

International Code Council

93-Tall-Mass-Timber-Buildings

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Question: 1

For a sprinklered Business Occupancy (Group B) in a 15-story building of Type IV-A construction, the maximum allowable building area is:

- A. 54,000 sq. ft.
- B. 648,000 sq. ft.
- C. 972,000 sq. ft.
- D. unlimited.

Answer: C

Explanation:

The calculation begins with 2021 IBC Table 506.2. Because the building is a Group B occupancy, has more than one story, and is protected throughout by an automatic sprinkler system complying with Section 903.3.1.1, the applicable tabular classification is “SM”—a multistory, fully sprinklered building. For Group B and Type IV-A construction, Table 506.2 assigns an SM allowable area factor of 324,000 square feet. However, this is not the final total allowable building area. Section 506.2.1 requires a single-occupancy building with more than three stories above grade plane to use Equation 5-2. Where no frontage increase is stated, the calculation is:

$324,000 \text{ square feet} \times 3 = 972,000 \text{ square feet.}$

The story-area multiplier is limited to three even though the building contains 15 stories. The code does not permit multiplying 324,000 square feet by all 15 stories. Additionally, the actual area of an individual story cannot exceed its calculated allowable area. Option A represents a different construction-type area factor, while option B does not result from the required IBC multistory calculation. The building is not automatically unlimited merely because it is Type IV-A and sprinklered.

Reference: 2021 IBC Sections 506.2 and 506.2.1; Equation 5-2; Table 506.2, Group B, Type IV-A, SM area factor.

Question: 2

Which of the following products is not included in the definition of mass timber?

- A. Solid sawn lumber
- B. Prefabricated wood I-joists
- C. Glued laminated timber
- D. Cross-laminated timber

Answer: B

Explanation:

Prefabricated wood I-joists are engineered wood framing products, but they are not mass timber elements because their configuration does not meet the minimum solid cross-sectional dimensions required for Type IV mass timber construction. Option B is therefore correct.

An I-joist consists of relatively thin flanges connected by a thin structural web. Its efficient open-web-like cross section is fundamentally different from a large solid, laminated, built-up or panelized timber element. I-joists are separately regulated by IBC Section 2303.1.2 and are manufactured and evaluated in accordance with ASTM D5055.

Solid-sawn lumber can qualify as mass timber when it satisfies the minimum heavy-timber dimensions. Structural glued-laminated timber is a recognized large-section engineered timber product, while cross-laminated timber is explicitly recognized as a panelized mass timber product and is regulated by ANSI/APA PRG 320.

The critical inspection point is that the term “engineered wood” does not automatically mean “mass timber.” The special inspector must verify the product category, minimum dimensions, approved construction type, applicable product standard, identification marks and installation requirements shown in the approved construction documents.

Reference: 2021 IBC Chapter 2 definition of “Mass Timber”; Sections 2303.1.2, 2303.1.3, 2303.1.4 and 2304.11; ASTM D5055.

Question: 3

In mass timber construction of Type IV-B, each of the following is suitable for use as fireblocking except:

- A. mineral wool.
- B. one-half-inch gypsum board.
- C. 7/16-inch wood structural panels.
- D. mass timber complying with IBC Section 2304.11.

Answer: C

Explanation:

A 7/16-inch wood structural panel is not one of the prescriptively acceptable fireblocking materials listed by IBC Section 718.2.1. Therefore, option C is correct.

Section 718.2.1 permits fireblocking to consist of several specified materials. These include one-half-inch gypsum board; properly secured batts or blankets of mineral wool, mineral fiber, or other approved materials; and mass timber complying with Section 2304.11. Options A, B, and D are consequently valid. For wood structural panels, however, the IBC requires a substantially greater thickness: a single thickness of approximately 0.719 inch, conventionally represented as 23/32 inch, with joints backed by material of the same required thickness. A 7/16-inch panel is only approximately 0.438 inch thick and therefore does not satisfy that prescriptive fireblocking provision.

Fireblocking is intended to interrupt concealed draft openings and restrict the movement of flame and hot gases through concealed combustible spaces. It should not be confused with a tested firestop system used at penetrations through fire-resistance-rated assemblies.

Special inspection should confirm that the installed material, thickness, joint backing, retention, and location conform to the approved construction documents and the applicable code provision.

Reference: 2021 IBC Sections 718.2 and 718.2.1; Section 2304.11; permitted fireblocking materials.

Question: 4

One code-recognized method for calculating the fire-resistance rating of exposed wood members and decking is:

- A. ACI 216.1
- B. TMS 0216
- C. ASCE 29 Chapter 5
- D. AWS NDS Chapter 16

Answer: D

Explanation:

The intended answer is ANSI/AWC NDS Chapter 16. The video option uses “AWS,” but the correct standards organization is the American Wood Council—AWC . Option D is therefore correct based on its intended reference.

IBC Section 722.1 expressly permits exposed wood members and wood decking to have their calculated fire resistance determined in accordance with Chapter 16 of the ANSI/AWC National Design Specification for Wood Construction. The method evaluates charring, the effective char depth, the reduced residual cross section, elevated-temperature effects, loading, and the remaining structural capacity for the required exposure period.

ACI 216.1 applies to concrete and masonry fire resistance. TMS 0216 addresses masonry assemblies. ASCE 29 Chapter 5 provides procedures for calculating the fire resistance of structural steel assemblies. Those references are code-recognized methods, but they apply to different construction materials. For mass timber inspection, the approved calculations should identify the exposed surfaces, required rating, timber species or product, member dimensions, design loads, protective contribution, and connection treatment. Field reductions in member dimensions can invalidate the calculated fire resistance.

Question: 5

In Type IV-C construction, a connection between two members of the primary structural frame supporting a floor is required to be protected to achieve a minimum fire-resistance rating of:

- A. 1 hour
- B. 1-1/2 hours
- C. 2 hours
- D. 3 hours

Answer: C

Explanation:

The required minimum fire-resistance rating is two hours , making option C correct. Table 601 assigns a two-hour fire-resistance rating to the primary structural frame in Type IV-C construction. The structural

connection between members of that rated frame cannot become a premature failure point in the load path.

IBC Section 2304.10.1 specifically addresses structural connections in Types IV-A, IV-B, and IV-C mass timber construction. Connection protection must provide the fire-resistance performance required for the connected building element. This can be accomplished through protected connection configurations, approved fire testing, or engineering analysis satisfying the applicable code criteria. The connection includes more than the visible steel plate or bolt. Fasteners, connectors, concealed steel, bearing zones, and portions of the timber participating structurally in the connection must collectively maintain the required performance. A one-hour or 1½-hour connection would undermine a structural frame required to remain functional for two hours. Three hours is the primary-frame rating associated with Type IV-A, not the Type IV-C condition specified here.

The inspector should verify protection thickness, wood cover, gypsum layers, hardware embedment, edge conditions, and approved connection geometry before concealment.

Reference: 2021 IBC Table 601; Section 2304.10.1; fire-resistant structural connections in Types IV-A, IV-B, and IV-C.

Question: 6

The building owner shall be responsible for each of the following for fire safety during construction except:

- A. completion of a daily fire safety inspection at the project site by the site safety director.
- B. documentation and maintenance on-site of each inspection's results until a certificate of occupancy has been issued.
- C. securing documentation in a fire- and water-resistant safe until a certificate of occupancy has been issued.
- D. making documentation immediately available on-site for presentation to the fire code official upon request.

Answer: C

Explanation:

Option C is not an IFC requirement. The 2021 IFC requires inspection records to be maintained on-site, but it does not require those records to be secured in a fire- and water-resistant safe.

Section 3303.2 requires the owner to designate a site safety director. Section 3303.3 then makes that director responsible for completing a daily fire safety inspection of the project site. Every day, building and outdoor construction areas must be evaluated against the prescribed fire-safety inspection items. The results of each inspection must be documented and retained on-site until a certificate of occupancy has been issued. The records must also be immediately available at the site for presentation to the fire code official upon request. Options A, B, and D therefore accurately reflect the code requirements. The daily inspection program covers practical hazards such as hot work, temporary heating, combustible debris, temporary electrical wiring, hazardous-material storage, fire apparatus access, hydrants, fire department connections, standpipe availability, and portable extinguishers.

For tall mass timber projects, this documentation is particularly important because substantial combustible construction may be present before permanent fire protection systems are complete.

Question: 7

Which of the following requires continuous special inspection?

- A. Bolted connections
- B. Concealed connections
- C. Anchorage of mass timber construction to deep foundation systems
- D. Adhesive anchors installed horizontally resisting sustained tension loads

Answer: D

Explanation:

Adhesive anchors installed horizontally to resist sustained tension loads require continuous special inspection. Therefore, option D is correct.

Continuous special inspection means that the special inspector must be present during the performance of the regulated work. This heightened oversight is necessary because horizontal or upwardly inclined adhesive-anchor installations resisting sustained tension are sensitive to installation variables such as borehole cleaning, adhesive proportioning, mixing, placement, embedment depth, temperature, cure time, and prevention of adhesive loss before curing. A concealed installation defect can substantially reduce long-term tension capacity.

The other listed activities are generally subject to periodic inspection under the mass timber special-inspection provisions. Periodic inspection allows the inspector to observe the work intermittently at appropriate stages rather than remaining present throughout the entire operation. Bolted connections, concealed mass timber connections, and anchorage of mass timber construction to deep foundation systems must still be inspected, but the code does not automatically designate each of those activities as continuous.

The inspector should also verify installer certification where required, approved adhesive-anchor evaluation documentation, expiration dates, storage conditions, drilling method, hole dimensions, and compliance with the approved structural documents.

Reference: 2021 IBC Sections 1705.3 and 1705.5.3; Table 1705.3; continuous inspection of adhesive anchors under sustained tension.

Question: 8

In mass timber construction of Type IV-C, the fire-resistance ratings of bearing walls are permitted to be reduced by _____ where supporting a roof only.

- A. 30-minutes
- B. 45-minutes
- C. 1-hour
- D. 2-hours

Answer: C

Explanation:

IBC Table 601, Footnote “a,” permits a one-hour reduction in the required fire-resistance rating of the primary structural frame and bearing walls where those elements support a roof only. Option C is therefore correct.

For Type IV-C construction, the normal Table 601 requirement for bearing walls is two hours. Where a bearing wall qualifies as supporting only roof construction, application of the footnote permits that rating to be reduced from two hours to one hour.

The limitation “supporting a roof only” is critical. The reduction cannot be applied simply because a wall is located at the uppermost occupied level. If the wall carries a floor, mezzanine, transfer load, occupied rooftop structure, or another structural element beyond qualifying roof construction, the condition for the reduction is not satisfied.

Options A and B are not reductions prescribed by Table 601. Option D would effectively eliminate the entire normal two-hour Type IV-C bearing-wall rating, which the footnote does not permit.

For inspection purposes, the approved construction documents and structural load path must substantiate use of the reduction. The fire-protection installation should then be checked against the actual reduced rating specifically authorized by the design.

Reference: 2021 IBC Table 601, Footnote “a”; Type IV-C bearing walls supporting roof construction only.

Question: 9

Are mass timber elements permitted to serve as a fire barrier to an adjacent occupancy if they are separated from the interior of the building with an approved thermal barrier consisting of a minimum of 1/2 in. gypsum board or a noncombustible equivalent?

- A. No
- B. Yes, for Type IV-B only
- C. Yes, for Type IV-HT
- D. Yes for Type IV-B and IV-C

Answer: D

Explanation:

Yes. The allowance applies to both Type IV-B and Type IV-C construction , making option D correct.

IBC Section 508.4.4.1 regulates the construction of required separations between adjacent occupancies. Where the required separation is formed by a fire barrier or horizontal assembly, mass timber elements are specifically permitted to serve that function in Type IV-B or Type IV-C construction provided the mass timber is separated from the building interior by an approved thermal barrier.

The prescribed thermal barrier is gypsum board not less than 1/2 inch thick , or another material that has been tested and meets both the Temperature Transmission Fire Test and Integrity Fire Test acceptance criteria of NFPA 275.

The requirement is supplemental to the actual fire-resistance rating required for the occupancy separation. In other words, simply installing 1/2-inch gypsum board does not independently create the required fire barrier; the underlying mass timber assembly must also provide the applicable rated performance.

Type IV-HT is not included in this specific Section 508.4.4.1 mass timber allowance.

Reference: 2021 IBC Section 508.4.4.1; Type IV-B and IV-C occupancy separations; NFPA 275 thermal barriers.

Question: 10

Where Type X gypsum board serves as noncombustible protection for interior surfaces of wall and ceiling assemblies, all of the following code provisions are correct except:

- A. Screws shall penetrate at least 1 in. into mass timber.
- B. Screws shall be spaced 12 in. on center in both directions.
- C. Panel edges of any layer shall be offset 18 inches from those of the previous layer.
- D. Panel edges of the base layer shall be taped and finished with joint compound.

Answer: D

Explanation:

Option D is the incorrect statement. IBC Section 722.7.2.1 requires the panel edges of the face layer, rather than the base layer, to be taped and finished with joint compound. Fastener heads on the face layer must also be covered with joint compound.

The other three provisions accurately reproduce the code. Each gypsum-board layer must be secured with Type S drywall screws long enough to penetrate the mass timber at least 1 inch when driven flush. Screws for the base layer are installed at 12 inches on center in both directions. Subsequent layers use the same general spacing but are offset from screws in the preceding layer. In addition, the panel edges of each succeeding layer must be offset 18 inches from the panel edges of the previous layer.

These details are not merely workmanship recommendations. They form part of the installation conditions under which the protection contributions in Table 722.7.1(2) can be credited.

Total Questions:
100

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