City of Bozeman
BUILDING INSPECTION DIVISION

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New Residential Subdivisions – Soils Analysis, Load- Bearing Capacity and Foundation Design

The City of Bozeman, Building Division has adopted the International Residential Code (IRC), which sets prescriptive standards for the load-bearing capacity of soil and foundation design that may be utilized. Prescriptive tables in the IRC, based on soil bearing capacity, set the minimum width and thickness for footings and the minimum thickness and depth for foundation walls (modified by our local frost depth and our Seismic Design Category D-1). **A soils report is required for all new subdivisions to set the minimum standard for building foundation design in the entire subdivision based on soils type and load-bearing capacity. This report is to be provided to the Building Division prior to any permits being issued within the subdivision. Fill over 12" in depth requires an engineers compaction report provided to the Building Division unless ¾" washed rock is utilized for fill. It is imperative that the soils type and load-bearing capacity be verified and the foundation design is approved prior to requesting any foundation inspection. A letter detailing compliance to the applicable foundation and soils investigation report shall also be provided by a licensed engineer for each individual construction project prior to a building permit being issued. This report will become part of the approved plans.**

IRC Presumptive Load-Bearing Values of Foundation Materials - Table R401.4.1

Class of Material	Load-Bearing Pressure (pounds/sq. ft.)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC.)	2,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CI, ML, MH and CH)	1,500*

* Load-bearing capacities of less than 1,500 psf require a foundation design by a State of Montana Registered Engineer

IRC Footings Supporting Walls of Light-Frame Construction - IRC Table 403.1

Number of Floors Supported by the Footings	Minimum Width of Footings (inches) (based on 1500 psf Load-Bearing Pressure)	Minimum Thickness of Footings (inches)
1	12	6
2	15	6*
3	23	6*

Note: footing projections beyond foundation walls shall be at least 2 inches but shall not exceed the footing thickness

* The City of Bozeman suggests a minimum 8" thick footing for 2 & 3 story designs

IRC R404.1 Foundation Walls. Concrete (and masonry) foundation walls shall be constructed as set forth in Tables R404.1.1 (2) through R404.1.1 (4) (except as modified for Seismic Design Category D-1 requirements). A design by a Licensed Architect or Engineer is required when any of the following conditions exist: 1.) Walls are subject to hydrostatic pressure from groundwater. 2.) Walls supporting more than 48 inches of unbalanced backfill that do not have permanent lateral support at the top and bottom. **The minimum stem wall thickness is 10 inches when utilizing IRC prescriptive design methods.**

IRC Foundation Walls - IRC Table R404.1.1(3)
Minimum Vertical Reinforcement Size and Spacing for 8-Inch Nominal Wall Thickness

Maximum Wall Height (feet)	Maximum Unbalanced Fill (feet)	Soil Classes: GW, GP, SW, and SP	Soil Classes: GM, GC, SM, SM-SC and ML	Soil Classes: SC, MH, ML-CL and inorganic CL
6 feet 8 inches	4 feet (or less) 5 feet 6 feet 8 inches	#4 at 56" o.c. same same	#4 at 56" o.c. same #5 at 56" o.c.	#4 at 48" o.c. same #5 at 48" o.c.
7 feet 4 inches	4 feet (or less) 5 feet 6 feet 7 feet	#4 at 56" o.c. same same #4 at 56" o.c.	#4 at 56" o.c. same same #5 at 56" o.c.	#4 at 56" o.c. Same #5 at 56" o.c. #6 at 56" o.c.
8 feet	4 feet (or less) 5 feet 6 feet 7 feet 8 feet	#4 at 56" o.c. same same #4 at 56" o.c. #5 at 56" o.c.	#4 at 56" o.c. same same #5 at 56" o.c. #6 at 56" o.c.	#4 at 56" o.c. same #6 at 56" o.c. #6 at 56" o.c. #6 at 48" o.c.
9 feet 4 inches	4 feet (or less) 5 feet 6 feet 7 feet 8 feet 9 feet 4 inches	#4 at 56" o.c. same # 4 at 56" o.c. same # 5 at 56" o.c. #6 at 56" o.c.	#4 at 56" o.c. same #5 at 56" o.c. same #6 at 56" o.c. #6 at 40" o.c.	#5 at 56" o.c. same #5 at 56" o.c. #6 at 56" o.c. #6 at 40" o.c. #6 at 24" o.c.

Minimum Prescriptive Requirements

- Vertical reinforcing steel shall be Grade 60 minimum
- Where a construction joint is created between a concrete footing and stem wall, a minimum of one vertical #4 rebar shall be provided at not more than 48" on center
- The vertical rebar shall be a minimum of 5" from the face of the soil
- The vertical rebar shall extend to 3" clear of the bottom of the footing, have a standard hook and extending a minimum of 14" into the stem wall
- Foundations with stem walls shall be provided with a minimum of one #4 rebar at the top of the wall and one #4 rebar at the bottom of the footing
- Interior footings supporting bearing or bracing walls and cast monolithically with a slab on grade shall extend to a depth of 18" below top of slab
- Slabs on grade with turned down footings shall have a minimum of one #4 rebar at the top and bottom of the footing or one #5 rebar located in the middle 1/3 of the footing
- Frost depth for the Bozeman area is 36 inches for single story and 48 inches for two story and masonry footings (same standard utilized by the State Building Codes Bureau)
- When the building is heated to a minimum of 64° an IRC prescriptive design mono-slab may be utilized per Table R403.3 and figures 403.3(1) through 403.3(4) (utilize an air freezing index of 2500)
- The City of Bozeman, Building Division's default design may be utilized for residential foundations which includes: 2 - #4 rebar in footings, #4 rebar spaced 18" o.c. horizontal and vertical in foundation walls, upper horizontal bar to be within 12" of the top of the foundation wall; single story foundation walls 6" thick on 6"X12" footing, two story and masonry foundation walls 8" thick on 8"X15" footing (not applicable for sites containing a soil load-bearing capacity of less than 1500 psf). Slab-on-grade reinforcement is to be #3 bars at 18" o.c. in the longitudinal and transverse directions or 6"X6"X10X10 woven wire mesh. **All reinforcing materials are to be chaired up.**
- Slab on grade foundations and mono-slab foundation systems can be constructed in conformance with the IRC tables detailed above, City of Bozeman default standards and, if applicable, IRC table 403.3 and figure 403.3(1) based on an air freezing index of 2,500