

**General Design Standards
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Chapter 2 General Design Standards

2.1 Applicability

The Design standards contained in this Chapter shall be applicable to any construction project, private or public, undertaken in the City of Harrisonburg, Virginia.

2.2 Phasing

(2.2.1) Delineation

If development is to be constructed in phases, plans shall clearly indicate by phase lines, notes or other methods which facilities are to be constructed under each phase. Plans shall indicate locations of contour tie-ins for each phase and specific measures for phased termination of all water, sewer, storm drainage, streets and other public improvements. Plans for erosion control and drainage facilities shall be designed and displayed independently for each phase.

(2.2.2) Bonding

Bonding for public improvements, stormwater management and erosion control measures as required by City ordinances and herein, shall be provided for each phase if separately built. If phased construction is not adequately indicated on the plans, then bonding will be required for the entire project before construction plans will be approved and released.

2.3 Drainage

(2.3.1) General

(2.3.1.1) An evaluation shall be performed for all proposed drainage systems to ensure adequate hydraulic capacity for conveyance of the minimum ten-year event including, but not limited to channels, stormwater management facilities, and conduits.

(2.3.1.2) Hydraulic capacity must be verified with engineering calculations, in accordance with the procedures outlined in the Virginia Erosion and Sediment Control Handbook, the Virginia Department of Transportation Drainage Manual, and this manual. If these standards conflict for a particular

application, the City Engineer shall determine which standard is to be applied. Submit two complete copies of drainage calculations with submitted site plans.

Calculations shall include descriptive data on computer software used and references to charts and tables used. Computer spreadsheets created "in-house" used in lieu of standard forms or standard manual calculations shall be substantiated at least initially, with manually calculated versions showing equivalent results. Acceptance of or request for substantiation of spreadsheet or in-house computer programs in lieu of manual calculations will be the decision of the City Engineer. Calculations shall include a copy of the site grading and drainage plan, at the plan scale, upon which the boundaries, acreages and C-factors of the interior drainage areas shall be shown. Calculations shall also include a map at an appropriate scale delineating the boundaries, flow paths, acreages and C-factors of the drainage areas, upstream of the development, which would contribute storm water to the development.

(2.3.1.3) Due consideration must be given to infrequent events (100-year) resulting in runoff quantities greater than minor system design capacity. The design for the major drainage system shall provide for overland relief of the 100-year event without flooding or damaging buildings and structures and without reliance upon the minor drainage system.

(2.3.1.4) The drainage system shall be designed to generally honor all natural drainage divides and create no adverse impact on downstream properties; to account for all off-site storm water and; to convey discharge surface waters to the flow line of a natural watercourse or an existing underground or above-ground adequate conveyance system.

(2.3.1.5) The influence of grassed or wooded areas which represent less than 25 percent of the drainage area to the point of consideration shall be excluded from consideration when computing the time concentration for drainage or stormwater detention systems. In such a case, those areas may be excluded from the area figure used in the calculation of flow.

(2.3.1.6) The Owner or Developer may continue to discharge stormwater as sheet flow (non-concentrated) into a lower-lying property if at the same location:

(2.3.1.6.1) The post-development peak runoff rate based on documentation and computations, including sheet flow, does not exceed the pre-development peak rate.

(2.3.1.6.2) If the above conditions are not met, the developer must provide an acceptable drainage system to preclude adverse impacts upon adjacent or downstream properties.

(2.3.1.7) The Owner or Developer may not create a new discharge of concentrated storm water from a pipe, culvert, channel, or other drainage structure, onto or through lands of another without first obtaining a permanent storm drainage easement and constructing a channel to guarantee continuity of an outfall from the point of discharge to the nearest natural or man-made watercourse.

(2.3.1.8) If off-site downstream construction and easements are required to construct an adequate channel outfall, no plans shall be approved until such storm drainage easements, extending to the nearest natural or man-made watercourse, have been obtained and recorded. It will be the responsibility of the Developer to obtain all off-site easements.

(2.3.1.9) Energy dissipation devices and/or friction channel linings shall be used at and downstream of outfalls when discharged velocities exceed the maximum permissible as defined by the Virginia Erosion and Sediment Control Handbook.

(2.3.1.10) Plans shall be prepared to preclude adverse impacts due to higher flow rates that may occur during construction.

(2.3.1.11) Construction plans shall show the location size, flow line elevations, profiles and details of drainage facilities and structures, including, but not limited to, swales, ditches, culverts under public streets and private drives, drop inlets, storm sewers and detention/retention ponds. Typical cross sections of all swales and ditches shall be shown.

(2.3.1.12) Profiles of streets shall show profiles of storm sewers and cross sections of culverts together with points of intersection. Profiles shall show clearance of such drainage facilities with water mains and sanitary sewers.

(2.3.1.13) For purpose of computing runoff, all existing and proposed gravel drives and parking areas shall be treated as being asphalt-paved.

(2.3.1.14) Design should consider the provision of drainage easements for off-site contributory runoff through the site, to allow future improvements by adjacent developer.

(2.3.2) Storm Sewer Systems

(2.3.2.1) Design and capacity of culverts, inlets, and piped storm drainage systems shall be in accordance with the requirements of the Virginia Department of Transportation (VDOT) Drainage Manual, the latest release, and this manual. Ultimate developed condition of currently undeveloped areas within a watershed shall be based upon the current or anticipated zoning of those areas.

(2.3.2.2) All publicly owned storm inlets and manholes shall include inlet/invert shaping per VDOT IS-1.

(2.3.2.3) Drop inlets shall be sized and spaced such that a minimum of one half of the travelway in each direction shall be free of flooding during a ten-year return storm. Submit VDOT Form LD-204. Grate inlets shall be allowed in a public travelway only if approved by the City Engineer, and only where extreme physical restrictions require grate inlets for the purpose of meeting storm design criteria.

(2.3.2.4) To properly drain sag vertical curves, it is required on roads classified as minor arterial or higher to place three inlets in each curve; one inlet at the low point and one flanking inlet on each side of the low point. The flanking inlets shall be placed so that they will limit the spread in the low (flatter) gradient approaches to the sag point and will act in relief of the sag inlet if it should not accept water designed.

(2.3.2.5) Where the pavement on a continuous grade is warped in transition between super-elevated and normal sections, water conveyed along the curb shall be intercepted at the point in transition where the cross slope of the road section is equal to one percent to maintain spread requirements; further, road pavement with less than one percent cross slope towards a curb and gutter section shall not be utilized to convey flow. All flow in areas of less than one percent cross slope, except at median header curb, shall be confined to the gutter pan. Water concentrated in a pavement gutter shall not escape the gutter and cross the travelway before interception by an inlet.

(2.3.2.6) No reverse curb and gutter (Virginia Department of Transportation CG-6r) shall be allowed in public rights-of-way.

(2.3.2.7) Where curbs are used in cut slope areas; runoff shall be collected through a system of ditches and inlets at the top of the cut slope prior to the

flow of traversing the slope and entering the right-of-way. This shall be required where any concentrated flows are present and for all cut slopes greater than ten feet in height, measured from the top of curb to the top of slope.

(2.3.2.8) No concentrated flow greater than one cubic feet per second based upon the ten-year event shall cross a sidewalk or curb.

(2.3.2.9) Drainage flowing in street gutters shall be intercepted 100 percent, during a ten-year storm, prior to entering an intersection with another public street.

(2.3.2.10) Culverts and storm sewers shall be of a size adequate to transport the runoff from a ten-year return storm, for the ultimate developed condition of the subject property. Contributions of off-site flow from permanently developed properties shall be based upon existing conditions. Contributions of offsite flow from undeveloped properties shall be calculated based upon the two-year developed flow (undetained) from such properties. Submit VDOT Forms LD-269 and LD-229 as applicable and necessary supporting data.

(2.3.2.11) The hydraulic gradient of storm sewers for the post-development ten-year return storm shall be lower than the gutter line or grate inlet top elevation at all points. Submit VDOT form LD-347.

(2.3.2.11.1) Where a proposed drainage system is connected to an existing drainage system the hydraulic gradient shall be computed through the existing system until the stormwater contained within the system outfalls to daylight to demonstrate hydraulic capacity. System computations for the existing system will be made available by the City to the designer for those systems for which the City has this information. The City Engineer may waive this requirement when it has been previously determined that the receiving system is known to have sufficient capacity.

(2.3.2.12) The minimum street gutter elevation in the vicinity of culverts and bridges shall be no lower than the flood water elevation for the 25-year return storm, calculated for the entire watershed in a developed condition, disregarding the effect of upstream or on-site stormwater detention systems. Culverts shall be designed and installed to account for ultimate right-of-way and road widths.

(2.3.2.13) All storm sewer pipe(s) within a public right-of-way or public drainage easement shall be reinforced concrete pipe with a minimum diameter of 15 inches or equivalent elliptical size. Storm sewer pipe that begins or ends within a public right-of-way or public easement shall be reinforced concrete for its entire length between terminal structures. All

reinforced concrete pipe shall be Class III, or greater as conditions require. Installation shall be in accordance with VDOT Standard PB-1, joined using cement mortar or o-ring seals. Precast box culvert sections shall be joined using a closed-cell extruded rubber gasket, Delta Rubber "Omni-Flex" or approved equal.

(2.3.2.14) Reinforced concrete flared end sections shall be installed at the open ends of all storm drainage pipe. Concrete endwalls may be accepted 42 inches in diameter or less subject to approval by the City Engineer.

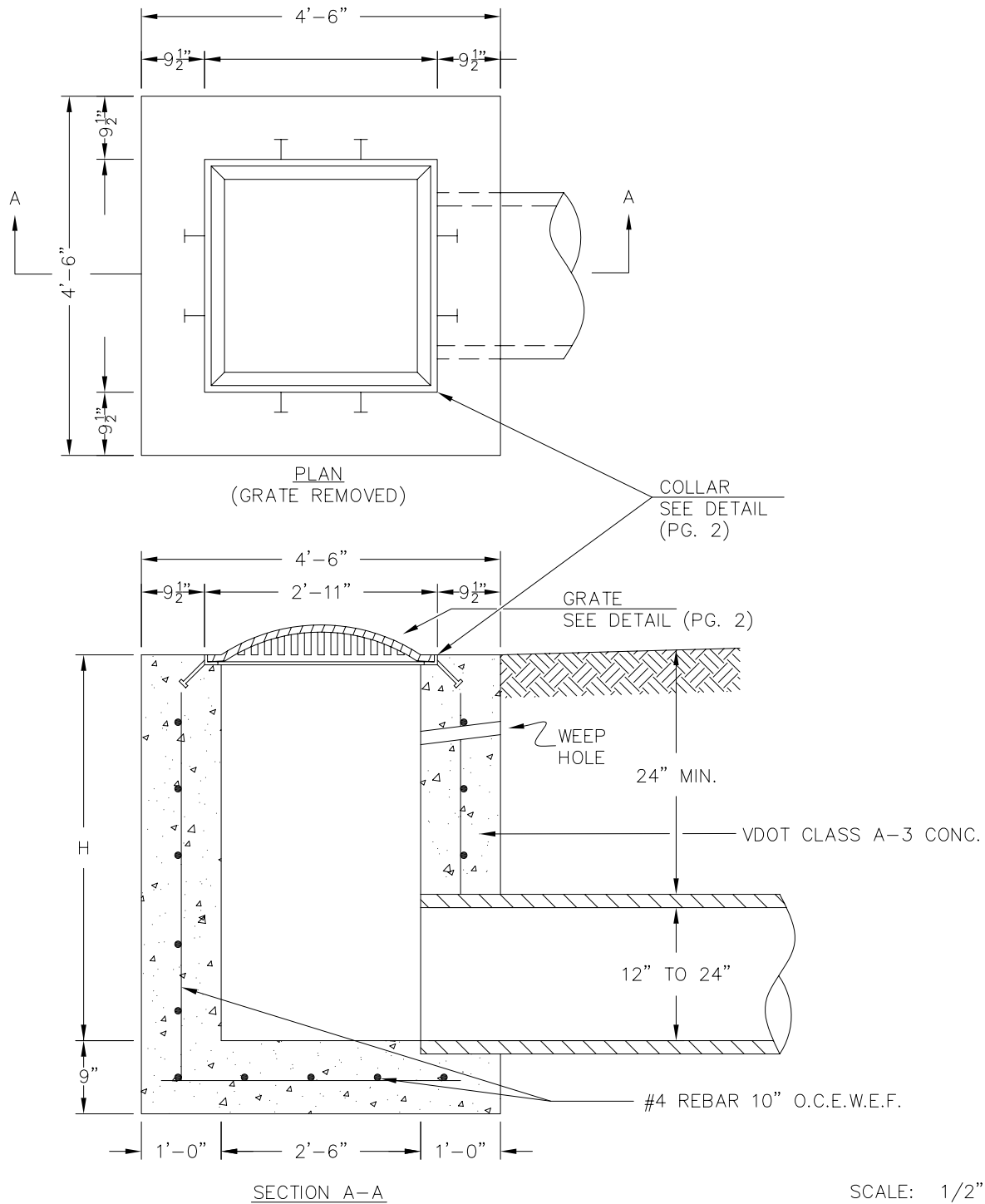
(2.3.2.15) Culvert headwalls and endwalls shall be located a minimum of 25 feet outside the edge of pavement of traffic lanes unless traffic is separated from the walls by a guardrail that is required due to warrants other than the walls.

(2.3.2.16) In general, pipe of diameter less than 42 inches shall be aligned between access structures with no horizontal or vertical deflection. Where situations warrant, such pipe may be installed on a radius produced by the pulling the pipe joint open to a maximum of one-fourth (1/4) of the spigot depth. Such radius shall be specified on the plans. Pipes on slopes greater than 20 percent shall be anchored. (See Ch. 7, Drwg. No. 15).

(2.3.2.17) Minimum cover for storm sewer pipe shall be two feet vertically from finish grade to the outside crown of pipe, except where structural correction is provided and approved. Requests for less than two feet of cover shall be recorded on the plans and clearly denoted. Test pits will be required and shall be shown on the plans for all crossings which involve gas lines, water mains 12 inches in diameter and larger, sanitary sewer crossings which have minimum clearance, and all fiber optic telephone service lines. Test pits shall be dug and clearances verified prior to installing any portion of the storm sewer system.

(2.3.2.18) Drainage structures shall, in so far as practical, conform to the details and requirements of the VDOT Road and Bridge Standards of the latest date of issue. Complete detailed drawings of all non-standard structures shall be included in the project plans. Such detailed drawings shall include at least three views of the structure and each view shall be completely dimensioned. Drop Inlets within public right-of-way or public easements that drain turf areas shall be Harrisonburg Standard Convex Grate Inlet.

(2.3.2.19) Drainage easements dedicated to the City will be required for storm sewer systems as necessary for maintaining adequate street drainage. The City Engineer will determine extent of drainage easements and their designation as public or private during plan review. Refer to detail on Page 4-18A for easement width criteria.



REVISIONS			
NO.	DATE	DESCRIPTION	INIT.

**CONVEX GRATE
INLET STRUCTURE
DETAILS**

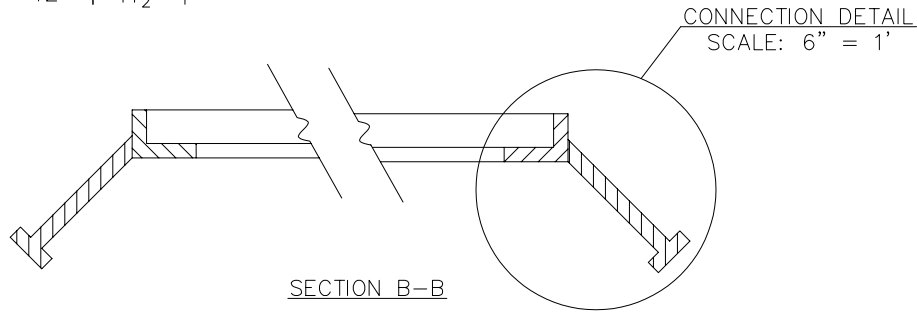
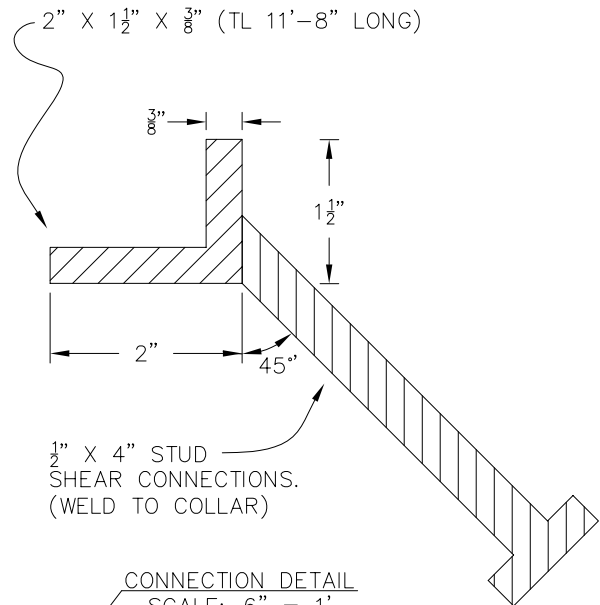
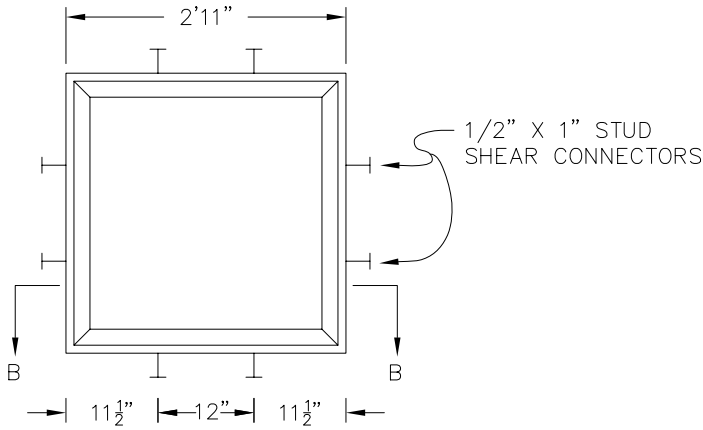
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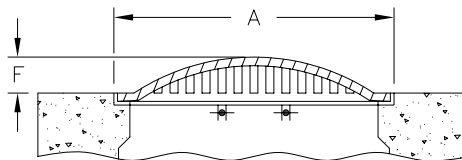
1 OF 2

TOP VIEW
SCALE: 1/2" = 1'



CONVEX GRATE DETAIL
NEENAH R-4215-C

Catalog No.	Dimensions in inches				Wt. lbs.
	A	F	G	H	
R-42 15-C	34x34	6	1 1/2	1 1/4	190



SECTION THRU GRATE

REVISIONS

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**CONVEX GRATE
INLET STRUCTURE
DETAILS**

DWG. NO.

2.3.2.18

PAGE

2 OF 2

(2.3.3) Stormwater Conveyance Channels

(2.3.3.1) Channel adequacy, hydraulic capacity, maximum velocities, channel linings and other related design variables shall be determined by the procedures outlined in Chapter 5 of the Virginia Erosion and Sediment Control Handbook. The computed velocity shall approximate the assumed velocity used to determine the Manning's "n" value. Submitted calculations shall prove the adequacy, capacity, and stability of all open channels and their linings.

(2.3.3.1.1) As an alternative to the trial-and-error based methodology contained in the Handbook, it is acceptable for proposed channel to confirm ditch depth and velocity using a computer program which simulates the combined Continuity/Manning Equation. However, if this option is chosen, separate runs shall be made to confirm velocity and depth using a Manning's 'n'-value of 0.03 for velocity and 0.08 for depth.

(2.3.3.2) All open channels shall be designed to contain the ten-year event. Contributions of off-site flow from permanently developed properties shall be based upon existing conditions. Contributions of off-site flow from undeveloped properties shall be calculated based upon the two-year developed flow (undetained) from such properties. Plans shall account for overland relief resulting from less frequent events.

(2.3.3.3) The velocity of flow in open channels including bends is determined through the use of Manning's Equation and "n" values, and Bernoulli's Equation.

(2.3.3.4) Unless otherwise approved, the need, type, and dimensions of lining for erosion control shall be based on the velocity and depth of flow associated with the ten-year event. The lining selected shall be consistent throughout the channel until it outfalls to an adequate natural watercourse or underground storm sewer. Riprap size shall be confirmed against velocity per VDOT Fig. 12, Ch. 2.

(2.3.3.5) Maximum side slope for grass lined conveyance channels shall be three horizontal to one vertical with a minimum longitudinal slope of one percent (two percent minimum recommended).

(2.3.3.6) Conveyance channels with side slopes steeper than 3H:1V shall be stabilized by paving, riprap, gabions, or other approved measures.

(2.3.3.7) Conveyance channels with longitudinal slopes less than one percent shall be paved.

(2.3.3.8) The sides of all conveyance channels shall be extended until a minimum of six inches of freeboard is provided above the ten-year event water surface elevation within the conveyance channel.

(2.3.3.9) Grass swales shall be lined (where required) and seeded immediately after being graded, and shall be maintained until project completion. Release of surety will be contingent on grass swales being in accordance with the approved typical section, un-eroded and fully vegetated.

(2.3.4) Flood Plain Development

(2.3.4.1) Flood plain calculations required by the City's Flood Plain Ordinance shall be performed utilizing the HEC-RAS river analysis program.

(2.3.4.2) Original model data for use in computing the effect of floodplain development shall be obtained through the Federal Emergency Management Agency (FEMA). Base Model shall duplicate the original FEMA data.

(2.3.4.3) If the engineer who is preparing the flood study can demonstrate, to the satisfaction of the City Engineer, that the existing FEMA data and/or the City's flood plain maps are inaccurate or inappropriate, then the engineer's base model may be accepted subject to approval by the FEMA. The City must endorse submissions to FEMA; however, they remain the responsibility of the developer or his agent.

(2.3.4.4) Location of the floodway shall be computed using the equal conveyance of flow method.

(2.3.4.5) Calculation packages submitted for review shall contain at least the following:

(2.3.4.5.1) A copy of the City's topography showing the location of cross sections used for existing conditions.

(2.3.4.5.2) A copy of the City's topography showing the location of cross sections used for developed conditions.

(2.3.4.5.3) Cross section drawings for existing and developed conditions.

(2.3.4.5.4) A copy of the output from the hydraulic computer model representing the 100-year flood profile and the floodway run for existing conditions.

(2.3.4.5.5) A copy of the output from the hydraulic computer model representing the 100-year flood profile and the floodway run for developed conditions.

(2.3.4.5.6) A copy of the City's topography showing the location of the computed flood plain and floodway.

(2.3.4.5.7) A summary sheet listing the existing and developed 100-year base flood and floodway elevations determined by HEC computer analysis.

(2.3.4.6) Cross sections used in establishing the base computer model shall be, at a minimum, those used in the original study. Additional cross sections will be required in developed areas and as necessary to accurately depict existing topography and to match the original flood profile as previously discussed.

(2.3.4.7) Cross sections shall extend to points 1,000 feet upstream and downstream of the proposed development or to a cross section used in the original SCS or FEMA study, whichever is further from the development.

2.4 Erosion and Sediment Control

(2.4.1) General

(2.4.1.1) All Erosion and Sediment Control plans shall be prepared such that, as a minimum, the requirements and Minimum Standards of the Virginia Erosion and Sediment Control Regulations are met.

(2.4.1.2) The Virginia Erosion and Sediment Control Handbook, most recent edition, hereinafter referred to as the "E & S Handbook," shall be used as the guideline for preparation of such plans. The checklists for the plan and accompanying narrative included in the E & S Handbook shall be completed and submitted with the plans.

(2.4.1.3) In general, erosion control plans shall be prepared on a separate plan sheet, complete with all supporting notes and details. For development plans that indicate disturbance of less than two acres, the erosion control measures and notes may be included on the site plan sheet. However, all checklist items of the E & S Handbook shall be noted on the plans or on supplementary drawings to be included with the narrative submission.

(2.4.1.4) For plans that contain a separate narrative the plans shall contain a note that directs the contractor to comply with any additional requirements contained in the narrative.

(2.4.1.5) All erosion and sediment control plans shall have affixed to them, verbatim, Minimum Standards numbers 1, 2, 4, 5, 16, 17, and 18 of the Virginia Erosion and Sediment Control Regulations.

(2.4.1.6) All erosion control measures shall meet or exceed those detailed in the Virginia Erosion & Sediment Control Handbook.

(2.4.1.7) The time of year has no bearing on the applicability of site stabilization requirements in the Minimum Standards. Plans for projects that will be worked through the winter months shall contain adequate specifications for temporary or permanent winter seeding.

(2.4.1.8) Seeding specifications shall be included on plans.

(2.4.1.9) Any approved variances to State standards shall be clearly noted on plans.

(2.4.2) Minimum Standard 19 - Stormwater Detention

(2.4.2.1) Calculations for Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations, which address all requirements therein, shall be performed and two copies submitted with the plans for review. Calculation package shall include a narrative that explains the basis of the design and how it meets the standards, as well as providing a guideline for the reviewer to follow (explanation of hydrographs, routings, lagging, drainage areas, outlet structure data, etc.). Compliance with the water quantity provisions of the VA Stormwater Management Regulations shall be considered to meet MS-19.

Any runoff from a development which drains to an existing sinkhole, whether on-site or off-site, shall be detained to pre-development rates, for the two-year and ten-year storms, considered individually, regardless of any other considerations such as outfall adequacy, distance to sinkhole, etc. Pre-development hydrology must be duplicated as closely as possible. Construction of detention facilities or site grading shall be sequenced such that no increase in flow to sinkholes occurs during construction.

(2.4.2.2) Calculations for channel adequacy shall be carried downstream of the proposed development for a minimum distance of 300 feet beyond the subject property, and shall continue until the flow is discharged into a natural watercourse of sufficient capacity to convey the two-year storm event without overtopping or eroding its banks. A natural watercourse is hereby defined as

a watercourse, which is indicated by a blue line on a USGS 7.5 minute series topographic map.

(2.4.2.3) Pre-development and post-development runoff rates shall be verified by calculations that are consistent with good engineering practices and are acceptable to the City Erosion and Sediment Control Administrator. For purposes of computing runoff, all lands in the site shall be assumed prior to development to be in good condition (if the lands are pastures, lawns or parks), with good cover (if the lands are woods), or with conservation treatment (if the lands are cultivated) regardless of conditions existing at the time of computation. Porous pavement shall be considered as standard pavement when computing runoff, unless considered part of a stormwater BMP covered under a BMP Maintenance Agreement.

(2.4.2.4) Design of stormwater conveyance channels and verification of channel adequacy shall be performed in accordance with the water quantity provisions of the VA Stormwater Management Regulations.

(2.4.2.5) Verification of detention pond capacity shall be performed in accordance with SCS methods, or using Modified Rational Method (per City guidelines) to produce critical volume storm. Calculations shall show compliance with the water quantity provisions of the VA Stormwater Management Regulations.

(2.4.2.5.1) Calculations shall include hand or computer-generated reservoir routings of all design storms analyzed. Validation of the source and methodology for all computer programs used in the calculations shall be submitted and approved by the City Erosion and Sediment Control Administrator.

(2.4.2.6) Detention basin outlets shall discharge into a natural or man-made conveyance system or channel. Basin outflow shall be limited to the maximum rate which maintains the adequacy of the channel, or the outflow shall be detained to the pre-development rate of flow to the specific point of concentrated discharge, not the pre-developed flow from the entire drainage area. If a channel does not exist at the point of discharge, then one shall be constructed to convey the drainage to a stable outlet. Any such channel constructed off the site will require an appropriate private drainage easement.

Where natural or other open receiving channel is in poor condition, applicant must look first to make downstream channel improvements before settling on detention. If property owner agrees, then applicant must balance improved channel capacity with on-site detention. Detention alone will be accepted only after documentation is provided that downstream owner would not agree to channel improvements.

Downstream channel will be considered poor if ill-defined, eroded, has a capacity less than needed to prevent flooding or other property damage, or is proximate to an existing building to where deterioration or overtopping could cause building flooding. Such will be determined based on site visit prior to or during plan review by the City Engineer or his designated agent. Designer is encouraged to arrange with the City Engineer to visit the downstream site prior to design to confirm the condition and subsequent design requirements.

(2.4.2.7) Minimum conduit diameter for basin outlets shall be 12 inches. Basins requiring a lesser orifice size for flow control shall be provided with a manhole structure fitted with the required orifice. For smaller basins, it may be acceptable on a case-by-case basis for the orifice to be provided within a sealed plug attached to the end of the pipe outlet. Above ground basins shall be provided with low flow channels capable of conveying initial inflow to the control structure without eroding the basin sides or bottom.

(2.4.2.8) All above-ground detention facilities shall be designed to pass the 100-year storm without overtopping with a minimum of one foot of free board between the 100-year elevation and the top of the structure. Sites designed with underground detention facilities shall be provided with a means of conveying the 100-year storm to a stable outlet without damage to structures, embankments, adjacent properties and other critical installations and without causing erosion.

(2.4.2.9) Underground detention systems shall be designed and constructed using VDOT approved storm drainage pipe. Adequate access structures (per VDOT) shall be provided for all pipelines within the system for the purpose of maintenance. Underground stone-filled trench systems will not be allowed. Prefabricated, buried storage systems may be accepted on a case-by-case basis. Such systems must be fully accessible for maintenance and cleaning. Certain systems may require manufacturer's observation and certification of proper installation.

(2.4.2.10) Infiltration systems will be considered for review only if a soils and geo-technical report is provided which discusses soil permeability, potential effects on ground water and potential effects on underlying geologic strata. System design shall provide for a 24-hour drawdown of the entire storage volume. Porous pavement will not be considered as an infiltration media.

(2.4.2.11) Design of above-ground stormwater detention or retention basins greater than ten feet high, measured from the top of the embankment to the lowest point along the toe of embankment, shall be accompanied by a Geotechnical report prepared by a Geotechnical engineer licensed to practice in Virginia. Such report shall contain recommendations for subgrade preparation, core trenching embankment construction, spillway construction,

anti-seep collars and other significant factors, all of which shall be incorporated into the design of the facility.

(2.4.2.12) All above ground earth dam detention facilities shall include an emergency spillway capable of conveying the 100-year storm flow, assuming any other principal spillway is blocked. Emergency spillways shall be constructed in cut sections of previously existing ground unless structural measures such as riprap or concrete are provided to protect the pond embankment from eroding. Consideration shall be given to providing even greater emergency spillway capacity in critical areas or where public safety is threatened by embankment failure.

(2.4.2.13) Safety measures should be incorporated into the design of all stormwater detention facilities. These may include, but are not limited to, safety ledges, fencing, warning signs, anti-vortex devices, stadia rod indicating depth at the lowest point, and outlet structures designed to limit public access. This is of particular importance in residential areas where children are present.

(2.4.2.14) All stormwater detention and stormwater management facilities shall be covered under a Stormwater Management/BMP Facilities Maintenance Agreement (Appendix I). Recordation of this Agreement, and delivery of a recorded copy to the City, is a prerequisite to obtaining a Land Disturbing Permit. Plans shall denote a "BMP Area Boundary" around the facilities. This area shall also be denoted on all final plats. Such area shall extend beyond the limits of the facilities a sufficient distance to accommodate maintenance equipment. Plans shall include a completed table as per City DWG No. 2.5.1.5 "BMP Table".

(2.4.2.15) For projects including a stormwater detention or retention facility, the plans or narrative shall include information regarding short and long-term maintenance required to assure perpetual operation of the facility, and shall set forth the person(s) or parties responsible for such maintenance.

(2.4.3) Site Grading

(2.4.3.1) In general, sites shall be graded to provide adequate drainage and prevent erosion.

(2.4.3.2) Minimum slope for lawn areas shall be one percent, with two percent minimum preferred.

(2.4.3.3) Maximum slope for grass embankments shall be 2H:1V horizontal to vertical. Embankments steeper than 2H:1V will be considered by the City on a case-by-case basis. Slopes steeper than 2H:1V shall be stabilized by structural means such as riprap, waffle blocks, stabilization matting or other

accepted methods. A written statement from the owner of the property stating awareness of slopes steeper than 2H:1V and claiming responsibility for their stability and continued maintenance shall be submitted before the plans will be accepted for construction. In no case shall earthen slopes steeper than 2H:1V be allowed which encroach into a 2H:1V plane extending from the right-of-way line into the property.

2.5 Stormwater Management

(2.5.1) Plans

(2.5.1.1) Stormwater Management plans shall be prepared and submitted for all projects with a land disturbance of one acre or more. Such plans may be included in a broader site plan set, but must be on a separate sheet(s) in order to adequately identify control measures and their corresponding details and special conditions.

(2.5.1.1.1) Projects with land disturbance less than one acre and part of a common plan of development greater than one acre, shall be subject to the requirements of this section. This is applicable to lots within a subdivision or individual phases of a larger project. In general, the requirements herein shall be waived for individual lot single family home construction, within or outside of a common plan of development, disturbing less than five acres of land. Applicants for such projects shall execute with the city an "Agreement in Lieu of a Stormwater Management Plan", and shall pay the applicable fees and post a bond prior to receiving a building permit. Applications for a building permit on such projects on lots that contain an established stormwater best management practice shall include a detailed grading plan sufficient to show continued function of such practice(s) per its (their) original design.

(2.5.1.2) Plans and calculations shall be developed and performed in accordance with the Virginia Stormwater Management Handbook ("SWM Handbook"), latest edition as available from VADCR/VADEQ and submitted for review per the City's plan review policy. The runoff reduction method spreadsheet shall be used to calculate runoff rates and BMP pollutant removal. Additional requirements are set forth in the Virginia Stormwater Management Regulations and in the City Stormwater Management Ordinance.

(2.5.1.3) Designers are encouraged to select Best Management Practices (BMPs) that are easily maintained. Selection of multiple BMPs serving smaller areas is recommended over one large BMP to serve an entire development. Plans shall denote a "BMP Area Boundary" around the facilities. This area shall also be denoted on all final plats. Such area shall

extend beyond the limits of the facilities a sufficient distance to accommodate maintenance equipment.

(2.5.1.4) Plans shall include detailed information on BMP components, construction specifications, dimensions, plant selection, bed preparation, maintenance and long-term care as necessary to ensure adequate initial installation and to provide for longevity. Maintenance information shall be adequate to be included in an owner's or association's records for their use in maintaining the facilities.

(2.5.1.5) Plans shall include a completed table as per City DWG No. 2.5.1.5 "BMP Table".

(2.5.1.6) Plan submission shall include for review and approval a project Pollution Prevention Plan, prepared in accordance with the VA Stormwater Management Regulations and the City Stormwater Management Ordinance. City standard notes addressing pollution prevention shall be included on the stormwater management plan.

(2.5.2) Bonding and Permitting

The following additional conditions shall be met before a Land Disturbing Permit will be issued:

(2.5.2.1) All BMPs shall be bonded, with bond price per City's standard unit prices. Any BMP not in the standard list shall be priced appropriately and included in bond.

(2.5.2.2) The developer will be responsible for providing evidence that they have obtained coverage under a VPDES Stormwater Permit for Construction Sites.

(2.5.2.3) The City will require a copy of the project's Stormwater Pollution Prevention Plan (SWPPP) prepared for the VPDES Permit. Later revisions to the SWPPP should be forwarded to the City.

(2.5.3) BMP Maintenance Agreement

(2.5.3.1) All stormwater detention and stormwater management facilities shall be covered under a Stormwater Management/BMP Facilities Maintenance Agreement (Appendix I). Recordation of this Agreement, and delivery of a recorded copy to the City, is a prerequisite to obtaining a Land Disturbing Permit or receiving Final Plat approval.

(2.5.3.2) If other than owner, developer/builder is responsible for ensuring that the approved Stormwater Management plan is delivered to owner of the property, and that owner is instructed as to the responsibility of maintenance of all facilities included in the plan.

(2.5.3.3) The Stormwater Management/BMP Facilities Maintenance Agreement binds the owner, its successors and assigns to perpetual maintenance of all BMPs. Appendix J “Stormwater BMP Post-Construction Inspection Policy” discusses the procedures and requirements for inspections called for in the Agreement. BMPs must be inspected by a licensed engineer every five years using forms from the VA Stormwater Management Handbook, available from the City Engineer’s office.

(2.5.4) Certification of As-Built Facilities

(2.5.4.1) Prior to release of the bond, the developer will be required to provide to the City the BMP AS-BUILT CERTIFICATION, DWG. NO. 2.5.4.1. This is a certification statement from a licensed engineer that all BMPs were properly installed and/or constructed per the approved plan and per any manufacturer’s recommendations. This Certification shall be accompanied by As-Built Drawings, signed and sealed by a VA professional engineer.

(2.5.4.2) Engineer is expected to provide the onsite observation needed to provide such certification. Contractor shall coordinate the work with the engineer to ensure observation of critical, and particularly below grade, components. Plans should include a construction period inspection schedule to allow engineer to view certain stages of BMP construction before previous items are covered up.

(2.5.4.3) Plans shall contain a note clearly stating that this certification and as-built documentation is required prior to bond release.

2.6 Parking Lots and Travelways

(2.6.1) Layout

Layout of parking lots shall be designed in accordance with the “Standard Parking Layout” drawing. Refer to Zoning Ordinance for compact space standards.

(2.6.2) Handicap Parking

Handicap parking and handicap accessible routes shall be designed and provided with signage in accordance with applicable ADA, FHA and Virginia Construction Code standards.

BMP AS-BUILT CERTIFICATION

Project Name (as it appears on approved plans): _____

As-Built conditions field verified on: _____

Certification Statement:

Based upon construction-period and post-construction observation of project BMPs, as listed in the attached BMP Table of the above named project, I certify that all structural and non-structural stormwater management BMP facilities are in general conformance with the requirements and specifications of the facility as described in the approved construction drawings, approved design documents, manufacturers installation instructions and/or any approved modifications, and that the facilities should function as intended by the original design. Further, I have observed the stormwater runoff patterns on the site, including the disposition of roof drainage, and it appears that drainage areas to constructed BMPs are in general conformance with the approved plans.

The attached, sealed Record Drawings reflect the final, installed BMP's, and are adequately marked or edited to show any deviations from the approved plans. I further certify that the Owner/Developer has been provided a copy of these Record Drawings and has been advised of his/her/their responsibility to transfer such drawings to the party responsible for BMP maintenance per the BMP Maintenance Agreement.

Signature: _____

Print Name: _____

Seal

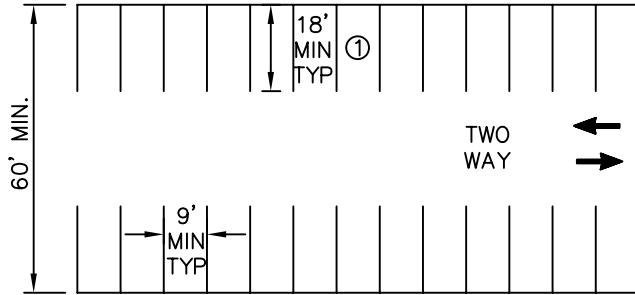
Date: _____

Note: This certification statement must be executed by a registered professional engineer with experience in the design and construction or operation of stormwater BMP's of a nature similar in scope to that certified to in this certification. Engineer is advised to consult the Virginia Stormwater Management Handbook for as-built inspection checklists on various facilities.

REVISIONS				BMP AS-BUILT INSPECTION CERTIFICATION	DWG. NO.
NO.	DATE	DESCRIPTION	INIT.		2.5.4.1
1	7/1/14	Add record dwg req'ts.	DR		PAGE

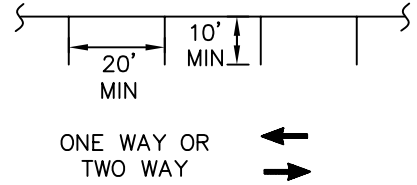
90° PARKING

Not To Scale



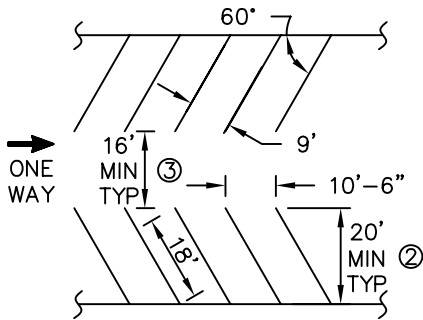
90° PARKING

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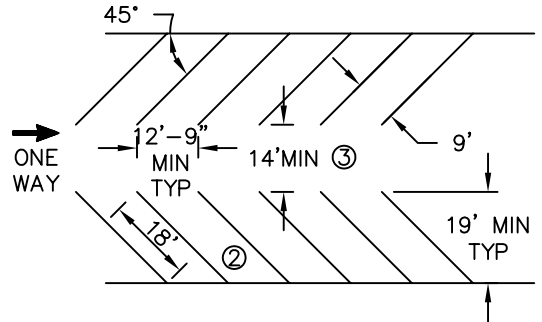
60° PARKING

Not To Scale



45° PARKING

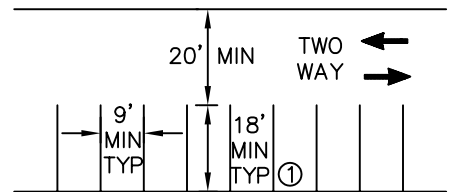
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- ① IF WALL EXISTS OR IS TO BE CONSTRUCTED AT THE HEAD OF PARKING STALL, THEN LENGTH SHALL BE 20'. THE TOTAL DISTANCE ACROSS LOT SHALL BE INCREASED ACCORDINGLY.
- ② IF WALL EXISTS OR IS TO BE CONSTRUCTED AT THE HEAD OF PARKING STALL, THEN LENGTH SHALL BE INCREASED BY ONE FOOT.
- ③ 18' MINIMUM IF LANE PROVIDES FIRE ACCESS TO ANY PORTION OF A BUILDING.

90° PARKING

Not To Scale



REVISIONS

NO.	DATE	DESCRIPTION	INIT.

**STANDARD
PARKING LAYOUT**

DWG. NO.

2.6.1

PAGE

(2.6.3) Slope

Maximum slope of parking areas and site travelways shall be six and ten percent, respectively, in any direction, unless owner acknowledges, in writing and prior to plan approval, the acceptance of slopes greater than that.

(2.6.4) Delineation

Parking lots shall be striped and otherwise marked to delineate parking spaces, accessible routes, crosswalks, fire lanes, traffic direction, and other items necessary for pedestrian and vehicular safety. Such markings shall be indicated on the plans.

(2.6.5) Surfacing

Parking areas and vehicular travel ways requiring all-weather surfacing shall be stabilized with at least VDOT standard Asphalt Surface Treatment. A minimum six inch compacted stone base (VDOT type 21-A) shall be provided. Paving for parking areas serving a high volume or heavy vehicles shall be designed to accommodate expected traffic without sustaining excessive deterioration.

(2.6.6) Width of Travelways

Minimum width of a two-way travelway separate from a parking area shall be twenty (20) feet exclusive of gutter pans. Minimum width of a one-way travel way separate from a parking area shall be fourteen (14) feet, exclusive of gutter pans, unless it provides the only fire access to any portion of a building, in which case the minimum width shall be twenty (20) feet. Travel ways to and within parking areas shall be designed to provide safe and smooth maneuvering of vehicles.

(2.6.7) Internal Flow

Parking areas shall be designed to provide safe, adequate flow of vehicles, including service and emergency vehicles. Areas shall be configured to avoid stacking of queued vehicles that may impose safety hazards to pedestrians or motorists, or cause interruption to traffic flow in streets.

Certain sites may be required to be designed to accommodate the City's fire ladder truck and/or transit buses. Designer is encouraged to confirm this need with City staff prior to design to avoid revisions during plan review. Ladder truck requires a minimum outside turning radius of sixty (60) feet and a clear pavement width of twenty-six (26) feet through turns. Transit buses require a minimum outside turning radius of fifty (50) feet and a clear pavement width of twenty-four (24) feet through turns.

Commercial and multi-family developments are shall limit parking along primary travelways or to widen travelways that contain parking . Developers are encouraged to utilize private streets to provide unfettered access to separated parking lots and connect areas within the development.

Safe pedestrian facilities that provide for pedestrian movements within the development and to the public street shall be provided.

(2.6.8) Landscaping

Plans shall include a landscaping space analysis to address zoning requirements. Such analysis shall include a drawing showing proposed green spaces counted in calculations.

(2.6.9) Drive-Thru Queuing

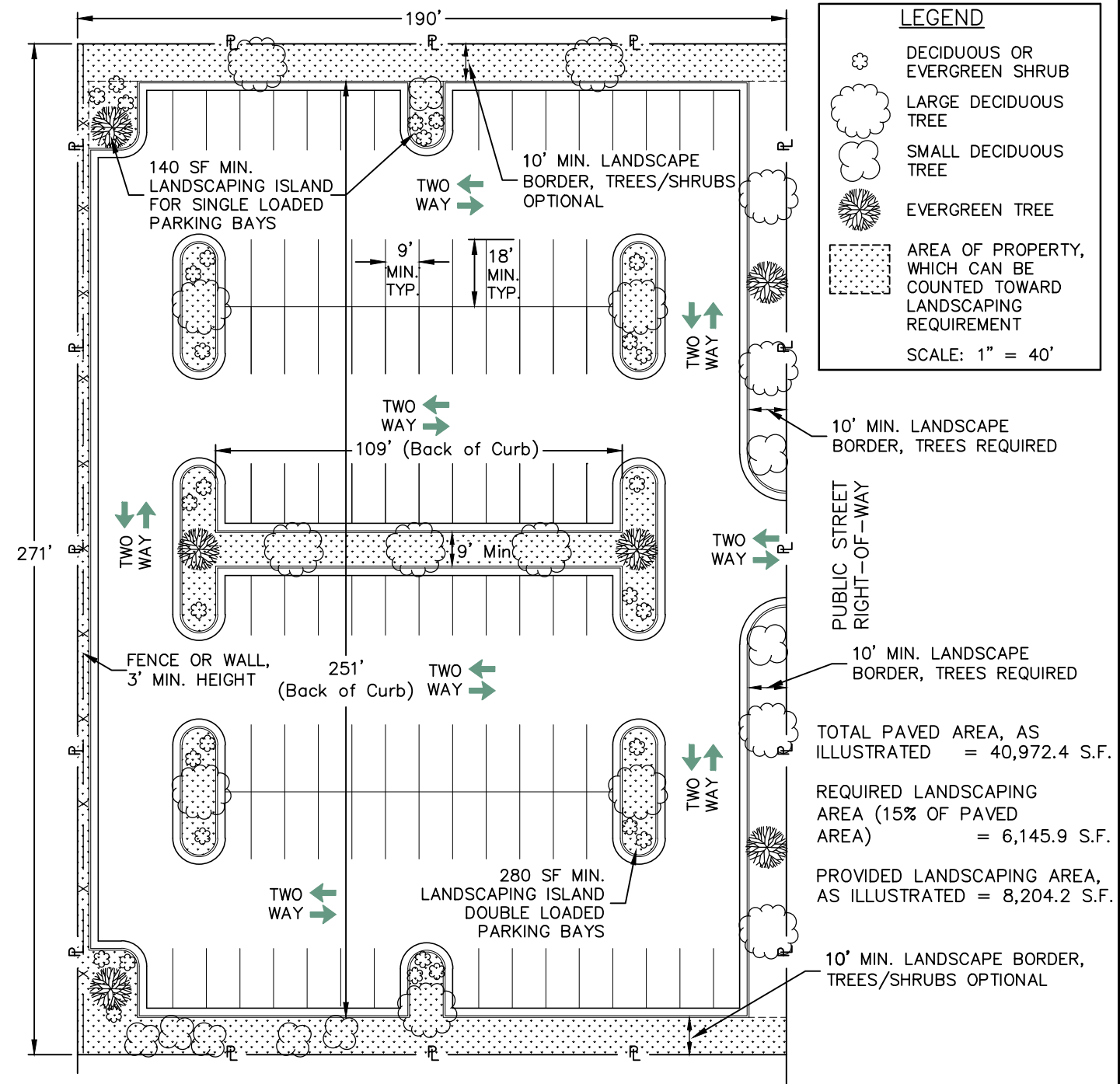
Site design shall provide adequate onsite stacking space for queuing at drive-thru and pickup windows per the following table. Reduction in distance may be considered by the City where multiple lanes or windows are provided. Increased distance may be required for restaurants or other facilities with advance ordering stations.

Bank	200 feet
Restaurant	200 feet
Convenience market	200 feet
Pharmacy pickup	60 feet
Car wash full serve	100 feet
Car wash self serve	60 feet
Gas pump	40 feet
Quick serve lube	60 feet

(2.6.10) Bicycle Parking

Plans shall include bicycle parking details to address zoning requirements in City Zoning Ordinance Article G Off-Street Vehicle and Bicycle Parking. Such details shall include the location, design, and spacing of bicycle parking on site. Refer to Drawing No. 2.6.10, pages 1 and 2, and include applicable details on plans based on specific design.

Developments providing interior garage parking are encouraged to provide interior facilities for bicycle parking.



NOTES

1. For all parking lot landscaping requirements, reference the Zoning Ordinance Section 10-3-30.1.
2. For definitions of landscaping, landscaping island, vegetation types and specifications, and others, reference the Zoning Ordinance Section 10-3-24.
3. Planting locations within required landscaping areas are at the discretion of the property owner/developer.
4. All landscaping shall be located as to not interfere with the adequate sight distance standards as specified within the Design and Construction Standards Manual.

REVISIONS

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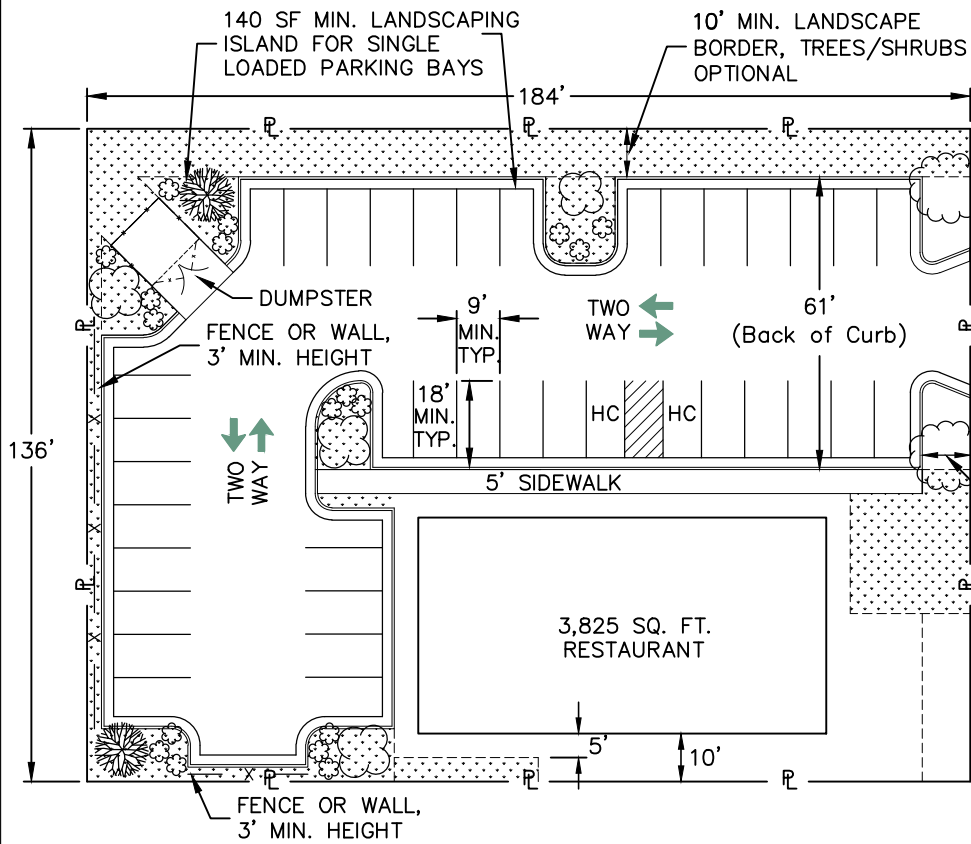
**E□AMPLE A
PARKING LOT
LAND□CAPING**

DWG. NO.

2.6.□

PAGE

1 OF 2



TOTAL PAVED AREA, AS ILLUSTRATED = 12,967.6 S.F.
 REQUIRED LANDSCAPING AREA (15% OF PAVED AREA) = 1,945.1 S.F.
 PROVIDED LANDSCAPING AREA, AS ILLUSTRATED = 4,500.2 S.F.

PUBLIC STREET RIGHT-OF-WAY

10' MIN. LANDSCAPE BORDER, TREES REQUIRED

LEGEND

- DECIDUOUS OR EVERGREEN SHRUB
- LARGE DECIDUOUS TREE
- SMALL DECIDUOUS TREE
- EVERGREEN TREE
- AREA OF PROPERTY, WHICH CAN BE COUNTED TOWARD LANDSCAPING REQUIREMENT

SCALE: 1" = 40'

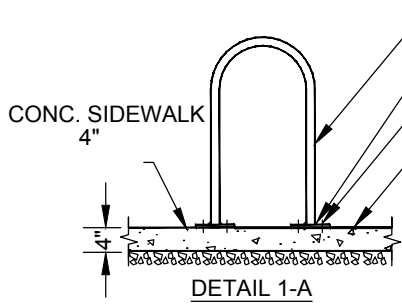
NOTES

1. For all parking lot landscaping requirements, reference the Zoning Ordinance Section 10-3-30.1.
2. For definitions of landscaping, landscaping island, vegetation types and specifications, and others, reference the Zoning Ordinance Section 10-3-24.
3. Planting locations within required landscaping areas are at the discretion of the property owner/developer.
4. All landscaping shall be located as to not interfere with the adequate sight distance standards as specified within the Design and Construction Standards Manual.
5. Only landscaping within the parking lot and/or within a thirty (30) foot perimeter of the parking lot, exclusive of the required landscaping border adjacent to public street right-of-ways and landscaping immediately adjacent (within five (5) feet) to a principal building/structure, shall be permitted to count towards meeting the fifteen (15) percent requirement.

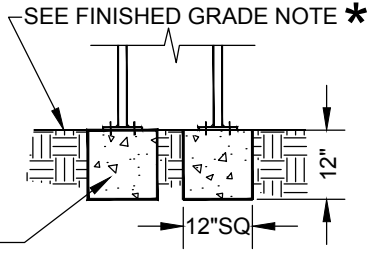
REVISIONS			
NO.	DATE	DESCRIPTION	INIT.

**E□AMPLE B
PARKING LOT
LAND□CAPING**

DWG. NO.	2.6.□
PAGE	2 OF 2

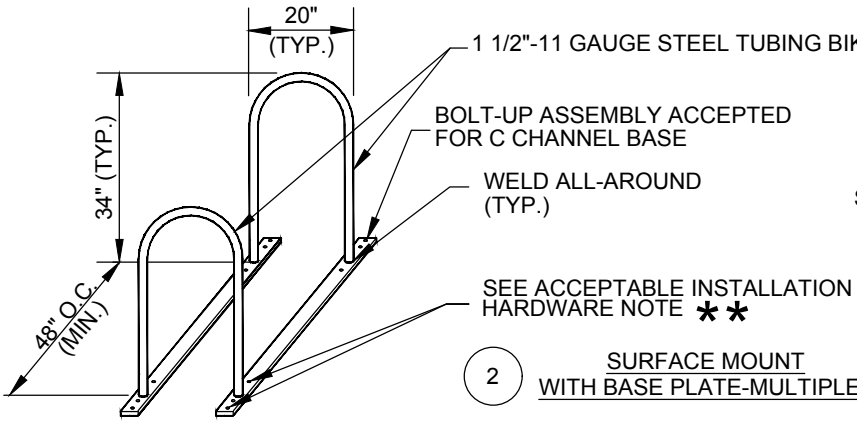


1 1/2"-11 GAUGE STEEL TUBING
BIKE RACK @ 48" O.C. (TYP.)
WELD ALL-AROUND
SEE ACCEPTABLE INSTALLATION HARDWARE NOTE **
SEE FINISHED GRADE NOTE *



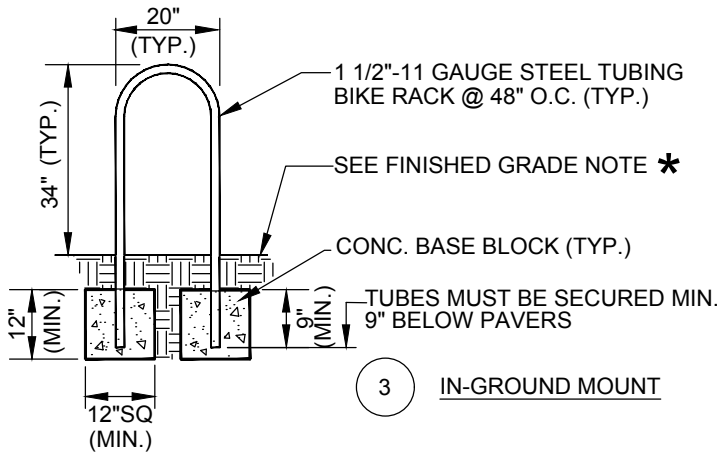
1 SURFACE MOUNT WITH BASE PLATE-INDIVIDUAL RACK

DETAIL 1-B



SEE FINISHED GRADE NOTE *

2 SURFACE MOUNT WITH BASE PLATE-MULTIPLE RACK



3 IN-GROUND MOUNT

* FINISHED GRADE FOR ALL DETAILS SHALL BE:
A. INTERLOCKING CONC. OR BRICK PAVERS, OR
B. 4" CONC. SIDEWALK, OR
C. UNPAVED GRADE/GRASS STRIP

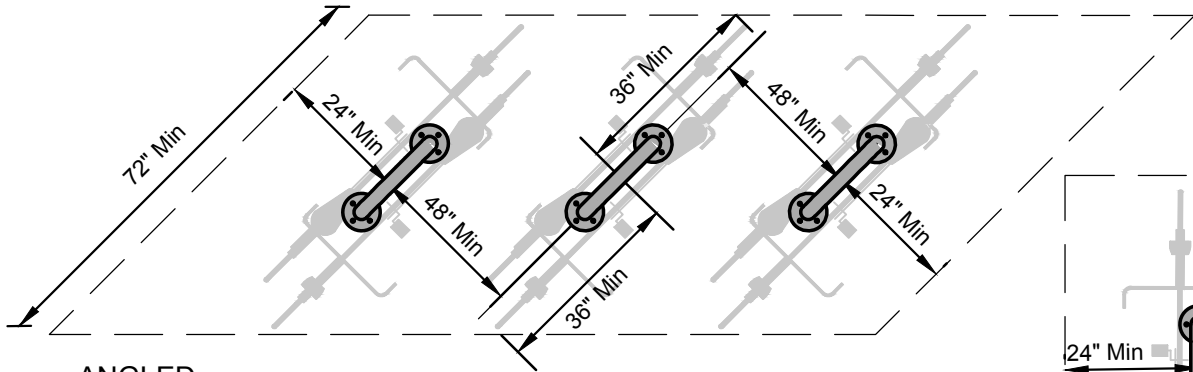
** ACCEPTABLE INSTALLATION HARDWARE:
A. CONCRETE WEDGE ANCHOR BOLT OR TAMPER-PROOF STUD ANCHOR (RAWL OR APPROVED EQUAL)
B. ASPHALT PAVEMENT: LANDSCAPE NAILS (6" - 12" LONG SPIKES, TYPICALLY 1/4" TO 3/8" IN MIN. OF 2 STUDS PER MOUNTING PLATE)

NOTES:

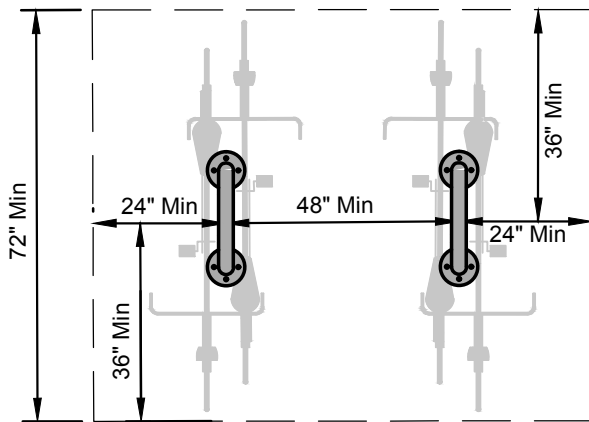
1. ALL RACKS & BASE PLATES SHALL BE HOT-DIP GALVANIZED, THERMOPLASTIC, OR STAINLESS STEEL FINISH.
2. BICYCLE RACK DESIGN AND LAYOUT SHALL BE AS RECOMMENDED BY THE "BICYCLE PARKING GUIDELINES" AS ADOPTED BY THE ASSOCIATION OF PEDESTRIAN AND BICYCLE PROFESSIONALS (WWW.APBP.ORG). OTHER RACK STYLES MEETING THESE GUIDELINES ARE ACCEPTABLE.

REVISIONS				DWG. NO. 2.6.10
NO.	DATE	DESCRIPTION	INIT.	
				PAGE 1 OF 2

**BICYCLE PARKING
DETAIL (TYP.)**



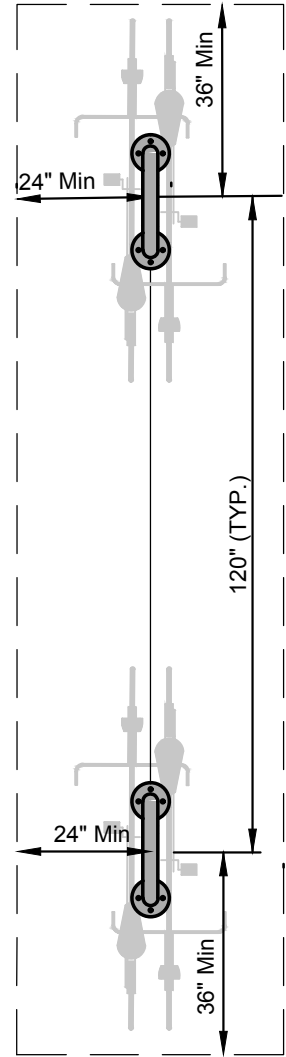
ANGLED



SIDE-BY-SIDE

NOTES:

1. ALL MEASUREMENTS ARE ON CENTER
2. ADEQUATE AREA TO MANEUVER BICYCLES TO ACCESS BICYCLE PARKING SPACES REQUIRED
3. BICYCLE PARKING SHALL NOT ENCROACH UPON ACCESSIBLE PATHS
4. BICYCLE PARKING SPACES SHALL BE A MINIMUM 12" FROM VEHICULAR PARKING, VEHICULAR TRAVELWAYS, AND VERTICAL SURFACES



END-TO-END

REVISIONS

NO.	DATE	DESCRIPTION	INIT.

**BICYCLE PARKING
DETAIL (TYP.)**

DWG. NO.

2.6.10

PAGE

2 OF 2

2.7 Private Street Standards

For all developments in which private streets are allowed, the street must meet the following standards or comparable standards approved by the City Engineer and Director of Public Works:

1. Twenty-four (24) foot curb-to-curb width, 44-foot easement width (minimum), no parking permitted, 2-ft utility strips and 5-foot wide sidewalks on both sides of the street.
2. Twenty-eight (28) foot curb-to-curb width, 48-foot easement width (minimum), no parking permitted, 2-foot utility strips and 5-foot wide sidewalk on both sides of street.
3. Thirty-two (32) foot curb-to-curb width, 52-foot easement width (minimum), no parking permitted on one side, 2-foot utility strips and 5-foot wide sidewalks on both sides of street.
4. Forty (40) foot curb-to-curb width, 60-foot easement width (minimum), parallel parking permitted on both sides of street, 2-foot utility strips, 5-foot wide sidewalks on both sides of street, six-foot wide street median.
5. Divided entryway streets – 20-foot curb-to-curb for both directions of travel, 60-foot easement width minimum, 2-foot utility strips and 5-foot wide sidewalks on both sides of street, six-foot wide street median.
6. Street width measured from curb face to curb face.
7. Designated bicycle routes (“share the road”) or painted bicycle lanes are encouraged to be utilized where space permits. Refer to AASHTO Guidelines for the Development of Bicycle Facilities.
8. Visitor vehicle parking spaces required where on-street parking not provided.
9. All other street design criteria, materials, methods, etc. not mentioned above shall conform to standards for public streets.
10. Developments with private streets shall provide appropriate easements and a Maintenance Agreement per 3.1.13.

2.8 Retaining Walls

(2.8.1) Design

All retaining walls shall be designed in accordance with sound engineering, based on specific installations. Prefabricated sectional retaining walls shall be designed and constructed in strict accordance with manufacturer’s standards. Retaining wall design shall account for soil types, soil bearing, loading, slope stability, global stability, drainage and any other factors which may impact the integrity of the design or installation.

(2.8.2) Calculations

The plan submission shall include detailed design calculations for any

retaining wall within a public right-of-way or public easement, and any retaining wall whose failure would cause damage to or interruption of public facilities. Such calculations shall be sealed, signed and dated by a professional engineer licensed to practice in Virginia.

(2.8.3) Acceptance

Acceptance by the City of retaining wall designs and installations on private property shall not imply that the City is in any way responsible for their integrity or liable for their failure.

(2.8.4) Building Permit

All retaining walls greater than four feet in height shall be covered under a Building Permit (plans shall include such a note). Calculations and details may be required regardless of whether they were included with the site plan.

(2.8.5) Maintenance Easement

Retaining walls to be owned and maintained by the City must be made accessible for maintenance. Provision for such accessibility on private property shall be in the form of a retaining wall access/maintenance easement. Limits of the easement shall be determined during plan review. Recordation of the easement plat and deed is a prerequisite to release of bond.

2.9 Site Lighting

(2.9.1) Orientation

Site lighting shall be designed such that light is directed away from adjacent properties and public right-of-ways and shall be directed downward to minimize light emission directed at the sky. Outside flood-type lighting attached to building shall also be so designed.

(2.9.2) Location

Site plans shall show location of lighting on site and indicate location of flood-type lighting on buildings. Plans shall also show, either on the construction plan or on a reduced scale insert, the foot-candle distribution of such lighting, drawn to scale, for the particular fixtures proposed. Illumination beyond the site boundaries shall not exceed 0.5 foot-candles.

(2.9.3) Advertising

Sign luminaries utilized for advertising shall be shielded to eliminate glare or extraneous light on the roadway.

2.10 Traffic Control

Development plans which indicate significant interruption of existing traffic patterns or traffic safety shall contain a specific traffic control plan, devised and detailed in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and approved by the Public Works Director or his designee.

Plans which indicate limited interruptions of existing traffic patterns shall have a note affixed to them stating that traffic control on public streets will be performed in accordance with the MUTCD and as further directed by City public works inspectors.

The Public Works Director or City Engineer shall make the decision during the plan development or plan review stage as to whether a development plan requires a detailed traffic control plan.

2.11 Emergency Access/Site Protection

(2.10.1) Access Roads

All construction sites shall have, prior to placement of combustible materials or erection of any structure, a minimum twenty feet wide all-weather access road, located and constructed in accordance with City Fire Department requirements. Such road shall be accessible to emergency vehicles at all times during construction. Plans shall show such access roads and shall note any specifications necessary for their construction, maintenance and continued accessibility. **(2.11.2) Fire Protection**

Major construction sites, at the discretion of the City Fire Chief, shall be provided with adequate fire protection water of a temporary and/or permanent nature, prior to the placement of any combustible materials or the erection of any structure on the site. Adequacy of such fire protection shall be determined by the City Fire Chief during the site plan review process. Temporary or private installations thus required shall be bonded along with other public facilities prior to issuance of a land-disturbing permit. Plans shall show such measures and shall note any specifications necessary for their construction.

(2.11.3) Utility Protection

All gas meters, electric transformers or other similar utility installations that are located in areas subject to vehicular traffic shall be provided with vehicle protection barriers.

2.12 General Notes

The following general notes, as applicable, shall be affixed to all plans, unless separate specifications accompanying the project plans that address these requirements are submitted for review with the plans:

1. Work in this project shall conform to the latest editions of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications, the VDOT Road and Bridge Standards, the Virginia Erosion and Sediment Control Handbook, the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Handbook, the Virginia Stormwater Management Regulations and the City of Harrisonburg Design and Construction Standards Manual. In the event of conflict between any of these standards, specifications or plans, the most stringent shall govern. All utilities to be dedicated to the City of Harrisonburg Municipal Water and/or Sanitary Sewer System shall be constructed and tested to conform to Commonwealth of Virginia/State Board of Health Waterworks and/or Sewerage Regulations and the City of Harrisonburg Design and Construction Standards Manual.
2. Erosion and Sediment control measures shall be maintained continuously relocated when and as necessary and shall be checked after every rainfall. Seeded areas shall be checked regularly and shall be watered, fertilized, reseeded and mulched as necessary to obtain a dense stand of grass.
3. All drain inlets shall be protected from siltation. Ineffective protection devices shall be immediately replaced and the inlet cleaned. Flushing is not an acceptable method of cleaning.
4. When the crushed stone construction entrance has been covered with soil or has been pushed into the soil by construction traffic, it shall be replaced with a depth of stone equal to that of original application.
5. The location of existing utilities as shown is approximate only. The contractor is responsible for locating all public or private utilities that lie in or adjacent to the construction site. The contractor shall be responsible for repairing, at his expense, all existing utilities damaged during construction. Forty-eight (48) hours prior to any excavation call Miss Utility 1 (800) 552-7001.
6. All underground facilities located within the City's rights-of-way shall be installed prior to the placement of any part of the pavement structure.
7. Installation of concrete storm pipe shall comply with VDOT Standard Drawing PB-1.

8. All materials used for fill or back-fill shall be free of wood, roots, rocks, boulders or any other non-compactable soil type material. Unsatisfactory materials also include man-made fills and refuse debris derived from any source.
9. Satisfactory material for use as fill for public streets include material classified in ASTM D-2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, and CL groups. The moisture content shall be controlled within plus or minus 2 percentage points of optimum to facilitate compaction. Generally, unsatisfactory materials include materials classified in ASTM D-2487 as PT, CH, MH, OL, OH, and any soil too wet to facilitate compaction. CH and MH soils may be used subject to approval of the City Engineer. Soils shall have a minimum dry density of 92lb/cubic foot per ASTM D-698 and shall have a plasticity index less than 12.
10. Compaction of fill material under building slabs shall be based upon recommendations of soils engineer after completion of standard Proctor test and shall meet bearing requirements of architect for buildings. The contractor shall be responsible for testing.
11. Materials used to construct embankments for any purpose, back-fill around drainage structures or in utility trenches or any other depression requiring fill or back-fill shall be compacted to 95% of maximum density as determined by the standard Proctor test as set out in ASTM standard D-698. The contractor shall, prior to any operations involving filling or backfilling, submit the result of the Proctor test to the city's on-site inspector together with a certification that the soil tested is representative of the materials to be used on the project. Tests shall be conducted by a certified materials testing laboratory and the certifications made by a licensed professional engineer representing the laboratory.
12. Certifications for materials including, but not limited to stone, concrete, pipes, precast units, handrails, stabilization mats, traffic signal items, must be provided to the city's on-site inspector and approved by the inspector prior to installation. See inspector for Materials Certification Checklist.
13. Embankment fill and trench back-fill shall be placed in lifts at a maximum uncompacted depth of 8-inches and 6-inches, respectively. Density tests shall be conducted at the following minimum frequencies:
 - (a) Embankment for roads, streets, dams, etc.: One test per lift per 10,000 square feet of lift.
 - (b) Back-fill around structures and in trenches: One test per lift per 500 lineal feet of trench.
14. Compaction tests for street pavement structure shall be made in cut and fill areas at the following minimum frequencies:
 - (a) Sub-Grade: One test per lane per 500 lineal feet.

- (b) Stone Base: One test per lane per 6" compacted lift per 500 lineal feet.
 - (c) Hot Asphaltic Concrete: One test per lane per lift per 500 lineal feet.
- 15. All excavations, including trenches, shall be kept dry to protect their integrity.
- 16. Test results shall be submitted to the City Engineer. Failure to conduct density tests and submit test results shall be cause for non-acceptance of the facility. Tests shall be conducted at the sole cost of the developer or his agent.
- 17. Combination under-drains type CD-1 shall be installed at the lower end of the cut sections. Under-drains type CD-2 shall be installed at the low point of all vertical curves.
- 18. Standard UD-1 and UD-3 under-drains shall be installed where indicated on plans on further where determined necessary in the field by the City Inspectors.
- 19. City Inspectors have full authority to reject fill or backfill materials, require undercutting or sub grade stabilization, require provisions for sub drainage, or require other measures which affect the integrity of road and utility construction. Failure to comply with Inspectors' directives shall be cause for non-acceptance of the facility.
- 20. Traffic control on public streets shall be in conformance with the Manual of Uniform Traffic Control Devices and as further directed by City Inspectors. City Inspectors must be notified 24-hours in advance of any planned work or activity in city right-of-way that requires flagging, lane closure or street closure. All signage and other control devices shall be in place before such activities can commence.
- 21. Any discrepancies found between the drawings and specifications and site conditions or any inconsistencies or ambiguities in drawings or specifications shall be immediately reported to the engineer, in writing, who shall promptly address such inconsistencies or ambiguities. Work done by the contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the contractor's risk.
- 22. A preconstruction conference shall be held prior to the start of construction. The contractor shall arrange the meeting with the City Engineer. At this time, the contractor shall provide a schedule and traffic control plan for work within the city right-of-way.
- 23. Install City standard street centerline monuments where required for new streets.
- 24. If Traffic Signal plans have been revised or changed since approval, the developer must provide to the Director of Public Works as-built drawings reflecting changes. Provision of as-built drawings is a condition of bond release.