### 5. STANDARDS OF STREET DESIGN - Notes:

Use of Hilly Terrain criteria is NOT permitted w/o prior approval of the Town Engineer.

<table>
<thead>
<tr>
<th>Terrain Classification</th>
<th>0% - 5%</th>
<th>5% - 15%</th>
<th>15% - 30%</th>
<th>&gt; 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Grade</td>
<td>12%</td>
<td>15%</td>
<td>18%</td>
<td>20%</td>
</tr>
<tr>
<td>Design Speed (mph)</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>Min. Radius (ft)</td>
<td>150</td>
<td>90</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>Private Street</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Min. Tangent between Hr. Reverse Curve (ft)</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>K Value (Crib Bag)</td>
<td>20/20</td>
<td>15/25</td>
<td>25/30</td>
<td>30/35</td>
</tr>
<tr>
<td>K Value (Stop Condition)</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

Notes:
- **K** = Rate of Vertical Curve for Min. Sight Distance. Provisions of adequate stopping sight distance may require use of larger *K* values than those listed above. The Town Code, reserves the right to prescribe more stringent sight distance standards, and/or means to achieve adequate sight distance than those listed above.

### INTERSECTIONS:

- a. Max. Street Grade at Intersections a/b

### THROUGH MOVEMENT Condition:
- Vert. alignment is 5% max. through the crosswalk areas.
- Where feasible, it is recommended that the vert. alignment for a through movement street also be set at 2% max. through the crosswalk areas (marked or unmarked).
- Minimum Angle of Intersection is 75 deg.

### PROCESSING:
- e. Min. Intersection Separation.

<table>
<thead>
<tr>
<th>Minimum Intersection Distance</th>
<th>Along collector streets 200'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collecror Only</td>
<td>05. Stone shall be primed if paving is not complete w/in 7 days following base stone approval.</td>
</tr>
<tr>
<td>R/Wide</td>
<td>04. When placing asphalt against exist. surfaces, a straight edge shall be used to prevent 'humping' at that location.</td>
</tr>
<tr>
<td>R/Wide</td>
<td>03. Paper joints shall be used to seal the ends of an asphalt pour so that future extensions can be made w/o causing rough joints.</td>
</tr>
<tr>
<td>R/Narrow</td>
<td>02. All asphalt cuts shall be made w/ a saw when preparing street surfaces for patching or widening strips.</td>
</tr>
<tr>
<td>R/Wide</td>
<td>01. Along collector streets 200'</td>
</tr>
</tbody>
</table>

### Notes:
- All work & materials shall conform to the latest edition of SCDOT Std. Specs. for Roads & Structures unless otherwise specified in this manual.
- All asphalt cuts shall be made w/ a saw when preparing street surfaces for patching or widening strips.
- Paper joints shall be used to seal the ends of an asphalt pour so that future extensions can be made w/o causing rough joints.
- When placing asphalt against exist. surfaces, a straight edge shall be used to prevent ‘humping’ at that location.
- Stone shall be primed if paving is not complete w/in 7 days following base stone approval.
- Surfaces shall be tack when asphalt is being placed over exist. asphalt streets or adjoining conc., storm drain, & sanitary sewer structures.
- In rolling & hilly areas, sweeping of the stone base and/or application of a tack coat may be required near intersections. These requirements will be established by the Town Inspector based on field conditions.
- All conc. used for streets, C/G & sidewalk & drainage structures, etc. shall have a min. compressive strength of 3600 PSI at 28 days. This requirement shall be provided regardless of any lesser compressive strength specified in the SCDOT Std. Specs for Roads & Structures. The contractor shall prepare conc. test cylinders in accordance w/ related sections of the SCDOT Specs for Roads & Structures at all locations where the contractor has placed conc. The concrete test cylinders shall be 8' feet behind the curb for C&G sections.
- Land Development Standards Manual (LDSM) and the SCDOT Subdivision Roads Specifications C309, Type I, applied at a uniform rate at 1 gal. to 400 sq. ft. w/in 24 hrs. of placing the conc.
- All conc. shall be cured w/ 100% Resin Base, white pigmented curing compound which meets ASTM C930, Type I, applied at a uniform rate at 1 gal. to 400 sq. ft. w/in 24 hrs. of placing the conc.
- All conc. shall be placed and cured w/ a 100% Resin Base, white pigmented curing compound which meets ASTM C930, Type I, applied at a uniform rate at 1 gal. to 400 sq. ft. w/in 24 hrs. of placing the conc.
- The fill around all pipe shall be placed in layers not to exceed 6” and each layer shall be tamped under the tamping blows or proof rolling.
- All C&G shall be backfilled w/ soil approved by the Inspector w/in 48 hrs. after construction to prevent settlement damage to all adjacent properties & streams in accordance w/ the appropriate Town of Blacksburg Erosion & Sedimentation Control Ordinance.
- Along collector streets 200’ along thoroughfares To be determined by SCDOT Intersection offsets/separation from a thoroughfare, at signalized intersections, or at intersections that may become signalized in the future may need to be > these minimums and will be determined SCDOT on a case by case basis.
- Design criteria for arterial streets shall be established jointly by the Town Engineer and the Director of the SCDOT on a case by case basis using the latest edition of the American Association of State Highway and Transportation Officials (AASHHTO) A Policy on Geometric Design of Highway and Streets and/or SCDOT Roadway Design Manual.
- Intersection corner – A min. 30’ x 35’ sight triangle (measured along R/W lines) shall be provided at each intersection corner. An additional 10’ x 70’ sight triangle shall be provided at intersections connecting to SCDOT maintained roadways. Other sight distance requirements may be required by the SCDOT or the Town. Refer to the SCDOT Subdivision Roads Min. Construction Manual for development criteria for sites located within the Town Extraterritorial Jurisdiction (ETJ) with these areas governed by Blacksburg Land Development Standards Manual (LDSM) and the SCDOT Subdivision Roads Min. Construction Standards Manual. The more restrictive standard shall apply.

### GRADING:

- 1. Proposed street R/W shall be graded to their full width for ditch type streets and a min. of 8’ feet behind the curb for C&G sections.
- 2. Fill embankments shall be formed of suitable material placed in successive layers not to exceed more than 8’ in depth for the full width of the cross section, including the width of the slope area. No stumps, trees, brush, rubbish or other unsuitable materials or substances shall be placed in the embankment.
GENERAL NOTES

11. All storm drainage structures shall be pointed up & smoothed to an adequately graded base, except where excessive natural grades make this requirement impractical. In such cases, the Town Engineer may authorize a suitable grade.

12. All storm drainage piping shall be placed in a straight alignment at uniform grade. No changes in alignment shall be allowed except at catch basins, manholes, or other junctions that provide appropriate clean out access. The max. length between access points is 300 linear feet.

i. A pipe collar meeting SCDDOT stds. or standard joint structure is required where pipes from 2 manufacturers or materials are tied together. Pipes should be on the same grade & alignment and have the same internal diameter, where a pipe collar is specified.

13. All grades, grates, rings, covers, etc., must conform to the std. set forth in this manual. Supply covers w/ a min. of 2 and a max. of six 1’/2” diam. vent holes.

14. All graded creek banks & slopes shall be at a max. of 2:1 and not to exceed 10’ w/ terracing or the slopes shall be designed by a Prof. Geotechnical Engineer and approved by the City Town Engineer on a case by case basis.

15. PIPE VIDEO STANDARDS: Installation of pipes/culverts consisting of the following approved materials (concrete, HDPE, & CAAP) used for the purpose of conveying stormwater runoff in and out of public R/W, that are eligible for maintenance by the Town, is subject to the following:

A. Five inch (5”) diameter or larger storm drain video documentation shall be provided to the applicable review agency and the agency has provided a written response noting acceptance. All CCTV video will be performed by a current Nat. Assoc. of Sewer Service Co. Pipeline assessment & Certification Program (NASSCO-PACP) certified contractor and in compliance with NASSCO-PACP stds. All videos, reports, and related methods will meet the most recent published version of Town Stds. The Town expects storm drainage systems to be clean, have good alignment, tight joints, no broken or cracked pipes, and built per the approved plans prior to submission of CCTV video documentation for drainage systems that do not meet the above may be rejected at the discretion of the Town Engineer.

b. The storm drainage system owner (developer, builder, property owner, etc.) will provide at their cost the following prior to final inspection & Town acceptance: i. Plat, map or dwg. identifying each pipe segment being presented for acceptance w/ all inlet nodes labeled and corresponding to the accompanying video such that it is clear as to the pipe/culvert being accepted. For ex: start of video is at inlet CB1 to JB2 as shown on accompanying deg video (map segments should match the approved deg).
   ii. A CCTV video performed by a NASSCO-PACP certified contractor for each pipe/culvert segment being considered for acceptance.
   iii. A digital copy of report for each pipe/culvert segment that certifies the condition of pipe as installed is in compliance w/ the most recent version of NASSCO-PACP methodology & std. All defects are to be coded & reported per NASSCO-PACP certification guidelines to the City for review. after all repairs have been made. Any repair or treatment to defects (prior to submittal of video) or as observed by the Town agency) will be corrected in compliance w/ Industry Std. approved methods. Ex: by providing the 3m Conc. Pipe Assoc. acceptable methods & applicable material treatment standards w/ conc. pipe deficiency (broken conc. pipe will be repaired structurally by an approved method.)
B. BACKFILL

1. Provide and install backfill per SC DOT. Layers shall not exceed 6" loose and each layer shall be compacted thoroughly.

2. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means and the material shall have no tendency to flow or behave in a plastic manner under the tamping blows or proof rolling.

3. Materials deemed by the Engineer as unsuitable for backfill purposes shall be removed and replaced with select backfill material.

4. Backfilling of trenches shall be accomplished immediately after the pipe is laid. Do not operate heavy equipment over any pipe culvert until the pipe culvert has been properly backfilled, covered and compacted with at least 3' approved material.

5. Compaction requirements shall be attained using mechanical compaction methods. Each layer of backfill shall be placed loose and thoroughly compacted in place.

6. Under no circumstances shall water be permitted to rise in un-backfilled trenches after the pipe has been placed.

B. REINF. CONC. PIPE (RCP) & CULVERTS

1. Conc. pipe used with the street R/W shall be a min. of Class III Rein. Conc. Pipe. Installation of Class IV or higher conc. pipe shall be identified on the As-Built Plan and the ‘The Inspector’ shall be given documentation & notification of this info. prior to construction. All conc. shall be at least 3600 psi.

2. Joints shall consist of one of the following and should be specified by the Engineer for each respective project as applicable:
   a. Preformed joint sealant, which conforms to ASTM C 990 Section 6.2 “Butyl Rubber Sealant” & SC DOT 1032-6.2.
   b. Utilizing preformed joint sealant shall be combined in w/ Type 2 filtration geotextile wrap around all RCP pipe joints.
   c. Rubber (elastomeric) gasket seals in accordance w/ ASTM C 443 which are in compliance w/ ASTM C 1616, Class C (unless otherwise required to exceed this specs., as specified by the Engineer). Joints shall be produced w/ single offset spigot or w/ a confined O-ring grooves.
   d. Rubber gasket installation shall be per manufacturer’s recommendations. Where rubber gaskets meeting this section are specified, no filtration geotextile wrap is required around the joints for RCP.
   e. Fill lift hole w/ a manufactured soil lift fill hole plug or as approved by the manufacturer. Provide the manufacturer’s approved method for filling lift holes upon request by the Town.
   f. Max. pipe slope for rein. conc. pipe is 10%. Provide a special design by a structural Engineer for rein. conc. pipe slopes exceeding 10%.

D. CORRUGATED ALUMINIZED METAL PIPE (CAMP) & CORRUGATED ALUMINUM ALLOY PIPE (CAAP)

1. Testing requirements & are appropriate for the selected CAMP or CAAP.

2. PIPE (CAAP) - Continued

   a. Perform physical, chemical & resistivity tests on the soil and water at 2 or more locations along the proposed culvert alignment. Perform additional tests at the request of the pipe manufacturer.
   b. Conduct routine tests on backfill material prior to installation.
   c. Submit manufacturer specs showing that the physically collected soil- and stream-side ph & resistivity values are appropriate for the selected CAMP or CAAP.
   d. All test & sampling data shall be maintained by the Town.
   e. All water samples shall have a pH within the range of 5.0 < pH < 9.0 and resistivity of > 1500 ohm-cm.

3. Hydraulic computation:
   a. CAMP & CAAP can be used where velocities are < 5 per second in the 2-yr storm events.
   b. Where velocities are > 5 per second in the 2-yr event, field pave a 4” thick reinforced conc. invert, assuming the height of the culvert to be > 0.5’ above the flow height of the 2-yr storm event, whichever is more restrictive. This requirement applies to both buried & non-buried culvert events. Field paving should not be completed until the pipe is backfilled.
   c. Where bottomless CAMP & CAAP culverts are proposed, the walls of the culvert should be protected from abrasion by reinst. conc. up to either 2/3 the height of the culvert or to 0.5' above the flow height of the 2-yr storm event, whichever is more restrictive.
   d. Metal end sections, pipe tees, elbows & reducers are not allowed.

E. HIGH DENSITY POLYETHYLENE PIPE (HDPE)

1. The Product used shall be corrugated exterior/smooth interior pipe (Type 5), conforming to the requirements of AAHSO Spec M204 (latest edition) for Corrugated Polyethylene Pipe.

2. Bell & spigot joints shall be required on all pipes inside the R/W. Bell shall cover at least 2 full corrugations on each section of pipe. The bell & spigot joint shall have an O-ring gasket meeting ASTM F477 w/ the gasket factory installed, placed on the spigot end of the pipe. Pipe joints shall consist of one of the following and should be specified by the Engineer for each respective project as applicable:
   a. Preformed joint sealant, which conforms to ASTM C 990 Section 6.2 “Butyl Rubber Sealant” & SC DOT 1032-6.2.
   b. Utilizing preformed joint sealant shall be combined in w/ Type 2 filtration geotextile wrap around all RCP pipe joints.
   c. Joints shall be produced w/ single offset spigot or w/ a confined O-ring grooves.
   d. Rubber gasket installation shall be per manufacturer’s recommendations. Where rubber gaskets meeting this section are specified, no filtration geotextile wrap is required around the joints for RCP.
   e. Fill lift hole w/ a manufactured soil lift fill hole plug or as approved by the manufacturer. Provide the manufacturer’s approved method for filling lift holes upon request by the Town.
   f. Max. pipe slope for rein. conc. pipe is 10%. Provide a special design by a structural Engineer for rein. conc. pipe slopes exceeding 10%.

F. STANDARDS FOR DESIGN


2. Adequate storm drainage shall be provided throughout the development by means of storm drainage pipes or properly graded channels. All pipes shall be of sufficient size & capacity, as approved by the Town Engineer, to carry all storm water in its drainage area.

3. In accordance w/ the town of the City Zoning Ordinance, the Town Engineer shall review the preliminary plan & final application for a F DEEDS Development Permit shall be submitted to The Town Eng. in accordance w the requirements set forth in the Town/City Floodway Regulations.

4. All appr. information on any structures or specifics used win the plans in reference to the most current copy of Blacksburg Land Development Std. Manual.

G. SUBDIVISIONS - PRELIM. PLAN

1. The prelim. plan must include, at a min., the info. described in Blacksburg’s Subdivision Development Stds. Manual.

2. Storm Drainage Easements shall be provided for all storm drainage pipe and shown on site plans, construction plans & plats w/ widths specified below. The following note shall be placed on all grading plans & plats: “The purpose of the storm drainage easement (IDE) is to provide storm water conveyance & drainage, are not permitted in the easement area. Any other objects which impede storm water flow or system maintenance are also prohibited.”

3. Overlapping of storm drainage easements shall be approved by the Town Engineer.

H. BOND POLICY – SUBDIVISION IMPROVEMENTS

1. Release of the final subdivision plat will not occur until the improvements required in the area of the final plat are constructed & a final inspection has been performed & found to be in conformance w/ the plans approved by Blacksburg Planning Commission, or a security has been posted w/ the Land Development Bond Coordinator of the applicable dept. & all required documents are received in their entirety.

2. The security shall be posted and remain in force until the construction is complete and found to be in conformance w/ the plans approved by Blacksburg’s Planning Commission.

3. The Applicant shall notify the Town Commissioner or his assigns that construction is complete according to the subdivision ordinance and Blacksburg Land Development Std. Manual before any security will be released. A final inspection will be made to check completeness of the project upon notification.

4. One type of security may be replaced by another type of security in certain situations. The amount of the replacement security shall be based on the Town’s Engineer Estimate of the work remaining. If the estimate of work results in a lower amount, the replacement security will be treated as a reduction. Certain situations will require an increase in a security and in such cases the replacement security shall be required to equal the higher