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UNIFIED FACILITIES CRITERIA (UFC)

DESIGN: GENERAL BUILDING REQUIREMENTS

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U.S. ARMY CORPS OF ENGINEERS

NAVAL FACILITIES ENGINEERING COMMAND (Preparing Activity)

AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

Record of Changes (changes are indicated by **1**\ ... /**1**/)

Change No.	Date	Location

FOREWORD

The Unified Facilities Criteria (UFC) system as prescribed by MIL-STD 3007, provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with USD(AT&L) Memorandum dated 29 May 2002. UFC will be used for all service projects and work for other customers where appropriate.

UFC are living documents and will be periodically reviewed, updated, and made available to users as part of the Services' responsibility for providing technical criteria for military construction. Headquarters, U.S. Army Corps of Engineers (HQUSACE), Naval Facilities Engineering Command (NAVFAC), and Air Force Civil Engineer Support Agency (AFCESA) are responsible for administration of the UFC system. Defense agencies should contact the preparing service for document interpretation and improvements. Technical content of UFC is the responsibility of the cognizant DoD working group. Recommended changes with supporting rationale should be sent to the respective service proponent office by the following electronic form: Criteria Change Request (CCR). The form is also accessible from the Internet sites listed below.

UFC are effective upon issuance. UFC are distributed only in electronic media from the following sources:

- Unified Facilities Criteria (UFC) Index http://65.204.17.188//report/doc ufc.html.
- USACE TECHINFO Internet site **http://www.hnd.usace.armv.mil/techinfo/index.htm.**
- NAVFAC Engineering Innovation and Criteria Office Internet site http://criteria.navfac.navymil.
- Construction Criteria Base (CCB) system maintained by the National Institute of Building Sciences at Internet site **http//www.nibs.org/ccb.**

Hard copies of UFC printed from electronic media should be checked against the current electronic version prior to use to ensure that they are current.

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INTRODUCTION

1-1 **PURPOSE.** This UFC provides guidance for the use of model building codes for design and construction of Department of Defense (DOD) facilities.

1-2 **AUTHORITY.** Public Law 104-113, *National Technology Transfer and Advancement Act of 1995,* requires Federal use of private sector consensus standards wherever practicable. The goal of the law is to reduce reliance on Federal standards by using industry standards when there is potential to simplify contracting, increase timeliness and cost effectiveness, and promote the safety and welfare of users.

1-3 **POLICY.** Model building codes must be used as a basis of future development of criteria, standards and guide specifications by all DOD components. This UFC will be revised to address new and updated industry standards as they become available. It is DOD policy to select the best model code provisions and industry standards for military use.

1-4 **IMPLEMENTATION.** This UFC is effective immediately.

1-5 **STRUCTURE OF THE UFC.** This UFC references IBC 2000 and other government and nongovernment standards and criteria. Paragraph 1-6 provides modifications to IBC 2000 and is structured around its format. The IBC has 35 chapters and 10 appendices that contain both technical and administrative provisions. The administrative portions of the code are not applicable to the military construction process. Technical portions of the code are applicable as modified herein.

1-6 **MODIFICATIONS.** The *IBC 2000* provisions are directed toward public health, safety, and general welfare, and represent minimum standards that must be met by the private-sector construction industry. The use of industry standards for DOD projects is intended to promote communication in the marketplace, improve competition, and result in cost savings. However, the military often requires higher standards to achieve more stringent life-cycle performance, or to construct facilities that do not exist in the private sector. Modifications to the model code provisions contained herein are based upon those unique military requirements. In the case of conflicts between the model code and military criteria, use military requirements.

1-6.1 **Fire Protection and Life Safety.** For fire protection and life safety requirements, refer to *MIL-HDBK-1008C, *Fire Protection for Facilities Engineering, Design and Construction*.

1-6.2 **Chapter 1 - ADMINISTRATION.** Delete.

1-6.3 **Chapter 2 - DEFINITIONS.** Definitions apply to terms used in the model codes and are not intended to replace definitions and terms in military documents.

1-6.4 **Chapter 3 - USE AND OCCUPANCY CLASSIFICATION.** Use Chapter 3 and *MIL-HDBK-1008/C.

1-6.5 **Chapter 4 - SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY.** Delete Sections 412.1, 412.2, 414 and 415. Refer to applicable DOD and individual military service standards.

1-6.6 **Chapter 5 - GENERAL BUILDING HEIGHTS AND AREAS.** Refer to *MIL-HDBK-1008/C for limitations on the use of Table 503. In Section 506.3, the area limitations in Table 503 may be increased by 300 percent for Air Force facilities when an approved automatic sprinkler system is installed, regardless of building height.

1-6.7 **Chapter 6 – TYPES OF CONSTRUCTION.** Use this chapter.

1-6.8 **Chapter 7 – FIRE-RESISTANCE-RATED CONSTRUCTION.** Use this chapter.

1-6.9 **Chapter 8 - INTERIOR FINISHES.** Use Chapter 8 and *MIL-HDBK-1008/C.

1-6.10 **Chapter 9 – FIRE PROTECTION SYSTEMS.** Use *MIL-HDBK-1008/C.

1-6.11 **Chapter 10 - MEANS OF EGRESS.** Use *MIL-HDBK-1008/C.

1-6.12 **Chapter 11 - ACCESSIBILITY.** Delete Chapter 11 and use the *Uniform Federal Accessibility Standards (UFAS)* and the *Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).*

1-6.13 **Chapter 12 - INTERIOR ENVIRONMENT.**

1-6.13.1 **Paragraph 1202.2.1.** Delete the last sentence and substitute "Combustion air shall be obtained from attic areas only in accordance with Unified Facility Criteria documents, Unified Facility Guide Specifications and military criteria and guidance documents."

1-6.13.2 **Paragraph 1202.3.2, Subparagraph 4.** Delete "in accordance with the International Energy Conservation Code."

1-6.13.3 **Paragraph 1202.4.2.** Delete "the International Mechanical Code and the International Fire Code" and substitute "Unified Facility Criteria documents, Unified Facility Guide Specifications and military criteria and guidance documents."

1-6.13.4 **Paragraph 1203.1.** Delete, including the exception, and substitute "Temperature control shall be in accordance with Unified Facility Criteria documents, Unified Facility Guide Specifications and military criteria and guidance documents."

1-6.13.5 **Paragraphs 1206.2 and 1206.3.** Delete and replace with the following:

Table 1-1 Sound Transmission Standards for Party Walls and Floor/Ceiling Construction

Area	FSTC [1]	FIIC [2]
Party Walls (unit Separation)	52	-
Primary Habitable Areas (Living, Dining, Family Room, Bedrooms, Circulation)	52	65
Habitable Wet Areas (Kitchen, Bath, Utility, Laundry, Equipment)	52	57
Habitable Areas Over Garages	52	-
Note [1] Field Sound Transmission Class. See ASTM E336-97, Standard Test Method for Measurement of Airborne Sound Insulation in Buildings. Note [2] Field Impact Isolation Class. See ASTM E1007-97, Standard Test Method for Field Measurement of Tapping Machine Impact sound Through Floor-Ceiling Assemblies and Associated Support Structure.		

IBC- Air-borne Sound = 50 STC; 45 FSTC ASTM E 90-99, Standard Test Method for Laboratory Measurement of Sound Transmission Loss of Building Partition Elements.

IBC- Structure-borne Sound = 50 IIC; 45 FIIC ASTM E 492-90, Standard Test Method for Laboratory Measurement of Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.

1-6.13.6 **Paragraph 1207.3.** Delete and replace with following: "Use the latest DoD approved minimum sizes for barracks and dormitory rooms."

1-6.13.7 **Paragraph 1207.4.** Delete. The services define their own parameters for dwelling units.

1-6.14 **Chapter 13 - ENERGY EFFICIENCY.** Delete Chapter 13 and replace with "Federal facilities are required to comply with Public Laws, Executive Orders, Federal Regulations and other mandates regarding energy use, conservation and efficiency standards. In addition, the military has other unique requirements to ensure the planning, design and construction of energy efficient, cost effective facilities that meet mission requirements. These requirements are reflected in criteria and standards used by each military service. Compliance with Unified Facility Criteria documents, Unified Facility Guide Specifications and military criteria documents will ensure that facilities meet all applicable mandates."

1-6.15 **Chapter 14 - EXTERIOR WALLS.** Use Army Technical Instruction 800-01, *Design Criteria* for guidance for air infiltration, glazing area, and moisture migration pertaining to exterior wall systems.

1-6.16 **Chapter 15 - ROOF ASSEMBLIES AND ROOFTOP STRUCTURES.** Use Chapter 15 for basic guidance and NRCA, *Roofing and Waterproofing Manual* and UFGS Division 7 Thermal and Moisture Protection for technical criteria. The use of any

asbestos containing materials in roofing products such as mastics, felts, etc. is prohibited.

1-6.17 **Chapter 16 – STRUCTURAL DESIGN.** Use Chapter 16 in its entirety with the following revisions:

1-6.17.1 **Paragraph 1616.2.3**. Buildings classified as Seismic Use Group III; as defined in Table 1604.5; and within Seismic Design Category D, E, or F; as defined by paragraph 1616.3, require enhanced performance objectives for earthquake response. These facilities will require, in addition to the requirements of Chapter 16, a linear elastic analysis utilizing 'm' factors in accordance with the requirements contained in the Technical Instruction TI 809-04 *Seismic Design for Buildings*. For this analysis, use the applicable ground motion and design procedures as defined in TI 809-04. In addition, nonlinear design procedures may be required for these facilities according to Paragraph 5-4.b of TI 809-04. (The classification of a building as Seismic Use Group III should only be used for essential facilities that are required for post-earthquake recovery, and/or house mission-essential functions, with no redundant back-up facility on- or off-site. Mission-essential functions are those absolutely critical to mission continuation of the activity.)

1-6.17.2 **Paragraph 1622.3.7**. Replace the second sentence with the following: "The seismic design of Navy piers and wharves will be according to the Technical Report TR-2069-SHR, *Design Criteria for Earthquake Hazard Mitigation of Navy Piers and Wharves*."

1-6.17.3 Use Appendices B and C for design at locations outside of CONUS.

1-6.17.4 All inhabited buildings must meet the requirements of **UFC 4-010-01, *DoD Minimum Antiterrorism Standards for Buildings*.

1-6.18 **Chapter 17 – STRUCTURAL TESTS AND INSPECTIONS.** Use Chapter 17 and the requirements in the Unified Facilities Guide Specifications.

1-6.19 **Chapter 18 – SOILS AND FOUNDATIONS.** Use Chapter 18 for basic guidance and ***DM 7.2, *Foundations and Earth Structures* for detailed requirements. For Section 1802.2, the foundation and soils investigation requirements are provided as a minimum. Additional requirements provided by the design agency will take precedence. Also use supplemental requirements in UFGS Division 2, Site Work.

1-6.20 **Chapter 19 – CONCRETE.** Use Chapter 19, and UFGS Division 3, Concrete. Chapter 19 supersedes MIL-HDBK 1002/4, *Concrete Structures*.

1-6.21 **Chapter 20 – ALUMINUM.** Use Chapter 20 and UFGS 05500 (Navy or Army as appropriate) *Miscellaneous Metals*. Chapter 20 supersedes MIL-HDBK-1002/6, *Aluminum Structures, Composite Structures, Structural Plastics, and Fiber-Reinforced Composites*.

1-6.22 **Chapter 21 – MASONRY.** Use Chapter 21 and UFGS Division 4, Masonry. Chapter 21 supercedes Army TM 5-809-3, NAVFAC DM-2.9, AFM 88-3,

Chapter 3, *Masonry Structural Design for Buildings*. Give special attention to control cracking in concrete masonry structures using the guidance contained in Tables 1-2 and Table 1-3. Because the Masonry Society has a waiver for use of metric products, brick and concrete masonry units (CMU) are normally not available in metric sizes.

Table 1-2 Recommended Joint Control Spacing[a]

Vertical Spacing Of Joint Reinforcement With 2-#9 Wires[b] (in)	Maximum Ratio Of Panel Length To Wall Height (L/H)[c]	Maximum Spacing Of Control Joints [d] (ft)
None [e]	2	18
16	3	24
8	4	30

[a] Based on moisture-controlled, type I, concrete masonry in intermediate humidity conditions (ASTM C 90). The designer should adjust the control joint spacing for local conditions. The recommended spacing may be increased 6 ft in humid climates and decreased 6 ft in arid climates.
[b] Joint reinforcement will be cold-drawn deformed wire with a minimum 9-gauge longitudinal wire size.
[c] L is the horizontal distance between control joints. H is generally the vertical distance between structural supports.
[d] The spacing will be reduced approximately 50% near masonry-bonded corners or other similar conditions where one end of the masonry panel is restrained.
[e] Not recommended for walls exposed to view where control of cracking is important.

Table 1-3 Maximum Spacing of Vertical Expansion Joints in Brick Walls, $\Delta T=100^0F$

EXP.JT Width (in)	W x in	Max. Spacing of BEJs [a]
3/8	3/16	22
1/2	1/4	30
3/4	3/8	44
1 (MAX)	1/2	60

[a] Provide expansion joints at 6 to 10 ft from corners.
Recommended vertical BEJ locations.

a. At regular intervals as noted in table above.
b. At changes in wall height or thickness
c. Near wall intersections in “L”, “T”, and “U”-shaped buildings at approximately 6 to 10 ft) from corners.
d. At other points of stress concentration.
e. At edges of openings.

1-6.23 **Chapter 22 – STEEL.** Use Chapter 22 and UFGS Division 5, Metals. Chapter 22 supersedes MIL-HDBK 1002/3, *Structural Engineering Steel Structures*.

1-6.24 **Chapter 23 – WOOD.** Use Chapter 23 and UFGS Division 6, Wood and Plastics. Chapter 23 supersedes MIL-HDBK 1002/5, *Timber Structures*.

1-6.25 **Chapter 24 - GLASS AND GLAZING.** Use Chapter 24 and MIL-HDBK-1013/12, *Evaluation and Selection Analysis of Security Glazing for Protection Against Ballistic, Bomb, and Forced Entry Tactics* for force protection.

1-6.26 **Chapter 25 – GYPSUM BOARD AND PLASTER.** Use this chapter and applicable UFGS.

1-6.27 **Chapter 26 – PLASTIC.** Use this chapter.

1-6.28 **Chapter 27 – ELECTRICAL.** Delete and use NFPA 70, *National Electrical Code.*

1-6.29 **Chapter 28 – MECHANICAL SYSTEMS.** Delete Section 2801 and substitute "Mechanical appliances, equipment and systems shall be planned, designed and constructed in accordance with Unified Facility Criteria documents, Unified Facility Guide Specifications and military criteria and guidance documents. This will ensure energy efficient, cost effective facilities are provided that meet mission requirements and are in compliance with Public Laws, Executive Orders, Federal Regulations and similar mandates. Also comply with NFPA 54, *National Fuel Gas Code.*"

1-6.30 **Chapter 29 – PLUMBING SYSTEMS.** Delete Paragraph 2901.1 and substitute "Plumbing appliances, equipment and systems shall be planned, designed and constructed in accordance with the Unified Facility Criteria documents, Unified Facility Guide Specifications and military criteria and guidance documents. This will ensure energy efficient, water conserving and cost effective facilities are provided that meet mission requirements and are in compliance with Public Laws, Executive Orders, Federal Regulations and similar mandates."

1-6.31 **Chapter 30 – ELEVATORS AND CONVEYING SYSTEMS.** ITG 01-01, *Interim Technical Guidance Elevator Design* supersedes Chapter 30 wherever applicable.

1-6.32 **Chapter 31 - SPECIAL CONSTRUCTION.** Use entire chapter except Sections 3107 and 3108.

1-6.33 **Chapter 32 - ENCROACHMENT INTO THE PUBLIC RIGHT-OF-WAY.** Delete.

1-6.34 **Chapter 33 - SAFEGUARDS DURING CONSTRUCTION.** Delete.

1-6.35 **Chapter 34 - EXISTING STRUCTURES.** Delete entire chapter and refer to *MIL-HDBK-1008/C and ASCE 11-99, *Guidelines for Structural Condition Assessment of Existing Buildings*. Use ASCE 11-99 to conduct structural condition assessment of existing buildings prior to major additions, alterations or repairs.

1-6.36 **Chapter 35 - REFERENCED STANDARDS.** Use the chapter.

1-6.37 **Appendixes A, B, D, E, G, and J.** Delete.

1-6.38 **Appendix H - SIGNS.** Delete Appendix H. Follow the requirements of ADAAG and individual signage publications for each military service.

APPENDIX A

REFERENCES

GOVERNMENT PUBLICATIONS:

1. Unified Facilities Criteria

http:/criteria.navfac.navy.mil/criteria

http:/www.hnd.usace.army.mil/techinfo/index.asp

**UFC 4-010-01, Minimum Antiterrorism Standards for Buildings. (This UFC is due to be published 1 Aug 2002. For questions, please contact the preparing activity.)

2. Naval Facilities Engineering Command (NAVFAC)
1510 Gilbert Street
Norfolk, VA 23511-2669

http://criteria.navfac.navy.mil/criteria
http://www.nfesc.navy.mil

ITG 01-01, Interim Technical Guidance Elevator Design

*MIL-HDBK-1008C, Fire Protection for Facilities Engineering, Design and Construction. (Will be replaced by UFC 3-600-01, Fire Protection for Facilities Engineering, Design and Construction, September 2002. For questions, please contact the preparing activity.)

MIL-HDBK-1013/12, Evaluation and Selection Analysis of Security Glazing for Protection Against Ballistic, Bomb, and Forced Entry Tactics. (Restricted access. Contact your government sponsor if required.)

***DM 7.2, Foundations and Earth Structures. (This Design Manual is due to be replaced by UFC 3-220-01, Geotechnical Engineering by the end of calendar year 2002. For questions, please contact the preparing activity.)

Technical Report, TR-2069-SHR, Design Criteria for Earthquake Hazard mitigation of Navy Piers and Wharves, February 1987.

3. U.S. Army Corps of Engineers (USACE)
4820 University Square,
Huntsville, Al, 35816

Technical Instruction 800-01, Design Criteria

Technical Instruction 809-04, Seismic

http://www.hnd.usace.army.mil/techinfo/index.asp	Design for Buildings Technical Instruction 809-29, Structural Considerations for Metal Roofing Technical Instruction 809-53, Commentary on Roofing Systems
4. National Archives and Records Administration (NARA) gpoaccess@gpo.gov Telephone (202) 512-1530 Toll Free (888) 293-6498 Fax (202) 512-1262	Public Law 104-113, National Technology Transfer and Advancement Act of 1995
5. http://www.access-board.gov/ufas/ufas-html/ufas.htm	Uniform Federal Accessibility Standards (UFAS)
6. http://www.access-board/adaag/html/adaag.htm	Americans with Disabilities Act Accessibility Guidelines for Building and Facilities (ADAAG)

NON-GOVERNMENT PUBLICATIONS:

1. International Code Council (ICC) 5203 Leesburg Pike, Suite 600 Falls Church, VA 22041 (703) 931-4533 (703) 379-1546 fax http://www.intlcode.org/	International Building Code (IBC) 2000
2. National Fire Protection Association (NFPA) 1 Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 (617) 770-3000 www.nfpa.org	NFPA 70, National Electrical Code NFPA 54, National Fuel Gas Code
3. ASTM International 100 Barr Harbor Drive PO Box C700 West Conshohocken, PA 19428-2959	ASTM E336-97, Standard Test Method for Measurement of Airborne Sound Insulation in Buildings ASTM E1007-97, Standard Test Method

www.astm.org	for field Measurement of Tapping Machine Impact Sound Through Floor-Ceiling Assemblies and Associated Support Structure ASTM E90-99, Standard Test Method for Laboratory Measurement of Sound Transmission Loss of Building Partition Elements. ASTM E492-90, Standard Test Method for Laboratory Measurement of Sound Transmission Loss Through Floor-Ceiling Assemblies Using the Tapping Machine
4. American Society of Civil Engineers 1801 Alexander Bell Drive Reston, Virginia 20191-4400 1-800-548-2723 toll free (703) 295-6300 international (703) 295-6222 fax (703) 295-6444 faxback http://www.asce.org	ASCE 7, Minimum Design Loads for Buildings and Other Structures. ASCE 11-99, Guidelines for Structural Condition Assessment of Existing Buildings.
5. National Roofing Contractors Association (NRCA) 10255 W. Higgins Road, Suite 600, Rosemont, IL 60018 (847) 299-9070; fax (847) 299-1183; e-mail nrca@nrca.net http://www.nrca.net/	*Roofing and Waterproofing Manual*, 5th Edition, 2001

APPENDIX B

Wind Parameters (as published in ITG 01-2, *Minimum Design Loads for Buildings and Other Structures*)

ID	Name	Ground Snow Load (PSF)	Frost Penetration (in)	Basic Wind Speed (MPH)
1	Woomera, Australia	0	0	80
2	Chievres, Belgium	15	25	115
3	Manama, Bahrain	0	5	80
4	Guantanamo Bay, Cuba	0	5	90
5	Copenhagen, Denmark	25	35	90
6	Diego Garcia, Diego Garcia	0	5	105
7	Stuttgart, Germany	25	40	60
8	Heidelberg, Germany	25	30	60
9	Bad Kreuznach, Germany	25	30	60
10	Grefrath, Germany	25	20	60
11	Wuerzburg, Germany	25	35	60
12	Grafenwoehr, Germany	25	5	60
13	Hanau, Germany	25	25	60
14	Berchtesgaden, Germany	30	50	60
15	Landstuhl, Germany	25	40	60
16	Spangdahlem, Germany	25	35	60
17	Crete, Greece	5	5	85
18	Thule, Greenland	25	255	130
19	Agana Fleet Activities, Guam	0	5 (1)	155(2)
20	Agana Ship Repair, Guam	0	5(1)	155(2)
21	Agana Anderson AFB, Guam	0	5(1)	155(2)
22	Keflavik, Iceland	25	50	110
23	Vicenzia, Italy	35	25	80
24	Gaeta, Italy	20	5	80
25	La Maddalena, Italy	20	5	80
26	Naples, Italy	20	5	80
27	Sigonella, Italy	20	5	80
28	Pordenone, Italy	35	25	80
29	Atsugi, Japan	15	25(3)	120
30	Iwakuni, Japan	0	10(3)	120
31	Sagamihara, Japan	10	5(3)	110
32	Okinawa, Japan	0	5(3)	110
33	Naha, Japan	0	5(3)	110
34	Koza City, Japan	0	5(3)	110
35	Misawa, Japan	40	50(3)	110
36	Tokyo, Japan	10	5(3)	110
37	Sasebo, Japan	10	5(3)	100
38	Atsugi, Japan	20	25(3)	120

ID	Name	Ground Snow Load (PSF)	Frost Penetration (in)	Basic Wind Speed (MPH)
39	Yokosuka NCTC, Japan	20	5(3)	110
40	Yokosuka CFA, Japan	20	5(3)	110
41	Yokosuka Ship Repair, Japan	20	5(3)	110
42	Teague, Korea	20	40(4)	110
43	Pyongtaek, Korea	20	50(4)	100
44	Uijongbu, Korea	20	45(4)	105
45	Seoul, Korea	20	45(4)	105
46	Chinhae, Korea	20	15(4)	105
47	Kunsan, Korea	20	30(4)	100
48	Songtan, Korea	20	50(4)	95
49	Port Lyautey, Morocco	0	5	85
50	Schirmen, Netherlands	15	20	80
51	Antarctica	30	190	105
52	Balboa, Panama	0	5	110
53	Panama City, Panama	0	5	90
54	Colon, Panama	0	5	95
55	Galeta Island, Panama	0	5	90
56	Panama Canal, Panama	0	5	110
57	Terceira, Portugal-Azores	0	5	120
58	Guaynaba, Puerto Rico	0	5	120(5)
59	San Juan, Puerto Rico	0	5	120(5)
60	Sabana Seca, Puerto Rico	0	5	120(5)
61	Roosevelt Roads, Puerto Rico	0	5	140(5)
62	Rota, Spain	5	5	85
63	Adana, Turkey	0	5	70
64	Diyarbakir, Turkey	15	25	105
65	Southampton, England	15	10	85
66	London, England	15	15	100
67	Edzell, England	15	25	85
68	Croughton, England	15	15	100
69	Lakenheath, England	15	15	100
70	Mildenhall, England	15	15	100
71	Antigua, Virgin Islands	0	5	140(6)

Notes:
(1) No frost in Guam or Diego Garcia. Need to identify as minimum footing depth.
(2) ASCE 7 recommends 170 m.p.h. Use ASCE value.
(3) Need to confirm large variance in frost penetration for Japan.
(4) Need to confirm large variance in frost penetration for Korea.
(5) ASCE 7 recommends 145 m.p.h. Use ASCE value.
(6) ASCE 7 recommends 145 m.p.h. Use ASCE value.

APPENDIX C

Seismic Parameters

			S_s	S_1
AFRICA	ALGERIA	Alger	1.24	0.56
		Olan	1.24	0.56
	ANGOLA			
		Luanda	0.06	0.06
	BENIN			
		Cotonou	0.06	0.06
	BOTSWANA			
		Gaborone	0.06	0.06
	BURUNDI			
		Bujumbura	1.24	0.56
	CAMEROON			
		Douala	0.06	0.06
		Yaounde	0.06	0.06
	CAPE VERDE			
		Praia	0.06	0.06
	CENTRAL AFRICAN REPUBLIC			
		Bangui	0.06	0.06
	CHAD			
		Ndjamena	0.06	0.06
	CONGO			
		Brazzaville	0.06	0.06
	DJIBOUTI			
		Djibouti	1.24	0.56
	EGYPT			
		Alexandria	0.62	0.28
		Cairo	0.62	0.28
		Port Said	0.62	0.28
	EQUATORIAL GUINEA			
		Malabo	0.06	0.06
	ETHIOPIA			
		Addis Ababa	1.24	0.56
		Asmara	1.24	0.56
	GABON			
		Libreville	0.06	0.06
	GAMBIA			
		Banjul	0.06	0.06
	GHANA			
		Accra	1.24	0.56
	GUINEA			
		Bissau	0.31	0.14
		Conakry	0.06	0.06
	IVORY COAST			
		Abidijan	0.06	0.06
	KENYA			
		Nairobi	0.62	0.28

	LESOTHO			
		Maseru	0.62	0.28
	LIBERIA			
		Monrovia	0.31	0.14
	LIBYA			
		Tripoli	0.62	0.28
		Wheelus AFB	0.62	0.28
	MALAGASY REPUBLIC			
		Tananarive	0.06	0.06
	MALAWI			
		Blantyre	1.24	0.56
		Lilongwe	1.24	0.56
		Zomba	1.24	0.56
	MALI			
		Bamako	0.06	0.06
	MAURITANIA			
		Nouakchott	0.06	0.06
	MAURITIUS			
		Port Louis	0.06	0.06
	MOROCCO			
		Casablanca	0.62	0.28
		Port Lyautey	0.31	0.14
		Rabat	0.62	0.28
		Tangier	1.24	0.56
	MOZAMBIQUE			
		Maputo	0.62	0.28
	NIGER			
		Niamey	0.06	0.06
	NIGERIA			
		Ibadan	0.06	0.06
		Kaduna	0.06	0.06
		Lagos	0.06	0.06
	REPUBLIC OF RWANDA			
		Kigali	1.24	0.56
	SENEGAL			
		Dakar	0.06	0.06
	SEYCHELLES			
		Victoria	0.06	0.06
	SIERRA LEONE			
		Freetown	0.06	0.06
	SOMALIA			
		Mogadishu	0.06	0.06
	SOUTH AFRICA			
		Cape Town	1.24	0.56
		Durban	0.62	0.28
		Johannesburg	0.62	0.28
		Natal	0.31	0.14
		Pretoria	0.62	0.28
	SWAZILAND			
		Mbabane	0.62	0.28
	TANZANIA			
		Dar es Salaam	0.62	0.28

		Zanzibar	0.62	0.28
	TOGO			
		Lome	0.31	0.14
	TUNISIA			
		Tunis	1.24	0.56
	UGANDA			
		Kampala	0.62	0.28
	UPPER VOLTA			
		Ougadougou	0.06	0.06
	ZAIRE			
		Bukavu	1.24	0.56
		Kinshasa	0.06	0.06
		Lubumbashi	0.62	0.28
	ZAMBIA			
		Lusaka	0.62	0.28
	ZIMBABWE			
		Harare		
ASIA	AFGHANISTAN			
		Kabul	1.65	0.75
	BAHRAIN			
		Manama	0.25	0.10
	BANGLADESH			
		Dacca	1.24	0.56
	BRUNEI			
		Bandar Seri Begawan	0.31	0.14
	BURMA			
		Mandalay	1.24	0.56
		Rangoon	1.24	0.56
	CHINA			
		Canton	0.62	0.28
		Chengdu	1.24	0.56
		Nanking	0.62	0.28
		Peking	1.65	0.75
		Shanghai	0.62	0.28
		Shengyang	1.65	0.75
		Tibwa	1.65	0.75
		Tsingtao	1.24	0.56
		Wuhan	0.62	0.28
	CYPRUS			
		Nicosia	1.24	0.56
	HONG KONG			
		Hong Kong	0.62	0.28
	INDIA			
		Bombay	1.24	0.56
		Calcutta	0.62	0.28
		Madras	0.31	0.14
		New Delhi	1.24	0.56
	INDONESIA			
		Bandung	1.65	0.75
		Jakarta	1.65	0.75
		Medan	1.24	0.56

		Surabaya	1.65	0.75
	IRAN			
		Isfahan	1.24	0.56
		Shiraz	1.24	0.56
		Tabriz	1.65	0.75
		Tehran	1.65	0.75
	IRAQ			
		Baghdad	1.24	0.56
		Basra	0.31	0.14
	ISRAEL			
		Haifa	1.24	0.56
		Jerusalem	1.24	0.56
		Tel Aviv	1.24	0.56
	JAPAN			
		Fukuoka	1.24	0.56
		Itazuke AFB	1.24	0.56
		Misawa AFB	1.24	0.56
		Naha, Okinawa	1.65	0.75
		Osaka/Kobe	1.65	0.75
		Sapporo	1.24	0.56
		Tokyo	1.65	0.75
		Wakkanai	1.24	0.56
		Yokohama	1.65	0.75
		Yakota	1.65	0.75
	JORDAN			
		Amman	1.24	0.56
	KOREA			
		Kwangju	0.31	0.14
		Kimhae	0.31	0.14
		Pusan	0.31	0.14
		Seoul	0.06	0.06
	KUWAIT			
		Kuwait	0.31	0.14
	LAOS			
		Vientiane	0.31	0.14
	LEBANON			
		Beirut	1.24	0.56
	MALAYSIA			
		Kuala Lumpur	0.31	0.14
	NEPAL			
		Kathmandu	1.65	0.75
	OMAN			
		Muscat	0.62	0.28
	PAKISTAN			
		Islamabad	1.68	0.75
		Karachi	1.65	0.75
		Lahore	0.62	0.28
		Peshawar	1.65	0.75
	QUATAR			
		Doha	0.06	0.06
	SAUDI ARABIA			

		Al Batin	0.31	0.14
		Dhahran	0.31	0.14
		Jiddah	0.62	0.28
		Khamis Mushayf	0.310.14	
		Riyadh	0.06	0.06
	SINGAPORE			
		All	0.31	0.14
	SOUTH YEMEN			
		Aden City	1.24	0.56
	SRI LANKA			
		Colombo	0.06	0.06
	SYRIA			
		Allepo	1.24	0.56
		Damascus	1.24	0.56
	TAIWAN			
		All	1.65	0.75
	THAILAND			
		Bangkok	0.31	0.14
		Chinmg Mai	0.62	0.28
		Dongkhia	0.06	0.06
		Udorn	0.31	0.14
	TURKEY			
		Adana	0.62	0.28
		Ankara	0.62	0.28
		Istanbul	1.65	0.75
		Izmir	1.65	0.75
		Karamursel	1.24	0.56
	UNITED ARAB EMIRATES			
		Abu Dhabi	0.06	0.06
		Dubai	0l.06	0.06
	VIETNAM			
		Ho Chi Minh City		
		(Saigon)	0.06	0.06
	YEMEN ARAB REPUBLIC			
		Sanaa	1.24	0.56
ATLANTIC OCEAN AREA	AZOREA			
		All	0.62	0.28
	BURMUDA			
		All	0.31	0.14
CARIBBEAN SEA	BAHAMA ISLANDS			
		All	0.31	0.14
	CUBA			
		All	0.62	0.28
	DOMINICAN REPUBLIC			
		Santo Domingo	1.24	0.56
	FRENCH WEST INDIES			
		Martinique	1.24	0.56
	GRENADA			
		Saint Georges	1.24	0.56

	HAITI			
		Port au Prince	1.24	0.56
	JAMAICA			
		Kingston	1.24	0.56
	LEEWARD ISLANDS			
		All	1.24	0.56
	TRINADAD AND TOBAGO			
		All	1.24	0.56
CENTAL AMERICA	BELIZE			
		Beimopan	0.26	0.28
	CANAL ZONE			
		All	0.62	0.28
	COSTA RICA			
		San Jose	12.4	0.56
	EL SALVADORE			
		San Salvador	1.65	0.75
	GUATEMALA			
		Guatemala	1.65	0.75
	HONDURAS			
		Tegucigalpa	1.24	0.56
	NICARAGUA			
		Managua	1.65	0.75
	PANAMA			
		Colon	1.24	0.56
		Galeta	0.83	0.38
		Panama	1.24	0.56
	MEXICO			
		Ciudad Juarez	0.62	0.28
		Guadalajara	1.24	0.56
		Hermosillo	1.24	0.56
		Matamoros	0.06	0.06
		Mazatlan	0.60	0.28
		Merida	0.06	0.06
		Mexico City	1.24	0.56
		Monterrey	0.06	0.06
		Nuevo Laredo	0.06	0.06
		Tijuana	1.24	0.56
EUROPE	ALBANIA			
		Tirana	1.24	0.56
	AUSTRIA			
		Salzburg	0.62	0.28
		Vienna	0.62	0.28
	BELGIUM			
		Antwerp	0.31	0.14
		Brussels	0.62	0.28
	BULGARIA			
		Sofia	1.24	0.56
	CZECH REPUBLIC			
		Prague	0.31	0.14
	DENMARK			
		Copenhagen	0.31	0.14

	FINLAND			
		Helsinki	0.31	0.14
	FRANCE			
		Bordeaux	0.62	0.28
		Lyon	0.31	0.14
		Marseille	1.24	0.56
		Nice	1.24	0.56
		Strasbourg	0.62	0.28
	GERMANY, FEDERAL REPUBLIC			
		Berlin	0.06	0.06
		Bonn	0.62	0.28
		Bremen	0.06	0.06
		Dusseldorf	0.31	0.14
		Frankfurt	0.62	0.28
		Hamburg	0.06	0.06
		Munich	0.31	0.14
		Stuttgart	0.62	0.28
		Vaihigen	0.62	0.28
	GREECE			
		Athens	1.24	0.56
		Kavalla	1.65	0.75
		Makri	1.65	0.75
		Rhodes	1.24	0.56
		Souda Bay	1.65	0.75
		Thessaloniki	1.65	0.75
	HUNGARY			
		Budapest	0.62	0.28
	ICELAND			
		Keflavik	1.0	0.40
		Reykjavik	1.65	0.75
	IRELAND			
		Dublin	0.06	0.06
	ITALY			
		Aviano AFG	1.24	0.56
		Brindisi	0.06	0.06
		Florence	1.24	0.56
		Gaeta	0.50	0.21
		Genoa	1.24	0.56
		La Maddalena	0.22	0.09
		Milan	0.62	0.28
		Naples	0.67	0.27
		Palermo	1.24	0.56
		Rome	0.62	0.28
		Sicily	1.20	0.31
		Trieste	1.24	0.56
		Turin	0.62	0.28
	LUXEMBOURG			
		Luxembourg	0.31	0.14
	MALTA			
		Valletta	0.62	0.28
	NETHERLANDS			
		All	0.06	0.06

	NORWAY			
		Oslo	0.62	0.28
	POLAND			
		Krakow	0.62	0.28
		Poznan	0.31	0.14
		Waraszawa	0.31	0.14
	PORTUGAL			
		Lisbon	1.65	0.75
		Oporto	1.24	0.56
	ROMANIA			
		Bucharest	1.24	0.56
	SLOVAK REPUBLIC			
		Bratislava	0.62	0.28
	SPAIN			
		Barcelona	0.62	0.28
		Bilbao	0.62	0.28
		Madrid	0.06	0.06
		Rota	0.75	0.30
		Sevilla	0.62	0.28
	SWEDEN			
		Goteborg	0.62	0.28
		Stockholm	0.31	0.14
	SWITZERLAND			
		Bern	0.62	0.28
		Geneva	0.31	0.14
		Zurich	0.62	0.28
	UNITED KINGDOM			
		Belfast	0.06	0.06
		Edinburgh	0.31	0.14
		Edzell	0.31	0.14
		Glasgow/Renfrew	0.31	0.14
		Hamilton	0.31	0.14
		Liverpool	0.31	0.14
		London	0.125	0.025
		Londonderry	0.31	0.14
		St. Mawgan	0.20	0.04
		Thurso	0.31	0.14
	USSR			
		Kiev	0.06	0.06
		Leningrad	0.06	0.06
		Moscow	0.06	0.06
	YUGOSLAVIA			
		Belgrade	0.62	0.28
		Zagreb	1.24	0.56
NORTH AMERICA	GREENLAND			
		All	0.31	0.14
	CANADA			
		Argentina NAS	0.62	0.28
		Calgary, Alb	0.31	0.14
		Churchill, Man	0.06	0.06

		Cold Lake, Alb	0.31	0.14
		Edmonton, Alb	0.31	0.14
		E. Harmon, AFB	0.62	0.28
		Fort Williams, Ont	0.06	0.06
		Frobisher N.W. Ter	0.06	0.06
		Goose Airport	0.31	0.14
		Halifax	0.31	0.14
		Montreal, Quebec	1.24	0.56
		Ottawa, Ont	0.62	0.28
		St. Johns Nfld	1.24	0.56
		Toronto, Ont	0.31	0.14
		Vancouver	1.24	0.56
		Winnepeg, Man	0.31	0.14
SOUTH AMERICA	ARGENTINA			
		Buenos Aires	0.25	0.10
	BRAZIL			
		Belem	0.06	0.06
		Belo Horizonte	0.06	0.06
		Brasilia	0.06	0.06
		Manaus	0.06	0.06
		Porto Allegre	0.06	0.06
		Recife	0.06	0.06
		Rio de Janeiro	0.06	0.06
		Salvador	0.06	0.06
		San Paulo	0.31	0.14
	BOLIVIA			
		La Paz	1.24	0.56
		Santa Cruz	0.31	0.14
	CHILE			
		Santiago	1.65	0.75
		Valparaiso	1.65	0.75
	COLOMBIA			
		Bogotá	1.24	0.56
	ECUADOR			
		Quito	1.65	0.75
		Guayaquil	1.24	0.56
	PARAQUAY			
		Asuncion	0.06	0.06
	PERU			
		Lima	1.65	0.75
		Plura	1.65	0.75
	URUGUAY			
		Montevideo	0.06	0.06
	VENEZUELA			
		Maracaibo	0.62	0.28
		Caracas	1.65	0.75
PACIFIC OCEAN AREA	AUSTRALIA			
		Brisbane	0.31	0.14
		Canberra	0.31	0.14
		Melbourne	0.31	0.14

		Perth	0.31	0.14
		Sydney	0.31	0.14
	CAROLINE ISLANDS			
		Koror, Paulau Is	0.62	0.28
		Ponape	0.06	0.06
	FIJI			
		Suva	1.24	0.56
	JOHNSON ISLAND			
		All	0.31	0.14
	MARIANA ISLANDS			
		Saipan	1.24	0.56
		Tinian	1.24	0.56
	MARSHAL ISLANDS			
		All	0.31	0.14
	NEW ZEALAND			
		Auckland	1.24	0.56
		Wellington	1.65	0.75
	PAPAU NEW GUINEA			
		Port Moresby	1.24	0.56
	PHILLIPINE ISLANDS			
		Cebu	1.65	0.75
		Manila	1.65	0.75
		Baguio	1.24	0.56
	SAMOA			
		All	1.24	0.56
	WAKE ISLAND			
		All	0.06	0.06