

APPENDIX 120.R

GUIDANCE FOR SELECTION OF FOUNDATION MATERIAL CLASSES

120.R1.1 Purpose: The purpose of Appendix D is to provide guidance for the selection of the material class and consistency in place when using Table AD-2, Allowable Bearing Pressures for Foundation Materials.

120.R1.2 Application: Appendix D is provided only as a general guide to engineering judgment. All available data should be evaluated and professional engineering judgment exercised in selection of the appropriate material classification for use with Table AD-2. The references on soil and rock classification and typical ranges of index properties provided in this appendix should not be considered to be code requirements.

120.R1.3 Classification of Soil: Guidelines for generally accepted engineering practice in the description and classification of soils are provided in ASTM D2488-84 Description and identification of

Soils (Visual-Manual Procedure) and ASTM D2487-85 Classification of Soils for Engineering Purposes.

120.R1.4 Classification of Rock: Guidelines for generally accepted engineering practice in the description and classification of rocks are provided in Chapter 1 of Design Manual 7.1 - Soil Mechanics, Naval Facilities Engineering Command, May 1982 (NAVFAC DM-7.1)

120.R1.5 Typical Index Properties: Typical ranges of index properties for the Material Classes listed in Table 120.R1 are provided in Table 120.R2.

Table 120.R1
ALLOWABLE BEARING PRESSURES FOR
FOUNDATION MATERIALS

Material Class	Description	Notes	Consistency in Place ¹	Allowable Net Bearing Pressure (tons/ft ²)
1a	Massive bedrock: Granite, diorite gabbro, basalt, gneiss	3	Hard, sound rock, minor jointing	100
1b	Quartzite, well cemented conglomerate	3	Hard, sound rock moderate jointing	60
2	Foliated bedrock: slate, schist	3	Medium hard rock, minor jointing	40
3	Sedimentary bedrock: cementation shale, siltstone, sandstone, limestone, dolomite, conglomerate	3, 4	Soft rock, moderate jointing	20
4	Weakly cemented sedimentary bedrock: compaction shale or other similar rock in sound condition	3	Very soft rock	10
5	Weathered bedrock: any of the above except shale.	3, 5	Very soft rock, weathered and/or major jointing and	8

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Material Class	Description	Notes	Consistency in Place ¹	Allowable Net Bearing Pressure (tons/ft ²)
			fracturing	
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgement), hardpan	7,8	Very dense	10
7	Gravel, widely graded sand and gravel; and granular ablation till	6, 7, 8	Very dense Dense Medium dense Loose Very loose	8 6 4 2 Note 11
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials)	6, 7, 8, 9	Dense Medium dense Loose Very loose	4 3 2 Note 11
9	Fine sand, silty fine sand, and non-plastic inorganic silt	6, 7, 9	Dense Medium dense Loose Very loose	3 2 1 Note 11
10	Inorganic sandy or silty clay, clayey sand, clayey silt, clay, or varved clay; low to high plasticity	5, 6, 10	Hard Stiff Medium Soft	4 2 1 Note 11
11	Organic soils: peat, organic silt, organic clay	11		Note 11

Notes for Table 120.R1:

1. Refer to 120.R2 regarding typical index test values that may be helpful as guides for evaluation of consistency in place.
2. Refer to Chapter 18 of the 6TH Edition Massachusetts Building Code for determination of design loads and for special cases.
3. The allowable bearing pressures may be increased by an amount equal to 10% for each foot of depth below the surface of sound rock; however, the increase shall not exceed two times the value given in the table.
4. For limestone and dolomite, the bearing pressures given are acceptable only if an exploration program performed under the direction of a registered design professional demonstrates that there are no cavities within the zone of influence of the foundations. If cavities exist, a special study of the foundation conditions is required.
5. Weathered shale and/or weathered compaction shale shall be included in Material Class 10. Other highly weathered rocks and/or residual soils shall be treated as soil under the appropriate description in Material Classes 6 to 10. Where the transition between residual soil and bedrock is gradual, a registered design professional shall make a judgment as to the appropriate bearing pressure.
6. Settlement analyses in accordance with Chapter 18 of the 6th Edition Massachusetts Building Code should be performed if the ability of a given structure to tolerate settlements is in question, particularly for, but not limited to, soft or very soft clays and silts and loose granular materials.
7. Allowable bearing pressures may be increased by an amount equal to 5% for each foot of depth of the bearing area below the minimum required in Chapter 18 of the 6th Edition Massachusetts Building Code; however, the bearing pressure shall not exceed two times the value given in the table. For foundation bearing areas having a least lateral dimension smaller than three feet, the allowable bearing pressure shall be 1/3 of the tabulated value times the least dimension in feet.
8. Refer to Chapter 18 of the 6th Edition Massachusetts Building Code when these materials are used as compacted fills.

9. These materials are subject to the provisions in Chapter 18 of the 6th Edition Massachusetts Building Code for Liquefaction).
10. Alternatively, the allowable bearing pressure may be taken as 1.5 times the peak unconfined compressive strength of undisturbed samples for square and round footings or 1.25 times that strength for footings with length to width ratio of 4 or greater. For intermediate cases, interpolation may be used.
11. A registered design professional shall be engaged to provide recommendations for these special cases. Direct bearing on organic soils is not permitted. Organic soils are allowed under foundations for those cases defined in Chapter 18 of the 6th Edition Massachusetts Building Code , Preloaded materials.

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**TABLE 120.R2
TYPICAL RANGE OF INDEX PROPERTIES**

Material Class	Description	Consistency in Place	Rock Quality Designation (RQD%)	Unconfined Compressive Strength (PSF)	Standard Penetration Resistance (Blows/Foot)
1a 1b	Massive bedrock - granite, diorite, gabbro, basalt, gneiss, quartzite, well-cemented conglomerate	Hard rock, minor jointing Hard sound rock, moderate jointing	>75 50 to 75	>8000	-
2	Foliated bedrock	Medium hard rock minor jointing	>50	>8000	-
3	Sedimentary bedrock-cementation shale, silt-stone, sandstone, limestone, dolomite, conglomerate	Soft rock, moderate jointing	>50		-
4	Weakly cemented sedimentary bedrock - compaction shale or other similar rock in sound condition	Very soft rock	<50		
5	Weathered bedrock - any of the above except shale	Very soft rock. weathered and/or major jointing and fracturing	<50		-
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgement), haropan	Very dense	-		>50
7	Gravel, widely graded sand and gravel, and granular abiation till	Very dense Dense Medium dense Loose Very loose	-		>50 41-50 16-40 8-15 <8
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials)	Dense Medium dense Loose Very loose	-		>30 11-30 6-10 <6
9	Fine sand, silty sand and non-plastic inorganic silt	Dense Medium dense loose Very loose	-		>30 11-30 6-10 <6
10	Inorganic sandy or silty clay, clayey sand, clayey slit, clay or varved clay low to high plasticity	Hard Stiff Medium Soft	-		>20 9-20 4-8 <4
11	Organic soils - peat organic silt, organic clay	-	-		-

Notes to table 120.R2

Note 1: For discussion of RQD values see Deere, D.U., Rock Mechanics in Engineering Practice (Chapter 1), Stagg and Zinkiewicz, Eds., 1968, John Wiley and Sons, Inc.

Note 2: For determination of Unconfined Compressive Strength see ASTM D2938.

Note 3: For determination of Standard Penetration Resistance N-value see ASTM D1586. The presence of large particles (coarse gravel, cobbles, boulders) may cause N-values to be unrealistically high. Such values should not be used. Also standard penetration resistance should not be used over depths less than five feet.

