Speed, S (mi/h)	45.0
D (pc/mi/ln)	18.1
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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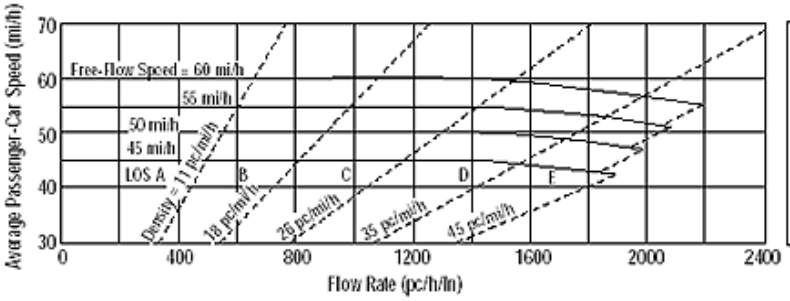
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	2371	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1350
Speed, S (mi/h)	45.0
D (pc/mi/ln)	30.0
LOS	D

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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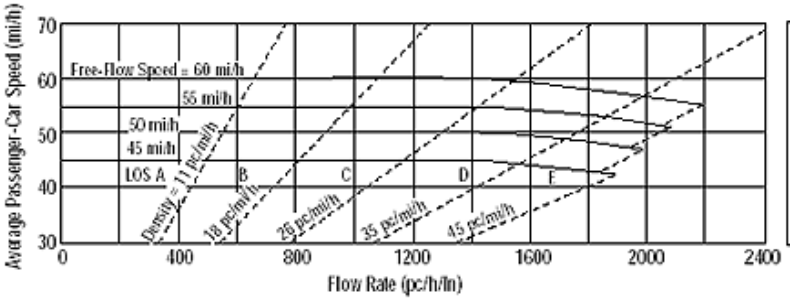
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1501	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	854
Speed, S (mi/h)	45.0
D (pc/mi/ln)	19.0
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2385	0.90	Level	22	0	0.901	1.00	2942
Ramp	544	0.90	Level	22	0	0.901	1.00	671
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2942 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2942	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2271	Exhibit 25-14	4800	No
V_R	671	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2942	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 26.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.488 (Exhibit 25-19)

S_R= 56.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1841	0.90	Level	22	0	0.901	1.00	2271
Ramp	1518	0.90	Level	22	0	0.901	1.00	1872
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2271 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4143	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4143	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 33.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.528 (Exibit 25-19)
S_R= 55.2 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 55.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2466	0.90	Level	22	0	0.901	1.00	3041
Ramp	810	0.90	Level	22	0	0.901	1.00	999
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3041 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3041	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2042	Exhibit 25-14	4800	No
V_R	999	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3041	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 27.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.518 (Exhibit 25-19)

S_R= 55.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 55.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1656	0.90	Level	22	0	0.901	1.00	2042
Ramp	902	0.90	Level	22	0	0.901	1.00	1112
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2042 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3154	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3154	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 25.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.368 (Exibit 25-19)

S_R= 59.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 59.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*352*		*192*					*1206*	*1085*	*433*	*1211*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *13.6*	G = *0.0*	G = *0.0*	G = *0.0*	G = *17.7*	G = *93.7*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *140.0*

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	*391*		*213*					*2546*		*481*	*1346*	
Lane Group Capacity, c	*167*		*149*					*2142*		*268*	*2864*	
v/c Ratio, X	*2.34*		*1.43*					*1.19*		*1.79*	*0.47*	
Total Green Ratio, g/C	*0.10*		*0.10*					*0.67*		*0.83*	*0.83*	
Uniform Delay, d_1	*63.2*		*63.2*					*23.1*		*54.5*	*3.3*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.50*		*0.50*					*0.50*		*0.50*	*0.11*	
Incremental Delay, d_2	*621.9*		*227.5*					*89.9*		*372.2*	*0.1*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*685.1*		*290.7*					*113.0*		*426.7*	*3.4*	
Lane Group LOS	*F*		*F*					*F*		*F*	*A*	
Approach Delay	*546.0*						*113.0*			*114.8*		
Approach LOS	*F*						*F*			*F*		
Intersection Delay	*166.2*			X_C = *4.28*			Intersection LOS			*F*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*PM Peak Hour*	Analysis Year	*2033 Existing w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*438*			*616*	*942*			*1206*	*286*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *23.1*	G = *0.0*	G = *0.0*	G = *0.0*	G = *28.2*	G = *33.7*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *100.0*

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				*487*			*684*	*1047*			*1658*	
Lane Group Capacity, c				*397*			*557*	*2305*			*1128*	
v/c Ratio, X				*1.23*			*1.23*	*0.45*			*1.47*	
Total Green Ratio, g/C				*0.23*			*0.67*	*0.67*			*0.34*	
Uniform Delay, d_1				*38.5*			*29.5*	*7.9*			*33.1*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.50*			*0.50*	*0.11*			*0.50*	
Incremental Delay, d_2				*122.5*			*117.8*	*0.1*			*216.3*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*160.9*			*147.3*	*8.0*			*249.5*	
Lane Group LOS				*F*			*F*	*A*			*F*	
Approach Delay				*160.9*			*63.0*			*249.5*		
Approach LOS				*F*			*E*			*F*		
Intersection Delay	*155.1*			X_C = *1.81*			Intersection LOS			*F*		

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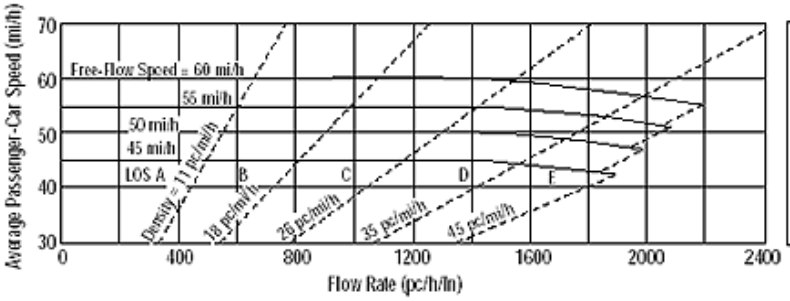
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1492	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	849
Speed, S (mi/h)	45.0
D (pc/mi/ln)	18.9
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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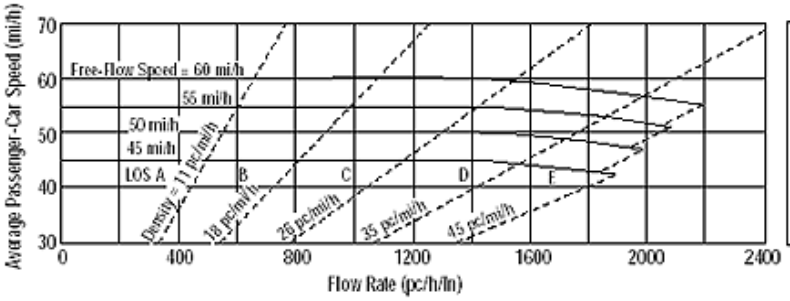
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1314	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	748
Speed, S (mi/h)	45.0
D (pc/mi/ln)	16.6
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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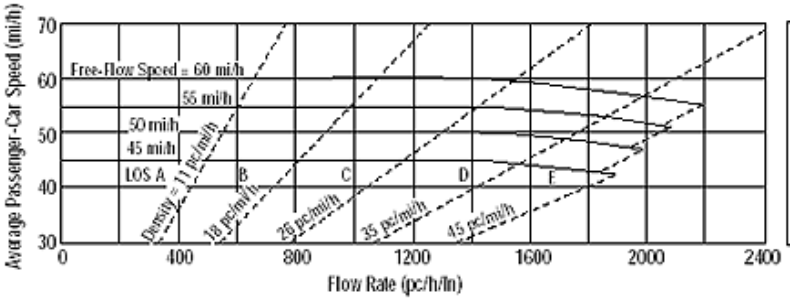
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1644	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	936
Speed, S (mi/h)	45.0
D (pc/mi/ln)	20.8
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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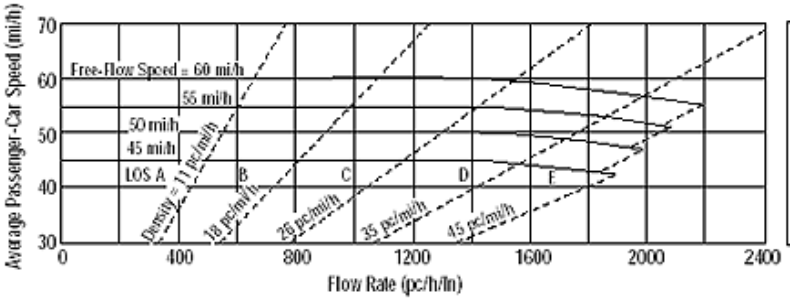
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1558	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	887
Speed, S (mi/h)	45.0
D (pc/mi/ln)	19.7
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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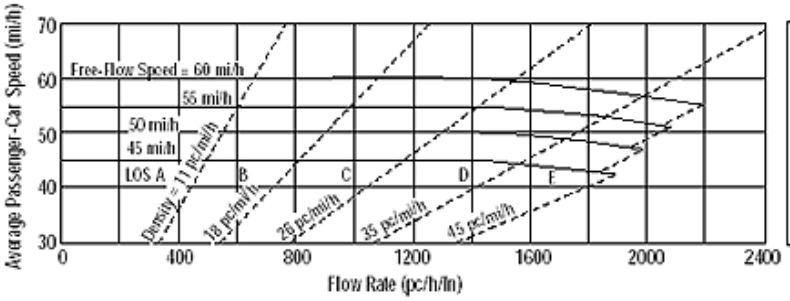
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1403	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	798
Speed, S (mi/h)	45.0
D (pc/mi/ln)	17.7
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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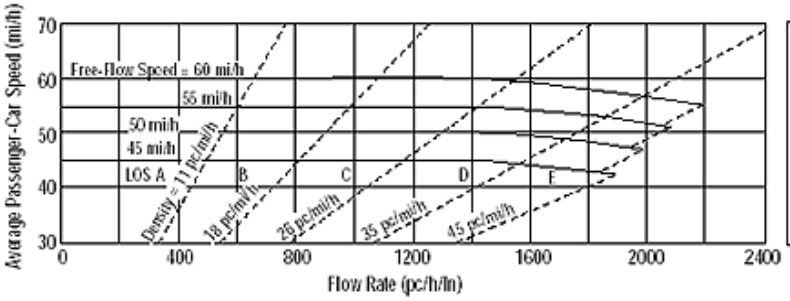
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Existing w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	2291	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1304
Speed, S (mi/h)	45.0
D (pc/mi/ln)	29.0
LOS	D

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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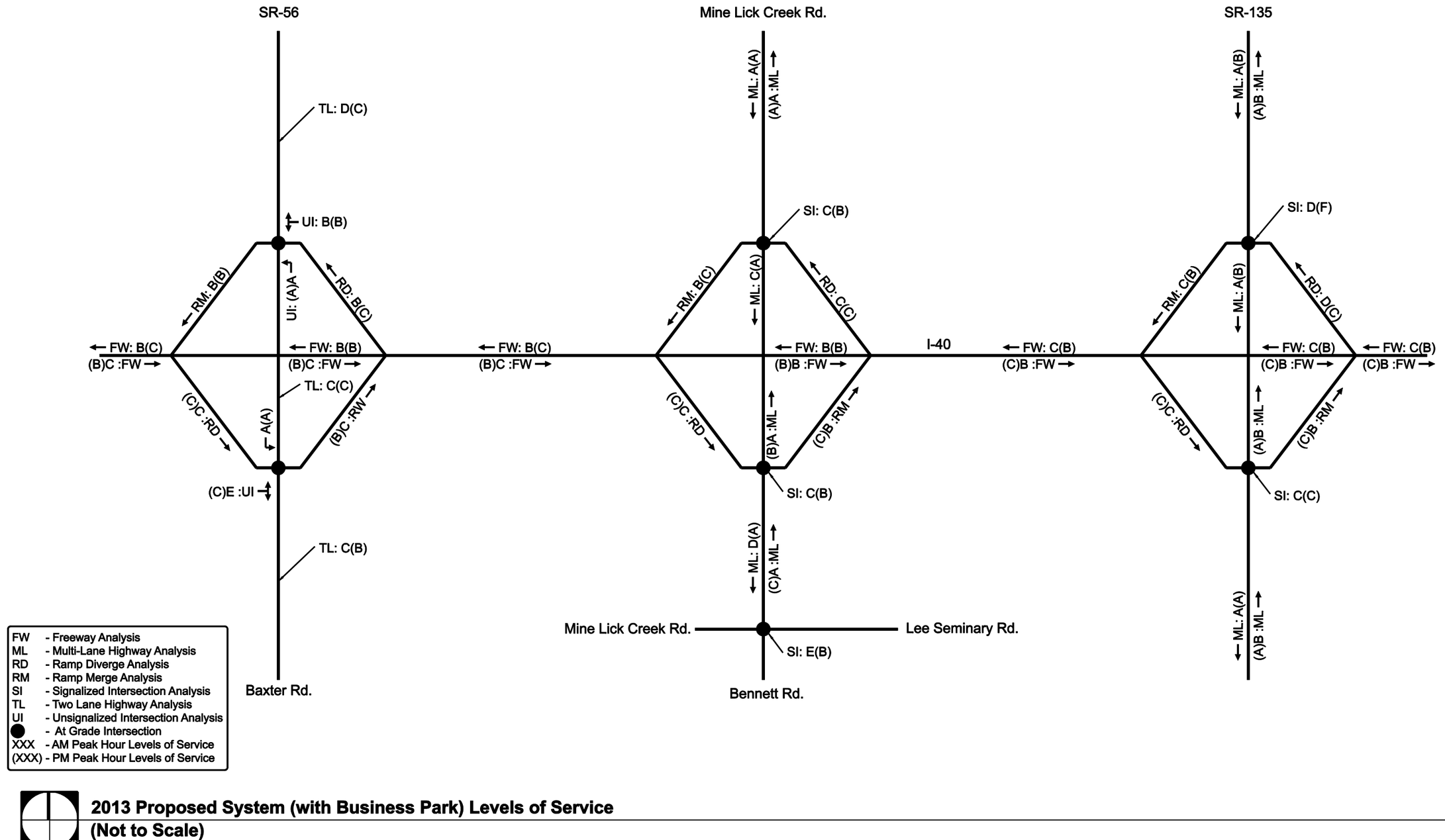
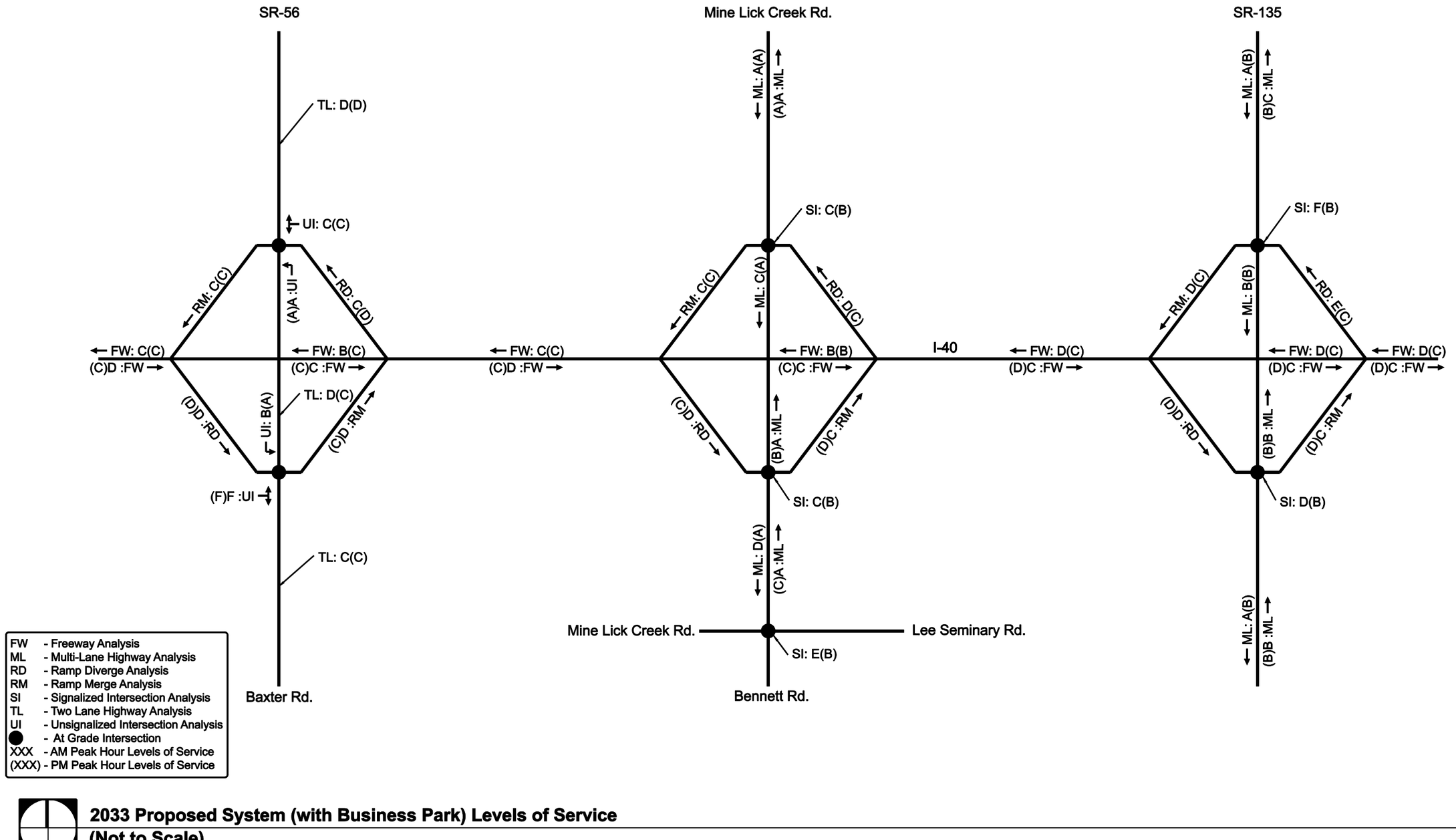
LEVEL OF SERVICE ANALYSIS
PROPOSED SYSTEM



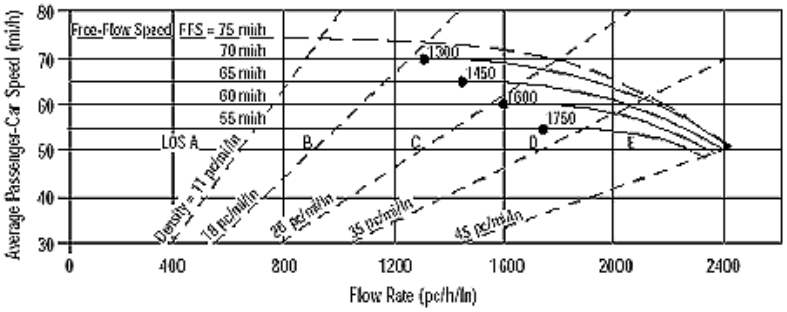
2013 Proposed System (with Business Park) Levels of Service
(Not to Scale)



2033 Proposed System (with Business Park) Levels of Service
(Not to Scale)

BASE YEAR 2013
INTERSTATE 40 MAINLINE

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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2186*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1348*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*20.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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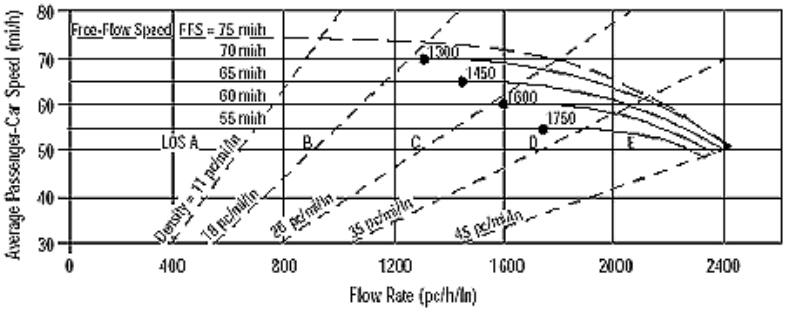
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2095*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1292*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*19.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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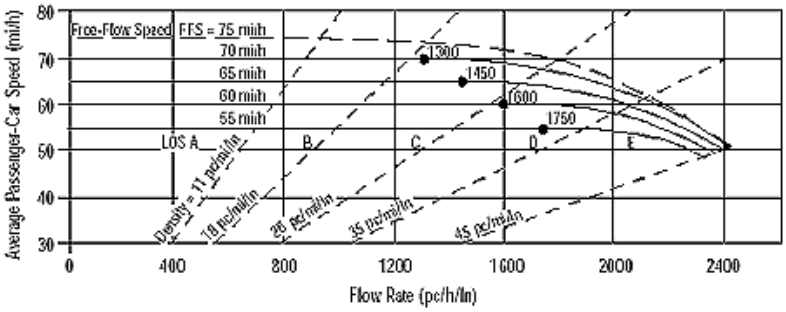
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Bt SR-56 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2380*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1468*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*22.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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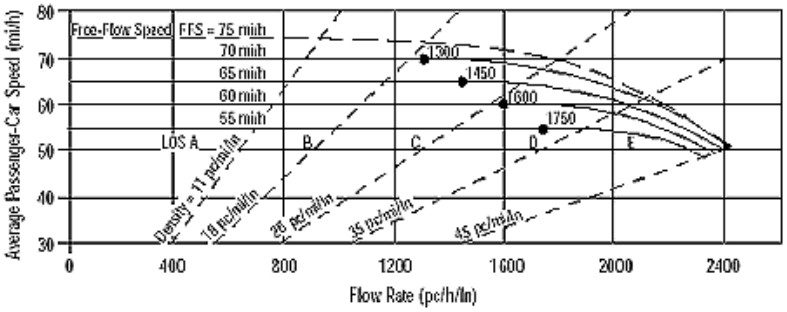
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Bt Mine Lick Creek Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1496*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*923*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*14.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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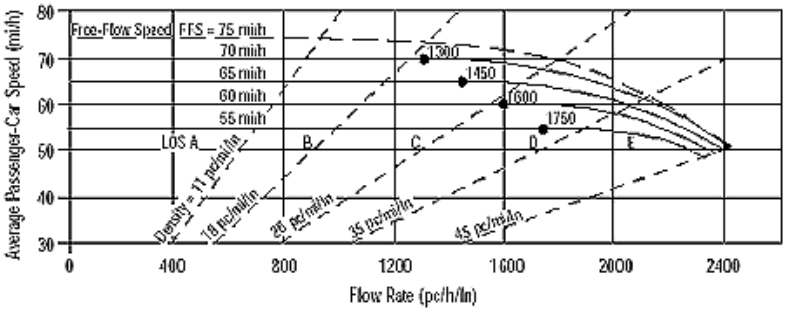
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt SR-135 & Mine Lick Creek*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*1793*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1106*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*16.9*	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 - Exhibits23-8, 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			

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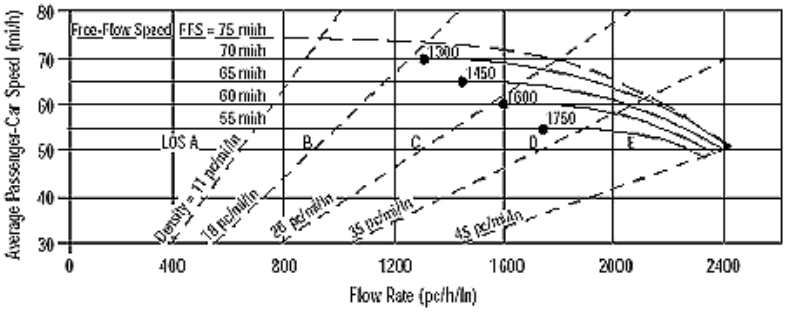
BASIC FREEWAY SEGMENTS WORKSHEET



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		Site Information	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-135 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1537*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*948*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*14.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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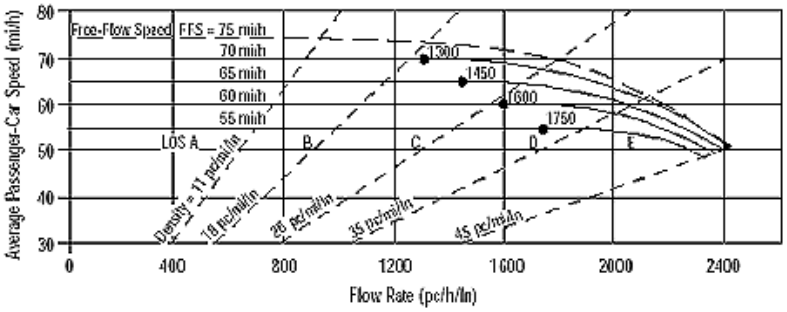
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*east of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1867*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1151*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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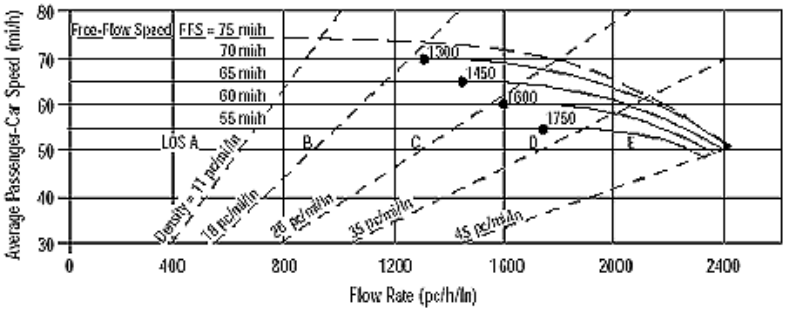
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2616*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*22*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
Driver type adjustment	*1.00*		Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1613*	pc/h/ln
S	*65.3*	mi/h
D = v_p / S	*24.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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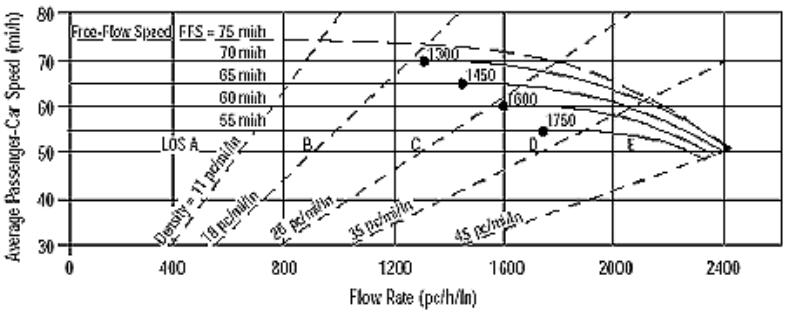
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-135 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2202*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

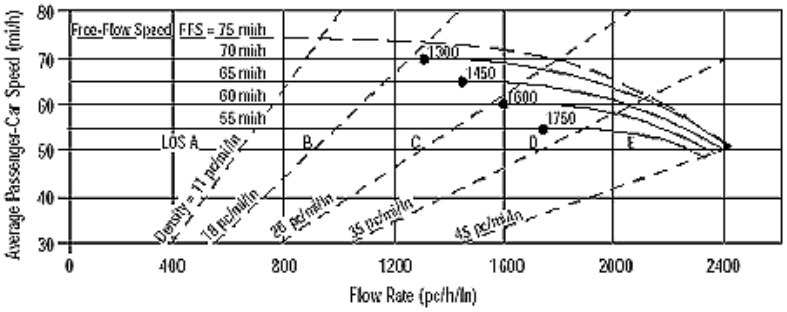
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1358*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*20.7*	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 - Exhibits23-8, 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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt SR-135 & Mine Lick Creek*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2352*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

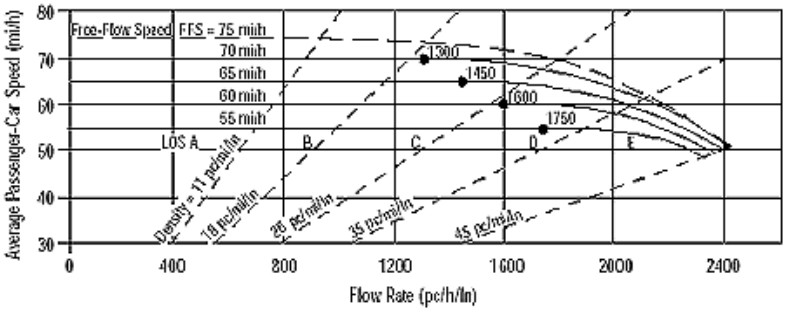
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1450*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*22.1*	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 - Exhibits23-8, 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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt Mine Lick Creek Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1262*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*778*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*11.9*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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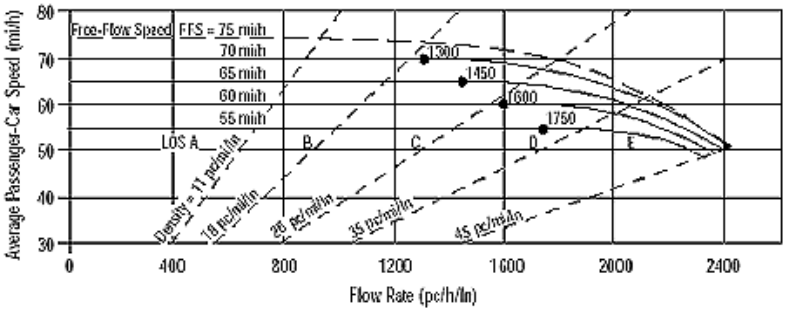
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt SR-56 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1465*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*903*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*13.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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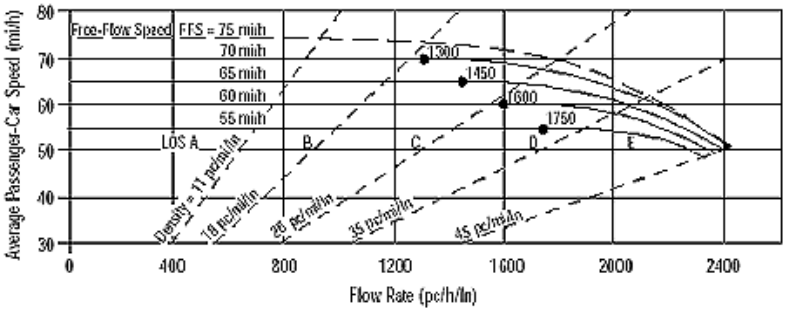
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-56 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*1292*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

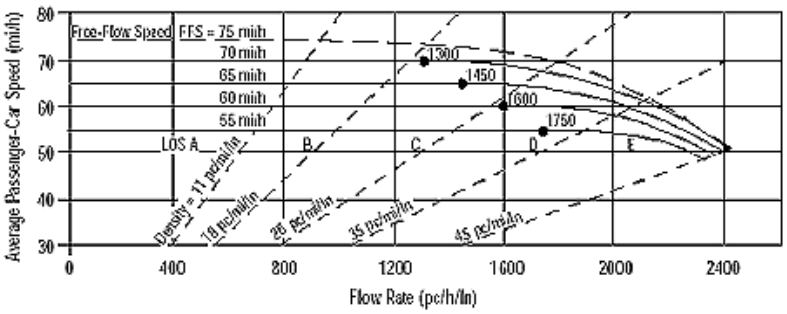
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*797*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*12.2*	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 - Exhibits23-8, 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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1437*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*886*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*13.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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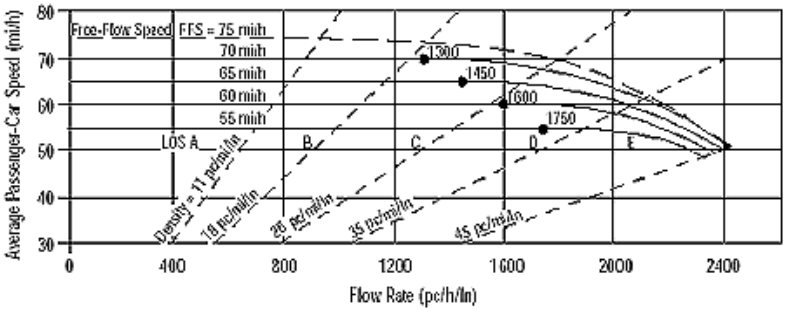
BASIC FREEWAY SEGMENTS WORKSHEET



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		Site Information	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*west of SR-56*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1830*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1129*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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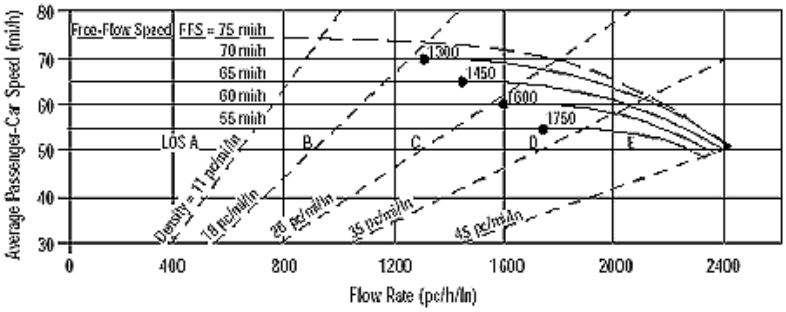
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-56 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*1629*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

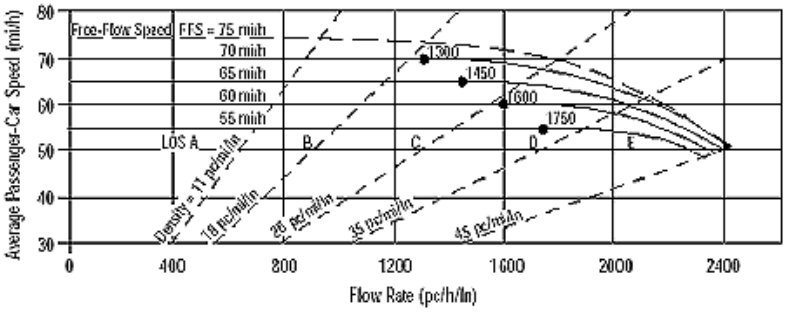
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1005*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*15.3*	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 - Exhibits23-8, 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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Bt SR-56 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1768*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1090*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*16.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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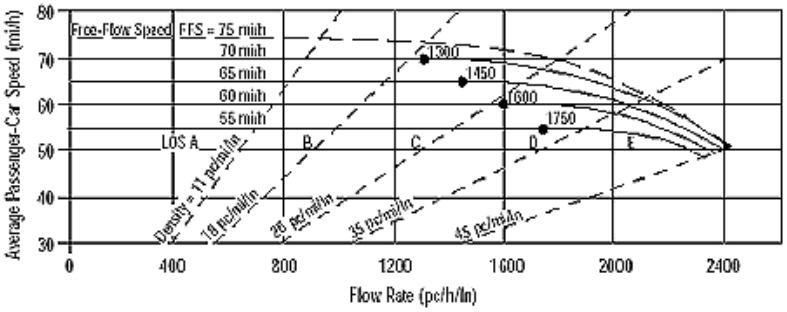
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt Mine Lick Creek Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*1482*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

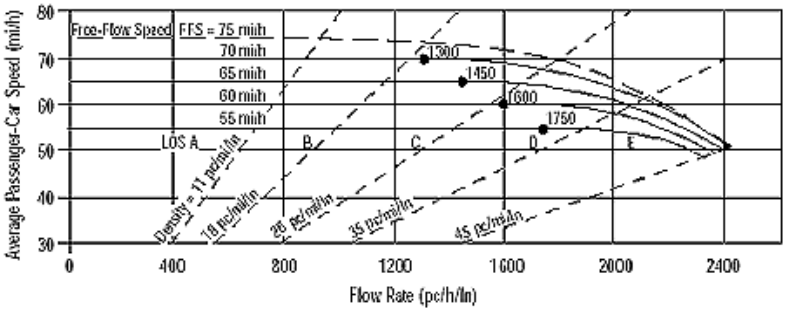
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*914*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*14.0*	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 - Exhibits23-8, 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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Bt SR-135 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2450*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1511*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*23.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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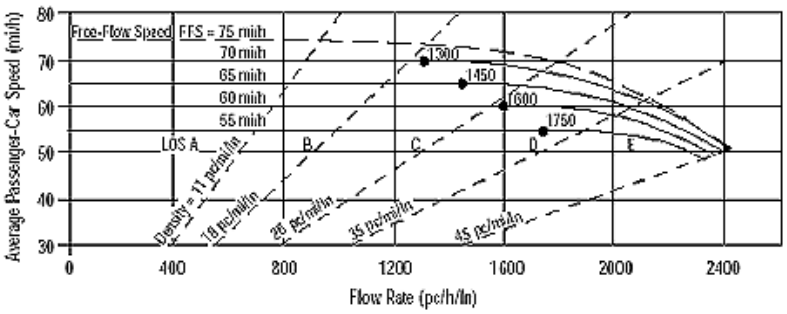
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-135 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2202*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

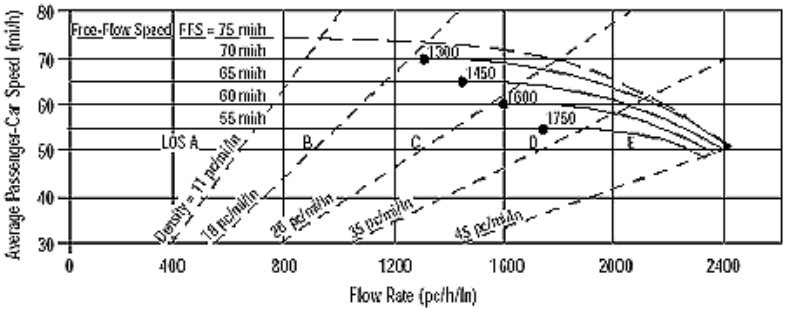
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1358*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*20.7*	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 - Exhibits23-8, 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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*east of SR-135*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2628*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

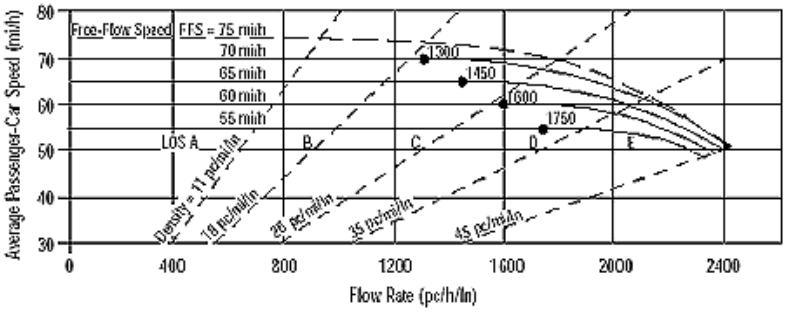
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1621*	pc/h/ln	Design LOS	
S	*65.3*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*24.8*	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 - Exhibits23-8, 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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1807*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1114*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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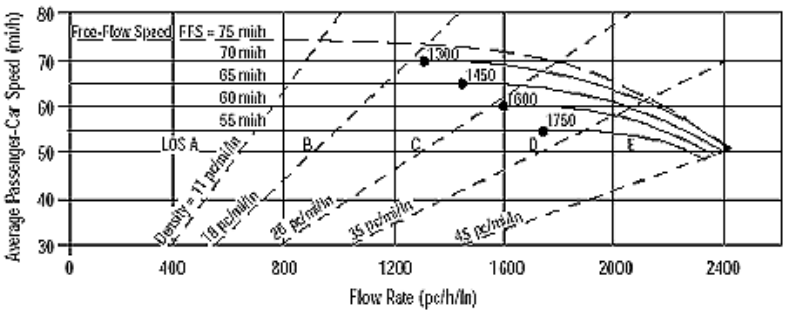

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-135 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*1422*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*877*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*13.4*	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 - Exhibits23-8, 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			

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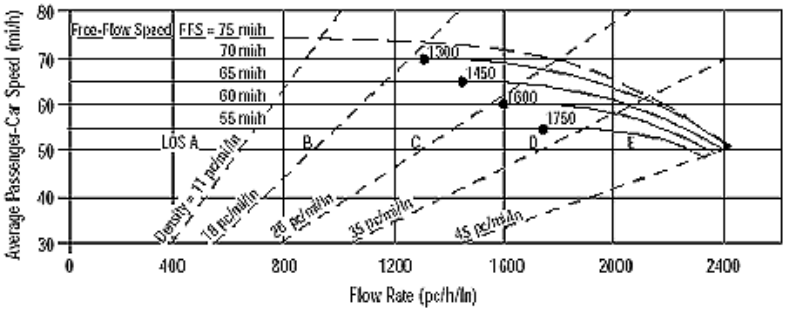

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt SR-135 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1631*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1006*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*15.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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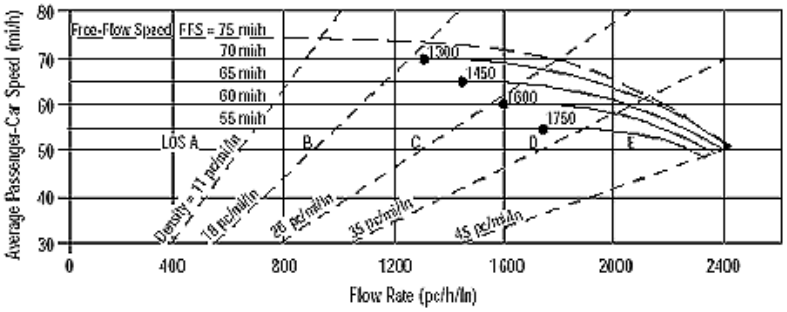
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt Mine Lick Creek Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1285*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*792*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*12.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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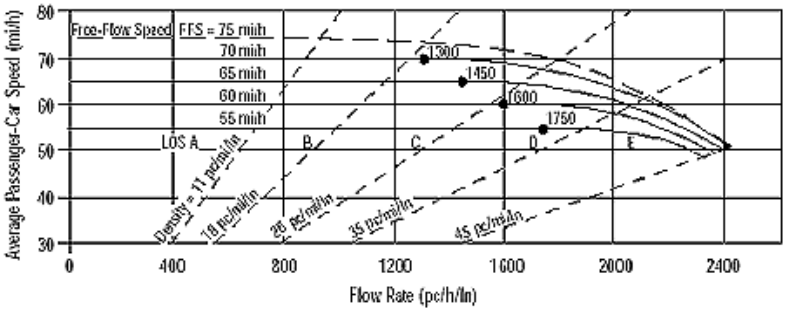

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt SR-56 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2061*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1271*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*19.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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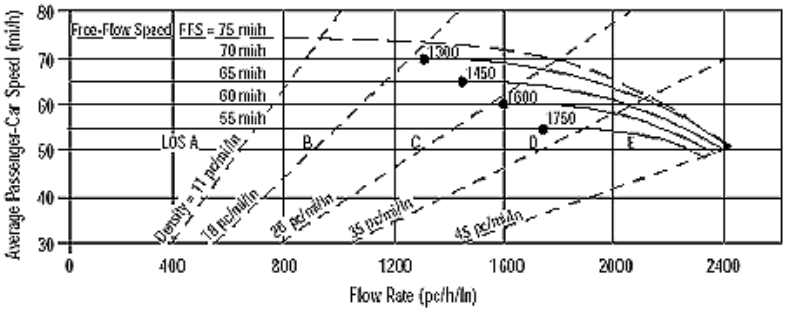
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1835*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*22*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
Driver type adjustment	*1.00*		Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1132*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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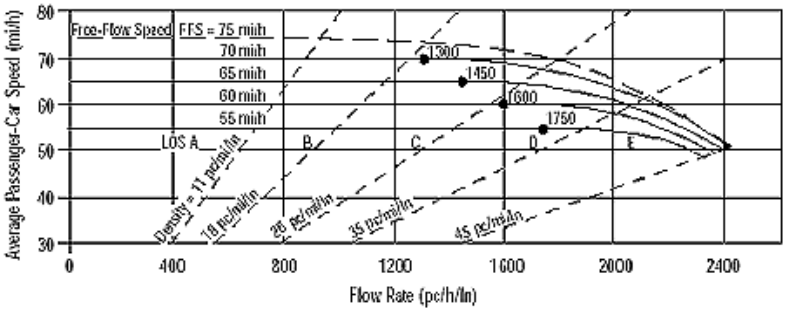
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2013 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1936*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1194*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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BASE YEAR 2013
INTERSTATE 40 AT STATE ROUTE 56 (BAXTER ROAD)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2186	0.90	Level	22	0	0.901	1.00	2696
Ramp	91	0.90	Level	22	0	0.901	1.00	112
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2696 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2696	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2584	Exhibit 25-14	4800	No
V_R	112	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2696	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 24.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.438 (Exhibit 25-19)

S_R= 57.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2095	0.90	Level	22	0	0.901	1.00	2584
Ramp	285	0.90	Level	22	0	0.901	1.00	352
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2584 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2936	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2936	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 23.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.346 (Exibit 25-19)
S_R= 60.3 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 60.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1465	0.90	Level	22	0	0.901	1.00	1807
Ramp	173	0.90	Level	22	0	0.901	1.00	213
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 1807 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	1807	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1594	Exhibit 25-14	4800	No
V_R	213	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1807	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 16.5 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.447 (Exhibit 25-19)

S_R= 57.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1292	0.90	Level	22	0	0.901	1.00	1593
Ramp	145	0.90	Level	22	0	0.901	1.00	179
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 1593 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1772	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1772	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 15.0 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.297 (Exibit 25-19)
S_R= 61.7 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 61.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Proposed w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*319*	*39*	*246*	*148*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*354*	*43*	*273*	*164*	*0*
Percent Heavy Vehicles	*0*	--	--	*22*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*75*		*16*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*83*	*0*	*17*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*273*					*100*	
C (m) (veh/h)		*1061*					*192*	
v/c		*0.26*					*0.52*	
95% queue length		*1.03*					*2.65*	
Control Delay (s/veh)		*9.6*					*42.5*	
LOS		*A*					*E*	
Approach Delay (s/veh)	--	--				*42.5*		
Approach LOS	--	--				*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Proposed w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*28*	*366*			*379*	*117*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*31*	*406*	*0*	*0*	*421*	*130*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*15*		*158*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*16*	*0*	*175*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*31*			*191*				
C (m) (veh/h)	*926*			*600*				
v/c	*0.03*			*0.32*				
95% queue length	*0.10*			*1.36*				
Control Delay (s/veh)	*9.0*			*13.8*				
LOS	*A*			*B*				
Approach Delay (s/veh)	--	--	*13.8*					
Approach LOS	--	--	*B*					

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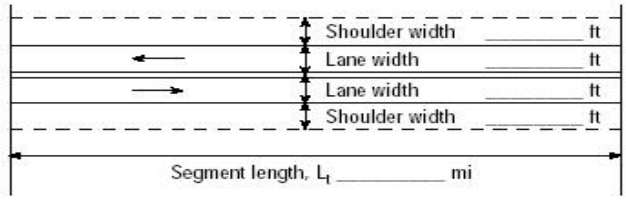
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1020* veh/h
Directional split	*51 / 49*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1140*
v_p * highest directional split proportion[2] (pc/h)	*581*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.4*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*41.1*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1137*
v_p * highest directional split proportion[2] (pc/h)	*580*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*63.2*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*8.8*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*72.0*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.36*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*283*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1020*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*6.9*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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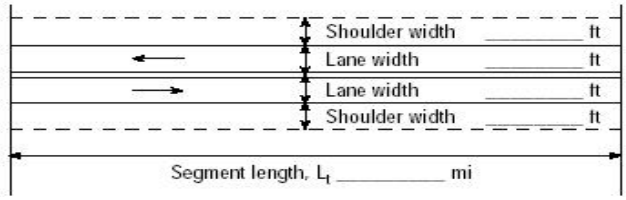
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*788* veh/h
Directional split	*50 / 50*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*881*
v_p * highest directional split proportion[2] (pc/h)	*441*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*2.8*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*34.9*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*878*
v_p * highest directional split proportion[2] (pc/h)	*439*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*53.8*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*14.4*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*68.2*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.28*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*22*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*79*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*0.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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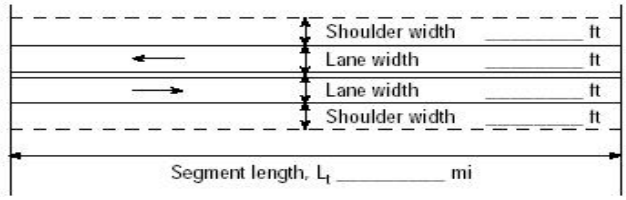
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*522* veh/h
Directional split	*69 / 31*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.979*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*592*
v_p * highest directional split proportion[2] (pc/h)	*408*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*3.9*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*32.8*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*582*
v_p * highest directional split proportion[2] (pc/h)	*402*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*40.0*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*21.1*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*61.1*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.19*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*87*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*313*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*2.7*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1830	0.90	Level	22	0	0.901	1.00	2257
Ramp	201	0.90	Level	22	0	0.901	1.00	248
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2257 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2257	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2009	Exhibit 25-14	4800	No
V_R	248	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2257	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 20.7 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.450 (Exhibit 25-19)

S_R= 57.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1629	0.90	Level	22	0	0.901	1.00	2009
Ramp	139	0.90	Level	22	0	0.901	1.00	171
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2009 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2180	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2180	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 18.1 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.307 (Exibit 25-19)

S_R= 61.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2061	0.90	Level	22	0	0.901	1.00	2542
Ramp	226	0.90	Level	22	0	0.901	1.00	279
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2542 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2542	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2263	Exhibit 25-14	4800	No
V_R	279	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2542	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 22.8 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.453 (Exhibit 25-19)

S_R= 57.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1835	0.90	Level	22	0	0.901	1.00	2263
Ramp	101	0.90	Level	22	0	0.901	1.00	125
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2263 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2388	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2388	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.8 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.316 (Exibit 25-19)

S_R= 61.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Proposed w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*130*	*21*	*118*	*144*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*144*	*23*	*131*	*160*	*0*
Percent Heavy Vehicles	*0*	*--*	*--*	*22*	*--*	*--*
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*165*		*36*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*183*	*0*	*40*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*131*					*223*	
C (m) (veh/h)		*1298*					*466*	
v/c		*0.10*					*0.48*	
95% queue length		*0.34*					*2.54*	
Control Delay (s/veh)		*8.1*					*19.6*	
LOS		*A*					*C*	
Approach Delay (s/veh)	--	--				*19.6*		
Approach LOS	--	--				*C*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2013 Proposed w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*18*	*277*			*233*	*83*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*20*	*307*	*0*	*0*	*258*	*92*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*29*		*197*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*32*	*0*	*218*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*20*			*250*				
C (m) (veh/h)	*1106*			*709*				
v/c	*0.02*			*0.35*				
95% queue length	*0.06*			*1.59*				
Control Delay (s/veh)	*8.3*			*12.8*				
LOS	*A*			*B*				
Approach Delay (s/veh)	--	--	*12.8*					
Approach LOS	--	--	*B*					

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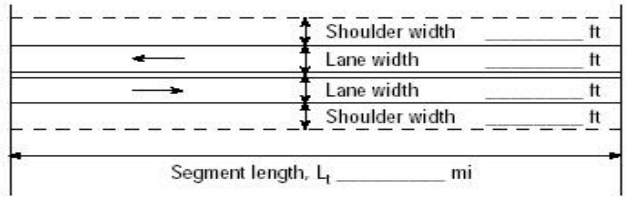
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*790* veh/h
Directional split	*60 / 40*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*883*
v_p * highest directional split proportion[2] (pc/h)	*530*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.9*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*42.7*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*880*
v_p * highest directional split proportion[2] (pc/h)	*528*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*53.9*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*10.3*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*64.1*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.28*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*219*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*790*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*5.1*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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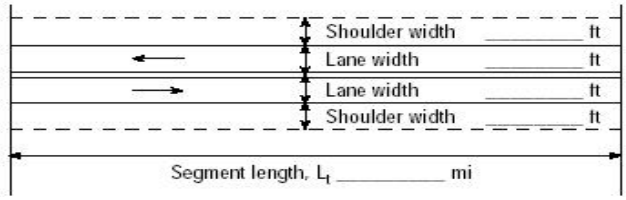
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*557* veh/h
Directional split	*53 / 47*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*623*
v_p * highest directional split proportion[2] (pc/h)	*330*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*3.8*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*36.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*621*
v_p * highest directional split proportion[2] (pc/h)	*329*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*42.1*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*20.0*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*62.1*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.19*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*15*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*56*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*0.4*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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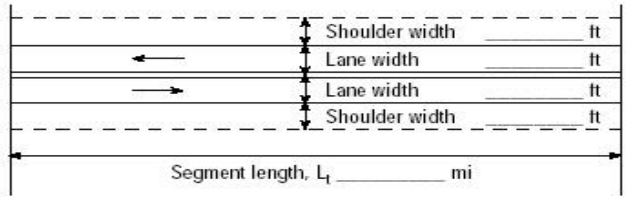
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*331* veh/h
Directional split	*54 / 46*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.979*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*376*
v_p * highest directional split proportion[2] (pc/h)	*203*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*4.4*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*34.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*369*
v_p * highest directional split proportion[2] (pc/h)	*199*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*27.7*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*23.6*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*51.3*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*B*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.12*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*55*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*199*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*1.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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BASE YEAR 2013
INTERSTATE 40 AT MINE LICK CREEK ROAD

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2380	0.90	Level	22	0	0.901	1.00	2935
Ramp	884	0.90	Level	22	0	0.901	1.00	1090
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 1.000 using Equation (Exhibit 25-12)
V_{12} = 2935 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2935	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1845	Exhibit 25-14	4800	No
V_R	1090	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2935	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$
D_R = 26.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.526 (Exhibit 25-19)
S_R= 55.3 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 55.3 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1496	0.90	Level	22	0	0.901	1.00	1845
Ramp	297	0.90	Level	22	0	0.901	1.00	366
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1845 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2211	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2211	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 18.2 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.308 (Exibit 25-19)

S_R= 61.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to Mine Lick Creek
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2352	0.90	Level	22	0	0.901	1.00	2901
Ramp	1090	0.90	Level	22	0	0.901	1.00	1344
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2901 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2901	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1557	Exhibit 25-14	4800	No
V_R	1344	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2901	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.549 (Exhibit 25-19)

S_R= 54.6 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 54.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1262	0.90	Level	22	0	0.901	1.00	1556
Ramp	203	0.90	Level	22	0	0.901	1.00	250
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1556 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	1806	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	1806	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 15.2 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.297 (Exibit 25-19)

S_R= 61.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 EB ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*2*					*2*	*2*	*1*	*2*	
Lane Group	*L*		*R*					*T*	*R*	*L*	*T*	
Volume, V (vph)	*91*		*793*					*256*	*167*	*130*	*1512*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
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*	
Initial Unmet Demand, Q_b	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*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	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *27.5*	G = *0.0*	G = *0.0*	G = *0.0*	G = *8.6*	G = *28.9*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*
Duration of Analysis, T = *0.25*						Cycle Length, C = *80.0*		

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	*101*		*881*					*284*	*186*	*144*	*1680*	
Lane Group Capacity, c	*591*		*936*					*1245*	*983*	*568*	*1830*	
v/c Ratio, X	*0.17*		*0.94*					*0.23*	*0.19*	*0.25*	*0.92*	
Total Green Ratio, g/C	*0.34*		*0.34*					*0.36*	*0.36*	*0.53*	*0.53*	
Uniform Delay, d_1	*18.3*		*25.5*					*17.8*	*17.5*	*9.7*	*17.2*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k	*0.11*		*0.45*					*0.11*	*0.11*	*0.11*	*0.44*	
Incremental Delay, d_2	*0.1*		*17.0*					*0.1*	*0.1*	*0.2*	*7.9*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay	*18.4*		*42.5*					*17.9*	*17.6*	*10.0*	*25.1*	
Lane Group LOS	*B*		*D*					*B*	*B*	*A*	*C*	
Approach Delay	*40.0*						*17.8*			*23.9*		
Approach LOS	*D*						*B*			*C*		
Intersection Delay	*27.8*			X_C = *0.93*			Intersection LOS			*C*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 WB ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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				*2*		*1*	*2*	*2*			*2*	*1*
Lane Group				*L*		*R*	*L*	*T*			*T*	*R*
Volume, V (vph)				*963*		*127*	*126*	*221*			*679*	*77*
% Heavy Vehicles, %HV				*5*		*5*	*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*		*0.90*	*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*		*A*	*A*	*A*			*A*	*A*
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*
Initial Unmet Demand, Q_b				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Ped / Bike / RTOR Volumes				*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*		*12.0*	*12.0*	*12.0*			*12.0*	*12.0*
Parking / Grade / Parking				*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				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *25.0*	G = *0.0*	G = *0.0*	G = *0.0*	G = *5.0*	G = *25.0*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *70.0*

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				*1070*		*141*	*140*	*246*			*754*	*86*
Lane Group Capacity, c				*1192*		*549*	*724*	*1723*			*1230*	*549*
v/c Ratio, X				*0.90*		*0.26*	*0.19*	*0.14*			*0.61*	*0.16*
Total Green Ratio, g/C				*0.36*		*0.36*	*0.50*	*0.50*			*0.36*	*0.36*
Uniform Delay, d_1				*21.3*		*15.9*	*10.4*	*9.4*			*18.5*	*15.3*
Progression Factor, PF				*1.000*		*1.000*	*1.000*	*1.000*			*1.000*	*1.000*
Delay Calibration, k				*0.42*		*0.11*	*0.11*	*0.11*			*0.20*	*0.11*
Incremental Delay, d_2				*9.3*		*0.2*	*0.1*	*0.0*			*0.9*	*0.1*
Initial Queue Delay, d_3				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Control Delay				*30.6*		*16.2*	*10.5*	*9.5*			*19.4*	*15.5*
Lane Group LOS				*C*		*B*	*B*	*A*			*B*	*B*
Approach Delay				*28.9*			*9.8*			*19.0*		
Approach LOS				*C*			*A*			*B*		
Intersection Delay	*22.5*			X_C = *0.74*			Intersection LOS			*C*		

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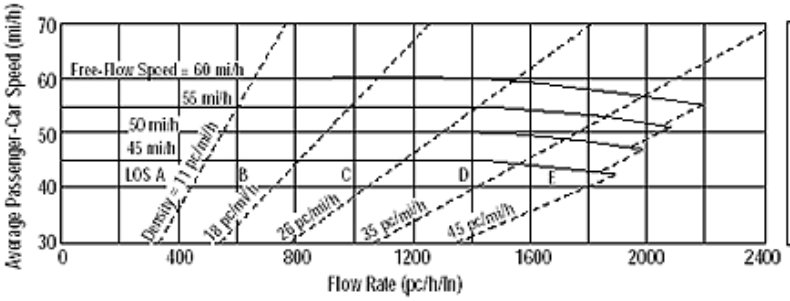
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	756	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	420
Speed, S (mi/h)	45.0
D (pc/mi/ln)	9.3
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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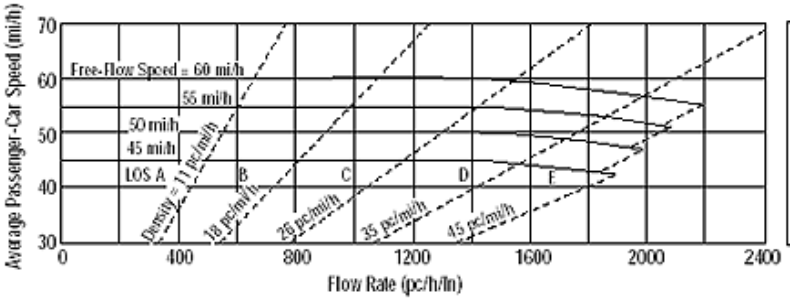
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	348	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	193
Speed, S (mi/h)	45.0
D (pc/mi/ln)	4.3
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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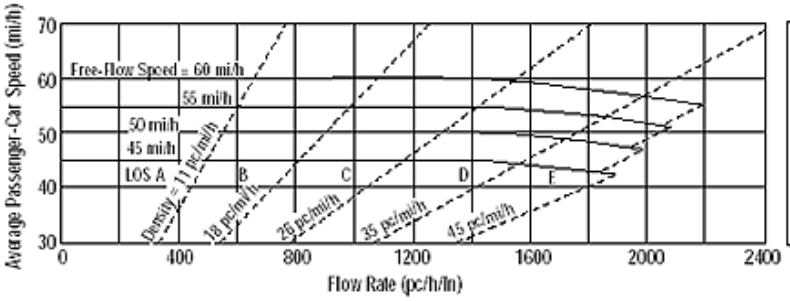
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1642	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	912
Speed, S (mi/h)	45.0
D (pc/mi/ln)	20.3
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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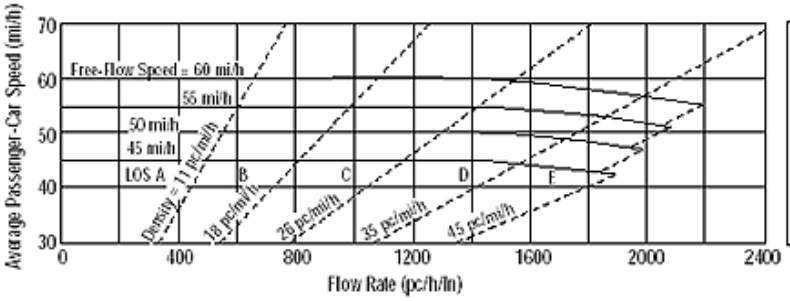
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	347	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	192
Speed, S (mi/h)	45.0
D (pc/mi/ln)	4.3
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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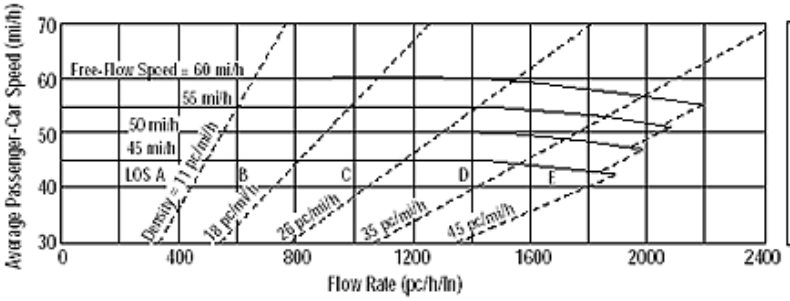
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	2305	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1280
Speed, S (mi/h)	45.0
D (pc/mi/ln)	28.4
LOS	D

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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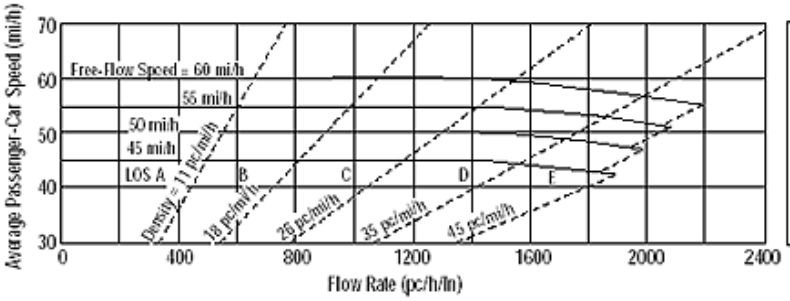
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	423	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	235
Speed, S (mi/h)	45.0
D (pc/mi/ln)	5.2
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1768	0.90	Level	22	0	0.901	1.00	2181
Ramp	286	0.90	Level	22	0	0.901	1.00	353
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2181 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2181	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1828	Exhibit 25-14	4800	No
V_R	353	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2181	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 20.0 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.460 (Exhibit 25-19)

S_R= 57.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1482	0.90	Level	22	0	0.901	1.00	1828
Ramp	968	0.90	Level	22	0	0.901	1.00	1194
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1828 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3022	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3022	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.2 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.353 (Exibit 25-19)

S_R= 60.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to Mine Lick Creek
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft	S_{FF} = 70.0 mph S_{FR} = 35.0 mph	L_{down} = ft
V_u = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1631	0.90	Level	22	0	0.901	1.00	2012
Ramp	346	0.90	Level	22	0	0.901	1.00	427
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2012 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2012	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1585	Exhibit 25-14	4800	No
V_R	427	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2012	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 18.2 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.466 (Exhibit 25-19)

S_R= 56.9 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1285	0.90	Level	22	0	0.901	1.00	1585
Ramp	776	0.90	Level	22	0	0.901	1.00	957
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1585 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2542	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2542	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.323 (Exibit 25-19)

S_R= 60.9 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 EB ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*2*					*2*	*2*	*1*	*2*	
Lane Group	*L*		*R*					*T*	*R*	*L*	*T*	
Volume, V (vph)	*122*		*164*					*1098*	*846*	*122*	*421*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
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*	
Initial Unmet Demand, Q_b	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*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	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *24.0*	G = *0.0*	G = *0.0*	G = *0.0*	G = *7.0*	G = *84.0*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *130.0*

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	*136*		*182*					*1220*	*940*	*136*	*468*	
Lane Group Capacity, c	*317*		*503*					*2226*	*1759*	*297*	*2544*	
v/c Ratio, X	*0.43*		*0.36*					*0.55*	*0.53*	*0.46*	*0.18*	
Total Green Ratio, g/C	*0.18*		*0.18*					*0.65*	*0.65*	*0.74*	*0.74*	
Uniform Delay, d_1	*46.9*		*46.3*					*12.6*	*12.4*	*8.5*	*5.1*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k	*0.11*		*0.11*					*0.15*	*0.14*	*0.11*	*0.11*	
Incremental Delay, d_2	*0.9*		*0.4*					*0.3*	*0.3*	*1.1*	*0.0*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay	*47.9*		*46.8*					*12.9*	*12.8*	*9.6*	*5.2*	
Lane Group LOS	*D*		*D*					*B*	*B*	*A*	*A*	
Approach Delay	*47.2*						*12.8*			*6.2*		
Approach LOS	*D*						*B*			*A*		
Intersection Delay	*15.1*			X_C = *0.55*			Intersection LOS			*B*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 WB ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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				*2*		*1*	*2*	*2*			*2*	*1*
Lane Group				*L*		*R*	*L*	*T*			*T*	*R*
Volume, V (vph)				*209*		*137*	*693*	*527*			*334*	*83*
% Heavy Vehicles, %HV				*5*		*5*	*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*		*0.90*	*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*		*A*	*A*	*A*			*A*	*A*
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*
Initial Unmet Demand, Q_b				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Ped / Bike / RTOR Volumes				*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*		*12.0*	*12.0*	*12.0*			*12.0*	*12.0*
Parking / Grade / Parking				*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				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *10.0*	G = *0.0*	G = *0.0*	G = *0.0*	G = *31.3*	G = *13.7*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *70.0*

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				*232*		*152*	*770*	*586*			*371*	*92*
Lane Group Capacity, c				*477*		*220*	*1872*	*2461*			*674*	*301*
v/c Ratio, X				*0.49*		*0.69*	*0.41*	*0.24*			*0.55*	*0.31*
Total Green Ratio, g/C				*0.14*		*0.14*	*0.71*	*0.71*			*0.20*	*0.20*
Uniform Delay, d_1				*27.6*		*28.5*	*4.2*	*3.4*			*25.4*	*24.1*
Progression Factor, PF				*1.000*		*1.000*	*1.000*	*1.000*			*1.000*	*1.000*
Delay Calibration, k				*0.11*		*0.26*	*0.11*	*0.11*			*0.15*	*0.11*
Incremental Delay, d_2				*0.8*		*8.9*	*0.1*	*0.1*			*1.0*	*0.6*
Initial Queue Delay, d_3				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Control Delay				*28.4*		*37.4*	*4.4*	*3.5*			*26.3*	*24.7*
Lane Group LOS				*C*		*D*	*A*	*A*			*C*	*C*
Approach Delay				*32.0*			*4.0*			*26.0*		
Approach LOS				*C*			*A*			*C*		
Intersection Delay	*13.5*			X_C = *0.56*			Intersection LOS			*B*		

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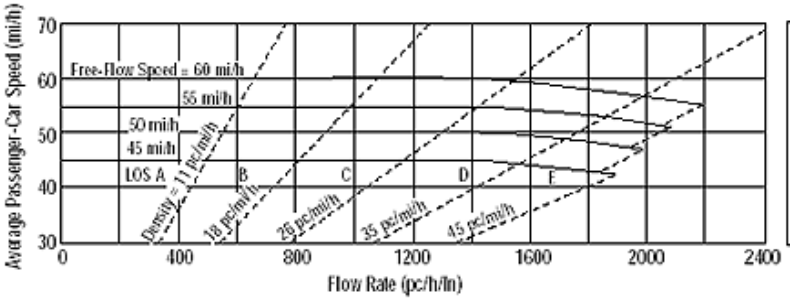
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	417	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	231
Speed, S (mi/h)	45.0
D (pc/mi/ln)	5.1
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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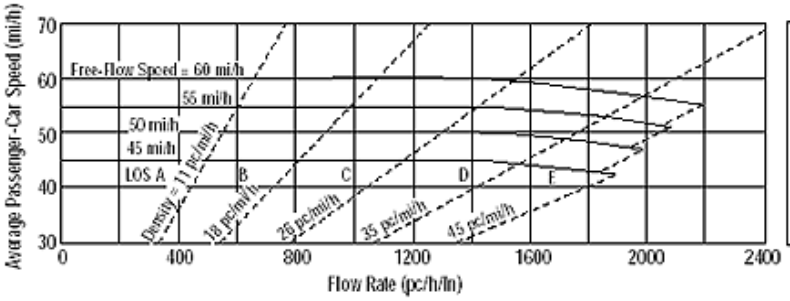
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	664	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	368
Speed, S (mi/h)	45.0
D (pc/mi/ln)	8.2
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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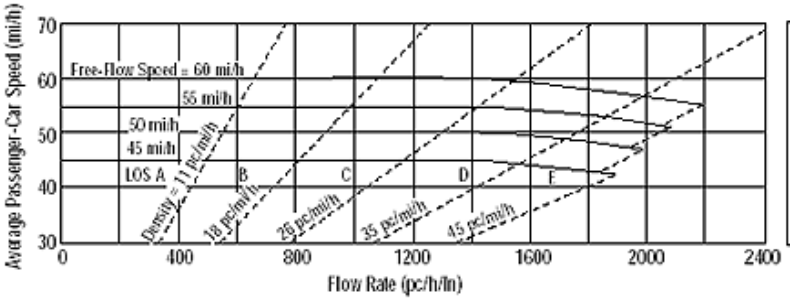
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	543	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	301
Speed, S (mi/h)	45.0
D (pc/mi/ln)	6.7
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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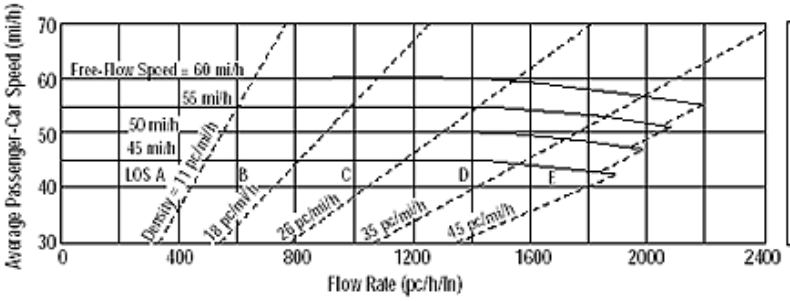
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1220	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	677
Speed, S (mi/h)	45.0
D (pc/mi/ln)	15.0
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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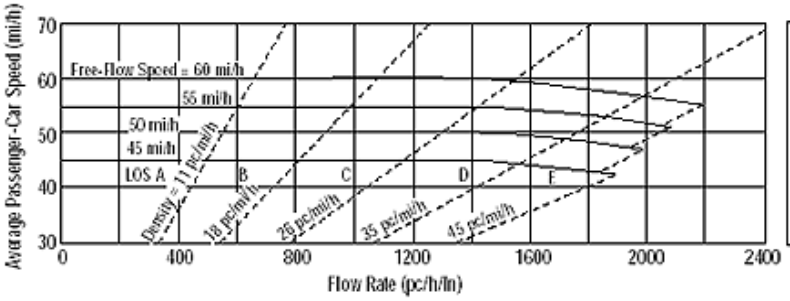
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	585	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	325
Speed, S (mi/h)	45.0
D (pc/mi/ln)	7.2
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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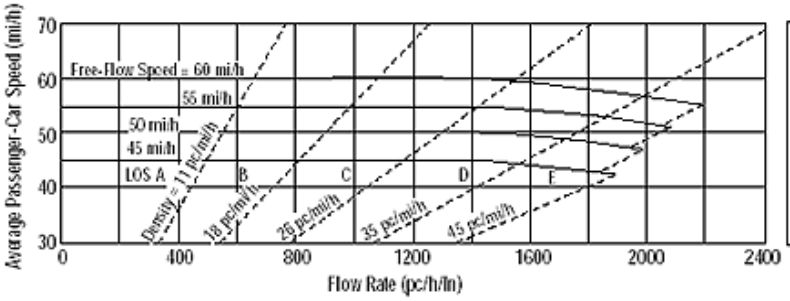
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1944	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1080
Speed, S (mi/h)	45.0
D (pc/mi/ln)	24.0
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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BASE YEAR 2013
INTERSTATE 40 AT STATE ROUTE 135 (S. WILLOW AVENUE)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1793	0.90	Level	22	0	0.901	1.00	2211
Ramp	256	0.90	Level	22	0	0.901	1.00	316
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 1.000 using Equation (Exhibit 25-12)
V_{12} = 2211 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2211	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1895	Exhibit 25-14	4800	No
V_R	316	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2211	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 20.7 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.456 (Exhibit 25-19)
S_R= 57.2 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 57.2 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1537	0.90	Level	22	0	0.901	1.00	1896
Ramp	330	0.90	Level	22	0	0.901	1.00	407
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1896 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2303	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2303	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 19.8 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.321 (Exibit 25-19)

S_R= 61.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2616	0.90	Level	22	0	0.901	1.00	3226
Ramp	414	0.90	Level	22	0	0.901	1.00	511
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3226 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3226	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2715	Exhibit 25-14	4800	No
V_R	511	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3226	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 29.5 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.474 (Exhibit 25-19)

S_R= 56.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2202	0.90	Level	22	0	0.901	1.00	2716
Ramp	150	0.90	Level	22	0	0.901	1.00	185
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2716 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2901	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2901	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.348 (Exibit 25-19)
S_R= 60.3 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 60.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*197*		*59*					*752*	*185*	*145*	*524*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *50.6*	G = *0.0*	G = *0.0*	G = *0.0*	G = *11.8*	G = *52.6*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* | Cycle Length, C = *130.0*

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*		*66*					*1042*		*161*	*582*	
Lane Group Capacity, c	*669*		*599*					*1353*		*247*	*1839*	
v/c Ratio, X	*0.33*		*0.11*					*0.77*		*0.65*	*0.32*	
Total Green Ratio, g/C	*0.39*		*0.39*					*0.40*		*0.53*	*0.53*	
Uniform Delay, d_1	*27.8*		*25.3*					*33.5*		*22.1*	*17.0*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*		*0.11*					*0.32*		*0.23*	*0.11*	
Incremental Delay, d_2	*0.3*		*0.1*					*2.8*		*6.0*	*0.1*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*28.1*		*25.4*					*36.3*		*28.1*	*17.1*	
Lane Group LOS	*C*		*C*					*D*		*C*	*B*	
Approach Delay	*27.5*						*36.3*			*19.5*		
Approach LOS	*C*						*D*			*B*		
Intersection Delay	*29.0*			X_C = *0.60*			Intersection LOS			*C*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*188*			*37*	*912*			*481*	*113*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *76.2*	G = *0.0*	G = *0.0*	G = *0.0*	G = *6.4*	G = *32.4*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *130.0*

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				*209*			*41*	*1013*			*660*	
Lane Group Capacity, c				*1008*			*164*	*1161*			*834*	
v/c Ratio, X				*0.21*			*0.25*	*0.87*			*0.79*	
Total Green Ratio, g/C				*0.59*			*0.34*	*0.34*			*0.25*	
Uniform Delay, d_1				*12.7*			*31.5*	*40.5*			*45.6*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.11*			*0.11*	*0.40*			*0.34*	
Incremental Delay, d_2				*0.1*			*0.8*	*7.5*			*5.2*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*12.8*			*32.3*	*48.0*			*50.9*	
Lane Group LOS				*B*			*C*	*D*			*D*	
Approach Delay				*12.8*			*47.4*			*50.9*		
Approach LOS				*B*			*D*			*D*		
Intersection Delay	*44.8*			X_C = *0.45*			Intersection LOS			*D*		

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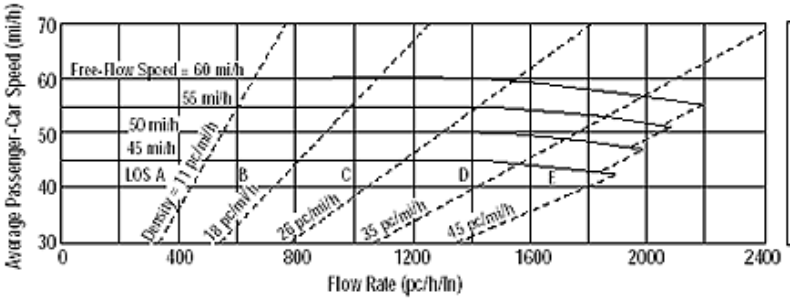
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	594	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	338
Speed, S (mi/h)	45.0
D (pc/mi/ln)	7.5
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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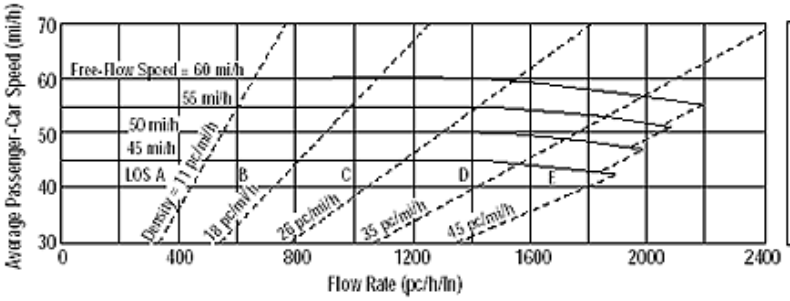
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1138	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	648
Speed, S (mi/h)	45.0
D (pc/mi/ln)	14.4
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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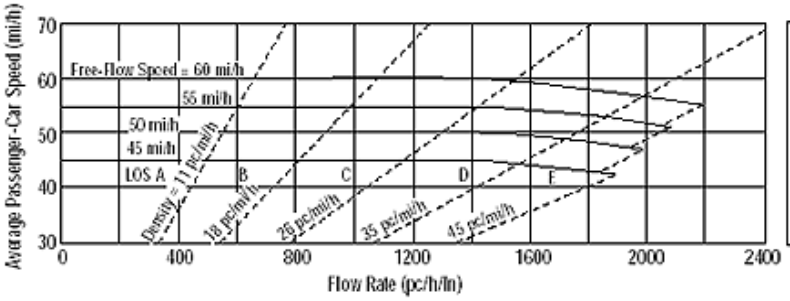
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	669	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	380
Speed, S (mi/h)	45.0
D (pc/mi/ln)	8.4
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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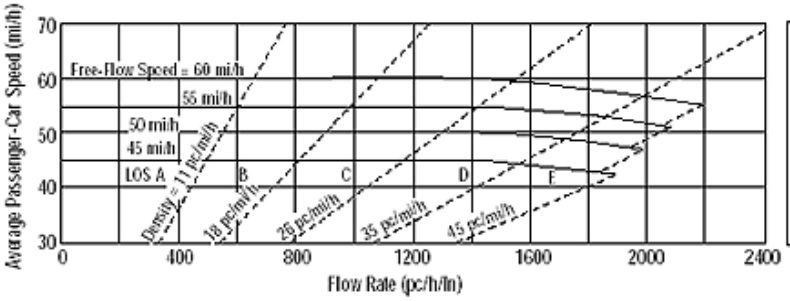
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	949	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	540
Speed, S (mi/h)	45.0
D (pc/mi/ln)	12.0
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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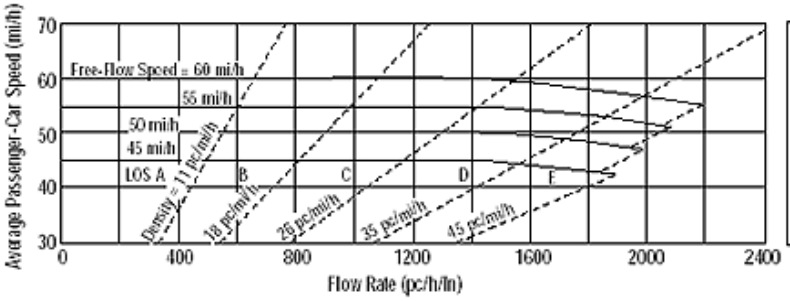
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	583	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	331
Speed, S (mi/h)	45.0
D (pc/mi/ln)	7.4
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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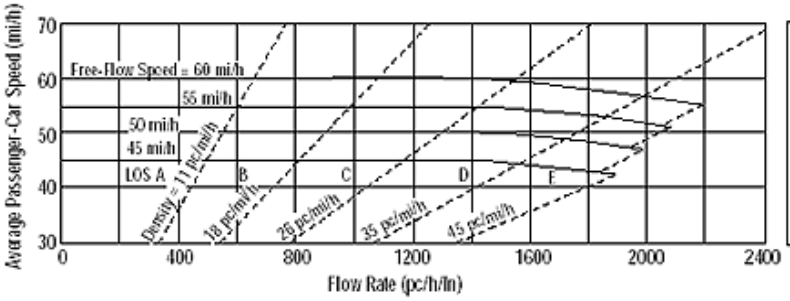
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	937	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	533
Speed, S (mi/h)	45.0
D (pc/mi/ln)	11.8
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2450	0.90	Level	22	0	0.901	1.00	3022
Ramp	248	0.90	Level	22	0	0.901	1.00	306
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3022 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3022	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2716	Exhibit 25-14	4800	No
V_R	306	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3022	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 27.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.456 (Exhibit 25-19)

S_R= 57.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2202	0.90	Level	22	0	0.901	1.00	2716
Ramp	426	0.90	Level	22	0	0.901	1.00	525
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2716 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3241	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3241	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 27.0 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.382 (Exibit 25-19)
S_R= 59.3 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 59.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1807	0.90	Level	22	0	0.901	1.00	2229
Ramp	385	0.90	Level	22	0	0.901	1.00	475
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2229 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2229	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	1754	Exhibit 25-14	4800	No
V_R	475	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2229	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 20.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.471 (Exhibit 25-19)

S_R= 56.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1422	0.90	Level	22	0	0.901	1.00	1754
Ramp	209	0.90	Level	22	0	0.901	1.00	258
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 1754 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2012	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2012	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 17.1 (pc/mi/ln)

LOS = B (Exhibit 25-4)

Speed Determination

M_S = 0.306 (Exibit 25-19)

S_R= 61.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.4 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*201*		*47*					*495*	*179*	*247*	*761*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *41.9*	G = *0.0*	G = *0.0*	G = *0.0*	G = *8.0*	G = *45.1*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *110.0*

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	*223*		*52*					*749*		*274*	*846*	
Lane Group Capacity, c	*655*		*586*					*1356*		*319*	*1820*	
v/c Ratio, X	*0.34*		*0.09*					*0.55*		*0.86*	*0.46*	
Total Green Ratio, g/C	*0.38*		*0.38*					*0.41*		*0.53*	*0.53*	
Uniform Delay, d_1	*24.2*		*21.8*					*24.8*		*31.0*	*16.2*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*		*0.11*					*0.15*		*0.39*	*0.11*	
Incremental Delay, d_2	*0.3*		*0.1*					*0.5*		*20.3*	*0.2*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*24.5*		*21.9*					*25.2*		*51.3*	*16.4*	
Lane Group LOS	*C*		*C*					*C*		*D*	*B*	
Approach Delay	*24.0*						*25.2*			*25.0*		
Approach LOS	*C*						*C*			*C*		
Intersection Delay	*24.9*			X_C = *0.61*			Intersection LOS			*C*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*173*			*46*	*650*			*835*	*163*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *10.8*	G = *0.0*	G = *0.0*	G = *0.0*	G = *5.0*	G = *39.2*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *70.0*

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				*192*			*51*	*722*			*1109*	
Lane Group Capacity, c				*265*			*319*	*2421*			*1882*	
v/c Ratio, X				*0.72*			*0.16*	*0.30*			*0.59*	
Total Green Ratio, g/C				*0.15*			*0.70*	*0.70*			*0.56*	
Uniform Delay, d_1				*28.2*			*4.9*	*3.9*			*10.1*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.29*			*0.11*	*0.11*			*0.18*	
Incremental Delay, d_2				*9.5*			*0.2*	*0.1*			*0.5*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*37.6*			*5.2*	*4.0*			*10.6*	
Lane Group LOS				*D*			*A*	*A*			*B*	
Approach Delay				*37.6*			*4.1*			*10.6*		
Approach LOS				*D*			*A*			*B*		
Intersection Delay	*10.7*			X_C = *0.60*			Intersection LOS			*B*		

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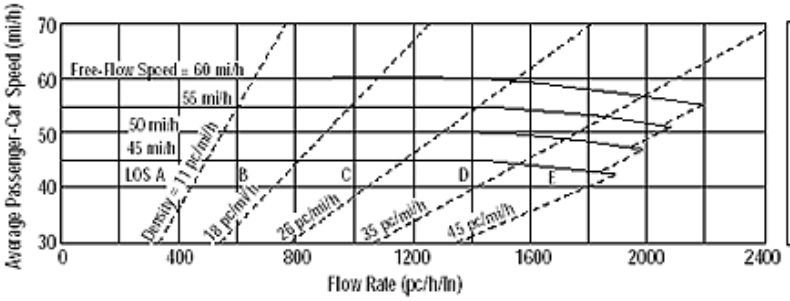
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	998	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	568
Speed, S (mi/h)	45.0
D (pc/mi/ln)	12.6
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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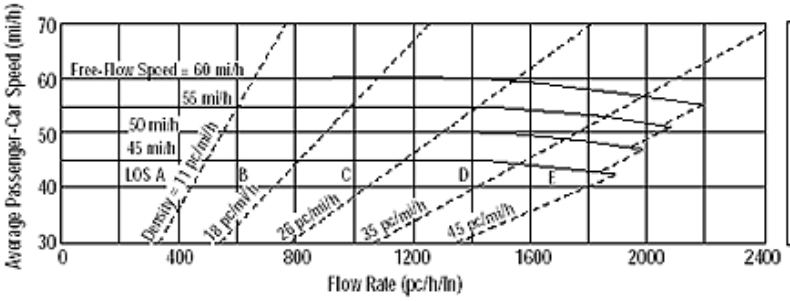
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	862	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	490
Speed, S (mi/h)	45.0
D (pc/mi/ln)	10.9
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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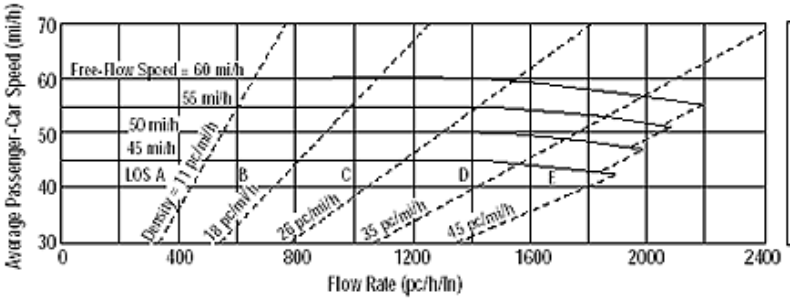
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1008	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	574
Speed, S (mi/h)	45.0
D (pc/mi/ln)	12.8
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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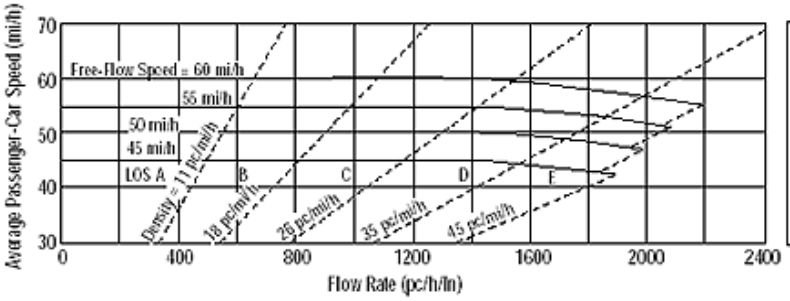
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	696	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	396
Speed, S (mi/h)	45.0
D (pc/mi/ln)	8.8
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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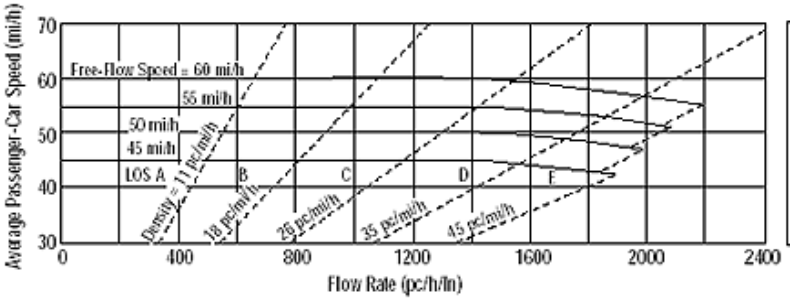
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	808	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	460
Speed, S (mi/h)	45.0
D (pc/mi/ln)	10.2
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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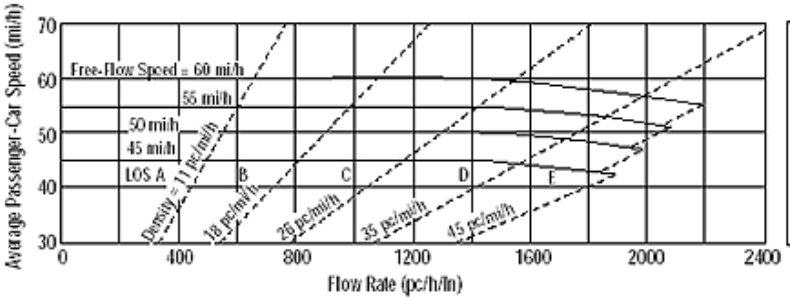
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2013 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	674	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	383
Speed, S (mi/h)	45.0
D (pc/mi/ln)	8.5
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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BASE YEAR 2013
BENNETT ROAD AT LEE SEMINARY ROAD

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*JH*	Intersection	*LEE SEMINARY RD & BENNETT RD*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*	*1*	*0*	*1*	*1*	*2*	*1*	*1*	*1*	*2*	*1*	*1*
Lane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*
Volume, V (vph)	*56*	*159*	*3*	*28*	*30*	*342*	*3*	*25*	*194*	*2247*	*23*	*35*
% Heavy Vehicles, %HV	*5*	*0*	*5*	*0*	*0*	*0*	*0*	*5*	*5*	*5*	*5*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*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*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Arrival Type, AT	*3*	*3*		*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
Unit Extension, UE	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*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*	*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*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*40*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	SB Only	NS Perm	07	08
Timing	G = *10.0*	G = *0.0*	G = *0.0*	G =	G = *85.0*	G = *10.0*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y =	Y = *5*	Y = *5*	Y = *0*	Y = *0*
Duration of Analysis, T = *0.25*						Cycle Length, C = *120.0*		

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	*62*	*180*		*31*	*33*	*380*	*3*	*28*	*171*	*2497*	*26*	*39*
Lane Group Capacity, c	*111*	*158*		*63*	*158*	*2382*	*117*	*151*	*128*	*2364*	*1508*	*1346*
v/c Ratio, X	*0.56*	*1.14*		*0.49*	*0.21*	*0.16*	*0.03*	*0.19*	*1.34*	*1.06*	*0.02*	*0.03*
Total Green Ratio, g/C	*0.08*	*0.08*		*0.08*	*0.08*	*0.83*	*0.08*	*0.08*	*0.08*	*0.71*	*0.83*	*0.83*
Uniform Delay, d_1	*52.9*	*55.0*		*52.6*	*51.3*	*1.9*	*50.5*	*51.2*	*55.0*	*17.5*	*1.7*	*1.7*
Progression Factor, PF	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*

Delay Calibration, k	0.16	0.50		0.11	0.11	0.11	0.11	0.11	0.50	0.50	0.11	0.11
Incremental Delay, d_2	6.2	113.9		5.9	0.7	0.0	0.1	0.6	194.6	35.5	0.0	0.0
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay	59.1	168.9		58.5	52.0	2.0	50.6	51.8	249.6	53.0	1.7	1.7
Lane Group LOS	E	F		E	D	A	D	D	F	D	A	A
Approach Delay	140.8			9.6			219.2			51.7		
Approach LOS	F			A			F			D		
Intersection Delay	62.3			X_C = 1.09			Intersection LOS			E		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*JH*	Intersection	*LEE SEMINARY RD & BENNETT RD*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2013 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*	*1*	*0*	*1*	*1*	*2*	*1*	*1*	*1*	*2*	*1*	*1*
Lane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*
Volume, V (vph)	*58*	*36*	*5*	*170*	*147*	*1862*	*5*	*24*	*41*	*460*	*32*	*93*
% Heavy Vehicles, %HV	*5*	*0*	*5*	*0*	*0*	*0*	*0*	*5*	*5*	*5*	*5*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*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*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Arrival Type, AT	*3*	*3*		*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
Unit Extension, UE	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*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*	*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*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	SB Only	NS Perm	07	08
Timing	G = *33.0*	G = *0.0*	G = *0.0*	G =	G = *32.0*	G = *10.0*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y =	Y = *5*	Y = *5*	Y = *0*	Y = *0*
Duration of Analysis, T = *0.25*						Cycle Length, C = *90.0*		

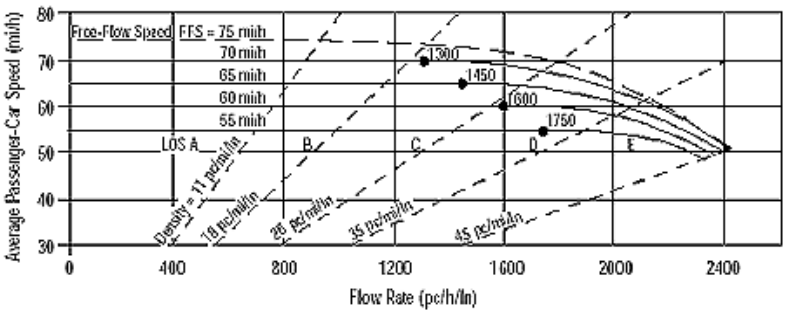
Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	*64*	*46*		*189*	*163*	*2069*	*6*	*27*	*46*	*511*	*36*	*103*
Lane Group Capacity, c	*425*	*679*		*506*	*697*	*2224*	*155*	*201*	*171*	*1187*	*945*	*843*
v/c Ratio, X	*0.15*	*0.07*		*0.37*	*0.23*	*0.93*	*0.04*	*0.13*	*0.27*	*0.43*	*0.04*	*0.12*
Total Green Ratio, g/C	*0.37*	*0.37*		*0.37*	*0.37*	*0.78*	*0.11*	*0.11*	*0.11*	*0.36*	*0.52*	*0.52*
Uniform Delay, d_1	*19.1*	*18.5*		*20.9*	*19.7*	*8.0*	*35.7*	*36.1*	*36.7*	*22.1*	*10.5*	*11.0*
Progression Factor, PF	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*

Delay Calibration, k	0.11	0.11		0.11	0.11	0.45	0.11	0.11	0.11	0.11	0.11	0.11
Incremental Delay, d_2	0.2	0.0		0.5	0.2	7.7	0.1	0.3	0.9	0.3	0.0	0.1
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay	19.3	18.6		21.4	19.9	15.8	35.8	36.4	37.5	22.3	10.5	11.0
Lane Group LOS	B	B		C	B	B	D	D	D	C	B	B
Approach Delay	19.0			16.5			37.0			19.9		
Approach LOS	B			B			D			B		
Intersection Delay	17.7			X_C = 0.85			Intersection LOS			B		

FUTURE YEAR 2033
INTERSTATE 40 MAINLINE

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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*west of SR-56*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2800*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1727*	pc/h/ln	Design LOS	
S	*64.8*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*26.6*	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 - Exhibits23-8, 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			

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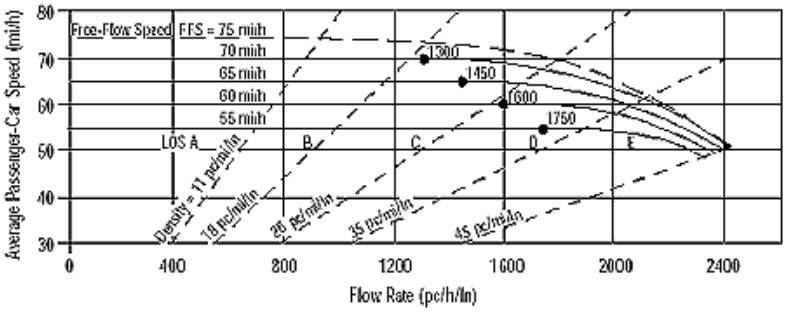
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2680*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1653*	pc/h/ln
S	*65.2*	mi/h
D = v_p / S	*25.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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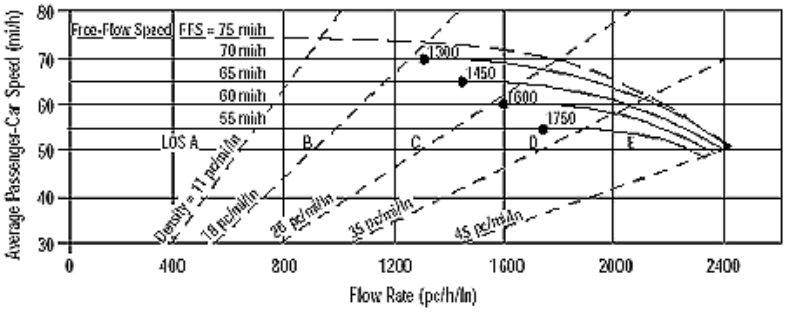
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt SR-56 & Mine Lick Creek*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3053*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1883*	pc/h/ln	Design LOS	
S	*63.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*29.7*	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 - Exhibits23-8, 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			

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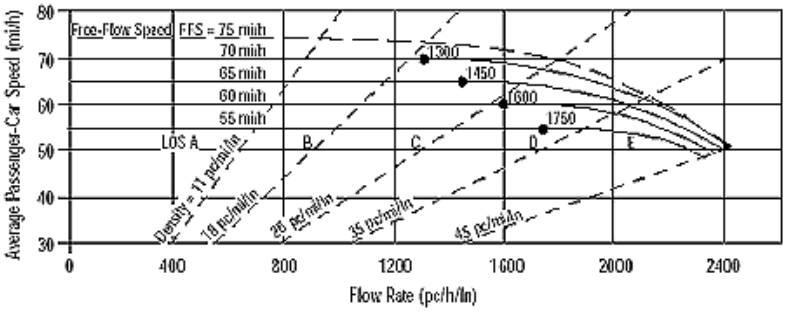
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt Mine Lick Creek Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2139*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1319*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*20.1*	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 - Exhibits23-8, 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			

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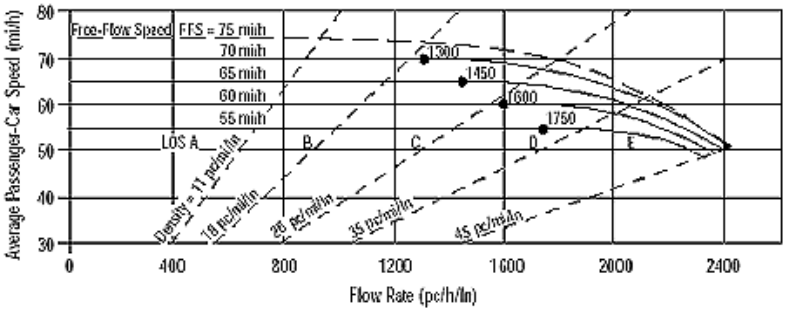
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt SR-135 & Mine Lick Creek*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2485*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1532*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*23.4*	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 - Exhibits23-8, 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			

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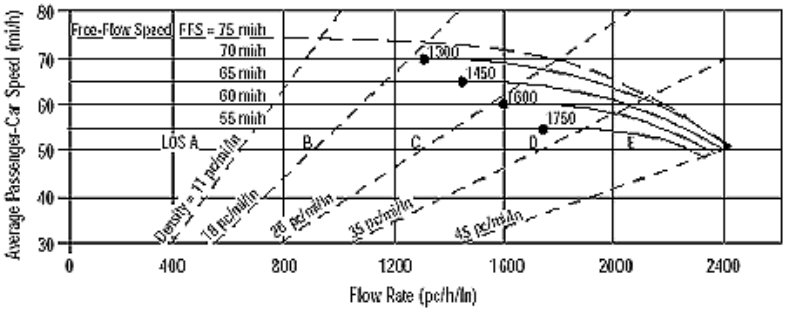
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2148*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1325*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*20.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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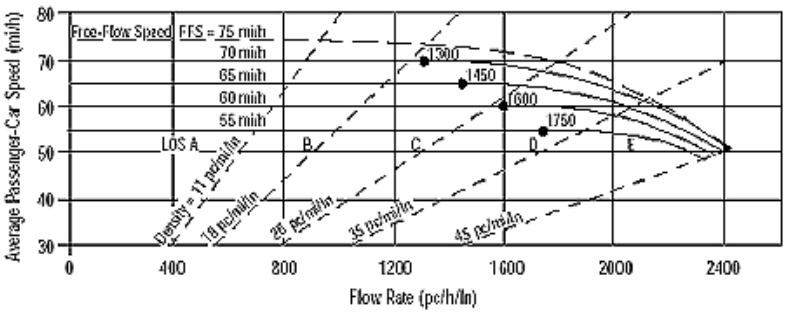
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*east of SR-135*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2583*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

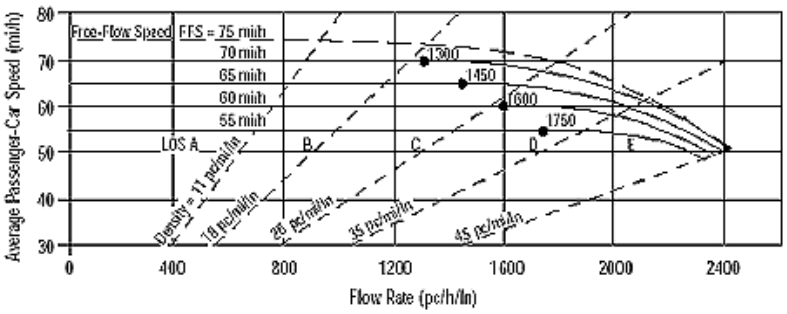
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1593*	pc/h/ln	Design LOS	
S	*65.4*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*24.4*	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 - Exhibits23-8, 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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*East of SR-135*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3294*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

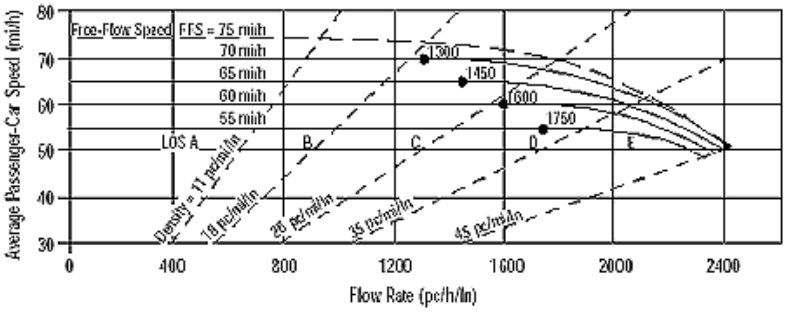
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*2031*	pc/h/ln	Design LOS	
S	*61.2*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*33.2*	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 - Exhibits23-8, 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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2751*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1696*	pc/h/ln
S	*65.0*	mi/h
D = v_p / S	*26.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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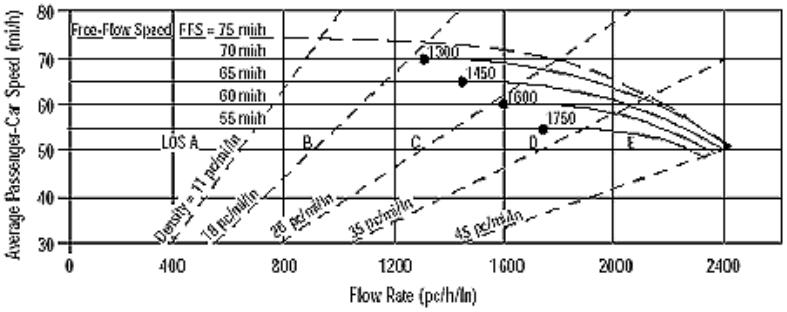

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt SR-135 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2949*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1819*	pc/h/ln
S	*64.1*	mi/h
D = v_p / S	*28.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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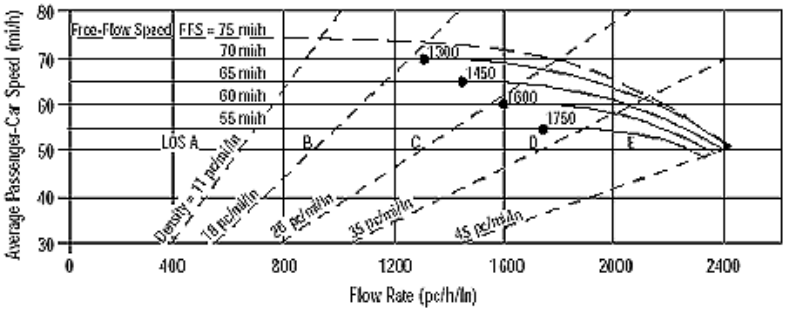
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt Mine Lick Creek Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1811*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1117*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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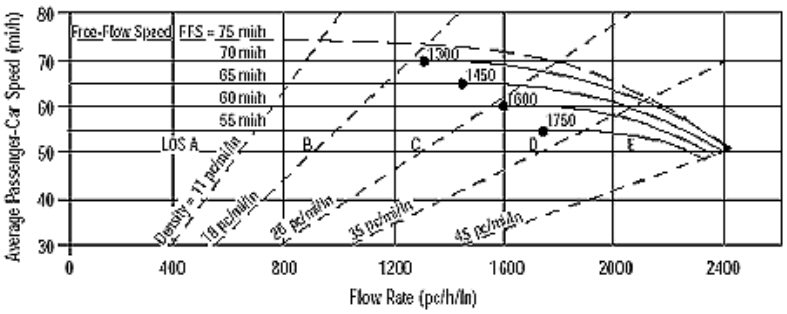
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt SR-56 & Mine Lick Creek*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2040*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1258*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*19.2*	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 - Exhibits23-8, 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			

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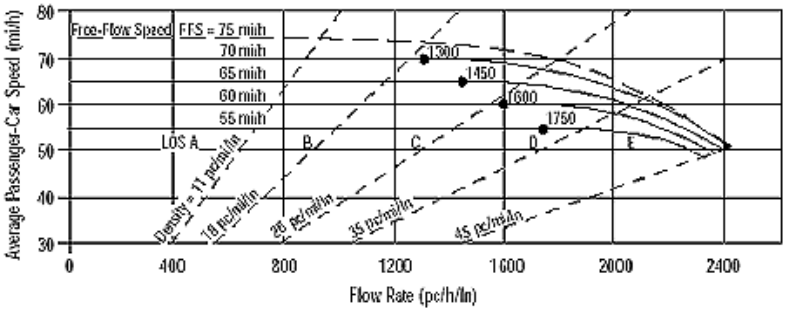
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-56 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*1812*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1117*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*17.1*	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 - Exhibits23-8, 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			

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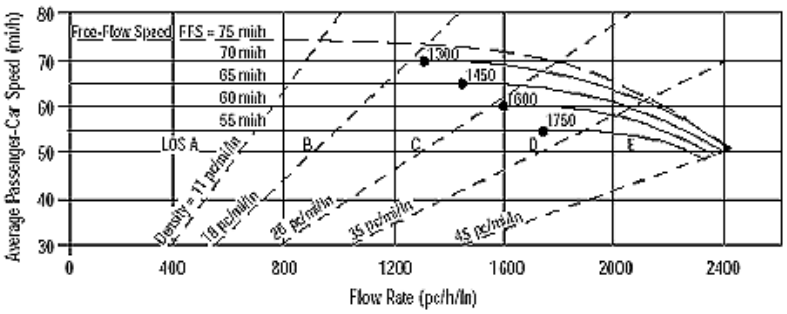
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2003*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1235*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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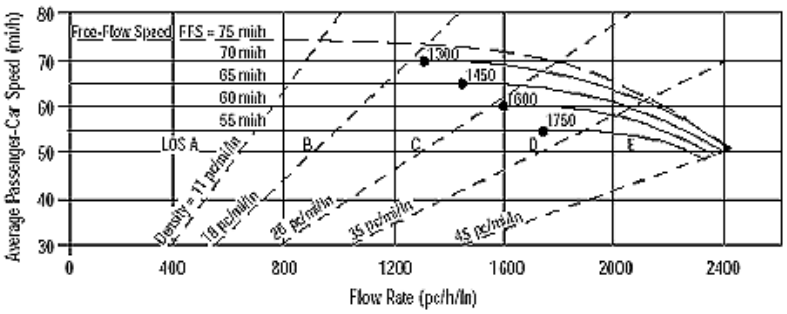
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*west of SR-56*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2521*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

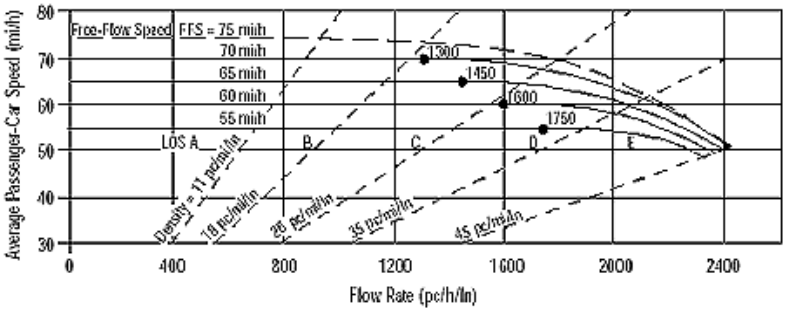
Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1555*	pc/h/ln	Design LOS	
S	*65.4*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*23.8*	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 - Exhibits23-8, 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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-56 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2256*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1391*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*21.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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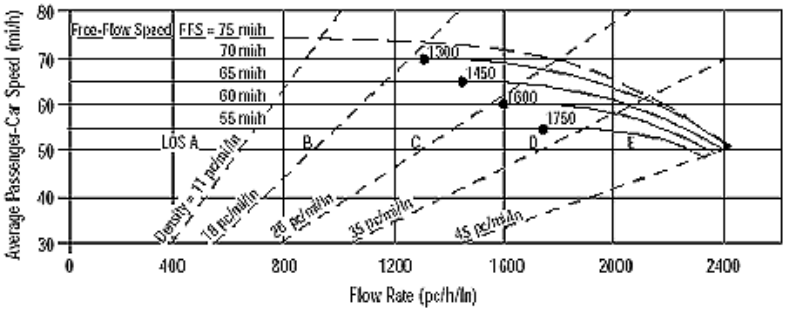
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Bt SR-56 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2438*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1503*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*23.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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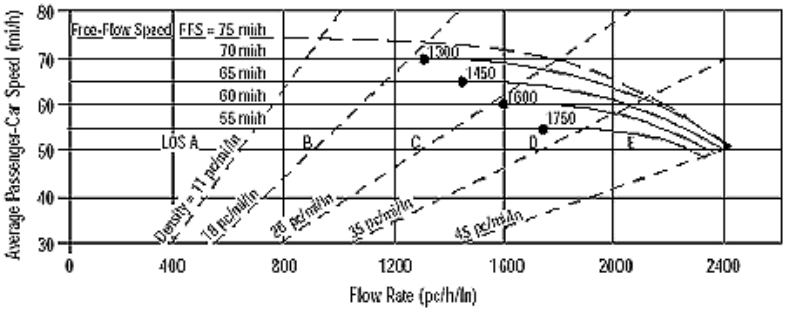
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Bt Mine Lick Creek Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2111*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1302*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*19.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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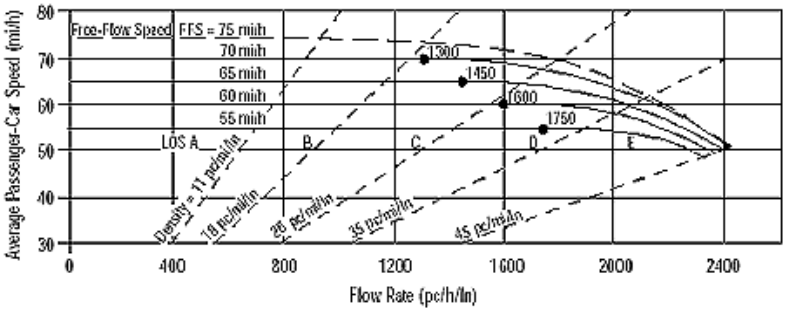
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Bt SR-135 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*3124*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1926*	pc/h/ln
S	*62.9*	mi/h
D = v_p / S	*30.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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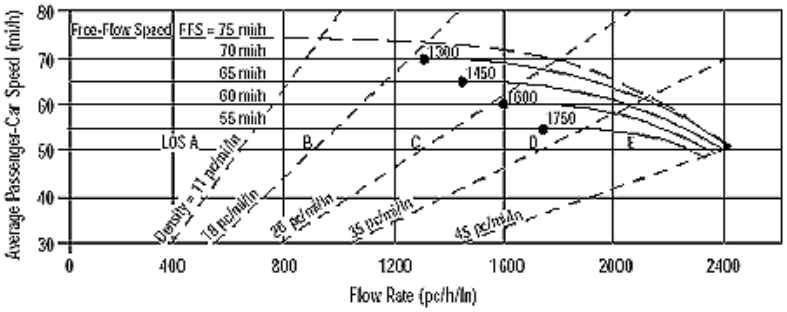
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Eastbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2799*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1726*	pc/h/ln
S	*64.8*	mi/h
D = v_p / S	*26.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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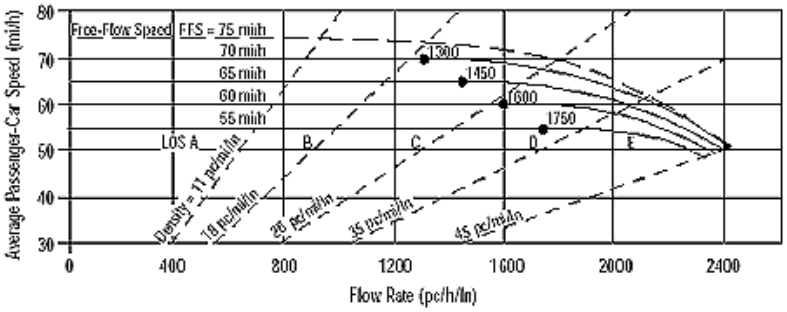
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Eastbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*east of SR-135*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*3359*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*2071*	pc/h/ln	Design LOS	
S	*60.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*34.3*	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 - Exhibits23-8, 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			

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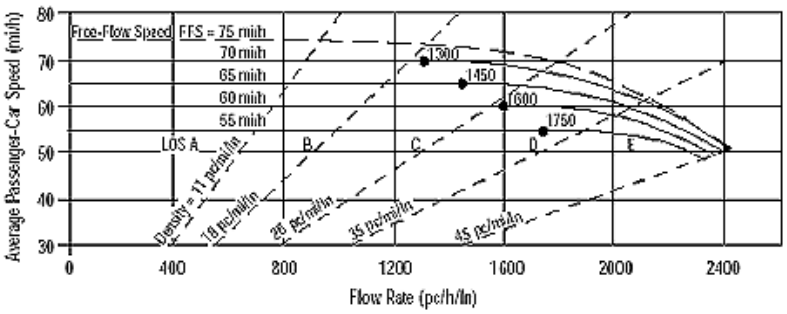
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*East of SR-135*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2466*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1521*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*23.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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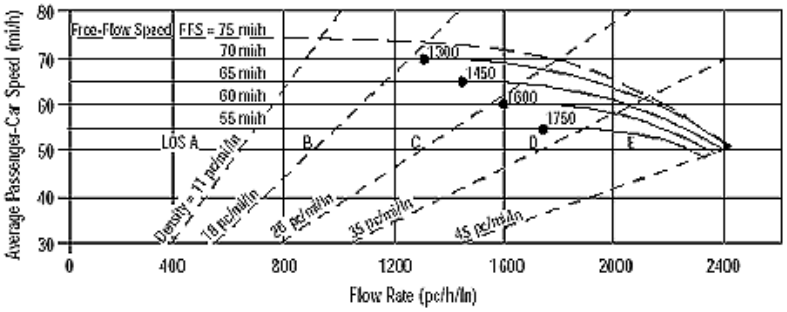
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Between SR-135 Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1960*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1209*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*18.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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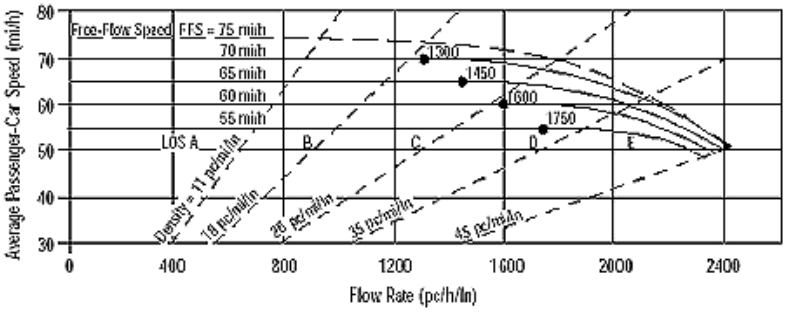
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt SR-135 & Mine Lick Creek*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2235*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1378*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*21.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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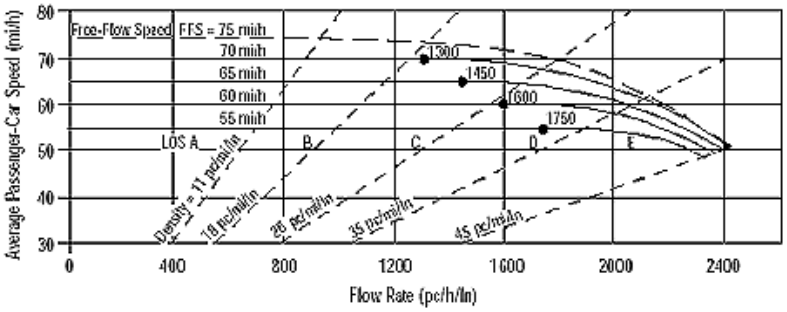
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*Bt Mine Lick Creek Ramps*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*1840*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1135*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*17.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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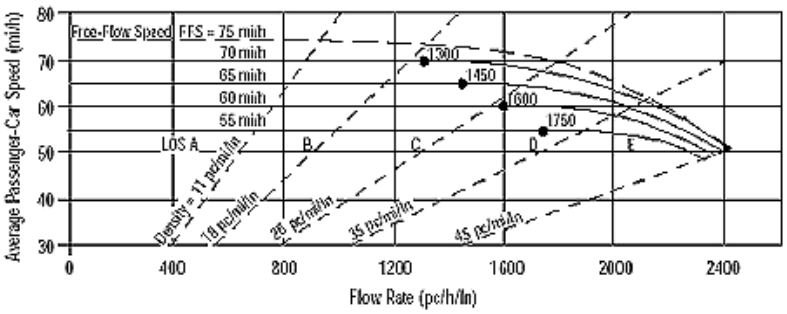
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Bt SR-56 & Mine Lick Creek*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2644*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1630*	pc/h/ln	Design LOS	
S	*65.3*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*25.0*	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 - Exhibits23-8, 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			

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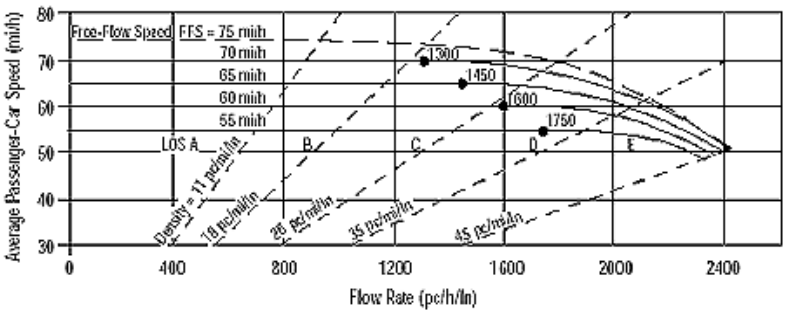
BASIC FREEWAY SEGMENTS WORKSHEET



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		***Site Information***	
Analyst	*ALB*	Highway/Direction of Travel	*I-40 (Westbound)*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between SR-56 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*2344*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

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	*0.50*	I/mi	f_{ID}	*0.0*	mi/h
Number of Lanes, N	*2*		f_N	*4.5*	mi/h
FFS (measured)		mi/h	FFS	*65.5*	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)	*1445*	pc/h/ln	Design LOS	
S	*65.5*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*22.1*	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 - Exhibits23-8, 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			

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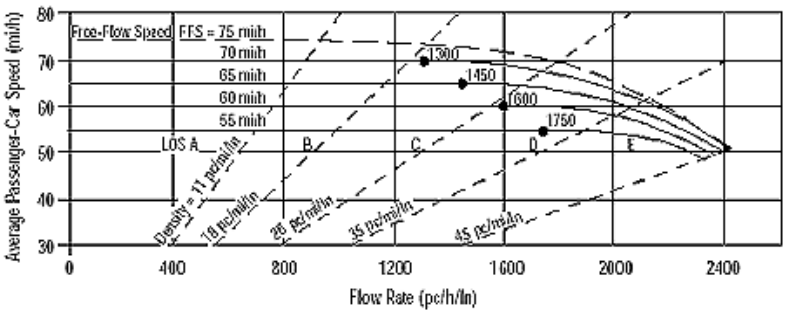
BASIC FREEWAY SEGMENTS WORKSHEET



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	*ALB*
Agency or Company	*RPM Transportation Consultants*
Date Performed	*5/22/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*I-40 (Westbound)*
From/To	*west of SR-56*
Jurisdiction	*Putnam Co*
Analysis Year	*2033 Proposed w/ Business Park*

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*2476*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*22*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.901*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/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}	*0.0*	mi/h
f_N	*4.5*	mi/h
FFS	*65.5*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1527*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*23.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x 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 - Exhibits23-8, 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

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FUTURE YEAR 2033
INTERSTATE 40 AT STATE ROUTE 56 (BAXTER ROAD)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2800	0.90	Level	22	0	0.901	1.00	3453
Ramp	120	0.90	Level	22	0	0.901	1.00	148
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 1.000 using Equation (Exhibit 25-12)
V_{12} = 3453 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3453	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	3305	Exhibit 25-14	4800	No
V_R	148	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3453	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$
D_R = 31.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.441 (Exhibit 25-19)
S_R= 57.6 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 57.6 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2680	0.90	Level	22	0	0.901	1.00	3305
Ramp	373	0.90	Level	22	0	0.901	1.00	460
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 3305 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3765	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3765	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 30.3 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.441 (Exibit 25-19)

S_R= 57.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.7 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2040	0.90	Level	22	0	0.901	1.00	2516
Ramp	228	0.90	Level	22	0	0.901	1.00	281
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 1.000 using Equation (Exhibit 25-12)
V_{12} = 2516 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2516	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2235	Exhibit 25-14	4800	No
V_R	281	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2516	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 22.6 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.453 (Exhibit 25-19)
S_R= 57.3 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 57.3 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1812	0.90	Level	22	0	0.901	1.00	2235
Ramp	191	0.90	Level	22	0	0.901	1.00	236
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2235 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2471	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2471	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.4 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.320 (Exibit 25-19)

S_R= 61.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Proposed w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*419*	*51*	*322*	*197*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*465*	*56*	*357*	*218*	*0*
Percent Heavy Vehicles	*0*	--	--	*22*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*98*		*22*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*108*	*0*	*24*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*357*					*132*	
C (m) (veh/h)		*951*					*100*	
v/c		*0.38*					*1.32*	
95% queue length		*1.76*					*9.31*	
Control Delay (s/veh)		*11.0*					*276.0*	
LOS		*B*					*F*	
Approach Delay (s/veh)	--	--				*276.0*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Proposed w/ Business Park*
Analysis Time Period	*AM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*37*	*480*			*498*	*154*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*41*	*533*	*0*	*0*	*553*	*171*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*21*		*207*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*23*	*0*	*230*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*41*			*253*				
C (m) (veh/h)	*794*			*494*				
v/c	*0.05*			*0.51*				
95% queue length	*0.16*			*2.88*				
Control Delay (s/veh)	*9.8*			*19.7*				
LOS	*A*			*C*				
Approach Delay (s/veh)	--	--	*19.7*					
Approach LOS	--	--	*C*					

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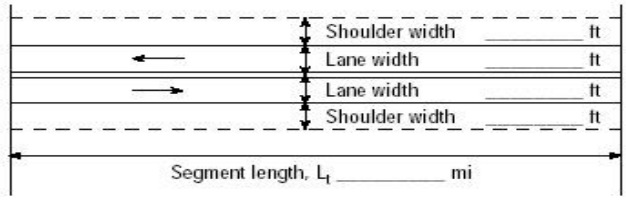
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1339* veh/h
Directional split	*51 / 49*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1492*
v_p * highest directional split proportion[2] (pc/h)	*761*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*0.9*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*38.9*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/ (1+ P_T(E_T-1)+P_R(E_R-1))$	*1.000*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1488*
v_p * highest directional split proportion[2] (pc/h)	*759*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*73.0*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*5.4*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*78.4*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.47*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*372*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*1339*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*9.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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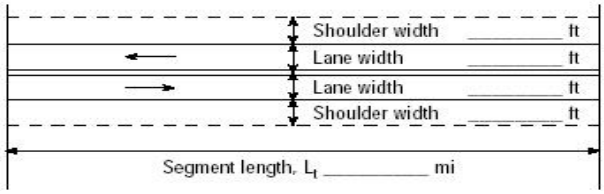
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1036* veh/h
Directional split	*50 / 50*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4%*
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1158*
v_p * highest directional split proportion[2] (pc/h)	*579*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS FFS=S_{FM}+0.00776(V_f/ f_{HV})	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*2.2*
Average travel speed, ATS (*mi/h*) ATS=FFS-0.00776v_p-f_{np}	*33.4*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1155*
v_p * highest directional split proportion[2] (pc/h)	*578*
Base percent time-spent-following, BPTSF(%)=100(1-$e^{-0.000879v_p}$)	*63.8*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*11.0*
Percent time-spent-following, PTSF(%)=BPTSF+$f_{d/np}$	*74.7*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, v/c=V_p/ 3,200	*0.36*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= 0.25L_t(V/PHF)	*29*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=V*L_t	*104*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*0.9*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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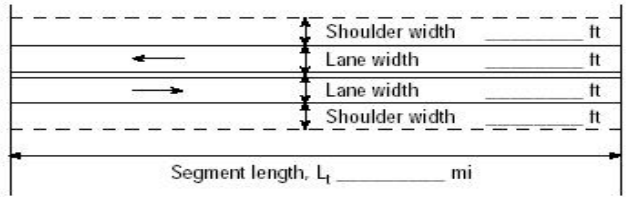
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*689* veh/h
Directional split	*68 / 32*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*770*
v_p * highest directional split proportion[2] (pc/h)	*524*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*3.1*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*32.2*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*768*
v_p * highest directional split proportion[2] (pc/h)	*522*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*49.1*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*15.6*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*64.7*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.24*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*115*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*413*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*3.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2521	0.90	Level	22	0	0.901	1.00	3109
Ramp	265	0.90	Level	22	0	0.901	1.00	327
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3109 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3109	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2782	Exhibit 25-14	4800	No
V_R	327	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3109	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 28.0 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.457 (Exhibit 25-19)

S_R= 57.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2256	0.90	Level	22	0	0.901	1.00	2782
Ramp	182	0.90	Level	22	0	0.901	1.00	224
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2782 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3006	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3006	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.352 (Exibit 25-19)

S_R= 60.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 60.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft	S_{FF} = 70.0 mph S_{FR} = 35.0 mph	L_{down} = ft
V_u = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2644	0.90	Level	22	0	0.901	1.00	3261
Ramp	300	0.90	Level	22	0	0.901	1.00	370
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3261 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3261	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2891	Exhibit 25-14	4800	No
V_R	370	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3261	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 29.0 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.461 (Exhibit 25-19)

S_R= 57.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2344	0.90	Level	22	0	0.901	1.00	2891
Ramp	132	0.90	Level	22	0	0.901	1.00	163
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2891 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3054	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3054	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$
D_R = 25.0 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.356 (Exibit 25-19)
S_R= 60.0 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 60.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & EB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Proposed w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 EB Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)		*169*	*27*	*155*	*192*	
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*187*	*30*	*172*	*213*	*0*
Percent Heavy Vehicles	*0*	--	--	*22*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*217*		*48*			
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*241*	*0*	*53*	*0*	*0*	*0*
Percent Heavy Vehicles	*22*	*0*	*22*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*Y*			*N*	
Storage		*1*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*					*LR*	
v (veh/h)		*172*					*294*	
C (m) (veh/h)		*1243*					*342*	
v/c		*0.14*					*0.86*	
95% queue length		*0.48*					*7.92*	
Control Delay (s/veh)		*8.4*					*55.1*	
LOS		*A*					*F*	
Approach Delay (s/veh)	--	--				*55.1*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-56 & WB I-40 Ramps*
Agency/Co.	*RPM Transportation Consultants*	Jurisdiction	*Putnam Co*
Date Performed	*5/22/2009*	Analysis Year	*2033 Proposed w/ Business Park*
Analysis Time Period	*PM Peak Hour*		

Project Description *09-0402 Mine Lick Creek - TDOT OC Planning*

East/West Street: *I-40 Westbound Exit Ramp* | North/South Street: *SR-56*

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 (veh/h)	*23*	*363*			*306*	*109*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*25*	*403*	*0*	*0*	*340*	*121*
Percent Heavy Vehicles	*22*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*41*		*259*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*45*	*0*	*287*
Percent Heavy Vehicles	*0*	*0*	*0*	*22*	*0*	*22*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*Y*	
Storage		*0*			*1*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*			*LR*				
v (veh/h)	*25*			*332*				
C (m) (veh/h)	*1003*			*616*				
v/c	*0.02*			*0.54*				
95% queue length	*0.08*			*3.22*				
Control Delay (s/veh)	*8.7*			*17.5*				
LOS	*A*			*C*				
Approach Delay (s/veh)	--	--	*17.5*					
Approach LOS	--	--	*C*					

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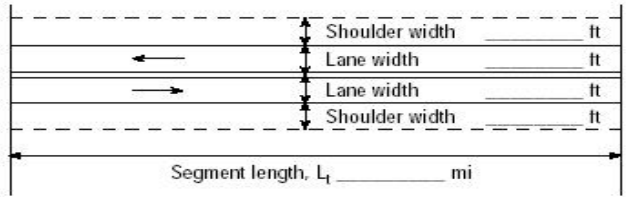
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*north of WB I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*1037* veh/h
Directional split	*60 / 40*
Peak-hour factor, PHF	*0.90*
No-passing zone	*45*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*4*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1159*
v_p * highest directional split proportion[2] (pc/h)	*695*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*55.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*2.6 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*1.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*51.4 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*1.4*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*41.0*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*1156*
v_p * highest directional split proportion[2] (pc/h)	*694*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*63.8*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*7.9*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*71.7*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*D*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.36*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*288*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*1037*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*7.0*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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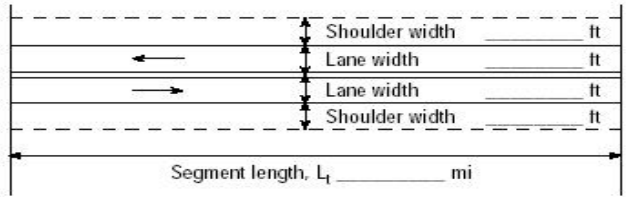
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*Between I-40 Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*733* veh/h
Directional split	*53 / 47*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*0*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*819*
v_p * highest directional split proportion[2] (pc/h)	*434*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*0.4 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*0.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*44.6 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*3.0*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*35.3*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*817*
v_p * highest directional split proportion[2] (pc/h)	*433*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*51.2*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*14.9*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*66.1*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.26*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*20*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*73*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*0.6*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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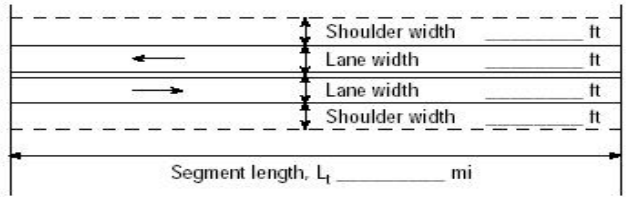
TWO-WAY TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		Site Information	
Analyst	*ALB*	Highway	*SR-56*
Agency or Company	*RPM Transportation Consultants*	From/To	*South of I-40 EB Ramps*
Date Performed	*5/22/2009*	Jurisdiction	*Putnam Co*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*

Project Description: *09-0402 Mine Lick Creek - TDOT OC Planning*

Input Data



☐ Class I highway ☑ Class II highway

Terrain ☑ Level ☐ Rolling

Two-way hourly volume	*436* veh/h
Directional split	*55 / 45*
Peak-hour factor, PHF	*0.90*
No-passing zone	*100*
% Trucks and Buses , P_T	*3* %
% Recreational vehicles, P_R	*4*%
Access points/ *mi*	*8*

Average Travel Speed

Grade adjustment factor, f_G (Exhibit 20-7)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-9)	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 20-9)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.979*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*495*
v_p * highest directional split proportion[2] (pc/h)	*272*

Free-Flow Speed from Field Measurement		Estimated Free-Flow Speed	
Field Measured speed, S_{FM}	*mi/h*	Base free-flow speed, $BFFS_{FM}$	*45.0 mi/h*
Observed volume, V_f	*veh/h*	Adj. for lane width and shoulder width[3], f_{LS} (Exhibit 20-5)	*1.7 mi/h*
Free-flow speed, FFS $FFS=S_{FM}+0.00776(V_f/f_{HV})$	*mi/h*	Adj. for access points, f_A (Exhibit 20-6)	*2.0 mi/h*
		Free-flow speed, FFS $(FSS=BFFS-f_{LS}-f_A)$	*41.3 mi/h*

Adj. for no-passing zones, f_{np} (*mi/h*) (Exhibit 20-11)	*4.2*
Average travel speed, ATS (*mi/h*) $ATS=FFS-0.00776v_p-f_{np}$	*33.2*

Percent Time-Spent-Following

Grade Adjustment factor, f_G (Exhibit 20-8)	*1.00*
Passenger-car equivalents for trucks, E_T (Exhibit 20-10)	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 20-10)	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.997*
Two-way flow rate[1], v_p (pc/h)=V/ (PHF * f_G * f_{HV})	*486*
v_p * highest directional split proportion[2] (pc/h)	*267*
Base percent time-spent-following, $BPTSF(\%)=100(1-e^{-0.000879v_p})$	*34.8*
Adj. for directional distribution and no-passing zone, $f_{d/hp}$(%)(Exh. 20-12)	*22.3*
Percent time-spent-following, $PTSF(\%)=BPTSF+f_{d/np}$	*57.0*

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 20-3 for Class I or 20-4 for Class II)	*C*
Volume to capacity ratio, $v/c=V_p/3{,}200$	*0.15*
Peak 15-min veh-miles of travel, VMT_{15} (veh- *mi*)= $0.25L_t(V/PHF)$	*73*
Peak-hour vehicle-miles of travel, VMT_{60}(veh- *mi*)=$V*L_t$	*262*
Peak 15-min total travel time, TT_{15}(veh-h)= VMT_{15}/ATS	*2.2*

Notes

1. If Vp >= 3,200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split Vp>= 1,700 pc/h, terminated anlysis-the LOS is F.

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FUTURE YEAR 2033
INTERSTATE 40 AT MINE LICK CREEK ROAD

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3053	0.90	Level	22	0	0.901	1.00	3765
Ramp	914	0.90	Level	22	0	0.901	1.00	1127
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3765 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3765	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2638	Exhibit 25-14	4800	No
V_R	1127	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3765	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 33.7 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.529 (Exhibit 25-19)

S_R= 55.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 55.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2139	0.90	Level	22	0	0.901	1.00	2638
Ramp	346	0.90	Level	22	0	0.901	1.00	427
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2638 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3065	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3065	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 24.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.356 (Exibit 25-19)
S_R= 60.0 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 60.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to Mine Lick Creek
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2949	0.90	Level	22	0	0.901	1.00	3637
Ramp	1138	0.90	Level	22	0	0.901	1.00	1404
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3637 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3637	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2233	Exhibit 25-14	4800	No
V_R	1404	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3637	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 32.2 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.554 (Exhibit 25-19)

S_R= 54.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 54.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1811	0.90	Level	22	0	0.901	1.00	2234
Ramp	229	0.90	Level	22	0	0.901	1.00	282
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2234 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2516	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2516	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 20.7 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.322 (Exibit 25-19)

S_R= 61.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 61.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 EB ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*2*					*2*	*2*	*1*	*2*	
Lane Group	*L*		*R*					*T*	*R*	*L*	*T*	
Volume, V (vph)	*119*		*795*					*276*	*175*	*171*	*1544*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
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*	
Initial Unmet Demand, Q_b	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*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	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *27.3*	G = *0.0*	G = *0.0*	G = *0.0*	G = *6.5*	G = *31.2*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *80.0*

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	*132*		*883*					*307*	*194*	*190*	*1716*	
Lane Group Capacity, c	*587*		*929*					*1344*	*1062*	*541*	*1839*	
v/c Ratio, X	*0.22*		*0.95*					*0.23*	*0.18*	*0.35*	*0.93*	
Total Green Ratio, g/C	*0.34*		*0.34*					*0.39*	*0.39*	*0.53*	*0.53*	
Uniform Delay, d_1	*18.8*		*25.7*					*16.3*	*16.0*	*10.0*	*17.3*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k	*0.11*		*0.46*					*0.11*	*0.11*	*0.11*	*0.45*	
Incremental Delay, d_2	*0.2*		*18.7*					*0.1*	*0.1*	*0.4*	*9.3*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay	*19.0*		*44.4*					*16.4*	*16.1*	*10.3*	*26.7*	
Lane Group LOS	*B*		*D*					*B*	*B*	*B*	*C*	
Approach Delay	*41.1*						*16.3*			*25.0*		
Approach LOS	*D*						*B*			*C*		
Intersection Delay	*28.5*			X_C = *0.94*			Intersection LOS			*C*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 WB ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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				*2*		*1*	*2*	*2*			*2*	*1*
Lane Group				*L*		*R*	*L*	*T*			*T*	*R*
Volume, V (vph)				*970*		*168*	*128*	*267*			*745*	*101*
% Heavy Vehicles, %HV				*5*		*5*	*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*		*0.90*	*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*		*A*	*A*	*A*			*A*	*A*
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*
Initial Unmet Demand, Q_b				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Ped / Bike / RTOR Volumes				*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*		*12.0*	*12.0*	*12.0*			*12.0*	*12.0*
Parking / Grade / Parking				*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				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *29.7*	G = *0.0*	G = *0.0*	G = *0.0*	G = *5.0*	G = *30.3*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *80.0*

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				*1078*		*187*	*142*	*297*			*828*	*112*
Lane Group Capacity, c				*1239*		*571*	*670*	*1735*			*1305*	*583*
v/c Ratio, X				*0.87*		*0.33*	*0.21*	*0.17*			*0.63*	*0.19*
Total Green Ratio, g/C				*0.37*		*0.37*	*0.50*	*0.50*			*0.38*	*0.38*
Uniform Delay, d_1				*23.4*		*18.0*	*12.0*	*10.8*			*20.3*	*16.6*
Progression Factor, PF				*1.000*		*1.000*	*1.000*	*1.000*			*1.000*	*1.000*
Delay Calibration, k				*0.40*		*0.11*	*0.11*	*0.11*			*0.21*	*0.11*
Incremental Delay, d_2				*6.9*		*0.3*	*0.2*	*0.0*			*1.0*	*0.2*
Initial Queue Delay, d_3				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Control Delay				*30.3*		*18.3*	*12.1*	*10.8*			*21.3*	*16.8*
Lane Group LOS				*C*		*B*	*B*	*B*			*C*	*B*
Approach Delay				*28.5*			*11.3*			*20.8*		
Approach LOS				*C*			*B*			*C*		
Intersection Delay	*22.9*			X_C = *0.75*			Intersection LOS			*C*		

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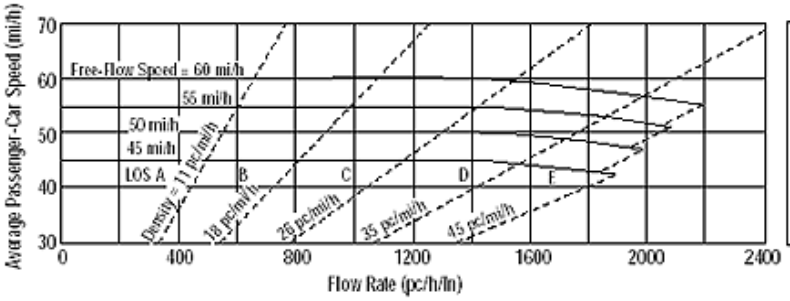
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	846	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	470
Speed, S (mi/h)	45.0
D (pc/mi/ln)	10.4
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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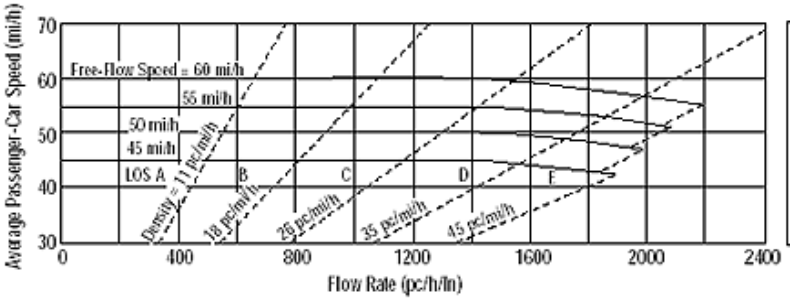
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	435	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	241
Speed, S (mi/h)	45.0
D (pc/mi/ln)	5.4
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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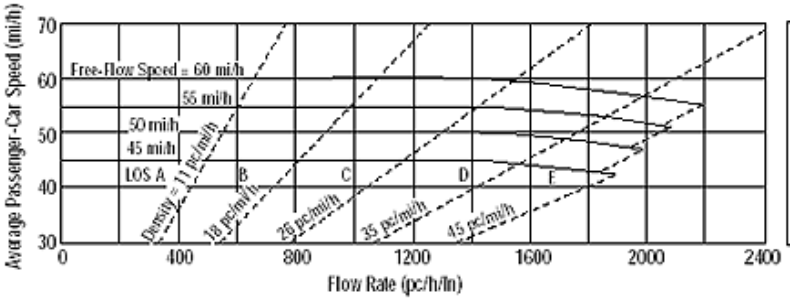
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1715	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	952
Speed, S (mi/h)	45.0
D (pc/mi/ln)	21.2
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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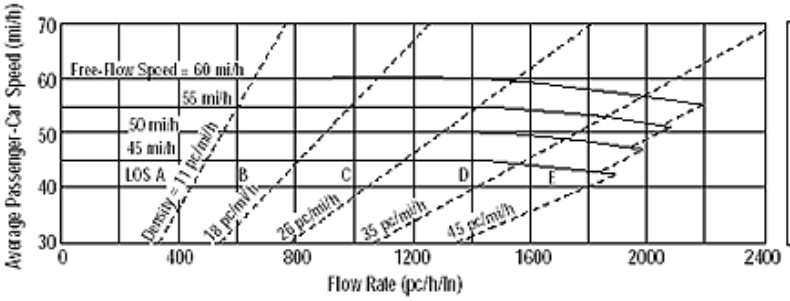
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	395	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	219
Speed, S (mi/h)	45.0
D (pc/mi/ln)	4.9
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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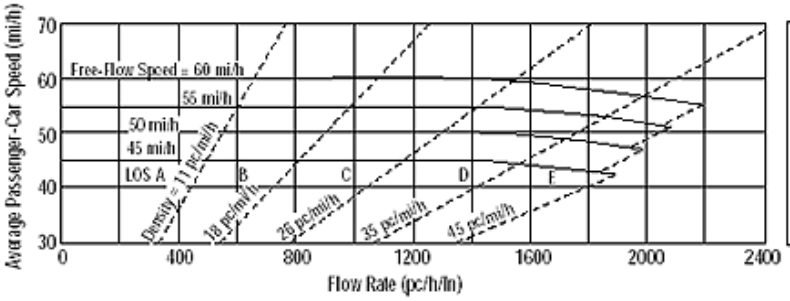
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	2339	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1299
Speed, S (mi/h)	45.0
D (pc/mi/ln)	28.9
LOS	D

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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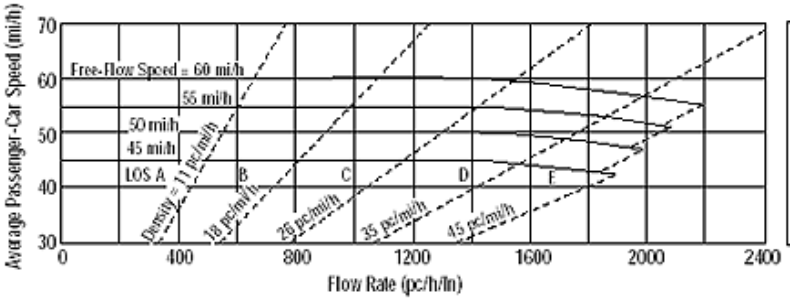
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	451	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	250
Speed, S (mi/h)	45.0
D (pc/mi/ln)	5.6
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-56
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2438	0.90	Level	22	0	0.901	1.00	3007
Ramp	327	0.90	Level	22	0	0.901	1.00	403
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 1.000 using Equation (Exhibit 25-12)
V_{12} = 3007 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3007	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2604	Exhibit 25-14	4800	No
V_R	403	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3007	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$

D_R = 27.1 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.464 (Exhibit 25-19)
S_R= 57.0 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 57.0 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2111	0.90	Level	22	0	0.901	1.00	2604
Ramp	1013	0.90	Level	22	0	0.901	1.00	1249
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2604 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3853	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3853	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 30.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.457 (Exibit 25-19)
S_R= 57.2 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 57.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to Mine Lick Creek
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2235	0.90	Level	22	0	0.901	1.00	2757
Ramp	395	0.90	Level	22	0	0.901	1.00	487
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 2757 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	2757	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2270	Exhibit 25-14	4800	No
V_R	487	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2757	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 24.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.472 (Exhibit 25-19)

S_R= 56.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from Mine Lick
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1840	0.90	Level	22	0	0.901	1.00	2269
Ramp	804	0.90	Level	22	0	0.901	1.00	992
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2269 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3261	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3261	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.2 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.375 (Exibit 25-19)

S_R= 59.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 59.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 EB ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*2*					*2*	*2*	*1*	*2*	
Lane Group	*L*		*R*					*T*	*R*	*L*	*T*	
Volume, V (vph)	*160*		*167*					*1151*	*853*	*160*	*479*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
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*	
Initial Unmet Demand, Q_b	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*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	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *25.0*	G = *0.0*	G = *0.0*	G = *0.0*	G = *8.0*	G = *82.0*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *130.0*

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	*178*		*186*					*1279*	*948*	*178*	*532*	
Lane Group Capacity, c	*331*		*523*					*2173*	*1717*	*283*	*2517*	
v/c Ratio, X	*0.54*		*0.36*					*0.59*	*0.55*	*0.63*	*0.21*	
Total Green Ratio, g/C	*0.19*		*0.19*					*0.63*	*0.63*	*0.73*	*0.73*	
Uniform Delay, d_1	*47.3*		*45.5*					*14.1*	*13.6*	*11.0*	*5.6*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k	*0.14*		*0.11*					*0.18*	*0.15*	*0.21*	*0.11*	
Incremental Delay, d_2	*1.7*		*0.4*					*0.4*	*0.4*	*4.4*	*0.0*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay	*49.0*		*45.9*					*14.5*	*14.0*	*15.4*	*5.6*	
Lane Group LOS	*D*		*D*					*B*	*B*	*B*	*A*	
Approach Delay	*47.5*						*14.3*			*8.1*		
Approach LOS	*D*						*B*			*A*		
Intersection Delay	*16.6*			X_C = *0.61*			Intersection LOS			*B*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*Mine Lick & I-40 WB ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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				*2*		*1*	*2*	*2*			*2*	*1*
Lane Group				*L*		*R*	*L*	*T*			*T*	*R*
Volume, V (vph)				*216*		*179*	*696*	*615*			*423*	*108*
% Heavy Vehicles, %HV				*5*		*5*	*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*		*0.90*	*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*		*A*	*A*	*A*			*A*	*A*
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*
Initial Unmet Demand, Q_b				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Ped / Bike / RTOR Volumes				*0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*		*12.0*	*12.0*	*12.0*			*12.0*	*12.0*
Parking / Grade / Parking				*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				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *11.5*	G = *0.0*	G = *0.0*	G = *0.0*	G = *30.0*	G = *13.5*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *70.0*

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				*240*		*199*	*773*	*683*			*470*	*120*
Lane Group Capacity, c				*548*		*253*	*1842*	*2387*			*664*	*297*
v/c Ratio, X				*0.44*		*0.79*	*0.42*	*0.29*			*0.71*	*0.40*
Total Green Ratio, g/C				*0.16*		*0.16*	*0.69*	*0.69*			*0.19*	*0.19*
Uniform Delay, d_1				*26.3*		*28.1*	*5.1*	*4.1*			*26.4*	*24.7*
Progression Factor, PF				*1.000*		*1.000*	*1.000*	*1.000*			*1.000*	*1.000*
Delay Calibration, k				*0.11*		*0.33*	*0.11*	*0.11*			*0.27*	*0.11*
Incremental Delay, d_2				*0.6*		*15.1*	*0.2*	*0.1*			*3.5*	*0.9*
Initial Queue Delay, d_3				*0.0*		*0.0*	*0.0*	*0.0*			*0.0*	*0.0*
Control Delay				*26.9*		*43.2*	*5.2*	*4.2*			*29.9*	*25.6*
Lane Group LOS				*C*		*D*	*A*	*A*			*C*	*C*
Approach Delay				*34.3*			*4.7*			*29.0*		
Approach LOS				*C*			*A*			*C*		
Intersection Delay	*15.7*			X_C = *0.63*			Intersection LOS			*B*		

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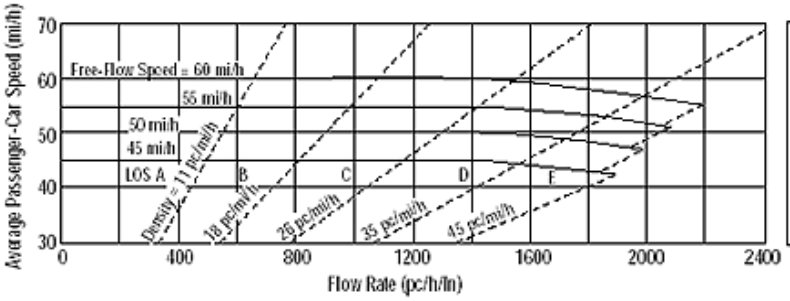
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	531	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	295
Speed, S (mi/h)	45.0
D (pc/mi/ln)	6.6
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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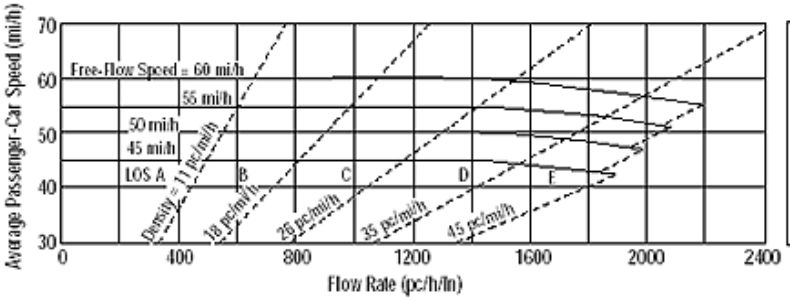
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	North of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	794	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	441
Speed, S (mi/h)	45.0
D (pc/mi/ln)	9.8
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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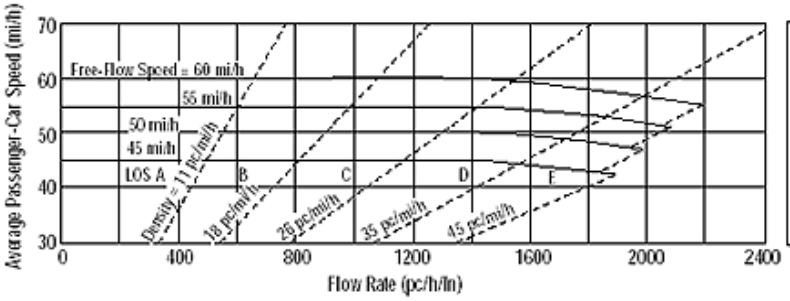
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	639	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	355
Speed, S (mi/h)	45.0
D (pc/mi/ln)	7.9
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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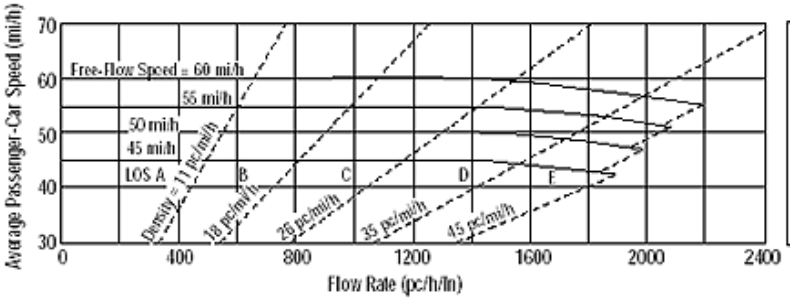
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	Between I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1311	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	728
Speed, S (mi/h)	45.0
D (pc/mi/ln)	16.2
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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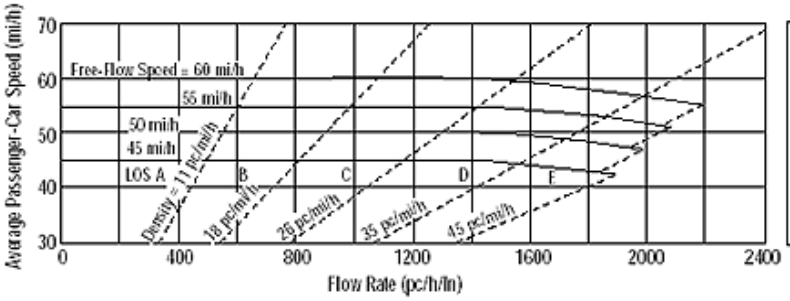
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	646	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	358
Speed, S (mi/h)	45.0
D (pc/mi/ln)	8.0
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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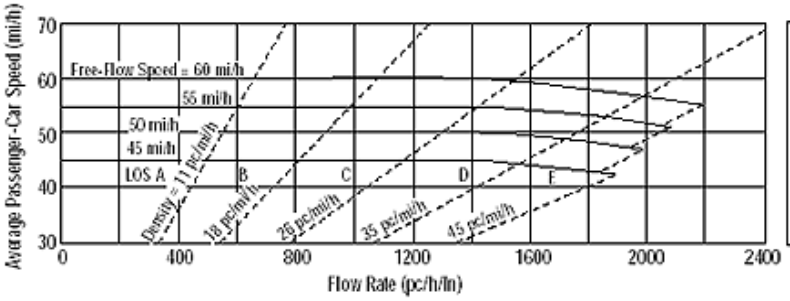
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/27/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	Mine Lick Creek
From/To	South of EB I-40 Ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	2004	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	0
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	1.000

Speed Inputs

Lane Width, LW (ft)	12.0
Total Lateral Clearance, LC (ft)	12.0
Access Points, A (A/mi)	0
Median Type, M	Divided
FFS (measured)	
Base Free-Flow Speed, BFFS	45.0

Calc Speed Adj and FFS

f_{LW} (mi/h)	0.0
f_{LC} (mi/h)	0.0
f_A (mi/h)	0.0
f_M (mi/h)	0.0
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	1113
Speed, S (mi/h)	45.0
D (pc/mi/ln)	24.7
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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FUTURE YEAR 2033
INTERSTATE 40 AT STATE ROUTE 135 (S. WILLOW AVENUE)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2485	0.90	Level	22	0	0.901	1.00	3065
Ramp	337	0.90	Level	22	0	0.901	1.00	416
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3065 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3065	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2649	Exhibit 25-14	4800	No
V_R	416	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3065	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 28.0 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.465 (Exhibit 25-19)

S_R= 57.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 57.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2148	0.90	Level	22	0	0.901	1.00	2649
Ramp	435	0.90	Level	22	0	0.901	1.00	537
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 2649 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3186	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3186	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 26.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.376 (Exibit 25-19)

S_R= 59.5 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 59.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3294	0.90	Level	22	0	0.901	1.00	4063
Ramp	543	0.90	Level	22	0	0.901	1.00	670
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 4063 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4063	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	3393	Exhibit 25-14	4800	No
V_R	670	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4063	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 36.7 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.488 (Exhibit 25-19)

S_R= 56.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2751	0.90	Level	22	0	0.901	1.00	3393
Ramp	198	0.90	Level	22	0	0.901	1.00	244
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 3393 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	3637	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3637	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 29.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.425 (Exibit 25-19)
S_R= 58.1 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 58.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*259*		*78*					*988*	*244*	*191*	*689*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *50.6*	G = *0.0*	G = *0.0*	G = *0.0*	G = *11.8*	G = *52.6*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *130.0*

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	*288*		*87*					*1369*		*212*	*766*	
Lane Group Capacity, c	*669*		*599*					*1353*		*212*	*1839*	
v/c Ratio, X	*0.43*		*0.15*					*1.01*		*1.00*	*0.42*	
Total Green Ratio, g/C	*0.39*		*0.39*					*0.40*		*0.53*	*0.53*	
Uniform Delay, d_1	*29.1*		*25.7*					*38.7*		*40.8*	*18.2*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.11*		*0.11*					*0.50*		*0.50*	*0.11*	
Incremental Delay, d_2	*0.4*		*0.1*					*27.4*		*61.8*	*0.2*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*29.6*		*25.8*					*66.1*		*102.6*	*18.3*	
Lane Group LOS	*C*		*C*					*E*		*F*	*B*	
Approach Delay	*28.7*						*66.1*			*36.6*		
Approach LOS	*C*						*E*			*D*		
Intersection Delay	*50.4*			X_C = *0.76*			Intersection LOS			*D*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*247*			*49*	*1198*			*633*	*149*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *76.2*	G = *0.0*	G = *0.0*	G = *0.0*	G = *6.4*	G = *32.4*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *130.0*

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				*274*			*54*	*1331*			*869*	
Lane Group Capacity, c				*1008*			*141*	*1161*			*834*	
v/c Ratio, X				*0.27*			*0.38*	*1.15*			*1.04*	
Total Green Ratio, g/C				*0.59*			*0.34*	*0.34*			*0.25*	
Uniform Delay, d_1				*13.2*			*33.9*	*43.1*			*48.8*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.11*			*0.11*	*0.50*			*0.50*	
Incremental Delay, d_2				*0.1*			*1.7*	*76.4*			*42.6*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*13.4*			*35.6*	*119.5*			*91.4*	
Lane Group LOS				*B*			*D*	*F*			*F*	
Approach Delay				*13.4*			*116.2*			*91.4*		
Approach LOS				*B*			*F*			*F*		
Intersection Delay	*96.5*			X_C = *0.59*			Intersection LOS			*F*		

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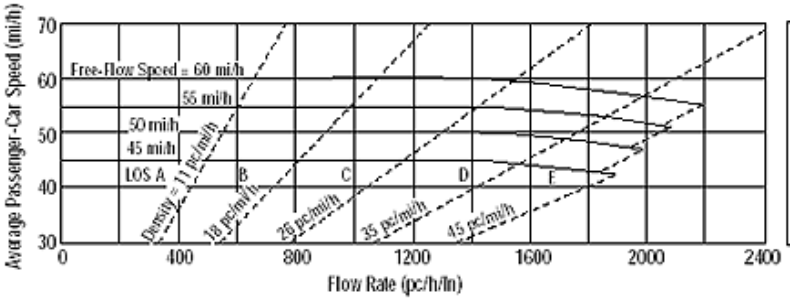
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	782	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	445
Speed, S (mi/h)	45.0
D (pc/mi/ln)	9.9
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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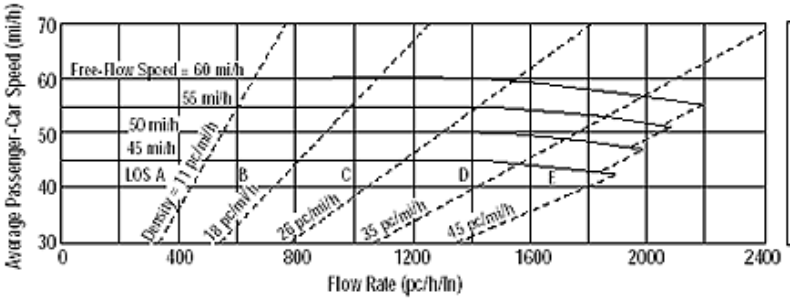
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1494	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	850
Speed, S (mi/h)	45.0
D (pc/mi/ln)	18.9
LOS	C

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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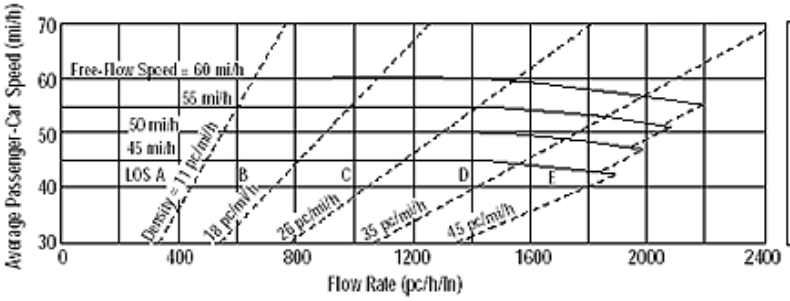
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	880	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	501
Speed, S (mi/h)	45.0
D (pc/mi/ln)	11.1
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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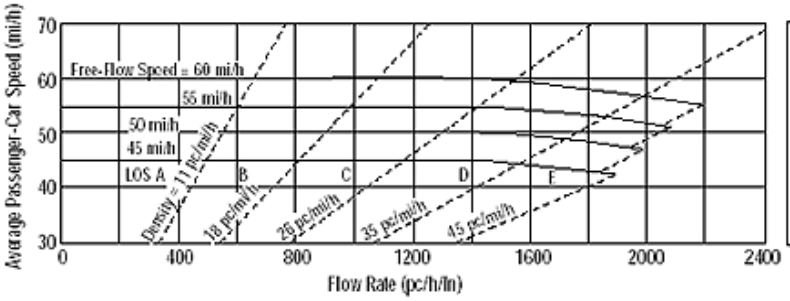
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1247	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	710
Speed, S (mi/h)	45.0
D (pc/mi/ln)	15.8
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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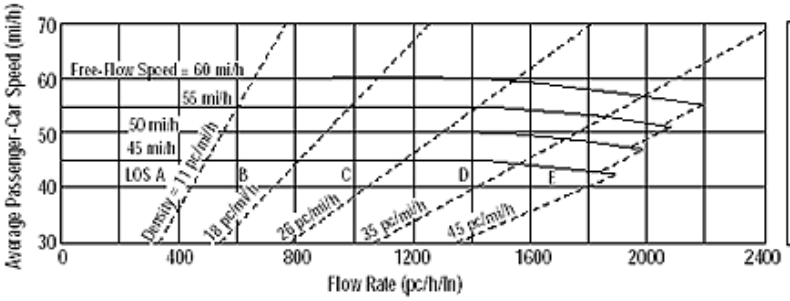
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	767	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	436
Speed, S (mi/h)	45.0
D (pc/mi/ln)	9.7
LOS	A

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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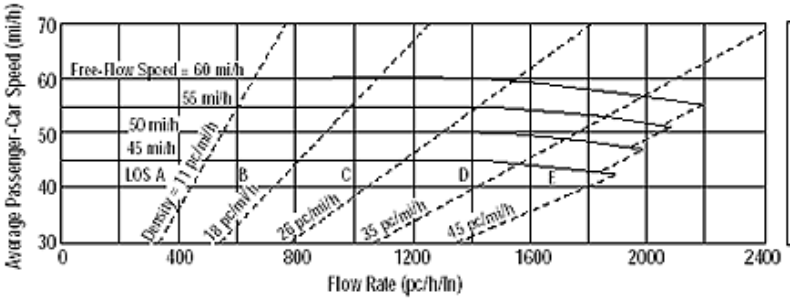
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	AM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1232	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	701
Speed, S (mi/h)	45.0
D (pc/mi/ln)	15.6
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3124	0.90	Level	22	0	0.901	1.00	3853
Ramp	325	0.90	Level	22	0	0.901	1.00	401
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 1.000 using Equation (Exhibit 25-12)
V_{12} = 3853 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3853	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	3452	Exhibit 25-14	4800	No
V_R	401	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3853	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.0009 L_D$
D_R = 34.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.464 (Exhibit 25-19)
S_R= 57.0 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 57.0 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Eastbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2799	0.90	Level	22	0	0.901	1.00	3452
Ramp	560	0.90	Level	22	0	0.901	1.00	691
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 1.000 using Equation (Exhibit 25-5)

V_{12} = 3452 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4143	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4143	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 34.0 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.528 (Exibit 25-19)

S_R= 55.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 55.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Exit Ramp to SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	PM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek IJS - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	2466	0.90	Level	22	0	0.901	1.00	3041
Ramp	506	0.90	Level	22	0	0.901	1.00	624
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 1.000 using Equation (Exhibit 25-12)

V_{12} = 3041 pc/h

V_3 or V_{av34} 0 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	3041	Exhibit 25-14	4800	No
$V_{FO} = V_F - V_R$	2417	Exhibit 25-14	4800	No
V_R	624	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3041	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = 27.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.484 (Exhibit 25-19)

S_R= 56.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 56.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	ALB	Freeway/Dir of Travel	I-40 (Westbound)
Agency or Company	RPM Transportation Consultants	Junction	Entrance Ramp from SR-135
Date Performed	5/22/2009	Jurisdiction	Putnam Co
Analysis Time Period	AM Peak Hour	Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D,V_R,V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	1960	0.90	Level	22	0	0.901	1.00	2417
Ramp	275	0.90	Level	22	0	0.901	1.00	339
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 1.000 using Equation (Exhibit 25-5)
V_{12} = 2417 pc/h
V_3 or V_{av34} 0 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes,V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	2756	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2756	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 22.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.338 (Exibit 25-19)
S_R= 60.5 mph (Exhibit 25-19)
S_0= N/A mph (Exhibit 25-19)
S = 60.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes,V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.0009\ L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 eastbound ramps*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*		*1*					*2*	*0*	*1*	*2*	
Lane Group	*L*		*R*					*TR*		*L*	*T*	
Volume, V (vph)	*264*		*61*					*650*	*235*	*325*	*1000*	
% Heavy Vehicles, %HV	*5*		*5*					*5*	*5*	*5*	*5*	
Peak-Hour Factor, PHF	*0.90*		*0.90*					*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)	*A*		*A*					*A*	*A*	*A*	*A*	
Start-up Lost Time, l_1	*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*	
Arrival Type, AT	*3*		*3*					*3*		*3*	*3*	
Unit Extension, UE	*3.0*		*3.0*					*3.0*		*3.0*	*3.0*	
Filtering/Metering, I	*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*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*				*0*	*0*	*0*	*0*	*0*	
Lane Width	*12.0*		*12.0*					*12.0*		*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*				*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*		*0*					*0*		*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*						*3.2*			*3.2*		

Phasing	EB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *12.7*	G = *0.0*	G = *0.0*	G = *0.0*	G = *10.2*	G = *22.1*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *60.0*

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	*293*		*68*					*983*		*361*	*1111*	
Lane Group Capacity, c	*364*		*326*					*1218*		*413*	*2142*	
v/c Ratio, X	*0.80*		*0.21*					*0.81*		*0.87*	*0.52*	
Total Green Ratio, g/C	*0.21*		*0.21*					*0.37*		*0.62*	*0.62*	
Uniform Delay, d_1	*22.5*		*19.5*					*17.0*		*13.1*	*6.3*	
Progression Factor, PF	*1.000*		*1.000*					*1.000*		*1.000*	*1.000*	
Delay Calibration, k	*0.35*		*0.11*					*0.35*		*0.40*	*0.12*	
Incremental Delay, d_2	*12.4*		*0.3*					*4.1*		*18.4*	*0.2*	
Initial Queue Delay, d_3	*0.0*		*0.0*					*0.0*		*0.0*	*0.0*	
Control Delay	*34.9*		*19.8*					*21.2*		*31.4*	*6.6*	
Lane Group LOS	*C*		*B*					*C*		*C*	*A*	
Approach Delay	*32.1*						*21.2*			*12.7*		
Approach LOS	*C*						*C*			*B*		
Intersection Delay	*18.1*			X_C = *0.85*			Intersection LOS			*B*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*ALB*	Intersection	*SR-135 & I-40 westbound ramps*
Agency or Co.	*RPM Transportation Consultants*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam County*
Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*			*1*	*2*			*2*	*0*
Lane Group				*L*			*L*	*T*			*TR*	
Volume, V (vph)				*227*			*60*	*854*			*1098*	*215*
% Heavy Vehicles, %HV				*5*			*5*	*5*			*5*	*5*
Peak-Hour Factor, PHF				*0.90*			*0.90*	*0.90*			*0.90*	*0.90*
Pretimed (P) or Actuated (A)				*A*			*A*	*A*			*A*	*A*
Start-up Lost Time, l_1				*2.0*			*2.0*	*2.0*			*2.0*	
Extension of Effective Green, e				*2.0*			*2.0*	*2.0*			*2.0*	
Arrival Type, AT				*3*			*3*	*3*			*3*	
Unit Extension, UE				*3.0*			*3.0*	*3.0*			*3.0*	
Filtering/Metering, I				*1.000*			*1.000*	*1.000*			*1.000*	
Initial Unmet Demand, Q_b				*0.0*			*0.0*	*0.0*			*0.0*	
Ped / Bike / RTOR Volumes				*0*	*0*		*0*	*0*		*0*	*0*	*0*
Lane Width				*12.0*			*12.0*	*12.0*			*12.0*	
Parking / Grade / Parking				*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*			*0*	*0*			*0*	
Min. Time for Pedestrians, G_p				*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	NB Only	NS Perm	07	08
Timing	G = *26.3*	G = *0.0*	G = *0.0*	G = *0.0*	G = *5.0*	G = *63.7*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y = *0*	Y = *5*	Y = *5*	Y = *0*	Y = *0*

Duration of Analysis, T = *0.25* Cycle Length, C = *110.0*

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				*252*			*67*	*949*			*1459*	
Lane Group Capacity, c				*411*			*180*	*2308*			*1946*	
v/c Ratio, X				*0.61*			*0.37*	*0.41*			*0.75*	
Total Green Ratio, g/C				*0.24*			*0.67*	*0.67*			*0.58*	
Uniform Delay, d_1				*37.3*			*13.0*	*8.3*			*17.2*	
Progression Factor, PF				*1.000*			*1.000*	*1.000*			*1.000*	
Delay Calibration, k				*0.20*			*0.11*	*0.11*			*0.30*	
Incremental Delay, d_2				*2.7*			*1.3*	*0.1*			*1.7*	
Initial Queue Delay, d_3				*0.0*			*0.0*	*0.0*			*0.0*	
Control Delay				*40.0*			*14.3*	*8.4*			*18.9*	
Lane Group LOS				*D*			*B*	*A*			*B*	
Approach Delay				*40.0*			*8.8*			*18.9*		
Approach LOS				*D*			*A*			*B*		
Intersection Delay	*17.1*			X_C = *0.72*			Intersection LOS			*B*		

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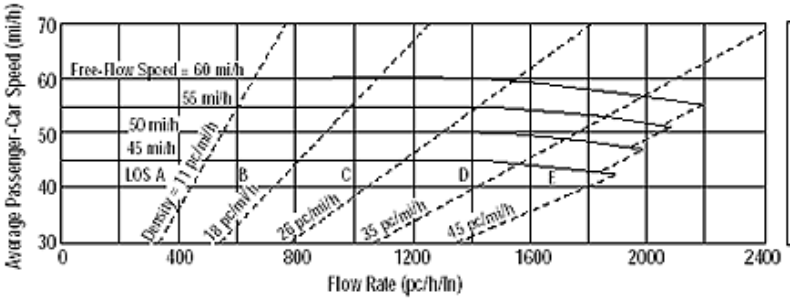
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1313	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	41
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	747
Speed, S (mi/h)	45.0
D (pc/mi/ln)	16.6
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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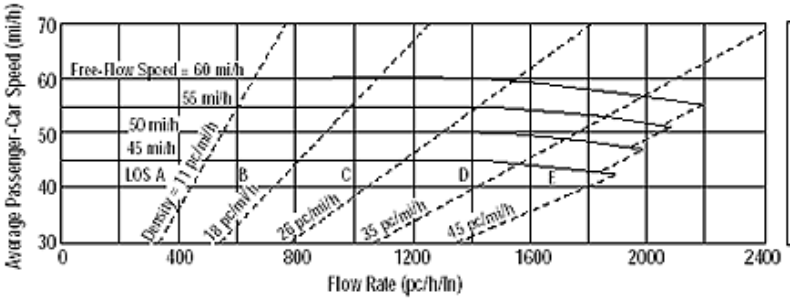
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	north of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1133	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	47
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	645
Speed, S (mi/h)	45.0
D (pc/mi/ln)	14.3
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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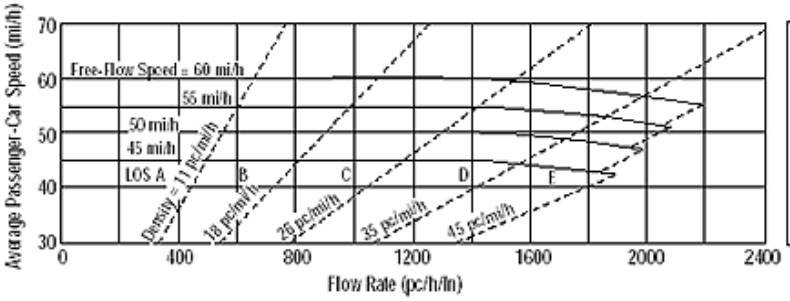
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1325	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	754
Speed, S (mi/h)	45.0
D (pc/mi/ln)	16.8
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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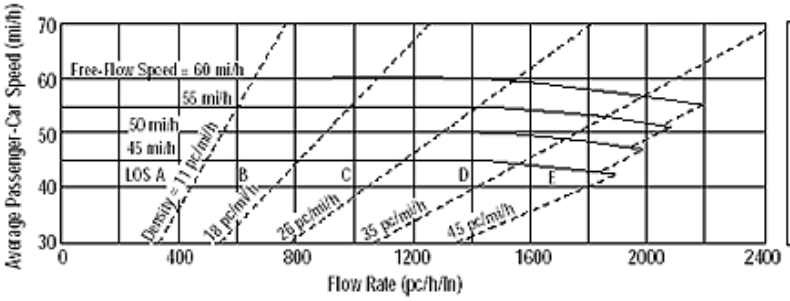
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	between I-40 ramps
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	914	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	0
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	520
Speed, S (mi/h)	45.0
D (pc/mi/ln)	11.6
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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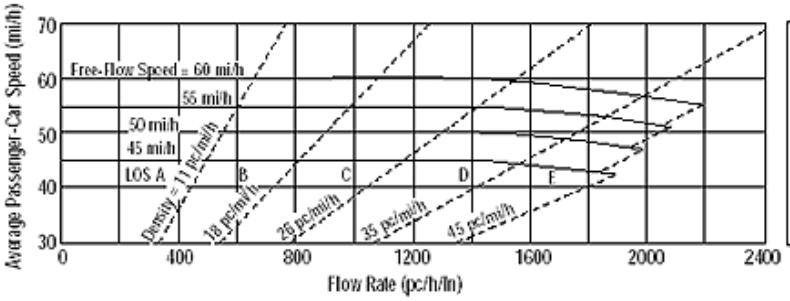
MULTILANE HIGHWAYS WORKSHEET(Direction 1)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	1061	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	28
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	604
Speed, S (mi/h)	45.0
D (pc/mi/ln)	13.4
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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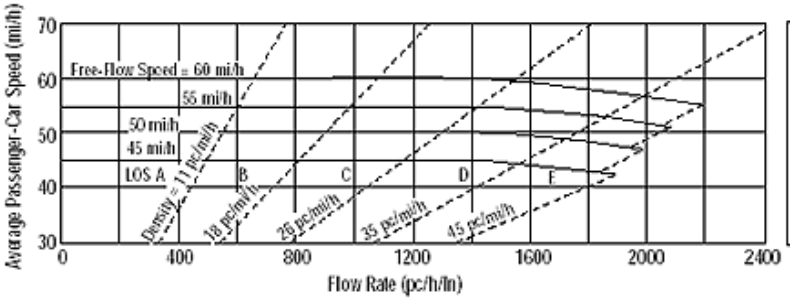
MULTILANE HIGHWAYS WORKSHEET(Direction 2)



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	ALB
Agency or Company	RPM Transportation Consultants09-0402 Mine Lick Creek - TDOT OC Planning
Date Performed	5/26/2009
Analysis Time Period	PM Peak Hour

Site Information

Highway/Direction to Travel	SR-135
From/To	south of I-40
Jurisdiction	Putnam Co
Analysis Year	2033 Proposed w/ Business Park

Project Description 09-0402 Mine Lick Creek - TDOT OC Planning

☑ Oper.(LOS) ☐ Des. (N) ☐ Plan. (vp)

Flow Inputs

Volume, V (veh/h)	885	Peak-Hour Factor, PHF	0.90
AADT(veh/h)		%Trucks and Buses, P_T	5
Peak-Hour Prop of AADT (veh/d)		%RVs, P_R	0
Peak-Hour Direction Prop, D		General Terrain:	Level
DDHV (veh/h)		Grade Length (mi)	0.00
Driver Type Adjustment	1.00	Up/Down %	0.00
		Number of Lanes	2

Calculate Flow Adjustments

f_p	1.00	E_R	1.2
E_T	1.5	f_{HV}	0.976

Speed Inputs

Lane Width, LW (ft)	11.0
Total Lateral Clearance, LC (ft)	6.5
Access Points, A (A/mi)	7
Median Type, M	
FFS (measured)	45.0
Base Free-Flow Speed, BFFS	

Calc Speed Adj and FFS

f_{LW} (mi/h)	
f_{LC} (mi/h)	
f_A (mi/h)	
f_M (mi/h)	
FFS (mi/h)	45.0

Operations

Operational (LOS)

Flow Rate, v_p (pc/h/ln)	503
Speed, S (mi/h)	45.0
D (pc/mi/ln)	11.2
LOS	B

Design

Design (N)

Required Number of Lanes, N	
Flow Rate, v_p (pc/h)	
Max Service Flow Rate (pc/h/ln)	
Design LOS	

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FUTURE YEAR 2033
BENNETT ROAD AT LEE SEMINARY ROAD

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*JH*	Intersection	*LEE SEMINARY RD & BENNETT RD*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*AM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*	*1*	*0*	*1*	*1*	*2*	*1*	*1*	*1*	*2*	*1*	*1*
Lane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*
Volume, V (vph)	*73*	*159*	*5*	*33*	*30*	*345*	*5*	*33*	*196*	*2264*	*30*	*45*
% Heavy Vehicles, %HV	*5*	*0*	*5*	*0*	*0*	*0*	*0*	*5*	*5*	*5*	*5*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*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*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Arrival Type, AT	*3*	*3*		*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
Unit Extension, UE	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*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*	*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*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*40*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	SB Only	NS Perm	07	08
Timing	G = *10.0*	G = *0.0*	G = *0.0*	G =	G = *85.0*	G = *10.0*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y =	Y = *5*	Y = *5*	Y = *0*	Y = *0*
Duration of Analysis, T = *0.25*						Cycle Length, C = *120.0*		

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	*81*	*183*		*37*	*33*	*383*	*6*	*37*	*173*	*2516*	*33*	*50*
Lane Group Capacity, c	*111*	*157*		*63*	*158*	*2382*	*117*	*151*	*128*	*2364*	*1508*	*1346*
v/c Ratio, X	*0.73*	*1.17*		*0.59*	*0.21*	*0.16*	*0.05*	*0.25*	*1.35*	*1.06*	*0.02*	*0.04*
Total Green Ratio, g/C	*0.08*	*0.08*		*0.08*	*0.08*	*0.83*	*0.08*	*0.08*	*0.08*	*0.71*	*0.83*	*0.83*
Uniform Delay, d_1	*53.7*	*55.0*		*53.0*	*51.3*	*1.9*	*50.6*	*51.5*	*55.0*	*17.5*	*1.7*	*1.7*
Progression Factor, PF	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*

Delay Calibration, k	0.29	0.50		0.18	0.11	0.11	0.11	0.11	0.50	0.50	0.11	0.11
Incremental Delay, d_2	21.5	123.3		13.5	0.7	0.0	0.2	0.8	200.8	38.4	0.0	0.0
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay	75.2	178.3		66.5	52.0	2.0	50.8	52.3	255.8	55.9	1.7	1.7
Lane Group LOS	E	F		E	D	A	D	D	F	E	A	A
Approach Delay	146.7			10.9			215.2			54.2		
Approach LOS	F			B			F			D		
Intersection Delay	65.4			X_C = 1.10			Intersection LOS			E		

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HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*JH*	Intersection	*LEE SEMINARY RD & BENNETT RD*
Agency or Co.	*RPM Transportation*	Area Type	*All other areas*
Date Performed	*5/26/2009*	Jurisdiction	*Putnam Co*
Time Period	*PM Peak Hour*	Analysis Year	*2033 Proposed w/ Business Park*
		Project ID	*09-0402 Mine Lick Creek - TDOT OC Planning*

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*	*1*	*0*	*1*	*1*	*2*	*1*	*1*	*1*	*2*	*1*	*1*
Lane Group	*L*	*TR*		*L*	*T*	*R*	*L*	*T*	*R*	*L*	*T*	*R*
Volume, V (vph)	*78*	*36*	*7*	*172*	*147*	*1893*	*7*	*33*	*42*	*478*	*43*	*125*
% Heavy Vehicles, %HV	*5*	*0*	*5*	*0*	*0*	*0*	*0*	*5*	*5*	*5*	*5*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*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*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*
Arrival Type, AT	*3*	*3*		*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
Unit Extension, UE	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*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*	*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*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	EW Perm	02	03	04	SB Only	NS Perm	07	08
Timing	G = *33.0*	G = *0.0*	G = *0.0*	G =	G = *32.0*	G = *10.0*	G = *0.0*	G = *0.0*
	Y = *5*	Y = *0*	Y = *0*	Y =	Y = *5*	Y = *5*	Y = *0*	Y = *0*
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	*87*	*48*		*191*	*163*	*2103*	*8*	*37*	*47*	*531*	*48*	*139*
Lane Group Capacity, c	*425*	*674*		*506*	*697*	*2224*	*153*	*201*	*171*	*1187*	*945*	*843*
v/c Ratio, X	*0.20*	*0.07*		*0.38*	*0.23*	*0.95*	*0.05*	*0.18*	*0.27*	*0.45*	*0.05*	*0.16*
Total Green Ratio, g/C	*0.37*	*0.37*		*0.37*	*0.37*	*0.78*	*0.11*	*0.11*	*0.11*	*0.36*	*0.52*	*0.52*
Uniform Delay, d_1	*19.5*	*18.5*		*20.9*	*19.7*	*8.4*	*35.8*	*36.3*	*36.7*	*22.2*	*10.6*	*11.2*
Progression Factor, PF	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*

Delay Calibration, k	0.11	0.11		0.11	0.11	0.46	0.11	0.11	0.11	0.11	0.11	0.11
Incremental Delay, d_2	0.2	0.0		0.5	0.2	9.3	0.1	0.4	0.9	0.3	0.0	0.1
Initial Queue Delay, d_3	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay	19.8	18.6		21.4	19.9	17.7	35.9	36.7	37.6	22.5	10.6	11.3
Lane Group LOS	B	B		C	B	B	D	D	D	C	B	B
Approach Delay	19.3			18.2			37.1			19.5		
Approach LOS	B			B			D			B		
Intersection Delay	19.0			X_C = 0.86			Intersection LOS			B		

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COST ESTIMATE DATA

Project: I-40 Interchange at Mine Lick Creek Rd
Length: N/A Cross Section: Variable

Right-of-Way			
Land, Improvements and Damages (Acres)	54.0±		$588,000.00
Incidentals (8 Tracts)			$26,000.00
Relocation Payments (Residentials)		1	$13,000.00
(Businesses)		0	
(Non-Profit)		0	
Total Right-of-Way Cost			$627,000.00
Utility Relocation			
Reimbursable			$17,000.00
Non-Reimbursable			$200,000.00
Total Adjustment Cost			$217,000.00
Construction Cost			
Clearing and Grubbing			$108,000.00
Earthwork			$1,492,000.00
Pavement Removal			$97,000.00
Drainage			$1,843,000.00
Major Items	$1,507,000.00		
Other Drainage	$101,000.00		
Erosion Control	$235,000.00		
Structures			$1,800,000.00
Railroad Crossing or Separation Structure			$0.00
Paving			$2,537,000.00
Retaining Walls			$0.00
Maintenance of Traffic			$110,000.00
Topsoil			$48,000.00
Seeding			$31,000.00
Sodding			$51,000.00
Signing			$114,000.00
Signalization			$224,000.00
Fence			$221,000.00
Guardrail			$180,000.00
Rip-Rap or Slope Protection			$0.00
Other Const. Items (15%)			$1,328,000.00
Sub-Total Construction			$10,184,000.00
Mobilization			$436,000.00
Sub-Total Construction			$10,620,000.00
10% Engineering and Contingencies			$1,062,000.00
Total Construction Cost			$11,682,000.00
Preliminary Engineering (10%)			$1,062,000.00
TOTAL PROJECT COST			$13,588,000.00

TRANSPORTATION PLANNING REPORT

RIGHT-OF-WAY COST ESTIMATE WORKSHEET

Route No.: Interchange A **County:** Putnam **From:** All **To:**

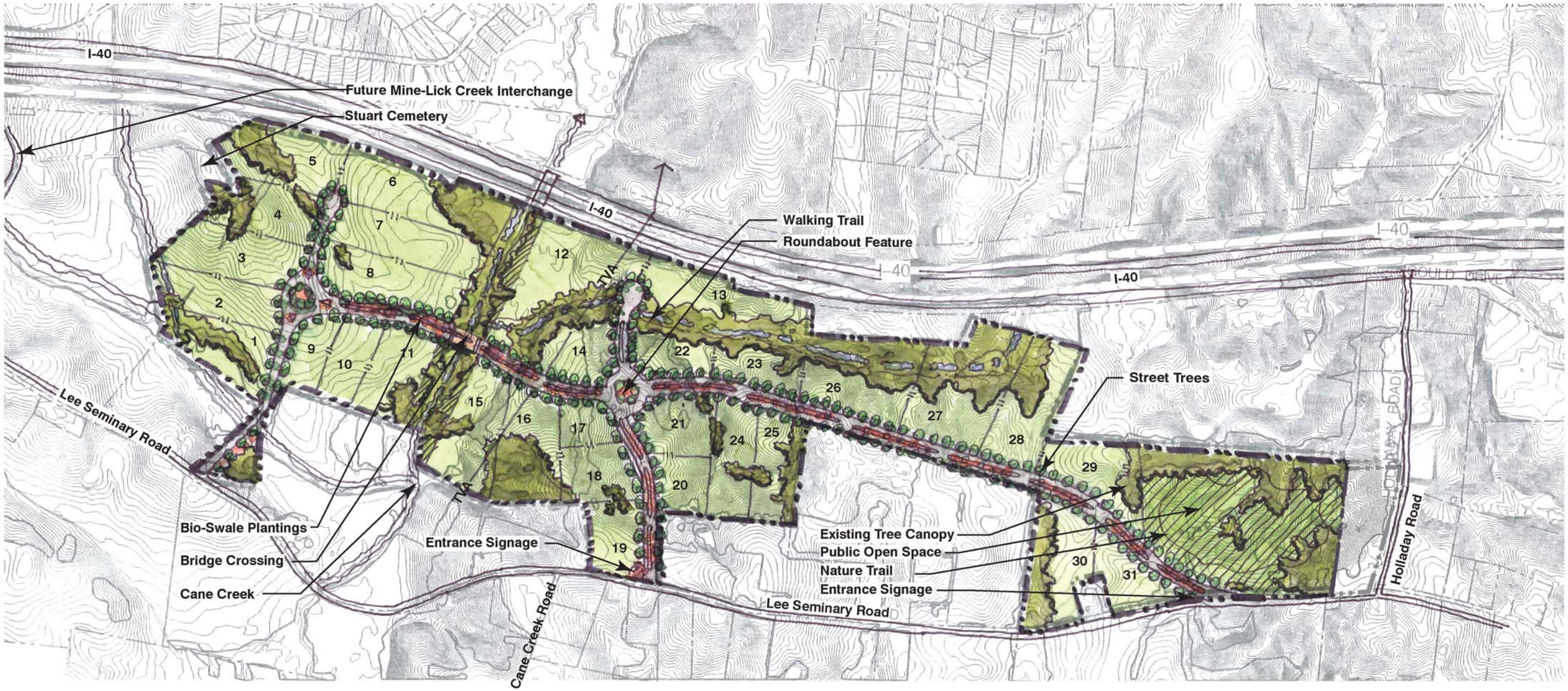
Project	No.	Land Required		Improvements Taken		Damages	Total	Incidentals	Residential Relocations				Bus. & Farm Reloc.		Total ROW
Sections	Tracts	Acres	Cost	Number	Cost	Cost	Cost	Cost	Houses	Cost	Trailers	Cost	Number	Cost	Cost
All	8	54	$335,000	2	$68,000	$8,000	$588,000	$26,000	1	$13,000		$0	0	$0	$627,000
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0	0	$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	$0		$0		$0		$0	$0
			$0				$0	0		$0		$0		$0	$0

Land Cost $6,200 **/ ACRE** **Incidentals** $3,200 **/ Tract**

UTILITY COST ESTIMATE WORKSHEET

ROUTE: Mine Lick Creek int		ALTERNATE		A	SECTION	All		
		(Off) ROW	(On) ROW			Reimb. (Off R/W)	Non-Reimb. (On R/W)	TOTAL
Electric								
	Two Phase	5	15	poles @	$2,400	$12,000	$36,000	$48,000
	Three Phase	0	0	poles @	$2,900	$0	$0	$0
	Service Drop	0	0	poles @	$1,500	$0	$0	$0
	Transformer	0	6	@	$1,600	$0	$9,600	$9,600
	TVA Lines	0	0	tw/poles @	$96,000	$0	$0	$0
	Luminaire	0	0	poles @	$700	$0	$0	$0
Telephone								
	Owned	0	0	poles @	$1,600	$0	$0	$0
	Shared	0	5	poles @	$900	$0	$4,500	$4,500
	Service Drop	0	0	poles @	$1,500	$0	$0	$0
Underground								
	Direct Bury	0	0	feet @	$11	$0	$0	$0
	In Conduit	0	1900	feet @	$24	$0	$45,600	$45,600
	Closures	0	0	@	$250	$0	$0	$0
	Terminals	0	0	@	$400	$0	$0	$0
	Manholes	0	0	@	$4,000	$0	$0	$0
AT&T Toll Cable		0	0	feet @	$80	$0	$0	$0
Water								
	2"	0	0	feet @	$8	$0	$0	$0
	4"	0	0	feet @	$9	$0	$0	$0
	6"	0	0	feet @	$12	$0	$0	$0
	30"	0	600	feet @	$47	$0	$28,200	$28,200
	Hydrants	0	3	@	$2,300	$0	$6,900	$6,900
	Meters	0	6	@	$400	$0	$2,400	$2,400
Sanitary Sewer								
	6"	0	0	feet @	$32	$0	$0	$0
	8"	0	0	feet @	$35	$0	$0	$0
	15"	0	0	feet @	$38	$0	$0	$0
	Manholes	0	0	@	$1,400	$0	$0	$0
Natural Gas								
	2"	0	0	feet @	$13	$0	$0	$0
	4"	0	1260	feet @	$16	$0	$20,160	$20,160
	6"	0	1340	feet @	$24	$0	$32,160	$32,160
	Valves/Tap	0	4	@	$900	$0	$3,600	$3,600
Pipelines (Petroleum)								
	12"	0	0	feet @	$400	$0	$0	$0
Cable TV								
	Owned	0	0	poles @	$1,600	$0	$0	$0
	Shared	5	12	poles @	$900	$4,500	$10,800	$15,300
	Total Estimated Cost					$16,500	$199,920	$216,000

FUNCTIONAL DRAWINGS



Highlands Business Park

Cookeville, Tennessee
February 2009

ILLUSTRATIVE MASTER PLAN

BWSC Barge Waggoner Sumner & Cannon, Inc.

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")

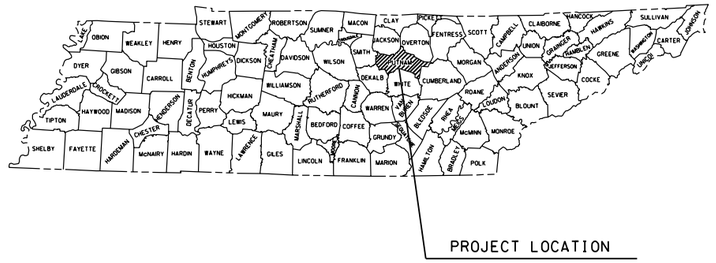
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING AND DEVELOPMENT

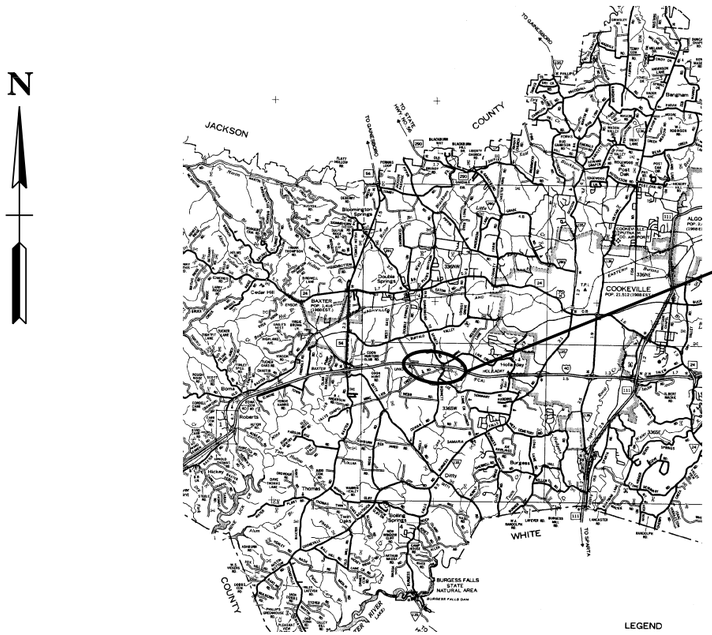
TENN.	YEAR	SHEET NO.
	2000	1
FED. AID PROJ. NO.		
STATE PROJ. NO.		

PUTNAM COUNTY

INTERCHANGE JUSTIFICATION STUDY
MINE LICK CREEK ROAD
AT
INTERSTATE 40

STATE HIGHWAY NO. 265 F.A.H.S. NO. N/A





N.T.S.

APPROVED:

DESIGN DIVISION

DATE:

APPROVED:

COMMISSIONER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED:

DIVISION ADMINISTRATOR DATE

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 ANALYSIS 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

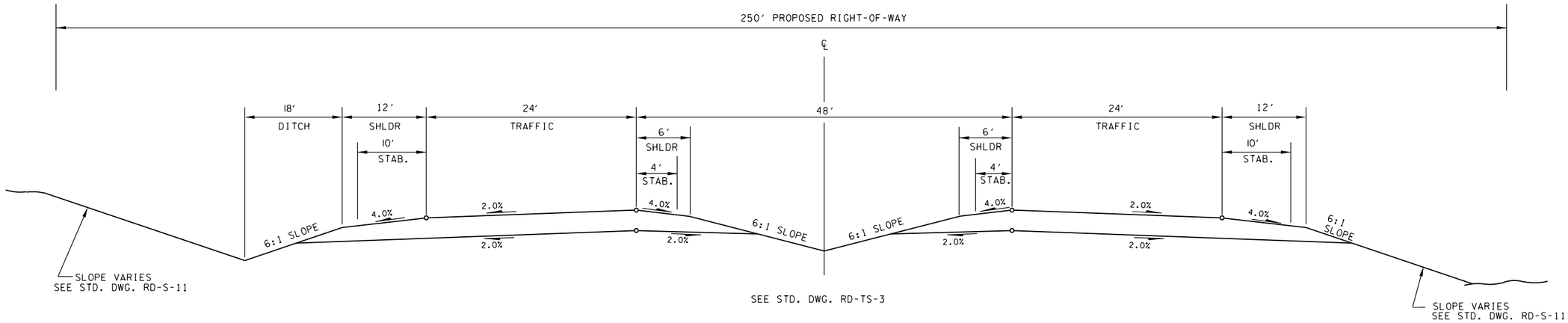
TDOT CIVIL ENGINEERING MANAGER 1 _____

DESIGNED BY NEEL-SCHAFFER, INC.

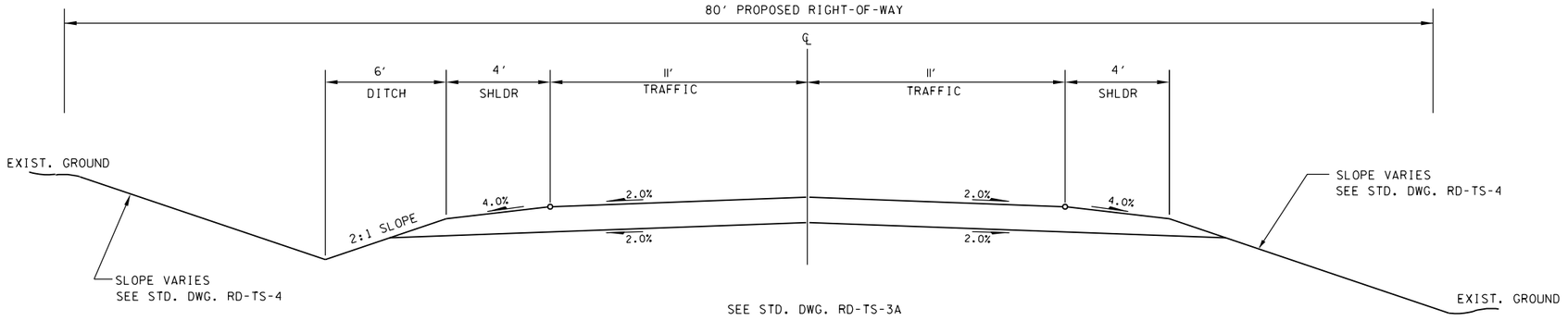
DESIGNER _____ CHECKED BY _____

P.E. NO. _____

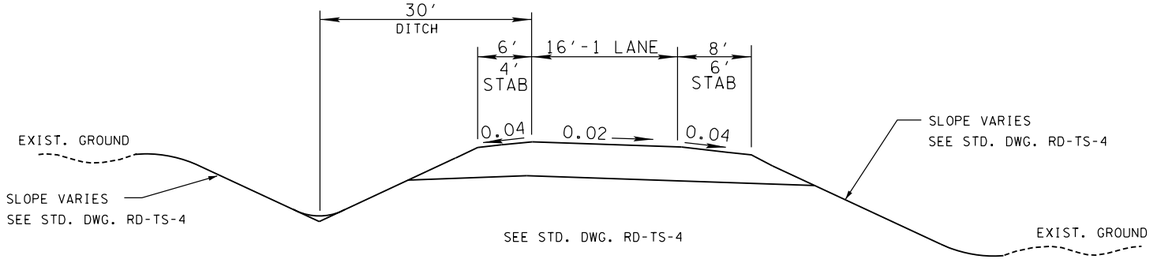
TYPE	YEAR	PROJECT NO.	SHEET NO.
APR	2000		2



TYPICAL TANGENT SECTION
"INTER-CONNECTOR"



TYPICAL TANGENT SECTION
FRONTAGE ROADS



TYPICAL 1 LANE RAMP SECTION

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

0 100 200 300

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

RES
BARN
POND
PROP. R.O.W.
TO US 70
PROP. R.O.W.(CA)
HANKINS CRAWFORD RD.
MINE LICK CREEK RD.
PARK WEST DR.
N
MATCH LINE SEE SHT. NO. 3A
MATCH LINE SEE SHT. NO. 5A
SHED
I-40 WEST BOUND
I-40 EAST BOUND
BENNETT RD.
STEWART CEMETERY RD.
STEWART CEMETERY
MATCH LINE SEE SHT. NO. 6A

0 100 200 300

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

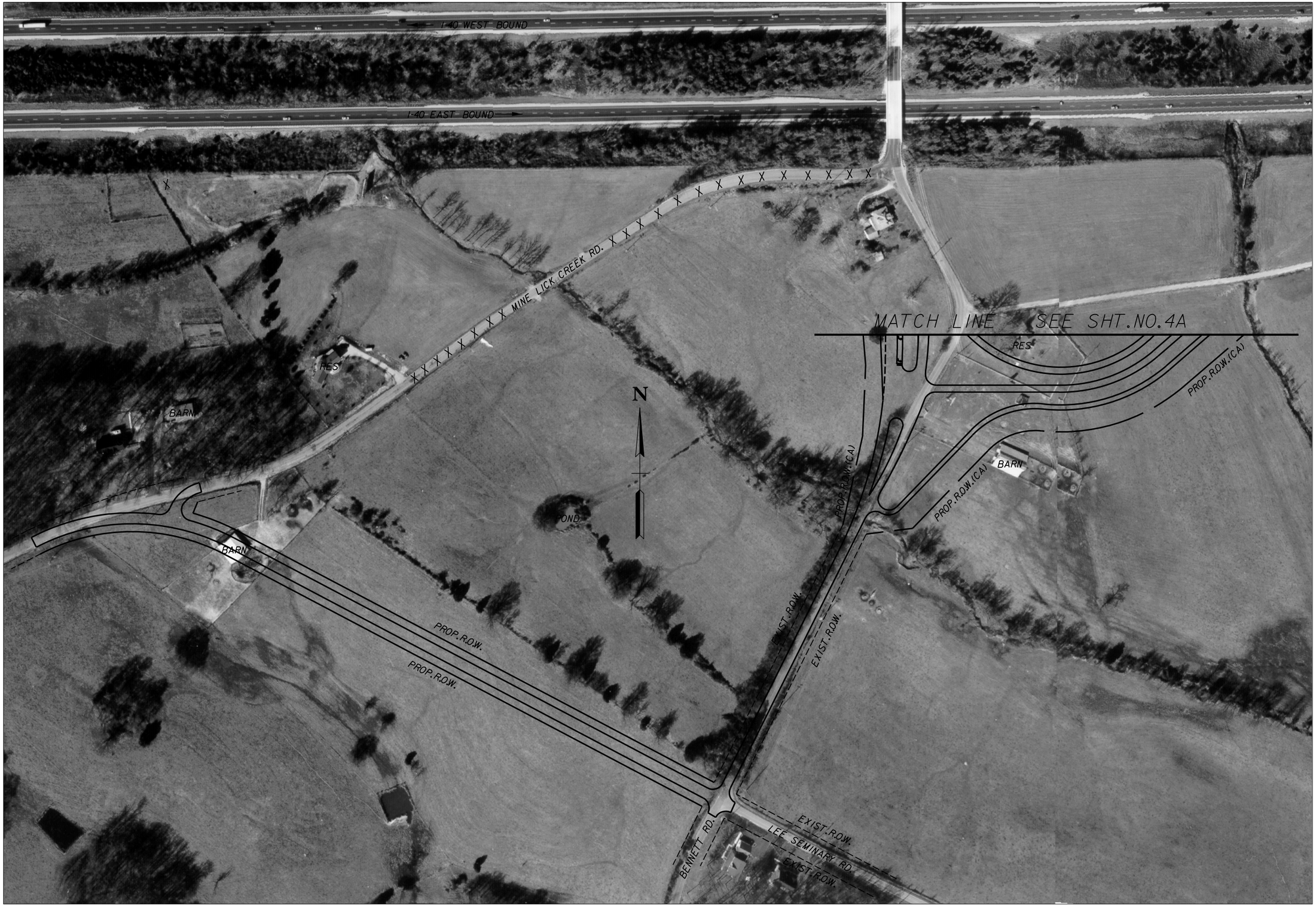
0 100 200 300

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		6A



0 100 200 300

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK RD.

ALTERNATE "A"

TENN.	YEAR	SHEET NO.
	2009	1
FED. AID PROJ. NO.		
STATE PROJ. NO.		

SHEET NO. DESCRIPTION

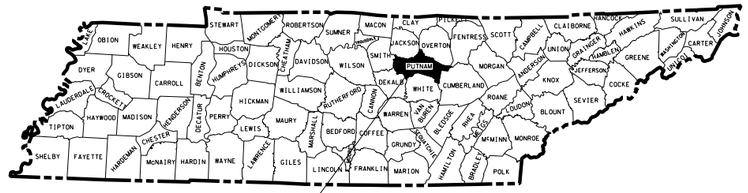
1 ..... TITLE SHEET
2-2B ..... TYPICAL SECTIONS
3-5 ..... PROPOSED LAYOUTS (ALT. "A")

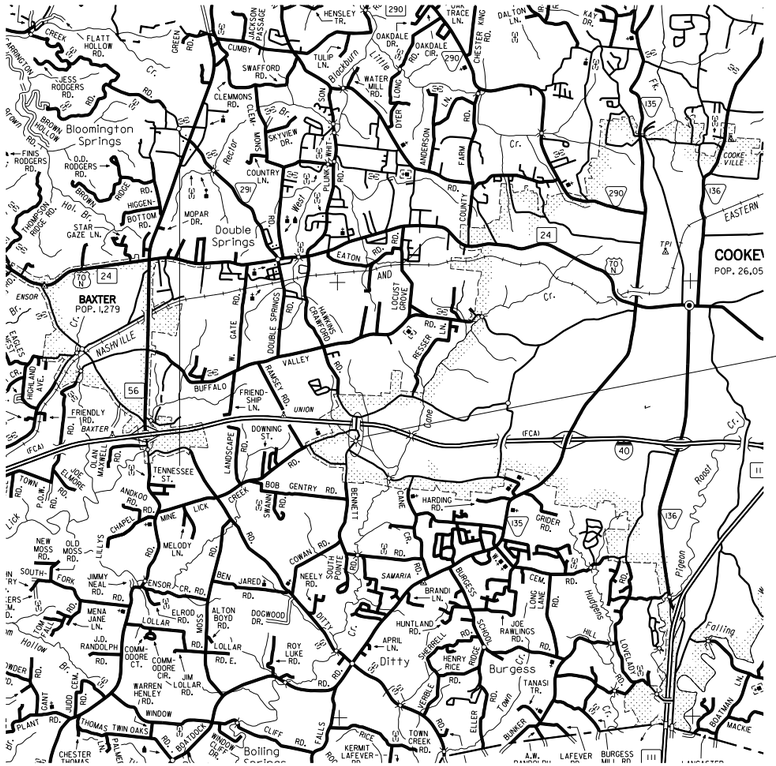
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION

PUTNAM COUNTY

INTERCHANGE JUSTIFICATION STUDY
FROM MINE LICK CREEK ROAD
AT
INTERSTATE 40

STATE HIGHWAY NO. N/A F.A.H.S. NO. N/A





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TDOT C.E. MANAGER 1 _____

DESIGNED BY RPM Transportation Consultants, LLC

DESIGNER _____ CHECKED BY _____

P.E. NO. _____

PIN NO. _____

APPROVED: _____
CHIEF ENGINEER

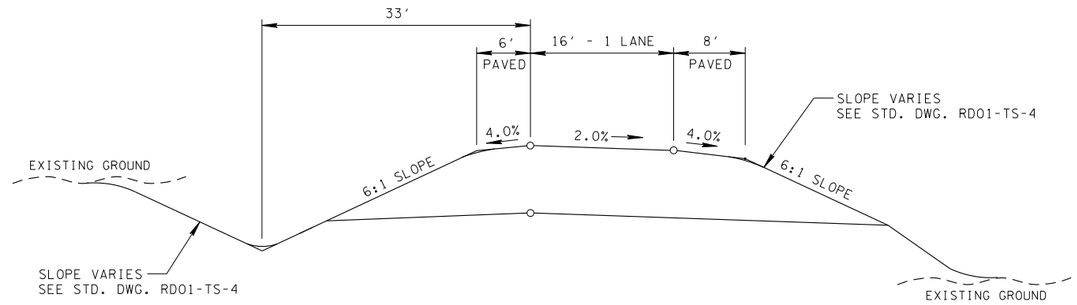
DATE: _____

APPROVED: _____
COMMISSIONER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

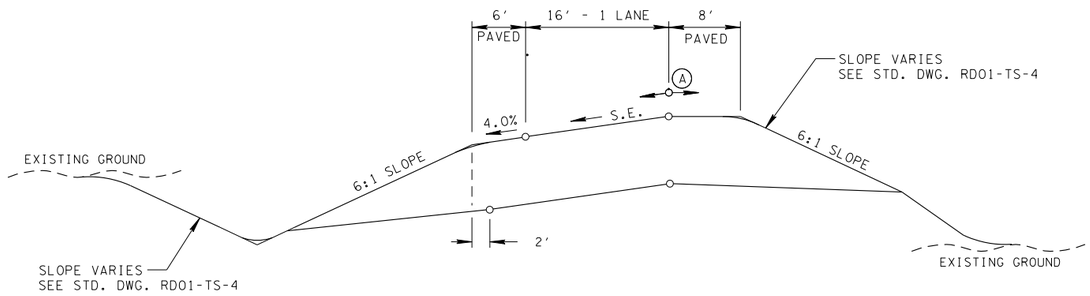
APPROVED: _____ _____
DIVISION ADMINISTRATOR DATE

TYPE	YEAR	COUNTY	SHEET NO.
IJS	2009	PUTNAM	2



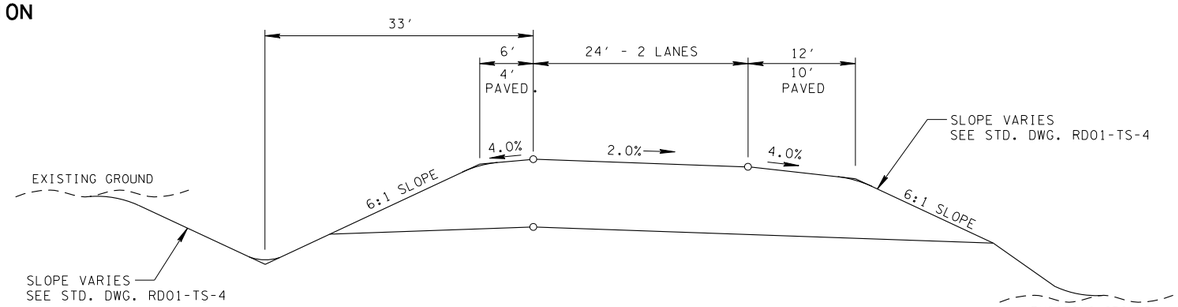
TYPICAL 1 LANE RAMP SECTION

(SEE STD. DWG. RD01-TS-4)



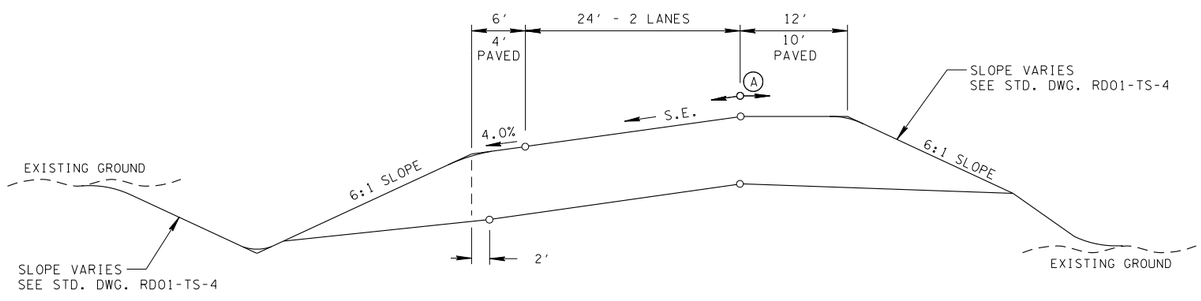
SUPERELEVATED 1 LANE RAMP SECTION

(SEE STD. DWG. RD01-TS-4)



TYPICAL 2 LANE RAMP SECTION

(SEE STD. DWG. RD01-TS-4)



SUPERELEVATED 2 LANE RAMP SECTION

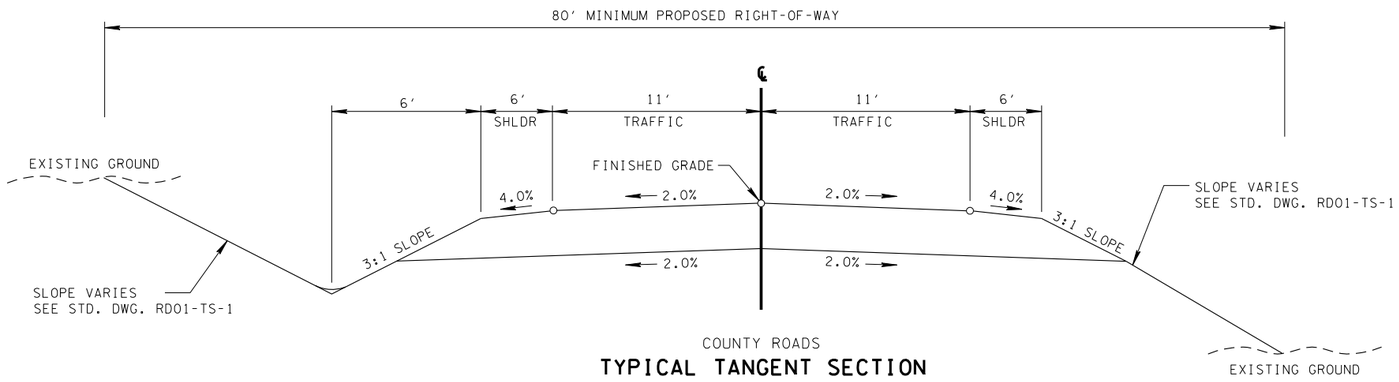
(SEE STD. DWG. RD01-TS-4)

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION STUDY I-40 AT MINE LICK CREEK ROAD

TYPICAL SECTIONS

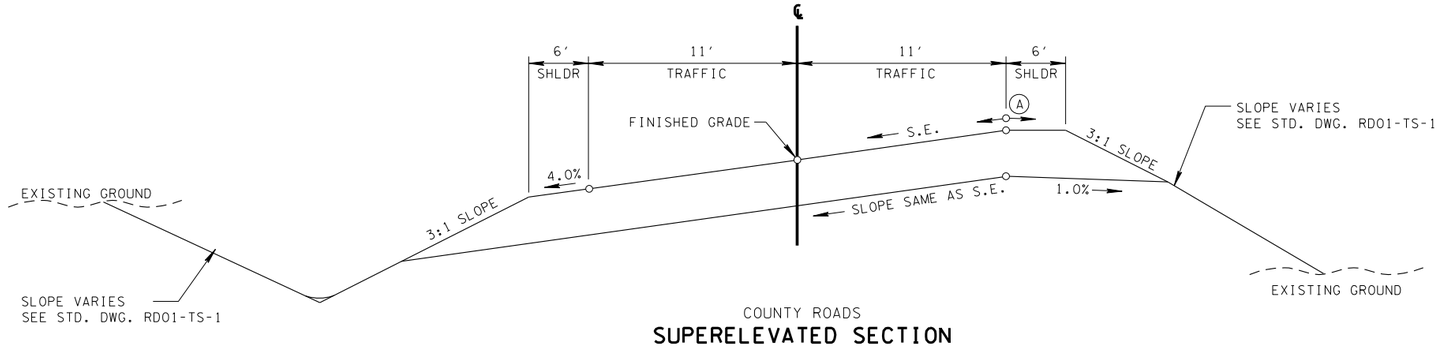
TYPE	YEAR	COUNTY	SHEET NO.
IJS	2009	PUTNAM	2A



COUNTY ROADS

TYPICAL TANGENT SECTION

SEE STD. DWG. RD01-TS-1



COUNTY ROADS

SUPERELEVATED SECTION

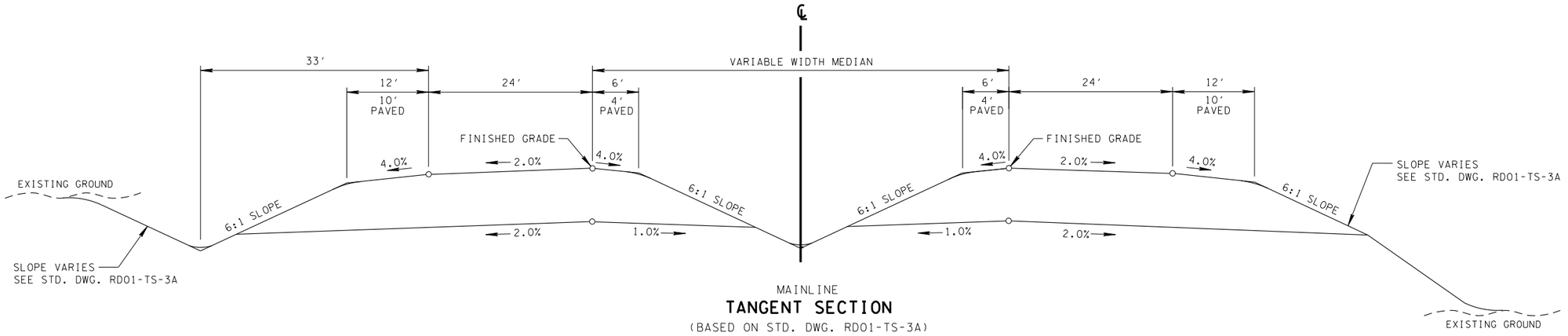
(BASED ON STD. DWG. RD01-TS-1)

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION STUDY I-40 AT MINE LICK CREEK ROAD

TYPICAL SECTIONS

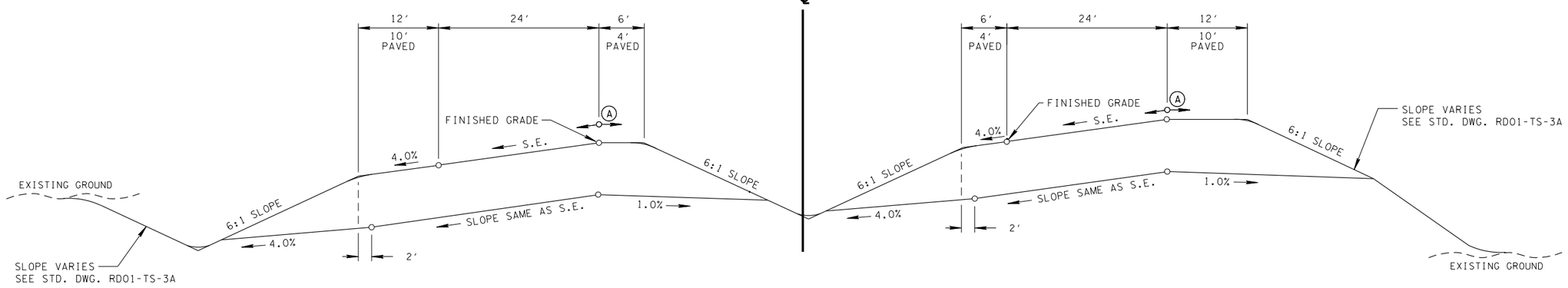
TYPE	YEAR	COUNTY	SHEET NO.
IJS	2009	PUTNAM	2B



MAINLINE

TANGENT SECTION

(BASED ON STD. DWG. RD01-TS-3A)



MAINLINE

SUPERELEVATED SECTION

(BASED ON STD. DWG. RD01-TS-3A)

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION STUDY I-40 AT MINE LICK CREEK ROAD

TYPICAL SECTIONS

TYPE	YEAR	COUNTY	SHEET NO.
IJS	2009	PUTNAM	3

N

BARN

PRES. R.O.W.

PRES. R.O.W.

POND

PROP. R.O.W.

80'

PROP. R.O.W.

HAWKINS CRAWFORD ROAD

XX

PROP. R.O.W. (C.A.) & FENCE

POND

SHED

RES.

SEE SHEET NO. 4

INTERSTATE 40

MATCH LINE

INTERSTATE 40

MINE LICK CREEK ROAD

PROP. R.O.W. (C.A.) & FENCE

BARN

PRES. R.O.W.

PRES. R.O.W.

MATCH LINE

SEE SHEET NO. 5

0 100 200 300

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE
JUSTIFICATION STUDY
I-40 AT MINE
LICK CREEK ROAD

ALTERNATE "A"

TYPE	YEAR	COUNTY	SHEET NO.
IJS	2009	PUTNAM	4

POND

TO BE EXTENDED AS ACCESS CONTROLED HIGHWAY TO S.R. 24 (US 70 N)

MEDIAN TAPERS TO 48' WIDTH

PROP. R.O.W.

PROP. R.O.W.

80'

PROP. R.O.W.

PROP. R.O.W.

PROP. R.O.W. (C.A.) & FENCE

250'

PROP. R.O.W. (C.A.) & FENCE

PROP. R.O.W. (C.A.) & FENCE

300'

PROP. R.O.W. (C.A.) & FENCE

MINE LICK CREEK ROAD

PRES. R.O.W.

PRES. R.O.W.

RES.

N

PROPOSED TRAFFIC SIGNAL

SEE SHEET NO. 3

MATCH LINE

INTERSTATE 40

PROPOSED STRUCTURE

INTERSTATE 40

PROPOSED TRAFFIC SIGNAL

BENNETT ROAD

PROP. R.O.W. (C.A.) & FENCE

STEWART CEMETERY ROAD

PROP. R.O.W. (C.A.) & FENCE

CEMETERY

PRES. R.O.W.

300'

MATCH LINE

SEE SHEET NO. 5

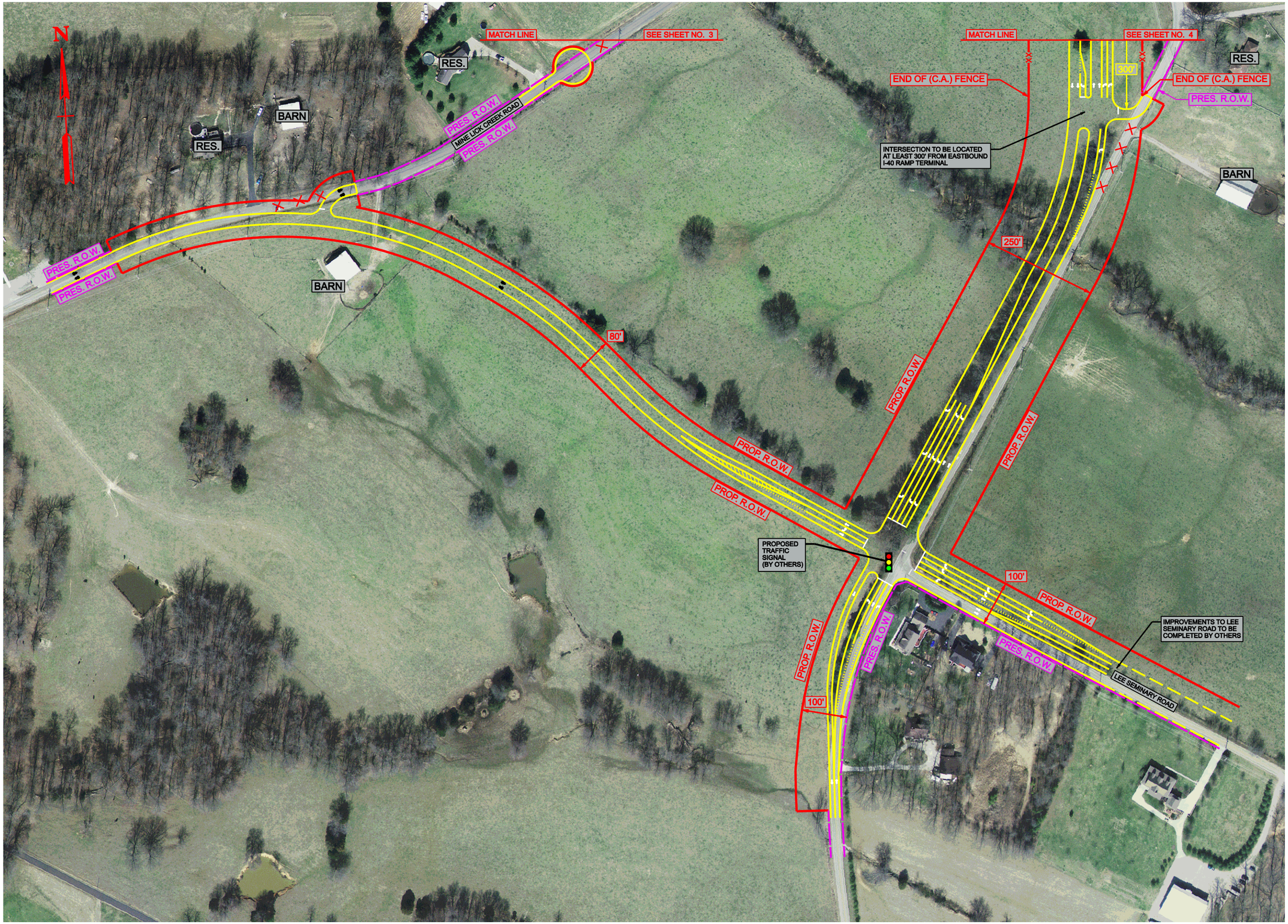
0 100 200 300

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION STUDY I-40 AT MINE LICK CREEK ROAD

ALTERNATE "A"

TYPE	YEAR	COUNTY	SHEET NO.
IJS	2009	PUTNAM	5



0 100 200 300

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

INTERCHANGE JUSTIFICATION STUDY I-40 AT MINE LICK CREEK ROAD

ALTERNATE "A"