

UNIFIED FACILITIES CRITERIA (UFC)

STRUCTURAL ENGINEERING



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STRUCTURAL ENGINEERING

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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

This UFC supersedes UFC 3-300-10N, dated May 2005; UFC 3-310-01, dated 25 May 2005; UFC 3-310-02A, dated 1 March 2005; UFC 3-310-05A, dated 1 March 2005; UFC 3-310-07A, dated 19 June 2006; UFC 3-320-01A, dated 1 March 2005; UFC 3-320-02A, dated 1 March 2005; UFC 3-320-04A, dated 1 March 2005; UFC 3-320-05A, dated 1 March 2005; UFC 3-330-01A, dated 1 March 2005.

FOREWORD

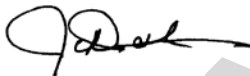
The Unified Facilities Criteria (UFC) system is prescribed by MIL-STD 3007 and provides planning, design, construction, sustainment, restoration, and modernization criteria, and applies to the Military Departments, the Defense Agencies, and the DoD Field Activities in accordance with [USD\(AT&L\) Memorandum](#) dated 29 May 2002. UFC will be used for all DoD projects and work for other customers where appropriate. All construction outside of the United States is also governed by Status of Forces Agreements (SOFA), Host Nation Funded Construction Agreements (HNFA), and in some instances, Bilateral Infrastructure Agreements (BIA.) Therefore, the acquisition team must ensure compliance with the more stringent of the UFC, the SOFA, the HNFA, and the BIA, as applicable.

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 Center for Engineering and the Environment (AFCEE) 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.

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- Whole Building Design Guide web site <http://dod.wbdg.org/>.

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.



JAMES C. DALTON, P.E.
Chief, Engineering and Construction
U.S. Army Corps of Engineers



DENNIS FIRMAN
Director of the Air Force Center for Engineering
and the Environment
Department of the Air Force



JOSEPH E. GOTT, P.E.
Chief Engineer
Naval Facilities Engineering Command



MICHAEL McANDREW
Director, Facility Investment and
Management
Office of the Deputy Under Secretary of Defense
(Installations and Environment)

**UNIFIED FACILITIES CRITERIA (UFC)
REVISION SUMMARY SHEET**

Document: UFC 3-301-01, *Structural Engineering*

Superseding: UFC 3-300-10N, *Structural Engineering*, UFC 3-310-01, *Structural Load Data*, UFC 3-310-02A, *Structural Design Criteria for Buildings*, UFC 3-310-05A, *Masonry Structural Design for Buildings*, UFC 3-310-07A, *Cold-Formed Load Bearing Steel Systems and Masonry Veneer/Steel Stud Walls*, UFC 3-320-01A, *Welding – Design Procedures and Inspections*, UFC 3-320-02A, *Design and Construction of Conventionally Reinforced Ribbed Mat Slabs*, UFC 3-320-04A, *Metal Building Systems*, UFC 3-320-05A, *Structural Design Criteria for Structures Other Than Buildings*, and UFC 3-330-01A, *Commentary on Snow Loads*.

Description of Changes: This replacement for UFC 3-300-10N, UFC 3-310-01, UFC 3-310-02A, UFC 3-310-05A, UFC 3-310-07A, UFC 3-320-01A, UFC 3-320-02A, UFC 3-320-04A, UFC 3-320-05A and UFC 3-330-01A provides requirements for the design and renovation of new and existing structures. The new UFC adopts the structural design provisions of the 2006 *International Building Code (IBC 2006)* for use in DoD building design.

Reasons for Changes:

- The new UFC updates the guidance contained in several existing structural engineering documents and consolidates it into a single UFC. The updated UFC is designed to be consistent with and to supplement the guidance contained in the IBC 2006 as modified by UFC 1-200-01.
- The superseded UFC documents included requirements that were not consistent with industry standards.

Impact: There are negligible cost impacts. However, the following benefits should be realized:

- Replacement of outdated and inconsistent criteria documents.
- Creation of a single-source reference for modifications to a commercial structural building code that provides guidance for the design of DoD facilities.
- Ensuring that the locations identified and the loadings described are complete and current with the most up-to-date available information.

Non-Unified Items: This document contains no non-unified items.

CONTENTS

CHAPTER 1 – INTRODUCTION.....	1
1-1 PURPOSE AND SCOPE.....	1
1-2 BACKGROUND.....	1
1-3 APPLICABILITY.....	1
1-4 OTHER CRITERIA.....	2
1-4.1 General Building Requirements.....	2
1-4.2 Seismic Design.....	2
1-4.3 Antiterrorism.....	2
1-4.4 Progressive Collapse.....	2
1-5 REFERENCES.....	2
CHAPTER 2 – MODIFICATIONS TO IBC.....	3
2-1 CHAPTER 16 STRUCTURAL DESIGN.....	3
2-1.1 Section 1603 CONSTRUCTION DOCUMENTS.....	3
2-1.1.1 1603.5 Delegated Engineered Systems.....	3
2-1.2 Section 1604 GENERAL DESIGN REQUIREMENTS.....	3
2-1.2.1 1604.3 Serviceability.....	3
2-1.2.2 1604.3.1 Deflections.....	4
2-1.2.3 1604.3.6 Limits.....	4
2-1.2.4 1604.5 Occupancy Category.....	5
2-1.2.5 Table 1604.5.....	5
2-1.2.6 1604.11 Fall Prevention and Protection.....	8
2-1.2.6.1 1604.11.1 Loads.....	8
2-1.2.6.2 1604.11.2 Load Combinations.....	8
2-1.2.6.3 1604.11.3 Impact.....	8
2-1.3 Section 1607 LIVE LOADS.....	8
2-1.3.1 1607.1 General.....	8
2-1.3.2 Table 1607.1.....	8
2-1.4 Section 1608 SNOW LOADS.....	9

2-1.4.1	1608.3 Specific Locations Within the United States	9
2-1.4.2	1608.4 Specific Locations Outside of the United States	9
2-1.4.3	1608.5 Snow Load Case Studies	9
2-1.5	Section 1609 WIND LOADS	9
2-1.5.1	1609.2 Definitions	9
2-1.5.2	1609.3.1 Specific Locations Within the United States	9
2-1.5.3	1609.3.2 Specific Locations Outside of the United States	10
2-1.5.4	1609.3.3 Wind Speed Conversion	10
2-1.6	Section 1613 EARTHQUAKE LOADS	10
2-1.6.1	1613.5.1.1 Specific Locations Within the United States	10
2-1.6.2	1613.5.1.2 Specific Locations Outside of the United States	11
2-2	CHAPTER 17 STRUCTURAL TESTS AND SPECIAL INSPECTIONS	11
2-2.1	Section 1703 APPROVALS	11
2-2.1.1	1703.4 Performance	11
2-2.1.2	1703.4.1 Research and Investigation	11
2-2.1.2	1703.4.2 Research Reports	11
2-3	CHAPTER 18 SOILS AND FOUNDATIONS	11
2-3.1	Section 1805 FOOTINGS AND FOUNDATIONS	11
2-3.1.1	1805.2.1.1 Frost Line Depth	11
2-3.1.2	1805.4.1.2 Vibratory Loads	12
2-3.1.3	1805.4.2.7 Reinforcement	12
2-4	CHAPTER 19 CONCRETE	12
2-4.1	Section 1901 General	12
2-4.1.1	1906.4 Joints in Concrete Construction	12
2-4.2	Section 1907 Details of Reinforcement	12
2-4.2.1	1907.7.5 Corrosive Environments	12
2-4.3	Section 1910 Minimum Slab Provisions	12
2-4.3.1	1910.1 General	12
2-4.3.2	1910.2 Slab-on-Ground Design	12
2-4.3.2.1	1910.2.1 Wall Loads on Slab-on-Ground	13
2-4.3.2.2	1910.2.2 Slab-on-Ground Over Permafrost	13
2-4.3.2.3	1910.2.3 Post-Tensioned Slab-on-Ground	13

2-5	CHAPTER 21 MASONRY	17
2-5.1	Section 2101 GENERAL	17
2-5.1.1	2101.2.1 Allowable Stress Design	17
2-5.1.2	2101.2.2 Strength Design	17
2-5.1.3	2101.2.4 Empirical Design	17
2-5.1.4	2101.5 Coupling Beams	17
2-5.1.5	2101.6 Shear Wall Construction	17
2-5.2	Section 2103 MASONRY CONSTRUCTION MATERIALS	17
2-5.2.1	2103.13.2 Joint Reinforcement	17
2-5.2.2	2103.13.5 Anchors, Ties and Accessories	17
2-5.3	Section 2104 CONSTRUCTION	18
2-5.3.1	2104.1.2.7 Grouted Masonry	18
2-5.3.2	2104.6 Concrete Masonry Control Joints	18
2-5.3.3	2104.7 Vertical Brick Expansion Joints	18
2-5.4	Section 2109 EMPIRICAL DESIGN OF MASONRY	18
2-6	CHAPTER 22 STEEL	18
2-6.1	Section 2204 CONNECTIONS	18
2-6.1.1	2204.2 Bolting	18
2-6.2	Section 2205 STRUCTURAL STEEL	18
2-6.2.1	2205.1 General	18
2-6.2.2	2205.4 Steel Structures in Corrosive Environments	19
2-6.3	Section 2209 COLD-FORMED STEEL	19
2-6.3.1	2209.3 Steel Deck Diaphragms	19
2-6.4	Section 2210 COLD-FORMED STEEL LIGHT-FRAMED CONSTRUCTION	19
2-6.4.1	2210.7 Diagonal Bracing Material	19
2-6.4.2	2210.8 Wall Studs and Wall Stud Assemblies	19
2-6.4.3	2210.9 Floor Vibrations	19
2-6.4.4	2210.10 Brick Veneer/Steel Stud Walls	20
2-6.4.5	2210.11 Cold-Formed Steel Connections	20
2-6.4.6	2210.12 Galvanized Cold-Formed Framing	20

CHAPTER 3 – OTHER STRUCTURES	21
3-1 HIGHWAY BRIDGE DESIGN.....	21
3-2 RAILROAD BRIDGE DESIGN	21
3-3 TANKS FOR LIQUID STORAGE	21
3-4 TANKS FOR PETROLEUM STORAGE	21
3-5 ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES.....	21
3-6 PRESTRESSED CONCRETE TANKS	21
3-7 WATER TREATMENT FACILITIES.....	21
3-8 TRANSMISSION TOWERS AND POLES.....	21
3-9 ANTENNA TOWERS	22
APPENDIX A – REFERENCES	A-1
APPENDIX B – BEST PRACTICES	B-1
APPENDIX C – ABBREVIATIONS.....	C-1
APPENDIX D – MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM CONCENTRATED LIVE LOADS	D-1
APPENDIX E – SITE-SPECIFIC STRUCTURAL LOADING DATA – UNITED STATES, ITS TERRITORIES AND POSSESSIONS	E-1
APPENDIX F – SITE-SPECIFIC STRUCTURAL LOADING DATA – OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS	F-1
APPENDIX G – EARTHQUAKE LOADING DATA AT ADDITIONAL SELECTED LOCATIONS OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS.....	G-1
APPENDIX H - SEISMIC SPECTRAL ACCELERATION MAPS AT SELECTED LOCATIONS OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS	H-1

TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
2-1	LATERAL DEFLECTION LIMITS FOR FRAMING SUPPORTING EXTERIOR WALL FINISHES.....	5
2-2	OCCUPANCY CATEGORY OF BUILDINGS AND OTHER STRUCTURES	6
2-3	MAXIMUM ALLOWABLE WALL LOAD AT A THICKENED SLAB FOR WALL LOAD NEAR CENTER OF SLAB OR NEAR KEYED OR DOWELED JOINTS	14
2-4	MAXIMUM ALLOWABLE WALL LOAD AT A THICKENED SLAB FOR WALL LOAD NEAR FREE EDGE	15
D-1	MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM CONCENTRATED LIVE LOADS	D-1
E-1	STRUCTURAL CLIMATIC LOADING DATA – UNITED STATES, ITS TERRITORIES AND POSSESSIONS	E-1
E-2	EARTHQUAKE LOADING DATA – UNITED STATES, ITS TERRITORIES AND POSSESSIONS	E-14
F-1	STRUCTURAL CLIMATIC LOADING DATA – OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS	F-1
F-2	EARTHQUAKE LOADING DATA – OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS	F-9
G-1	EARTHQUAKE LOADING DATA AT ADDITIONAL LOCATIONS OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS	G-1

FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
2-1	WIDTHS OF THICKENED SLABS AND SLAB EDGE CONDITIONS UNDER WALL LOADS	16
H-1	AFGHANISTAN - HORIZONTAL SPECTRAL RESPONSE ACCELERATION FOR 1.0 SECOND PERIOD (5 PERCENT OF CRITICAL DAMPING) WITH 2 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS.....	H-1
H-2	AFGHANISTAN - HORIZONTAL SPECTRAL RESPONSE ACCELERATION FOR 0.2 SECOND PERIOD (5 PERCENT OF CRITICAL DAMPING) WITH 2 PERCENT PROBABILITY OF EXCEEDANCE IN 50 YEARS.....	H-2

CANCELLED

CHAPTER 1 – INTRODUCTION

1-1 PURPOSE AND SCOPE

This Unified Facility Criteria (UFC) provides requirements for structures designed and constructed for the Department of Defense (DoD). These technical requirements are based on the 2006 International Building Code (IBC 2006), as modified by UFC 1-200-01. This information shall be used by structural engineers to develop design calculations, specifications, plans, and design-build Requests for Proposal (RFPs).

1-2 BACKGROUND

UFC 1-200-01 uses and supplements IBC 2006 as the building code for DoD. Chapter 2 of this UFC further modifies the IBC for structural-specific design requirements and is organized by the chapter of IBC that each section modifies. The climatic and seismic data included in this UFC is intended as a tool to assist in the consistent interpretation of the data in the IBC at significant DoD installations within the United States, and as the basis for applying the provisions of UFC 1-200-01 to significant DoD installations outside of the United States. Chapter 3 provides additional guidance for the design of structures other than buildings. The IBC 2006 section modifications are one of four actions, according to the following legend:

[Addition] – Add new section, including new section number, not shown in IBC 2006.

[Deletion] – Delete referenced IBC 2006 section.

[Replacement] – Delete referenced IBC 2006 section or noted portion and replace it with the narrative shown.

[Supplement] – Add narrative shown as a supplement to the narrative shown in the referenced section of IBC 2006.

1-3 APPLICABILITY

This UFC applies to all service elements and contractors involved in the planning, design and construction of DoD facilities worldwide.

1-4 **OTHER CRITERIA**

Military criteria other than those listed in this document may be applicable to specific types of structure. Such structures shall meet the additional requirements of the applicable military criteria.

1-4.1 **General Building Requirements**

For general building requirements, refer to UFC 1-200-01.

1-4.2 **Seismic Design**

For seismic design for buildings, refer to UFC 3-310-04.

1-4.3 **Antiterrorism**

For antiterrorism requirements, refer to UFC 4-010-01.

1-4.4 **Progressive Collapse**

For design of buildings to resist progressive collapse, refer to UFC 4-023-03.

1-5 **REFERENCES**

For references see Appendix A.

CHAPTER 2 – MODIFICATIONS TO IBC

2-1 CHAPTER 16 STRUCTURAL DESIGN

2-1.1 Section 1603 CONSTRUCTION DOCUMENTS

2-1.1.1 1603.5 Delegated Engineered Systems [Addition]

The engineer of record for a structure may delegate responsibility for the design of systems or component parts of the structure to a qualified delegated engineer. Both the engineer of record for the structure and the delegated engineer must comply with the requirements of this UFC. The following are some examples of delegated systems.

- a. Prefabricated wood components
- b. Cast-in-place post-tensioned concrete structural systems
- c. Precast, prestressed concrete components
- d. Open web steel joists and joist girders
- e. Pre-engineered metal buildings
- f. Foundation systems
- g. Structural steel connections
- h. Cold-formed steel joist/stud/truss framing and pre-fabricated components
- i. Seismic anchorage of equipment
- j. Proprietary track for under-hung cranes and monorails
- k. Autoclaved aerated concrete

The structural engineer of record must review all submittals that have been signed and sealed by the delegated engineer, to verify compliance with the design intent and the specified design criteria and to ensure coordination with the contract documents and other shop drawings. All submittals from the delegated engineer must be approved by the engineer of record prior to the start of fabrication of the system or component part and prior to any field construction that may be affected by the system or component part.

2-1.2 Section 1604 GENERAL DESIGN REQUIREMENTS

2-1.2.1 1604.3 Serviceability [Supplement]

The structural designer shall ensure that the maximum allowable frame drift is suitable for the proposed structure considering all details of construction. See ASCE 7 Appendix C “Serviceability Considerations” including commentary, and Section B-1.1 of UFC 3-301-01 for additional guidance.

Wall systems and other building elements that are not part of the lateral force resisting system in the direction under consideration shall be designed to be adequate to safely support all applied loadings in combination with the forces resulting from the displacements due to the design story drift; either from wind or seismic; or be isolated to

ensure that they are not susceptible to damage. Masonry and other brittle wall systems are particularly susceptible to damage if not properly integrated into the design to ensure that they can adequately resist the stresses resulting from the building deformations or are effectively isolated to prevent damage.

Exception:

- 1) Reinforced concrete frame members not designed as part of the seismic lateral force-resisting system shall comply with Section 21.9 of ACI 318.

All structural vertical load bearing wall elements shall be considered to be part of the lateral force-resisting system. All applicable provisions of UFC 3-310-04 Table B-2 shall apply.

2-1.2.2 **1604.3.1 Deflections [Replacement]**

Deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or those permitted by Table 1604.3, or Table 2-1 of UFC 3-301-01.

2-1.2.3 **1604.3.6 Limits [Replacement]**

Deflection of structural members over span, l , shall not exceed that permitted by Table 1604.3 or Table 2-1 of UFC 3-301-01.

**TABLE 2-1
LATERAL DEFLECTION LIMITS FOR FRAMING SUPPORTING EXTERIOR WALL
FINISHES^{a,b,c}**

Brick veneer	L/600
Stucco	L/360
Exterior Insulation Finish Systems	L/240
Cement board	L/360
Stone Masonry	VERIFY WITH STONE SUPPLIER
Plywood and Wood-Based Structural-Use Panels	L/240
Gypsum sheathing	L/240
Metal or vinyl siding	L/240

Notes to Table 2-1, “LATERAL DEFLECTION LIMITS FOR FRAMING SUPPORTING EXTERIOR WALL FINISHES”

- a. Lateral deflection limits under seismic or wind loads
- b. The wind load is permitted to be taken as 0.7 times the “component and cladding” loads for the purpose of determining the deflection limits herein.
- c. For cantilevered members, L shall be taken as twice the length of the cantilever.

2.1.2.4 1604.5 Occupancy Category [Replacement]

Buildings shall be assigned an occupancy category in accordance with Table 2-2 of UFC 3-301-01. Importance factors for snow load, wind load and seismic load for each occupancy category are also shown in Table 2-2 of UFC 3-301-01.

Note: IBC section 1604.5.1 shall remain in effect as written.

2.1.2.5 Table 1604.5 [Replacement]

Replace Table 1604.5 of the IBC with Table 2-2 of this UFC. (All references in the IBC to Table 1604.5 shall be interpreted as a reference to Table 2-2 of this UFC.)

**TABLE 2-2
OCCUPANCY CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

Occupancy Category	Nature of Occupancy	Seismic Factor I_E	Snow Factor I_S	Wind Factor I_W
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including, but not limited to: <ul style="list-style-type: none"> • Agricultural facilities • Certain temporary facilities • Minor storage facilities 	1.00	0.8	0.87 ^a
II	Buildings and other structures except those listed in Categories I, III, IV and V	1.00	1.00	1.00
III	Buildings and other structures that represent a substantial hazard to human life or represent significant economic loss in the event of failure, including, but not limited to: <ul style="list-style-type: none"> • Buildings and other structures where more than 300 people congregate in one area • Buildings and other structures with elementary school, secondary school, or daycare facilities with an occupant load greater than 250 • Buildings and other structures with an occupant load greater than 500 • Health care facilities with an occupant load of 50 or more resident patients, but not having surgery or emergency treatment facilities • Jails and detention facilities • Structures and equipment in power-generating stations; water treatment facilities that are required for primary treatment and disinfecting of potable water; waste water treatment facilities that are required for primary treatment; and other public utility facilities that are not included in Categories IV and V • Buildings and other structures not included in Categories IV and V containing sufficient quantities of toxic, flammable, or explosive substances to be dangerous to the public if released • Facilities having high-value equipment, as designated by the using agency 	1.25	1.10	1.15

Occupancy Category	Nature of Occupancy	Seismic Factor I_E	Snow Factor I_S	Wind Factor I_W
IV	<p>Buildings and other structures designed as essential facilities, including, but not limited to:</p> <ul style="list-style-type: none"> • Hospitals and other health care facilities having surgery or emergency treatment facilities • Fire, rescue, and police stations, and emergency vehicle garages • Designated earthquake, hurricane, or other emergency shelters • Designated emergency preparedness, communication, and operation centers, and other facilities required for emergency response • Power-generating stations and other utility facilities required for primary power or as emergency backup facilities for Category IV structures • Structures containing highly toxic materials as defined by Section 307, where the quantity of material exceeds the maximum allowable quantities of Table 307.7(2) • Aviation control towers, air traffic control centers, and emergency aircraft hangars that house aircraft required for post-earthquake emergency response • Buildings and other structures not included in Category V, having DoD mission-essential command, control, primary communications, data handling, and intelligence functions that are not duplicated at geographically separate locations, as designated by the using agency • Water treatment facilities required to maintain water pressure for fire suppression 	1.50	1.20	1.15
V ^b	<p>Facilities designed as national strategic military assets, including, but not limited to:</p> <ul style="list-style-type: none"> • Key national defense assets (e.g. National Missile Defense facilities), as designated by the using agency • Facilities involved in operational missile control, launch, tracking, or other critical defense capabilities • Emergency backup power-generating facilities required for primary power for Category V structures • Power-generating stations and other utility facilities required for primary power for Category V structures, if emergency backup power generating facilities are not available • Facilities involved in storage, handling, or processing of nuclear, chemical, biological, or radiological materials, where structural failure could have widespread catastrophic consequences, as designated by the using agency. 	Not Required	1.50	1.70

Notes to Table 2-2, "OCCUPANCY CATEGORIES OF BUILDINGS AND OTHER STRUCTURES"

- a. In hurricane-prone regions with $V > 100$ miles per hour, I_w shall be 0.77 for category I structures.
- b. A new Category has been added to address national strategic military assets. A Seismic Importance Factor, I_E , is not required for the design of these facilities. (Occupancy Category V is equivalent to Seismic Use Group IV)

2-1.2.6 **1604.11 Fall Prevention and Protection [Addition]**

Fall prevention and protection shall be considered at a facility whenever there is a need or requirement to perform maintenance work at high locations, deliver material to or store equipment at heights as defined by OSHA 29 CFR 1926, subpart M, 29 CFR 1910, subpart D, American National Standards Institute ANSI A1264.1, and ANSI Z359 "Fall Protection Code". At the planning and design phase of a project, fall hazards shall be considered and eliminated whenever possible. When elimination or prevention of fall hazards is not feasible, the design shall include certified and labeled anchorages meeting the requirements of OSHA 29 CFR 1926.502, subpart M, and the American National Standards Institute, ANSI Z359. Where fall protection is required in the vicinity of weight-handling equipment, care must be taken to prevent potential conflicts between the weight-handling equipment and the fall protection measures.

2-1.2.6.1 **1604.11.1 Loads [Addition]**

Fall protection loads (including dynamic / impact) shall be considered as live loads when applying the load combinations of Section 1605.

2-1.2.6.2 **1604.11.2 Load Combinations [Addition]**

Fall protection loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.

2-1.2.6.3 **1604.11.3 Impact [Addition]**

For the purpose of design, fall protection loads (fall arrest forces) shall be increased 100 percent to allow for impact.

2-1.3 **Section 1607 LIVE LOADS**

Table D-1 of this UFC includes IBC Table 1607.1 with additional Occupancy or Use classifications for military facilities. The additional classifications that have been added to IBC Table 1607.1 are shown in bold italics within Table D-1.

2-1.3.1 **1607.1 General [Replacement]**

Live loads are those loads defined in Section 1602.1. Table D-1 of UFC 3-301-01 defines minimum uniformly distributed live loads and minimum concentrated live loads for the design of structures.

2-1.3.2 **Table 1607.1 [Replacement]**

Replace Table 1607.1 of the IBC with Table D-1 of this UFC. (All references in the IBC to Table 1607.1 shall be interpreted as a reference to Table D-1 of this UFC.)

2-1.4 **Section 1608 SNOW LOADS**

2-1.4.1 **1608.3 Specific Locations Within the United States [Addition]**

Ground snow loads at DoD installations within the United States and its territories and possessions are identified in Table E-1 of UFC 3-301-01, to facilitate consistent interpretation of the information provided in Figure 1608.2 and Table 1608.2.

2-1.4.2 **1608.4 Specific Locations Outside of the United States [Addition]**

Ground snow loads at specific locations outside of the United States and its territories and possessions are identified in Table F-1 of UFC 3-301-01. At locations where the ground snow load is not provided, use the best available locality information. For additional guidance contact the authorizing design agency.

2-1.4.3 **1608.5 Snow Load Case Studies [Addition]**

Snow load case studies may be done to clarify and refine snow loadings at site-specific locations with the approval of the authorizing design agency. The methodology used to conduct snow load case studies at site-specific locations is presented in the Cold Regions Research and Engineering Laboratory (CRREL) report "Snow Loads for the United States."

2-1.5 **Section 1609 WIND LOADS**

2-1.5.1 **1609.2 Definitions [Replacement]**

Replace the definition of Wind-Borne Debris Region with the following:

WIND-BORNE DEBRIS REGION. For locations within the United States and its territories and possessions, portions of hurricane-prone regions that are within 1 mile (1.61 km) of the coastal mean high water line where the basic wind speed is 100 mph (48 m/s) or greater; or portions of hurricane-prone regions where the basic wind speed is 120 mph (53 m/s) or greater; or Hawaii.

For locations outside of the United States and its territories and possessions, regions where the basic wind speed is 120 mph (53 m/s) or greater.

2-1.5.2 **1609.3.1 Specific Locations Within the United States [Replacement]**

Basic wind speeds at DoD installations within the United States and its territories and possessions are identified in Table E-1 of UFC 3-301-01 to facilitate consistent interpretation of the information provided in Figure 1609.

2-1.5.3 **1609.3.2 Specific Locations Outside of the United States [Addition]**

Basic wind speeds at specific locations outside of the United States and its territories and possessions are identified in Table F-1 of UFC 3-301-01. At locations where the basic wind speed is not provided, use the best available locality information. For additional guidance contact the authorizing design agency.

Use a minimum wind speed of 85 mph (137 km/h) at all locations unless a lower wind speed is approved by the authorizing design agency.

2-1.5.4 **1609.3.3 Wind Speed Conversion [Addition]**

When required, the 3-second gust basic wind speeds of Figure 1609 shall be converted to fastest-mile wind speeds, V_{fm} , using Table 1609.3.1 or Equation 16-34.

$$V_{fm} = (V_{3S} - 10.5) / 1.05 \quad (\text{Equation 16-34})$$

where:

V_{3S} = 3-second gust basic wind speed from Figure 1609.

2-1.6 **Section 1613 EARTHQUAKE LOADS**

2-1.6.1 **1613.5.1.1 Specific Locations Within the United States [Addition]**

Seismic acceleration parameters at DoD installations within the United States and its territories and possessions are identified in Table E-2 of UFC 3-301-01 to facilitate consistent interpretation of the information provided in Figures 1613.5(1) through 1613.5(14).

The values in Table E-2 were determined utilizing the web-based United States Geological Survey (USGS) Earthquake Ground Motion Parameters Calculator, Version 5.0.8, for the 2006 version of the International Building Code, utilizing latitude and longitude data. This tool or other approved software may be used to determine seismic design data where site-specific location information is available, with the approval of the authorizing design agency.

The seismic acceleration parameters in Table E-2 were typically determined at the approximate geographical centroid of the installation / city. For larger installations and where the potential seismic accelerations vary considerably over relatively short distances, it may not be appropriate to use the acceleration values at the installation centroid. At select locations the maximum and minimum values of S_S and S_1 within the installation are listed. Use the maximum values unless site-specific location (latitude / longitude) information is available and lesser values can be justified by the use of Figures 1613.5(1) through 1613.5(14) or by approved computerized tools for determining seismic ground motion parameters. For additional guidance contact the authorizing design agency.

2-1.6.2 **1613.5.1.2 Specific Locations Outside of the United States [Addition]**

Seismic ground motion parameters S_S and S_1 at specific locations outside of the United States and its territories and possessions are identified in Table F-2 and G-1 of UFC 3-301-01. For locations not shown, the best available information shall be used with the approval of the authorizing design agency. Appendix H includes available seismic spectral acceleration maps at selected locations outside of the United States. These maps may be used to interpolate the seismic ground motions at locations that are not identified in Tables F-2 and G-1.

2-2 **CHAPTER 17 STRUCTURAL TESTS AND SPECIAL INSPECTIONS**

2-2.1 **Section 1703 APPROVALS**

2-2.1.1 **1703.4 Performance [Replacement]**

New, unusual, or innovative materials, systems or methods previously untried may be incorporated into designs when evidence shows that such use is in the best interest of the Government from the standpoint of economy, lower life-cycle costs, and quality of construction. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in the code, shall consist of valid evaluation reports from International Code Council – Evaluation Services (ICC-ES).

2-2.1.2 **1703.4.1 Research and Investigation [Deletion]**

This section shall be deleted in its entirety.

2-2.1.2 **1703.4.2 Research Reports [Deletion]**

This section shall be deleted in its entirety.

2-3 **CHAPTER 18 SOILS AND FOUNDATIONS**

2-3.1 **Section 1805 FOOTINGS AND FOUNDATIONS**

2-3.1.1 **1805.2.1.1 Frost Line Depth [Addition]**

Depths to the frost line at specific locations within the United States and its territories and possessions are identified in Table E-1 of UFC 3-301-01. Frost line depths at specific locations outside of the United States are identified in Table F-1 of UFC 3-301-01. At locations where frost depths are not provided, use the best available locality information. For additional guidance contact the authorizing design agency.

2-3.1.2 **1805.4.1.2 Vibratory Loads [Supplement]**

Add the following to the end of the paragraph: Design foundations in accordance with ACI 351.3R, ACI 350.4R and UFC 3-220-10N.

2-3.1.3 **1805.4.2.7 Reinforcement [Addition]**

For footings over three feet (914 mm) thick, the minimum ratio of reinforcement area to gross concrete area in each direction shall be 0.0015, with not less than one-half nor more than two-thirds of the total reinforcement required placed in any one face. Minimum bar size shall be No. 4 (#13M) with a maximum spacing of 12 inches (305 mm).

2-4 **CHAPTER 19 CONCRETE**

2-4.1 **Section 1901 General**

2-4.1.1 **1906.4 Joints in Concrete Construction [Replacement]**

Provide construction, contraction, and expansion joints in structures in accordance with ACI 224.3R and ACI 318, Section 6.4.

2-4.2 **Section 1907 Details of Reinforcement**

2-4.2.1 **1907.7.5 Corrosive Environments [Supplement]**

Add the following to the end of the paragraph: In a marine environment where concrete is subjected to salt-water wave action and spray, reinforcement protection shall be in accordance with ACI 357R.

2-4.3 **Section 1910 Minimum Slab Provisions**

2-4.3.1 **1910.1 General [Replacement]**

Replace the first line of the paragraph to read: The thickness of concrete floor slabs supported directly on the ground shall not be less than 4 inches (102 mm).

2-4.3.2 **1910.2 Slab-on-Ground Design [Addition]**

Slabs-on-ground shall be designed in accordance with ACI 360R, except slabs-on-ground supporting aircraft loading shall be designed in accordance with UFC 3-260-02.

2-4.3.2.1 1910.2.1 Wall Loads on Slab-on

-Ground [Addition]

Slabs-on-ground shall have adequate thickness to support wall line load as indicated in Tables 2-3 and 2-4. The thickened portion shall have a minimum width as shown in Figure 2-1.

2-4.3.2.2 1910.2.2 Slab-on-Ground Over Permafrost [Addition]

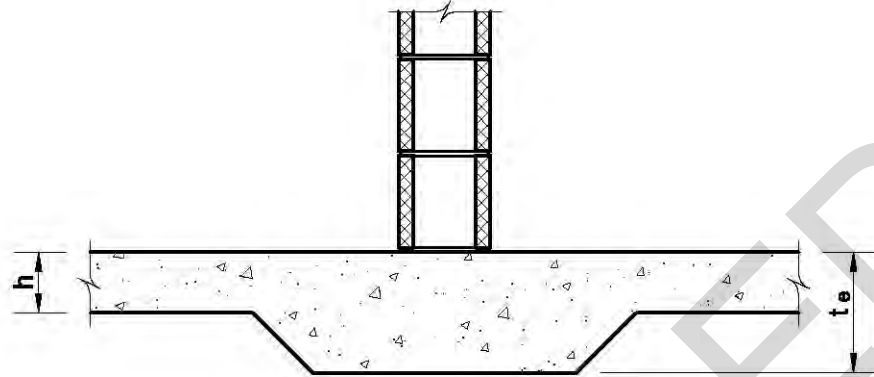
Design and construction of slabs-on-ground over permafrost shall be in accordance with UFC 3-130-01 and UFC 3-130-04.

2-4.3.2.3 1910.2.3 Post-Tensioned Slab-on-Ground [Addition]

The design of post-tensioned slabs-on-ground shall be in accordance with PTI DC10.1.

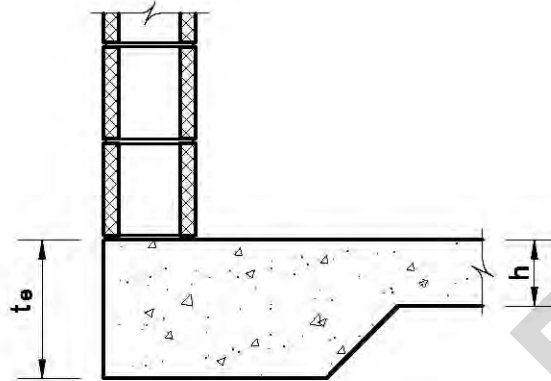
CANCELLED

TABLE 2-3
MAXIMUM ALLOWABLE WALL LOAD AT A THICKENED SLAB FOR WALL LOAD
NEAR CENTER OF SLAB OR NEAR KEYED OR DOWELED JOINTS



Thickness of Thickened Floor Slab, t_e (inches)	Slab Line Load Capacity, P (lb/ft)			
	Flexural Strength ^a of Concrete (lb/in ²)			
	550	600	650	700
4	425	455	485	510
5	565	600	640	675
6	710	755	805	850
7	860	920	975	1030
8	1015	1080	1150	1215
9	1175	1255	1330	1410
10	1340	1430	1520	1605

TABLE 2-4
MAXIMUM ALLOWABLE WALL LOAD AT A THICKENED SLAB FOR WALL LOAD
NEAR FREE EDGE



Thickness of Thickened Floor Slab, t_e (inches)	Slab Line Load Capacity, P (lb/ft)			
	Flexural Strength ^a of Concrete (lb/in ²)			
	550	600	650	700
4	330	355	375	395
5	435	465	495	525
6	550	585	620	660
7	665	710	755	800
8	785	840	890	945
9	910	975	1035	1090
10	1040	1110	1180	1245

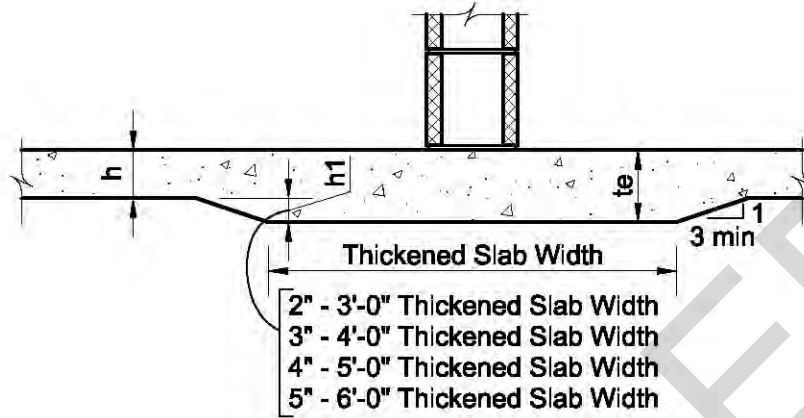
Notes for Table 2-3 and Table 2-4: The allowable wall loads are based on a modulus of subgrade reaction (k) of 100 pounds per cubic inch. The thickness of the thickened slab will be computed by multiplying the above thickness by a constant factor. Constants for other subgrade moduli are tabulated below.

Modulus of Subgrade Reaction (k)	25	50	100	200	300
Constant Factor	1.3	1.1	1.0	0.9	0.8

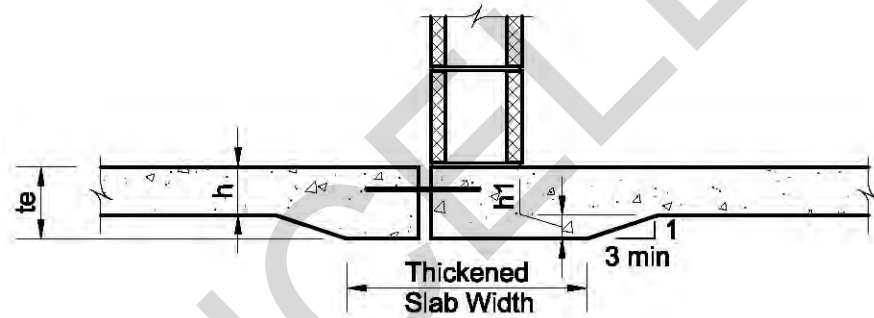
For other modulus of subgrade reaction values the constant values may be found from the equation $\sqrt[3]{100/k}$.

^a For this application the flexural strength of concrete was assumed equal to $9\sqrt{f'_c}$ where f'_c is the specified compressive strength of concrete (lb/in²).

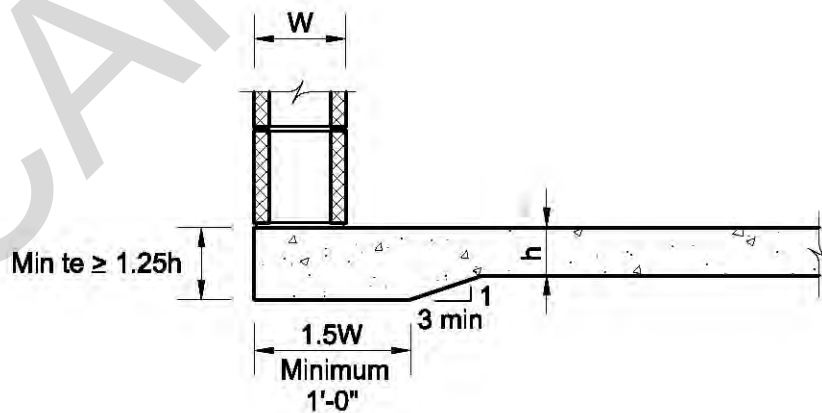
FIGURE 2-1
WIDTHS OF THICKENED SLABS AND SLAB EDGE CONDITIONS UNDER WALL
LOADS



A) SLABS LOADED NEAR THE CENTER



B) SLABS LOADED NEAR A KEYED OR DOWELED JOINT



C) SLABS LOADED NEAR A FREE EDGE

2-5 **CHAPTER 21 MASONRY**

2-5.1 **Section 2101 GENERAL**

2-5.1.1 **2101.2.1 Allowable Stress Design [Supplement]**

Add the following to the end of the paragraph: Masonry shall be designed as reinforced unless the element is isolated from the structure so that vertical and lateral forces are not imparted to the element.

2-5.1.2 **2101.2.2 Strength Design [Supplement]**

Add the following to the end of the paragraph: Masonry shall be designed as reinforced unless the element is isolated from the structure so that vertical and lateral forces are not imparted to the element.

2-5.1.3 **2101.2.4 Empirical Design [Replacement]**

Masonry shall not be designed by the empirical method.

2-5.1.4 **2101.5 Coupling Beams [Addition]**

Design of coupling beams shall be in accordance with paragraph 14.4.7.3 of ASCE 7.

2-5.1.5 **2101.6 Shear Wall Construction [Addition]**

Shear walls shall be running bond construction only; stack bond construction is not permitted.

2-5.2 **Section 2103 MASONRY CONSTRUCTION MATERIALS**

2-5.2.1 **2103.13.2 Joint Reinforcement [Supplement]**

Add the following to the end of the paragraph: Horizontal wall reinforcement shall be continuous around wall corners and through wall intersections, unless the intersecting walls are separated. Reinforcement that is spliced in accordance with the applicable provisions of ACI 530 shall be considered continuous.

2-5.2.2 **2103.13.5 Anchors, Ties and Accessories [Supplement]**

Add the following line to the end of the paragraph: Corrugated metal brick ties shall not be used.

2-5.3 **Section 2104 CONSTRUCTION**

2-5.3.1 **2104.1.2.7 Grouted Masonry [Supplement]**

Add the following line to the end of the paragraph: Masonry walls below grade shall be grouted solid.

2-5.3.2 **2104.6 Concrete Masonry Control Joints [Addition]**

Spacing and placement of control joints shall be in accordance with NCMA TEK 10-2B or 10-3.

2-5.3.3 **2104.7 Vertical Brick Expansion Joints [Addition]**

Spacing, placement, and size of vertical brick expansion joints shall be in accordance with BIA Technical Notes 18 and 18A.

2-5.4 **Section 2109 EMPIRICAL DESIGN OF MASONRY [Deletion]**

This section shall be deleted in its entirety.

2-6 **CHAPTER 22 STEEL**

2-6.1 **Section 2204 CONNECTIONS**

2-6.1.1 **2204.2 Bolting [Supplement]**

Add the following to the end of the paragraph: Compressible-washer-type direct tension indicators or twist-off-type tension-control bolts conforming to RCSC, *Specification for Structural Joints Using ASTM A325 or A490 Bolts* shall be provided at all bolted connections.

2-6.2 **Section 2205 STRUCTURAL STEEL**

2-6.2.1 **2205.1 General [Supplement]**

Add the following to the end of the paragraph: Structural steel floor framing systems shall be designed for vibration serviceability in accordance with AISC Design Guide 11.

2-6.2.2 **2205.4 Steel Structures in Corrosive Environments [Addition]**

Steel structures or elements exposed to weather, salt spray or other corrosive environments shall be protected through coatings, galvanizing or the use of stainless alloy. Select the appropriate system or material to suite the anticipated exposure. For steel deck exposed to spray from salt, salt water, or brackish water, provide ASTM A653 G90 galvanizing. For cold-formed steel members exposed to spray from salt, salt water, or brackish water, provide ASTM A653 G90 galvanizing and connect with corrosion-resistant fasteners. See Section B-5.5 of UFC 3-301-01 for additional guidance.

2-6.3 **Section 2209 COLD-FORMED STEEL**

2-6.3.1 **2209.3 Steel Deck Diaphragms [Addition]**

Design of steel deck diaphragms for in-plane loads shall be in accordance with the SDI DDM03. Design of steel deck for out-of-plane loads shall be in accordance with SDI Design Manual No. 31.

2-6.4 **Section 2210 COLD-FORMED STEEL LIGHT-FRAMED CONSTRUCTION**

2-6.4.1 **2210.7 Diagonal Bracing Material [Addition]**

Diagonal bracing material shall be ASTM A653 steel without rerolling, which induces strain hardening and reduces the elongation of the material which is not desirable for performance under seismic loading.

2-6.4.2 **2210.8 Wall Studs and Wall Stud Assemblies [Addition]**

Wall studs shall be designed on the basis of an all steel system in accordance with chapter C and D4(a) of AISI 2001. Studs shall not be designed on the basis of Sheathing Braced Design as described in Chapter D4(b) of AISI 2001.

Require that wall stud assemblies be constructed so that the studs are firmly placed in the track prior to attachment, with no gaps between the wall stud and the attached track.

All wall studs in bending shall have stiffened or partially stiffened compression flanges. Unstiffened compression flanges shall not be allowed. Require that all strap bracing be anchored to solid blocking.

2-6.4.3 **2210.9 Floor Vibrations [Addition]**

Cold-formed steel framing systems shall be designed for vibration serviceability in accordance with the proposed design procedure in *Floor Vibration Design Criterion for Cold-Formed C-Shaped Supported Residential Floor Systems* thesis by Kraus and Murray. Proposed design procedure is based on residential construction, but is applicable to all applications of cold-formed floor construction.

2-6.4.4 2210.10 Brick Veneer/Steel Stud Walls [Addition]

Design of steel stud backup for brick veneer shall follow the recommendations from BIA Technical Note 28B. In particular the recommendations for minimum stud gage, minimum galvanization, minimum anchorage of studs to track, welding of studs, use of deflection track, allowable stud deflection, wall sheathing and water-resistant barrier shall be followed.

2-6.4.5 2210.11 Cold-Formed Steel Connections [Addition]

Cold-formed steel members shall be interconnected with screw fasteners or by welding. The use of pneumatic nailing is permitted only for the connection of cold-formed members to other materials.

2-6.4.6 2210.12 Galvanized Cold-Formed Framing [Addition]

Cold-formed steel members exposed to spray from salt, salt water, brackish water, or seawater, shall be galvanized per ASTM A653 G90 and all fasteners shall be corrosion-resistant.

CANCELLED

CHAPTER 3 – OTHER STRUCTURES

3-1 HIGHWAY BRIDGE DESIGN

Design of highway bridges shall be in accordance with AASHTO Bridge Design Specifications and AISC Highway Structures Design Handbook.

3-2 RAILROAD BRIDGE DESIGN

Design of railroad bridges shall be in accordance with the AREMA Manual for Railway Engineering.

3-3 TANKS FOR LIQUID STORAGE

Design of tanks for liquid storage shall be in accordance with NFPA 22, AWWA D100, AWWA D103, AWWA D110 and AWWA D120 as applicable.

3-4 TANKS FOR PETROLEUM STORAGE

Design of tanks for petroleum storage shall be in accordance with UFC 3-460-01.

3-5 ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES

Design of environmental engineering concrete structures shall be in accordance with ACI 350-06.

3-6 PRESTRESSED CONCRETE TANKS

Design of prestressed concrete tanks shall be in accordance with ACI 372R.

3-7 WATER TREATMENT FACILITIES

Design of water treatment facilities shall be in accordance with the WEF Manual of Practice 8.

3-8 TRANSMISSION TOWERS AND POLES

Design of transmission towers shall be in accordance with ASCE 10. Design of transmission poles shall be in accordance with the National Electric Safety Code.

3-9 **ANTENNA TOWERS**

Design of antenna towers shall be in accordance with ANSI/TIA-222-G.

CANCELLED

APPENDIX A – REFERENCES

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Department of Defense
Washington, DC

UFCs can be obtained on the Whole
Building Design Guide website at
<http://dod.wbdg.org/>

UFC 1-200-01, *General Building
Requirements*, 27 November 2007

UFC 3-130-01, *General Provisions -
Arctic and Subarctic Construction*, 16
January 2004

UFC 3-130-04, *Foundations for
Structures - Arctic and Subarctic
Construction*, 16 January 2004

UFC 3-220-01N, *Geotechnical
Engineering Procedures for Foundation
Design of Buildings and Structures*, 15
August 2005

UFC 3-220-03FA, *Soils and Geology
Procedures for Foundation Design of
Buildings and Other Structures (Except
Hydraulic Structures)*, 16 January 2004

UFC 3-220-10N, *Soil Mechanics*, 8 June
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UFC 3-260-02, *Pavement Design for
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UFC 3-320-06A, *Concrete Floor Slabs
on Grade Subjected to Heavy Loads*, 1
March 2005

UFC 3-460-01, *Petroleum Fuel Facilities*, 16 January 2004

UFC 4-010-01, *DoD Minimum Antiterrorism Standards for Buildings*, 8 October 2003

UFC 4-023-03, *Design of Buildings to Resist Progressive Collapse*, 25 January 2005

NON-GOVERNMENT PUBLICATIONS:

1. American Association of State Highway and Transportation Officials
444 N Capitol St. NW, Suite 249
Washington, DC 20001
(202)-624-5800
<http://www.transportation.org/>

LRFD Bridge Design Specifications, Customary U.S. Units, 4th Edition, 2008
Interim Revisions

2. American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331
(248) 848-3700
<http://www.concrete.org/general/home.asp>

ACI 223, *Standard Practice for the Use of Shrinkage-Compensating Concrete*, 1998

ACI 224R, *Control of Cracking in Concrete Structures*, 2001

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ACI 302.1R, *Guide for Concrete Floor and Slab Construction*, 2004

ACI 318, *Building Code Requirements for Structural Concrete*, 2005

ACI 350.4R, *Design Considerations for Environmental Engineering Concrete Structures*, 2004

ACI 350-06, *Code Requirements for Environmental Engineering Concrete Structures*

- ACI 357R, *Guide for the Design and Construction of Fixed Offshore Concrete Structures*, 1984
- ACI 360R, *Design of Slabs-on-Ground*, 2006
- ACI 372R, *Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures*, 2003
- ACI 530, *Building Code Requirements for Masonry Structures*, 2005
3. American Institute of Steel Construction
One East Wacker Drive
Suite 700
Chicago, IL 60601-1802
(312) 670-2400
<http://www.aisc.org/>
- AISC 360, *Specification for Structural Steel Buildings*, 2005
- AISC Design Guide 3, *Serviceability Design Considerations for Steel Buildings*, Second Edition, 2003
- AISC Design Guide 11, *Floor Vibrations Due to Human Activity*, 1997 with 2003 Revision
- Highway Structures Design Handbook*, Second Edition
- RCSC, *Specification for Structural Joints Using ASTM A325 or A490 Bolts*, 2004 Version
4. American Iron and Steel Institute
1140 Connecticut Avenue NW
Suite 705
Washington, DC 20036
(202) 452-7100
<http://www.steel.org/>
- AISI 2001, *North American Specification for the Design of Cold-Formed Steel Structural Members*, 2001

Effective Lengths for Laterally Unbraced Compression Flanges of Continuous Beams Near Intermediate Supports, J. H. Garrett, Jr., G. Haaijer, and K. H. Klippstein, Proceedings, Sixth Specialty Conference on Cold-Formed Steel Structures (<http://www.ccfsonline.org/>)

5. American National Standards Institute
1819 L Street, NW
Suite 600
Washington, DC 20036
(202) 293-8020
<http://www.ansi.org/>
ANSI Z359, Fall Protection Code, 2007
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6. American Railway Engineering and Maintenance-of-Way Association
10003 Derekwood Lane, Suite 210
Lanham, MD 20706
(301) 459-3200
<http://www.arena.org/eseries/scriptcontent/index.cfm>
Manual for Railway Engineering, 2008
7. American Society of Civil Engineers
1801 Alexander Bell Drive
Reston, VA 20191
(800) 548-2723
<http://www.asce.org/asce.cfm>
ASCE 7, Minimum Design Loads for Buildings and Other Structures, 2005
ASCE 10, Design of Latticed Steel Transmission Structures, 1997
8. American Water Works Association
6666 W. Quincy Ave.
Denver CO 80235
(800) 926-7337
<http://www.awwa.org/>
AWWA D100, Welded Carbon Steel Tanks for Water Storage, 2005
AWWA D103, Factory-Coated Bolted Steel Tanks for Water Storage, 1997
AWWA D110, Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks, 2004
AWWA D120, Thermosetting Fiberglass-Reinforced Plastic Tanks, 2002

9. ASM World Headquarters
9639 Kinsman Road
Materials Park, OH 44073
(440) 338-5151
<http://asmcommunity.asminternational.org/portal/site/www/>
ASM Handbook Volume 13B Corrosion: Materials, 2005
10. ASTM International
100 Barr Harbor Drive
West Conshohocken, PA, 19428
(610) 832-9500
<http://www.astm.org/>
ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, 2009
ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar, 2003
11. Brick Industry Association
1850 Centennial Park Drive
Suite 301
Reston, VA 20191
(703) 620-0010
<http://www.gobrick.com/index.cfm>
BIA Technical Note 18, Volume Changes – Analysis and Effects of Movement, 2006
BIA Technical Note 18A, Accommodating Expansion of Brickwork, 2006
BIA Technical Note 28B, Brick Veneer/Steel Stud Walls, 2005
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500 New Jersey Avenue, N.W.
Washington, D.C. 20001
(888) 422-7233
<http://www.iccsafe.org/>
International Building Code – 2006 Edition
13. McGraw-Hill
P.O. Box 182604
Columbus, OH 43272
(877) 833-5524
<http://www.mhprofessional.com/>
Metal Building System Design and Specification, Alexander Newman

14. Metal Building Manufacturers Association
1300 Sumner Avenue
Cleveland, Ohio 44115
(216) 241-7333
<http://www.mbma.com/>
Metal Building Systems Manual, 2006
15. National Academy of Sciences
500 Fifth Street, NW
Washington, DC 20001
(202) 334-2000
<http://www.nasonline.org/site/PageServer>
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16. National Concrete Masonry Association
13750 Sunrise Valley Drive
Herndon, VA 20171-4662
(703) 713-1900
<http://www.ncma.org/Pages/default.aspx>
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TEK 10-3, *Control Joints for Concrete Masonry Walls – Alternative Engineered Method*, 2003
17. National Fire Protection Association
1 Batterymarch Park
Quincy, Massachusetts 02169-7471
(617) 770-3000
<http://www.nfpa.org/>
NFPA 22, *Standard for Water Tanks for Private Fire Protection*
18. Occupational Safety & Health Administration
200 Constitution Avenue
Washington, D.C. 20210
(800) 321-6724
<http://www.osha.gov/>
Standard 29 CFR, Part 1926, *Safety and Health Regulations for Construction*
Standard 29 CFR, Part 1910, *Occupational Safety and Health Standards for General Industry*
19. Post-Tensioning Institute
38800 Country Club Drive
Farmington Hills, MI 48331
(248) 848-3180
<http://www.post-tensioning.org/>
PTI DC10.1, *Design of Post-Tensioned Slabs-on-Ground*, 2008
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P.O. Box 25
Fox River Grove, IL 60021
(847) 458-4647
<http://www.sdi.org/>
SDI DDM03, *Diaphragm Design Manual Third Edition*, 2004

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21. Telecommunications Industry Association
2500 Wilson Boulevard, Suite 300
Arlington, VA 22201
(703) 907-7700
<http://www.tiaonline.org/>
- ANSI/TIA-222-G, *Structural Standards for Steel Antenna Towers and Antenna Supporting Structures*, 2005
22. United States Geological Survey
USGS National Center
Earthquake Hazards Program
12201 Sunrise Valley Drive
Reston, VA 20192, USA
(703) 648-4000
<http://earthquake.usgs.gov/research/hazmaps/design/>
- Earthquake Ground Motion Parameters Calculator*, Version 5.0.8, for the 2006 version of the International Building Code
23. Virginia Tech
Blacksburg, VA 24061
(540) 231-6000
<http://www.vt.edu/>
- Kraus and Murray, *Floor Vibration Design Criterion for Cold-Formed C-Shaped Supported Residential Floor systems*, Masters Thesis, 10 February 1997
24. Water Environment Federation
601 Wythe Street
Alexandria, VA 22314
(800) 666-0206
<http://www.wef.org/Home>
- WEF MOP8, *Design of Municipal Wastewater Treatment Plants*, 4th Edition, 1998

APPENDIX B – BEST PRACTICES

B-1 STRUCTURAL DESIGN

B-1.1 Building Drift Limits

The IBC and ASCE 7 provide guidance and discussion on establishing drift limits and load combinations that must be considered in evaluating serviceability. The establishment of acceptable drift limits requires significant engineering judgment. Application of a requirement that is too stringent can significantly impact the cost of a structure. Requirements that are too lax can lead to damage of rigidly connected components.

The Metal Building Systems Manual provides guidance for allowable drift due to wind loads for pre-engineered metal buildings, and serviceability recommendations for metal buildings can also be found in Chapter L of AISC 360 with additional guidance in *AISC Steel Design Guide 3*.

When separate support columns are used for top-running cranes, they must be supported so that differential movement between the crane columns and building columns, due to differences in stiffness, does not overstress either column and result in local column buckling.

B-1.2 Expansion Joints

Recommendations for the spacing of expansion joints can be found in *NAS Technical Report No. 65*.

B-2 SOILS AND FOUNDATIONS

B-2.1 Gable Bent Footings

Moment frame reactions from metal building gable bents have horizontal thrusts at column bases which can be resisted by several methods. For large thrust forces (40 to 50 kips (118 kN to 222 kN)), tie rods are usually cost-effective. The tie rod can be embedded in a thickened slab or as part of a tie beam between column foundations. Where reinforcement is used as a tension tie, splices shall be made with a full mechanical or full welded splice per chapter 12 of ACI 318. For smaller thrust forces, hairpin rebar may be used to transfer the thrust force from the column anchor bolts into the slab-on-ground reinforcement which acts as the tie between the columns. However, each of these methods requires close attention to detailing of control joints in the slab, isolation joints around a foundation pier and other possible interruptions in the continuous slab reinforcement between columns. Also, future renovation that might require trenching across the continuous slab reinforcement could result in the loss of the tension tie. A third method is to design the foundation for an overturning moment due to the thrust force at the base of the column. Each of these methods can provide the

necessary resistance to the thrust force, but need to be evaluated for each project condition. For further discussion on the design of foundations for gable bent reactions, refer to *Metal Building Systems* by Alexander Newman.

B-2.2 Footings on Expansive Soils

In the presence of expansive soils, footings must be designed to withstand expansive soil movement in order to prevent significant damage to structures. Cyclical expansive soil movement from soil water content, usually caused by a combination of inadequate drainage and seasonal wetting and drying cycles, are especially troublesome. Base the design on soil testing and recommendations by qualified geotechnical engineers. Ensure soil investigations include estimates of settlement, heave, and recommendations to mitigate effects of expansive soil movement. Ensure positive drainage away from structures that will prevent ponding close to structures. Guidance on design of foundations on expansive soils can be found in UFC 3-220-03FA and UFC 3-220-01N.

B-3 CONCRETE

B-3.1 Slab-on-Ground Concrete Strength

For slabs-on-ground subject to forklift traffic, it is recommended that the minimum compressive strength for the concrete be 4,000 psi (27.6 MPa) for pneumatic tire traffic and 5,000 psi (34.5 MPa) for steel tire traffic.

B-3.2 Slab-on-Ground Control Joints

For slabs-on-ground it is recommended that the control joints align across the building floor plate to avoid joints ending abruptly along the length or width of a panel. Joints that end abruptly at an adjacent panel edge could cause a crack to propagate into the adjacent panel. For locations where placement of joints at a panel edge are unavoidable, refer to UFC 3-320-06A for additional reinforcement requirements to minimize crack propagation.

Location of control joints in slabs-on-ground need to be coordinated with the joints in hard-surface finishes to avoid having the control joint telegraph through the hard-surface finish.

B-3.3 Slab-on-Ground Drying Shrinkage

Cracking in slabs generally results from drying shrinkage and restraint caused by friction between the slab and subgrade. Curling and warping occur due to differential shrinkage when the top of the slab dries to lower moisture content than the bottom of the slab. Recommendations for reducing the effects of drying shrinkage can be found in ACI 360R, ACI 224R and ACI 302.1R. Shrinkage compensating concrete can also be used to reduce shrinkage cracking. See recommendations in ACI 223.

B-3.4 Slab-on-Ground Vapor Retarder/Barrier

To facilitate proper moisture control of a slab-on-ground to meet the moisture limits of water-based adhesives and durability during construction, it is recommended that the vapor retarder have a minimum thickness of 10 mil (250 μm) with a maximum permeance rating of 0.04 perm. Where moisture is a critical issue under the floor covering, such as wood floors, and a vapor barrier required, it is recommended to reduce the maximum permeance rating to 0.01 perm.

B-4 MASONRY

B-4.1 Masonry Veneer Base Detail

The base of the masonry veneer should be placed on a shelf angle or a foundation ledge that is lower than the base of the steel stud wall by at least 4 inches (102 mm). The width of this shelf angle or foundation ledge will include the width of the masonry veneer and the cavity. This width should not be less than two-thirds of the veneer thickness plus the minimum air space.

B-5 STEEL

B-5.1 Shelf Angles for Masonry

Shelf angles should be hot-dip galvanized structural steel members. Angles should be provided in segments approximately 10 feet (3 m) in length, with gaps between segments. Shelf angles should be detailed to allow enough gaps for thermal expansion and contraction of the steel in angle runs and at building corners. Corners of buildings should have corner pieces with each leg no less than 4 feet (1.2 m) in length where possible.

Limit deflection of horizontal legs of shelf angles under masonry loading to 1/16 inch (1.6 mm) at the end of the horizontal leg. Rotation of the shelf angle support should be included in the 1/16 inch (1.6 mm) deflection limit for the horizontal leg displacement calculation.

B-5.2 Lightweight Insulating Concrete on Metal Deck

Due to the high water content of lightweight insulating concrete it is necessary to provide a vented deck to allow for the moisture in the concrete to escape through the deck.

B-5.3 Cold-Formed Continuous Beams and Joists

Guidance on determining the effective length of the unbraced compression flange for cold-formed continuous beams and joists can be found in AISI *Effective Lengths for Laterally Unbraced Compression Flanges of Continuous Beams Near Intermediate Supports*.

B-5.4 Masonry Veneer/Steel Stud Wall Detailing

Recommended details for masonry veneer/steel stud wall assemblies can be found in BIA Technical Note 28B.

B-5.5 Steel Structures in Corrosive Environments

Steel structures designed for corrosive environments should include consideration of the following corrosion protection measures:

- 1) Box-shaped members should be designed so that all inside surfaces may be readily inspected, cleaned, and painted, or should be closed entirely, except when hot-dip galvanized, to prevent exposure to moisture.
- 2) The legs of two back-to-back angle members, when not in contact, should have a minimum separation of 3/8 inch (9.5 mm) to permit air circulation.
- 3) Pockets or depressions in horizontal members should have drain holes to prevent water from ponding in low areas. Positive drainage should be provided away from exposed steel. Column bases should be terminated on concrete curbs or piers above grade, and tops of curbs or piers should be pitched to drain.
- 4) Where extremely corrosive conditions exist, consideration should be given to providing cathodic protection in addition to protective coatings for steel members exposed to salt water moisture environments.
- 5) Structural members embedded in concrete and exterior railing, handrails, fences, guardrails, and anchor bolts should be galvanized or constructed of stainless steel.
- 6) Dissimilar metals, (e.g., aluminum and steel, stainless steel and carbon steel, zinc coated steel and uncoated steel) should be isolated by appropriate means to avoid the creation of galvanic cells which can occur when dissimilar metals come in contact.
- 7) Consult a corrosion specialist certified by NACE International to recommend material protection for elements exposed to heavy industrial pollution, chemicals or corrosive soils.
- 8) For increased serviceability and compatibility with fireproofing use galvanized steel deck in accordance with ASTM A653.
- 9) Note that some common grades of stainless alloy such as ASTM Type 306 or 316 are susceptible to corrosion when immersed in salt or brackish water.

Further guidance in designing steel structures in corrosive environments can be found in ASM *Handbook Volume 13B*.

B-5.6 Steel Structures in Arctic and Antarctic Zones

For carbon steel, the transition from ductile to brittle behavior occurs within temperatures to be expected in Arctic and Antarctic zones. Ductility is important for structures in high seismic areas. Toughness, a characteristic also affected by cold temperatures, is important for structures which could be subjected to cyclic or impact loadings. Design of structures which could be subjected to cyclic or impact loads in cold climates, should include consideration of the following measures to mitigate potential fatigue and fracture problems:

- 1) Provide ample fillets to avoid stress risers.
- 2) Use bolted joints whenever possible. If welded joints are used, take precautions to eliminate gas and impurities in welds. Proper preheating and post-cooling are essential.
- 3) Use low-carbon steels and nickel-alloy steel that have good toughness characteristics at low temperatures.

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APPENDIX C – ABBREVIATIONS

10/50 S_s. ... Spectral acceleration of 5% damped short period (0.2 second) response corresponding to an earthquake with a 10% probability of being exceeded in 50 years

10/50 S₁. ... Spectral acceleration of 5% damped long period (1.0 second) response corresponding to an earthquake with a 10% probability of being exceeded in 50 years

CS Case Study

DOD Department of Defense

%g Percent Gravity

ft² Square Feet

in² Square Inches

IP Inch-Pound

kg/m³ Kilograms per Cubic Meter

km/h Kilometers per Hour

kN Kilonewton

kN/m² Kilonewton per Square Meter

kPa Kilopascal

lbs Pounds

lb/ft Pounds per Foot

lb/ft² Pounds per Square Foot

lb/in² Pounds per Square Inch

m Meter

m² Square Meter

mil 0.001 Inches

mm Millimeter

mm²	Square Millimeter
MPa	Megapascal
mph	Miles per Hour
psf	Pounds per Square Foot
psi	Pounds per Square Inch
S_s	Spectral Accelerations for Short Periods as determined by IBC Section 1613.5.1
S₁	Spectral Accelerations for 1-Second Periods as determined by IBC Section 1613.5.1
μm	micrometer (micron)
V	Velocity

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APPENDIX D

MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM
CONCENTRATED LIVE LOADS

D-1 REFERENCES. All section references are to the International Building Code (IBC) 2006. Table D-1 includes the IBC 2006 Table 1607.1 with additional Occupancy or Use classification for military facilities that are shown in bold italics.

**TABLE D-1 MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS
AND MINIMUM CONCENTRATED LIVE LOADS⁹**

OCCUPANCY OR USE	UNIFORM		CONCENTRATED	
	(kPa)	(psf)	(kN)	(lbs.)
1. Access floor systems				
Office use	2.4	50	8.9	2,000
Computer use	4.8	100	8.9	2,000
2. Ammunition Storage				
<i>High explosives (one story)</i>	23.9	500	---	---
<i>Inert explosives (one story)</i>	23.9	500	---	---
<i>Pyrotechnics (one story)</i>	23.9	500	---	---
<i>Small arms (one story)</i>	23.9	500	---	---
<i>Torpedo (one story)</i>	16.8	350	---	---
3. Armories and drill rooms	7.2	150	---	---
4. Assembly areas and theaters				
Fixed seats (fastened to floor)	2.9	60	---	---
Follow spot, projection and control rooms	2.4	50	---	---
Lobbies	4.8	100	---	---
Movable seats	4.8	100	---	---
Stages and platforms	6.0	125	---	---
5. Balconies	4.8	100	---	---
On one- and two-family residences only, and not exceeding 9.3m ² (100 ft. ²)	2.9	60	---	---
6. Battery charging room	9.6	200	---	---
7. Boiler houses	9.6	200	---	---
8. Bowling alleys	3.6	75	---	---
9. Catwalks	1.9	40	1.33	300
10. Cleaning gear / trash room compactor	3.6	75	---	---
11. Cold Storage (Food or provision freezer)				
<i>First floor</i>	19.2	400	---	---
<i>Upper floors</i>	14.4	300	---	---
12. Command Duty Officer Day room	2.9	60	---	---
13. Cornices	2.9	60	---	---
14. Corridors, except as otherwise indicated	4.8	100	---	---

OCCUPANCY OR USE	UNIFORM		CONCENTRATED	
	(kPa)	(psf)	(kN)	(lbs.)
15. Court rooms	3.8	80	---	---
16. Dance halls and ballrooms	4.8	100	---	---
17. Dining rooms and restaurants	4.8	100	---	---
18. Decks	Same as Occupancy Served ^h	Same as Occupancy Served ^h	---	---
19. Dwellings (see residential)	---	---	---	---
20. Elevator machine room grating (on area of 2600 mm ² (4 in. ²))	---	---	1.33	300
21. Finish light floor plate construction (on area of 650 mm ² (1 in. ²))	---	---	0.89	200
22. Fire escapes On single-family dwellings only	4.8 1.9	100 40	---	---
23. Galleys				
Dishwashing rooms	14.4	300		
General kitchen area	12.0	250		
Provision storage (not refrigerated)	9.6	200	---	---
Preparation room				
Meat	12.0	250		
Vegetable	4.8	100		
24. Garages (passenger vehicles only) Trucks & buses	1.9 See Section 1607.6 - IBC	40 See Section 1607.6 - IBC	Note a See Section 1607.6 - IBC	Note a See Section 1607.6 - IBC
25. Generator rooms	9.6	200	---	---
26. Grandstands (see stadium and arena bleachers)	---	---	---	---
27. Guard House	3.6	75	---	---
28. Gymnasiums, main floors and balconies	4.8	100	---	---
29. Handrails, guards and grab bars	See Section 1607.7 - IBC	See Section 1607.7 - IBC	See Section 1607.7 - IBC	See Section 1607.7 - IBC
30. Hospitals				
Corridors above first floor	3.8	80	4.45	1,000
Operating rooms, laboratories	2.9	60	4.45	1,000
Private rooms	1.9	40	4.45	1,000
31. Hotels (see residential)	---	---	---	---
32. Incinerators; charging room	7.2	150	---	---
33. Laboratories, normal scientific equipment	6.0	125	---	---
34. Latrines / Heads / Toilets / Washroom	3.6	75	---	---
35. Libraries				
Reading rooms	2.9	60	4.45	1,000
Stack rooms	7.2 ^b	150 ^b	4.45	1,000
Corridors above first floor	3.8	80	4.45	1,000
36. Manufacturing				
Light	6.0	125	8.9	2,000
Heavy	12.0	250	13.34	3,000
37. Marquees and canopies	3.6	75	---	---

OCCUPANCY OR USE	UNIFORM		CONCENTRATED	
	(kPa)	(psf)	(kN)	(lbs.)
38. Mechanical equipment room (general)	4.8	100	---	---
39. Mechanical room (HVAC)	6.0	125	---	---
40. Mechanical telephone and radio equipment room	7.2	150	---	---
41. Morgue	4.8	100	---	---
42. Office buildings File and computer rooms shall be designed for heavier loads based on anticipated occupancy Lobbies and first floor corridors Offices Corridors above first floor	4.8 2.4 3.8	100 50 80	8.9 8.9 8.9	2,000 2,000 2,000
43. Penal Institutions Cell blocks Corridors	1.9 4.8	40 100	--- ---	--- ---
44. Post offices General area Work rooms	4.8 6.0	100 125	--- ---	--- ---
45. Power plants	9.6	200	---	---
46. Projection booths	4.8	100	---	---
47. Promenade roof	2.9	60	---	---
48. Pump houses	4.8	100	---	---
49. Recreation room	4.8	100	---	---
50. Receiving rooms (radio) including roof areas supporting antennas and electronic equipment	7.2	150	---	---
51. Refrigeration storage rooms Dairy Meat Vegetable	9.6 12.0 13.2	200 250 275	--- --- ---	--- --- ---
52. Residential One & two family dwellings Uninhabitable attics without storage ⁱ Uninhabitable attics with limited storage ^{ij,k} Habitable attics and sleeping areas All other areas except balconies and decks Hotels and multifamily dwellings Private rooms & corridors serving them Public rooms and corridors serving them	0.5 1.0 1.4 1.9 1.9 4.8	10 20 30 40 40 100	--- --- --- --- --- ---	--- --- --- --- --- ---
53. Reviewing stands, grandstands and bleachers	Note c	Note c	Note c	Note c

OCCUPANCY OR USE	UNIFORM		CONCENTRATED	
	(kPa)	(psf)	(kN)	(lbs.)
54. Roofs				
All roof surfaces subject to maintenance workers	---	---	1.33	300
Awnings and canopies				
Fabric construction supported by a light weight rigid skeleton structure	0.23 Nonreduceable	5 Nonreduceable	---	---
All other construction	1.0	20	---	---
Ordinary flat, pitched, and curved roofs	1.0	20	---	---
Primary roof members, exposed to a work floor:				
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs:				
Over manufacturing, storage warehouses, and repair garages	---	---	8.9	2000
All other occupancies	---	---	1.33	300
Roofs used for special purposes	Note I	Note I	Note I	Note I
Roofs used for promenade purposes	2.9	60	---	---
Roofs used for roof gardens or assembly purposes	4.8	100	---	---
55. Schools				
Classrooms	1.9	40	4.45	1,000
Corridors above first floor	3.8	80	4.45	1,000
First floor corridors	4.8	100	4.45	1,000
56. Scuttles, skylight ribs, and accessible ceilings	---	---	0.89	200
57. Shops: Manufacturing and Industrial				
Aircraft utility	9.6	200	---	---
Assembly and repair	12.0	250	---	---
Bombsight (w/o shielding)	6.0	125	---	---
Carpenter	6.0	125	---	---
Electrical	14.4	300	---	---
Engine overhaul	14.4	300	---	---
58. Sidewalks, vehicular driveways and yards, subject to trucking	12.0 ^d	250 ^d	35.6 ^e	8,000 ^e
59. Skating rinks	4.8	100	---	---
60. Stadiums and arenas				
Bleachers	4.8 ^c	100 ^c	---	---
Fixed seats (fastened to floor)	2.9 ^c	60 ^c		
61. Stairs and exits				
One- and two-family dwellings	1.9	40	Note f	Note f
All other	4.8	100		

OCCUPANCY OR USE	UNIFORM		CONCENTRATED	
	(kPa)	(psf)	(kN)	(lbs.)
62. Storage warehouses (shall be designed for heavier loads if required for anticipate storage)				
General				
Light	6.0	125		
Heavy	11.97	250		
Aircraft	9.58	200		
Building Materials	11.97	250	---	---
Drugs, paint, oil	9.58	200		
Dry Provisions	14.36	300		
Groceries, wine, Liquor	14.36	300		
Light Tools	7.2	150		
Pipe & metal	47.88	1000		
Paint and oil (one story)	23.94	500		
Hardware	14.36	300		
63. Stores				
Retail				
First floor	4.8	100	4.45	1,000
Upper floors	3.6	75	4.45	1,000
Wholesale, all floors	6.0	125	4.45	1,000
64. Tailor shop	3.6	75	---	---
65. Telephone exchange rooms and central computer IT server spaces	7.2	150	8.9	2000
66. Vehicle barriers	See Section 1607.7.3 - IBC	See Section 1607.7.3 - IBC	See Section 1607.7.3 - IBC	See Section 1607.7.3 - IBC
67. Walkways and elevated platforms (other than exit ways)	2.9	60	---	---
Pedestrian Bridges	4.1	85		
68. Yards and terraces, pedestrian	4.8	100	---	---

**Notes to Table D-1, "MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND
MINIMUM CONCENTRATED LIVE LOADS"**

For SI: 1 square inch = 645.16 mm², 1 pound per square foot = 0.0479 kN/m² = 0.0479 kPa, 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m³.

- a. Floors in garages or portions of building used for the storage of motor vehicles shall be designed for the uniformly distributed live loads shown or the following concentrated loads: (1) for passenger cars accommodating not more than nine passengers, 3,000 pounds (13.34 kN) acting on an area of 4.5 inches x 4.5 inches (114 mm x 114 mm); (2) for mechanical parking structures without slab or deck which are used for storing passenger vehicles only, 2,250 pounds (10.0 kN) per wheel.
- b. The loading applies to stack room floors that support non-mobile, double-faced library book stacks, subject to the following limitations:
 - 1) The nominal book stack unit height shall not exceed 90 inches (2,290mm).
 - 2) The nominal shelf depth shall not exceed 12 inches (305mm) for each face; and
 - 3) Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches (915 mm) wide.
- c. Design in accordance with the ICC *Standard on Bleachers, Folding and Telescoping Seating and Grandstands*.
- d. Other uniform loads in accordance with an approved method which contains provisions for truck loadings shall also be considered where appropriate.
- e. The concentrated wheel load shall be applied on an area of 20 square inches (12,900 mm²).
- f. Minimum concentrated load on stair treads (on area of 4 square inches (2,600 mm²)) is 300 pounds (1.3 kN).
- g. Where snow loads occur that are in excess of the design conditions, the structure shall be designed to support the loads due to the increased loads caused by drift buildup or a greater snow design determined by the building official. (See IBC Section 1608). For special-purpose roofs, see IBC Section 1607.11.2.2.
- h. See IBC Section 1604.8.3 for decks attached to exterior walls.
- i. Attics without storage are those where the maximum clear height between the joist and rafter is less than 42 inches (1067 mm), or where there are not two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches (1067 mm) high by 2 feet (610 mm) wide, or greater, located within the

plane of the truss. For attics without storage, this live load need not be assumed to act concurrently with any other live load requirements.

- j. For attics with limited storage and constructed with trusses, this live load need only be applied to those portions of the bottom chord where there are two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches (1067 mm) high by 2 feet (610 mm) wide or greater, located within the plane of the truss. The rectangle shall fit between the top of the bottom chord and the bottom of any other truss member, provided that each of the following criteria is met:
 - 1) The attic area is accessible by a pull-down stairway or framed opening in accordance with Section 1209.2, and
 - 2) The truss shall have a bottom chord pitch less than 2:12
 - 3) Bottom chords of trusses shall be designed for the greater of actual imposed dead load or 10 psf (0.5 kPa), uniformly distributed over the entire span.
- k. Attic spaces served by a fixed stair shall be signed to support the minimum live load specified for habitable attics and sleeping rooms.
- l. Roofs used for other special purposes shall be designed for appropriate loads as approved by the contracting officer, or the contracting officer's designated representative.

APPENDIX E

**SITE-SPECIFIC STRUCTURAL LOADING DATA –
UNITED STATES, ITS TERRITORIES AND POSSESSIONS**

E-1 Climatic Loading Data Table. Site-specific structural climatic loading data for DoD locations within the United States, its territories and possessions is provided in Table E-1.

E-2 Earthquake Loading Data Table. Site-specific earthquake loading data for DoD locations within the United States, its territories and possessions is provided in Table E-2.

**TABLE E-1 STRUCTURAL CLIMATIC LOADING DATA –
UNITED STATES, ITS TERRITORIES AND POSSESSIONS**

TABLE E-1

State	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration
		(psf)	(mph)	(inches)	(kPa)	(km/h)	(mm)
Alabama	Anniston Army Depot	5	90	6	0.24	145	152
	Birmingham	5	90	6	0.24	145	152
	Fort McClellan	5	90	6	0.24	145	152
	Fort Rucker	0	107	0	0.00	172	0
	Maxwell-Gunther AFB / Montgomery	5	97	4	0.24	156	102
	Mobile	0	130	0	0.00	209	0
	Redstone Arsenal / Huntsville	10	90	9	0.48	145	229
Alaska	Clear AS	60	90		2.87	145	
	Eielson AFB	60	90	permafrost	2.87	145	permafrost
	Elmendorf AFB	50	100	129	2.40	161	3277
	Fort Greely	60	90	Permafrost	2.87	145	permafrost
	Fort Richardson	50	110	129	2.40	177	3277
	Fort Wainwright	60	90	permafrost	2.87	145	permafrost
	Galena AFB	60	100		2.87	161	
	Juneau	60	105	86	2.87	169	2184
	Ketchikan		115		0.00	185	
	Kodiak	30	130	86	1.44	209	2184
	Sitka	50	122	56	2.40	196	1422
	Valdez	160	100	136	7.66	161	3454
Arizona	Davis-Monthan AFB / Tucson AFB	0	90	0	0.00	145	0

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
Arizona	Fort Huachuca	10	90	0	0.48	145	0
	Luke Air Force Base	0	90	5	0.00	145	127
	Phoenix	0	90	0	0.00	145	0
	MCAS Yuma	0	90	0	0.00	145	0
	Yuma Proving Ground	0	90	0	0.00	145	0
Arkansas	Little Rock AFB	10	90	14	0.48	145	356
	Pine Bluff Arsenal	10	90	9	0.48	145	229
California	Alameda	0	85		0.00	137	
	MCLB Barstow	0	85	18	0.00	137	457
	Beale AFB	0	85		0.00	137	
	MCMWTC Bridgeport	150	100	36	7.19	161	914
	MCB Camp Pendleton	0	85	4	0.00	137	102
	NWS China Lake	0	Special	22	0.00	Special	559
	NSWC Corona	0	85	0	0.00	137	0
	NRTF Dixon	0	85	0	0.00	137	0
	Edwards AFB	0	Special	22	0.00	Special	559
	El Centro NAF	0	85	0	0.00	137	0
	Fort Irwin	0	85	22	0.00	137	559
	Fresno ANG	0	85	0	0.00	137	0
	NAS Lemoore	0	85	0	0.00	137	0
	Los Angeles AFB / El Segundo	0	85	0	0.00	137	0
	Los Angeles	0	85	0	0.00	137	0
	March ARB	0	85	0	0.00	137	0
	McClellan AFB / Sacramento	0	85	5	0.00	137	127
NWC Mohave Range	0	85	22	0.00	137	559	
Presidio of Monterey	0	85	4	0.00	137	102	
Point Mugu / Port Hueneme	0	85	0	0.00	137	0	

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
California	San Diego Region NAS North Island NAB Coronada MCRD MCAS Miramar Naval Medical Ctr San Diego NS Point Loma	0	85	0	0.00	137	0
	Moffett Field - Onizuka / Sunnyvale	0	85	0	0.00	137	0
	San Clemente Island Naval Reservation	0	85	0	0.00	137	0
	San Nicolas Island	0	85	0	0.00	137	0
	Seal Beach NWS	0	85	0	0.00	137	0
	Seal Beach NWS – Concord Detachment	0	85	0	0.00	137	0
	Sierra Army Depot / Herlong	15	85	54	0.72	137	1372
	Stockton / San Joaquin	0	85	4	0.00	137	102
	Travis AFB	0	85	0	0.00	137	0
	MCB Twentynine Palms	0	85	5	0.00	137	127
	Vandenberg AFB	0	85	0	0.00	137	0
Colorado	Buckley AFB / Aurora	20	90	52	0.96	145	1321
	Denver	20	90	52	0.96	145	1321
	Fort Carson	15	90 Special	38	0.72	145 Special	965
	Cheyenne Mountain AS / NORAD	15	90 Special	38	0.72	145 Special	965
	Peterson AFB / Colorado Springs	30	90	38	1.44	145	965
	Schriever AFB	CS	90		CS	145	
	USAF Academy	30	90 Special	38	1.44	145 Special	965
Connecticut	NSB New London / Groton	30	120	38	1.44	193	965
Delaware	Dover AFB	25	95	22	1.20	153	559

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
District of Columbia	Washington Region Bolling AFB Anacostia NS Fort McNair Marine Barracks NRL Washington NDW / Anacostia Pentagon Walter Reed	25	90	26	1.20	145	660
Florida	Avon Park AS	0	110	0	0.00	177	0
	Cape Canaveral AFS	0	125	0	0.00	201	0
	Eglin AFB	0	133	0	0.00	214	0
	Homestead	0	150	0	0.00	241	0
	Hurlburt Field	0	135	0	0.00	217	0
	NAS Jacksonville / MCSF Blount Island / Jacksonville	0	115	0	0.00	185	0
	NAS Key West	0	150	0	0.00	241	0
	MacDill AFB	0	120	0	0.00	193	0
	NAS Mayport	0	120	0	0.00	193	0
	HQ Southcom / Miami	0	140	0	0.00	225	0
	Orlando	0	108	0	0.00	174	0
	NAS Panama City	0	130	0	0.00	209	0
	Patrick AFB	0	125	0	0.00	201	0
	NAS Pensacola	0	140	0	0.00	225	0
	Tampa	0	118	0	0.00	190	0
	Tyndall AFB	0	130	0	0.00	209	0
	NAS Whiting Field / Milton	0	125	0	0.00	201	0
Georgia	MCLB Albany	0	98	0	0.00	158	0
	Athens NCSC	5	90	0	0.24	145	0
	Dobbins AFB / Atlanta NAS	5	90	0	0.24	145	0
	Fort Benning	5	95	0	0.24	153	0
	Fort Gordon	10	93	0	0.48	150	0
	Fort McPherson / Fort Gillem	5	90	0	0.24	145	0

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
Georgia	Fort Stewart	0	110	0	0.00	177	0
	Hunter Army Airfield / Savannah	0	120	0	0.00	193	0
	NSB Kings Bay	0	120	0	0.00	193	0
	Moody AFB	0	98	0	0.00	158	0
	Robins AFB	5	92	0	0.24	148	0
Hawaii	PMRF Barking Sands, Kauai	0	105	0	0.00	169	0
	MCBH Kaneohe Bay	0	105	0	0.00	169	0
	Pohakuloa Training Area	0	105	0	0	169	0
	Pearl Harbor Region: Camp H.M. Smith Fort Shafter Hickam AFB Pearl Harbor Tripler AMC	0	105	0	0.00	169	0
	Wahiawa Region: Lualualei Wahiawa Naval Reservation Wheeler AFB Schofield Barracks	0	105	0	0.00	169	0
Idaho	ARD Bayview	10	90		0.48	145	
	Boise ANG	10	90		0.48	145	
	Mountain Home AFB	20	90	64	0.96	145	1626
Illinois	Fort Sheridan / Chicago	25	90	59	1.20	145	1499
	Great Lakes	25	90	64	1.20	145	1626
	Rock Island Arsenal	20	90	64	0.96	145	1626
	Scott AFB	20	90	38	0.96	145	965
	Springfield	20	90		0.96	145	
Indiana	Crane NWSC	20	90	36	0.96	145	914
	Grissom ARB	20	90	49	0.96	145	1245
	Fort Benjamin Harrison / Indianapolis	20	90	44	0.96	145	1118
Iowa	Des Moines	25	90	82	1.20	145	2083

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
Kansas	Fort Leavenworth	20	90	54	0.96	145	1372
	Fort Riley	20	90	52	0.96	145	1321
	McConnell AFB	25	90	38	1.20	145	965
Kentucky	Fort Campbell	15	90	22	0.72	145	559
	Fort Knox	15	90	32	0.72	145	813
	Louisville	15	90	32	0.72	145	813
	Richmond	15	90		0.72	145	0
Louisiana	Barksdale AFB	5	90	7	0.24	145	178
	Fort Polk / Leesville	5	95	0	0.24	153	0
	NAS JRB New Orleans / Belle Chasse	0	130	0	0.00	209	0
Maine	NAS Brunswick	50	100	86	2.40	161	2184
	NRTF Cutler	50	98	86	2.40	158	2184
	PNSY Kittery	50	100	64	2.40	161	1626
	Winter Harbor NSGA	50	98	86	2.40	158	2184
Maryland	Aberdeen Proving Ground	25	90	29	1.20	145	737
	Adelphi	25	90	24	1.20	145	610
	Andrews AFB	25	90	26	1.20	145	660
	Carderock NSWC / Bethesda	25	90	20	1.20	145	508
	Bloods Island	20	102		0.96	164	
	Edgewood Arsenal	25	90	29	1.20	145	737
	Fort Detrick / Fredrick	30	90	29	1.44	145	737
	Fort Meade	25	90	26	1.20	145	660
	Indian Head NSWC	25	90	22	1.20	145	559
	Martin State ANG	25	90	29	1.20	145	737
	NS Pax River , Webster Field / St. Inigoes	20	90	26	0.96	145	660
Massachusetts	U.S Naval Academy / Annapolis	25	90	26	1.20	145	660
	Fort Devens / Ayer	50	97	64	2.40	156	1626
	Hanscom AFB	50	100	54	2.40	161	1372

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
Massachusetts	Natick	50	100		2.40	161	
	Otis AGB / Falmouth	25	115	38	1.20	185	965
	Westover ARB	35	95	64	1.68	153	1626
Michigan	Battle Creek	30	90		1.44	145	
	Detroit Arsenal / Warren	25	90	61	1.20	145	1549
	Selfridge ANG Base	25	90	59	1.20	145	1499
Minnesota	Minneapolis – St Paul	50	90	125	2.40	145	3175
Mississippi	Stennis / Bay St. Louis	0	130		0.00	209	
	Columbus AFB	10	90	7	0.48	145	178
	Gulfport	0	135	0	0.00	217	0
	Jackson	5	92	5	0.24	148	127
	Keesler AFB	0	140	0	0.00	225	0
	NAS Meridian	5	97	5	0.24	156	127
	Pascagoula NS	0	150	0	0.00	241	0
Missouri	Vicksburg	5	90		0.24	145	
	Fort Leonard Wood	20	90	36	0.96	145	914
	Kansas City	20	90	49	0.96	145	1245
	Overland	20	90		0.96	145	
	St. Louis	20	90	38	0.96	145	965
Montana	Whiteman AFB	20	90	46	0.96	145	1168
	Great Falls ANG	20	90	107	0.96	145	2718
Nebraska	Malmstrom AFB	20	90	107	0.96	145	2718
	Offutt AFB	25	90	73	1.20	145	1854
Nevada	Lincoln	25	90	64	1.20	145	1626
	NAS Fallon	5	90	23	0.24	145	584
	Indian Springs AFS	5	90	7	0.24	145	178
	Nellis AFB	5	90	7	0.24	145	178
New Hampshire	Nellis AF Range	5	90	7	0.24	145	178
	Portsmouth Naval Shipyard	50	100	64	2.40	161	1626
New Jersey	NWS Earle / Colts Neck	20	110		0.96	177	
	Fort Dix / Trenton	25	105	29	1.20	169	737

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
New Jersey	Fort Monmouth	20	110	38	0.96	177	965
	Lakehurst	25	105	29	1.20	169	737
	McGuire AFB	25	105	29	1.20	169	737
	Picatinny Arsenal	35	90	32	1.68	145	813
New Mexico	Albuquerque	10	90	18	0.48	145	457
	Cannon AFB	15	90	18	0.72	145	457
	Holloman AFB	5	90	4	0.24	145	102
	Kirtland AFB	10	(a)	18	0.48	(a)	457
	White Sands	5	90	4	0.24	145	102
New York	Buffalo	45	90	59	2.16	145	1499
	Fort Drum	70	90	94	3.35	145	2388
	Fort Hamilton / Brooklyn	25	105		1.20	169	
	Griffis AFB / Rome	60	90	86	2.87	145	2184
	NIAGARA FALLS IAP	35	90	59	1.68	145	1499
	NSU Saratoga Springs	50	90		2.40	145	
	Stewart ANG / Newburgh	35	90	54	1.68	145	1372
	Syracuse	40	90	73	1.92	145	1854
	West Point	30	Special	54	1.44	Special	1372
	Watervliet Arsenal / Albany	40	90	82	1.92	145	2083
North Carolina	MCAS Cherry Point	10	128	0	0.48	206	0
	Fort Bragg	10	95	0	0.48	153	0
	Jacksonville Region MCB Camp Lejeune MCAS New River	10	130	0	0.48	209	0
	Pope AFB	10	95	0	0.48	153	0
	Raleigh	15	93		0.72	150	
	Seymour Johnson AFB	10	100	4	0.48	161	102
	North Dakota	Grand Forks AFB	60	90	156	2.87	145
	NRTF La Moure	40	90		1.92	145	
	Minot AFB	40	90	163	1.92	145	4140
Ohio	Cleveland	20	90	52	0.96	145	1321

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
Ohio	DSC Whitehall / Columbus	20	90	46	0.96	145	1168
	Wright-Patterson AFB	20	90	49	0.96	145	1245
	Youngstown ARS / Vienna	20	90		0.96	145	
Oklahoma	Altus AFB	10	90	14	0.48	145	356
	Fort Sill	10	90	14	0.48	145	356
	McAlester Army Ammunition Plant	10	90	16	0.48	145	406
	Tinker AFB / Oklahoma City	10	90	17	0.48	145	432
	Tulsa	10	90	23	0.48	145	584
	Vance AFB	15	90	22	0.72	145	559
	Portland	10	85	14	0.48	137	356
Pennsylvania	ARS Coraopolis / Pittsburg	25	90	38	1.20	145	965
	Carlisle Barracks	25	90	36	1.20	145	914
	Fort Indiantown Gap / Annville	35	90	49	1.68	145	1245
	Letterkenny / Chambersburg	30	90	36	1.44	145	914
	Mechanicsburg	25	90		1.20	145	
	Philadelphia	25	90	30	1.20	145	762
	New Cumberland / Defense Depot Susquehanna	25	90		1.20	145	0
	Tobyhanna Army Depot	50	90	52	2.40	145	
	Willow Grove ARS / NAS	30	90		1.44	145	0
	Rhode Island	NS Newport	30	115	35	1.44	185
South Carolina	MCAS Beaufort	5	122	0	0.24	196	0
	Charleston Region: Charleston AFB NWS Charleston	5	125	0	0.24	201	0
	Columbia Region: McEntire Fort Jackson Shaw AFB	10	97	0	0.48	156	0
	MCRD Parris Island	0	125	0	0.00	201	0
South Dakota	Ellsworth AFB	20	90	86	0.96	145	2184

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
Tennessee	Arnold AFB	10	90		0.48	145	
	NSWC LCC / Memphis	10	90	0	0.48	145	0
	NSA Mid-South / Millington	10	90		0.48	145	
	Nashville	10	90	22	0.48	145	559
Texas	NAS JRB, Carswell / Fort Worth	5	90	7	0.24	145	178
	NAS Corpus Christi	0	130	0	0.00	209	0
	Dallas / Irving	5	90	7	0.24	145	178
	Dyess AFB	5	90	7	0.24	145	178
	Ellington ANG / Houston	0	115	0	0.00	185	0
	Fort Bliss / El Paso	5	90	0	0.24	145	0
	Fort Hood / Killeen	5	90	6	0.24	145	152
	Goodfellow AFB	5	90	5	0.24	145	127
	NS Ingleside	0	130	0	0.00	209	0
	NAS Kingsville	0	115	0	0.00	185	0
	Laughlin AFB	0	90	0	0.00	145	0
	Red River Army Depot / Texarkana	5	90	8	0.24	145	203
	San Antonio Region Brooks AFB Fort Sam Houston Kelly AFB Lackland AFB Randolph AFB	5	90	0	0.24	145	0
	Sheppard AFB	5	90	11	0.24	145	279
Utah	Dugway Proving Ground	10	90	54	0.48	145	1372
	Hill AFB	40	90	73	1.92	145	1854
	Salt Lake City	15	90	59	0.72	145	1499
	Tooele Army Depot	25	90	52	1.20	145	1321
Virginia	Dahlgren	25	90		1.20	145	
	Dam Neck / Virginia Beach Ocean front	10	115	5	0.48	185	127
	Fort A. P. Hill	25	90		1.20	145	
	Fort Belvoir	25	90	26	1.20	145	660
	Fort Eustis	15	97	9	0.72	156	229

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)	
Virginia	Fort Lee	20	90	14	0.96	145	356	
	Fort Monroe	10	105	9	0.48	169	229	
	Fort Myer	25	90	26	1.20	145	660	
	Fort Story	10	113	9	0.48	182	229	
	Henderson Hall / Arlington	25	90	26	1.20	145	660	
	Langley AFB / Hampton	10	105	9	0.48	169	229	
	NAB Little Creek	10	110	9	0.48	177	229	
	Norfolk Region: Camp Elmore Crane Island Depot Norfolk Naval Base	10	107	9	0.48	172	229	
	Norfolk Shipyard – Naval Hospital / Portsmouth	10	105	9	0.48	169	229	
	NSA Northwest / Chesapeake	10	105	9	0.48	169	229	
	NAS Oceana / Virginia Beach	10	113	9	0.48	182	229	
	MCB Quantico	25	90	22	1.20	145	559	
	Radford AAP	25	90		1.20	145		
	Defense Supply Ctr / Richmond	20	90	18	0.96	145	457	
	Wallops Island	20	115		0.96	185		
	Yorktown Region: Camp Perry Cheatham Annex Yorktown NWS	15	95	9	0.72	153	229	
	Washington	NS Everett	15 (b)	85		0.72(b)	137	
		Fairchild AFB	42	85	64	2.01	137	1626
		Fort Lewis / Tacoma	15 (b)	85	9	0.72(b)	137	229
Indian Island SWC		15 (b)	85		0.72(b)	137		
NRS Jim Creek		15 (b)	85		0.72(b)	137		
Keyport / Bangor Engin. Sta Annex		15 (b)	85	9	0.72(b)	137	229	
McChord AFB		15	85	9	0.72	137	229	

TABLE E-1

State	Base / City	Ground Snow (psf)	Wind Speed (mph)	Frost Penetration (inches)	Ground Snow (kPa)	Wind Speed (km/h)	Frost Penetration (mm)
Washington	Puget Sound Region: Bangor NSB Bremerton NS Puget Sound NSY	15 (b)	85	9	0.72(b)	137	229
	NAS Whidbey Island / Oak Harbor	15 (b)	85		0.72(b)	137	
	Seattle	15	85	9	0.72	137	229
West Virginia	Allegheny Ballistics Lab	CS	90		CS	145	
	Beckley	30	90		1.44	145	
	Huntington	20	90	22	0.96	145	559
	Sugar Grove NRS	30	90	38	1.44	145	965
Wisconsin	Fort McCoy	40	90	114	1.92	145	2896
	General Mitchell AFRC / Milwaukee	30	90	75	1.44	145	1905
	Madison	30	90	75	1.44	145	1905
Wyoming	F. E. Warren AFB	20	90	59	0.96	145	1499
American Samoa	Pago Pago / Tutuila Island	0	125	0	0.00	201	0
Mariana Islands	Guam	0	170	0	0.00	274	0
	Saipan / Tinian	0	150	0	0.00	241	0
Puerto Rico	All	0	145	0	0.00	233	0

Notes to TABLE E-1, “STRUCTURAL CLIMATIC LOADING DATA – UNITED STATES, ITS TERRITORIES AND POSSESSIONS”

(a) – Wind speed equals 125 mph (201 km/h) in the south sector of Kirtland AFB.
Wind speed equals 100 mph (161 km/h) on the remainder of the base.

(b) – Ground snow load to be used for Navy facilities at identified locations in Washington State equals 25 psf (1.20 kPa).

CS – Site specific case studies are required to establish ground snow loads.

Special - Special wind regions where unusual geographic conditions require consideration for potential unusual wind conditions. The wind speeds shown are minimum values. The potential for higher wind speeds due to unusual geographic conditions should also be considered.

CANCELLED

**TABLE E-2 EARTHQUAKE LOADING DATA –
UNITED STATES, ITS TERRITORIES AND POSSESSIONS**

TABLE E-2		Seismic Data (Site Class B)			
State	Base / City	S_s (%g)	S₁ (%g)	10/50 S_s (%g)	10/50 S₁ (%g)
Alabama	Anniston Army Depot	28	9	11	4
	Birmingham	30	10	11	4
	Fort McClellan	28	9	11	4
	Fort Rucker	11	6	4	2
	Maxwell-Gunther AFB / Montgomery	16	7	6	3
	Mobile	12	5	4	2
	Redstone Arsenal / Huntsville	30	11	11	4
Alaska	Clear AS	108	30	47	14
	Eielson AFB	106	29	44	14
	Elmendorf AFB	149	55	100	30
	Fort Greely	81	38	34	14
	Fort Richardson	152	57	101	31
	Fort Wainwright	111	31	49	14
	Galena AFB	35	10	15	4
	Juneau	57	27	27	14
	Ketchikan	23	14	11	8
	Kodiak	179	66	116	37
	Sitka	102	52	52	31
Valdez	147	57	93	30	
Arizona	Davis-Monthan AFB / Tucson AFB	28	8	13	4
	Fort Huachuca	26	8	12	3
	Luke Air Force Base	17	6	11	3
	Phoenix	18	6	11	3
	MCAS Yuma	68	26	37	14
	Yuma Proving Ground	47 Max 20 Min	23 Max 14 Min	29 Max 15 Min	11 Max 6 Min
Arkansas	Little Rock AFB	57	18	14	4
	Pine Bluff Arsenal	44	15	11	4
California	Alameda	150	60	123	55
	MCLB Barstow	133	48	61	22
	Beale AFB	44	20	26	11
	MCMWTC Bridgeport	110	39	63	21

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
California	MCB Camp Pendleton	139 Max 111 Min	51 Max 42 Min	61	25
	NWS China Lake	136 Max 109 Min	45 Max 38 Min	80 Max 61 Min	27 Max 19 Min
	NSWC Corona	169	60	127	47
	NRTF Dixon	129	42		
	Edwards AFB	115 Max 86 Min	59 Max 39 Min	85 Max 47 Min	39 Max 21 Min
	El Centro NAF	190 Max 150 Min	66 Max 60 Min	160 Max 128 Min	54 Max 39 Min
	Fort Irwin	197 Max 78 Min	95 Max 29 Min	144 Max 40 Min	55 Max 15 Min
	Fresno ANG	49	22	27	12
	NAS Lemoore	89	33	49	20
	Los Angeles AFB / El Segundo	150	60	113	39
	Los Angeles	188	68	119	42
	March ARB	150	60	127	50
	McClellan AFB / Sacramento	48	22	28	13
	NWC Mohave Range	197 Max 94 Min	95 Max 33 Min	106 Max 49 Min	36 Max 20 Min
	Presidio of Monterey	151	63	105	37
	Point Mugu / Port Hueneme	219	91	128	54
	San Diego Region				
	NAS North Island	146	56	66.4	24.8
	NAB Coronada	157	63	62.8	22.8
	MCRD	163	65	67.5	25.4
	MCAS Miramar	137	51	64.8	24.1
	Naval Medical Ctr	155	60	63.4	24.3
	San Diego NS	140	54	60.8	22.2
	NS Point Loma	154	61	72.5	26.1
	Moffett Field – Onizuka / Sunnyvale	150	60	125	57
	San Clemente Island Naval Reservation	83	26	31	12
	San Nicolas Island	62	22	26	10
	Seal Beach NWS	164	61	110	37

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
California	Seal Beach NWS – Concord Detachment	150	60	145	55
	Sierra Army Depot / Herlong	95	35	48	16
	Stockton / San Joaquin	148	48	76	26
	Travis AFB	186	60	111	37
	MCB Twentynine Palms	162 Max 88 Min	58 Max 30 Min	102 Max 39 Min	32 Max 14 Min
	Vandenberg AFB	138 Max 105 Min	49 Max 36 Min	64 Max 53 Min	24 Max 19 Min
	Colorado	Buckley AFB / Aurora	20	5	7
Denver		21	6	8	2
Fort Carson		21	6	7	2
Cheyenne Mountain AS / NORAD		21	6	7	2
Peterson AFB / Colorado Springs		20	6	7	2
Schriever AFB		19	6	7	2
USAF Academy		22	6	8	2
Connecticut	NSB New London / Groton	21	6	8	3
Delaware	Dover AFB	16	5	7	2
District of Columbia	Washington Region Bolling AFB Anacostia NS Fort McNair Marine Barracks NRL Washington NDW / Anacostia Pentagon Walter Reed	15	5	6	2
Florida	Avon Park AS	8	3	2	1
	Cape Canaveral AFS	9	4	3	1
	Eglin AFB	10	5	3	2
	Homestead	5	2	1	0
	Hurlburt Field	9	5	3	2
	NAS Jacksonville / MCSF Blount Island / Jacksonville	14	6	5	2
	NAS Key West	3	1		
	MacDill AFB	7	3	2	1

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Florida	NAS Mayport	15	6	5	2
	HQ Southcom / Miami	5	2	1	1
	Orlando	10	4	3	1
	NAS Panama City	8	5	3	2
	Patrick AFB	8	4	2	1
	NAS Pensacola	10	5	3	2
	Tampa	8	3	2	1
	Tyndall AFB	8	4	3	2
	NAS Whiting Field / Milton	11	5	4	2
Georgia	MCLB Albany	13	6	5	3
	Athens NCSC	26	9	12	5
	Dobbins AFB / Atlanta NAS	25	9	11	4
	Fort Benning	15	7	6	3
	Fort Gordon	33	11	14	5
	Fort McPherson / Fort Gillem	22	9	10	4
	Fort Stewart	29	10	9	4
	Hunter Army Airfield / Savannah	38	12	12	4
	NSB Kings Bay	17	7	6	3
	Moody AFB	13	6	5	3
	Robins AFB	19	8	8	4
	Hawaii	PMRF Barking Sands, Kauai	19	6	8
MCBH Kaneohe Bay		63	18	30	8
Pearl Harbor Region: Camp H.M. Smith Fort Shafter Hickam AFB Pearl Harbor Tripler AMC		61	18	29	8
Pohakuloa Training Area		150	60		

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Hawaii	Wahiawa Region: Lualualei Wahiawa Naval Res Wheeler AFB Schofield Barracks	59	17	28	8
Idaho	ARD Bayview	42	12	17	5
	Boise ANG	30	10	16	5
	Mountain Home AFB	26	9	14	4
Illinois	Fort Sheridan / Chicago	15	6	5	2
	Great Lakes	14	5	5	2
	Rock Island Arsenal	13	6	5	2
	Scott AFB	66	19	24	6
	Springfield	27	11	10	4
Indiana	Crane NWSC	35	12	13	4
	Grissom ARB	15	7	6	3
	Fort Benjamin Harrison / Indianapolis	18	8	7	3
Iowa	Des Moines	8	4	3	1
Kansas	Fort Leavenworth	13	6	4	2
	Fort Riley	19	5	6	2
	McConnell AFB	14	5	5	2
Kentucky	Fort Campbell	74 Max 59 Min	22 Max 19 Min	24 Max 18 Min	6 Max 6 Min
	Fort Knox	26	11	10	4
	Louisville	25	10	10	4
	Richmond	23	9	10	4
Louisiana	Barksdale AFB	16	7	5	2
	Fort Polk / Leesville	12	5	4	2
	NAS JRB New Orleans / Belle Chasse	11	5	4	1
Maine	NAS Brunswick	30	8	12	4
	NRTF Cutler	27	7		
	PNSY Kittery	36	8	13	4
	Winter Harbour NSGA	21	6	8	3
Maryland	Aberdeen Proving Ground	20	5	8	2
	Adelphi	16	5	6	2
	Andrews AFB	15	5	6	2

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Maryland	Carderock NSWC / Bethesda	16	5	6	2
	Bloods Island	12	5	5	2
	Edgewood Arsenal	19	5	7	2
	Fort Detrick / Fredrick	16	5	7	2
	Fort Meade	16	5	6	2
	Indian Head NSWC	16	5	7	2
	Martin State ANG	18	5	7	2
	NS Pax River , Webster Field / St. Inigoes	14	5	6	2
	U.S Naval Academy / Annapolis	16	5	6	2
	Massachusetts	Fort Devens / Ayer	28	7	11
Hanscom AFB		28	7	11	3
Natick		26	7	10	3
Otis AGB / Falmouth		20	5	8	2
Westover ARB		23	7	9	3
Michigan	Battle Creek	11	5	4	2
	Detroit Arsenal / Warren	12	4	4	2
	Selfridge ANG Base	11	4	4	2
Minnesota	Minneapolis – St Paul	6	3	2	1
Mississippi	Stennis / Bay St. Louis	12	5	4	2
	Columbus AFB	28	11	8	4
	Gulfport	12	5	4	2
	Jackson	20	9	6	3
	Keesler AFB	12	5	4	2
	NAS Meridian	20	8	7	3
	Pascagoula NS	11	5	4	2
	Vicksburg	20	9	6	3
Missouri	Fort Leonard Wood	30	12	10	4
	Kansas City	13	6	4	2
	Overland	52	16	19	5
	St. Louis	58	17	21	6
	Whiteman AFB	14	7	5	2
Montana	Great Falls ANG	23	8	13	4
	Malmstrom AFB	20	8	12	4

TABLE E-2

		Seismic Data (Site Class B)			
State	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Nebraska	Offutt AFB	13	4	4	1
	Lincoln	18	5	5	2
Nevada	NAS Fallon	81	29	43	14
	Indian Springs AFS	45	16	24	8
	Nellis AFB	50	17	26	9
	Nellis AF Range	70Max 59 Min	26 Max 19 Min	37 Max 28 Min	13 Max 9 Min
New Hampshire	Portsmouth Naval Shipyard	36	8	13	4
New Jersey	NWS Earle / Colts Neck	30	6	11	3
	Fort Dix / Trenton	26	6	10	3
	Fort Monmouth	30	6	11	3
	Lakehurst	25	6	10	3
	McGuire AFB	26	6	10	3
	Picatinny Arsenal	32	7	12	3
New Mexico	Albuquerque	55	17	27	7
	Cannon AFB	11	3	4	1
	Holloman AFB	32	10	13	4
	Kirtland AFB	56	17	27	7
	White Sands	41	13	13	4
New York	Buffalo	28	6	9	2
	Fort Drum	30	8	12	4
	Fort Hamilton / Brooklyn	35	7	12	3
	Griffis AFB / Rome	22	7	9	3
	NIAGARA FALLS IAP	28	6	9	2
	NSU Saratoga Springs	26	7	11	4
	Stewart ANG / Newburgh	28	7	11	3
	Syracuse	18	6	8	3
	West Point	31	7	12	3
	Watervliet Arsenal / Albany	23	7	10	3
North Carolina	MCAS Cherry Point	16	7	5	2
	Fort Bragg	29	10	9	4
	Jacksonville Region MCB Camp Lejeune MCAS New River	21	8	6	3
	Pope AFB	29	10	9	4

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
North Carolina	Raleigh	20	8	8	4
	Seymour Johnson AFB	20	8	7	3
North Dakota	Grand Forks AFB	5	2	2	0
	NRTF La Moure	6	2		
	Minot AFB	7	2	2	1
Ohio	Cleveland	19	5	6	2
	DSC Whitehall / Columbus	15	6	7	3
	Wright-Patterson AFB	19	7	8	3
	Youngstown ARS / Vienna	17	5	6	2
Oklahoma	Altus AFB	20	6	6	2
	Fort Sill	38	9	8	2
	McAlester Army Ammunition Plant	21	7	7	2
	Tinker AFB / Oklahoma City	32	7	10	3
	Tulsa	16	7	6	2
	Vance AFB	23	6	7	2
	Portland	93	32	43	17
Pennsylvania	ARS Coraopolis / Pittsburg	12	5	5	2
	Carlisle Barracks	17	5	7	2
	Fort Indiantown Gap / Annville	21	6	8	2
	Letterkenny / Chambersburg	16	5	6	2
	Mechanicsburg	18	5	7	2
	Philadelphia	28	6	10	3
	New Cumberland / Defense Depot Susquehanna	19	5	7	2
	Tobyhanna Army Depot	22	6	9	3
	Willow Grove ARS / NAS	28	6	11	3
	NS Newport	21	6	8	2
South Carolina	MCAS Beaufort	71	19	19	6
	Charleston Region:				
	Charleston AFB	192	49	34	8
	NWS Charleston	219	55	36	8

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
South Carolina	Columbia Region:				
	McEntire	56	16	22	6
	Fort Jackson	56	15	20	6
	Shaw AFB	67	18	22	6
	MCRD Parris Island	62	17	18	5
South Dakota	Ellsworth AFB	15	4	5	2
Tennessee	Arnold AFB	30	11	12	5
	NSWC LCC / Memphis	141	38	28	7
	NSA Mid-South / Millington	150	43	32	7
	Nashville	33	13	12	5
Texas	NAS JRB, Carswell / Fort Worth	11	5	4	2
	NAS Corpus Christi	8	2	2	1
	Dallas / Irving	12	5	4	2
	Dyess AFB	9	4	3	1
	Ellington ANG / Houston	9	4	3	1
	Fort Bliss / El Paso	31	10	14	4
	Fort Hood / Killeen	8	4	3	1
	Goodfellow AFB	8	3	3	1
	NS Ingleside	8	2	2	1
	NAS Kingsville	8	2	2	1
	Laughlin AFB	6	2	2	1
	Red River Army Depot / Texarkana	17	8	6	2
	San Antonio Region				
	Brooks AFB	12	3	3	1
	Fort Sam Houston	11	3	3	1
Kelly AFB	11	3	3	1	
Lackland AFB	11	3	3	1	
Randolph AFB	11	3	3	1	
Sheppard AFB	17	6	5	2	
Utah	Dugway Proving Ground	35	14	17	6
	Hill AFB	114	48	50	17
	Salt Lake City	153	60	61	20
	Tooele Army Depot	73	27	35	12
Virginia	Dahlgren	16	5	6	2
	Dam Neck / Virginia Beach Ocean front	11	5	4	2
	Fort A. P. Hill	18	5	7	2

TABLE E-2

State	Base / City	Seismic Data (Site Class B)				
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)	
Virginia	Fort Belvoir	15	5	6	2	
	Fort Eustis	13	5	5	2	
	Fort Lee	19	6	7	3	
	Fort Monroe	12	5	5	2	
	Fort Myer	15	5	6	2	
	Fort Story	11	5	4	2	
	Henderson Hall / Arlington	15	5	6	2	
	Langley AFB / Hampton	12	5	5	2	
	NAB Little Creek	11	5	5	2	
	Norfolk Region: Camp Elmore Craney Island Depot Norfolk Naval Base	12	5	5	2	
	Norfolk Shipyard – Naval Hospital / Portsmouth	12	5	5	2	
	NSA Northwest / Chesapeake	12	5	5	2	
	NAS Oceana / Virginia Beach	11	5	4	2	
	MCB Quantico	17	5	7	2	
	Defense Supply Ctr / Richmond	22	6	8	3	
	Radford AAP	32	8			
	Wallops Island	10	4	4	2	
	Yorktown Region: Camp Perry Cheatham Annex Yorktown NWS	13	5	5	2	
	Washington	NS Everett	118(a)	42(b)	62	20
		Fairchild AFB	39	11	13	4
Fort Lewis / Tacoma		117	41	59	20	
Indian Island SWC		127(a)	46(b)	63	21	
NRS Jim Creek		110(a)	38(b)	59	19	
Keyport / Bangor Engin. Sta Annex		129(a)	45(b)	69	22	
McChord AFB		119	41	61	20	
Puget Sound Region: Bangor NSB		158(a)	56(b)	76	23	
Bremerton NS		150(a)	53(b)	72	23	
Puget Sound NSY	153(a)	54(b)	73	23		

TABLE E-2

State	Base / City	Seismic Data (Site Class B)			
		S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Washington	NAS Whidbey Island / Oak Harbor	133(a)	47(b)	59	20
	Seattle	151	52	75	22
West Virginia	Allegheny Ballistics Lab	13	6		
	Beckley	26	8	10	4
	Huntington	19	7	8	3
	Sugar Grove NRS	18	6	7	3
Wisconsin	Fort McCoy	6	3	2	1
	General Mitchell AFRC / Milwaukee	11	5	4	1
	Madison	11	4	4	1
Wyoming	F. E. Warren AFB	20	5	8	2
American Samoa	Pago Pago / Tutuila Island	100	40	50	20
Mariana Islands	Guam	150	60	75	30
	Saipan / Tinian	150	60	75	30
Puerto Rico	NRTF Aguada	119	38		
	Fort Buchanan	89	31	50	20
	Ramey AFB	120	38		
	NS Roosevelt Roads	87	28		
	Sebana Seca NRS	90	31		

Notes to TABLE E-2, "EARTHQUAKE LOADING DATA – UNITED STATES, ITS TERRITORIES AND POSSESSIONS"

- (a) – For Navy facilities at identified locations in Washington State use minimum S_s of 150 %g.
- (b) – For Navy facilities at identified locations in Washington State use minimum S₁ of 50 %g.

APPENDIX F

**SITE-SPECIFIC STRUCTURAL LOADING DATA –
OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS**

F-1 Climatic Loading Data Table. Site-specific structural climatic loading data for potential DoD locations outside of the United States, its territories and possessions is provided in Table F-1.

F-2 Earthquake Loading Data Table. Site-specific earthquake loading data for potential DoD locations outside of the United States, its territories and possessions is provided in Table F-2.

TABLE F-1 STRUCTURAL CLIMATIC LOADING DATA – OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS

TABLE F-1			Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration	
Continent / Region	Country	Base / City	(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)	
Africa	Djibouti	Djibouti	0	90	0	0.00	145	0	
	Egypt	Alexandria	0	85	0	0.00	137	0	
	Morocco	Casablanca	0	90	0	0.00	145	0	
Asia	Afghanistan	Kabul		78			125		
	Bahrain	NSA Bahrain	0	85	0	0.00	137	0	
	India		Bombay	0	91	0	0.00	146	0
			Calcutta	0	114	0	0.00	183	0
			Madras	0	92	0	0.00	148	0
			New Delhi	0	91	0	0.00	146	0
	Iraq		Baghdad						
			Basra						
	Japan		NAF Atsugi	21	100	6	1.00	161	152
			MCAS Iwakuni	12	120	10	0.57	193	254
			Iwo Jima	0	210	0	0.00	338	0
Misawa AFB			58	101	30	2.78	163	762	
Okinawa (All installations)			0	180	0	0.00	290	0	
Sagamihara			21	100	6	1.00	161	152	
Sasebo			12	100	6	0.57	161	152	
Tokyo	15	100	6	0.71	161	152			

TABLE F-1

Continent / Region	Country	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration	
			(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)	
Asia	Japan	COMFLTACT Yokosuka	12	100	6	0.57	161	152	
		Yokota AFB, Honshu	21	100	6	1.00	161	161	
		Camp Zama	21	100	6	1.00	161	152	
		Kuwait	Kuwait City	0		0	0.00		0
		Oman	Areas south and west of Jabal Akehadar						
			- Ibri	0	105	0	0.00	169	0
			- Nazwa	0	105	0	0.00	169	0
			Batinah Coast						
			- Ash Shinash	0	105	0	0.00	169	0
			- Sib	0	105	0	0.00	169	0
			- Suhar	0	105	0	0.00	169	0
			Central, Southern, and Coastal Areas Sur to Sarfait						
			- Barik	0	115	0	0.00	185	0
			- Dawqa	0	115	0	0.00	185	0
			- Hayma	0	115	0	0.00	185	0
			- Salalah	0	115	0	0.00	185	0
			- Shalim	0	115	0	0.00	185	0
			High Jabal Locations						
			- Miskin	0	115	0	0.00	185	0
			- Sumail	0	115	0	0.00	185	0
			- Rikshah	0	115	0	0.00	185	0
		- Shaww	0	115	0	0.00	185	0	
			Kuria Muria Island	0	120	0	0.00	193	0
		Masirah Island	0	120	0	0.00	193	0	
		Mussandam Island	0	120	0	0.00	193	0	
	Pakistan	Peshawar	10	88	6	0.48	142	152	
	Qatar	Doha	0		0	0.00		0	
	Saudi Arabia	Dhahran	0	87	0	0.00	140	0	
		Hafr al Batin	0	80	0	0.00	129	0	

TABLE F-1

Continent / Region	Country	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration
			(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)
Asia	Saudi Arabia	Khamis Mushayt	0	80	0	0.00	129	0
		Jeddah	0	80	0	0.00	129	0
		Jubail	0	80	0	0.00	129	0
		Qadimah	0	80	0	0.00	129	0
		Riyadh	0	80	0	0.00	129	0
		Tabuk	0	80	0	0.00	129	0
	South Korea	Camp Casey	20	105	48	0.96	169	1219
		Camp Hialeah, Pusan	20	110	24	0.96	177	610
		Camp Humphreys / Pyongyang	20	95	45	0.96	153	1143
		Chinhae	20	105	24	0.96	169	610
		Kimpo AFB	20	105	48	0.96	169	1219
		Kunsan / Kunsan City	20	100	30	0.96	161	762
		Osan AFB / Songtan	20	95	45	0.96	153	1143
		Pohang	20	110	24	0.96	177	610
		Seoul	20	105	48	0.96	169	1219
		Taegu	20	115	40	0.96	185	1016
		Uijongbu	20	105	48	0.96	169	1219
		Yongsan	20	105	45	0.96	169	1143
		Vietnam	Da Nang	0	120	0	0.00	193
Ho Chi Minh City	0		95	0	0.00	153	0	
Nha Trang	0		95	0	0.00	153	0	
Taiwan	Tainan	0	120	0	0.00	193	0	
	Taipei	0	130	0	0.00	209	0	
	Tsoying	0	110	0	0.00	177	0	
Thailand	Bangkok	0	80	0	0.00	129	0	
	Chiang Mai	0	95	0	0.00	153	0	
	Sattahip	0	85	0	0.00	137	0	
	Udonthani	0	85	0	0.00	137	0	
Turkey	Ankara	20	99	24	0.96	159	610	

TABLE F-1

Continent / Region	Country	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration
			(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)
Asia	Turkey	Incirlik AB / Adana	0	70	5	0.00	113	127
		Izmir AS						
		Karamursel	15	95	12	0.72	153	305
Central America	Canal Zone		0	95	0	0.00	153	0
Europe	Belgium	Brussels						
		Kester						
		Kleine Brogel						
		Shape - Chievres						
	Bosnia - Herzegovina	Tulza AFB						
		England	RAF Alconbury, Molesworth / Huntingdon					
	Birmingham		15	89	12	0.72	143	305
	RAF Croughton / Brackley		15	100	15	0.72	161	381
	RAF Fairford							
	RAF Lakenheath / Lakeheath Village		15	100	15	0.72	161	381
	USNA UK / London		15	95	12	0.72	153	305
	RAF Menwith Hill / Harrogate							
	RAF Mildenhall		15	104	12	0.72	167	305
	Plymouth		10	94	12	0.48	151	305
	RAF Upwood / Ramsey							
	JMF St. Mawgan / Cornwall							
	Sculthorpe AB	15	99	12	0.72	159	305	
	Southport	10	104	12	0.48	167	305	
	South Shields	15	99	12	0.72	159	305	
	Spurn Head	15	99	12	0.72	159	305	
Germany	Ansbach							
	Bamberg							

TABLE F-1

Continent / Region	Country	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration
			(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)
Europe	Germany	Baumholder						
		Bremen	25	85	30	1.20	137	762
		Buechel Air Base / Cochem						
		Darmstadt						
		Garmisch AST						
		Geilenkirchen						
		Grafenwoehr	25	90	0	1.20	145	0
		Hanau	25	55	25	1.20	89	635
		Heidelberg	25	55	30	1.20	89	762
		Hohenfels						
		Illesheim						
		Kaiserslautern						
		Kalkar						
		Mannheim						
		Munich	40	98	36	1.92	158	914
		Ramstein AB						
		Rhein-Main Air Base	25	85	30	1.20	137	762
		Schweinfurt						
		Spangdahlem Air Base	25	55	30	1.20	89	762
		Stuttgart	45	90	36	2.16	145	914
Vilseck								
		Wiesbaden / Mainz / Dexheim						
		Wuerzburg / Kitzingen / Giebelstadt	25	90	35	1.20	145	889
	Greece	Athens	5	92	0	0.24	148	0
		Larissa						
		NAS Soudi Bay / Mouzouras	5	86	0	0.24	138	0
	Iceland	Keflavik - NSA	30	115	24	1.44	185	610
		Thorshofn	30	146	36	1.44	235	914
	Italy	Aviano AB	35	80	18	1.68	129	457
		Brindisi / San Vito	5	110	6	0.24	177	152

TABLE F-1

Continent / Region	Country	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration	
			(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)	
Europe	Italy	Camp Darby Livorno							
		Gaeta - NSA	20	80	0	0.96	129	0	
		Ghedi							
		NSA La Maddalena	20	80	5	0.96	129	127	
		NSA Naples	20	80	5	0.96	129	127	
		Niscemi	20	90	5	0.96	145	127	
		NAS Sigonella	20	90	5	0.96	145	127	
	Vicenza	35	80	25	1.68	129	635		
	Netherlands	Volkel Air Base							
		AF North Brunssum							
			Schinnen	15	70	20	0.72	113	508
	Northern Ireland		Londonderry	15	133	12	0.72	214	305
	Norway		Stavanger						
	Portugal	Azores / Lajes Field	0	120	0	0.00	193	0	
		Southlant / Oeiras							
	Scotland	Aberdeen	15	90	12	0.72	145	305	
		Edinburgh	15	99	12	0.72	159	305	
		Edzell	15	85	12	0.72	137	305	
		Glasgow	15	99	12	0.72	159	305	
		Prestwick	15	100	12	0.72	161	305	
		Stornoway	15	120	12	0.72	193	305	
Thurso		15	105	12	0.72	169	305		
Spain	Madrid / JHQ SW	10	83	6	0.48	134	152		
	Moron AB								
	NS Rota	5	90	5	0.24	145	127		
	San Pablo	5	117	6	0.24	188	152		
	HRF Valencia								
		Zaragoza	10	117	6	0.48	188	152	
North America	Canada	Argentia NAS, Newfoundland	47	115	36	2.25	185	914	
		Churchill, Manitoba	66	107	permafrost	3.16	172	permafrost	

TABLE F-1

Continent / Region	Country	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration	
			(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)	
North America	Canada	Cold Lake, Alberta	41	81	72	1.96	130	1829	
		Edmonton, Alberta	27	84	60	1.29	135	1524	
		E. Harmon AFB, Newfoundland	86	113	60	4.12	182	1524	
		Fort William, Ontario	73	81	60	3.50	130	1524	
		Frobisher, NWT	50	107	permafrost	2.40	172	permafrost	
		Goose Airport, Newfoundland	100	89	60	4.79	143	1524	
		Ottawa, Ontario	60	90	48	2.87	145	1219	
		St. John's, Newfoundland	72	114	36	3.45	183	914	
		Toronto, Ontario	40	90	36	1.92	145	914	
		Winnipeg, Manitoba	45	82	60	2.16	132	1524	
		Greenland	Narsarssuak AB	30	139	60	1.44	224	1524
			Simiutak AB	25	166	60	1.20	267	1524
			Sondrestrom AB	20	120	permafrost	0.96	193	permafrost
			Thule AB	25	135	permafrost	1.20	217	permafrost
Atlantic Ocean	Ascension Island	0	67	0	0.00	108	0		
Caribbean Sea	The Bahamas	Eleuthera Island	0	148	0	0.00	238	0	
		Grand Bahama Island	0	148	0	0.00	238	0	
		Grand Turk Island	0	161	0	0.00	259	0	
		Great Exuma Island	0	148	0	0.00	238	0	
		Cuba	NS Guantanamo Bay	0	105	0	0.00	169	0
	Trinidad Island	Port of Spain	0	59	0	0.00	95	0	
Indian Ocean	British Indian Ocean Territory	NSF Diego Garcia		105	0	0.00	169	0	
Pacific Ocean	Australia	H.E. Holt / N.W. Cape	0	130	0	0	209	0	
		Woomera	0	80	0	0	129	0	

TABLE F-1

Continent / Region	Country	Base / City	Ground Snow	Wind Speed	Frost Penetration	Ground Snow	Wind Speed	Frost Penetration
			(psf)	(mph) Note (a)	(inches)	(kPa)	(km/h) Note (a)	(mm)
Pacific Ocean	Caroline Islands	Koror, Paulau Islands	0	95	0	0.00	153	0
		Ponape	0	110	0	0.00	177	0
	Johnston Atoll		0	95	0	0.00	137	0
	Marcus Island		0	150	0	0.00	241	0
	Marshall Islands	Kwajalein	0	105	0	0.00	169	0
		Wake Island	0	110	0	0.00	177	0
	Midway Island		0	95	0	0.00	153	0
	Philipine Is.	Clark AFB	0	90	0	0.00	145	0
		Sangley Point	0	90	0	0.00	145	0
		Subic Bay	0	90	0	0.00	145	0
	Samoa	Apia / Upolu	0	150	0	0.00	241	0

Notes to Table F-1, “STRUCTURAL CLIMATIC LOADING DATA – OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS”

Note (a) – Use a minimum wind speed of 85 mph (137 km/h) for all locations

TABLE F-2 EARTHQUAKE LOADING DATA – OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS

TABLE F-2			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S_s (%g)	S₁ (%g)	10/50 S_s (%g)	10/50 S₁ (%g)
Africa	Djibouti	Djibouti	82	33	41	16
	Egypt	Alexandria	23	9	11	5
	Morocco	Casablanca	25	10	13	5
Asia	Afghanistan	Kabul	128	51	64	26
	Bahrain	NSA Bahrain	31	12	15	6
	India	Bombay	26	10	13	5
		Calcutta	50	20	25	10
		Madras	14	6	7	3
		New Delhi	71	28	35	14
	Iraq	Baghdad	124	56	62	29
		Basra	98	39	49	20
	Japan	NAF Atsugi	187	75		
		MCAS Iwakuni	94	38	47	19
		Iwo Jima	89	36	45	18
		Misawa AFB	124	56		
		Okinawa (All installations)	165	75	83	38
		Sagamihara	187	75		
		Sasebo	91	36	45	18
		Tokyo	187	75	94	37
		COMFLTACT Yokosuka	187	75		
		Yokota AFB, Honshu	200	80	100	40
	Camp Zama	187	75			
	Kuwait	Kuwait City	54	22	27	11
	Oman	Areas south and west of Jabal Akehadar				
- Ibri		91	36	46	18	
- Nazwa		88	35	44	18	
Batinah Coast						
- Ash Shinash		166	66	83	33	
- Sib		129	52	65	26	
- Suhar		149	60	75	30	
	Central, Southern, and Coastal Areas Sur to Sarfait					

TABLE F-2

			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Asia	Oman	- Barik				
		- Dawqa	3	1	2	1
		- Hayma	0	0	0	0
		- Salalah	8	3	4	2
		- Shalim	0	0	0	0
		High Jabal Locations				
		- Miskin	107	43	54	21
		- Sumail				
		- Rikshah	98	39	49	20
		- Shaww	99	40	50	20
		Kuria Muria Island				
		Masirah Island	19	8	9	4
		Mussandam Island				
	Pakistan	Peshawar	105	42	53	21
	Qatar	Doha	6	6	3	3
	Saudi Arabia	Dhahran	10	4	5	2
		Hafr al Batin				
		Khamis Mushayt	6	2	3	1
		Jeddah	49	20	24	10
		Jubail	35	14	18	7
		Qadimah	24	10	12	5
		Riyadh	6 (a)	6 (a)	3 (a)	3 (a)
		Tabuk	28	11	14	6
	South Korea	Camp Casey	15	6	7	3
		Camp Hialeah, Pusan	30	12	15	6
		Camp Humphreys / Pyongtaek	19	7	9	4
		Chinhae	17	7	8	3
		Kimpo AFB	15	6	8	3
		Kunsan / Kunsan City	17	7	8	3
		Osan AFB / Songtan	19	7	9	4
		Pohang	14	6	7	3
		Seoul	17	7	8	3
		Taegu	29	11	14	6
		Uijongbu	17	7	8	3
		Yongsan / Seoul	17	7	9	3
	Vietnam	Da Nang	18	7	9	4

TABLE F-2

			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Asia	Vietnam	Ho Chi Minh City	14	6	7	3
		Nha Trang	13	5	6	3
	Taiwan	Tainan	239	96	120	48
		Taipei	325	130	162	65
		Tsoying	251	100	125	50
	Thailand	Bangkok	28	11	14	6
		Chiang Mai	27	11	14	5
		Sattahip	21	9	11	4
		Udonthani	24	10	12	5
	Turkey	Ankara	99	40	49	20
		Incirlik AB / Adana	105	42	52	21
		Izmir AS	242	97	121	48
		Karamursel	139	56	70	28
	Central America	Canal Zone		93	37	46
Europe	Belgium	Brussels	32	13	16	6
		Kester	36	14	18	7
		Kleine Brogel	31	13	16	6
		Shape - Chievres	54	22	27	11
	Bosnia - Herzegovina	Tulza AFB	92	37	46	18
	England	RAF Alconbury, Molesworth / Huntingdon	18	7	9	4
		Birmingham	22	9	11	4
		RAF Croughton / Brackley	28	11	14	6
		RAF Fairford	16	6	8	3
		RAF Lakenheath / Lakeheath Village	15	6	8	3
		USNA UK / London	13	3	6	1
		RAF Menwith Hill / Harrogate	21	9	11	4
		RAF Mildenhall	15	6	8	3
		Plymouth	20	8	10	4
		RAF Upwood / Ramsey	16	6	8	3
		JMF St. Mawgan / Cornwall	20	4	10	2
		Sculthorpe AB	16	6	8	3
Southport		23	9	12	5	

TABLE F-2

			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Europe	England	South Shields	11	5	6	2
		Spurn Head				
	Germany	Ansbach	24	10	12	5
		Bamberg	21	8	10	4
		Baumholder	25	10	13	5
		Bremen	10	4	5	2
		Buechel Air Base / Cochem	33	13	16	7
		Darmstadt	40	16	20	8
		Garmisch AST	46	18	23	9
		Geilenkirchen	55	22	27	11
		Grafenwoehr	24	10	12	5
		Hanau	38	15	19	8
		Heidelberg	38	15	19	8
		Hohenfels	26	10	13	5
		Illesheim	23	9	11	5
		Kaiserslautern	25	10	13	5
		Kalkar	22	9	11	4
		Mannheim	40	16	20	8
		Munich	26	10	13	5
		Ramstein AB	24	10	12	5
		Rhein-Main Air Base	39	16	20	8
		Schweinfurt	21	8	10	4
	Spangdahlem Air Base	24	10	12	5	
	Stuttgart	44	18	22	9	
	Vilseck	22	9	11	4	
	Wiesbaden / Mainz / Dexheim	38	15	19	8	
	Wuerzburg / Kitzingen / Giebelstadt	21	9	11	4	
	Greece	Athens	81	32	40	16
		Larissa	140	26	70	13
		NAS Soudi Bay / Mouzouras	120	34	60	17
	Iceland	Keflavik - NSA	100	40	50	20
		Thorshofn	49	19	24	10
	Italy	Aviano AB	115	46	57	23
		Brindisi / San Vito	37	15	18	7

TABLE F-2

			Seismic Loading (Site Class B)				
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)	
Europe	Italy	Camp Darby Livorno	62	25	31	12	
		Gaeta - NSA	50	21	25	11	
		Ghedi	71	29	36	14	
		NSA La Maddalena	23	9	12	5	
		NSA Naples	67	27	34	14	
		Niscemi	120	31	60	16	
		NAS Sigonella	120	31	60	16	
		Vicenza	93	37	46	19	
		Netherlands	Volkel Air Base	29	12	15	6
	AF North Brunssum		55	22	28	11	
	Schinnen		6	6	3	3	
	Northern Ireland	Londonderry	8	3	4	2	
	Norway	Stavanger					
	Portugal	Azores / Lajes Field	165	75	83	38	
		Southlant / Oeiras	61	25	31	12	
	Scotland	Aberdeen	9	4	5	2	
		Edinburgh	17	7	8	3	
		Edzell	11	4	5	2	
		Glasgow	21	9	11	4	
		Prestwick	12	5	6	2	
		Stornoway	10	4	5	2	
		Thurso	9	3	4	2	
	Spain	Madrid / JHQ SW	13	5	6	3	
		Moron AB	61	24	31	12	
		NS Rota	72	28	36	14	
		San Pablo					
		HRF Valencia	66	27	33	13	
		Zaragoza	15	6	8	3	
	North America	Canada	Argentia NAS, Newfoundland	21	8	10	4
			Churchill, Manitoba	1	0	0	0
			Cold Lake, Alberta	5	2	3	1
			Edmonton, Alberta	8	3	4	2
E. Harmon AFB, Newfoundland			16	6	8	3	
Fort William, Ontario							
	Frobisher, NWT	7	3	3	1		

TABLE F-2

			Seismic Loading (Site Class B)				
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)	
North America	Canada	Goose Airport, Newfoundland	16	6	8	3	
		Ottawa, Ontario	91	36	46	18	
			St. John's, Newfoundland	19	8	10	4
			Toronto, Ontario	36	15	18	7
			Winnipeg, Manitoba	31	14	16	7
		Greenland	Narsarsuak AB	31	14	16	7
			Simiutak AB	31	14	16	7
			Sondrestrom AB	22	9	11	4
			Thule AB	37	15	18	7
Atlantic Ocean	Ascension Island						
Caribbean Sea	The Bahamas	Eleuthera Island	2	1	1	0	
		Grand Bahama Island	2	1	1	0	
		Grand Turk Island	58	23	29	12	
		Great Exuma Island	19	8	10	4	
		Cuba	NS Guantanamo Bay	126	50	63	25
			Trinidad Island	171	68	86	34
Indian Ocean	British Indian Ocean Territory	NSF Diego Garcia	70	28	35	14	
Pacific Ocean	Australia	H.E. Holt / N.W. Cape	47	19	23	9	
		Woomera	47	19	23	9	
		Caroline Islands	Koror, Paulau Islands	70	28	35	14
			Ponape	103	41	51	21
		Johnston Atoll		136	54	68	27
		Marcus Island		95	38	47	19
		Marshall Islands	Kwajalein	119	48	60	24
			Wake Island	137	55	68	27
		Midway Island					
		Philippine Is.	Clark AFB	159	64	79	32
			Sangley Point	195	78	97	39
	Subic Bay		177	71	88	35	
	Samoa	Apia / Upolu	158	63	79	32	

APPENDIX G

**EARTHQUAKE LOADING DATA AT ADDITIONAL SELECTED LOCATIONS
OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS**

G-1 Earthquake Loading Data Table. Earthquake loading data for additional selected cities outside of the United States, its territories and possessions is provided in Table G-1.

**TABLE G-1 EARTHQUAKE LOADING DATA AT ADDITIONAL
LOCATIONS OUTSIDE OF THE UNITED STATES, ITS
TERRITORIES AND POSSESSIONS**

TABLE G-1			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S_s (%g)	S₁ (%g)	10/50 S_s (%g)	10/50 S₁ (%g)
Africa	Algeria	Alger	96.1	38.4	48.0	19.2
		Oran	60.0	24.0	30.0	12.0
	Angola	Luanda	5.6	2.2	2.8	1.1
	Benin	Cotonou	10.9	4.4	5.4	2.2
	Botswana	Gaborone	2.6	1.0	1.3	0.5
	Burkina Vaso	Kampala	44.1	17.7	22.1	8.8
	Burundi	Bujumbura	66.1	26.5	33.1	13.2
	Cameroon	Douala	15.8	6.3	7.9	3.2
		Yaounde	26.0	10.4	13.0	5.2
	Central African Republic	Bangui	26.0	10.4	13.0	5.2
	Chad	Ndjamena	5.6	2.2	2.8	1.1
	Congo	Brazzaville				
	Congo, Democratic Republic of the	Bukavu	74.0	29.6	37.0	14.8
		Kinshasa				
		Lubumbashi	37.4	14.9	18.7	7.5
	Cote d'Ivoire	Abidjan	3.7	1.5	1.8	0.7
	Egypt	Cairo	67.2	26.9	33.6	13.4
		Port Said	65.1	26.1	32.6	13.0
	Equatorial Guinea	Malabo	15.8	6.3	7.9	3.2
	Eritrea	Asmara	43.0	17.2	21.5	8.6
Ethiopia	Addis Ababa	55.3	22.1	27.6	11.1	
Gabon	Libreville	26.0	10.4	13.0	5.2	
Gambia	Banjul					

TABLE G-1

			Seismic Loading (Site Class B)				
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)	
Africa	Ghana	Accra	35.6	14.3	17.8	7.1	
	Guinea	Conakry	36.1	14.5	18.1	7.2	
	Guinea-Bissau	Bissau	0.9	0.4	0.5	0.2	
	Kenya	Nairobi	30.7	12.3	15.3	6.1	
	Lesotho	Maseru	6.3	2.5	3.1	1.3	
	Liberia	Monrovia	21.4	8.5	10.7	4.3	
	Libya	Tripoli	57.1	22.9	28.6	11.4	
	Madagascar	Tananarive	18.4	7.3	9.2	3.7	
	Malawi		Blantyre	46.3	18.5	23.1	9.3
			Lilongwe	26.3	10.5	13.2	5.3
			Zomba	48.3	19.3	24.2	9.7
	Mali	Bamako					
	Mauritania	Nouakchott	7.7	3.1	3.8	1.5	
	Morocco		Kenitra	27.0	10.8	13.5	5.4
			Rabat	25.5	10.2	12.7	5.1
			Tangier	44.3	17.7	22.2	8.9
	Mozambique	Maputo	10.2	4.1	5.1	2.0	
	Niger	Niamey	0.2	0.1	0.1	0.0	
	Nigeria		Ibadan				
			Kaduna	5.6	2.2	2.8	1.1
			Lagos	0.3	0.1	0.1	0.1
	Rwanda	Kigali	27.8	11.1	13.9	5.6	
	Senegal	Dakar	7.7	3.1	3.8	1.5	
	Sierra Leone	Freetown	34.9	14.0	17.4	7.0	
	Somalia	Mogadishu					
	South Africa		Cape Town	26.0	10.4	13.0	5.2
			Durban	28.7	11.5	14.3	5.7
			Johannesburg	3.1	1.2	1.5	0.6
			Natal	6.4	2.6	3.2	1.3
	Swaziland	Pretoria	3.1	1.2	1.5	0.6	
	Tanzania		Dar es Salaam	17.1	6.8	8.5	3.4
			Mbabane	17.9	7.2	9.0	3.6
Togo	Zanzibar	11.5	4.6	5.7	2.3		
Tunisia	Lome	37.5	15.0	18.8	7.5		
Uganda	Tunis	91.0	36.4	45.5	18.2		
Zambia	Ougadougou						
Zimbabwe		Harare	5.6	2.2	2.8	1.1	
		Lusaka	21.9	8.8	11.0	4.4	
Asia	Afghanistan	Bagram	140.0	70.0			
		Gardeyz	70.0	28.0			
		Herat	60.0	20.0			
		Jalalabad	130.0	32.0			
		Kandahar	30.0	16.0			
	Lashkar Gah	17.0	10.0				

TABLE G-1

			Seismic Loading (Site Class B)				
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)	
Asia	Afghanistan	Mazar-e Sharif	80.0	30.0			
		Pol-e Charkhi	100.0	40.0			
		Qalat	60.0	30.0			
	Bahrain	Manama	26.9	10.8	13.5	5.4	
	Bangladesh	Dhaka	69.5	27.8	34.8	13.9	
	Brunei	Bandar Seri Begawan	37.2	14.9	18.6	7.4	
	Burma	Mandalay	201.0	80.4	100.5	40.2	
	Burma	Rangoon	76.8	30.7	38.4	15.4	
	China	Beijing (Peking)	55.9	22.4	28.0	11.2	
		Chengdu	44.2	17.7	22.1	8.8	
		Chongqing	8.4	3.4	4.2	1.7	
		Guangzhou (Canton)	13.5	5.4	6.8	2.7	
		Harbin	12.4	4.9	6.2	2.5	
		Nanjing	23.4	9.4	11.7	4.7	
		Qingdao (Tsingtao)	31.6	12.6	15.8	6.3	
		Shanghai	17.3	6.9	8.7	3.5	
		Shengyang	88.7	35.5	44.3	17.7	
		Tianjin (Tientsan)	72.2	28.9	36.1	14.4	
		Wuhan	7.3	2.9	3.7	1.5	
		Hong Kong	Hong Kong	12.8	5.1	6.4	2.6
		Indonesia	Bandung	164.3	65.7	82.1	32.9
			Jakarta	138.1	55.2	69.0	27.6
	Medan		111.5	44.6	55.7	22.3	
	Surabaya		96.4	38.6	48.2	19.3	
	Iran	Isfahan	90.8	36.3	45.4	18.2	
		Shiraz	173.2	69.3	86.6	34.6	
		Tabriz	181.2	72.5	90.6	36.2	
		Tehran	205.0	82.0	102.5	41.0	
	Iraq	Kirkuk	165.0	75.0			
	Israel	Haifa	136.9	54.7	68.4	27.4	
		Jerusalem	106.9	42.8	53.4	21.4	
		Tel Aviv	95.2	38.1	47.6	19.0	
	Japan	Fukuoka	67.4	27.0	33.7	13.5	
		Itazuke AFB	73.6	29.4	36.8	14.7	
		Kobe	189.8	75.9	94.9	38.0	
		Osaka	178.1	71.2	89.0	35.6	
		Sapporo	100.4	40.2	50.2	20.1	
		Yokohama	187	75			
	Jordan	Amman	70.2	28.1	35.1	14.0	
	Kuwait	Ali Al Salem	24.2	9.7	12.1	4.8	
	Laos	Vientiane	53.9	21.6	27.0	10.8	
	Lebanon	Beirut	149.7	59.9	74.9	29.9	
	Malaysia	Kuala Lumpur	55.8	22.3	27.9	11.2	
	Nepal	Kathmandu	245.5	98.2	122.8	49.1	

TABLE G-1

			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Asia	Oman	Muscat	123.6	49.5	61.8	24.7
	Pakistan	Islamabad	128.9	51.6	64.5	25.8
		Karachi	73.3	29.3	36.6	14.7
		Lahore	117.1	46.8	58.5	23.4
	Singapore	All	37.5	15.0	18.8	7.5
	Sir Lanka	Colombo	2.6	1.0	1.3	0.5
	South Korea	Kimhae	18.3	7.3	9.2	3.7
	South Korea	Kwangju	12.9	5.2	6.5	2.6
	Syria	Aleppo	64.3	25.7	32.2	12.9
		Damascus	79.1	31.6	39.5	15.8
	Taiwan	Changhua	274.4	109.8	137.2	54.9
		Kao-hsiung	250.6	100.3	125.3	50.1
	Thailand	Songkhla	29.6	11.8	14.8	5.9
		Udon	24.1	9.6	12.0	4.8
	Turkey	Istanbul	145.8	58.3	72.9	29.2
	United Arab Emirates	Abu Dhabi	107.0	42.8	53.5	21.4
		Dubai	168.4	67.4	84.2	33.7
		Yemen	Aden City	36.6	14.7	18.3
	Sanaa		34.3	13.7	17.2	6.9
	Central America	Belize	Belmopan	53.7	21.5	26.8
Costa Rica		San Jose	280.4	112.2	140.2	56.1
El Salvador		San Salvador	170.8	68.3	85.4	34.2
Guatemala		Guatemala	168.3	67.3	84.2	33.7
Honduras		Tegucigalpa	99.9	40.0	50.0	20.0
Europe	Albania	Tirana	111.6	44.6	55.8	22.3
	Austria	Salzburg	41.5	16.6	20.7	8.3
		Vienna	49.3	19.7	24.7	9.9
	Belgium	Antwerp	19.7	7.9	9.9	3.9
	Bulgaria	Sofia	116.3	46.5	58.1	23.3
	Cyprus	Nicosia	118.0	47.2	59.0	23.6
	Czech Republic	Prague	12.8	5.1	6.4	2.6
	Denmark	Copenhagen	11.6	4.7	5.8	2.3
	England	Liverpool	23.0	9.2	11.5	4.6
	Finland	Helsinki	5.1	2.0	2.6	1.0
	France	Bordeaux	16.4	6.6	8.2	3.3
		Istres AFB	36.2	14.5	18.1	7.2
		Lyon	28.6	11.4	14.3	5.7
	France	Marseille	44.4	17.8	22.2	8.9
		Nice	41.3	16.5	20.7	8.3
	Strasbourg	42.7	17.1	21.3	8.5	
Germany	Babenhausen	34.2	13.7	17.1	6.8	

TABLE G-1

			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Europe	Germany	Berlin	5.1	2.0	2.6	1.0
		Bonn	42.2	16.9	21.1	8.4
		Dusseldorf	30.6	12.3	15.3	6.1
		Frankfurt am Main	37.7	15.1	18.8	7.5
		Giebelstadt	21.9	8.8	11.0	4.4
		Hamburg	9.2	3.7	4.6	1.8
		Kitzingen	21.2	8.5	10.6	4.2
		Landstuhl	23.7	9.5	11.9	4.7
		Vaihingen an der Enz	38.7	15.5	19.4	7.7
	Greece	Kavalla	108.2	43.3	54.1	21.6
		Nea Makri	86.7	34.7	43.4	17.3
		Rhodes	137.0	54.8	68.5	27.4
		Thessaloniki	142.1	56.8	71.0	28.4
	Hungary	Budapest	46.3	18.5	23.1	9.3
		Taszar AB				
	Iceland	Reykjavik	91.8	36.7	45.9	18.4
	Italy	Florence	96.4	38.6	48.2	19.3
		Genoa	66.1	26.4	33.0	13.2
		Milan	41.3	16.5	20.7	8.3
		Palermo	66.9	26.8	33.5	13.4
		Rome	89.8	35.9	44.9	18.0
		Siculiana	44.8	17.9	22.4	9.0
		Trieste	72.3	28.9	36.2	14.5
	Turin	53.7	21.5	26.8	10.7	
	Luxembourg	Luxembourg	21.4	8.6	10.7	4.3
	Malta	Valletta	28.6	11.5	14.3	5.7
	Netherlands	Amsterdam	13.0	5.2	6.5	2.6
Northern Ireland	Belfast	8.7	3.5	4.3	1.7	
Norway	Oslo	14.8	5.9	7.4	3.0	
Poland	Krakow	19.1	7.6	9.5	3.8	
	Poznan	5.6	2.2	2.8	1.1	
	Warszawa	11.7	4.7	5.9	2.3	
	Warsow	10.2	4.1	5.1	2.0	
Portugal	Lisbon	67.7	27.1	33.9	13.5	
	Oporto	64.5	25.8	32.2	12.9	
Republic of Ireland	Dublin	9.4	3.8	4.7	1.9	
Romania	Bucharest	104.9	42.0	52.5	21.0	
Russia	Kiev	6.6	2.7	3.3	1.3	
	Moscow	6.6	2.7	3.3	1.3	
	St. Petersburg (Leningrad)	6.6	2.7	3.3	1.3	
Scotland	Hamilton	18.3	7.3	9.2	3.7	

TABLE G-1

			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Europe	Scotland	Renfrew	21.6	8.6	10.8	4.3
	Serbia and Montenegro	Belgrade	97.2	38.9	48.6	19.4
	Serbia and Montenegro	Zagrebac	103.9	41.6	52.0	20.8
	Slovakia	Bratislava	56.2	22.5	28.1	11.2
	Spain	Barcelona	60.0	24.0	30.0	12.0
		Bilbao	32.1	12.9	16.1	6.4
		Sevilleja de la Jara	12.8	5.1	6.4	2.6
	Sweden	Goteborg	14.4	5.7	7.2	2.9
		Stockholm	7.7	3.1	3.8	1.5
	Switzerland	Bern	44.0	17.6	22.0	8.8
		Geneva	46.3	18.5	23.1	9.3
		Zurich	38.9	15.6	19.5	7.8
North America	Canada	Calgary	19.8	7.9	9.9	4.0
		Halifax	25.0	10.0	12.5	5.0
		Montreal	102.9	41.2	51.4	20.6
		Vancouver	90.4	36.2	45.2	18.1
	Mexico	Ciudad Juarez	18.2	7.3	9.1	3.6
		Guadalajara	146.9	58.8	73.4	29.4
		Hermosillo	46.3	18.5	23.1	9.3
		Matamoros	2.0	0.8	1.0	0.4
		Mazatlan	97.4	39.0	48.7	19.5
		Merida	3.6	1.4	1.8	0.7
		Mexico City	56.9	22.8	28.5	11.4
		Monterrey	21.5	8.6	10.8	4.3
		Nuevo Laredo	14.8	5.9	7.4	3.0
		Tijuana	92.7	37.1	46.4	18.5
South America	Argentina	Buenos Aires	6.6	2.7	3.3	1.3
	Bolivia	La Paz	111.0	44.4	55.5	22.2
	Brazil	Belem	0.5	0.2	0.3	0.1
		Belo Horizonte	0.5	0.2	0.3	0.1
		Brasilia	0.5	0.2	0.3	0.1
		Manaus	1.7	0.7	0.8	0.3
		Porto Alegre	0.5	0.2	0.3	0.1
		Recife	4.1	1.6	2.0	0.8
		Rio de Janeiro	0.5	0.2	0.3	0.1
		Salvador	0.5	0.2	0.3	0.1
	Brazil	Sao Paulo	0.5	0.2	0.3	0.1
	Chile	Santiago	202.5	81.0	101.2	40.5
		Valparaiso	289.3	115.7	144.7	57.9
	Colombia	Bogata	166.4	66.6	83.2	33.3
	Ecuador	Guayaquil	136.9	54.8	68.5	27.4
		Quito	204.6	81.8	102.3	40.9

TABLE G-1

			Seismic Loading (Site Class B)				
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)	
South America	Paraguay	Asuncion	15.3	6.1	7.7	3.1	
	Peru	Lima	355.2	142.1	177.6	71.0	
	Peru	Piura	188.3	75.3	94.1	37.7	
	Uruguay	Montevideo	3.6	1.4	1.8	0.7	
	Venezuela	Caracas	131.0	52.4	65.5	26.2	
	Venezuela	Maracaibo	104.4	41.8	52.2	20.9	
Caribbean Sea	Bahamas	Nassau	7.1	2.9	3.6	1.4	
	Barbados	Bridgetown	37.4	15.0	18.7	7.5	
	Cuba	Havana	25.5	10.2	12.8	5.1	
	Dominica	Roseau	107.7	43.1	53.8	21.5	
	Dominican Republic	Santo Domingo	173.6	69.5	86.8	34.7	
	Grenada	Saint Georges	107.3	42.9	53.6	21.5	
	Guadeloupe	Basse-Terre	131.0	52.4	65.5	26.2	
	Haiti	Port au Prince	80.0	32.0	40.0	16.0	
	Jamaica	Kingston	144.9	58.0	72.4	29.0	
	Martinique	Fort-de-France	97.4	39.0	48.7	19.5	
	Montserrat	Plymouth	162.4	65.0	81.2	32.5	
	Saint Kitts and Nevis	Basseterre	149.6	59.8	74.8	29.9	
	Saint Lucia	Castries	89.8	35.9	44.9	18.0	
	Saint Vincent and The Grenadines	Port Eliazabeth	53.1	21.2	26.5	10.6	
	St. Croix	Frederiksted	80.5	24.2	40.2	12.4	
	St. John	Bethany	108.1	32.6	60.1	17.8	
	St. Thomas	Charlotte Amalie	107.5	32.5	59.7	17.8	
	Trinidad & Tobago	Scarborough	111.8	44.7	55.9	22.4	
	Trinidad	Trinidad NS	0.0	0.0	0.0	0.0	
	Vieques	Isabel Segunda	93.1	28.8	49.1	15.4	
Pacific Ocean	Australia	Brisbane	30.6	12.2	15.3	6.1	
		Canberra	46.4	18.6	23.2	9.3	
		Melbourne	46.9	18.8	23.4	9.4	
		Perth	45.1	18.0	22.5	9.0	
		Sydney	43.9	17.6	21.9	8.8	
		Caroline Islands	Yap	78.6	31.4	39.3	15.7
		Fiji	Suva	57.1	22.8	28.5	11.4
		Marshall Islands	Majuro	121.4	48.6	60.7	24.3
		New Zealand	Auckland	83.8	33.5	41.9	16.8
	New Zealand	Wellington	228.2	91.3	114.1	45.6	

TABLE G-1

			Seismic Loading (Site Class B)			
Continent / Region	Country	Base / City	S _s (%g)	S ₁ (%g)	10/50 S _s (%g)	10/50 S ₁ (%g)
Pacific Ocean	Papau New Guinea	Port Moresby	78.1	31.3	39.1	15.6
	Philippine Is.	Baguio	164.0	65.6	82.0	32.8
	Philippine Is.	Cebu	114.0	45.6	57.0	22.8
		Manila	193.2	77.3	96.6	38.6
	Saipan	Capitol Hill	99.8	39.9	49.9	20.0
	Tinian		99.4	39.8	49.7	19.9

CANCELLED

APPENDIX H

SEISMIC SPECTRAL ACCELERATION MAPS
AT SELECTED LOCATIONS
OUTSIDE OF THE UNITED STATES, ITS TERRITORIES AND POSSESSIONS

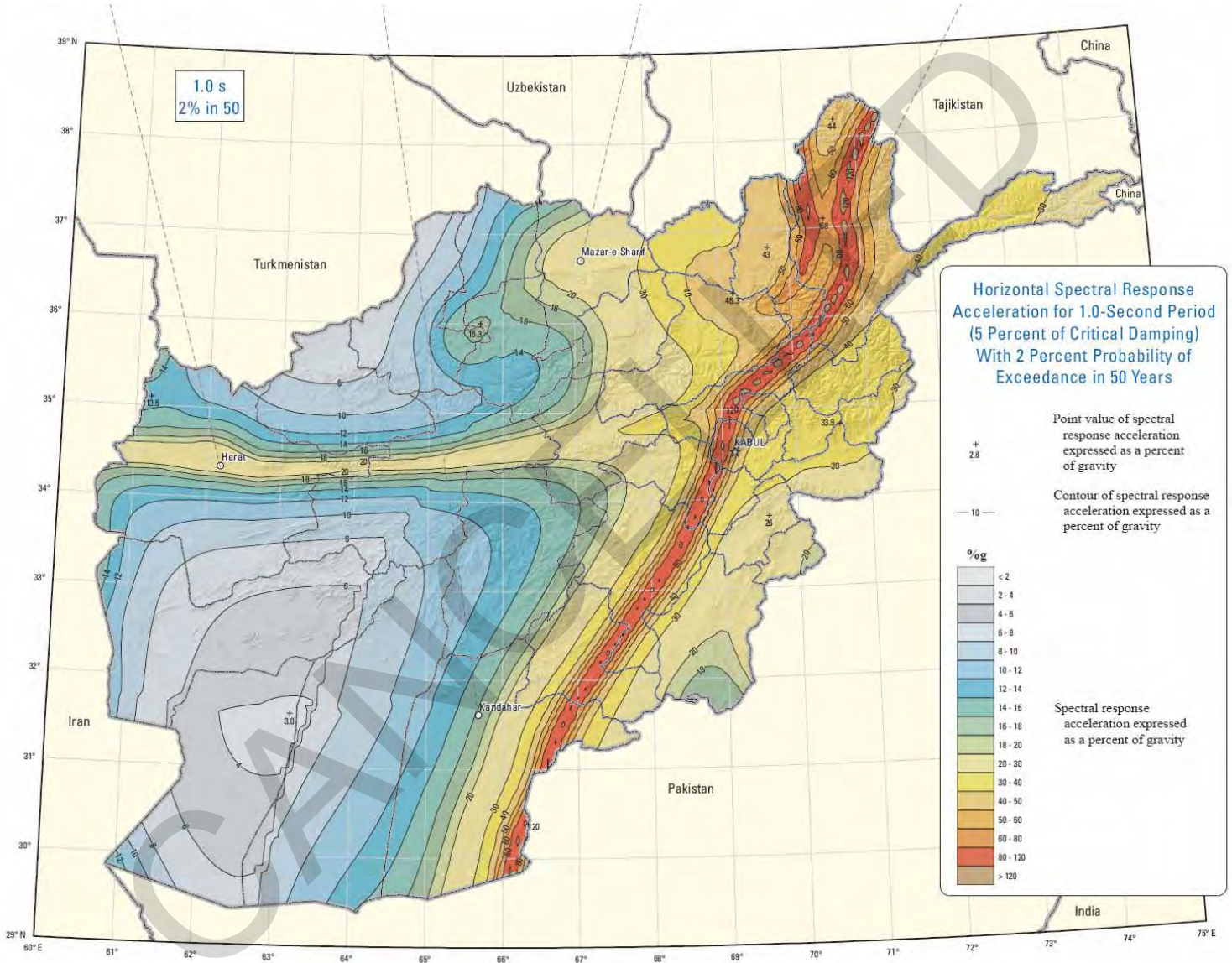


FIGURE H-1
AFGHANISTAN - HORIZONTAL SPECTRAL RESPONSE ACCELERATION FOR 1.0
SECOND PERIOD (5 PERCENT OF CRITICAL DAMPING) WITH 2 PERCENT
PROBABILITY OF EXCEEDANCE IN 50 YEARS

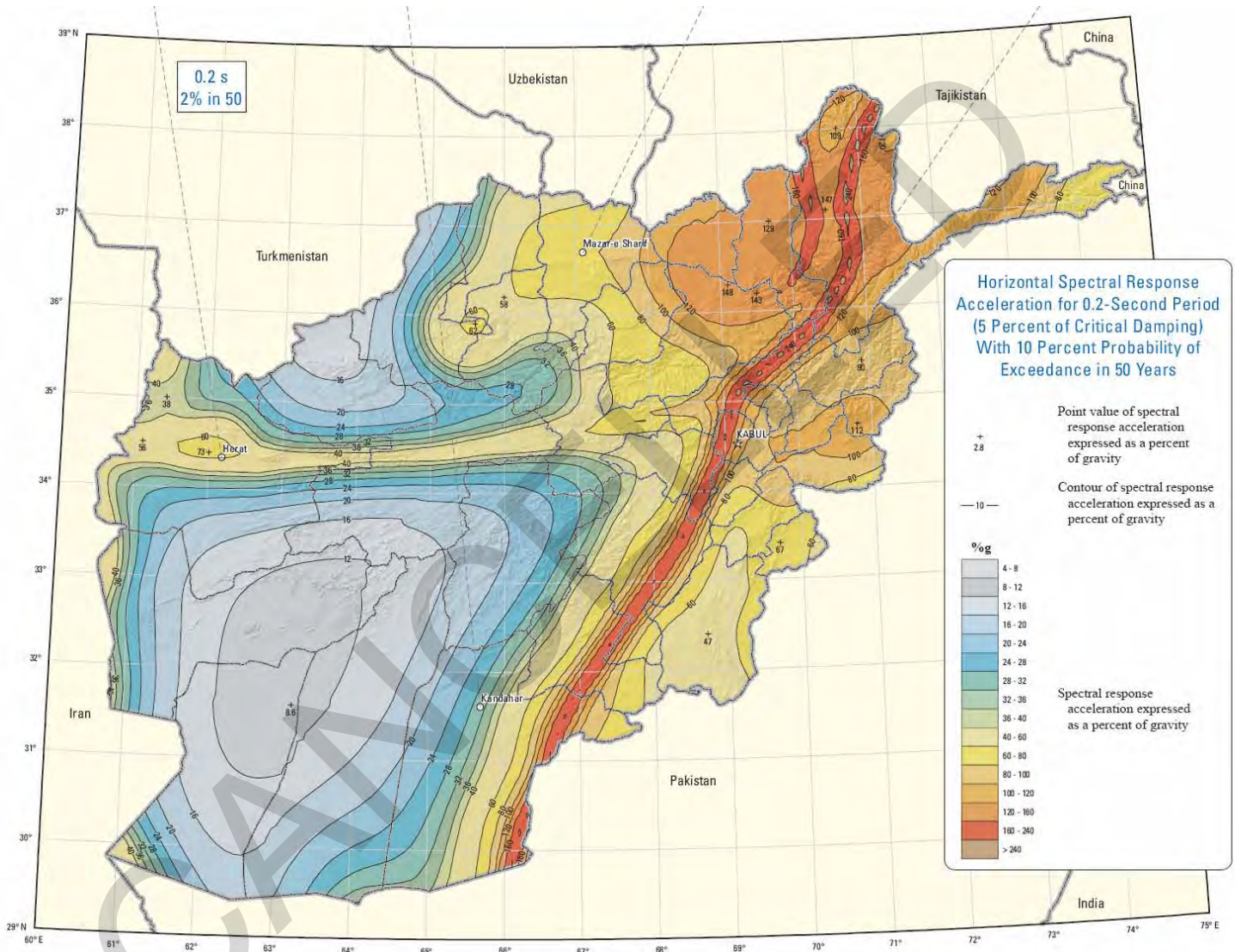


FIGURE H-2
AFGHANISTAN - HORIZONTAL SPECTRAL RESPONSE ACCELERATION FOR 0.2
SECOND PERIOD (5 PERCENT OF CRITICAL DAMPING) WITH 2 PERCENT
PROBABILITY OF EXCEEDANCE IN 50 YEARS