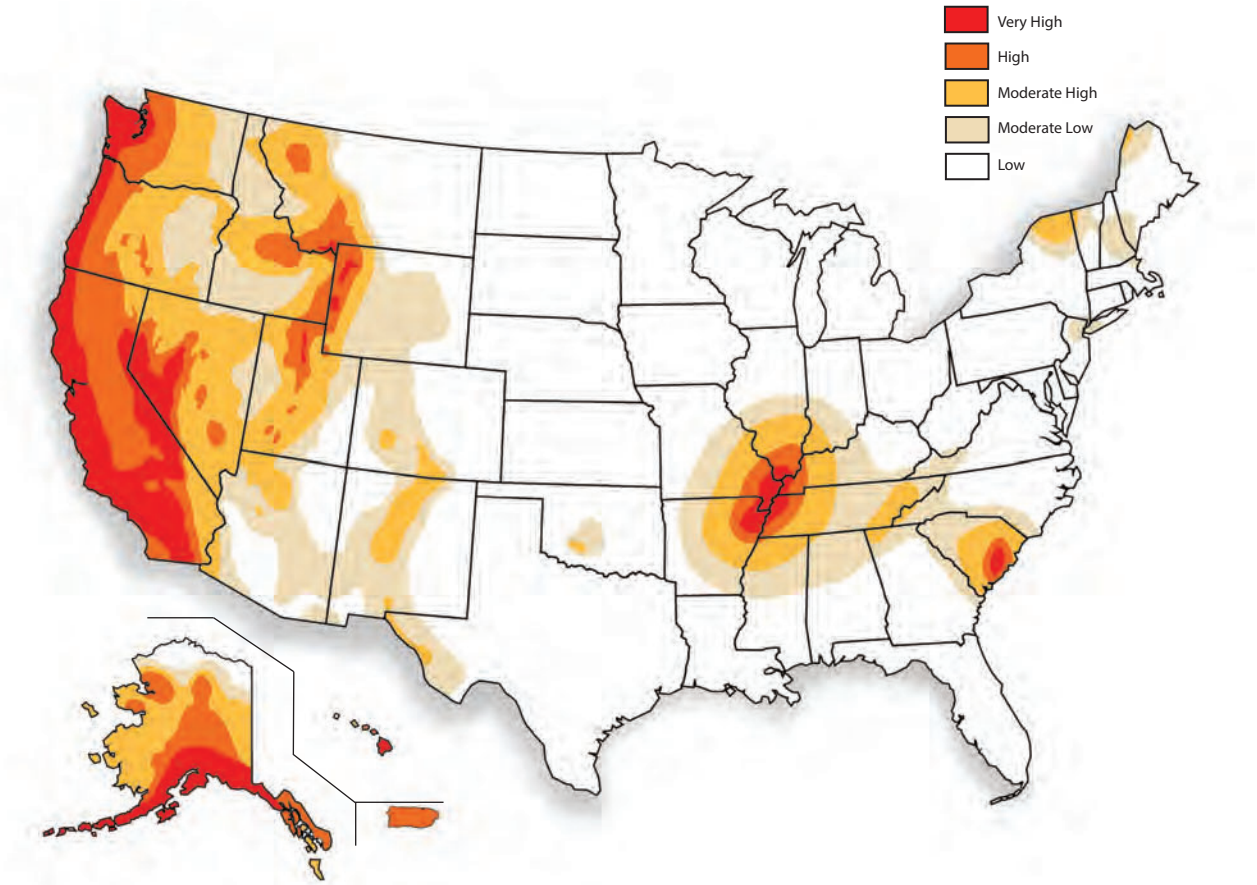
VA

U.S. Department of Veterans Affairs

Office of Construction & Facilities Management




# Seismic Design Requirements

October 1, 2016

H-18-8

# FOREWORD

Background

In 1971, after the San Fernando earthquake when two VA buildings collapsed, VA began to undertake a full seismic safety program. Title 38 - United States Code, section 8105 required the Secretary to assure that each medical facility constructed or altered shall be of construction that is resistant to fire, earthquake, and other natural disasters. This initiated the creation of the Secretary's Advisory Committee on Structural Safety of VA Facilities, which formally approved in 1975 the original VA Seismic Design document, H-08-8, Earthquake Resistant Design Requirements for VA Facilities. These requirements were developed with the concept that all VA Essential Facilities must remain in operation after an earthquake and were far in advance of National Codes.

This document is periodically updated and revised. The revision of H-08-8 to H-18-8 in 1995 was a major rewrite to bring VA seismic design requirements more in line with the updated national model codes. Further updates/revisions of minor nature were made in 1997, 1998, 2000, 2002, 2003, 2005, 2006, 2008, 2010, 2011, and 2013.

Current Revision Highlights:

- Referenced versions of national codes and standards changed to the latest date-specific editions at the time this standard was published.
- Seismic evaluation and retrofit requirements for existing buildings are updated to align with the baseline requirements of RP 8, with modifications, and ASCE 41-13.
- Redundant exemptions for existing structures and nonstructural components and equipment were removed as they are covered in Sections 2.3-2.4 and ASCE 7 Chapter 13, respectively.

Note: A vertical bar is placed to the right of the revised sections.

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## 1.0 DEFINITIONS

**1.1 AISC 341:** Seismic Provisions for Structural Steel Buildings, 2010 Edition.

**1.2 ASCE 7:** ASCE/SEI 7-10, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, 2010 Edition.

**1.3 ASCE 41:** ASCE/SEI 41–13, Seismic Evaluation and Retrofit of Existing Buildings, American Society of Civil Engineers, 2013 Edition.

**1.4 Category of Facilities:**

a) **Critical Facilities:** Buildings that are required to remain functional after an earthquake or other natural disaster such as hurricane, tornado, etc. These facilities include, but are not limited to, the VA occupancy categories listed as Critical Facilities in Table 5, and they shall be assigned to Risk Category IV.

b) **Essential Facilities:** Buildings that must remain operational with minor repairs after an earthquake or other natural disaster such as hurricane, tornado, etc. These facilities include, but are not limited to VA occupancy categories listed as Essential Facilities in Table 6, and they shall be assigned to Risk Category III.

c) **Ancillary Facilities:** These facilities include, but are not limited to, the VA occupancy categories listed as Ancillary Facilities in Table 7. All ancillary facilities shall be designated as non-essential facilities and shall be assigned to Risk Category II.

**1.5 FEMA 396:** Incremental Seismic Rehabilitation of Hospital Buildings, American Society of Civil Engineers.

**1.6 IBC**: International Building Code, 2015 Edition.

**1.7 OSHPD:** Office of Statewide Health Planning & Development, State of California.

**1.8 Risk Category:** A category used to determine earthquake design loads based on the nature of the occupancy, as defined in Section 7.0.

**1.9 RP 8:** Standards of Seismic Safety for Existing Federally Owned and Leased Buildings, Interagency Committee on Seismic Safety in Construction (ICSSC) Recommended Practice 8 (RP 8), The National Institute of Standards and Technology (RP 8 is available at http://www.nehrp.gov/pdf/nistgcr11-917-12.pdf).

**1.10 Seismic Design Category:** A classification assigned to a structure based on its risk category and the severity of the design earthquake ground motion at the site (as defined in ASCE 7).

**1.11 Seismicity**

**Table 1. Seismicity Levels**

| Region of Seismicity | $S_S$ | $S_1$ |
|---|---|---|
| **Very High** | ≥ 1.250g | ≥0.500g |
| **High** | < 1.250g<br>≥0.750g | < 0.500g<br>≥ 0.300g |
| **Moderate – High** | < 0.750g<br>≥ 0.350g | < 0.300g<br>≥ 0.140g |
| **Moderate – Low** | < 0.350g<br>≥ 0.250g | < 0.140g<br>≥ 0.100g |
| **Low** | < 0.250g | < 0.100g |

Note: Values for $S_S$ and $S_1$ at all VA sites are given in Table 8. The seismicity levels defined in this table are only used for managing the VA seismic inventory (e.g., Exceptionally High Risk, High Risk buildings, etc.).

**1.12 Soft Story & Extreme Soft Story:** As defined in ASCE 7, Table 12.3-2.

**1.13 Spectral Response Acceleration:** A parameter used to characterize the anticipated earthquake shaking at a given site (Table 8).

$S_s$**:** Spectral response acceleration parameter at short periods corresponding to the mapped maximum considered earthquake.

$S_1$**:** Spectral response acceleration parameter at a period of 1 sec corresponding to the mapped maximum considered earthquake.

$S_{DS}$: Design spectral response acceleration parameter at short periods adjusted for site class effects, as defined in ASCE 7.

$S_{D1}$: Design spectral response acceleration parameter at a period of 1 sec adjusted for site class effects, as defined in ASCE 7.

**1.14 VA Seismic Safety Coordinator:** A VA Designated Seismic Safety Coordinator in the Office of Facilities Planning (OFP) within the Office of Construction & Facilities Management (CFM), responsible for reporting VA compliance with Executive Order 13717, Establishing a Federal Earthquake Risk Management Standard. When the VA Seismic Safety Coordinator is referenced in this manual for approvals, the Associate Executive Director for OFP also maintains the same approval authority.

## 2.0 GENERAL

These requirements cover all VA facilities including those of National Cemetery Administration, Veterans Benefits Administration, and Veterans Health Administration.

### 2.1 New Critical and Essential Facilities

All new Critical and Essential Facilities shall be designed and constructed in full compliance with the earthquake design and detailing requirements of IBC as modified in these provisions.

### 2.2 New Ancillary Facilities

All new Ancillary Facilities shall be designed and constructed in full compliance with the earthquake design and detailing requirements of IBC with no additional modifications.

### 2.3 Existing Facilities

Evaluation and retrofit of all existing facitilites shall comply with the minimum RP 8 standards as modified in these provisions, including triggers for evaluation and potential mitigation in Section 2.4.

### 2.4 Existing Facilities - Evaluation

a. In addition to the RP 8 Section 2.1 triggers, a seismic evaluation and potential mitigation shall be conducted for existing Critical and Essential facilities in areas where $S_{DS} \geq 0.167$ and $S_{D1} \geq 0.067$ and Ancillary Facilities in areas where $S_{DS} \geq 0.330$ and $S_{D1} \geq 0.133$ that meet one or more of the following criteria:

   i. Facilities selected for renovation as part of a VA classified Major Construction project.
   ii. Facilities assigned to Seismic Design Category C, D, E, or F that are selected for renovation where the area of renovation is greater than 50% of the total area.
   iii A project is planned which significantly extends the building's useful life through alterations or repairs which total more than 30% of the replacement value of the facility. This applies for facilities assigned to Seismic Design Category C, D, E, or F.
   iv. Facilities under consideration by VA for lease with total floor area greater than 10,000 $ft^2$.

   v. A significant addition to an existing building is planned that is not structurally independent of the existing building is planned.

   vi. A building is being relocated from its current site.

b. Existing Critical, Essential, and Ancillary Facilities shall be evaluated using the

procedures in ASCE 41 for the performance objectives in accordance with Table 2.

### 2.5 Existing Facilities – Retrofit

All Critical and Essential Existing Facilities shall be retrofitted using nonlinear procedures described in ASCE 41 to achieve the performance objectives in accordance with Table 2.

### 2.6 Existing Facilities Performance Objectives for Evaluation and Retrofit

The performance objectives used for Evaluation and Retrofit are shown in Tables 2-4 and are defined in ASCE 41.

**Table 2. Performance Objectives**

| Description | Evaluation | Retrofit |
|---|---|---|
| All triggered situations in Section 2.4.a and RP 8 Section 2.1, unless noted otherwise below | BPON | BPON |
| Damaged structures described in RP 8 Section 2.1(d) | BPOE | BPOE |
| Leased space | BPOE | BPOE |

**Table 3. Basic Performance Objectives Equivalent to New Building Standards (BPON)**

| Risk Categories | Seismic Hazard Level | |
|---|---|---|
| | BSE-1N | BSE-2N |
| Critical and Essential | Immediate Occupancy Structural Performance | Life Safety Structural Performance |
| | Operational Nonstructural Performance | N/A |
| Ancillary | Life Safety Structural Performance | Collapse Prevention Structural Performance |
| | Position Retention Nonstructural Performance | N/A |

**Table 4. Basic Performance Objectives Equivalent to Existing Building Standards (BPOE)**

| Risk Categories | Seismic Hazard Level | |
|---|---|---|
| | BSE-1E | BSE-2E |
| Critical and Essential | Immediate Occupancy Structural Performance | Life Safety Structural Performance |
| | Position Retention Nonstructural Performance | N/A |
| Ancillary | Life Safety Structural Performance | Collapse Prevention Structural Performance |
| | Life Safety Nonstructural Performance | N/A |

## 2.7 Existing Facilities Retrofit – Alternative Approach

An alternative approach may be permitted on a case-by-case basis upon approval by the VA Seismic Safety Coordinator for Critical and Essential Facilities to be strengthened according to procedures in ASCE 41.

## 2.8 Spectral Response Accelerations

The selection of Seismic Design Category for use in the design and analysis of all new and existing facilities shall be based on the spectral response accelerations shown in Table 8 after adjustment for site class effects as specified in ASCE 7. For the design of buildings in Seismic Design Category A, use ASCE 7 section 11.7. For all other Seismic Design Categories (B – F), use ASCE 7 Chapter 12: Seismic Design Requirements for Building Structures.

## 3.0 MODIFICATIONS TO THE REQUIREMENTS OF ASCE 7 FOR NEW CRITICAL AND ESSENTIAL FACILITIES ASSIGNED TO HIGH SEISMIC DESIGN CATEGORIES

### 3.1 Structural Irregularities (ASCE 7, Section 12.3.3)

For structures assigned to Seismic Design Categories D, E, or F, the following types of vertical irregularities as defined by ASCE 7 Table 12.3-2 are not allowed:

a. Stiffness irregularity – Soft Story
b. Stiffness irregularity – Extreme Soft Story
c. Weight (mass) irregularity
d. Vertical geometric irregularity

### 3.2 Seismic-force-resisting-systems (ASCE 7, Table 12.2-1)

The following structural systems are permitted for new Critical and Essential Facilities assigned to Seismic Design Categories D, E, or F.

a. Building Frame Systems

   i. Steel eccentrically braced frames (EBF) moment resisting connections at columns away from links
   ii. Special reinforced concrete shear walls (Building Frame)
   iii. Special reinforced masonry shear walls (Building Frame)
   iv. Special steel concentrically braced frames
   v. Light frame walls with shear panels-wood structural panels/sheet steel panels (Building Frame) for structures two stories or less
   vi. Buckling-restrained braced frames, moment-resisting beam-column connections

b. Moment-Resisting Frame Systems, if approved by the VA Seismic Safety Coordinator.

   i. Special steel moment-resisting frames (SMRF)
   ii. Special reinforced concrete moment-resisting frames

c. Dual Systems

   i. Special reinforced concrete shear walls with SMRF
   ii. Special reinforced masonry shear walls with SMRF
   iii. Steel EBF with SMRF
   iv. Special steel concentrically braced frame with SMRF
   v. Buckling-restrained braced frame

Other structural systems as permitted by the ASCE 7 for Seismic Design Categories D, E or F, including ones that employ seismic isolation and seismic damping systems are permitted subject to written approval by the VA Seismic Safety Coordinator. Proposals to obtain written approval for other structural systems shall demonstrate the equivalent performance of those systems, relative to the permitted systems,

considering (a) initial construction and maintenance costs, (b) requirements for bracing non-structural components and building contents, (c) risk of economic losses and disruption to hospital functions due to earthquakes and (d) other demonstrable benefits.

### 3.3 Special Provisions for structures assigned to Seismic Design Categories D, E, or F.

The provisions of this section shall apply to all new Critical and Essential Facilities.

a. Bay spacing essentially shall be equal and uniform throughout.

b. Transfer beams or trusses supporting upper level columns shall not be used unless permitted on a case by case basis by the VA Seismic Safety Coordinator.

c. Seismic joints shall be avoided, if at all possible. When required, they shall be specifically identified in the schematic design phase of the project and approved by the VA Seismic Safety Coordinator, subject to the following provisions:

   i. Seismic joints shall be properly detailed on the working drawings;
   ii. Seismic joints shall be sized based on the maximum expected displacements, considering the effects of story drift, diaphragm displacements and rotations, and a realistic approximation of element section properties. For materials designed considering the ultimate limit state, such as concrete, the stiffness representative of this state shall be used. Seismic separations shall be 125% of the separation required by ASCE 7; and
   iii. Adjacent structures that are not integral with an existing structure shall be separated by not less than 2 inches per story.

### 3.4 Limitations on Reinforced Concrete Structures

The provisions of this section shall apply to all new Critical and Essential Facilities assigned to Seismic Design Categories D, E, or F.

a. Prestressed concrete structural members, including pre-tensioned and post-tensioned members, and precast elements such as tilt-up wall panels, and precast beam and column elements shall not be used to resist seismic forces.

b. Lightweight concrete shall not be used in structural members resisting earthquake forces, except in concrete floors and roof slabs used as diaphragm elements to distribute earthquake forces to vertical lateral-load resisting elements.

### 3.5 Limitations on Steel Structures

The provisions of this section shall apply to all new Critical and Essential Facilities assigned to Seismic Design Categories D, E, or F.

a. Special steel moment resisting frame system shall be in compliance with Section E3

of AISC 341.

b. Steel eccentrically braced systems shall be subject to the following special provisions:

i. Connections of non-structural elements shall not be located in the vicinity of EBF link beams. Non-structural elements include, but are not limited to, pre-cast panel connections, elevator guide rail supports, stairs, and pipe supports, etc.

### 3.6 Story Drift Limitations

The calculated story drift for the construction of all new Critical and Essential Facilities assigned to Seismic Design Categories D, E, or F shall not exceed 50% of the values allowed by ASCE 7.

## 4.0 ELEMENTS OF STRUCTURES, NONSTRUCTURAL COMPONENTS, AND EQUIPMENT SUPPORTED BY STRUCTURES FOR CRITICAL AND ESSENTIAL FACILITIES

**4.1** In structures assigned to Seismic Design Category C, D, E, or F, new or relocated permanent equipment and nonstructural components and their attachments, and the structure-supported attachments of permanent equipment shall be designed to resist total design forces prescribed in ASCE 7, Chapter 13 as modified by this document.

Exceptions: Seismic restraint may be omitted for the exceptions prescribed in ASCE 7, Chapter 13, with the modifications below:

a. Gas and medical piping less than 1 inch inside diameter;

b. Piping in boiler and mechanical equipment rooms less than 1 inch inside diameter for Seismic Design Category D, E, or F and 1 ¼ inch inside diameter for Seismic Design Category C; and

c. All other piping less than 2 ½ inch inside diameter except for automatic fire suppression systems.

**4.2** In structures assigned to Seismic Design Category C, D, E, or F, permanent equipment and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7 except for equipment and components that are considered rugged as listed in section 2.2 of OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

## 5.0 SITE DATA FOR CRITICAL AND ESSENTIAL FACILITIES

### 5.1 New and Existing Facilities

Geologic hazards and site-specific ground-response reports shall be required for all proposed construction of new and proposed seismic retrofit of existing Critical and Essential Facilities assigned to Seismic Design Category C, D, E, or F.

The geotechnical investigation shall use appropriate methods to allow the most accurate evaluation of the site class in accordance with Chapters 20 and 21 of ASCE 7, including field shear wave velocity measurements.

### 5.2 Geologic Hazards Report

The purpose of the geologic hazards report shall be to identify potential geologic and seismic conditions that require detailed evaluation, and may require mitigation by the project. The report shall contain data that provide an assessment of the nature of the site and potential for earthquake damage based on preliminary investigations of the regional and site geology, subsurface conditions and the potential seismic shaking. The engineering geologic report shall not contain design criteria, but shall contain basic data to be used for a preliminary earthquake engineering evaluation of the project. The basis for seismic assessment in geologic hazards reports must be stated clearly.

The report shall include, but shall not be limited to the following:

a. Geologic investigation;

b. Identification of any known active and potentially active faults, both regional and local, including estimates of the peak ground accelerations that could occur at the site; and

c. Evaluation of any slope stability problems at or near the site, liquefaction potential and settlement potential of the building site.

VA shall approve the engineering geologic hazard report prior to the preparation of the geotechnical report.

### 5.3 Site-Specific Ground-Response Report

The site-specific ground-response report shall present a detailed characterization of earthquake ground motions for the site. The characteristics of the expected strong ground motion to be used in design shall be determined by site evaluation studies based on geological and seismological characteristics of the site, including data given in the engineering geologic hazards report. The estimates should be derived by accepted methods of seismological practice, including Next Generation Attenuation (NGA) relationships where applicable, and fully documented in the ground response report. The

level of ground motions to be developed shall be determined using the procedures in Chapter 21 of ASCE 7.

VA shall approve the site-specific ground response report prior to its adoption for project design.

## 6.0 COMMENTARY

### Section 2.0

Sections 2.3-2.6: Executive Order 13717 requires Federal agencies adopt RP 8 and future editions for the minimum seismic safety standards of existing buildings and encourages agencies to exceed the minimum standards of RP 8 to achieve more resilience in Federal buildings. The H-18-8 seismic evaluation and retrofit requirements for existing buildings are aligned with the baseline requirements of RP 8, with modifications. The modifications are consistent with ASCE 41-13. Note that ASCE 41-13 merges evaluation and retrofit of existing buildings into a single standard and is adopted in H-18-8.

### Section 3.0

Section 3.1: The design engineer shall provide multiple lines of resistance when selecting a lateral force-resisting configuration. Redundancy of frame lines is intended to avoid concentration of seismic force demands in the structure and/or foundation system. Lines of lateral force resistance shall be located at major areas of plan irregularity such as reentrant corners.

Section 3.2: The permitted structural systems listed in Section 3.2 are chosen to provide cost-effective and reliable seismic performance.

Section 3.3c: Because seismic joints have a serious impact on exterior veneer/building envelope, floor joints, and interior construction and utilities, they should be avoided if at all possible.

**Section 5.0**

Site class is used to determine the values of short-period and 1-second design spectral accelerations, $S_{DS}$ and $S_{D1}$ that define Seismic Design Category in accordance with ASCE 7. An accurate evaluation of site class is to be made in accordance with Chapter 20 and Chapter 21 of ASCE 7 and is to be presented in the geotechnical evaluation report. Field shear wave velocity measurements typically provide the most reliable basis for an accurate evaluation of site class. Exceptions for low seismicity were removed because certain local site conditions have been observed to significantly amplify response spectral characteristics within a period range which may be in resonance with certain structures.

Although geotechnical studies exist for most of VA's vulnerable sites, the intent of this provision is to replace those studies (conducted in mid-seventies) for all proposed construction of new and proposed seismic retrofit of existing Critical and Essential Facilities assigned to moderate or high seismic design categories.

New site-specific studies for VA facilities are to consider up-to-date information on the attenuation of earthquake ground motions with distance from the earthquake source, and other relevant seismologic and geologic information. Research sponsored by the Pacific Earthquake Engineering Research Center has led to significantly improved procedures to estimate attenuation of earthquake motions (e.g., publication in 2008 of so-called Next Generation Attenuation (NGA) relationships for plate-boundary tectonic regimes dominated by crustal faults, such as the Western United States). It is the intent of VA requirements that new site-specific studies for VA facilities take advantage of those improved procedures and other pertinent published information on earthquake ground motion estimation, in accordance with the state of practice for the seismic design of buildings.

The standard practice of preparing a geotechnical report containing foundation recommendations, soil-bearing values, results of any necessary soil borings, etc., is still required for all VA projects.

## 7.0 RISK CATEGORIES AND SPECTRAL RESPONSE ACCELERATIONS

**[VA Facilities Occupancy Categories]**

**Table 5. Critical Facilities**

| Occupancy Sub-name |
|---|
| Acute Care |
| Ambulatory Care/ Outpatient Clinic |
| Animal Facility |
| Boiler Plants |
| Communications Center |
| Emergency Command Center |
| Emergency Generator |
| Fire/Police Station |
| Hazardous Material Storage |
| Hospital |
| Information Technology |
| Medical Gas Storage |
| Medical Research/Records |
| National Continuity of Operation Center |
| Security & Law Enforcement |
| Water Tower, Utility Supply Storage Structure |

**Table 6. Essential Facilities**

| Occupancy Sub-name |
|---|
| Consolidated Mail-Out Pharmacy |
| Dietetics |
| Domiciliary |
| Drug/Alcohol Rehabilitation |
| Long Term Care |
| Medical Equipment Storage |
| Mental Health - Inpatient |
| Psychiatric Care Facility |
| Rehabilitation Medicine |

**Table 7. Ancillary Facilities**

| Occupancy | Sub-name |
|---|---|
| Accessory Non-Building Structure | Maintenance Facility (Shops) |
| Auditorium | Maintenance Storage (Equipment) |
| Biomedical Eng. (equip. & wheelchair repair) | Materials Management Storage |
| Canteen-Cafeteria | Office |
| Canteen-Retail Store | School |
| Cemetery Building | Parking Garage |
| Chapel | Plant Outbuilding |
| Child Care | Post Office |
| Clinical Service Administration Office | Recreational |
| Community-Based Outpatient Clinic (CBOC) | Student Housing |
| Connecting Corridor-Concourse, and Bridge | Temporary Building |
| Credit Union | Toilets (Outhouse) |
| General Administration Office | Training, Education |
| Greenhouse | Veterans Services |
| Quarter (Residential) | Warehouse |
| Laundry | Waste Management (Incinerator & Recycle) |
| Library/Museum | Waste Storage |

## Table 8. Spectral Response Accelerations at VA Facilities

| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| Abraham Lincoln | 915 | IL | 41.392 | -88.123 | 0.157 | 0.071 | L |
| Albany | 528A8 | NY | 42.651 | -73.772 | 0.181 | 0.07 | L |
| Albuquerque | 501 | NM | 35.055 | -106.578 | 0.453 | 0.136 | MH |
| Alexandria (VAMC) | 502 | LA | 31.355 | -92.437 | 0.112 | 0.063 | L |
| Alexandria (NCA) | 825 | LA | 31.322 | -92.433 | 0.111 | 0.063 | L |
| Alexandria | 826 | VA | 38.802 | -77.058 | 0.118 | 0.051 | L |
| Alton | 800 | IL | 38.885 | -90.163 | 0.348 | 0.149 | MH |
| Altoona | 503 | PA | 40.489 | -78.396 | 0.114 | 0.051 | L |
| Amarillo | 504 | TX | 35.205 | -101.906 | 0.154 | 0.045 | L |
| American Lake | 663A4 | WA | 47.137 | -122.574 | 1.296 | 0.513 | VH |
| Anchorage | 463 | AK | 61.233 | -149.744 | 1.5 | 0.682 | VH |
| Ann Arbor | 506 | MI | 42.287 | -83.716 | 0.094 | 0.048 | L |
| Annapolis | 801 | MD | 38.976 | -76.506 | 0.119 | 0.05 | L |
| Asheville | 637 | NC | 35.588 | -82.484 | 0.302 | 0.107 | ML |
| Atlanta | 508 | GA | 33.802 | -84.312 | 0.187 | 0.09 | L |
| Augusta | 509 | GA | 33.472 | -81.99 | 0.296 | 0.113 | ML |
| Augusta (Lenwood) | 509A0 | GA | 33.465 | -82.026 | 0.292 | 0.113 | ML |
| Balls Bluff | 827 | VA | 39.126 | -77.586 | 0.124 | 0.052 | L |
| Baltimore (VAMC) | 512 | MD | 39.29 | -76.624 | 0.13 | 0.052 | L |
| Baltimore (NCA) | 802 | MD | 39.277 | -76.707 | 0.128 | 0.051 | L |
| Baltimore (Loch Raven) | 512GD | MD | 39.336 | -76.596 | 0.132 | 0.052 | L |
| Barrancas | 828 | FL | 30.352 | -87.286 | 0.087 | 0.053 | L |
| Batavia | 528A4 | NY | 43.012. | -78.199 | 0.205 | 0.062 | L |
| Bath (NCA) | 803 | NY | 42.347 | -77.349 | 0.134 | 0.055 | L |
| Bath (VAMC) | 528A6 | NY | 42.343 | -77.346 | 0.133 | 0.055 | L |
| Baton Rouge | 829 | LA | 30.449 | -91.169 | 0.106 | 0.056 | L |
| Battle Creek | 515 | MI | 42.345 | -85.292 | 0.087 | 0.049 | L |
| Bay Pines (VAMC) | 516 | FL | 27.811 | -82.779 | 0.055 | 0.03 | L |
| Bay Pines (NCA) | 830 | FL | 27.813 | -82.766 | 0.055 | 0.03 | L |
| Beaufort | 831 | SC | 32.44 | -80.679 | 0.545 | 0.183 | MH |
| Beckley | 517 | WV | 37.765 | -81.193 | 0.202 | 0.078 | L |
| Bedford | 518 | MA | 42.505 | -71.273 | 0.223 | 0.071 | L |
| Beverly | 804 | NJ | 40.054 | -74.916 | 0.207 | 0.061 | L |
| Big Spring | 519 | TX | 32.231 | -101.473 | 0.084 | 0.03 | L |
| Biloxi (VAMC) | 520 | MS | 30.414 | -88.944 | 0.103 | 0.057 | L |
| Biloxi (NCA) | 832 | MS | 30.409 | -88.946 | 0.103 | 0.056 | L |
| Birmingham | 521 | AL | 33.504 | -86.801 | 0.265 | 0.105 | ML |
| Black Hills | 884 | SD | 44.344 | -103.449 | 0.117 | 0.041 | L |
| Boise | 531 | ID | 43.621 | -116.191 | 0.315 | 0.107 | ML |
| Bonham | 549A4 | TX | 33.566 | -96.166 | 0.134 | 0.063 | L |
| Boston | 523 | MA | 42.327 | -71.111 | 0.211 | 0.068 | L |

Note: Values of $S_s$ and $S_1$ have been obtained from the design maps of Chapter 22 of ASCE 7 and are intended for design of new facilities. For existing buildings, refer to ASCE 41 for spectral response acceleration parameters that correspond to the appropriate seismic hazard level. Site acronyms: NCA (National Cemetery Administration), VAMC (VA Medical Center), VBA (Veterans Benefits Administration).

| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| Brevard | 675GA | FL | 28.255 | -80.743 | 0.07 | 0.035 | L |
| Brockton | 523A5 | MA | 42.063 | -71.054 | 0.191 | 0.064 | L |
| Bronx | 526 | NY | 40.868 | -73.906 | 0.281 | 0.072 | ML |
| Brooklyn | 630A4 | NY | 40.609 | -74.024 | 0.271 | 0.07 | ML |
| Buffalo | 528 | NY | 42.952 | -78.813 | 0.211 | 0.06 | L |
| Butler | 529 | PA | 40.874 | -79.944 | 0.125 | 0.053 | L |
| Calverton | 805 | NY | 40.923 | -72.82 | 0.166 | 0.058 | L |
| Camp Butler | 806 | IL | 39.867 | -89.653 | 0.201 | 0.103 | ML |
| Camp Nelson | 833 | KY | 37.895 | -84.564 | 0.185 | 0.093 | L |
| Canandaigua | 528A5 | NY | 42.901 | -77.2712 | 0.15 | 0.059 | L |
| Castle Point | 620A4 | NY | 41.544 | -73.963 | 0.209 | 0.067 | L |
| Cave Hill | 834 | KY | 38.245 | -85.728 | 0.204 | 0.106 | ML |
| Charleston | 534 | SC | 32.784 | -79.954 | 1.135 | 0.361 | H |
| Chattanooga | 835 | TN | 35.036 | -85.245 | 0.383 | 0.126 | MH |
| Cheyenne | 442 | WY | 41.148 | -104.786 | 0.156 | 0.054 | L |
| Chicago (Lakeside CBOC) | 537GD | IL | 41.893 | -87.622 | 0.132 | 0.061 | L |
| Chicago (Westside) | 537 | IL | 41.87 | -87.678 | 0.135 | 0.062 | L |
| Chillicothe | 538 | OH | 39.389 | -83.019 | 0.124 | 0.066 | L |
| Cincinnati | 539 | OH | 39.139 | -84.508 | 0.144 | 0.078 | L |
| City Point | 836 | VA | 37.306 | 77.298 | 0.16 | 0.059 | L |
| Clarksburg | 540 | WV | 39.27 | -80.362 | 0.11 | 0.057 | L |
| Cleveland (Brecksville) | 541A0 | OH | 41.294 | -81.629 | 0.166 | 0.057 | L |
| Cleveland (Wade Park) | 541 | OH | 41.514 | -81.614 | 0.18 | 0.058 | L |
| Coatesville | 542 | PA | 39.998 | -75.796 | 0.206 | 0.061 | L |
| Cold Harbor | 837 | VA | 37.589 | -77.28 | 0.168 | 0.059 | L |
| Columbia | 589A4 | MO | 38.937 | -92.328 | 0.168 | 0.093 | L |
| Columbia | 544 | SC | 33.975 | -80.959 | 0.428 | 0.146 | MH |
| Columbus Amb. Care Center | 757 | OH | 39.982 | -82.911 | 0.117 | 0.061 | L |
| Corinth | 838 | MS | 34.925 | -88.508 | 0.431 | 0.184 | MH |
| Crown Hill | 807 | IN | 39.826 | -86.176 | 0.156 | 0.085 | L |
| Culpeper | 839 | VA | 38.471 | -77.991 | 0.152 | 0.058 | L |
| Cypress Hills | 808 | NY | 40.687 | -73.882 | 0.271 | 0.07 | ML |
| Dallas | 549 | TX | 32.693 | -96.792 | 0.092 | 0.051 | L |
| Dallas (Fort Worth) | 916 | TX | 32.716 | -96.942 | 0.091 | 0.05 | L |
| Danville (VAMC) | 550 | IL | 40.132 | -87.592 | 0.177 | 0.092 | L |
| Danville (NCA) | 809 | IL | 40.127 | -87.58 | 0.177 | 0.092 | L |
| Danville | 840 | KY | 37.65 | -84.769 | 0.18 | 0.096 | L |
| Danville | 841 | VA | 36.725 | -78.132 | 0.142 | 0.064 | L |
| Dayton (VAMC) | 552 | OH | 39.743 | -84.264 | 0.153 | 0.072 | L |
| Dayton (NCA) | 810 | OH | 39.748 | -84.258 | 0.154 | 0.072 | L |
| Denver | 554 | CO | 39.732 | -104.936 | 0.178 | 0.058 | L |
| Des Moines | 636A6 | IA | 41.628 | -93.661 | 0.065 | 0.046 | L |

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| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| Detroit | 553 | MI | 42.356 | -83.06 | 0.096 | 0.047 | L |
| Dublin | 557 | GA | 32.536 | -82.943 | 0.17 | 0.084 | L |
| Durham | 558 | NC | 36.009 | -78.938 | 0.152 | 0.076 | L |
| Eagle Point | 906 | OR | 42.462 | -122.789 | 0.594 | 0.317 | H |
| East Orange | 561 | NJ | 40.753 | -74.236 | 0.275 | 0.072 | ML |
| El Paso | 756 | TX | 31.821 | -106.463 | 0.358 | 0.111 | MH |
| Erie | 562 | PA | 42.102 | -80.063 | 0.155 | 0.053 | L |
| Fargo | 437 | ND | 46.906 | -96.775 | 0.053 | 0.02 | L |
| Fayetteville (VAMC) | 564 | AR | 36.081 | -94.157 | 0.17 | 0.093 | L |
| Fayetteville (NCA) | 842 | AR | 35.068 | -94.165 | 0.169 | 0.093 | L |
| Fayetteville | 565 | NC | 35.088 | -78.877 | 0.216 | 0.096 | L |
| Finn's Point | 811 | NJ | 39.608 | -75.551 | 0.181 | 0.057 | L |
| Florence | 843 | SC | 34.223 | -79.628 | 0.551 | 0.194 | MH |
| Florida | 911 | FL | 28.606 | -82.21 | 0.071 | 0.037 | L |
| Fort Bayard | 885 | NM | 32.798 | -108.154 | 0.253 | 0.077 | ML |
| Fort Bliss | 886 | TX | 31.826 | -106.428 | 0.367 | 0.113 | MH |
| Fort Custer | 909 | MI | 42.337 | -85.318 | 0.087 | 0.049 | L |
| Fort Gibson | 844 | OK | 35.806 | -95.23 | 0.151 | 0.078 | L |
| Fort Harrison | 436 | MT | 46.616 | -112.1 | 0.533 | 0.154 | MH |
| Fort Harrison | 845 | VA | 37.429 | -77.366 | 0.173 | 0.061 | L |
| Fort Howard | 512GF | MD | 39.198 | -76.445 | 0.128 | 0.051 | L |
| Fort Leavenworth | 887 | KS | 39.352 | -94.931 | 0.109 | 0.06 | L |
| Fort Logan | 888 | CO | 39.649 | -105.053 | 0.188 | 0.06 | L |
| Fort Lyon | 889 | CO | 38.085 | -103.142 | 0.152 | 0.055 | L |
| Fort McPherson | 890 | NE | 41.023 | -100.524 | 0.074 | 0.033 | L |
| Fort Meade (VAMC) | 568 | SD | 44.412 | -103.469 | 0.113 | 0.041 | L |
| Fort Meade (NCA) | 891 | SD | 44.374 | -103.472 | 0.115 | 0.041 | L |
| Fort Mitchell | 908 | AL | 32.346 | -85.024 | 0.122 | 0.071 | L |
| Fort Richardson | 910 | AK | 61.266 | -149.681 | 1.5 | 0.683 | VH |
| Fort Rosecrans | 892 | CA | 32.69 | -117.245 | 1.115 | 0.42 | H |
| Fort Sam Houston | 846 | TX | 29.476 | -98.433 | 0.08 | 0.031 | L |
| Fort Scott | 893 | KS | 37.83 | -94.713 | 0.114 | 0.071 | L |
| Fort Sill | 920 | OK | 34.766 | -98.352 | 0.47 | 0.131 | MH |
| Fort Smith | 847 | AR | 35.384 | -94.429 | 0.171 | 0.09 | L |
| Fort Snelling | 894 | MN | 44.864 | -93.222 | 0.048 | 0.028 | L |
| Fort Thomas | 539A | OH | 39.065 | -84.446 | 0.146 | 0.078 | L |
| Fort Wayne | 610A4 | IN | 41.031 | -85.143 | 0.119 | 0.062 | L |
| Fresno | 570 | CA | 36.773 | -119.779 | 0.634 | 0.257 | MH |
| Gainesville | 573 | FL | 29.636 | -82.345 | 0.088 | 0.049 | L |
| Glendale | 848 | VA | 37.436 | -77.235 | 0.16 | 0.058 | L |
| Golden Gate | 895 | CA | 37.633 | -122.428 | 2.471 | 1.188 | VH |
| Grafton | 812 | WV | 39.336 | -80.031 | 0.111 | 0.056 | L |

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| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| Grand Island | 636A4 | NE | 40.942 | -98.359 | 0.103 | 0.042 | L |
| Grand Junction | 575 | CO | 39.066 | -108.533 | 0.233 | 0.069 | L |
| Gulfport | 520A0 | MS | 30.414 | -88.944 | 0.103 | 0.057 | L |
| Hampton (VAMC) | 590 | VA | 37.016 | -76.333 | 0.097 | 0.048 | L |
| Hampton (NCA) | 849 | VA | 37.019 | -76.335 | 0.097 | 0.048 | L |
| Hines | 578 | IL | 41.864 | -87.838 | 0.143 | 0.063 | L |
| Hines (VBA) | 201 | IL | 41.864 | -87.838 | 0.143 | 0.063 | L |
| Honolulu | 459 | HI | 31.36 | -157.89 | 0.575 | 0.166 | MH |
| Hot Springs (NCA) | 896 | SD | 43.432 | -103.474 | 0.155 | 0.048 | L |
| Hot Springs (VAMC) | 568A4 | SD | 43.437 | -103.475 | 0.154 | 0.048 | L |
| Houston (VAMC) | 580 | TX | 29.706 | -95.39 | 0.071 | 0.038 | L |
| Houston (NCA) | 851 | TX | 29.932 | -95.453 | 0.073 | 0.039 | L |
| Houston (VBA) | 362 | TX | 29.702 | -95.388 | 0.071 | 0.038 | L |
| Huntington | 581 | WV | 38.384 | -82.484 | 0.152 | 0.073 | L |
| Indianapolis | 583 | IN | 39.777 | -86.187 | 0.159 | 0.086 | L |
| Indianapolis, Cold Spring Rd | 583A4 | IN | 39.802 | -86.203 | 0.159 | 0.086 | L |
| Indiantown Gap | 813 | PA | 40.33 | -76.515 | 0.164 | 0.057 | L |
| Iowa City | 636A8 | IA | 41.631 | -91.496 | 0.086 | 0.056 | L |
| Iron Mountain | 585 | MI | 45.811 | -88.063 | 0.045 | 0.025 | L |
| Jackson | 586 | MS | 32.328 | -90.168 | 0.159 | 0.088 | L |
| Jackson (VBA) | 323 | MS | 32.327 | -90.166 | 0.159 | 0.088 | L |
| Jefferson Barracks | 852 | MO | 38.502 | -90.287 | 0.449 | 0.171 | MH |
| Jefferson City | 853 | MO | 38.566 | -92.162 | 0.201 | 0.106 | ML |
| Kansas City | 589 | MO | 39.064 | -94.527 | 0.112 | 0.065 | L |
| Keokuk | 814 | IA | 40.398 | -91.407 | 0.122 | 0.075 | L |
| Kerrville (NCA) | 854 | TX | 30.047 | -99.14 | 0.057 | 0.027 | L |
| Kerrville (VAMC) | 671A4 | TX | 30.014 | -99.117 | 0.057 | 0.027 | L |
| Knoxville (VAMC) | 636A7 | IA | 41.32 | -93.099 | 0.071 | 0.051 | L |
| Knoxville (NCA) | 855 | TN | 35.976 | -83.926 | 0.414 | 0.124 | MH |
| Lake City | 573A4 | FL | 30.182 | -82.637 | 0.099 | 0.055 | L |
| Las Vegas | 593 | NV | 36.283 | -115.083 | 0.515 | 0.169 | MH |
| Leavenworth (NCA) | 897 | KS | 39.267 | -94.89 | 0.11 | 0.061 | L |
| Leavenworth (VAMC) | 589A6 | KS | 39.267 | -94.89 | 0.11 | 0.061 | L |
| Lebanon (NCA) | 856 | KY | 37.57 | -85.253 | 0.186 | 0.102 | ML |
| Lebanon (VAMC) | 595 | PA | 40.312 | -76.406 | 0.172 | 0.058 | L |
| Lexington (NCA) | 857 | KY | 38.061 | -84.509 | 0.187 | 0.091 | L |
| Lexington, Cooper Dr (VAMC) | 596A4 | KY | 38.03 | -84.507 | 0.187 | 0.091 | L |
| Lexington, Leestown (VAMC) | 596 | KY | 38.075 | -84.539 | 0.186 | 0.091 | L |
| Lincoln | 636A5 | NE | 40.796 | -96.625 | 0.132 | 0.049 | L |
| Little Rock (VAMC) | 598 | AR | 34.733 | -92.316 | 0.4 | 0.162 | MH |
| Little Rock (NCA) | 858 | AR | 34.723 | -92.259 | 0.406 | 0.164 | MH |
| Livermore | 640A4 | CA | 37.626 | -121.763 | 1.5 | 0.6 | VH |

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| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| Loma Linda | 605 | CA | 34.05 | -117.251 | 2.411 | 1.104 | VH |
| Long Beach | 600 | CA | 33.777 | -118.119 | 1.57 | 0.584 | VH |
| Long Island | 815 | NY | 40.753 | -73.402 | 0.224 | 0.064 | L |
| Los Angeles (NCA) | 898 | CA | 34.061 | -118.455 | 2.237 | 0.822 | VH |
| Los Angeles (VAMC) | 691GE | CA | 34.05 | -118.45 | 2.225 | 0.827 | VH |
| Loudon Park | 816 | MD | 39.28 | -76.675 | 0.128 | 0.052 | L |
| Louisville | 603 | KY | 38.27 | -85.697 | 0.201 | 0.104 | ML |
| Lyons | 561A4 | NJ | 40.666 | -74.55 | 0.253 | 0.069 | ML |
| Madison | 607 | WI | 43.074 | -89.43 | 0.084 | 0.046 | L |
| Manchester | 608 | NH | 43.012 | -71.441 | 0.268 | 0.081 | ML |
| Marietta | 859 | GA | 33.951 | -84.538 | 0.209 | 0.094 | L |
| Marion | 657A5 | IL | 37.716 | -88.95 | 0.909 | 0.31 | H |
| Marion (VAMC) | 610 | IN | 40.52 | -85.637 | 0.123 | 0.069 | L |
| Marion (NCA) | 817 | IN | 40.52 | -85.637 | 0.123 | 0.069 | L |
| Martinez | 612 | CA | 37.994 | -122.116 | 1.589 | 0.6 | VH |
| Martinsburg | 613 | WV | 39.418 | -77.911 | 0.13 | 0.053 | L |
| Massachusetts | 818 | MA | 41.672 | -70.571 | 0.162 | 0.057 | L |
| McClellan | 612GH | CA | 38.673 | -120.39 | 0.627 | 0.239 | MH |
| Memphis (VAMC) | 614 | TN | 35.144 | -90.025 | 0.985 | 0.343 | H |
| Memphis (NCA) | 860 | TN | 35.174 | -89.941 | 0.966 | 0.335 | H |
| Menlo Park | 640A0 | CA | 37.466 | -122.16 | 1.5 | 0.648 | VH |
| Miami | 546 | FL | 25.792 | -80.217 | 0.042 | 0.02 | L |
| Miles City | 436GJ | MT | 46.406 | -105.829 | 0.073 | 0.032 | L |
| Mill Springs | 861 | KY | 37.056 | -84.815 | 0.192 | 0.1 | ML |
| Milwaukee (Wood) | 695 | WI | 43.02 | -87.975 | 0.087 | 0.047 | L |
| Minneapolis | 618 | MN | 44.902 | -93.205 | 0.048 | 0.028 | L |
| Mobile | 862 | AL | 30.673 | -88.063 | 0.102 | 0.058 | L |
| Montgomery (VAMC) | 619 | AL | 32.377 | -86.244 | 0.133 | 0.074 | L |
| Montgomery (VBA) | 322 | AL | 32.376 | -86.246 | 0.133 | 0.074 | L |
| Montrose | 620 | NY | 41.249 | -73.926 | 0.251 | 0.071 | ML |
| Mound City | 863 | IL | 37.088 | -89.178 | 2.538 | 0.966 | VH |
| Mountain Home (VAMC) | 621 | TN | 36.311 | -82.373 | 0.304 | 0.104 | ML |
| Mountain Home (NCA) | 864 | TN | 36.31 | -82.373 | 0.304 | 0.104 | ML |
| Murfreesboro | 626A4 | TN | 35.91 | -86.384 | 0.253 | 0.128 | ML |
| Muskogee | 623 | OK | 35.763 | -95.413 | 0.149 | 0.076 | L |
| Nashville (VAMC) | 626 | TN | 36.142 | -86.804 | 0.304 | 0.146 | MH |
| Nashville (NCA) | 865 | TN | 36.241 | -86.725 | 0.297 | 0.144 | MH |
| Natchez | 866 | MS | 31.581 | -91.395 | 0.119 | 0.07 | L |
| NCA Operations Support | 786 | VA | 38.478 | -77.433 | 0.134 | 0.054 | L |
| New Albany | 867 | IN | 38.299 | -85.804 | 0.208 | 0.107 | ML |
| New Bern | 868 | NC | 35.124 | -77.052 | 0.125 | 0.062 | L |
| New Orleans | 629 | LA | 29.954 | -90.079 | 0.096 | 0.051 | L |

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| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| New York | 630 | NY | 40.737 | -73.977 | 0.278 | 0.072 | ML |
| Newington | 689A4 | CT | 41.702 | -72.741 | 0.182 | 0.064 | L |
| Natl. Mem. Cemetery of Arizona | 914 | AZ | 33.696 | -112.029 | 0.206 | 0.065 | L |
| Natl. Mem. Cemetery of Pacific | 899 | HI | 21.313 | -157.843 | 0.579 | 0.169 | MH |
| North Chicago | 556 | IL | 42.305 | -87.859 | 0.115 | 0.056 | L |
| North Little Rock | 598A0 | AR | 34.755 | -92.321 | 0.409 | 0.164 | MH |
| Northampton | 631 | MA | 42.35 | -72.682 | 0.17 | 0.066 | L |
| Northport | 632 | NY | 40.894 | -73.309 | 0.22 | 0.065 | L |
| Oklahoma City | 635 | OK | 35.483 | -97.496 | 0.263 | 0.077 | ML |
| Omaha | 636 | NE | 41.243 | -95.974 | 0.097 | 0.045 | L |
| Orlando | 675 | FL | 28.579 | -81.321 | 0.078 | 0.038 | L |
| Palo Alto | 640 | CA | 37.405 | -122.14 | 1.751 | 0.762 | VH |
| Perry Point | 512A5 | MD | 39.552 | -76.064 | 0.164 | 0.055 | L |
| Philadelphia (VAMC) | 642 | PA | 39.948 | -75.2 | 0.202 | 0.06 | L |
| Philadelphia (NCA) | 819 | PA | 39.926 | -75.228 | 0.202 | 0.06 | L |
| Phoenix | 644 | AZ | 33.497 | -112.067 | 0.174 | 0.058 | L |
| Pittsburgh (Heinz Div.) | 646A4 | PA | 40.495 | -79.889 | 0.111 | 0.052 | L |
| Pittsburgh (Highland Dr.) | 646A5 | PA | 40.482 | -79.903 | 0.111 | 0.053 | L |
| Pittsburgh (Univ. Dr.) | 646 | PA | 40.446 | -79.963 | 0.11 | 0.053 | L |
| Poplar Bluff | 657A4 | MO | 36.772 | -90.418 | 0.95 | 0.331 | H |
| Port Hudson | 870 | LA | 30.66 | -91.287 | 0.106 | 0.058 | L |
| Portland | 648 | OR | 45.497 | -122.684 | 0.994 | 0.427 | H |
| Prescott (VAMC) | 649 | AZ | 34.555 | -112.453 | 0.304 | 0.089 | ML |
| Prescott (NCA) | 900 | AZ | 34.547 | -112.448 | 0.303 | 0.088 | ML |
| Providence | 650 | RI | 41.832 | -71.434 | 0.176 | 0.062 | L |
| Quantico | 872 | VA | 38.561 | -77.382 | 0.129 | 0.053 | L |
| Quincy | 820 | IL | 39.932 | -91.356 | 0.147 | 0.085 | L |
| Raleigh | 873 | NC | 35.774 | -78.621 | 0.154 | 0.076 | L |
| Reno | 654 | NV | 39.516 | -119.799 | 1.833 | 0.618 | VH |
| Richmond (VAMC) | 652 | VA | 37.496 | -77.466 | 0.188 | 0.062 | L |
| Richmond (NCA) | 874 | VA | 37.514 | -77.393 | 0.18 | 0.061 | L |
| Riverside | 901 | CA | 33.953 | -117.396 | 1.5 | 0.6 | VH |
| Rock Island | 821 | IL | 41.51 | -90.57 | 0.108 | 0.062 | L |
| Roseburg (VAMC) | 653 | OR | 43.224 | -123.366 | 0.832 | 0.444 | H |
| Roseburg (NCA) | 902 | OR | 43.215 | -123.37 | 0.834 | 0.445 | H |
| Sacramento | 612A4 | CA | 38.572 | -121.296 | 0.548 | 0.261 | MH |
| Saginaw | 655 | MI | 43.445 | -83.962 | 0.065 | 0.039 | L |
| Salem | 658 | VA | 37.274 | -80.019 | 0.199 | 0.077 | L |
| Salisbury (VAMC) | 659 | NC | 35.684 | -80.486 | 0.2 | 0.092 | L |
| Salisbury (NCA) | 876 | NC | 35.661 | -80.475 | 0.201 | 0.092 | L |
| Salt Lake City | 660 | UT | 40.758 | -111.841 | 1.239 | 0.45 | H |
| San Antonio (VAMC) | 671 | TX | 29.506 | -98.58 | 0.076 | 0.029 | L |

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| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| San Antonio (NCA) | 877 | TX | 29.422 | -98.467 | 0.082 | 0.03 | L |
| San Diego | 664 | CA | 32.875 | -117.232 | 1.2 | 0.465 | H |
| San Francisco (VAMC) | 662 | CA | 37.782 | -122.505 | 1.944 | 0.911 | VH |
| San Francisco (NCA) | 903 | CA | 37.801 | -122.463 | 1.518 | 0.694 | VH |
| San Joaquin Valley | 913 | CA | 37.115 | -121.078 | 2.112 | 0.697 | VH |
| San Juan | 672 | PR | 18.391 | -66.079 | 0.974 | 0.38 | H |
| Santa Fe | 904 | NM | 35.697 | -105.95 | 0.451 | 0.135 | MH |
| Saratoga | 917 | NY | 43.026 | -73.615 | 0.202 | 0.075 | L |
| Seattle | 663 | WA | 47.564 | -122.305 | 1.465 | 0.564 | VH |
| Sepulveda | 691A4 | CA | 34.244 | -118.482 | 2.248 | 0.718 | VH |
| Seven Pines | 878 | VA | 37.521 | -77.302 | 0.171 | 0.06 | L |
| Sheridan | 666 | WY | 44.827 | -106.986 | 0.206 | 0.057 | L |
| Shreveport | 667 | LA | 32.503 | -93.722 | 0.126 | 0.071 | L |
| Sioux Falls | 438 | SD | 43.531 | -96.755 | 0.09 | 0.035 | L |
| Sitka | 905 | AK | 57.054 | -135.322 | 0.915 | 0.611 | VH |
| Somerville AMS | 796 | NJ | 40.538 | -74.62 | 0.246 | 0.068 | L |
| Spokane | 668 | WA | 47.703 | -117.478 | 0.331 | 0.115 | ML |
| Springfield | 879 | MO | 37.174 | -93.264 | 0.198 | 0.015 | L |
| St. Albans | 630A5 | NY | 40.691 | -73.769 | 0.263 | 0.069 | ML |
| St. Augustine | 875 | FL | 29.886 | -81.309 | 0.099 | 0.059 | L |
| St. Cloud | 656 | MN | 45.574 | -94.214 | 0.06 | 0.021 | L |
| St. Louis, Jefferson Barracks | 657A0 | MO | 38.493 | -90.283 | 0.451 | 0.172 | MH |
| St. Louis, John Cochran | 657 | MO | 38.642 | -90.231 | 0.423 | 0.164 | MH |
| St. Petersburg (VBA) | 317 | FL | 27.813 | -82.772 | 0.055 | 0.03 | L |
| Staunton | 880 | VA | 38.14 | -79.05 | 0.164 | 0.065 | L |
| Syracuse | 528A7 | NY | 43.039 | -76.139 | 0.143 | 0.062 | L |
| Tahoma | 919 | WA | 47.388 | -122.095 | 1.259 | 0.473 | VH |
| Tampa | 673 | FL | 28.065 | -82.428 | 0.062 | 0.033 | L |
| Temple | 674 | TX | 31.077 | -97.347 | 0.067 | 0.039 | L |
| Togus (VAMC) | 402 | ME | 44.28 | -69.704 | 0.225 | 0.078 | L |
| Togus (NCA) | 822 | ME | 44.277 | -69.711 | 0.225 | 0.078 | L |
| Tomah | 676 | WI | 44.003 | -90.493 | 0.056 | 0.036 | L |
| Topeka | 589A5 | KS | 39.026 | -95.723 | 0.132 | 0.059 | L |
| Tucson | 678 | AZ | 32.181 | -110.965 | 0.27 | 0.077 | ML |
| Tuscaloosa | 679 | AL | 33.191 | -87.486 | 0.238 | 0.101 | ML |
| Tuskegee | 619A4 | AL | 32.444 | -85.711 | 0.13 | 0.074 | L |
| Vancouver | 648A4 | WA | 45.639 | -122.658 | 0.926 | 0.401 | H |
| Waco | 674A4 | TX | 31.512 | -97.164 | 0.071 | 0.041 | L |
| Walla Walla | 687 | WA | 46.054 | -118.356 | 0.377 | 0.133 | MH |
| Washington, DC | 688 | DC | 38.929 | -77.01 | 0.119 | 0.051 | L |
| West Haven | 689 | CT | 41.283 | -72.959 | 0.188 | 0.062 | L |
| W. Los Angeles | 691 | CA | 34.053 | -118.453 | 2.228 | 0.826 | VH |

Note: Values of $S_s$ and $S_1$ have been obtained from the design maps of Chapter 22 of ASCE 7 and are intended for design of new facilities. For existing buildings, refer to ASCE 41 for spectral response acceleration parameters that correspond to the appropriate seismic hazard level. Site acronyms: NCA (National Cemetery Administration), VAMC (VA Medical Center), VBA (Veterans Benefits Administration).

| Site | Station Number | State | Lat. | Long. | $S_s$ | $S_1$ | Seismicity |
|---|---|---|---|---|---|---|---|
| West Palm Beach | 548 | FL | 26.784 | -80.113 | 0.05 | 0.025 | L |
| West Roxbury | 523A4 | MA | 42.275 | -71.172 | 0.203 | 0.067 | L |
| West Virginia | 912 | WV | 39.334 | -80.073 | 0.111 | 0.056 | L |
| White City | 692 | OR | 42.442 | -122.836 | 0.599 | 0.323 | H |
| White River Junction | 405 | VT | 43.648 | -72.342 | 0.239 | 0.083 | L |
| Wichita | 589A7 | KS | 37.681 | -97.275 | 0.109 | 0.054 | L |
| Wilkes-Barre | 693 | PA | 41.248 | -75.836 | 0.153 | 0.058 | L |
| Willamette | 907 | OR | 45.46 | -122.543 | 0.972 | 0.408 | H |
| Wilmington (VAMC) | 460 | DE | 39.74 | -75.607 | 0.195 | 0.059 | L |
| Wilmington (NCA) | 881 | NC | 34.238 | -77.922 | 0.218 | 0.092 | L |
| Winchester | 882 | VA | 39.184 | -78.157 | 0.131 | 0.055 | L |
| Wood | 823 | WI | 43.029 | -87.98 | 0.087 | 0.047 | L |
| Woodlawn | 824 | NY | 42.112 | -76.827 | 0.121 | 0.054 | L |
| Zachary Taylor | 883 | KY | 38.275 | -85.643 | 0.198 | 0.103 | ML |

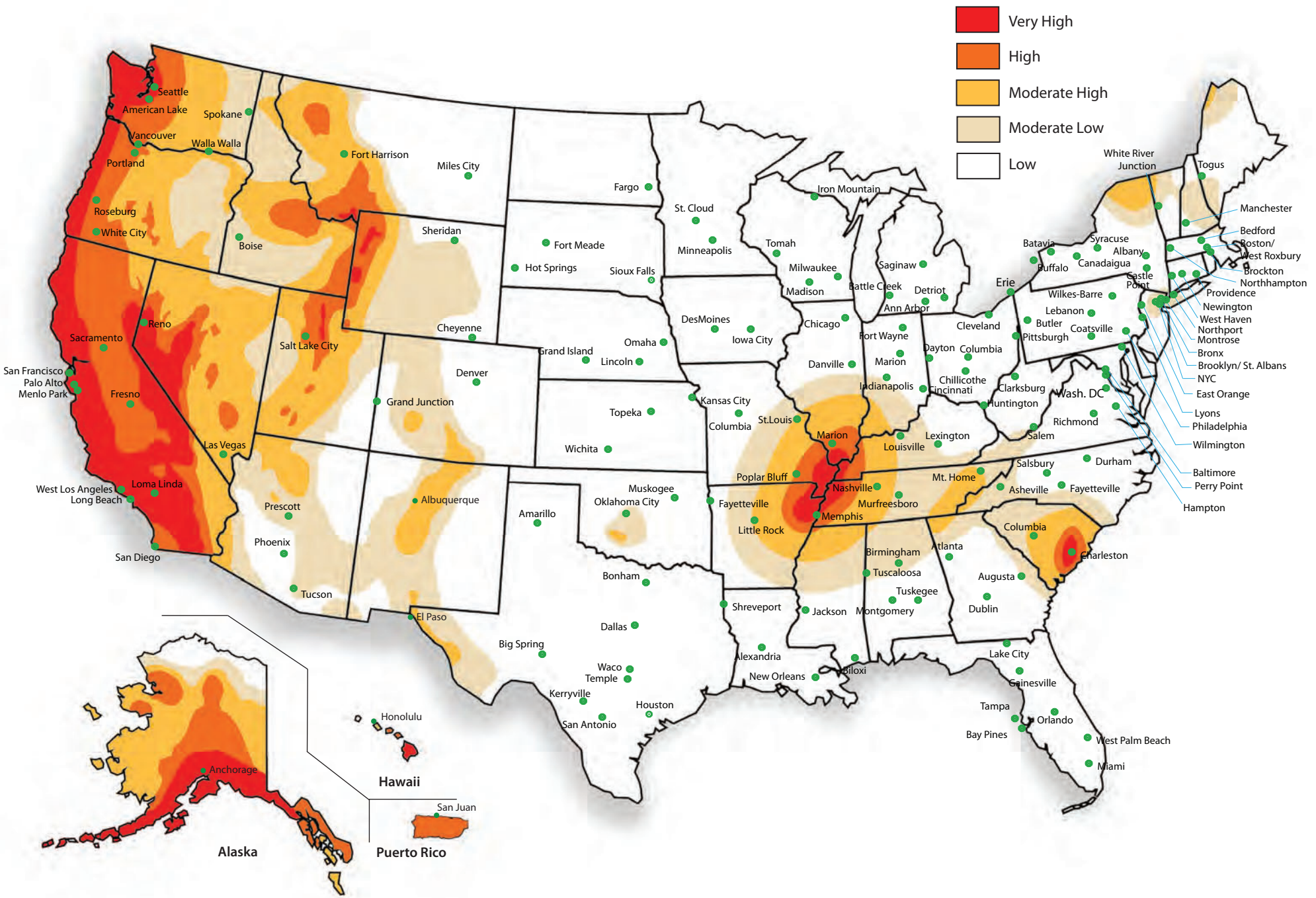
Note: Values of $S_s$ and $S_1$ have been obtained from the design maps of Chapter 22 of ASCE 7 and are intended for design of new facilities. For existing buildings, refer to ASCE 41 for spectral response acceleration parameters that correspond to the appropriate seismic hazard level. Site acronyms: NCA (National Cemetery Administration), VAMC (VA Medical Center), VBA (Veterans Benefits Administration).

October 1, 2016

# U.S. Department of Veterans Affairs Seismic Zone Map

H-18-8

Note: Seismicity is based on Spectral acceleration listed in ASCE 7-10

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