Snow Load Changes

2025 DBC, 2024 IBC/IRC, ASCE 7-22

Outline

1. New snow loads – why?
2. 2024 IBC snow load changes
3. ASCE 7-22 snow load changes
4. 2025 DCBC snow load changes
5. 2024 IRC snow load changes
6. 2025 DRC snow load changes
7. ASCE Hazard Tool
8. Plan review and design issues

New Snow Loads – Why?

- ASCE 7-22 has a target reliability (annual probability of failure) for each risk category
- Old snow loads based on 50-year mean recurrence interval provided nonuniform reliability due to climatic differences across the country (some conservative, some not!)
- New reliability-targeted (strength based) ground snow loads provide uniform reliability based on historic snow depth records
- New loads are based on 30 more years of snow depth records

2024 IBC – 202 Definitions and 1602.2 Notations

Building

New definitions:

GROUND SNOW LOAD, p_g. Design ground snow loads.

GROUND SNOW LOAD, $p_{g(asd)}$. *Allowable stress design* ground snow loads.

GROUND SNOW LOAD GEODATABASE. The ASCE database (version 2022-1.0) of geocoded values of risk-targeted design ground snow load values.

New notations:

$p_{g(asd)}$ = *Allowable stress design* ground snow load.

p_g = Ground snow load determined from Figures 1608.2(1) through 1608.2(4) and Table 1608.2(1)

2024 IBC – 1608.2 Ground Snow Loads

The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with the reliability-targeted (strength based) ground snow load values in Chapter 7 of ASCE 7 or Figures 1608.2(1) through 1608.2(4) for the contiguous United States and Table 1608.2 for Alaska.

Key takeaways:

- Strength based – previously allowable stress design based
- More figures – one for each Risk Category
- Figures are too small to read – footnote sends you to the Ground Snow Load Geodatabase which can be accessed through the ASCE 7 Hazard Tool (first website to become part of the code!)
- Chapter 7 of ASCE 7 also sends you to the Hazard Tool

2024 IBC - Snow Load Figures

FIGURE 1608.2(2) GROUND SNOW LOADS, p_g, FOR RISK CATEGORY II FOR THE CONTERMINOUS UNITED STATES (lb/ft^2)

Notes:

1. Location-specific ground snow load values are provided in the Ground Snow Load Geodatabase of geocoded design ground snow load values, which can be accessed at the ASCE 7 Hazard Tool at https://asce7hazardtool.online/ or anapproved equivalent.

2024 IBC – Misc. snow changes

- 1608.2.1 Ground snow conversion: $p_{g(asd)} = 0.7\ p_g$
- 1603.1 Construction documents for conventional light-frame construction must now show p_g and $p_{g(asd)}$
- 1603.1.3 Construction documents snow load data:
  - Risk category instead of importance factor
  - Winter wind parameter for snow drift added
- 1605.2 Alternative ASD load combinations: 0.7S instead of S

ASCE 7-22 – Ground Snow Loads

- 7.1.1 Definitions: New definition for ASCE DESIGN GROUND SNOW LOAD GEODATABASE (similar to IBC definition, based on risk-targeted ground snow)

- 7.1.1 Definitions: GROUND SNOW LOAD definition removes reference to 50-year mean recurrence interval
- 7.1.2 Symbols: W_2 added for winter wind parameter (used for drift)
- 7.2 Ground Snow Loads: Sends you to the Geodatabase and has a user note for the ASCE 7 Hazard Tool

ASCE 7-22 – Roof Snow Loads

- 7.3 Flat Roof Snow Load: Importance factor removed from formula since there are different snow loads for each risk category

- 7.3.2 Thermal Factor: Major change - factor is now variable based on insulation R-value and ground snow load

- 7.6 and 7.7 Unbalanced Loads and Drifts: Revised to now include a winter wind parameter (percent of time wind speed is above 10 mph during winter)

ASCE 7-22 – Thermal Factors

Table 7.3-2. Thermal Factor, C_t.

REVISED

Thermal condition[a]	C_t
All structures except as indicated as follows	See Table 7.3-3
Unheated structures, open-air structures, structures kept just above freezing [40 to 50 °F (4 to 10 °C)], and other structures with cold, ventilated roofs meeting the minimum requirements of the applicable energy code	1.2
Freezer building	1.3
Continuously heated greenhouses[b] with a roof having a thermal resistance (R-value) less than 2.0 h·ft²·°F/Btu (0.4 m²·K/W) or a thermal transmittance (U-factor) greater than 0.5 Btu/h·ft²·°F (2.5 W/m²·K)	0.85

Table 7.3-3. Thermal Factor, C_t, for Heated Structures with Unventilated Roofs.[a] NEW TABLE

		P_g (psf [kPa])						
R_{roof} (h·ft²·°F/Btu [m²·K/W])	U_{roof} (Btu/h·ft²·°F [W/m²·K])	≤10 [0.48]	20 [0.96]	30 [1.44]	40 [1.92]	50 [2.40]	60 [2.88]	≥70 [3.36]
≤20 [3.52]	≥0.050 [0.284]	1.20	1.11	1.05	1.01	1.00	1.00	1.00
30 [5.28]	0.033 [0.189]	1.20	1.17	1.14	1.13	1.12	1.11	1.10
40 [7.04]	0.025 [0.142]	1.20	1.19	1.17	1.16	1.16	1.15	1.15
50 [8.80][b]	0.020 [0.114][b]	1.20	1.20	1.19	1.19	1.19	1.18	1.18

ASCE 7-22 – Load Combinations

Snow load combinations revised for strength level snow loads (*S*)

- Strength Design Example

  OLD: $1.2D + 1.6S$

  NEW: $1.2D + 1.0S$

- Allowable Stress Design Example

  OLD: $D + S$

  NEW: $D + 0.7S$

2025 DCBC – Snow Loads

- Amendment for ground snow load deleted – determine with ASCE 7 Hazard tool per IBC or ASCE 7
- Amendment for increased importance factors deleted – this is now incorporated in the ASCE 7 snow loads for RC III and IV, which are based on single event maximum snow loads in Denver
- Amendment for snow load on uncovered parking decks remains, but is revised to a strength level load
  (old 55 psf x 1.6 = 88 psf, rounded up to 90 psf)

2025 IRC – Snow loads

Residential

- Table R301.2 Climatic and Geographic Design Criteria – snow load is allowable stress design ground snow load, $p_{g(asd)}$, from Figure R301.2(3)
- Figure is too small to read – footnote sends you to ASCE 7 Hazard Tool
- Hazard Tool simply converts newly developed strength level loads to allowable stress design loads by multiplying by 0.7
- Prescriptive tables haven't changed and are based ground snow load in Table R301.2, which is allowable stress design load per footnote

2025 DRC - Snow Loads

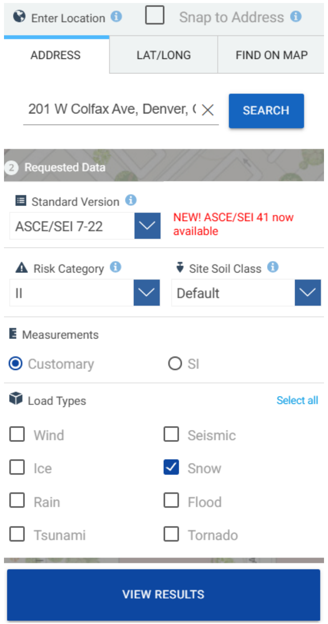
- Table R301.2 – ground snow load is 43 psf (previously 35 psf)
- New footnote permits location specific ground snow load from ASCE 7 Hazard Tool, based on Risk Category II
- 43 psf is worst case $p_{g(asd)}$ within Denver city limits
- $p_{g(asd)}$ is for prescriptive IRC design only
- p_g must be used for engineered design to work with new load combinations in ASCE 7-22

ASCE 7 Hazard Tool

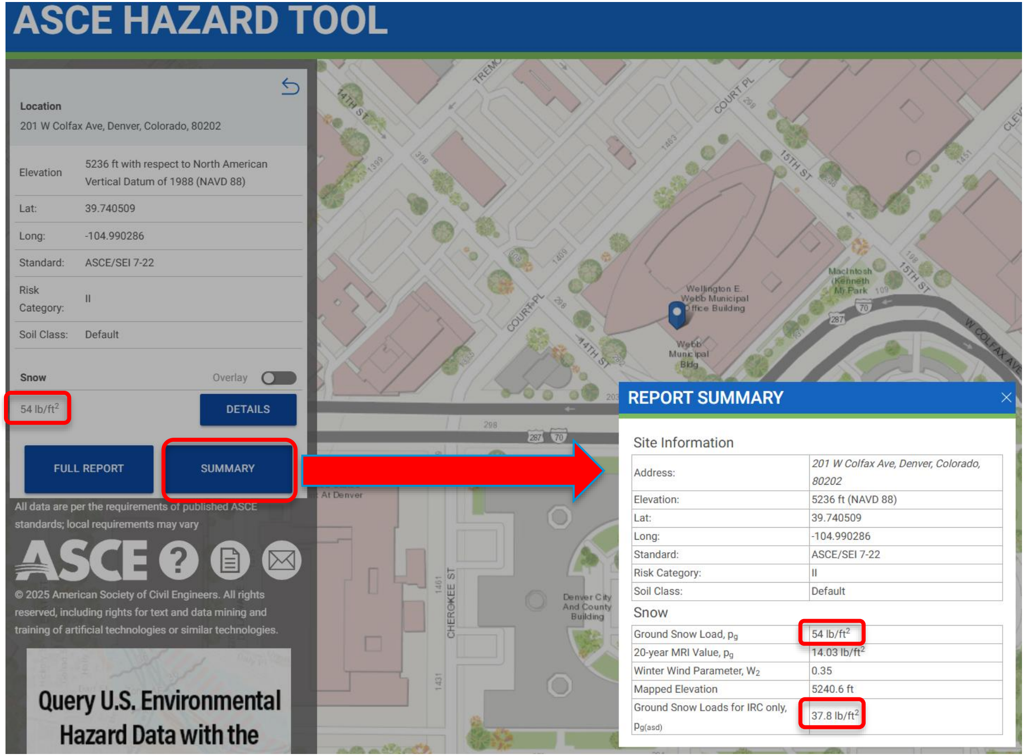
https://ascehazardtool.org/

Inputs:
- Address
- Standard Version: ASCE/SEI 7-22
- Risk Category: actual for IBC, II for IRC
- Load Type: Snow

View Results:
- Initial view shows strength level snow, p_g
- Click “Summary” to see $p_{g(asd)}$ for IRC



ASCE 7 Hazard Tool Results



Initial view shows 54 psf strength level

Summary shows 54 psf strength level and 37.8 asd level for IRC (54x0.7=37.8)

Plan Review and Design Issues

- Design Criteria on Drawings
  - p_g required for IBC
  - $p_{g(asd)}$ for IRC + p_g if engineered design is used

- $p_{g(asd)}$ is for IRC prescriptive only
- p_g is for IBC and IRC engineered design that complies with IBC
- ASCE 7-22 load combinations are based on p_g , not $p_{g(asd)}$
  (if $p_{g(asd)}$ is used, it is incorrectly reduced by 0.7 factor)

- Red Flag: roof snow load calculation uses an importance factor
  - indicates old ASCE 7-16 is being used
  - thermal factor changes are not being incorporated
  - winter wind parameter for drifting is not being incorporated

Plan Review and Design Issues
Existing Buildings

Renovations that increase roof insulation:

- Roof replacement with insulation entirely above roof deck (IECC C503.2.1)
- Change of occupancy to higher energy-demand category (DEC C505.1)
- Voluntary thermal upgrades

Potential issues:

- Added insulation may increase the thermal factor, which increases snow loads
- 5% rule applies for increase in load effects (DEBC 503.3, 706.2, 805.2)
- If load effects increase more than 5%, structure needs to be analyzed and altered as needed to carry gravity loads required for new structures

Evaluation of 5% rule:

- Denver amendments are based on load effects (M, V) from load combinations (dead + snow)
- Only include increase in snow load caused by the alteration (i.e., increased thermal factor)
- Change in ground snow load is not caused by alteration and shouldn't be included in evaluation of 5% rule (but is included in analysis where load effects increase more than 5%)

Questions?

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