



City of Rockville

Comprehensive Transportation  
Review

March 21, 2011

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## Section A Introduction

On October 4, 2004, Rockville’s Mayor and Council adopted the Comprehensive Transportation Review (CTR). This policy applies to new development or redevelopment applications filed on or after September 29, 2004. The CTR lists the transportation requirements for all new development applications. One of the main objectives of these requirements is to ensure that development in Rockville addresses the needs of all transportation users – transit users, motorists, pedestrians, and bicyclists, to the extent appropriate for the land use. In order to meet this objective, the CTR requires developers to provide a Transportation Report that assesses multimodal impacts to a site and requires mitigation measures to alleviate impacts to the transportation system as a result of the new development. Appendix A provides a summary of all CTR requirements.

Because the CTR evaluates the overall transportation system from a comprehensive, multimodal perspective, it is fundamentally linked to the goals in City plans and policies. Transportation goals set forth in the City Master Plan form the basis for the methodology, standards, and impact thresholds outlined in the requirements. Development applicants shall comply with the requirements of the CTR and the standards listed in Table 1 as well as other relevant policies as adopted.

<b>Table 1: Relevant Standards</b>		
<b>City</b>	<b>County</b>	<b>Federal</b>
<ul style="list-style-type: none"> <li>• Adequate Public Facilities Ordinance (APFO)</li> <li>• Bicycle Master Plan</li> <li>• Complete Streets Policy</li> <li>• Comprehensive Master Plan</li> <li>• Guidelines for Neighborhood Traffic Management</li> <li>• Neighborhood Plans</li> <li>• Pedestrian Policies</li> <li>• Sidewalk Prioritization Policy</li> <li>• Standards and Details for Construction</li> <li>• Streetlight Policy</li> <li>• Zoning Ordinance</li> </ul>	<ul style="list-style-type: none"> <li>• Montgomery County Local Area Transportation Review (LATR)</li> <li>• Montgomery County Policy Area Mobility Review Guidelines (PAMR)</li> </ul>	<ul style="list-style-type: none"> <li>• Uniform Federal Accessibility Standards</li> <li>• Leadership in Energy and Environmental Design (LEED) Certification System</li> <li>• Manual on Uniform Traffic Control Devices (MUTCD)</li> <li>• The Institute of Transportation Engineers (ITE) Urban Street Geometric Design Handbook</li> <li>• American Association of State Highway and Transportation Officials Guidelines (AASHTO)</li> </ul>

## Section B

### The Transportation Development Review Process

#### B1. Steps in the Transportation Development Review Process\*

Step 1:	The applicant receives a Scoping Intake Form (Appendix B) and a copy of the CTR from the Traffic and Transportation Division.
Step 2:	The applicant shall submit a Scoping Intake Form to the Traffic and Transportation Division and the Planning Division. Staff will schedule a pre-application meeting (PAM). All site plan, major site plan amendments, project plans, and special exception development applications are required to hold a pre-application area meeting with the community surrounding the proposed development to gain input on the application. This meeting shall occur prior to submitting a final development application and a Transportation Report.
Step 3:	The Traffic and Transportation Division and the Planning Division will hold a pre-application meeting, which all applicants must attend prior to preparing their Transportation Report. At the pre-application meeting, staff and the applicant will discuss the contents of the applicant's Transportation Report. If this discussion does not occur at the pre-application meeting, or if the pre-application meeting was not required, a separate meeting will be arranged.
Step 4:	The Traffic and Transportation Division prepares a Scoping Agreement. This agreement states the required contents of the Transportation Report. If a development generates less than 30 trips, the report shall contain only an introduction and proposed transportation features on site. If a development generates 30 or more trips, (except for Montgomery County Public Schools relocatable classrooms), all components of the Transportation Report are required. Circumventing the threshold by submitting piecemeal development applications is not permitted. If the applicant submits a new Site Plan Application, at the same location, within a five-year period, the applicant will be required to include all trips generated by both applications in a new study.
Step 5:	The Traffic and Transportation Commission may request a preliminary review presentation from the applicant regardless of the number of trips generated by the development.
Step 6:	The applicant provides all methodology and elements of the Transportation Report, such as use of data, assumptions, vehicle and pedestrian trip generation, trip distribution, and mode share to the Traffic and Transportation Division for approval before the draft Transportation Report is submitted.
Step 7:	The applicant submits a Transportation Report to Traffic and Transportation Division for review. The Transportation Report must be in accordance with the Scoping Agreement.

Step 8:	The Traffic and Transportation Division reviews the Transportation Report for compliance with the CTR and requests any necessary revisions from the applicant.
Step 9:	For developments that generate 125 or more total peak hour trips, a public meeting shall be held. The purpose of the meeting will be to present development impacts and solicit comments from the community and from the Traffic and Transportation Commission. The applicant will be required to send written notice to announce the meeting to homeowner and civic association leaders, with assistance from City staff. This meeting will take place as part of the regularly scheduled Traffic and Transportation Commission meetings. The Traffic and Transportation Commission shall provide written comments to staff regarding the development application. Staff will forward the comments to the approving body. If the timing of a development application is such that a meeting would need to be convened prior to the Traffic and Transportation Commission meeting, staff will send out special notifications.
Step 10:	After incorporating any revisions, the applicant submits a completed Transportation Report with the development application to the Traffic and Transportation Division and the Planning Division. The applicant must pay a review fee and submit an electronic and paper copy of the report. Revisions to the Transportation Report, if necessary, must be submitted at least six weeks prior to the scheduled meeting date of the approving body.
Step 11:	Following a final review of the Transportation Report, the Traffic and Transportation Division will provide a memorandum to the Planning Division summarizing the Division's recommendation regarding the development application.
Step 12:	Approving body reviews and takes action on the development application.

\* These steps apply only to projects, site plan applications, and amendments filed after the new CTR resolution is adopted (March 21, 2011). Applications filed before this date but after September 29, 2004 will follow the 2004 CTR version.

## **B2. Special Cases/Amendments**

Once a Transportation Report is approved by the Traffic and Transportation Division, further Transportation Reports are not required except if one or more of the following conditions apply:

- As mentioned in step 4, submitting piecemeal development applications is not permitted, and therefore, new applications and amendments submitted for the same site, within a five-year period from most recent approval, will require a new study including all trips generated by both applications. The new application/amendment will follow the new CTR if filed after March 21, 2011. The new application shall mitigate thresholds as required by the CTR. If the mitigation is not feasible and the

application is denied, the applicant will be allowed to proceed with the original approval or up to the level of development not exceeding the thresholds.

- Other amendments for site plans, approved beyond the five-year period, will be treated as a new project and the applicant will follow the new CTR - if filed after March 21, 2011 - for the additional trips generated by the amendment.

## **Section C**

### **The Transportation Report**

This section describes the required contents of the Transportation Report. Applicants shall provide three copies of the Transportation Report, printed on 8-1/2 x 11 pages, five copies if county or state roads are impacted. All vehicle and pedestrian count data and Critical Lane Volume (CLV) analyses utilized in the report must be included in appendices.

#### **C1. Introduction**

The introduction of the Transportation Report should include the following:

- Map of the area
- Project phasing
- Existing land use
- Proposed land use
- Transit-oriented area (TOA) designation in the Scoping Agreement (Appendix C)
- Hours and description of employment and commercial activity, size of development, and number of units
- Figure in tabular format showing trip generation total with any reductions

#### **C2. Multimodal Analysis**

The report shall include the transportation study area. As shown in Table 2, the transportation study area is defined by new peak hour site trips (as defined under Section C5), before any trips reductions (See Section C7) are applied. The number of intersections to be analyzed may be adjusted based on development-specific features, the overall level of congestion, critical flow paths, the configuration of the roadway system, natural or man-made barriers, and the adjacent existing or proposed land uses. The transportation study area may not be limited to City boundaries.

<b>Table 2: Determining the Transportation Study Area</b>		
<b>New Peak Hour Site Trips</b>	<b>Minimum Number of Intersections to Analyze</b>	<b>Minimum Radius for Transportation Study Area</b>
30 – 124	4	.25 mile
125 – 349	8	.35 mile
350 – 699	12	.45 mile
700 +	16	.50 mile

#### **C3. Existing Conditions**

The following existing conditions within the transportation study area should be included in the Transportation Report and shown in maps, figures, or tables:

- Size and location of land parcel within the city
- General terrain features
- Vehicle and pedestrian counts, including turning movement counts at identified intersections
- Roadway network, including ownership
- Existing peak hour traffic volumes at identified locations
- Existing peak hour turning movement counts at identified intersections
- Existing peak hour critical lane volume summary at identified intersections
- Number of phases and cycle length for the peak hour at identified signalized intersections
- Level of service at identified signalized intersections
- Existing sidewalks
- Missing sidewalks
- Curb ramps
- Street lights
- Signed-shared roadways
- Shared-use paths
- Bicycle lanes
- Results from city pedestrian inventories for all intersections in study area
- Pedestrian crossing times at identified signalized intersections
- Metro stations
- Bus hubs
- Bus and shuttle routes
- Bus and shuttle shelters
- Sidewalk connections to bus shelters/stops
- Amenities and technologies at bus shelters
- Bus and shuttle ridership volumes

The study area roadway network shall be presented in figures scaled appropriately to the size of the site. State and local roadway projects programmed and funded for completion at the time of development occupancy must be included. Lane configuration, types of intersection controls, median openings, irregular vertical and horizontal alignment, and location of access points if they have a direct effect on roadway capacity or traffic flow should be included.

Paper and electronic copies of vehicle and pedestrian counts, not more than three years old, should be provided for all roadways in the transportation study area. If the City does not have recent counts, the applicant shall conduct new counts. The City can request the applicant to fund the collection of counts to be performed by an independent contractor hired by the City. These counts cannot delay a project's review and approval for more than 15 business days.

#### **C4. Background Conditions**

The following background traffic conditions within the transportation study area should be included in the Transportation Report:



- Description of approved development projects without occupancy permit and/or building permit
- Description of annual traffic growth generated solely by land uses outside the transportation study area (i.e., through traffic)
- Total peak hour traffic volumes and critical lane volume figures that include:
  - Approved development projects without occupancy permit and/or building permit
  - Traffic growth from land uses outside the transportation study area
  - Existing peak hour traffic volumes at identified intersections

Annual traffic growth may be calculated either through extrapolation techniques or the use of data obtained from area wide forecasting models. City staff may be able to provide data from previous Transportation Reports, data from area wide travel forecast models, and lists of approved development projects without occupancy permits and/or building permits. The applicant shall obtain lists of approved development projects without occupancy or building permits in Montgomery County and/or the City of Gaithersburg, as needed.

### **C5. Trip Generation**

Trip generation determines the frequency of origins or destinations of trips in each zone by trip purpose, as a function of land uses and household demographics, and other socio-economic factors. The latest editions of the Maryland-National Capital Park and Planning Commission Local Area Transportation Review Guidelines and the Institute of Transportation Engineers trip generation tables will be used as the primary sources of trip generation factors for all land uses as described below. The new peak hour site trips include all the trips generated by the site under development. Credit for existing trips generated by existing occupants of the site will be provided based on the most recent use of the site.

When the peak hour of the generator occurs at a time differing from the peak hour of the adjacent street, site-generated traffic volumes will be computed separately for both the peak-hour of the generator and for the peak-hour of the adjacent street. When there are multiple options to determine the number of trips generated by the development (i.e., square footage, number of employees, number of students, etc.), the option with the highest number of trips should be used. If these options provide similar results, trip generation should be calculated by square footage. This computation of daily traffic generation should also be made and included in the applicant's report.

The Transportation Report should include tables and figures showing existing trips, background trips, site generation trips, and the total trips during peak hour.

### **C6. Trip Distribution and Trip Assignment**

Trip distribution, or the number of trips going from each origin to each destination, should be determined using regional trip tables produced by the Maryland-National Capital Park and Planning Commission in the Local Area Transportation Review Guidelines. Site-generated traffic volumes should also be assigned to the roadway network within the transportation study area using these distribution factors.

Route assignment allocates trips between an origin and destination by a particular mode to a route. Trip assignments should initially be made using “shortest path” methods. Reassignment using multiple routings to balance traffic flows may be used. Figures showing daily and peak hour directional distribution within the transportation study area should be included in the Transportation Report.

## **C7. Trip Reduction**

Some developments may be eligible for a pass-by, modal split, or mixed-use trip reduction. Reductions cannot be used when determining the transportation study area or the required components of the Transportation Report. The following are descriptions of the reductions:

- Pass-by reduction: Pass-by trips are those that would have otherwise traveled on a street adjacent to the development even if the development had not been constructed. For commercial retail development only, the applicant may make reasonable assumptions consistent with guidance provided by ITE.
- Mixed use reduction: Mixed use developments, as defined by the Zoning Ordinance, are eligible for a maximum 10 percent reduction in TOAs and a maximum 5 percent in non-TOAs.

To calculate the net new peak-hour site trips, subtract the pass-by trips, modal split (15%, only for TOAs) and the mixed-use reduction trips from the total peak-hour trips generated by the new site, after providing the credit for existing trips as described under section C5. The net new peak-hour site trips will be applied during the intersection capacity analysis described in the following section. It should be noted that the maximum potential trip reductions and credits, including TDM credit through the Trip Reduction Tool if applicable, is 30% for TOAs and 20% for non-TOAs.

## **C8. Intersection Capacity Analysis**

The following intersection capacity analysis information within the transportation study area should be included in the Transportation Report:

- Figures showing level of service
- Description of lane configuration and number of signal phases
- Figures showing total peak hour critical lane volume summary
- Figures and tables showing peak hour critical lane volume comparison

In Rockville, system capacity is generally governed by the capacity of individual intersections. Levels of service must therefore be determined for all identified intersections in the transportation study area, using the critical lane analysis technique described further in Appendix D. The lane use factors used in the analysis are based on typical conditions. Application of critical lane analysis techniques generally requires professional assistance.

## **C9. Other Studies**

The following studies within the transportation study area may also be required in the Transportation Report:

- Neighborhood impacts
- Average daily traffic
- Traffic calming
- Crashes
- Traffic signals
- Turning lanes
- Interchange capacities
- Vehicle classification study
- Pedestrian/bicycle safety study

The purpose of a traffic signal study will be to determine the need for a traffic signal at access points or other nearby non-signalized locations. This requires a 12-hour turning movement count or estimate for the forecast year including site-related traffic. At access points where a traffic signal already exists, the applicant will be responsible for determining all necessary modifications to the signal due to site-generated traffic so that it operates in a safe and efficient manner.

Exclusive turning lane studies may be necessary to determine the need and adequacy of turning lanes for handling forecasted traffic volumes. For signalized and unsignalized intersections, the length of left turn lane(s), in feet, not including taper, must equal or exceed the equivalent car length for the number of left turns per peak hour per lane, with a minimum turn lane length of 100 feet. The need for right turn lanes may also be reviewed.

## **C10. Proposed On-Site Transportation**

The following is a list of the proposed on-site transportation features to be included in the Transportation Report:

- Discussion of and justification for planned site features that do not comply with city codes, standards, and policies
- Hours of deliveries, pick-ups, and other services
- Number of driveways versus motorized access demand
- Accommodation and circulation plan for largest size vehicles that will access site
- Parking demand versus parking supply
- Internal and abutting roadways:
  - Ownership
  - Road classification
  - Average daily traffic (ADT) volumes
  - Traffic speeds
  - Speed limits

- Motorized and non-motorized access in and out of site and to abutting roadways, including plan view of both sides of roadways. City standards for site access are in Appendix E.
- Transit stations
- Bus stops – easements are required for bus shelter facilities, if not within the public right-of-way
- Sidewalks – sidewalks are required on all of the site’s frontage(s)
- Bikeways – bikeway facilities on the site’s frontage(s) shall comply with the Bikeway Master Plan.
- Curb ramps
- Street lights
- Driveways:
  - Location and design
  - Proximity to entrances, intersections, and other driveways
  - Alignment with medians and driveways across the roadway
  - Traffic control
- Parking lot layout
- Carpool and vanpool spaces
- Long term and short-term bicycle parking spaces
- Location of light poles and illumination
- Fire lanes
- Loading/unloading of goods and persons
- Handicapped facilities
- Storage
- Dumpsters/refuse compactors
- Other service areas
- Truck maneuvering areas
- Signage and pavement markings
- Easements
- Right of way lines
- Landscape buffer areas

### **C11. Mitigation Requirements**

The report shall include the mitigation requirements that apply to the development. As shown in Table 3, mitigation requirements are determined by new peak hour site trips, before trip reductions have been applied. Fulfilling any of the requirements listed in Table 3 does not make an applicant eligible for Montgomery County Development Impact Tax credit.

#### *Transportation Improvement Fee*

Developments generating 30 or more trips are required to pay a Transportation Improvement Fee. The one-time fee is \$1.50 per square foot of gross floor area or \$900 per unit of multi-unit residential development. The fee will be used to implement multimodal improvements throughout the City of Rockville, to provide transportation information and services to

employers and commuters in Rockville, and to monitor employer Trip Reduction Plans to ensure compliance with trip reduction goals. The fee will not be used to increase automobile capacity.

<b>Table 3: Mitigation Requirements</b>	
<b>New Peak Hour Site Trips</b>	<b>Requirement</b>
0 – 29	None
30 – 124	Transportation Improvement Fee Intersection Mitigation if exceeds Intersection Impact Thresholds
125 – 349	Transportation Improvement Fee Intersection Mitigation if exceeds Intersection Impact Thresholds Trip Reduction Plan consistent with Trip Reduction Tool for Office Uses
350 +	Transportation Improvement Fee Intersection Mitigation if exceeds Intersection Impact Thresholds Trip Reduction Plan consistent with Trip Reduction Tool for Office Uses Transportation Improvement Contribution consistent with Multimodal Analysis

*Intersection Mitigation*

Developments that exceed intersection impact thresholds (Table 4), regardless of land use category, will be responsible for mitigating the intersection impact through intersection improvements. Mitigation will be the responsibility of the applicant. For any development activity whose impact is a volume/capacity ratio increase of 0.01 (a full one percent) or more at intersections where the LOS for “background” traffic conditions exceed acceptable congestion thresholds outlined in Tables 5 and 6, new development applications must:

- Mitigate at least half of the impact if their impact is 0.01-0.06.
- Mitigate their impact to 0.03 or less if the impact is greater than 0.06.

<b>Table 4: General Intersection Impact Thresholds</b>
<ol style="list-style-type: none"> <li>1. A deterioration in intersection LOS by one level (0.10 v/c, a full one percent) or greater</li> <li>2. Automobile trips that cause the City’s criteria for acceptable traffic volumes on residential streets to be exceeded, as outlined in the Master Plan</li> <li>3. Contributing significantly toward the need for, or modification of, a traffic signal or other traffic control devices as established in the <u>Manual on Uniform Traffic Control Devices</u> or determined by the Director of Public Works or designee</li> <li>4. Exceeding the capacity of a turn lane as established in the Policy on Geometric Design of Highways and Streets (AASHTO) or determined by the Director of Public Works or designee</li> <li>5. Contradicting principles of proper design and location for driveways, medians and median openings, service drives, and similar facilities</li> <li>6. Any condition creating or aggravating a safety hazard for motorists, pedestrians, or bicyclists</li> </ol>

<b>Table 5: Intersection Impact Thresholds for Non-TOA's</b>		
Road Classification*	Threshold for Volume/Capacity	Corresponding LOS
Primary Residential – Class II (Minor Collector), Secondary Residential	.79	C
Major Arterials (Except where two Major Arterials connect), Minor Arterials, Primary Residential – Class I (Major Collector), Primary Industrial, Secondary Industrial	.89	D
Business District roads, freeway ramps, and for locations where two Major Arterials intersect	.99	E

*\*At intersections where two or more roads with different road classifications meet, the LOS threshold will be established based on the higher roadway classification (the classification where more congestion is acceptable).*

<b>Table 6: Intersection Impact Thresholds for TOA's</b>		
Road Classification*	Threshold for Volume/Capacity	Corresponding LOS
Primary Residential – Class II (Minor Collector), Secondary Residential	.89	D
Major Arterials, Minor Arterials, Primary Residential – Class I (Major Collector), Primary Industrial, Business District and Secondary Industrial	.99	E

*\*At intersections where two or more roads with different road classifications meet, the LOS threshold will be established based on the higher roadway classification.*

### *Trip Reduction Plan*

Office use developments generating 125 or more trips will be required to prepare a Trip Reduction Plan consistent with Rockville's trip reduction tool. The goal of the Trip Reduction Plan is to reduce single-occupancy vehicle usage and increase biking, walking, ridesharing, use of transit, and travel outside of the peak hours. The Trip Reduction Tool is a web-based application that takes applicants through a series of questions about the development site's availability of transit, land use mix, density, and pedestrian accessibility to determine a trip reduction range and a list of trip reduction strategies. Based on the answers to these questions, point values will be assigned to a list of trip reduction strategies. Applicants will select preferred strategies so that the total point value equals a minimum of 80 points. Applicants developing in transit-oriented areas will automatically receive ten points toward their total score. After the site is fully occupied, the applicant shall perform annual traffic counts for a ten-year period until the site meets its trip reduction range for three consecutive years.

The applicant's Trip Reduction Plan shall include the following elements:

- Description of trip reduction strategies to be implemented
- Trip reduction goal
- Applicant commitment to do annual traffic counts until trip reduction goal is met for three consecutive years
- Applicant commitment to provide annual reports to the Traffic and Transportation Division summarizing how the applicant is implemented the strategies for ten years
- Budgetary minimum requirements for the strategies proportional to development's impact, if required
- Penalties associated with not reaching trip reduction goals
- "Summary of Results" page from trip reduction tool

#### *Transportation Improvement Contribution*

Developments generating 350 or more trips will be required to provide a Transportation Improvement Contribution. The goal of the Transportation Improvement Contribution is to correct any multimodal connectivity and accessibility gaps within, through, and outside the development site. The multimodal analysis in the Transportation Report will help determine the accessibility and connectivity gaps. Typically the contribution will consist of an improvement to be funded and constructed by the applicant, as listed in the development conditions of approval. In some circumstances, the applicant will provide a monetary contribution to the City to construct the improvement, as approved by the Director of Public Works. The contribution will be proportional to the development's impact. Transportation improvements or intersection mitigations outside the City of Rockville may require coordination with other jurisdictions. Approval is required from other jurisdictions six weeks prior to the scheduled meeting date of the Rockville approving body for the development application.

#### **C12. Attachments**

The following is a list of attachments to be included in the Transportation Report:

- Scoping Agreement
- Signal warrant analysis
- Crash data analysis
- Sight distance analysis
- Background traffic by project
- Critical lane volume worksheets by intersections
- Vehicle, pedestrian and bicycle counts
- Yearly growth from existing traffic
- Electronic version of report including counts conducted for the study

## Appendix A: Summary of Comprehensive Transportation Review

Requirements	New Peak Hour Site Trips			
	0-29	30 - 124	125 - 349	350 +
<b>Transportation Development Review Process – Key Steps</b>				
Scoping Intake Form	X	X	X	X
Future Applications Agreement	X	X	X	X
Pre-application Meeting	X	X	X	X
Pre-application Area Meeting	X	X	X	X
Scoping Agreement	X	X	X	X
Traffic and Transportation Commission Meeting			X	X
<b>Transportation Report</b>				
Introduction	X	X	X	X
Multimodal Analysis		X	X	X
Existing Conditions		X	X	X
Background Conditions		X	X	X
Trip Generation		X	X	X
Intersection Capacity Analysis		X	X	X
Other Studies		X	X	X
Proposed On-Site Transportation	X	X	X	X
Mitigation Requirements		X	X	X
Attachments	X	X	X	X
<b>Fees</b>				
CTR Review Fee	X	X	X	X
Transportation Improvement Fee		X	X	X
Intersection Mitigation if exceeds Intersection Impact Thresholds		X	X	X
Trip Reduction Plan consistent with Trip Reduction Tool for Office Use			X	X
Transportation Improvement Contribution consistent with Multimodal Analysis				X



## Appendix B: Scoping Intake Form

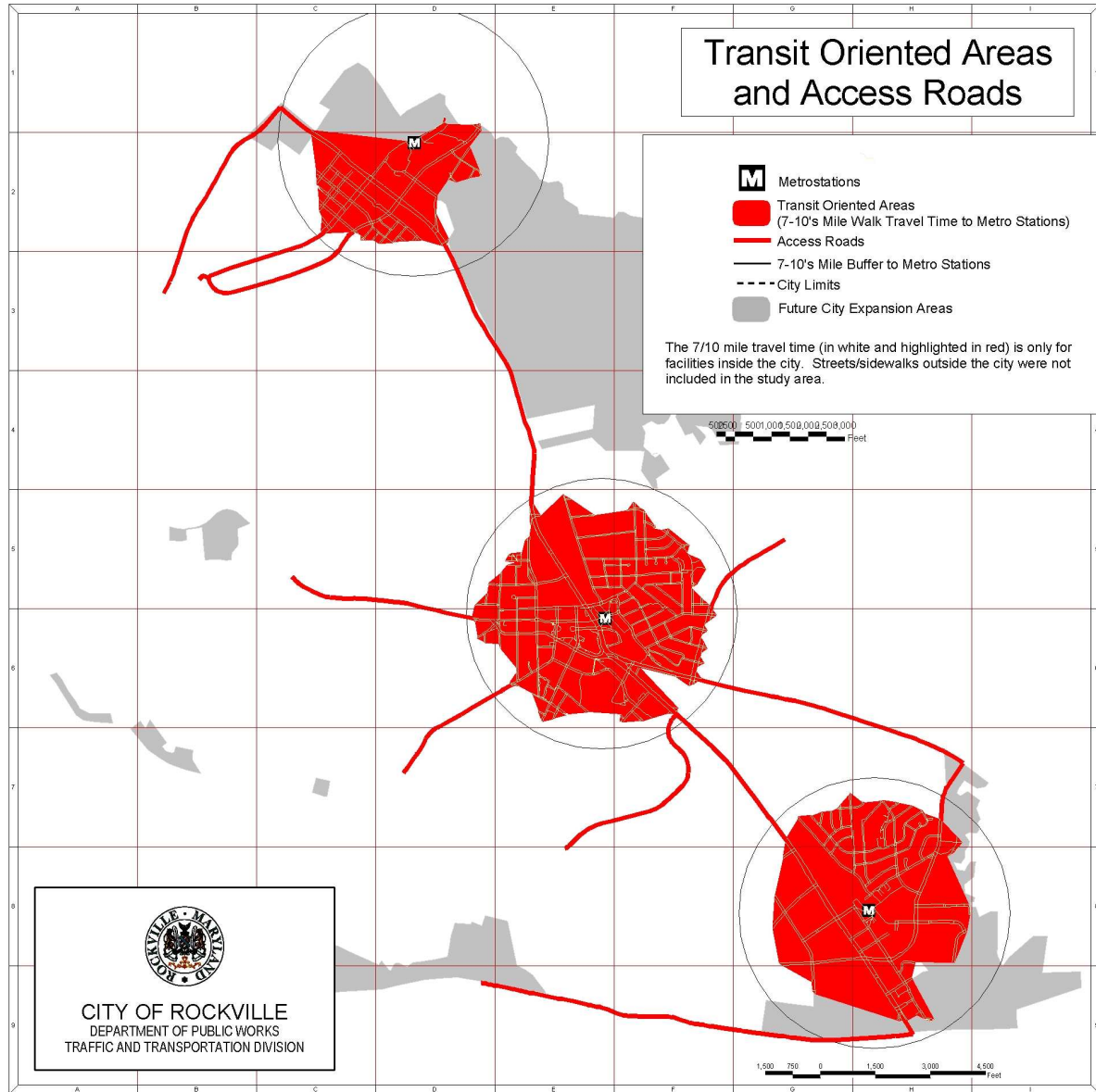


City of Rockville

### Comprehensive Transportation Review Scoping Intake Form

Project name:				
Permit number, if available:				
Property address:				
Contact person:				
Contact phone number:				
Contact e-mail address:				
Existing and proposed land use density:	Use	Square Footage / Dwelling Units		
Trip generation:  Land use code:  ITE or LATR:	Peak Hour Site Trips			
	Peak Period	In	Out	Total
	AM			
	PM			
	SAT			
Proposed study area, including boundaries and intersections:				
Proposed access points:				
Projected build out date:				
Statement of operations:				

# Appendix C: Map of Transit Oriented Areas



**Appendix D: Intersection Capacity Analysis—Critical Lane Volume (CLV) Method**

This Appendix describes the methodology used by the City of Rockville to analyze the capacity of intersections.<sup>1</sup> This Appendix should be sufficiently descriptive to enable the applicant to utilize the CLV method at both signalized and unsignalized intersections within the study area, as per City standards. For the latter, a two-phase operation with a 90 second cycle should be assumed. The CLV method will be appropriate for most intersection configurations and can be easily varied for special situations or unusual conditions. This method applies to isolated intersections or any other location where the operation is not radically affected by adjacent traffic signals. Conversely, modification to this procedure or use of methodology specific to arterial streets is necessary if the intersection operation is affected by the development. Any variations from the procedures outlined below must be approved by the Chief of Traffic and Transportation Division and properly documented in the applicant’s Transportation Report.

- Step 1. Determine/Collect the following information
  - a. Intersection Control Type
  - b. Cycle Length (Assume 90 seconds for stop sign control)
  - c. Signal Phasing (Assume 2 phases for stop sign control), noting the following features: right turn on red, split phasing, exclusive movements, total number of phases
  - d. Turning Movement Volumes
  - e. Intersection Geometries
  - f. Note the following features: free-flow right lanes

Step 2. Determine intersection capacity based on the following table:

<b>Intersection Capacity (100% of capacity)</b>			
<b>Cycle Length (seconds)</b>	<b>Number of Phases</b>		
	<b>2</b>	<b>3</b>	<b>4 or more</b>
89 or less	1500	1400	1300
90 – 119	1600	1500	1400
120 – 149	1650	1600	1500
150 or more	1700	1650	1550

Step 3. Determine the left turn movement equivalent: This equivalent is use in conjunction with through movements for shared lanes or in comparison to through movements for split phasing. Left turns as opposing movements are calculated in Step 6.

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<sup>1</sup> A technical description of the critical lane volume (CLV) method was introduced in the January 1971 issue of *Traffic Engineering*. Since its introduction, the CLV method has evolved into a more sophisticated intersection capacity analysis. Different jurisdictions have adopted the CLV method with minor modifications. Although different versions of the CLV method have been developed, the same basic concepts have been embraced.

<b>Shared Left Turn Lane</b>	
<b>Opposing Volume (Through+Right)</b>	<b>Lane Use Factor</b>
<199	1.10
200 – 599	2.00
600 – 799	3.00
800 – 999	4.00
> 999	5.00

<b>Exclusive Left Turn Lane</b>	
<b>Number of Lanes</b>	<b>Lane Use Factor</b>
1	1.10
2	0.60
3	0.40

Step 4. Determine the right turn movement equivalent

a. Free-Flow Right Turns

A free-flow right turn is one that is not controlled by the traffic signal or stop sign. Normally the movement is isolated by a channelizing island and controlled by a yield sign. If the right turn movement is serviced by an exclusive right turn lane of sufficient length that right turning vehicles are not part of the queue of through vehicles, the right turning volumes can be excluded from the critical lane analysis. Documented data or evaluation of the intersection can be used to combine a sufficient number (percent) of the right turns with the through traffic to reflect actual peak hour operations. In the absence of such knowledge a queuing analysis could be done. As a rule-of-thumb 150 feet of exclusive right turn lane will permit excluding all right turns; less than 50 feet will require that all rights be included. Distances within that range suggest that a portion of the right turn volume be included.

b. Exclusive Right Turn Lanes

Where the right lane is devoted to the exclusive use of right turn vehicles, a maximum lane volume should be computed separately for through movements and right turn movements. If a right turn phase overlap is provided with a left turn phase on the cross street, subtract the overlapping left turn volume from the right turn volume. The highest of the through or right turn lane volumes should be added to the opposing left turn volume, except where significant right turns on red occur.

c. Right Turn on Red (RTOR)

The number of vehicles that can take advantage of the RTOR feature vary greatly based on site and traffic characteristics. At higher volume intersections, as the level of service (LOS) diminishes, few gaps are generally available for

RTOR. Unless observations of the RTOR operations support excluding some right turns from the critical lane analysis, this feature will normally not be considered.

<b>Right Turn Lane Use Factor</b>	
<b>Right Turn</b>	<b>Lane Use Factor</b>
Shared Lane	1.00
Free-Flow	Zero
Exclusive	Right Turns - Overlapping Left Turns
Right Turn on Red	Case-by-case determination

Step 5. Determine the through movement equivalent: On multi-lane approaches with no separate left turn lane, the left turn volume will be adjusted using the lane factor (shared lane) of step 3. When the adjusted left turn volume is greater than the remaining volume being included in the analysis, the left most lane will be considered an exclusive left turn lane. The analysis will proceed with that assumption. For other cases, the resulting left turn volume will be added to the rest of the approach volume and the appropriate through lane use factor applied to the total. Similar consideration should be given to approaches with no separate right turn lane.

<b>Through Lane Use Factor</b>	
<b>Number of Lanes</b>	<b>Lane Use Factor</b>
1	1.00
2	0.53
3	0.37
4	0.30
5	0.25

Step 6. Determine the opposing movement equivalent: This step is not necessary for intersection approaches operating under split phasing. A shared left turn lane should be counted as one lane in addition to any other exclusive left turn lane(s).

<b>Opposing Left Turn Lane Use Factor</b>	
<b>Number of Left Turn Lanes</b>	<b>Lane Use Factor</b>
Split Phase Operation	Zero
1	1.10
2	0.60
3	0.40

Step 7. Determine the approach CLV by adding the highest of the through movement equivalent (Step 5) or the right turns minus overlapping left turns (Step 4) plus opposing

movement equivalent (Step 6) unless the approach operates under a split phase. If the approach operates under split phase, select the highest left, right or movement equivalent (Steps 3, 4, and 5, respectively).

Step 8. Determine the East-West CLV by selecting the highest approach CLV (Step 7) of the two approaches unless they operate under a split phase. If the East and West approaches operated under split phase, add the two approach CLVs.

Step 9. Determine the North-South CLV by selecting the highest approach CLV of the two approaches unless they operate under a split phase. If the North and South approaches operated under split phase, add the two approach CLVs

Step 10. Determine the intersection CLV by adding the East-West CLV (Step 8) and North-South CLV (Step 9).

Step 11. Determine the intersection volume/capacity (V/C) by dividing the intersection CLV (step 10) by the intersection capacity (step 2).

Step 12. Determine the intersection level of service (LOS) by comparing the intersection V/C obtained in Step 11 to the following table:

<b>Level of Service (LOS)</b>	
<b>LOS</b>	<b>Range (% of capacity)</b>
A	Less than 59%
B	60% to 69%
C	70% to 79%
D	80% to 89%
E	90% to 99%
F	Greater than 100%

## Appendix E: Site Access Summary

For a detailed discussion of the principles in this Appendix, please refer to the latest edition of *Transportation and Land Development* by Vergil G. Stover and Frank J. Koepke; Institute of Transportation Engineers.

### 1. Access Location

- a. Pedestrian and bicycle access must comply with the standards outlined in the City's Pedestrian Policies, the Sidewalk Prioritization Policy, the Complete Streets Policy, and the Bicycle Master Plan.
- b. Driveways should not be situated within the functional boundary of at-grade intersections. This boundary would include the longitudinal limits of auxiliary lanes (AASHTO 1, p.793, 1994; p.841, 1990;p.888, 1984).
- c. Access and circulation design of the site must be designed so as to provide good access to the site from abutting roadway networks. Layout of the buildings develops from a good access and circulation plan. Footprint of the building depends on the access circulation plan.
- d. Minimum Corner Clearance: *Transportation and Land Development*, Figure 6-18: Definition of Marginal Corner Clearance, pages 6-26.
- e. Median Corner Clearance: *Transportation and Land Development*, Figure 6-19: Definition of Marginal Corner Clearance, pages 6-26.
- f. Upstream Functional Intersection Area: *Transportation and Land Development*, Figure 5-20, Upstream Functional Intersection Area, pages 5-42.

### 2. Access Design

- a. Pedestrian and bicycle access design must comply with the standards outlined in the City's Pedestrian Policies, the Sidewalk Prioritization Policy, the Complete Streets Policy, and the Bicycle Master Plan.
- b. Driveway apron and street cut are the two basic access design types. Street cuts should be used whenever the access location coincides with two intersecting streets. For all other locations, the appropriate Driveway Apron Design Standard should be selected. For reference, see the City of Rockville's *Standards and Details for Construction*.
- c. Control design (e.g.; yield, stop, traffic signal) must conform to MUTCD.
- d. For sight distance, minimum requirements as established by AASTHO must be applied through the design process. Except for single-family dwellings, the developer must present a Sight Distance Certification form with the detail application.
- e. Adequate throat distance must be provided to allow for queuing of outbound vehicles and proper transition of inbound vehicles.
- f. The adjacent road network may not be utilized for site circulation.
- g. Visibility and visual cues should be provided to identify access points