

## Florida Greenbook Drainage Chapter Considerations

**Greenbook** – Provides generic considerations for Drainage and does not include references to the Departments Optional Pipe requirements.

**Drainage Manual** – Provides return period/risk based criteria for design, as well as technical and documentation standards.

FDOT requested other state DOTs advise if they provided separate design criteria for off-system roadways. Of the responses received, no other state DOT provides separate design criteria for off-system roads.

**The following is the general note in Section 1 of the Drainage Manual.**

**GENERAL NOTE**

**Chapter 334, F.S.**, known as the **Florida Transportation Code**, establishes the responsibilities of the State, counties, and municipalities for the planning and development of the transportation systems serving the people of Florida, with the objective of assuring development of an integrated, balanced statewide system. The Code's purpose is to protect the safety and general welfare of the people of the State and to preserve and improve all transportation facilities in Florida. Under **Section 334.044, F.S.**, the **Code** sets forth the powers and duties of the Department of Transportation to develop and adopt uniform minimum standards and criteria for the design, construction, maintenance, and operation of public roads.

The standards in this **Manual** provide a basis for uniform design practice for typical roadway drainage design situations. Realizing that drainage design is primarily a matter of sound application of good engineering judgment, it is impossible to give precise rules which would apply to all possible situations that may arise. Situations will exist where these standards will not apply. THE INAPPROPRIATE USE OF AND ADHERENCE TO THESE STANDARDS DOES NOT EXEMPT THE ENGINEER FROM THE PROFESSIONAL RESPONSIBILITY OF DEVELOPING AN APPROPRIATE DESIGN. The engineer is responsible for identifying those standards that do not apply to a particular design, and to obtain approval to deviate from those standards. Deviation from a standard in this **Manual** must be approved the District Drainage Engineer.

Greenbook	FDOT Drainage Manual	AASHTO
Chapter 3 Geometric Design Page 3-1 <i>Every effort should be made to obtain the best possible...and proper drainage consistent with the terrain...</i>	The Drainage Manual provides a basis for uniform design practice which aides in the provision of the best possible drainage system.	States same basic principle of proper drainage for the terrain.
Chapter 3 Geometric Design Page 3-11 Consider surface drainage in superelevation sections.	Curb inlets shall also be placed at the critical section prior to the level section in superelevation transitions, to avoid concentrated flows across the pavement.	Ch 9 AASHTO Highway Drainage Guidelines

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<p>Chapter 3 Geometric Design Page 3-17 <i>Shoulders should be provided on all streets and highways incorporating open drainage.</i></p>	<p>Open channels shall be designed to convey, without damage, and to confine within the ditch, stormwater flow with standard design frequencies as follows:</p> <table border="1" data-bbox="680 191 1436 396"> <thead> <tr> <th>TYPE CHANNEL</th> <th>FREQUENCY</th> </tr> </thead> <tbody> <tr> <td>Roadside, Median, and Interceptor ditches or swales</td> <td>10-year</td> </tr> <tr> <td>Outfall ditches</td> <td>25-year</td> </tr> <tr> <td>Canals</td> <td>25-year</td> </tr> <tr> <td>Temporary roadside and median ditches or swales</td> <td>2-year</td> </tr> <tr> <td>Temporary Outfalls and Canals</td> <td>5-year</td> </tr> </tbody> </table> <p>Site-specific factors may warrant the use of an atypical design frequency</p>	TYPE CHANNEL	FREQUENCY	Roadside, Median, and Interceptor ditches or swales	10-year	Outfall ditches	25-year	Canals	25-year	Temporary roadside and median ditches or swales	2-year	Temporary Outfalls and Canals	5-year	<p>Ch 4 &amp; 6 AASHTO Highway Drainage guidelines</p>
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<p>Chapter 3 Geometric Design Page 3-23 <i>The design of the roadway must also provide for adequate drainage of the roadway. Drainage swales within the clear zone should be gently rounded and free of protruding drainage discontinuities. Where large volumes of water must be carried, the approach should be to provide wide, rather than deep drainage channels. Side slopes and drainage swales that lie within the clear zone should be free of protruding drainage structures.</i></p>	<p>Criteria for clear zone and side slopes are provided in Greenbook.</p> <p><i>Inlets, and other hydraulic structures shall be selected/designed to satisfy hydraulic capacity, structural capacity, safety (vehicular, pedestrian, cyclist) and durability requirements.</i></p>	<p>Ch 9 AASHTO Highway Drainage Guidelines</p>												
<p>Chapter 3 Geometric Design Page 3-25 <i>Curbs may be used to provide drainage control and improve the delineation of the roadway.</i></p>	<p>Standard design storm frequencies for the design of storm drain systems are as follows:</p> <table border="1" data-bbox="680 992 1556 1333"> <thead> <tr> <th>TYPE STORM DRAIN</th> <th>FREQUENCY</th> </tr> </thead> <tbody> <tr> <td>General design</td> <td>3-year</td> </tr> <tr> <td>General design work that involves replacement of a roadside ditch with a pipe system by extending side drain pipes.</td> <td>10-year</td> </tr> <tr> <td>General design on work to Interstate Facilities</td> <td>10-year</td> </tr> <tr> <td>Interstate Facilities for sag vertical curves which have no outlet other than a storm drain system, and for the outlet of systems requiring pumping stations</td> <td>50-year</td> </tr> </tbody> </table> <p>Site-specific factors may warrant the use of an atypical design frequency</p>	TYPE STORM DRAIN	FREQUENCY	General design	3-year	General design work that involves replacement of a roadside ditch with a pipe system by extending side drain pipes.	10-year	General design on work to Interstate Facilities	10-year	Interstate Facilities for sag vertical curves which have no outlet other than a storm drain system, and for the outlet of systems requiring pumping stations	50-year	<p>Ch 9 AASHTO Highway Drainage Guidelines</p>		
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<p>Chapter 3 Page 3-55 <i>Roadway conditions should be favorable for bicycling. This includes safe drainage grates...</i></p>	<p>Inlet type, location, and spacing shall consider pedestrian and bicycle safety. (Page 18)</p> <p><i>Inlets, and other hydraulic structures shall be selected/designed to satisfy hydraulic capacity, structural capacity, safety (vehicular, pedestrian, cyclist) and durability requirements.</i></p>	<p>Ch 9 AASHTO Highway Drainage Guidelines</p>										
<p>Chapter 4 Roadside Design Page 4-5 <i>Drainage swales may be protected from hazardous scouring (alteration of safe ditch contour) by the appropriate vegetation. Grass, vines, or other plants can be beneficial in stabilizing embankments to prevent erosion of material onto adjacent roadways. The appropriate use of grass or shrubbery can also aid in retarding runoff in the vicinity of the roadway, thus benefiting the overall drainage pattern</i></p>	<p>The design of open channels shall consider the need for channel linings. Standard lining types are shown in Standard Indexes 199 and 281. Maximum velocities for the various forms of channel lining are given in Tables 2.3 and 2.4. When design flow velocities do not exceed the maximum permissible for bare earth as given in Table 2.3, standard treatment of ditches consists of grassing and mulching. For higher design velocities, sodding, ditch paving, or other form of lining consistent with Tables 2.3 and 2.4 shall be provided.</p>	<p>CH 3 AASHTO Highway Drainage Guidelines</p>										
<p>Chapter 4 Roadside Design Page 4-6 <i>Proper drainage of the pavement, shoulders, median, and roadsides is important for maintaining a safe street or highway. Techniques utilized for providing drainage should result in safe vehicle operation on or off the roadway.</i></p>	<p>Pipe material selection shall be in accordance with Chapter 6 of this manual.</p> <table border="1" data-bbox="680 748 1558 1084"> <thead> <tr> <th data-bbox="680 748 1398 779">TYPE STORM DRAIN</th> <th data-bbox="1398 748 1558 779">FREQUENCY</th> </tr> </thead> <tbody> <tr> <td data-bbox="680 779 1398 812">General design</td> <td data-bbox="1398 779 1558 812">3-year</td> </tr> <tr> <td data-bbox="680 812 1398 933">General design work that involves replacement of a roadside ditch with a pipe system by extending side drain pipes.</td> <td data-bbox="1398 812 1558 933">10-year</td> </tr> <tr> <td data-bbox="680 933 1398 966">General design on work to Interstate Facilities</td> <td data-bbox="1398 933 1558 966">10-year</td> </tr> <tr> <td data-bbox="680 966 1398 1084">Interstate Facilities for sag vertical curves which have no outlet other than a storm drain system, and for the outlet of systems requiring pumping stations</td> <td data-bbox="1398 966 1558 1084">50-year</td> </tr> </tbody> </table> <p>Site-specific factors may warrant the use of an atypical design frequency</p>	TYPE STORM DRAIN	FREQUENCY	General design	3-year	General design work that involves replacement of a roadside ditch with a pipe system by extending side drain pipes.	10-year	General design on work to Interstate Facilities	10-year	Interstate Facilities for sag vertical curves which have no outlet other than a storm drain system, and for the outlet of systems requiring pumping stations	50-year	<p>Ch 9 AASHTO Highway Drainage Guidelines</p>
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<p>Chapter 4 Roadside Design Page 4-6 <i>Drainage inlets should not be placed in a bus bay, travel, or bike lane and should not be placed in a shoulder, except at the exterior edge, when drainage restrictions are severe. Drainage inlets within the median or roadsides shall be traversable. A small area around the inlet should be paved to improve drainage and to prevent local erosion. Corner radii inlets should be avoided as they hinder pedestrians, create ponding, create maintenance problems, and complicate intersection design.</i></p>	<p>Inlet type, location and spacing shall consider the following:</p> <ol style="list-style-type: none"> <li>1. Inlet capacity and width of spread.</li> <li>2. Movement of vehicles to and from adjacent property on turnouts.</li> <li>3. Pedestrian and Bicycle Safety</li> <li>4. Maximum pipe length without maintenance access (section 3.10.1)</li> <li>5. Roadway Geometry</li> <li>6. Hydraulic efficiency of the system</li> <li>7. Potential for flooding of off-site property</li> </ol> <p>Inlets shall be placed at all low points in the gutter grade, and as appropriate at intersections, median breaks, and on side streets where drainage would adversely flow onto the highway pavement.</p> <p>For curb inlets on a continuous grade, a maximum spacing of 300 feet shall be used unless spread calculations indicate greater spacing is acceptable. Spread standards are provided below in Section 3.9.</p> <p>Curb inlets shall also be placed at the critical section prior to the level section in superelevation transitions, to avoid concentrated flows across the pavement. Curb inlets shall not be located within handicap drop curb locations. The use of inlets on returns shall be justified and documented. Inlets in sag vertical curves that have no outlet other than the storm drain system and do not have open throats, should have flanking inlets on one or both sides. These flanking inlets should be located to satisfy spread criteria when the sag inlet is blocked. Even with an open throat inlet, flanking inlets should be considered when the minimum gutter grade cannot be met.</p> <p>(Additional maintenance considerations are provided in the drainage manual)</p>	<p>Ch 9 AASHTO Highway Drainage Guidelines</p>													
<p>Chapter 5 Pavement Design Page 5-1 <i>Provide drainage to promote quick drying and to reduce the likelihood of hydroplaning and splashing.</i></p>	<p>The spread resulting from a rainfall intensity of 4.0 inches per hour shall be limited as follows.</p> <table border="1" data-bbox="680 1003 1558 1364"> <thead> <tr> <th>Typical Section Condition</th> <th>Design Speed (mph)</th> <th>Spread Criteria*</th> </tr> </thead> <tbody> <tr> <td>Parking Lane or Full Width Shoulders</td> <td>All</td> <td>No encroachment</td> </tr> <tr> <td rowspan="3">All Other</td> <td>Design speed ≤ 45</td> <td>Keep ½ of lane clear</td> </tr> <tr> <td>45 &lt; Design Speed ≤ 55</td> <td>Keep 8" of lane clear</td> </tr> <tr> <td>Design Speed &gt; 55</td> <td>No encroachment</td> </tr> </tbody> </table> <p>* The criteria in this column applies to travel, turn, or auxiliary lanes adjacent to barrier wall or curb, in normal or super elevated sections.</p>	Typical Section Condition	Design Speed (mph)	Spread Criteria*	Parking Lane or Full Width Shoulders	All	No encroachment	All Other	Design speed ≤ 45	Keep ½ of lane clear	45 < Design Speed ≤ 55	Keep 8" of lane clear	Design Speed > 55	No encroachment	<p>Ch 9 AASHTO Highway Drainage Guidelines</p>
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<p>Chapter 17 Bridges and Other Structures Page 17-4 All bridge designs shall include a drainage design that is specific to its site. <b>Conveyance of drainage off the bridge roadway should be designed to meet spread standards contained in the Department's Drainage Manual,</b> <b>Chapter 3 and may include open systems (i.e., scuppers) or closed systems (i.e., inlets and pipes) based on environmental permitting restrictions.</b> Drainage from the bridge should not drop onto traffic below.</p>	<p>Greenbook refers to the Drainage Manual</p>	<p>Ch 7 AASHTO Highway Drainage</p>
<p>Chapter 17 Bridges and Other Structures Page 17-5 A hydrologic/hydraulic analysis shall be performed to quantify expected stages and flows at the bridge site. Anticipated substructure scour shall be developed for the following:</p> <ul style="list-style-type: none"> <li>• Worst case scour condition up through the 100-year frequency flood event (Scour Design Flood Event).</li> <li>• Worst case scour condition up through the 500-year frequency flood event (Scour Check Flood Event).</li> </ul> <p>Any exceptions to the standards above hydrologic/hydraulic and scour analysis requirements shall be approved in writing by the local Department District Structures and Facilities Engineer. <b>Methodology for computing bridge hydrology/hydraulics and bridge scour should follow the guidelines set forth in the most recent versions of the Department's "Drainage Manual."</b></p>	<p>Greenbook refers to the Drainage Manual</p>	<p>Ch 7 AASHTO Highway Drainage</p>
<p>Optional Materials not covered in Greenbook.</p>	<p>Chapter 6 of Drainage Manual – Optional Culvert Materials The Department also provides a service life estimator tool on the Drainage website.</p>	