### Structural Load Requirements (2012)

**Table 1607.1—continued**

<table>
<thead>
<tr>
<th>OCCUPANCY OR USE</th>
<th>UNIFORM (psf)</th>
<th>CONCENTRATED (lbs.)</th>
</tr>
</thead>
</table>
| 28. School
   Classrooms     | 100           | —                   |
   Corridors       | 100           | —                   |
   First-floor      | 100           | —                   |
| 29. Sidewalks, vehicular drive ways and yards, subject to tracking | 1250         | 80,000             |

For SI: 1 ft² = 0.0929 m²,
1 pound per square foot = 0.0049 kN/m²,
1 pound per cubic foot = 0.0624 kg/m³.

a. Floors in garages or parts of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated loads: (1) for garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 by 4.5 inches; (2) for mechanical parking structures without slabs or decks that are used for storing passenger vehicles only, 1,500 pounds per wheel.

b. The loading applies to stack rooms that support nonmobile, double-faced library book stacks, subject to the following limitations:

1. The nominal stack unit height shall not exceed 90 inches.
2. The nominal shelf depth shall not exceed 12 inches for each face, and parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches wide.

c. Design in accordance with ICC.300.

d. Other uniform loads in accordance with an approved method containing provisions for truck loadings shall also be considered where appropriate.

e. The concentrated wheel load shall be applied on an area of 4.5 by 4.5 inches.

f. The minimum concentrated load on stair treads shall be applied on an area of 2 by 2 inches. This load need not be assumed to act concurrently with the uniform load.

g. Where snow loads occur that are in excess of the design conditions, the structure shall be designed to support the loads due to the increased loads caused by drift buildup or a greater snow design determined by the building official (see Section 1608).

h. See Section 1604.8.3 for decks attached to exterior walls.

i. Uninhabitable attics without storage are those where the maximum clear height between the joists and rafters is less than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating a rectangular 14 inches by 14 inches in height by 42 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
Live Loads & Allowed Reductions

1607.10 Reduction in uniform live loads. Except for uniform live loads at roofs, all other minimum uniformly distributed live loads, \( L_o \), in Table 1607.1 are permitted to be reduced in accordance with Section 1607.10.1 or 1607.10.2. Uniform live loads at roofs are permitted to be reduced in accordance with Section 1607.12.2.

1607.10.1 Basic uniform live load reduction. Subject to the limitations of Sections 1607.10.1.1 through 1607.10.1.3 and Table 1607.1, members for which a value of \( K_{LL}A_f \) is 400 square feet (37.16 m\(^2\)) or more are permitted to be designed for a reduced uniformly distributed live load, \( L \), in accordance with the following equation:

\[
L = L_o \left( 0.25 + \frac{15}{\sqrt[6]{K_{LL}A_f}} \right) \quad \text{(Equation 16-23)}
\]

For SI:

\[
L = L_o \left( 0.25 + \frac{4.57}{\sqrt[6]{K_{LL}A_f}} \right)
\]

where:

- \( L \) = Reduced design live load per square foot (m\(^2\)) of area supported by the member.
- \( L_o \) = Unreduced design live load per square foot (m\(^2\)) of area supported by the member (see Table 1607.1).
- \( K_{LL} \) = Live load element factor (see Table 1607.10.1).
- \( A_f \) = Tributary area, in square feet (m\(^2\)).
- \( L \) shall not be less than \( 0.50L_o \) for members supporting one floor and \( L \) shall not be less than \( 0.40L_o \) for members supporting two or more floors.

<table>
<thead>
<tr>
<th>TABLE 1607.10.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIVE LOAD ELEMENT FACTOR, ( K_{LL} )</td>
</tr>
<tr>
<td>ELEMENT</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Interior columns</td>
</tr>
<tr>
<td>Interior columns without cantilever slabs</td>
</tr>
<tr>
<td>Edge columns with cantilever slabs</td>
</tr>
<tr>
<td>Center columns with cantilever slabs</td>
</tr>
<tr>
<td>Edge beams without cantilever slabs</td>
</tr>
<tr>
<td>Interior beams</td>
</tr>
<tr>
<td>All other members not identified above including:</td>
</tr>
<tr>
<td>Edge beams with cantilever slabs</td>
</tr>
<tr>
<td>Cantilever beams</td>
</tr>
<tr>
<td>One-way slabs</td>
</tr>
<tr>
<td>Two-way slabs</td>
</tr>
<tr>
<td>Members without provisions for continuous shear transfer normal to their span</td>
</tr>
</tbody>
</table>

1607.10.1.1 One-way slabs. The tributary area, \( A_r \), for use in Equation 16-23 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

1607.10.1.2 Heavy live loads. Live loads that exceed 100 psf (4.79 kN/m\(^2\)) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than \( L \) as calculated in Section 1607.10.1.

2. For use other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

1607.10.1.3 Passenger vehicle garages. The live loads shall not be reduced in passenger vehicle garages.

Exception: The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than \( L \) as calculated in Section 1607.10.1.

1607.10.2 Alternative uniform live load reduction. As an alternative to Section 1607.10.1 and subject to the limitations of Table 1607.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m\(^2\)) except that the design live load for members supporting two or more floors is permitted to be reduced by a maximum of 20 percent.

Exception: For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent.

3. For live loads not exceeding 100 psf (4.79 kN/m\(^2\)), the design live load for any structural member supporting 150 square feet (13.94 m\(^2\)) or more is permitted to be reduced in accordance with Equation 16-24.

4. For one-way slabs, the area, \( A_r \), for use in Equation 16-24 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

\[
R = 0.08(A_r - 150) \quad \text{(Equation 16-24)}
\]

For SI:

\[
R = 0.86(A_r - 13.94)
\]

Such reduction shall not exceed the smallest of:

1. 40 percent for horizontal members;
2. 60 percent for vertical members; or
3. \( R \) as determined by the following equation.

\[
R = 23.11(1 + D/L_o) \quad \text{(Equation 16-25)}
\]

where:

- \( A_r \) = Area of floor supported by the member, square feet (m\(^2\)).
- \( D \) = Dead load per square foot (m\(^2\)) of area supported.
- \( L_o \) = Unreduced live load per square foot (m\(^2\)) of area supported.
- \( R \) = Reduction in percent.

1607.11 Distribution of floor loads. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. Floor live loads are permitted to be reduced in accordance with Section 1607.10.
Minimum Roof Loads

1607.12 Roof loads. The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.12.1 Distribution of roof loads. Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m²) in accordance with Section 1607.12.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect. See Section 1607.12.2 for reductions in minimum roof live loads and Section 7.5 of ASCE 7 for partial snow loading.

1607.12.2 General. The minimum uniformly distributed live loads of roofs and marquees, \( L_u \), in Table 1607.1 are permitted to be reduced in accordance with Section 1607.12.2.1.

1607.12.2.1 Ordinary roofs, awnings and canopies. Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load, \( L_u \), as specified in the following equations or other controlling combinations of loads as specified in Section 1605, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m²).

\[
L_u = L_u R_1 R_2
\]  
(Equation 16-26)

where: \( 12 \leq L_u \leq 20 \)

For SI: \( L_u = L_u R_1 R_2 \)
where: \( 0.58 \leq L_u \leq 0.96 \)

\( L_u \) = Unreduced roof live load per square foot (m²) of horizontal projection supported by the member (see Table 1607.1).

\( L_u \) = Reduced roof live load per square foot (m²) of horizontal projection supported by the member.

The reduction factors \( R_1 \) and \( R_2 \) shall be determined as follows:

\[
R_1 = 1 \text{ for } A_s \leq 200 \text{ square feet (18.58 m²)}
\]  
(Equation 16-27)

\[
R_1 = 1.2 - 0.001A_s \text{ for 200 square feet } < A_s < 600 \text{ square feet}
\]  
(Equation 16-28)

For SI: \( R_1 = 1.2 - 0.011A_s \) for 18.58 square meters \( < A_s < 55.74 \) square meters

\[
R_2 = 0.6 \text{ for } A_s \geq 600 \text{ square feet (55.74 m²)}
\]  
(Equation 16-29)

where:

\( A_s \) = Tributary area (span length multiplied by effective width) in square feet (m²) supported by the member, and

\[
R_1 = 1 \text{ for } F \leq 4
\]  
(Equation 16-30)

\[
R_1 = 1.2 - 0.05 F \text{ for } 4 < F < 12
\]  
(Equation 16-31)

\[
R_1 = 0.6 \text{ for } F \geq 12
\]  
(Equation 16-32)

where:

\( F \) = For a sloped roof, the number of inches of rise per foot (for SI: \( F = 0.12 \times \) slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607.12.3 Occupiable roofs. Areas of roofs that are occupiable, such as roof gardens, or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607.10.

1607.12.3.1 Landscaped roofs. The uniform design live load in unoccupied landscaped areas on roofs shall be 20 psf (0.958 kN/m²). The weight of all landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

1607.12.4 Awnings and canopies. Awnings and canopies shall be designed for uniform live loads as required in Table 1607.1 as well as for snow loads and wind loads as specified in Sections 1608 and 1609.
Minimum Snow Loads
SECTION 1603
CONSTRUCTION DOCUMENTS

1603.1 General. Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the construction documents.

Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2208 shall indicate the following structural design information:

1. Floor and roof live loads.
2. Ground snow load, $P_e$.
3. Ultimate design wind speed, $V_{10}$, (3-second gust), miles per hour (mph) (km/hr) and nominal design wind speed, $V_{15}$, as determined in accordance with Section 1609.3.1 and wind exposure.
4. Seismic design category and site class.
5. Flood design data, if located in flood hazard areas established in Section 1612.3.
6. Design load-bearing values of soils.

1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.10 shall be indicated for each type of live load used in the design.

1603.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas (Section 1607.12).

1603.1.3 Roof snow load data. The ground snow load, $P_e$, shall be indicated. In areas where the ground snow load, $P_e$, exceeds 10 pounds per square foot (psf) (0.479 kN/m²), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

   1. Flat-roof snow load, $P_f$.
   2. Snow exposure factor, $C_e$.
   3. Snow load importance factor, $I_e$.
   4. Thermal factor, $C_r$.

1603.1.4 Wind design data. The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force-resisting system of the structure:

   1. Ultimate design wind speed, $V_{10}$, (3-second gust), miles per hour (mph) and nominal design wind speed, $V_{15}$, as determined in accordance with Section 1609.3.1.
   2. Risk category.
   3. Wind exposure. Where more than one wind exposure is utilized, the wind exposure and applicable wind direction shall be indicated.
   4. The applicable internal pressure coefficient.
   5. Components and cladding. The design wind pressures in terms of psf (kN/m²) to be used for the design of exterior component and cladding materials not specifically designed by the registered design professional.

1603.1.5 Earthquake design data. The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

   1. Risk category.
   2. Seismic importance factor, $I_s$.
   3. Mapped spectral response acceleration parameters, $S_s$ and $S_y$.
   4. Site class.
   5. Design spectral response acceleration parameters, $S_{os}$ and $S_{oy}$.
   6. Seismic design category.
   7. Basic seismic force-resisting system(s).
   8. Design base shear(s).
   9. Seismic response coefficient(s), $C_r$.
   10. Response modification coefficient(s), $R$.
   11. Analysis procedure used.

1603.1.6 Geotechnical information. The design load-bearing values of soils shall be shown on the construction documents.

1603.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.5, shall be included and the following information, referenced to the datum on the community’s Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

   1. In flood hazard areas not subject to high-velocity wave action, the elevation of the proposed lowest floor, including the basement.
   2. In flood hazard areas not subject to high-velocity wave action, the elevation to which any nonresidential building will be dry flood proofed.
   3. In flood hazard areas subject to high-velocity wave action, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1603.1.8 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof shall be indicated along with the specified section of this code that addresses the special loading condition.

1603.1.9 Systems and components requiring special inspections for seismic resistance. Construction documents or specifications shall be prepared for those systems and components requiring special inspection for seismic resistance as specified in Section 1705.11 by the registered design professional responsible for their design and shall be submitted for approval in accordance with Section 107.1. Reference to seismic standards in lieu of detailed drawings is acceptable.
1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift. See Section 12.12.1 of ASCE 7 for drift limits applicable to earthquake loading.

1604.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

1604.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJII CJ-1.0, SJII JG-1.1, SJII K-1.1 or SJII LH/DLH-1.1, as applicable.

1604.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by TMS 402/ACI 530/ASCE 5.

1604.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM.

1604.3.6 Limits. The deflection limits of Section 1604.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

<table>
<thead>
<tr>
<th>TABLE 1604.3 DEFLECTION LIMITS</th>
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</thead>
<tbody>
<tr>
<td><strong>CONSTRUCTION</strong></td>
</tr>
<tr>
<td>Roof members:</td>
</tr>
<tr>
<td>Supporting plaster or stucco ceiling</td>
</tr>
<tr>
<td>Supporting nonplaster ceiling</td>
</tr>
<tr>
<td>Not supporting ceiling</td>
</tr>
<tr>
<td>Floor members</td>
</tr>
<tr>
<td>Exterior walls and interior partitions:</td>
</tr>
<tr>
<td>With plaster or stucco finishes</td>
</tr>
<tr>
<td>With other brittle finishes</td>
</tr>
<tr>
<td>With flexible finishes</td>
</tr>
<tr>
<td>Farm buildings</td>
</tr>
<tr>
<td>Greenhouses</td>
</tr>
</tbody>
</table>

for SI: 1 foot = 304.8 mm.

a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed L/60. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed L/150. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed L/50. For roofs, this exception only applies when the metal sheets have no roof covering.

b. Interior partitions not exceeding 6 feet in height and flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.14.

c. See Section 2403 for glass supports.

d. For wood structural members having a moisture content of less than 16 percent at time of installation and used under dry conditions, the deflection resulting from 

\[ L + 0.5D \] 

is permitted to be substituted for the deflection resulting from 

\[ L + D \]

e. The above deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to assure adequate drainage shall be investigated for ponding. See Section 1611 for rain and ponding requirements and Section 1503.4 for roof drainage requirements.

f. The wind load is permitted to be taken as 0.42 times the “component and cladding” loads for the purpose of determining deflection limits herein.

g. For steel structural members, the dead load shall be taken as zero.

h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers, not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed L/60. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed L/175 for each glass lite or L/60 for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed L/120.

i. For cantilever members, L shall be taken as twice the length of the cantilever.