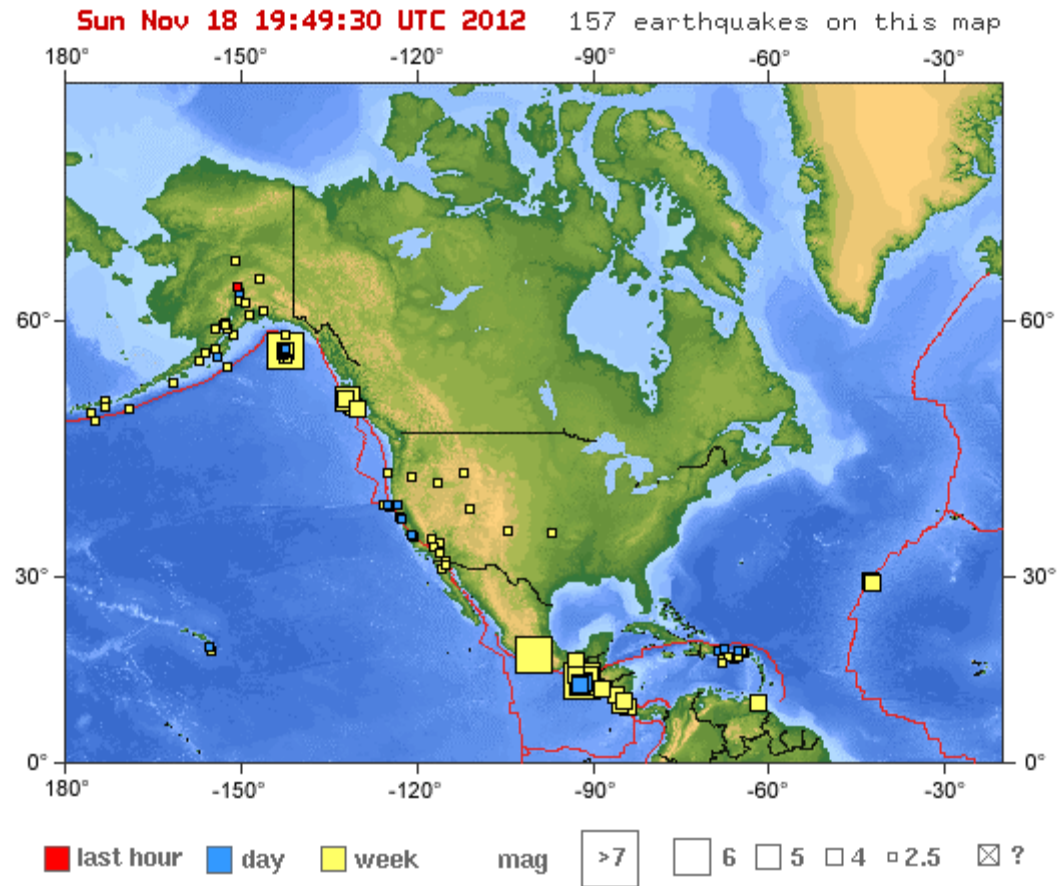




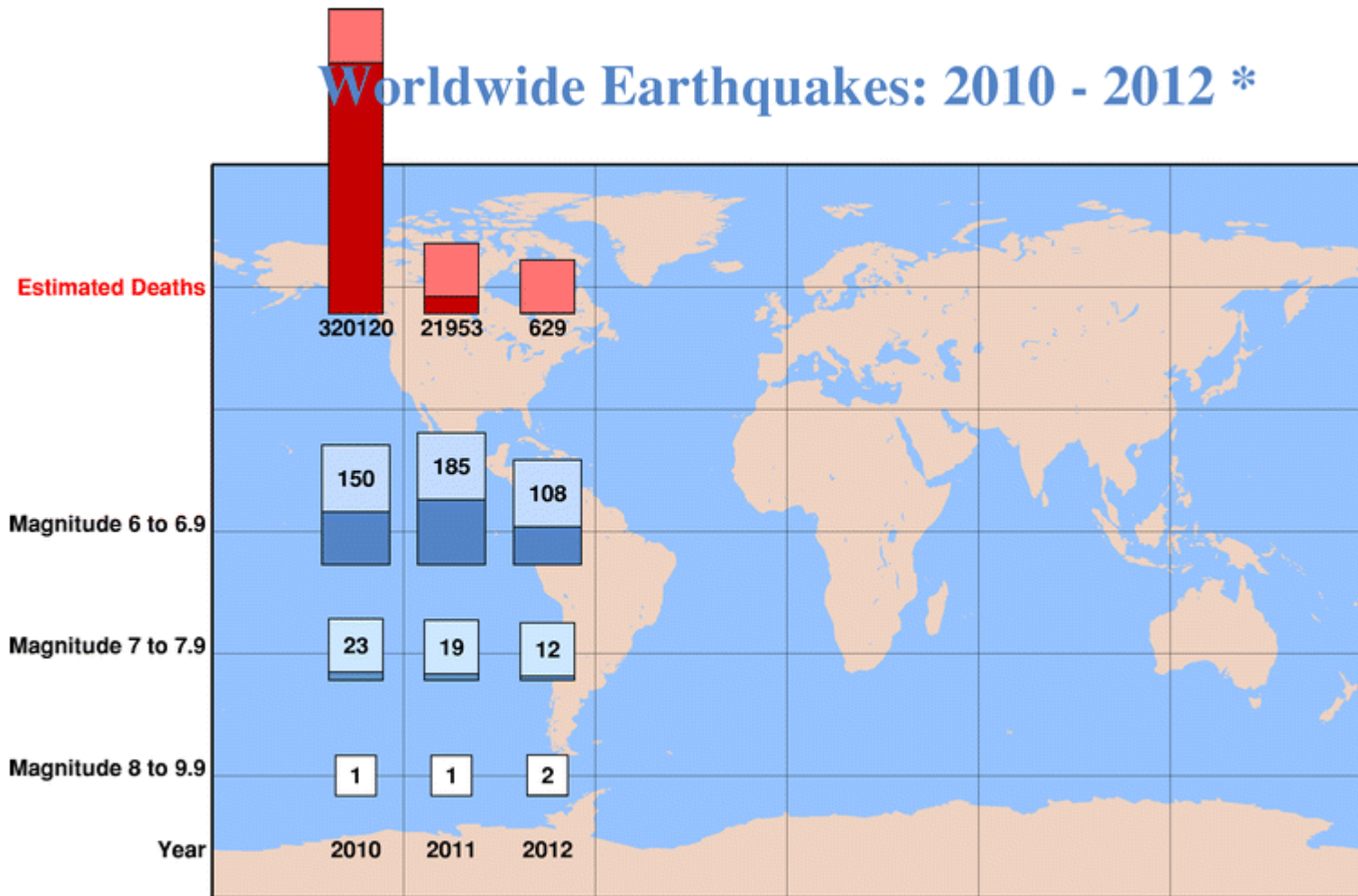
SEISMIC QUALIFIED EQUIPMENT

Eddie Wilkie – Engineering Manager
Power Distribution Organization - Americas

Globally - Anywhere & Everywhere



Globally - Anywhere & Everywhere



2012 11 18

* Located by the USGS National Earthquake Information Center

Lessons Learned

Damage to Contents Can Exceed Building Damage



Lessons Learned

Damage to Contents Can Exceed Building Damage



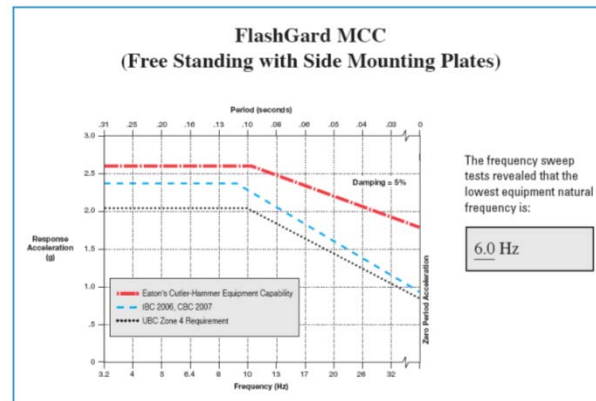
Need for “SEISMIC QUALIFIED”

SEISMIC QUALIFIED



TEST CERTIFICATE OF SEISMIC WITHSTAND CAPABILITY

Eaton's Cutler-Hammer® equipment identified below was tested for seismic withstand capability and tested in accordance with the combined requirements specified in the International Building Code, California Building Code and the Uniform Building Code. As required by the codes, the equipment demonstrated its ability to function after the seismic tests. The seismic capability of the equipment exceeds the worst-case required levels, as illustrated in the figure below.



Mostafa A. Ahmed
3RD PARTY TEST ENGINEER IN CHARGE

TESTED BY
Wyle Laboratories
July, 2006 – 53753-1



For interpretation of testing data
refer to Eaton
Publication SA12501SE
Drawing Number SA04300005E, Rev. 1

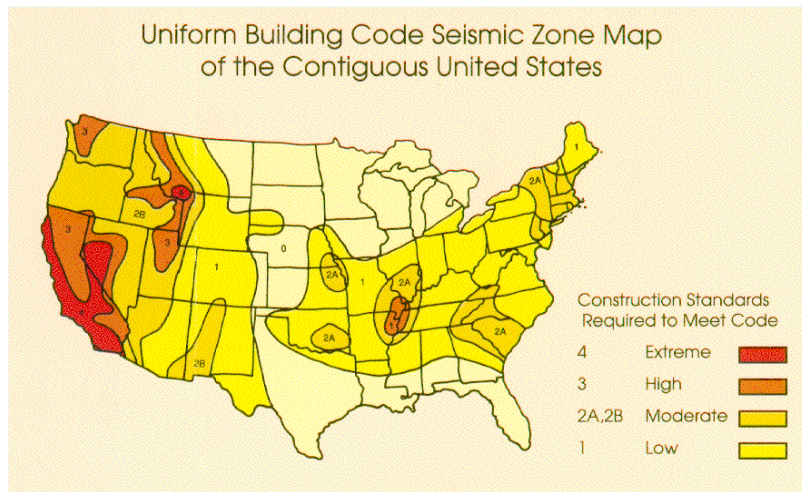
Codes & Standards Confusion

Which One Applies?

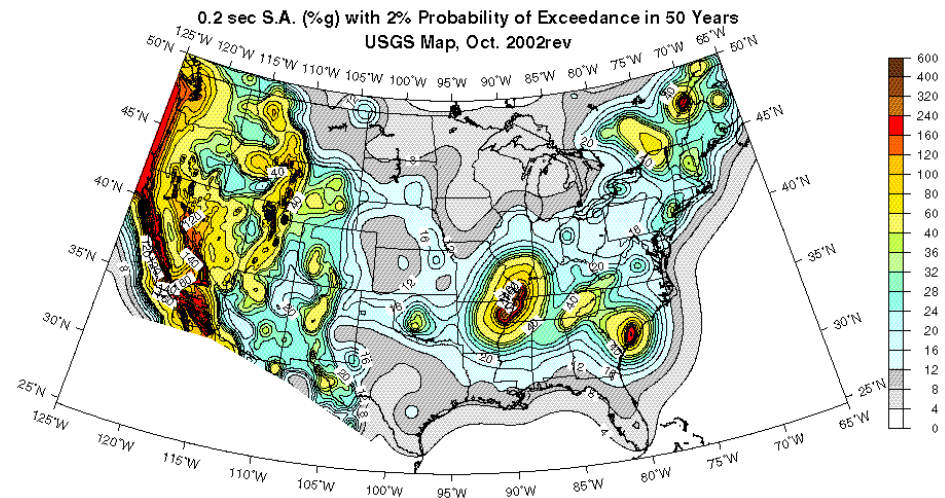
- A. IBC
- B. CBC
- C. UBC
- D. BOCA

Code Development Evolution

- 1997 UBC - Last seismic “Zone Map”
- 2000 IBC - First “Probabilistic Seismic Hazard Map” – Results in localized ground motion data that enables site specific analysis



< 2000 Seismic Zones 1 - 4
(No USGS Revision Since 1969)

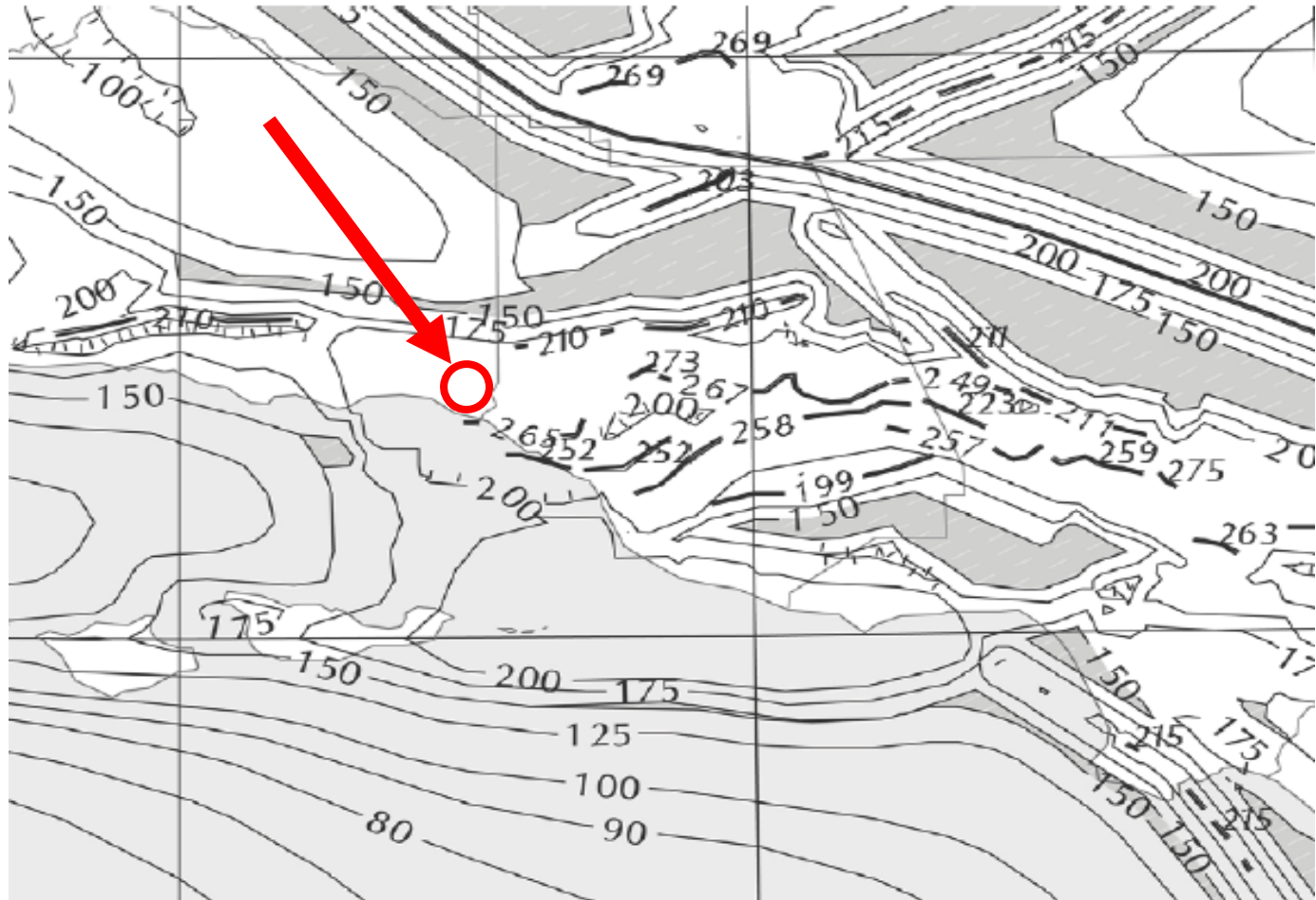


2000 Site Specific Lat / Lon

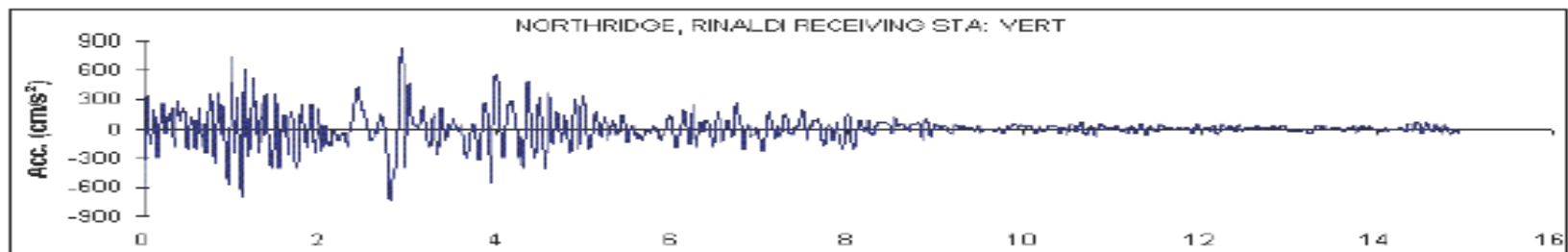
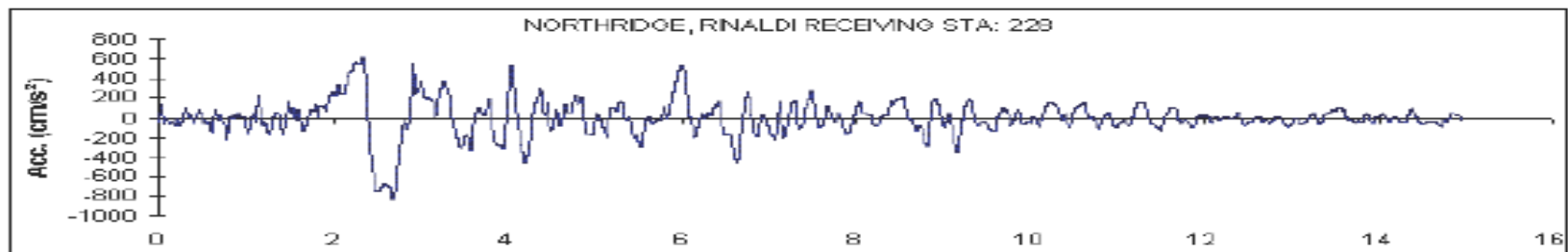
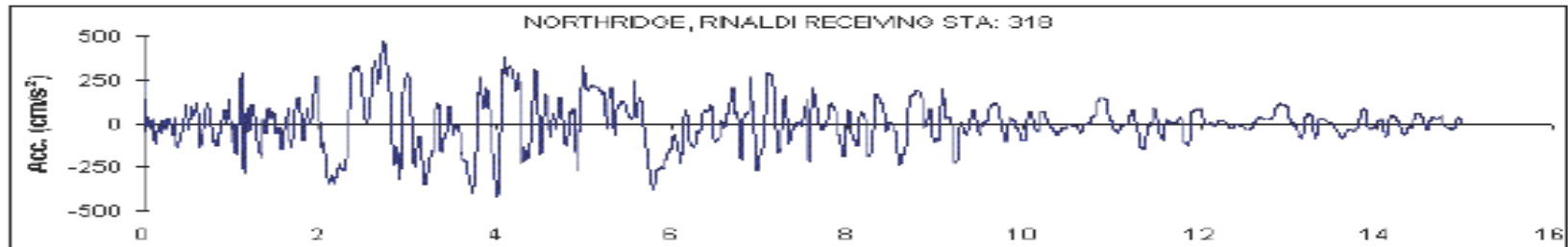
<http://geohazards.cr.usgs.gov/eq/2002April03/US/US5hz2500v4.gif>

Why Site Specific Design Criteria

S_s
 S_1
 F_a
 F_v



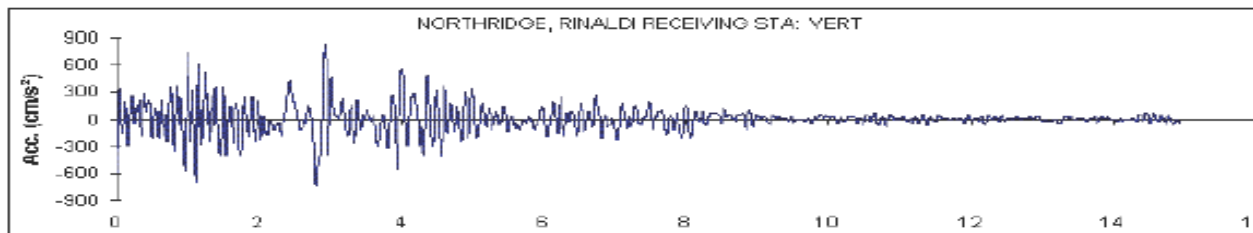
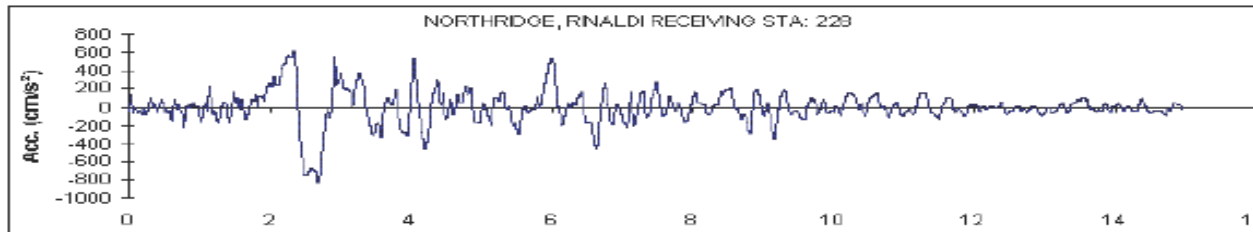
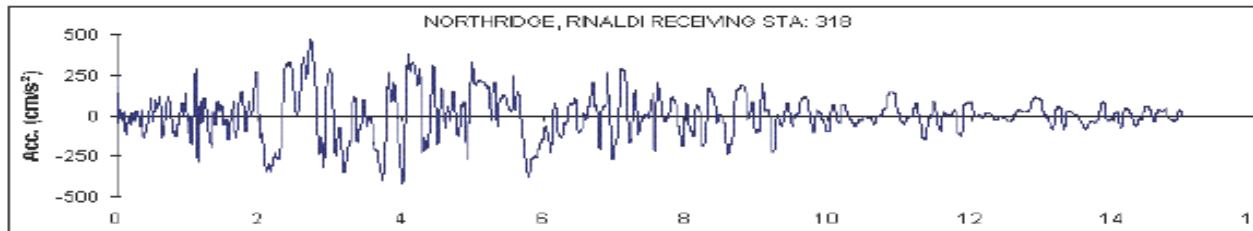
Same Earthquake, Same City



Strong Motion Time History's - Northridge
Trinet

Same Earthquake, Same City

Zip Code OR Longitude & Latitude?



Strong Motion Time History's - Northridge

Trinet

Seismic Data Collection Point Asheville Airport



Codes & Standards - BOCA



Redirect

Building Officials and Code Administrators (BOCA)

(published the BOCA National Building Code and other National Codes) **is now the International Code Council.** You are being redirected to the International Code Council website. In 2003, more than 190 years of combined building and fire safety code development and 30 years of anticipation for one organization to produce codes for use across the country and around the globe became a reality when BOCA, ICBO and SBCCI consolidated to become the [International Code Council](#).

Codes & Standards - UBC

UBC – Uniform Building Code

The International Conference of Building Officials (ICBO), the publisher of the UBC, announced that the 1997 Edition was going to be the last edition of the UBC – long before the edition was even published.

Source: “CODE WATCH”

Codes & Standards - UBC

UBC – Uniform Building Code

The 2000 ***International Building Code*** (IBC) is the successor of the 1997 UBC.....The basis of the 2001 CBC continued to be the 1997 UBC, thus extending the life of the code.

Source: "CODE WATCH"

Codes and Standards – Not UBC

Which One Applies?

A. IBC – In most states

B. CBC – in California

~~C. UBC~~

~~D. BOCA~~

Codes & Standards – CBC

CBC – California Building Code

California's Building Standards Commission, a body with members who are appointed by the governor and ratified by the state senate process, produces the **California Building Standards Code** (of which the CBC is a part). The **California Building Standards Code** is published in its entirety every three years, with supplements published in the intervening years.

Source: "CODE WATCH"

Codes & Standards – IBC

Origin

The International Code Council (ICC) was established in 1994 as a nonprofit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes. The founders of the ICC are Building Officials and Code Administrators International, Inc. (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International, Inc. (SBCCI). Since the early part of the last century, these nonprofit organizations developed the three separate sets of model codes used throughout the United States. Although regional code development has been effective and responsive to our country's needs, the time came for a single set of codes. The nation's three model code groups responded by creating the International Code Council and by developing codes without regional limitations the International Codes.

Codes & Standards – IBC

50 states now use the ICC

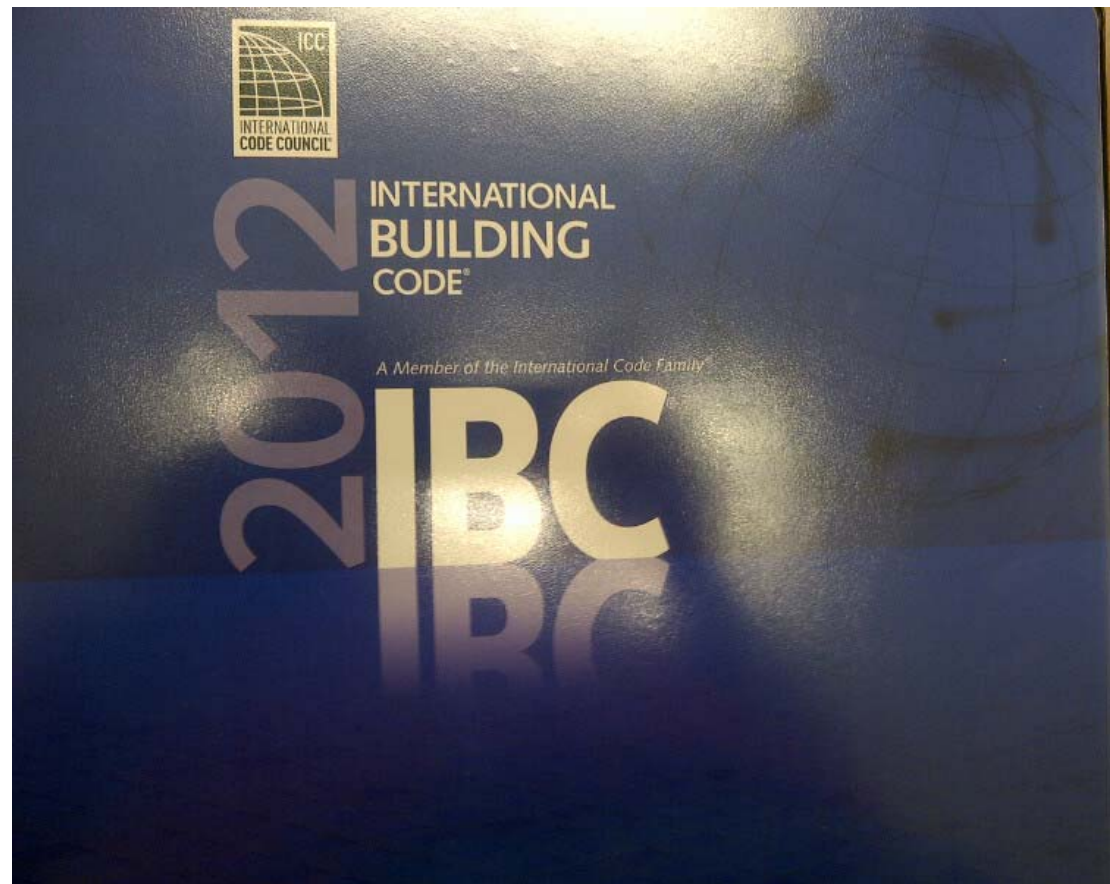
The *International Building Code* (IBC) is in use or adopted in 50 states, the District of Columbia, the U.S. Virgin Islands, NYC, Guam, and the Northern Marianas Islands.

Source: ICC Website

IBC Seismic Standards

Standards

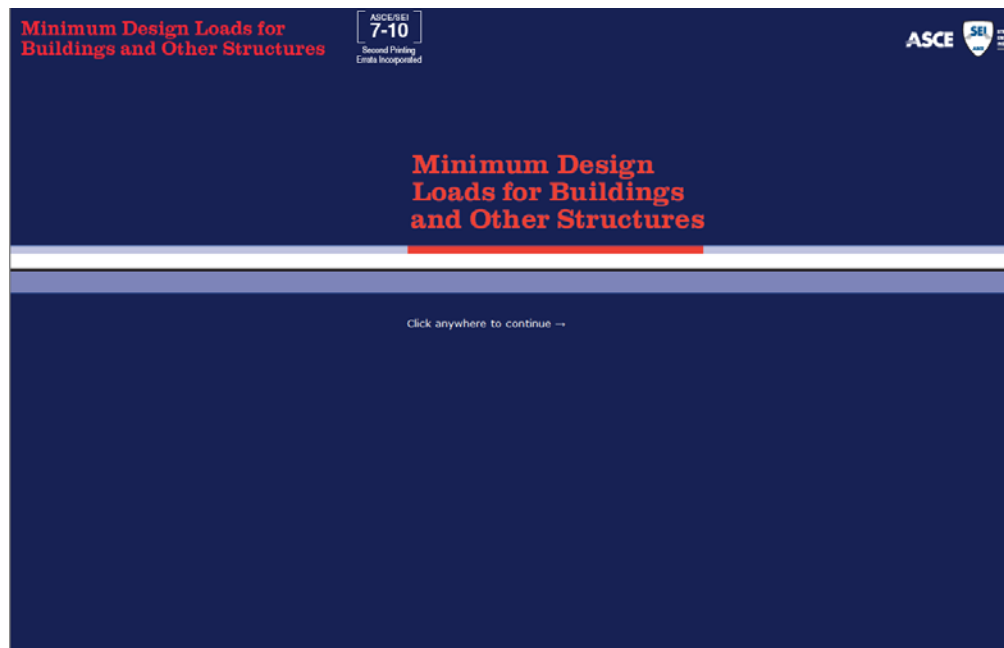
- 2012 IBC



ASCE 7-10 Seismic Design Requirements

Standards

- ASCE-7-10 provides that backbone for IBC Section 1613, “Earthquake Loads”



ASCE 7-10 Seismic Design Requirements

13.2 GENERAL DESIGN REQUIREMENTS

13.2.1 Applicable Requirements for Architectural, Mechanical, and Electrical Components, Supports, and Attachments.

Architectural, mechanical, and electrical components, supports, and attachments shall comply with the sections referenced in Table 13.2.1. These requirements shall be satisfied by one of the following methods:

ASCE 7-10 Seismic Design Requirements

1. Project-specific design and documentation submitted for approval to the authority having jurisdiction after review and acceptance by a registered design professional.
2. Submittal of the manufacturer's certification that the component is seismically qualified by:
 - a. Analysis
 - b. Testing in accordance with the alternative set forth in Section 13.2.5
 - c. Experience data in accordance with the alternative set forth in Section 13.2.6

ASCE 7-10: Project Specific Documentation

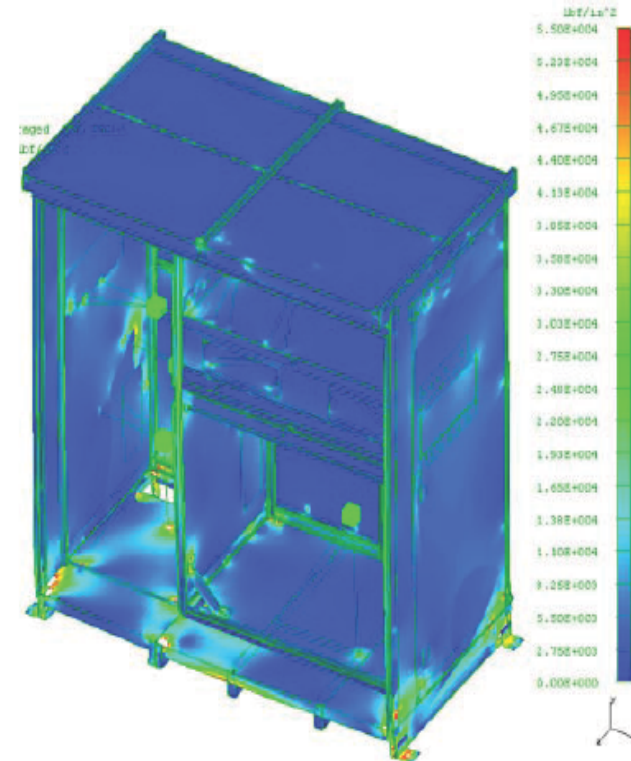
1. Project-specific design and documentation prepared and submitted by a registered design professional.

NOTE: Shall include longitude & latitude based on the project address; seismic criteria for that location and any restrictions

ASCE 7-10: Certification by Analysis

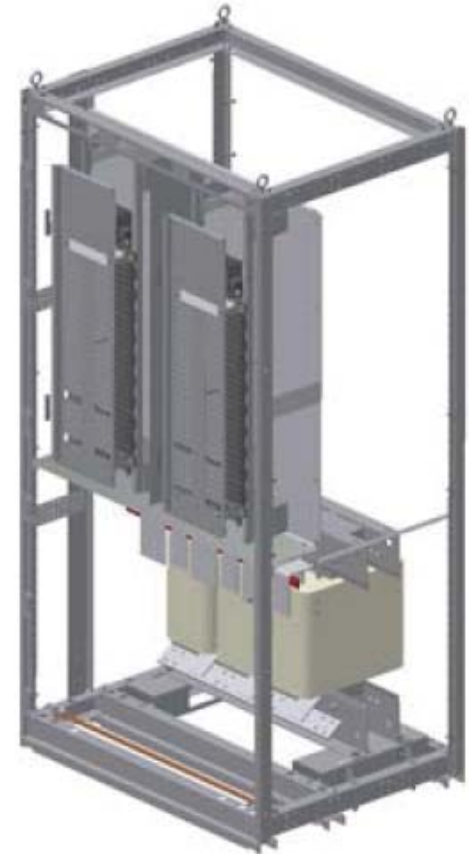
2. Submittal of the manufacturer's certification that the component is seismically qualified by:
 - a. Analysis

$$F_p = \frac{a_p C_a I_p}{R_p} \left(1 + 3 \frac{h_x}{h_r} \right) W_p$$



ASCE 7-10: Certification by Analysis

ANALYSIS of a similar piece of equipment that has actually been TESTED by a 3rd party independent laboratory by recognized test standards, and the results have been recorded for extrapolation by specialty software for seismic modeling.



ASCE 7-10: Certification by Testing

2. Submittal of the manufacturer's certification that the component is seismically qualified by:
 - a. Analysis
 - b. Testing in accordance with the alternative set forth in Section 13.2.5

ASCE 7-10: Certification by Testing



ASCE 7-10: Certification by Testing



ASCE 7-10: Testing to What Standard

13.2.5 Testing Alternative for Seismic Capacity Determination. As an alternative to the analytical requirements of Sections 13.2 through 13.6, testing shall be deemed as an acceptable method to determine the seismic capacity of components and their supports and attachments. Seismic qualification by testing based on a nationally recognized testing standard procedure, such as **ICC-ES-AC 156**, acceptable to the authority having jurisdiction, shall be deemed to satisfy the design and evaluation requirements provided that the substantiated seismic capabilities equal or exceed the seismic demands determined in accordance with Sections 13.3.1 and 13.3.2.

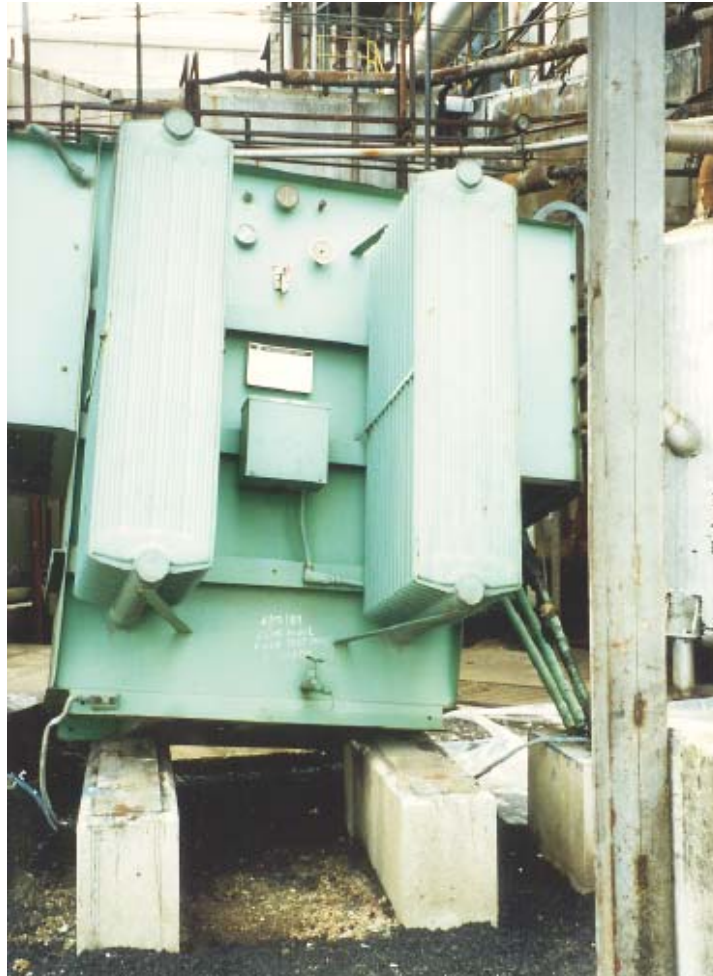
Seismic Testing – Performance Criteria

- Equipment maintains structural integrity, no projectiles
- Perform its design function immediately after the event.
- Equipment mounting will maintain structural integrity
- Equipment and its insulating systems must be verified to perform function at the certified levels
- We often check stability of circuit breakers and switches during testing to ensure they do not change state. However, this is not a requirement.

ASCE 7-10: Certification by Experience

1. Project-specific design and documentation prepared and submitted by a registered design professional.
2. Submittal of the manufacturer's certification that the component is seismically qualified by:
 - a. Analysis
 - b. Testing in accordance with the alternative set forth in Section 13.2.5
 - c. Experience data in accordance with the alternative set forth in Section 13.2.6

ASCE 7-10: Certification by Experience



ASCE 7-10: Certification by Experience

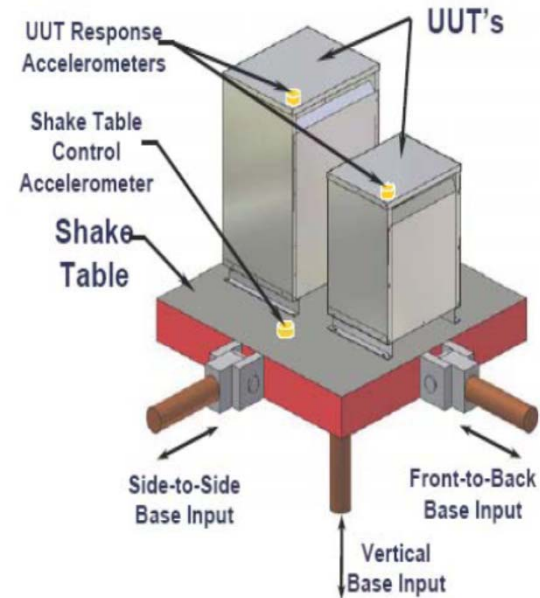
Experience Data

- Permanent graphic elements
 - Subjected to Known String Motion Events
 - Detailed Engineering Studies of Performance
 - Anchorage Evaluation
 - Root Cause of Failure Determined by Experts
- Project Site Lower Demand Than Database
- Equipment Must Be of Equal or Better Construction

UBC Zone 4 vs. ASCE 7-10 Certification

$$F_p = \frac{0.4 a_p S_{DS}}{\left(\frac{R_p}{I_p}\right)} \left(1 + 2 \frac{z}{h}\right) W_p$$

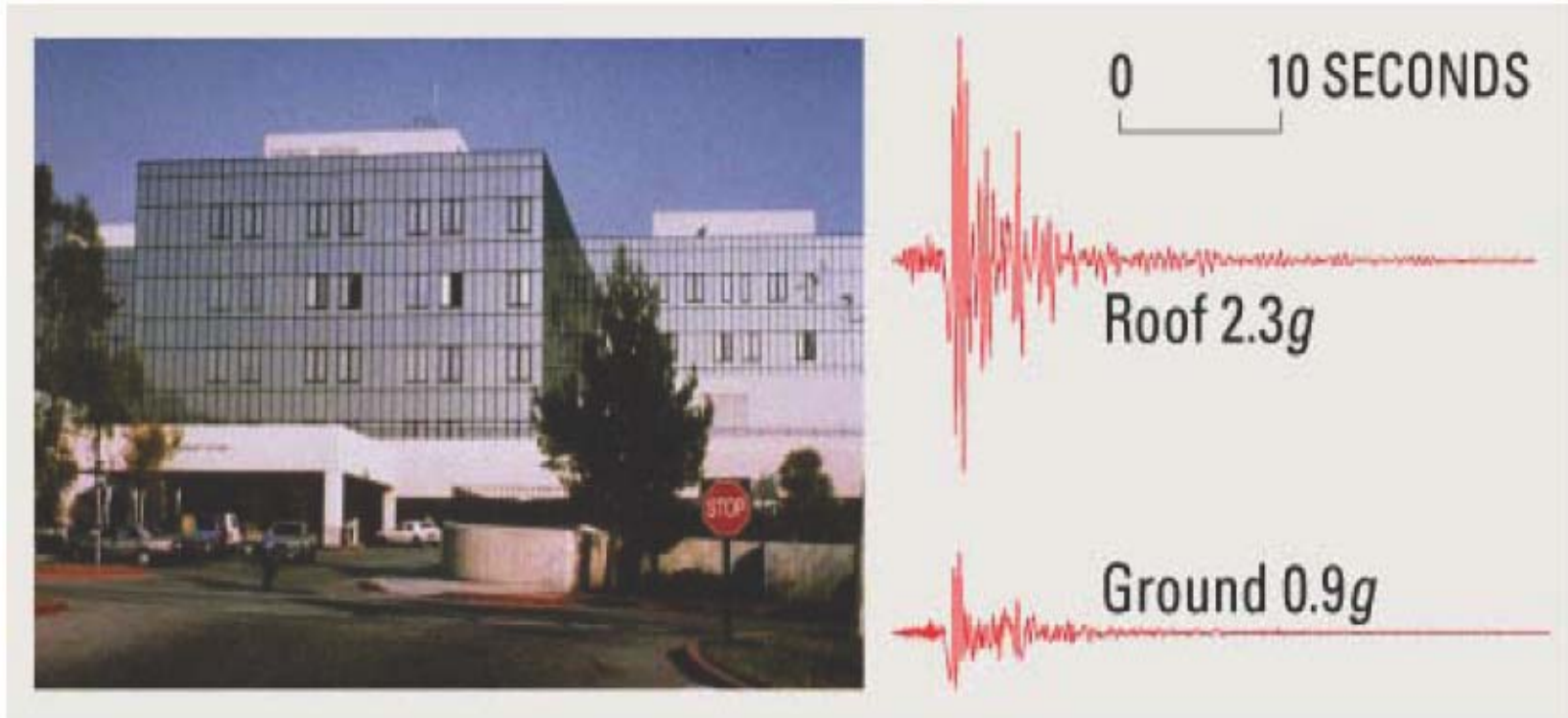
Code basis was
Static Lateral
Push Over Forces



Shake Table Test
is **Dynamic**
Demand

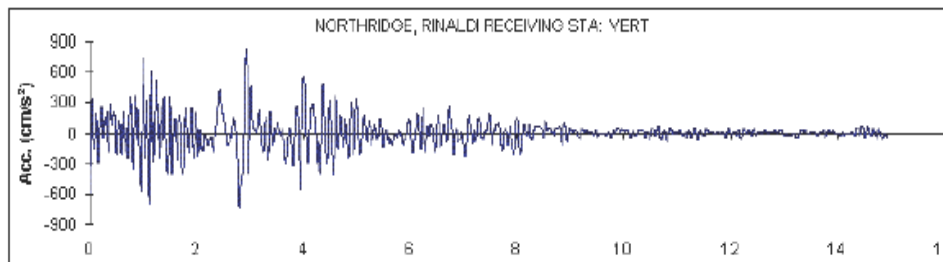
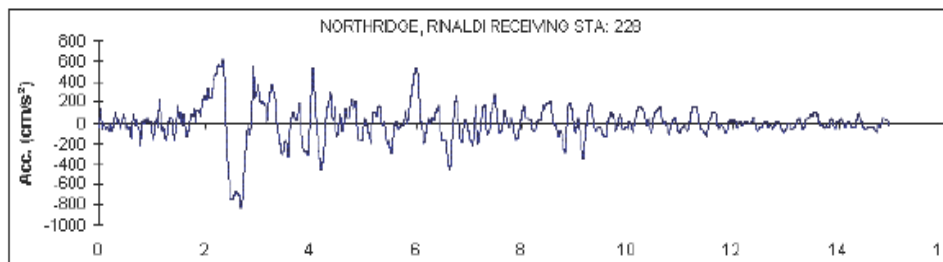
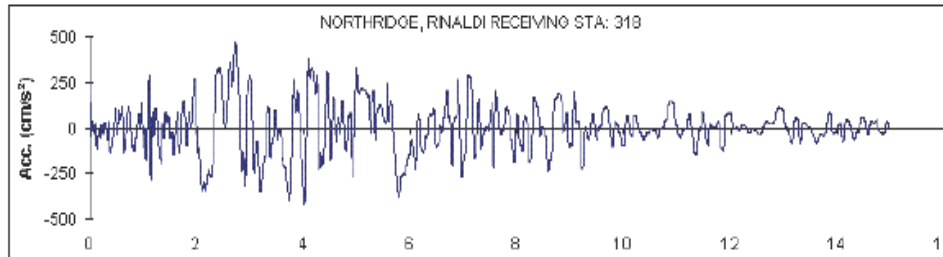
Illustration by Jeff Gatscher & Scott Littler

Ground VERSUS Roof Mounted



1994 Northridge Earthquake - Instrumented Building LA County Olive View-UCLA Medical Center
Sylmar, California

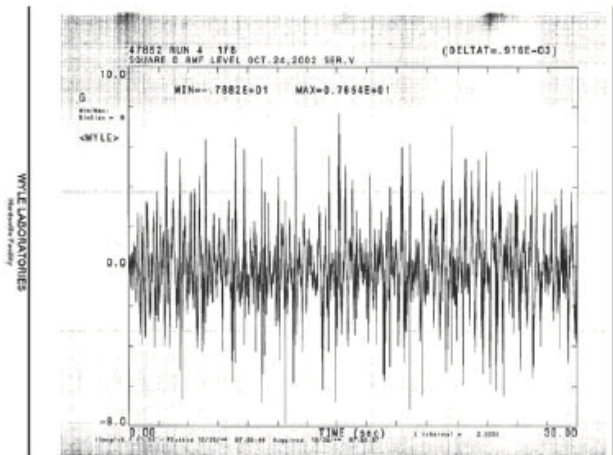
Shaker Table Test VERSUS Seismic Event



Strong Motion Time History's - Northridge

Trinet

Actual Test Tries to Cover
“Worse Case” and
Full Spectrum



Random Motion
30 Seconds
Three Axis

Shaker Table Test Motion

Wyle Labs

Manufacturer's Recommendations

Considerations for Seismic Qualified Installations

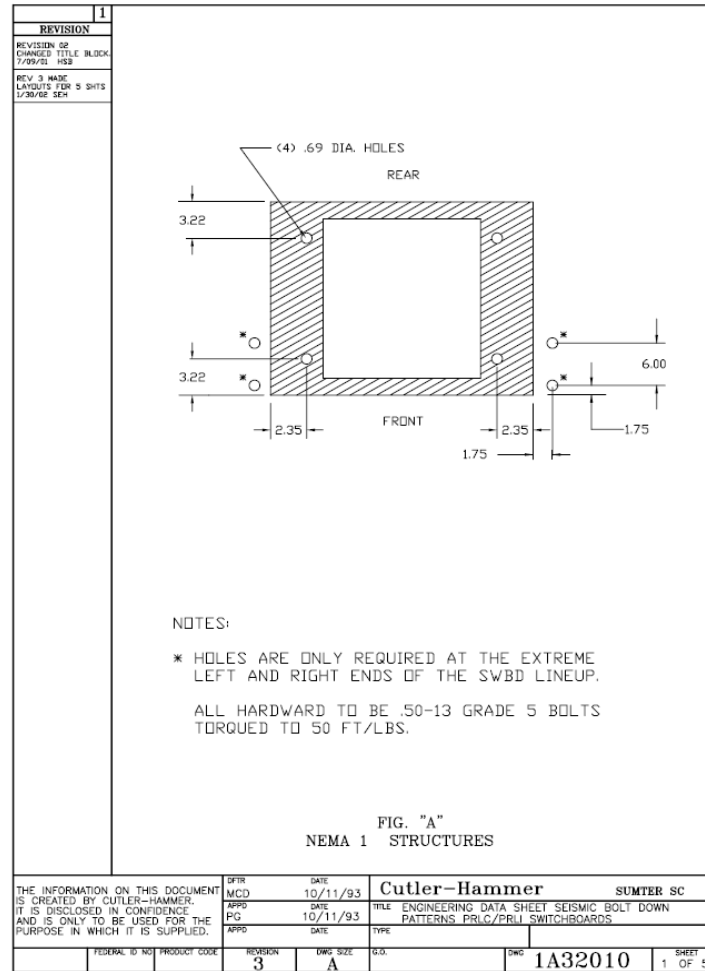
Switchboards that are "Seismically Qualified" require additional considerations. Since electrical equipment is installed as part of a system, pre-engineering layouts are critical in seismic applications.

When seismic qualified and marked Cutler-Hammer brand switchboards are used, anchoring the switchboard recommended by the design engineer is critical. Experienced engineers in seismic requirements should select methods and techniques of attachment and tested anchoring systems. Embedded concrete anchors or steel attachments must be adequate to resist the forces established by the local building code. Bolts of the proper grade of steel must be correctly sized and torqued. The embedded anchors must be correctly installed in accordance with the method specified by the anchor manufacturer.

Conduit layout in concrete for loads entering and/or exiting the bottom must be designed and installed to prevent damage from an earthquake. If top entry is necessary, seismic fittings or flexible conduit is needed.

Consult applicable local building codes and regulatory agencies for other specific requirements for seismic installations.

Follow Anchorage Instructions



Type & Embedment & Location of Anchor

- **Fastened to a Wall?**
 - A. Center-Line of Gravity and Weight
 - B. Construction Material of Wall
 - C. Type of Anchor
 - D. Depth of Anchor
 - E. Quantity Per Structure or Line-up
- **Concrete Slab?**
 - A. Center Line of Gravity and Weight
 - B. PSI
 - C. Type of Anchor
 - D. Depth of Anchor
 - E. Per Structure or Line-up

Will the Structure Handle It?

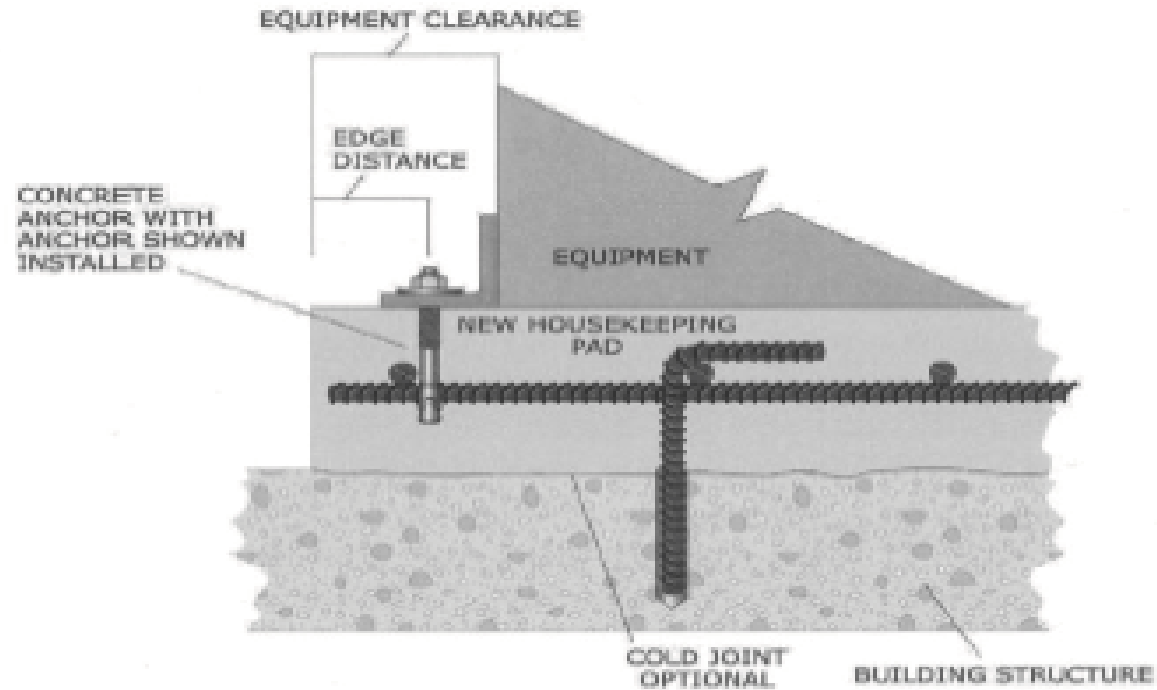


Figure 159: Housekeeping pad in section view.



If edge distance is not met, get an evaluation from your supervisor.

Illustration from: FEMA 413

Was This Installation “Seismic Qualified”?

Housekeeping
Pad was NOT
tied to the Slab
or Building
Steel



How To Specify Seismic Qualified Equipment

As an Electrical Consultant, You May Wonder:

What Type of Specification Should be Used?

Where Do We Find Site Specific Information?

I'm not a Structural Engineer, What Criteria Do I Need to Use and is Important to Include?

EATON Sample Specification

NOTE to SPEC WRITER:

To help understand the 2009 IBC/2010 CBC seismic parameters for a specific location, the attached link to the US Geological Survey will be extremely helpful:

<http://earthquake.usgs.gov/research/hazmaps/design/>

Download the file “[Java Ground Motion Parameter Calculator - Version 5.0.8 \(4.6 MB\)](#)” and save it to your hard drive, then run the executable (.exe) that was downloaded.

Enter the latitude and longitude of your project location.

(To find exact Latitude and Longitude, go to <http://geocoder.us/> and type in the address.)

The IBC seismic criteria for that location will then be displayed. It is simply a matter of verifying that the criteria shown for your specific building location is less than those listed above.

Sample Specification

The equipment and major components shall be suitable for and certified ***by actual seismic testing*** to meet all applicable seismic requirements of the 2009 International Building Code (IBC), Site Classification [Enter classification from above website]. The site coefficients $F_a =$ [Enter value from above website], and spectral response accelerations of $S_s =$ [Enter value from above website]g, $S_1 =$ [Enter value from above website]g are used. The test response spectrum shall be based upon a 5% damping factor, and a peak (S_{DS}) of at least [Enter value from above website]g's (3 - 12 Hz) applied at the base of the equipment in the horizontal direction. The forces in the vertical direction shall be at least 66% of those in the horizontal direction. The tests shall cover a frequency range from 1 to 100Hz. Guidelines for the installation consistent with these requirements shall be provided by the equipment manufacturer and based upon testing of representative equipment. Equipment certification acceptance criteria shall be based upon the ability for the equipment to be returned to service immediately after a seismic event within the above requirements without the need for repairs.

Abbreviations & Definitions

F_a = Site Coefficients @ 0.2 Second Short Period

F_v = Site Coefficients @ 1.0 Second Period

S_s = 0.2 Second Spectral Response Acceleration

S_1 = 1.0 Second Spectral Response Acceleration

S_{MS} = Maximum Spectral Response @ 0.2 Second

S_{M1} = Maximum Spectral Response @ 1.0 Second

S_{DS} = Peak Response @ 0.2 Second

S_{D1} = Peak Response @ 1.0 Second

T_s = Response Spectrum Curve Start

T_o = Response Spectrum Curve Acceleration Band

How to Find Longitude & Latitude

geocoder.us: a free US address geocoder - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Print Mail Print

Address <http://geocoder.us/> Go Links

Free Zone Daylight Savings Elevation FIPS Codes Census Info And Many More!

Convert Any U.S. Address into Valuable Data with Geocode USA.

CLICK HERE To Try a Free Evaluation!

✓ Native .NET Component ✓ Easy To Use ✓ Royalty-Free ThinkGeo

geocoder.us / geocoder.net

find the latitude & longitude of any US address - for free

Enter the Address

Look up an Address:

Enter a US address or intersection, e.g. *1600 Pennsylvania Ave, Washington, DC.*

1292 Harrison Street, San Francisco, California Search

For best results please use a comma between the street and the city, and add the zip code if possible. Free lookups are throttled by your IP address to one request every 15 seconds.

Or try one of these examples...

- 1600 Pennsylvania Ave, Washington DC
- West 42nd & Broadway, New York NY
- Hollywood & Vine, Los Angeles, CA
- Mission & Valencia Sts. San Francisco CA

Recent News and Notes

May 15, 2008 Discover the power of deep zoom! [Read how you can get Gigapixel imagery on your web site](#) (Forget 6 or 12 Megapixels, many of my images are over 1,000 megapixels)

(2 items remaining) Opening page <http://googleads.g.doubleclick.net/pagead/ads?client=ca-pub-1219510847949987&dt=123...> Internet

How to Find Longitude & Latitude

geocoder.us / geocoder.net
find the latitude & longitude of any US address - for free

Address 1292 Harrison St
San Francisco CA 94103
(37.772729, -122.409782)

Latitude 37.772729 °
N 37 ° 46' 21.8"
37 ° 46.3637' (degree m.mmmm)

Longitude -122.409782 °
W 122 ° 24' 35.2"
-122 ° 24.5869' (degree m.mmmm)

Search for another address:

(it can take a bit for the map to load-wait for the red circle to turn green. Stay in your happy place.)

Opening page http://geocoder.us/demo.cgi?address=1292+Harrison+Street%2C+San+Francisco%2C+California... Internet

USGS - Ground Motion Parameter Calculator

Seismic Design Values for Buildings - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites

Address <http://earthquake.usgs.gov/research/hazmaps/design/> Go Links

USGS
science for a changing world

USGS Home
Contact USGS
Search USGS

Earthquake Hazards Program

Home | **Earthquake Center** | Regional Information | About Earthquakes | **Research & Monitoring** | Other Resources

You are here: [Home](#) » [Research & Monitoring](#) » [Seismic Hazard Mapping](#) » Seismic Design Values for Buildings

NSHM Home
Probabilistic Ground-Motion Maps

Seismic Design Values for Buildings

Custom Mapping
Analysis Tools
Quaternary Faults
Earthquake Hazards 101
Scenario Maps
Time-Dependent Maps
Project Information and News
Related Links
NSHM FAQ
NSHM Site Map
A-7 Site Index

Seismic Design Values for Buildings

Earthquake Ground Motion Parameter Java Application

The Java Application includes hazard curves, uniform hazard response spectra, and design parameters for sites in the 50 states of the United States, Puerto Rico, and the U.S. Virgin Islands. Design parameters are also available for Guam and American Samoa. Parameters are searchable by zip code or latitude and longitude, can be graphed, saved, and printed for later use.

Note: The Ground Motion Parameter Calculator is a Java(TM) Application and requires the [Java\(TM\) Runtime Environment version 1.5.0 or higher](#). This application also requires an active internet connection to retrieve data from our servers.

[Java Ground Motion Parameter Calculator - Version 5.0.9 \(5.6 MB\)](#)

For information on anticipated updates to the seismic design values for buildings, please click the following link to a recap of the [Building Seismic Safety Council \(BSSC\) Seismic Design Procedures Reassessment Group \(SDPRG - a.k.a., Project '07\) Workshop](#).

Please read our [Frequently Asked Questions](#) for answers to common problems.

Internet

USGS - Ground Motion Parameter Calculator

Seismic Hazard Curves and Uniform Hazard Response Spectra

File Help

Select Analysis Option: NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures

Probabilistic hazard curves
Probabilistic Uniform Hazard Response Spectra
NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures
ASCE 7 Standard, minimum design loads for buildings and other structures
International Building Code
International Residential Code
2003 NEHRP Seismic Des NFPA 5000 Building Construction and Safety Code

Region and Data Set Selection

Geographic Region: Conterminous 48 States

Data Edition: 2003 NEHRP Seismic Des

Latitude (Degrees): Longitude (Degrees):
(24.7, 50.0) (-125.0, -65.0)

Basic Parameters

Ground Motion: MCE Ground Motion

Calculate Ss & S1 Calculate SM & SD Values

Response Spectra

Map Spectrum Site Modified Spectrum
Design Spectrum View Spectra

View Maps Clear Data

USGS
science for a changing world

From the Drop Down MENU, select "International Building Code"

Confirm Code Reference & Location

Seismic Hazard Curves and Uniform Hazard Response Spectra

File Help

Select Analysis Option: International Building Code

Region and DataSet Selection

Geographic Region: Conterminous 48 States

Data Edition: 2006 International Building Code

Lat/Lon | Zip Code | Batch File

Latitude (Degrees): 39.772729 Longitude (Degrees): -122.409782

(24.7, 50.0) (-125.0, -65.0)

Basic Parameters

Ground Motion: MCE Ground Motion

Calculate Ss & S1 Calculate SM & SD Values

Response Spectra

Map Spectrum Site Modified Spectrum

Design Spectrum View Spectra

View Maps Clear Data

USGS science for a changing world

Confirm the edition of the IBC is correct for your local area from the Drop Down MENU.

Then, enter (cut & paste) the Latitude and Longitude from the us.geocoder.org Website

Confirm Soil Classification & F_a

Seismic Hazard Curves and Uniform Hazard Response Spectra

File Help

Select Analysis Option: International Building Code Description

Region and DataSet Selection

Geographic Region: Conterminous 48 States

Data Edition: 2006 International Building Code

Lat/Lon Zip Code Batch File

Latitude (Degrees): 39.772729 Longitude (Degrees): -122.409782

(24.7, 50.0) (-125.0, -65.0)

Basic Parameters

Ground Motion: MCE Ground Motion

Calculate Ss & S1 Calculate SM & SF values

Response Spectra

Map Spectrum Site Modified Spectrum

Design Spectrum View Spectra

Output for All Calculations

View Maps Clear Data

USGS
science for a changing world

CLICK on the “Map Spectrum” button to CONFIRM the Soil Classification (or change to the minimum level of “D” in California) and then get the value of F_a for the Specification

Confirm Soil Classification & F_a

Soil Factors as Function of Site Class and Spectral Acceleration
Values of F_a as a function of Site Class and 0.2 sec MCE Spectral Acceleration

Site Class	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	a	a	a	a	a

Values of F_v as a function of Site Class and 1.0 sec MCE Spectral Acceleration

Site Class	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	a	a	a	a	a

Calculate Site Coefficient
Spectral Accelerations

S_s, g 1.50 **S_1, g** 0.661

Site Class

Set Site Class:

- Site Class D
- Site Class A
- Site Class B
- Site Class C
- Site Class D
- Site Class E
- Site Class F

Site Coefficients

Interpolated soil factors for the conditions shown. Values may also be entered manually.

Fa: 1.00

Fv: 1.50

OK

The Site Classification for an address in California will have to be change to a "D".

Note that for either Class "B" or "D" the value of F_a is 1.0

Confirm S_s & S_1 Values

Soil Factors as Function of Site Class and Spectral Acceleration
Values of F_a as a function of Site Class and 0.2 sec MCE Spectral Acceleration

Site Class	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	a	a	a	a	a

Values of F_v as a function of Site Class and 1.0 sec MCE Spectral Acceleration

Site Class	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
					1.5
					2.4
					a

Calculate Site Coefficient
Spectral Accelerations

S_s, g **S_1, g**

Site Class

Set Site Class:

- Site Class D
- Site Class A
- Site Class B
- Site Class C
- Site Class D
- Site Class E
- Site Class F

Site Coefficients

Interpolated soil factors for the conditions shown. Values may also be entered manually.

F_a :

F_v :

Also shown on the screen in the TOP RIGHT are the “Spectral Response Acceleration” values for S_s & S_1 .

Click on the “OK” button to return to the Main Screen

Confirm S_{DS} Value

Seismic Hazard Curves and Uniform Hazard Response Spectra

File Help

Select Analysis Option: International Building Code

Region and DataSet Selection

Geographic Region: Conterminous 48 States

Data Edition: 2006 International Building Code

Latitude (Degrees): 37.772729 Longitude (Degrees): -122.409782

Basic Parameters

Ground Motion: MCE Ground Motion

Calculate S_s & S_1 Calculate S_M & S_D Values

Response Spectra

Map Spectrum Site Modified Spectrum

Design Spectrum View Spectra

Output for All Calculations

Site Class D - $F_a = 1.0, F_v = 1.5$

Period (sec)	S_a (g)
0.2	1.500 (S_M , Site Class D)
1.0	0.991 (S_1 , Site Class D)

Conterminous 48 States
2006 International Building Code
Latitude = 37.772729
Longitude = -122.409782
Design Spectral Response Accelerations S_D s and S_{D1}
 S_D s = $2/3 \times S_M$ s and S_{D1} = $2/3 \times S_{M1}$
Site Class D - $F_a = 1.0, F_v = 1.5$

Period (sec)	S_a (g)
0.2	1.000 (S_D s, Site Class D)
1.0	0.661 (S_{D1} , Site Class D)

Output for analysis.

View Maps Clear Data

**CLICK on the "Calculate S_M & S_D Values".
CLICK on the "OK" button of the "Site Coefficient" Screen that will appear to return to this MAIN Screen**

View “Spectral Data”

Seismic Hazard Curves and Uniform Hazard Response Spectra

File Help

Select Analysis Option: International Building Code Description

Region and DataSet Selection

-Geographic Region:
Conterminous 48 States

-Data Edition:
2006 International Building Code

Lat/Lon | Zip Code | Batch File

-Latitude (Degrees): 37.772729 Longitude (Degrees): -122.409782
(24.7, 50.0) (-125.0, -65.0)

Basic Parameters

-Ground Motion:
MCE Ground Motion

Calculate Ss & S1 Calculate SM & SD Values

Response Spectra

Map Spectrum Site Modified Spectrum
Design Spectrum View Spectra

Output for All Calculations

Site Class D - Fa = 1.0 ,Fv = 1.5

Period (sec)	Sa (g)
0.2	1.500 (SMs, Site Class D)
1.0	0.991 (SM1, Site Class D)

Conterminous 48 States
2006 International Building Code
Latitude = 37.772729
Longitude = -122.409782
Design Spectral Response Accelerations SDs and SD1
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.0 ,Fv = 1.5

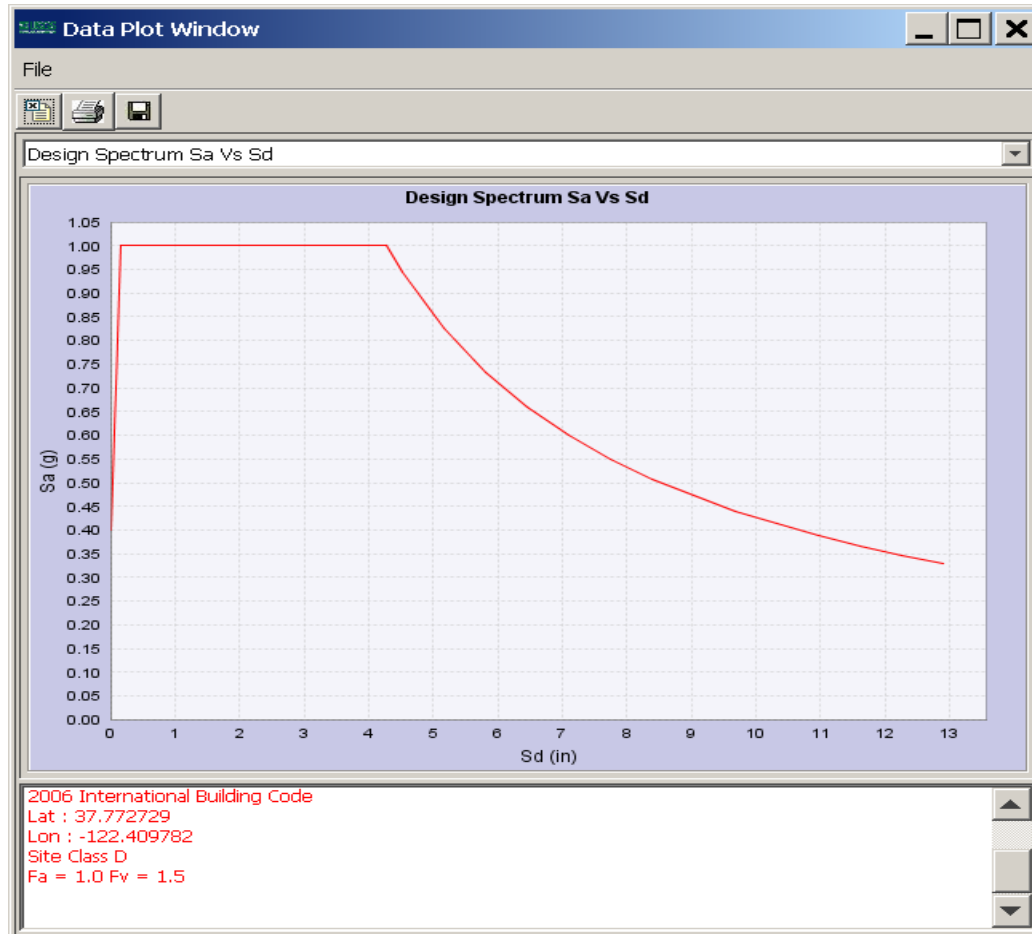
Period (sec)	Sa (g)
0.2	1.000 (SDs, Site Class D)
1.0	0.661 (SD1, Site Class D)

Output for analysis.

View Maps Clear Data

CLICK on the “View Spectra” button to see a graphical representation of the Design Response Spectrum

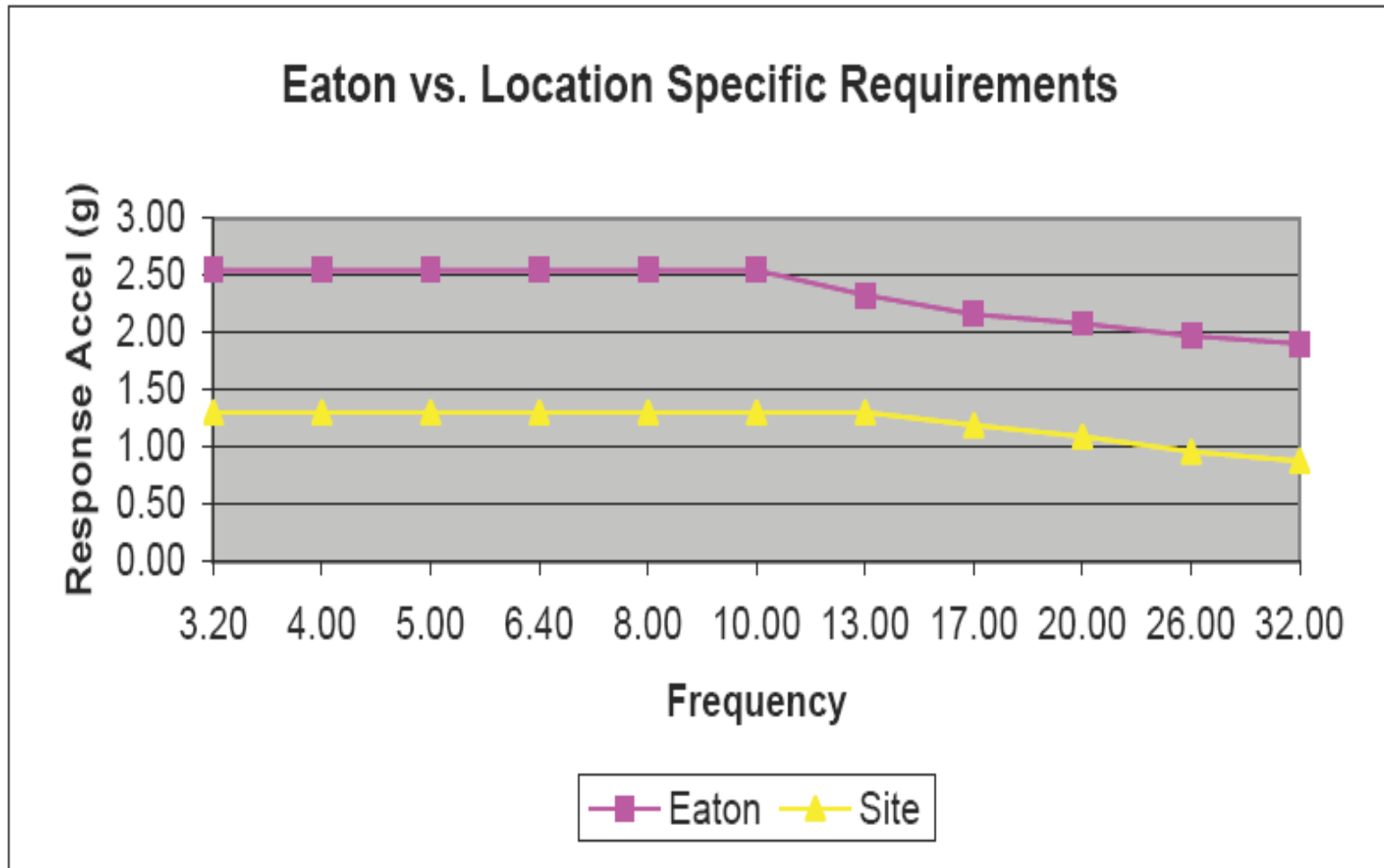
View “Spectral Data”



The Completed Specification

The equipment and major components shall be suitable for and certified **by actual seismic testing** to meet all applicable seismic requirements of the 2009 International Building Code (IBC), Site Classification **D**. The site coefficients $F_a = 1.00$, and spectral response accelerations of $S_s = 1.5g$, $S_1 = .661g$, are used. The test response spectrum shall be based upon a 5% damping factor, and a peak (S_{DS}) of at least **1.0g's** (3 -12 Hz) applied at the base of the equipment in the horizontal direction. The forces in the vertical direction shall be at least 66% of those in the horizontal direction. The tests shall cover a frequency range from 1 to 100Hz. Guidelines for the installation consistent with these requirements shall be provided by the equipment manufacturer and based upon testing of representative equipment. Equipment certification acceptance criteria shall be based upon the ability for the equipment to be returned to service immediately after a seismic event within the above requirements without the need for repairs.

The Bottom Line



For Additional Information

EATON Equipment Seismic Website

- www.eaton.com/seismic
- “Seismic Qualified” Certificates
- White Paper #SA122501SE on:
 “Earthquake Requirements and Seismic Capabilities for EATON’s Electrical Distribution and Control Equipment”
- Specification Template

