## ARTICLE 9
### TRANSPORTATION STANDARDS AND SPECIFICATIONS

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ARTICLE 9
TRANSPORTATION STANDARDS AND SPECIFICATIONS

SECTION 9-100 GENERAL CRITERIA
Requirements of this Article shall apply to all roadway construction in the City. Where no specific roadway construction, or design standard, or specification is set forth in this Manual, the requirements of the Virginia Department of Transportation (VDOT) Road and Bridge Standards, Minimum Standards for Entrances to State Highways, Road Design Manual - Appendix A, the Virginia Supplement to the Manual of Uniform Traffic Control Devices (MUTCD), and the applicable Federal AASHTO standards shall be used. All streets shall be designed and built as set forth in this Manual or by the VDOT Urban Manual for Acceptance of Public Street into the State Maintenance System, whichever is more stringent. The review of all transportation systems shall be the responsibility of the Public Works Department. All public streets will be, upon completion, accepted into the State system, but will be maintained by the City of Manassas.

9-110 TRAFFIC IMPACT ANALYSIS
A. A Traffic Impact Analysis (TIA) shall be required for all developments, if the total generated additional trips meet or exceed one (1) or more of the following thresholds:

1. One hundred (100) or more total site generated peak hour trips or 1,200 trips per day as defined by the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual or by a trip generation study acceptable to the City.

2. Anticipated new trip generation that uses any reserve roadway capacity to a point which changes the existing level of service on a roadway or each lane group at the intersection to "D" or below, based on the highway capacity manual thresholds.

3. The study area contains a segment of roadway and/or intersection considered unsafe. A location is considered unsafe when five (5) reportable accidents have
occurred in the prior twelve (12) month period, or if it is on the City’s list of most hazardous locations, provided by the Manassas City Police Department.

4. The Department of Public Works deems that it is prudent to require such assessment in the plan review process.

B. If a TIA was submitted at the rezoning or special use permit review stage, and the assumptions used in the TIA are consistent with the submitted site plan, no additional TIA will be required.

C. The TIA shall be prepared and submitted in accordance with Section 9-120 of this Manual.

9-120 APPROVAL OF TRAFFIC STUDY

A. A TIA shall conform to all of the requirements of this section unless the requirements of specific subsections are modified or deemed not necessary by the Department of Public Works as a result of the pre-application meeting. The applicant shall meet with the Department of Public Works or designee prior to preparation of any TIA to determine the scope of the TIA, which shall include the following:

1. The study area.
2. Size and phasing of the proposed development.
3. Clarification, justification, and agreement for all assumptions and methodologies to be used in the analysis.
4. Submitted or approved plans, within the study area for estimation of background traffic.
5. The future street construction/improvements in the study area which may impact the subject site.
6. The applicant shall provide a written summary of the pre-application agreements of the proposed analysis before proceeding.

B. The applicant shall provide three (3) copies of the TIA at the time of submission of the site development plan application. Two (2) copies of the TIA shall contain computer disk(s) (CDs) containing computer files used in the analysis.

C. If the applicant fails to comply with the technical requirements and the scope of study outlined in the pre-application meeting, the applicant shall be advised that the TIA shall be revised.
D. Each TIA shall contain a signed and sealed Certification of Statement of the responsible person for the contents of the documents. The responsible person shall be certified or licensed to do traffic engineering or planning (PE, PTOE, AICP) professional work in the Commonwealth of Virginia.

9-120.1 STUDY AREA
A. The study area shall be determined with staff during the scoping meeting. However, generally, the study area shall consist of the area containing and/or surrounding the proposed development within which the transportation network is impacted in one of the following ways:
1. At a minimum, the study area shall include all site access driveways and intersections on adjacent roadways and all major internal intersections.
2. At least five percent (5%) of the average daily traffic (ADT) or peak hour(s) traffic of the roadways and/or intersections within the study area is composed of the development's new trips.
3. The generated trips from the proposed development changes the level of service of a roadway or intersection.
4. An identified dangerous roadway or intersection within the area identified above.
B. The study area shall also include any additional area deemed appropriate based on acceptable transportation engineering criteria.

9-120.2 DESIGN YEAR
The design year shall be in accordance with the following table:

<table>
<thead>
<tr>
<th>TIA GUIDELINES FOR STUDY DESIGN YEAR HORIZONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Characteristic</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>2. Single-phase development ( 500 – 1,000 peak hour trips)</td>
</tr>
</tbody>
</table>
**TIA GUIDELINES FOR STUDY DESIGN YEAR HORIZONS**

<table>
<thead>
<tr>
<th>Development Characteristic</th>
<th>Suggested Horizons</th>
</tr>
</thead>
</table>
| 3. Single-phase development (>1,000 peak hour trips)                                      | 1. Anticipated opening year, assuming full build-out and occupancy.  
                                                                                     | 2. Five years after full build-out and occupancy.  
                                                                                     | 3. Adopted transportation plan horizon year if the development is significantly larger than that included in the adopted Comprehensive Plan or travel forecasts for the area. |
| 4. Multiple-phase development (when ultimate road improvements are proposed to be phased) | 1. Anticipated opening years of each major phase, assuming build-out and full occupancy of each phase.  
                                                                                     | 2. Anticipated year of complete build-out and occupancy.  
                                                                                     | 3. Adopted transportation plan horizon year if the development is significantly larger than that included in the adopted plan or travel forecasts for the area.  
                                                                                     | 4. Five years after opening date if completed by then and there is no significant trip generation increase from adopted Comprehensive Plan or area transportation forecasts (e.g., at least 15%) |

**Note:** Peak hour trips based on the ITE Trip Generation Manual

**9-120.3 TRAFFIC DATA REQUIREMENTS AND EXISTING CONDITIONS**

A. All existing traffic counts used shall have been conducted within the prior twelve (12) month period. The Department of Public Works shall determine if and what growth rate factor shall be used to update the counts (i.e., utilizing historical traffic counts or available data from a transportation model).

B. The peak hour(s) shall be determined using a minimum three (3) hour counting period on an average weekday (Tuesday - Thursday) not on a holiday, and conducted in favorable weather conditions or other period as deemed necessary. All count data, including daily traffic volumes, shall be presented in the study.

C. Existing conditions of the study area shall be documented including some or all of the following:
1. Roadway configurations (number and length of lanes and lane usage).
2. On-street parking availability and regulations.
3. Driveways serving developments on roadways adjacent to subject site.
4. Transit stops.
5. Posted speeds and current traffic count data.
6. Substandard roadway design features.
7. Adjacent land uses.
8. Roadway geometrics and traffic controls such as traffic signals and stop and yield signs.

9-120.4 TRIP GENERATION
A. The estimated trip generation for each land use shall be obtained by utilizing the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual. The appropriate land use code and independent variable units from the manual shall be indicated for each category.
B. The fitted curve equation shall be used for all trip generation estimates. For those land uses for which the equation is not available, average trip rates shall be used.
C. In addition to peak hour trip generation, the daily trip generation for all uses shall also be included in the report.
D. For commercial development (e.g., shopping centers), calculations for weekend trip generation, and capacity analysis shall be included in the report.
E. The peak hour trip generation for single-family attached dwelling shall be calculated by using the single-family detached housing category (land use category #210, ITE Trip Generation Manual, current edition). If an adopted local trip generation rate exists for a specific category, it shall be utilized.
F. A pass-by trip reduction factor up to fifteen percent (15%) may be considered for commercial development, upon concurrence of the Department of Public Works prior to preparation of the report. Each case shall be considered individually. An internal capture rate reduction up to fifteen (15) percent may be considered on mixed use development.
G. Any trip reduction based on a mixed-use concept, pass-by trips, or transportation demand management (TDM) program, etc., shall be considered during the pre-application meeting of the TIA. Only the following justifications shall be considered by staff for the purpose of defining a trip reduction rate:

1. Transit service (i.e., bus or rail service).
2. Developments which provide for less than two thousand (2,000) feet of uninterrupted walking or biking distance or uninterrupted pedestrian movement facilities (such as, pedestrian bridge or signals) between non-similar uses (i.e., residential to commercial or office to commercial).
3. Any trip reduction rate based on the TDM program concept shall include a concise binding plan/program and funding mechanisms for implementation of the proposed TDM program. Any study of a TDM program within the Washington metropolitan area, which is similar in nature to the proposed development, may be submitted to staff to assist them in evaluating the proposed TDM program prior to preparation of the TIA.

9-120.5 FUTURE TRAFFIC CONDITIONS
The documented total future traffic in the report shall include the following:

A. Background traffic that may be calculated using one or both of the following techniques.
   1. Existing traffic adjusted by an annual growth rate factor and based on the design year(s), and the total estimated traffic generated at build-out of submitted and approved development plans within the designated study area; or
   2. Projected traffic volumes from approved regional or local traffic forecasting models.

B. Estimated generated trips to and from the site.

9-120.6 TRIP DISTRIBUTION AND ASSIGNMENT
A. Any one of the following trip distribution and assignment methodologies shall be acceptable with the concurrence of staff. Justifications for trip generation and
assignment shall be discussed and approved by staff at the pre-application meeting. One of the following techniques shall be used:

1. The gravity distribution model technique may be acceptable, but may require calibration prior to its use, particularly if utilizing an old gravity model for the study area.

2. Metropolitan Washington Council of Government (MWCOG) latest trip assignments. Portions of MWCOG's trip assignment report related to the study area shall be included in the TIA.

3. Utilization of local and/or regional demographic data.

4. The current directional distribution based on observed traffic counts is acceptable if justification is provided indicating the directional distribution will not change before the design year, due to future changes in the land use or transportation system improvements.

B. Assignment of traffic to the network shall be in accordance with the agreed upon percentage distribution and type of transportation facility. The Department of Public Works shall approve and may provide recommendations prior to preparation of the report.

C. Inbound/outbound traffic may not always have similar distribution or assignments; therefore, the approach and/or departure routes may be different. The calculations for inbound/outbound traffic are subject to discussion and concurrence of the Department of Public Works.

D. The twenty-four (24) hour (daily) volume shall be distributed and assigned according to the method used for peak hour distribution and assignment.

9-120.7 ANALYSIS

A. Capacity analysis shall be performed for all intersections, streets, ramps, weaving sections, internal circulation and access points as identified in the TIA scoping meeting.

B. The latest version of the Highway Capacity Software (HCS) operational module shall be used. All worksheets indicating the inputs and outputs of the HCS program shall
be presented in the study. Any deviation from the default values in the program shall be proposed, documented and agreed to by the Department of Public Works.

C. If approved by the Department of Public Works, Highway Capacity Manual (HCM) "planning procedure" may be used for any proposed intersections being analyzed, subject to the evaluation of ten (10) years or more into the future.

D. A level of service (LOS) "D" or better is the minimum acceptable level of service on existing or planned freeway segments, interchanges, signalized/unsignalized intersections and ramp terminals, multi-lane, two-lane and urban roadways. A level of service "D" also shall be maintained for the segment or link of roadways and all individual movements at all analyzed intersections.

E. A level of service (LOS) "C" or better is the minimum acceptable level of service for subdivision streets.

F. The Department of Public Works may require all intersections be analyzed for off-site/on-site queuing (i.e., queuing analysis to determine the length of a left and right-turn lane(s) and storage area(s) to assess potential spill-back effects.

G. The TIA shall include a capacity analysis for all identified locations within the study area before and after each phase of the proposed development to determine the development's impact and necessary improvements.

H. If roadways and/or intersections within the study area are currently operating or are projected to operate under hazardous conditions or unacceptable levels of service, the improvements needed to mitigate the conditions shall be noted in the recommendations.

I. Use of any reserve capacity of a roadway or intersection resulting at a level of service "D" or below shall warrant recommendations in the study for future improvements.

J. On-site traffic circulation analysis may be included in the TIA. The analysis shall include, but not be limited to, major internal intersections, access points, travelways, and parking circulation and queuing analysis.

K. If required by the Department of Public Works, a progression analysis shall be performed for arterials having two or more signalized intersections within a mile of the proposed development. Transportation/traffic computer software or programs
such as Synchro, HCS or SIDRA may be utilized for the analysis. Other software may be used when approved by the Department of Public Works.

L. Diagrams included in the study should include and identify the existing and proposed spacing(s) of all intersections/entrances and/or crossovers of divided roadways.

9-120.8 RECOMMENDATIONS
A. At a minimum, the TIA shall include recommendations on the following items to mitigate the traffic impacts on the study area:
   1. Widening and/or construction of roadways and intersections.
   2. Intersection signalization, including but not limited to, signal warrant analysis, timing, phasing, and optimization and approved signal priority control equipment.
   3. Transportation demand management (TDM) programs which reduce the number of vehicle trips being generated by the proposed development.
   4. Pedestrian, bicycle or transit facilities which reduce the number of vehicle trips being generated by the proposed development.
   5. Transportation system management (TSM) techniques, such as traffic signal coordination, which optimizes the capacity of the transportation network.

B. The recommended improvements shall be achievable. The DCSM, HCS, VDOT standards, and American Association of State Highway and Transportation Officials (AASHTO) manuals shall be utilized to design the recommended improvements.

Whether or not the recommended improvements can be constructed shall not preclude acceptance of the TIA.

C. All recommended roadway improvements shall include the description, timing, funding, and source of the construction of said improvements.

D. A traffic impact analysis (TIA) which does not contain specific recommendations to mitigate any noted negative impacts shall not be considered complete.

9-130 APPROVAL OF TRAFFIC STUDY
The Department of Public Works shall approve the traffic study prior to approval of any site plan or prior to recommending approval or denial to the Planning Commission of the preliminary subdivision plat or generalized development plan.
9-140 COORDINATION OF TRAFFIC STUDIES AND CONSTRUCTION DRAWINGS

The approved traffic study shall be submitted with the submission of the site plan, final subdivision plat, or generalized development plan, and such plat or plan submission shall show that:

A. All intersection improvements are supported by the traffic study;
B. All street widths are supported by the traffic study;
C. The construction drawings agree with the traffic study; and
D. The minimum "Level of Service" requirements are satisfied.

SECTION 9-200 STREET FUNCTIONAL CLASSIFICATIONS

9-210 GENERAL CRITERIA

Functional classification is the process by which streets and highways are grouped into systems according to the character of service they provide or are intended to provide. It is a method of organizing the network of streets into hierarchies of travel movement for comprehensive transportation planning. The hierarchy of functional classification in the City of Manassas shall be:

- Limited access facilities.
- Major (principal) arterial streets.
- Minor arterial streets.
- Through collector streets.
- Local collector streets.
- Local streets.

The urban functional classification is applied to the entire network of streets in the City of Manassas. Refer to Standard Detail TS-2.0 of this Article for a graphic illustration of these classifications.

Limited Access Street System

- This system controls access by giving preference to through traffic by providing access connections with selected public roads only and prohibiting other crossings at grade or direct private driveway connections.
The Major Arterial Street System.

- The major arterial street carries the principal portion of the vehicular trips entering and leaving urban areas as well as the majority of through travel and important intra-urban travel may be served by this class of facilities.

- Within the major arterial system, the concept of service to the abutting land is subordinate to the priority of travel service and major traffic movements.

The Minor Arterial Street System

- The minor arterial street system interconnects and expands the principal arterial system and provides service to vehicular trips of moderate length at a somewhat lower level of travel mobility.

- This system serves intra-urban vehicular trips between smaller geographic areas than those associated with the major arterial system.

The Collector Street System

- The collector street system differs from the arterial systems in that facilities on this system penetrate neighborhoods. Local collectors also may provide access to abutting land use.

- The collector street distributes vehicular trips from the minor arterial through the area to the ultimate destination, which may be on a local, or collector street.

The Local Street System

- The local street system provides direct access to abutting land and access to the higher order system and offers the lowest level of mobility.

- Through traffic on these facilities is deliberately discouraged.

- A local street system is further defined as a tertiary subdivision street, which for the purposes of this Manual shall be a cul-de-sac, or small loop street.

9-220 STREET CLASSIFICATIONS

Streets shall be functionally classified to conform to the following:

<table>
<thead>
<tr>
<th>Projected Vehicles Per Day</th>
<th>Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cul-de-sacs, loops, and other streets of fixed vehicular generation.</strong></td>
<td></td>
</tr>
<tr>
<td>Up to 250 VPD</td>
<td>Local Street</td>
</tr>
<tr>
<td>Projected Vehicles Per Day</td>
<td>Functional Classification</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Cul-de-sacs, loops, and other streets of fixed vehicular generation.</td>
<td></td>
</tr>
<tr>
<td>251-500 VPD</td>
<td>Local Street</td>
</tr>
<tr>
<td>Tertiary subdivision streets</td>
<td></td>
</tr>
<tr>
<td>Up to 250 VPD</td>
<td>Local Street</td>
</tr>
<tr>
<td>Major subdivision roads and streets</td>
<td></td>
</tr>
<tr>
<td>251-400 VPD</td>
<td>Local Street</td>
</tr>
<tr>
<td>401-2000 VPD</td>
<td>Local Collector</td>
</tr>
<tr>
<td>2000+ VPD</td>
<td>Through Collector</td>
</tr>
</tbody>
</table>

Determination of the functional classification by projected vehicle counts is presented as a guide and may be modified by the Department of Public Works to account for site particulars.

**9-230 STREET LAYOUT CRITERIA**

A. The arrangement of streets in a development shall provide for the continuation of principal streets of adjoining developments, and for the proper projection of principal streets into adjoining properties that are not yet developed. This interparcel connecting arrangement shall be accomplished by the use of stub streets and temporary cul-de-sacs, etc., in order to provide possible necessary fire and police protection, school bus services, movement of traffic and the construction or extension, presently or when later required, of needed utilities and public services and facilities. The principal street will be designed to carry no more than 3,000 VPD. Stub streets and loop streets will be designed to carry no more than 1,000 VPD and will be considered tertiary streets.

B. The development traffic network shall be designed to provide an orderly local access progression from local streets, to collector streets, to arterial highways.

C. Local streets shall be laid out so that their use by through and cut-through traffic will be discouraged. In the design pattern of local street systems, cross (four-way) street intersections shall be avoided as far as possible.
D. In instances where the Comprehensive Plan or Functional Plan indicate the necessity for major collector or arterial roads, their design and provision for continuation shall be addressed in the design of all developments.

E. All such interparcel connections streets shall be designed in consideration of the anticipated future traffic from undeveloped adjacent tracts based on the current adopted Comprehensive Plan.

SECTION 9-300 STREET DESIGN REQUIREMENTS

Typical sections shall be labeled by functional classification and VPD. Streets shall conform to the following design requirements based upon projected traffic counts and functional classification.

<table>
<thead>
<tr>
<th>Projected Vehicles Per Day</th>
<th>Terrain</th>
<th>Maximum % Grade</th>
<th>Design Speed (Min.)</th>
<th>Absolute Min. Stopping Sight Distance</th>
<th>With Curb &amp; Gutter Min. Distance Face to Face of Curbs</th>
<th>Minimum Right-of-Way</th>
<th>Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>251-400</td>
<td>Rolling</td>
<td>9</td>
<td>30</td>
<td>225 (E)</td>
<td>36</td>
<td>52</td>
<td>Local Street</td>
</tr>
<tr>
<td>401-1000</td>
<td>Rolling</td>
<td>8</td>
<td>35 (B)</td>
<td>225 (E)</td>
<td>38</td>
<td>60</td>
<td>Local Street</td>
</tr>
<tr>
<td>1001-2000</td>
<td>Rolling</td>
<td>6</td>
<td>35 (B)</td>
<td>225 (E)</td>
<td>38</td>
<td>64</td>
<td>Local Street</td>
</tr>
<tr>
<td>2000+</td>
<td>Use VDOT</td>
<td>GS-7</td>
<td>40</td>
<td>275</td>
<td>*</td>
<td>64</td>
<td>Local Collector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GS-6</td>
<td>40</td>
<td>275</td>
<td>*</td>
<td>84</td>
<td>Minor Arterial</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GS-5</td>
<td>50</td>
<td>375</td>
<td>*</td>
<td>120</td>
<td>Principal Arterial</td>
</tr>
</tbody>
</table>

*Width to be determined by capacity analysis; all lanes to be 12-feet wide with two-foot curb and gutter and one-foot curb clearance at median (if used).
### Geometric Design Guides for Tertiary Subdivision Streets.

<table>
<thead>
<tr>
<th>Projected Vehicles Per Day</th>
<th>Terrain</th>
<th>Maximum % Grade</th>
<th>Design Speed (Min.)</th>
<th>Absolute Min. Stopping Sight Distance With Curb &amp; Gutter Min. Distance Face to Face of Curbs</th>
<th>Minimum Right-of-Way</th>
<th>Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 250</td>
<td>Rolling</td>
<td>9 (C)</td>
<td>25</td>
<td>150 (E)</td>
<td>36</td>
<td>52</td>
</tr>
</tbody>
</table>

### Geometric Design Guides for Cul-de-Sacs, Loops, and Other Streets of Fixed Vehicular Generation.

<table>
<thead>
<tr>
<th>Projected Vehicles Per Day</th>
<th>Terrain</th>
<th>Maximum % Grade</th>
<th>Design Speed (Min.)</th>
<th>Absolute Min. Stopping Sight Distance With Curb &amp; Gutter Min. Distance Face to Face of Curbs</th>
<th>Minimum Right-of-Way</th>
<th>Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 250</td>
<td>Rolling</td>
<td>9 (C)</td>
<td>25</td>
<td>150 (E)</td>
<td>30</td>
<td>52</td>
</tr>
<tr>
<td>251-500</td>
<td>Rolling</td>
<td>9 (C)</td>
<td>30</td>
<td>150 (E)</td>
<td>36</td>
<td>52</td>
</tr>
</tbody>
</table>

Footnotes:

A. Determination of functional classification by projected vehicle counts is presented as a guide and may be modified by the Department of Public Works to account for individual site differences.

B. Arterial or limited access streets shall have no direct access from single-family detached residential driveways.

C. Grades of relatively short lengths (up to 300 feet) may be increased to 10% absolute maximum. Approval by the Department of Public Works is required and design
rationale shall show that such steep grades will not cause an intolerable maintenance situation.

D. Dimensions shown take into consideration that on-street parking will be permitted.
E. Sufficient stopping sight distance shall be provided to safely accommodate realistic operating speeds notwithstanding the suggested design speed shown in the tabulation.
F. Dimension, as shown, applicable only if on-street parking is prohibited on one side of the street.
G. A minimum of fifty-two (52) feet of right-of-way is required to accommodate the full roadway elements including curbs and sidewalks. Easements will be required for the grading of cut and/or fill slopes outside of the right-of-way.
H. Due to the normal density of development adjacent to residential subdivision streets, standard curve super-elevation is not practical; therefore, on local or collector streets where the posted speed is 25 MPH or less, no super-elevation is applicable. On collector streets with traffic volumes over 2,000 VPD and speed limits of 35 MPH or less, the maximum super-elevation rate shall be 0.0208 ft. (reverse crown). For arterial or through collectors with projected volumes exceeding 2000 VPD where the posted speed is greater than 35 MPH, super-elevation and pavement widening should be provided in accordance with standard TC-5 of Virginia's Department of Transportation road design standards.
I. Due to nature local of streets and low design speed, curve super-elevation is not required.
J. Each street should have continuity of design throughout. Therefore, multiple or "step down" typical designs will not be acceptable except where a major traffic generator such as an intersection with a collector street would delineate a clear line of demarcation.
K. An adequate turnaround shall be provided at the end of dead-end or cul-de-sac streets to allow safe maneuvering by service vehicles, highway equipment, and school buses. A minimum 50-foot pavement radius and 58-foot right-of-way radius is required. Refer to Standard Detail TS - 5.0 and TS - 5.1.
L. Each cul-de-sac shall have a minimum of identifiable typical street sections equal to
the normal lot width between the intersecting street curb return and the beginning of
the circular turn-around. Absolute minimum length of typical street sections shall be
seventy-five (75) feet (PC to PC).
M. The minimum radius to be used for local roads with no super-elevation shall be two
hundred and fifty (250) feet.
N. For the purpose of this Article, "local streets" shall be defined as subdivision streets
with single-family detached driveways.
O. Streets in areas zoned industrial shall have a minimum width, face of curb to face of
curb, of fifty-two (52) feet, and a minimum pavement section as specified in Section
9-410 of this Article.
P. All elements of roadway design shall meet the VDOT road design standards except
as modified herein.

9-310 GENERAL REQUIREMENTS
A. All right-of-way shall conform to the standards as set forth in this Manual.
B. Subdivision blocks shall be spaced to provide reasonable traffic circulation within
and between existing or anticipated subdivisions.
C. For a site plan or subdivision that abuts one side of any publicly owned and
maintained street, the applicant shall be required to dedicate one-half (1/2) of any
right-of-way necessary to make such street comply with the minimum width
established for same.
D. The applicant may be required to dedicate more than one-half (1/2) of the right-of-
way to improve the horizontal alignment or meet the minimum design standards for
that street.
E. The applicant will be required to assume responsibility for grading, widening,
surfacing, sidewalks, trails, and curbing of such streets to meet minimum City and
VDOT safety and design standards. All single-family detached dwelling unit sites
shall have frontage on existing city maintained public streets unless otherwise
approved through a rezoning or subdivision waiver. Streets that are approved shall
be bonded and will be constructed to a standard acceptable for addition to the VDOT
System. The amount of frontage shall be established in accordance with the appropriate regulations as set out in the Zoning Ordinance.

F. Single-family attached or duplex dwellings, multifamily dwellings, and non-residential building lots may be approved for recording without public street frontage provided the building lots have frontage on a right-of-way or access easement in accordance with the Zoning Ordinance with a design satisfactory to the Department of Public Works. A mandatory owners’ association shall be established prior to the approval of any plats or plans to assure the maintenance of the access easement, parking, planting, and other necessary open space. Improvements within the access easement shall be sufficient to accommodate the type and volume of traffic anticipated and constructed to standards.

G. All streets shall be constructed to the lot line if eligible to be accepted into the VDOT Street System, and shall terminate with an off-site temporary turnaround. If this construction causes undue hardship to the developer and the developer is unable to obtain the off-site easements necessary to construct the streets to the lot line, the Department of Public Works may allow the street construction to stop a distance from the lot line. In such instances, an escrow shall be obtained for the following future completion of the street to the lot line and removal of the temporary turnaround. In these cases, it is also necessary to dedicate on-site grading easements for the future completion of the street when the off-site area is developed.

H. The maximum cul-de-sac length is one thousand (1,000) feet.

9-320 CROSSOVER CRITERIA

A. Subdivision street intersections and entrances to major non-residential developments (with traffic volume over 3,000 VPD), that tie into existing crossovers of other approved locations will meet all the design criteria of VDOT and this Manual.

B. Minimum crossover spacing requirements shall be designed as established in the following table:
### Table 9-1

<table>
<thead>
<tr>
<th>Design Speed (mph)</th>
<th>Minimum Distance Between Crossovers (ft.)</th>
<th>Desirable Distance Between Crossovers (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>500</td>
<td>600</td>
</tr>
<tr>
<td>40</td>
<td>600</td>
<td>700</td>
</tr>
<tr>
<td>45</td>
<td>650</td>
<td>800</td>
</tr>
<tr>
<td>50</td>
<td>700</td>
<td>900</td>
</tr>
<tr>
<td>55</td>
<td>800</td>
<td>1000</td>
</tr>
</tbody>
</table>

### 9-330 DESIGN PROCEDURES AND TABLES

The following procedures and tables should be followed in the design of all roadways and street connections, including commercial entrances:

A. Determine the design speed of the roadway in question. On new roadways the minimum design speed for sight distance consideration is based on the projected A.D.T. as shown in the following table:

#### Table 9-2

<table>
<thead>
<tr>
<th>Project A.D.T. (VPD)</th>
<th>0-250</th>
<th>251-400</th>
<th>401-1,000</th>
<th>1,001-3,000</th>
<th>3,001-5,500</th>
<th>Over 5,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed</td>
<td>30</td>
<td>35*</td>
<td>40*</td>
<td>40</td>
<td>40</td>
<td>45**</td>
</tr>
</tbody>
</table>

* For cul-de-sacs, loops and other streets of fixed traffic generation, refer to Standard Detail TS-4.0 and TS-4.1 of this Article for radii.

** Minimum Design Speed: Roadways with projected A.D.T.’s exceeding 5,500 shall be designed per VDOT standards.

B. On existing roadways the design speed can be determined by the use of the following table:

#### Table 9-3

<table>
<thead>
<tr>
<th>Posted Speed</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>55</td>
<td>65</td>
<td>70</td>
</tr>
</tbody>
</table>

C. Design each new roadway so that all horizontal and vertical curves meet the minimum stopping sight distance outlined in Table 9-4 and the minimum passing sight distance outlined in Table 9-5. The alignment of all new roadways has to meet...
these sight distance requirements with the exception that sag vertical curves are required to provide not less than the sight distance given in Table 9-4.

9-330.1 STOPPING SIGHT DISTANCE

Table 9-4

<table>
<thead>
<tr>
<th>Height of Eye 3.5 feet</th>
<th>Design Speed (MPH)</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Sight Distance (ft.)</td>
<td>120</td>
<td>160</td>
<td>200</td>
<td>240</td>
<td>275</td>
<td>325</td>
<td>375</td>
<td>450</td>
<td>525</td>
<td>550</td>
<td>625</td>
<td></td>
</tr>
</tbody>
</table>

K Value For:

| Crest Vert. Curve | 30 | 40 | 60 | 80 | 120 | 150 | 210 | 230 | 290 |
| Sag. Vert. Curve | 40 | 50 | 60 | 70 | 90 | 100 | 120 | 130 | 150 |

Desirable Sight Distance (ft.) | 120 | 160 | 200 | 250 | 325 | 400 | 475 | 550 | 650 | 725 | 850 |

K Value For:

| Crest Vert. Curve | 30 | 50 | 80 | 120 | 170 | 230 | 320 | 400 | 540 |
| Sag. Vert. Curve | 40 | 50 | 70 | 90 | 110 | 130 | 160 | 180 | 220 |

A. Use desirable values as the minimum values on all roads that will carry in excess of 5500 VPD.

B. K value is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve that will provide minimum sight distance.

C. After each street has been designed to meet the criteria in Tables 9-4 and 9-5, then each intersection needs to be checked to see that the criteria in Table 9-5 is achieved and other intersectional items such as standard landings, channelization, etc., are met. It is also necessary that each connection to existing roads be checked to insure that these distances are achieved. The verification of this sight distance should be done graphically checking both the horizontal and vertical alignments.
9-330.2 SIGHT DISTANCES ALONG MAJOR ROAD AT INTERSECTION WITH MINOR ROAD, CROSSEOVERS, AND COMMERCIAL ENTRANCES

Table 9-5

<table>
<thead>
<tr>
<th>Height of Eye 3.5’</th>
<th>Height of Object 0.5’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed (MPH)</td>
<td>25</td>
</tr>
<tr>
<td>2 Ln Maj. Ln Maj. Rd not at crossover</td>
<td>250*</td>
</tr>
<tr>
<td>Undivided and divided 4 Ln Maj. Rd. at crossover</td>
<td>300*</td>
</tr>
</tbody>
</table>

* The term "Major Road" refers to the road with the highest VPD of the two (2) intersecting roads.

All existing City maintained roads are considered as the "Major Road". For median widths greater than sixty (60) feet, each roadway can be considered separately.

For more than four (4) lanes on major roads, or for large truck volumes on minor roads (20% to 25% of ADT), crossover, or commercial entrance, use values in the latest edition of "Policy on Geometric Design of Rural Highways" published by AASHTO.

Sight distances shall be noted on the profile sheet for all vertical curves and on the plan sheets for all horizontal curves and at all intersections. In addition, profiles of existing roads shall be provided for a minimum 350 feet or the applicable sight distance whichever is greater in each direction. Adequate sight distance easements shall be provided, outside of the rights-of-way, to assure that the line of sight will be kept clear of any obstructions that may diminish the available sight distance. An appropriate note to identify the person or entity that has the maintenance responsibility of the sight distance easement shall be shown on the plans and plats.
9-330.3 TRIP GENERATION SCALE

A. For non-residential or other residential Trip Generation, the Institute of Transportation Engineers, latest edition, should be utilized.

B. When the traffic generated from an entire development is projected to exceed 960 vehicles per day, the development shall provide through access and connect to an existing City maintained road in two (2) locations. One of the two required connections may be to a road constructed to a State standard and to be included in the State System, with approval by the Department of Public Works. Internal roads shall be designed in such a manner to incorporate good traffic design, providing ease of access for domestic service and emergency vehicular traffic. In situations where two connections cannot be physically made in single-family detached developments, due to restrictions in topography or sight distance, or limitations in City road frontage, a single connection may be allowed where specifically approved by the Department of Public Works. This single connecting roadway shall be of a four (4) lane divided standard, extending at least three hundred (300) feet into the development for the first 960 vehicle trips per day generated. For every additional 500 vehicle trips per day generated, or portion thereof, the four (4) lane divided standard shall be extended an additional 100 feet. No private entrances shall connect to a four-lane divided roadway. Internal roadways may connect where crossovers are permitted.

9-330.4 INTERSECTION IMPROVEMENTS

A. When deemed necessary by a traffic study or by the City, a protected left turn lane shall be required at all roadway intersections where the traffic count on those roadways exceeds 5000 vehicles per day. The required turn lanes and tapers shall be designed in accordance with VDOT and AASHTO standards (see Table 9-6).

B. A right turn lane and taper shall be required at all intersections of urban section streets that carry in excess of 5000 vehicle trips per day, or as otherwise provided in the Manual (see Table 9-6).

C. At intersections, all shoulders of turning lanes shall be paved as per VDOT specifications.
**TABLE 9-6 MINIMUM TURN LANE REQUIREMENTS**

<table>
<thead>
<tr>
<th>Design Speed</th>
<th>Min. Length Turn Lane</th>
<th>Min. Length of Taper</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 mph</td>
<td>150 feet</td>
<td>100 feet</td>
</tr>
<tr>
<td>35 mph</td>
<td>200 feet</td>
<td>100 feet</td>
</tr>
<tr>
<td>40 mph</td>
<td>200 feet</td>
<td>200 feet</td>
</tr>
<tr>
<td>45 mph</td>
<td>250 feet</td>
<td>200 feet</td>
</tr>
<tr>
<td>50 mph</td>
<td>350 feet</td>
<td>200 feet</td>
</tr>
<tr>
<td>55 mph</td>
<td>400 feet</td>
<td>200 feet</td>
</tr>
</tbody>
</table>

Street intersections:

A. The number of intersections of local streets with collector or arterial streets shall be held to a minimum to avoid hazard and delay.

B. Along undivided arterial and major collector roadways, the centerline separation of streets intersections (including high traffic generating commercial entrances of 1,000 VPD or more) within the same lot, parcel, or development shall follow the minimum distance between crossovers, noted on Table 9-1. For minor collector roadways, the separation will be 300 feet unless proven undesirable by an approved intersection study.

C. A distance of at least 200 feet shall be maintained between centerlines of offset intersecting local streets.

D. In general, all streets shall join each other so that for a distance of at least 100 feet the street is approximately at right angles to the street it intersects.

E. No more than one (1) commercial entrance serving a townhouse or multi-family development will be allowed off the circular segment of a publicly maintained cul-de-sac. If possible, this entrance should align at 180 degrees with the centerline of the public road. Two (2) entrances will be allowed for non-residential developments provided that their centerlines are aligned at 90 degrees.

**SECTION 9-400 PAVEMENT DESIGN REQUIREMENTS**

**9-410 ROAD PAVEMENT SECTIONS**

Road Pavement Sections in the City of Manassas Shall Conform to the Following:
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>SUBBASE</th>
<th>BASE</th>
<th>SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>UP to 250 VPD</td>
<td>1. 6&quot; Agg. Subbase</td>
<td>3&quot; ASPH Conc Type BM-2</td>
</tr>
<tr>
<td>II</td>
<td>251 to 400 VPD</td>
<td>1. 8&quot; Agg. Subbase</td>
<td>3&quot; ASPH Conc Type BM-2</td>
</tr>
<tr>
<td>III</td>
<td>401 to 1000 VPD</td>
<td>1. 8&quot; Agg. Subbase</td>
<td>3&quot; ASPH Conc Type BM-2</td>
</tr>
<tr>
<td>IV</td>
<td>1001 to 1500 VPD</td>
<td>1. 10&quot; Agg. Subbase</td>
<td>3&quot; ASPH Conc Type BM-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. 8&quot; Agg. Subbase</td>
<td>6&quot; ASPH Conc. Type BM-3</td>
</tr>
<tr>
<td>V</td>
<td>1501 to 3000 VPD</td>
<td>1. 6&quot; Cement CTA &amp; 5&quot; Agg. Subbase</td>
<td>3&quot; ASPH Conc. Type BM-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. 12&quot; Agg. Subbase</td>
<td>3&quot; ASPH Conc. Type BM-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. 8&quot; Agg. Subbase</td>
<td>6&quot; ASPH Conc. Type BM-3</td>
</tr>
<tr>
<td>VI</td>
<td>3001 to 8000 VPD</td>
<td>1. 12&quot; Agg. Subbase</td>
<td>6&quot; ASPH Conc. Type BM-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. 10&quot; Agg. Subbase</td>
<td>8&quot; ASPH Conc. Type BM-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. 8&quot; Cement CTA</td>
<td>4&quot; ASPH Conc. Type BM-3</td>
</tr>
<tr>
<td>VII</td>
<td>8001+ VPD</td>
<td>1. 8&quot; Cement CTA</td>
<td>8&quot; ASPH Conc. Type BM-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. 12&quot; Agg. Subbase</td>
<td>8&quot; ASPH Conc. Type BM-3</td>
</tr>
</tbody>
</table>

*Underdrains shall be installed per VDOT Standards and Specifications*
A. Two-way travelways in parking courts or private parking lots serving more than three single-family attached units shall meet the pavement design requirements for Category I for the entire width and length of the travelway. Minimum two-way travelway width is twenty-four (24) feet exclusive of gutter pans used for drainage in parking courts and parking lots. Minimum width of pipestem drives exclusive of gutter pans shall be twenty-two (22) feet. If two (2) single-family detached dwellings are served by a pipestem driveway, then the pavement shall conform to requirements of Category I for the full length and width.

B. These sections are minimum sections to be utilized when the actual California Bearing Ratio (CBR) of the pavement subgrade is ten (10) or more.

C. Where the actual CBR is below five (5), the Vaswani method, or acceptable VDOT method shall be used for determining the overall pavement thickness design. When using the Vaswani design, additional material shall be provided to increase the pavement thickness beyond the minimum, and the following conditions also apply:
   1. Pavement design in accordance with "A Design Guide for Subdivision Roads Pavements in Virginia" by Dr. N.K. Vaswani is required. Increase the thickness equivalency value of the asphalt concrete from 1.67 to 2.25 where its total thickness is 4.50 inches or more as required by Vaswani's method. The nomograph of the thickness index (T.I.) and Soil Support Value (SSV) are found in the aforementioned design guide.
   2. When the projected traffic requires a four-lane facility, 90% of the projected traffic (ADT) shall be the basis for determining the applicable class for the pavement structure design.
   3. Representative California Bearing Ratio (CBR) samples VTM-8, taken at subgrade elevation, should be used as the basis for evaluating the Soil Support Value (SSV).

D. Each street should have continuity of design throughout. Therefore, multiple and/or variable pavement structure designs will not be acceptable except in unusual situations, with the approval of the Department of Public Works.

E. Cement treated aggregate (CTA) or full depth asphalt concrete may be substituted for any aggregate, subgrade stabilization, or select material on basis of one inch of
CTA or asphalt concrete for two(2) inches of the other materials. Neither CTA nor asphalt concrete should be placed directly on a resilient soil (as defined in Vaswani's design guide) unless the soil is stabilized with cement or other approved stabilizing agent. Cement treated aggregate (CTA) should have a minimum of four(4) inches of aggregate base material under it when less than four(4) inches of asphalt concrete is to be applied over the CTA.

F. All materials and construction controls shall be in accordance with current VDOT specifications and special requirements, except as modified herein.

G. Asphalt concrete with a total thickness greater than four and one-half (4- ½) inches is considered base and surface. All aggregate materials under same are considered subbase. Appropriate structural values should be assigned these materials when using the Vaswani method of design.

H. For principal and minor arterial, design the pavement using the Vaswani method based upon actual CBR values or based upon the Vaswani predicted CBR value equal to four(4). In either case, the resiliency factor shall be one, and in no case shall the pavement section be less than the pavement section for through collectors.

I. For all roads within the City of Manassas, subgrades with a CBR value below five (5) will not be accepted. In the specific areas where the subgrade CBR is below five, a minimum of six (6) inches of cement treated aggregate, eighteen (18) inches of untreated aggregate or twenty-four (24) inches of non-plastic select material, Type II (min. CBR = 20) will be provided to form an acceptable pavement subgrade.

J. Soil stabilization with cement (low plasticity soils) at a minimum of 10% by volume or lime (high plasticity soils) at a minimum of 5% by weight will be accepted only on streets classified as through collectors or higher.

9-420 ACTUAL DESIGN
For actual pavement section design, laboratory CBR tests shall be conducted.
A. Tests shall be taken whenever subgrade soil types change.
B. Tests shall be made at a maximum of 500-foot intervals where the subgrade soils remain constant.
C. A minimum of two (2) CBR tests are required for a cul-de-sac or streets less than 500-feet in length.
D. The Department's inspector shall witness the sampling.
E. The Department may require stronger pavement sections where specific soil problems exist based on the Type II Geotechnical Report. Refer to Article 10-200 of this Manual.

9-430 ALTERNATE EQUIVALENT PAVEMENTS

When using an alternate equivalent pavement, the following minimum and maximum thickness of layers shall apply:

A. Minimum thickness of the aggregate layer used as the base in a one or two layer system is six (6) inches.
B. Minimum thickness of the aggregate layer used as the subbase is four (4) inches.
C. Minimum thickness of the bituminous concrete base (BM-2 or BM-3) layer used on top of subbase is three (3) inches.
D. Minimum thickness of the bituminous concrete surface (SM-2A) layer used on top of bituminous concrete base (BM-2 or BM-3) or binder (IM-1P) is one and one-half (1½) inches.
E. Minimum thickness of the bituminous concrete surface (SM-2A) layer used on top of aggregate material (treated or untreated) is two (2) inches, if installed in one lift, three (3) inches if two lifts are applied.
F. Minimum thickness of bituminous concrete intermediate base (IM-1P) is two (2) inches.
G. Minimum thickness of the stabilized soil layer (cement, lime, etc.), is six (6) inches.
H. The maximum thickness of the bituminous concrete surface (SM-2A) for one lift is two (2) inches.
I. For stage constructions of the pavement surface, the minimum thickness of bituminous concrete surface (SM-2A) is one and one half (1 ½) inches for the lower lift. Maximum thickness of bituminous concrete surface (SM-2A) is three (3) inches.
J. Aggregate material shall be placed in no less than one-half (½) inch thickness. (Example: 8" or 8½", but not 8 ¼").
K. The combined aggregate material of the subbase should not exceed twelve (12) inches. If it is anticipated that twelve (12) inches will be exceeded, a bituminous material (BM-2 or BM-3) should be substituted.

L. Should the aggregate material reach a depth of eighteen (18) inches or more, under drain shall be considered.

M. When the bituminous concrete base is equal to or exceeds three (3) inches, the underlying material is considered as subbase.

N. As long as the total bituminous concrete thickness does not exceed four (4) inches, the first eight (8) inches of the underlying material may use the thickness equivalency value for the base. The remaining depth shall use the subbase value.

O. Maximum thickness of aggregate layer used over soil cement or cement treated aggregate is six (6) inches.

P. Minimum thickness of cement treated aggregate placed directly on untreated subgrade soil is six (6) inches.

9-430.1 AIRPORT PAVEMENT STANDARDS
The minimum standards for pavement materials for all land designated as Airport on the Comprehensive Plan Character Area Map are as follows:

A. Airside:
   1. Heavy Duty Airside Pavement (Gulfstream, Falcon, BBJ): 4” FAA P-401 Type Asphalts Surface Course 10” FAA P-304 Type Cement Treated Base Course (8% cement content by weight) and compacted subgrade in accordance with FAA P-152 specification (found in the most current revision of Advisory Circular (AC) 150/5370-10).
   2. Light Duty Airside Pavement for all other Airside areas (Single, Twin, King Air): 2” FAA P-401 Type Asphalt Surface Course 8” FAA P-304 Type Cement Treated Base Course (8% cement content by weight) and compacted subgrade in accordance with FAA P-152 specification (found in the most current revision of AC 150/5370-10).
   3. All airside pavement sections may be required to conform to a greater pavement design to control for differing subgrade conditions, high water table, etc.
B. Landside:

1. **All Landside Pavement (Parking Lots, Access Roads):** 2” VDOT Type SMEA Asphalt Surface Course (SM12.5 a or SM9.5A) 6” VDOT Cement Treated Base Course (8% cement content by weight)

2. All sidewalks shall be constructed of 6 inches of VDOT A3 concrete on a minimum of 4 inches of VDOT 21A or 21B crushed aggregate base course.

3. All new entrances to local roads shall include the construction of a PCC apron meeting VDOT requirements.

**SECTION 9-500 SITE PLAN AND SUBDIVISION REQUIREMENTS AND DESIGN STANDARDS**

The site plan or subdivision shall include either a typical section or a reference to a specific standard and pavement design. The site plan or subdivision shall conform with or show the following:

A. Existing topography and all proposed grading for roads and lots. If the lots are to be graded with the roadway, house and building locations shall be shown in accordance with this Manual. If the plan involved roads only, the limits of grading beyond this 25-foot line will be required to balance the earthwork for the roadway construction.

B. Indicate stations every 100 feet on centerline; at points of curvature, points of intersection, and points of tangency; at centerline intersections, at subdivision or section limits and at turnaround radius points.

C. A profile along the building restriction lines shall be included on the plan. Where there is no building restriction line, a profile of 25 feet from the right-of-way shall require approval by the Department of Public Works.

D. When a proposed street is an extension of or connects with an existing street, a centerline profile of the existing street shall be provided for a minimum distance of 300 feet to ensure proper grade tie.

E. When a proposed street intersects with an existing street, a centerline profile of the existing street in both directions shall be provided for a minimum of 300 feet or any longer distance necessary to insure an appropriate sight distance in accordance with Section 9-330 of this article.
F. A grade line of all proposed street construction shall include:

1. The minimum grade for curb and gutter, which shall be 1%, except that the Department may allow a decrease to 1/2%, based upon unusual topographic conditions.

2. The length of vertical curves with elevations and stations of vertical points of intersection (P.V.I.).

3. Elevations shall be computed at all:

4. All centerline intersections of streets:
   - All Street centerline intersections within the boundaries of a subdivision;
   - All Curb returns;
   - All Culvert and storm sewer crossings;
   - All Curb inlets and manholes; and
   - The beginning and the end of all vertical curves.
   - Every fifty (50) feet on all tangent sections, and grades computed every twenty-five (25) feet in all vertical curves.

G. The point of finished grade on typical sections (i.e., centerline, top of curb, etc.) shall be indicated.

H. Grade profiles shall be provided for proposed curb and gutter construction in beginning of the curb return, following the face of curb around the cul-de-sac and then to the end of the return opposite the point of beginning. Grade ties of the proposed street, before entering the cul-de-sac grade shall be shown on each end of the cul-de-sac grade profile to insure proper grade connection. Other approved methods may be used subject to approval of the Department of Public Works.

I. If a difference exists in elevations on proposed curb grades, curb elevations showing top of right curb and top of left curb shall be shown on the plans.

J. A consistent grade shall be maintained from centerline of existing road to proposed curb and gutter to preclude the forming of false gutters and/or the ponding of any water on the roadway. The minimum cross slope of the street shall be established at ¼": 1'. The developer will be required to provide an asphalt overlay to the centerline of the roadway with a milled joint for the tie-in. If the centerline elevation shall be built up to establish the required cross slope, then the roadway shall be resurfaced
for the entire width and edge milled at the opposite side curbing at no expense to the City.

K. The maximum centerline grade across permanent cul-de-sacs may not exceed 3%. However, steeper grades may be permitted in certain instances with prior approval of the Department of Public Works.

L. Building restriction line profiles for cul-de-sacs shall be radial to the existing profile at face of curb and proposed curb grade. The maximum centerline grade of a permanent cul-de-sac shall not exceed 5%. The cross slope of the street for cul-de-sacs shall be a minimum of ¼": 1’.

M. The centerline of the roadway maybe realigned on streets that are widened to one side and there are no foreseeable plans to install improvements on the opposite side. This will normally be accomplished when the lack of the required cross slope necessitates an asphalt build up at the centerline. The centerline realignment shall be approved by the Department prior to the commencement of the work.

N. Street construction shall be for the full frontage of all lots.

O. All street construction, including sidewalks, shall be within the dedicated street right-of-way. Grading or filling may be done in adjoining easements.

P. Indicate standard street landings on plans to provide adequate sight distance.

Q. Adequate vehicular clearances and entrance radii shall be provided at all site entrances to ensure the safe movement of the projected traffic volumes and the types of vehicles using the site.

R. A City of Manassas excavation permit shall be required prior to any construction within the right-of-way or any new access being connected to the State System.

S. The owner/developer of a site that is to be redeveloped shall replace, at no expense to the city, all concrete improvements (i.e. curbing, sidewalk, handicap ramps) that are cracked and/or misaligned or do not meet current code. A city site inspector shall determine which items are to be replaced after a request from the owner during the plan review process.

T. Indicate 3:1 maximum slope at end of street construction with necessary easement shown on the plan.

U. Show and provide slope and maintenance easement where required.
V. Indicate the erosion control protection to be provided at the end of construction of curb and gutter.

W. Indicate typical cross-section for public and private streets, access aisles, and parking areas. Where a typical section is not specified, provide details on plans. Typical sections and geometric design criteria for streets shall conform to this Manual.

X. Show traffic barricades where required.

Y. All proposed pavement markings shall be VDOT type B material at no cost to the City.

Z. The following typical notes should be shown on all plans:
   1. The pavement design shall be based on CBR value of ten (10) or greater. Soil tests of subgrade will be performed by developer and witnessed by City of Manassas to determine the existing value.
   2. A smooth grade shall be maintained from centerline of existing road to proposed curb and gutter to preclude the forming of false gutters and/or the ponding of any water on the roadway.

AA. A temporary turnaround/cul-de-sac shall be constructed in a public easement on the abutting property at the end of a street that is intended to be extended with the development of the abutting property. This intent shall be posted at the cul-de-sac and at the entrance of the street to be extended.

BB. Intersections between existing and proposed streets shall have a symmetrical transition of pavement.

CC. Transitions shall be sixty (60) feet from the end of the curb return to the existing edge of pavement.

DD. A longer pavement transition and a turn lane may be required by the Department depending on the location of the intersection.

EE. When a proposed street parallels or is located near an existing stream or open drainage way, elevations of the top of the stream bank, computed water surface elevations and invert (or flow line) of stream or open drainage way shall be provided. Street construction shall not encroach on the approved flood plain limit of the stream except as provided for in Section 8-600, Flood Plain Policy.
FF. Street landings shall be provided to ensure adequate sight distance. Refer to Standard Detail TS-6.0 of this Article.

GG. Roadside ditches shall be indicated, along with its computations, where the depth is not in conformance with the standard street cross section.

1. Grade ties of the proposed street, before entering the cul-de-sac grade, shall be determined on each end of the cul-de-sac grade profile to ensure proper grade connection.

2. Other acceptable methods may be used subject to the approval of the Department.

HH. Cul-de-sacs shall be provided at the ends of all dead-end streets, except where the extension of the street beyond an intersection serves only one lot on each side of the extension. The criteria for a pipestem entrance will be used in the latter case. In order to reduce the length of permanent residential cul-de-sac streets, they shall be designed to carry a maximum of 250 VPD.

II. The minimum pavement radius in the cul-de-sac shall be no less than 50 feet and the minimum right-of-way radius of the cul-de-sac shall be no less than 58 feet. Refer to Standard Detail TS-5.0.

JJ. Adequate and recorded ingress-egress easements shall be provided with a width based upon the number of lots when more than one lot is to use a common driveway. Refer to Standard Detail TS-10.3.

KK. Traffic barricades and "NO OUTLET" signs shall be located where required. Refer to Standard Detail TS-21.0.

LL. Vandal-proof street name, stop, and yield signs shall be installed within the dedicated public street right-of-way at all street intersections in a location satisfactory to the Department based on the criteria used by VDOT. Refer to Standard Detail TS-16.0.

1. Stop or Yield signs shall be placed at intersections on those streets that have the least amount of anticipated traffic.

2. Stop signs shall be placed at intersections where the potential for poor sight distance would necessitate a full stop to increase safety.
MM. All private street and private driveway signs that do not meet the vandal-proof sign standard for use within the dedicated public street right-of-way shall be privately owned and privately maintained.

NN. A street name sign shall be required for all common private streets or pipistem driveways indicating the private street name, where applicable, the house numbers, and designation "private driveway" or "private street".

9-510 CURB AND GUTTER

A. Curb and gutter shall be installed for all new construction within the public right-of-way and shall be Type (CG-2) header curb, (CG-3) header curb, (CG-6) curb and gutter, (CG-7) Curb and gutter according to VDOT standards, or others with the approval of the Department. Curb and gutter that are adjacent to drop inlet will be reinforced with #4 rebar, Refer to Exhibit 24 in Appendix A.

B. The use of reverse curb and gutter, or spill type curb and gutter (CG-6R) is permitted only within the public right-of-way in conjunction with specific entrances VDOT CG-10 or CG-11. Refer to Standard TS-9.0 of this Article.

C. For curb and gutter section streets, the aggregate material shall extend under the curb and gutter a minimum distance of six (6) inches beyond the back of curb. The aggregate thickness under the curb and gutter shall be the sectional difference of the total pavement design and the gutter pan which is seven (7) inches or a minimum of four (4) inches, whichever is greater; i.e., pavement design of twenty (20) inches minus gutter pan of seven (7) inches requires thirteen (13) inches of 21-A aggregate under the curb and gutter.

D. Provide expansion joints at intervals of approximately 100' and around stationary structures.

9-510.1 UNDERDRAIN

Underdrains (UD-1): etc. will be required under curb and gutter when 21B aggregate or coarser aggregate is used in the subbase. UD-1 will be reviewed for use in sag vertical curves and cut and fill transitions. The City may require UD-1 on a project if field conditions warrant. Underdrain will conform to Section 9-550.1 of this Manual.
9-520 CURB CUT RAMPS

Ramps for the Handicapped:

A. All residential developments shall provide the VDOT standard curb-cut ramps located to provide access to and from the development by the public.

B. In parking lots, standard curb-cut ramps shall be located at handicapped parking spaces and major crosswalks and shown on the development plan. Where site sidewalks are constructed at various vertical elevations, a curb-cut ramp shall be installed at each sidewalk elevation.

C. Schools and other facilities where the public assembles shall provide standard curb-cut ramps as required by the Americans with Disabilities Act (ADA).

D. The locations of curb-cut ramps for handicapped persons shall be:
   1. In the public right-of-way, located adjacent to the normal location of the cross walk and on the intersection side of the stop line pavement marking.
   2. On-site, located:
      a. As close as possible to the entrance of the building that is fully accessible to the handicapped.
      b. To provide a route for the handicapped from a vehicle to the building that does not traverse parking lot aisles, travelways, or vehicle stacking areas.

E. At commercial entrances utilizing a CG-10 entrance, the sidewalk will be ramped down to the travel way in accordance with VDOT's Standards. Refer to Standard Detail TS-11.0 and TS11.1.

9-530 GUARDRAILS AND HANDRAILS

A. A standard "W" beam guardrail shall be provided when vehicles are to be protected from fill slopes in excess of ten (10) feet. The requirement of guardrails and handrails shall be determined on the plans, whenever possible, in order to include their cost in the bond estimate.

B. Furthermore, the following note shall be added to the plan: "A joint inspection will be held with the developer, City representatives, and representatives of VDOT to determine if and where guardrail and/or handrails will be needed. Further, the
developer will be responsible for providing guardrail and handrails as determined by this joint inspection." Refer to VDOT guardrail and handrail specifications.

C. Alternative to standard "W" beam guardrail which may be permitted in subdivisions are:
   1. A rustic wood post and wood rail design, or
   2. A weathered steel guardrail with wooden posts.

D. Written approval of the Department for the alternatives within the public right-of-way is required prior to plan approval by the City.

E. For design criteria of a specific type of guardrail, refer to American Association of State Highways and Transportation Officials "Guide for Selecting, Locating and Designing Traffic Barriers."

F. At a minimum, the construction plans shall indicate the following:
   1. Strong post or weak post system and design criteria.
   2. Terminal end treatment and anchorage.
   3. Warrant for guardrail installation.
   4. Curvature radius, if applicable.
   5. Installation height.

9-540 ENTRANCES ONTO THE PUBLIC RIGHT-OF-WAY

A. Driveway entrances shall be designed to accommodate all vehicle types having occasion to enter the site, including delivery vehicles. There shall be not more than one (1) entrance and exit or one combined entrance and exit along any street frontage unless deemed necessary by the Department of Public Works in order to alleviate traffic congestion and interference along such street. The width of all entrances and exits to off-street parking and loading areas shall comply with the requirements herein, Refer to Standard Detail TS-10.0, except that the Department of Public Works may authorize a narrower driveway width for parking and loading areas if:
   1. The driveway leading to the off-street parking or loading area is no longer than fifty (50) feet in length;
2. The driveway provides access to not more than ten (10) parking spaces; and
3. Sufficient turning space is provided so that vehicles need not back into a public street.

B. Arterial or limited access streets shall have no direct access to single-family detached residential driveways.
C. All entrances shall incorporate a 2% landing for a minimum of 25 feet from the existing edge of pavement or right-of-way.

9-540.1 ENTRANCE TYPES

Only two (2) types of entrances onto the highway system are permitted: private entrances and commercial entrances.

A. "Private entrances" shall mean a single-family detached driveway entering onto the public right-of-way.
B. "Commercial Entrance" shall mean all other access points onto the public right-of-way.

C. Subdivision street connections to the existing highway system are considered as commercial entrances until these streets are accepted into the public system.

D. Roads within subdivisions shall meet the sight distance requirements of commercial entrances at their intersections.

E. At all driveway entrances (including pipestem entrances), the size, length, and type of driveway entrance shall be indicated on development plans.

F. "Private Entrances" shall be constructed as per the CG-9D Standard.

G. Standard Detail TS-10.0 of this Article is to be used for all detached single-family and pipe stem residential lots entering onto streets with curb and gutter.

H. The minimum private entrance width is 12 feet and the minimum commercial entrance width is 30 feet.

I. Where driveway grades exceed 8%, a profile of the driveway for at least 25 feet outside the right-of-way shall be provided to demonstrate that vehicles will not "bottom out" or "scrape" while entering or leaving the public right-of-way.

J. The following standard entrances shall be constructed for all commercial entrances.
1. TS-10.0 of this Article shall be used within the limits of the Historic District or where pedestrian movements warrant this type of entrance as determined by the Department.

2. CG-9D (modified) shall be used within the limits of the Historic District where the entrance crosses a brick sidewalk.

3. CG-13 shall be used for all entrances onto arterial roadways, or for high volume, high truck traffic entrances as determined by the Department. The Department will require this entrance regardless of the type of abutting pavement.

4. CG-10 shall be used for entrances that have more than one CFS of water flowing in the gutter at the entrance centerline.

5. CG-11 shall be used for high volume entrances with a curb inlet immediately upstream of the entrance.

6. The Department may modify the type of entrance required in order to maintain consistency along a street segment.

7. Where entrance grades beyond the apron exceed eight percent, a profile of the on-site travelway for at least 50 feet shall be provided to demonstrate that vehicles will not "bottom out" or "scrape" while entering or leaving the public right-of-way.

K. All elements of entrances onto the public right-of-way shall meet the requirements set forth in the VDOT Minimum Standards of Entrances to State Highways, except as modified herein.

L. All commercial entrances shall be designed such that all vehicle types that may use the entrance can enter and exit the entrance without committing an illegal traffic maneuver within the public right-of-way. Further, the design of the entrance will be such that a vehicle may enter and exit the entrance to the right of the driveway centerline.

M. All private streets that enter onto the public right-of-way shall meet the design requirements for public road intersections.

N. All common driveways serving more than 100 VPD or ten (10) dwelling units, shall meet the design requirements for public road intersections where the common driveway enters the public right-of-way.
O. All common driveways serving less than 100 VPD or ten (10) dwelling units, shall meet the design requirements for commercial entrances where the common driveway enters the public right-of-way.

P. All common parking courts serving more than 100 VPD or fourteen (14) dwelling units, shall meet the design requirements for commercial entrances where the common parking court enters the public right-of-way.

9-540.2 SPACING OF ENTRANCES
A. No entrance (commercial or private) shall be placed within the limits of a public street intersection auxiliary lane (to include storage bay or taper).

B. The entrance centerline for commercial entrances shall align with those on the opposite side of the street or shall be offset a minimum of 125 feet.

C. The entrance centerline for commercial entrances entering along the same side of the street shall be spaced a minimum of 25 feet (P.C. to P.C.).

D. Generally, private entrances (single-family detached driveway entrances) shall be separated a minimum of four (4) feet from edge of apron to edge of apron. Refer to Standard Detail TS-10.1 of this Article.

E. No entrance onto a street intersecting a street classified as a minor arterial or higher, shall be placed closer than 125 feet (P.C. to P.C.) from the nearest edge of the right-of-way for the arterial street.

F. No side street entrance shall be placed closer than 25 feet from the curb return of a road classified as a through collector or lesser classification. This separation shall be measured P.C. to P.C.

9-550 SIDEWALKS
Sidewalks shall be provided on both sides of the street in all residential subdivisions. Public sidewalks shall be provided for all non-residential and mixed use lots.

A. Sidewalks shall have a minimum unobstructed width of five (5) feet; except in the Downtown Character Area zoned "B", "I" or "P", the minimum sidewalk width shall be eight (8) feet.

B. The maximum cross-slope allowed shall be 2.08 %.
C. The maximum longitudinal slope shall be 5% except sidewalks adjacent to streets shall match and not exceed the roadway slope. Where stairs are employed, consideration shall be given for including handicapped ramps and handrails.

D. Sidewalks shall be constructed of VDOT type A3 concrete, to a minimum depth of four (4) inches. Provide expansion joints at intervals of approximately 100 feet and around stationary structures. All sidewalks shall be constructed on a 21-An aggregate base at least four (4) inches in depth.

E. On-site private sidewalks shall be connected to public sidewalks if public sidewalks are within 650 feet of the development.

F. For typical sidewalk section, refer to Standard TS-14.1 and TS-22.0 of this Article.

9-550.1 UNDERDRAIN REQUIREMENTS

A. Sidewalk underdrain may be required when the sidewalk longitudinal gradient is 3% or more and/or when the underlying soil has 34% or more passing the No. 200 sieve and has a Plasticity Index (PI) of 13 or less. Refer to Standard Detail TS-14.0 of this Article.

B. Sidewalk underdrains should be tied into the storm sewer systems at points approximately a city block apart with runs not exceeding 1,000 feet in length without discharging into the storm drain system or into an open drain. The length of run may be increased by up to an additional 1,000 feet if eight (8) inch diameter pipe is used in the downstream 1,000 foot section of the run.

C. All underdrain pipe to be six (6) inch unless otherwise noted on plans. Minimum grade of pipe shall be 0.5%. Bends of 45 degrees may be used to permit connection to drainage structures. Plastic pipe (PVC) will not be permitted under street pavement sections. The pipe used in the pavement section shall be as specified by VDOT.

D. After the street section has been rough graded, CBR tests are to be conducted for street pavement design, sieve and PI analysis shall be done in conjunction with them. If these tests indicate that underdrains are required, additional classification tests will be made of the sidewalk subgrade to determine the size and location of sidewalk underdrains.
E. These tests will be made at all changes of subgrade soil type and not more than 500 feet apart. Plan revisions based on these tests will then be prepared by the designer and submitted to the Department for review and approval.

F. Density tests on natural subgrade shall be made and approved after the subgrade has been shaped and compacted to 95% density at optimum moisture, prior to the placing of sidewalks.

G. Where required, sidewalk underdrains shall be used for all walkways that are to be maintained by a public agency or a homeowner association.

H. Underdrain strength.

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<th>TABLE 9-8 ALTERNATE UNDERDRAIN PIPE</th>
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<td><em><em>S.T.</em> 6” Pipe Crushing Strength Lbs/LF</em>*</td>
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<tr>
<td>Perforated Helically Corrugated Lock Seam Steel</td>
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<td>Perforated Corrugated Aluminum</td>
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* Sheet Thickness - inches

9-550.2 SIDEWALK OVERHANGS

Sidewalks which are constructed to at least a six (6) foot width and are directly in front of a parking or loading space may include two (2) feet of the sidewalk width when determining the length of the parking or loading space. In no cases will overhangs be permitted across a City maintained sidewalk and a physical barrier no less than 36” high will be constructed to prohibit vehicular encroachment on the pedestrian walkway.
9-560 TRAILS

A. An interconnected trail system may be substituted for sidewalks with the approval of the Department, provided the trail system provides equal or improved access to buildings and dwellings or where required by the Zoning Ordinance, Comprehensive Plan, or Bicycle and Pedestrian Plan.

B. Trails shall conform to the following when approved by the Department.

- Trails shall be constructed in accordance with Standard Detail TS-13 of this Article.
- Two-way trails shall be designed and constructed to a minimum ten (10) foot width. One-way trails shall be a minimum of 6 feet.
- Trails shall have a vertical clearance of ten (10) feet to allow for bicycle travel.
- Trails outside the road right-of-way shall be provided with a minimum 12 foot easement.
- The maximum cross-slope allowed shall be 2.08 %.
- The maximum longitudinal slope allowed shall be 10 %.
- The minimum allowable centerline radius shall be 20 feet.
- Appropriate drainage measures shall be provided for all trails in accordance with Article 8 of this Manual.
- Bike trail design shall conform to VDOT standards, as indicated in the Instructional and Information memorandum, LD-83(D) 148, latest revision.
- Trails may be allowed to cross roads or streams provided adequate safety measures are taken as required by the Department.
- Standard handicapped ramps shall be provided at all trail curb crossings to allow continuity of trail use.

9-570 SHARED DRIVEWAYS

These driveways when permitted within the jurisdiction are limited private access to a public street for two (2) but no more than five (5) single-family detached dwellings. All units that share a driveway shall provide a minimum of two (2) on-site parking spaces per dwelling. In addition, these driveways shall be clearly labeled "No Parking Along
Driveway” on all plats and plans submitted. The plats and plans shall also designate the person or entity that has the maintenance responsibility.

9-570.1 ACCESS EASEMENTS
A. Adequate and recorded ingress and egress easements shall be provided when more than one (1) lot uses a common driveway or travelway.
B. All access easements regardless of number of units served or easements width shall have such additional easements provided for slope maintenance where necessary due to steepness in terrain.
   1. Easements shall note which lots have the right to use these travelways and maintains responsibilities.
   2. Access easements are to include rights-of-access for publicly owned and emergency vehicles.

9-570.2 DESIGN CRITERIA
A. The design for all pipestem driveways which are to serve more than one (1) lot shall be shown in typical section and on the grading plan of the construction plans, together with turnaround and required utilities, and shall be included in the completion bond for the project.
B. Pipestem driveways shall be constructed in accordance with the standards as set forth in this Manual and materials shall conform to VDOT’s specifications.
   1. The maximum grade for all pipestem driveways shall be 12%.
   2. All pipestem driveways shall have an adequate angle of approach and angle of departure.
   3. The minimum centerline radius of pipestem driveways is 50 feet.
   4. Provision shall be made for a turnaround on all pipestem driveways serving three or more lots as per Standard TS-5.4 of this Article for an AASHTO "SU" vehicle. An AASHTO "WB-50" vehicle shall be able to back into and exit the pipestem driveway.
C. An approved alternative to standard asphalt driveways is a five (5) inch non-reinforced portland cement concrete pavement subject to the following:
1. Concrete shall be the VDOT, Class A3. Refer to VDOT Section 217.06 and 217.07.
2. Concrete may be hand finished and shall be provided with a broom texture.
3. Forming, testing, jointing, finishing, curing, protection of pavement and opening to traffic shall be in accordance with the VDOT Road and Bridge Specifications.
4. Transverse crack control joints shall be provided at a maximum spacing of 15 feet.
5. Longitudinal control joints shall be provided in all pavement sections wider than 12 feet.
6. Stormwater runoff shall not be longitudinally channeled within the paved portion of the pipestem driveway.

9-580 PARKING COURTS
Driveways with no adjacent parking bays shall be clearly labeled "No Parking Along Driveway" on all plats and plans submitted.

9-580.1 ACCESS EASEMENTS
A. Adequate and recorded ingress and egress easements shall be provided when more than one lot is to use a common parking or travelway court and suitable provision shall be made for an AASHTO "SU" vehicle turnaround on all common parking courts serving three or more lots as per Standard Detail TS-5.4 in this Article.
B. All common parking courts, regardless of number of units served or easement width shall have such additional easements provided for slope maintenance where necessary due to steepness in terrain.
   1. Easements shall note which lots have the right to use these parking courts.
   2. Access easements are to include rights of access for publicly owned and emergency vehicles.

9-580.2 DESIGN CRITERIA
The design for all common parking courts, which are to serve more than one (1) lot, shall be shown in typical section and on the grading plan of the construction plans,
together with turnaround and required utilities, and shall be included in the completion bond for the project.

A. No common parking court shall serve as a through function.
B. Dimensions of parking spaces. The width of all aisles and sizes of all parking spaces shall comply with the standards established in Section 9-600 of this Manual.
C. Landscaping required. Common parking courts shall be landscaped to ensure the residential character of the development, as required by the Zoning Ordinance and Article 3 of the DCSM.
D. Identification of common parking court. Each common parking court shall be clearly identified as a private roadway. A single sign, not to exceed two (2) square feet in area, shall be posted at the entrance of each such parking court, displaying only the words "Private Parking Court" and the addresses of any residences utilizing the parking court.
E. Final plat requirements. In addition to all other requirements for a final plat, any subdivision containing a common parking court shall include a statement on the final plat acknowledging the private maintenance responsibility and guaranteeing public utility and emergency vehicle access.
F. The maximum grade for all common parking courts shall be 12 %.
G. All common parking courts shall have an adequate angle of approach and angle of departure.
H. The minimum centerline radius of common parking court travel aisles is 50 feet, with no adjacent parking.

9-590 PRIVATE STREETS & TRAVELWAYS
A. Single-family attached or duplex, multifamily, manufactured home parks, and non-residential developments shall have access to City maintained roads. This access may be via a private street or travelway provided that it meets the appropriate design standards in this section of the Manual.
B. Private streets shall be platted such that all lot owners are assured perpetual right of access to the City maintained road. The final recorded plat shall note each private street as "privately owned and privately maintained by the lot owner(s)". The final
plat shall also provide an adequate easement for ingress, egress, maintenance of utilities, and public agencies including Police and Fire Departments to allow them to carry out their duties. Travelways that provide access to multi-structure developments shall also provide this emergency access easement.

C. Private streets will not carry in excess of one thousand (1,000) vehicles per day. In manufactured home developments, streets with projected vehicle counts in excess of one hundred (100) VPD shall be designed and constructed to VDOT standards in regard to design, materials, and construction practices.

D. Entrances and travelways into shopping centers, non-residential, and similar developments may carry in excess of 1,000 VPD, provided that these entrances and travelways are designed with the appropriate wider pavement widths, higher pavement categories, channelization, and controlled access based on the projected traffic counts and movements.

E. Parking spaces shall not have direct access to private streets or main travelways carrying in excess of six hundred (600) VPD unless permitted by the Department of Public Works (excluding travelways serving parking bays in shopping centers, and non-residential developments.)

F. Private streets carrying in excess of sixty (60) lots or six hundred (600) VPD shall have at least two (2) accesses to a public roadway.

G. All permitted private streets and travelways shall be named in accordance with Section 9-800 of this Manual. Private roadway names shall be subject to the requirements of Section 9-810 of this Manual.

H. Entrances carrying in excess of 1,000 VPD and all private streets shall have the standard landing at all intersections with State maintained roads. All other entrances shall conform to Section 9-540 of this Article.

I. Stop signs shall be provided and posted at all intersections of roads or travelways that each carry in excess of 600 VPD including those with City maintained roads.

J. In order to permit more flexibility in the design of single-family attached or duplex, multifamily and manufactured home developments while encouraging the maximum utilization of City maintained streets, this Manual includes a standard for streets in developments that are acceptable for inclusion in the State Secondary System.
These streets do not provide for any on-street parking and are to be utilized only in developments when adequate off-street parking in separate parking bays is provided and no individual units front directly on the street. Permitted private roadways and parking areas Single-family attached or duplex, multifamily, and non-residential developments are designed and constructed in accordance with Standard Drawing TS-4.4.

K. A cul-de-sac or appropriate turnaround shall be provided at the end of all private streets. If a turnaround is provided, it shall be designed to allow for the safe movement of emergency vehicles, service trucks, and school buses. Otherwise, travelways shall interconnect to provide for adequate emergency vehicular access within the same development. Examples of turnaround configurations are shown in Standard Drawing TS-5.4.

L. For access streets, aisles and parking lots that will be maintained by the property owner (i.e., shopping centers, office buildings, etc.) a six (6) inch base and a two (2) inch bituminous surface will be required to insure a dust free surface. Use of a prime and double seal surface treatment will be reviewed on a case-by-case basis. For access streets with traffic counts exceeding one hundred (100) VPD, refer to Standard Drawing TS-3.0 for the appropriate pavement section. CBR tests are required. The methods and materials used in the construction of all site improvements shall conform to the current VDOT Road and Bridge Specifications unless herein modified.

M. In single –family attached or duplex, condominiums, and other multi-family residential developments where parking area that will be maintained by a homeowners’ association or similar organization, a minimum six (6) inch base and two (2) inch bituminous surface will be required based upon a CBR valve of 10. Private streets with traffic counts exceeding one hundred (100) VPD, which shall have pavement sections that conform to Standard Drawing TS-4.4. Aggregate material shall extend under curb and gutter as per Section 9-510 except when the calculated thickness under the curb is less than four (4) inches. When calculated aggregate thickness is less than four (4) inches, no aggregate under curb shall be required. Soils tests shall be provided for by laboratory CBR testing. Should the
subgrade CBR be less than ten (10), one (1) inch of subbase should be added for each point below CBR 10 or redesigned per the Vaswani Method. If the subgrade CBR is 10 or greater, no additional subbase is required. Alternate equivalent pavement design may be substituted with the approval of the Department of Public Works when designed by the Vaswani Method. The methods and materials used in the construction of all site improvements shall conform to the current VDOT Road and Bridge Specifications unless herein modified.

N. When two or more lots use a private travelway or street an automatic owners’ association shall be established and given the responsibility of ownership and perpetual maintenance of private roadways and, where appropriate, sidewalks and/or trails.

O. The plat recorded for residential subdivisions being served by private roads where allowed shall contain the following statement in a highlighted box:

“The road serving this development is private and is not eligible for acceptance into the State System. Maintenance of the road, including snow removal, is not a public responsibility.”

P. Any street within a subdivision that is not intended to be incorporated into the State System shall be identified with a sign attached to the street sign or address sign (for pipestem) state: Private Road Not Public Maintained. Signs are available through the City and are paid for by the developer. The signs shall meet the requirements of Section 9-830 of this Manual.

9-5100 PAVEMENT RESTORATION

9-5100.1 GENERAL

A. Description of work: Provide the necessary traffic controls, labor, materials and equipment to restore and maintain the various street pavement and driveway bases, curbs, curb and gutter, and sidewalks disturbed, damaged or demolished during the performance of the work.

B. Related Work Specified Elsewhere:

- Section 11-700 - Cast-in-Place Concrete

C. Applicable Specifications:
Virginia Department of Transportation (VDOT), Road and Bridge Specifications.


E. Permits: Before performing any work, secure the necessary permits to work within the City right-of-way and dedicated easements.

9-5100.2 MATERIALS

A. The quality of materials used in the restoration of existing pavements and driveways shall produce a street surface equal to or better than the condition before the work began.

B. Concrete shall be Class A3 air-entrained Portland cement type as specified in Section 11-720.2.

C. The base course shall be bituminous concrete consisting of course and fine aggregate combined with asphalt cement, resulting in a mixture of BM-3 in conformance with Section 211 of the VDOT Specifications.

D. The surface course shall be bituminous concrete consisting of crushed stone, crusted slag, or crushed gravel and the fine aggregate, slag or stone screening, or combination thereof, combined with asphalt, cement, resulting in a mixture of SM-2A in conformance with Section 211 of VDOT Specifications.

E. Stone aggregate shall be size 21-A in conformance with Section 205 of the VDOT Specifications. Refer to VDOT Section 308 for the required rate of compaction.

F. Joint filler shall be ½” preformed asphalt expansion joint material conforming at ASTM D1751.

G. Asphalt for a temporary patch shall be BM-3 or UPM Cold Mix as specified.

9-5100.3 EXECUTION

A. Where trenches have been opened in any roadway or street that is a part of the State of Virginia highway system, restore surfaces in accordance with the requirements of VDOT. All other restoration shall be done in accordance with the
Manufacturer's Specifications or these specifications, and Section 10-700 of this Manual.

B. Excavation in the pavement area shall require that pavement surfaces be saw-cut to provide a straight and smooth edge. Cut out pavement 16 to 24-inches wider than the trench width or excavation opening as shown on Standard Detail TS-15.0 of this Article.

C. Upon completion of installation of utility and backfill, fill the trench with stone aggregate and temporary asphalt patch until such time that the permanent pavement patch will be constructed.

D. Complete the pavement restoration for the various types of streets in conformance with Standard Detail TS-15.0 and this Manual.

E. Concrete curb and gutter, and sidewalks, shall be restored as required to match existing construction. Replace damaged sections with complete new sections or squares; patching of damaged sections will not be permitted.

F. Maintain restored sections and surfaces for a period of one (1) year following the date of final acceptance.

G. When a manhole top requires adjustments to an elevation one (1) inch or more above the existing pavement grade and is exposed to traffic before final paving is completed, a temporary ramp shall be constructed by slope of not less than two (2) feet per one (1) inch shall be used. During the paving operation but prior to the placement of the topping course, the bituminous concrete taper shall be removed from around the manhole to a minimum depth of one inch below the top of manhole.

9-5110 MISCELLANEOUS STANDARDS

A. The methods and materials used in the construction of all streets shall conform to the current VDOT Road and Bridge Specification unless herein notified.

B. All base and subbase material and subgrade for all sidewalks and curb and gutter shall be compacted as per Section 502 and 504 of VDOT Road and Bridge Specifications.

C. Subbase shall be primed with a priming material approved by VDOT.
D. Rights-of-way shall be cleared for full width of construction, utilities shall be in place, and roadbed subgraded before bituminous material is applied on all streets. All utility structures within the roadway shall be adjusted to final grade before any paving is performed.

E. Dust control shall be maintained on those sections of the project as may be designated by the inspector.

F. Roadway and Raised Grass Median Underdrains: Underdrains for roadways and raised grass median shall be provided in areas of frost susceptible soils and high ground water on a case-by-case basis, or based upon actual field verification of such conditions. A traffic barricade shall be installed at road closings, entrance stubs for future developments or as required by the Department of Public Works. Refer to Standard Detail TS-19.0 of this Article.

G. Street name signs and stop signs shall be posted at the following locations:
   1. All street intersections.
   2. At the entrance to a parking bay for the residential units.
   3. These signs, or approved temporary signs, shall be installed prior to the occupancy of any house or unit being served by the street.

H. Prior to the release of the performance bond, or during emergencies that could endanger the public health, safety and welfare, the Department of Public Works may require the developer of a site development project to provide the additional safety features such as:
   "No Parking" signs
   "Speed Limit" signs
   "Stop" signs
   "Pavement Markings"
   "Traffic Barricades"

Any other emergency measures that may be necessary for the safety of the travelling public. These emergency items are to be installed at the developer's expense.

I. Prior to the acceptance of a street into the State Secondary System, the developer is required to post the necessary traffic control signs inclusive of pavement markings,
for the safety of the travelling public. Traffic control signs shall conform to the current VDOT standards and the current edition of the Manual on Uniform Traffic Control Devices. All required pavement markings that are installed in conjunction with new developments shall be type B markings.

J. Street name signs shall be located at intersections such that they can be seen from the major (higher VPD) road at a reasonable distance.

K. Frost Line Depth: The Building Official has established the minimum frost line depth to be twenty-four (24) inches.

L. Utility Easements: A ten (10) foot wide utility easement is required to be shown on the plat for all subdivision and site plans. Since the location of utilities may vary, it is recommended that the individual utilities be contacted prior to the location of any easements.

M. Installation and storage of LP Facilities: LP tanks shall be shown on the site plans, installed, and protected with bollards in accordance with the Fire Marshal's specifications.

N. Debris Disposal: Every construction site shall be provided with on-site facilities adequate for the premises storage of all construction debris, refuse, and worker’s litter that may be generated during construction. The number and size of receptacles shall be determined by the primary contractor; except no less than one (1) receptacle shall be place on each site.

SECTION 9-600 PARKING AND LOADING DESIGN STANDARDS

Parking and loading shall be provided according to the requirements of the Zoning Ordinance and this Article.

9-610 OFF-STREET PARKING LOT DESIGN STANDARDS

A. The design of any off-street parking lot shall meet the dimensions provided in the table below. Alternative dimensions may be approved by the City provided they conform to commonly accepted engineering design standards and do not compromise the safety, appearance, or function of the parking area.
TABLE 9-9 MINIMUM OFF-STREET PARKING LOT DIMENSIONS

<table>
<thead>
<tr>
<th>Angle of Parking (Degrees)</th>
<th>Direction of Traffic</th>
<th>Dimensions of Stall (in feet)</th>
<th>Width of Aisle (in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel</td>
<td>One-way</td>
<td>9x22</td>
<td>12</td>
</tr>
<tr>
<td>30</td>
<td>One-way</td>
<td>9x18</td>
<td>14</td>
</tr>
<tr>
<td>45</td>
<td>One-way</td>
<td>9x18</td>
<td>14</td>
</tr>
<tr>
<td>60</td>
<td>One-way</td>
<td>9x18</td>
<td>18</td>
</tr>
<tr>
<td>90</td>
<td>Two-way</td>
<td>9x18</td>
<td>24</td>
</tr>
<tr>
<td>No adjacent parking</td>
<td>One-way</td>
<td>n/a</td>
<td>11</td>
</tr>
<tr>
<td>No adjacent parking</td>
<td>Two-way</td>
<td>n/a</td>
<td>22</td>
</tr>
</tbody>
</table>

B. Compact Vehicle Requirements
   1. When ten (10) or more off-street parking spaces are required, compact parking spaces may fulfill up to 15% of the minimum parking requirement.
   2. The minimum size requirement for a compact parking space shall be 8x16 feet.
   3. Compact spaces shall be grouped together and clearly identified with markings on the surface of the parking space and with signage restricting use of the parking space for compact vehicles only.

C. Entrances to parking bays shall be located along the site accessway to avoid blockage of the street right-of-way by vehicles entering the site.

D. A hierarchy of on-site travelways shall be maintained with no direct parking along the major site accessways.

E. All loading spaces and all trash dumpsters, trash compactors, or refuse collection areas shall be accessible by the design vehicle with all parking spaces occupied.

F. All parking bays with more than twenty (20) spaces shall provide a turnaround at the most remote end. The turnaround shall accommodate an AASHTO SU Design Vehicle.

G. Minimum aisle width is exclusive of gutter pans used for drainage.

H. The maximum travel aisle slope within off-street parking areas shall be 7%.

I. All retaining, screening, landscaping, and building walls shall be protected from vehicle contact.

J. "Overhang" areas that are a part of the required parking space shall be graded no higher than two (2) inches above the top of the curb and shall not be encroached by landscaping, signs, or other obstructions.
K. A physical barrier shall be provided adjacent to a sidewalk that runs parallel with a travelway or parking bay.
L. Head-in parking that abuts a sidewalk shall provide wheel stops, or a 6-inch header curb and shall maintain the minimum sidewalk width required under the DCSM.
M. Off-street parking spaces and any vehicle display areas shall be demarcated by lines painted on the pavement.
N. Parking lot landscaping shall be provided in accordance with DCSM Section 3-460, Parking Lot Landscaping.
O. Off-street parking areas containing four (4) or more parking spaces, except for single-family detached dwellings, shall provide a minimum of one direct and continuous paved pedestrian connection within the parking area that connects building entrances, off-street parking spaces, and new or existing sidewalks adjacent any street right-of-way. The pedestrian connection shall be uninterrupted by off-street parking spaces and may be contained within landscaping islands or buffer areas.

9-620 ACCESSIBLE PARKING REQUIREMENTS
A. Accessible parking and building or sidewalk accessibility shall be provided in accordance with the current adopted Virginia Construction Code (VCC).

TABLE 9-10 MINIMUM ACCESSIBLE PARKING SPACE REQUIREMENT

<table>
<thead>
<tr>
<th>Total Parking in Lot</th>
<th>Required Minimum Number of Accessible Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 25</td>
<td>1</td>
</tr>
<tr>
<td>26 to 50</td>
<td>2</td>
</tr>
<tr>
<td>51 to 75</td>
<td>3</td>
</tr>
<tr>
<td>76 to 100</td>
<td>4</td>
</tr>
<tr>
<td>101 to 150</td>
<td>5</td>
</tr>
<tr>
<td>151 to 200</td>
<td>6</td>
</tr>
<tr>
<td>201 to 300</td>
<td>7</td>
</tr>
<tr>
<td>301 to 400</td>
<td>8</td>
</tr>
<tr>
<td>401 to 500</td>
<td>9</td>
</tr>
<tr>
<td>501 to 1000</td>
<td>2 Percent of Total</td>
</tr>
</tbody>
</table>
B. Accessible parking spaces shall be identified by above grade signs and demarcated per Standard Detail TS-12.0 and TS-12.1 of this Article as modified by the VCC Accessible Parking Signage requirements. The sign shall be supplemented by the painting of the international symbol with a 4-foot by 4-foot blue box on the surface.

C. Accessible parking spaces shall be located as close as possible to a main building entrance, ramp, or walkway and shall have a maximum cross slope of 2%. If serving more than one (1) building, accessible parking spaces shall be centrally located and a designated walkway shall be provided.

D. Where a curb exists between the parking lot surfaces and the sidewalk or walkway, an inclined approach shall be provided to allow convenient access for wheelchairs. Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes. The approach shall have a slope of not more than one (1) foot in twelve (12) feet and be a minimum of five (5) feet standard width, exclusive of flared sides. Inclined approaches shall be provided and arranged to allow convenient access to a building entrance and from one (1) curb area to another. Such approaches shall be provided at intervals not exceeding one hundred (100) feet.

E. A request for modification of any of the requirements of this section shall be submitted, in writing to the Building Official.

### 9-630 OFF-STREET PARKING LOCATION REQUIREMENTS

The location of off-street parking or driveways shall meet the following requirements, in addition to the requirements of the Zoning Ordinance.

A. In single-family attached, duplex, and multifamily dwelling developments with private driveways and parking areas owned by a homeowner’s association, required off-street parking, except parking required for boats, trailers, and similar vehicles, shall be provided on each lot or within one hundred (100) feet of each dwelling unit’s door.
or ground level stairwell landing and measured over the sidewalk path or other paved surfaces.

B. Traditional Neighborhood. For single-family attached or duplex dwelling located in the Traditional Neighborhood Character Area of the Comprehensive Plan, no off-street parking or driveways shall be provided anywhere in the front yard abutting a public street.

C. Airport. In the I-A, Airport zoning district, vehicle parking shall be located a minimum distance of ten (10) feet from any security fence.

D. Special Districts: Mathis Corridor and Hospital/Sudley. In the Mathis Corridor and Hospital/Sudley Character Areas of the Comprehensive Plan, the following standards shall be met:

1. No off-street parking shall be located in any required landscaping buffer areas, or open space.

2. A minimum of 75% of off-street parking shall be located to the rear or side of the principal structure. Where off-street parking is visible from a street right-of-way, the off-street parking shall be fully screened in accordance with DCSM requirements within an enclosed courtyard or by a wall or decorative fence no less than four (4) feet in height, and supplemented by landscaping.

E. Special Districts: Downtown. In the Downtown Character Area of the Comprehensive Plan, the following standards shall be met:

1. No off-street parking shall be located in any required landscaping areas, buffer areas, or open space.

2. All off-street parking shall be located to the rear or side of a principal structure. Where off-street parking is visible from a street right-of-way, the off-street parking shall be fully screened in accordance with DCSM requirements within an enclosed courtyard or by a wall or decorative fence no less than four (4) feet in height, and supplemented by landscaping.

3. No off-street parking or driveways shall be provided anywhere in the front yard abutting a public street of a single-family attached or duplex dwelling.
9-640 SURFACING

A. Surfacing of off-street parking, driveways, travelways, accessways, and aisles, and exterior storage areas used for the storage or movement of vehicles shall be designed to maintain proper drainage, shall consist of an improved dustless surface, and shall not include dirt, gravel, or sand.

B. Historic Overlay District. The use of gravel or other pervious material may be permitted for single-family detached dwellings located in the Historic Overlay District (HOD), provided the use is approved by the City in accordance with the requirements of the HOD and the DCSM.

C. Low-impact design. Pervious or semi-pervious materials, such as open joint pavers, porous asphalt, pervious concrete, turf grid, or other comparably effective material, may be approved for off-street parking or driveways provided:

1. The materials conform to commonly accepted engineering design standards.
2. The site is designed to maintain proper drainage in accordance with the DCSM.
3. The property owner has provided sufficient assurance that such areas shall be properly maintained.
4. The use of engineered grass pavers shall only be approved by the City in low-traffic, non-residential areas (such as overflow parking areas), where it can be demonstrated that the vegetation will survive the level of expected traffic.

9-650 ALTERNATIVE PARKING STANDARDS

Alternative parking may be approved as permitted under the Zoning Ordinance and in accordance with the following requirements.

A. Alternative Parking Plans

1. An alternative parking plan for off-site parking may be approved in accordance with the Zoning Ordinance to fulfill the minimum off-street parking requirements for a land use. The parking plan shall identify the alternative off-street parking, show that it is located no more than 650 feet from the land use to which it is designated, and demonstrate compliance with the off-street parking requirements enumerated in the Zoning Ordinance.
2. An alternative parking plan may be approved to allow off-street parking spaces to be shared between multiple, separate uses. The parking plan shall show that the uses, tenants, or activities have established operating hours that do not generate an overlap in employee or client use of the parking spaces to be shared under the plan. The process for City approval of alternative parking shall be in accordance with the Zoning Ordinance.

B. Downtown Character Area parking fund.

1. Any use of land in the Downtown Character Area may meet off-street parking requirements through payment-in-lieu of required off-street parking spaces. Credit for an off-street parking requirement met in this manner shall run with the land. No refund shall be made when a subsequent change of use requires less parking.

2. The City shall collect the fee prior to the issuance of a certificate of use or occupancy. Such payment shall be in one lump sum or as otherwise approved. Payment of this fee does not guarantee parking spaces will be constructed for the sole use or within immediate proximity of a particular land use. These funds shall be deposited by the City in a special parking fund and shall be used to:
   a. Provide additional off-street public parking to serve the Downtown Character Area;
   b. Acquire land for such parking through purchase, lease, or license;
   c. Develop land to make it suitable for public parking;
   d. Replace existing City-owned parking lots with public parking structures; or
   e. Engage in projects that increase the amount of available public parking spaces or reduce dependence upon automobiles and thereby reduce parking demand.

9-660 OFF-STREET STACKING REQUIREMENTS

Off-street stacking spaces shall be provided in accordance with the following requirements:

A. Stacking spaces shall not to interfere with the travelway traffic or designated parking spaces.
B. Stacking spaces shall be at a minimum eighteen (18) feet in length.
C. Stacking spaces shall be located to the side or rear of the building and shall be located between the building and any street right of way.
D. For drive-through restaurant uses, an abort lane shall be provided at or near the menu board or service unit.
E. Within the I-A, Airport zoning district, stacking areas shall be limited to taxicab and bus lanes at terminals, and pick up and drop off lanes. All other vehicles shall either be on an authorized travel way or in a designed parking space. Stacking lane shall be a minimum of 12 feet wide for buses and 10 feet wide for taxi cab unless multiple stacking lanes are running parallel then all lanes may be 10 feet in width.
F. Off-street stacking spaces shall be provided according to the requirements set forth in the following table:

<table>
<thead>
<tr>
<th>TYPE OF ACTIVITY</th>
<th>REQUIRED NUMBER OF STACKING SPACES</th>
<th>START POINT FOR STACKING SPACES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Institutions - automated teller machine</td>
<td>3</td>
<td>Teller machine</td>
</tr>
<tr>
<td>Financial Institutions - bank teller lane</td>
<td>3</td>
<td>Teller window/Tube</td>
</tr>
<tr>
<td>Professional Personal Service - dry-cleaning/laundry</td>
<td>3</td>
<td>Cleaner/laundry window</td>
</tr>
<tr>
<td>Retail Sales - pharmacy</td>
<td>3</td>
<td>Pharmacy window</td>
</tr>
<tr>
<td>Restaurant</td>
<td>6</td>
<td>Order box/speaker</td>
</tr>
<tr>
<td></td>
<td>4*</td>
<td>Pick-up window</td>
</tr>
<tr>
<td>Other</td>
<td>To be determined by City. Such determination shall consider any study prepared by an engineer or other qualified design professional.</td>
<td></td>
</tr>
</tbody>
</table>

* These spaces are required in addition to the stacking spaces required to be located behind the order box/speaker and shall be located between the pickup window and the order box/speaker.
9-670 OFF-STREET LOADING REQUIREMENTS

A. Off-street loading requirements. The quantity of off-street loading spaces shall comply with the requirements of the Zoning Ordinance.

B. Standard Loading Area:
   1. Standard loading spaces shall be a minimum of 15 feet in width and 30 feet in length, and provide a minimum vertical clearance of 15 feet.
   2. When loading spaces are located alongside each other, additional loading spaces shall require a minimum of 12 feet in width.
   3. All uses required to provide standard loading spaces shall provide an entrance and circulation system which can accommodate an American Association of State Highway and Transportation Officials (AASHTO) SU Design Vehicle.

C. Semi-Trailer Loading Space:
   1. Semi-Trailer loading spaces shall be a minimum of 15 feet in width and 55 feet in length and provide a minimum horizontal clearance of 15 feet.
   2. Uses requiring a semi-trailer loading space shall utilize an AASHTO WB-50 Design Vehicle for planning the entrance and on-site circulation system.

D. All loading spaces shall be accessible to the design vehicle with no more than two (2) backing movements. The circulation pattern for the design vehicle shall provide for forward movements and shall discourage backing movements.

E. Access lanes shall be a minimum of 12 feet in width for one-way traffic and 22 feet in width for two-way lanes. This space may also be considered as a space for the maneuvering apron.

F. Surfacing. All outdoor or exterior loading areas shall be surfaced with an improved, dustless material capable to bear a live load of 200 pounds per square foot.

9-680 GASOLINE STATION DESIGN REQUIREMENTS

Gasoline stations shall be approved by the Fire Marshal's Office and installed in accordance with the requirements of VUSBC and the following standards:

A. Gasoline pump islands shall be protected at each corner by a vertically imbedded metal post filled with concrete at least thirty (30) inches in height above the ground and three (3) inches in diameter.
B. Each gasoline pump island shall be located so that there is a refueling area of at least ten (10) feet in width on both sides of the pump island. A minimum of twenty (20) feet is required between pump islands and an abort lane adjacent to the building of eleven (11) feet to bypass the pumps.

C. There shall be travel lanes of not less than twenty-two (22) feet in width between any refueling area at the pumps and any parking spaces provided on-site.

D. Parking spaces located outside of the refueling area will be demarcated with paint and equipped with wheel stops where deemed necessary by the Department of Public Works.

E. The following minimum setback distance from the pump islands to the ultimate right-of-way line shall be required for various angles:
   1. Parallel to R/W: 12'
   2. From 1 Degree to 45 Degrees: 20'
   3. From 45 Degrees to 90 Degrees: 30'

9-690 BICYCLE PARKING REQUIREMENTS

A. The following are minimum requirements of site plan submissions:
   1. Show and label all bike parking locations on overall site plan.
   2. Provide dimensioned detail drawings for each external bike rack installation along with dimensions to each object nearby (e.g., curb, streetlight base, planter box, bench, trashcan, driveway apron, etc.).
   3. Provide dimensional detail drawing for each interior long-term storage area. Show the proposed room or cage walls, wall material, door, cage wall and/or door security plates, lock, strike guard, dimensions between racks, dimensions from racks to walls, and aisle width.
   4. Provide detail drawing/spec sheet for all proposed bike rack products to be used.

B. For the purpose of this section, “long-term bicycle parking” shall mean facilities for the parking or storing of bicycles for six or more hours.

C. All uses requiring a new parking tabulation shall provide at least the number of bicycle parking spaces identified in the table in this subsection. Bicycle parking spaces may be either long-term or short-term spaces.
D. The City shall specify the number of required spaces for any use not listed in the following table based upon a similar use.

**TABLE 9-12 MINIMUM BIKE PARKING REQUIREMENTS**

<table>
<thead>
<tr>
<th>Use Category</th>
<th>Specific Use</th>
<th>Number of Bicycle Parking Spaces Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Multi-Family Dwelling:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Without private garage or equivalent separate storage space for each unit</td>
<td>(1) space per (20) units</td>
</tr>
<tr>
<td></td>
<td>With private garage or equivalent separate storage space for each unit</td>
<td>None</td>
</tr>
<tr>
<td>Commercial</td>
<td>Office</td>
<td>(1) space per 20,000 sq. ft. of floor area</td>
</tr>
<tr>
<td></td>
<td>Retail</td>
<td>(1) space per 10,000 sq. ft. of floor area</td>
</tr>
<tr>
<td></td>
<td>Parking Garage</td>
<td>(1) space per 20 motor vehicle spaces</td>
</tr>
<tr>
<td>Assembly and</td>
<td>Institutional</td>
<td></td>
</tr>
<tr>
<td>Institutional Uses</td>
<td>Assembly, Place of and Educational Facility</td>
<td>(1) space per 10,000 sq. ft. of floor area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spaces for (2) percent of maximum expected daily attendance</td>
</tr>
<tr>
<td>Industrial</td>
<td>Manufacturing and Production</td>
<td>(1) space per 25,000 sq. ft. of floor area</td>
</tr>
</tbody>
</table>

E. General standards for bicycle parking. All bike parking shall be subject to the following standards:

1. Each space on the facility or rack shall accommodate a bike at least six (6) feet in length.
2. No bike parking shall be installed in locations that obstruct pedestrian paths or vehicle rights-of-way.
3. Parking areas shall be well lit if accessible to the public or bicyclists after dark.
4. Parking areas shall be located to ensure significant visibility by the public and building users, except in the case of long-term bike parking located in secure areas.
5. Any in-street bicycle parking areas shall be separated from motor vehicles by a physical barrier (such as bollards, concrete or rubber curbing or pads, etc.) designed to adequately protect the safety of bicyclists and bikes.
6. Bike rack materials shall consist of stainless steel, vinyl coating, or powder coating.
7. The bike parking area shall consist of a dustless, hard surface, and shall not include any gravel, dirt, sand, or turf.

F. Maneuvering areas. All required bike parking shall meet all of the following minimum criteria:
1. All bike racks shall be located at least 36 inches in all directions from any obstruction (other bike racks, walls, doors, posts, columns, interior or exterior landscaping, etc.)
2. Each parking space shall be accessible without moving another parked bicycle.
3. The maneuvering area may extend into portions of a street right of way but not portions established as an alley, driveway, off-street parking space, or any buffer or landscaped area.
4. Vertical space-saving racks may be used as set forth in the figure below.
G. Standards for short-term bicycle parking. All short-term bicycle parking facilities or racks shall meet the following standards:

1. Location. The parking area shall be located either:
   a. Within 50 feet of the main public entrance of the facility, measured along the most direct pedestrian access route; or
   b. No further than the nearest motor vehicle parking space to the main public entrance (excluding handicapped parking).

2. A publicly owned or shared bicycle facility or rack may be utilized to meet the requirements for short-term bicycle parking provided the facility or rack has sufficient capacity to accommodate the proposed use and meets the minimum requirements of this section.

3. The bike rack or facility shall be maintained to withstand severe weather and permanent exposure to elements.

4. The facility or rack shall be securely anchored to concrete footings, a concrete sidewalk, or comparably secure concrete surface or structural element of a building or structure.

5. The bike rack or facility shall accommodate securing a bicycle using an industry-standard lock that shall provide for at least two points of contact with the bike.

6. Each space shall be sufficient to accommodate a bicycle at least six (6) feet in length.

H. Standards for long-term bicycle parking. All long-term bicycle parking facilities or racks shall meet the following standards:

1. Location. The parking area shall be located in a secure location in which access to the bicycles is limited and is unavailable to the general public. The facility or rack shall be located within 650 feet of the main entrance, measured along the most direct pedestrian access route.

2. The parking area shall be constructed with at least one of the following features:
   a. Bicycle locker. A structure solely used for securing and protecting a standard size bicycle from rain, theft, and tampering within a temporary enclosure.
   b. Indoor storage. A dedicated, secured bicycle parking area either inside the principal building on the lot or a building located within 650 feet of a main
entrance to the principal building. Indoor storage areas shall contain bike racks or comparable storage devices. Such rooms shall be designed to maximize visibility of all portions of the room or designated area from the entrance.

c. Covered. A dedicated, secured parking area that completely protects bicycles from rain with a minimum of eight (8) feet of clearance above the floor or ground with improved hard surface.

3. The facility or rack shall be securely anchored to concrete footings, a concrete sidewalk, or comparably secure concrete surface or structural element of a building or structure.

9-6100 BUS PARKING REQUIREMENTS

A. If bus parking is provided, it shall be arranged for functional efficiency and convenience and shall be designed to be amenable to surrounding property.

1. Site plan required. In accordance with the zoning ordinance, site plans shall be submitted for all new off-street parking areas designated for buses or for any additions to existing bus off-street parking areas.

2. Location. Bus parking shall be located no closer than 30 feet to adjacent residential uses, hotels, hospitals, or institutes of human care and occupancy. Upon finding that due to enhanced landscaping, use of berms, or other site characteristics and/or improvements, the bus parking area is sufficiently screened from the aforementioned uses, the Department of Public Works may reduce this setback requirement to a minimum of 20 feet.

3. Signs for bus parking only. Parking areas designated for bus parking shall only be used for bus parking. Signs shall be present within the parking lot indicating areas that are designated solely for bus parking.

4. Dimensions. The bus parking lot shall meet the minimum geometric standards outlined in the following table:
TABLE 9-13 MINIMUM OFF-STREET BUS PARKING DIMENSIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>Stall Dimensions (in feet)</th>
<th>Aisle Width (in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parallel Parking</td>
<td>12x50</td>
<td>Determined by the turning radii necessary to safely maneuver in and out of parking spaces, but no less than 24 feet.</td>
</tr>
<tr>
<td>Perpendicular or Angled Parking</td>
<td>12x40</td>
<td></td>
</tr>
</tbody>
</table>

5. Entrances to parking areas. The site plan shall clearly indicate the location, size, and number of entrances from parking areas onto public or private roads. The Department of Public Works may approve modified entrance designs upon finding that on-site traffic circulation, off-site traffic flow, or public safety may be impaired or improved.

SECTION 9-700 STREET, SITE, AND PARKING LOT LIGHTING

9-710 GENERAL REQUIREMENTS

A. The design and layout of a power distribution system to service lights will generally be accomplished by the City Electric Department. Advice on lighting levels, selections of poles, heights of mounting, type of luminaries, and placement of lights shall be in conformance with this manual or standards required by the City Electric Department.

B. All installation costs for the system will be the responsibility of the developer. Where the proposed system lies within dedicated right-of-way and the City Electric Department requires that such installation only be contracted by Public Utilities, the developer will sign an agreement with the City of Manassas guaranteeing full payment to the City of Manassas of all installation charges, as well as all administrative costs to the City in contracting for such installation. Said agreement shall be executed prior to the approval of a record plat.

C. Operational and maintenance costs of the lighting system shall be the responsibility of the City of Manassas within the public system of roads. The record plat of the subdivision will indicate this and will further designate with whom this responsibility will ultimately lie for private streets within a development.
D. The developer shall post a completion bond with the City prior to approval of plans covering the entire cost of installation.

9-720 LUMINAIRE AND POLE STANDARD

A. All luminaries and supporting poles shall conform to the following:

1. Standard fixture shall mean those fixtures normally supplied by the City Electric Department for the site in question. (Standard fixtures will be maintained by the City.)

2. Within the Downtown Character Area of the Comprehensive Plan, the standard fixture shall be an acorn lighting fixture (refer to Standard Detail TS-20.3) unless otherwise approved by the Department of Public Utilities and the Department of Community Development in order to achieve acceptable minimum lighting levels for public safety purposes.

3. Alternate fixture shall mean one (1) of the three (3) fixture designs as approved by the Department of Public Utilities. Alternate fixture installations will be maintained by the City and shall be metered. The Developer shall provide 25% in excess of the total number of alternate fixtures installed for parts and replacement.

B. The City Electric Department will be responsible for the review of all streetlight, parking, and onsite lighting plans. All roadways serving more than five (5) dwellings and all non-residential roadways and all commercial entrances will be provided with street lighting. This includes lighting of any new intersections along existing roadways. All public street lighting will be bonded by the developer and installed by the City Electric Department. All illumination levels of roadway lighting designs shall conform to the Section 9-740 of this Article and shall meet all requirements of the City Electric Department for the site in question.

C. The standard roadway fixture shall be utilized where one or more of the following conditions apply: Refer to Standard Detail TS-20.2 or TS-20.3 of this Article.

1. Installations along extensions of roadways that are lighted with standard fixtures.
2. Installations along roadways within or surrounding a non-residential subdivision.
3. Installations along roadways with projected or existing traffic counts of 1,000 or more vehicles per day.

9-730 LIGHT SOURCES
All light sources shall be high pressure sodium vapor or light emitting diode (LED), with type, model, and make, as approved by the Department of Public Utilities. When a different color rendition is necessary, a metal halide or other source will be reviewed on a case-by-case basis for on-site lighting. A photometric design shall accompany all site plans.

9-740 DESIGN OF STREET LIGHT INSTALLATION
A street lighting design prepared and stamped by a professional engineer shall be presented with the site plan. This design shall conform to the following criteria.

| TABLE 9-14 |
| AVERAGE MAINTAINED ILLUMINANCE VALUES IN FOOTCANDLES |
| ROAD TYPE | AREA CLASS | FOOTCANDLES | UNIFORMITY RATIO (Eavg to Emin) |
| LIMITED ACCESS/ MAJOR/ MINOR | Commercial | 1.7 | 3 to 1 |
| | Intermediate | 0.3 | 3 to 1 |
| | Residential | 0.9 | 3 to 1 |
| COLLECTOR | Commercial | 1.2 | 4 to 1 |
| | Intermediate | 0.9 | 4 to 1 |
| | Residential | 0.6 | 4 to 1 |
| LOCAL | Commercial | 0.9 | 6 to 1 |
| | Intermediate | 0.7 | 6 to 1 |
| | Residential | 0.4 | 6 to 1 |

NOTES:
The values given in Table 9-14 represent the lowest in-service illuminance values.

The illuminance value for intersections shall be at least equal to the sum of the recommended values associated with each roadway that forms the intersection.
AVERAGE MAINTAINED ILLUMINANCE VALUES IN FOOTCANDLES

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>AREA CLASS</th>
<th>FOOTCANDLES</th>
<th>UNIFORMITY RATIO (Eavg to Emin)</th>
</tr>
</thead>
</table>
| Commercial: Business areas of the City where ordinarily there are many pedestrians during night hours. The area contains land use that frequently attracts a heavy volume of nighttime vehicular and pedestrian traffic.  
Intermediate: Areas of the City characterized by frequent moderately heavy nighttime pedestrian activity, as in blocks having public facilities, large multifamily buildings, industrial buildings, or neighborhood retail stores.  
Residential: Residential areas characterized by few pedestrians at night. This definition includes areas with single-family homes detached dwellings, duplex, single-family attached dwellings, or small multifamily buildings. |

9-750 DESIGN OF PARKING FACILITIES

A parking lot lighting design prepared and stamped by a professional engineer shall be presented with the site plan. Parking lot lighting shall not exceed twenty-two (22) feet in height above grade and shall conform to the following criteria:

TABLE 9-15

<table>
<thead>
<tr>
<th>GENERAL PARKING &amp; PEDESTRIAN AREA</th>
<th>FOOTCANDLES (min. on pavement)</th>
<th>UNIFORMITY RATIO (Average: Minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>1.0</td>
<td>4:1</td>
</tr>
<tr>
<td>Medium</td>
<td>0.6</td>
<td>4:1</td>
</tr>
<tr>
<td>Low</td>
<td>0.4</td>
<td>4:1</td>
</tr>
</tbody>
</table>
DEFINITIONS:

High Activity:
- Institutional, public, or assembly uses (operating more than 5 days per week)
- Regional & community commercial (excluding B-2 zoning)
- Restaurant facilities that include a drive-through

Medium Activity:
- Office
- Hospitals
- Transportation facilities (airports, commuter parking lots, etc.)
- Institutional, public, or assembly uses (operating 3 to 5 days per week)

Low Activity:
- Neighborhood commercial (B-2 zoning only)
- Industrial
- Educational facilities
- Institutional, public, or assembly uses (operating up to 2 days per week)
- Residential

9-760 SUBDIVISION LIGHTING
A. On each residential lot within a subdivision where the minimum required lot area is fifteen thousand (15,000) square feet or less, the subdivider shall install a yard light on each lot that conforms to the design standards of this Manual (see Standard Detail TS-20.5). A photoelectric entrance light may be used on an individual single-family attached or duplex unit where approved by the Department of Public Utilities. In lieu of this, a single yard light may be used to serve a single-family attached group provided that adequate parking area lighting provided 0.6 foot candle of illumination. Halogen lighting is prohibited in residential districts and developments.

B. Poles located at intersections shall be installed as close as possible to, but outside the radius of the intersection. Poles located along roadways between intersections shall be installed with a one (1) foot offset to side lot property boundaries. All pole placements and bracket lengths shall conform to the lighting design and the manufacturer's specifications.
C. Alternate security lighting fixtures shall utilize black fiberglass poles. These poles shall be installed two (2) feet behind the face of curb and require a minimum eight (2) foot clear zone.

9-770 LIGHTING INFORMATION TO BE SHOWN ON DEVELOPMENT PLANS
A. The standard roadway fixture will be for use on curb and gutter roads. (Refer to Standard Detail TS-20.2.) The locations shall be designated on the plan. Each shall be labeled as to luminaire size and bracket length as follows: RF-2 (luminaire size) - (bracket length), i.e., RF-2-14-10 refers to a 14,000 lumen luminaire with a ten (10) foot bracket length.
B. Alternative Security Fixture. The locations shall be designated on the plan. Each shall be labeled as to luminaire size as follows: SF-5-14 (luminaire size) - (pole height) i.e., 5000 lumens and 14-foot pole.
C. All street lights shall be plotted accurately and to scale on the plan with respect to pole location and, where applicable, bracket length. Refer to Standard Detail TS-20 of this Article.

9-780 MAXIMUM ON-SITE LIGHTING FOR PARKING, SECURITY, OR SIGNAGE
A. A lighting plan shall be provided that indicates all outdoor lighting fixtures, exclusive of street lights, and signage will not have a source of illumination that is visible beyond the site or cause illumination of adjacent properties in excess of 0.5 foot-candles, as measured at the lot line.
B. Sign luminaries shall be shielded to eliminate glare or extraneous light on the roadway.

9-790 AIRPORT LIGHTING REQUIREMENTS
No use may be made of land within the I-A, Airport zoning district in such a manner as to create electrical interference with radio aircraft, inhibit the ability for pilots to distinguish between Airport lights and others, cause glare to pilots using the Airport or personnel engaged in air traffic control operations, impair visibility in the vicinity of the Airport or otherwise endanger the landing, taking off, or maneuvering of aircraft. Lighting
within the I-A, Airport zoning district shall be subject to the following additional requirements:
A. Parking Lot Poles are subject possible height restrictions under FAR Part 77.
B. Pole lighting shall provide adequate lighting for access and safety of all facilities.
C. Lighting poles or any type of illuminating system cannot interfere with aeronautical services and the vision of pilots and air traffic controllers.
D. Shielding of lights may be required depending on their location relative to the airport's runways and taxiways.

SECTION 9-800 STANDARDS FOR NEW STREET NAMES, ADDRESSES, SIGNS, AND MONUMENTS

Street names and address numbers shall conform to appropriate requirements of Article 9-810 and 9-820 respectively.

9-810 STREET NAMES

A. All new street names shall be reviewed and approved by the Zoning Administrator and City Council prior to approval of the final site or subdivision plan.
B. No duplication of existing street names in the City of Manassas or the City of Manassas Park or Prince William County adjacent to Manassas will be approved. Streets with the same name, but different type designations will be considered duplications (i.e., Longstreet Drive is considered a duplication of Longstreet Court).
C. Near duplications in spelling, confusing spelling, or names that are phonetically similar will not be approved. A word beginning a name may be used a total of three (3) times when used in the two or three word name, i.e., Willow Brook Court, Willow Glen Court, Willow Grove Trail.
D. Names shall not exceed seventeen (17) characters in length including spaces between words and excluding the street type designation. Names containing hyphens, apostrophes, or other non-letter characters will not be approved. Street names shall not contain more than three (3) words, including the street type.
E. Streets continuing directly through an intersection shall keep the same name. Exceptions may be authorized by the Zoning Administrator in the event that a street
crosses a major arterial road. This does not apply to cul-de-sacs directly opposite each other that intersect with a common street. For commercial, multifamily, or townhouse developments that have entrance or access through a publicly maintained cul-de-sac, a separate street name for the entrance or access road may be required in the event that it serves or is intended to serve a structure or structures that require the assignment of more than three address numbers.

F. Compass points, such as "north" and "south", shall not be used in street names.

G. A developer may submit street names for conditional approval by telephone or letter prior to the submission of plans. Reservation of street names for use should not be construed to mean that the name has been approved for use.

H. Names shown and approved on a preliminary or final plan shall be reserved only for the period that the plan remains valid.

I. Subdivision plats shall not be signed and released for recordation or building permits issued until approved street names are shown thereon.

J. Proposed street names shall appear on all final site and subdivision plans and plats.

K. The following street type designators are the only designators that will be approved by the City:

1. Major roadways such as an Interstate, multilane Federal highway normally four (4) or more lanes, limited access, divided Parkway, Highway, Pike, Freeway, Expressway, Throughway.

2. Major roadways - multilane, non-limited access, usually the main traffic arteries carrying high volume traffic: Highway, Boulevard, Avenue, Road.

3. Local connector roads - usually two (2) lane, non-limited access: Avenue, Street, Road, Drive.

4. Local roadway providing access to individual lots within a subdivision or commercial area: Lane, Drive, Way, Trail, Loop, Circle.

5. Local streets that have only one way in and out such as a cul-de-sac: Court, Place, Terrace, Mews.

6. Ingress/Egress to shopping malls: Square, Arcade, Center, Plaza.

7. Travelway usually behind housing and not used for normal through travel: Alley.
8. Travelways restricted to pedestrian access shall be referred to as Way, Walk, Promenade, Square or Alley.

9-820 STREET ADDRESSES

A. Addresses shall be assigned during final plan review, site development, or prior to building permit application by the Zoning Administrator. The assigned addresses shall be transmitted to the owner or owner’s agent and those departments or individuals requesting notice via e-mail. Assignment of street addresses shall be handled solely by the Zoning Administrator. Addresses assigned by any other person or entity may be voided and changed by the Zoning Administrator. No addresses will be assigned over the telephone.

B. Determination of the proper address for corner lots will be based upon which road the driveway accesses. If a driveway accesses more than one road, the proper address will be determined by the Zoning Administrator.

C. Multi-family or condominium developments, including conversions, shall have unit numbers assigned by the Zoning Administrator with the street numbers.

D. The entrance(s) to each building and to units within a building shall be clearly identified on the final plans. Floor plans detailing the configuration of the building, separate levels, units within the levels, and common entrances, as well as individual unit entrances, shall be forwarded when available to the Zoning Administrator for use in addressing.

E. Plans for variable office, warehouse and retail space shall specify the maximum number of units possible within the overall structure. The number shall be broken down by level for multi-story structures.

F. Addresses will be assigned only after receipt of the information required to properly assign addresses.

9-830 SIGNS

All street name signs shall be purchased through the Public Works Department and paid for by the developer. Other signs required in this section and available through the City Sign Shop shall be paid for by the developer.
9-830.1 STREET NAME SIGNS

Standard street name signs shall be installed at all street intersections in accordance with MUTCD Standards and/or as directed by the City; shall meet the following criteria:

A. Street name signs shall be nine (9) inches wide extruded blank. The length will be determined by the number of letters in the street name, including prefixes and suffixes. Street name sign posts shall be 3/8” O.D. galvanized steel posts, or equivalent as approved by the Engineer.

B. Reflective materials shall be applied to treated blanks with mechanical equipment as specified by the sheeting manufacturer.

C. The street name or legend may be screened on the green background or applied with cut out letters or numbers of white reflective sheeting mechanically applied, and shall appear on both sides of the blank. Letter size shall be 6 inches as shown on Detail TS-16.0. Letter type shall conform to MUTCD, "Standard Alphabets for Highway Signs," Series C. The Department of Public Works will require, on the site plan, a symbol that street signs will be placed in locations that best identify named travelways and streets so that time is not lost by emergency response teams.

D. The shorter name plate shall be mounted above the longer name plate in assembly.

E. In locations where no curb and gutter is placed, the street name sign shall be erected in such a manner that the longest name plate is a minimum of two (2) feet behind the ditch line and is safe from damage by traffic. Where curb and gutter exist, the sign shall be placed in the grass utility strip near its terminus at an intersection.

F. Standard street signs shall be installed prior to issuance of occupancy permits.

G. No street signs shall be erected until the street name has been approved by the City Council.

9-830.2 PRIVATE STREET DESIGNATION SIGNS

Private street designation signs, when required by Section 9-5110, shall be installed in accordance with the following:
A. Private streets, including pipestem driveways serving two (2) or more houses, which are not maintained by the City, shall be designated as such. See Section 9-590 of this Article.

B. Private streets and pipestem driveways serving two or more houses shall have signs installed stating "PRIVATE ROAD NOT PUBLIC MAINTAINED."

C. Private street designation signs shall be twelve (12) inches wide and eighteen (18) inches long. Signs shall be installed as shown in Standard Detail TS-16.1.

SECTION 9-900 SPECIAL STRUCTURES

A. Highway bridges shall meet all VDOT requirements and shall be designed with appropriate live and dead loadings.
   1. All highway bridges shall be designed and sealed by a registered Professional Engineer licensed to practice in the Commonwealth of Virginia and specializing in highway bridge design.
   2. All highway bridges will be referred to VDOT for review and comment prior to approval by the Department.

B. Pedestrian bridges, when required, shall be a minimum width of 8 feet and shall be designed with appropriate dead and live loadings. Trails adjacent to streets shall have a 10 foot width.
   1. All pedestrian bridges shall be designed and sealed by a registered Professional Engineer licensed to practice in the Commonwealth of Virginia and specializing in bridge design.
   2. The Department may require an independent review of any highway bridge, pedestrian bridge, or other specialized structure, prior to approval of the structure.
   3. Independent review shall be by a registered professional engineer licensed to practice in the Commonwealth of Virginia and specializing in design of the type of structure to be reviewed. The review professional shall be chosen by the Department.
   4. The developer shall bear all costs of such independent review.
SECTION 9-1000 PROCEDURE FOR WORK REQUIRED WITHIN EXISTING PUBLIC RIGHT-OF-WAYS, AND EASEMENTS

9-1010 GENERAL CRITERIA
Any person who undertakes the performance of any work upon, in, under, above or about any public street, highway, roadway, alley, dedicated easement or sidewalk, hereafter collectively called public right-of-way, which requires that the street be partially or completely closed for a construction maintenance operation, which work shall require excavation within or occupancy of the whole or a portion of the width of any such public right-of-way by equipment, materials, debris or workmen shall use barricades, signals, flags, flares, and all other traffic control and warning devices. All procedures about the work area during the duration of the work within the public right-of-way shall designate the type and in the manner required by the Manual of Uniform Traffic Control Devices for Streets and Highways, Part VI, Traffic Controls for Street and Highway Construction and Maintenance Operations and the latest edition of the Virginia Work Area Protection Manual, VDOT.

9-1010.1 WORK ZONE TRAFFIC CONTROL (WZTC)
Work Zone Traffic Control plans shall be developed as a part of the initial plan for all Projects, Permits and/or Contracts which pertain to Improvements, Utility Work, Maintenance Operations including Minor Maintenance and Utility Projects prior to occupying the City Right of Way or Easements. The WZTC plan shall be consistent with Part IV of the Manual of Uniform Traffic Control Devices for Streets and Highways (MUTCD) and designate the type and in the manner required of:

- Traffic control methods to be implemented
- Public and pedestrian safety to be implemented
- Certified and Trained personal in WZTC Operation, Management and Maintenance

All Work Zone Traffic Control plans shall be submitted to the City of Manassas Public Works and Utilities Engineering Departments or City Designee for review and approval. Approved Permitted Developer or Contractors Shall provide documentation of Competent Certified Personnel responsible and trained to maintain and manage the
WZTC as part of the Approved City Permit or Contract and a copy of the WZTC Contractor Certification shall be kept at all times with the approved permit or contract for the duration of the subject project, permit or contract.

9-1020 REQUIREMENTS
A. A plan shall be prepared by the permittee showing where the work is to be performed. The plan will include a detailed barricading layout drawn to scale showing placement of arrow boards, barricades, cones, and informational signs used on the project. In most cases, layouts will be similar to those shown in the latter part of the Manual of Uniform Traffic Control Devices. Deviation from the Manual will be allowed only with approval of the Department.
B. The plan required in paragraph 1, shall be submitted prior to issuance of permits and construction to allow the Public Works Department the opportunity to survey the construction site, to determine any traffic problems that may develop as a result of the barricading. A note shall be added that this work shall not be performed during the peak hour congestion periods of 7:00-9:00 A.M. and 4:00-6:00 P.M., on major thoroughfares or arterial roads, unless approved by the Department.
C. An excavation permit shall be approved by the Department of Public Works upon the posting of the applicable bonds. The applicant shall call the Public Works Department 24 hours in advance of the actual construction.

9-1020.1 SPECIAL REQUIREMENTS
A. All work done under this permit on the road right of way, shall in all respects, including location, alignment, elevation and grade; manner of performing the work; restoration of conditions, etc., be subject to the Manual and shall be done to the satisfaction of the Department.
B. Long, open trenches will not be permitted. The maximum length of trench at any time, including backfill portion of the same not suitable for traffic, shall not exceed 100 feet. Trenches are not to be left open overnight.
C. All backfilling of trenches shall be in layers of not greater thickness than six (6) inches, and shall be made to a minimum of 95% theoretical density, at optimum
moisture content, in accordance with the Virginia Department of Highways and Transportation's Highway, Road and Bridge Specifications. On pavement cuts, the pavement shall be replaced and the material used shall conform to this Manual and the Virginia Department of Highways and Transportation's Highway, Road and Bridge Specifications. Compaction shall be by pneumatic tampers, or by other approved method or methods. Compaction by water will not be permitted. The permittee will be held responsible for any sinks in backfill or pavement for a period of one (1) year after the completion of the work. The backfill trench shall be maintained to the satisfaction of the City.

D. Wherever pavement is permitted to be cut, not over one-half of the width shall be disturbed at one time; and on crossings, the first opening shall be completely restored to satisfactory travelable condition before the second half can be opened. Where the pavement is disturbed, or deemed weakened, it, in its entirety, or such portions of it as deemed desirable by the City Inspector, shall be restored or replaced in manner as directed by the City Inspector, and to the satisfaction of the City Engineer.

E. No excavated material is to be placed on the pavement without written permission of the Engineer. When so permitted the pavement shall be satisfactorily cleaned by an approved method. Tracking of material onto roadway is a violation of City ordinance and subject to legal action.

F. Road drainage is not to be blocked. The shoulders, ditches, roadside, and drainage facilities, as well as the pavement, shall be kept in condition satisfactory to the City Inspector.

G. Road and street connections and private entrances are to be kept in satisfactory condition. Entrances are not to be blocked, and ample provision shall be made for safe ingress and egress to adjacent property at all times.

H. Traffic is not to be blocked or re-routed without special written permission of the Fire Marshal or Department of Public Works. Traffic shall at all times be properly protected by adequate lights, barricades, and signs, and flagmen when needed.
I. The City reserves the right to stop the work at any time the terms of the permit are not satisfactorily complied with; and the City may, at its discretion, complete any of the work covered in the permit, at the expense of the permittee.

J. The permit is revocable at the pleasure of the City and permittee may be required to move, alter, change, or remove from the road right-of-way in a satisfactory manner any installation made on the right-of-way under the permit.

K. The permittee shall immediately have corrected any situation that may arise as a result of these installations that the Inspector or Engineer deems hazardous to the traveling public even though it may not be specifically covered in the permit or this Manual.

L. The permittee assumes full responsibility for all damages that occur due to work performed under this permit.

M. All open cut roadway crossings are to be made as nearly as possible at right angles to the center line of the road. Wherever possible, pipe lines shall be bored and jacked, or otherwise pushed under the roadway or a portion thereof, especially on concrete or other hard surface roadways, in order to eliminate as far as possible the cutting of the pavement.

N. Restoration of pavement shall conform to Standard Detail TS-15.0 and Sections 9-5100 and 10-700 of this Manual. Open cut trenches shall be cut by a saw method in a smooth line to present a neat appearance. Ripping and jackhammer cutting of pavement will not be allowed. The trench shall be backfilled in accordance with VDOT’s Road and Bridge Specifications. The entire trench shall be filled with stone aggregate base course type 21-A, five inch (5") section of BM-2 bituminous base course and a one and one half inch (1 ½") minimum SM-2A bituminous surface course. The surface course shall overlap the trench and be bonded to the existing pavement.

O. In the event of the possibility of interference to the flow of traffic, the Permittee shall notify the Department of Public Works at 257-8235 giving the location and time schedule of the work to be accomplished, and again shall call the Department of Public Works upon completion of the work or upon reopening of the road.
P. The permittee will be responsible for all damages to City facilities, roadways, etc., incidental to this construction.

Q. The permittee shall provide adequate means of cleaning trucks and/or other equipment of mud prior to entering a City of Manassas roadway and it is the permittee's responsibility to clean the streets and allay dust and to take whatever measures necessary to insure that the road is maintained in a clean, mud and dust free condition, at all times.

R. All damages to existing road(s) will be restored to the satisfaction of the Engineer.

S. Driveway and curbs shall be maintained for the duration of the permittee's interest in the entrance exactly as indicated on the permit.

T. No tree trimming or removal allowed without approval of the Department of Public Works.

U. All damaged sidewalk and/or curb and gutter to be removed to provide a minimum of a six (6) foot section of curbing and a four (4) foot section of sidewalk.

V. Signs shall be in accordance with the specifications of the "Virginia Manual of Uniform Traffic Control Devices" and the "Virginia Work Area Protection Manual." The signs are to be located as directed by the Engineer or his representative.

W. Emergencies. The requirements herein are to be used for all planned construction projects. In the event of an emergency, notification of work to be done can be made by telephone directly to the City of Manassas Police Department, thereby bypassing the requirements mentioned above. Under these conditions, the contractor or agency shall still follow the basic barricading standards of the Uniform Traffic Control Devices Manual. The applicant shall apply for the proper permits the following work day.

9-1030 SAFETY PRECAUTIONS

Public Protection: The following provision shall apply to insure adequate and safe protection to the public whenever construction work is readily accessible to the public.
9-1030.1 WARNING SIGNS AND LIGHTS
A. Danger signs on construction, excavation, or demolition projects shall be posted in a conspicuous manner.
B. Excavations shall be conducted in accordance with the requirements of VUSBC and Section 10-700 of this Manual.

9-1030.2 APPLICABILITY
For the purposes of Section 9-1030, construction work deemed readily accessible to the public shall include, but not be limited to the following:
A. Sites within five hundred (500) feet of residential areas; or
B. Sites within five hundred (500) feet of public use areas such as schools, parks, places of assembly, commercial areas, etc.; or
C. Any other sites which in the determination of the Department of Public Works are readily accessible to the public by reason of one or more of the following factors:
   1. Prolonged time of construction;
   2. Close proximity to public or private streets; or
   3. Any other characteristics or conditions making the site particularly attractive to children.

9-1030.3 FENCING
A. These types of projects are attractive to children and can be very dangerous. Therefore, they shall be fenced and posted, or otherwise made inaccessible to persons or animals unless this is deemed unnecessary due to the remoteness of the site or other circumstances.
B. In general, temporary fencing shall be a minimum of five (5) feet high woven wire fabric or approved equal.

9-1030.4 WAIVER
Whenever in the determination of the Department of Public Works a construction site otherwise subject to the requirements of Section 9-1030 is adequately isolated from
public access by existing physical barriers, he may, in writing, waive application of any or all requirements of Section 9-1030.

9-1040 FINAL APPROVAL

Final approval for the satisfactory completion of the roadway improvements or repairs within an existing right-of-way shall not be given until all site work is completed, an as-built plan (if required) is submitted to and approved by the Department, and the applicable bonds are released. All new subdivisions will be inspected by a representative from VDOT as part of the final approval of the project.
## SECTION 9-1100 TRANSPORTATION SYSTEM DETAILS

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Proposed sanitary sewer (size noted on plan) and manhole, direction of flow
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Proposed storm sewer (size noted on plan) and catch basin and manhole
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<td></td>
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This design is based upon a minimum CBR value of 10. Redesign is not permissible for higher values.

(1) When the projected traffic requires a four lane facility, 60% of the projected traffic shall be the basis for determining the applicable class for the pavement structure design.

(2) Subgrade support soils, immediately under the pavement, with C.B.R. values of less than 10 will require an additional 4 inches of subbase or base. In lieu of this, the C.B.R. value may be improved to a minimum of 10 by any other acceptable means.

(3) Sufficient engineer certified C.B.R. tests must be run to determine the soil support value (sw) of the various soils in the subgrade. Details as to the VDOT approved method may be obtained through any VDOT District or Residency Office or its Central Office.

(4) Pavement design in accordance with "A Design Guide for Subdivision Road Pavement in Virginia" by M.K. Vyaswani is acceptable for values less than 10 only.

(5) Each street should have continuity of design throughout. Therefore, multiple and/or variable base design will not be acceptable except in unusual situations.

(6) Designs within a specific traffic category may not be structurally equal because of differences in the materials flexural strengths and practical construction consideration.

(7) Cement Treated Aggregate (CTA) or full depth Bituminous Concrete can be substituted for any aggregate, subgrade stabilization, or select material on a basis of 1 inch of CTA or Bituminous Concrete for 2 inches of the other materials. Neither CTA nor Bituminous Concrete should be placed directly on a resilient soil unless the soil is stabilized with cement or other stabilizing agent.
GENERAL NOTES:

1. This typical section shall be used in subdivisions where the required minimum lot size is less than 10,000
   (cul-de-sac or loop streets).
2. Standard landings required at intersections.
3. Stone material shall extend under the curb and gutter, a minimum of 6” beyond the back of curb. The stone thickness under the curb and gutter
   shall be that in excess of the depth of the gutter face or a minimum of 4”, whichever is greater.
4. Category I applies for a permanent cul-de-sac only.
5. Changes in categories, where permitted, shall occur at intersections only and to the next lower or higher category only.
6. Sidewalks shall be provided in accordance with Section 9-550 of this manual.
7. Pavement section shown is standard requirement. Refer to Section 9-430 for alternative pavement sections.
8. Maximum grade may be increased upon approval by the Director of Public Works when rationale shows grades will not cause intolerable
   maintenance situations and driveway entrances are not negatively impacted.
9. Superelevation not required for roadways with 25 MPH design speed or less. For roadways with speeds of 35 MPH or less, superelevation shall be
   provided in an amount equal to the standard pavement crown. For roadways with greater than 35 MPH design speed, standard TC-4 or TC-5 of
   VDOT standards will apply.
GENERAL NOTES:

(1) This typical section shall be used only for multifamily developments (not mixed use developments).

(2) No parking permitted on travelways.

(3) Stone material shall extend under the curb and gutter, a minimum of 6" beyond the back of curb. The aggregate thickness under the curb and gutter shall be that in excess of the depth of the gutter face or a minimum of 4", whichever is greater.

(4) Changes in categories, where permitted, shall occur at intersections only and to the next lower or higher category only.

(5) Standard landings required at intersections.

(6) Pavement section shown is standard requirement. Refer to Section 9-430 for alternative pavement sections.

(7) Maximum grade may be increased upon approval by the Director when rationale shows such grades will not cause intolerable maintenance situations.

(8) Superelevation not required for roadways with 25 MPH design speed or less. For roadways with design speeds of 35 MPH or less, superelevation shall be provided in an amount equal to the standard pavement crown. For roadways with greater than 35 MPH design speed, standard TC-4 or TC-5 of VDOT standards will apply.
GENERAL NOTES:

(1) This typical section shall be used for all streets within commercial and industrial areas.
(2) Standard landings required at intersections.
(3) Stone material shall extend under the curb and gutter, a minimum of 6" beyond the back of curb. The stone thickness under the curb and gutter shall be that in excess of the depth of the gutter face or a minimum of 4", whichever is greater.
(4) No parking allowed along curb.
(5) Minimum cul-de-sac radius is 50' to face of curb.
(6) Major intersections may require channelization in accordance with VDOT standards. This will be determined during plan review.
(7) Pavement section shown is standard requirement. Refer to Section 9-430 for alternative pavement sections.
(8) Superelevation not required for roadways with 25 MPH design speed or less. For roadways with design speeds of 35 MPH or less, superelevation shall be provided in an amount equal to the standard pavement crown. For roadways with greater than 35 MPH design speed, standard TC-6.11 of VDOT standards will apply.
(9) Minimum radius for industrial streets only.
GENERAL NOTES:

(1) Individual residential lots shall not front on this category.

(2) No parking permitted.

(3) Stone material shall extend under the curb and gutter, a minimum of 6" beyond the back of curb. The stone thickness under the curb and gutter shall be that in excess of the depth of the gutter face or a minimum of 4", whichever is greater.

(4) Additional right-of-way may be required to accommodate channelization (Additional right turn lane) at major intersections.

(5) Sidewalks shall be provided in accordance with Section 9–350 of this manual.

(6) Standard landings required at intersections.

(7) Pavement section shown is standard requirement. Refer to Section 9–430 for alternative pavement sections.

(8) Superelevation not required for roadways with 25 MPH design speed or less. For roadways with design speeds of 30 MPH or less, superelevation shall be provided in an amount equal to the standard pavement crown. For roadways with greater than 35 MPH design speed, standard TC–5.11 of VDOT standards will apply.
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<td>Parallel (one side)</td>
<td>30'</td>
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<td>24'</td>
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NOTES:

1. These dimensions are between parking stalls.
2. Sidewalk locations to be determined during final site plan review.
3. Stone material shall extend under the curb and gutter, a minimum of 6" beyond the back of curb. The aggregate thickness under the curb and gutter shall be that in excess of the depth of the gutter face or a minimum of 4", whichever is greater.
TYPICAL CUL-DE-SAC DESIGN FOR A 36' STREET WITH SIDEWALK, CURB AND GUTTER

1. If the cul-de-sac is determined by the City to be subject to bus traffic or other large vehicle traffic regularly, a larger pavement radius is required.

2. Minimum length of cul-de-sac is one lot width between the intersecting street and the beginning of the circular turn-around.

NOTES:

1. 12' BLK
2. 25' 500'
3. 36'
4. FACE OF CURB
5. REV. 5/96

CITY OF MANASSAS, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

4/19/96

TS - 5.0
NOTES:

1. If the cul-de-sac is determined by the City to be subject to bus traffic or other large vehicle traffic regularly, a larger pavement radius is required.
NOTES:

1. If the cul-de-sac is determined by the City to be subject to bus traffic or other large vehicle traffic regularly, a larger pavement radius is required.

TYPICAL CUL-DE-SAC DESIGN FOR A 44' STREET WITH SIDEWALK, CURB AND GUTTER

CITY OF MANASSAS, VIRGINIA

DEPARTMENT OF PUBLIC WORKS

4/19/96

DIRECTOR

DATE

TS - 5.2

REVISION & DATE

DRAWING NUMBER
TYPICAL CUL-DE-SAC DESIGN FOR A 44’ STREET WITH SIDEWALK, CURB AND GUTTER

NOTES:

1. If the cul-de-sac is determined by the City to be subject to bus traffic or other large vehicle traffic regularly, a larger pavement radius is required.

CITY OF MANASSAS, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

REVISION & DATE
4/19/96

DRAWING NUMBER
TS - 5.3
PRIVATE
ACCESS ROAD FOR TOWNHOUSE, CONDOMINIUM AND APARTMENT STRUCTURE TURNAROUND STANDARDS

CITY OF MANASSAS, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

REVISION & DATE
DRAWING NUMBER
TS - 5.4
NOTE:

For actual distances refer to Section 9-330.2 of this manual.
1. The length of the stacking and transition lane to be built according to current VDOT standards and existing site constraints.

2. Pavement transition normally requires an asphalt overlay from the centerline to eliminate false gutters and to provide a consistent cross slope.

3. Pavement markings to be VDOT Type B. This marking is to be at the expense of the developer.

4. Modified handicap ramps shall be placed at the end of the sidewalk.
THE DEPTH OF CURB MAY BE REDUCED AS MUCH AS THREE INCHES OR INCREASED AS MUCH AS THREE INCHES IN ORDER THAT THE BOTTOM OF THE CURB WILL COINCIDE WITH THE TOP OF A COURSE OF PAVEMENT SUBSTRUCTURE.

THE BOTTOM OF THE CURB AND GUTTER MAY BE CONSTRUCTED PARALLEL TO THE SLOPE OF THE SUBSURFACE COURSES PROVIDED A MINIMUM DEPTH OF 7" IS MAINTAINED.

A. A TWO INCH RADIUS SHALL BE ALLOWED WITH CURB GUTTER.
B. CURB HAVING A RADIUS OF THREE HUNDRED FEET OR LESS (ALONG FACE OF CURB) SHALL BE CONSIDERED RADIAL CURB.
C. THE USE OF REVERSED CURB AND GUTTER (CG-6R) IS NOT ALLOWED IN PUBLIC RIGHT-OF-WAY.
D. SUBGRADE FOR ALL CURB AND GUTTER SHALL BE COMPACTED TO 95% DENSITY AT OPTIMUM MOISTURE TO THE FULL WIDTH OF RIGHT-OF-WAY IN ACCORDANCE WITH AASHTO,T99.

TYPICAL COMBINATION CURB AND GUTTER
Driveway Clearances –
Lot grading plans must provide for adequate vehicular clearance for driveway approach, departure and breakover transitions. Driveway profiles are required where steep grades prevail.

NOTE: Construction methods to comply with the current VDOT specifications.
NOTE: All concrete shall be VDOT Class A-3.
6" minimum cover over pipe or 4" of asphalt.

**UNPAVED ROADSIDE DITCH**

Surface to r/w line. Minimum of 1 1/2" of the same type of surfacing as used on the street and 6" of 21A stone base or 5" of concrete.

**PAVED ROADSIDE DITCH**

A paved ditch is required where soil conditions and runoff velocities will cause erosion.

Concrete or Asphalt to minimum cover over pipe.

\[ C \] of ditch
Varies see V.D.O.T. (GS) Standards
Main roadway pavement

Notes:
1. Concrete pipe or C.C.M.P. shall be used. Indicate class and size on plans.
2. Driveways shall be surfaced from edge of pavement to property line with the same type of surfacing used on the street.
3. All driveway grades shall start back of the shoulder line.
4. In cut sections, sides of driveway shall be graded to a maximum 3:1 slope.
5. Minimum length of culverts shall be 20 feet with flared endsections.
6. Ditch line may be moved back to provide required cover. The transition of the ditch line shall be smooth with a minimum length of 10 feet.

---

**PRIVATE DRIVEWAY ENTRANCE WITH NO CURB AND GUTTER**
PIPE STEM DESIGN FOR CURB AND GUTTER SECTIONS

CITY OF MANASSAS, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

REVISION & DATE
DRAWING NUMBER

TS - 10.3
NOTES:
1. The texture of the detectable warning surface shall be truncated domes conforming to VDOT cg-12 standards. The ramp shall always have a wood float or rougher finish made of 2x2 precast panels. Hanover Architectural Products or approved equal.
2. Ramps are to be located as shown on the plans or as determined by VDOT cg-12 standards.
3. The maximum ramp slope shall not exceed 1:12.1 under any circumstance.
4. This detail shall be used when the sidewalk will not continue around the radius on either side of the entrance.
5. Provide dowels every 12" when the center of the ramp is not poured monolithically with the entire ramp.
6. When no utility strip exists, ramp width shall be narrowed.
7. The ramp shall be flush with the gutter pan.
8. There may be situations where right of way restrictions dictate this ramp configuration. It should not be used where right of way or a pedestrian access route continues around the curve. The bottom of the ramp may be located to the left of the curb return. The above example, however, the ramp width should not be less than 4' at the bottom.
1. The texture of the center of the ramp surface shall be concrete with a broom finish. The detectable warning surface is required, install truncated domes conforming to VDOT CG-12 Standards. The detectable surface shall be made of 2 x 2 precast panels. Hanover Architectural Products, or approved equal.

2. Ramps are to be located as shown on the plans or as determined by VDOT standards. The maximum slope shall not exceed 1:21 under any circumstance.

3. This detail shall be used when the sidewalk will continue around the radius on either side of the entrance.
Curb ramps for city sidewalks (10' width or greater)
Light colored reflective background material
Dark colored 2" letters
and 3/8" border

RESERVED PARKING

Wheel Stop

Minimum

13'

4'

6'

2'

4' if attached to building.
6'-6" if attached to free standing post.

4" stainless steel pipe filled with concrete.

Display conditions
PENALTY, $100-500 Fine
TOW-AWAY ZONE

Dark colored reflective background mat'l
Light colored 1" letters

* Van accessible spaces provide 8' aisle
** Pipe can be substituted with a 4X4 post when located in grassed area.

HANDICAPPED PARKING SIGN AND SPACE

CITY OF MANASSAS, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

9/15/99
9/15/99

Director
Date

FINES
9/15/99
REVISION & DATE
DRAWING NUMBER
TS - 12.0
NOTES:
1.) Access ramp must be located at the center of the adjacent aisle.
2.) For signage information see Standard Detail TS-12.0

STANDARD FOR TWO ADJACENT PARKING SPACES RESERVED FOR THE HANDICAPPED

CITY OF MANASSAS, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

TS - 12.1
(1) Maximum grades: 10% for length up to 100', 5% for length up to 300', 2% for length up to 1500' must conform to maximum street grades allowed. Minor variations may be permitted with approval.

(2) Minimum radius of curvature is 15'.

(3) Minimum horizontal clearance is 12' total.

(4) Minimum vertical clearance is 10'.

(5) Pavement cross slope of 1/4": 1' required. Pavement surface may be crowned in the middle or sloped to on

(6) Superelevation will be used on all curves as specified in the following table:

Location shall be shown on the development plans.

For roads with shared bike lane or trail behind curb and gutter see VDOT Standards.

(9) Minimum one way trail width is 6'.

(10) Trails adjacent to streets shall have a 10' width.

<table>
<thead>
<tr>
<th>Bike Speed</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>80</th>
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<th>100</th>
<th>150</th>
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<tbody>
<tr>
<td>MPH</td>
<td>0.30</td>
<td>0.30</td>
<td>0.27</td>
<td>0.22</td>
<td>0.17</td>
<td>0.13</td>
<td>0.11</td>
<td>0.08</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
<td>0.02</td>
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<td>0.14</td>
<td>0.10</td>
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</tbody>
</table>

(7) For drainage and other specifications not enumerated above, refer to: PLANNING AND DESIGN OF BIKEWAYS, Virginia Dept. of Highways and Transportation, October, 1974.
Sidewalk underdrain is to be used when the sidewalk longitudinal gradient is 3% or more and when the underlying soil has 34% or more passing the No. 200 sieve and has a PI of 13 or less.

(2) Minimum pipe size is 6" in diameter.

(3) Sidewalk underdrain should be tied into the storm sewer system at points about a city block apart. Underdrain runs must not exceed 1,000 feet in length without discharging into the storm drain system or into an open drain. The length of run may be increased up to an additional 1,000 feet if 8" diameter pipe is used in the downstream 1,000 feet section of the run. All pipe to be 6" unless otherwise noted on the plans.

### ALTERNATE UNDERDRAIN PIPE

<table>
<thead>
<tr>
<th>STRENGTH OF PIPE</th>
<th>6&quot; Pipe</th>
<th>8&quot; Pipe</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><em>ST</em> Crushing Strength Lbs/ LF</td>
<td><em>ST</em> Crushing Strength Lbs/ LF</td>
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<tr>
<td>Perforated Helically Corrugated Lock Seam Steel</td>
<td>.052</td>
<td>.084</td>
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<tr>
<td>Porous Wall Concrete</td>
<td>1100</td>
<td>1300</td>
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<tr>
<td>Perforated Concrete</td>
<td>1100</td>
<td>1300</td>
</tr>
<tr>
<td>Perforated Corrugated Aluminum</td>
<td>.048</td>
<td>.060</td>
</tr>
<tr>
<td>Perforated Bituminized Fiber</td>
<td>1400</td>
<td>1700</td>
</tr>
</tbody>
</table>
Sidewalk to be built with VDOT A-3 concrete. The use of calcium will not be permitted.

Aggregate base shall be compacted according to VDOT standards.

NOTES:
Existing pavement
Tack edges with RC-250 or Approved Emulsion
2" SM-9.5 Bituminous Concrete Surface
6" (Min.) BM-25 Bituminous Concrete Base
Cut to neat line

Undisturbed Earth

Compacted subbase,
VDOT 21-A or
Approved Equal
(Min. CBR-30)
Full Depth Backfill,
in Specified Layers
at a Minimum of
95% Density Compaction
(Max. 1’ Lifts)

Trench Width

NOTES:
1. When the distance from the edge of existing pavement to the edge of the trench is
   3’ less then the additional pavement shall be removed and replaced back to the edge.
2. Thickness of BM-25 base may be reduced to 3” when patch is being made in pavements
   with low traffic volumes, and approved by the Engineer.
3. When widening or patching a street with asphalt, a neat, clean joint of at least
   one (1) inch in depth between old and new pavement shall be provided for topping.
4. For trench and bedding details, see Drawings W - 1.0, SS - 4.0 and SS - 4.1.
5. Use of alternate backfill (select material) will be reviewed by the inspector in the field.
   In all cases a minimum (1) foot lift of No. 21A aggregate will be used.
6. Mill & overlay 25’ on each side of the outer edge of each utility.
   Trench the full lane width of the effected area of road.

PAVEMENT RESTORATION FOR UTILITY CUTS
Extruded 0.08 aluminum alloy
0.1 inch thick treated with "Alodine 1200" coating
Enclosed lens green sheet reflective material

Pyramidal Cut
4" x 4"
24" stop or 30" yield sign location
2 3/8" O.D. galvanized steel post
Treated wood post
100 lbs. of the dry ingredients as in VDOT class A3 concrete dry mixed with backfill material during compaction

Main Center
Mutcd series "C" white reflective letters
2 3/8" O.D. galvanized steel post

36" x 12"

STOP
24" x 24"

YIELD
30" x 30" x 30"

VDOT class A3 concrete

Anchor rod
Sign panel
Attachment detail

Street type A B
Three lanes or less 6" 4"
Four or more lanes 9" 6"

Galvanized 3/8" bolt
Nylon washer
Galvanized washer and nut

TYPICAL STREET SIGNS AND INSTALLATION

CITY OF MANASSAS, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

REVISION & DATE
4/19/96
DIRECTOR
DATE
TS - 16.0
Sign to be mounted with aluminum alloy brackets which clamp to sign 1 1/2" from top and bottom of sign.

Existing street name sign (for pipestem driveway, address range will replace existing street name sign.)

Enclosed lens green sheet reflective material

Mutcd series "C", white 2" reflective letters top and bottom margins spaced 1-1/2"

Flat, aluminum alloy blank, 0.80" thick, ASTM 209B-6061-T6, deburred and treated "alodine 1200" coating.

PRIVATE ROAD

NOT PUBLIC MAINTAINED

3/4" radius, die cut, all corners bolted to existing street name sign post.

Existing street name sign post.

PRIVATE ROAD SIGN INSTALLATION

CITY OF MANASSAS, VIRGINIA

DEPARTMENT OF PUBLIC WORKS

TS - 16.1
NOTES:

1. On curb and gutter section streets, face of box to be in line with back edge of curb line.

2. Mail box height shall be:
   a.) On ditch section 35" to 42", from shoulder grade to bottom of box.
   b.) On curb and gutter section, 36" from top of curb to bottom of box.

MAIL BOX LOCATION
GENERAL NOTES

(1) Special delineators are made from aluminum alloy, not less than 0.080 inches thick conforming to ASTM B209, alloy 6061-T6 or 5052-H38.

(2) Delineators extend one inch above the top of the post.

(3) Delineators are reflectorized, and in all cases, the color shall conform to the color of the edgelines, alternating with a black stripe.

(4) The stripes shall slope down toward the center of roadway.

(5) Delineators are mounted on U-type posts fabricated from rolled-rail steel 1.33 lb./lf. minimum or U-type ASTM B221 6063-T6 aluminum alloy 0.78 lb./lf.

(6) The bottom of the delineator panel is 12 inches above the pavement edge elevation.
GENERAL NOTES

(1) Standard ED–1 delineators consist of reflectorised sheeting, cut to a 3 inch by 8 inch vertical rectangle, mounted on a backing of aluminum alloy, not less than 0.063 inches thick conforming to ASTM B209, alloy 6061–T6 or 5052–H38. The color of the reflective sheeting shall, in all cases, conform to the color of the edgelines.

(2) The reflectors are attached to wood posts with aluminum nails or screws produced from alloy 2024–T4 or 6061–T6.

(3) The top of the posts are painted black, with an optional black band at the bottom. The remainder is painted white. The black paint is to be number 31, and the white paint is to be number 11.

(4) Posts are treated with a water–borne preservative in accordance with Section 246 of the Road and Bridge Specifications.

(5) The top of the posts may have a flat, shed, or pyramidal cut; however, they shall be uniform throughout a project.
NOTE:

1.) Provide carsonite roadmarker or approved equal.
2.) Color - white with (3") reflectorized marking on top.
3.) Width 3 3/4" length 62,66,72,78 inches respectively.
4.) Locate as specified in the development plans.
NOTES:

1. Lumber dimensions are nominal sizes, 2" x 10" boards, 4" x 4" posts.
2. Planks to be fastened to the posts using 25-3/8" x 6 1/2" carriage bolts to be placed no closer than 2" from the edge of the planks.
3. Planks shall be decaled in alternating stripes with reflectorized red and white decals. The reflectorized area shall be in conformance with current VDOT Standards.
4. Jersey barriers with reflectorized decals are an equivalent equal.
Fixture type: TS-20.2
Lumens: 23,000
Bracket length: 6'-20'

Note:
This is an illustration for typical lighting only.
Note:
The developer must provide the light which most closely resembles the applicable fixture.

STANDARD PARKING LOT FIXTURE
Bracket length
(6' to 20' in 2' increments)

22 3/8" - 29 5/8"

2' minimum

Wood, aluminum, or other acceptable pole

Set back from lighting geometrics
(TS - 20.1)

Sidewalk

Pavement

Note:
The developer must provide the light which most closely resembles the applicable fixture.
Set back from lighting geometrics (TS-20.1)

Note:
The developer must provide the light which most closely resembles the applicable fixture.
Note:

The developer must provide the light which most closely resembles the applicable fixture.
Note:
To be located as shown on approved plan.

PHOTOELECTRIC YARD LIGHTS
CROSSWALK DETAILS
SOLID CONCRETE PAVING UNITS

LIMITS OF PAVEMENT

STANDARD CG-12
6" 2'-0"
(TYPICAL)

1:20

STREET CROSS SLOPE

GEOSYNTHETIC DRAINAGE
FABRIC 8"x8"

3 1/8" SOLID CONC. PAVING UNITS
1" FINE AGGREGATE GRADING A
8" HYDRAULIC CEMENT
CONCRETE CLASS A3

4" (MINIMUM) AGGREGATE
BASE MATERIAL
TYPE 1, SIZE 21 B

2" DIA. WEEP HOLE FILLED
WITH FINE AGGREGATE

#6 DEFORMED BAR
@ 6" C-C

#4 DEFORMED BAR
@ 12" C-C

SECTION A-A

NOTES:

(1) Color of paving units shall be terra cotta color from Betco-Bal-Con Bmf-8cm Holland I.

(2) Existing pavement to be removed will be removed by saw cutting and excavating as necessary for the placement of the base material, and will be replaced by new material as directed by the engineer.

(3) Joints (except for expansion joints) between paving units shall be hand tight, sand swept, and a maximum of 1/4" wide for concrete and for brick.

(4) Expansion joints shall be parallel to the street centerline and located along the edge of a traffic lane near the street centerline when possible.

(5) Construction joints shall follow the edge of traffic lanes.

(6) Paving work will be plum and true to line and grade and shall be installed to properly coincide with adjacent work and elevations. The cutting of the pavers shall be clean with no apparent spalls or breaks.

(7) Construction joints in the hydraulic cement concrete shall be formed around all appurtenances such as manholes and water meters that extend into or through the crosswalk. These joints shall be filled with 1/2" joint filler and sealed with silicone joint sealant according to standard PR-2.

(8) Pattern for paving units shall be a herringbone pattern with 45 degree angles to the concrete edge restraint or longitudinal edge unless otherwise noted on the plans.
PAVER DETAILS

SOLID CONCRETE OR BRICK PAVING UNITS WITH TRUNCATED DOMES
4" HYDRAULIC CEMENT CONCRETE CLASS A3
4" (MINIMUM) AGGREGATE BASE MATERIAL TYPE 1, SIZE 21 B

GUTTER

12:1 MAX.
2'

EXPANSION JOINT DETAILS
LOCATED IN CROSSWALK 30' OR GREATER IN LENGTH

SEAL JOINT WITH SILICONE JOINT SEALANT ACCORDING TO STANDARD PR-2
CONCRETE PAVING UNITS FINE AGGREGATE GRADING A
HYDRAULIC CEMENT CONCRETE REINFORCING BAR
1/2" JOINT FILLER
STOP REINFORCING BAR 2" OFF JOINT FILLER

GEOSYNTHETIC DRAINAGE FABRIC 12" WIDE
EXPANSION DOWEL CAP (SEE STANDARD PR-2)
COAT MINIMUM OF 1/2 BAR (CAPPED END) WITH LUBRICANT TO PREVENT BOND WITH CONCRETE

*Steel edging may be deleted where sidewalk is directly adjacent to pavement curb, etc.: 1/2" joint filler and silicone sealant required when adjacent to building, wall or as directed by the engineer.

**Optional treatment may consist of a minimum thickness of 8" of asphalt concrete with:

1. 6" asphalt concrete base course, type BM-25.0, placed in two lifts.
2. 2" asphalt concrete intermediate course, type IM-19.00.

For this option adequate drainage and total thickness to support truck traffic must be approved by the engineer.
CROSSWALK DETAILS
SOLID CONCRETE PAVING UNITS

GEOSYNTHETIC DRAINAGE
FABRIC 8"x8"

2" DIA. WEEP HOLE FILLED
WITH FINE AGGREGATE

LIMITS OF PAVEMENT

12 1/8"

1/2" R

3 1/8" SOLID CONC. PAVING UNITS
1" FINE AGGREGATE GRADING A

** 8" HYDRAULIC CEMENT
CONCRETE CLASS A3

4" (MINIMUM) AGGREGATE
BASE MATERIAL
TYPE 1, SIZE 21 B

#6 DEFORMED BAR
@ 6" C-C

#4 DEFORMED BAR
@ 12" C-C

SECTION B-B

EXTEND LIMITS OF EXCAVATION
2'-0" FOR RETROFIT

SIDEWALK DETAILS
SOLID CONCRETE OR BRICK PAVING UNITS

GEOSYNTHETIC DRAINAGE
FABRIC 8"x8"

2 1/4" SOLID CONC. OR
OR BRICK PAVING UNITS
1" FINE AGGREGATE GRADING A
4" HYDRAULIC CEMENT
CONCRETE CLASS A3
4" (MINIMUM) AGGREGATE
BASE MATERIAL
TYPE 1, SIZE 21 B

6"x 1/4" STEEL EDGING
WITH 1'-6" STEEL STAKES
3'-0" ON CENTER

2" DIA. WEEP HOLE FILLED
WITH FINE AGGREGATE

STANDARD CG-6

WIDTH SHOWN ON PLANS

SECTION C-C
NOTES:

(1) Sidewalk to be built with VDOT A-3 concrete. The use of calcium will not be permitted.

(2) Aggregate base shall be compacted according to VDOT standards.

(3) 8.0 ft. walks will be used in the old town area, city center transitional districts and other areas with high pedestrian volumes.