

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT TECHNICAL POLICY

POLICY NO.: Technical Policy, TECH-014

EFFECTIVE DATE: August 31, 2009
Figure 014-A Revised April 9, 2015

POLICY NAME: Erosion Protection of Stem Wall Foundations in Floodway Fringe Areas

PURPOSE: To clarify 16.20.020.C.4 of the Ordinance regarding the specifications for building construction and materials in order to establish consistent permitting requirements that are sufficiently protective of the structure elevated on stem walls for the flood and erosion hazards that have been identified.

BACKGROUND:

The Floodplain and Erosion Hazard Management Ordinance (Ordinance) provision 16.20.020.C.4 requires that an applicant submit specifications for building construction when requested by the Chief Engineer. Historically, this placed the burden on the District to identify when the foundation design considerations would be required, and when found necessary, this requirement was often objectionable to the applicant due to the unanticipated cost and time associate with the evaluation, design, and approval of the foundation.

In order to more consistently implement this provision, reduce engineering costs and review times, and sufficiently protect the structure from flood and erosion hazards, the District has developed this policy which establishes minimum toe-down depths for stem wall foundations. The toe-down depths have been developed using standard engineering practice including use of the following:

- 1) The City of Tucson Drainage Standards Manual, specifically Chapter 6, which provides methods to determine maximum anticipated erosion/scour depths. The scour equation in Chapter 6 includes the effects of local scour due to obstructions of flow, such as a structure. The applicable portions of the scour equation will be used in estimating maximum anticipated scour. However, Equation 6-3 of the Manual is an additive equation that establishes maximum anticipated scour based on a variety of scour components. Since some of these components are not applicable for structures in broad floodplains, this policy may establish design criteria that is not as restrictive as the equation.
- 2) FLO-2D - The District commenced an evaluation of the flooding effects on stem wall foundation using FLO-2D modeling. This analysis provided significant insights regarding the flow of water around structures, demonstrating that an increased level of protection at the upstream corners should be provided.

In addition, in order to efficiently and effectively address the need for minimum erosion protection standards across a wide variety of flow regimes, the District has chosen to apply minimum standards categories using ranges of flow depths and flow velocities. The criteria from these publications and calculations are used as the basis for this policy.

POLICY:

This policy may be used to calculate stem wall foundation toe-down depths as long as the following conditions are met:

- 1) The structure does not encroach into an Erosion Hazard Setback, a study area that establishes a requirement for an engineering analysis or an area that the District has determined that, due to unusual conditions, engineering is required. If a structure is proposed in these areas, an engineering analysis to specify foundation construction characteristics will be required and will supersede this policy.
- 2) The obstructive width of the structure is 40 feet or less. The attached Table has been developed for a structure that is 40 feet wide and may be used for structures that are 40 feet wide or less. Structures wider than 40 feet will require an engineering analysis to determine the foundation construction characteristics.
- 3) The structure shall be oriented with the long axis parallel to the direction of flow. This will minimize the flow obstruction and reduce the potential scour depths.
- 4) Stem wall foundation scour protection shall be constructed in accordance with the attached Table, which prescribes protection at specific locations:
 - a. When the structure is surrounded by floodwaters:
 - i. A toe-down depth is prescribed along the entire upstream edge of the structure and at least 10 feet along the sides of the structure extending from the upstream corners,
 - ii. A second toe-down depth is prescribed along the remaining perimeter of the structure.
 - b. When the fill pad is not surrounded by floodwaters:
 - i. A toe-down depth is prescribed along the upstream edge and at least 10 feet along the side(s) of the structure that are located within the 100-year floodplain,
 - ii. A second toe-down depth is prescribed along the remaining perimeter of the structure that is located within the 100-year floodplain,
 - iii. The portions of the structure that are not exposed to floodwaters do not require erosion protection.
- 5) If the stem wall has the potential to retain more than 4 feet of fill after accounting for the anticipated scour, the applicant shall provide a construction detail, prepared by an Arizona registered structural engineer, for the retaining wall.
- 6) Stem wall details and specifications shall either be shown on the site plan, or the appropriate Figure(s) referenced on the site plan.

APPROVED BY:


Suzanne Shields
Director

Date



Original Policy Approved:

Date(s) Revised: Figure 014-A revised 4/9/2015

TABLE 014 STEM WALLS

TOE-DOWN DEPTH REQUIREMENTS FOR EROSION PROTECTION OF STEM WALLS WITH A MAXIMUM WIDTH OF 40 FEET PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT TECHNICAL POLICY TECH-014

- ASSUMPTIONS:
1. Structure constructed/installed such that long dimension is generally aligned with the direction of flow;
 2. design scour depth at upstream corners applies over entire upstream edge and 10 feet along sides measured from upstream corners
 3. manning's roughness coefficient for overbank flow per Table 8.1, SMDDFM = 0.060;
 4. hydrodynamic forces negligible below flow velocity of 5 fps

Flow Depth, ft	slope, ft/ft														
	0.002	0.004	0.006	0.008	0.010	0.012	0.014	0.016	0.018	0.020	0.022	0.024	0.026	0.028	0.030
0.5	0.7	1.0	1.2	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7
1.0	1.1	1.6	1.9	2.2	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.3
1.5	1.4	2.0	2.5	2.9	3.2	3.5	3.8	4.1	4.3	4.6	4.8	5.0	5.2	5.4	5.6
2.0	1.8	2.5	3.0	3.5	3.9	4.3	4.6	5.0	5.3	5.5	5.8	6.1	6.3	6.5	6.8
2.5	2.0	2.9	3.5	4.1	4.5	5.0	5.4	5.7	6.1	6.4	6.7	7.0	7.3	7.6	7.9
3.0	2.3	3.2	4.0	4.6	5.1	5.6	6.1	6.5	6.9	7.2	7.6	7.9	8.2	8.6	8.9

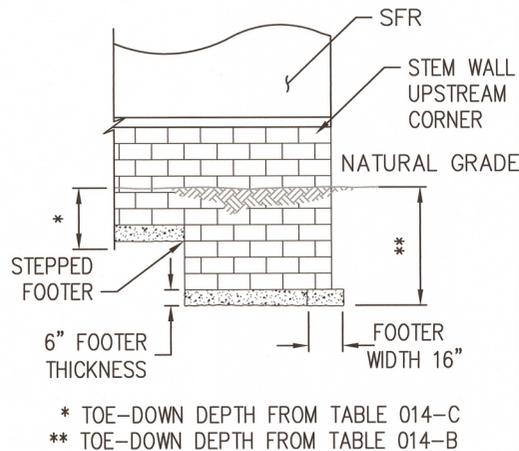
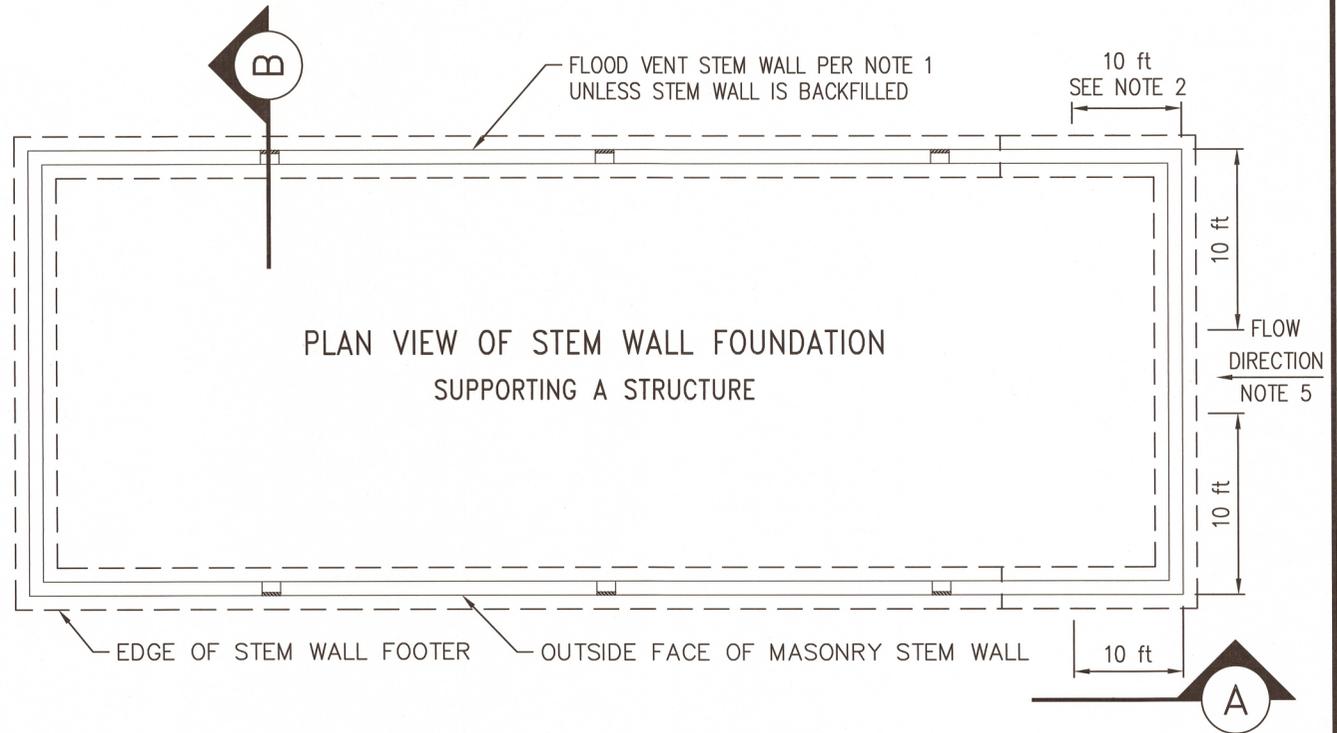
Flow Depth, ft	slope, ft/ft														
	0.002	0.004	0.006	0.008	0.010	0.012	0.014	0.016	0.018	0.020	0.022	0.024	0.026	0.028	0.030
0.5															
1.0															
1.5															
2.0															
2.5															
3.0															

Flow Depth, ft	slope, ft/ft														
	0.002	0.004	0.006	0.008	0.010	0.012	0.014	0.016	0.018	0.020	0.022	0.024	0.026	0.028	0.030
0.5															
1.0															
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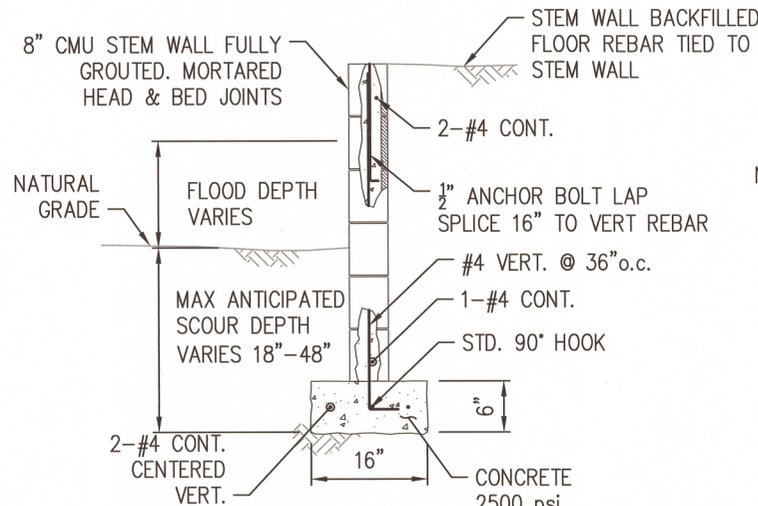
DV² Greater than 18	= 18 inches deep	= 24 inches deep	= 36 inches deep	= 48 inches deep	= Engineered foundation required.
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NOTES

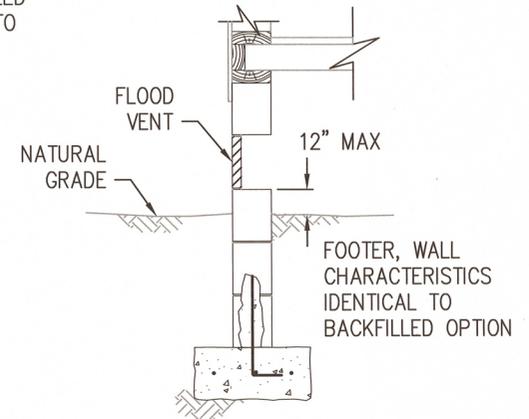
- VENT OPENINGS IN STEM WALL:
 - PROVIDE 1 SQUARE INCH OF NET OPEN VENT AREA FOR EACH SQUARE FOOT OF BUILDING FLOOR SPACE
 - PLACE BOTTOM OF VENTS 1 FOOT (MAX) ABOVE NATURAL GRADE.
 - ALL SCREENS AND LOUVERS MUST AUTOMATICALLY OPEN TO ALLOW UNOBSTRUCTED FLOW OF FLOOD WATERS, OR OTHERWISE MAY BE SCREENED WITH 1/2-INCH MIN SCREEN.
 - DISTRIBUTE REQUIRED VENTS UNIFORMLY ON AT LEAST TWO OPPOSING WALLS.
- FOOTER DEPTH FROM TABLE 014, SHALL APPLY ALONG ENTIRE UPSTREAM END, AND ALONG UPSTREAM-MOST 10 FEET OF BOTH SIDES OF STEM WALL. FOOTER DEPTH FOR REMAINING STEM WALL FROM TABLE 014-C.
- FOR MONOPOUR FOUNDATIONS, POUR FOUNDATION DOWN TO DEPTH FROM TABLE 014B-C AND 014-C.
- FOUNDATION ELEMENTS LOCATED WITHIN THE PERIMETER OF STEM WALL SHALL NOT BE REQUIRED TO BE PLACED BELOW MAXIMUM ANTICIPATED SCOUR DEPTH. LOCATION OF, AND STRUCTURAL CHARACTERISTICS OF INTERIOR FOUNDATION ELEMENTS SHALL BE DETERMINED BY OTHERS.
- STRUCTURAL FOOTER CHARACTERISTICS SUCH AS WIDTH, THICKNESS, REINFORCING, ETC. ARE MINIMUM ALLOWED AND ARE SUBJECT TO BUILDING CODE REVIEW.
- LONG DIMENSION OF FOUNDATION TO BE ORIENTED PARALLEL TO DIRECTION OF FLOW.
- MATERIALS: CONCRETE 2500 psi; MORTAR TYPE M, N, OR S PER ASTM C270; GROUT SHALL BE COARSE AGGREGATE PER ASTM VC476; REBAR 60 KSI; CMU ASTM C-90 TYPE I OR TYPE II.



A SECTION
SCALE: N.T.S.



B SECTION BACKFILLED
SCALE: N.T.S.



B SECTION VENTED
SCALE: N.T.S.