

County Council Of Howard County, Maryland

2017 Legislative Session

Legislative Day No. ~~13~~ 14

Resolution No. 138 -2017

Introduced by: The Chairperson at the request of the County Executive

A RESOLUTION adopting a comprehensive revision of Volume III (Roads and Bridges) of the Design Manual to revise the criteria and standards for the design of road systems in Howard County; repealing a previously adopted version of Volume III; and generally related to Volume III of the Design Manual.

Introduced and read first time November 6, 2017.

By order Jessica Feldmark
Jessica Feldmark, Administrator

Read for a second time at a public hearing on November 20, 2017.

By order Jessica Feldmark
Jessica Feldmark, Administrator

This Resolution was read the third time and was Adopted , Adopted with amendments , Failed , Withdrawn , by the County Council on December 4, 2017.

Certified By Jessica Feldmark
Jessica Feldmark, Administrator

NOTE: [[text in brackets]] indicates deletions from existing law; TEXT IN SMALL CAPITALS indicates additions to existing law; Strike-out indicates material deleted by amendment; Underlining indicates material added by amendment.

1 **WHEREAS**, in accordance with Section 18.210 of the Howard County Code, the
2 Design Manual sets forth Howard County’s technical standards for the design and
3 construction of roads and utilities in Howard County; and
4

5 **WHEREAS**, the last comprehensive revision of Volume III of the Design Manual
6 occurred in 2006 with the passage of Council Resolution No. 136-2006; and
7

8 **WHEREAS**, since the comprehensive revision, there have been amendments to
9 Volume III as passed by Council Resolution No. 1-2009 and Council Resolution No. 97-
10 2010; and
11

12 **WHEREAS**, the Director of Public Works has proposed a revision of Volume III
13 (Roads and Bridges) of the Design Manual, attached hereto and incorporated herein; and
14

15 **WHEREAS**, for convenience of the Council and the public, the Manual attached
16 shows new language in blue (or gray) and deleted text stricken; and
17

18 **WHEREAS**, the proposed revision was considered by the Public Works Board at
19 its public hearing on June 13, 2017; and
20

21 **WHEREAS**, the proposed revision was approved by the Public Works Board on
22 August 8, 2017; and
23

24 **WHEREAS**, the proposed revision incorporates previously passed amendments,
25 mechanically stabilized earth wall criteria, and American Association of State, Highway
26 and Transportation (“AASHTO”) updates; and
27

28 **WHEREAS**, the proposed revision does not incorporate design criteria for
29 Complete Streets as the Office of Transportation is currently working on such criteria and
30 will put forth a separate amendment.
31

1 **NOW, THEREFORE, BE IT RESOLVED** by the County Council of Howard
2 County, Maryland this 4th day of December, 2017 that it repeals the version of
3 Volume III (Roads and Bridges) of the Design Manual adopted pursuant to Council
4 Resolution No. 136-2006, and amended by Council Resolution No. 1-2009 and Council
5 Resolution No. 97-2010, and adopts new Volume III (Roads and Bridges) attached hereto
6 and incorporated herein.

7
8 **AND BE IT FURTHER RESOLVED** by the County Council of Howard
9 County, Maryland that the Department of Public Works is authorized to publish the
10 Design Manual Volume III, to remove strikethroughs and to change the font color of the
11 added language in order to produce a final version of the Manual that accurately reflects
12 the legislative action of the Council in this Resolution, and to correct obvious errors in
13 section references, capitalization, spelling, grammar, headings and similar matters.

Amendment 1 to Council Resolution No. 138-2017

BY: Chairperson at the request
of the County Executive

Legislative Day No. 15
Date: December 4, 2017

Amendment No. 1

(This amendment corrects the name of a chapter to be consistent with changes made in Council Resolution No. 97-2010. CR 97-2010 renamed Chapter 4 to be Adequate Transportation Facilities Test Evaluation Requirements.)

- 1 In the Design Manual Volume III, Roads and Bridges, attached to the Resolution as filed, with
2 regard to the name of Chapter 4, strike “Adequate Road Facilities Test Evaluation
3 Requirements” and substitute “ADEQUATE TRANSPORTATION FACILITIES TEST EVALUATION
4 REQUIREMENTS” in the following instances:
- 5 1. In the Table of Contents;
 - 6 2. On the page immediately following page 3-61;
 - 7 3. In the header included on every page of Chapter 4; and
 - 8 4. In any other instance where Council Resolution No. 97-2010 changed the title of Chapter 4 to
9 “Adequate Transportation Facilities Test Evaluation Requirements”.
- 10

ADOPTED 12/4/17
FAILED _____
SIGNATURE Jessica Feldman

HOWARD COUNTY DESIGN MANUAL

VOLUME III

ROADS AND BRIDGES

- CHAPTER 1 INTRODUCTION AND GENERAL INFORMATION**
- CHAPTER 2 DESIGN OF ROADS**
- CHAPTER 3 DESIGN OF BRIDGES, RETAINING WALLS AND SMALL STRUCTURES**
- CHAPTER 4 ADEQUATE ROAD FACILITIES TEST EVALUTION REQUIREMENTS**
- CHAPTER 5 TRAFFIC STUDIES**



CHAPTER 4

**ADEQUATE ROAD FACILITIES TEST
EVALUATION REQUIREMENTS**

**CHAPTER 4
ADEQUATE ROAD FACILITIES TEST EVALUATION REQUIREMENTS**

		<u>PAGE NO.</u>
4.1	<u>PURPOSE</u>	4-1
4.2	<u>REQUIREMENTS</u>	4-1
	A. Projects Requiring Evaluation/Traffic Study Outside of the Downtown Columbia Area	4-1
	B. Level of Service	4-1
	C. Study Area	4-2
4.3	<u>TRAFFIC VOLUMES</u>	4-2
	A. Existing Traffic Volumes	4-2
	B. Projected Site-Generated Traffic Volumes	4-2
	C. Projected Background Development	4-3
4.4	<u>ROADWAY CONDITIONS</u>	4-3
	A. Existing Roadway Conditions	4-3
	B. Proposed Roadway Conditions	4-3
	C. Proposed Capital Program Improvements	4-4
4.5	<u>GENERAL COUNTY MITIGATION REQUIREMENTS</u>	4-4
	A. Project Schedule Deferment	4-4
	B. Project Scope Reduction	4-4
	C. Roadway/Intersection Mitigation Plan	4-4
4.6	<u>TRANSITIONAL REQUIREMENTS</u>	4-6
4.7	<u>EXEMPTIONS</u>	4-6
	A. Exempt Non-Residential Projects	4-6
	B. Exempt Residential Projects	4-7
4.8	<u>APPROVAL REQUIREMENTS</u>	4-7
	A. Subdivision Approval	4-7
	B. Site Development Plan	4-8
4.9	<u>REQUIREMENTS – DOWNTOWN COLUMBIA</u>	4-8
	<u>4.9.1 Evaluation Requirements</u>	
	Projects Requiring Evaluation/Traffic Study	4-8
	Vehicle Level of Service	4-8
	C. Pedestrian and Bicycle Level of Service Tests	4-11
	D. Transportation Demand Management Statement	4-11

<u>4.9.2 Downtown Columbia Mitigation Requirements</u>	4-12
A. Mitigation Option	4-12
B. Special Considerations	4-14
<u>4.9.3 Other Relevant Sections</u>	4-15
<u>4.9.4 Monitoring</u>	4-16
<u>4.9.5 Cordon Line</u>	4-17
<u>Appendix</u>	
I. Critical Lane Volume Analysis	4-19
II. Calculating Queue Length	4-21
III. Pedestrian and Bicycle Impact Test	4-24

CHAPTER 4 ADEQUATE ROAD FACILITIES TEST EVALUATION REQUIREMENTS

4.1 Purpose

This chapter of the Design Manual provides the guidelines for the preparation of the portion of the Traffic Study required pursuant to the Adequate Public Facilities requirements of the Subdivision and Land Development Regulations. The purpose of this portion of the Traffic Study is to determine the level of service of intersections and critical roadway segments within an impact area of a proposed subdivision or land development when the project is phased or completed.

The intent of the Adequate Public Facilities requirements is to direct new development to areas where road facilities are adequate and to require mitigation where deficiencies exist. The developer is required to analyze the intersections and critical links in the vicinity of the proposed development and pass the test for adequate road facilities as a condition of subdivision and land development approval.

4.2 Requirements

A. **Projects Requiring Evaluation/Traffic Study Outside of the Downtown Columbia Area**

An Adequate Road Facilities Test Evaluation is required in most cases for property going through the subdivision and/or land development process and is to be submitted with the first submission to the County. The development must pass the test or have an approved mitigation plan, if necessary, to proceed through the process. This evaluation will show the traffic conditions on the collector and higher classified highway intersections in the vicinity of the project. The evaluation will be based upon the scheduled phase and/or completion year of the project. All projects that are not classified as comprehensive or phased are classified as Conventional Projects and the analysis time frame will be three years (e.g., 2005 - 2008) from the first submission to the County. Projects that are zoned new town, planned golf course community, mixed use, and R-A-15, and any zoning district with a planned development (P.D.) overlay are considered comprehensive projects and/or phased. For comprehensive and phased projects, the developer is required to submit a phasing and completion schedule, which will be the basis for establishing the test years.

For projects within the boundaries of Downtown Columbia, the standards and evaluation requirements found in Section 4.9 will be used in place of those found in this section (Section 4.2 A through 4.2 C). All other sections of this chapter will apply as noted.

B. **Level of Service**

The intersection level of service (LOS) standard for this evaluation for County-controlled intersections is LOS D and the standard for State-controlled intersections is LOS E. The LOS evaluation shall be for the overall intersection.

The Intersection Standard for Downtown Columbia can be found in Section 4.9.

C. Study Area

Projects are required to evaluate the designated intersections in the impact area of the site. The impact area of a project is [defined below](#). [Projects within Downtown Columbia shall refer to Section 4.9](#)

- **IN PLANNED SERVICE AREA FOR PUBLIC WATER AND SEWER** - In that portion of the County in the Planned Service Area for Public Water and Sewer, an “Impact Area” means an area up to one and one-half road miles in all directions from each project entrance on a County or State road, but not beyond the intersection of a major collector or higher classified road with a major collector or higher classified road. The first intersection in all directions that meets this definition shall be evaluated.
- **IN NO-PLANNED SERVICE AREA FOR PUBLIC WATER AND SEWER** - In that portion of the County in the No-Planned Service Area for Public Water and Sewer, an “Impact Area” means an area up to two road miles in all directions from each project entrance on a County or State road, but not beyond the intersection of a minor collector or higher classified road with a minor collector or higher classified road. The first intersection in all directions that meets this definition shall be evaluated.

When a project’s impact area crosses the Planned Service Area Boundary, the boundary limitations and intersection evaluation criteria will change to the applicable standards of the service area entered.

Classifications of the roadway segments in the intersections will be governed by the General Plan Highways Map. The General Plan Highways Map will be used to establish which intersections will be analyzed in the Adequate Road Facilities Test Evaluation except as provided in Section 4.4.

4.3 Traffic Volumes

An Adequate Facilities Test Evaluation will be conducted in accordance with the procedures and technical standards identified in Chapter 5. [Specific reference is made to the latest editions of the following publications: ITE Trip Generation Handbook, ITE Transportation Impact Analysis for Site Development, and ITE Trip Generation](#). Each intersection is required to be analyzed for the end of each scheduled phase and/or scheduled completion year of the project. The intersection will be tested with the traffic volumes that consist of the following components:

A. Existing Traffic Volumes

Existing traffic volumes that have been field counted at the intersection as of the date the developer submits the application for approval of the project to the Department of Planning and Zoning.

B. Projected Site-Generated Traffic Volumes

The project’s projected site-generated traffic volumes at the intersection in the scheduled phase and/or completion years. [Site-Generated Peak Hour trips shall be estimated based on](#)

the latest edition of Trip Generation, published by the Institute of Transportation Engineers (ITE) or trip generation studies approved by Howard County staff.

C. Projected Background Development

1. Unrecorded Previously Approved Development

Traffic volumes projected for the intersection from other proposed subdivisions and site development plans that have passed the test for adequate road facilities prior to the submission of the application for approval of the project but not yet recorded (if not previously counted).

2. Recorded Previously Approved Development

Traffic volumes generated by subdivisions or site development plans that were recorded or approved prior to submission of the application for approval of the project and are scheduled to be completed before or during the scheduled phase and/or completion year of the proposed project (if not previously counted).

3. Background Traffic Growth Rate

Background traffic growth of 3% per year compounded for up to three years or other rate if adequate traffic data exists to support a change. Comprehensive or phased projects will use a background traffic growth of 6% compounded per year beyond year three in the study. The developer may propose or the Department may require different background traffic growth rates if validated field counts and other traffic data about the intersection support a different rate.

4.4 Roadway Conditions

The analysis of the intersections shall be based upon:

A. Existing Roadway Conditions

Actual existing intersection conditions in existence as of the date the developer submits the application for approval to the Department of Planning and Zoning for the project.

B. Proposed Roadway Conditions

New road facilities or improvements to existing road facilities that are included in developer's mitigation plans submitted prior to date of application of the project to the Department of Planning and Zoning. These plans shall be included in the evaluation if they

are scheduled to be completed before or during the scheduled phase, and/or completion year of the proposed project.

C. Proposed Capital Program Improvements

New road facilities or improvements to existing road facilities identified in the County's current Capital Program or extended Capital Program as defined in Title 22 of the Howard County Code and/or the Maryland Consolidated Transportation Program for which sufficient funds have been included so that the facilities will be substantially completed before or during the scheduled phase and/or completion year of the project, unless the Director of Public Works determines that such facilities or improvements are not likely to be completed by that time.

4.5 General County Mitigation Requirements

When the analysis of an intersection indicates operations will be below the adopted standards of Section 4.2, the developer shall revise the project with one or more of the following actions listed below. Intersections and roadways within Downtown Columbia shall follow the guidelines set forth in Section 4.9.

A. Project Schedule Deferment

Defer the project until a future date when the Adequate Road Facilities Test Evaluation indicates that the level of service standard will not be exceeded.

B. Project Scope Reduction

Reduce the scope of the proposed project to meet the level of service standard.

C. Roadway/Intersection Mitigation Plan

Develop a mitigation plan for the intersection(s) that will increase the capacity on road facilities in the impact area so that the level of service after construction of the project would be equal to the level of service if the project had not been constructed but not more than the minimum level of service. Mitigation means the funding of improvements by the developer, approved by the Department, to off-site road facilities. Mitigation measures may include any intersection capacity improvement except grade-separation of the roadways and ramps within the intersection or improvements to the through lanes of intermediate arterial and higher classified roads. Please note the following:

- Existing Traffic Signal Modification: For existing traffic signal(s), mitigation may initially appear possible by adjustments in the signal phasing and/or timing. In reality, this is rarely possible due to signal coordination, storage of queued vehicles, etc. The developer is required to obtain advance approval from the agency responsible for the existing traffic signal maintenance prior to proposing modification to signal as a mitigation measure.

- Grade Separation: When grade separation of the intersection is the only viable mitigation alternative, full mitigation will not be required. When grade separation of an intersection or improvement to the through lanes is the only feasible alternative to providing mitigation, the County will program these improvements into the Capital Improvement Budget request for consideration of adoption. This request will be based upon receiving a payment in lieu of the cost of the partial mitigation from the developer.

1. Shared Developer Mitigation Plan

When two or more developers are proposing mitigation plans for the same intersection, the Department will apportion the improvements between the parties based upon their proportion of the critical movements in the intersection. In the event that the timing of the development, technical infeasibility, or other factors do not allow the apportionment of the improvements, the Department shall collect from each developer the proportionate cost of the improvements corresponding to the development's proportion of the critical movements in the intersection. The funds collected will satisfy the developer's obligation for mitigation for the affected intersection. These funds will be collected on the basis that these funds will be programmed into a future Capital Project for the purpose of improving the intersection to mitigate the traffic generated by the multiple projects.

2. Capital Project Impact

When a developer's mitigation plan is proposed with a time frame that shows that a future capital project by the State and/or County will remove or negate the intersection improvements, the Department may waive the improvements and collect the estimated construction costs of the mitigation. These funds will then be programmed into a future Capital Project. Alternately, the improvements may be delayed to a certain date if a major facilities agreement is executed guaranteeing the improvements and the time schedule. If a proposed mitigation plan provides only temporary improvements due to proposed improvement plans for the road facility by others, a waiver may be granted for the improvements if the waiver does not cause traffic safety problems. In the event that a waiver is granted, the developer will be required to enter into a major facilities agreement to pay the cost of mitigation to the County, which will be used to help fund the cost of a Capital Project for future road facility improvements.

3. Constrained Roadway Impact

When a developer is required to evaluate a traffic capacity-constrained road facility, the Adequate Road Facilities Test Evaluation is still required. In the event that the level of service is below the standards in this manual, a mitigation plan is required. However, mitigation will be required to the extent that the mitigation plan improvements do not have a negative impact on the physical and right-of-way characteristics that have caused the constrained road facility to be designated. The developer may obtain the listing of constrained road facilities from the Department. The listing of constrained road facilities will be established by a resolution of the Howard County Council.

4.6 Transitional Requirements

If a project in the submission process has received sketch plan, preliminary plan, or final plan approval prior to the effective date of the Adequate Public Facilities Ordinance, an Adequate Road Facility Test Evaluation is not required provided that the project continues to meet the milestones established in the subdivision regulations.

If a project passes the test but is deferred because it cannot receive a school allocation, the Department may require an update of the data for Adequate Road Facility Test Evaluation and accompanying mitigation plan provided that the changes to the plan do not increase the cost of mitigation.

Once a subdivision has passed the Adequate Road Facilities Test Evaluation, no further approval for adequate road facilities for that project is required provided that the project's milestones are met, the developer executes a developer agreement and/or major facilities agreement for the proposed mitigation plan, the project is recorded, and in the case of site development plans, the traffic volume from the project does not exceed the traffic volume in the traffic study that formed the basis for passing the test during the subdivision plan approval process. If the traffic volume exceeds the volumes in the subdivision traffic study, the site development plan will be tested for the excess traffic.

However, projects within Downtown Columbia are subject to a 5-year monitoring study conducted and issued by the County. Specifically, in cases where a site development plan is submitted immediately after the issue date of the County study, and where, based on the findings of the County study, traffic data at test intersections are found to differ significantly from the assumptions projected by the traffic study that formed the basis for passing the Adequate Road Facility Test during the First Development Plan (FDP) stage of the subdivision process, then the FDP traffic study shall be modified using the most recently issued 5-year monitoring data as a guide. This modified study shall then be used as the basis for passing the Adequate Road Facility Test for each site development plan submitted after the County study issuance date. A Site Development Plan (SDP) submitted prior to the issuance of the first County 5-year study shall be subject to the traffic study submitted with the approved FDP. See Section 4.9.4 Monitoring.

4.7 Exemptions

Projects which do not generate any traffic are exempt from the requirement of submitting and passing the Adequate Road Facilities Test Evaluation. Site Development Plans which do not increase the traffic beyond what is already generated from the site at the time of application are exempt from submitting and passing the Adequate Road Facilities Test Evaluation. In order to obtain the exemption, an affidavit must be submitted and approved which provides an explanation of why no additional traffic is generated.

The following projects are exempt from the requirements of passing the Adequate Road Facilities Test Evaluation:

A. Exempt Non-Residential Projects

1. Non-Residential Subdivision Plans

- a. A non-residential resubdivision (see subdivision regulations)
- b. An exempt Government Facility, as follows:
 - 1) A facility to be owned or operated by the Federal Government, State Government, Howard County Public Schools, or any agency thereof.
 - 2) A facility owned by Howard County or any agency thereof where essential County Government services are provided, including police services, fire prevention and suppression services, emergency medical services, highway maintenance, detention facilities, water treatment and supply, sewage disposal and treatment, and solid waste disposal.

2. Non-Residential Site Development Plans

- a. An exempt Government Facility as defined in Section 4.7.A.1.b.2). above.

B. Exempt Residential Projects

1. Parcel Divisions (see Subdivision and Land Development Regulations)
2. Exempt Divisions (see Subdivision and Land Development Regulations)
3. Subdivisions in agricultural preservation districts for dwellings of the owner or the owner's child(ren).
4. Residential Resubdivisions (see Subdivision and Land Development Regulations) that do not increase the unit of housing units allowed.
5. Minor Subdivisions
6. Residential Site Development Plans **previously tested in the subdivision process** for single family attached and detached housing.

4.8 Approval Requirements

A. Subdivision Approval

Once a subdivision has been approved for Adequate Road Facilities, no further approval for Adequate Road Facilities for that project is required during the subdivision or site development plan approval process, provided that:

1. The developer continues to meet all required milestones;
2. The developer executes a major facilities agreement for any proposed mitigation;
3. The project proceeds to recordation and is recorded; and,
4. The traffic volume from the project in the site development plan traffic study does not exceed the traffic volume in the projected traffic study that formed the basis for passing the Adequate Road Facilities Test during the subdivision plan approval process. If the traffic volume in the site development plan exceeds the traffic volume in the subdivision traffic study, the site development plan will be tested for the excess traffic only. **This provision does not apply in Downtown Columbia.**

Exception:

Projects within Downtown Columbia are subject to a 5-year monitoring study conducted and issued by the County. Specifically, in cases where a site development plan (SDP) is submitted immediately after the issue date of the County study, and where, based on the findings of the County study, traffic data at test intersections are found to differ significantly from the assumptions projected by the traffic study that formed the basis for passing the Adequate Road Facility Test during the first development plan (FDP) stage of the subdivision process, then the FDP traffic study shall be modified using the most recently issued 5-year monitoring data as a guide. This modified study shall then be used as the basis for passing the Adequate Road Facility Test for each site development plan submitted after the County study issuance date. A SDP submitted prior to the issuance of the first county 5-year study shall be subject to the traffic study submitted with the approved FDP. See Section 4.9.4 Monitoring.

B. Site Development Plan

Once a site development plan has been approved for Adequate Road Facilities, no further approval for Adequate Road Facilities is required, provided that the developer executes a developer agreement and/or a major facilities agreement for any proposed mitigation or as stipulated in the exception above.

4.9 Requirements - Downtown Columbia

4.9.1 Evaluation Requirements

A. Projects Requiring Evaluation/Traffic Study

This section shall be used in place of Section 4.2, Requirements, for development projects located within Downtown Columbia as defined in the New Town Zoning Regulations. All other sections of Chapter 4 remain applicable to the projects as noted.

An Adequate Road Facilities Evaluation consists of a series of tests and is required for most property going through the subdivision and/or land development process. It is to be submitted with the first submission to the County. This evaluation determines the development impact on traffic conditions in the vicinity of the project and will be based upon the scheduled phase and/or completion year of the project. The development must pass the tests or have an approved mitigation plan to proceed through the process. Developments located within Downtown are considered comprehensive and/or phased projects. Construction or implementation of improvements in the mitigation plan must appropriately coincide with the phasing and occupancy schedule.

B. Vehicle Level of Service Test

1. Minimum Trip Threshold

All new developments in Downtown Columbia projected to generate 20 or more net peak hour trips must submit a traffic study. Developments projected to generate less

than 20 net peak hour trips may be required to submit a traffic study if the existing Critical Lane Volume (CLV) at the test intersection is greater than CLV 1500. The CLV may be determined by county monitoring study or the most recently accepted and approved APF study.

2. Impact Area

At a minimum, the traffic study shall determine the CLV of the nearest intersection in all directions and the next closest signalized intersections in accordance with Table 1 below.

TABLE 1 – SIGNALIZED INTERSECTIONS TO BE INCLUDED IN THE TRAFFIC STUDY

Net Peak Hour Site Trips	Minimum Number of Signalized Intersections in Each Direction
20 – 100	1
101 – 500	2
501 – 800	3
800 – 1500	4
>1500	5

The impact area is limited to intersections within the Cordon Line as it is defined in Section 4.9.5. Additional intersections or significant driveway locations within the Cordon Line and impacted by the new development may be required in the traffic study by the Department of Planning and Zoning and Department of Public Works. In the event that the minimum number of signalized intersections to be tested, as indicated in Table 1, extends beyond the Cordon Line then only those intersections within the Cordon Line will be evaluated regardless of number.

3. Intersection Standard

The intersection standard within the Cordon Line, as defined in Section 4.9.5., shall not exceed CLV 1600 for the overall intersection. This standard is subject to a transitional CLV requirement. During the transition phase to CLV 1600, all Downtown intersection testing and mitigation will be subject to the following:

- (A) All Downtown intersections must be evaluated and, if necessary, mitigated per Section 4.9.2 using an initial CLV of 1500.
 - (1) In the event the sum of existing and projected background traffic volumes (Total Projected Background Traffic) result in a CLV exceeding 1500 before the addition of site generated Net Peak Hour Trips, then the acceptable CLV standard for mitigation at the subject intersection will be the CLV as determined by Total Projected Background Traffic.

(2) If it is determined by DPZ/DPW that:

- (I) An intersection cannot be improved to the applicable CLV standard as described above or,
- (II) The proposed improvement to attain the applicable CLV standard does not satisfy the design balance as further discussed in Section 4.9:2 or
- (III) Mitigation of the intersection to the applicable CLV standard would require the construction of an improvement which DPZ, in consultation with DPW, finds not to be necessary to maintain an intersection CLV of no more than 1600 at the time of full buildout of the Downtown Columbia Plan.

then, the applicable CLV standard will increase by increments of 50 until the conditions identified in both (I) and (II) above are no longer true. Thereafter, the adjusted intersection CLV will then become the new accepted CLV standard for that intersection and will be used as the initial CLV for subsequent evaluations of that intersection under paragraphs (A)(1) and (2) of this Subsection, 4.9.1.B.3.

- (B) In no case shall the incremental adjustment of the intersection CLV exceed 1600.
- (C) When analyzing intersections for the traffic study, the latest version of Maryland State Highway Administration's (MSHA) Critical Lane Volume (CLV) analysis procedures must be used, the methodology will fit most intersection configurations and can be varied easily for special situations and unusual conditions. The methodology is also described in the Appendix.

4. Queuing Analysis Test

In addition to a CLV test at applicable intersections, a queuing analysis shall also be performed on all approaches of the same intersections, and shall include left turn and through movements. Queue length shall be calculated during the weekday peak hours using the procedures found in the Appendix. For signalized intersection spacing greater than 300 feet, the queue shall not exceed 80 percent of the distance between signalized intersections. For signalized intersection spacing less than 300 feet, the queue shall not exceed more than 90 percent of the distance to an adjacent signalized intersection.

If the queue exceeds the specified standard, then it shall be treated as insufficient capacity and must be addressed under the mitigation plan.

5. Traffic Volumes

An Adequate Facilities Test Evaluation will be conducted in accordance with the scope, procedures, and technical standards identified in Chapter 5. Specific reference is made to the latest editions of the following publications: ITE Trip Generation Handbook, ITE Transportation Impact Analysis for Site Development, and ITE Trip Generation.

Site-Generated Peak Hour trips shall be estimated based on the latest edition of Trip Generation, published by the Institute of Transportation Engineers (ITE) or trip generation studies approved by Howard County. Net Peak Hour Trips are defined as Site-Generated Trips minus appropriate reductions for internal trips, non-auto trips (i.e., transit, bike, walking, and/or other non-auto trips), transportation demand management (TDM) trip reductions, and pass-by/diverted-link trips in accordance with the references cited above. Test intersections in the impact area, as described by Table 1, are required to be analyzed for the end of each scheduled phase and/or scheduled completion year of the project. Section 4.3, Traffic Volumes, is applicable to intersections within Downtown Columbia and shall be used to determine traffic volumes.

6. Roadway Conditions

The analysis of intersections shall be based upon the guidelines previously established in Section 4.4 Roadway Conditions, Parts A through C.

C. Pedestrian and Bicycle Level of Service Tests

All new developments must satisfy a Pedestrian Level of Service (PLOS) no less than PLOS C, and a Bicycle Level of Service (BLOS) no less than BLOS C for any study segment identified as a bicycle route on the Bicycle and Pedestrian Circulation Plan in the Downtown Columbia Plan or a County approved bicycle plan. The study must evaluate existing and proposed sidewalks, crossings and bicycle facilities along the study segment.

The Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) shall be calculated as shown in the Appendix. However, if it is the finding of DPZ/DPW that (i) a reasonable alternative bicycle or pedestrian route exists or is proposed, or (ii) meeting the BLOS or PLOS Standard would negatively impact the BLOS, PLOS, or the design balance as further discussed in Section 4.9.2, then the BLOS or PLOS test, as appropriate, is deemed satisfied.

D. Transportation Demand Management Statement

A Transportation Demand Management (TDM) statement shall be provided with each traffic study. The statement will discuss appropriate TDM strategies for the development program planned in the FDP or SDP, how they may be implemented, and how the proposed selected strategies and implementation would complement any current Downtown Transportation Demand Management Plan developed under Section 2.4 of the Downtown Columbia Plan.

The statement should also discuss the status of past initiatives, if applicable. Statements shall address strategies to reduce automobile travel and promote alternative means of mobility to and from the proposed development. A typical statement will encourage alternative means of mobility through promotional incentives and programs, transit contributions such as contributions to a circulator system, new bus routes, higher frequency of service and improved stops and service information, enhancements to the connections between Downtown Columbia and the Village Centers and areas outside of Downtown Columbia, including transit right-of-ways, off-site bicycle and pedestrian facilities improvements or other measures. The scale of the TDM statement shall reflect the number of trips generated by the development and the remaining capacity of the transportation facility.

4.9.2 Downtown Columbia Mitigation Requirements

In order to obtain Departmental approval, the mitigation plan shall address the findings of the vehicle, pedestrian and bicycle level of service tests as well as the inclusion of the TDM statement. All mitigation plans are required to incorporate a design balance between safety, mobility, modes of transportation, scale and character of the surrounding area, aesthetics, and the County General Plan.

If it is the finding of the Director of Planning and Zoning and Public Works that a proposed mitigation plan does not satisfactorily address the design balance described above then the County reserves the right to require modifications to the proposed mitigation plan.

Also, the developer shall be required to submit a phasing and completion schedule. Implementation of improvements in the mitigation plan must appropriately coincide with the significant milestones in the phasing and completion schedule that required the mitigation.

- A. Mitigation Options:** When analysis of an intersection indicates CLV values exceeding the requirements of Section 4.9.1.B.3. Intersection Standard, the developer shall revise the project as indicated by the following.

Roadway/Intersection Mitigation Plan

Develop a mitigation plan for the intersection(s) that will increase the capacity on road facilities in the impact area so that the level of service after construction of the project will be equal to or better than the level of service/CLV required under Section 4.9.1.B.3. Mitigation means full funding of improvements by the developer, approved by the Department, to off-site road facilities. Mitigation measures may include any intersection capacity improvement except grade-separated roadways and ramps within intersections, or improvements to through lanes of roads classified as intermediate arterials or higher. Please note the following:

(A) **Existing Traffic Signal Modification:** For existing traffic signal(s), mitigation may initially appear possible by adjustments in the signal phasing and/or timing. In reality, this is rarely possible due to signal coordination, storage of queued vehicles, etc. The developer is required to obtain advance approval from the agency responsible for the existing traffic signal maintenance prior to proposing modification to a signal as a mitigation measure.

(B) **Grade Separation:**

(1) Construction of a third grade-separated interchange on Route 29 shall not be required to achieve a CLV of less than 1600.

(2) When grade-separated roadways or arterial through lane improvements are the only viable mitigation alternatives, full mitigation will not be required by the developer but may be provided. If full mitigation is not provided then final department signature of the approved site development plan will not occur until:

(3) The project is fully funded in the approved Capital Budget with construction initiating within 3 years after budget approval and

(4) A major facilities agreement has been executed outlining the improvement cost share, comparative construction schedules between the improvement and the development project, and other terms and conditions as applicable between the parties.

The time frame to reach the major facilities agreement will be 3 years from the date of the site development plan submission. If an agreement cannot be executed within that time, then any of the following may be considered:

(I) A 1-year extension may be granted,

(II) Terms of the agreement may be mutually modified by the parties,

(III) A modified site development plan may be submitted,

(IV) The site development-plan may be withdrawn without prejudice.

2. **Non-Automobile Trip Credits:** In order to enhance pedestrian safety and to encourage transit and bicycle use, trip credits are allowed if a developer improves an existing or provides a new non-automobile (pedestrian, bicycle, transit or transportation demand management) facility or program not otherwise

required according to Table 2. Use of the trip credits and determination of the amount within a range of the credit is at the discretion and approval of the Department of Planning and Zoning as deemed to promote mobility to, in and around the Downtown area.

TABLE 2 NON-AUTOMOBILE TRIP CREDITS

Non-Automobile Transportation Facility	Trip Credit Per Peak Hour Trip
100 Linear Feet of Off-Site Five-Foot Wide Sidewalk	5
100 Linear Feet of Off-Site Eight-Foot Wide Bike Path	5
Off-Site Curb Extension/Pedestrian Refuge Island/Handicap Ramp	2
Off-Site Accessible Pedestrian Pushbuttons (set of two each leg)	3
Off-Site Countdown Pedestrian Signal Head (set of two each leg)	3
Off-Site Signalized Pedestrian Crosswalk (includes APS, Countdown Heads, Pavement Markings each leg)	7
Bike Rack (set of 8)	2
Bus Shelter	3
Information Kiosk	2
Bike Lockers (set of 8)	3
Real-time Transit Information Sign	2
Static Transit Information Sign	0.5
Shuttle or Bus	5-15
Bus Pullout	3
Maximum Trip Credits	50

3. Project Scope Reduction

Reduce the scope of the proposed project to meet the level of service standard.

4. Project Schedule Deferment

Defer the project until a future date when the Adequate Road Facilities Test Evaluation indicates that the level of service standard will not be exceeded.

B. Special Considerations

1. Shared Developer Mitigation Plan

(A) When two or more developers are proposing separate mitigation plans for the same non-grade separated intersection or non-arterial through lane, the

Department may apportion the improvements between the parties based upon their proportion of the critical movements in the intersection. In the event that timing of the development, technical infeasibility or other factors do not allow the apportionment of the improvements, the Department shall collect from each developer the proportionate cost of the improvements corresponding to the development's proportion of the critical movements in the intersection. The funds collected will satisfy the developer's obligation to mitigate the affected intersection. These funds will be collected on the basis that they will be programmed into a future Capital Project for the purpose of mitigating traffic generated by the multiple projects at the test intersections. However, final approval of the site development plan will not occur until:

- (1) The project is fully funded in the approved Capital Budget with construction initiating within 3 years after budget approval, and
- (2) A major facilities agreement has been executed outlining the improvement cost share, comparative construction schedules between the improvement and the development project, and other terms and conditions as applicable between the parties.

The time frame to reach the major facilities agreement will be 3 years from the date of the site development plan submission. If an agreement cannot be executed within that time, then any of the following may occur:

- (I) A 1-year extension may be granted,
- (II) Terms of the agreement may be mutually modified by the parties,
- (III) A modified site development plan may be submitted,
- (IV) The site development plan may be withdrawn without prejudice.

- (5) Alternatively, developers of multiple projects may jointly propose a mitigation plan for purposes of meeting the Adequate Road Test Requirement. Each mitigation plan must indicate the participants in the plan; which participant(s) will be responsible for implementing the plan and constructing any required transportation improvement; and how the transportation capacity to be created will be apportioned among the plan participants.

4.9 Other Relevant Sections

Other relevant sections of the Adequate Road Public Facilities Test Evaluation requirements that apply to developments in Downtown Columbia are listed here for clarity.

4.6 Transitional Requirements

4.7 Exemptions

4.8 Approval Requirements

4.9.4 **Monitoring**

The County will conduct independent traffic monitoring studies every 5 years, the first monitoring study will occur 5 years after submission of the first subdivision plan (FDP) for the Downtown Columbia area. The final study will be issued as specified in the Howard County Code. The date the study is issued will be the issuance date for purposes of Section 4.6 Transitional Requirements and Section 4.8 Approval Requirements. The monitoring studies will be a comprehensive assessment of existing transportation facilities within the Downtown Columbia area. The purpose of the monitoring study will be to validate and/or recalibrate projections made in the redevelopment traffic study (September 2008 Columbia Town Center Generalized Traffic Study) and/or subsequent studies submitted with future subdivision final development plans and/or site development plans, and that form the basis of the proposed development program. Refer to Section 4.6 Transitional Requirements and Section 4.8 Approval Requirements for the application of the monitoring study to the FDP and SDP submittal process.

The study will include an analysis of the following:

Traffic Signal Optimization

Comprehensive Traffic Study HCM and CLV

Transit Ridership

Corridor Line Study –

Total in/out,

Historical growth,

Directional split,

Vehicle classification,

Vehicle occupancy,

Analyze Downtown TDM data provided by others

Interchange ramp weaves and merges

Travel Demand Sub-Area Modeling

The studies will measure or validate:

Intersection STANDARD – DPW

Trip distribution/diversion – DPW

Transit Ridership – DPZ

Modal Split - DPW/DPZ

Internal trip capture rate - DPW with TDM data supplied by others

Background traffic rate – DPW
(define in Section 4.3.C.3)

Regional transportation impacts including interchanges

When the monitoring study indicates significant differences between County determined values and those used in the development traffic studies, the developer shall revise the traffic study with one or more of the following actions:

1. Obtain new data for all intersections in the development impact area to recalculate the CLV.
2. Modify background traffic growth rate.
3. Modify internal trip rate
4. Modify modal split reductions
5. Modify pass-by trip rate estimations supplied by TDM data
6. Reevaluate trip distribution/diversion percentages

Based on the new data for the traffic study and the subsequent reevaluation of intersections in the impact area, the developer shall revise the mitigation plan as outlined in Section 4.9.2.

4.9.5 Cordon Line

The Cordon Line defines the basic limits of traffic studies within Downtown Columbia. Additionally, the Cordon Line identifies critical locations to monitor total amounts of traffic entering and leaving the Downtown area (see Figure 1).

Current base line trips are maintained and available from the Department of Planning and Zoning. Net Peak Hour Trips generated by each new development will be added to the current base line and shall not exceed the applicable cap established by background, growth and total new development trip volume. Current Cordon Line Locations are as follows:

1. Little Patuxent Parkway East of Columbia Road and west of the Route 29 ramps
2. Columbia Road just North of Little Patuxent Parkway
3. West Running Brook Road just North of Little Patuxent Parkway and prior to Hyla Brook Road

4. Windstream just North of Governor Warfield Parkway and prior to Placid Lake Road
5. Twin Rivers Road just North of Governor Warfield Parkway and prior to Daystar Court
6. Little Patuxent Parkway just West of Governor Warfield Parkway/Banneker Road
7. Hickory Ridge Road just West of Broken Land Parkway and prior to Martin Road
8. Broken Land Parkway South of Hickory Ridge Road and West of the Route 29 ramps
9. South Entrance Road just South of Symphony Woods Road and West of the Route 29 ramps

As newly constructed roadways intersect the Cordon Line, new roadway locations shall be added.

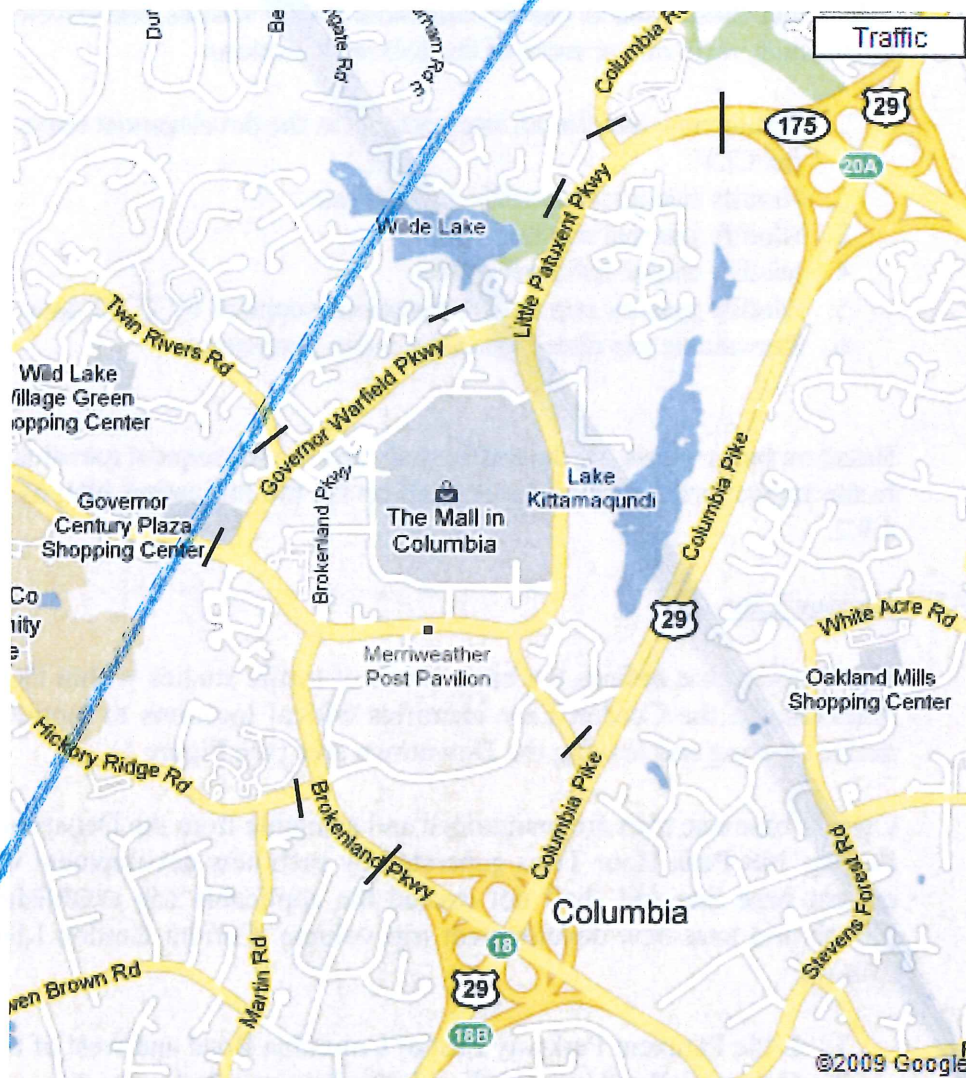


FIGURE 1 – CORDON LINE LOCATIONS

APPENDIX

(I) Critical Lane Volume Analysis

An applicant can use the following procedure at signalized or unsignalized intersections. For unsignalized intersections, a two-phase operation should be assumed. The traffic volumes used in the analysis are those approaching the intersection as determined in each step of the traffic study (existing, existing plus background, and existing plus background plus site). The following steps describe how to determine the CLV of an intersection with a simple two-phase signal operation.

- Step 1. Determine the signal phasing, number of lanes, and the total volume on each entering approach to an intersection and the traffic movement permitted in each lane.
- Step 2. Subtract from the total approach volume any right-turn volume that operates continuously throughout the signal cycle, (a free-flow right-turn by-pass). Also, subtract the left-turn volume if it is provided with an exclusive lane.
- Step 3. Determine the maximum volume per lane for each approach by multiplying the volume calculated in Step 2 by the appropriate lane-use factor selected from the lane use factor table below. (Note: Do not count lanes established for exclusive use such as right- or left-turn storage lanes – the lane use factor for a single exclusive use lane is 1.00.)
- Step 4. Select the maximum volume per lane in one direction (e.g., northbound) and add it to the opposing (e.g., southbound) left turn volume.
- Step 5. Repeat Step 4 by selecting the maximum volume per lane in the opposite direction (e.g., southbound) and the opposing (e.g., northbound) left-turn volume.
- Step 6. The higher total of Step 4 or Step 5 is the critical volume for phase one (e.g., north-south).
- Step 7. Repeat Steps 4 through 6 for phase two (e.g., east-west).
- Step 8. Sum the critical lane volumes for the two phases to determine the CLV for the intersection. (Note: At some intersections, two opposing flows may move on separate phases, for these cases, each phase becomes a part of the intersection's CLV.)

Special Cases

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.

Free Right

A free right turn is one which 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 thru vehicles, the right turning volumes can be excluded from the critical lane analysis. Knowledge of the intersection can be used to combine a sufficient number (percent) of the right turns with the thru 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.

Right Turn on Red

The number of vehicles which can take advantage of the RTOR feature vary greatly based on site and traffic characteristics. At high volume intersections, as the Level-of-Service 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.

No Separate Left Turn Lane

On multi-lane approaches with no separate left turn lane the impact of left turning traffic may be significant, especially on high volume roadways. Typically, the left lane operates as a left turn lane with nearly all thru traffic avoiding this lane. Calculations for such an approach should be as follows:

The left turn volume will be adjusted using the PCE Factor (shared lane) of the 1985 HCM Pages 9-35. The opposing volume will be total through traffic and rights. 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 lane use factor applied to the total.

One Lane Approaches

Where a bypass of left turning vehicle is available the one lane approach should be treated as if there is a separate left turn lane. If no bypass area is available traffic on the one lane approach can proceed only when there is no vehicle waiting to turn left. This case should be analyzed using PCE (shared lane) equivalencies (1985 HCM pages 9-35) to modify the left turn volumes. The resulting total will be added to the rest of the approach volume and the appropriate lane use factor applied.

Double Left Turn Lanes

Both the access to the double left turn lane and movements made immediately after the left turn will influence the distribution of traffic between the available lanes. Generally, the distribution is less balanced than for thru lanes; thus the recommended lane use factor of 0.60. Variations observed at specific sites may suggest the use of different factor for this movement.

Lane Use Factors

Lane Use Factors are to be as follows:

TABLE A-1 LANE USE FACTORS

Number of Lanes	Factor
1	1.00
2	.55
3	.40
4	.30
DBLLT	.60

(II) Calculating Queue Length

For Signal Cycle Length less than 120 seconds

- Queue length = 1.25 x Volume

For Signal Cycle Length greater than 120 seconds

Procedures for determining queue lengths at signalized and unsignalized intersections:

A. Signalized Intersections

This Procedure can be used at intersections with existing signals and intersections where it is felt a signal may be installed.

1. Perform critical lane analysis
2. Select Cycle length
 - Use existing timing if available
 - If timing is not available, use the suggested cycle lengths

TABLE A-2 – RECOMMENDED MAXIMUM CYCLE LENGTHS

Recommended Maximum Cycle Lengths			
LOS	2 Phase	3-5 Phase	6-8 Phase
A	90	100	120
B	90	100	120
C	100	120	135
D	120	135	150
E	135	150	165
F	150	165	180

3. Note: These cycle lengths are to be used as a guide, knowledge of the intersection may result in using a higher or lower cycle.
4. Use Poisson Distribution Chart/Formula to determine maximum number of vehicles per cycle of a specific movement.

Formula:

$$\text{Avg. Veh/Cycle} = \frac{\text{Critical Lane Volume (veh/hr)} \times \text{Cycle Length (sec)}}{3600 \text{ (sec/hr)}}$$

5. Assume a Vehicle Length of 25 ft.
6. Once the average vehicles per cycle (specific movement) is determined, the chart can be used to find the maximum vehicles per cycle for that movement.
7. The queue length will be the maximum vehicles per cycle times 25 ft. per vehicle.
8. It is noted that the chart ends at an average of 20 vehicles per cycle. In cases where the average number of vehicles per cycle exceeds 20 the following formula can be used to determine the queue length. This formula can also be used in lieu of the chart.

$$Q = \text{Avg. No. of Veh} \times 1.4 \text{ (Surge Factor)} \times 25 \text{ ft}$$

TABLE A-3 – POISSON DISTRIBUTION FOR VEHICLES PER CYCLE

Poisson Distribution	
Average No. of Vehicle per Cycle	Maximum No. of Vehicle per Cycle
0.1 – 0.3	
0.4 – 0.8	2
0.9 – 1.3	3
1.4 – 1.9	4
2.0 – 2.6	5
2.7 – 3.2	6
3.3 – 3.9	7
4.0 – 4.7	8
4.8 – 5.4	9
5.5 – 6.1	9
6.2 – 6.9	10
7.0 – 7.7	11
7.8 – 8.4	12
8.5 – 9.2	13
9.3 – 10.0	14
10.1 – 10.8	15
10.9 – 11.6	16
11.7 – 12.4	17
12.5 – 13.2	18
13.3 – 14.0	19
14.1 – 14.9	20
15.0 – 15.7	21
15.8 – 16.5	22
16.6 – 17.3	23
17.4 – 18.2	24
18.3 – 19.0	25
19.1 – 19.8	26
19.9 – 20.0	27

Unsignalized Intersection

This procedure can be used at isolated intersections where it is felt a signal will not be placed. If there is any chance that a signal may be placed at an intersection, the procedure for signalized intersections should be used.

1. Determine the critical gap needed for the movement (from chart) this chart is also found in the 1985 HCM unsignalized intersections.

TABLE A-4 – BASIC CRITICAL GAP FOR PASSENGER CARS, SEC

VEHICLE MANEUVER AND TYPE OF CONTROL	VEHICLE RUNNING SPEED MAJOR ROAD			
	30 MPH		55 MPH	
	NUMBER OF LANES ON MAJOR ROAD			
	2	4	2	4
RT FROM MINOR ROAD				
STOP	5.5	5.0	5.5	5.0
YIELD	6.5	5.5	6.5	5.5
LT FROM MAJOR ROAD	5.0	5.5	5.5	6.0
CROSS MAJOR ROAD				
STOP	6.0	5.5	6.5	6.0
YIELD	7.5	6.5	8.0	7.0
LT FROM MINOR ROAD				
STOP	6.5	7.0	7.0	6.5
YIELD	8.0	7.0	8.5	7.5

2. Note: If restricted sight distance exists add one second to the gap needed. Where average running speeds are between 30 mph and 55 mph, interpolate.
3. Determine average gap between opposing vehicles

Average Gap Between Opposing Vehicle = $3600 \text{ sec} / (\text{volume}/\text{hour})$
4. If the average gap is greater than the gap needed for the maneuver the same procedure as signalized intersections can be used with the cycle length equal to the critical gap required (from chart) plus 4 seconds (start-up time).
5. If the average gap is less than or equal to the gap needed, this maneuver should be analyzed as if a signal were in place.

(U) Pedestrian and Bicycle Impact Test

A Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) shall be computed using the PLOS and BLOS equations and the Pedestrian and Bicycle LOS categories from Table 6 below. The acceptable PLOS and BLOS for Downtown Columbia is PLOS C and BLOS C.

Unlike the PLOS and BLOS methodologies described in the Highway Capacity Manual, these methodologies take into account the existence of sidewalks, lateral separation of pedestrians from motorized vehicles, average effective width of the outside through lane, motorized vehicle volumes, motorized vehicle speeds, heavy vehicle (truck) volumes, and pavement condition. If it is the finding of DPZ/DPW that (i) a reasonable alternative bicycle or pedestrian route exists or is proposed, or (ii) meeting the BLOS or PLOS Standard would negatively impact the BLOS, PLOS, or the design balance as further discussed in Section 4.9.2, then the BLOS or PLOS test, as appropriate, is deemed satisfied.

The Pedestrian Level of Service (PLOS) score is calculated using the following equation:

$$\text{PLOS score} = -1.2276 \text{ LN} [(W_{ol} + W_L + (F_P \times \% \text{OSP})) + ((F_B \times W_B) + F_{sw} \times W_s)] + 0.0091(\text{Vol}_{15}/L) + 0.0004 \text{ SPD}^2 + 6.046$$

Where:

- PLOS = Pedestrian level of service score
- LN = Natural log
- W_{ol} = Width of outside lane
- W_L = Width of shoulder or bicycle lane
- F_P = On-street parking effect coefficient (=0.20)
- % OSP = percent of segment with on-street parking
- F_B = Buffer area barrier coefficient (=5.37 for trees spaced 20 feet on center)
- W_B = Buffer width (distance between edge of pavement and sidewalk, feet)
- F_{sw} = Sidewalk presence coefficient (=6-0.3 W_s)
- W_s = Width of sidewalk
- Vol_{15} = Volume of motorized vehicles in the peak 15-minute time period
- L = Total number of directional through lanes
- SPD = Average running speed of motorized vehicles traffic (mi/hr)

The Bicycle level of service (BLOS) is calculated using the following equation:

$$\text{BLOS score} = 0.507 \text{ LN}(\text{Vol}_{15}/L) + 0.199 \text{ SP}_T (1 + 10.38 \text{ HV})^2 + 7.066 (1/\text{PR}_5)^2 - 0.005 (W_E)^2 + 0.760$$

Where:

- BLOS = Bicycle level of service score
- LN = Natural log
- Vol_{15} = Volume of directional motorized vehicles in the peak 15-minute time period
- L = Total number of directional through lanes
- SP_T = Effective speed factor = $1.1199 \text{ LN} (\text{SP}_P - 20) + 0.8103$
- SP_P = Posted speed limit (a surrogate for average running speed)
- HV = Percentage of heavy vehicles
- PR_5 = FHWA's five-point pavement surface condition rating
- W_E = Average effective width of outside through lane

Where:

$$W_E = W_v - (10\text{ft} \times \% \text{OSP}) \text{ where } W_1 = 0$$

$$W_E = W_v - W_1 (1 - 2 \times \%OSP) \text{ where } W_1 > 0 \text{ \& } W_{ps} = 0$$

$$W_E = W_v + W_1 - 2 (10 \times \%OSP) \text{ where } W_1 > 0 \text{ \& } W_{ps} > 0$$

and a bicycle lane exists

Where:

- W_1 = total width of outside lane (and shoulder) pavement
- $\%OSP$ = percentage of segment with occupied on-street parking
- W_1 = width of paving between the outside lane stripe and the edge of pavement
- W_{ps} = width of pavement striped for on-street parking
- W_v = effective width as a function of traffic volume

TABLE A-5 – PEDESTRIAN AND BICYCLE LOS CATEGORY

Level of Service	PLOS/BLOS Score
A	≤ 1.5
B	$> 1.5 \text{ and } \leq 2.5$
C	$> 2.5 \text{ and } \leq 3.5$
D	$> 3.5 \text{ and } \leq 4.5$
E	$> 4.5 \text{ and } \leq 5.5$
F	> 5.5

Amendment 1 to Council Resolution No. 138-2017

BY: Chairperson at the request
of the County Executive

Legislative Day No. 15
Date: December 4, 2017

Amendment No. 1

(This amendment corrects the name of a chapter to be consistent with changes made in Council Resolution No. 97-2010. CR 97-2010 renamed Chapter 4 to be Adequate Transportation Facilities Test Evaluation Requirements.)

- 1 In the Design Manual Volume III, Roads and Bridges, attached to the Resolution as filed, with
2 regard to the name of Chapter 4, strike “Adequate Road Facilities Test Evaluation
3 Requirements” and substitute “ADEQUATE TRANSPORTATION FACILITIES TEST EVALUATION
4 REQUIREMENTS” in the following instances:
- 5 1. In the Table of Contents;
 - 6 2. On the page immediately following page 3-61;
 - 7 3. In the header included on every page of Chapter 4; and
 - 8 4. In any other instance where Council Resolution No. 97-2010 changed the title of Chapter 4 to
9 “Adequate Transportation Facilities Test Evaluation Requirements”.
- 10



Howard County

Internal Memorandum

Subject: Resolution Adopting the 2017 Revisions to the Howard County Design Manual
Volume III- Roads and Bridges

To: Lonnie Robbins
Chief Administrative Officer

From: James M. Irvin, Director
Department of Public Works

Date: September 5, 2017

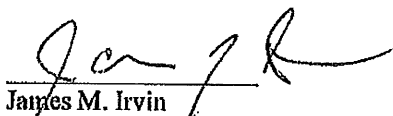
We are presenting to the County Council for consideration and adoption a revision to the Howard County Design Manual Volume III - Roads and Bridges. The significant changes include: approved County Council resolutions (i.e. downtown Columbia guidelines), AASHTO updates, MSE (mechanically stabilized earth) wall criteria and various recommendations of stakeholders. There is no fiscal impact with this change.

Input on the proposed revision was received from various Bureaus within the Department of Public Works, Department of Planning and Zoning, and private engineering consulting firms affiliated with the Howard County Chapter of the Maryland Building Industry Association.

Pursuant to the provisions of Section 18.210 of the Howard County Code, a public hearing was held before the Public Works Board on June 13, 2017, and all interested parties were given an opportunity to speak on the proposed revision. After consideration of the testimony presented at the public hearing, the Public Works Board recommended approval of the proposed revisions to the Howard County Design Manual Volume III - Roads and Bridges on August 8, 2017.

In accordance with Section 18.210 of the Howard County Code, we are presenting the proposed revisions to the Howard County Design Manual Volume III - Roads and Bridges to the County Council for adoption by resolution.

If you require any further information concerning this matter or have any additional questions, please do not hesitate to contact me at your convenience. Representatives from the Department of Public Works will be present at the public hearing to answer your questions.



James M. Irvin
Director

Cc: Thomas Butler
Brandon Love



HOWARD COUNTY DEPARTMENT OF PUBLIC WORKS

9250 Bendix Road

Columbia, Maryland 21045

410-313-2414

Thomas E. Butler, P.E., Deputy Director of Public Works

Engineering, Development and Construction

www.howardcountymd.gov

FAX 410-313-6144

TDD 410-313-2323

September 5, 2017

To: County Council

Subject: Proposed Revisions to the Howard County Volume III Design Manual - Roads and Bridges

Below is a list of changes of the Howard County Design Manual Volume III, Roads and Bridges, dated August 2017. Please note that the Office of Transportation is currently working on proposed design criteria for complete streets and those revisions are not part of this draft version.

The proposed Design Manual Volume III changes include approved County Council resolutions (i.e. downtown Columbia guidelines), MSE (mechanically stabilized earth) wall criteria, AASHTO updates and various consultations with stakeholders. The changes have been distinguished into two categories below: "Volume III Significant Changes" and less significant "Volume III Improvements, Updates and Clarifications."

Volume III Significant Changes:

CHAPTER 1:

- Page 1-12 (PDF 017) 1.8 B 2. j. Under "Items to Include in Topographic Surveys" added "Stormwater Management Facilities" to be included in the topographic surveys to include all structures, pipes, inverts and pipe sizes, cleanouts, observation wells and contours.

CHAPTER 2:

- Page 2-6 (PDF 039) Table 2.02 Minimum Passing Sight Distance. Revised values based on 2011 edition of *A Policy on Geometric Design of Highways and Streets*.
- Page 2-10 (PDF 043) 2.3 A. 3. e. "Permanent Non-Through Streets" has been revised to: clarify the definition of a "Permanent Non-Through Street", clarify that the 1200' maximum length of a non through street will start over after any intersection with a public road, clarified that all non-residential roads shall be terminated with a cul-de-sac and added that the head of a tee or y-turnaround will have a 60' width.
- Page 2-17 (PDF 050) Table 2.05 Design Controls for Crest Vertical Curves Based on Passing Sight Distance. Revised values based on 2011 edition of *A Policy on Geometric Design of Highways and Streets*.
- Page 2-20 (PDF 053) B. Pavement and Right-of-Way Width 2. Pavement Widths and Cross Slope: Delete the specification of requiring a 3' unpaved shoulder where sidewalks are not present
- Page 2-21 (PDF 054) C. Paving Section second paragraph: Removed the suggestion that the Soils Evaluation and Pavement Design Report be prepared using the DPW "Geotechnical Data required for Water, Sewer, Storm Drain and Road Design and Construction Guideline."

- Page 2-21 (PDF 054) C. Paving Section Third paragraph: Removed requirements of Soils Evaluations and Pavement Report from this section and referenced requirements for the Soils Evaluation and Pavement Report are in Section 504.03 Design Manual Volume IV.
- Page 2-21 (PDF 054) D. Curb and Gutter: Revised permitted use of Modified Curb and Gutter from cul-de-sac bulb, local streets and minor collectors Street in residential areas to Access Place, Access Street and minor collector in residential areas.
- Page 2-24 (PDF 057) J. Pathways and Bikeways: Added the Office of Transportation in the 5th and 6th paragraphs as offices to be consulted when planning a bikeway.
- Page 2-31 (PDF 064) 7. Median Lanes and Openings: Eliminated the third paragraph saying “Barriers shall not be used to separate the through and left turn lanes.”
- Page 2-33 (PDF 066) 9. Intersection Sight Distance: Revised intersection sight distance to be measured in accordance to AASHTO procedures. In residential areas, stopping sight distance may be used on the Major Street when the Major Street classification is a Minor Collector or below.
- Page 2- 39 (PDF 072) G. Auxiliary Lanes: Added minor arterials as locations where auxiliary lanes may be required and removed the restriction width of 40’ maximum.
- Page 2-40 (PDF 073) 2.7 Alleys: Revised the paragraph to better define Alleys. Raised the minimum width of alleys from 16’ to 20’. Added a restriction for alleys greater than 200’ in length to add a cul-de-sac or tee-turnaround.
- Page 2-40 to 2-41 (PDF 073 to PDF 074) B. Residential Parking: Clarified that On Street Parking shall be treated according to Table 2.11. Removed the second paragraph clarifying information on how zoning requirements for off-street parking can be met. Revised the heading of Table 2.11 from OVERFLOW / GUEST PARKING to ON STREET PARKING. Removed the column in Table 2.11 for Overflow/Unit.
- Page 2-44 to 2-46 (PDF 077 to 079) 2.13 Roadway Lighting: Section revised from relocating Street Lighting from Chapter 5 Traffic Studies and moving to Chapter 2 Design of Roads and has been revised in its entirety.
- Page 2-49 (PDF 082) C. Design Characteristics, 6. Speed Humps: Added new section.
- Page 2-49 to 2-50 (PDF 082 to PDF 083): Added specification Section 2.15 Standard for Maintenance of Scenic Roads.
- Appendix A (PDF 084) Public Roadway Design Criteria: The *Max. Dist. Between Speed Control Devices* column has been noted to apply to “Capital Improvement Project Only”.
- Appendix A (PDF 084) Public Roadway Design Criteria: Under Notes: Added to Note 1.a. Flush curb on inside of all curves with radius of 1000 feet or less.
- Appendix G (PDF 091) Parking Stall Layout Elements- Removed curb notation, line representing curb on plan, and offset to curb from plan and table.
- Appendix H (PDF 092) Intersection Sight Distance in Residential Areas when Major Street Classification is Equal to or Less Than a Minor Collector – New Figure
- TYPICAL SECTIONS: All Typical Sections removed from Chapter 2 Appendix

CHAPTER 3:

- Page 3-17 to 3-18 (PDF 112 to 113) 3.4 A.: Added a paragraph making a distinction between “Fill” Retaining Walls and “Cut” Retaining Walls. Added a Table providing guidelines for fill retaining walls selection.
- Page 3-21 (PDF 116) f. MSE: Revised the MSE wall specification adding detail concerning Overall Stability, Reinforced Soil Mass and Facing Elements.
- Page 3-21 to 3-22 (PDF 116 to PDF 117) f. MSE: Added General design guidelines at end of section.
- Page 3-24 to 3-26 (PDF 119 to PDF 121) Added 3 pages for: 2. Cut Type Retaining Walls specification.
- Page 3-30 (PDF 125) f. Design Calculations / Failure Analysis: Removed the word three in order to not limit the possible modes of failure. Removed the resistance factors and added that the resistance factors meet AASHTO.

CHAPTER 4:

- Page 4-1, 4-2 (PDF 160, PDF 161) Reference is made to the point that Downtown Columbia will have its own separate set of standards and evaluation requirements as set forth in section 4.9.
- Page 4-2 (PDF 161) 4.3 Traffic Volumes: Reference were added to include the ITE Trip Generation Handbook, ITE Transportation Impact Analysis for Site Development, and ITE Trip Generation.
- Page 4-2 to 4-3 (PDF 161 to PDF 162) B. Project Site-Generated Traffic Volumes: References were added to include ITE and trip generation studies approved by Howard County.
- Page 4-4 (PDF 163) 4.5 Mitigation Requirements: The words "General County" were added to the heading. Reworded the first paragraph from "that the level of service will be below the adopted level of service standard" to "operations will be below the adopted standards of Section 4.2".
- Page 4-6 (PDF 165) 4.6 Traditional Requirements Added a 4th paragraph exception allowing Downtown Columbia to modify certain FDP traffic studies.
- Page 4-7 (PDF 166) A. Subdivision Approval: Added under 4. This provision does not apply to Downtown Columbia
- Page 4-8 (PDF 167) 4.8 Approval Requirements: Added paragraph "Exception" allowing Downtown Columbia to modify certain FDP traffic studies
- Page 4-8 (PDF 167) B. Site Development Plan: Added "or as stipulated in the exception above" at the end of the paragraph.
- Page 4-8 to 4-26 (PDF 167 to PDF 185) Added Specification Section 4.9 Requirements – Downtown Columbia.

CHAPTER 5:

- Page 5-9 (PDF 196) C. Safety Studies: Added information to clarify how to obtain crash data from SHA and Howard County.
- Page 5-15 (PDF 202) B. Roundabouts: Revised the last paragraph to update the reference from June 2004 to October 2012 for Maryland's SHA "Roundabout Design Guidelines". Removed the references to FHA and added a reference to NCHRP Report 672 or latest edition.
- Page 5-17 (PDF 204) 5.5 Street Lighting: Removed the entire section from Chapter 5.

Volume III Improvements, Updates and Clarifications**CHAPTER 1:**

- Page i thru ii (PDF 004, PDF 005) Revised Table of Contents
- Page 1-4 (PDF 009) 1.3 Definitions, Standard Specifications: Revised the capitalized letter F in the word For to non-capital, removed a comma.
- Page 1-6 (PDF 011) 1.5 Minor Collector: Changed a semi colon to a comma.
- Page 1- 11 (PDF 016) 1.8 B 2. e. Under "Items to Include in Topographic Surveys" clarified hydrants are "fire" hydrants and added "Sanitary sewer mains" as an item to be included in the topographic surveys.
- Page 1-12 (PDF 017) 1.8 B 2. k. Under "Items to Include in Topographic Surveys" added "Wetland Buffers" to be included in the topographic surveys.
- Page 1-17 (PDF 022) 1.9.C 7.c. Revision Box. Added "and the plan has been signed by the approving authority" to after the designers seal and signature has been affixed to the plan.
- Page 1-19 (PDF 024) 1.9 E, Clarified that the coordinate system is based on Maryland State "Plane Coordinate" System by adding the words "Plane Coordinate".

CHAPTER 2:

- Page i thru iii (PDF 31 thru 33) Revised Table of Contents
- Page 2-5 (PDF 038) D Sight Distance: Updated the references for Table 2.01 "Stopping Sight Distances" from 2004 to 2011.
- Page 2-6 (PDF 039) D Sight Distance: Updated the references for Table 2.02 "Minimum Passing Sight Distance" from 2004 to 2011
- Page 2-6 (PDF 039) Reference stating that " E. Permanent Non-Through Streets/Temporary Non-Through Streets" and " F. Alleys" are discussed in different sections were removed from this heading of "Roadway Design".
- Page 2-8 (PDF 041) 2.3 A. 1. f. Horizontal Sight Distance: Updated the references from 2004 to 2011.
- Page 2-10 (PDF 043) 2.3 A. 3. d. Updated the references in paragraph 2 from 2004 to 2011.
- Page 2-11 (PDF 044) 2.3 A. 3. F. Temporary Non-Through Streets: Revised the un-capitalized letter n in the word non to Non-capital.
- Page 2-12 (PDF 045) Table 2.03: Revised the reference from Exhibit 3-15 to Table 3-7 and updated from 2004 to 2011.
- Page 2-12 (PDF 045) Second paragraph after Table 2.03 references: Revised the reference from Exhibit 3-32 to Table 3-17 and updated from 2004 to 2011.
- Page 2-13 (PDF 046) B. Vertical Alignment, Grades: Revised numerical heading for "Grades" from 5. To 1.
- Page 2-15 (PDF 048) Crest Vertical Curves, first paragraph after formula definitions: Revised the reference from Exhibit 3-71 to Figure 3-43 and updated from 2004 to 2011.
- Page 2-16 (PDF 049) Table 2.04: Revised the reference title from "Stopping Sight Distance and for Crest Vertical Curves" to "Crest Vertical Curves Based on Stopping Sight Distance", From Exhibit 3-72 to Table 3-34 and from 2004 to 2011.
- Page 2-17 (PDF 050) Table 2.05 References: Revised the reference from Exhibit 3-73 to Table 3-35 and updated from 2004 to 2011.
- Page 2-18 (PDF 051) Table 2.06 References: Revised the reference from Exhibit 3-75 to Table 3-36 and updated from 2004 to 2011. Next paragraph revised the reference from Exhibit 3-74 to Figure 3-44 and updated from 2004 to 2011.
- Page 2-19 (PDF 052) 3. Critical Length of Grade, third and fourth paragraph: revised references from exhibit 3-59 to Figure 3-28 and updated the reference from 2004 to 2011.
- Page 2-22 (PDF 057) I. Traffic Barrier: Replaced the word needed with required.
- Page 2-26 (PDF 059) 2.5 Intersection Design A.: Revised the heading from "Staged Construction" to "General".
- Page 2-28 (PDF 061) B. Geometric Design 3.: Updated reference from 2004 to 2011.
- Page 2-28 (PDF 061) B. Geometric Design 4.: Updated two references from 2004 to 2011. Revised the reference from Exhibit 9-19 to Table 9-15 and from Table 9-20 to Table 9-16. Added the words "Simple Curve Radius with Taper" to the "Edge-of-Traveled-Way Design for Turns at Intersections" reference. Added the words "Designs" and "Three-Centered Curves" to the "Edge-of-Traveled-Way for Turns at Intersections" of AASHTO reference.
- Page 2-28 (PDF 061) TABLE 2.08: Corrected the spelling of MIMIMUM to MINIMUM in the title.
- Page 2-29 (PDF 062) Updated the reference from 2004 to 2011. Revised the reference from Exhibit 9-19 to Table 9-15 and revised the reference from Table 9-20 to 9-16.
- Page 2-30 (PDF 063) 5. Auxiliary Lanes, 3rd paragraph after d.: Updated the reference from 2004 to 2011. Revised the reference from Exhibit 10-70 to Table 10-3. Revised the reference from Table 10-73 to Table 10-5.
- Page 2-31 (PDF 064) 6. Turning Roadways: First paragraph revised the reference from Exhibit 3-51 to Table 3-59 and updated the reference from 2004 to 2011. Second paragraph revised the reference from Exhibit 3-51 to Table 3-29 and updated the reference from 2004 to 2011.

- Page 2-32 (PDF 065) 7. Median Lanes and Openings: 5th Paragraph; Revised the reference from Exhibit 9-79 to Table 9-26 and Figure 9-81 to Figure 9-56. Added "(SU-30) Design Vehicle, Control Radius of 50 ft. to the reference. 7th Paragraph; Revised the reference from Exhibit 9-87 to Figure 9-59 and updated the reference from 2004 to 2011.
- Page 2-32 (PDF 065) 8. Traffic Islands: First paragraph changed the word "marked" to "demarcated" and the word "paint" to "pavement markings".
- Page 2-32 (PDF 065) 8. Traffic Islands: Sixth paragraph changed the word "evergreens" to "materials".
- Page 2-43 (PDF 076) E. Design Unit Size and Location: First paragraph removed the reference to a "Private Access Place" requirement for screening a collection area from adjacent properties.
- Page 2-47 (PDF 080) 2.14 Speed Control Devices B. Definitions: Added the term Vertical deflection as a device including speed humps and clarifying what horizontal deflections cover.
- Appendix G (PDF 091) Parking Stall Layout Elements: Under Notes: Revise Note 2 reference from See Section 2.8... to See Section 2.9...

CHAPTER 3:

- Page 3-12 (PDF 107) M. Foundation Reports: Added in the first paragraph that the depth and number of borings should be per AASHTO requirements.
- Page 3-13 (PDF 108) M. Foundation Reports: Added in the second paragraph the words "impact of" prior to settlement. Added construction control considerations as an item to be addressed in the foundation report. Revised the word "accompanies" to "accompanied".
- Page 3-20 (PDF 115) f. MSE: Added a description of what an MSE wall is.
- Page 3-27 (PDF 122) Revised the heading number from 2. to 3. For Retaining Wall Design Guidelines.
- Page 3-30 (PDF 125) e. Construction Details- Fences/Guardrails: 8th paragraph – grammatical correction: shortened space between words.
- Page 3-31 (PDF 126) g. Construction Drawings – Required Notes: Changed the "pressure" to "resistance" in the second paragraph.

CHAPTER 4:

- Page i thru ii (PDF 158 to PDF 159) Revised Table of Contents
- Page 4-1 (PDF 160) B. Level of Service: Description has been slightly reworded.
- Page 4-2 (PDF 161) C. Study Area: The words "as follows" were changed to "defined below".
- Page 4-7 (PDF 166) B. Exempt Residential Projects: Added to item 6 "previously tested in the subdivision process".

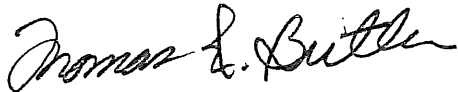
CHAPTER 5:

- Page i (PDF 187) Revised Table of Contents
- Page 5-2 (PDF 189) 2 Traffic Studies A. 1.: Changed the word from "accident" to "safety".
- Page 5-8 (PDF 195) b. At-Grade Intersection (Interrupted Flow): Changed the word from "assures" to "assumes".
- Page 5-13 (PDF 200) 4. Revised date to MONTH YEAR
- Page 5-15 (PDF 202) 5.3 A. Traffic Signals: Added the acronym (SHA).
- Page 5-16 (PDF 203) A. General: Added the words "latest edition of" for the MUTCD and removed the 2003 date.
- Page 5-16 (PDF 203) B.: Capitalized the word "The".

- Page 5-17 (PDF 204) Revised the heading number from 5.6 to 5.5 for Maintenance of Traffic During Construction.
- Page 5-18 (PDF 205) Maintenance of Traffic During Construction: Added the words "latest edition of" for the MUTCD and removed the 2003 date in the ninth paragraph.
- Page 5-18 (PDF 205) Revised the heading number from 5.7 to 5.6 for At-Grade Railroad Crossings.
- Page 5-18 (PDF 205) At-Grade Railroad Crossings: Added the words "latest edition of" for the MUTCD and removed the 2003 date in the ninth paragraph.

If you have any question, please contact Thomas Auyeung of the Transportation and Special Projects Division at 410-313-6142.

Very truly yours,

A handwritten signature in black ink that reads "Thomas E. Butler". The signature is written in a cursive style with a large initial 'T' and 'B'.

Thomas E. Butler, Deputy Director
Department of Public Works
Engineering, Development and Construction