DRAFT

Section I
Roadway Development Guidelines

Table of Contents

Chapter 4 Permitting

Chapter 5 Capital Improvement Program

List of Tables

Chapter 1
Introduction

A. The Department

1. Mission Statement

The mission of the Department of Public Works and Transportation is to provide and sustain a safe, well-maintained, aesthetically pleasing, and environmentally responsible transportation system of roads, bridges, sidewalks, bicycle paths, and transit services, as well as to enforce site development compliance. The Department also strives to provide the highest quality services to County residents and businesses, thereby stimulating the economic and community development of the County through improvements to the transportation infrastructure.

2. Organization

The Department is divided into four operating offices under the oversight of the Office of the Director. (See organization chart, page 5.) The *Office of the Director* is responsible for the overall direction and management of the Department and provides staff support and services to the four operating offices, including human resource management; financial management; maintenance and repair of the Department's fleet of equipment used to deliver services; information technology management; and coordination of State, regional, and Federal transportation issues.

The *Office of Transportation* provides administration and departmental coordination for its two operating divisions: Transit and Traffic Management and Operations.

- The Division of Transit operates and manages the County's transit services, including *The Bus*, paratransit services for senior and disabled citizens, and ridesharing programs; analyzes transit data; and advises County officials on mass transit operations within the County, including Metrobus, Metrorail, and commuter rail.
- The Division of Traffic Management and Operations reviews traffic signal plans; evaluates the need for implementing traffic management measures; oversees the operation of the Transportation Response Information Partnership (TRIP) Center, which monitors County traffic signals through close circuit television cameras; observes and monitors real-time traffic signal coordination and signal timing; deploys temperature probes throughout the County to monitor pavement temperatures and weather conditions; and provides special pavement markings on roads in high-traffic-volume areas; provides special equipment for the speed awareness program; provides special pavement markings; and maintains all existing traffic signal equipment and street signs within the County rights-of-way.

The *Office of Project Management* manages the planning, design, and construction of County-funded roadway and bridge projects. It is composed of two operating divisions: Highways and Bridges, and Right-of-Way.

- The Division of Highways and Bridges plans, designs, and constructs

roadway, drainage, flood control, and bridge-related capital improvement projects. This division also manages ing and construction management firms engaged in the design and construction of road, bridge, drainage, and flood control projects.

- The Division of Right-of-Way appraises and acquires the necessary rights-of-way and easements for Department construction and maintenance activities. This division also provides property acquisition support for many of the County's other departments.

The *Office of Engineering* is composed of two divisions: Engineering and Inspection Services (which includes the Permits and Utility Sections) and Stormwater Management.

- The Engineering and Inspection Services Division (EISD) reviews and approves construction plans for proposed road improvements and site developments submitted by the development community; issues permits for various work located within the County rights-of-way and site development; reviews, approves, and inspects stormwater management facilities, flood plain delineation and site grading; provides review comments to the Maryland-National Capital Park and Planning Commission (M-NCPPC) in reference to subdivision referrals; inspects and enforces code requirements for all permitted site construction and road construction within the public rights-of-way; and provides technical assistance to the County Council, citizens, and other agencies.

  The EISD also reviews and issues permits, regulates construction, and enforces all Chesapeake Bay Critical Area (CBCA) requirements. The CBCA is comprised of three distinct overlay zones (e.g., Intense Development, Limited Development, and Resource Conservation), all of which are subject to code enforcement, review, and the permitting process. The Division performs compliance reviews for new building construction building additions, accessory structures, and grading that may be impacted by the CBCA program.
- The Materials Lab performs quality assurance testing of construction materials and reviews geotechnical studies in support of permits and the Department's Capital Improvement Program (CIP) projects.
- The Division of Traffic reviews and approves traffic designs for roadways and parking facilities, new developments, and subdivisions, including signing, pavement marking, and maintenance of traffic; forecasts future traffic volumes and patterns; implements the County's street lighting program; conducts street light studies, traffic signal studies, traffic counts, traffic studies, and the speed awareness program; prepares traffic signal designs and maintenance of traffic designs. This division also implements the Neighborhood Traffic Management Program (NTMP). (See Section IV, Appendix D.)
- The Permits Section, also part of the EISD, accepts and processes all permit-related activities for the Department. This section accepts applications from the general public, private contractors, and developers to perform site construction and roadway construction work within the public rights-of-way; collects permit fees and processes permit applications; and reviews cost estimates and roadway construction

plans prepared by consultant engineers. The Permits Section also works in liaison with the Department's EISD, the Utility Section, and the County's Office of Law, as well as other county agencies, to ensure that County Code requirements related to the issuance of building permits are met. The Permits Section is responsible for releasing and closing out all permits.

- The Utility Section coordinates with utility service companies whose facilities are located within the County rights-of-way. It administers all aspects of the permitting of utility installation and maintenance in the County rights-of-way, including application, review, issuance, and inspections, in accordance with the *Prince George's County Policy and Specification for Utility Installation and Maintenance*. (See Section IV, Appendix E.)

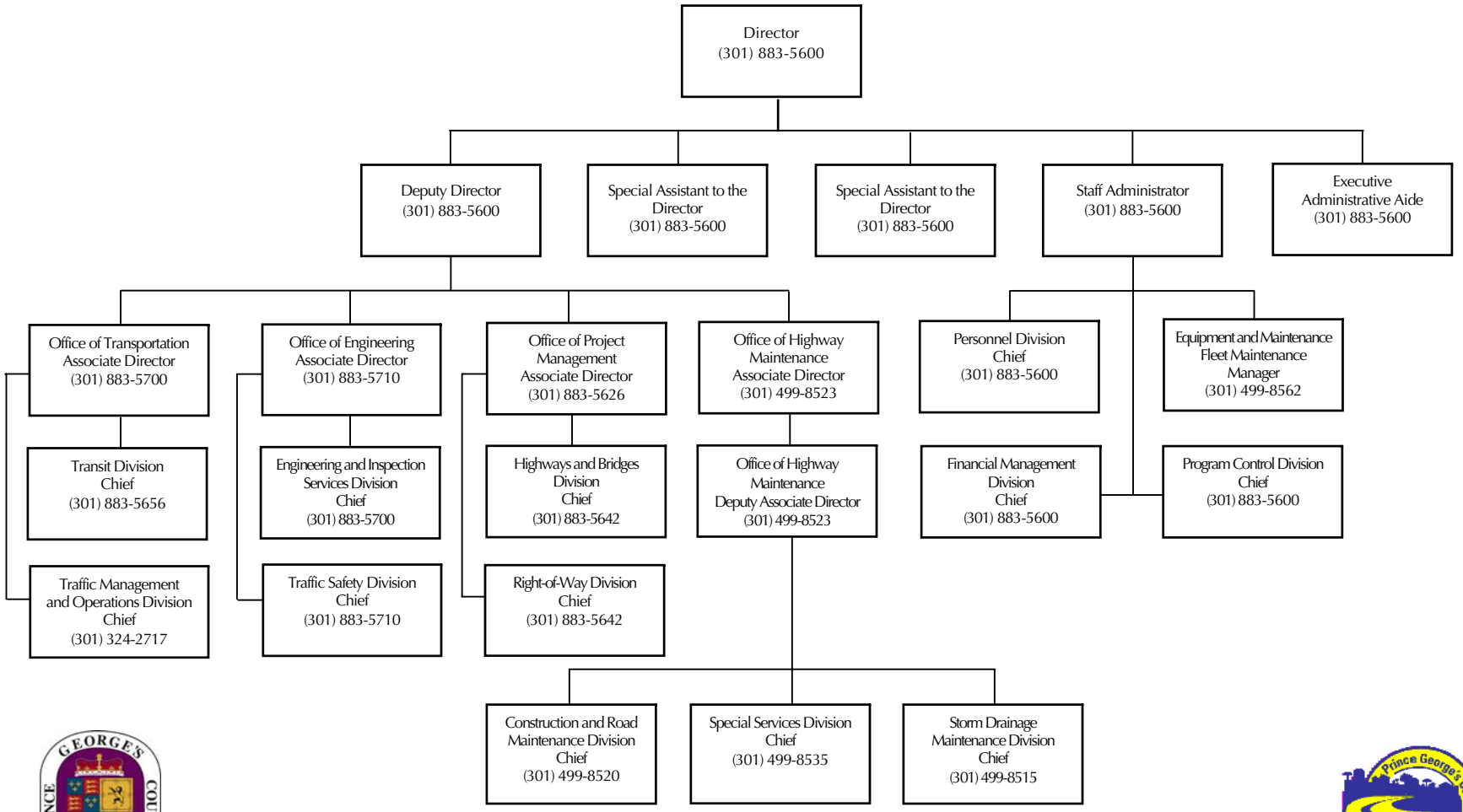
The *Office of Highway Maintenance* provides a variety of services required for keeping the County's roadway system ready for use and reasonably free of hazards through its three operating divisions: Construction and Road Maintenance, Special Services, and Storm Drainage Maintenance.

- The Division of Construction and Road Maintenance coordinates maintenance and repair activities for the County's roadways. These activities include roadway repair, side ditch maintenance, leaf collection, and snow and ice control. This division also coordinates the construction of minor Capital Improvement Program (CIP) projects that are unsuitable for contracting and maintains bridges, box culverts, inlets, guardrails, sidewalks, and concrete curbs and gutters. The division also provides construction administration for roadway resurfacing and related rehabilitation projects.
- The Division of Special Services maintains the trees, turf, and grounds associated with County roadways and certain buildings. This responsibility includes collecting and disposing of roadside litter and other debris and managing the County's mechanical street sweeping program.
- The Division of Storm Drainage Maintenance develops, administers, and inspects both contractual and in-house maintenance and repair activities for the County's public storm drainage and flood control facilities; maintains and repairs the County's flood control pumping stations; and maintains stormwater systems, drainage channels, stormwater management ponds, and all County-owned facilities located within storm drainage easements.

3. Organization Chart

The organization chart of the Prince George's County Department of Public Works and Transportation appears on page 5.

Prince George's County
Department of Public Works and Transportation
Organization Chart



Permits Section (301) 883-5915
Utility Section (301) 883-5710

February 2007

B. General Information

The purpose of the *Specifications and Standards for Roadways and Bridges in Prince George's County, Maryland* (*Specifications and Standards*) is to promote uniform and consistent criteria, standards, and practices for the construction of roadways in Prince George's County, Maryland (the County). Section I serves as a guide to Permittees and their engineers, County Department of Public Works and Transportation (the Department) staff reviewers and designers, and consultants. It is intended for use, in conjunction with the requirements set out in Section II, "Technical Specifications," and Section III, "Standard Roadway Sections and Details," and regulations and policies of the Department, as well as applicable State and Federal standards, for the design and construction of a roadway system that is safe, efficient, durable, aesthetically pleasing, and environmentally acceptable.

The engineering data and recommendations presented herein are intended to represent acceptable standards for routine designs in normal circumstances. The user of this document should be alert, however, to the existence of special or nonstandard situations involving roadway design. Any departures from normal circumstances should be considered in consultation with Department reviewing engineers. Lowering of the acceptable standards established herein should be avoided unless there is a reasonable expectation that the situation will be upgraded at a future time to conform to these standards and it is evident that the lowered standards will fully meet the needs of the design requirements and predicted traffic volume for the life of the development without jeopardizing safety.

NOTE: Any lowering of standards from those prescribed in this document shall occur only with the prior written approval of the Department Director.

Departures from these standards that result in consistently higher standards and innovative solutions promoting traffic safety, and roadway durability and capacity, are encouraged.

NOTE: In all cases, roadway designs prepared for use in Prince George's County are subject to final review and approval by the Department Director.

These *Specifications and Standards* govern the design and construction work done in relation to Prince George's County Capital Improvement Program (CIP) projects and construction contracts administered by the Department, except in those instances referenced in such contracts. The scope of services to be performed under a departmental design contract, the design approval criteria, and the exact work to be performed under a departmental construction contract will be established by the Department Offices of Engineering, Highway Maintenance, Project Management, and/or Transportation, using the guidelines, specifications, and standards provided in these specifications.

1. Definitions

The technical, geometric, structural, and design terms used in these *Specifications and Standards* shall have the meanings stated in the *Standard Specifications for Construction and Materials* of the Maryland State Highway Administration (MSHA), and the Prince

George's County Code, Subtitle 23. Where not defined therein, those terms shall have the meanings established by the American Association of State Highway and Transportation Officials (AASHTO) and the American Society for Testing and Materials (ASTM).

In addition, certain terms that are used in this document shall be defined as follows:

Arterial roadway—A through roadway with four to six traffic lanes divided by a median and designed to carry higher traffic volumes where parking and direct access are generally prohibited, and entrances, intersections, and median crossings are placed at wide intervals

Major Collector roadway—A through roadway with four traffic lanes divided by a median and designed to carry moderate traffic volumes where parking is generally prohibited and direct property access is limited

Collector roadway—A through roadway with four traffic lanes divided by a painted centerline and designed to carry moderate traffic volumes where parking is generally prohibited and direct property access is limited

Commercial roadway—A roadway designed with sufficient strength to serve adjacent properties with commercial zoning designations; low-volume two-way traffic lanes may be accommodated, as well as some on-street parking, unless otherwise prohibited

Department—The Prince George's County Department of Public Works and Transportation

Industrial roadway—A roadway designed with superior strength to accommodate all industrial-related vehicles and serve adjacent properties having industrial zoning designations; high-volume two-way traffic lanes may be accommodated where on-street parking is prohibited

Residential roadway—A local roadway designed to accommodate light vehicle traffic and to serve adjacent property having residential zoning classifications

Road Ordinance—Subtitle 23 of the Prince George's County Code

2. Abbreviations

The abbreviations listed in GP-Section 1, Item 1.04, of the MSHA *General Provisions for Construction Contracts,* latest edition, are adopted. In addition, the following abbreviations shall have the meanings indicated here:

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
BGE	Baltimore Gas & Electric
CATV	Cable Television
CIP	Capital Improvement Program
DER	Department of Environmental Resources, Prince George's County

DPW&T	Department of Public Works and Transportation, Prince George's County
ENR	Engineering News-Record
FHWA	Federal Highway Administration
MDE	Maryland Department of the Environment
MDOT	Maryland Department of Transportation
M-NCPPC	Maryland-National Capital Park and Planning Commission
MSHA	Maryland State Highway Administration
MSMT	Maryland Standard Method of Tests
MUTCD	*Manual on Uniform Traffic Control Devices*
NCHRP	National Cooperative Highway Research Program
NTMP	Neighborhood Traffic Management Program
PEPCO	Potomac Electric Power Company
PGSCD	Prince George's Soil Conservation District
PUE	Public Utility Easement
SMECO	Southern Maryland Electric Cooperative
MOT	Maintenance of Traffic
USCS	Unified Soil Classification System
WGL	Washington Gas Light Company
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Washington Suburban Sanitary Commission

3. References

The following documents provide general guidelines and policies on the design of highways. References to dated publications shall be understood to be updated as revisions or supplements are released by their respective publishers.

a. Publications of the American Association of State Highway and Transportation Officials (AASHTO):

- *A Policy on Geometric Design of Highways and Streets*, latest edition
- *Roadside Design Guide*, latest edition
- *A Policy on Design Standards/ Interstate Systems*, latest edition
- *Manual on Uniform Traffic Control Devices*, latest edition
- *Standard Specifications for Highway Bridges*, 1996 and current interim specifications
- *Guide for the Development of Bicycle Facilities,* latest edition

b. Publications of the Transportation Research Board (TRB), National Research Council, including the *Highway Capacity Manual*, latest edition.

c. Publications of the Prince George's County Department of Public Works and Transportation:

- The component parts of these *Specifications and Standards*:
  - Roadway Development Guidelines;
  - Technical Specifications;
  - Standard Roadway Sections and Details;
  - Appendixes.
- *Specifications and Standards for Traffic Control Signals*, Section IV, Appendix G;

- *Neighborhood Traffic Management Program*, Section IV, Appendix D;
- *Guidelines for the Design of Scenic and Historic Roads*, Section IV, Appendix F;
- *Policy and Specifications for Utility Installation and Maintenance*, Section IV, Appendix E;
- *Prince George's County Road Ordinance*, Section IV, Appendix C;
- *Specifications and Standards for Stormwater Management;*
- *Stormwater Management Design Manual*.

d. Other publications of the Prince George's County Government, including the County Code, and especially:

- Prince George's Soil Conservation District—Soil Erosion and Sediment Control—Pond Safety Reference Manual, May 2000 or latest edition;
- Subtitle 4, Building;
- Subtitle 5A, Cable Television;
- Subtitle 23, Roads and Sidewalks (Road Ordinance 1989);
- Subtitle 24, Subdivisions;
- Subtitle 25, Trees and Vegetation;
- Subtitle 26, Vehicles and Traffic;
- Subtitle 27, Zoning Ordinance;
- Subtitle 28, Civil Monetary Fines or Penalties.

e. Publications of the Maryland State Highway Administration (MSHA), Maryland Department of Transportation (MDOT):

- *MDE 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control,* or latest edition;
- *Standard Specifications for Construction and Materials*, latest edition;
- *Book of Standards for Highways and Incidental Structures*, latest edition;
- Maryland Supplement to the *Manual on Uniform Traffic Control Devices*, latest edition.

f. The following landscape technical publications are referenced and their requirements adopted for landscape and arboricultural operations in Prince George's County:

- *Specifications and Standards for Roadways and Bridges in Prince George's County, Maryland,* Prince George's County Department of Public Works and Transportation (DPW&T), Section III, Standards 600.01 through 600.20;
- *Specifications and Standards for Construction and Materials,* MDOT, MSHA, Category 700, Landscaping, and Section 920, Landscaping;
- *Book of Standards—Maintenance of Traffic and Safety,* MDOT, MSHA;
- *The Maryland Roadside Tree Law, Title 08, Law and Regulations—Permits and Certified Tree Care Experts,* Maryland Department of Natural Resources (DNR);

- ANSI Z133.1-2000 for Arboricultural Operations, American National Standards Institute (ANSI);
- *Standard Procedures and Specifications—Planting Operations*, American Association of Nurserymen;
- *Seeding Operations,* Maryland Department of Agriculture, Seed Certification Agency;
- *Maryland Pesticide Applicator's Law—Certified Applicator of Pesticides (Category IIIA or VI),* Maryland Department of Agriculture;
- *Standards of the Association of Official Analytical Chemists—Fertilizer Grades,* Association of Official Analytical Chemists;
- *Topsoil Testing*, University of Maryland or certified private laboratory; and
- *Invasive Species,* Maryland Department of Agriculture, Maryland Invasive Species Council, Plant Protection and Weed Management Section.

g. Publications of the Washington Metropolitan Area Transit Authority (WMATA), including *General Provisions and Standard Specifications for Construction Projects*.

Chapter 2
Objectives and Road Classifications

A. Objectives

The general intention of these roadway classifications is to meet three objectives. First, new roadway construction or reconstruction shall result in roadways that are safe and that promote mobility for auto, pedestrian, bicycle, public transit, and all other elements of the traveling public. Second, to the extent possible, sufficient roadway capacity should be developed to accommodate existing local and regional traffic as well as that anticipated by recognized future traffic projections. Third, these objectives should be attained in a manner that is aesthetically pleasing, with minimal adverse impact on the environment, including all lands adjoining the roadway.

Because the primary objective is safety, all aspects of roadway design and construction (including hiker/biker trails, sidewalks, and street lighting) are expected to adhere to minimum nationally recognized standards. Where it is practical and consistently attainable, the highest level of safety should be sought by exceeding these minimum standards.

Subject to the foregoing, all roadway design and construction must meet the additional objectives of providing a safe, durable, low-maintenance, right-of-way area that is free of clutter, drainage problems, and other nuisances in a high-quality and visually pleasing environment.

In all cases, the Department Director or a duly authorized representative shall have final approval authority for all proposed roadway improvement projects within County rights-of-way.

B. Road Classifications

The following are the functional classifications of roadways in Prince George's County. Urban classifications are closed-section (e.g., with curb and gutter) and rural classifications are open-section (e.g., no curb and gutter) roadways. For appropriate widths and rights-of-way, see Table I-1.

1. Arterial Road (Urban and Rural)

A through roadway which links principal State highways, or County arterial or collector roads. An arterial road:

- Is intended to serve major centers of activity in urban and rural areas and to carry the highest traffic volumes of County roadways;
- Separates opposing traffic with a median of sufficient width to contain exclusive left-turn lanes and to allow crossing vehicles to clear one-half of the roadway and wait safely in the median before entering the other half;
- Provides four or six through lanes;
- Generally prohibits on-street parking and direct private property access; where allowed, such parking and access are supported by additional lanes and specially approved entrances;
- Provides controlled access, limited to widely spaced entrances, intersections, and median crossings; with left turn, acceleration, and deceleration lanes; and signals provided as necessary;
- May use curbed or open drainage construction in both the median and roadside areas, depending on the setting and conditions of connecting roads; and
- In urban areas only, may provide either sidewalks or hiker/biker trails for pedestrian use.

Generally, the median width may vary, depending on the intersection and median crossing requirements and the availability of sufficient right-of-way width to accommodate the median. Additional median and/or right-of-way widths may be provided to accommodate sidewalks, hiker/biker trails, bike lanes, and future high-occupancy vehicle lanes, busways, or other public transit facilities (e.g., light rail).

Arterial roads shall be constructed to conform with the requirements stipulated in Section III, Standards 100.01 and 100.08.

2. Major Collector Road (Urban and Rural)

A through roadway which links State highways, or County arterial or collector roads. A major collector road:

- Is intended to carry moderate daily and peak traffic volumes typical of generally continuous, occasionally interrupted, traffic flow along a route that is dominant over the local streets, but subordinate to the State highways and County arterial roads;
- Separates opposing traffic by a median or painted centerline median and contains exclusive left-turn lanes while maintaining continuity;
- Provides four through lanes;
- Generally prohibits on-street parking and direct private property access; where allowed, such parking and access are supported by additional lanes or bays;
- Provides entrances, intersections, and median crossings that are spaced to avoid interference with right turn, acceleration, or deceleration lanes, as necessary;
- In urban areas only, may provide sidewalks or hiker/biker trails for pedestrian/bicycle use or bike lanes within the travel lanes; and
- May use curbed or open drainage roadside construction, depending on the setting and conditions of connecting roads.

Major collector roads shall be constructed to conform with the requirements stipulated in Section III, Standard 100.02.

3. Collector Road (Urban and Rural)

A through roadway comparable in function to a major collector road, except a median or other physical traffic barrier to separate opposing traffic is not required other than at critical locations. The collector road:

- Separates opposing traffic by a painted centerline or, where warranted, by a painted continuous two-way left-turn lane or exclusive left-turn lane; such exclusive left-turn lanes may be required in:
  - Commercial areas where access spacing is close;
  - Residential areas where homes front the roadway; or
  - Any area where closely spaced intersections require frequent transitions to accommodate left turns;
- Provides four through lanes for ultimate construction, except that, where traffic volumes are expected to remain low for some time, a phased construction of two through lanes with provisions for future widening may be provided; in addition:
  - On a four-lane collector where on-street parking is prohibited and where there is not a continuous left-

turn lane, the pavement width is 46 feet; where one-side parking or separate bicycle lanes are required, a width of 54 feet is necessary;
    - On a four-lane collector with a continuous left-turn lane, where on-street parking is prohibited, a width of 58 feet is necessary; and
    - In low-traffic rural areas, permanent two-lane construction may be allowed;
- Treats on-street parking, direct private property access, entrances, intersections, and crossings in the same manner as a major collector road, except that access may be more liberally allowed in urbanized areas;
- In urban areas only, may provide sidewalks or hiker/biker trails for pedestrian/bicycle use or bike lanes within the travel lanes; and
- May use curbed or open drainage roadside construction, depending on the setting and conditions of connecting roads.

Collector roads shall be constructed to conform with the requirements stipulated in Section III, Standards 100.03, 100.04, and 100.09.

4. Urban Commercial and Industrial Road

A local roadway serving a developed area having commercial or industrial uses on either side, or predominantly institutional or high-density residential uses in the general area. A commercial and industrial road:

- Is geometrically similar to a collector road;
- Is intended to allow for frequent turning movements, and occasional curbside parking or standing of heavy vehicles;
- Separates opposing traffic by a painted centerline;
- Restricts on-street parking and direct private property access only where necessary for capacity, turning movements, or safety;
- Requires curbed roadside construction; increased intersection curb radii should be provided to accommodate large vehicles;
- Industrial roads require a more durable pavement design to accommodate increased-weight vehicles, characteristic of industrial areas; and
- May provide sidewalks for pedestrian use.

Commercial and industrial roads shall be constructed to conform with the requirements stipulated in Section III, Standard 100.05.

5. Primary Residential Road (Urban and Rural)

A local roadway intended to distribute light vehicles and occasional service traffic into or through a large residential area from a dominant roadway. A primary residential road:

- Is intended to serve adjacent properties with a clear two-way roadway at low speeds subject to traffic interruptions at intersections and driveways; through and point-to-point traffic may occur;
- Separates opposing traffic by a painted centerline;
- Restricts direct private property access only where necessary for capacity, turning movements, or other safety considerations;
- Restricts on-street parking only in the case of open drainage construction

where the shoulder width is insufficient to park vehicles clear of the two through lanes and where necessary for safe turning movements;
- May require either curbed or open drainage roadside construction, depending on the continuity with adjacent construction, available right-of-way, lot widths, spacing of entrances, availability of sufficient off-street parking, or drainage requirements; curbed construction is required where the abutting development will result in closely spaced entrances or where off-street parking will be in short supply, as is usually determined by the predominant lot widths, sizes, or setbacks, and by where the continuity of the roadway or drainage requires curbing; and
- In urban areas only, provides sidewalks for pedestrian use.

Primary residential roads shall be constructed to conform with the requirements stipulated in Section III, Standards 100.06 and 100.10.

6. Secondary Residential Road (Urban and Rural)

A local roadway intended to provide access to small residential areas with very limited or no through traffic. A secondary residential road:

- Is intended to provide adjacent properties with slow-speed access adequate for light vehicles and occasional service vehicles;
- Provides one clear through lane;
- May require opposing traffic to yield or to use adjacent parking lanes for passing;
- Generally does not restrict direct private property access, except in proximity to intersections;
- Restricts on-street parking only in the case of open drainage roadside construction, or where necessary for turning movements or other safety considerations;
- May require either curbed or open drainage roadside construction, depending on the density, setting, location, and style of the residential development and conditions of the connecting roads; curbed construction is required where the abutting development will result in closely spaced entrances or where off-street parking will be in short supply, as is usually determined by predominant lot widths, sizes, or setbacks, and by where the continuity of the roadway or drainage requires curbing; and
- In urban areas only, provides sidewalks for pedestrian use.

Secondary residential roads shall be constructed to conform with the requirements stipulated in Section III, Standards 100.07 and 100.11.

7. Scenic or Historic Rural Road

A through roadway which has been designated as possessing unique scenic or historic characteristics deemed worthy of preservation. Scenic or historic roadways may include among their identifying features: scenic views, distinctive topographical features, curving and/or rolling roadway alignments, leaf tunnels, views of historic buildings or sites, etc.

NOTE: For more information, including an approved list of scenic and historic rural roads in Prince George's County, and procedures for designation and planning, refer to the Department's *Guidelines for the Design of Scenic and Historic Roadways in Prince George's County, Maryland*. (See Section IV, Appendix F.)

A scenic roadway:

- Has been designated by the Prince George's County Council and provides scenic views along a substantial part of its length through natural or manmade features, such as forest or extensive woodland, cropland, pasturage, or meadows; distinctive topography, including outcroppings, streambeds, or wetlands; traditional building types; historic sites; or roadway features such as curving, rolling roadway alignment and 'leaf tunnels';
- Shall have as its goal to provide safe and enjoyable travel while preserving the scenic or historic value of adjacent areas;
- Is, in most cases, a two-lane rural roadway with open drainage;
- Requires that typical section and drainage needs be determined in each case by the Department Director, based on the projected development and traffic capacity needs of the area;
- May require, in some cases, an urban roadway with enclosed drainage; and
- Shall in no case be less than a 22-foot pavement, excluding the shoulder area. (See Section IV, Appendix F.)

A historic roadway:

- Has been designated as historic by the Prince George's County Council and is documented by historic surveys or maps that maintain its historic alignment and historic landscape context through views of natural features, historic sites and structures, historic farmstead groupings, or rural villages;
- Has been designated as historic because its use dates back to the County's early settlement, and it provides irreplaceable links to our past;
- Is, in most cases, a two-lane rural roadway with open drainage;
- Requires that typical section and drainage needs be determined in each case by the Department Director, based on the projected development and traffic capacity needs of the area;
- May require, in some cases, an urban roadway with enclosed drainage; and
- Shall in no case be less than a 22-foot pavement, excluding the shoulder area. (See Section IV, Appendix F.)

To set minimum standards for design and construction, each proposal for undertaking work on a particular rural road designated by the County as scenic or historic shall be reviewed by the Department Director or by a duly authorized representative, who shall also have final approval authority for all proposed roadway improvement projects within the County rights-of-way. This coordination will begin when the preliminary plan of subdivision is submitted by the prospective permit applicant to the M-NCPPC for approval. Prior to application submittal, a conceptual meeting will be scheduled by the applicant with M-NCPPC and the Department. The applicant will be required to present adequate project information in order that fundamental design requirements and approvals can be made. This information will include supporting statistics

on present and projected travel demands, alignment alternatives, and a recommendation that addresses and satisfies necessary safety issues.

Scenic or historic rural roads shall be constructed to conform with the requirements stipulated in Section III, Standards 100.13 through 100.16.

8. Private Road (Rural)

A low-volume roadway designed to serve a limited number of properties in rural developments, particularly in open space; or residential agricultural, residential estate, or rural residential zones, as permitted under M-NCPPC regulations. A private rural road:

- Is comparable to a rural/secondary residential road, except that it is maintained by residents of the development;
- Does not necessarily restrict on-street parking, although the size of associated lots encourages off-street parking;
- Usually provides two usable through travel lanes;
- Generally does not restrict direct private property access, except as may be provided under the subdivision regulations;
- Usually does not separate opposing traffic;
- Requires open drainage, side ditch construction with permanent reinforced concrete storm drainage, concrete inlets and manholes, and steel guardrail barrier systems as standard;
- May not connect to more than one public roadway;

Shall be located within a minimum private right-of-way of 50-foot width in the development served; and

- May serve a varying number of single-family lots, depending on the property zoning classification; in some rural areas, ingress/egress access may be provided to a maximum number of 8 lots, each being 2 acres or larger; in other rural areas, an unlimited number of lots, 5 acres or larger, with a minimum property frontage width of 300 feet, may be served.

The M-NCPPC Planning Board may approve a subdivision with private rural roads, provided that the roads are designated as common areas. In all cases, the property owner/subdivider shall submit covenants that apply maintenance responsibilities to the individual owners of property. Those covenants will always remain with whomever holds the title to the land. The covenants shall also be filed in the land records at the time of filing the final plat of the subdivision.

Private rural roads shall be constructed in accordance with the "Rural/Secondary Residential Road" standards, pursuant to Subtitle 23 of the Prince George's County Code, and in conformity with the requirements stipulated in Section III, Standard 100.12.

Chapter 3
Road Design Guidelines and Criteria

A. Design

1. Design Speeds, Radii, Grades, and Sight Distances

For purposes of designing safe roadways, the geometric and sight distance values recommended in Table I-2 should be used. They are derived from the applicable AASHTO criteria. In accordance with AASHTO publications, the designer is expected to make a reasonable effort to provide sight distances equaling or exceeding those stated herein or as appropriate to the approved design speed throughout the length of the roadway under design.

Bearing in mind the goal of consistent driver expectation, the designer should use consistent standards to discourage driving at excessive speeds when transitioning onto roads with more restrictive standards. Specific situations, however, may allow other design speeds and provisions for corresponding sight distances, in consultation with Department reviewing engineers. The designer has latitude to submit designs based on other speeds if supported by recognized, authoritative references for the expected future traffic situation.

In urban situations and when approaching all intersections, necessary stopping sight distances require that pavement geometry, markings, and other traffic controls be visible sufficiently in advance for vehicle operators to stop their vehicles before they reach objects in their paths. Drivers should be able to comply without having to make abrupt maneuvers.

NOTE: See Table I-2 at the end of Section I for recommended radii, grades, and stopping sight distances.

Stopping sight distance is measured from a height of 3.5 feet (equivalent to a driver's eye) to the height of a 2-foot object lying on the surface of the road. Intersection sight distance is measured from a point on the minor roadway at least 15 feet from the edge of the major roadway pavement and measured from a height of 3.5 feet on the minor roadway to a 3.5-feet-high object in the major roadway. Both of these values must be considered at a driveway or intersection located near vertical or horizontal curves.

These eye-height and object-height criteria are established in the AASHTO *Policy on Geometric Design of Highways and Streets,* latest edition, which shall be used as the principal authority to justify any variance of design elements from these recommendations. The designer shall make a reasonable effort to provide sight distances equal to or exceeding those established by the applicable AASHTO publication.

The minimum centerline grades for all classes of roads are:

- 1 percent for urban (curbed) roads; and
- 2 percent for rural (side ditch or swale-drained) roads in cuts.

Where it will be necessary to allow surface flow across an intersection to drain to a curb return, the minimum grade of the roadway parallel to the swale shall not be

less than 2 percent, or 1.5 percent for urban roads. Flatter grades may be approved for designated rural roads, located on fills where the roadside drainage ditch or swale follows the toe of the fill and has a grade of 2 percent or greater. Where the pattern of development and future intersection or entrance locations have not been determined along primary residential roads, and higher classes of roadways, or where future development along a primary or secondary residential street may introduce closely spaced entrances or an on-street parking demand, it is anticipated that curbing would be required in the future. In such cases, the minimum grade would be the same as for a curbed street. Design speed and sight distance requirements for scenic or historic roads shall be determined by the Department, depending upon projected development of the area, traffic generation, and requirements necessary to provide safe travel, including factors such as vertical and horizontal alignment, road width, and traffic volume.

The minimum design criteria shall adhere to the specifications cited in Table I-2. Exceptions apply in the following circumstances:

- For commercial and industrial, primary and secondary residential, and private rural roads, where the right-of-way has been established by previously approved and recorded plats of subdivisions and where the subdivision is surrounded by developed lots and parcels, the centerline radius will generally follow the center of the right-of-way. Any specific potential hazards or obstructions should be alleviated by dedicating to public use or obtaining for and granting the County additional rights-of-way to increase the radius.
- Where the Department's reviewing engineers deem it appropriate, superelevation may be required on collector or higher class roads to provide consistent driver expectations and to accommodate existing or future roadway connections or general drainage patterns.

2. Road Widths

The right-of-way and travel way widths recommended in Table I-1 are for normal or standard conditions for each class of road; for use where specified to implement the Master Plans of the County; or for conformity to the above described functions. It is expected that roadways will be designed to be suitable for their projected traffic and level of service. Recognized, authoritative standards and engineering principles are to be applied.

Any departures from these recommendations must be supported by properly prepared and approved traffic studies. The Department recognizes the AASHTO *Policy on Geometric Design of Highways and Streets*, latest edition, as the principal authority in justifying any variance of design elements from these recommendations.

It should be recognized that most of the roadway classifications and requirements appearing on the County Master Plans are already supported by traffic estimates compiled by the staff of M-NCPPC and are based on the proposed ultimate zoning and development phasing. In the absence of specific direction or other approved studies, the designer is expected to comply with the Master Plans. The designer should be prepared to use or provide additional studies for roadway design as a possible prerequisite to obtain either authorization to proceed

with the design or the Planning Board's approval of a development proposal.

In cases of in-fill development, where the roadway in question extends a previously constructed roadway or lies between previously constructed sections of the roadway of the same class, the designer is expected to conform to the width and alignment of the previously constructed roadway to attain a consistent travel way. Exceptions may be made in cases where a special design or additional lanes may be required for parking, turning, intersection approaches, or transitions between different classes or dissimilar existing sections. At major intersections on collector roads, the collector road shall ordinarily be modified with a left-turn lane.

NOTE: See Table I-1 at the end of Section I for required right-of-way and road widths.

3. Right-of-Way

The County controls the County rights-of-way in any of the following ways:

- The County may own the right-of-way by fee simple interest;
- A right-of-way may be dedicated to public use via the subdivision plat recordation process or via other instruments recorded in the land records of the County;
- A right-of-way may be held by less than fee simple interest, such as recorded easements;
- In many cases, a right-of-way may be established by a long-term use, commonly known as a prescriptive right-of-way.

The actual width of a right-of-way may vary and sometimes depends on the specific roadway and what interest, if any, the adjacent property owners have conveyed to the County.

In many instances, existing rights-of-way are of insufficient width to accommodate needed construction and roadway widening. Drainage structures and slope protection are sometimes required to accommodate construction. In these instances, additional land, private property, or easements must be acquired. The acquisition of additional rights-of-way should be conducted in a fair manner in accordance with all County, State, and Federal laws. Equally important, all landowners are entitled to just compensation when their land is taken for public improvements.

The County will not issue a permit for roadway construction unless all rights-of-way and easements necessary are dedicated or otherwise lawfully conveyed for public use and recorded among the land records of the County.

If a developer of property or Permittee is required to acquire any necessary land as part of their permit requirements, they shall be responsible to make every effort to acquire the rights-of-way through the process of negotiation. Should these efforts fail, however, Subtitle 23 of the County Code allows the County to acquire necessary rights-of-way through the process of eminent domain. The developer of the property or the Permittee will be required to reimburse the County for ***all costs*** the County may incur in the land acquisition and eminent domain processes, and will also provide front-end funding to cover the estimated costs.

A developer or Permittee developing property abutting an existing or proposed County roadway shall be required to obtain dedication or otherwise lawful conveyance of sufficient right-of-way to public use and provide any necessary easements to enable roadway construction. This includes slope and drainage easements required for storm drainage construction and outfalls. All documents required as part of the permit and the developers land assembly responsibility, including rights-of-way, deeds, easements, conveyance instruments, and agreements, shall be prepared and recorded among the County's land records by the Department Right-of-Way Division. It should be noted that under no circumstances are such documents ever to be recorded by the developer or any third party soliciting this type of service.

In general, to be developable, lots are required to have frontage on public roadways so as to allow direct access for every lot. Any exception to this policy requires establishment of a private right-of-way or easement as the means of vehicular access. Subtitle 23 of the County Code requires that the Department review all private rights-of-way and access easements to assess entrance adequacy and suitability for use as a roadway, and to ensure that emergency vehicles can adequately access the property. The Department requires submittal of the following information for review of private rights-of-way:

- Letter of request outlining need for right-of-way, including name and address of applicant and copy of building permit application;
- Copy of deed(s) and plat, and tax account number;
- Copies of any existing private easement or rights-of-way documents;
- Copy of the site plan indicating existing and proposed topography; and
- Photo(s) of private road alignment and conditions.

The private rural/urban road shall also be constructed in accordance with private rural road regulations pursuant to Subtitles 23 and 24. The Department may also impose additional requirements and/or restrictions on the design and construction of the private drive to ensure the safety of the property owner and the public.

4. Geotechnical Requirements for Suitable Roadway Subgrade

Proper preparation and/or construction of the subgrade are critical to the surface quality and longevity of the roadway. In certain areas of the County, problematic soils may be encountered which complicate achievement of suitable subgrade conditions. Potential problems of such soils include ground slippage and instability, shrinking and swelling of certain high plasticity soils, high water table, and perched water conditions. Many of these conditions may be mitigated through proper design and construction techniques, while others may require complete removal and replacement of unsuitable material(s).

NOTE: For additional information on acceptable and unacceptable soil conditions for roadway subgrades, please see Item b, "Unsuitable Soil Conditions for Roadway Subgrade," under this heading.

Because of the likelihood of encountering unsuitable soil conditions on roadway construction projects, the Department requires that a complete geotechnical engineering study be performed to evaluate subsurface soil conditions and determine if soils are adequate to support the design traffic loading and roadway structures. A report detailing the findings of the geotechnical study shall be submitted to the Department.

NOTE: For further information on the properties of subgrade materials, see Table I-3; for further information on the types and uses of soils, see Table I-4.

Because subgrade conditions affect many aspects of roadway construction, the geotechnical report may affect a variety of issues related to the construction process. The following is a summary of report requirements, as well as issues generally to be addressed in the report.

a. *General Requirements for Geotechnical Reports*

For subdivisions, site plans, and Department design contracts, two copies of a soils report conforming to the following requirements must be submitted with the construction plans to the District Engineer or Project Manager prior to issuance of any grading or roadway construction permits or plan approval. The construction plans must incorporate recommendations based on the geotechnical report as requirements.

The investigation leading up to the geotechnical report must be planned with knowledge of the intended project size and the geologic history of the area.

i. Site and Soil Exploration

Site and soil exploration should take into account, but not be limited to, the following factual information, analysis, and recommendations:

- Surface features should include such features as old construction, rock outcrops, water courses, ditches, and filled-in areas. Reviewing aerial photographs of the area is recommended.
- Subsurface features should include a plotted record of vertical stratification and a subsurface profile, and should indicate the elevations of borings and test pits, and should provide 24-hour water level readings.
- Surface features and the boring locations shall be depicted on a site plan plotted with a true scale, a North arrow, and a general location map.
- Exploration methods must follow the applicable standards as set forth by the ASTM, the ASCE, the AASHTO, and the Association of Engineering Geologists, etc.
- Soil borings shall be spaced every 300 feet along the roadway, depending on the site conditions and the proposed construction, and extend a minimum of 10 feet below the design grade or existing ground, whichever is lower. Soil borings should include standard penetration tests that meet ASTM D-1586.

- The vertical interval of sampling will be based on soils encountered and other conditions. At least one sample shall be taken from each soil stratum at no more than 5-foot intervals.
- Hydrologic features must be documented, including the presence of any seepage zones and depth to groundwater (if encountered). Groundwater measurements will be made at the time of boring and at a minimum of 24 hours later.
- If long-term water level readings are required by the Department, then perforated casings or piezometers in selected bore holes will be required.

ii. Classification and Description

Observation of soil samples from various depths and locations shall be required for comparison with the known geology of the area. Classification and description of soils and aggregates shall be performed according to AASHTO M-145; ASTM D-2487, Uniform Soil Classification System; and ASTM D-2488, Visual Manual Identification Procedure. Nomenclature used for description of soils must be clearly defined and include in-place conditions like moisture, color, and consistency or relative density; geologic names; local names; and any other information pertinent to the interpretation of soil characteristics.

NOTE: For further information on the AASHTO Soil Classification System, see Table I-5; for the State of Maryland DOT SHA soil classification system, see Table I-6.

iii. Laboratory Testing

The nature and extent of laboratory testing required depends upon the soil characteristics and anticipated geotechnical issues to be addressed. The following tests are required per the latest specification updates:

- Moisture content of all samples (AASHTO T-265).
- California Bearing Ratio (CBR) tests (ASTM D-1883) are required on all roadway subgrades and shall be performed at or near the design subgrade finished elevations.
- Granular soils testing shall include gradation tests on representative samples (ASTM D-421) and moisture content determinations (ASTM D-2216).
- Testing of cohesive soils shall, at a minimum, include determination of Atterberg Limits (ASTM D-4318).
- On compacted subgrade materials, Modified Proctor tests (AASHTO T-180 or ASTM D-1557) are required for at least the two most common types of soils at proposed grades.
- In stiff, fissured clays, such as Marlboro clays, Atterberg limits and hydrometer analysis tests are needed for classification and prediction of certain properties.

- Consolidation tests should be performed on samples taken from relatively soft soils that may underlie foundations of roadway structures. Expansive pressure of clays should also be determined for the foundation design.
- For deltaic clays that have been subject to large strains in the past, properties for predicting long-term behavior include the residual effective friction angle and cohesion intercept (the absolute minimum strength of the clay material). These require appropriate additional laboratory testing.

iv. Engineering Analysis and Recommendations

The complete record of field and laboratory findings shall be included in the report, as well as any conclusions and recommendations for the owner, the designer, and the Contractor. The report shall provide an elevation of the investigated *in-situ* soils and comments on their suitability for structural fill and roadway subgrade. It shall address any need for undercutting unsuitable materials, providing mechanical or chemical subgrade treatment or stabilization, and installing subsurface drainage. The report shall also provide a recommended pavement design addressing any demonstrated susceptibility to high water table (permanent, perched, and/or seasonal), as well as sufficient foundation and/or slope stability studies to allow reviewers to understand the logic and assumptions on which findings are based. Recommendations on pavement design, earthwork, site grading, drainage, slope and/or subgrade stabilization, and construction procedures must be included. The report shall further address any retaining wall design, as well as impacts on adjacent properties. If the presence of Marlboro or Christiana clays, or soils that are diatomaceous in nature, is possible, the engineering analysis shall include the short- and long-term stability of existing and planned roadways and slopes.

The report shall include a discussion on the problems of any potentially expansive soils including Codorus silt loam (CH) and Manor loam (MH) types. Design recommendations for such soils should be based on expansive properties, unless shown otherwise by X-ray diffraction studies or by other appropriate laboratory tests.

v. Report Appendix

The geotechnical engineering industry typically presents required testing and analysis data, like boring logs and laboratory testing results, in the report appendix. In addition, the appendix must include the following items:

- Tabulation of natural moisture content of all samples unless such data are numerically presented on the boring logs.
- At least two moisture density curves representing the two most common soil types at the proposed grades.

- All lab test results shall identify the tested samples in terms of soil type, sampling locations, and sampling depth.
- A grade establishment plan showing the boring locations on plan view, and their soil strata and depths on profile view.
- Addenda to the report if, after the soil report preparation, off-site or borrow material is identified and tested for use on the subject permit; if the submitted report is more than 5 years old or if there is a reason to believe that the subsurface conditions have significantly changed; or if the proposed roadway alignment (horizontal or vertical) has been modified.
- If an old report is still valid in terms of current *surface and subsurface conditions* and *recent roadway alignments* (horizontal and vertical), the geotechnical engineer shall submit a professional-opinion statement to that effect certifying that the report still meets current County requirements and geotechnical industry practice.

b. Unsuitable Soil Conditions for Roadway Subgrade

When suitable granular materials consisting of sand, silty sand, or sandy silt are not available, thereby necessitating the use of clayey sand, sandy clay, silt, clayey silt, silty clay, clay, and colloidal clay soil groups, *special attention shall be given to the design and construction of the embankment*. Materials from these groups shall be compacted to not less than 95 percent of the maximum dry density and to within 2 percentage points of the optimum moisture content per AASHTO T-180 requirements.

At least the top 12 inches of base and subgrade materials shall be compacted to a depth specified to not less than 97 percent of the maximum density and to within 2 percentage points of the optimum moisture content per AASHTO T-180 requirements.

NOTE: Base and subgrade materials consisting of sandy clay, silt, sandy silt, clayey silt, silty clay, clay, colloidal clay, mica, diatoms, silt, and swamp muck are unacceptable for roadway development and must be avoided, if at all possible. Such soils must be removed and replaced with an approved structural fill or base material.

These unacceptable materials may have high plasticity indexes and considerable volume change. All materials having high plasticity indexes in relation to liquid limit are subject to high volume change and are considered unacceptable or undesirable in all cases. Some of the above-mentioned materials may be approved for subgrade applications, but are still considered *poor to very poor* (Table I-6). Materials for aggregate and soil-aggregate subbase and subgrade shall meet minimum AASHTO criteria and allow the fraction passing the 0.075 mm sieve to be not greater than two-thirds of the fraction passing the 0.425-mm (No. 40) sieve. The fraction passing the 0.425 mm

sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6.

Silty clays, clay, and colloidal clay are cohesive soils and have no significant angle of internal friction. Soils in this category are subject to a large change of volume simply because they have a tendency to hold water. The volume change could amount to as much as 20 percent of the overall soil volume. Soils with these characteristics do not drain well nor do they dry out rapidly.

Areas of Marlboro clay outcrops are also of great concern. Many landslides, soil cave-ins, and structure failures occurring in this region have been attributed to shrinkage and slippage due to Marlboro clay. All new roadway developments in the County requiring significant cut through such soils must be carefully studied for shear and stability.

c. Subgrade Classification Guide

Table I-9 of this document presents typical saturated CBRs for use in determining suitability of soil types for roadway subgrades. Using this table may help developers determine if their site contains problematic soils and, if so, what geotechnical solutions are most cost-effective. The Department requires most proposed roadway subgrades to have a minimum CBR of ***7***, on average. Where approved, soil cement may be used to achieve this requirement.

d. Soil Cement

Soil cement is a term given to soils stabilized with at least five percent cement by weight. Subgrades treated with less cement are called cement-modified subgrades. In addition to being, like lime, a quick answer to wet soils, cement stabilization offers a way to improve inherently weak, possibly expansive soil to a usable construction material whose physical engineering properties can be regulated. This significant improvement to the soil may include increased strength, decreased water sensitivity, and decreased volume change. Thus, otherwise unsuitable soils can be improved for use as a subbase for subsequent paving applications. The micaceous silts of the Piedmont can be greatly improved by the addition of cement. Soils having high water content, high mica content, or a plasticity index of less than 20 are also good candidates for such improvement.

NOTE: For further information on typical cement requirements for various soil types, see Table I-7.

It should be noted, however, that soil cement is not a cure-all. Among other limitations, it is not suited for soils that are extremely wet or frozen; nor for soils that have a high content of deleterious materials, an organic content greater than two percent, a pH of less than 5.3 (as in the case of acid sulfate soils), or underlying soil layers that may cause future settlement (e.g., existing, deep, uncontrolled fill). *If the cement requirement and the target strength are not specified in the approved soils report, the Geotechnical Engineer of Record must submit a proposal in that regard to the Department Materials Lab for approval at least 10*

days prior to commencement of the soil cement fieldwork.

Soil cement shall be applied and cured in general compliance with Section 502 of the MSHA *Standard Specifications for Construction and Materials*, latest edition, and in accordance with recommendations set forth in the soils report, subject to Department approval. Prior to applying soil cement, the subgrade shall be prepared in accordance with MSHA Section 502.03.03. Any soft subgrade materials must be removed and replaced with structurally adequate fill material so that the required soil cement strength can be achieved. As a subbase material, soil cement should have a 7-day, unconfined, compressive strength of at least 250 psi.

Test results verifying the required strength must be submitted to the Department. The structural integrity of soil cement shall also be verified to the Department Inspector either by witnessed-in-place density tests (per MSMT 350) performed by a certified quality-control technician or by witnessed proof-rolling with a 20-ton, loaded, dump truck. For new roadway construction, the soil cement layer must extend beneath the curb and gutter for closed sections, and beneath the shoulders for open sections. Regular Portland cement is most commonly used for soil cement, and may be applied to in-situ soils or imported select borrow material, depending on the purpose of the soil cement layer.

For in-situ applications, mixing shall be thoroughly uniform to the full thickness of the soil layer to be stabilized, and shall be in general compliance with MSHA Section 502.03.07. Pulverizing will be required to eliminate any particles not passing the 1-inch sieve. The Portland Cement Association Bulletin D5 reports test results showing that the quality of plastic silty or clayey soil cement is highest when all of the soil, exclusive of gravel-sized rock pieces, is pulverized to pass a No. 4 sieve. It is also recommended that the spreading of Portland cement be monitored to ensure uniform coverage and proper mix contents.

NOTE: All use of soil cement shall be closely coordinated with, and approved by, the Department.

Particular care must be exercised in grading or controlling the finished-surface (per Section 502.03.08 of the MSHA *Standard Specifications for Construction and Materials)*, since adjusting the final surface after soil cement has set is extremely difficult and possibly detrimental. Verification of grades during soil cement placement is highly recommended as pavement thickness may otherwise be compromised to match existing gutter elevations in closed sections. To avoid diminishing the cement value, all spreading, compaction, and shaping shall be completed within 3 hours after the mixing water and cement have come in contact.

Compaction of soil cement shall be done in accordance with MSHA Section 502.03.10. The compacted lifts shall be no less than 4 inches, nor more than 10 inches in compacted thickness.

Finishing, protecting, and curing shall be done in accordance with MSHA Sections 502.03.09 and 502.03.12. Soil cement is most often cured with emulsified asphalt, but proper plastic or paper sheeting or other moisture-retaining materials may also be acceptable to the Department. Construction joints must be made to conform with MSHA Specification Section 502.03.11 and Department recommendations.

Shrinkage is a natural occurrence of soil cement as the cement hydrates. Shrinkage cracks are not the result of structural failure of the soil cement or the underlying soils' strata. Reflection of these cracks into the courses of asphalt pavement, if adhered to the soil cement, is common. Such cracking can be greatly reduced or eliminated by placing a 4-inch-thick, crack-relief, stone layer (CR-6) between the asphalt and the soil cement, according to Paper 99-0600 of the TRB Record 1673. The stone layer is required in cut areas, where cut is needed to reach the planned subgrade, and particularly if perched water from adjacent properties is inevitable. Based on accelerated loading tests at the Louisiana Transportation Research Center Facility, Paper 99-0600 indicates that the lane in which a stone layer topped the soil cement resulted in a fatigue life that was five to six times longer than that of pavements without the stone layer.

When properly constructed, soil cement can provide a stable and durable subgrade for roadway construction.

e. Construction Plans

The recommendations based on the soils report shall be incorporated into the plans as *requirements* to be performed during construction. A professional engineer licensed in the State of Maryland must review and certify the report and the final construction plans, stating whether the plans have been prepared in accordance with the recommendations provided and noting deviations from those recommendations.

f. Footings of Roadway Structures

Footings of roadway structures (box culverts and crossing pipe cradles) must be placed at depths that will minimize differential settlement due to desiccation of underlying clays. Consideration must be given to stratification of underlying materials, natural moisture content, gradation of backfill soils, site grading, and adjacent vegetation.

Foundations in clays, such as Marlboro clays, should be at least 4 feet (1.2 meters) deep, and deeper where the geotechnical study indicates that the 4-foot (1.2-meter) depth would be insufficient. Foundations in areas of expansive clay developed in residual soils can usually be emplaced on firm, underlying, weathered, rock materials.

g. Construction Techniques and Drainage

Surface and subsurface drainage are of special importance in the construction process of pavements (particularly Superpave). Good site drainage should be maintained during construction in order to minimize undercutting of wet subgrade. Sufficient surface and subsurface drainage (underdrain) systems shall be installed to minimize the effects of water entering

the roadway subgrade and embankments. The underdrain shall be tied to a storm drain system unless otherwise approved by the Department.

In areas where subgrades are subject to moisture infiltration (behind curbs/gutters, at the edge of the pavement, through pavement joints, etc.), free-draining subgrades are required to maintain the structural integrity of the pavement section. Such areas may require capping of borrow materials to conform with the requirements of the MSHA *Standard Specifications for Construction and Materials,* 916.01.02.

Sheeting and shoring or other approved methods for trench bracing may be required during the construction of storm drains, utility trenches, and/or foundation excavations. Engineered fill and backfill in trenches or around structures shall be placed throughout with approved, select materials and shall be uniformly compacted in accordance with AASHTO T-180 or ASTM D-1557. (For information on materials for trenching and backfilling, see MSHA *Standard Specifications for Construction and Materials* and Section II of this document, "Technical Specifications.") Within the roadway, clays are not permitted as backfill in trenches or around structures.

h. Inspection and Testing

Geotechnical inspection and testing shall be performed under the supervision of a Maryland licensed engineer. Such engineer shall use an accredited testing laboratory and bear complete responsibility. The Department may monitor some field testing or make suggestions for quality assurance (QA), but *the Department is not responsible for providing quality control (QC) testing and/or geotechnical consultation to developers or their contractors. The Permittee is responsible for constructing roadways that meet the minimum County standards. The Permittee shall bear all costs for QA and QC testing.*

Unless otherwise approved by the Department, the *Guidelines for QA/QC of Road Construction* provided in Section IV, Appendix A, shall be followed. Construction QC testing shall be performed by an independently accredited laboratory and be certified by a Maryland licensed professional engineer retained by the Department, the Permittee, or the designer—not the Contractor. The Department representative shall witness the proof-rolling of the final layer of subgrade and must receive copies of all construction QC test reports (laboratory and field) for each layer of the roadway prior to coverage with a subsequent layer. If any subgrade layer is affected by weather, vehicular traffic, or prolonged exposure before coverage, a second proof-rolling may be requested by Department representatives. Department representatives may also request additional field tests.

Upon completion of subgrade QC testing and prior to any subsequent paving, the Permittee (or Contractor, if CIP work) shall provide to the District Engineer (or Project Manager, if CIP work) a complete set of the QC test reports with an attached Letter of Certification from a licensed professional engineer. The letter shall certify that the subgrade inspection and testing were performed in accordance with the approved plans and geotechnical engineer's recommendations.

i. Minimum Frequency of Roadway Materials Density Testing

The minimum frequency of field density testing is depicted in Table I-8, unless otherwise approved by the Department. Testing frequencies are minimums considered necessary to provide effective QC of roadway materials under normal conditions. Additional testing will be performed if deemed necessary by the inspection and testing agency, the geotechnical engineer of record, or the Department site representative. All testing shall be done in conformance with MSMT test methods. In the event that other applicable standards or specifications require more frequent testing, these shall supersede the frequencies listed in Table I-8.

j. Review of Geotechnical Reports, Plans, and Specifications

An additional copy of the soils report and the geotechnical requirements shall be forwarded to the appropriate person in the Department Materials Section, who will review them and make recommendations to the District Engineer (or Project Manager, if CIP work). Recommendations may be made for approval, denial, or requirement of additional information or revisions of the plans, as appropriate. This review will be limited to geotechnical aspects of the design. All decisions regarding approval of the plans will be made by the District Engineer (or Project Manager, if CIP work), who will take into consideration the recommendations received from the Department Materials Section. Revisions to the soils report and/or the plans will remain the responsibility of the geotechnical engineer and/or designer, even if the revisions are based on Department recommendations.

5. Pavement Design

The purpose of pavement design is to develop a pavement structure with sufficient strength to accommodate anticipated traffic while preventing failure or excessive distress over the pavement design life. The latest version of the manual, *AASHTO Guide for Design of Pavement Structures*, shall be used for the structural design of pavements. Pavement sections are typically designed in accordance with this manual. Other design methods, such as the California Design Method or the Asphalt Institute Method, may also be approved on a case-by-case basis.

Design of pavement sections is typically based on the following major factors:

a. Strength of the subgrade soil. Most pavement systems are supported by native soils, either as they exist in place or after being remolded as compacted, engineered fill. Unsuitable soils usually require substantial modification, such as cement or lime stabilization, depending on the strength of the subgrade soils. The strength of the subgrade soil shall be evaluated using the test known as the California Bearing Ratio (CBR) test. The County requires an average CBR value of ***7*** for roadway subgrades situated within the County right-of-way. For assistance in determining the suitability of various soil types for the roadway subgrade, see Table 1-9.

b. Traffic loading conditions. Traffic loading conditions are also a function of the in-service use of the site.

c. *Design serviceability loss*. The design serviceability loss typically ranges between 2.0 to 3.0 (as explained in the above-referenced AASHTO manual). An index of 2.5 to 3.0 is often suggested for the design of major highways, and 2.0 is often suggested for roadways with a lower classification.

A structural number (SN) may be computed based on the above factors. Generally, once an SN has been reached, the designer can manipulate the thickness of the different layers of the pavement section. As a result, the layers should cumulatively yield the same design SN.

One additional factor plays a crucial role in pavement design: drainage requirements. Proper drainage is critical in the design and construction of any pavement. In certain circumstances, including but not limited to, high water table conditions or possible water accumulation in cut or low areas, the installation of underdrains and/or interceptor drains is required to prevent failure of the pavement structure. Also, a layer of graded aggregate subbase (CR-6 stone) with a minimum compacted thickness of 4 to 6 inches, is typically required on fine-grained and stabilized subgrade soils. This layer must be daylighted or hydraulically connected to suitable outfalls and should be placed on adequate geotextile fabric. Good surface drainage is also essential. For more on proper drainage, see Public Storm Drainage, in this chapter. The thickness of any pavement layer should not be less than specified for the different classes of roads provided in Section III, Standard Roadway Sections and Details, of these *Specifications and Standards*.

The final factor in pavement design and pavement application is the need for pavement surface profile testing. Longitudinal pavement roughness is a major factor in the elevation of pavement condition and determination of expected life. Unless otherwise indicated, the Department requires the use of an Inertial Profiler to perform quality assurance testing for acceptance of all County roads with a design speed of 50 mph.

A number of methods are currently in use for measuring the roughness of roads. Some of them produce a roughness index, but not all devices do this by direct measurement of the longitudinal elevation profile. This work shall consist of measuring the roughness of the final surface of hot mix asphalt (HMA) pavement. The Department requires that the Contractor or Permittee use an International Roughness Index (IRI) Inertial Profiler to collect quality control data. The Inertial Profiler shall conform to E950 and MSMT 563.

Category 500 of the MSHA *Standards for Construction and Materials* manual requires standardization testing (synchronization) of IRI equipment at regular intervals for compliance with MSMT 563 regulations. Proof of recent MSHA standardization of equipment testing shall accompany the profile report for the project. Quality control test data obtained with an Inertial Profiler that has not completed standardization testing in conformance with MSMT 563 will not be accepted. (See Section 535, Pavement Surface Profile, in Section II and Appendix B-18 of this manual for regulations.)

6. Pavement Milling and Resurfacing

Milling of roadway surface is required prior to resurfacing on all rehabilitation projects. The minimum allowable milling depth is 2 inches. Milling operations shall be performed in only one lane at a time. Saw cut and mill a 10-foot-wide

notch at existing edge of pavement where it is necessary to connect to or to extend an existing road. Overlay at a point of tie-in to ensure a smooth transition and positive drainage. In areas experiencing severe pavement deterioration or an uneven crown, additional milling could be necessary. If milling depth exceeds 2½ inches on highways actively carrying traffic, the abutting lane or shoulder must be milled on the same day. Regardless of depth, the abutting lane or shoulder must be milled prior to weekends or temporary shutdowns.

The milling contractor shall make every effort to avoid damage to existing signal detector loops during the performance of the milling operations. It will be the responsibility of the contractor to identify and field inspect potential conflicts with the field inspector prior to milling in these areas. Prior to commencing milling operations, contractors are required to contact the Department's Traffic Management and Operations Division to coordinate field location of signal loops. Failure to comply with these requirements may result in the Contractor being held responsible for the repair or replacement of damaged signal loops.

All milled materials become the property of the County. Milling contractors are required to deliver the material to either the Department's Glendale, Ritchie, or Brandywine facilities, as directed by the Department.

Prior to performing the milling operation, and placement of new resurface pavement material, all roadway patching shall be performed. The roadway foundation must be structurally inspected for excess cracking and pavement damage. All cracks shall be properly filled and all new base patch material applied where necessary. All loose material shall be removed and all potholes must be thoroughly cleaned, filled and tamped as well. All utility frames and covers, valve boxes, inlets and other appurtenances, shall be adjusted to accommodate the proposed finished road surface elevation.

The resurface paving shall be placed in 2-inch thick layers unless otherwise directed by the Department. All applicable hot mix asphalt resurfacing material requirements shall meet minimum requirements as specified in Section II, Technical Specifications, or in MSHA's *Standard Specifications for Construction and Materials*. Upon completion of paving operations, pavement profiling will be required on all major arterial and collector roadways. This procedure shall be accomplished in accordance with the guidelines provided in the County's contract documents, these *Specifications and Standards*, and the regulations included in Section IV, Appendix B, of this manual.

7. Public Storm Drainage

Public storm drainage and related stormwater management facilities shall be designed to meet Prince George's County DPW&T requirements and applicable Federal and State regulations. Subject to those requirements and within the roadway right-of-way and appurtenant slope areas, the following criteria apply:

a. In curbed areas, the allowable 10-year storm discharge along the curb should not result in a spread width greater than 10 feet, in the absence of parked vehicles or other temporary obstructions. The gutter discharge should never exceed the height of the curb or the containment capacity of

the gutter, nor apron at depressed entrances and lots lying lower than the street. Where the street or gutter serves as the principal or overflow path of a watershed exceeding 50 acres, or where otherwise required by the Department, it may be required that the discharge be calculated as provided by the Building Code, Subtitle 4 of the County Code, for flood overflow paths. In such cases, the roadway grade and drainage systems must also conform to Subtitle 23, the County Road Ordinance, Section 23-136(a)(4), and Subtitle 4 of the County Code, with respect to a 100-year flood event. For this purpose, the road is deemed to be passable during such a storm if one lane-width, at the center of the roadway or adjacent to each side of the median, remains flood-free.

b. Designers must consider the effects of nonstandard, superelevated, and intersection transition cross slopes in calculating the spread of flow and must avoid overflows that directly discharge in unintended directions. Superelevated roadways are to be designed to utilize both spill and non-spill gutter designs. Standard non-spill gutters are required along medians in urban arterial roadway designs.

c. Where drainage of a curb return is dependent on flow across a street at an intersection, the grade of the street parallel to the flow shall not be less than 2 percent; this allows for pavement irregularities. The actual flowline grade should not be less than 1 percent when allowance has been made for lowering the gutter lip at the spill-out area of the return. To determine the elevations and locations of the spill-out points and flowline grades, the curb return profiles must be plotted on a suitable scale as details of the paving plans. If the minimum grade cannot be provided, a shallow concrete gutter/swale may be required across the intersection to define the flowline. The 10-year storm discharge across an intersection in a swale should not exceed 3 cubic feet per second. Flowlines should cross only the side street—and not the main street—at an intersection.

d. Where superelevation is used in roadways that have or will have curbs, drainage must be accommodated accordingly. Superelevated roadways are to be designed utilizing both spill and non-spill gutter designs. In urban arterial roadways, use of non-spill gutters is required along median sections. Designers must be alert to the effects of super-elevation transitions that may tend to flatten or reverse the curb grade, especially near intersections and the crests or low points of vertical curves. Such combinations of transition and profile grade should be avoided, or where found necessary, should be provided with storm inlets located so as to minimize stagnation of gutter flow or minor sheet flow across the roadway, which can result in hazardous freezing in the winter.

e. Rural roadside drainage should use the shallowest ditch or swale section that can convey the calculated discharge. In general, the use of driveway culverts that force a deeper ditch profile downstream should be avoided near the upper end of the

drainage catchment so that shallow swale designs may be continued downstream as far as possible. To this end, designers should set driveway grades to be compatible with a swale drainage crossing. For such swales, the full available cross-section, including the roadway shoulder, may be included in the flow calculation as long as the depth of flow does not exceed the height of the confining cut slope or berm along the right-of-way line.

f. Using a paved ditch or paved swale sections is to be avoided, unless the calculated discharge will reach erosive velocities for the type of soil constituting the ditch or swale and no alternative is practicable. In such cases, alternative erosion-preventive measures, such as permanent turf-reinforcing mats or mesh, interceptor drains and subdrains, or special bioretention treatments, are encouraged instead of the use of concrete ditches, which require the approval of DER. The need for pilot ditch paving to assure positive drainage on flat slopes should be prevented by establishing roadway or ditch grades of 2 percent or more. Where this is not possible, the provision of shallow infiltration beds and interceptor inlets along the flowline is preferable to a paved pilot ditch.

Another alternative is the Low-impact Infiltration System depicted in Standard 300.16. This device operates much like an underdrain installed along the flowline of the ditch, consisting of a trench excavated below the invert grade of the ditch, and lined with filter fabric. The outfall pipe and gravel are enclosed in the trench by overlapping the filter fabric. The area is then graded to the regular profile of the ditch. Such systems help alleviate standing water where the roadway slope is not adequate for gravity surface flow.

g. Where infiltration trenches or similar devices are required by DER, the designer should seek to position them outside of the County right-of-way. Where this is not possible, they must be located clear of future curb lines, entrance aprons, and utility lines due to the probability of maintenance excavations and the consequences of settlement in these areas. Where it is found necessary to place an infiltration device in the roadside area, the device should be set deep enough to allow future utility installations to pass over it with a minimum 1-foot clearance.

h. A roadway drainage design should be selected that does not present a potential collision or overturning hazard. Fixed hazardous objects, such as protruding headwalls, inlets, and manholes, should be avoided in the design of a roadway. In general, the designer should seek to carry the full normal roadway and shoulder or sidewalk section across a culvert without reduction of normal clearances. In urban areas, this includes the typical section for the full width of the normal right-of-way.

i. Subdrains or underdrains are installed for a number of purposes, most of which fall into the following classifications:

- Control of seepage in cuts or hillside locations; these installations are generally called intercepting drains;
- The lowering of the groundwater table, as in very low or swampy areas; or
- Drainage of wet or moist subgrades.

The term "subdrainage" is related to the control of groundwater encountered in both existing and proposed roadways. Subdrains are a necessary part of a complete drainage system for many roadways in certain urban and rural areas. Subdrains function together with adequate surface drainage facilities to prevent damage caused by water in its various forms.

As shown in Section III, Standards 100.01 through 100.07, on urban road sections, underdrains are required to be placed behind the curb line of curbed road sections and extended to the nearest storm drainage inlet, manhole, or pipe. The purpose of this urban underdrain is twofold: to intercept, from abutting property, any springs and seepages that would otherwise flow continuously across the sidewalk or in the gutter, or otherwise affect the street subgrade or maintenance; and to provide an auxiliary system to which downspout and sump pump discharge connections may be required or permitted. The Department will not allow this type of connection to be installed through the curb line because it is likely to create icing conditions on the road during winter, cause algae growth, and stain concrete.

As shown in Section III, Standards 100.08 through 100.16, underdrains shall be required in all rural roadway sections used as part of the stormwater management low impact system. The Department will limit underdrain installation requirements in rural roadways to low points and high ground water areas. This is particularly important in areas where high ground water could affect or compromise adjacent properties or the roadway subgrade, base, and pavement in any way. Underdrain installation requirements must be shown on the plans indicating the area drained, the pipe layout and approximate depth, and the point of discharge to the surface or connection to the underground storm drainage system.

A highway-engineered construction subdrain or underdrain system usually consists of a circular pipe laid at a suitable depth in a trench, which is then backfilled with porous, granular material wrapped with geotextile filter fabric. Materials principally used in subdrains or underdrains include: solid and perforated 16 gauge, corrugated metal pipe (both galvanized steel and aluminum) to be used exclusively underneath the roadway pavement area, with no substitution. Outside of the paved roadway area, approved subdrains or underdrains include: rigid polyvinyl chloride (PVC) pipe, Schedule 40, ASTM designation F758; and corrugated, high-density, polyethylene-engineered (HDPE) drainage pipe that includes a smooth interior wall, meeting AASHTO M252, M294, Type S, minimum pipe stiffness 50 psi criteria. The size of the underdrain is usually based on previous experience and requires the approval of the Department. Pipes of 6-inch and 8-inch diameters are commonly used in Prince George's

County. (For more information on pipe use, see Table I-10.)

Hydraulic design of subdrains may sometimes be required on major projects. The maximum recommended slope is 25 percent. The slope of the pipe should always be set at a sufficient grade to prevent the deposition or settling out of solid materials that may enter the pipe through perforations or joints. To reduce the likelihood of clogging due to the entrance of fine-grained soil into the pipe, perforated circular pipe is laid with the perforations turned down, and the granular backfill material is wrapped with geotextile filter fabric. In addition, pipe systems require sealed joints.

Excavation may be accomplished by either hand or machine methods. Trenches are usually shallow, are excavated with vertical walls whenever possible, and lend themselves to construction through the use of a ditching machine. When the pipe is being laid in a pervious, waterbearing stratum, very little preparation of the trench bottom is necessary other than a nominal amount of shaping. If soft, unstable soils are encountered, sufficient granular material must be worked into the upper portion of the soil to ensure uniform support of the pipe. Proper granular backfilling and placement of geotextile filter fabric around the pipe and in the trench is extremely important if the drain is to function properly without an excessive amount of maintenance. The backfill material must be coarse enough to allow easy passage of water, but fine enough to prevent intrusion of fine-grained soil into the pipe.

In rolling terrain, cuts made during highway construction frequently expose flowing ground water or seepage. Seepage that occurs through a cut slope may be a source of damage to the slope and to the roadway itself. Similarly, a seepage zone itself may not be invaded by the construction of a hillside section, but the roadway and pavement structure may be located only slightly above a zone of flowing underground water, and, thus, may be subject to the detrimental effects of capillary action. In such cases, the flow of underground water is intercepted by a subdrain section so that the water is prevented from flowing beneath the roadway pavement. The subdrain or underdrain is normally placed parallel to the centerline and is called a longitudinal drain. In some cases, seepage flow may occur in a direction perpendicular or skewed to the centerline. Transverse drains beneath the pavement may then be needed to intercept this longitudinal seepage.

The design and location of the proposed subdrain system shall be provided on the paving and drainage plans before construction begins. Information obtained from a soil survey or geotechnical report may also dictate the actual location of any necessary transverse subdrains. In any case, water collected in the subdrains must be carried to a suitable outlet.

Lowering the water table in many locations, especially in flat terrain, may be cumbersome in certain cases. In the interest of economy, the roadway may be constructed on a low embankment, and the base may be only 2 or 3 feet above the water table. If the subgrade soil is one that is subject to capillary

action, water will be drawn up into the subgrade and base, resulting in a loss of stability, possible frost damage, and other similar detrimental effects. The solution to such a problem is simply to lower the water table a sufficient amount to prevent harmful capillary action. This is usually accomplished by installing parallel lines and subdrains at the edges of the roadway or shoulders at the proper elevation. In practice, the solution is frequently complicated by the need to provide satisfactory outlets for the water collected in the subdrains. The depth required beneath the base varies with the type of soil encountered, but is generally from 3 to 6 feet. When the storm drainage system is placed between the curb and sidewalk area, the cover over the pipe shall be a minimum of 4.5 feet to allow installation of street trees.

8. Intersections and Entrances

Closely spaced entrances along any class of roadway should be avoided. Designers should seek to provide development layouts that minimize the number of entrances and maximize spacing along public streets. Where entrances will be closely spaced, curbed construction may be required to minimize the problems associated with multiple entrances crossing a roadway side ditch with swales or culverts. Private entrances opening directly into collector or major collector roads should be avoided, and they must be limited or prohibited from opening directly into arterial roads.

Where an entrance is required along an existing roadway of any class, the applicant is required to investigate the resultant sight distances and operational safety of the entrance with respect to the design and operating speeds along the roadway. Where these conditions are found deficient, the applicant will be required to remove vegetation, grade adjacent banks, regrade shoulder areas, widen local pavement, or undertake such other measures as may be reasonably required to provide safe operation. Sight distance easements shall be required for all lines of sight falling outside the County's right-of-way. Where such measures are impracticable, unreasonably costly, or not available due to lack of land ownership, the Department may deny the entrance or require that it be relocated.

Maximum width for residential driveways is 20 feet at the right-of-way line. Transitions to serve wider onsite parking pads, carports, or garages shall not begin within 25 feet of the right-of-way line. (See Section III, Standard 200.09.) For duplex homes using a shared driveway apron, width may be increased to 22 feet, with prior Departmental approval.

For multifamily residential, institutional, or other uses requiring parking compounds in any zone, or for any uses in commercial or industrial zones, commercial entrances are required. These shall be standard commercial aprons not less than 30 feet wide, with curb radii of at least 12 feet. Heavily used entrances, such as shopping centers, may be designed as intersections with curb radii sufficient to smoothly accommodate expected traffic, provided that the street grade meets the minimum for swale drainage stated earlier in this Section. The designer may be required to provide acceleration, deceleration, or left-turn lanes in the vicinity of entrances where necessary for safety or to maintain the capacity of the roadway. In any case, the designer should consider

whether the entrance needs to operate two ways and whether entering turns will be made from the curbside lane of the roadway or from a lane further out where parking is permitted along the roadway. As conditions warrant, the designer should then establish curb radii and entrance widths sufficient to operate without conflicts between the entering and exiting vehicles.

The designer must set entrance grades to be compatible with the roadway grade while considering the possibility of future roadway widening and curb additions within the life of the facility. Driveways that descend from the roadway must be profiled so that passenger vehicles, when reasonably loaded, will not drag on the apron, and so that curb or roadside drainage is contained and conveyed to an acceptable outfall. Driveways that ascend from the roadway must be profiled so that passenger vehicles, when reasonably loaded, will not drag on the pavement or apron when crossing the gutter line or roadside swale or when starting up the driveway grade. (See Section III, Standards 200.01 through 200.09.)

Angled or perpendicular parking is not permitted along public roads. Where such parking may be allowed along private roads, as in apartment or townhouse developments, the parking spaces must be of sufficient dimensions and so delineated that standard vehicles, light trucks, and vans will neither obstruct travel lanes nor project over sidewalk sections, thereby blocking or inconveniencing pedestrians.

Intersections in new developments and, as far as practicable, in in-fill developments, should be made at or nearly at right angles. Where an intersection is expected to handle large volumes of traffic, it will require the presentation of traffic studies to determine the need for acceleration, deceleration, storage, turning lanes, right-turn ramps, or other special treatment, including special signing and marking, illumination, or signalization. Where an intersection is introduced along a main roadway, opposite or nearly opposite another side street intersection, the intersections will require design, modification, or relocation to align the lanes for continuity.

In commercial and industrial developments or other locations of expected heavy truck traffic, increased curb return radii should be provided to allow for off-tracking of large single unit and tractor-trailer vehicles. Scaled templates based on the turning characteristics of the WB-50 vehicle, as shown in the AASHTO publication, *A Policy on Geometric Design of Highways and Streets,* latest edition, should be used to ensure that such vehicles can make the required turns without over-encroaching into other lanes. In the absence of such checking, the curb returns or travel lane pavement edges for commercial and industrial streets and roadways of higher classification must have radii of at least 50 feet. (See Table 1-2 for minimum turning radius criteria.) Where desirable speeds and maintenance of capacity may warrant a larger turning radii than these minimums, the designer should consider providing separated right-turn ramps of sufficient width and radii to allow an island area, the ramps should be separated from the through lanes, and constructed of sufficient size to be seen by approaching traffic.

9. Cul-de-sacs

Developments should be laid out to avoid the use of long streets ending in cul-de-sacs. Where possible, each street should be extended either to intersect an-

other street or to be intercepted by other streets. This should be done either to eliminate any need for a cul-de-sac or to limit the length of a roadway from the nearest intersection to a cul-de-sac.

Where the introduction of a cul-de-sac is necessary, its right-of-way radius should be equal to the width of the right-of-way of the entering street. Please refer to the AASHTO publication, *A Policy on Geometric Design of Highways and Streets,* latest edition, for typical turning situations in cul-de-sacs. To avoid the necessity for long, dangerous backing maneuvers, any roadway with no outlet should be provided with a facility for turning around vehicles, such as fire trucks, snow plows, and refuse trucks. The preferred facility is a round cul-de-sac, either symmetrical or offset, adequate for turning single-unit trucks or buses less than 40 feet in length. For cul-de-sacs of minimum dimensions, a center island generally is not approved. Because it interferes with the aforementioned turning maneuver, the parking of vehicles, and the use of radially positioned entrances, a center island in a cul-de-sac is often driven over and becomes a maintenance problem. Finally, the designer must, in all cases, align the proposed low point of the cul-de-sac with the proposed property lot line. This will adequately address the required 100-year storm overflow path and minimize any impact on a proposed building location. The maximum centerline of the roadway grade in a cul-de-sac bulb shall not exceed 6 percent. (See Standards 200.12 through 200.20.)

T-pattern turnarounds may be used at the ends of privately maintained driveways within developments, such as townhouses, apartments, and certain cluster zones. (See Standard 200.10.) Because these turnarounds tend to be confused with parking areas, however, they seldom serve the intended purpose for vehicles turning at the ends of public streets. The use of T-pattern turnarounds on public streets should be limited to temporary situations in which there is a likelihood that the street will be extended in the future.

10. *Bridges and Culverts*

a. General Design Criteria

Subject to preliminary review and approval of type, size, and location (TS&L) by the Department and review/approval of any waterway opening also by the Department, all bridges and large culverts are to be designed to conform to AASHTO *Standard Specifications for Highway Bridges* (latest edition), "Standard Roadway Sections and Details," and design directives of the MSHA. The Department may require that certain Federal and State permits be obtained before granting TS&L approval and may further condition its recommendations or approval on a plan of subdivision or development, or applicable roadway design submission.

Bridges, culverts, and similar roadway crossings of waterways shall be designed to pass or withstand the 100-year flood event while maintaining a 1-foot clearance between the superstructure and the floodwater surface. The structure shall be designed to avoid structural damage or forced closure of the roadway during the 100-year storm event. For purposes of the latter determination, DER shall approve the 100-year discharge and water surface profile, and the flood stages may be based on an assumption of no debris blockage. The upstream headwater must be shown to leave one lane clear along the center or adjacent to the median of

the roadway. The roadway embankment may be classified as part of a Class 'A' pond during a 100-year storm event, necessitating close coordination with the Department and the approval process. Such culvert waterways shall be designed to meet the road embankment design criteria specified in *Natural Resources Conservation Service Maryland (NRCS-M) Code No. 378 Pond Standards / Specifications,* latest edition.

To reduce long-term operational and maintenance expenses, the design of the bridge structure shall contain those material and construction details that will prolong the service life of the structure and reduce its life cycle cost. Culverts require a minimum horizontal (span) and vertical (rise) opening of 5 feet. Culverts 75 or more feet in length require rise of 6 feet.

Bridges shall be designed for a minimum life of 100 years with no replacement of the structure's deck or other major maintenance being required for a minimum of 35 years from the date of construction.

To achieve these goals, the designer shall address the structural integrity of new bridges by considering the use of:

- Continuity and redundancy to provide one or more alternative load paths;
- Durable structural members (girders, stringers, abutments, and piers) to ensure resistance to instability; and
- External protection systems to minimize damage to the bridge.

The length of the structure shall be measured in accordance with National Bridge Inspection Standards (NBIS) 23CFR650.3. All box culverts, multiple cell pipe culverts, or simple span bridge structures that measure 17 feet or more, in accordance with the provisions of said standard, shall be resized to provide a minimum length of more than 20 feet as measured along the centerline of the roadway. Multiple pipe culverts shall be designed such that the clear distance between openings shall be less than half of the size of the smallest inside pipe diameter.

Bridges shall be designed to carry the following loads and forces: dead load, live load plus impact, dynamic effects of wind loads, ice loads, flood conditions, longitudinal forces, and other forces specified in the latest AASHTO *Standard Specifications for Highway Bridges*.

The water to cement ratio for all bridge structural concrete (except foundation footings) shall not exceed 0.40. This requirement pertains to cast-in-place as well as precast construction. Bridge superstructure concrete shall be high-performance concrete (HPC) with concrete porosity minimized and durability enhanced.

Where bridge parapets are provided, the parapets shall be designed so that a metal railing at the top of the parapet wall is not required. Where concrete box culverts are proposed, the endwalls and wingwalls shall be of cast-in-place construction, although the balance of the structure may be of precast construction.

The amount of concrete cover to be provided over reinforcing steel in reinforced concrete shall be a minimum of 2.5 inches, with the exception of bars at the top of piers and at the bottom and sides of all footings, which shall have 3-inch minimum cover. This requirement pertains to all cast-in-place construction. Where precast construction is proposed, the minimum cover over the reinforcing steel shall be 2 inches. Except at the beam seats, tops of abutments and pier caps shall be pitched to provide a 2% slope to enhance runoff and reduce the accumulation of water and debris around the beam seats.

A silane penetrant sealer shall be used as a protective sealant in the following areas prior to the application of epoxy coating:

- Entire bridge superstructure, including deck, beams, underside, sidewalks and parapets, and concrete approach slabs;
- Entire horizontal surface of the abutment bridge seat areas and contiguous vertical faces of backwalls and cheekwalls; and
- Entire horizontal surface of the pier bridge seat areas and all surfaces of the pier caps.

Multispan structures shall be designed to be continuous over piers, thereby eliminating all deck joints. The designer shall provide the Department with documentation of the proposed design and rating calculations for H15, HS20, Maryland Type 3, and Maryland Type 3S2 vehicles, completed in accordance with the MSHA "Bridge Weight Posting Policy" for bridges and culverts in the State of Maryland.

b. Specific Design Criteria for New Bridge Structures

NOTE: Main structural members shall consist of concrete girder beams, unless written approval for steel is granted by the Department Director.

i. Superstructure

Design Method: Service Load Design Method or Load Factor Design Method. All steel or concrete beam structures shall be designed and constructed as composite structures by providing shear reinforcement or mechanical shear connectors at the junction of the main member and deck. The main members and splices shall be sized without benefit of composite action from the deck.

Loading: HS27, Maryland Type 3, and Maryland Type 3S2 vehicles shall be used as the design live loadings, with provisions for a future 2-inch wearing surface when the bridge deck needs rehabilitation. In addition, the dead load design shall reflect an additional 15 lb/ft^2 loading where steel bridge deck forms used in construction are to remain in place.

NOTE: Prefabricated panel forms shall not be used as permanent bridge deck forms.

All new pedestrian structures shall be designed for 85 lb/ft^2 live load. In addition, the dead load design shall reflect an additional 15 lb/ft^2 loading where steel bridge deck forms used in construction are to remain in place.

Material: The design of new structures shall incorporate the use of concrete wherever possible. For environmental reasons, concrete arches or "bottomless culverts" are preferred over single or multiple box culverts for short spans. For moderate single spans of 30 to 70 feet, prestressed concrete box beams are the preferred structural element. For spans greater than 70 feet, the use of concrete girders (AASHTO Beam Sections) is to be incorporated into the design rather than the use of steel girders. Due to the long-term maintenance issues associated with the use of steel girders, written approval from the Department is required prior to any design incorporating the use of steel, whether painted with an anti-corrosive coating or high-performance weathering steel.

ii. Deck

Design Method: Service Load Design Method or Load Factor Design Method.

Deck Material: The use of high-performance concrete (HPC) or MSHA High-performance Lightweight Concrete (HPLC) is required. Bridge decks shall be continuous, with no joints. The use of integral abutments is encouraged. Approach slabs shall be required at integral abutments.

NOTE: Concrete or steel beam structures shall be designed and constructed as non-composite structures.

iii. Substructure

Design Method: Service Load Design Method or Load Factor Design Method.

Loading: HS27, Maryland Type 3, and Maryland Type 3S2 vehicles shall be used as the design live loadings.

Material: The minimum strength of concrete used in substructures (excluding pier caps and beam seat areas) shall be 3000 PSI. Minimum strength for pier caps and beam seats shall be 4500 PSI.

iv. Scour Evaluation

Structures shall be designed to resist damage from scour. The designer shall refer to MSHA Policy and Procedures Manual PPM D-91-42(4), titled "Scour Evaluation of Bridges Interim Design Criteria," (latest edition) for scour evaluation requirements and scour countermeasure design criteria.

v. Required Notes on the Contract Drawings

All Contract Drawings shall include notes detailing the design method, specifications, loading, concrete, structural reinforcement structural steel, chamfer requirements (if applicable), backfill materials, and any other relevant information as shown in the MSHA PPM, or as otherwise required by the Department.

c. Bridge Rehabilitation Projects

For rehabilitation projects involving replacement of the bridge deck, direction shall be taken from the MSHA PPM D-89-40(4), II (or latest amendment), regarding designs for the rehabilitation of existing bridges.

When rehabilitation work is to be performed to an existing bridge structure that involves replacement of the deck, then that bridge structure must be evaluated for the loading conditions described above. If the loading conditions are not satisfied, then the following sequence of analyses must be performed:

i. If the structure is a non-composite design, then it must be analyzed by making it a composite design to try to meet the new loading conditions.

ii. If step i above does not satisfy loading conditions, then the structure must be analyzed by reducing the weight for steel stay-in-place bridge deck forms from 15 lb/ft^2 to 9 lb/ft^2. The plans must specify that the form troughs must align with the transverse reinforcing bar spacing.

iii. If steps i and ii above do not satisfy the loading conditions, then the structure must be analyzed without the future 2-inch wearing surface.

iv. If steps i and iii above do not satisfy the loading conditions, then the structure must be analyzed by eliminating the 9 lb/ft^2 for steel stay-in-place bridge deck forms. Formwork shall be removed after the concrete has achieved its required strength.

v. If steps i–iv above do not satisfy the loading conditions, then the structure must be analyzed using lightweight concrete. The use of steel stay-in-place bridge deck forms and a future wearing surface are to be reconsidered.

vi. If steps i–v above do not satisfy the loading conditions, then a chart summarizing the above analyses must be prepared and forwarded to the Department for direction on how to proceed.

d. Reinforced Concrete Culverts

The design and installation of buried reinforced concrete structures that interact with the surrounding soil (soil-reinforced) shall be in accordance with the recommendations made in the most recent editions of the AASHTO publication, *A Policy on Geometric Design of Highways and Streets*, and the American Concrete Pipe Association's *Concrete Pipe Design Manual*. The design of such structures may be based on service load or load factor principles, as recommended by the MSHA. The design criteria shall include all struc-

tural aspects, handling, installation, and crack control.

Cast-in-place concrete box culverts shall have a minimum size of 5 feet by 5 feet, and wall thicknesses of not less than 12 inches. The thickness of the bottom slab shall be 1 inch greater than the top slab. All corners must be haunched and designed as fixed for applied bending moments. The minimum concrete cover for the reinforcing steel shall be 3 inches for the bottom slab and 2.5 inches for the walls and top slab. Culverts shall be installed at a minimum longitudinal slope of 2%.

To prolong the service life of box culvert structures (cast-in-place and precast), the following directions, as modified from the MSHA PPM D-77-14(4), V (or latest amendment), shall be followed:

i. If the culvert has a minimum of 2 feet of cover (fill material or paving), use Mix No. 6 concrete. Epoxy-coated reinforcing steel may be used for the entire box.

ii. If the culvert has less than 2 feet of cover (fill or pavement), the reinforcing bars in the top mat of the top slab, including truss bars and wall steel extending into the top mat, shall be epoxy coated, and the concrete shall be Mix No. 6.

iii. If the top slab of the culvert is built to the grade of the finished roadway and the minimum clearance between the top of the reinforcing bar mat and the finished roadway surface exceeds 6 inches, then a mat of epoxy coated 6 x 6–W2.9 x W2.9 welded wire fabric shall be placed 3 inches clear from the finished top of the slab for the full length and width of the culvert. For further direction, please refer to MSHA Standard Detail Nos. BC (6.07) and BC (6.08) (or latest amendment). In addition, all bars in the top mat of the top slab, including truss bars and wall steel extending into the top mat, shall be epoxy coated. Top slab concrete shall be Mix No. 6.

iv. Where the application of such a treatment will not conflict with opening a bridge to early traffic use, all top slabs built to grade shall receive a protective coating (silane penetrant sealer).

vi. No openings for storm drain pipes shall be made in the sidewall or top slab of any culvert.

vii. The exterior sides and top of all box culverts shall be coated with an asphaltic or tar coating to seal the surface of the concrete.

Precast reinforced concrete pipes (circular, elliptical, and arch) shall have minimum pipe diameter of 15 inches and a minimum 2 feet of cover over the pipes. Beneath roadways, minimum pipe size shall be 24 inches and the maximum 84 inches. All concrete pipe joints shall be sealed with rubber gaskets to meet minimum specifications (See Section II, Technical Specifications.) Pipe systems 48 inches or less require video camera inspection as part of the final "As Built" construction requirements. Final "As Built" construction plans

shall also be furnished to the Engineering and Inspection Services Division prior to the release of the construction performance bond. All pipes shall be designed, fabricated, and installed in accordance with the most recent editions of the AASHTO publication, *A Policy on Geometric Design of Highways and Streets*, the American Concrete Pipe Association's *Concrete Pipe Design Manual*, the MSHA *Standard Specifications for Construction and Materials*, and other publications of nationally recognized organizations such as the American Society of Civil Engineers (ASCE), etc. (For more on pipe use, see Table I-10.)

With respect to wall thicknesses, reinforcing, and reinforcing steel cover, for the above-stipulated loadings, precast concrete structures shall be fabricated in strict conformance with the recommended designs of the American Society for Testing and Materials (ASTM) and AASHTO. Further, the manufacturer shall furnish certification to that effect signed by a professional engineer who is currently registered in Maryland or a state recognized by Maryland as having comparable qualification requirements, and who is qualified to design highway bridges. All headwalls must be cast-in-place.

For the determination of culvert length and the design of culvert end treatments, the designer shall refer to MSHA PPM D-78-15(4), latest edition, for design requirements.

e. *Bottomless Culverts*

The use of bottomless culverts is encouraged but will be considered and approved on a case-by-case basis. These structures must be designed to withstand the worst case scour for the site as defined by Maryland and Federal requirements. These design requirements shall be the same as those used to consider scour for bridges (see MSHA PPM D-91-42(4), titled "Scour Evaluation of Bridges Interim Design Criteria," latest edition, with attention given to the design procedures for scour set forth in the FHWA publication, HEC 18, "Evaluating Scour at Bridges."

Footings for bottomless culverts shall be placed on piles or scour resistant rock. Spread footings shall not be used on erosion prone soils.

f. *Structural Plate/Aluminum/Steel Culverts*

In general, concrete is the preferred material for the construction of culverts. Any proposed use of structural plate pipe-arch culvert or corrugated metal structures will be reviewed and approved on a case-by-case basis. Similarly, aluminum pipe structures will be approved on a case-by-case basis. The use of galvanized steel is discouraged in urbanized conditions where inspection, maintenance, and replacement are costly, and stream pollution may aggravate corrosion.

g. *Precast Concrete Structures*

For the above-stipulated loadings and with respect to wall thicknesses, reinforcing, and reinforcing steel covers, all precast concrete structures shall be fabricated in strict conformance with the recommended designs of the ASTM and AASHTO. Further, the manufacturer shall furnish certification to that effect signed by a

professional engineer who is currently registered in Maryland or a state recognized by Maryland as having comparable qualification requirements, and who is qualified to design highway bridges. All headwalls for the precast concrete structures must be cast in place. Wingwalls can be precast, but tight joint construction between structure and wingwall must always be ensured.

h. Structure Inventory and Appraisal (SI&A)

The designer of any such class of bridge, or any major modification thereto, is required to provide the Department, as a condition of acceptance of construction, with prepared Structure Inventory and Appraisal (SI&A) and Pontis forms (refer to Section IV, Appendix B, Item B-2), as prescribed by the Federal Highway Administration (FHWA), for purposes of reporting the bridge to MSHA for inclusion in the Federal bridge inventory. The SI&A forms, including Form 6A, shall be prepared in accordance with the MSHA "Guide for Completing Structure Inventory and Appraisal Input Forms." The structural computations on which the load rating and design are based shall be prepared under the direct supervision of a professional engineer currently licensed in Maryland and qualified to practice highway bridge design and analysis. That professional engineer shall sign and seal the plans and furnish completed SI&A forms. Since the County is designated by MSHA to see that municipal structures comply with the FHWA inventory and posting regulations, the requirements stated herein apply within all municipalities in the County.

i. Bridge Rating

The designer shall use either the Service Load Design Method or the Load Factor Design Method and should consider the composite section. The loading analysis is to be in accordance with the AASHTO Manual for Condition Evaluation of Bridges.

j. *Bridge and Culvert Design, Installation, and Inspection.*

The designer of any proposed bridge or culvert, or any major modification to an existing structure is required to provide the Department with a complete inspection report and other pertinent information (refer to Section IV, Appendix B, Item B-2 for a complete list of items). The contractor or developer shall also provide the following information upon completion of the project:

- A complete Inspection Report shall include the following documents:
  - Location map
  - Bridge sketches
  - Sounding sheet
  - Inspection and rating summary
  - Bridge inspector's recommendation for maintenance repairs
  - Condition rating forms
  - Color Photographs
  - Structure inventory and appraisal forms
  - PONTIS form
  - As-built drawings

  - Shop drawings
  - Design calculation for all elements
  - Inventory and operating rating analysis for H-15, HS-20 Maryland Legal Load Type 3 and 3S-2
- All documents shall be signed by a Registered Professional Engineer in Maryland.

11. Utilities

Where new underground utility installations or extensions are provided, to the extent possible, they should not be located in the paved travel way. No above-ground utility appurtenances shall be allowed in County rights-of-way unless the activity has been permitted.

NOTE: For complete information and regulations regarding the installation and maintenance of utility appurtenances within County rights-of-way, see the Department's *Policy and Specification for Utility Installation and Maintenance* (the Department's Utility Policy) in Section IV, Appendix E.

The franchised electric, telephone, and cable television (CATV) lines should either be routed in the dedicated public utility easements (PUE) required to be granted on new plats of subdivision or in comparable easements obtained by the utilities. Where these easements are not available, the utilities should be routed in the roadside area within the County rights-of-way, but clear of the paved roadway, and if necessary, should use the under-sidewalk area. (This requires prior Departmental approval.) Utility lines should also be located clear of existing stormwater management and storm drain facilities.

In accordance with the Department's Utility Policy, except in emergency situations, no utility company or its contractor shall cut into any roadway pavement for a period of 5 years from the date of the County's acceptance of new roadway construction for perpetual maintenance, or County completion of pavement resurfacing in the case of improvement work.

Placing new utilities shall be accomplished to the maximum practicable extent by tunneling, jacking, boring, or other means that will avoid disturbing the new pavement, subject to the requirements and regulations set forth in the Department's Utility Policy.

12. Roadside Protection

One basic principle of safe roadway design is to avoid placing collision hazards in proximity to the traveled way. Fixed objects posing potential hazards include, but are not limited to light standards, utility poles, heavy sign supports, headwalls, parapets, abutments, traffic barriers, fire hydrants, trees, non-breakaway structural masonry mailbox supports, and gateposts. Because many of these items may be desirable or necessary parts of a roadway design, the designer has the task of locating or designing them so as to minimize the likelihood and consequences of a collision. The Department has established the following standards for roadside protection on County roadways. For cases not covered below, the clear zone criteria specified in the AASHTO publication, *Roadside Design Guide,* latest edition, shall be used for this purpose.

a. In many urban sections, a space 5 to 6 feet wide shall be provided behind the curb for necessary street appurtenances, such as fire hydrants, utility poles, street lights, guardrails, or trees. All other structures, including mailboxes, are to incorporate specifically designed breakaway features.

b. Since shade trees and many ornamental trees eventually become overgrown in size, roadside trees in rural areas should be planted near the right-of-way line and should, wherever possible, complement the landscaping requirements of the abutting properties. This is consistent with the tree placement in back of the ditch line, normally provided along open roadways, and it allows conversion to curbed construction later or the retrofit of sidewalks with minimal disturbance of the trees. Use of other planting schemes requires written approval by the Department.

c. In areas of new construction not subject to underground utilities, or where existing overhead utility lines will remain or be relocated, the utility poles shall be installed 1 foot inside the County's right-of-way line.

d. Where the U.S. Postal Service requires that mailboxes be close to the curb line, the owner or Permittee will be required to use a lightweight metal breakaway or wood post or swing-away design. Group or community mailboxes must also be of a collision-safe design. Masonry mailbox supports and gateposts of any design are not allowed within the County right-of-way. Likewise, all monumental community entrances are to be located outside of the County right-of-way.

d. In general, vehicular traffic barriers are to be avoided; and road alignment, grade, and slope should be configured to eliminate any need for them. The purpose of guardrail barriers is to redirect errant vehicles away from a hazard rather than to protect or prevent damage to a sign or other highway appurtenance. To be effective, guardrails must be carefully designed and installed. It should be remembered that guardrails may themselves constitute a fixed hazardous object. They should be used only where the hazardous feature cannot be eliminated.

Guardrails should be placed along roadways with steep embankments where the hazard of being redirected by a guardrail is less than that of being permitted access to the slope. The height and slope of an embankment are the factors that determine whether a guardrail should be installed along that embankment. While installation of barriers helps to improve safety for motorists, this objective is usually better attained through the proper design of roadside conditions. When required, the criteria for using such barriers shall conform with the AASHTO *Roadside Design Guide,* latest edition. Please refer to charts indicating the traffic volumes, slope, and fill height conditions under which such barriers are necessary. The use of barriers—where not warranted—may present a greater hazard to the roadway user than the condition from which the roadway user should be shielded. For a cost-effectiveness selection procedure,

please refer to Appendix A of the AASHTO *Roadside Design Guide*, latest edition.

Where vehicular traffic barriers are necessary, the locations of entrances and other roadside constraints must be considered. The preferred end treatment for all new and replacement barriers is the breakaway cable terminal for Type B, blocked-out steel, W-beam barriers. The appropriate, current MSHA standard details, W-beam, offset block, and type of posts should be used. The designer must provide a complete, technical description of the selected type with required offsets and development length in accordance with the tested designs; the roadside area must be designed to support them. The placement of barriers where the required development length and offset are not available, as at some entrances, must be avoided if possible. To ensure that barriers are not installed in a hazardous fashion, corrective measures, such as additional roadside slope easements and grading, relocation of entrances, use of energy-absorbing assemblies, or other measures may be required.

The use of vehicular traffic barriers in proximity to curbs is to be avoided. A curb in front of a barrier reduces the barrier's effectiveness. Where this is necessary, a special review will be required to ensure a safe design.

The location of barriers at corners or sharp curves where vehicles may hit them at high approach angles is to be avoided because the standard, W-beam, steel-post barrier is ineffective at such angles. In such cases, if the roadway location cannot be improved, a preferable solution is to provide one of the following: a safe runaway or recovery path for the vehicle, an energy absorbing barricade, or equivalent energy-absorbing grading.

Guardrail transitions to bridge parapets or other types of barrier connections should be carefully designed. Unless special precautions are taken, there could be a tendency for the guardrail to excessively deflect and pocket the vehicle, directing it into the end of the barrier. Special care should be exercised when designing and installing guardrail ends and transitions. Unless properly designed, exposed guardrail ends can sometimes spear a vehicle and injure or kill its occupants. It is advisable to flare guardrail ends away from the pavement or anchor them into a back slope, where possible. Barrier height should be maintained throughout the flare in order to redirect the errant vehicle and to minimize injuries and property damage.

13. Project Datum

All projects subject to review by the Department shall be referenced to the following geodetic datum, unless otherwise approved:

Horizontal—Maryland Coordinate System (state plane grid) based on North American Datum of 1983 (NAD83).
Vertical—North American Vertical Datum of 1988 (NAVD88).

B. Traffic

1. Roadway Lighting Plan Approval Process

Prince George's County intends to provide sufficient lighting along public streets to ensure the safety and security of our pedestrians and motorists. In this respect, guidelines have been established to ensure proper lighting installation with all new developments along County roadways. For scenic or historic roads, lighting requirements may differ. (See Section IV, Appendix A, Form A-8.)

The requirements discussed here apply to all County CIP roadway projects and those constructed under permit.

Generally, utility companies perform all street lighting work, and upon acceptance, provide electrical energy and maintenance to the lighting fixtures under contract with the County. Therefore, all construction and materials shall be as specified by the electrical utility company providing service to the area: Baltimore Gas & Electric (BGE), Potomac Electric Power Company (PEPCO), or Southern Maryland Electric Cooperative (SMECO). The utility company will install street lighting in accordance with the County-approved plan.

The following guidelines describe the Contractor/Permittee's responsibilities for the design of street lighting improvements along existing and proposed County-maintained roadways, and upon areas adjacent to the permit site.

a. *General Provisions and Responsibilities*

The Permittee shall be responsible for designing a plan for lighting all existing and proposed County-maintained roadways within and adjoining the permit area and, upon approval by the Department, for ensuring the installation of the required roadway lighting improvements by the local utility company at the expense of the Permittee. Roadway lighting improvements may include installing underground electrical wiring, new lighting fixtures, converting or upgrading existing lights, and/or, when necessary, removing and relocating existing lighting fixtures. The Permittee shall also be responsible for having all existing mercury vapor (MV) or high pressure sodium (HPS) lights upgraded to the proper wattage HPS lights in accordance with County Standards.

A street lighting plan must be submitted for each permit, including permits for areas where street lights exist. If the Permittee believes that the existing or pending lighting already satisfies these specifications, the Permittee should plot and correctly identify all existing lighting fixtures on the plan. If the Department agrees that the existing lighting is adequate, the plan will be approved and no further street lighting improvements will be required. A flow chart at the end of this section illustrates the procedure. (See Table I-11.)

b. *Lighting Design*

The Permittee shall determine:

- The utility company serving the area;
- The classification of each street within and adjoining the permit area; and
- The locations of all existing and pending lights along all connecting and adjoining streets within 150 feet of either end of the permit area. (Pending street lights are those approved for installation, but not yet installed.)

The Permittee shall contact the utility company for information regarding existing and pending street lighting, and consider their locations when preparing the lighting plan. Generally, the lamp type and wattage are indicated on a decal located on the underside of the luminaire. Yellow decals indicate HPS; blue decals indicate MV fixtures. The number on the decal indicates the wattage: 10 is 100 watts, 15 is 150 watts, 17 is 175 watts, 25 is 250 watts, etc. Cutoff optic luminaires are required when

street lighting is necessary along scenic and historic roadways within developments. A rectilinear pole and fixture of designated wattage is required within scenic and historic areas on major roadways.

Using the required information, the appropriate "Luminaire and Support Guide," and "Summary of Street Lighting Fixtures by Utility" tables (see Tables I-12 through I-15 at the end of this section), the Permittee shall prepare a Street Lighting Plan. The Permittee may use only those lighting fixtures that the local utility company will install and maintain under the prevailing maintenance contract between the utility company and the County.

c. Location Details

Typical street light location details for various roadway cross sections are included in Section III, 500 series, of the Department's Specifications and Standards for Roadways and Bridges manual.

d. Fixtures and Configurations

Light wattages, fixture styles, arrangement configurations, etc., are indicated in the "Luminaire and Support Guides" for the various utility companies. These guides apply primarily to below-ground, served, lighting systems. Whenever an above-ground, served, lighting system is proposed, the lights typically consist of pendant lighting with cobra head luminaires and Type II lighting distribution. The arm, or bracket, should extend at least 2 feet over the roadway.

Generally, colonial style fixtures are to be used on all residential roadways less than 36 feet wide or less, arranged in a staggered configuration on alternating sides of the roadway. Colonial style lights may be permitted on 36-foot roadways with single-family homes where the homes face the roadway. Pendant or rectilinear style lights may be required on all other roadways. (For the types of street lighting fixtures currently available, see the "Summary of Street Lighting Fixtures by Utility," Table I-12.)

On all divided roadways and along all roads 58 feet wide or greater, two separate lighting arrangements shall be used—one for each side of the street. In such cases, the pendant or rectilinear style lights are to be arranged opposite each other. Street lights shall not be placed in existing or future medians without the written permission of the Department. Also, documentation of such permission shall be made part of the Street Lighting Plan.

When only one-half of a future divided roadway (one with a right-of-way 96 feet or greater) is to be built or improved, the lights are to be installed on the finished side of the street using a one-sided configuration. The fixture style shall be based on the future or ultimate width of the roadway.

e. Placement of Street Lighting

Street lighting is required along all urban and suburban roadways. These environments, with their denser populations, are more likely to have activities (i.e., pedestrian and bicycle traffic, parking) in or near the County right-of-way. Proper illumination of the roadway is required for the safe conduct of these activities, as well as for the traveling motorist to see and avoid potential obstacles. Lighting shall be installed in order to provide the

most complete coverage possible, using the minimum number of light fixtures.

The Department has adopted the following guidelines for light placement. Because situations may exist where not all conditions can be satisfied, the guidelines are listed here in order of importance. Any significant deviation from these guidelines requires prior approval from the Department. (See Section III, Standard 500.12, Typical Street Light Spacing Detail, of the Department's Specifications and Standards for Roadways and Bridges manual.)

i. At least two lights must illuminate an intersection and should be placed along the main thoroughfare at or near opposite corners of the intersection; lighting for the side street(s) must commence within 75 feet of the intersection.

ii. Lights are required within 25 feet of any roadway terminus or the end of a cul-de-sac.

iii. The average spacing between lights shall be 150 feet. A maximum spacing of 170 feet is permitted in order to place lights at intersections and to avoid driveways and other obstructions. However, the 150-foot average must be maintained.

iv. Lights must be placed a minimum of 5 feet from driveways and 15 feet from existing or proposed street trees. For rural residential roadways, utility or street light poles shall be placed not less than 5 feet from the edge of paved shoulder. (See Section III, Standard 500.10, of the Department's Specifications and Standards for Roadways and Bridges manual.)

v. In areas of single-family residential development, lights should be placed on or near lot lines to minimize the lights' visual impact on homes. (This is not required if lot frontages exceed 150 feet.)

vi. Lights should be staggered (placed on alternate sides) or opposite along the roadway, in accordance with Tables I-13, I-14, and I-15.

f. Use of Existing Utility Poles

There may be roadways, or portions of roadways, within or adjacent to the permit area that have an overhead electrical distribution system existing prior to the issuance of the permit. Generally, the Department will not object to the Permittee using the utility company's poles for lighting, provided that the utility company approves and the utility poles are located in a manner suitable for roadway lighting purposes. However, under no circumstances shall overhead facilities be extended along any new or existing roadway without written permission from the Department. Also, where overhead facilities exist but the adjacent area will ultimately be served by below-ground distribution cables, the street lighting fixtures must also be served by a below-ground distribution system.

NOTE: When lights are mounted on utility poles, they may be placed higher than the typical underground-served street light. Consequently, the illumination is distributed over a greater area.

Therefore, on roadway lighting schemes utilizing utility poles, the distance between lights may be as great as 200 feet, but no greater, upon the written approval of the Department.

When an above-ground lighting scheme is proposed, it shall be the Permittee's responsibility to pay all costs associated with the relocation and/or installation of utility poles to provide a lighting arrangement necessary to satisfy the requirements herein.

g. Street Lighting Plan Submission

NOTE: To minimize delays, the Street Lighting Plan should be submitted to the Department for approval immediately after application for Street Construction Permit is completed.

The Permittee shall submit a Street Lighting Plan in triplicate (one reproducible and two prints) for review and approval by the Department. (For a flow chart of the approval process, see Section I—Roadway Development Guidelines, Table I-11, Street Lighting Plan Approval Process.)

All initial Street Lighting Plans must be submitted to the Department EISD, and must include the following documentation:

i. An outline of the permit area;

ii. A copy of the completed application for Street Construction Permit and corresponding street construction plans;

iii. A listing of the streets plus the lot and block numbers of the sites being developed;

iv. The location of all existing, pending, and proposed street lights along any connecting or adjacent street within 150 feet of the permit area, plus the information specified below for each existing, pending, and proposed street light:

- Below-ground, served, street lights—
  Post material;
  Mounting height;
  Luminaire (housing, lamp, and source); and
  Arm direction (where appropriate);
- Above-ground, served, street lights—
  Luminaire (housing, lamp, and source);
  Arm direction;
  Pole ownership; and
  Pole number.

v. Configuration and spacing arrangements; and

vi. A street light schedule for each permit, including: the subdivision name, the Department permit number, the utility company, and a summary of the required work, including the number, types, wattages, etc., of each street light fixture required. The schedule should also include the various symbols used on the plan to designate the lights.

NOTE: For a detailed checklist of plan requirements, see Section IV, Appendix A, Form A-6, Street Tree and Lighting Plan (STLP) Requirements Checklist.

h. Plan Review

If the Street Lighting Plan is not approved, the reproducible plan and a marked copy of the reproducible plan will be returned for revision to the Permittee by the Division of Traffic. Once the plan has been revised, the Permittee shall return the marked copy of the plan along with three sets of the revised plan (a reproducible and two prints) to the Division of Traffic for approval.

Once the plan is approved, the reproducible plan will be returned to the Permittee by the EISD; one print will be retained by EISD for use during inspection; and one print will be retained by the Division of Traffic. After acquiring an approved plan, the Permittee shall be responsible to contract with the utility company for the lighting improvements and to make prompt payment for the related work.

i. Acceptance

First, the utility company notifies the Department that the Permittee has paid for the required lighting improvements. Second, the utility provides an acceptable proposal for the energy and maintenance costs to the Department. Thereafter, the Department will authorize the release of the street lighting requirements of the road construction bond, provided that all other permit requirements have been completed to the Department's satisfaction.

j. Securing Approvals

The requirements for the release of the street lighting requirements of the road construction bonds are summarized below:

- The Permittee must submit and acquire approval of a Street Lighting Plan from the Department;
- The Permittee must contract with the utility company for the lighting improvements;
- The utility company must provide the Department with an acceptable proposal for the energy and maintenance costs; and
- The Permittee must provide the Department with documentation showing that the Permittee has satisfied all financial responsibilities related to the lighting improvements to the utility company's satisfaction.

To minimize delays and expedite the approval process, the Permittee should use distinct symbols for each type of light to show their locations on the plan. Please see Section III, Standard 500.12, for the correct usage of symbols for lampposts and pole-mounted lighting. Where more than two symbols are required, hollow and shaded symbols may be used.

The Street Lighting Plan to be approved by the Department must not include lighting improvements proposed for private roads or parking lots, State highways, or roadways maintained by an incorporated area. Such lighting fixtures may be included for reference, but they must be properly identified.

Once payment is made to the utility company, the Permittee shall submit the receipt or other proof of payment to the Division of Traffic. The proof of payment should include: the subdivision name, the Department permit number, the utility company's proposal or project number, and the amount paid.

2. *Traffic Control Devices*

a. Capital Projects

For County Capital Improvement Projects, all traffic control devices pertaining to roadway improvement projects, including plans for street name signs, traffic regulatory, warning and guide signs, pavement markings, and traffic signals shall be furnished and installed by the Contractor. Traffic control device plans indicating all signs, signals, and markings shall be included in the approved roadway design plans and approved by the Division of Traffic and / or the Division of Traffic Management and Operations prior to notice-to-proceed on the project.

b. Permit Projects

On all street construction permit projects, all required pavement markings shall be installed by the Permittee. All Permittees are required to pay a fee for the installation of all required street name signs to be installed by County forces.

i. Offsite/Access Road Improvements

For roadway improvements on subdivision access roadways such as arterial, collector or industrial roadways or offsite conditions for roadway improvements, the Permittee is responsible for the design and installation of all traffic control devices including traffic signs, signals, and markings. Separate signal plans shall be included in the permit plans, and be reviewed and approved by the Division of Traffic prior to permit issuance.

ii. Subdivision Streets

For internal subdivision streets, the Permittee is responsible for the design and installation of all traffic markings, traffic signals, if required, and payment of a fee for street name signs. Traffic signs will be furnished and installed by County forces.

The installation of all traffic control devices on County Roadways shall be designed in accordance with the MUTCD and the MSHA Maryland supplement to the MUTCD. All construction and material requirements shall be in conformance with the Technical Specifications in Section II of these *Specifications and Standards*. The traffic control device plans shall include the signing, signal and pavement marking plans, TS&Ls of all proposed signing, as well as the dimensions, type(s), and specifications of proposed pavement markings. The plans shall be prepared by a traffic engineer and sealed by a licensed professional engineer registered in the State of Maryland. All signing and pavement marking plans must be submitted to the Division of Engineering and Inspection Services

for review and approval by the Department's Division of Traffic and the Division of Traffic Management and Operations.

3. Traffic Control Signals

Traffic control signals play an integral role in ensuring the safe and smooth flow of traffic on County roadways. Current traffic signal designs incorporate the latest technologies for enhanced operations, safety, and maintenance. In addition to familiar tri-color signals known by most as "stoplights", traffic control signals also include pedestrian crossing signals and pushbuttons, hazard identification signs and beacons, and the sophisticated computer technology required to simultaneously coordinate signals for one or more roadway intersections. Designs include the use of video detection cameras, Light Emitting Diode (LED) signal displays, battery backup of on-street operations, traffic surveillance features, pavement temperature-sensing equipment, and communications. Physical support systems are also state-of-the-art, utilizing mast-arm poles and non-corrosive materials for all brackets, suspension, and mounting hardware.

Complete specifications for County-approved traffic controls are contained in Section IV, Appendix G, *Specifications and Standards for Traffic Control Signals in Prince George's County, Maryland*.

Note: Due to the rapid advancement of technology in traffic control signal equipment, please consult with the Department prior to specifying traffic control signal designs to ensure conformance to the latest requirements.

4. Maintenance of Traffic (MOT)

A Maintenance of Traffic (MOT) plan is essential for safe and continuous traffic circulation throughout a work zone. This is intended to maximize the safety of and minimize inconveniences to the traveling public while providing for the safety of motorists, pedestrians, and workers. A MOT plan shall include the design and placement of such items as: signing, pavement markings, variable message signs (VMS), delineation, channelization, barriers, crash cushions, and other items as required. All MOT plans shall conform with Part VI of the MUTCD and the MSHA *Temporary Traffic Control Manual*, latest editions. All MOT plans shall be approved prior to the issuance of a permit.

5. Residential Street Traffic Management

Quality of life for those along residential streets may be negatively impacted by excessive traffic volume and/or speeds. Thus, the Department supports design criteria that promote minimum traffic volumes and lowest possible speeds on residential streets. These objectives should be addressed at the planning and design stages through proper subdivision planning and street design. Subdivision layouts should limit average daily traffic (ADT) on secondary residential streets to 1000 vehicles and on primary residential streets to 3000 vehicles, with most streets experiencing volumes well below the upper limits. A discontinuous street pattern is also desirable, provided that the maximum travel distance from the furthest residence to the nearest collector road is limited to 0.5 miles and that a motorist need not make more than three turning movements. Street design elements, such as horizontal curves designed to the minimum allowable design speed, are acceptable.

6. The Neighborhood Traffic Management Program (NTMP)

On streets where high travel speeds and high traffic volumes are anticipated and where it is not possible to change the subdivision design to alleviate these conditions, physical traffic management devices may be required by the Department as part of the street construction permit. The type(s), design(s), and location(s) of these devices will be determined by the Department, in accordance with the NTMP.

Any determination of need for traffic calming measures should be based on the point assignment worksheet in the Department's *Neighborhood Traffic Management Program Guidelines and Criteria*. (See Section IV, Appendix D.) Designed for residential streets, NTMP promotes and maintains the safety and quality of life of the County's residential neighborhoods. By conducting the appropriate traffic engineering studies and by soliciting the input of community residents, NTMP provides a process for identifying, evaluating, and addressing undesirable traffic conditions related to speeding and excessive, cut-through, traffic volumes. Any physical, traffic calming measure(s) installed should comply with Department standards and specifications for speed humps, traffic circles, etc.

C. Streetscape

1. Street Trees

The planting of trees has many positive effects. Among their effects, carefully planted trees:

- Help create a sense of community and enhance the appearance of our land and roadways;
- Improve our environment by providing better air quality as well as intercepting and dampening roadway noise;
- Help protect our soils by intercepting and deflecting raindrops before they strike the ground, thereby lessening the impact on the soils below; and
- Help hold the soil in place, further reducing the potential for soil erosion.

CIP construction projects and all street construction permits require the planting of roadside trees within the limits of either the County right-of-way or elsewhere within the permit limits. Street trees may not be planted over storm drain pipe or other utilities where vertical clearance from top of pipe to surface is less than 4 to 6 feet. A "typical roadside tree" is a perennial woody plant having a main trunk and, usually, a distinct crown, which meets the minimum caliper and height requirements, is approved by the County, and otherwise complies with the requirements set forth in Section III, Standards 600.01 through 600.20. The CIP Contractor is required to plant, and shall be responsible for all costs associated with the maintenance or replacement of, such tree(s), for a period of two complete growing seasons after the CIP project roadway has been accepted by the County for perpetual maintenance. The street construction Permittee shall maintain and establish the plants for a period of one complete growing season (1 year). See Section II, MSHA Specification 710.03.06. (See also "Street Tree Guarantee and Maintenance Bond," in Chapter 4, Section 7.) The Permittee or Contractor must also obtain the required permit from the Maryland Department of the Environ-

ment Forest Service to cut existing trees within the County rights-of-way.

2. Concrete Sidewalks (Sidewalk Ramps and Crosswalks)

The term sidewalk generally implies a separated (horizontally and/or vertically) and prepared pathway of concrete paving with a broom-finished surface, intended exclusively for pedestrian use, including those with disabilities. Sidewalks are primarily designed to serve pedestrian circulation and/or transportation functions, particularly in urban areas. They are usually located within the public right-of-way and provide a direct pedestrian connection between neighborhoods, residential areas, parks, bus stops, schools, employment centers, and other origins and destinations. Rural areas usually cannot accommodate sidewalks due to the presence of a grassed drainage ditch and backslope.

The minimum desirable width for sidewalk travel along arterial, collector, and industrial roadways shall be 60 inches wide. The development of sidewalk along roadways serving commercial, industrial, and business districts must be reviewed and determined by the Department prior to construction. The minimum width requirement for sidewalk construction along primary and secondary classified roadways is 48 inches. (It is important to note that an individual traveling with a service animal or sighted guide will require a minimum of 48 inches width for convenient passage.) If the width of the sidewalk is less than 60 inches in clear width, passing zones, measuring at least 60 inches, would need to be installed as required by the Federal accessibility guidelines of the Americans with Disabilities Act. The passing zones shall be located at reasonable intervals not to exceed 200 feet. Driveway aprons and lead walks constructed to standard with a maximum 2 percent cross slope are considered acceptable as passing zones.

In most cases, sidewalks are to be separated from the back of curb by a landscape strip, consisting of grass and street tree planting material. The space is also used for the placement of traffic signs, street light poles, underground drainage systems, house connections, fire hydrants, water valves, and meters.

The centerline roadway grade and the sidewalk slope grade, which runs parallel to the direction of the approved centerline of roadway grade, shall be the same. The sidewalk cross slope grade, which runs perpendicular to the centerline of roadway, shall be a maximum of 2 percent, including crossings at driveway entrances and medians. The maximum tolerance, for differential elevations established between adjacent surfaces, at drop curbs, and sidewalk ramps is ¼ inch. Any deviation from this maximum tolerance is not an acceptable transition and is not in compliance with the Federal accessibility requirements of the Americans with Disabilities Act.

To ensure that public facilities are accessible and usable by pedestrians and those with disabilities, sidewalk construction is required on both sides of arterial, collector, and industrial roadways with no exceptions. Sidewalk construction requirements for primary and secondary classified roadways vary with the length of the roadway under consideration. Where the distance between the centerline of intersection roadways and the center of the cul-de-sac roadway is greater than 500 feet, sidewalk construction is required on both sides of the roadway. If the distance from the centerline of intersecting roadways to the center of the cul-de-sac is between 300 and 500 feet, sidewalks are required on one

side only. The sidewalk shall run around the entire circumference of the cul-de-sac bulb. Sidewalk construction is optional on roadways where the distance from the centerline of the intersecting roadways to the center of the cul-de-sac is less than 300 feet.

In cases where sidewalks already exist on both sides (and development is expected to continue), sidewalks are to be provided on both sides of the roadway and shall continue to the next intersection. From the point of intersection and beyond, the sidewalk may transition to one-sided construction.

Sidewalk ramps and median crosswalk ramps shall have a maximum running slope of grade 1:12, and minimum length of 8 feet unless otherwise specified on the standard detail. Crosswalks constructed beyond the ramps within the roadway median shall have a maximum running slope grade of 2 percent.

A perpendicular curb ramp may be located within the radius of a curb line. Perpendicular sidewalk ramps are so named because the cuts run at a 90-degree angle to the direction of the curb. A parallel curb ramp slopes in the direction of sidewalk travel. Such ramps are useful in narrow sidewalks along the curb. The landing must be a minimum of 5 feet long to permit a turn into and out of the sidewalk. Like the sidewalk, the landing should not slope more than 2 percent to the street.

Sidewalk ramps and median crosswalks shall be equipped with a detectable warning surface consisting of a pattern of raised truncated domes. The warning surface shall be placed a distance of 6 to 8 inches behind the curb line, and extend 2 feet in the direction of travel, over the full width of the ramp. Domes shall have a diameter of 0.9 inches, a height of a nominal 0.2 inches, and a center-to-center spacing of a nominal 2.35 inches. The detectable warning surface shall color contrast visually with adjoining surfaces, either light-on-dark or dark-on-light. Use brick red panel with brick crosswalk and dark gray panel at all other locations. For detailed information on sidewalk ramp and median crosswalk construction requirements, see Section III, Standards 300.05, 300.06, 300.07, 300.08, 300.09, and 300.10.

Since each sidewalk route or sidewalk ramp provides a unique connection between diverse origins and destinations, such pedestrian routes, when they occupy the public right-of-way, shall always be designated and constructed to be accessible to comply with current Federal requirements of the American with Disabilities Act.

3. Hiker/Biker Trails

The need for shared use paths (hiker/ biker trails) is a function of subdivision density, motor vehicle traffic volumes, residents' preferences, and the proximity of bicycle/pedestrian trip generators, such as educational institutions or parks. Also to be taken into consideration is the established community-wide bicycle route system. Bicycles shall be considered with all other users during transportation planning, new roadway design, roadway reconstruction, repair and capacity improvements, and transit projects, as recommended by AASHTO.

Trails shared by bicycles and pedestrians are appropriate for low-volume or low-speed use, particularly those that loop through subdivisions, but are not used by motor traffic. These facilities are most commonly designed for two-way travel within their own separate right-of-way. For hiker/ biker trail use, a paved area of 10-

foot width is desirable. However, due to right-of-way limitations, a minimum shared-use path width of 8 feet will be permitted, especially where the bicycle and pedestrian traffic volume is expected to be low.

Trails in common areas or other locations away from streets generally should be integrated into the detailed site plan or layout in a way that permits visual surveillance of the trails from the street or nearby homes. The opportunity for surveillance is an important factor for user safety and security. Other options may also be considered for accommodating bicycle traffic.

Street crossings for the biker and the pedestrian alike should always be located at points along the roadway that offer adequate sight distances. Traffic-controlled intersections are preferred. Curb cuts for bicycles may sometimes be provided in planned community developments when there are no ramps to accommodate a particular crossing. In some areas where heavily traveled trails cross busy collector streets, traffic control devices, such as signs and painted crosswalks may also be required. When trails intersect arterial streets, special traffic controls or overpasses provide the best methods for bicycle crossing. In all cases, the location and design of bicycle lanes and trails shall always be properly coordinated and approved by the Department.

4. Bike Lanes

In some cases, widening a street to accommodate a marked bicycle lane may be preferable to creating a separate trail. Where feasible, lanes should be 5 feet wide, located at the edge of the pavement, and striped and signed in accordance with the *AASHTO Guide for the Development of Bicycle Facilities*, latest edition. Limiting factors could include insufficient right-of-way, impacts to adjacent property, and/or excessive costs considered disproportionate to the projected need or use of a particular facility.

Bike lanes planned in urban areas within a new public roadway should be one-way facilities and should carry bike traffic flow in the same direction as that of adjacent motor vehicle traffic. Striping assists in separating bicyclists from motorists. One-way bike lanes should be 5 feet wide (minimum) as measured from the outside stripe of the motorists' travel way to the face-of-curb. Bike lanes should be provided on both sides of the roadway, assuming there are no obstructions or walls. Where feasible, pocket lanes shall be included in intersections along roads with bike lanes in accordance with the *AASHTO Guide for the Development of Bicycle Facilities*, latest edition. Bike lanes planned within a public roadway in rural areas shall use the roadway shoulder, unless otherwise restricted.

5. Concrete Pavers (Crosswalks and Sidewalks)

Concrete paving units are required to be used for crosswalks in certain intersections. If damage should occur to the concrete paver, individual units can be easily removed and replaced.

All concrete pavers shall meet the highest quality standards, in accordance with ASTM C902 (pedestrian/light traffic) and C1272 (heavy vehicular traffic) paving brick standards, with an average compressive strength of 8000 psi and an average absorption rate of less than 5 percent when tested in accordance with ASTM C140. Pigment in concrete pavers shall conform to ASTM C979. Paver size shall be a nominal 4

inches by 8 inches by 2.375 inches and shall have a tolerance of plus or minus 0.0625 inches in all dimensions. All top edges of pavers shall have a 0.01875-inch bevel at 45 degrees.

Pavers shall exhibit resistance to 50 cycles of freeze-thaw while immersed in 3 percent saline solution. Pavers should be installed over an approved concrete base. (See Section III, Standards 300.22 and 300.23.) Note: Pavers shall be installed on a one-inch thick setting bed of material meeting ASTM C33 designation.

6. Clay Brick Pavers (Sidewalks and Sidewalk Ramps)

Concrete pavers or clay brick pavers may be used for sidewalks and sidewalk ramps. Clay brick pavers may be used for virtually any size or shape sidewalk and/or sidewalk ramp and are available in a variety of patterns. To minimize or eliminate the cutting of brick, a basket weave or stack bond pattern may be considered.

Clay brick pavers shall be installed over a 1-inch-thick setting bed of fine graded sand meeting ASTM C33 designation. The size of a typical clay brick paver shall be 4 inches by 8 inches by 2.25 inches. All clay brick pavers shall meet the highest quality standards in accordance with ASTM C902.

Joint and bedding sand for the clay brick pavers shall be clean, nonplastic, and free from harmful or foreign matter. The sand shall be natural or manufactured from crushed rock. The grade of sand for the joints and bedding shall be according to ASTM C33, ASTM C136, and ASTM C144.

7. Bus Passenger Shelters

Shelters shall be installed adjacent to those established County transit and Metrobus stop locations where County transit planners and project engineers deem such construction feasible and cost-effective. These structures shall be fabricated to conform with Department specifications (See Section IV, Appendix A, Form A-25.) and the AASHTO publication, *Roadside Design Guide*.

D. Road Closure and Vacation of Right-of-Way

1. Temporary Closure

The temporary closing of any roadway requires the approval of the Department Director and may be required for construction activities, emergencies (hazardous material spills or leaks, vehicular accidents, etc.), or special activities (community or municipal events, etc.). Temporary closings may not interrupt traffic on primary, collector, or arterial roads, nor deny legal access of any person to their property without permission, unless the Director determines that:

- Acceptable alternative routes are available during the closure; or
- The closure will be of such short duration so as not to cause unreasonable inconvenience.

Any request for temporary closure must be made in writing to the Director at least 30 days in advance of the date of closure, except in emergencies. The request must include the following information:

- An explanation of the circumstances and a statement of necessity;
- The location and precise limits of the area to be closed;
- The date, time, and duration of the requested closing;

- A Maintenance of Traffic (MOT) plan indicating alternative routes, required signs, barricades, etc.; and
- Evidence of permission from property owners who will be denied access to their property.

The Director may approve, deny, or conditionally approve a temporary closing request. Any conditions imposed shall be provided to the person requesting closure and must be complied with throughout the duration of the closing. Noncompliance will result in immediate revocation of permission and may result in the immediate reopening of the roadway to public use. Completion of all activities necessitating the closure and any needed restoration of the roadway will be required prior to expiration of the time stated in the written permission for closure.

2. Permanent Closure

Road closure, which is recommended for rights-of-way no longer needed as public roadways, may be the result of realignment, access improvement, or other situations. The closure of a roadway terminates the right of the general public to use the right-of-way, but does not affect property ownership rights of the right-of-way or adjoining properties. (Property ownership in relation to right-of-way is addressed in "Procedure for Vacation of Right-of-Way," below.)

Permanent road closures may occur only by order of the County Executive upon recommendation by the Department Director, and shall be carried out in accordance with County Code Subtitle 23, Division 5. If no users of the roadway or of the portion of the roadway to be closed will be denied access to any property or area previously accessible, the County Executive may authorize the closing upon certification of such facts by the Director. Requests for road closures received from the general public are subject to a fee set by the Department to offset administrative costs of processing the closure.

A public hearing is required for the closing of any roadway where:

- The public would be denied access to certain properties or areas previously accessible;
- Access to abutting or nearby property owners will be denied; or
- There is potential, local objection to the closing.

The hearing is held to allow testimony to determine if a reasonable, alternative means of access exists and if the roadway is no longer needed as a public way. Public hearings are scheduled and administered by the Department.

Significant public notification of such hearings shall be provided, including:

- Certified mailing to abutting and nearby property owners;
- Advertisement of the hearing in local newspapers;
- Notification of offices of local elected officials; and
- Posting of signs in the vicinity of the proposed closure.

Public hearings are conducted at locations near the road closure. Public testimony is presented, and the minutes are professionally recorded and transcribed. Written comments will be accepted before and up to 30 days after the date of the hearing. All minutes and written testimony are forwarded to the Director,

who renders the recommendation regarding the closure to the County Executive.

3. Procedure for Vacation of Right-of-Way

Public ownership of dedicated rights-of-way may be vacated only by the M-NCPPC, and requires the filing of a vacation petition with the County Planning Board according to Section 24-112 of the Prince George's County Code. This process is administered entirely by M-NCPPC. (Please contact M-NCPPC for a complete list of requirements.) Department approval of such vacation, however, is also required. Included here are the requirements and procedures to obtain written consent from the Department for vacation of right-of-way.

Once filed with the Planning Board, a vacation petition is handled by the Department's Office of Engineering. Upon filing, the petitioner is required to submit the following information:

- A copy of the actual petition to be presented to the Planning Board;
- A copy of the plat(s) of the subdivision under which dedications were made;
- Copies of all other exhibits referenced in the petition that identify the area to be vacated; and
- Delineation on the plat(s) of the exact area(s) in the subdivisions to be vacated.

In order to determine whether any or all of the areas in question should be retained in dedicated status, the Office of Engineering consults with other relevant Department divisions, including the Office of Transportation and the Right-of-Way Division. Consideration of the vacation request will be subject to the following guidelines:

- Consent shall not be given to vacate rights-of-way shown on the approved Master Plan (or adopted revision thereof);
- Consent shall not result in the severing of a community or preclude development of alternative routes for safety, emergency service, traffic circulation, or community access;
- Consent shall not create a remnant right-of-way of substandard nature, or result in the isolation of any parcel from access to the public roadway system;
- Where existing public utilities or facilities remain, provisions for relocation or replacement easements must be provided;
- Requests which fall in incorporated municipalities will be subject to the jurisdiction and consent of the municipality; and
- Requests that may affect State highways require the consent of the MSHA.

Upon completion of the review, the Department will prepare a letter to the Planning Board granting consent to the petition and noting any limitations or recommended conditions. The letter will be accompanied by a copy of the subdivision record plats marked to delineate the exact location of the right-of-way for which consent to vacate is granted. If consent is denied, the petitioner will be notified with the reasons for denial.

Chapter 4
Permitting

A. Introduction

All construction work to be performed in the County right-of-way, or area to be dedicated, requires that an appropriate permit be issued by the Department (in addition to any permit required by other County, State, or Federal agencies). No work may begin until proper permits have been issued by the Department's Office of Engineering, EISD. In order to develop land abutting County right(s)-of-way, the owner/developer is required to construct and/or improve all abutting roadway(s) to an approved standard in accordance with Subtitle 23 of the Prince George's County Code, the Road Ordinance. The permit process ensures the proper and timely completion of projects within County rights-of-way. Submittal requirements vary with the type of permit to be issued.

Examples of activities requiring permits include but are not limited to:

- Grading within the County right-of-way, even with no other construction;
- Public storm drainage facility construction;
- Residential and commercial entrances for both new construction and repair/replacement;
- Utility construction/repairs and maintenance;
- Improvements/repairs to roadways;
- Specialized circumstances, such as using public roads for transportation of construction equipment and/or materials;
- Construction or reconstruction of County-maintained roadways, including sidewalks and other appurtenant facilities; and
- Construction of private roadways for single-family or townhouses.

Note: Checklists and requirements for various permit types are provided in Section IV, Appendix A. You may visit or call the Department's Permits Section to determine the permit type and other requirements necessary for your project.

B. Types of Permits

1. Grading Permit

A Grading Permit is required for all grading within the County right-of-way, including disturbances of vegetative ground. Key requirements include:

- Detailed design plans for grade establishment;
- Submittal of sediment/erosion control plans approved by the Prince George's Soil Conservation District;
- Soil boring;
- Payment of filing and permit fees; and
- Approval of Grading Permit bonds.

Please refer to checklist A-2 in Section IV, Appendix A, for specific requirements.

2. Storm Drainage Permit

Installation of a public storm drainage facility within the County right-of-way, as a discrete project, requires a Storm Drainage Permit. Key requirements for obtaining this permit include:

- DPW&T-approved storm drainage design plans and corresponding

stormwater management and storm drain construction permit;
- Submittal of sediment/erosion control plans approved by the Prince George's Soil Conservation District;
- Payment of filing and permit fees; and
- Approval of storm drainage permit bonds.

3. Street Construction Permit

Construction of County or public roadways and their appurtenances (sidewalks, storm drains, street trees, signage, etc.) requires a Street Construction Permit. A Street Construction Permit is required in those private developments where private roadways serve more than four single-family dwellings; or serve townhouse communities; or where the Department, in accordance with County Code regulations, has determined that a Street Permit is required. Permitting for street construction requires a comprehensive review by the Department of all aspects of the design and construction. Key requirements include:

- Detailed design plans for grade establishment, paving, and storm drainage;
- DPW&T-approved storm drainage design plans and corresponding stormwater management and storm drain construction permit;
- Submittal of sediment/erosion control plans approved by the Prince George's Soil Conservation District;
- Payment of filing and permit fees; and
- Approval of bonds for all phases of construction.

Please refer to checklist A-4 in Section IV, Appendix A, for specific requirements.

4. Utility Permit

Note: Please see Section IV, Appendix E, for complete information on all utility-related policies of the Department, including requirements, application instructions, and forms.

Utility permits are required for any installation or maintenance of utility facilities within the County right(s)-of-way, and fall into two categories.

- Utility Special Permit—A special permit is required for installation and/or construction of new facilities or equipment. This operates much like other permits for construction within the County right-of-way.
- Utility Maintenance Permit—An annually renewable permit is required, based on the number and size of actual work areas.

5. Rural/Urban Driveway Permit

All driveway entrances onto County roadways require a driveway permit. This policy applies to new driveway construction as well as repair or replacement of existing driveways. Key requirements for driveway permits include:

- A site plan indicating the existing conditions, proposed improvements, relevant dimensions, etc.;
- Payment of filing and permit fees; and
- Approval of driveway permit bond(s).

Please refer to checklist A-9 in Section IV, Appendix A, for specific requirements.

6. Haul Road Permit for Mining, Excavation, and Fill Operations

Using County roadways for hauling materials in excess of 1000 cubic yards in volume from mining, fill operations, and other excavation requires a Haul Road permit. Long-term use (greater than one year) requires annual extension of the permit. Permittees are responsible for all damage to County roadways resulting from hauling operations. Key requirements include:

- Submittal of a plan showing the location of the site and proposed hauling route;
- Submittal of sediment and erosion control plans approved by the Prince George's Soil Conservation District;
- Payment of filing and permit fees; and
- Approval of an appropriate performance bond for restoration in the amount of a $30,000 minimum to a $100,000 maximum.

Please refer to checklist A-17 in Section IV, Appendix A, for specific requirements.

7. Haul Road Permit for Transporting Timber/Equipment

Short-term use of the County right-of-way for hauling timber and related logging equipment requires a Haul Road Permit. Issued in conjunction with the DER Timber Harvest / DPW&T Grading Permit, a separate Haul Road Permit is required for each harvest site. Permittees are responsible for all damage to County roadways incurred by the hauling operations. Key requirements include:

- Submittal of a plan indicating the location of the site and proposed hauling route;
- Submittal of the sediment and erosion control plans approved by the Prince George's Soil Conservation District;
- Payment of the filing and permit fees; and
- Approval of an appropriate performance bond for restoration in the amount of $5000.

Please refer to checklist A-19 in Section IV, Appendix A, for specific requirements.

8. Special Permit for Overweight/ Oversize Vehicles

The transportation of extremely large or heavy items over County roadways (homes, electric transformers, turbines, etc.) requires an Overweight/Oversize Vehicle Permit. A minimum of 30 days notice is required for coordination of the haul route and impacted entities, including street lighting, traffic signals, etc. The Permittee is responsible for any damage to County roadways resulting from hauling operations and for coordination with all impacted utility companies to ensure no interference with overhead facilities and equipment en route. Key requirements include:

- Submittal of a route map indicating the location of the site and proposed hauling route;
- A copy of a MSHA Special Hauling Permit;
- A copy of a gross load analysis computation for combined loading;
- A copy of approvals from all affected local jurisdictions;
- Payment of the filing and permit fees; and

- Approval of an appropriate performance bond for restoration in the amount of a $10,000 minimum to a $100,000 maximum.

Please refer to checklist A-18 in Section IV, Appendix A, for specific requirements.

9. Special Permit for Incidental Activities

Onsite construction or incidental activities that may impact the adjacent County right-of-way require a Special Permit for Incidental Activities. This permit ensures that the County right-of-way will be left with no damage resulting from incidental activities. Requirements for the permit vary somewhat with the proposed activity, but, at a minimum, will include:

- Submittal of approved plans, sketches, or other documents relevant to the onsite activities;
- Copies of any related public agency permits for the incidental activity;
- Payment of the filing and permit fees; and
- Approval of bond(s) or a letter of responsibility.

C. Process of Permit Issuance

1. Application

At this time, applications must be filed in person at the Department Permit Center and must include copies of all plans, reports, cost estimates, and any prerequisite permits required by other agencies. Applicants are required to pay a nonrefundable filing fee equal to 3.3 percent of the estimated construction project cost, or a minimum of $50, whichever is greater. The cost estimate shall be prepared by the applicant's engineer using the Prince George's County DPW&T Construction Price List. (See Section IV, Appendix A, Item A-8.) The filing fee is applied toward the total permit fee. (For complete information on permit fees, please refer to Section IV, Appendix A, Item A-7, Schedule of Permit Fees.) The Office of Engineering performs a preliminary review of the permit package and confirms the accuracy of the applicant's cost estimate. The Department Permits Section uses the confirmed estimate to compute permit fees and establish bonding requirements. For most permits, a fee equal to 10 percent of the total project construction cost is assessed, which includes the filing fee already paid.

2. Bonding

All work conducted within the County right-of-way requires bonding to ensure satisfactory completion of all work and payment responsibilities covered by the permit. To achieve this, the Department uses three types of bonds.

The first type of bond is a performance bond. This bond is valued in the amount of 125 percent of the project construction cost, as estimated by the permittee and approved by the Department. A performance bond is required in all cases.

The second type of bond is the labor and materialman's bond, which is retained by the County to ensure payment of persons supplying labor or materials for work performed under the permit. This bond is valued in the amount of 50 percent of the project construction cost approved by the Department. This bond is required when a performance bond is posted in the form of a surety or when the project construction cost estimate is $25,000 or more.

The third type of bond is the restoration bond. This bond is valued in the full amount of the estimated cost to restore any damaged areas of County roads resulting from the permitted activity. It is required for repair or replacement of existing residential and commercial entrances to ensure proper and complete restoration of the County right-of-way and appurtenances after construction. For repair or replacement of existing residential driveway entrances, the applicant may sign a letter of responsibility in lieu of a restoration bond. A letter of responsibility is a signed and notarized affidavit indicating the applicant's promise to restore the County right-of-way damaged by the permitted activity.

Bonds may be posted in the following forms:

- Cash;
- Irrevocable letter of credit;
- Irrevocable assignment of funds, savings account, or certificate of deposit;
- Corporate surety bond issued by an acceptable insurer; and/or
- Certificate of Guaranty by the Development Guarantee Group of Prince George's County, Inc.

Note: All bonds, except those posted in cash, require the review and approval of the Prince George's County Office of Law, prior to permit issuance by the Department.

3. Submittal Review

The Department's Office of Engineering performs a thorough review of the permit application package for all required components. As applicable, submittals are routed to other offices within the Department, including the following:

- Office of Highway Maintenance;
- Office of Project Management;
- Division of Traffic Engineering;
- Division of Transit;
- Division of Traffic Management and Operations; and
- Soils/Materials Testing Section.

All design and construction documents are reviewed for conformance to County requirements and regulations, proper engineering design, and safety aspects of the project. Significant interaction among the review staff and applicant is typical throughout the review process. The Department may impose certain conditions or requirements on the project in the interest of public safety.

4. Permits Issuance

No permit will be issued without all of the following:

- Departmental review and approval from the Office of Engineering;
- Permits from other agencies;
- Dedication of all necessary right-of-way requirements;
- Satisfaction of all conditions;
- Payment of all fees; and
- Approval of all required bonds.

Upon satisfactory completion of these requirements, permits will be issued, valid for a period of time, as stipulated on the permit. If the work is not completed within the stipulated time period, the applicant must file for an extension. The Permittee is responsible for requesting any necessary extension at least 30 days prior to expiration of the original permit. The Department shall assess an extension fee equal to 25 percent of the original permit fee—subject to a $25

minimum. For permits for street construction that is 90 percent or more complete, as verified by the Department's construction inspectors, the extension fee shall be equal to either 25 percent of the original permit fee or a maximum of $750, whichever is less.

Permit issuance is granted subject to all conditions imposed during the review process. All such conditions are made a part of the permit document, and full compliance is necessary to ensure full release of bonds.

5. Construction Inspection

Once work is started, the project will be subject to field inspection by Department Inspectors to verify proper completion of the work in conformance with these Specifications and Standards. Inspectors are assigned to each project according to the project's location, based on the Departmental Engineering District. Inspection and approval of all subgrade and concrete form work is required prior to placing any storm drain, sidewalk, curb and gutter, or pavement. Inspections will be conducted for all phases of construction as deemed appropriate by the Department.

The Inspection staff maintain a log of all activities related to the project, including inspection results, contractor performance, and any reports of unsatisfactory performance. As the project nears completion, a list of uncompleted permit requirements is issued by the Inspector. The Permittee shall have 30 days to satisfactorily complete all items on the list. When all permit requirements are completed in accordance with plans and specifications, the inspector then recommends release of the permit.

6. Release of Bond/Closing Permit

Upon recommendation from EISD, the Permits Section notifies the Permittee of any outstanding requirements prior to release of the bond(s). Such outstanding requirements may include releases of liens and/or a street tree guarantee and maintenance bond. Upon receipt of the requirement(s), the Permits Section notifies the bonding company and Permittee of release of the permit and bonding responsibilities; or in the case of Cash Bond(s), a refund check will be forwarded by the Office of Finance.

If requested by the Permittee, bonds that are not secured by surety bonds (cash, letters of credit, assignment of accounts, etc.) may be reduced based on the prorated value of the work completed and approved by the Department, according to the following criteria:

Percentage of Work Completed	Percentage of Bond Reduction Amount
50	25
80	75
Acceptance	100

Approved levels of completion will be determined solely by the Department Office of Engineering staff. Surety bonds are not subject to bond reduction, except in the following case: For urban road classifications where all work is completed except the planting of trees and placement of sod, the Permittee may request a reduction in security to 50 percent of the original amount or $25,000, whichever is greater. No reduction applies to surety bonds posted for rural road classifications.

7. Street Tree Guarantee and Maintenance Bond

The Department includes the cost of roadside trees in the cost estimate for determining the performance bond values of street construction permits. Prior to releasing the performance bond for the permit, however, a separate performance bond may be required from Permittees to ensure planting and/or growth and survival of roadside trees for a duration of two full growing seasons.

Note: The tree planting season lasts from October 15 to April 30; however, no planting shall occur where the soil is frozen. See Specification 710.03.06 in Section II for more information.

Because the completion of projects varies in relation to growing seasons, the Department will use the following criteria to determine if Permittees will be required to post separate bonds for roadside trees and to determine the amount of the bond required:

Two growing seasons, all trees acceptable: No separate bonds will be required when roadside trees are maintained and established by the Permittee for two full growing seasons and are found in good health and of the species and cultivar approved in the tree plan for the permit, at the time of the final inspection and acceptance of the associated permit.

Two growing seasons, trees not acceptable: If any dead or damaged trees are found at the time of the final inspection and acceptance of the associated permit, the Permittee may elect to:

- Replace the unacceptable trees during the planting season with good stock trees; or
- Post a bond equivalent to 100 percent of the value of the replacement trees, as determined by the Department Inspector, using the prevailing unit cost of street trees.
- The Permittee shall be responsible for replacing and replanting all dead or damaged trees with trees of the species and cultivars approved in the tree plan for the permit.

Partial growing season: Should the final inspection and acceptance of the associated permit occur before the trees are established and maintained by the Permittee for two full growing seasons, the Permittee will be required to post a bond equivalent to 100 percent of the value of the planted trees, as determined by the Department Inspector, using the prevailing unit cost of planted trees.

Trees not planted: If all work stipulated by the permit is satisfactorily completed in accordance with the permit requirements, but the roadside trees required by the permit are not planted due to adverse weather conditions or other reasons, the Permittee will be required to post a bond equivalent to 100 percent of the value of the trees, as determined by the Department Inspector, using the prevailing unit cost of planted trees.

All tree bonds shall be valid for sufficient time to allow trees to be established for two full growing seasons. Cash bonds will be required when the value of trees to be bonded is less than $10,000. Other forms of surety noted above are acceptable if the value of trees to be bonded exceeds $10,000.

The trees are reinspected at the end of the two growing seasons, and the tree bond is released if all trees are found to be viable and in good health and of the species and cultivar approved in the tree plan for the permit. For any dead or damaged trees, the Permittee may either replace the trees during the planting season or pay the County the cost of replacement (fee-in-lieu), as determined by the Department Inspector, using the prevailing unit cost of planted trees. No further bonding will be required for the replacement trees.

8. Acceptance of New Street Construction

All new street construction, whether by permit or the CIP, will be subject to a formal acceptance procedure for inclusion in the County roadway network. Under this procedure, the Department staff prepares all necessary documentation on the new roadway and recommends that all construction work receive final approval. The Department Director then prepares an Executive Order and recommends to the County Executive that the work be accepted into the County road system for perpetual maintenance. The procedure is completed when the County Executive signs the document accepting the work under the authority of the Charter and the laws of Prince George's County.

9. Default

The Permittee must complete all work within the specified time of the permit or file for an appropriate extension. Within 30 days of the permit's expiration, the Department will inspect the project to determine if:

- Work has been completed and the permit can be accepted;
- Only minor work remains and bonds should not be called; or
- Significant work remains, necessitating the calling of bonds.

If the work is completed, the acceptance and bond release procedures will be initiated. For projects requiring only minor work for completion, the Permittee will be advised of outstanding work, and a timeframe for required completion will be specified. The Permittee may also be required to file for an extension at this time. If, however, a significant portion of the project remains uncompleted, the Permittee will be notified to file for an extension to complete the work. If the Permittee is unresponsive 30 days after the permit expiration date, the Director will declare the permit in default and move to call the bonds posted for the permit.

Once a permit is in default, the Department will immediately notify the bonding institution(s) to undertake and complete the work in accordance with the permit. If the bonding institution or agent fails to commit to undertaking completion of the work within 30 days of notice by the Department, the Director will move to collect all performance bonds posted for the work. The bonding institution or agent will have 30 days to issue payment to the County. Institutions that do not provide bond funding to complete the construction work risk being barred from issuing bonds for roadwork within the County for a period of 5 years.

The Department will move immediately to collect the bond and carry out the work. The Department will use a portion or all of the proceeds from the bonds. Any excess amount will be returned to the payer after all work has been finished and all costs have been settled.

10. Suspension/Revocation of Permit

The Director may suspend or revoke any permit for any of the following reasons:

- Violation of Subtitle 23 of the Prince George's County Code, the Road Ordinance;
- Violation of terms and conditions of the permit;
- Assignment or transfer of the permit; or
- Violation of a stop-work order issued by the Director.

Prior to revocation of a permit, the Permittee will be notified in writing. The Permittee will then have 14 days to request an administrative appeal. Once requested, sufficient notice of the appeal hearing will be given to both the Permittee and the public. After the appeal hearing, the Director will render a decision within 10 calendar days. If the ruling is for revocation, bond amounts posted will be forfeited to the County.

D. Policies Governing Fees in Lieu of Construction

Note: Subtitle 23 of the Prince George's County Code authorizes the Director to collect a fee in lieu of roadway construction under the following circumstances.

Developers are required to construct or improve roadways in conjunction with land development activity. When such construction or improvements may not be practical or feasible at the time the land development work is being done, the use of a fee-in-lieu allows developers to pay the cost of construction in lieu of actually undertaking the construction. Payment of all fee-in-lieu requirements must be made prior to permit issuance.

Note: Fees for the deferred roadway construction and improvement are calculated allowing for inflation and contingency factors.

A fee-in-lieu of roadway construction may be collected in either of the following two situations:

- In conjunction with permitting application—Approval of certain Department permits is often conditional on a requirement to improve roadways abutting areas of development to their ultimate configurations (as set out in the M-NCPPC Master Plan). Such improvements are not always practical or feasible at the time of permit issuance due to scattered development along the route, incomplete acquisition of right-of-way, or physical factors (grading, alignment, etc.).

  The Office of Engineering is responsible for reviewing comprehensive estimates for projects subject to fee-in-lieu using the current DER/Department Standard List of Unit Prices. This estimate is subject to a 25 percent contingency factor and an inflation factor. (The latter is calculated using the Engineering News-Record (ENR) Highway Construction Cost Index.) The resulting estimate is used for bonding and for calculating the construction cost charged to the developer.
- In conjunction with M-NCPPC approval of a subdivision, *M-NCPPC requires, as part of its subdivision approval process, a contribution toward construction and/or improvement of roadways to satisfy M-NCPPC Adequate Public Facilities (APF) requirements. In accordance with the provisions of Subtitle 24 of the Prince George's County Code and Article 28, Section 7-116, of the Annotated Code of Maryland, the Plan-*

ning Board has the authority to impose a fee-in-lieu in conjunction with subdivision approval. Please contact M-NCPPC for complete information and requirements.

Chapter 5
Capital Improvement Program

A. Summary/Overview

The Prince George's County Capital Improvement Program (CIP) is a comprehensive 6-year plan to program and expend funds for capital projects, involving:

- Physical public improvements, such as construction of County roadways and bridges;
- Acquiring property for public use, including rights-of-way; and
- Purchasing equipment for any public improvement, when first constructed.

The program includes a transportation component for the construction and rehabilitation of County roads and bridges, as well as for the construction of mass transit facilities, such as parking garages at Metro stations. Funding for transportation comes primarily from general obligation bonds, but may also come from the Federal Government (generally dedicated to the bridge construction program), from State Government, and from developer contributions.

B. The Role of the Department

The Department is responsible for all aspects of construction and rehabilitation projects relating to County roadways and bridges which are undertaken through the CIP, including the following:

- Analyzing and identifying roadway construction and/or rehabilitation needs;
- Establishing priorities for roadway construction and/or rehabilitation projects, and recommending projects for approval by the County Executive and, subsequently, the County Council;
- Managing the design phase, including the direction of the designers;
- Preparing contract specifications and bid documents for funded projects;
- Administering the construction bidding process;
- Appraising, negotiating, and purchasing the rights-of-way; and
- Managing all roadway/bridge construction and rehabilitation projects from groundbreaking through final acceptance.

C. Project Development

Through the course of its regular activities, the Department identifies roadway improvement and construction requirements that are beyond the scope of routine maintenance operations. Suggestions and requests for improvements may also come from communities impacted by transportation planning decisions or from concerns applicable to existing traffic or transportation conditions.

The initial development of a project requires a considerable amount of coordination to evaluate the purpose and need for the project and to prepare a project description and scope, including:

- The reasons the improvements are required;
- The location(s) of needed improvements;
- A detailed scope, including complete description and project limits;
- A preliminary cost estimate; and
- The anticipated CIP funding source.

Proposed projects are forwarded to the Director, who has full discretion to approve the project and funding source, and to assign a funding priority. The Program Control Division within the Director's Office maintains the list of approved projects that are awaiting funding. This Division also prepares the draft CIP for County Executive and County Council approval. The design and construction of approved CIP projects starts as soon as funds become available.

D. Contract Specifications/Bid Documents

In accordance with the County's regulations and procurement policies, the construction of CIP projects is generally competitively bid after the Department develops contract specifications and bid documents. The bid documents contain instructions to bidders, standard County contractual terms and conditions, and technical specifications for proposed projects, including:

1. Instructions to Bidders

This document provides detailed directions on the bid process, including:

- Deadlines for the receipt and opening of bids;
- Availability and pricing of project specifications and plans;
- Bid security requirements;
- Required time of completion and liquidated damages clauses;
- Bidder's submittal requirements;
- Minority business enterprise (MBE) participation requirements;
- Prebid conference/site visit dates; and
- Other relevant bidding information.

2. General Terms

All CIP contracts awarded are subject to the "Prince George's County General Terms and Conditions of the contract between the County and the Contractor" (general terms). The general terms govern all aspects of the contractual relationship, including, but not limited to, the following conditions:

- Contractors' and County's responsibilities, insurance and bonding requirements, and warranties;
- Control of work, including inspections and correction of defective work;
- Acquisition of materials, including use of substitutions, payment of sales tax, and the storage and handling of materials;
- Progress of the work, contractual enforcement mechanisms, and final inspection requirements and procedures;
- Payment terms, including for progress and final payments, retainage provisions, and payment withholding for uncorrected or deficient work; and
- Subcontractor relationships, including MBE utilization requirements.

3. Technical Specifications

All requirements pertaining to the design or the construction contract are specified in this section. The technical specifications provide extensive detail on, among other things, construction techniques, required materials, and specifications for appurtenant facilities. The information contained in the technical specifications, when combined with the project drawings, is intended to provide all information necessary to bid and perform the Contract.

E. Project Administrative Policies

The Department has enacted certain practices and policies regarding the contracting and the subcontracting of the work performed on CIP projects. The following policies are established in the general terms and fully enacted through Department directives:

1. Limits on Subcontracting

The Contractor shall not sublet more than 50 percent of the monetary value of the work. The costs of insurance, overhead, and supervision may not be claimed as a portion of the 50 percent requirement. All subcontractors must be approved by the Department.

2. Minority Business Enterprise (MBE) Utilization Requirements

The County's policy states that certified MBEs shall have maximum opportunities to participate in work on CIP projects. Mandatory utilization requirements are established in accordance with Subtitle 10A-136 of the Prince George's County Code.

3. Payment of Subcontractors

Final payment and the release of bonds will not be made until the Contractor provides the County with proof of payment to all subcontractors, including release of any liens.

4. Construction Inspection

Once work has begun, the project will be subject to field inspection by the Department's inspection staff, including consultant inspectors, to verify completion of all work and its conformance with the construction documents. Inspections are conducted through regular or frequent visits by the inspection staff and are documented.

F. Contractor Prequalification

Prior to bidding on work to be performed in Prince George's County rights-of-way, all Contractors and subcontractors are required to complete and submit a Contractor's Qualification questionnaire. (See Section IV, Appendix B, Item B-3.) Submitted questionnaires are evaluated prior to award of any bid. The prequalification document details corporate information, project experience, financial and insurance ratings, and other information relevant to the evaluation of the Contractor, and must be certified by a corporate officer and notarized. Prime Contractors are also responsible for gathering and submitting prequalification questionnaires for all proposed subcontractors. The Department reserves the right to disqualify Contractors and/or subcontractors who are deemed to be not qualified based on the information contained in the prequalification questionnaire, through information acquired in reference checks, past performance on departmental projects, or other sound reasons.

G. Contractor Performance Evaluation

The Contractor performance evaluation process is based on regular reporting of Contractor and subcontractor performance by the Department engineering and inspection staff. The purpose of this effort is to assist the County in the consideration of future contract award/qualification decisions.

The process uses a series of forms completed and maintained by the Department. (Sample copies of the forms can be found in Section IV, Appendix B, Forms B-4, B-5, and B-6.) At the end of each project, a project evaluation form will be completed to grade the Contractor and subcontractors on, among other things, management, equipment, safety, and the quality of the work. On an annual basis, the project reports are

summarized into an annual report and graded with a numerical score and provided to the Contractor. At any time, a report of unsatisfactory Contractor performance progress may be issued for incidents of unsatisfactory performance on the job. The Contractor is expected to correct all unsatisfactory performance progress within time limits requested by the Department. The Department will maintain Contractor evaluations, and may consider past performance when awarding future contracts.

H. Suspension/Disqualification

Contractors and subcontractors who receive more than one (1) evaluation which reflects less than satisfactory performance may, at the discretion of the Department, be suspended or disqualified from performing work in Prince George's County rights-of-way. Suspensions can be ordered on a term (a fixed time period) and/or conditional basis.

In order to be reinstated, suspended Contractors must demonstrate compliance with required conditions, and meet any time restriction imposed. Contractors and subcontractors compiling suspensions, financial irregularities, or poor safety records may be subject to permanent disqualification from working on County roadways.

Table I-1
Recommended Right-of-Way and Travel Way Widths

Source: Prince George's County Department of Public Works and Transportation

Department Standard No.	Road Classification	Right-of-Way (ft)	Travel Way (ft)	Median (ft)	Shoulders (ft)	Bike Lane (ft)
100.01	Urban Arterial Road	120 (130)*	2 x 36 (39)*	24 (26)	—	— (5)*
100.02	Urban Major Collector Road	100*	2 x 26 (30)*	20 (16)	—	— (5)*
100.03	Urban 4-Lane Collector Road	80*	46 (58)*	—	—	— (5)*
100.04	Urban 5-Lane Collector Road	80 (90)*	58 (68)*	—	—	— (5)*
100.05	Urban Commercial and Industrial Road	70	46	—	—	—
100.06	Urban Primary Residential Road	60 (70)*	36 (46)*	—	—	— (5)*
100.07	Urban Secondary Residential Road	50	26	—	—	—
100.08	Rural 4-Lane Arterial Road	130	2 x 22	24	4 (inside) 10 (outside)	Use shoulder
100.09	Rural 2-Lane Collector Road	80	24	—	10	Use Shoulder
100.10	Rural Primary Residential Road	60	24	—	6	Use shoulder
100.11	Rural Secondary Residential Road	60	22	—	4	Use shoulder
100.12	Rural Private Secondary Residential Road	50**	22	—	2	—
100.13	Scenic and Historic Rural 4-Lane Arterial Road	120	2 x 22	22	4 (inside) 6 (outside)	Use shoulder
100.14	Scenic and Historic Rural 2-Lane Collector Road	70	22	—	6	Use shoulder
100.15	Scenic and Historic Rural 4-Lane Collector Road	90	46	—	6	Use shoulder
100.16	Scenic and Historic Rural Primary Residential Road	60	22	—	4	Use shoulder

* For use with hiker/biker trail or bike lane application (both sides). Use Section III, Standards 100.01–100.04 and 100.06.

** Private right-of-way by easement (not publicly owned).

Table I-2
Design Criteria
Adapted from AASHTO, *A Policy on Geometric Design of Highways and Streets 2001*

Sources: Prince George's County Department of Public Works and Transportation and American Association of State Highway and Transportation Officials (AASHTO)

Road Classification	Design Speed (MPH)	Minimum C/L Radius (ft.)	Maximum C/L Grade (%)	Minimum C/L Grade (%)	Minimum Stopping Sight Distance (ft.)	Minimum "K" Value—Sag	Minimum "K" Value—Crest	Minimum Intersection Sight Distance (ft.)	Minimum Turning Radius (ft.)	Right-of-Way (ft.)
Urban Arterial Road	50	1200	6	1	425	100	90	555	50	120/130
Urban Major Collector Road	40	700	8	1	305	70	50	445	45	100
Urban 4-Lane Collector Road	40	700	8	1	305	70	50	445	45	80
Urban 5-Lane Collector Road	40	700	8	1	305	70	50	445	45	80/90
Urban Commercial and Industrial Road	35	500	10	1	250	50	30	390	50	70
Urban Primary Residential Road	35	500	10	1	250	50	30	390	37	60/70
Urban Secondary Residential Road	30	300	10	1	200	40	20	335	37	50
Rural 4-Lane Arterial Road*	50	1200	6	2	425	100	90	555	50	130
Rural 2-Lane Collector Road*	40	700	8	2	305	70	50	445	50	80
Rural Primary Residential Road*	35	500	10	2	250	50	30	390	45	60
Rural Secondary Residential Road*	30	300	10	2	200	40	20	335	45	60
Rural Private Residential Road*	30	300	10	2	200	40	30	335	40	50
Scenic and Historic-Rural 4-Lane Collector Road	40	700	8	2	305	70	50	445	50	120

Note: Posted speed limits on County-maintained roads may be equal to or less than design speed (MPH).
* Also applicable to Scenic and Historic Roadways.

Rate of vertical curvature: K = L/A
L = Length of vertical curve
A = Algebraic difference in grades (%)
Minimum 100' vertical curve

Table I-3
Properties of Subgrade Materials
Based on the Unified Soil Classification System (USCS) and AASHTO Classifications

Sources: Unified Soil Classification System (USCS) and American Association of State Highway and Transportation Officials (AASHTO)

Soil Type	Unified Soil Class	Finer Than 0.02 mm (%)	Permeability	Frost Potential[1]	Typical CBR[2]	Typical M_r psi[2]	Design Class
Gravels, Crushed Stone; Little or No Fines; < 0.02mm	GW,GP	0–1.5	Excellent	NFS	17	20,000	Very Good
Sands, Sand-Gravel Mix; Little or No Fines; < 0.02mm	SW, SP	0–3	Excellent	NFS	17	20,000	Very Good
Gravels, Crushed Stone; Some Fines; < 0.02mm	GW, GP	1.5–3	Good	PFS	17	20,000	Very Good
Sands, Sand-Gravel Mix; Some Fines; < 0.02mm	SW, SP	1.5–3	Good	PFS	17	20,000	Very Good
Gravelly Soils; Medium Fines; < 0.02mm	GW,GP, GM	3–6	Fair	Low	8	12,000	Good
Sandy Soils; Medium Fines; < 0.02mm	SW, SP, SM	3–6	Fair	Low	8	12,000	Good
Silty Gravel Soils; High Fines; < 0.02mm	GM GW-GM, GP GM	6–10 10–20	Fair to Low	Medium	8	12,000	Good
Silty Sand Soils; High Fines; < 0.02mm	SM SW-SM, SP-SM	6–15	Fair to Low	Medium	8	12,000	Good
Clayey Gravel Soils; High Fines; < 0.02mm	GM, GC	> 20	Fair to Low	Medium to High	5	7500	Medium
Clayey Sand Soils; High Fines; < 0.02mm	SM, SC	> 20	Low to Very Low	Medium to High	5	7500	Medium
Very Fine Silty Sands	SM	> 15	Low	High to Very High	5 Replace in severe frost areas	7500	Poor
Clays—Plasticity Index > 12	CL	—	Very Low	High	3 Replace in severe frost areas	4500	Poor
All Silt Soils	ML	—	Very Low	High to Very High	3 Replace in severe frost areas	4500	Poor
Clays—Plasticity Index < 12	CL, CL-CM	—	Very Low	High to Very High	3 Replace in severe frost areas	4500	Poor
Organic Soils	OL	—	Very Low	High to Very High	< 3 Replace	3000	Very Poor
Highly Plastic Soils (Plasticity Index > 20)	CH, MH	—	Very Low	High to Very High	 Replace		Very Poor

[1] NFS = not frost susceptible; PFS = possibly frost susceptible

[2] California bearing ratios (CBRs) and resilient modulus (M_r) values are minimum values expected for each subgrade class.

Table I-4
Types and Uses of Soils
Based on AASHTO Classifications

Source: American Association of State Highway and Transportation Officials (AASHTO)

Type	Composition	Recommendations
A-1	Well-graded gravels and sand-clays. Satisfactory treated surface. Good base with thin pavement. Excellent fill. Frost heave and breakup in North, if plastic.	Use subdrainage to lower water table. Stabilize chlorides or Portland cement mechanically.
A-2	Poorly graded sand and gravels. Good base for moderately flexible or thin, rigid pavement. Good fill. Frost heave, breakup, if plastic. Softens when wet if plastic.	Use base course when subgrade plasticity index is greater than 6. Subdrainage is effective. Stabilize with bitumen, chlorides, cement, or admixture soils.
A-3	Clean sands and gravels. Ideal base for moderately flexible or thin, rigid pavement. Good fill. No frost heave or breakup.	Subdrainage only through impervious shoulders. Stabilize with soil binder, bituminous, or chemical admixtures.
A-4	Silty soils. Not good for surface. Poor base, absorbs water. Unstable when wet. Bad frost heave and breakup.	Use subdrainage and/or base and subbase with flexible pavement. Use bituminous subgrade prime. Use thick concrete pavement (7–10″) with steel reinforcement and crack control.
A-5	Elastic silts.	Use subdrainage and/or granular base and subbase with bituminous subgrade prime. Use thick concrete pavement, reinforced with crack control. Stabilize with soil cement.
A-6	Clays. Impermeable and stable when dry and undisturbed (hard clay). Plastic and absorbent, if disturbed. Bad pumping into porous base macadam or pavement joints. Shrinks and cracks when dry.	Use granular base and subbase. Use subdrainage only when made pervious by cracks, foot holes, and laminations. Frost heave slight when impermeable, bad when pervious. Use subgrade prime. Use thick, strong, dense, flexible pavement or reinforced, crack-controlled concrete. Lime stabilization effective.
A-7	Expansive, plastic clays, excessive volume change. Bad frost heave and breakup.	Subdrainage not effective. Use thick, dense, flexible pavement with base and subbase over subgrade prime or reinforced, crack-controlled concrete placed on impervious paper. Stabilize with lime and kiln dust.
A-8	Muck and peat. Unfit for construction purposes.	Excavate to solid stratum and replace with selected fill. Displacement by superimposed fill is doubtful. Displacement by explosive under superimposed fill is sometimes effective.

Table I-5
AASHTO Soil Classification System—
Classification of Soils and Soil-Aggregate Mixtures (with Suggested Subgroups)

Source: American Association of State Highway and Transportation Officials (AASHTO)

General Classification	Granular Materials (35 Percent or less passing a No. 200 sieve)							Silt-Clay Materials (More than 35 Percent passing a No. 200 sieve)			
Group Classification	**A-1**		**A-3**	**A-2**				**A-4**	**A-5**	**A-6**	**A-7**
	A-1-a	**A-1-b**		**A-2-4**	**A-2-5**	**A-2-6**	**A-2-7**				**A-7-5, A-7-6**
Sieve Analysis (percent passing):											
No. 10	50 Max	—	—	—	—	—	—	—	—	—	—
No. 40	30 Max	60 Max	51 Max	—	—	—	—	—	—	—	—
No. 200	15 Max	25 Max	10 Max	35 Max	35 Max	35 Max	35 Max	36 Min	36 Min	36 Min	36 Min
Characteristics of the Fraction Passing a No. 40 Sieve:											
Liquid Limit	—		—	40 Max	41 Min	40 Max	41 Min	40 Max	41 Min	40 Max	41 Min
Plasticity Index	6 Max		N.P.	10 Max	10 Max	11 Min	11 Min	10 Max	10 Max	11 Min	11 Min*
Group Index	0		0	0		4 Max		8 Max	12 Max	16 Max	20 Max
Usual Types of Significant Constituent Materials	Stone Fragments, Gravel, and Sand		Fine Sand	Silty or Clayey Soils, Gravel, and Sand				Silty Soils		Clayey Soils	
General Rating as Subgrade	Excellent to Good					Fair to Poor					

Note: The upper 12 inches of roadway subgrade should be constructed of materials meeting the following characteristics:

Liquid limit	40 Maximum (ASTM D 4318)
Plasticity index	12 Maximum (ASTM D 4318)
California bearing ratio	7 Minimum (ASTM D 1883)
Maximum dry density	105 pcf Minimum (ASTM D 698)

The above characteristics usually apply to AASHTO group classifications: A-1, A-2, and A-3.

*The plasticity index of subgroup A-7-5 is equal to or less than the liquid limit (LL) minus 30. The plasticity index of subgroup A-7-6 is greater than the LL minus 30.

Table I-6
Maryland Department of Transportation State Highway Administration Soil Classification System—
Classification of Soils and Soil-Aggregate Mixtures (Characteristics and Performance)

Source: Maryland State Highway Administration (MSHA)

General Classification	Granular Materials						Silt-Clay Materials							
Group Classification	**A-2**		**A-3**	**A-2-4**	**A-4-2**	**A-2-7**	**A-7-2**	**A-4**	**A-4-7**	**A-7-4**	**A-7**	**A-6**	**A-5**	**A-8**
General Description	Sand			Silty Sand	Sandy Silt	Clayey Sand	Sandy Clay	Silt	Clayey Silt	Silty Clay	Clay	Colloidal Clay	Mica, Diatoms, and Silt	Swamp Muck
Stability	When nonplastic is high	When plastic, good when dry	Ideal when confined	Good when dry	Good when dry	Good when dry and properly compacted	Good when properly compacted or undisturbed				Poor		Good to Poor	None
Use as a Base	Fair	Fair	Excellent	Fair	Fair	Poor	Unsatisfactory							
Use as a Subbase	Excellent	Good	Excellent	Fair	Fair	Fair	Unsatisfactory							
Use as a Subgrade	Excellent	Excellent	Excellent	Fair	Fair	Fair	Poor				Very Poor	Poor		Unsatisfactory
Fills under 50′	Excellent	Good	Good	Good	Poor	Fair	Good to Poor				Poor	Very Poor	Poor	Unsatisfactory
Fills over 50′	Good	Good to Fair	Good to Fair	Fair	Poor	Fair	Poor to Very Poor				Very Poor	Very Poor	Poor	Unsatisfactory
Frost Action	None to Low			Medium	High	Medium	Medium	High	Medium to High		Medium		High	Medium
Range of Maximum Dry Density (AASHO T-180) (PCF)	115-135	115-135	105-130	110-130	110-135	115-135	115-130	110-135	110-135	105-130	100-120	90-115	100-135	< 100
Range of Optimum Moisture Contents (AASHO T-180) (%)	9-12	8-12	8-15	8-15	9-15	6-12	9-15	8-15	10-15	10-17	12-25	14-30	11-18	—
Required Compaction (AASHO T-180) (%)	92-95	92-95	92-95	92-95	92-95	92-95	92-95			≤ 95%				Waste
Compaction Methods	Rolling with smooth face tamping, rubber-tired roller, or vibratory compactor		Tractor disking vibration	Tamping or rubber-tired roller	Tamping or rubber-tired roller	Tamping or rubber-tired roller	Tamping, sheepfoot roller, or rubber-tired roller						Tamping or Rubber-Tired Roller	Waste
Compaction Abilities	Good, with close control		Good	Good to Poor	Good to Poor	Good to Poor	Good to Poor				Poor	Poor	Very Poor	Waste
Pumping Action	Slight to None						Fair to Poor				Poor			Waste
Bearing Value	Excellent to Fair			Good to Fair			Fair to Poor				Poor			Waste
Drainage	Good		Drains freely	Fair to Practically Impervious			Fair to Impervious				Poor	Impervious	Fair to Impervious	Poor

Notes:
A-2 to A-3 Soils: When used as a base, the plasticity index and the liquid limit should not exceed 6 and 25, respectively. These soils/silt-clay materials are best for soil-cement stabilization—generally, 8–12% cement by weight will be sufficient.
Nonplastic A-2 to A-3 Soils: These soils may require vibration for compaction.
A-4 to A-7 Soils: These fills should be placed during a dry season.
A-4 Silts: These are susceptible to settlement and erosion.
A-5 Soils: When mica is present, these soils are very difficult to compact because of expansion and rebound.
A-6 Soils (Clay): These soils will pump in porous bases, forming cracks. Fills will settle over long periods of time. High banks in cuts and fills are very liable to slide.

Table I-7
Typical Cement Requirements for Various Soil Types
Based on AASHTO and USCS Classifications

Sources: Prince George's County Department of Public Works and Transportation, American Association of State Highway and Transportation Officials (AASHTO), and Unified Soil Classification System (USCS)

AASHTO Soil Classification	USCS Soil Classification	Typical Range of Cement Requirement* (% by Weight)	Typical Cement Contents for Durability Tests ASTM D559 & D506 (% by Weight)
A-1-a	GW, GM	3–5	5
A-1-b	GP, GC	5–8	6
A-2	SM, SC, SW	5–9	7
A-3	SP	7–11	9
A-4	CL, ML	7–12	10
A-5	ML, MH	8–13	10
A-6	CL, CH	9–15	12
A-7	MH, CH	10–16	13

Note: Placement and curing procedures should generally comply with Section 502, "Soil Cement Base Course," MSHA *Standard Specifications for Construction and Materials*, latest edition. Field molds for compliance testing should have a minimum, unconfined, compressive strength of 250 psi in 7 days. Lime and kiln dust combinations have been more effective on Christiana clays used in 12-inch lifts. Soil cement is not suited for soil types with organic contents greater than 2 percent or pH less than 5.3. Acid sulfate soils are not suitable. Extremely cold temperatures or extremely wet soils should also be avoided. Minimum temperatures for curing should be 40 degrees Fahrenheit. Subgrade applications should be protected for 7 days by using straw mats or soil layers. Treated subgrades should not be exposed to vehicular traffic until adequate strength is attained; this usually occurs between 3 and 7 days.

* Does not include organic or poorly reacting soils. Also, additional cement may be required for severe exposure conditions, such as slope protection.

Table I-8
Minimum Frequency for Roadway Materials Density Testing

(unless otherwise advised by the Department or Materials Lab Inspector)

Sources: Prince George's County Department of Public Works and Transportation and American Association of State Highway and Transportation Officials (AASHTO)

Test Locations	Testing Frequency
Embankments—Fill sections for streets and travelways	One test shall be performed per 5000 ft² (500 m²) for each 8 in. (150 mm) compacted lift.
Subgrade—Cut and fill Sections	One test shall be performed per 5000 ft² (500 m²) of undivided roadway at the final subgrade elevation. The subgrade test shall not be performed at the same spot where the utility trench backfill test was performed. Trench testing shall be performed in addition to the subgrade testing. Under the curb and the gutter, one test shall be performed per 300 ft (90 m) on alternating sides.
Subbase Material—For streets and travelways	One test shall be performed per 5000 ft² (500 m²) for each 6 in. (150 mm) compacted lift. When the subbase aggregate is placed in layers or lifts, each lift shall be tested. Under curb and gutter when placed before the subbase material in the street, perform one test per 300 ft (90 m) on alternating sides.
Base Material	One test shall be performed per 5000 ft² (500 m²) at the finished base grade. When the base aggregate is placed in layers or lifts, each 6 in. (150 mm) compacted lift shall be tested at the required frequency.
Storm Drainage System—Backfill*	One test shall be performed per 300 ft (90 m) and at vertical intervals not to exceed 12 in. (300 mm).
Sidewalks and Driveway Aprons	• Sidewalk subgrade: One test shall be performed per 500 ft (150 m) on alternating sides at the subgrade elevation. A minimum of two tests per street is required. • Driveway apron: One test per apron shall be performed.
Asphalt Concrete Pavement (NOTE: The thin lift nuclear density test shall be used for any course placed with an amount under 200 tons or with a required constant or variable thickness less than 1.5 in., like wedge and leveling, patching, and other applications.)	*Cores (4 in. or 6 in. diameter; only 6 in. diameter for 25-mm mixes)* • A minimum of one set of five cores is required for County testing per paving day per 1,000 tons of an asphalt mix unless otherwise requested by County. One additional set is required for each additional 1,000 tons or fraction thereof regardless of street length. *Thin Lift Nuclear Density Gauge (See note in left column.)* • One test shall be performed per 300 ft of each lane. A minimum of two tests per lane is required, regardless of the length of the street.

*Testing required beneath structures only, including, but not limited to, sidewalks, driveways, streets, and stoops.

Table I-9
General Soil Classification Strength Correlation—California Bearing Ratio (CBR)

Sources: Prince George's County Department of Public Works and Transportation, American Association of State Highway and Transportation Officials (AASHTO), and Unified Soil Classification System (USCS)

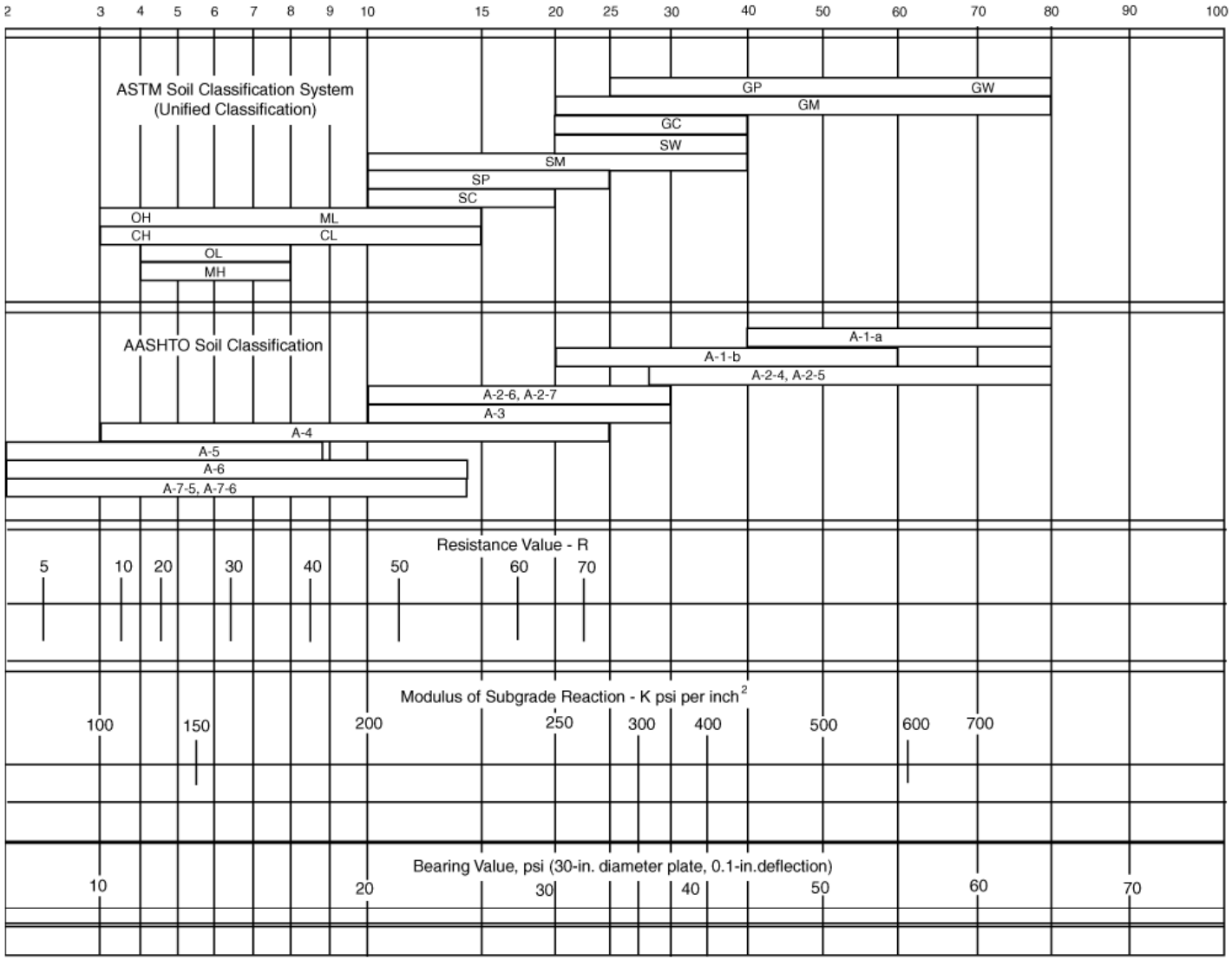


Table I-10
Pipe Use

Sources: Prince George's County Department of Public Works and Transportation, based on compiled data from American Association of State Highway and Transportation Officials (AASHTO) and American Society for Testing and Materials (ASTM)

Materials	Specifications		Requirements
	AASHTO	ASTM	
Reinforced, Concrete Pipe (RCP)	M170	C76, C361	Under roadbed, minimum Class 4; Beyond roadbed, minimum Class 3
Concrete End Sections	M170	C76	Must be reinforced to conform with Class 4 pipe
Polyvinyl Chloride (PVC) (solid), Plastic Pipe and Drain Pipe	M278	D1785 or D3034	For underdrain use, on a case-by-case basis
Polyvinyl Chloride (PVC) (perforated), Plastic Pipe	M278	F758 Type PS 28	For underdrain use, on a case-by-case basis
Polyethylene (HDPE) Plastic, Drain Pipe	M252 or M294	D2321	Underdrain outlet pipes, Type S—minimum pipe stiffness, 50 psi (rigid)
Reinforced Concrete Arch, Culvert	M206	C506	Under roadbed, minimum Class 4; Beyond roadbed, minimum Class 3
Reinforced Concrete Elliptical Pipe	M207	C507	Horizontal, elliptical pipe only Under roadbed, minimum Class 4; Beyond roadbed, minimum Class 3
Preformed, Rubber Joint for Circular, Reinforced, Concrete Pipe	M198 Type A	C443	Comply with slope requirements stipulated in County Storm Drainage Design Manual
Corrugated, Steel Pipe, Pipe Arches	M36	A760	Under driveways and under roadways* for underdrain purposes only
Corrugated, Aluminized, Steel Pipe	M36	A760	Under driveways and under roadways* for underdrain purposes only
Aluminum Steel, Spiral Rib Pipe	M36	A760	Under driveways and under roadways* for underdrain purposes only
Aluminum, Spiral Rib Pipe	M196	B745	Under driveways and under roadways* for underdrain purposes only
Standard Metal End Sections	M36	A760	All 3-piece units to have 12-gauge sides and 10-gauge center panels
Corrugated, Aluminum, Alloy Pipe	M196	B745	Use requires special approval by the Department
Aluminum, Structural, Plate Pipe, Pipe Arches, and Arches	M219	B746	Use requires special approval by the Department

* Corrugated steel pipe is not to be used under roadways if the Department allows the use of recycled concrete material in the roadbed in lieu of crushed stone.

Table I-11
Street Lighting Plan Approval Process

Source: Prince George's County Department of Public Works and Transportation

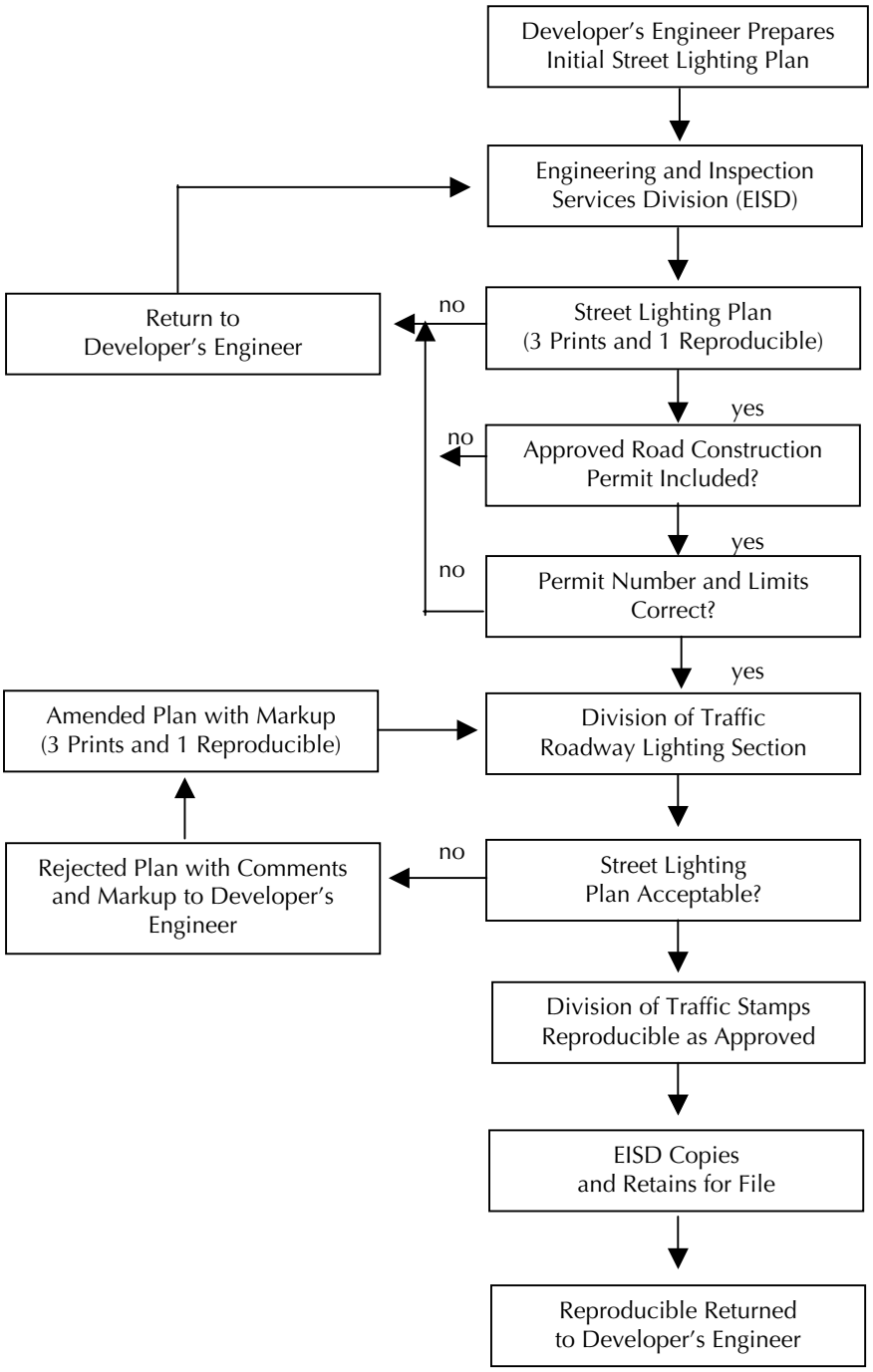


Table I-12
Summary of Street Lighting Fixtures by Utility
(Lamp Wattages as Specified in Previous Tables)

Source: Prince George's County Department of Public Works and Transportation

Potomac Electric Power Company (PEPCO)

Fixture	Wattage (HPS)	Pole/Installation	Mounting Height (ft)
Underground-Served Fixtures			
Colonial Post-Top	100	Black Fiberglass Direct Buried	16
Pendant	*150/250	Black Fiberglass Direct Buried	26
Pendant	*150/250	Aluminum with Foundation (Concrete or Screw Type)	26
Rectilinear	*400	Bronze Fiberglass Direct Buried	30
Overhead-Served Fixtures			
	*100/150/250	Determined by Utility	Determined by Utility

Baltimore Gas & Electric (BGE)

Fixture	Wattage (HPS)	Pole/Installation	Mounting Height (ft)
Underground-Served Fixtures			
Traditionaire Post-Top	100	Black Fiberglass Direct Buried	16
Pendant	*150/250	Galvanized Steel Embedded	25
Rectilinear	*150/400	Bronze Fiberglass Direct Buried	30
Overhead-Served Fixtures			
	*100/150/250	Mounting and Equipment Determined by Utility	Determined by Utility

Southern Maryland Electric Cooperative (SMECO)

Fixture	Wattage (HPS)	Pole/Installation	Mounting Height (ft)
Underground-Served Fixtures			
Colonial Post-Top	100	Black Fiberglass Direct Buried	16
Pendant Cobra Head	*150/250	Aluminum with Foundation (Concrete or Screw Type)	26
Overhead-Served Fixtures			
	*100 Open/ 250 Cobra Head	Mounting and Equipment Determined by Utility	Determined by Utility

* Permittee specifies the desired materials/installation options for DPW&T approval.

Table I-13
Luminaire and Support Guide for Potomac Electric Power Company (PEPCO)

Source: Prince George's County Department of Public Works and Transportation

DPW&T Std. No.	Road Classification	Lamp (WHPS)	Luminaire Distribution Type	Post Material Installation	Mounting Height	Spacing Avg./Max.	Configuration
500.01	Urban Arterial Road:	250	Pendant Cobra Head or	Aluminum Base Mounted	26′	150′/170′	Opposite
	For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Opposite
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Opposite
500.02	Urban Major Collector Road:	250	Pendant Cobra Head or	Aluminum Base Mounted	26′	150′/170′	Opposite
	For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Opposite
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Opposite
500.03	Urban 4-Lane Collector Road: For new roadways or roadways with underground service and no street lights in the area For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Staggered
500.04	Urban 5-Lane Collector Road: For new roadways or roadways with underground service and no street lights in the area For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Opposite

Continued on page 105

Continued from page 103

Table I-13
Luminaire and Support Guide for Potomac Electric Power Company (PEPCO)

Source: Prince George's County Department of Public Works and Transportation

DPW&T Std. No.	Road Classification	Lamp (WHPS)	Luminaire Distribution Type	Post Material Installation	Mounting Height	Spacing Avg./Max.	Configuration
500.05	Urban Commercial and Industrial Road:						
	For new roadways or roadways with underground service and no street lights in the area	250/400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Staggered
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Staggered
500.06	Urban Primary Residential Road:						
	For multiple housing or single-family homes not facing the roadway	150	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Staggered
	For single-family homes facing the roadway	100	Colonial Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
500.07	Urban Secondary Residential Road:						
	For new roadways or roadways with underground service and no street lights in the area	100	Colonial Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
500.08	Rural 4-Lane Arterial Road:	250	Pendant Cobra Head or	Black Fiberglass Direct Buried	26′	150′/170′	Opposite
	For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Opposite
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head	Black Fiberglass Direct Buried	26′	150′/170′	Opposite
	For existing roadways with existing utility pole	250 WHPS	Pendant Cobra Head	Wood Utility Poles	Varies	150′/200′	Opposite

Continued on page 107

Continued from page 105

Table I-13
Luminaire and Support Guide for Potomac Electric Power Company (PEPCO)

Source: Prince George's County Department of Public Works and Transportation

DPW&T Std. No.	Road Classification	Lamp (WHPS)	Luminaire Distribution Type	Post Material Installation	Mounting Height	Spacing Avg./Max.	Configuration
500.09	Rural 2-Lane Collector Road: For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Staggered
	For existing roadways with pendant lights in the area	150/250	Pendant Cobra Head 6′ Arm Type II	Black Fiberglass Direct Buried	26′	150′/170′	Staggered
	For existing roadways with existing utility pole	150/250	Pendant Cobra Head	Wood Utility Poles	Varies	150′/200′	Opposite
500.10	Rural Residential Road: For new roadways or roadways with underground service and no street lights in the area	100	Colonial Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
	For existing roadways with existing utility pole	100/150	Pendant Cobra Head	Wood Utility Poles	Varies	150′/200′	Opposite
500.11	Rural 4-Lane Collector Road: For new roadways or roadways with underground service and no street lights in the area For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Black Fiberglass Direct Buried	26′	150′/170′	Opposite
	For existing roadways with existing utility pole	150/250	Pendant Cobra Head	Wood Utility Poles	Varies	150′/200′	Opposite

Note: For lighting requirements on Scenic and Historic Roadways, see Section IV, Appendix F.

Table I-14
Luminaire and Support Guide for Baltimore Gas & Electric (BGE)

Source: Prince George's County Department of Public Works and Transportation

DPW&T Std. No.	Road Classification	Lamp (WHPS)	Luminaire Distribution Type	Post Material Installation	Mounting Height	Spacing Avg./Max.	Configuration
500.01	Urban Arterial Road:	250	Pendant Cobra Head or	Galvanized Steel Embedded	25′	150′/170′	Opposite
	For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Opposite
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Galvanized Steel Embedded	25′	150′/170′	Opposite
500.02	Urban Major Collector Road:	250	Pendant Cobra Head or	Galvanized Steel Embedded	25′	150′/170′	Opposite
	For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Opposite
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Galvanized Steel Embedded	25′	150′/170′	Opposite
500.03	Urban 4-Lane Collector Road: For new roadways or roadways with underground service and no street lights in the area For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Galvanized Steel Embedded	25′	150′/170′	Staggered
500.04	Urban 5-Lane Collector Road: For new roadways or roadways with underground service and no street lights in the area For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Galvanized Steel Embedded	25′	150′/170′	Opposite

Continued on page 111

Continued from page 109

Table I-14
Luminaire and Support Guide for Baltimore Gas & Electric (BGE)

Source: Prince George's County Department of Public Works and Transportation

DPW&T Std. No.	Road Classification	Lamp (WHPS)	Luminaire Distribution Type	Post Material Installation	Mounting Height	Spacing Avg./Max.	Configuration
500.05	Urban Commercial and Industrial Road: For new roadways or roadways with underground service and no street lights in the area	250/400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Staggered
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Galvanized Steel Embedded	25′	150′/170′	Staggered
500.06	Urban Primary Residential Road: For multiple housing or single-family homes not facing the roadway	150	Pendant Cobra Head 6′ Arm Type II	Galvanized Steel Embedded	25′	150′/170′	Staggered
	For single-family homes facing the roadway	100	Traditionaire Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
500.07	Urban Secondary Residential Road: For new roadways or roadways with underground service and no street lights in the area	100	Traditionaire Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
500.08	Rural 4-Lane Arterial Road:	250	Pendant Cobra Head or	Galvanized Steel Embedded	25′	150′/170′	Opposite
	For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Opposite
	For existing roadways with pendant lights in the area	250	Pendant Cobra Head	Galvanized Steel Embedded	25′	150′/170′	Opposite
	For existing roadways with existing utility poles	250	Pendant Cobra Head	Wood Utility Poles	Varies	150′/170′	Opposite

Continued on page 113

Continued from page 111

Table I-14
Luminaire and Support Guide for Baltimore Gas & Electric (BGE)

Source: Prince George's County Department of Public Works and Transportation

DPW&T Std. No.	Road Classification	Lamp (WHPS)	Luminaire Distribution Type	Post Material Installation	Mounting Height	Spacing Avg./Max.	Configuration
500.09	Rural 2-Lane Collector Road:	150/250	Pendant Cobra Head or	Galvanized Steel Embedded	25′	150′/170′	Staggered
	For new roadways or roadways with underground service and no street lights in the area	400	Rectilinear Type	Bronzed Fiberglass Direct Buried	30′	150′/170′	Staggered
	For existing roadways with pendant lights in the area	150/250	Pendant Cobra Head	Galvanized Steel Embedded	25′	150′/170′	Staggered
	For existing roadways with existing utility pole	150/250	Pendant Cobra Head	Wood Utility Poles	Varies	150′/170′	Opposite
500.10	Rural Residential Road:						
	For new roadways or roadways with underground service and no street lights in the area	100	Traditionaire Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
	For existing roadways with existing utility pole	100/150	Pendant Cobra Head	Wood Utility Poles	Varies	150′/170′	Opposite
500.11	Rural 4-Lane Collector Road:						
	For new roadways or roadways with underground service and no street lights in the area For existing roadways with pendant lights in the area	250	Pendant Cobra Head 6′ Arm Type II	Black Fiberglass Direct Buried	26′	150′/170′	Opposite
	For existing roadways with existing utility pole	150/250	Pendant Cobra Head	Wood Utility Poles	Varies	150′/170′	Opposite

Note: For lighting requirements on Scenic and Historic Roadways, see Section IV, Appendix F.

Table I-15
Luminaire and Support Guide for Southern Maryland Electric Cooperative (SMECO)

Source: Prince George's County Department of Public Works and Transportation

DPW&T Std. No.	Road Classification	Lamp (WHPS)	Luminaire Distribution Type	Post Material Installation	Mounting Height	Spacing Avg./Max.	Configuration
500.01	Urban Arterial Road	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Opposite
500.02	Urban Major Collector Road	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Opposite
500.03	Urban 4-Lane Collector Road	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Staggered
500.04	Urban 5-Lane Collector Road	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Opposite
500.05	Urban Commercial and Industrial Road	250	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	150′/170′	Staggered
500.06	Urban Primary Residential Road					1	
	For multiple housing or single-family homes not facing the roadway	150	Pendant Cobra Head 6′ Arm Type II	Aluminum Base Mounted	26′	50′/170′	Staggered
	For single-family homes facing the roadway	100	Colonial Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
500.07	Urban Secondary Residential Road	100	Colonial Post-Top Type IV	Black Fiberglass Direct Buried	16′	150′/170′	Staggered
500.08	Rural 4-Lane Arterial Road	250	Pendant Cobra Head 6′ Arm Type II	Black Fiberglass Direct Buried	26′	150′/170′	Opposite
500.09	Rural 2-Lane Collector Road	150/250	Pendant Cobra Head 6′ Arm Type II	Black Fiberglass Direct Buried	26′	150′/170′	Staggered
500.10	Rural Residential Road	100	Colonial Post-Top Type IV	Black Fiberglass Direct Buried	26′	150′/170′	Staggered
500.11	Rural 4-Lane Collector Road	150/250	Pendant Cobra Head 6′ Arm Type II	Black Fiberglass Direct Buried	26′	150′/170′	Opposite

Note: For lighting requirements on Scenic and Historic Roadways, see Section IV, Appendix F.