nc healthcare engineers association

District III

SEISMIC CODE REQUIREMENTS & IMPACTS IN HEALTHCARE

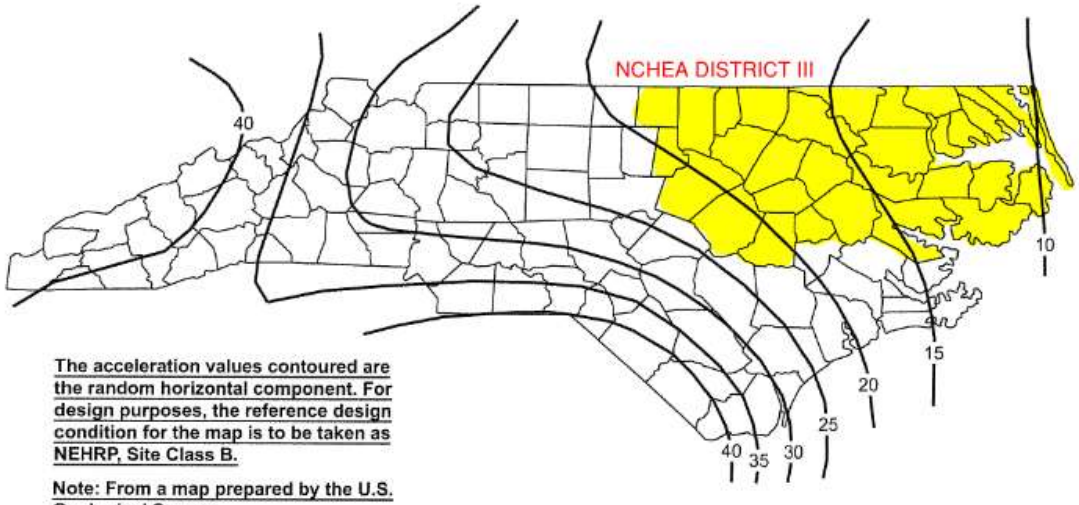
Presented by
Joe Wolhar, PE
Structural Discipline Manager
Associate Vice President
Dewberry Engineers Inc.

February 8, 2024

Dewberry

Is My Project/Building “Seismic”?

YES



The acceleration values contoured are the random horizontal component. For design purposes, the reference design condition for the map is to be taken as NEHRP, Site Class B.

Note: From a map prepared by the U.S. Geological Survey.

FIGURE 1613.1(3)
MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION FOR NORTH CAROLINA
OF 0.2 SECOND SPECTRAL RESPONSE ACCELERATION (5 PERCENT OF CRITICAL DAMPING), SITE CLASS B

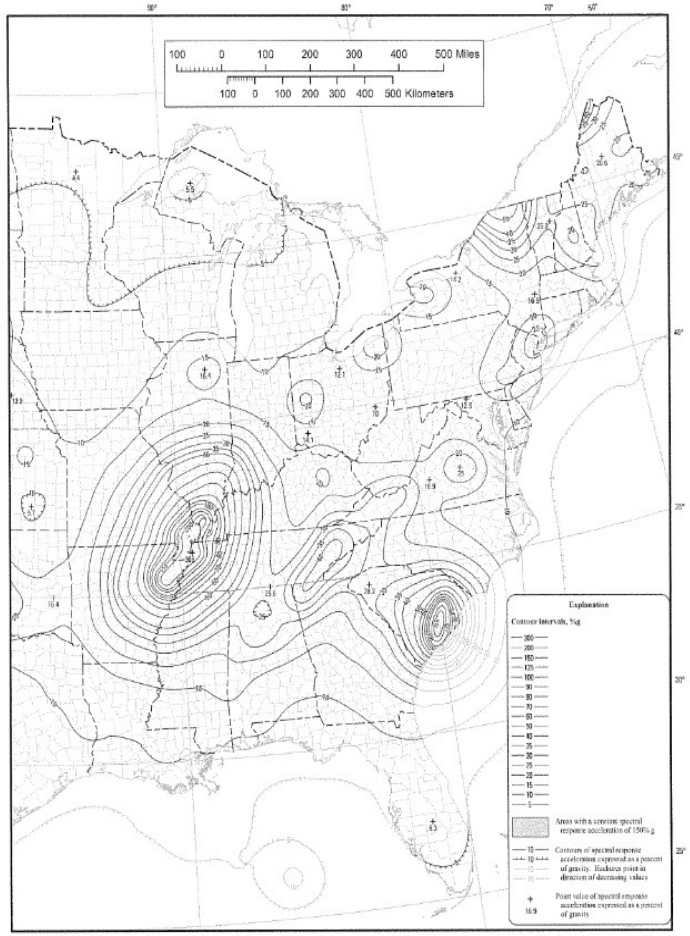


FIGURE 1613.3.1(1)—continued
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

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History of NC Code Requirements

- Seismic design was first introduced in the 1991 North Carolina State Building Code (1988 Standard Building Code)

TABLE 1206.1
OCCUPANCY IMPORTANCE FACTOR (I) AND SEISMIC HAZARD EXPOSURE GROUP

Group Type	Nature of Occupancy	I Factor
Group I	All buildings except those listed below	1.00
Group II Seismic Hazard Exposure Group II buildings are those which have a substantial public hazard due to occupancy or use, including buildings containing any one or more of the indicated uses.	1. Group A in which more than 300 people congregate in one room. 2. Group E with an occupant load greater than 250. 3. Group B used for college or adult education with an occupant load greater than 500. 4. Group I-Unrestrained with an occupant load greater than 50, not having surgery or emergency treatment facilities. 5. Group I-Restrained. 6. Power generating stations and other public utility	1.25
Group III Seismic Hazard Exposure Group III buildings are those having essential facilities which are required for post-earthquake recovery, including buildings containing any one or more of the indicated uses.	2. Group I-Unrestrained having surgery or emergency treatment facilities. 3. Earthquake emergency preparedness centers. 4. Post earthquake recovery vehicle garages. 5. Power generating stations and other utilities required as emergency back-up facilities. 6. Primary communication facilities. 7. Highly toxic materials as defined by 408.1.2 as an H4 occupancy where the quantity of the material exceeds the exempt amounts of Table 408.1.2D.	1.50

1206.1.3 Stress Increases. The requirements of this section presume that allowable stresses are increased by one-third for earthquake loadings,

Group I-Unrestrained having surgery or emergency treatment facilities

Design earthquake accelerations based on 475 year Return Period

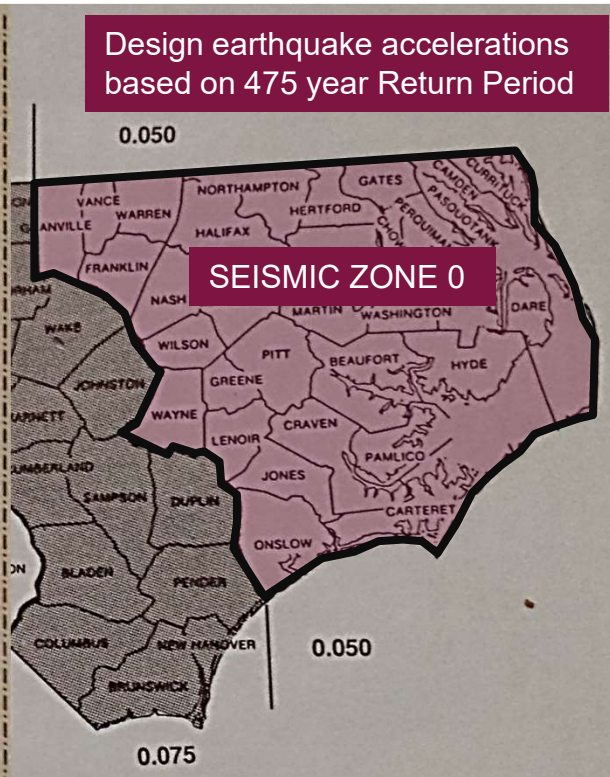
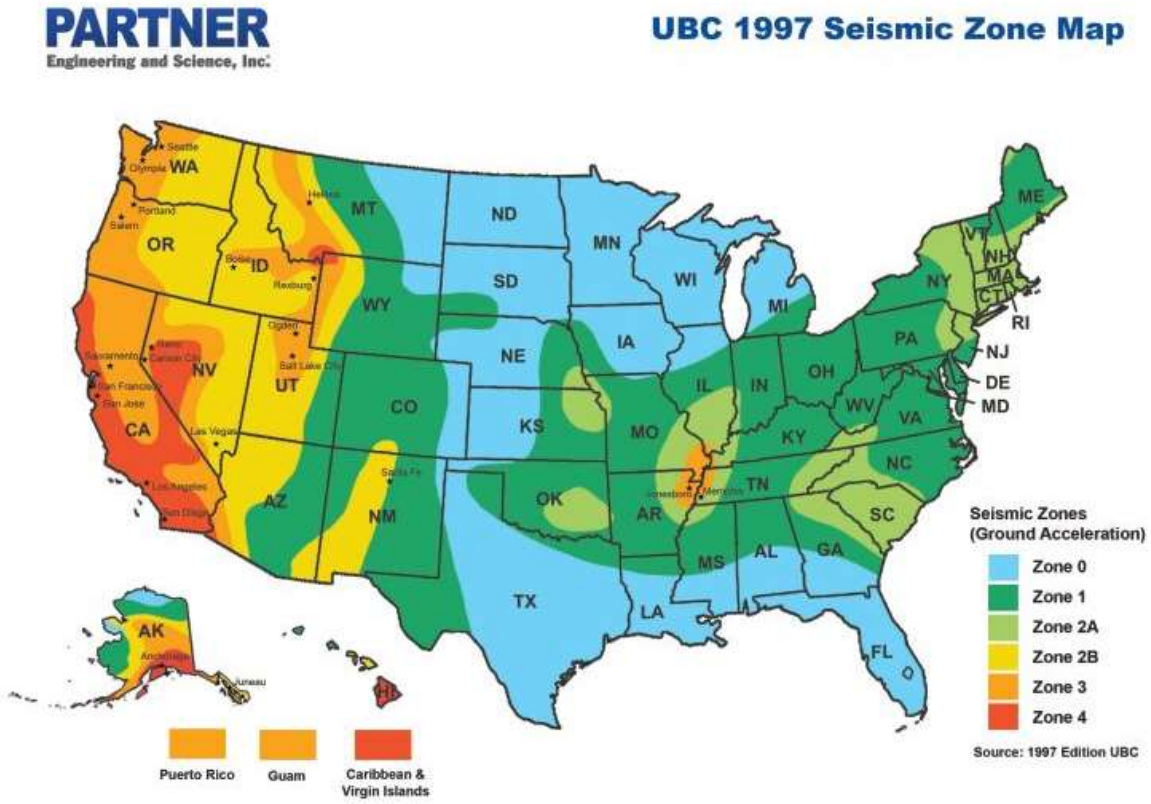


FIGURE 1206.1
MAP OF SEISMIC ZONES AND EFFECTIVE PEAK VELOCITY-RELATED ACCELERATION (A_v)

ZONE 0 = Representing places where earthquakes had never been experienced, and were deemed unlikely to occur

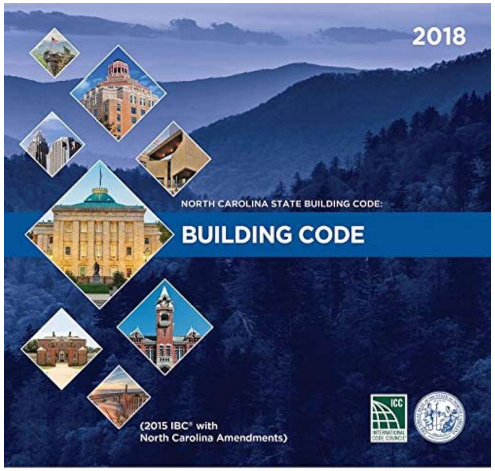
History of Seismic Requirements

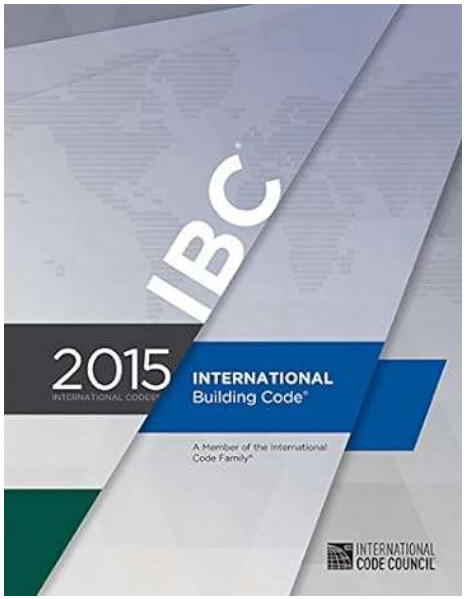


SEISMIC "ZONES" ARE NO LONGER USED IN THE CURRENT BUILDING CODES

Current Building Code Requirements

- 2018 North Carolina State Building Code
  (2015 IBC with North Carolina Amendments)



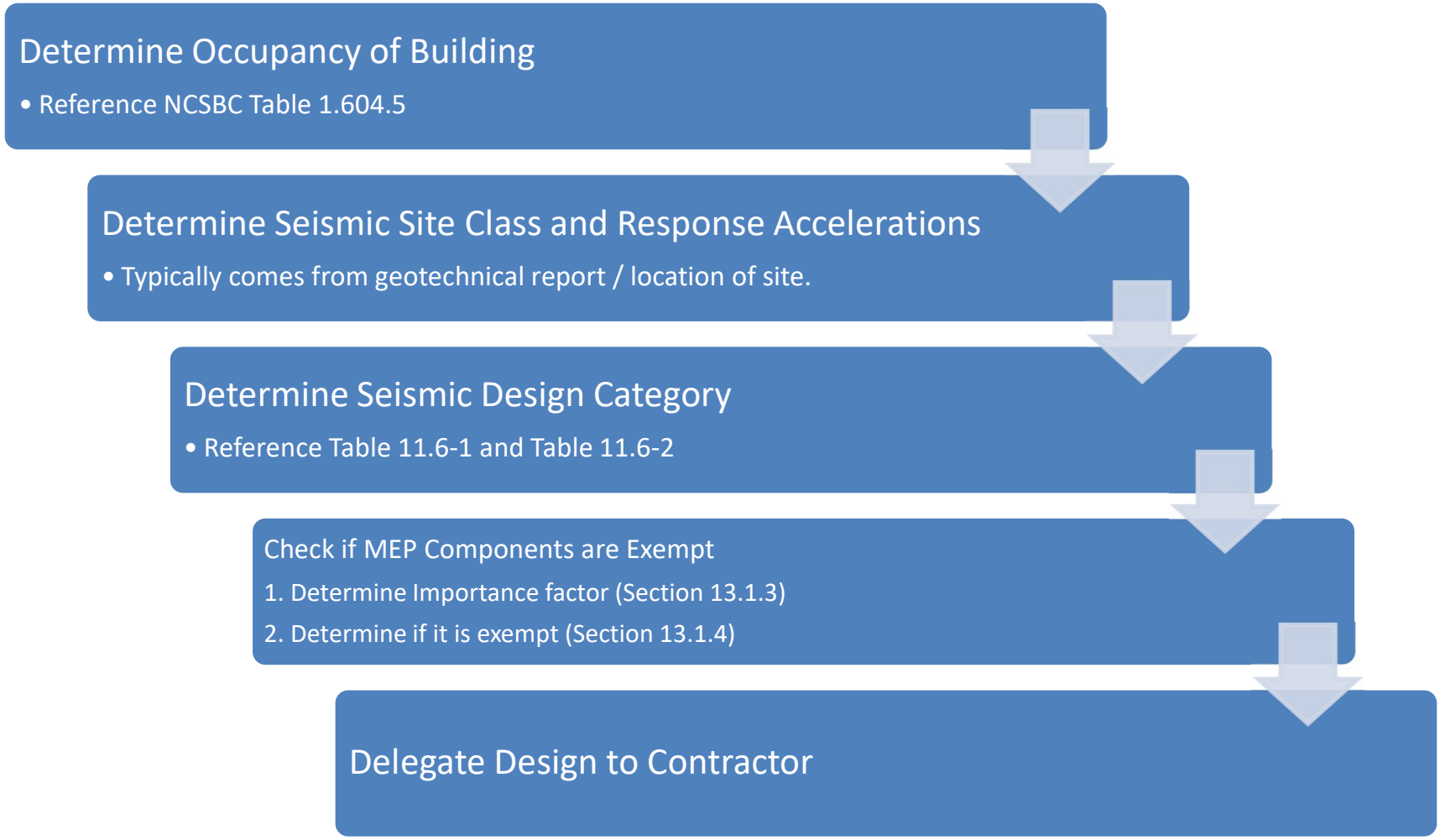


2018 NC BUILDING CODE

2015 IBC

ASCE 7-10

Current Building Code Requirements



Current Building Code Requirements

Seismic Design Criteria – Occupancy Category

Medical Office Building

Facilities that represent a substantial Hazard to Human Life in the event of Failure:
Health care facilities with a capacity of 50 or more resident patients, but not having surgery or emergency treatment facilities

Essential Facilities:
Hospitals and other health care facilities having surgery or emergency treatment facilities

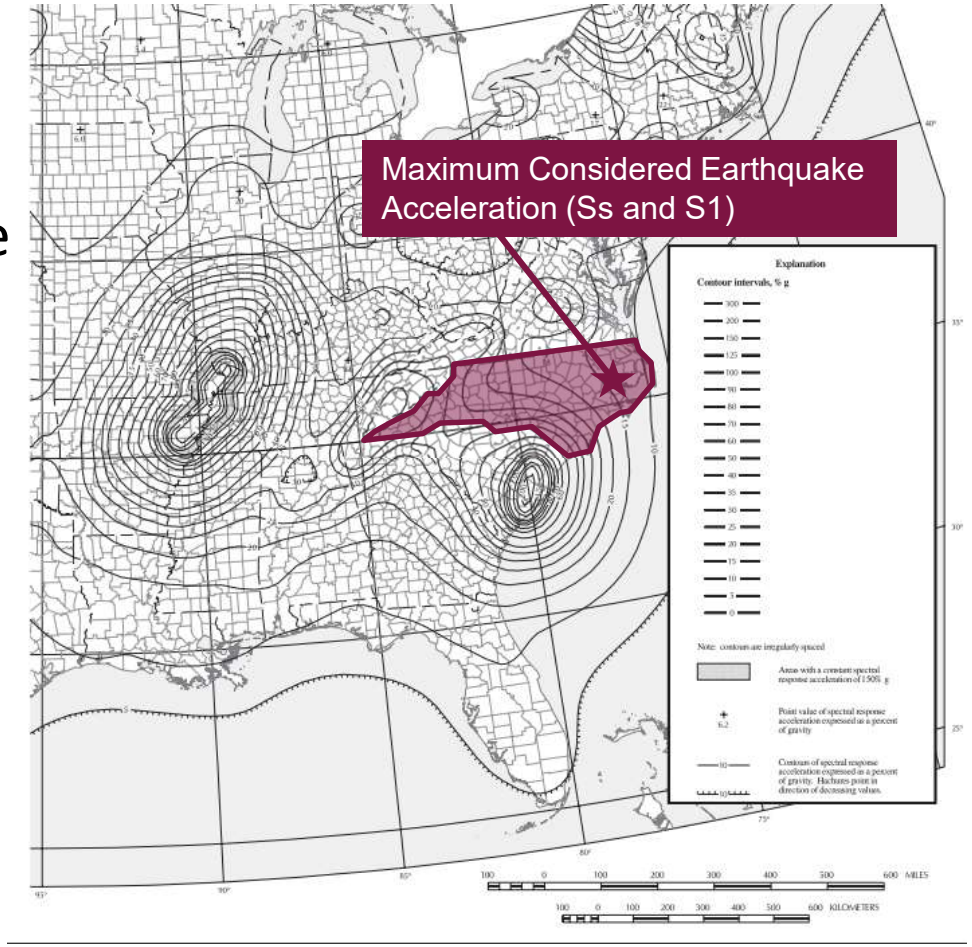
TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing Group E occupancies with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.[a] • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b]
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

Current Building Code Requirements

Seismic Design Criteria – Ground Acceleration

- Return Period Increased to 2,475 Years
- 2% Chance of Occurrence Every 50 Years
- Uniform Risk Maps
- Accelerations in 0.05g Contours
- **Maximum Considered Earthquake (MCE)**



Current Building Code Requirements

ATC Hazards by Location

Search by Address | Search by Coordinate

Rex Hospital | Search

Coordinates: 35.8180806, -78.7028387

Wind | Snow | Tornado | Seismic

Reference Document	ASCE7-10
Risk Category	IV
Site Class	D - Stiff Soil

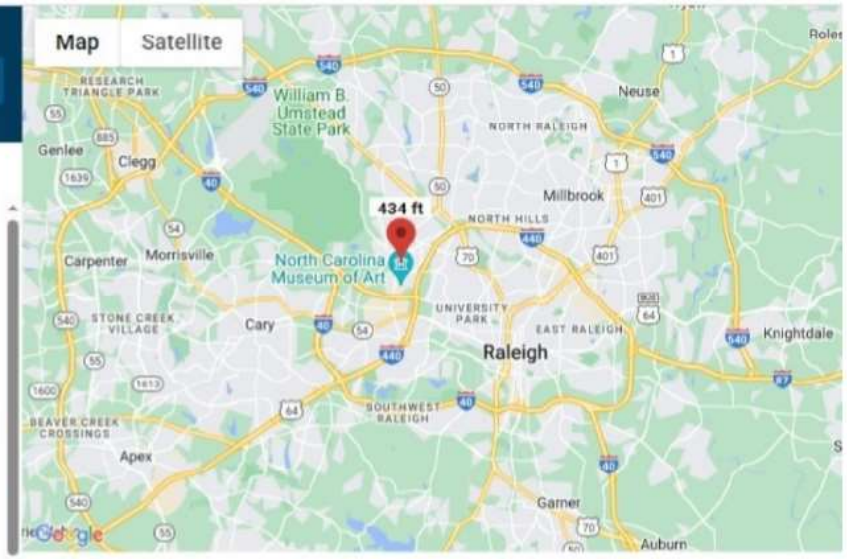
Print these results | Save these results

Basic Parameters

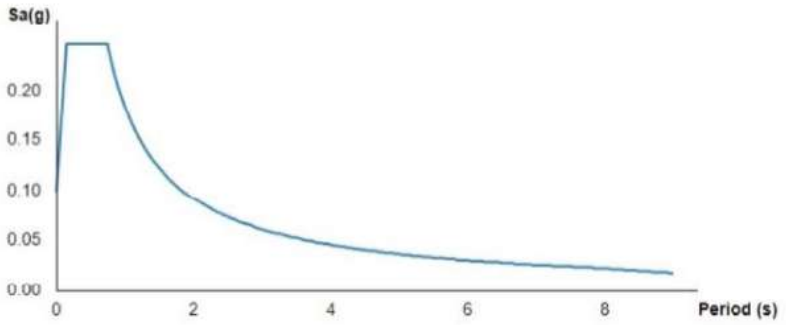
Name	Value	Description
S_S	0.154	MCE_R ground motion (period=0.2s)
S_1	0.077	MCE_R ground motion (period=1.0s)
S_{MS}	0.247	Site-modified spectral acceleration value
S_{M1}	0.184	Site-modified spectral acceleration value
S_{DS}	0.164	Numeric seismic design value at 0.2s SA
S_{D1}	0.123	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	C	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
CR_S	0.867	Coefficient of risk (0.2s)



MCER Horizontal Response Spectrum



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Current Building Code Requirements

Seismic Design Criteria – Site Class (Soil)

ASCE 7-10 TABLE 11.4-1 Site Coefficient, Fa

Site Class	Mapped Maximum Considered Earthquake Spectral Response Acceleration Parameter at Short Period				
	Ss ≤ 0.25	Ss = 0.5	Ss = 0.75	Ss = 1.0	Ss ≥ 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	Site Specific Ground Motions				

WORSE SOIL

MORE INTENSE EARTHQUAKE

ASCE 7-10 TABLE 11.4-2 Site Coefficient, Fv

Site Class	Mapped Maximum Considered Earthquake Spectral Response Acceleration Parameter at Short Period				
	S1 ≤ 0.1	S1 = 0.2	S1 = 0.3	S1 = 0.4	S1 ≥ 0.5
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	Site Specific Ground Motions				

WORSE SOIL

MORE INTENSE EARTHQUAKE

$S_{DS} = 2/3 F_a S_s = 0.164$ g

$S_{D1} = 2/3 F_v S_1 = 0.123$ g

$S_s = 0.154$ $S_1 = 0.077$
(for Raleigh, NC)

DESIGN ACCELERATIONS

Current Building Code Requirements

Seismic Design Criteria – Seismic Design Category

ASCE 7-10 TABLE 11.6-1 Short Periods

MORE INTENSE EARTHQUAKE

S_{DS}	Occupancy Category		
	I or II	III	IV
$S_{DS} < 0.167$	A	A	A
$0.167 \le S_{DS} < 0.33$	B	B	C
$0.33 \le S_{DS} < 0.50$	C	C	D
$0.50 \le S_{DS}$	D	D	D

MORE DESIGN REQUIREMENTS

From Example: $S_{DS} = 0.164$

ASCE 7-10 TABLE 11.6-2 Long Periods

MORE INTENSE EARTHQUAKE

S_{D1}	Occupancy Category		
	I or II	III	IV
$S_{D1} < 0.067$	A	A	A
$0.067 \le S_{D1} < 0.133$	B	B	C
$0.133 \le S_{D1} < 0.20$	C	C	D
$0.20 \le S_{D1}$	D	D	D

MORE DESIGN REQUIREMENTS

From Example: $S_{D1} = 0.123$

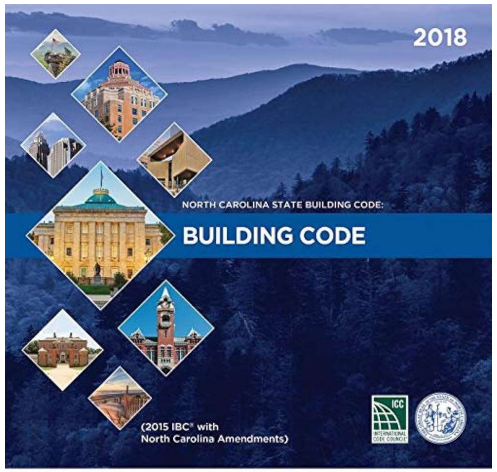
The most restrictive Seismic Design Category shall be used (some exceptions)

In our example, SDC = C

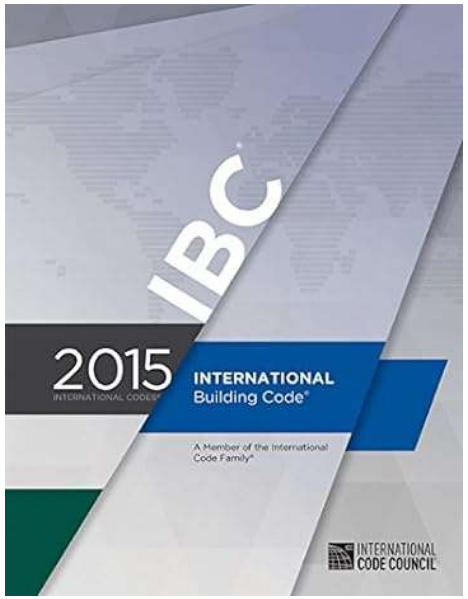
SDC = C is typical for Risk Category IV Hospitals in District III
Unless Soil Conditions are Very Poor (Liquefaction) or Very Good (Rock)

Current Building Code Requirements

Seismic Design Criteria – Nonstructural Components



2018 NC BUILDING CODE



2015 IBC

ASCE 7-10

SECTION 1613 EARTHQUAKE LOADS

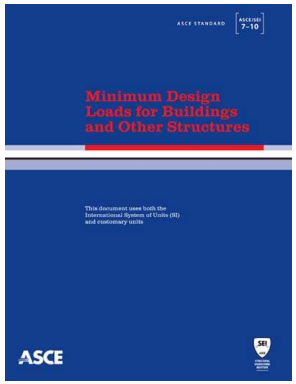
SECTION 1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to the structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with ASCE 7.

CHAPTER 13 - SEISMIC DESIGN REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS

Current Building Code Requirements

Seismic Design Criteria – Nonstructural Components

CHAPTER 13 SEISMIC DESIGN REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS



ASCE 7-10

13.1.3 Component Importance Factor

All components shall be assigned a component importance factor as indicated in this section. The component importance factor, Ip, shall be taken as 1.5 if any of the following apply:

1. The component is required to function for **life-safety** purposes after an earthquake, including **fire protection sprinkler systems** and egress stairways
2. The component conveys, supports or otherwise contains toxic, highly toxic, or explosive substances where the quantity of the material exceeds a threshold quantity established by the AHJ and is sufficient to pose a threat to the public if released.
3. The component is in or attached to an **Occupancy Category IV** structure and **it is needed for the continued operation of the facility, or its failure could impair the continued operation of the facility.**
4. The component conveys, supports, or otherwise contains hazardous substances and is attached to a structure or portion thereof classified by the AHJ as a hazardous occupancy.

All other components shall be assigned an importance factor, Ip, equal to 1.0

Current Building Code Requirements

Seismic Design Criteria – Nonstructural Components

ASCE 7-10

CHAPTER 13 SEISMIC DESIGN REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS

13.1.4 Exemptions

The following nonstructural components are exempt from the requirements of this section:

1. Mechanical and electrical components in SDC B.
2. Mechanical and electrical components in SDC C provided that Ip is equal to 1.0.
3. Mechanical and electrical components in SDC C D, E, and F where all of the following apply:
   a. The component importance Factor, Ip is equal to 1.0
   b. The component is positively connected to the structure.
   c. Flexible connections are provided between the component and associated ductwork, piping, and conduit; and either.
      i. The component weights 400 lb or less and has a center of mass located 4 ft or less above the adjacent floor level; or floor level and weigh 400 lb or less.
      ii. The component weighs 20 lb or less or, in the case of distributed systems, 5 lb/ft or less.

Current Building Code Requirements

Seismic Design Criteria – Nonstructural Components

ASCE 7-10

CHAPTER 13 SEISMIC DESIGN REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS

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. The requirements shall be satisfied by one of the following methods:

1. Project-specific design and documentation submitted for approval to the authority having jurisdiction after **review and acceptance a registered design professional.**
2. Submittal of the **manufacturer's certification** that the component is seismically qualified by:
   a. Analysis
   b. Testing
   c. Experience Data

Current Building Code Requirements

Seismic Design Criteria – Nonstructural Components

ASCE 7-10

CHAPTER 13 SEISMIC DESIGN REQUIREMENTS FOR NONSTRUCTURAL COMPONENTS

13.2.2 Special Certification Requirements for Designated Seismic Systems

Certifications shall be provided for designated seismic systems assigned to Seismic Design Categories C through F as follows:

1. Active mechanical and electrical equipment **that must remain operable following the design earthquake ground motion** shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of the approved shake table testing…. Unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components. Evidence demonstrating compliance of this requirement shall be submitted for approval to the authority having jurisdiction after review and acceptance by the registered design professional.
2. Components with hazardous contents and assigned a component importance factor (Ip) shall be certified by the manufacturer as maintaining containment following the design earthquake by (1) analysis, (2) approved shake table testing, (3) experience data. Evidence demonstrating compliance of this requirement shall be submitted for approval to the authority having jurisdiction after review and acceptance by the registered design professional.

Current Building Code Requirements

Delegated Design

SECTION 230548 – HVAC SEISMIC AND WIND VIBRATION CONTOLS

Engineer of Record Provides Relevant Seismic Design Criteria Based on the Project Location, Importance Factor and type of soil at project site (Seismic Site Classification)

2.2. PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D
2. Seismic Design Category as Defined in the IBC: C
   a. Component Importance Factor: 1.5
   b. Component Response Modification Factor: Per ASCE 7
   c. Component Amplification Factor: Per ASCE 7
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.211 %g
4. Design Spectral Response Acceleration at 1.0-Second Period: 0.123 %g
5. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they are subjected.

B. Seismic Performance: HVAC equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI-7. The term "withstand" means the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

Current Building Code Requirements

Delegated Design

Engineer of Record Delegates Structural Design to Manufacturer's Engineer

1.2. ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation and seismic restraint device required.

B. Delegated-Design Submittal: For each vibration isolation and seismic restraint device:

1. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces required to select vibration isolators and seismic and for designing vibration isolation bases.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system was examined for excessive stress and that none exists.

4. Seismic Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

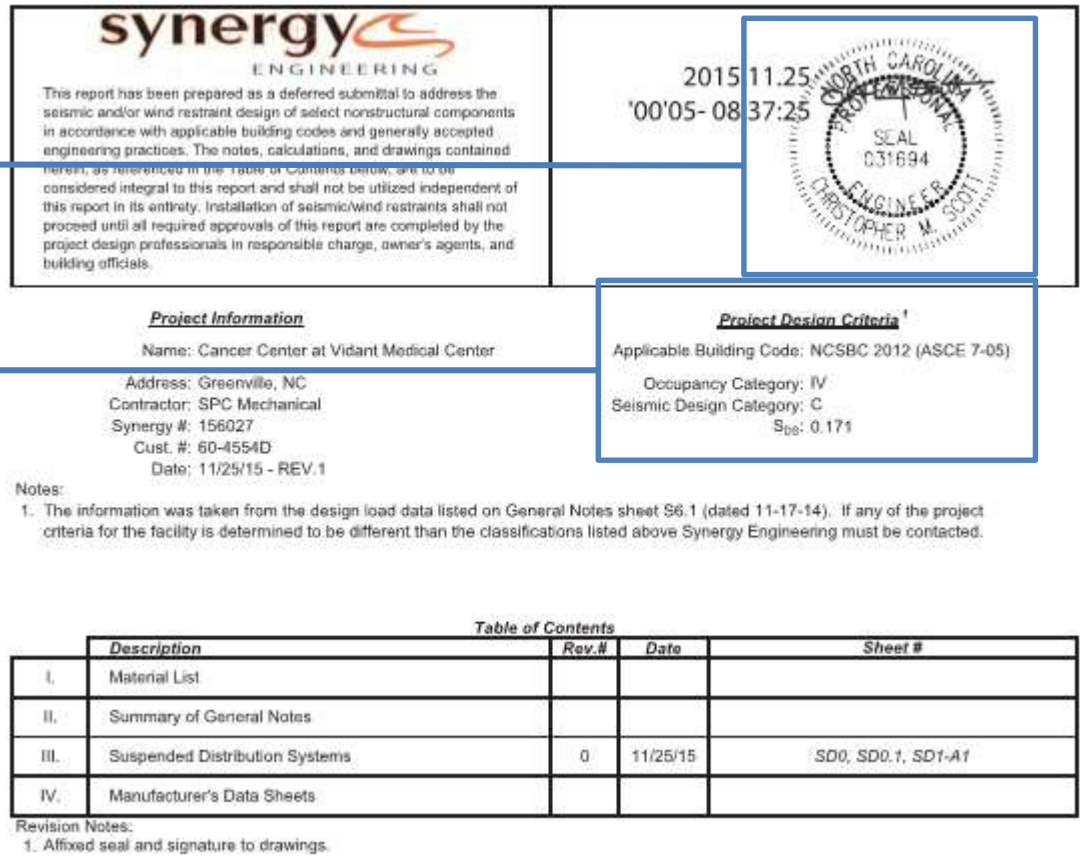
Current Building Code Requirements

Delegated Design

A Hospital Project Example

Contractor's Structural Engineer Takes Responsibility for Design of Seismic Restraints for Nonstructural Components

Contractor's Structural Engineer Reflects Back Design Criteria



synergy ENGINEERING

This report has been prepared as a deferred submittal to address the seismic and/or wind restraint design of select nonstructural components in accordance with applicable building codes and generally accepted engineering practices. The notes, calculations, and drawings contained herein, as referenced in the Table of Contents below, are to be considered integral to this report and shall not be utilized independent of this report in its entirety. Installation of seismic/wind restraints shall not proceed until all required approvals of this report are completed by the project design professionals in responsible charge, owner's agents, and building officials.

2015.11.25 '00'05- 08:37:25

NORTH CAROLINA PROFESSIONAL SEAL 031694 ENGINEER CHRISTOPHER M. SCOTT

Project Information

Name: Cancer Center at Vidant Medical Center
Address: Greenville, NC
Contractor: SPC Mechanical
Synergy #: 156027
Cust. #: 60-4554D
Date: 11/25/15 - REV.1

Project Design Criteria[1]

Applicable Building Code: NCSBC 2012 (ASCE 7-05)
Occupancy Category: IV
Seismic Design Category: C
S_{DS}: 0.171

Notes:
1. The information was taken from the design load data listed on General Notes sheet S6.1 (dated 11-17-14). If any of the project criteria for the facility is determined to be different than the classifications listed above Synergy Engineering must be contacted.

Table of Contents

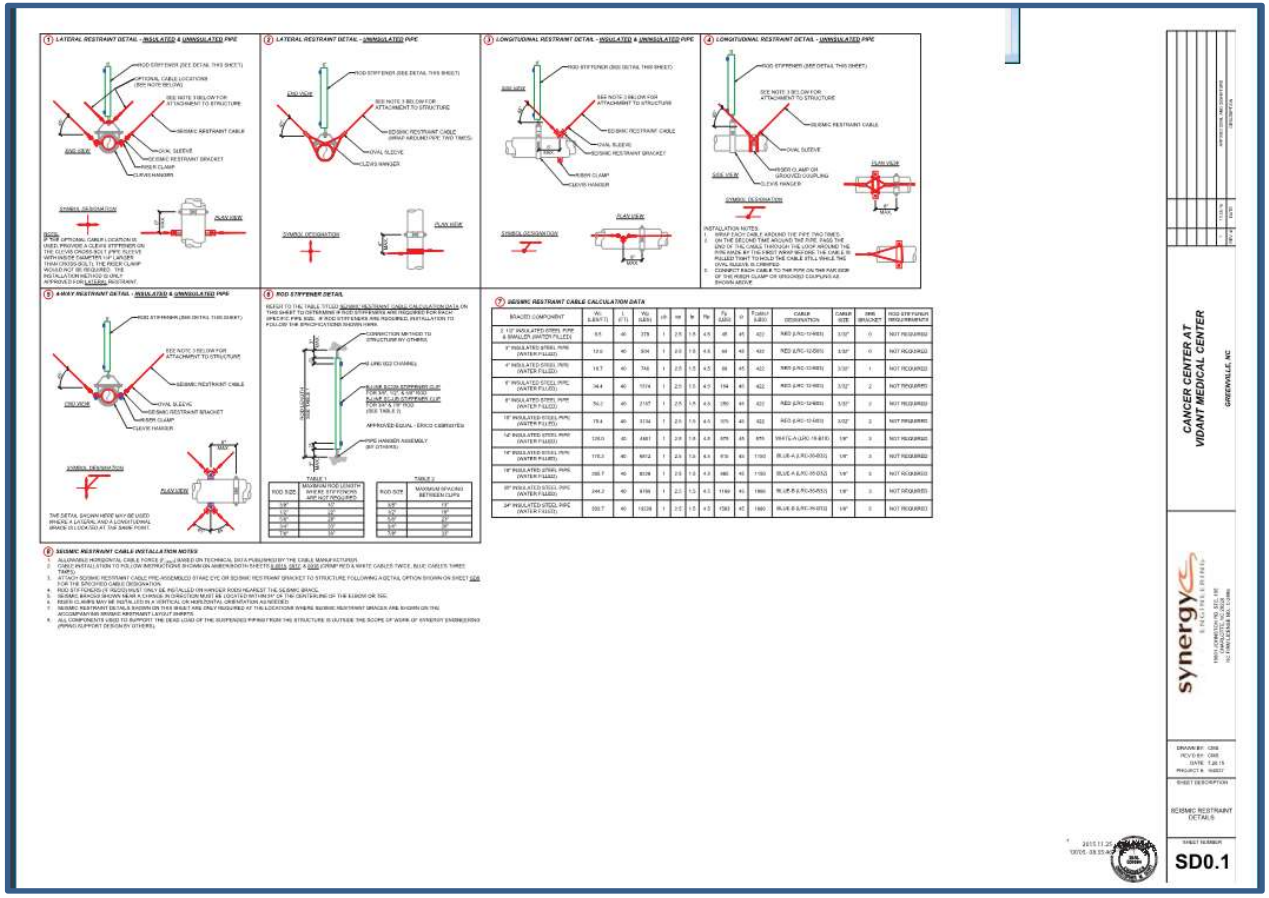
	Description	Rev.#	Date	Sheet #
I.	Material List			
II.	Summary of General Notes			
III.	Suspended Distribution Systems	0	11/25/15	SD0, SD0.1, SD1-A1
IV.	Manufacturer's Data Sheets			

Revision Notes:
1. Affixed seal and signature to drawings.

Current Building Code Requirements

Delegated Design

Contractor's Structural Engineer Design Drawings, Details, and Manufacturer's Cut Sheets for Seismic Restraints



Current Building Code Requirements

What About Existing Buildings?

2018 North Carolina State Building Code: Existing Building Code

Addition is Structurally Independent

- Addition shall be designed and constructed with requirements for new structures. Typically, there would be a structural expansion joint between addition and existing building.

Alterations to an Existing Building

- Alterations shall conform to the current requirement for new structures.
- Alterations that increase seismic forces by 10% in any structural element or decrease design strength of any element to resist seismic forces by more than 10% shall not be permitted unless entire structure is determined to conform to current building code seismic requirements

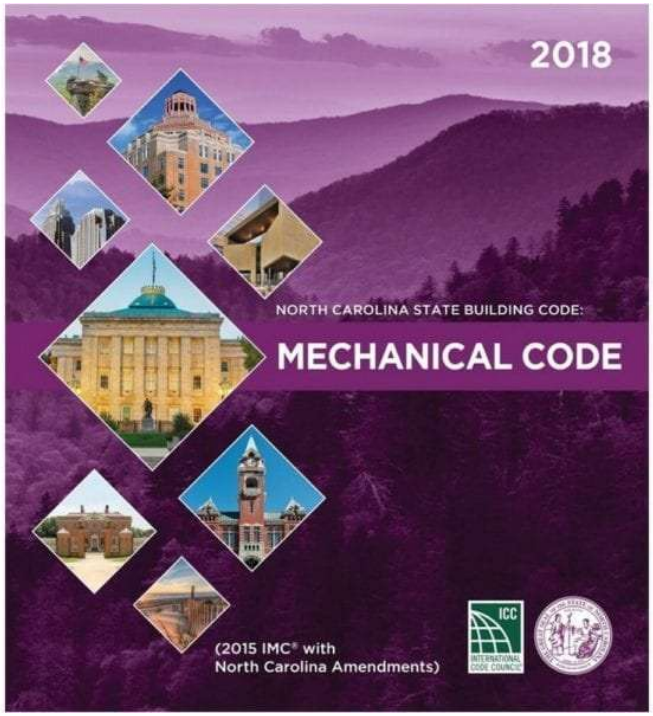
Addition Not Structurally Independent

- Shall be designed and constructed such that the entire structure conforms to the seismic-force-resistance unless the following criteria are met
  - The addition conforms to requirements of new structure
  - The addition does not increase seismic forces in any existing structural element by more than 10%
  - The addition does not decrease seismic resistance of any structural element by more than 10%

Current Building Code Requirements

What About Existing Buildings?

2018 NCSBC Mechanical Code



102.4 Additions, alterations, and repairs

Additions, alterations, renovations or repairs to a mechanical system shall conform to that required for a new mechanical system without requiring the existing mechanical system to comply with all of the requirements of this code.

102.9 Requirements not covered by this code.

Requirements necessary for the strength, stability or proper operation of an existing or proposed mechanical system, or for the public safety, health and general welfare, not specifically covered by this code, shall be determined by the code official.

Why Brace Non-Structural Components?

Areas of Louisa County High School in Louisa, Virginia constructed before seismic design was part of the building code.

"*The building was not designed for an earthquake, so why would we seismically brace the MEP components*?"

Why Brace Non-Structural Components?

- 2011 Virginia Earthquake – 5.8 on the Richter Scale
- Epicenter was about 5 miles from Louisa County High School

Outer Banks Hospital Project (2000)

Outer Banks Hospital Project (2000)

1997 Standard Building Code and the 1994 Standard Building Code with North Carolina Amendments Including 1996/1997/1998/1999 Revisions

5. SEISMIC LOAD:

DESIGN SEISMIC LOADS:

Av = 0.05, Aa = 0.05

SITE COEFFICIENT S = 1.2

SEISMIC HAZARD EXPOSURE GROUP III, ESSENTIAL FACILITIES

STRUCTURAL FRAME TYPE: ORDINARY MOMENT RESISTING FRAME

RESPONSE MODIFICATION FACTOR, R = 4.5

DEFLECTION AMPLIFICATION FACTOR, Cd = 4

SEISMIC PERFORMANCE CATEGORY 'A'

BASE SHEARS: Vx = 338 KIPS
Vy = 320 KIPS

3

Table 1607.1.8
Seismic Performance Categories

Effective Peak Velocity-Related Acceleration, A_v	Seismic Hazard Exposure Group I	II	III
$A_v = 0.05$	A	A	A
$0.05 < A_v < 0.10$	B	B	C
$0.10 \leq A_v < 0.15$	C	C	C
$0.15 \leq A_v < 0.20$	C	D	D
$0.20 \leq A_v$	D	D	E

1999 NCBC

Outer Banks Hospital Project (2000)

1997 Standard Building Code and the 1994 Standard Building Code with North Carolina Amendments Including 1996/1997/1998/1999 Revisions

1607.6 Architectural, Mechanical and Electrical Components and Systems

All components and systems in buildings shall be designed and constructed to resist seismic forces determined in accordance with this section.

EXCEPTIONS:

1. Architectural components in buildings assigned to Seismic Performance Category A are exempt from the requirements of this section.
2. Mechanical and electrical components and systems in buildings assigned to Seismic Performance Category A or B are exempt from the requirements of this section.
3. Architectural, mechanical and electrical components and systems in buildings assigned to Seismic Performance Category B or C, are in Seismic Hazard Exposure Group I buildings, and have a Performance Criteria Factor of 0.5, are exempt from the requirements of this section.
4. Elevator components and systems in buildings assigned to Seismic Performance Category A or B are exempt from the requirements of this section. Elevator components and systems in buildings assigned to Seismic Performance Category C, and are in Seismic Hazard Exposure Group I buildings, are exempt from the requirements of this section.

1999 NCBC

Table 1607.1.8
Seismic Performance Categories

Effective Peak Velocity-Related Acceleration, A_v	Seismic Hazard Exposure Group I	II	III
$A_v = 0.05$	A	A	A
$0.05 < A_v < 0.10$	B	B	C
$0.10 \leq A_v < 0.15$	C	C	C
$0.15 \leq A_v < 0.20$	C	D	D
$0.20 \leq A_v$	D	D	E

1999 NCBC

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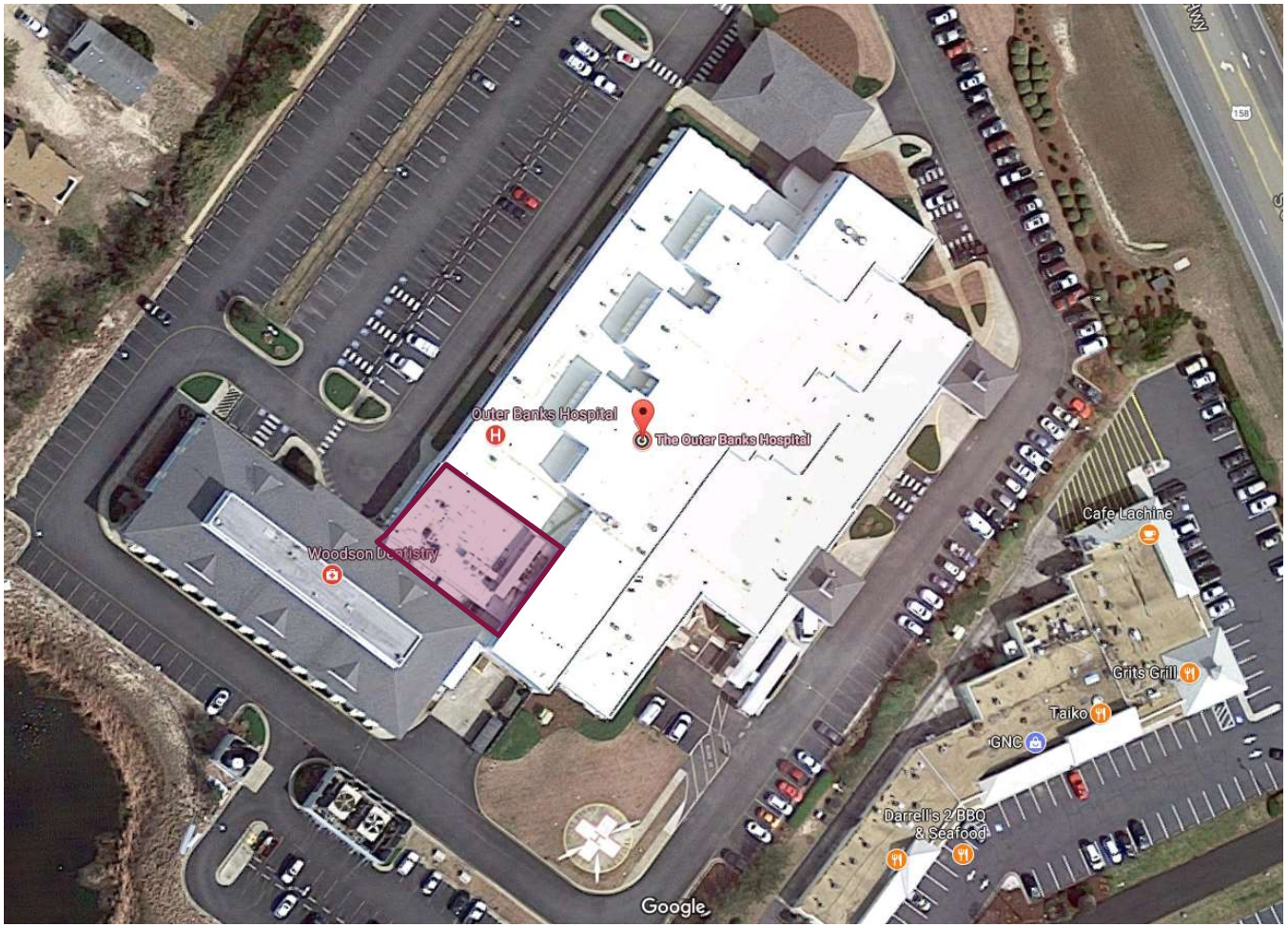
Outer Banks Hospital Project (2014)



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Outer Banks Hospital Project (2014)

2012 NCBC

F. SEISMIC DESIGN DATA:

SEISMIC OCCUPANCY CATEGORY	IV
SEISMIC IMPORTANCE FACTOR (I_E)	1.5
SPECTRAL RESPONSE ACCELERATION, S_S	0.095
SPECTRAL RESPONSE ACCELERATION, S_1	0.045
SPECTRAL RESPONSE COEFF. S_{DS}	0.101
SPECTRAL RESPONSE COEFF. S_{D1}	0.071
SITE CLASS (ASSUMED)	D
SEISMIC DESIGN CATEGORY	C
RESPONSE MODIFICATION FACTOR, R	
SURGERY ADDITION	3.5
MRI CANOPY	1.25
SEISMIC RESPONSE COEFF. Cs	
SURGERY ADDITION	0.043
MRI CANOPY	0.122
SEISMIC-FORCE-RESISTING SYSTEM	
SURGERY ADDITION	ORDINARY STEEL MOMENT FRAMES
MRI CANOPY	CANTILEVERED COLUMN SYSTEM
ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE

Mechanical and Electrical Components Not Exempt

G. SYSTEMS AND COMPONENTS REQUIRING SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE:
SEE STATEMENT OF SPECIAL INSPECTIONS ON SHEET S0.2.

Special Inspections and Seismic

What are Special Inspections?

NCSBC CHAPTER 17

1704.1 General. Special inspections and tests, statements of special inspections, responsibilities of contractors, submittals to the *building official* and structural observations shall meet the applicable requirements of this section.

Where application is made for construction as described in this section, the owner shall employ one or more special inspectors to provide inspections during construction on the types of work listed in accordance with Section 1705.1. These inspections are in addition to the inspections specified in the *North Carolina Administrative Code and Policies.*

OWNER TO CONTRACT NOT THE CONTRACTOR, AS THIS COULD BE A CONFLICT OF INTEREST

Special Inspections and Seismic

When are they required in North Carolina?

NCBSC 1705.1.2 Specific elements always requiring Special Inspections and NCBSC Section 1705.1.3 Structures requiring Special Inspections:

1. *Buildings or other structures listed in Table 1604.5 in Occupancy Category II if:*
   a. *Building height exceeds 45 feet or three stories, or*
   b. *The building is an Underground buildings per 405.1*
2. *Buildings or other structures listed in table 1604.5 in categories III or IV*
3. *Piles, piers and special foundations*
4. *Retaining walls or mechanically stabilized earth walls exceeding 5 feet height with a horizontal distance of 50 feet or less per 1806.2*
5. *Smoke control and smoke exhaust systems*
6. *Sprayed fire-resistant materials, or*
7. *Special case described in 1704.13*
8. *Retaining or mechanically stabilized earth walls exceeding 5 feet in height on a site require permits and special inspections by the engineer of record and the owner shall reserve funds for same in the project budget or engage an independent firm at their expense*

Exceptions:

1. *Special inspections* and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as *approved* by the *building official.*

Special Inspections and Seismic

Aren't Special Inspections Just for Structural Elements?

No

1705.12.6 Plumbing, mechanical and electrical components. *Periodic special inspection* of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to *Seismic Design Category* C, D, E or F.
2. Anchorage of other electrical equipment in structures assigned to *Seismic Design Category* E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to *Seismic Design Category* C, D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to *Seismic Design Category* C, D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to *Seismic Design Category* C, D, E or F where the *approved construction documents* require a nominal clearance of $^{1}/_{4}$ inch (6.4 mm) or less between the equipment support frame and restraint.

Special Inspections and Seismic

Who is Responsible for Requiring Them?

Registered Design Professional

2018 NCBSC

1705.13.2 Nonstructural components. For structures assigned to *Seismic Design Category* B, C, D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by seismic qualification as specified in Item 2 therein, the *registered design professional* shall specify on the *approved construction documents* the requirements for seismic qualification by analysis, testing or experience data. *Certificates of compliance* for the seismic qualification shall be submitted to the *building official* as specified in Section 1704.5.

1705.13.3 Designated seismic systems. For structures assigned to *Seismic Design Category* C, D, E or F and with *designated seismic systems* that are subject to the requirements of Section 13.2.2 of ASCE 7 for certification, the *registered design professional* shall specify on the *approved construction documents* the requirements to be met by analysis, testing or experience data as specified therein. *Certificates of compliance* documenting that the requirements are met shall be submitted to the *building official* as specified in Section 1704.5.

ASCE 7-10

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:

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 at least one of the following:
   a. Analysis, or
   b. Testing in accordance with the alternative set forth in Section 13.2.5, or
   c. Experience data in accordance with the alternative set forth in Section 13.2.6.

13.2.2 Special Certification Requirements for Designated Seismic Systems. Certifications shall be provided for designated seismic systems assigned to Seismic Design Categories C through F as follows:

1. Active mechanical and electrical equipment that must remain operable following the design earthquake ground motion shall be certified by the manufacturer as operable whereby active parts or energized components shall be certified exclusively on the basis of approved shake table testing in accordance with Section 13.2.5 or experience data in accordance with Section 13.2.6 unless it can be shown that the component is inherently rugged by comparison with similar seismically qualified components. Evidence demonstrating compliance with this requirement shall be submitted for approval to the authority having jurisdiction after review and acceptance by a registered design professional.
2. Components with hazardous substances and assigned a component importance factor, I_p, of 1.5 in accordance with Section 13.1.3 shall be certified by the manufacturer as maintaining containment following the design earthquake ground motion by (1) analysis, (2) approved shake table testing in accordance with Section 13.2.5, or (3) experience data in accordance with Section 13.2.6. Evidence demonstrating compliance with this requirement shall be submitted for approval to the authority having jurisdiction after review and acceptance by a registered design professional.

Questions?

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Thank you!

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