ICC SPRING INTERCHANGE

2021 IBC Performing Structural Plan Reviews

Based on the 2021 International Building Code,® IBC®

1

To successfully perform a structural plan review of a simple- to moderate-sized commercial project.

2

Objectives

1. Perform hazard review.
2. Perform construction document review.
3. Perform calculations/ specifications review.
4. Perform component and materials review.

3

Tips

Guide to a successful class:

- Slides contain some text and iconic images to help you learn.
- Text and commentary is in the workbook.
- Use your workbook and code book.
- Ask Questions, ask questions, and ASK QUESTIONS!!!!

2021 IBC Performing Structural Plan Reviews

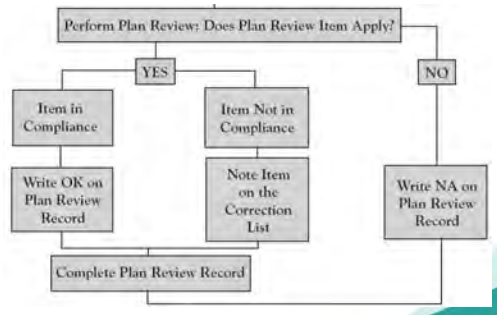
4

Course Icons

2021 IBC Performing Structural Plan Reviews

5

Plan Review Process



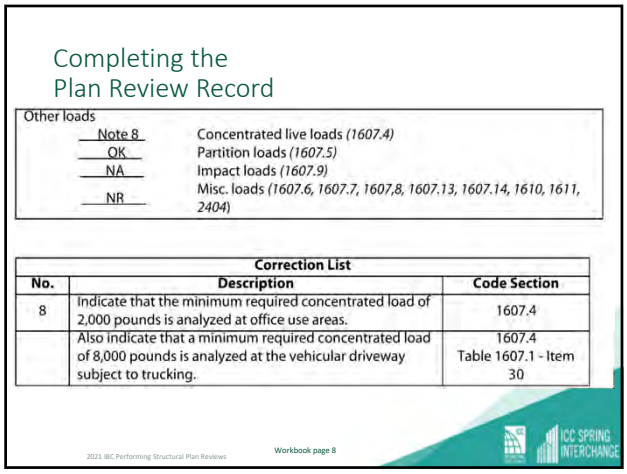
Workbook page 5

2021 IBC Performing Structural Plan Reviews

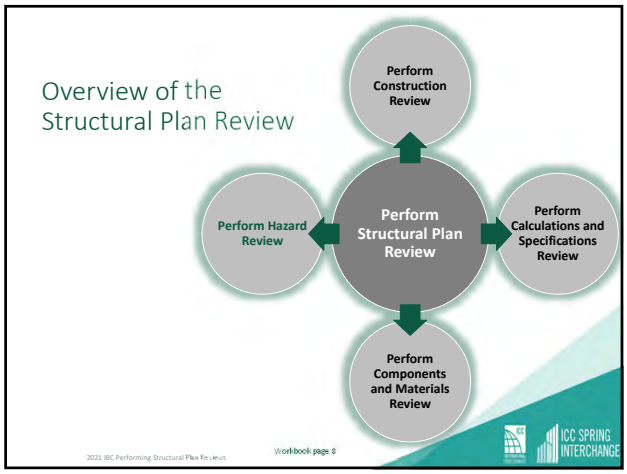
6


2021 INTERNATIONAL
BUILDING CODE®
PLAN REVIEW RECORD
JURISDICTION:
BUILDING LOCATION:
BUILDING DESCRIPTION:
REVIEWED BY:
CORRECTIONS LIST
No.
DESCRIPTION
Code Section
2021 IBC Performing Structural Plan Reviews
Workbook page 6
ICC SPRING INTERCHANGE

7


Completing the Plan Review Record
Other loads
Note 8
OK
NA
NR
Concentrated live loads (1607.4)
Partition loads (1607.5)
Impact loads (1607.9)
Misc. loads (1607.6, 1607.7, 1607,8, 1607.13, 1607.14, 1610, 1611, 2404)
Correction List
No.
Description
Code Section
8
Indicate that the minimum required concentrated load of 2,000 pounds is analyzed at office use areas.
1607.4
Also indicate that a minimum required concentrated load of 8,000 pounds is analyzed at the vehicular driveway subject to trucking.
1607.4 Table 1607.1 - Item 30
2021 IBC Performing Structural Plan Reviews
Workbook page 8
ICC SPRING INTERCHANGE

8


Overview of the Structural Plan Review
Perform Construction Review
Perform Hazard Review
Perform Structural Plan Review
Perform Calculations and Specifications Review
Perform Components and Materials Review
2021 IBC Performing Structural Plan Reviews
Workbook page 8
ICC SPRING INTERCHANGE

9

Importance

The main goal of all plan reviews is to ensure the **life safety** of the public:

- Fire
- Egress
- **Structural**

Workbook page 9

10

Course Limitations

1. The course provides a simplified approach to structural plan reviews.
2. This course does not address existing buildings.
3. This course will not cover conventional residential construction.
4. This course does not cover performance-based design.

Workbook page 9-10

11

INTRODUCTION:

About Structural Loads

12

12

Dead Loads

Roof Dead Load	Floor Dead Load
Framing Members = 3.0psf	Framing Members = 2.5psf
1/2" Sheathing = 1.5psf	3/4" Sheathing = 2.5psf
2 Layers Asphalt Shingles = 3.0psf	2" Lightweight Concrete = 16psf
12" Insulation = 3.6psf	Carpet & Pad = 1.0psf
5/8" Gypsum = 2.8psf	5/8" Gypsum = 2.8psf
Lights/Misc. = 1.2psf	Lights/Misc. = 1.2psf
Total Roof DL = 15.0psf	**Total Floor DL = 26.0psf**

Workbook page 12

13

Live Loads

REFER TO CODE BOOK

2021 IBC
Table 1607.1
Pages 16-8 to 16-10

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE			UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION
1.	Apartments (see residential)		—	—	—
2.	Access floor systems	Office use	50	2,000	—
		Computer use	100	2,000	—
3.	Armories and drill rooms		150[a]	—	—
4.	Assembly areas	Fixed seats (fastened to floor)	60[a]	—	—
		Follow spot, projections and control rooms	50		
		Lobbies	100[a]		
		Movable seats	100[a]		
		Stage floors	150[a]		
		Platforms (assembly)	100[a]		
		Bleachers, folding and telescopic seating and grandstands	100[a] (See Section 1607.19)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60[a] (See Section 1607.19)		
		Other assembly areas	100[a]		

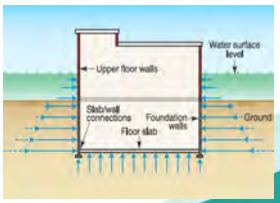
Workbook page 13-14

14

Other Loads

- Snow Loads

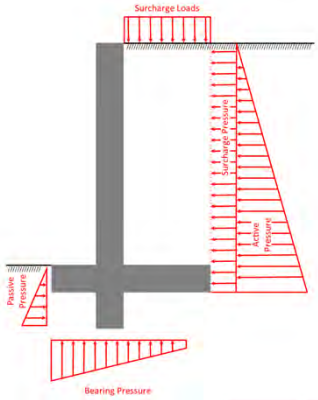
- Flood Loads



Workbook page 15

15

Soil Loads



2021 IBC Performing Structural Plan Reviews

Workbook page 15-17

ICC SPRING INTERCHANGE

16

Rain and Ice Loads

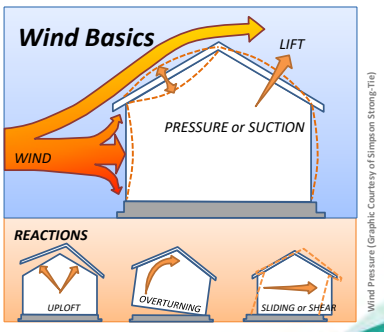
2021 IBC Performing Structural Plan Reviews

Workbook page 17

ICC SPRING INTERCHANGE

17

Wind Loads



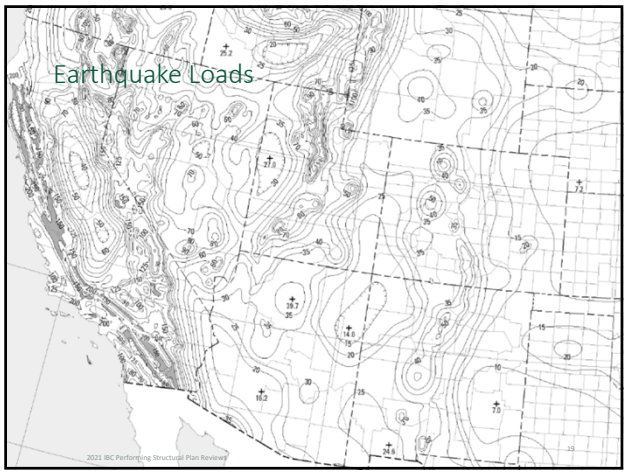
Wind Pressure (Graphic Courtesy of Simpson Strong-Tie)

2021 IBC Performing Structural Plan Reviews

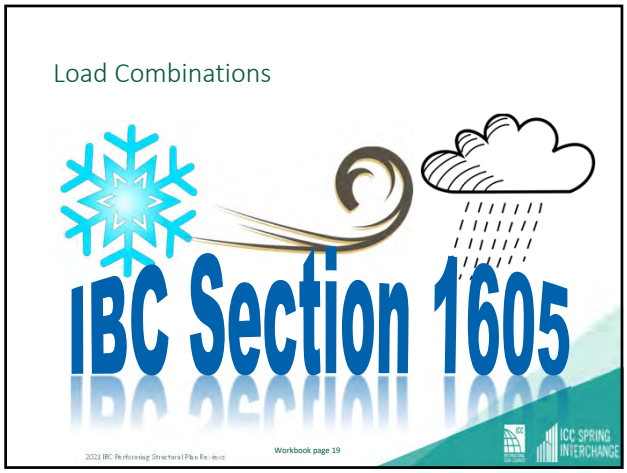
Workbook page 18

ICC SPRING INTERCHANGE

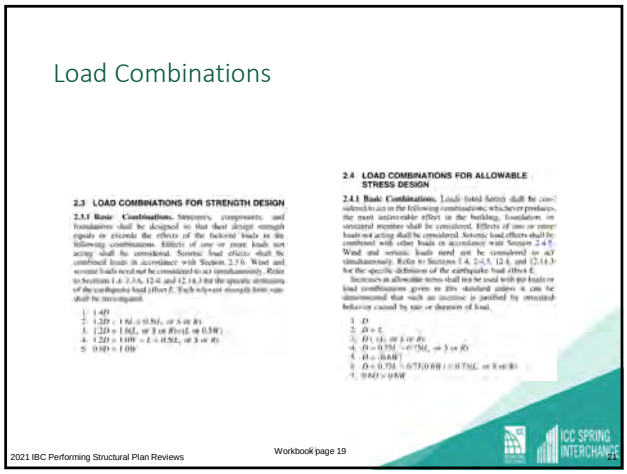
18


Earthquake Loads
2021 IBC Performing Structural Plan Reviews
19

19

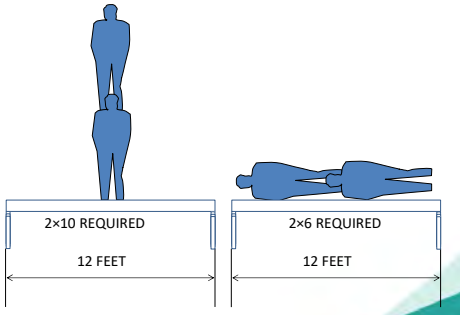

Load Combinations
IBC Section 1605
2021 IBC Performing Structural Plan Reviews
Workbook page 19
ICC SPRING INTERCHANGE

20


Load Combinations
2.3 LOAD COMBINATIONS FOR STRENGTH DESIGN
2.4 LOAD COMBINATIONS FOR ALLOWABLE STRESS DESIGN
2021 IBC Performing Structural Plan Reviews
Workbook page 19
ICC SPRING INTERCHANGE
21

21

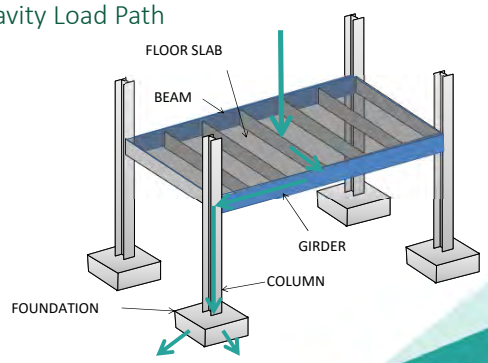
Concentrated vs Uniform Loads



2021 IBC Performing Structural Plan Reviews
Workbook page 20

22

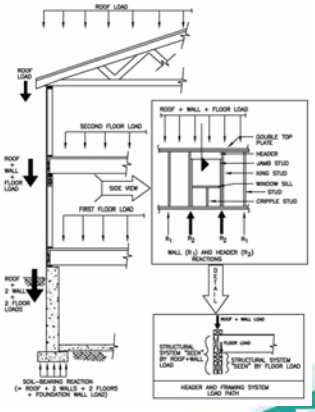
Gravity Load Path



2021 IBC Performing Structural Plan Reviews
Workbook page 21

23

Gravity Load Path



2021 IBC Performing Structural Plan Reviews
Workbook page 22

24

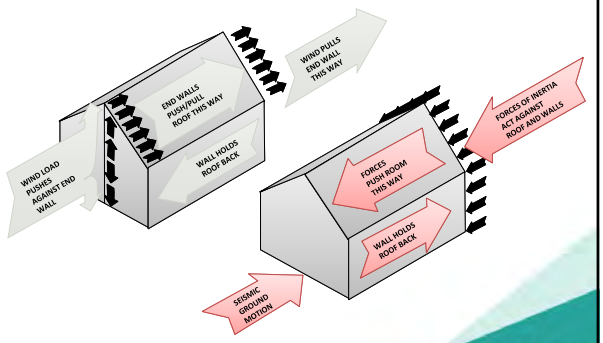
Incomplete Load Path

2021 IBC Performing Structural Plan Reviews

Workbook page 23

25

Lateral Load Path

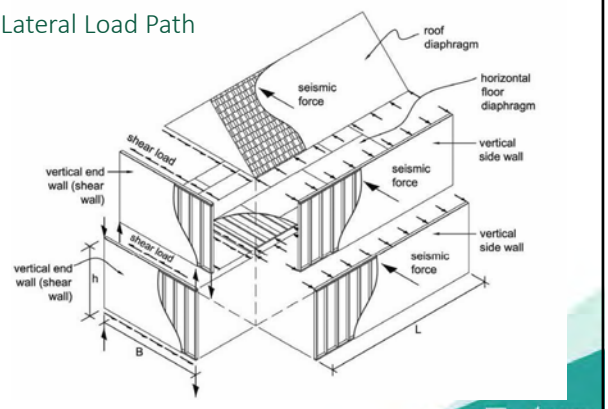


2021 IBC Performing Structural Plan Reviews

Workbook page 23-24

26

Lateral Load Path

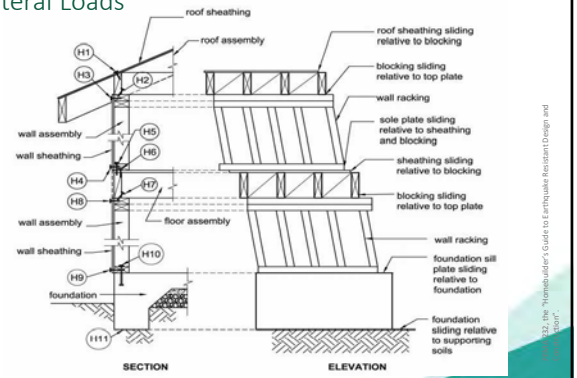


2021 IBC Performing Structural Plan Reviews

Workbook page 24

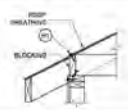
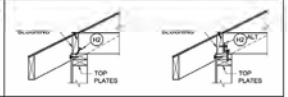
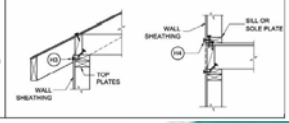
27

Lateral Loads



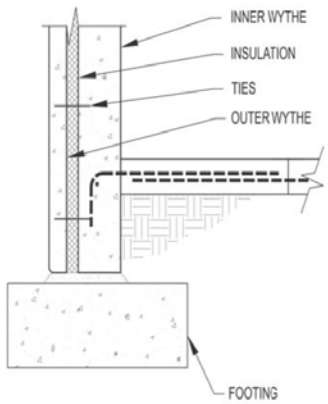
28

Table 2-1 Load Path Connections for Horizontal Sliding

Item	Minimum Fastening per IRC Table R602.3(1) and Discussion	Illustration
H1	Sheathing[a] Nailing[b] 5/16" to ½" 6d common @ 6" 19/32" to 1" 8d common @ 6" 1⅛" to 1¼" 10d common @ 6" • Resists roof sheathing sliding with respect to blocking below. • Six-inch nail spacing applies to supported sheathing edges and blocking. Twelve-inch spacing applies at other panel supports. • Rafter blocking is not always required by IRC; however, sheathing should be nailed to blocking where blocking is provided.	
H2	Three 8d box (0.113"x2½") or three 8d common (0.131"x2½") nails in each block. • Resists rafter blocking sliding with respect to wall top plate. • Use of angle clips in lieu of toenails is a recommended above-code measure. • Rafter blocking is not always required by IRC; however, it should be fastened where provided.	
H3 & H4	Sheathing[a] Nailing[b] 5/16" to ½" 6d common @ 6" 19/32" to 1" 8d common @ 6" 1⅛" to 1¼" 10d common @ 6" • Provides wall racking resistance. • Six-inch nail spacing applies to sheathing edges. Twelve-inch spacing applies at other studs.	

29

Panel Connection to Slab-on-grade

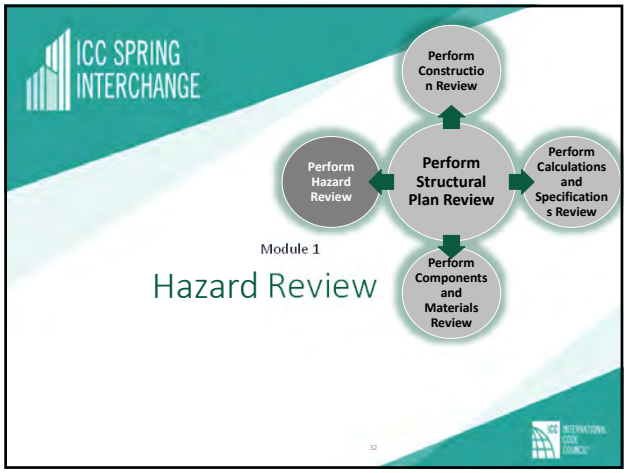


30

Plan Review Activity

- Let's look at the plan set and the plan review record.

31



32

Hazard Review Tasks

1. Verify Project Location.
2. Review Geotechnical Report.
3. Determine Risk Category
4. Verify Ground Motions.
5. Verify Wind Loads.
6. Verify Snow Loads.
7. Review Geologic Hazards.
8. Review Adopted Flood and Tsunami Maps.

Workbook page 29-30

33

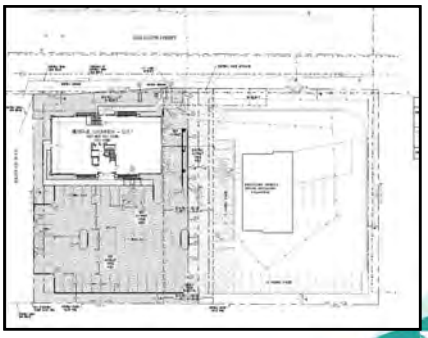
TASK 1 – Verify Project Location

- Step 1. Open Google Earth and find project site

Workbook page 30-31

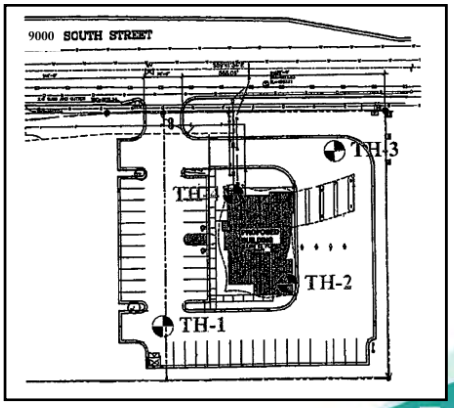
34

Step 2. Compare to site plans



Workbook page 32

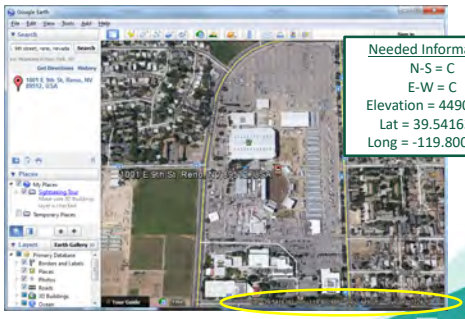
35



Workbook page 33

36

Step 3. Determine Coordinates, Wind Exposure, Site Elevation, etc.



Needed Information
N-S = C
E-W = C
Elevation = 4490 feet
Lat = 39.541638°
Long = -119.800986°

2021 IBC Performing Structural Plan Reviews Workbook page 34

37

TASK 2 – Review Geotechnical Report

- Section 1803 Geotechnical Investigations
- Section 1803.2 Investigations Required
- Section 1803.5.5 Deep Foundations
- Section 1803.5.11 Seismic Design Categories C-F
- Section 1803.5.12 Seismic Design Categories D-F
- Section 1803.6 Reporting

2021 IBC Performing Structural Plan Reviews Workbook page 35

38

Step 1. Determine if a geotechnical report required.

2021 IBC Performing Structural Plan Reviews Workbook page 35

39

Step 1. Determine if a geotechnical report required.

- Questionable soil (Section 1803.5.2)
- Expansive soil (Section 1803.5.3)
- Ground-water table (Section 1803.5.4)
- Deep foundations (Section 1803.5.5)
- Rock strata (Section 1803.5.6)
- Excavation near foundations (Section 1803.5.7)
- Compacted fill material (Section 1803.5.8

2021 IBC Performing Structural Plan Reviews Workbook page 35

40

Step 1. Determine if a geotechnical report required.

- Controlled low-strength material (Section 1803.5.9)
- Alternate setback and clearance (Section 1803.5.10)
- Structure assigned to Seismic Design Category C, D, E or F (Sections 1803.5.11 and 1803.5.12)

2021 IBC Performing Structural Plan Reviews Workbook page 35 41

41

Step 2. Determine soil site class

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard rock	> 5,000 ft/s	NA	NA
B. Rock	2,500 to 5,000 ft/s	NA	NA
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	> 50	> 2,000 psf
D. Stiff soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	< 600 ft/s	< 15	< 1,000 psf
	Any profile with more than 10 ft of soil having the following characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

Figure 17: Soil Site Classification,
Courtesy of American Society of Professional Engineers (ASCE), ASCE 7-16 [5], Table 20.3-1

2021 IBC Performing Structural Plan Reviews Workbook page 36

42

Step 3. Determine allowable bearing pressure of soil

2021 IBC Table 1806.2 Page 18-6

TABLE 1806.2
PRESUMPTIVE LOAD-BEARING VALUES

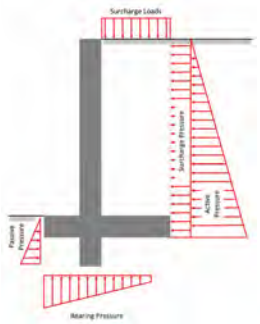
CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction[a]	Cohesion (psf)[b]
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.
a. Coefficient to be multiplied by the dead load.
b. Cohesion value to be multiplied by the contact area, as limited by Section 1806.3.2.

2021 IBC Performing Structural Plan Reviews 43

43

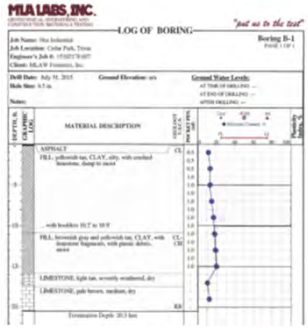
Step 4. Find lateral soil pressures



2021 IBC Performing Structural Plan Reviews

44

Step 5. Verify reporting requirements are met.



2021 IBC Performing Structural Plan Reviews Workbook page 37

45

Discussion of these requirements

- Look at page 37-38 and discuss what information is required.
- What would be a suitable comment to write if anything was missing?

Workbook page 37-38

46

TASK 3 – Determine Risk Category

- Section 202 Definitions
- Section 1603 Construction Documents
- Section 1604.5 Risk Category
- Section 1609.3 Wind Speeds
- Section 1613.2.5 Seismic Design Category
- Section 1615 Tsunami Loads
- Section 1616 Structural Integrity
- Section 1704.6 Structural Observations

Workbook page 38-39

47

REFER TO CODE BOOK

2021 IBC Table 1604.5, page 16-5

Step 1. Review Table 1604.5

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 one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500. • Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, 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, Condition 1 occupancies with 50 or more care recipients. • Group I-2, Condition 2 occupancies not having emergency 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, Condition 2 occupancies having emergency surgery or emergency treatment facilities. • Ambulatory care facilities having emergency 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.

a. For purposes of occupant load calculations, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

Workbook pages 39-40

48

Step 2. Determine if there multiple occupancies

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 one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of the public assembly spaces of greater than 2,500. • Buildings and other structures containing Group E or Group I-4 occupancies or combination therof, 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, Condition 1 occupancies with 50 or more care recipients. • Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. • Group I-3 occupancies.

2021 IBC Performing Structural Plan Reviews

Workbook page 40

49

Step 3. Determine Importance Factors

Risk Category from Table 1604.5 of IBC	Snow Importance Factor, I_s	Ice Importance Factor—Thickness, I_i	Ice Importance Factor—Wind, I_w	Seismic Importance Factor, I_e
I	0.80	0.80	1.00	1.00
II	1.00	1.00	1.00	1.00
III	1.10	1.25	1.00	1.25
IV	1.20	1.25	1.00	1.50

Figure 24: Snow Importance Factor
American Society of Professional Engineers (ASCE), ASCE 7-16, Table 1.5-2

2021 IBC Significant Changes

Workbook page 41

50

Task 4 – Verify Ground Motions

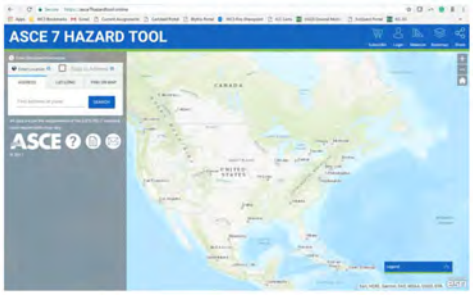
- Section 1613.2 Seismic Ground Motion Values
- Section 1613.2.1 Mapped Accelerations
- Figures 1613.2.1 (1-8) (SS and S1) Mapped Ground Motion Values
- Section 1613.2.3 Site Coefficients
- Section 1613.2.4 Design Accelerations
- Section 1613.2.5 Seismic Design Category

2021 IBC Significant Changes

Workbook page 42

51

1. Identify mapped spectral accelerations



2021 IBC Significant Changes

Workbook page 42

52

2. Adjust mapped accelerations for Soil Site Class

2021 IBC Significant Changes

Workbook page 44

53

Step 3. Determine the seismic design category

$$S_{DS} = (2/3)(S_S)(F_A)$$

(IBC Equation 16-38)

$$S_{D1} = (2/3)(S_1)(F_V)$$

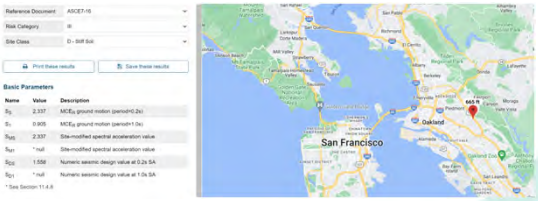
(IBC Equation 16-39)

2021 IBC Performing Structural Plan Reviews

Workbook page 44

54

Step 3. Determine the seismic design category



55

Step 3. Determine the seismic design category

TABLE 1613.3.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

TABLE 1613.3.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

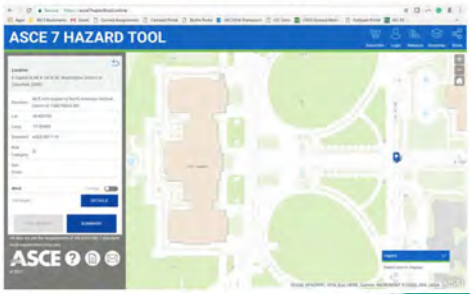
56

TASK 5 – Verify Wind Loads

• Section 1609.1.1	Determination of Wind Loads
• Section 1609.3	Ultimate Design Wind Speed (V_{ult})
• Figures 1609.3 (1-3)	Wind Speed for Risk Categories I, II and III-IV
• Section 1609.4	Exposure Category

57

Step 1. Determine the basic design wind speed



2021 IBC Performing Structural Plan Reviews

Workbook page 46

58

Step 2. Determine the exposure category

CATEGORY	GROUND SURFACE DESCRIPTION	LOCATION
Exposure B	For buildings with a mean roof height greater than 30 feet, where the ground surface roughness condition prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater. For buildings whose mean roof height is less than or equal to 30 feet (9144 mm), the upwind distance is permitted to be 1,500 feet (457 m).	Urban and suburban areas, wooded areas or other terrain with Numerous closely spaced obstructions having the size of single-family dwellings or larger.
Exposure C	Exposure C shall apply for all cases where Exposure B or D does not apply.	Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat, open country and Grasslands
Exposure D	Where the ground surface roughness prevails in the upwind direction for a distance of at least 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall also apply where the ground surface roughness immediately upwind of the site is B or C and the site is within a distance of 600 feet (183 m) or 20 times the height of the building, whichever Is greater.	Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

2021 IBC Performing Structural Plan Reviews

Workbook page 47

59

Step 3. Determine if proposed structure is located in a wind-borne debris region

2021 IBC Performing Structural Plan Reviews

Workbook page 48

60

Step 3. Determine if proposed structure is located in a wind-borne debris region

- Within 1 mile of the coastal mean high water line where the ultimate design wind speed, *Vult*, is 130 mph or greater; or
- In areas where the ultimate design wind speed is 140 mph or greater.

If the jurisdiction is located within a hurricane-probe region the review must make sure that the project is not located within a wind-borne debris region. If it is, all exterior glazing must shall be impact resistant in accordance with Section 1609.1.2.

Workbook page 48

61

Step 4. Calculate wind loads

- **Chapter 27 of ASCE 7-16:** Wind loads on buildings—MWFRS (Directional Procedure)
- **Chapter 28 of ASCE 7-16:** Wind loads on buildings—MWFRS (Envelope Procedure)
- **Chapter 29 of ASCE 7-16:** Wind loads building appurtenances and other structures
- **Chapter 30 of ASCE 7-16:** Components and cladding
- **Chapter 31 of ASCE 7-16:** Wind tunnel procedure

Workbook page 48

62

TASK 6 – Verify Snow Loads

- Section 1608.2 Ground Snow Loads
- Figure 1608.2 Ground Snow Loads for the United States

Workbook page 49

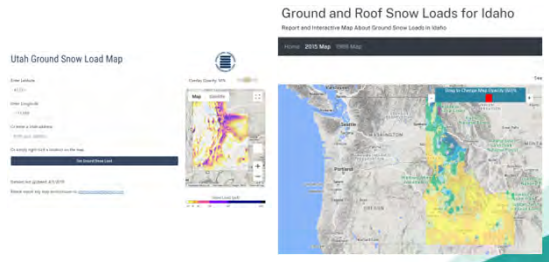
63

Step 1. Determine ground snow load (P_g)

Workbook page 49

64

Step 1. Determine ground snow load (P_g)



Workbook page 49

65

Step 1. Determine ground snow load (P_g)

REFER TO CODE BOOK

2021 IBC
Figure 1608.2(2)
Page 16-19

Workbook page 48

66

Step 2. Verify roof snow load (P_f)

$$P_f = (0.7)(C_e)(C_t)(I_s)(P_g)$$

(Equation 7.3-1, ASCE 7-16)

67

Exposure Factor (C_e)

Table 7-2 Exposure Factor, C_e

Terrain Category	Fully Exposed	Exposure of Roof* Partially Exposed	Sheltered
B (see Section 26.7 of ASCE 7)	0.9	1.0	1.2
C (see Section 26.7 of ASCE 7)	0.9	1.0	1.1
D (see Section 26.7 of ASCE 7)	0.8	0.9	1.0
Above the treeline in windswept mountainous areas.	0.7	0.8	N/A
In Alaska in areas where trees do not exist within a 2-mile (3 km) radius of the site.	0.7	0.8	N/A

68

Thermal Factor (C_t)

Table 7-3 Thermal Factor, C_t

Thermal Condition*	C_t
All structures except as indicated below.	1.0
Structures kept just above freezing and others with cold, ventilated roofs in which the thermal resistance (R-value) between the ventilated space and the heated space exceeds 25°F × h × ft²/Btu (4.4K × m²/W).	1.1
Unheated and open air structures.	1.2
Structures intentionally kept below freezing.	1.3
Continuously heated greenhouses[b] with a roof having a thermal resistance (R-value) less than 2.0°F × h × ft²/Btu (0.4 K × m²/W)	0.85

69

Importance Factor (I_s)

Risk Category from Table 1604.5 of IBC	Snow Importance Factor, I_s	Ice Importance Factor-Thickness, I_i	Ice Importance Factor-Wind, I_w	Seismic Importance Factor, I_e
I	0.80	0.80	1.00	1.00
II	1.00	1.00	1.00	1.00
III	1.10	1.25	1.00	1.25
IV	1.20	1.25	1.00	1.50

70

Step 3. Determine if drifting snow should be considered

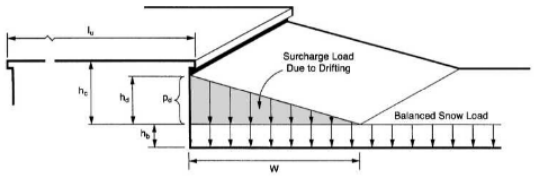
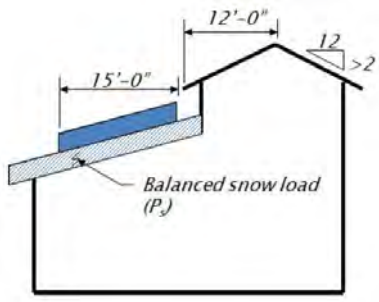


FIGURE 7.7-2 Configuration of Snowdrifts on Lower Roofs

Snow Drift Loading American Society of Professional Engineers (ASCE), ASCE 7-16©, Figure 7-7-2

71

Step 4. Determine if sliding snow should be considered



72

TASK 7 – Review Geologic Hazards

Section 1803.3	Basis of Investigation
Section 1803.5.11	Seismic Design Categories C through F
Section 1803.5.12	Seismic Design Categories D through F
Section 1808.7	Foundations on or Adjacent to Slopes
Figure 1808.7.1	Foundation Clearances from Slopes

2021 IBC Performing Structural Plan Reviews

Workbook page 54

73

Step 1. Determine if project is located within a geologic hazard area

2021 IBC Performing Structural Plan Reviews

Workbook page 54

74

TASK 8 – Review Adopted Flood Maps

Section 1603.1.7	Flood Design Data
Section 1612	Flood Loads
Section 1612.2	Design and Construction
Section 1612.3	Establishment of Flood Hazard Areas
Section 1612.4	Flood Hazard Documentation
Section 1615	Tsunami Loads

2021 IBC Performing Structural Plan Reviews

Workbook page 55

75

Step 1. Review Flood Hazard Map

2021 IBC Performing Structural Plan Reviews

Workbook page 55

76

Step 2. Review Flood Hazard Documentation

- Flood design class
- Elevation of proposed lowest floor, including basement
- Elevation nonresidential buildings will be Floodproofed
- Elevation of lowest horizontal structural member supporting a floor in Coastal High Hazard Areas.

2021 IBC Performing Structural Plan Reviews

Workbook page 56

77

Step 3. Review Tsunami Design Zone Maps

- The 2021 IBC and ASCE have specific provisions for several coastal areas defined tsunami inundation zones.
- If a project occurs within one of these inundation zones, they should ensure that the requirements of the state or local ordinances are being met in the design.
- If it is a Risk Category III or IV structure the IBC requires the design to also meet requirements of Chapter 6 in ASCE 7-16.

2021 IBC Performing Structural Plan Reviews

Workbook page 56

78

Exposure Category

2021 IBC Performing Structural Plan Reviews

Workbook page 57

ICC SPRING INTERCHANGE

79

Plan Review Activity

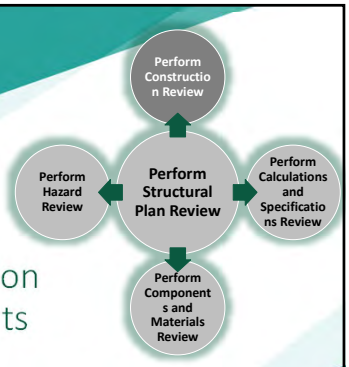
- Let's look at the plan set and the plan review record.

2021 IBC Performing Structural Plan Reviews

ICC SPRING INTERCHANGE

80

ICC SPRING INTERCHANGE



Module 2

Construction Documents Review

81

81

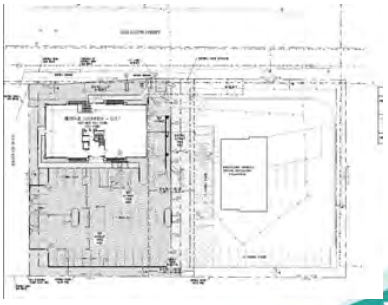
TASK 1 – Civil, Architectural and MEP Review

Section 107.2.1	Information on Construction Documents
Section 1603.1	Construction Documents—General
Section 1613.1	Earthquake Loads—Scope
Section 1705.13.5	Architectural Components
Section 1705.13.6	Plumbing, Mechanical and Electrical Components

Workbook page 60

82

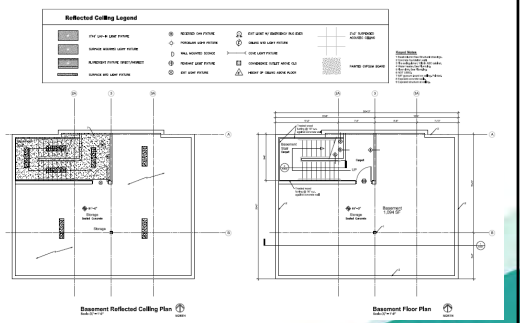
Step 1. Review civil plans



Workbook page 61

83

Step 2. Review architectural plans



Workbook page 61

84

Step 3. Review MEP plans

PACKAGED AIR CONDITIONING UNIT SCHEDULE

MARK	DESCRIPTION	SUPPLY CFM	COOLING CAPACITY AT 4500' (BTU/hr)	HEATING CAPACITY AT 4500' (BTU/hr)	ELECTRICAL			AIR EFFICIENCY			REMARKS
					VOLT/PH/HZ	UNIT MCA	UNIT MOCP	SEER	EER	IPLV IEER	OPERATING WEIGHT(LB)	
AHU 1	ROOF TOP UNIT – GAS HEAT DESIGN STANDARD: CARRIER 48TCE SERIES	2,400	70,000	output 115,000	208/3/60	41	50	--	11	11.2	700	
AHU 2	ROOF TOP UNIT – GAS HEAT DESIGN STANDARD: CARRIER 48TCE SERIES	3,000	83,000	output 148,000	208/3/60	51	60	--	11	12.8	850	
AHU 3	ROOF TOP UNIT – GAS HEAT DESIGN STANDARD: CARRIER 48TCE SERIES	7,000	208,000	output 251,000 input 310,000	208/3/60	101.8	125	--	10.8	12.7	1950	
AHU 4	ROOF TOP UNIT – GAS HEAT DESIGN STANDARD: CARRIER 48TCE SERIES	5,000	140,000	output 184,000 input 224,000	208/3/60	73	80	--	10.8	11.8	1200	
AHU 5	ROOF TOP UNIT – GAS HEAT DESIGN STANDARD: CARRIER 48TCE SERIES	6,000	174,000	output 195,000 input 240,000	208/3/60	80	100	--	10.8	12.4	1950	

Workbook page 62

85

TASK 2 – General Structural Notes

Section 107.3.4.1	Deferred Submittals	Section 1903.1	Documents General
Section 107.2.7	Structural Information	Section 1904	Durability Requirements
Section 1603	Construction Documents	Section 2103	Masonry Construction Materials
Section 1603.1.1	Floor Live Load		
Section 1603.1.2	Roof Live Load	Section 2202 Structural Purposes	Identification of Steel for
Section 1603.1.3	Roof Snow Load Data	Section 2205	Structural Steel
Section 1603.1.4	Wind Design Data	Section 2207	Steel Joists
Section 1603.1.5	Earthquake Design Data	Section 2208	Steel Cable Structures
Section 1603.1.6	Geotechnical Information	Section 2209	Steel Storage Racks
Section 1603.1.7	Flood Design Data	Sections 2210	Cold-Formed Steel
Section 1603.1.8	Special Loads	Sections 2303	Minimum Standards and Quality
Section 1603.1.9	Roof Rain Loads		
Section 1901.5	Construction		

Workbook page 63

86

Step 1. Check design criteria

Workbook page 64-65

87

Step 1. Check design criteria

Table 26.13-1 Main Wind Force Resisting System and Components and Cladding (All Heights): Internal Pressure Coefficient, (GC_{pi}), for Enclosed, Partially Enclosed, Partially Open, and Open Buildings (Walls and Roof)

Enclosure Classification	Criteria for Enclosure Classification	Internal Pressure	Internal Pressure Coefficient, (GC_{pi})
Enclosed buildings	A_o is less than the smaller of $0.01A_g$ or 4 sq ft (0.37 m) and $A_{oi}/A_{gi} \le 0.2$	Moderate	+0.18 −0.18
Partially enclosed buildings	$A_o > 1.1A_{oi}$ and $A_o >$ the lesser of $0.01A_g$ or 4 sq ft (0.37 m) and $A_{oi}/A_{gi} \le 0.2$	High	+0.55 −0.55
Partially open buildings	A building that does not comply with Enclosed, Partially Enclosed, or Open classifications	Moderate	+0.18 −0.18
Open buildings	Each wall is at least 80% open	Negligible	0.00

2021 IBC Significant Changes

Workbook page 66-67

88

TABLE 12.2-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE–RESISTING SYSTEMS

Seismic Force–Resisting System	ASCE 7 Section where Detailing Requirements are Specified	Response Modification Coefficient, R^a	System Overstrength Factor, Ω_0^g	Deflection Amplification Factor, C_d^b	Structural System Limitations and Building Height (h) Limit[c] Seismic Design Category				
					B	C	D[d]	E[d]	F[e]
A. BEARING WALL SYSTEMS									
1. Special reinforced concrete shear walls	14.2 and 14.2.3.6	5	2½	5	NL	NL	160	160	100
2. Ordinary reinforced concrete shear walls	14.2 and 14.2.3.4	4	2½	4	NL	NL	NP	NP	NP
3. Detailed plain concrete shear walls	14.2 and 14.2.3.2	2	2½	2	NL	NP	NP	NP	NP
4. Ordinary plain concrete shear walls	14.2 and 14.2.3.1	1½	2½	1½	NL	NP	NP	NP	NP
5. Intermediate precast shear walls	14.2 and 14.2.3.5	4	2½	4	NL	NL	40[f]	40[f]	40[f]
6. Ordinary precast shear walls	14.2 and 14.2.3.3	3	2½	3	NL	NP	NP	NP	NP
7. Special reinforced masonry shear walls	14.4 and 14.4.3	5	2½	3½	NL	NL	160	160	100
8. Intermediate reinforced masonry shear walls	14.4 and 14.4.3	3½	2½	2¼	NL	NL	NP	NP	NP
9. Ordinary reinforced masonry shear walls	14.4	2	2½	1¾	NL	160	NP	NP	NP
10. Detailed plain masonry shear walls	14.4	2	2½	1¾	NL	NP	NP	NP	NP
11. Ordinary plain masonry shear walls	14.4	1½	2½	1¼	NL	NP	NP	NP	NP
12. Prestressed masonry shear walls	14.4	1½	2½	1¼	NL	NP	NP	NP	NP
13. Light-framed walls sheathed with wood structural panels rated for shear resistance or steel sheets	14.1, 14.1.4.2, and 14.5	6½	3	4	NL	NL	65	65	65
14. Light-framed walls with shear panels of all other materials	14.1, 14.1.4.2, and 14.5	2	2½	2	NL	NL	35	NP	NP
15. Light-framed wall systems using flat strap bracing	14.1, 14.1.4.2, and 14.5	4	2	3½	NL	NL	65	65	65

2021 IBC Performing Structural Plan Reviews

Workbook page 67-71

89

Step 2. Confirm geotechnical information

- Soil Site Class
- Allowable Bearing Pressure
- Passive, Active and At-Rest Earth Pressures
- Structural Fill Requirements
- Soft soil or liquefaction mitigation measures (if applicable)

2021 IBC Performing Structural Plan Reviews

Workbook page 72

90

Step 3. Verify material requirements

- Appropriate Standards
- Material Strengths
- Appropriate Instructions
- Extraneous Information

Workbook page 73

91

Step 4. Review deferred submittal requirements

- To be reviewed by design professional in responsible charge.
- Design professional shall affix a notation that the deferred items are in general conformance with their design of the building.
- They shall be submitted to B.O. for review.
- Shall not be installed until approved by B.O.

Workbook page 73

92

TASK 3 – Special Inspection Program

Section 1702	New Materials
Section 1703	Approvals
Section 1704.2	Special Inspections and Tests
Section 1704.3	Statement of Special Inspections
Section 1704.4	Contractor Responsibility
Section 1704.6	Structural Observation
Section 1705	Required Special Inspections and Tests

Workbook page 74

93

Step 1. Verify approval criteria

Workbook page 74

94

Step 2. Verify Statement of Special Inspections (SSI)

95

Step 2. Verify Statement of Special Inspections (SSI)

- See 2018 IBC Tables 1705.2.3, 1705.3, 1705.5.3, 1705.6, 1705.7, 1705.8
- Appendix D in back of book.

96

Step 2. Verify Statement of Special Inspections (SSI)

97

Step 3. Verify approved fabricators

Workbook page 76

98

Step 4. Obtain contractor's statement of responsibility

1704.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or *seismic force-resisting system*, *designated seismic system* or a wind- or seismic force-resisting component listed in the statement of *special inspections* shall submit a written statement of responsibility to the *building official* and the owner or the owner's authorized agent prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of *special inspections*.

Workbook page 76

99

Step 5. Verify structural observations

Workbook page 76-77

100

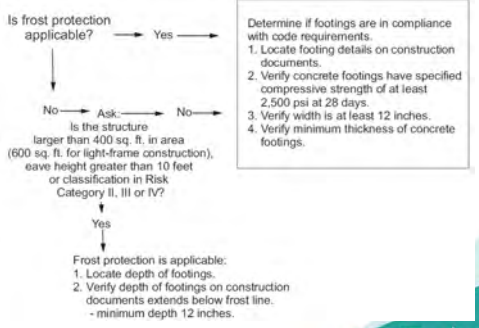
TASK 4 – Footing and Foundation Review

Section 1807	Foundation Walls, Retaining Walls and Embedded Posts and Poles	Section 1809	Shallow Foundations
		Section 1809.3	Stepped Footings
		Section 1809.4	Depth and Width of Footings
Section 1808	Foundations	Section 1809.5	Frost Protection
Section 1808.3	Design Loads	Section 1809.13	Footing Seismic Ties
Section 1808.6.2	Slab-on-Ground Foundations	Section 1810	Deep Foundations
Section 1808.7	Foundations on or Adjacent to Slopes	Section 1810.2	Analysis
		Section 1810.3	Design and Detailing

Workbook page 78

101

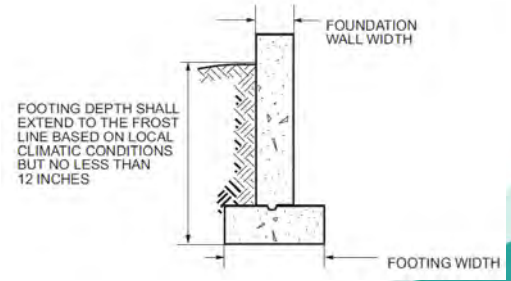
Step 1. Verify frost protection



Workbook page 79

102

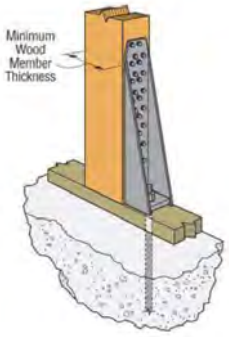
Step 2. Verify footing depth, width and thickness



2021 IBC Performing Structural Plan Reviews Workbook page 79-80 ICC SPRING INTERCHANGE

103

Step 3. Verify holdown sizes and locations

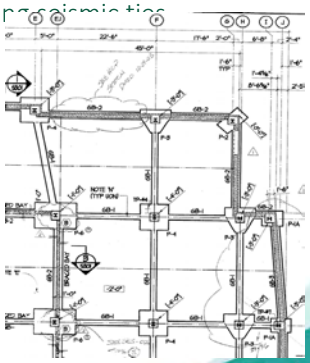


2021 IBC Performing Structural Plan Reviews Workbook page 80-81 ICC SPRING INTERCHANGE

104

Step 4. Verify footing seismic ties

- S.D.C. 'D-F'
- Site Class 'E-F'

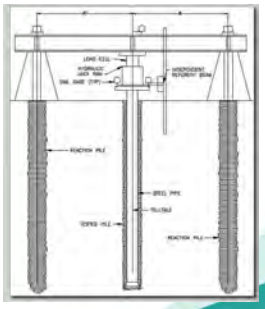


2021 IBC Performing Structural Plan Reviews Workbook page 81-82 ICC SPRING INTERCHANGE

105

Step 5. Deep foundations

- Geotechnical Report
- Stability
- Settlement
- Testing



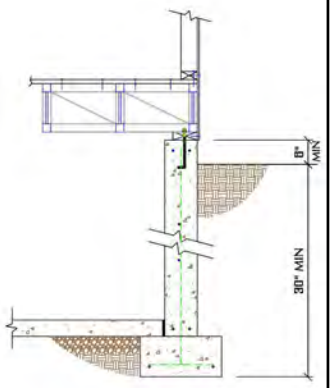
2021 IBC Performing Structural Plan Reviews

Workbook page 82-84

106

Step 6. Verify foundation walls

- Prescriptive Requirements
- Restrained?

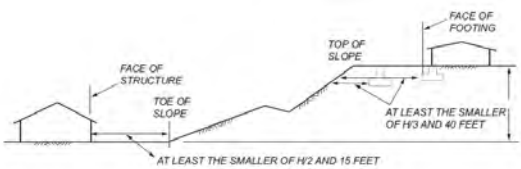


2021 IBC Performing Structural Plan Reviews

Workbook page 85

107

Step 7. Foundations on slopes



For SI: 1 foot = 304.8 mm.

2021 IBC Performing Structural Plan Reviews

Workbook page 86

108

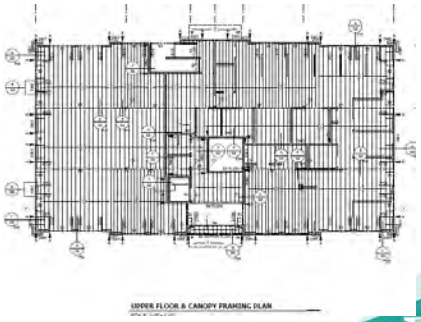
TASK 5 – Floor and Roof Framing Plan(s)

Section 107.2.1	Information on Construction Documents
Section 1603.1	Construction Documents

Workbook page 86

109

Step 1. Verify member sizes, spans and spacing requirements



Workbook page 87

110

Step 2. Verify shear walls and frames requirements

ANCHOR BOLTS AND SILL PLATE

5/8" DIAMETER x 10" LONG ANCHOR BOLTS EMBEDDED 7" MINIMUM AT 24" OC W/ 2x TREATED SILL PLATE, TYPICAL EXCEPT WHEN SPECIFICALLY NOTED ON FOUNDATION PLAN.

ALL ANCHOR BOLTS FOR SHEAR WALLS REQUIRE 3"x3"x0.229" PLATE WASHERS WITH DIAGONAL SLOTTED HOLE. PLACE EDGE OF WASHER MAX 1/2" FROM INSIDE FACE OF WALL SHEATHING. PROVIDE STANDARD CUT WASHER BETWEEN 3"x3"x0.229" WASHER AND NUT.

Workbook page 87

111

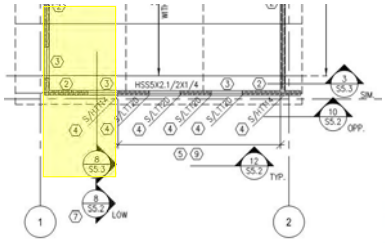
Step 3. Verify diaphragm requirements

ROOF DECK SHALL BE 1½" X 20 GAUGE TYPE "B" GALVANIZED ROOF DECK WITH INTERLOCKING SIDE LAPS. THREE SPAN MINIMUM. ATTATCH TO PERPENDICULAR SUPPORTS WITH (7) ¾" DIAMETER PUDDLE WELDS PER 36" WIDE SHEET. ATTATCH TO PARALLEL SUPPORTS WITH ¾" DIAMETER PUDDLE WELDS AT 12"O.C. ATTACH SIDE LAPS WITH 1½" LONG TOP SEAM WELDS AT 12" O.C. MINIMUM SHEAR STRENGTH REQUIRED = 1200 PLF. VERCO PUNCHLOCK DECKING (PLB) DECK WITH VERCO SIDE LAP CONNECTIONS (VSC2) IS ALSO ACCEPTABLE PROVIDED THE SHEAR STRENGTH IS EQUAL TO OR GREATER THAN SPECIFIED ABOVE.

Workbook page 87

112

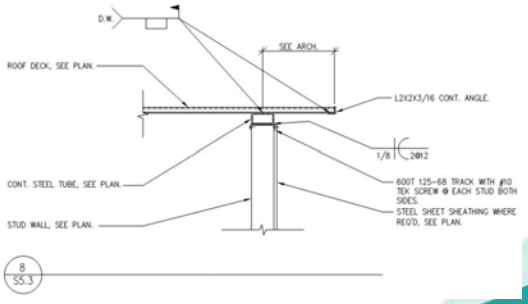
Step 4. Verify detail callouts



Workbook page 88

113

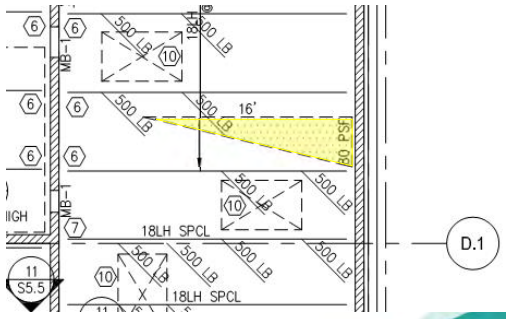
Step 4. Verify detail callouts



Workbook page 89

114

Step 5. Verify snow drift loads

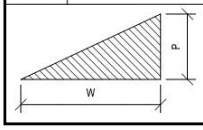


115

Step 5. Verify snow drift loads

SNOW DRIFT SCHEDULE

MARK	MAX PRESSURE (P)	APPLIED WIDTH (W)	NOTES
DR-1	44	5' - 9"	
DR-2	60	12' - 0"	
DR-3	26	5' - 3"	
DR-4	64	12' - 8"	
DR-5	34	6' - 9"	



NOTES:
1. DRIFT LOAD IS IN ADDITION TO SNOW LOADS SPECIFIED IN GENERAL NOTES.
2. ALL DRIFT LOAD TO RUN FULL LENGTH ALONG A WALL LINE, U.N.O.
3. PERPENDICULAR DRIFT LOADS DO NOT NEED TO BE APPLIED SIMULTANEOUSLY.

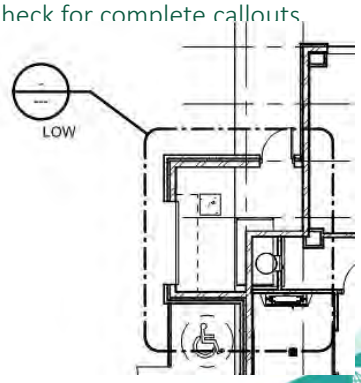
116

TASK 6 – Sections and Details

Section 107.2.1	Information on Construction Documents
Section 1603.1	Construction Documents

117

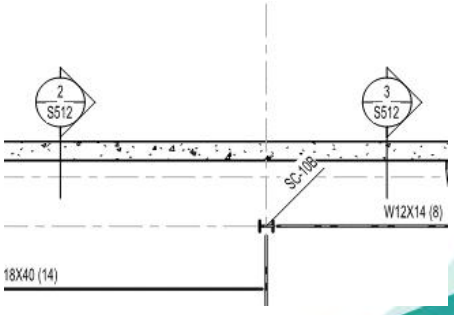
Step 1. Check for complete callouts



2021 IBC Performing Structural Plan Reviews Workbook page 91

118

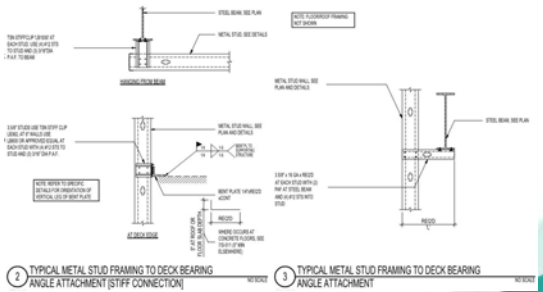
Step 2. Verify that appropriate details are included



2021 IBC Performing Structural Plan Reviews Workbook page 92

119

Step 2. Verify that appropriate details are included



2021 IBC Performing Structural Plan Reviews Workbook page 92

120

Step 3. Verify that load paths are complete

2021 IBC Performing Structural Plan Reviews

Workbook page 93

121

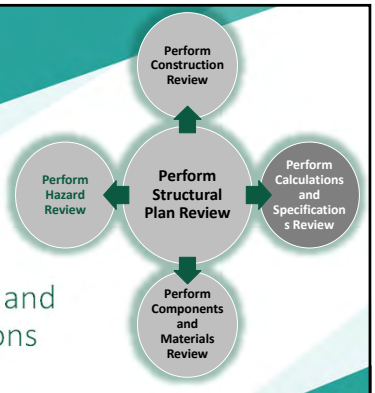
Plan Review Activity

- Let's look at the plan set and the plan review record.

2021 IBC Performing Structural Plan Reviews

122

ICC SPRING INTERCHANGE



Module 3

Calculations and Specifications Review

123

123

TASK 1 – Structural Calculations Review

Section 107	Submittal Documents	Loads	
Section 1603	Construction Documents	Section 1609.1.1	Determination of Wind Loads
Section 1604	General Design Requirements	Section 1611.1	Design Rain Loads
Section 1605	Load Combinations	Section 1612	Flood Loads
Section 1606	Dead Loads	Section 1613	Earthquake Loads
Section 1607	Live Loads	Section 1615	Tsunami Loads
Section 1608.2	Ground Snow	Chapter 35	Referenced Standards

Workbook page 96

124

Step 1. Verify that code references are current

Standard	Version	Description
ADM1	2015	Aluminum Design Manual—Part 1
ACI 318	*2014*	*Structural Concrete*
AISC 341	*2016*	*Structural Steel Buildings—Seismic Provisions*
AISC 360	*2016*	*Structural Steel Buildings—Specification*
AISI S100	2016	Cold-Formed Steel—Specification
AISI S220	2015	Cold-Formed Steel—Nonstructural Members
AISI S230	2015	Cold-Formed Steel—Prescriptive Method
AISI S400	2015	Cold-Formed Steel Structural Systems
APA A 190.1	2017	Structural Glued Laminated Timber
APA PRP 210	2014	Engineered Wood Siding
APA PRP 410	2016	Engineered Wood Rim Boards
APA PDS	2012	Panel Design Specification
PDS Supp. #1	2012	Plywood Curved Panels
PDS Supp. #2	2012	Plywood Lumber Beams
PDS Supp. #3	2012	Plywood Stressed-skin Panels

Workbook page 97-99

125

Step 1. Verify that code references are current

Steel Column

Description C10- TS4X4X3/8 (64 kips max)

General Information

Calculations are designed to AISC 9th Edition ASD and 1997 UBC Requirements

Steel Section	TS4X4X3/8	Fy	46.00 ksi	X-X Sidesway :	Sway Allowed
		Duration Factor	1.000	Y-Y Sidesway :	Sway Allowed
Column Height	9.000 ft	Elastic Modulus	29,000.00 ksi		
End Fixity	Pin-Pin	X-X Unbraced	9.000 ft	Kxx	1.000
Live & Short Term Loads Combined		Y-Y Unbraced	9.000 ft	Kyy	1.000

Masonry Wall Design

Description Typical wall section

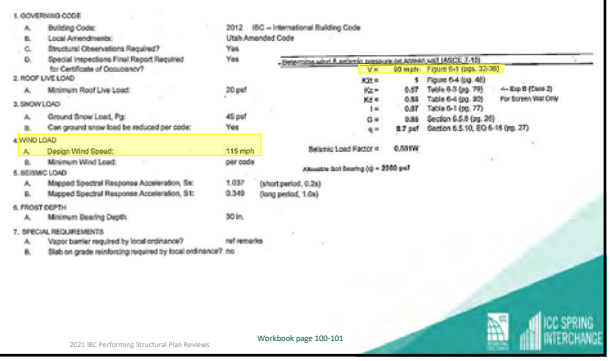
General Information

Wall Height	10.50 ft	Seismic Factor	0.1400	Fm	1,500.0 psi
Parapet Height	0.00 ft	Calc of Em = Fm *	750.00	Fs	24,000.0 psi
		Duration Factor	1.330	No Special Inspection	
Thickness	8.0 in	Wall Wt Mult.	1.000	Grout @ Rebar Only	
Rebar Size	4			Normal Weight Block	
Rebar Spacing	48 in			Equivalent	
Depth to Rebar	3.810 in @ Center			Solid Thickness	4.600 in

Workbook page 100

126

Step 2. Verify wind design speed is included in the structural calculations



1. GOVERNING CODE
   - A. Building Code: 2012 IBC – International Building Code
   - B. Local Amendments: Utah Amended Code
   - C. Structural Observations Required? Yes
   - D. Special Inspections Final Report Required for Certificate of Occupancy? Yes
2. ROOF LIVE LOAD
   - A. Minimum Roof Live Load: 20 psf
3. SNOW LOAD
   - A. Ground Snow Load, Pg: 45 psf
   - B. Can ground snow load be reduced per code: Yes
4. WIND LOAD
   - A. Design Wind Speed: 115 mph
   - B. Minimum Wind Load: per code
5. SEISMIC LOAD
   - A. Mapped Spectral Response Acceleration, Ss: 1.037 (short period, 0.2s)
   - B. Mapped Spectral Response Acceleration, S1: 0.349 (long period, 1.0s)
6. FROST DEPTH
   - A. Minimum Bearing Depth: 30 in.
7. SPECIAL REQUIREMENTS
   - A. Vapor barrier required by local ordinance? ref remarks
   - B. Slab on grade reinforcing required by local ordinance? no

Determine wind & seismic pressures per ASCE 7-10

V = 90 mph Figure 6-1 (pgs. 32-36)

Kzt = 1 Figure 6-4 (pg. 40)

Kz = 0.57 Table 6-3 (pg. 79) <-- Exp B (Case 2)

Kd = 0.85 Table 6-4 (pg. 80) For Screen Wall Only

I = 0.87 Table 6-1 (pg. 77)

G = 0.85 Section 6.5.8 (pg. 36)

q = 8.7 psf Section 6.5.10, EQ 6-15 (pg. 37)

Seismic Load Factor = 0.591W

Allowable Soil Bearing (q) = 3500 psf

Workbook page 100-101

127

Step 3. Verify seismic design data is included in the structural calculations

Workbook page 101

128

Step 4. Verify flood design documentation is provided

- IBC 1612.4

Workbook page 101

129

Step 5. Verify snow design

Workbook page 101

130

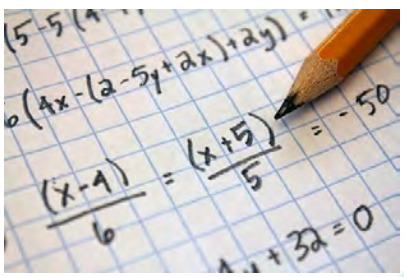
Step 6. Verify significant structural members calculations are complete

1. Manufacturer shall supply to the architect/engineer and the building department, calculations and shop drawings for approval prior to fabrication. All calculations and shop drawings shall be signed by a registered professional engineer licensed in the state the project will be constructed. It shall be the responsibility of the manufacturer to obtain building department approval for calculations and shop drawings prior to fabrication.

Workbook page 102

131

Step 7. Verify that calculations match in formation included in the plans



Workbook page 102

132

TASK 2 – Specifications Review

- Section 107 Submittal Documents

133

Step 1. Verify conformance

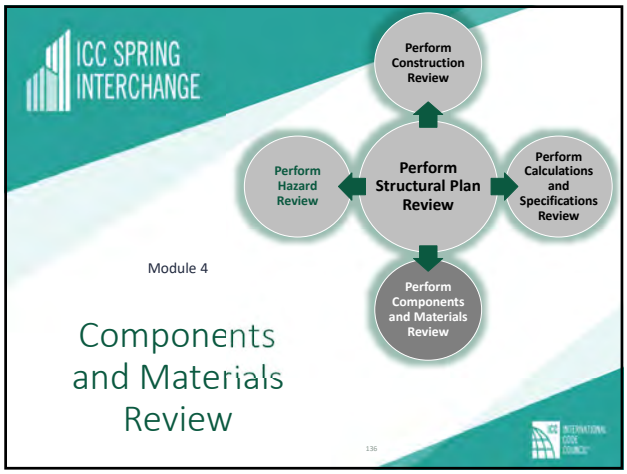
Workbook page 103

134

Plan Review Activity

- Let's look at the plan set and the plan review record.

135



136

TASK 1 – Concrete Construction Review

Table 1808.8.1	Compressive Strength of Concrete or Grout
Table 1808.8.2	Concrete Cover
Section 1901.2	Plain and Reinforced Concrete
Section 1901.3	Anchoring to concrete
Section 1901.4	Composite structural steel and concrete structures
Section 1904	Durability Requirements
Section 1905	Modifications to ACI 318
Section 1906.1	Plain Concrete Footings
Section 1907	Minimum Slab Provisions
Section 1908	Shotcrete
ACI 318-19	Building Code Requirements for Structural Concrete

2021 IBC Performing Structural Plan Reviews Workbook page 106

137

Step 1. Check compressive strength

Concrete Exposure Requirements

Use	*Exposure Classes*	*F'c (psi)*	*Maximum w/c Ratio*
Footings	F1, S0, P0, C0	4,500	0.45
Exterior Walls	F2, S0, P0, C0	4,500	0.45
Interior Walls	F0, S0, P0, C0	3,000	0.55
Interior Slab	F0, S0, P0, C0	3,000	0.55
Exterior Slab	F2, S0, P0, C0	4,500	0.45

Notes:

1. Air content for Exposures F1-F3 must meet the requirements of Table 4.4.1 of ACI 318-11.
2. The cement type for Exposures S1-S3 must meet the requirements of Table 4.3.1 of ACI 318-11.
3. Calcium chloride admixture shall not be used in Exposures S2 and S3.

2021 IBC Performing Structural Plan Reviews Workbook page 107

138

REFER TO CODE BOOK

Minimum Required Compressive Strengths

2021 IBC Table 1808.8.1

Page 18-14

TABLE 1808.8.1
MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to Seismic Design Category A, B or C	2,500 psi
2a. Foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to Seismic Design Category D, E or F	2,500 psi
2b. Foundations for other structures assigned to Seismic Design Category D, E or F	3,000 psi
3. Precast nonprestressed driven piles	4,000 psi
4. Socketed drilled shafts	4,000 psi
5. Micropiles	4,000 psi
6. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

Workbook page 107

2021 IBC Performing Structural Plan Reviews 139

139

Step 1. Check compressive strength

Table 19.3.1.1—Exposure categories and classes

Category	Class	Condition
[illegible]	[illegible]	[illegible]

2021 IBC Performing Structural Plan Reviews

Workbook page 108

ICC SPRING INTERCHANGE

140

Step 1. Check compressive strength

Table 19.3.2.1—Requirements for concrete by exposure class

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

2021 IBC Performing Structural Plan Reviews

Workbook page 109

ICC SPRING INTERCHANGE

141

Step 2. Check concrete cover

2021 IBC Table 1808.8.2

Page 18-15

TABLE 1808.8.2
MINIMUM CONCRETE COVER

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 20.6 of ACI 318
2. Precast nonprestressed deep foundation elements Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	3 inches 2 inches In accordance with Section 20.6.1.3.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	2.5 inches In accordance with Section 20.6.1.3.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

Workbook page 109

142

Step 3. Check slabs-on-grade

Workbook page 110

143

TASK 2 – Masonry Construction Review

Section 2101.2	Design Methods
Section 2103	Masonry Construction Materials
Section 2103.1	Masonry Units
Section 2103.2	Mortar
Section 2103.3	Grout
Section 2104	Construction

Workbook page 110

144

Step 1. Check material strengths

Table 1—Compressive strength of masonry based on the compressive strength of clay masonry units and type of mortar used in construction

Net area compressive strength of clay masonry, psi (MPa)	Net area compressive strength of clay masonry units, psi (MPa)	
	Type M or S mortar	Type N mortar
1,000 (6.90)	1,700 (11.72)	2,100 (14.48)
1,500 (10.34)	3,350 (23.10)	4,150 (28.61)
2,000 (13.79)	4,950 (34.13)	6,200 (42.75)
3,000 (20.69)	6,600 (45.51)	8,250 (56.88)
3,500 (24.13)	8,250 (56.88)	10,300 (71.02)
4,000 (27.58)	9,900 (68.26)	—
	11,500 (79.29)	—

Figure S4: TMS 602—Clay Masonry Unit Strengths

Workbook page 110-111

145

Step 1. Check material strengths

Table 2—Compressive strength of masonry based on the compressive strength of concrete masonry units and type of mortar used in construction

Net area compressive strength of clay masonry, psi (MPa)	Net area compressive strength of clay masonry units, psi (MPa)	
	Type M or S mortar	Type N mortar
1,700 (11.72)	—	1,900 (13.10)
1,900 (13.10)	1,900 (13.10)	2,350 (14.82)
2,000 (13.79)	2,000 (13.79)	2,650 (18.27)
2,250 (15.51)	2,600 (17.93)	3,400 (23.44)
2,500 (17.24)	3,250 (22.41)	4,350 (28.96)
2,750 (18.96)	3,900 (26.89)	—
3,000 (20.69)	4,500 (31.03)	—

Figure S5: TMS 602—Concrete Masonry Unit Strengths

Workbook page 110-111

146

Step 2. Check minimum reinforcing

Shear Wall Type	Minimum Reinforcement	Permitted Seismic Design Category
Empirically Designed	None	A
Ordinary Plain	None	A, B
Detailed Plain	Vertical Reinforcement = #4 at corners; within 16 inches of openings; within 8 inches of movement joints; and spaced no more than 10 feet Horizontal Reinforcement = W1.7 at 16"o.c. or #4 bond beams at 10 feet	A, B
Ordinary Reinforced	Same as above	A, B, C
Intermediate Reinforced	Same as above but maximum spacing of 4 feet for vertical reinforcement.	A, B, C
Special Reinforced	Same as above but maximum spacing of 4 feet for horizontal reinforcement and a minimum combined ratio of steel (ρ) of 0.002 with at ratio of at least 0.0007 in both the horizontal and vertical directions.	A, B, C, D, E, F

Workbook page 113

147

Step 2. Check minimum reinforcing

Actual Reinforcing Steel Ratio (ρ_{act})

	Ag (in²)	#4 bars (A_s=0.20in²)				
		8"o.c.	16"o.c.	24"o.c.	32"o.c.	48"o.c.
4" block	43.5	0.00690	0.00345	0.00230	0.00172	0.00115
6" block	67.5	0.00444	0.00222	0.00148	0.00111	0.00074
8" block	91.5	0.00328	0.00164	0.00109	0.00082	*0.00055*
10" block	115.5	0.00260	0.00130	0.00087	*0.00065*	*0.00043*
12" block	139.5	0.00215	0.00108	0.00072	*0.00054*	*0.00036*
	Ag (in²)	#5 bars (A_s=0.31in²)				
		8"o.c.	16"o.c.	24"o.c.	32"o.c.	48"o.c.
4" block	43.5	0.01069	0.00534	0.00356	0.00267	0.00178
6" block	67.5	0.00689	0.00344	0.00230	0.00172	0.00115
8" block	91.5	0.00508	0.00254	0.00169	0.00127	0.00085
10" block	115.5	0.00403	0.00201	0.00134	0.00101	*0.00067*
12" block	139.5	0.00333	0.00167	0.00111	0.00083	*0.00056*

Workbook page 114

148

Step 3. Check drawing information

- Design standards
- Masonry compressive strength
- Size and location of structural members
- Details of anchorage
- Details of reinforcement
- Size and permitted locations of conduits, pipes and sleeves.

Workbook page 114

149

TASK 3 – Steel Construction Review

Section 2202	Identification	Section 2208	Steel Cable Structures
Section 2203	Protection	Section 2209	Steel Storage Racks
Section 2204	Connections	Section 2210	Cold-Formed Steel (i.e. Decks)
Section 2205	Structural Steel	Section 2211	Cold-Formed Steel Light-Frame Construction
Section 2205.2	Seismic Design		
Section 2206	Composite Structural Steel and Concrete		
Section 2207	Steel Joists		

Workbook page 115

150

Step 1. Check drawing information

- Size, section, material grade and location of all members
- Floor elevations
- Column centers and offsets
- Camber requirements for members
- Joining requirements for built-up members
- Permanent bracing, column stiffeners, column web doubler plates, bearing stiffeners in beams and girders, web reinforcement, openings for other trades and other special details
- Complete connection design

151

Step 1. Check drawing information

- **High Seismic Regions (AISC 341):**
  - Identification of the members and connections that are part of the
  - LFRS:
    - Locations and dimensions of protected zones.
    - Configuration of the connections.
    - Locations of demand critical welds.
    - Locations where weld backing or weld tabs shall be removed.

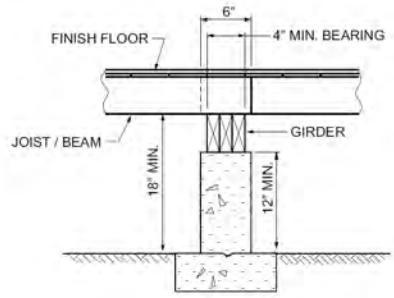
152

TASK 4 – Wood Construction Review

Section 2302.1	General Design Requirements
Section 2303	Minimum Standards and Quality
Section 2304	General Construction Requirements
Section 2305	General Design Requirements for LFRS
Section 2306	Allowable Stress Design (ASD)
Section 2307	Load and Resistance Factor Design (LRFD)
Section 2308	Conventional Light-Frame Construction

153

Step 1. Check wood materials



Workbook page 117-118

154

Step 1. Check wood materials

- 1. Species and Grade
  - To match calculations.

Workbook page 117-118

155

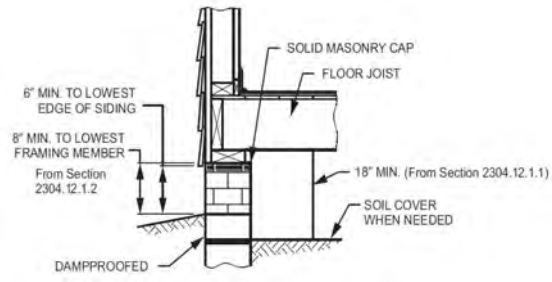
Step 1. Check wood materials

- 1. Species and Grade
- 2. Naturally Durable or Preservative Treated
  - In contact w/ masonry/concrete walls below grade.
  - Sleepers and sills on slabs in contact with earth.
  - Ends of wood girders entering masonry or concrete walls.
  - Wood that is exposed to weather (balconies, etc.)
  - Wood supporting moisture-permeable floors that are exposed to weather (decks, etc.)
  - Wood in contact with ground or fresh water.
  - Wood used in retaining walls.

Workbook page 117-118

156

Step 1. Check wood materials



2021 IBC Performing Structural Plan Reviews Workbook page 119

157

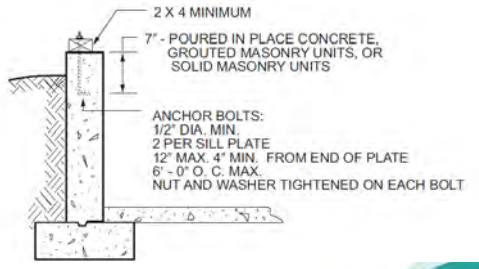
Step 1. Check wood materials

- 1. Species and Grade
- 2. Naturally Durable or Preservative Treated
- 3. Fire Retardant Treated
  - Type I or II construction
    - Nonbearing partitions w/ fire resistance ≤2 hours
    - Nonbearing exterior walls where fire-resistance rated construction not required.
    - Roof construction (except Type I-A and >2 stories)
  - Type III or IV construction – in exterior walls with 2 hr or less fire rating.
  - Miscellaneous

2021 IBC Performing Structural Plan Reviews Workbook page 119 158

158

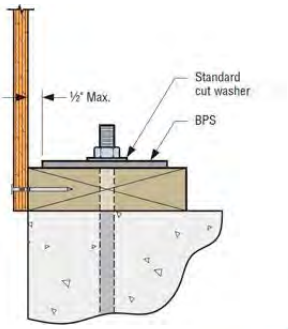
Step 2. Check sill anchorage



2021 IBC Performing Structural Plan Reviews Workbook page 120-121

159

Step 2. Check sill anchorage



Workbook page 121

160

Step 3. Check fastening

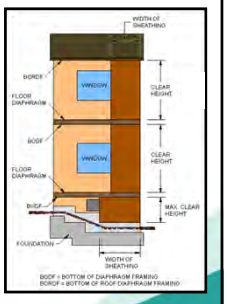
- Correct fasteners?
- Edge and field nailing
- Blocking
- 3X required when…
  - When edge nailing is 2 inches on center.
  - When using 10d nails at 3 inches on center.
  - Shear panels placed on each face and edges occur on the same stud.

Workbook page 122

161

Step 4. Check shear wall aspect ratio

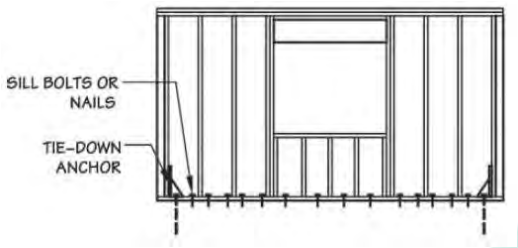
- Allowable aspect ratio
  - Seismic → 2:1 (3.5:1 if reduced)
  - Wind → 3.5:1 (e.g. 8'-0" x 2'-3")
- Example Seismic: 9-foot wall
  - 2:1 → 4.5 feet
  - 3.5:1 → 2.57 feet
  - WSP = 1.25 – 0.125*(h/w)
  - 43% reduction in capacity!



Workbook page 122

162

Step 5. Check perforated shear walls



2021 IBC Performing Structural Plan Reviews Workbook page 123

163

Step 5. Check perforated shear walls

- A shear panel meeting the aspect ratio must be provided at each end of the shear wall.
- Collectors for force-transfer shall be provided for the full length of the wall.
- Shall have uniform top-of-wall and bottom-of-wall elevations.
- Height ≤ 20 ft

2021 IBC Performing Structural Plan Reviews Workbook page 123 164

164

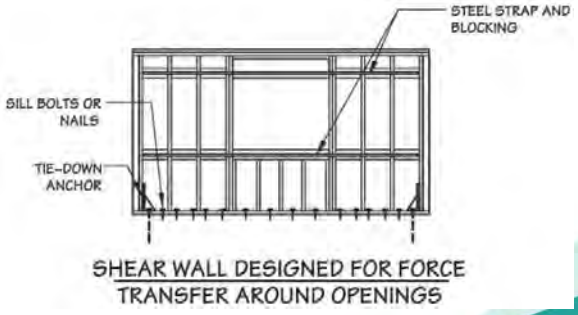
Step 5. Check perforated shear walls

Wall Height (h)	Maximum Opening Height Ratio & Height				
	h/3	h/2	2h/3	5h/6	h
8′-0″	2′-8″	4′-0″	5′-4″	6′-8″	8′-0″
10′-0″	3′-4″	5′-0″	6′-8″	8′-4″	10′-0″
% Full-Height Sheathing	Shear Capacity Adjustment Factor				
10%	1.00	0.69	0.53	0.43	0.36
20%	1.00	0.71	0.56	0.45	0.38
30%	1.00	0.74	0.59	0.49	0.42
40%	1.00	0.77	0.63	0.53	0.45
50%	1.00	0.80	0.67	0.57	0.50

2021 IBC Performing Structural Plan Reviews Workbook page 123

165

Step 6. Check force-transfer shear walls

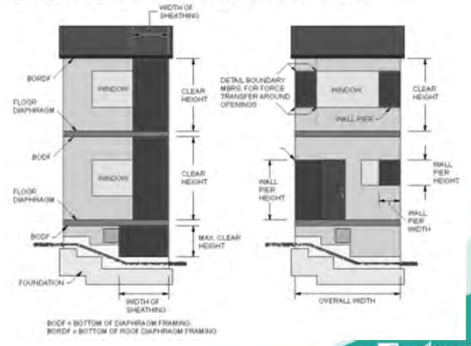


SHEAR WALL DESIGNED FOR FORCE TRANSFER AROUND OPENINGS

Workbook page 124

166

Step 6. Check force-transfer shear walls



Workbook page 125

167

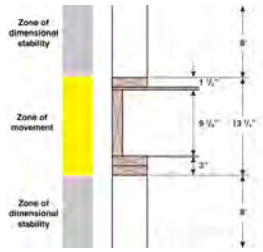
Step 6. Check force-transfer shear walls

- Wall pier width ≥ 2 ft.
- Full height wall segment at each end of wall.
- Collectors for force-transfer shall be provided through the full length of the shear wall.

Workbook page 125

168

Step 7. Check wood shrinkage



Workbook page 126

169

Plan Review Activity

170

Final Reflection

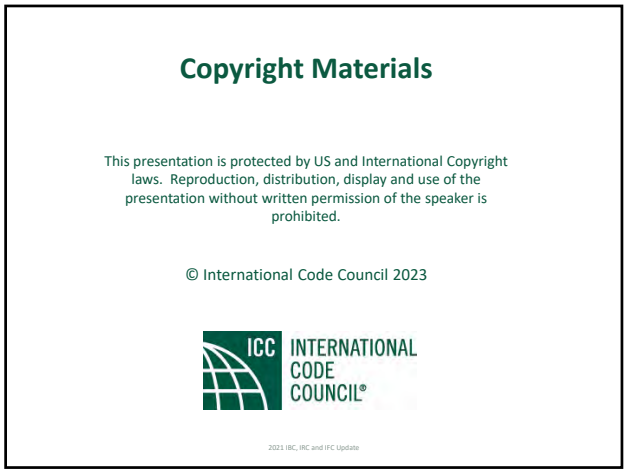
- *What (Happened)?*
  - What was the most important thing you learned today?
- *So What (Does It Mean to You)?*
  - Why is this information important for you to know?
- *Now What (Are You Going to Do)?*
  - How will you use this information at work?

Workbook page 127

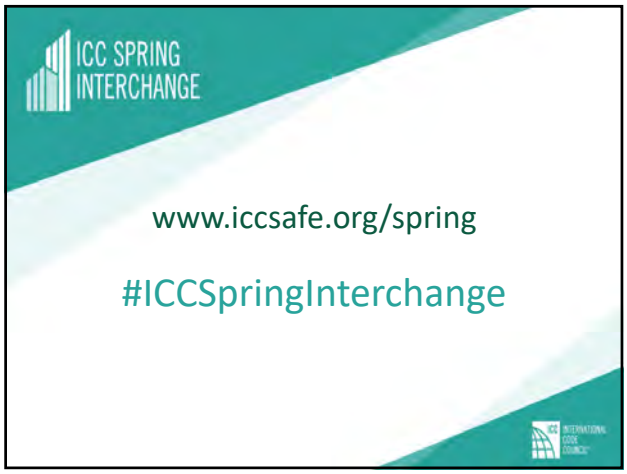
171


ICC SPRING INTERCHANGE
Thank you for Attending
Visit learn.iccsafe.org for more training opportunities

172


Copyright Materials
This presentation is protected by US and International Copyright laws. Reproduction, distribution, display and use of the presentation without written permission of the speaker is prohibited.
© International Code Council 2023
ICC INTERNATIONAL CODE COUNCIL®
2021 IBC, IRC and IFC Update

173


ICC SPRING INTERCHANGE
www.iccsafe.org/spring
#ICCSpringInterchange

174