HYBRID SEMINAR
May 17, 2022

Thanks for joining us a few minutes early.

We will start promptly at Noon!

Code Updates, GBO 2 Years Later, Ventilation and More!

Speaker Panel: Dan Cupit, *Professional Construction Services,* ***Kade Gromowski****, Terracon Consultants, and* ***John Gimple,*** *Gimple Roof Engineers.*

Thank you to our Sponsors:

Industry Leader

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Webinar Courtesies:

- Thank you to our virtual attendees for being on-time.
- Participant videos are turned off in this hybrid Zoom webinar format.
- All attendees are muted. If you would like to talk or ask a live question, you will need to send a chat message to Debbie. In the case of background noise, the host (me☺) may need to mute you.
- Please participate & use the Q&A, Chat functions for questions.
- Final note, in order to earn CIU/CEU credit, you will be required to answer a final poll question at the end of today's presentation.

Welcome!


CRA
COLORADO ROOFING ASSOCIATION


Colorado Chapter
IBEC
International Institute of
Building Enclosure Consultants

Introductions!

Colorado Chapter
IIBEC
International Institute of
Building Enclosure Consultants

Article 21. ANTITRUST COMPLIANCE POLICIES AND PROCEDURES

Section 1. Jurisdiction

These policies and procedures apply to all meetings of the membership, board and committees, other meetings sponsored by IIBEC, and all meetings attended by representatives of IIBEC and to IIBEC employees in all of their activities within the scope of their employment.

Section 2. Prohibitions and Violations

A. Discussions of prices or price levels are prohibited. In addition, no discussion is permitted of any elements of a company's operations which might influence price.

B. It is a violation of the antitrust laws to agree not to compete; therefore, discussions of division of territories or customers or limitations on the nature of business carried on or products sold are not permitted.

C. Boycotts in any form are unlawful. Discussion relating to boycotts is prohibited including discussions about blacklisting or unfavorable reports about particular companies including their financial situation.

Rules of The Day

- No arguments
- No recruiting
- Constructive input
- All questions are welcome!

Today's Agenda

- Building Codes and Standards - Background
  Dan Cupit
- Significant Code Changes 2021 i-codes (roofing related)
  Dan Cupit, John Gimple
- Expected Changes 2024 i-codes (roofing related)
  John Gimple
- Local Building Codes
  Kade Gromowski, Dan Cupit
- New Colorado Legislation affecting roofing contractors
  Kade Gromowski, Dan Cupit
- Ventilating Steep Slope Reroofs to meet building codes
  Dan Cupit

Dan Cupit

Professional Roofing Consultant
IIBEC Colorado, CRA Education Committee, Professional Construction Services

Dan Cupit is a roofing and building envelope consultant with over 39 years of experience in construction. Dan started his career as an engineering technician in 1980.He graduated in civil engineering from Colorado State University in 1985. Over 11 years, Dan worked for several engineering firms including the Army Corps of Engineers. In 1992 he got into manufacturing as a process engineer and eventually became a plant manager. Dan developed a full line of products and multiple manufacturing processes during that time. By 2001 he was back in construction consulting, inspecting, and repairing roofs. From 2004 through 2016 he was owner of a construction company that grew to 3 locations with over 50 employees installing most types of roofing and exteriors. In 2010 he started training others on roofing and consulting part time. Dan sold the construction company in early 2017 and has been working as a full-time roofing consultant and expert.

Dan has inspected over 2,300 residential and commercial roofs and currently designs roof systems and provides expert work for construction defects and insurance claims, and trains others on roofing. He has specified, supervised and/or managed the installation of over 1,300 roofing and/or exterior projects and is certified in almost every type of roofing with multiple manufacturers. Dan is heavily involved in roofing education. Dan was invited by the City and County of Denver to advise them on their Green Buildings Ordinance and was instrumental in pulling together industry professionals to participate in that process. He is an active member of ASCE, CRA, NRCA, PRE, Tile Roof Institute, is current president of the Colorado Chapter of IIBEC, and is on the state of Colorado ICC Code Standardization Committee.

Kade Gromowski, P.E., RRC, RWC, REWC RBEC
Senior Engineer
Terracon Consultants, Inc

Ms. Gromowski is a Senior Engineer with the Facilities Department in Terracon's Denver office. After graduating from the Pennsylvania State University with a Bachelors and Masters of Architectural Engineering, Ms. Gromowski began her building repair/restoration consulting career in Houston before relocating to the Denver area in 2014. She has worked on hundreds of projects involving the assessment and repair of roofing systems (steep-slope and low-slope), wall claddings, waterproofing, plazas, and building enclosure testing and diagnostics. In addition, Ms. Gromowski has worked on numerous projects involving the structural assessment, restoration, repair, and rehabilitation of a wide variety of building types.

John Gimple
Professional Engineer
Gimple Roof Engineers

John Gimple specializes in the evaluation, design, and testing of commercial and residential roof systems. From preliminary assessments through design consulting and construction monitoring, John uses the latest methods and equipment to assist clients with their roof management, repair and replacement programs. John is a senior member of IIBEC with over 30 years participation.

BUILDING Codes and Standards

IT'S THE LAW !

What are Building Codes?

- The main purpose of building codes is to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures
- Building Codes specify the minimum legal design and construction requirements for a given jurisdiction:
    - Structural integrity
    - Construction materials
    - Fire protection
- Building Codes provide a consistent standard
- Building Code becomes law of a particular jurisdiction when formally enacted by the appropriate governmental or private authority. These laws can be found in the municipal code

History of Building Codes

- Codes of Hammurabi – 2000 BC (Mesopotamia)
  "In the case of collapse of a defective building, the builder is to be put to death if the owner is killed by accident; and the builder's son if the son of the owner loses his life…"

- Socrates – 341 BC (Greece)
  "He shall set the joists against each other, fitting, and before inserting the dowels he shall show the architect all the stones to be fitting, and shall set them true and sound and dowel them with iron dowels, two dowels to each stone…"

Origins of Modern Building Codes

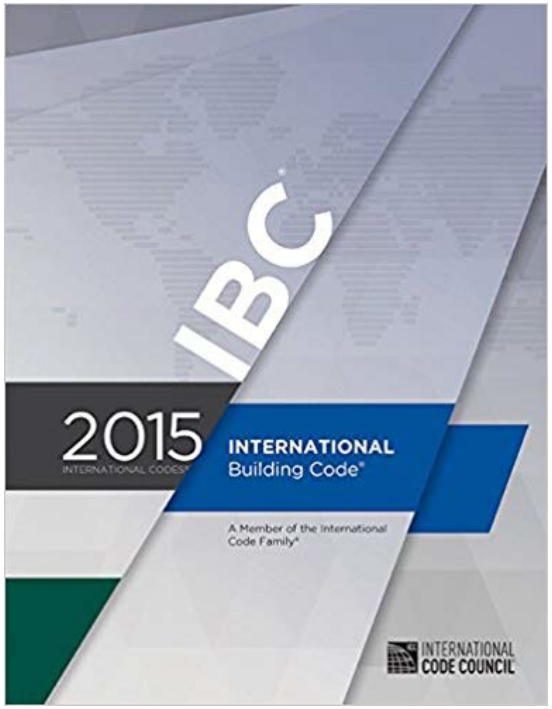
- **Insurance industry**
  Establish standards to minimize accidents/claims.
- **Social organizations**
  Eliminate squalor and impact on health.
- **Local governments**
  Develop regulations to deliver health and safety to citizens
- **Disasters**
  Mitigate loss of life and property based on public demand.

Modern Building Codes

- International Code Council (ICC)
  - The ICC publishes code that is adopted by gov't agencies and municipalities as their municipal code.
  - Once code is adopted by the governing agency it becomes law
  - Members of the ICC meet and hold hearings to adopt and/or change code. These members include:
    - Building Code Officials
    - Manufactures
    - Industry Experts
    - Insurance Companies
    - Testing Agencies
    - Other Industry Professionals

What are the different ICC Codes?

- **(IBC) International Building Code** (commercial buildings)
- **(IRC) International Residential Code** (residential buildings)
- **(IEBC) International Existing Building Code** (existing buildings)
- **(IECC) International Energy Conservation Code** (existing buildings)
- **(IPC) International Plumbing Code**
- **(IFC) International Fire Code**
- (IFGC) International Fuel Gas Code
- (IMC) International Mechanical Code
- (IgCC) International Green Construction Code
- (IPMC) International Property Maintenance Code
- (ISPSC) International Swimming Pool and Spa Code
- (IPSDC) International Private Sewage Disposal Code
- (ICCPC) ICC Performance Code
- (IZC) International Zoning Code

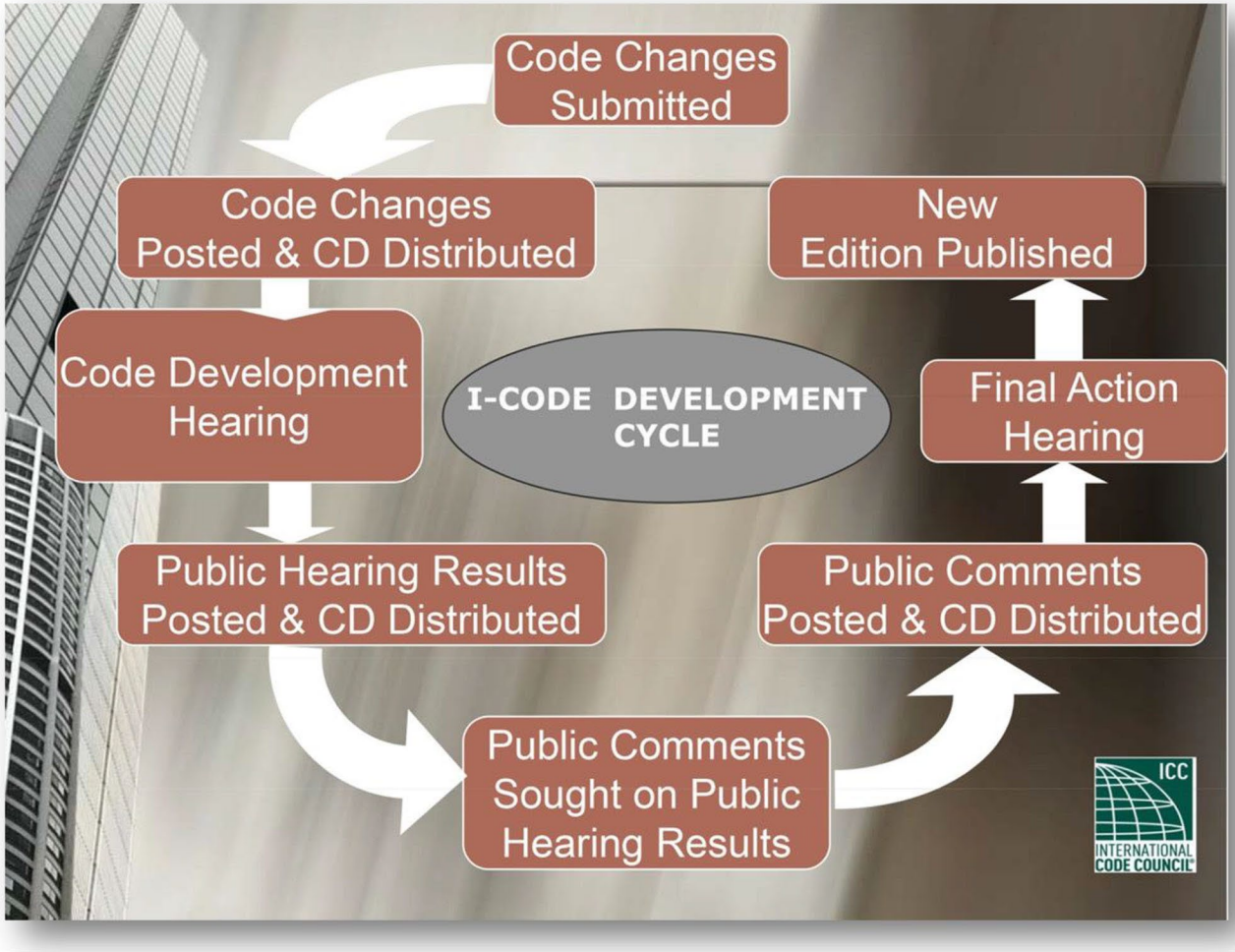


How often is building code updated?

It varies depending on the agency involved

- ICC Code is updated every 3 years.
- Government agencies and municipalities adopt when they feel it is necessary. That could be every 3 years or as many as 6 years or more. They may also make changes in between I-codes
- Government agencies meet to review, discuss, edit and adopt these codes in addition to their own code requirements
- Local code is often reviewed by building code committees or boards comprised of industry professionals working in conjunction with building code officials to propose code adoptions and amendments that are passed by city councils.

I-Code Development Cycle



FEMA

What other codes are there?

- **Federal Governments**
  - **FEMA** (Natural Disasters)
- **National Associations**
  - **NFPA** (National Fire Protection Association Codes)
- **State Codes** (State of Colorado governs state owned property)
- **County Codes**
  - There are 64 different counties in Colorado and each has their own code
  - Counties like Miami Dade can create code and standards that are adopted by various agencies across the country.
- **Municipal Codes**
  - There are also 272 municipalities in Colorado comprised of 197 towns, 73 cities and 2 consolidated city & county governments like the City & County of Denver. Each of these entities has a different code although some of the smaller towns have adopted Safe Built standards.

The CRA Building Code and Standards Committee provides information to help contractors interpret those codes and to provide best practices.

What are current code requirements and how do I find them?

- To determine the governing code for your project you must first know the governmental agency with jurisdiction. If you do not know the best way is to look up the property online at the city or county records. Don't Guess be sure you check as some jurisdictions require mid-roofs, ice and water shield, etc.

- The best place to find current code requirements is to look them up online by searching the current adopted building code for that jurisdiction (government agency).

- If you are a CRA member you can look up current code requirements in the members area under code guidelines https://www.coloradoroofing.org/code-guidelines

- State codes can be found at the state of Colorado website https://www.colorado.gov/pacific/osa/bldgcodes

- These websites will not only tell you the current ICC code versions that have been adopted and when but they will also provide the local code and amendments and often a publication on roofing guidelines

- The 2021 and previous ICC codes can be found at https://codes.iccsafe.org/

What is the Legal Building Code

- The building code you are required to follow as a contractor, design professional, or property owner is the written building code as adopted with amendments by the governing jurisdiction.
- Exceptions or changes offered by a local building inspector IS NOT the legal written building code. Building Officials are allowed to interpret the code and advise you. If they interpret or advise you incorrectly that does not alleviate your responsibly to follow the adopted building code. It will not absolve of a potential lawsuit if circumventing the written code results in damage to the property.
- Alternates, changes, or exceptions to the written adopted building code must be made and accepted by the governing body for that jurisdiction in writing. That is often a code review board or city council.
- It is very rare to see a building code official testify in court. Therefore, their word on a job will not protect you from a lawsuit.

Who enforces the code?

- **Code is enforced by the local building official for that jurisdiction**. The building official is the one that inspects the project and interprets the written code. They **do not** write code.
- The Chief Building Official is in charge of the department and hence is the final say on code enforcement. They may also have the authority to adopt rules and procedures that can become part of the code
- The Head or Chief Designer also interprets code and writes specifications that can become part of the code.
- The Head or Chief Engineer can set design guidelines that also become an extension of the code.
- A request to accept an alternative or equivalency to the written code may be heard and ruled on by the Code Review Board or equivalent governing body.

Local Code Adoptions & Amendments

Each of the 336 jurisdictions in Colorado has their own building code adoptions. This typically includes their local municipal codes, land use codes, building codes and other codes. The adopted building codes and amendments made will vary with each jurisdiction.

Examples of these adoptions are as follows…

2022 Building and Fire Code and Denver Green Code Adoption Process

The City and County of Denver is adopting a new building and fire code, which will incorporate the following 2021 series of international codes, as well as advance the voluntary 2019 Denver Green Code. The city will consider amendments to the 2021 international codes to ensure they work for Denver's specific climate and context. We will also take a hard look at our existing Denver amendments with the goal of eliminating unnecessary sections, jargon, and complexity.

- International Building Code (IBC)
- International Existing Building Code (IEBC)
- International Residential Code (IRC)
- International Energy Conservation Code (IECC)
- International Mechanical Code (IMC)
- International Plumbing Code (IPC)
- International Fuel Gas Code (IFGC)
- International Fire Code (IFC)
- Denver Green Code (DGC)

City of Fort Collins

COMMUNITY DEVELOPMENT & NEIGHBORHOOD SERVICES
281 N. College Ave. • Fort Collins, CO 80524 • Phone: 970.416.2740 • www.fcgov.com/building

2018 IRC AMENDMENTS

Adopted: January 12th, 2018

RESOLUTION NO. 2020-26
BOARD OF COUNTY COMMISSIONERS
OF THE
COUNTY OF SUMMIT
STATE OF COLORADO

A RESOLUTION AMENDING THE SUMMIT COUNTY BUILDING CODE SO AS TO REPEAL AND REPLACE SECTION 3 OF EXHIBIT A TO RESOLUTION NO. 2019-44 AND REPEAL AND REPLACE THE FEE SCHEDULE SET FORTH IN EXHIBIT B TO RESOLUTION 2019-44.

WHEREAS, the Board of County Commissioners of Summit County, Colorado has heretofore adopted the Summit County Building Code (Building Code) for the unincorporated areas of Summit County pursuant to C.R.S. 30-28-201, 1973, as amended; and

WHEREAS, pursuant to C.R.S. 30-28-204, the Board of County Commissioners is authorized to alter, and amend the Building Code from time to time after public hearing; and

WHEREAS, on June 25, 2019, the Board of County Commissioners adopted certain amendments to the Building Code as set forth in Resolution 2019-44; and

WHEREAS, the Board of County Commissioners directed the Building Department to work with its local partners and the towns to create amendments to the Building Code that would result in increased energy efficient building in our communities; and

WHEREAS, after numerous stakeholder and community input, meetings, and public meetings, the Summit Sustainable Building Code ("SSBC") was created and recommended as an amendment to the Building Code; and

WHEREAS, the Building Department's Board of Review considered the recommended amendment to the Building Code at a public meeting on February 18, 2020 and recommended that the Board of County Commissioners adopt such changes; and

WHEREAS, Summit County Countywide Planning Commission considered the recommended amendments to the Building Code at a work session on March 2, 2020, provided feedback, and recommends the adoption of the SSBC as an amendment to the Building Code; and

WHEREAS, the Board of County Commissioners has held a public hearing on March 31, 2020 regarding the proposed repeal of Section 3 of Exhibit A to Resolution 2019-44 in order to adopt the SSBC and also amend Exhibit B to Resolution 2019-44 in order to readopt the Fee Schedule, upon public notice pursuant to C.R.S. 30-28-204 and has considered the statements, evidence and testimony presented at such hearing; and

WHEREAS, upon consideration of the same, the Board of County Commissioners finds that the proposed amendments are reasonable and appropriate, will promote the public health, safety and welfare, and should accordingly be adopted;

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF SUMMIT COUNTY, COLORADO, THAT THE SUMMIT COUNTY BUILDING CODE SHALL BE SUBJECT TO THE ADDITIONS, DELETIONS, AND MODIFICATIONS, SET FORTH IN THE ATTACHED EXHIBIT A, AND THE ACCOMPANYING FEE SCHEDULE, SET FORTH IN THE ATTACHED EXHIBIT B, WITH AN EFFECTIVE DATE OF JULY 1ST, 2020.

ICC Building Guides

In addition to the adopted and published building codes most jurisdictions provide building guidelines for common types of construction to assist contractors and property owners. It is here that jurisdictions often publish additional requirements or code interpretations specific to their jurisdiction. These building guides are considered part of the building code unless otherwise stated.

The Colorado Chapter of the International Code Council (CCICC) publishes building guides for the 336 jurisdictions in Colorado. The local building departments in Colorado and surrounding states often adopt these buildings guides with their own amendments or create their own.

These building guides include: Decks, Patio Covers, Garages, Pole Barns, Basement Finish, Reroofs, Tiny Houses, and more.

The Reroof Building Guide is currently being rewritten and authored by one of our CRA and IIBEC members.

Building Guide

Colorado Chapter of the International Code Council

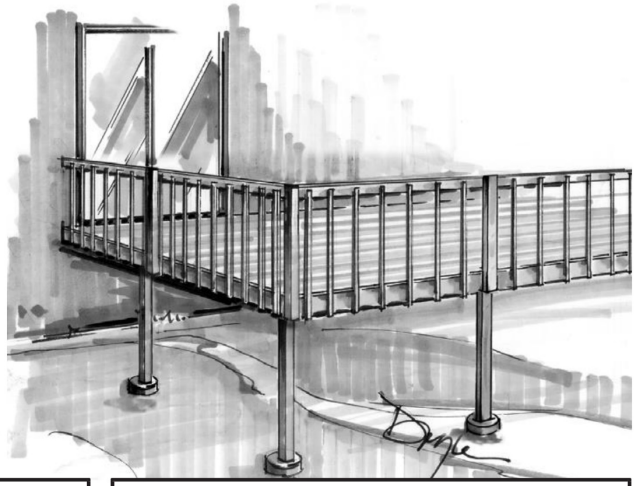
Single Family Residential Uncovered Decks and Porches

How to Use this Guide

Check with your jurisdiction regarding type of submittal (paper or electronic) and for additional requirements. Draw to scale and complete the following (hint: use graph paper with ¼" squares. Example: ¼" = 1').

1. **Complete this Building Guide** by filling in the blanks on page three, and indicating which construction details will be used.
2. **Provide Plot Plan** (site plan) showing dimensions of your project or addition and its relationship to existing buildings or structures on the property and the distance to existing property lines drawn to scale. See page 2.
3. **Fill out a building permit application.**

The majority of permit applications are processed with little delay. The submitted documents will help determine if the project is in compliance with building safety codes, zoning ordinances and other applicable laws.



The Colorado Chapter of the International Code Council is a professional organization seeking to promote the public health, safety and welfare to building construction. We appreciate your feedback and suggestions. please write to the Colorado chapter of the International code Council, P.O.Box 961, Arvada, CO 80001.This building guide can be found on Colorado Chapter of the International Code Council website at: http://www.coloradochaptericc.org

This handout was developed by the Colorado Chapter of the International Code Council as a basic plan submittal under the 2021 International Residential Code. It is not intended to cover all circumstances. Check with your Department of Building Safety for additional requirements.

NOTE: For all permits issued after September 12, 2016, the effective code is 2016 DBCA/2015 IBC/2015 IRC.

1. **Permits and Scope of Work**

Abbreviations
IBC = International Building Code IRC = International Residential Code IECC = International Energy Conservation Code DBCA = Denver Building Code Amendments IPC = International Plumbing Code

   A. When a roofing permit is needed for roof repairs:
      i. For buildings under 25,000 square feet (square footage of the entire building as defined in the Green Buildings Ordinance): If repairs are more than 10% of the *roof* square footage or two roof squares (whichever is smaller), then the repair needs a permit.
      ii. For buildings of 25,000 square feet or more: To be compliant with Denver's Green Buildings Ordinance, if repairs are more than 5% of the *roof* square footage or two roof squares (whichever is smaller), then the repair needs a permit.
      iii. Please be aware that online roof permits are not available for buildings over 25,000 square feet in size. These projects will need to be logged in for review. Visit denvergov.org/greenroofs for instructions, contact information, to download the Green Buildings Ordinance, and rules and regulations.

   B. All new roof penetrations require a permit (e.g., skylight, rooftop units, pipes, solar, etc.).

   C. Partial roofs that end at a natural edge may be replaced under a permit, but not partial slopes.

   D. Roof coatings do not require a permit.

2. **Underlayment**

   A. Ice and Water Shield Requirements
      i. Self-adhering bitumen installed at the eaves and rakes to two feet inside the exterior wall is NOT required per 2016 DBCA (see highlighted column in Table R301.2(1) below).

   B. For specific underlayment requirements, see Tables R905.1.1(1), R905.1.1(2), R905.1.1(3) governing underlayment types, applications, and attachments in the 2015 IRC or request a copy of these tables from Building Inspections.

Table R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

Ground Snow Load (psf)	Wind Design				Seismic Design Category	Subject to Damage From			Winter Design Temp (degrees)	Ice Barrier Under-layment Required	Flood Hazard	Air Freezing Index	Mean Annual Temp (degrees)
	Speed (MPH)	Topo-graphic Effects	Special Wind Region	Wind-borne Debris Zone		Weathering	Frost	Termite					
35	115/125/140	No	Yes	No	B	Severe	36"	Slight/Mod	1° C	No	1978	712	40-45° F

3. **Roof Decking**

   A. Existing roofs must be removed to deck and replaced where two or more layers of any roof covering exist.

   B. No continuous opening between boards can be greater than ½" regardless of manufacturer's recommendations. If manufacturer requires a smaller gap, then the manufacturer's requirement prevails.

   C. Asphalt Shingles
      i. For maximum gap definition on 1X decking sheathed roofs, consult the manufacturer's installation instructions for the product being installed, with the caveat that no opening can be greater than 6 square inches regardless of manufacturer's recommendation. Openings smaller than this dimension can be covered with 26-gauge metal.

4. **Low-slope Roofs**

Climatic and Geographic Design Criteria

A very important part of every code adoption is the Climatic and Geographic Design Criteria adopted by the local jurisdiction. This information is contained in Table R301.2(1) in chapter 3 of the International Residential Code (IRC).

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35	115/125/ 140	No	Yes	No	B	Severe	36”	Slight/ Mod	1° C	No	1978	712	40-45° F

Table R301.2(1) provides the wind design speed for structures including the roofs. It also provides the requirement for Ice Barrier at the eaves or the entire roof.

Local Codes Can Change With Little To No Warning!

- Local jurisdictions can change, amend, or adopt new code with little to no warning. They may have been reviewing the new codes for over a year or more but the adoption and effective dates can be sudden
- Municipalities can make amendments to there code throughout the year
- The Chief Building Official often has the authority to make changes to code in the rules that they chose to adopt. Those rules now become part of the code requirement or law and ordinance.
  For Example: A building official for a municipality that decides they no longer want to supply ladders can require they be set. That same building official can decide to add or remove a requirement for ice and water shield.
- Changes to building code must be in writing. If you are told a building official does not enforce the written code that does not alleviate the legal requirement that is in writing when the code was adopted or amended.

What Role Does Insurance Have With Building Code?

- Insurance Companies influence Building Code through their involvement with testing data and lobbying efforts.
- Insurance Companies perform testing on buildings through the IBHS to model the effects of extreme weather and natural disasters on buildings in an effort to increase the strength of buildings and reduce damage.
- FM Global (Factory Mutual Insurance Company) performs testing and creates standards for FM Approvals to be certified as an FM Approved property eligible to be insured or underwritten by Factory Mutual
- Insurance Companies rate the risk of loss in a particular are based on historical loss data and can consider local building code as part of the decision to rate and/or insure properties in a particular areas
- Insurance Companies provide code upgrade and law and ordinance riders in their policies to cover the additional costs to restore a property to current code and standards

IBHS

Insurance Institute for Business & Home Safety

The IBHS is dedicated to researching and promoting effective strategies to strengthen homes and businesses against a variety of natural hazards. IBHS is wholly supported by the property insurance industry.

Factory Mutual Insurance Company

- Based in Johnston, Rhode Island with offices worldwide FM Global specializes in loss prevention services primarily to large corporations throughout the world in the Highly Protected Risk (HPR) property insurance market sector. FM Global insures large and expensive properties

- FM Approvals is the independent testing arm of FM Global. FM approvals uses scientific research and testing to make sure products conform to the highest standards for safety and property loss prevention. Products that pass get the “FM APPROVED” mark.

- Factory Mutual insures and underwrites insurance for high risk properties like government buildings and other large properties

- FM Global standards are used in wind speed design

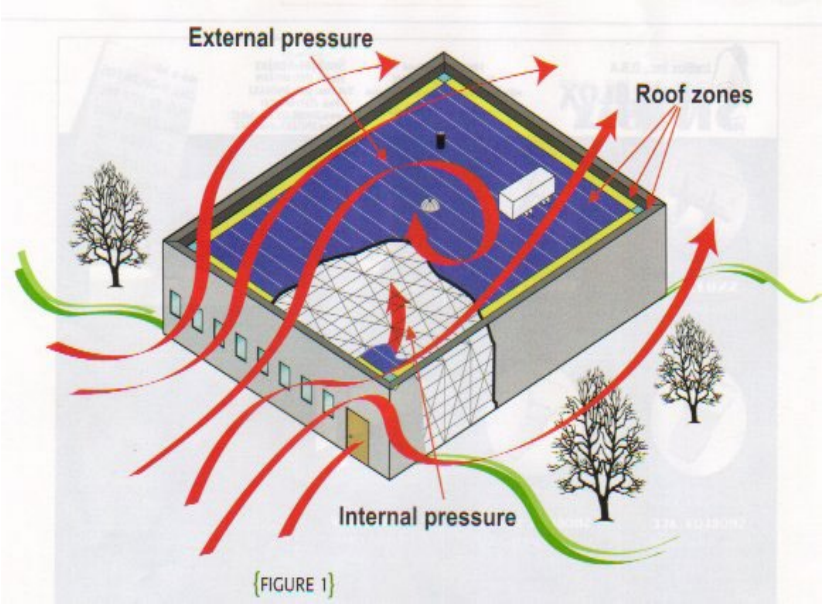
Why is Understanding Code Important?

- Code can greatly increase the cost of restoring a property. Denver's Green Buildings Ordinance is a prime example where costs on a project can increase by hundreds of thousands of dollars.
- It is important that you understand the building codes you are required to follow so that you can properly account for them along with their associated costs. More importantly to be able to properly follow the building codes and reduce liability.
- If you don't know the code for a project and leave out an important requirement, your company could be liable for a construction defect claim.
- It can be very costly to go back and add certain code items after the fact. This may require tearing off and replacing part of or the entire roof. As has been the case on one project where proper roof insulation was not installed to meet the IECC and several others where ice and water shield was not installed as required.

Understanding and following CODE requirements can Keep You Out of Trouble

Wind Ratings

- Code requires that roof systems are designed and installed to meet required wind ratings NOT wind warranties. These wind ratings can vary from 110 to 155 MPH basic wind speed which translates to 85 to 120 MPH design wind speed. While wind warranties typically range from 50 to 90 MPH.
- Be vary careful when installing low slop roof systems. The best practice is to make sure the roof is designed by and engineer and/or roofing consultant to ensure it meets the wind requirements.
- The current design standard for wind uplift ASCE 7/16 accounts for higher wind pressures at the perimeter and corners. ASCE 7/22 has additional changes we will learn about in the next section.



- For example a 5 story building in downtown Denver with a 125 MPH VULT wind requirement and exposure B requires 60 psf in the field, 105 psf at the perimeter and 150 psf at the corners
- Most manufactures publish their fastening patterns for various wind speeds and/or uplift pressures. Always make sure you have the manufacturers fastening patterns in writing

(IECC) International Energy Conservation Code

Most jurisdictions have adopted the International Energy Conservation Code and therefore you need to be familiar with it.

- **IECC requirements are applicable to roof replacement not recovers**. Unless the existing insulation is water-soaked requiring removal of the existing insulation and roof membrane/s.
- **2021 IECC C402.5 Air leakage - thermal envelope (Mandatory).** The building thermal envelope shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance Section C402.5.1.2.3. Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.
- **2021 IECC C402.5.1 Air barriers** A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be located on the inside or outside of the building thermal envelope, located within the assemblies composing the building thermal envelope, or any combination thereof. The air barrier shall comply with Sections C402.5.1.1 and C402.5.1.2.

TABLE C402.1.3 OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, *R*-VALUE METHOD[a],

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49

How do I document code requirements?

- Know your roof system. Most roof systems require components and accessories that are well in excess of what you will find on an insurance loss sheet
- Inspect the property in detail and take notes.
- Take photos, lots of photos and organize them
- Save copies of the applicable code n your project folder.
- Highlight and save the manufactures installation requirements.
- Save copies of your permit, receipt and final signed inspection.
- Hire a professional!

Manufacturer's Installation Instructions

GAF®
Quality You Can Trust...From North America's Largest Roofing Manufacturer!™
¡Calidad En La Que Usted Puede Confiar...Del Fabricante De Techos Más Grande De Norteamérica!™
Une Qualité À Laquelle Vous Pouvez Vous Fier... Du Plus Gros Fabricant De Toitures En Amérique Du Nord!™

INSTALLATION INSTRUCTIONS · INSTRUCCIONES DE INSTALACIÓN · INSTRUCTIONS D'INSTALLATION

Timberline® ARMORSHIELD™ II
Impact-Resistant Shingles–To Achieve Insurance Industry Recommended Criteria
Tejas De Impacto Resistente Para Lograr Seguro Industrial Para Los Criterios Recomendados
Influer – Les Bardeaux Resistants Pour Atteindre Assurance Industrie A Recommande Criteres

GENERAL INSTRUCTIONS

- **SAFETY DATA SHEETS:** When using GAF products, e.g., shingles, underlayments, plastic cement, etc., please refer to the applicable SDS. The most current versions are available at gaf.com. GAF does not provide safety data sheets or installation instructions for products not manufactured by GAF. Please consult the material manufacturer for their SDS and installation instructions where appropriate.
- **ROOF DECKS:** Use minimum 3/8" (10mm) plywood or OSB decking as recommended by APA-The Engineered Wood Assn. Wood decks must be well-seasoned and supported having a maximum 1/8" (3mm) spacing, using minimum nominal 1"(25mm) thick lumber, a maximum 6" (152mm) width, having adequate nail-holding capacity and a smooth surface. Do NOT fasten shingles directly to insulation or insulated deck unless authorized in writing by GAF. Roof decks and existing surfacing material must be dry prior to application of shingles.
- **UNDERLAYMENT (LEAK BARRIER):** Install GAF leak barrier at the eaves in localities where leaks may be caused by water backing up behind ice or debris dams.
- **UNDERLAYMENT (ROOF DECK PROTECTION):** Underlayment beneath shingles has many benefits, including helping to prevent wind-driven rain from reaching the interior of the building and to prevent sap in some wood decking from reacting with asphalt shingles. When an underlayment is installed, use a breather-type underlayment, such as GAF Shingle-Mate® or Deck-Armor™ underlayments. GAF Tiger Paw™ underlayment, with its moisture control design, can also be used. Always have a design professional review ventilation requirements when using a moisture control design underlayment. Underlayment is also required by many code bodies and is required to maintain the shingles' UL Class A fire rating. When using FeltBuster™ High-Traction Synthetic Roofing Felt as underlayment, it MUST be installed over one layer of VersaShield® Fire-Resistant Roof Deck Protection in order to maintain a Class A fire rating for GAF asphalt shingles.
- **FASTENERS:** Use only zinc-coated steel or aluminum, 10-12 gauge, barbed, deformed, or smooth shank roofing nails with heads 3/8" (10mm) to 7/16" (12mm) in diameter. Fasteners should be long enough to penetrate at least 3/4" (19mm) into wood decks or just through the plywood decks. Fasteners must be driven flush with the surface of the shingle. Overdriving will damage the shingle. Raised fasteners will interfere with the sealing of the shingles and can back out.
- **ASPHALT PLASTIC CEMENT:** Use asphalt plastic cement conforming to ASTM D4586 Type I or II.
- **WIND RESISTANCE/HAND SEALING:** These shingles have a special thermal sealant that firmly bonds the shingles together after application when exposed to sun and warm temperatures. Shingles installed in fall or winter may not seal until the following spring. If shingles are damaged by winds before sealing or are not exposed to adequate surface temperatures, or if the self-sealant gets dirty, the shingles may never seal. Failure to seal under these circumstances results from the nature of self-sealing shingles, and is not a manufacturing defect. If shingles are to be applied during PROLONGED COLD periods or in areas where airborne dust or sand can be expected before sealing occurs, the shingles MUST be hand sealed. See Nailing Instructions / Hand Sealing.
- **MANSARD AND STEEP SLOPE APPLICATIONS:** For roof slopes greater than 21" per foot (1750mm/m), shingle must be hand sealed. DO NOT use on vertical side walls.
- **RELEASE FILM:** Plastic film strips are present either on the back or face of each shingle. The film strips are to prevent shingles from sticking together while in the bundle. Do not remove the film strip before or during the application.
- **THROUGH VENTILATION:** For optimal shingle life and to help prevent mold growth, all roof structures must have through ventilation to prevent entrapment of moisture-laden air behind roof sheathing. Ventilation must be designed to meet or exceed current F.H.A., H.U.D., or local code minimum requirements. Note: Minimum net free ventilation area of 1 sq. foot per 150 sq. feet (1 sq. meter per 150 sq. meters) of ceiling area is required. When vents are located at the eaves and near the roof's peak (balanced) for maximum air flow, ventilation may be reduced to 1 sq. foot per 300 sq. feet (1 sq. meter per 300 sq. meters).
- **EXPOSED METAL:** Paint all exposed metal surfaces (flashing, vents, etc.) with matching GAF Shingle-Match™ roof accessory paint for best appearance.
- **NOTE:** All drawings not drawn to scale.

INSTRUCCIONES GENERALES

- **HOJAS DE DATOS DE SEGURIDAD (SDS):** Cuando utilice los productos de GAF, tales como tejas, bases de pisos, cemento plástico, etc., consulte las SDS correspondientes. Las versiones más actuales están disponibles en es.gaf.com. GAF no proporciona hojas de datos de seguridad ni instrucciones de instalación para productos que no sean fabricados por GAF. Consulte al fabricante del material para sus SDS e instrucciones de instalación según corresponda.
- **PLATAFORMAS BASE DE TECHOS:** Use una plataforma base de 3/8" (10mm) de madera terciada u madera aglomerada orientada (OSB por sus siglas en inglés) como mínimo según lo recomendado por la Asociación Americana de Madera Terciada (APA por sus siglas en inglés). Las cubiertas de madera deben estar bien preparadas y apoyadas, con un espacio máximo de 1/8" (3mm), con un espesor mínimo nominal de 1"(25mm), con un ancho máximo de 6" (152mm), y una capacidad de retención de clavos adecuada y una superficie suave. NO asegure las tejas directamente al aislante o a la plataforma base aislada a menos que sea autorizado por escrito por GAF. Las plataformas base de techo y material de superficie existentes deben estar secas antes de la aplicación de las tejas.
- **CAPA BASE (barrera contra goteras):** Instale barrera de filtraciones de GAF en los aleros en lugares donde el estancamiento de agua detrás de hielo o desechos podría causar filtraciones.
- **CAPA BASE (PROTECCIÓN PARA CUBIERTAS DE TECHOS):** La capa base debajo de las tejas tiene muchos beneficios, incluyendo el ayudar a evitar que la lluvia arrastrada por el viento alcance el interior del edificio y evitar que la savia de algunas plataformas de madera reaccione con las tejas asfálticas. Donde vaya a instalar una capa base, use una de tipo respirable como las capas base ShingleMate® o Deck-Armor™ de GAF. También se puede utilizar la capa base Tiger Paw™ de GAF, con su diseño de control de la humedad. Siempre pida a un profesional en diseño que revise los requisitos de ventilación cuando utilice una capa base con diseño de control de la humedad. La capa base también es requerida por muchos códigos de construcción para mantener la calificación Clase A de UL contra incendios. Cuando utilice el Fieltro Sintético De Alta Tracción FeltBuster™ Para Techos como capa base, DEBE instalarse sobre una capa de Protección de la Cubierta del Techo Ignífuga VersaShield® con el fin de mantener una clasificación Clase A contra incendios para las tejas asfálticas GAF.

Manufacturer’s Installation Instructions

How do you ensure that you get paid to roof to the manufacture's installation instructions.

1. Know what the manufacturers installation instructions are and keep copies of them in record.
2. Highlight the installation manual and keep a copy in the job file.
3. Ensure that your roofers follow these instructions and do not vary.
4. Get your company certified to install the manufactures product and do the same with your installers.
5. Document your roof installations with photos, bill of materials, and the manufactures warranty.
6. Sell extended system warranties for peace of mind and greater profits.

Manufacturer's Installation Instructions

The manufacturer's installation instructions are a part of the code by reference

- **2021 IBC 1503.1** General "Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed in accordance with this code, and installed in accordance with this code and the manufacturer's approved instructions."
- **2021 IBC 1507.1** Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions.
- **2021 IBC 1507.2.8 Flashings** *(and in various sections throughout the code)* Flashing for asphalt shingles shall comply with this section. Flashing shall be applied in accordance with this section and the asphalt shingle manufacturer's printed instructions.

You are required to follow the more stringent of the adopted building codes or the manufacturer's installation instructions. Failure to do so can result in a construction defect claim.

Manufacturer's Installation Instructions

Example of manufacturer's installation instructions for Dimensional Asphalt Shingles.

Note the following:

- Roof deck requirement with a maximum 1/8" spacing
- Leak barrier requirement
- Ventilation requirement

GAF
Quality You Can Trust…From North America's Largest Roofing Manufacturer!®

TIMBERLINE® LIFETIME HIGH DEFINITION® SHINGLES

INSTALLATION INSTRUCTIONS

Timberline® Shingles
North America's #1-Selling Shingle!

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- **EXPOSED METAL:** Paint all exposed metal surfaces (flashing, vents, etc.) with matching GAF ShingleMatch™ Roof Accessory Paint for best appearance.
- **NOTE:** All drawings not drawn to scale.

Underlayment & Starter Strip

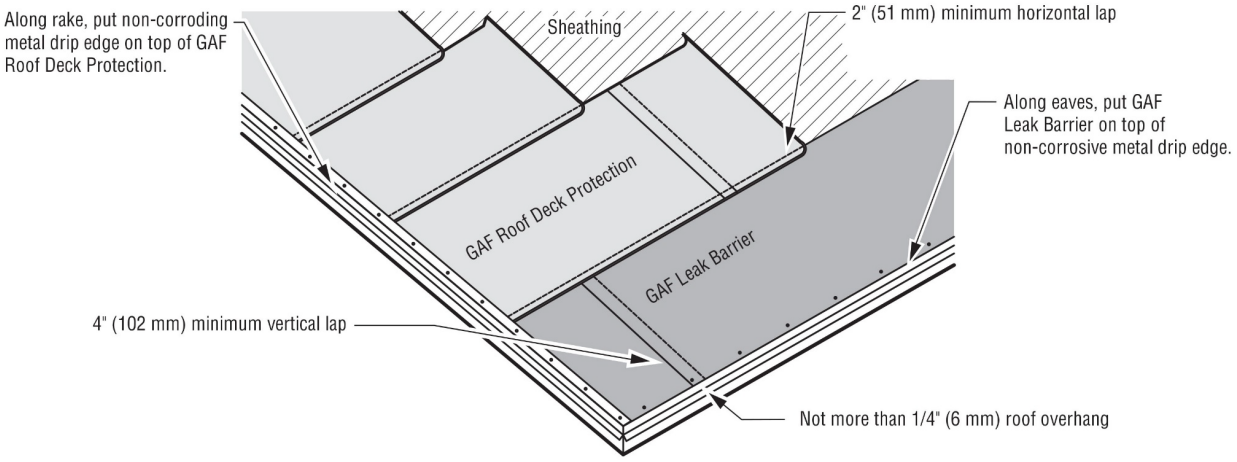
Manufacturer's installation instructions for Dimensional Asphalt Shingles.

Note the following:

- Leak barrier requirement
- Starter strip is required at the eaves and rakes
- The instructions do not say to fabricate starter shingles out of the roof shingles or 3-Tab shingles.
- When insurance tells you the starter strip is in the waste. It is not, starter shingles are specifically made for that purpose and must be ordered.
- If you were to starter for a 3-Tab roof you would still need to add for the additional shingles and then add the additional to labor fabricate them.
- The use of starter strip does not affect the shingle waste factor!

UNDERLAYMENT: FOR ROOF SLOPES 4:12 OR MORE

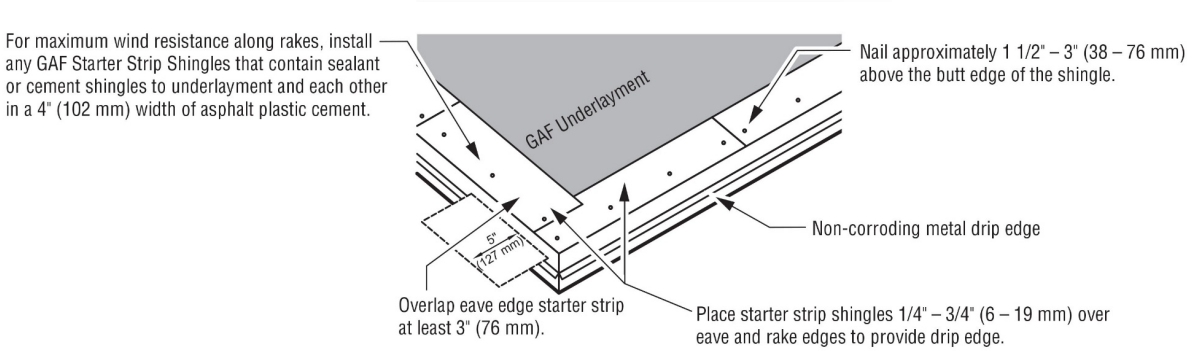
Application of eave flashing: At eaves and where ice dams can be expected, use one layer of GAF Leak Barrier. Eave flashing must extend 24" (610 mm) beyond the inside wall line. **Application of underlayment:** Cover deck with one layer of GAF Roof Deck Protection installed without wrinkles. Use only enough nails to hold underlayment in place until covered by shingles.



INSTALLING STARTER STRIP SHINGLES

STARTER COURSE

Use GAF Starter Strip Shingles along the eaves and rake. Apply as shown. **NOTE:** GAF Starter Strip Shingles are recommended at the rakes for best performance and required for enhanced warranty coverage on certain products (see limited warranties for details). Refer to application instructions for the selected starter strip shingles.



Hand Sealing Shingles

- Cold weather
- Steep sloped (>21:12)
- Mansard Roofs
- Repairs
- Accessories & flashings
- High wind areas

TECHNICAL ADVISORY BULLETIN

GAF — Quality You Can Trust… From North America's Largest Roofing Manufacturer!™

To: GAF Residential Sales, GAF Contractors, GAF Field Services

From: Technical Services Department

Date: 05/06/2011

Subject: Hand-Sealing Shingles

No: TAB-R 2011-114

What Is Hand-Sealing?

Hand-sealing is… the method to assure and enhance sealing of shingles with roofing cement (ASTM D-4586) on very steep slopes, in high wind areas, and when installing in cold weather.

GAF may choose to hand-seal a roof or slope of a roof… if there has been insufficient heat or sun exposure to seal shingles and blow-off damage has occurred. This does not mean that the sealant is defective, only that there has not been sufficient heat to activate the sealant. Failure of a shingle to seal due to insufficient heat is not a manufacturing defect.

When Should Shingles Be Hand-Sealed?

Hand-seal shingles when installing…

- **in cold weather, fall or winter**
- **on steep slopes (greater than 21/12 roof slopes)**
- **on mansard roofs**
- **while performing repairs**
- **after installation of accessories, such as power vents or skylights**
- **shingles up the rake of the roof for added wind protection**

How Done Hand Sealing Get Done?

Check shingle application instructions… to determine the number and location of the dabs of cement to be used for and sealing. All GAF shingle application instructions have hand-sealing procedures listed. Follow the instructions for the particular product to be sealed.

- **Use a caulking gun or small trowel…** to place dabs of cement under the shingle to be sealed.
- **Use a quarter sized dabs of cement…**as a guide to judge the correct amount of cement to be used.
- **Press shingle into cement…**to fully seal these shingles.

Note: Too much cement can run down the face of the shingle or cause blistering.

Where Can I Get More Information?

GAF Technical Services can assist you… with these and other questions you may have regarding your new roof installation. GAF Technical Services can be contacted **at 800-ROOF-411** (800-766-3411). Also, the GAF website is a great resource for just about any question you may have or for additional information you may require. Please visit: www.gaf.com.

Industry Standards

What are industry standards? Industry standards are a set of criteria within an industry relating to the standard functioning and carrying out of operations in their respective fields of production. In other words it is the generally accepted requirements followed by the members of an industry

Who sets industry standards? There are various associations that provide testing, manufacturing and installation standards

- ANSI (American National Standards Institute)
- ARMA (Asphalt Roofing Manufacturers Association)
- ASCE (American Society of Civil Engineers)
- ASTM (American Society for Testing and Materials)
- FM Global (Factory Mutual Insurance Company)
- NRCA (National Roofing Contractors Association)
- SPRI (Single Ply Roofing Industry)
- TRI (Tile Roofing Institute)
- UL (UL LLC - Formerly Underwriters Laboratories)

Why are Industry Standards Important?

- They are referenced through the International Codes
- They are adopted by Manufacturers
- They are adopted by industry associations
- They are adopted by a means of standard practice
- They create a standard or bar from which to judge a product, assembly, and/or installation that can be held up in court.

Why Install To Code, Mfr. Specs and Industry Standards?

- By roofing to code and the manufacturers installation instructions on every job you are following the standards that are required by law.
- You provide a better roof system for the property owner.
- You greatly reduce the risk of construction defect litigation.
- It leads to greater peace of mind

Follow the Building Code

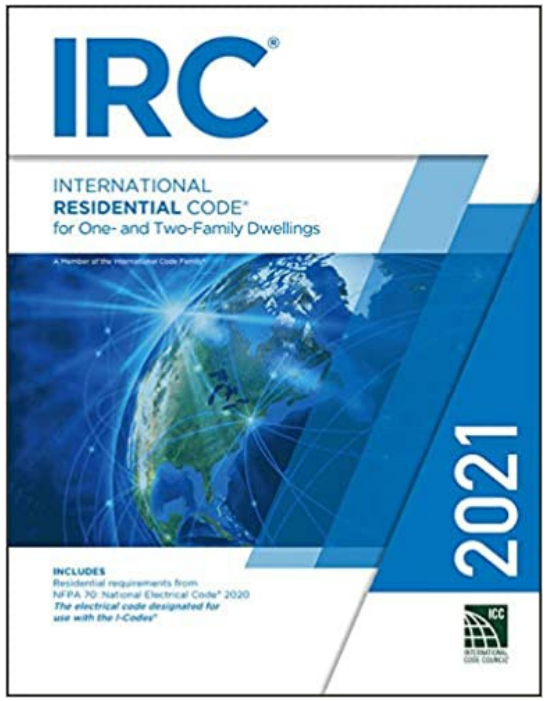
(Even when it can be difficult)

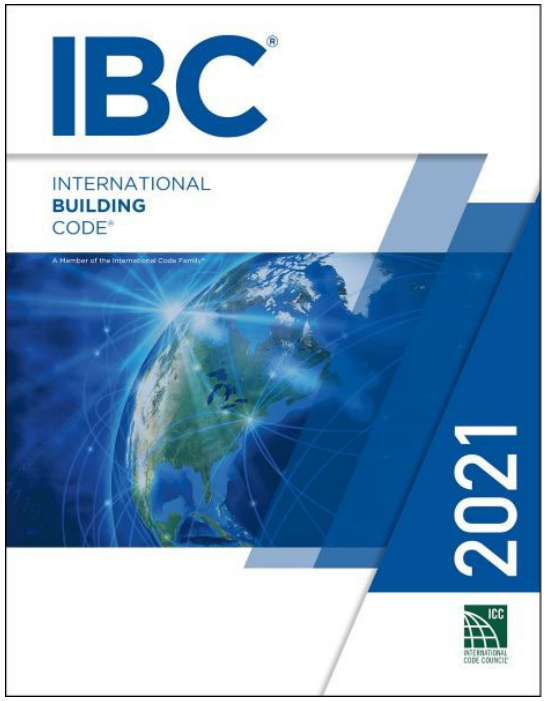
Both the IRC (903.2) and IBC (R903.2.1) require Roof Flashings to be corrosion resistant with a thickness of not less than 0.019 inch (0.5 mm) (No. 26 galvanized sheet) or 26-gauge steel. Yet, many of the roofing materials suppliers in Colorado are selling and delivering metal flashings that are fabricated from 28-gauge steel 0.0156 inch (0.396 mm).

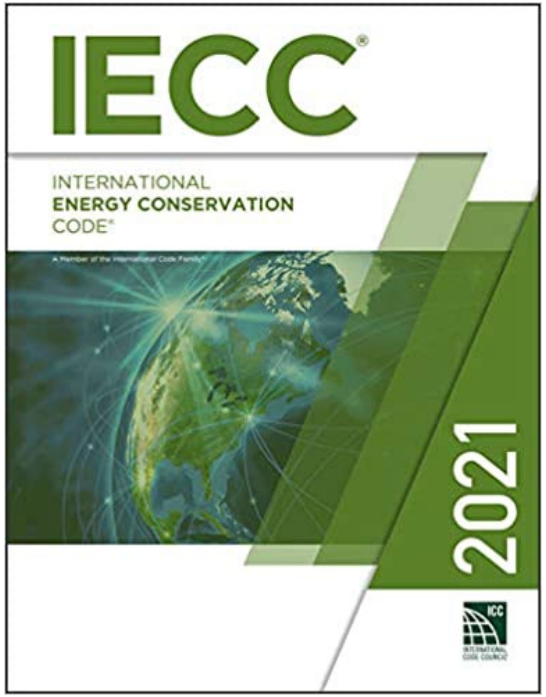
Check your materials and insist on those required to meet the building codes.

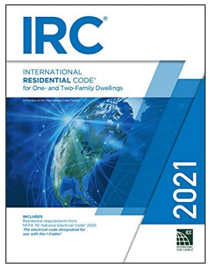
2021 Code Changes

Significant Changes to the i-codes from 2018









2021 IRC (significant changes)

R902.3 Building-integrated photovoltaic product. Building-integrated photovoltaic (BIPV) products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with UL 7103. Class A, B or C BIPV products shall be installed where the edge of the roof is less than 3 feet (914 mm) from a lot line.

R905.1.1 Underlayment. *Under exceptions.*
Now requires the alternative underlayment's to be labeled in compliance with ATSM D1970. Not just tested. It also changes ultimate design wind speed that exceed 140 mph to areas where wind design is required per Figure R301.2.1.1.

Changes the wind requirements to comply with the new wind map in Figure R301.2.1.1. showing the regions where wind design is required. Table R905.1.1(1) Underlayment Types has been updated to include ASTM standards in areas where wind design is required as opposed to areas where the ultimate design wind speed exceeds 140 mph.

R905.3.1 Deck requirements.
Concrete and clay tile shall be installed only over solid sheathing.

Exception: Spaced lumber sheathing in accordance with Section R803.1 shall be permitted in Seismic Design Categories A, B and C.

R905.4.4.1Wind resistance of metal roof shingles *(new section)*
New section requiring metal roof shingles to be tested in accordance with ASTM D3161, classified and labeled for the appropriate maximum basic wind speed per Table R905.4.4.1

2021 IRC (significant changes)

R905.4.4.1Wind resistance of metal roof shingles *(new section)*
New section requiring metal roof shingles to be tested in accordance with ASTM D3161, classified and labeled for the appropriate maximum basic wind speed per Table R905.4.4.1

TABLE R905.4.4.1
CLASSIFICATION OF STEEP SLOPE METAL ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult}, FROM FIGURE R301.2(2) (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD}, FROM TABLE R301.2.1.3 (mph)	ASTM D3161 SHINGLE CLASSIFICATION
110	85	A, D or F
116	90	A, D or F
129	100	A, D or F
142	110	F
155	120	F
168	130	F
181	140	F
194	150	F

For SI: 1 mile per hour = 1.609 kph.

2021 IRC (significant changes)

R905.16.6 Wind resistance *(replaced)*
Photovoltaic shingles shall comply with the classification requirements of Table R905.16.6 for the appropriate maximum basic wind speed.

TABLE R905.16.6
CLASSIFICATION OF PHOTOVOLTAIC SHINGLES

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult}, FROM FIGURE R301.2(2) (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD}, FROM TABLE R301.2.1.3 (mph)	UL 7103 SHINGLE CLASSIFICATION
110	85	A, D or F
116	90	A, D or F
129	100	A, D or F
142	110	F
155	120	F
168	130	F
181	140	F
194	150	F

For SI: 1 mile per hour = 1.609 kph.

2021 IRC (significant changes)

2021 IBC 503.1.4 *clarifies that an occupied roof should not be included when determining building height or number of stories per IBC 504*

Section R906 ROOF INSULATION

R906.1General

Where above-deck thermal insulation is installed, such insulation shall be covered with an approved roof covering and shall comply with NFPA 276 or UL 1256.

NFPA 276 Standard Method Of Fire Test For Determining The Heat Release Rate Of Roofing Assemblies With Combustible Above-Deck Roofing Components, 2019 Edition.

This standard describes a method for determining the heat release rate from below the deck of roofing assemblies that have combustible above-deck roofing components when the assemblies are exposed to a fire from below the roof deck.

UL 1256 Standard for Safety Fire Test of Roof Deck Constructions

These requirements cover fire test methods to evaluate the performance of metallic and nonmetallic roof deck constructions subjected to internal (under deck) fire exposures for the purpose of determining the contribution of the roof covering material, insulation, and other components of the roofing system to the spread of fire within a building.

2021 IBC (significant changes)

1502.1 General. Design and installation of roof drainage systems shall comply with this section, Section 1611 of this code and Chapter 11 of the International Plumbing Code.

1502.1 Secondary (emergency overflow) drains or scuppers.
Changes the code reference to the same sections as 1502.1. Section 1611 of this code and Chapter 11 of the International Plumbing Code.

1503.3 Parapet walls - *Replaces **1503.3 Coping.** New language has been added clarifying parapet walls shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall. For fire-resistance-rated parapet walls, the weatherproof materials must ensure the fire-resistance rating of the wall is not decreased.*

Parapet walls shall be coped or covered in accordance with Sections 1503.3.1 and 1503.3.2. The top surface of the parapet wall shall provide positive drainage.

1503.3.1 Fire-resistance-rated parapet walls.

Parapet walls required by Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall such that the fire-resistance rating of the wall is not decreased.

1503.3.2 Other parapet walls.

Parapet walls meeting one of the exceptions in Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall.

2021 IBC (significant changes)

SECTION 1504 PERFORMANCE REQUIREMENTS

Changes have been made to the sub section numbers and reference. However, the general information remains the same with the following notable changes.

1504.2 Wind resistance of asphalt shingles.

Reference to Table 1504.1.1 changed to TABLE 1504.2. The numbers in the tables are the same with the only change the addition of UL 7103 as an alternative to ASTM D3161

UL 7103 Outline for Investigation for Building-Integrated Photovoltaic Roof Coverings

These requirements cover building-integrated photovoltaic (BIPV) roof coverings for use as a component of a steep slope roof assembly. These products are intended to be installed in accordance with the National Electrical Code, NFPA 70, and either the International Building Code or the International Residential Code, and the installation instructions.

1504.3 Wind resistance of clay and concrete tile.

1504.3.1.2 Wind tunnel testing

Adds ASTM C1569 as an additional standard for testing the wind characteristics of concrete or clay tile.

1504.3.1.3 Air permeability testing. (New section)

The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined in accordance with SBCCI SSTD 11 or ASTM C1570.

2021 IBC (significant changes)

1504.5 Ballasted low-slope single-ply roof systems *(Ballasted EPDM Roofs)*

Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Section 1507.12 shall be designed in accordance with ANSI/SPRI RP-4.

ANSI/SPRI RP-4 2019 *allows for ballasted single roofs with wind speeds up to 140 mph with building heights up to 150 ft (15 stories +/-)*

1504.6 Edge systems for low-slope roofs *(The requirement for ANSI/SPRI ES-1 testing of metal edge systems has been expanded to include all built-up, polymer-modified bitumen and single-ply roof systems having slopes less than 2:12. A further clarification in this section indicates metal counterflashings are outside the scope of the code's ES-1 testing requirement)*

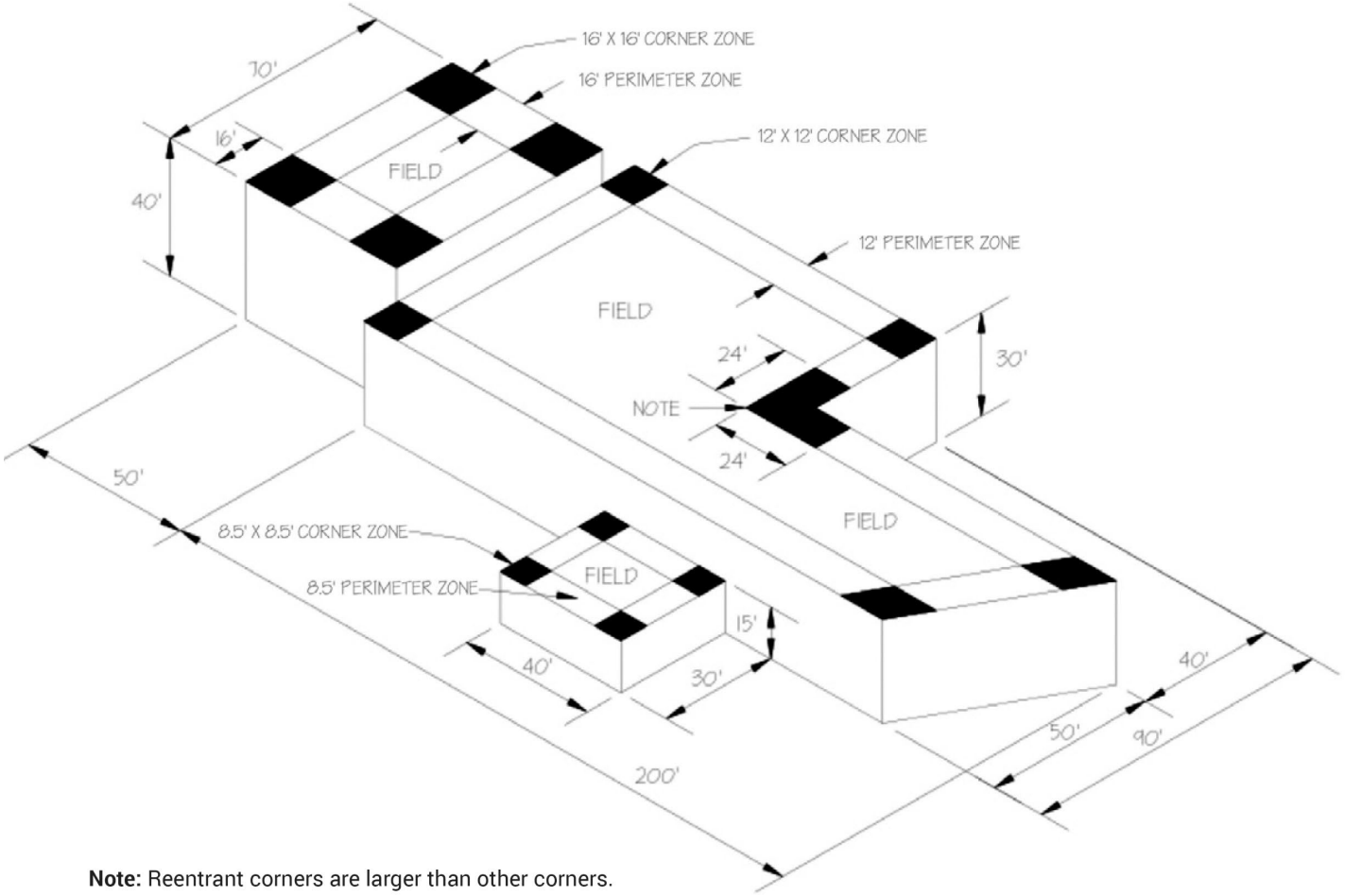
Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems having a slope less than 2 units vertical in 12 units horizontal (2:12) shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design wind speed, V, shall be determined from Figures 1609.3(1) through 1609.3(12) as applicable

1504.6.1 Gutter securement for low-slope roofs. *(Adds a requirement for gutters to be tested for wind resistance according to ANSI/SPRI GT-1's Test Methods G-1 and G-2 on built-up, polymer-modified bitumen and single-ply roof systems having slopes less than 2:12 where a gutter is used to secure the edge of the roof membrane)*

Gutters that are used to secure the perimeter edge of the roof membrane on low-slope (less than 2:12 slope) built-up, modified bitumen, and single-ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

Figure 1

Roof Layout
Systems 2 and 3



Note: Reentrant corners are larger than other corners.

	Low Roof	Main Roof	High roof
Roof Height	15 ft.	30 ft.	40 ft.
40% of Building Height	6.0 ft.	12 ft.	16 ft.
Corner Length	8.5 ft. (a)	12 ft.	16 ft.
Perimeter Width	8.5 ft. (a)	12 ft.	16 ft.

2021 IBC (significant changes)

1504.9 Wind Resistance of Aggregate-surfaced Roofs *(Provides new requirements for the use of aggregate surfacing on built-up and polymer-modified bitumen roof systems. A new table has been added, Table 1504.9-Minimum Required Parapet Height (inches) for Aggregate Surfaced Roofs, that prescribes minimum permitted parapet heights based on aggregate size by ASTM International designation, mean roof height, basic design wind speed and wind exposure.)*

Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.9.

TABLE 1504.9
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS[a, b, c]

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C[d]								
		≤ 95	100	105	110	115	120	130	140	150	≤ 95	100	105	110	115	120	130	140	150
ASTM D1863 (No. 7 or No. 67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
	150	17	19	22	25	27	30	36	41	46	23	26	29	32	35	38	44	50	56
ASTM D1863 (No. 6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

1. a.Interpolation shall be permitted for mean roof height and parapet height.
2. b.Basic design wind speed, *V*, and wind exposure shall be determined in accordance with Section 1609.
3. c.Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.
4. d.For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

2021 IBC (significant changes)

1507.3 Clay and Concrete Tile

1507.3.1 Deck Requirements

Exception: Spaced lumber sheathing shall be permitted in Seismic Design Categories A, B and C.
(an exception has been added indicating spaced lumber sheathing shall be permitted in Seismic Design Categories A, B and C. In previous code editions, tile roofs were limited to solid sheathing roof decks.)

1507.12-Single-ply Roofing *(Combines two previous sections 1507.12 Thermoset single-ply roofing and 1507.13 Thermoplastic single-ply roofing)*
The installation of single-ply roofing shall comply with the provisions of this section.

1507.12.1 Slope.
Single-ply membrane roofs shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.12.2 Material standards.
Single-ply roof coverings shall comply with the material standards in Table 1507.12.2.

TABLE 1507.12.2
SINGLE-PLY ROOFING MATERIAL STANDARDS

MATERIAL	MATERIAL STANDARD
Chlorosulfonated polyethylene (CSPE) or polyisobutylene (PIB)	ASTM D5019
Ethylene propylene diene monomer (EPDM)	ASTM D4637
Ketone Ethylene Ester (KEE)	ASTM D6754
Polyvinyl Chloride (PVC) or (PVC/KEE)	ASTM D4434
Thermoplastic polyolefin (TPO)	ASTM D6878

2021 IBC (significant changes)

1507.14-Liquid-applied Roofing *(ASTM International product standards for protective roof coatings have been moved to a new section specifically addressing protective roof coatings.)*

1507.16 Photovoltaic shingles

1507.16.6 Material standards.
Photovoltaic shingles shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

1507.17-Building-integrated Photovoltaic Roof Panels

1507.17.5 Material standards.
BIPV roof panels shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

1507.16.6 and 1507.17.5 add material standard UL 7103 Outline for Investigation for Building-Integrated Photovoltaic Roof Coverings as described in 1504.2 Wind resistance of asphalt shingles

2021 IBC (significant changes)

SECTION 1509 ROOF COATINGS *(New in 2021)*

1509.1 General.
The installation of a roof coating on a roof covering shall comply with the requirements of Section 1505 and this section.

1509.2 Material standards.
Roof coating materials shall comply with the standards in Table 1509.2.

TABLE 1509.2
ROOF COATING MATERIAL STANDARDS

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Asphaltic emulsion coating	ASTM D1227
Asphalt coating	ASTM D2823
Asphalt roof coating	ASTM D4479
Aluminum-pigmented asphalt coating	ASTM D2824
Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

Protective roof coatings must comply with one of the product standards listed in Table 1509.2-Roof Coating Materials Standards, the fire classification requirements in Section 1505-Fire Classification and manufacturers' installation instructions. Table 1509.2 provides a list of ASTM International product standards for acrylic, aluminum-pigmented asphalt, asphalt, asphaltic emulsion, moisture-cured polyurethane and silicone roof coatings.

2021 IBC (significant changes)

1512.4 Reinstallation of materials.
Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing ballast that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled.

Chapter 16 STRUCTURAL DESIGN

Provides requirements for determining design wind loads applicable to buildings, including buildings' roof assemblies.
1. Section 1603-Construction Documents provides the code's longstanding requirement for wind design data, including the basic design wind speed and design wind pressures, to be included in construction documents.
2. A provision has been added to the 2021 code language requiring the design wind zones (field, perimeter and corners) be denoted and dimensioned in the construction documents. This should assist with better understanding of complex roof zones and the resulting additional attachment requirements.

2021 IEBC (significant changes)

The 2021 IEBC was published Dec. 28, 2020, and applies to the repair, alteration, change of occupancy, addition to and relocation of existing buildings. Its intent is to provide some degree of flexibility to permit the use of alternative approaches to achieve compliance with the code's minimum requirements.

Most of the roofing-related provisions in IEBC 2021 apply to reroofing and are contained in Chapter 7-Alterations—Level 1. IEBC's Level 1 alterations are described to include removal and replacement of existing materials that serve the same purpose as the original.

***Section 705 Reroofing** specifically addresses re-covering and replacing existing roof systems. The requirements in Section 705 closely—nearly identically—match those of IBC 2021's Section 1512-Reroofing.*

***Section 706 Structural** also provides specific building structural requirements when reroofing. Section 706.3.2 lists requirements for analyzing and, if necessary, strengthening a roof diaphragm's resistance (a roof deck's lateral resistance) to wind loads in high-wind regions where a reroofing permit is required. IEBC 2021 raises the threshold where analysis is required to an ultimate design wind speed greater than 130 mph. In IEBC 2018, that threshold was greater than 115 mph.*

Also, for the same diaphragm requirement, IEBC 2021 adds an exception for buildings that have complied with the wind load provisions of ASCE 7-88, "Minimum Design Loads for Buildings and Other Structures," or later editions.

2021 IECC (significant changes)

C401.2.1 International Energy Conservation Code. *Provides 2 options for commercial buildings to comply. 1) Prescriptive Compliance with sections C401 – C406, C408 including Table C401.1.3. 2) Total Building Performance compliance with C407.*

C401.2.2 ASHRAE 90.1
Commercial buildings shall comply with the requirements of ANSI/ASHRAE/IESNA 90.1. *Energy Standard For Buildings Except Low-Rise Residential Buildings*

C401.3 Thermal envelope certificate. *Requires a thermal envelope certificate issued by an approved third party. Verifying the R-values, U-factors, and results of air leakage testing.*

C402.1.1 Low Energy buildings and greenhouses

> **C402.1.1 Greenhouses.** *Energy requirements added for greenhouses with a minimum U-factor of 0.50 for skylights and 0.70 for vertical fenestrations.*

C401.1.3 Insulation component R-value-based-method *(Table C402.1.3)*
Added clarification that cavity insulation R-values shall be summed to determine compliance with the cavity insulation. However, cavity insulation R-values shall not be used to determine compliance with continuous insulation (ci) R-value requirements such as insulation installed above the roof deck (R-30 ci)

2021 IECC (significant changes)

C402.2.1 Roof Assembly

C402.2.1.1 Tapered, above-deck insulation based on thickness. *The sloped roof insulation (tapered roof insulation) R-value contribution to the minimum thermal resistance (R-Value)*

shall use the average thickness (in inches).

C402.2.1.2 Minimum thickness, lowest point. *The minimum thickness of above deck insulation shall be 1-inch at its lowest point, gutter edge, roof drain, or scupper.*

C402.2.1.3 Suspended ceilings. *Insulation installed on suspended ceilings with removable ceiling tiles shall not be considered as part of the minimum thermal resistance (R-Value)*

C402.2.1.4 Joints Staggered *Continuous insulation board shall be installed in not less than 2 layers and the edge joints shall be staggered except where insulation tapers to the roof deck at a gutter, roof drain, or scupper.*

C402.5 Air leakage – thermal envelope

The 2021 building code adds language in subsections C402.5.1.5, C402.5.2, and C402.5.3 requiring the building thermal envelope to be tested for air leakage and verified by the code official, a registered design professional, or approved agency. A continuous air barrier for the opaque building envelope shall

2021 IPC (significant changes)

IPC 1106.2 Size of storm drain piping

Additional roof drain sizing requirements have been added. The intended flow rate through a roof drain calculated in accordance with Section 1106.2.1, shall be checked against the manufacturer's published flow rate for the specific roof drain model and size to verify that it will handle the anticipated flow.

2021 IFC (significant changes)

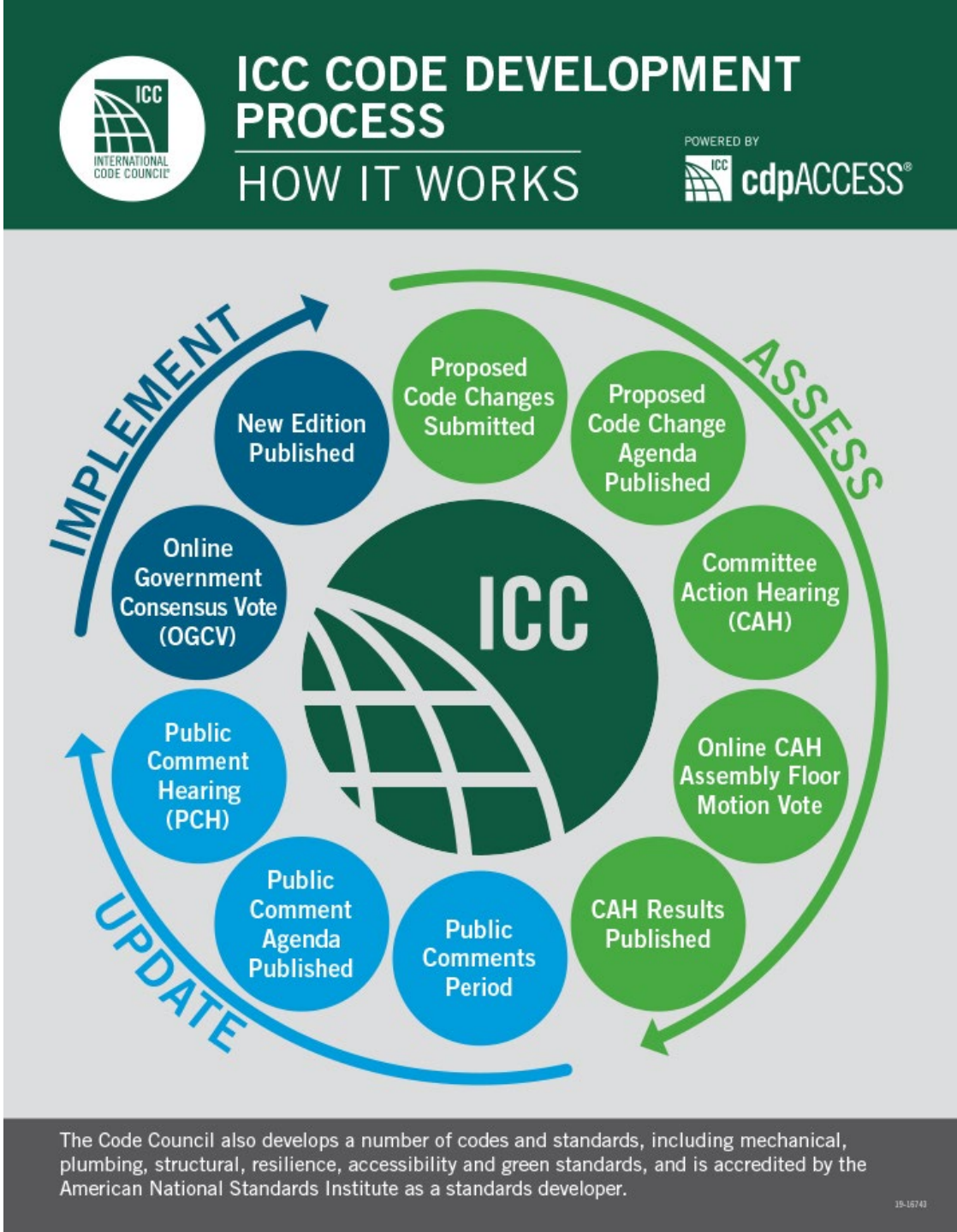
The 2021 International Fire Code (IFC) establishes regulations relating to structures, processes, premises and safeguards from the hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices.

The IFC largely applies to the installation (or reroofing) operations of a building roof assembly. Roofing-related requirements are provided in Section 303-Asphalt Kettles, Section 317-Landscaped Roofs, Section 905-Standpipe Systems (as they apply to landscaped roofs) and Section 3318-Safeguarding Roofing Operations. Also, a definition of torch-applied roof system is provided in Chapter 2-Definitions.

The 2021 IFC has minor changes to the requirements in Section 317 and Section 905 for landscaped roofs; however, these changes do not appear to result in technical changes to the code's requirements.

Expected Changes in 2024

Roofing Related i-Codes



2024 Expected Code Changes

IBC Chapter 16 STRUCTURAL DESIGN
Integration of ASCE 7-22 Wind Design Requirements

- Introduces tornado wind loads for any site east of the Rocky Mountains and Occupancy Type III or IV
  - Must be calculated *in addition* to standard wind loads
    - Occupancy Type III (Schools and non-critical assembly-type spaces) – may not control
    - Occupancy Type IV (essential facilities) – likely to control
  - For reroofing – unclear right now what the I-codes will require, since the building structures/roof decks weren't designed for these loads

- "Simplified method" (tables) eliminated

2024 Expected Code Changes

IBC Section 1512 REROOFING

1512.1 General

S-44 (approved) This proposal adds a requirement to Exception 1 of Section 1512.1 of the IBC to check for ponding instability if an existing roof doesn't meet minimum slope.

Roof replacement or roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of / unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage and meet the requirements of Section 1608.3 and Section 1611.2.

S-45 (approved) This proposal adds a requirement to Exception 2 of Section 1512.1 of the IBC to check for ponding instability if an existing roof doesn't have secondary drainage.

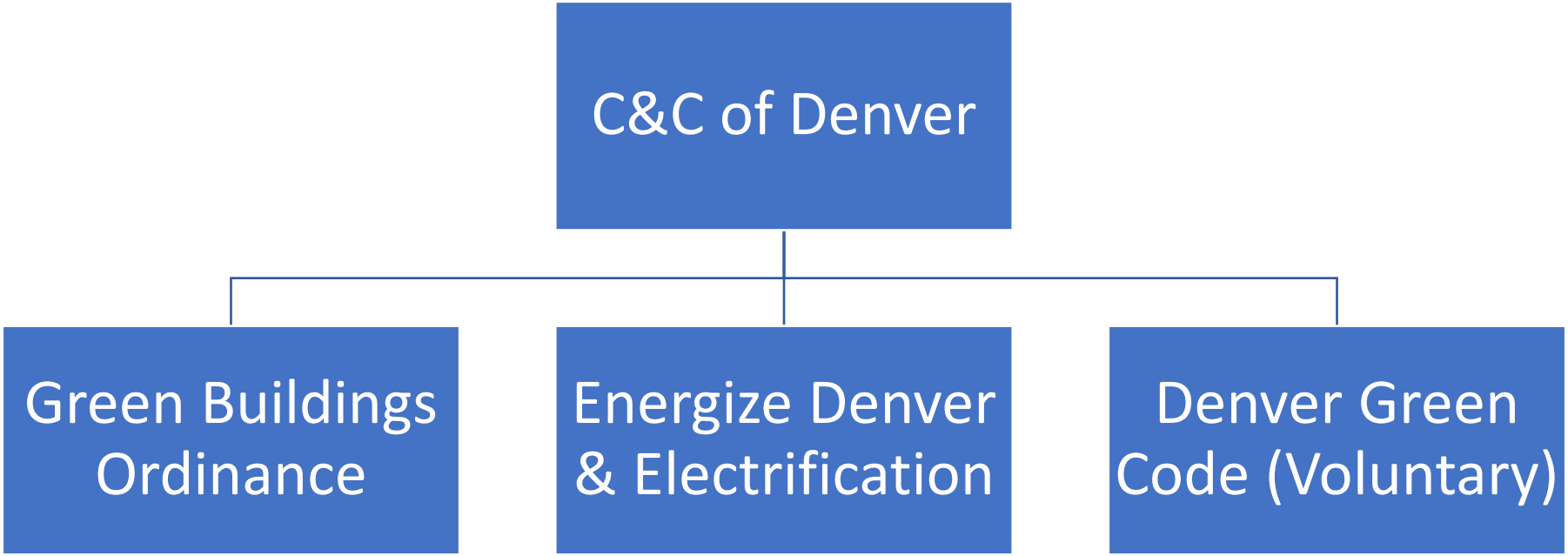
Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502.2 for roofs that provide for positive roof drainage and have been determined to resist all design loads meet the requirements of Section 1608.3 and Section 1611.2. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502.2.

Local Building Codes

Recent or expected code adoptions from some of the large jurisdictions in Colorado.

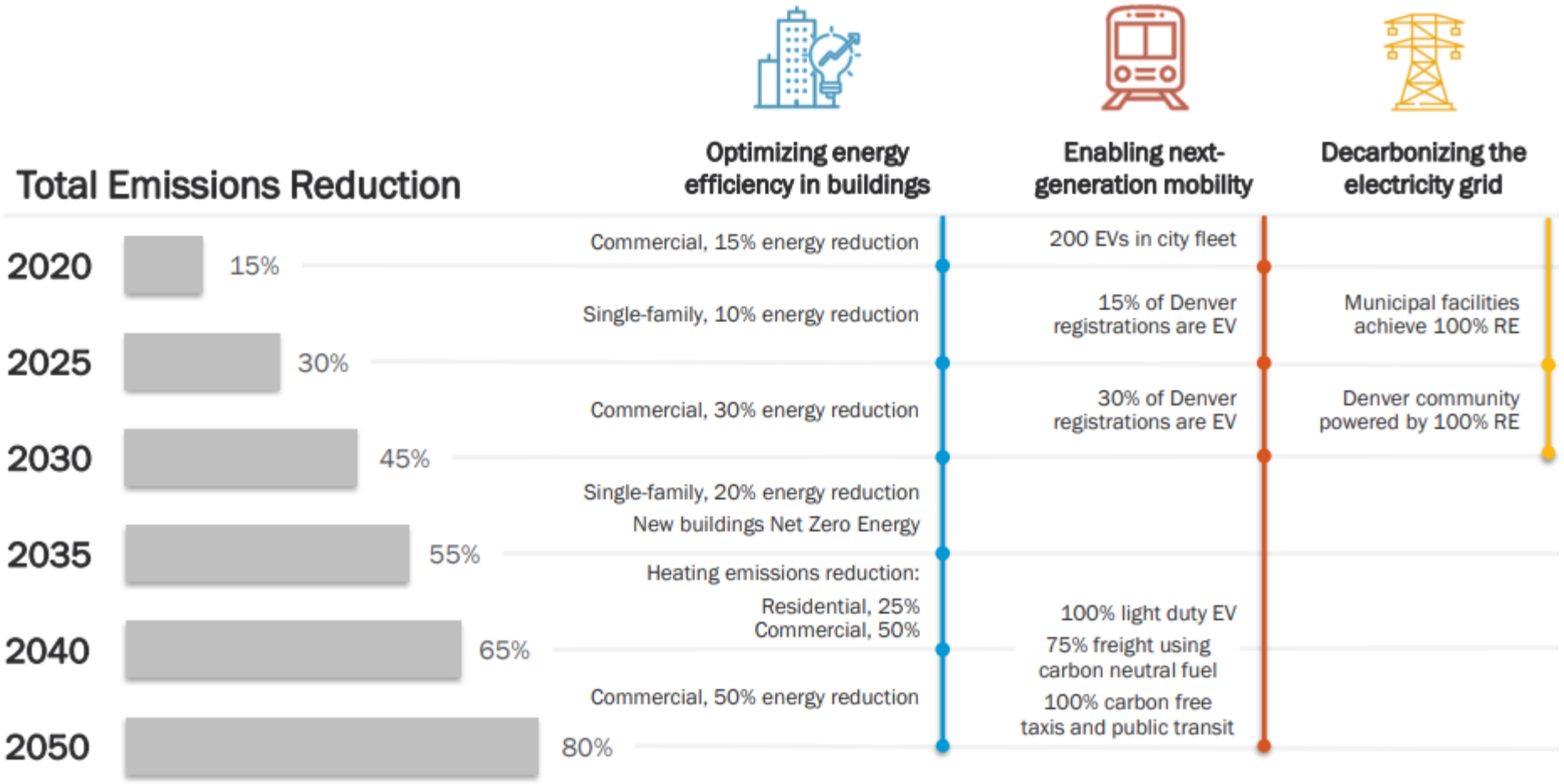
City & County of Denver

Focus on “Green”



City & County of Denver

"80x50" Plan



City & County of Denver

"Green" Timeline So Far

City & County of Denver

GBO Update

- Full compliance requires cool roofs AND a green/energy compliance option
- Applies to:
  - All buildings (new and existing) which have gross floor area of 25,000 or more (except some residential)
  - All additions to buildings (except some residential) with gross floor area of 25,000 or more

City & County of Denver

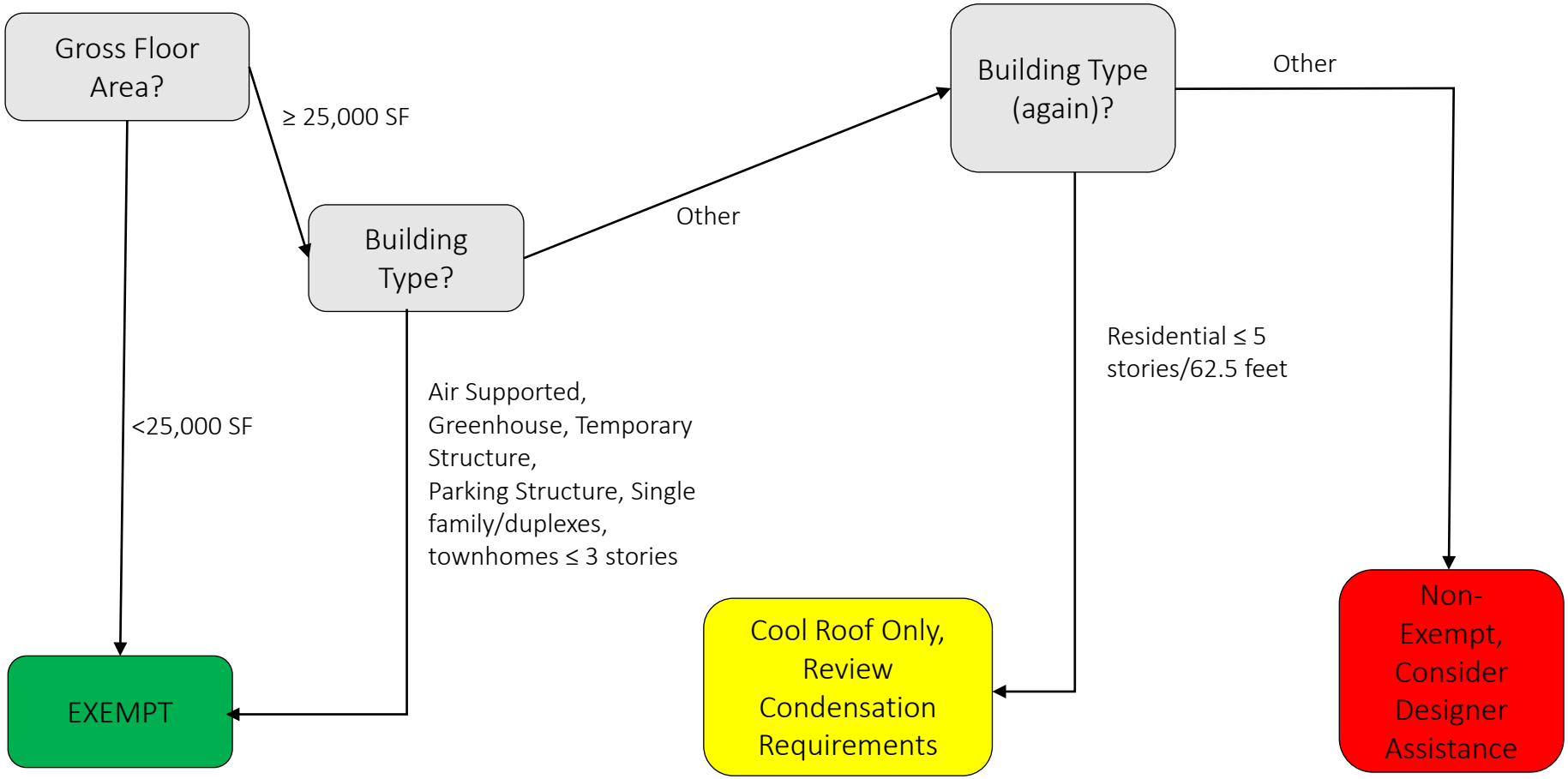
GBO Update – New Construction

Green Space: 	Green space on the roof, terraces, podiums, or at grade*	$ Payment for same amount of off-site green space
Energy Conservation: 	Solar production equal to 70% of roof area – onsite, community solar, or purchased from Xcel*	A minimum of 12% energy savings above current codes
Combination Approaches: 	Green space and solar*	Green space and 5% energy savings above codes
Certifications: 	Third-party green building certifications	

*Campus option

City & County of Denver

GBO Update – New Construction



City & County of Denver

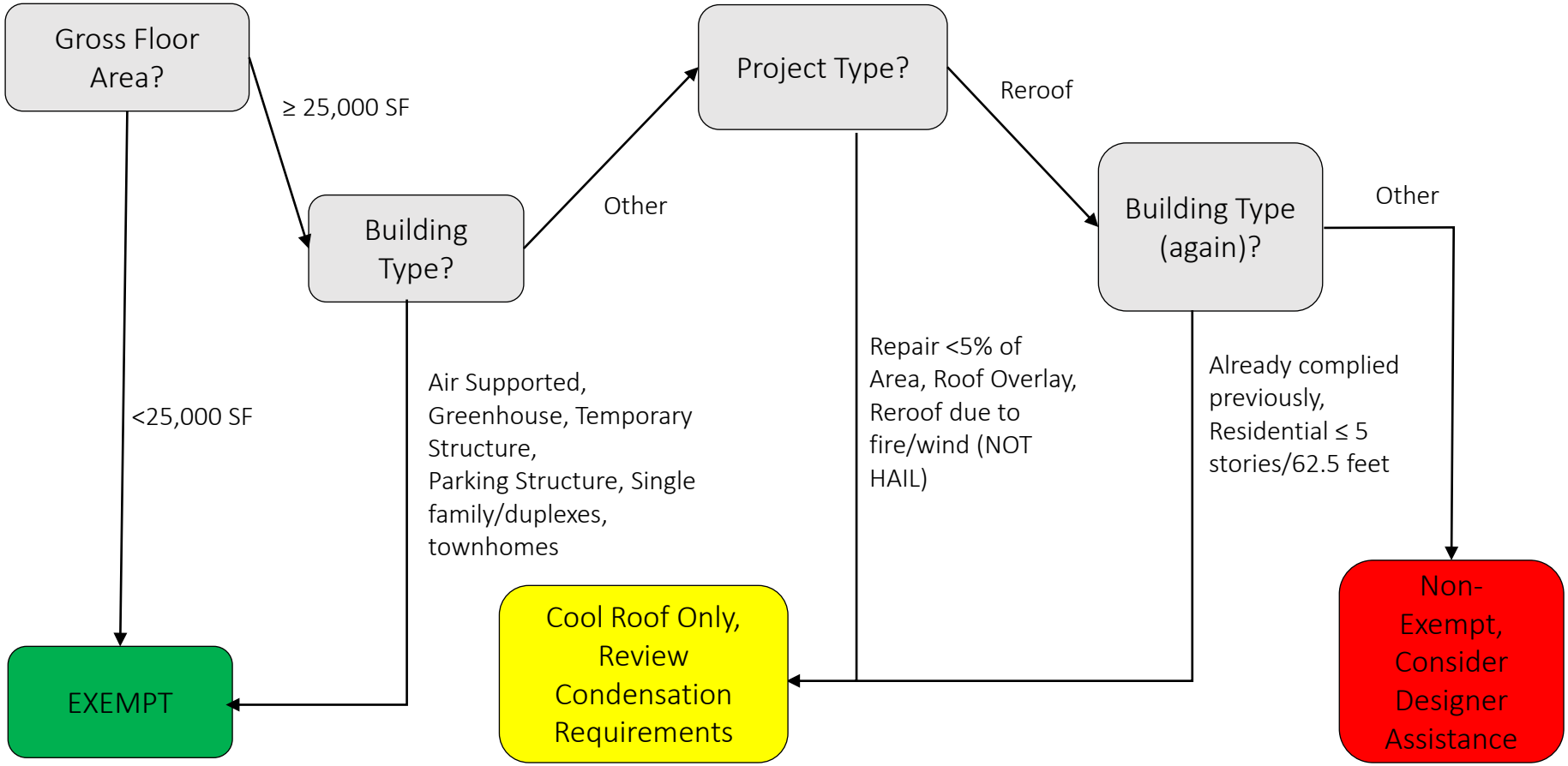
GBO Update – Existing Buildings

Green Space: 	Green space on the roof, terraces, podiums, or at grade*	$ Payment for same amount of off-site green space
Energy Conservation: 	Install solar to cover 42% of the roof, 5% of GFA, or an area sufficient to meet 100% of the building's annual electricity consumption*	
Energy Program: 	Enroll in a flexible energy program to achieve similar greenhouse gas emission reductions as onsite solar	
Certifications: 	Third-party green building certifications	

*Campus option

City & County of Denver

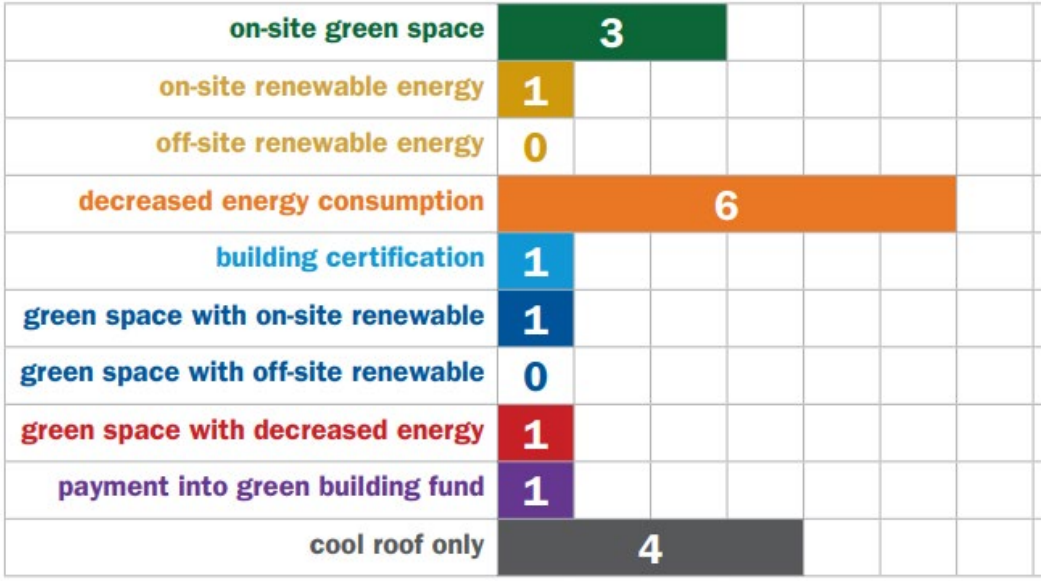
GBO Update – Existing Buildings



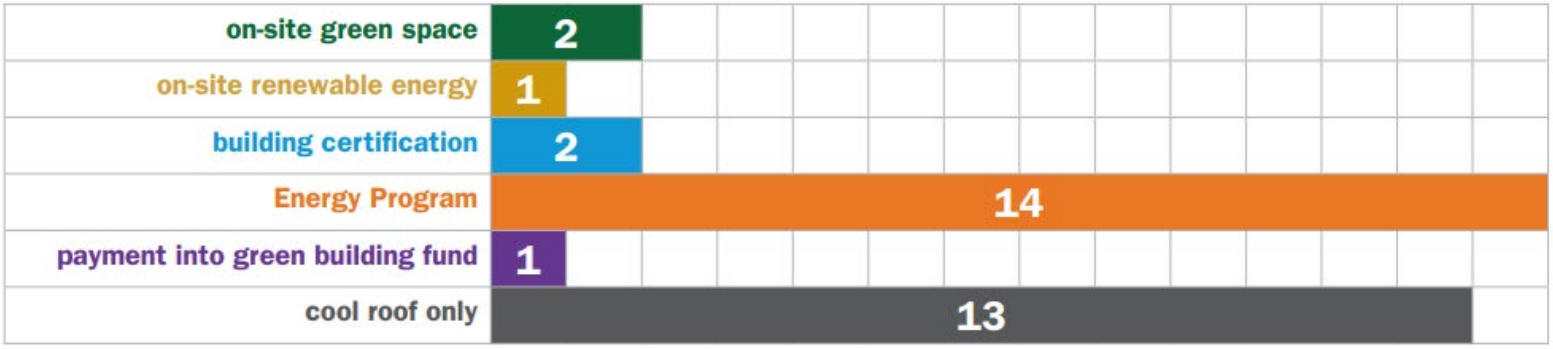
City & County of Denver

GBO Update

New Buildings



Existing Buildings



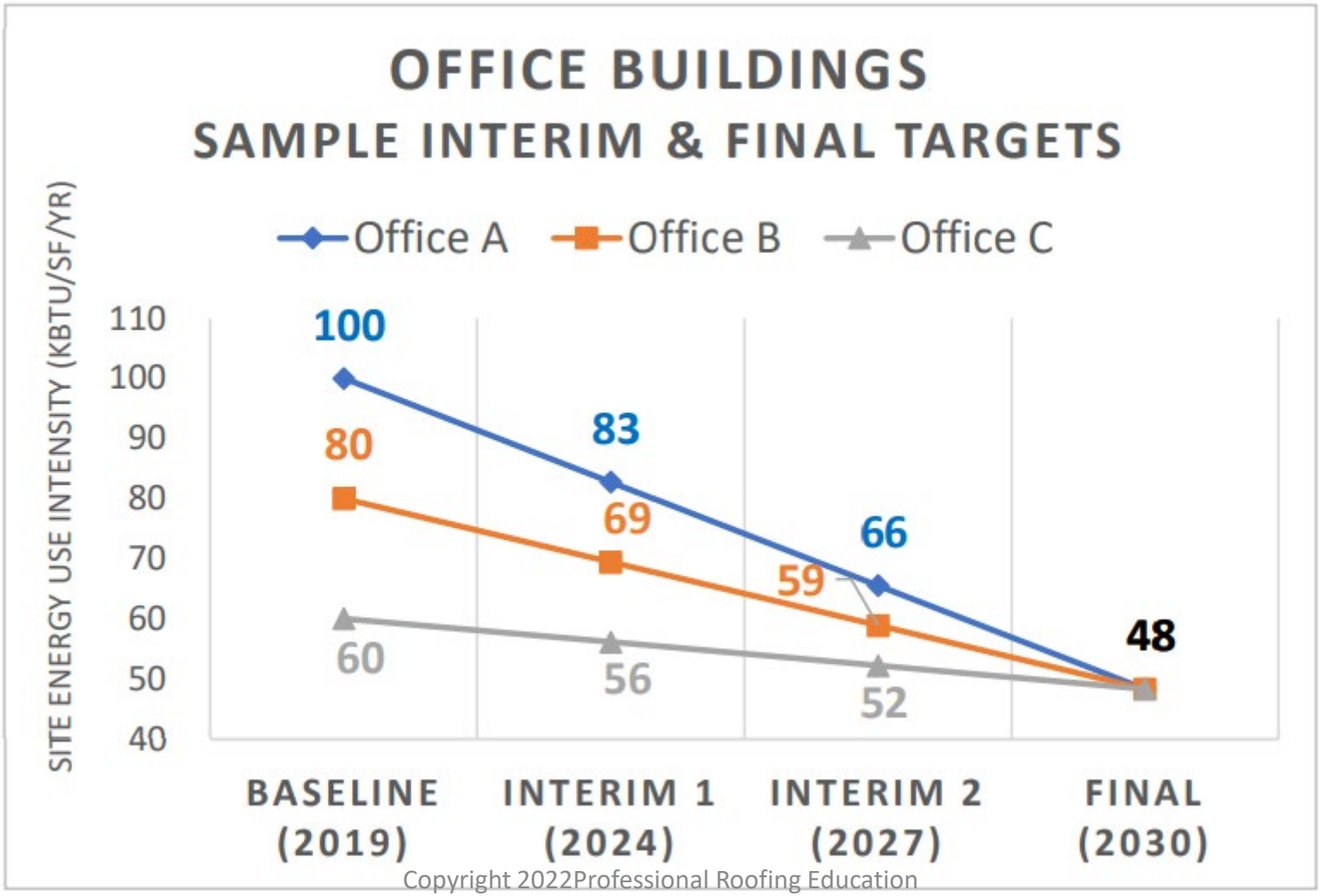
City & County of Denver

Energize Denver

- Started in 2017 with benchmarking
- Benchmarking data was used to develop initiative targets/goals
  - “Energy Usage Intensity” (EUI) was developed for each building type which reported
  - Targets were set for EUI by building type to improve all buildings to their type’s 85/15th percentile to achieve city’s goals

City & County of Denver

Energize Denver



City & County of Denver
Electrification

Amending Denver Building and Fire Code	2023	2025	2027
New requirements upon installation of gas equipment.	X	X	X
Heat Pump Required upon Replacement of Easy-to-Electrify Equipment (furnaces, roof top units, individual water heaters) when cost-effective.		X	
Heat Pump Required upon Replacement of Hard-to-Electrify Equipment (PTACs, boilers, central hot water) when cost-effective.			X

City & County of Denver

Energize Denver & Electrification

WHY SHOULD YOU CARE?

City & County of Denver

Denver Green Code

- Voluntary with Incentive-Based Compliance
  - Targeted at commercial buildings, but has residential provisions
- Based on International Green Construction Code
- Buildings that are LEED Platinum, Net-Zero Energy, or Passive House designs all comply

City & County of Denver

Denver Green Code

WHY SHOULD YOU CARE?

Marshall Fire Victims

Code Allowances

The Marshall fires that occurred at the end of 2021 destroyed 1,084 homes and damaged 149 others. It also destroyed 7 commercial buildings and damaged 30 others, That is a total of 1,270 building structures damaged by the fires. Current market conditions and limitations with insurance coverages may prevent many property owners from being able to rebuild the homes.

Property values in the fire damaged area increased by up to 30% or more in 2020 and 2021. This left some property owners under insured. Underinsurance clauses in their policies can reduce their property damage coverage by up to 20%.

Insurance coverage for code upgrades will be limited by the law and ordinance rider in the property owner's insurance policies. Many of these policy limits will fall well short of the actual costs to meet the current code requirements to rebuild. Leaving property owners short of the funds needed to rebuild their homes.

Construction costs for materials and labor have continued to increase in 2022 as supply chain issues continue to be a problem.

***Boulder County** approves more restrictive building code amendments inspired by the Marshall fires. Other jurisdictions will follow, further increasing the costs of construction.*

***City of Louisville** Publishes a building guide for the rebuilding process for Marshal fire victims. Louisville has not yet adopted new code to account for changes to address wildfires.*

***Town of Superior** Also publishes a building guide for the rebuilding process for Marshal fire victims. Superior has not yet adopted new code to account for changes to address wildfires.*

May 12, 2022

Boulder County updates building regulations to better protect against future wildfires

New requirements will be added to the Boulder County Building Code Amendments to the currently adopted 2015 International Codes

Boulder County, Colo. - At a public hearing on May 12, the Boulder County Commissioners approved an update to the ignition-resistant requirements for construction in Wildfire Zone 2, which comprises the Eastern area of unincorporated Boulder County. The update was prompted by recent wildfires, including the Marshall Fire.

Marshall Fire Rebuilding Process

As the debris removal process for Marshall Fire victims begins, the City is committed to implementing a rebuilding process that will be as easy as possible for residents to navigate.

The City will be hiring additional staff and assigning them to the rebuild process. These additional staff members will be committed to assisting property owners during the rebuilding process.

The next phases of the rebuilding process include Design, Plan Review & Permitting, and Construction & Inspections.

Additional information about rebuilding will be provided in the next days and weeks. We are currently evaluating codes and policies that may help facilitate and encourage reconstruction.

www.LouisvilleCO.gov/MarshallFire

Tip: Once you have 90% set of plans, begin interviewing and selecting a licensed contractor. Visit Chamber of Commerce and Better Business Bureau to find high-quality licensed contractors. All contractors must be licensed with the City of Louisville.

3. PLAN REVIEW & PERMITTING

A key milestone in building your new home will be applying for and receiving your building and associated permits. One way to save time and money is to first work with your design professional to ensure your application submittal packet is 100 % complete. Please refer to the City of Louisville Building and Safety Department for complete list of submittal packet requirements. Review timelines will vary depending on scope and size of work, but we intend to expedite and prioritize permits for affected properties..

KEY ACTIVITIES:

- Work with design professional to complete submittal packet

Marshall Fire Rebuilding Process

Town of Superior Planning
stevenw@superiorcolorado.gov
www.superiorcolorado.gov

Town of Superior Building
CBO@superiorcolorado.gov
buildingpermits@superiorcolorado.gov
303-499-3675 ext. 139

As the debris removal process for Marshall Fire victims begins, the Town of Superior is committed to implementing a rebuilding process that will be as easy as possible for residents to navigate.

The Town is working to secure staffing and resources to facilitate the rebuild process. These additional staff members will be committed to assisting property owners during the rebuilding process.

The next phases of the rebuilding process include Design, Plan Review & Permitting, and Construction & Inspections.

Additional information about rebuilding will be provided in the next days and weeks. We are currently evaluating codes and policies that may help facilitate and encourage reconstruction.

https://www.superiorcolorado.gov/community/marshall-fire-information

https://www.superiorcolorado.gov/departments/building-department

current building standards may impact whether a previously approved design remains buildable. Engineering and design updates may be necessary for a dated design to be permitted now.

KEY ACTIVITIES:

- Hire design professional
- Retrieve original plans, if any and discuss code changes; or
- Begin the design of a completely new home
- Attend Marshall Fire community meetings – details will be made available on the Town website.

Tip: Once you have a 90% set of plans, begin interviewing and selecting a licensed contractor. Visit Chamber of Commerce and Better Business Bureau to find high-quality licensed contractors. All contractors must be licensed.

3. PLAN REVIEW & PERMITTING

Working with a design professional will help ensure both application completeness and ensure your proposal meets current building requirements. Please refer to the Town of Superior Building Department (https://www.superiorcolorado.gov/departments/building-department) for complete list of submittal packet requirements. Review timelines will vary depending on scope and size of work, but we intend to expedite and prioritize permits for affected properties.

Boulder County

Fire Code Amendments

R327.4.1 Roof covering. Roof covering materials installed in Wildfire Zone 2 shall be listed Class A roof covering materials or be constructed as a Class A roof assembly. For roof coverings where the pro- file allows a space between the roof covering and roof decking, the space at the eave ends shall be fire stopped to preclude entry of flames or embers, or have one layer of 72-pound (32.4 kfg) mineral□surfaced, non-perforated cap sheet complying with ASTM D 3909 installed over the combustible decking.

R327.4.1.1 Roof valleys. When provided, valley flashings shall be not less than 0.019 inch (No. 26 galvanized sheet gage) corrosion-resistant metal installed over a minimum 36-inch-wide underlayment consisting of one layer of 72-pound miner- al-surfaced, non-perforated cap sheet complying with ASTM D 3909 running the full length of the valley.

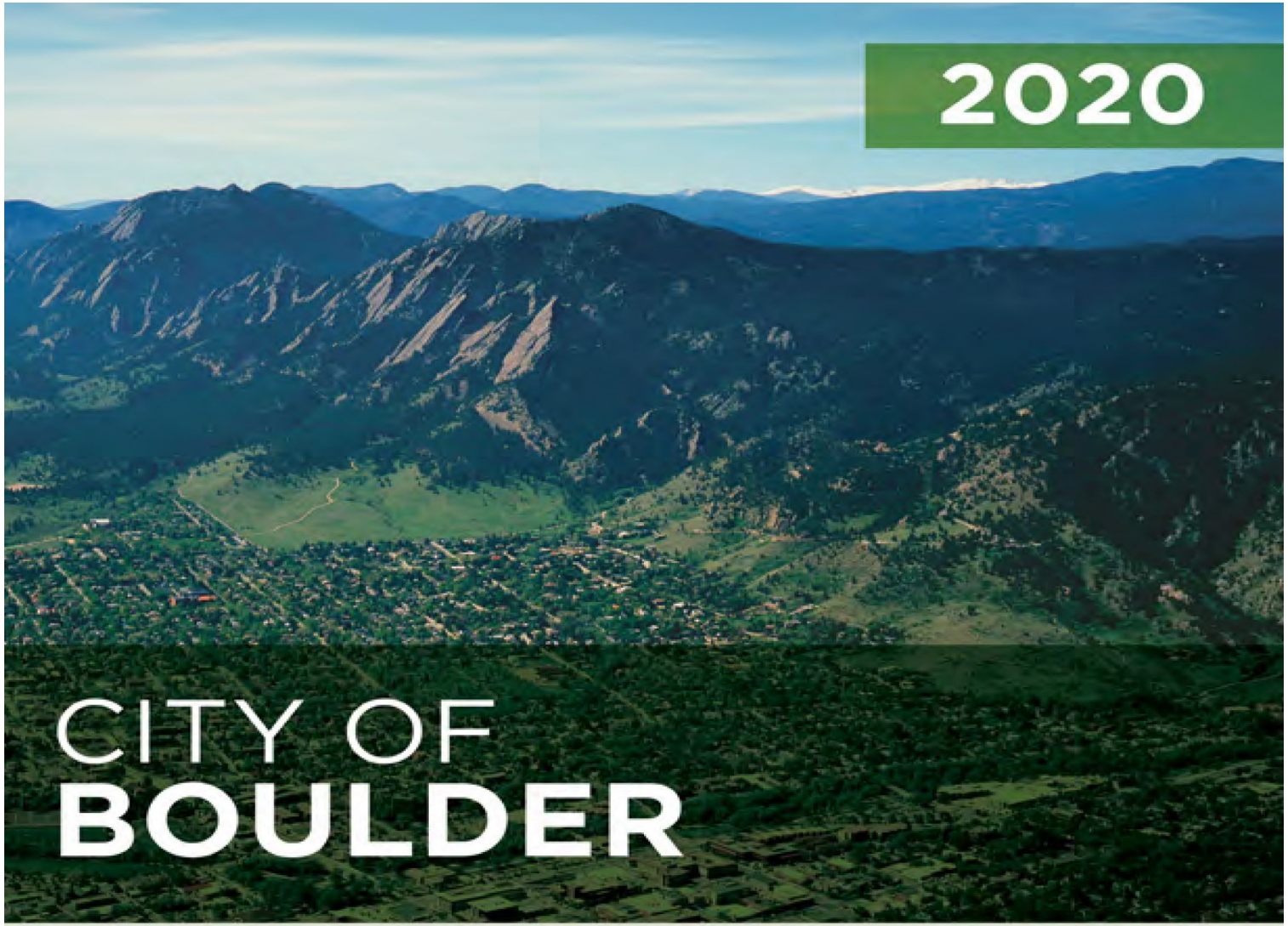
R327.4.11 Vents. Attic ventilation openings, foundation or under-floor vents, or other ventilation openings in vertical exterior walls and vents through roofs shall not exceed 144 square inches each.

R327.4.2 Gutters and downspouts. Gutters, downspouts, and gutter covering devices shall be constructed of noncombustible material. Gutters shall be provided with an approved means to prevent the accumulation of leaves, pine needles and debris in the gutter

R327.4.5 (7-1) Soffits - Vinyl or plastic soffits, fascia or trim are not permitted

R327.4.6 Exterior walls . (1) Noncombustible materials approved for a minimum of 1-hour fire-resistance-rated construction on the exterior side. Exception: Trim is not required to meet the materials requirements for exterior wall

R327.4.8 Decks, appendages, and projections. Decks and other unenclosed accessory structures attached to buildings shall be constructed of the following materials:



ENERGY CONSERVATION CODE

BASED ON THE 2018 INTERNATIONAL
ENERGY CONSERVATION CODE®

City of Boulder

2020 Energy Code

Table C402.1.3 Insulation Requirements. R-33 ci entirely above roof deck. R-53 in attic. Skylight Curbs R-5.

Table C402.4 Fenestrations. Building envelope fenestration minimum U-Factor: Fixed = 0.36, Operable = 0.45

C402.5.1.1 Air Barriers. Same as 2021 code. Required to be tested and certified.

Table C402.5.2 Maximum Air Leakage Rate. Windows 0.20 CFM/SF, Skylights 0.30 CFM/SF, Curtain Walls 0.06 CFM/SF

R327.4.5 (7-1) Soffits - Vinyl or plastic soffits, fascia or trim are not permitted

C402.3 Roof Solar Reflectance and Thermal Emittance (SRI). Deleted

C402.3.1 Aged Solar Reflectance. Deleted

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, *R*-VALUE METHOD[a, i]

	ALL OTHER	GROUP R
Roofs		
Insulation entirely above roof deck	R-33ci	R-33ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS
Attic and other	R-53	R-53
Walls, above grade		
Mass[g]	R-13.3ci	R-13.3ci
Metal building	R-13 + R-19.5ci	R-13 + R-13ci
Metal framed	R-13 + R-11ci	R-13 + R-11ci
Wood framed and other	R-13 + R-9ci or R-19 + R-5ci	R-13 + R-9ci or R-19 + + R-5ci
Walls, below grade		
Below-grade wall[d]	R-7.5ci	R-10ci
Floors		
Mass[e]	R-15ci	R-16.7ci
Joist/framing	R-30	R-30
Slab-on-grade floors		
Unheated slabs	R-15 for 24″ below	R-15 for 24″ below
Heated slabs[h]	R-20 for 48″ below + R-5 full slab	R-20 for 48″ below + R-5 full slab
Opaque doors		
Nonswinging	R-4.75	R-4.75

Jurisdictions on 2021 i-codes

The following jurisdictions along the front range have adopted the 2021 international building codes as of May 2022

- *Arapahoe County*
- *City of Aurora*
- *Denver Colorado*
- *City of Fort Collins*
- *Larimer County*
- *City of Longmont*

Most of the other municipalities are on the 2018 building codes.

Warranty Inspections

The following jurisdictions may require a manufacturers warranty on low slope roof systems or a warranty inspection.

- *Broomfield*
- *Castle Rock*
- *Denver*
- *Douglas County*
- *Longmont*
- *Thornton*
- *Wheat Ridge*

HB22-1362

Building Green House Gas Emissions

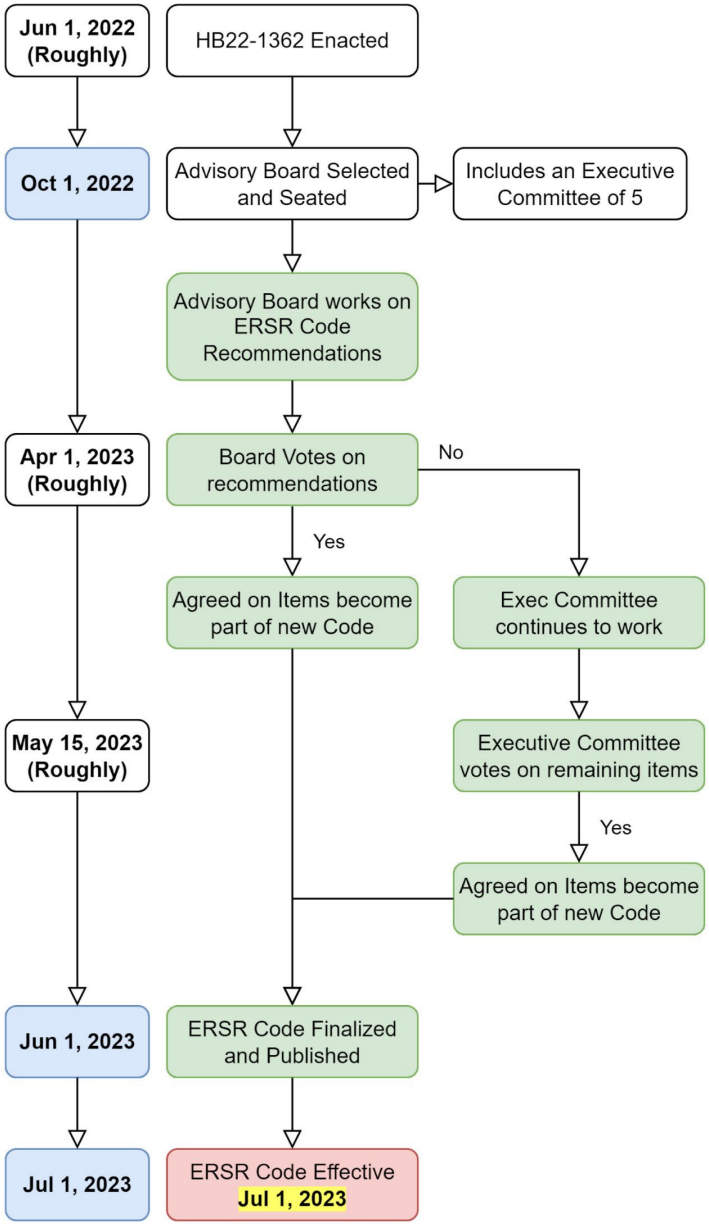
This energy code adopted by the state legislature on Mat 7, 2022 requires all 334 jurisdictions in Colorado to adopt the 2021 IECC and a model electric and solar ready code on or before January 1, 2025. it also requires adoption of a model energy code to be determined by the Colorado Energy Office by January 1, 2030. The bill also creates a $3 million energy fund and a total of $22 million in clean air building funds to assist in the administration of these new building requirements.

In the event of a conflict between the 2021 international energy conservation code, the 2024 international energy conservation code, or any of these 3 sets of model code language and either the Colorado plumbing code or the national electric code, the Colorado plumbing code or the national electric code prevails.

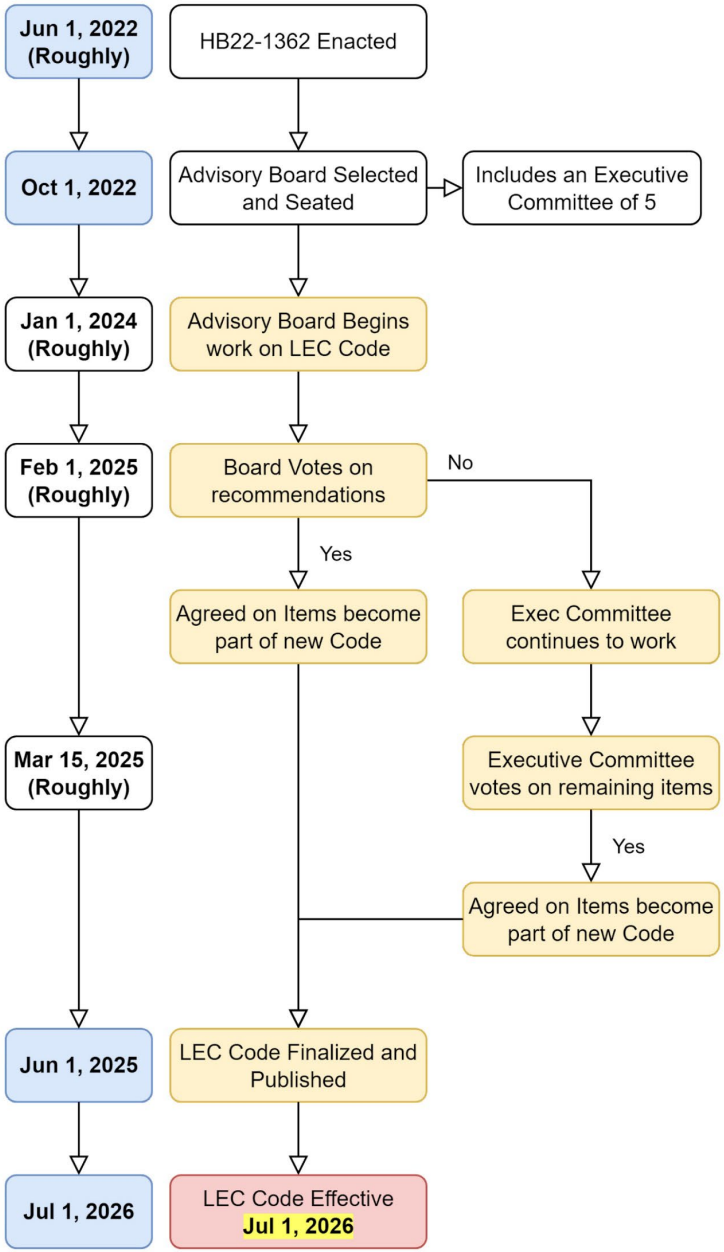
HB 1362 requires the formation of an energy code advisory board that will identify for adoption the Model electric and solar ready code language; and Model low energy and carbon code language.

This bill takes the power away from local jurisdictions to adopt their own energy codes that may be more applicable to their geographic location and local demographics.

Proposed - Model Electric Ready and Solar Ready (ERSR) Code TImeline



Proposed - Model Low Energy and Carbon (LEC) Code Timeline



Colorado Legislature

Bills likely to be introduced again in 2023

SB21-166 Colorado Fire Commission Recommendations

Concerning the implementation of recommendations from the Colorado fire commission, and, in connection therewith, making an appropriation. This bill creates a fund for wildfire mitigation.

SB21-258 Wildfire Risk Mitigation

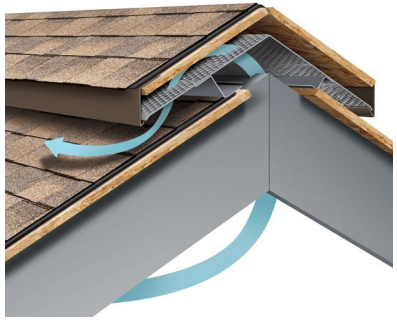
The act increases the amount that the forest service may use for the direct and indirect costs in administering the forest restoration and wildfire risk mitigation grant program from 3% to 7% of any amounts appropriated in any fiscal year.

SB22-206 Disaster Preparedness And Recovery Resources

- creates the disaster resilience rebuilding program in the division of local government
- creates the sustainable rebuilding program in the Colorado energy office.
- creates the office of climate preparedness in the governor's office.

Statewide Fire Code

We are likely to see legislation in 2023 for statewide building code designed to mitigate the risk of damage to buildings from wildfire.



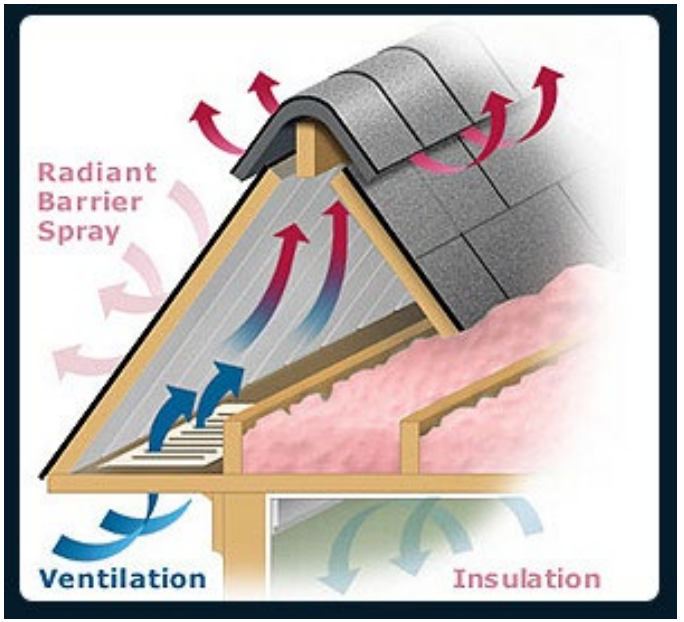
Steep Slope Roof Ventilation

- Roof Ventilation (Why Ventilate?)
- Damage to roofs and structure from inadequate roof ventilation
- Ventilation for Reroofs is included in The Building Codes
- Manufacturer’s Installation Instructions
- Warranty exclusions
- Balancing intake and exhaust venting
- Roof Ventilation Calculations
- Solutions for intake and exhaust venting

Roof Ventilation (Why Ventilate?)

Proper roof ventilation is extremely important for the proper function of a roof system. Inadequate or improper roof venting can cause the following issues:

- **Condensation**
- **Ice Dams**
- **Premature aging of the roof covering**



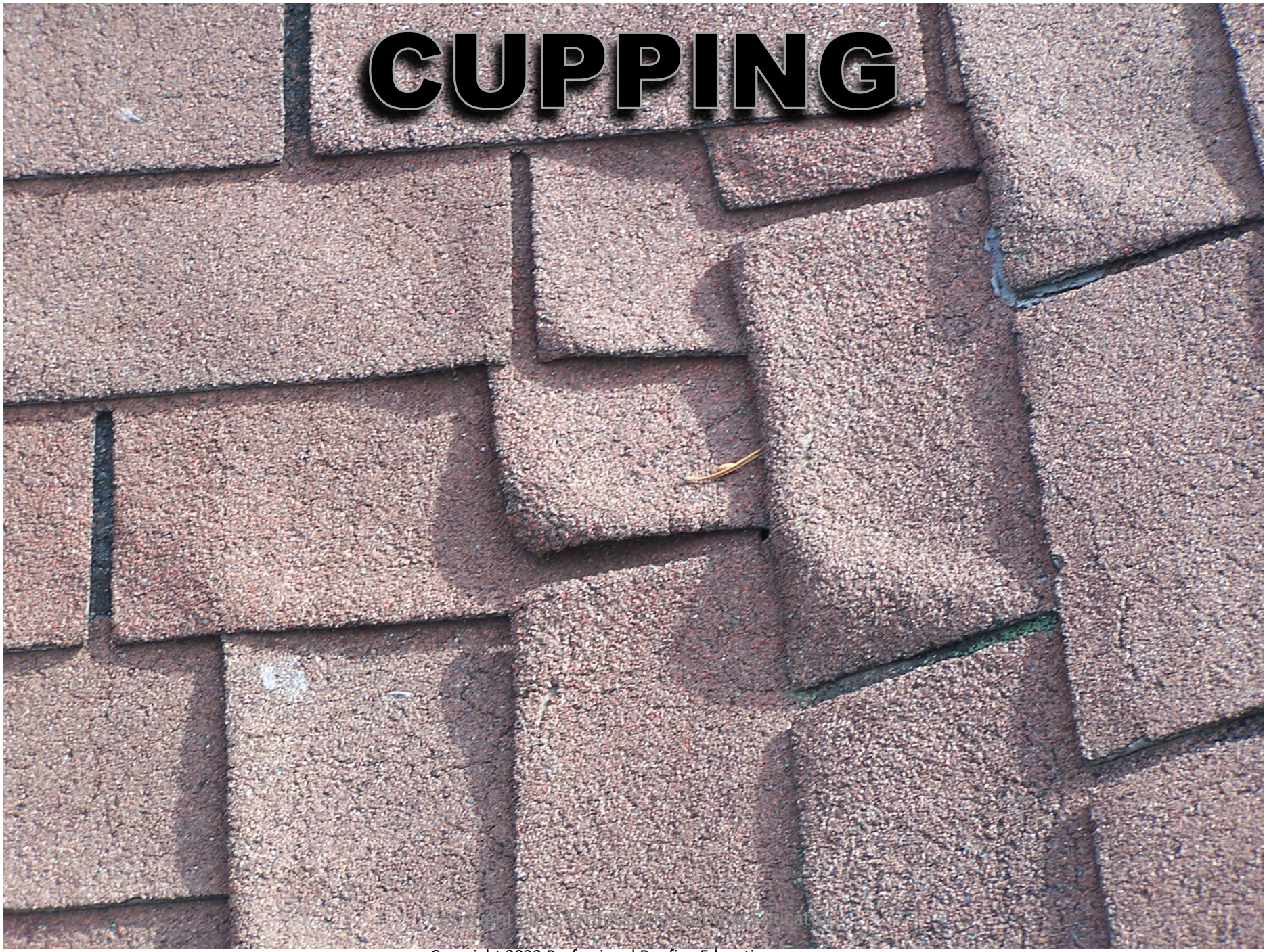
Ice Dams

Proper ventilation helps ensure that snow and ice melt more evenly on the roof. When a roof is improperly vented snow and ice melts prematurely on the upper portion of the roof where it is warm and runs down to the eaves and freezes to form ice dams, When the outside temperatures warm up the melting snow and pools at the ice dam and causes leaks.

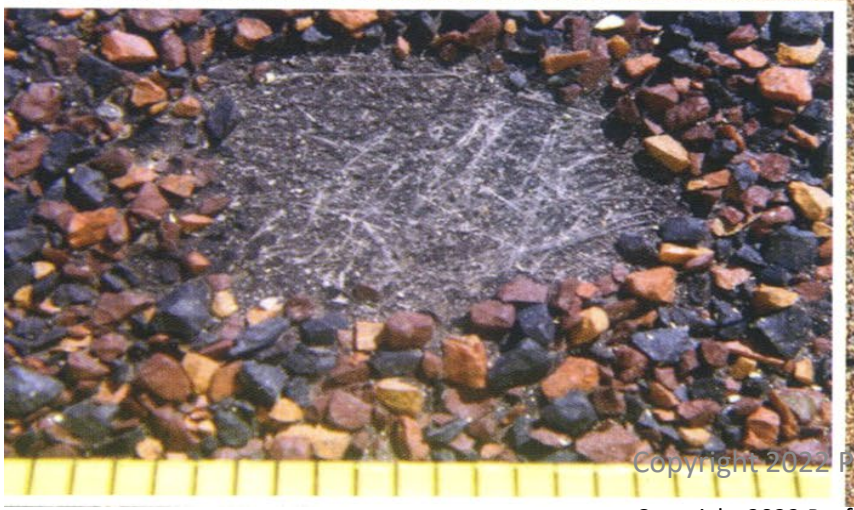
Premature Aging

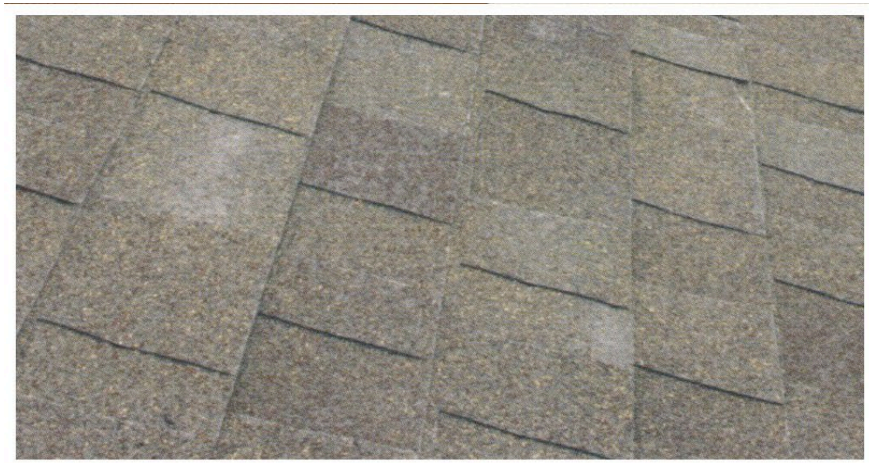
Improperly vented roofs can build up heat and moisture in the roof cavity and prematurely age roof shingles causing:

Blistering – Cracking – Crazing – Curling – Granule Loss - Delamination



BLISTERING





GRANULE LOSS

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DELAMINATION

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Building Damage
From improperly vented roofs

- Damage to buildings caused by insufficient or improperly installed roof ventilation has been an ongoing problem. This issue is accentuated in Colorado where we experience the more freeze thaw cycles than any other populated area in North America.
- It is important to install proper roof ventilation not only on new construction but also on reroofs to avoid the following issues:

1. Premature aging of roof coverings due to excessive heat and moisture in the roof system or roof cavity.
2. Damage to the sheathing and/or other parts of the building from condensation.
3. Damage to the sheathing and/or other parts of the building from ice dams that could be reduced or avoided with more uniform temperatures in the roof cavity afforded by proper through venting.

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1. Condensation (Denver, CO 2005)

No roof ventilation, air barrier, or vapor retarder

2. Ice Dams (Arvada, CO 2020)

Inadequate roof ventilation, no eaves

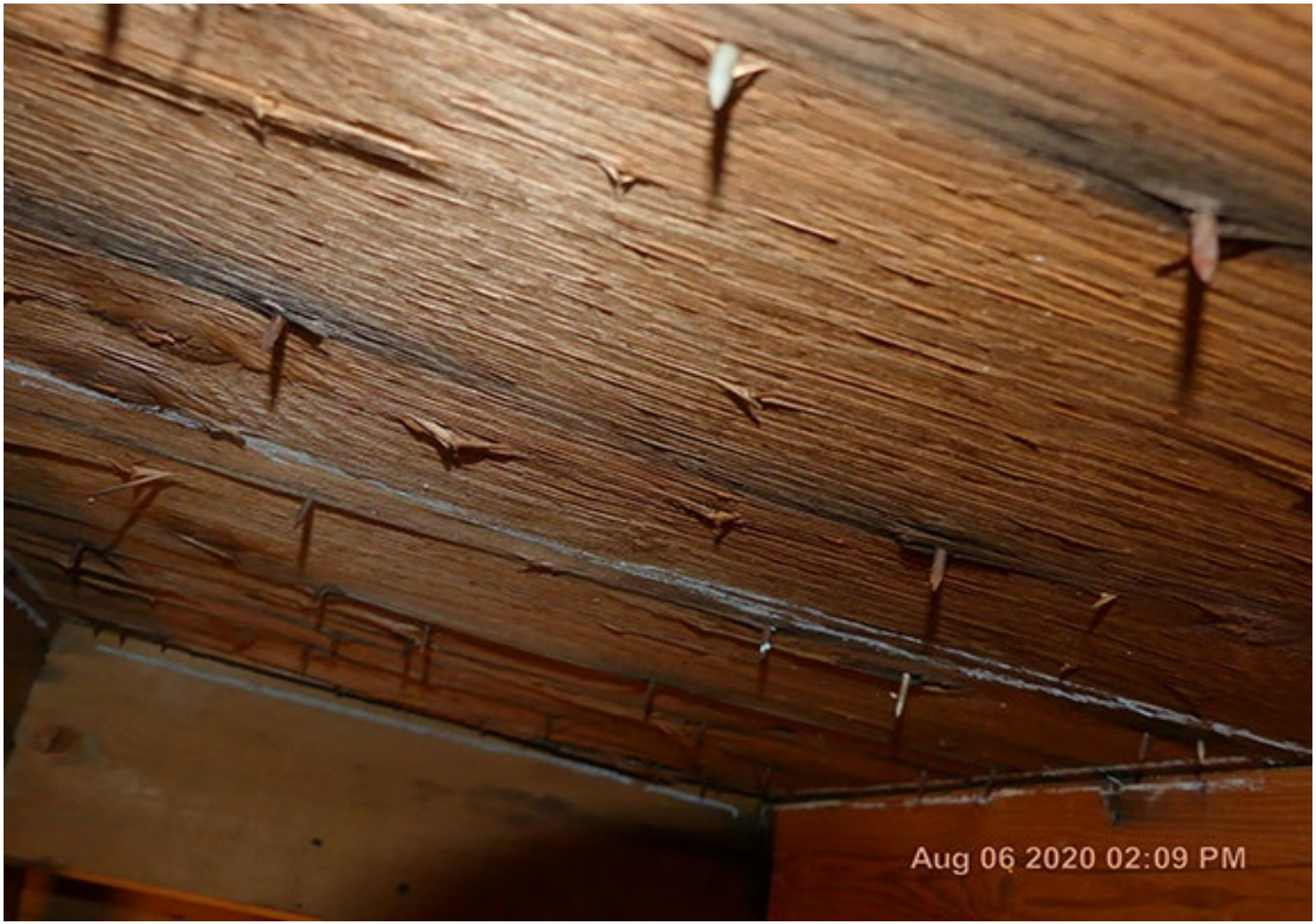
2. Ice Dams (Arvada, CO 2020)

Resulting damage to soffit after 36 months

3. Condensation (Snowmass, CO 2018)

No roof ventilation, 2-inch polyiso above roof deck,11-inch fiberglass batts inside roof cavity (installed 2009, Photo 2018)

4. Condensation (Lakewood, CO 2020)



Inadequate roof ventilation, 36-inch eaves

Reroofed with synthetic felt 18 months earlier, nothing else changed

Condensation (Louvers, CO 2020)

No intake ventilation

Reroofed wood shake with standing seam metal panels 26 months earlier

Condensation (Littleton, CO 2021)

Inadequate intake ventilation, blocked 50% of exhaust ventilation
Reroofed wood shake with stone coated steel 4-1/2 years earlier

Condensation (Denver, CO 2021)

Inadequate roof ventilation

Reroofed with synthetic felt 4-1/2 months earlier, nothing else changed

Condensation (Denver, CO 2021)

Inadequate roof ventilation

Previous roof had similar single laminate dimensional shingles

Condensation (Denver, CO 2021)

Inadequate roof ventilation

The previous roof was installed using asphalt impregnated felt

Condensation (Courtesy of Lomanco)

Inadequate roof ventilation

Reroofed with synthetic felt, nothing else changed

Extent of Property Damage

Improperly vented steep slope reroofs

12-month period from March 2020 to March 2021

6-construction defect claims totaling over $12 million in property damage

- **151-unit Multi-Family Residential** in Denver, CO ($7.9 million claim). Stone coated steel roofs installed without proper intake and exhaust venting resulted in moisture damage, mold, and mildew inside the attics.
- **10,000 SF 2-story Warehouse** in Denver, CO ($2.8 million defect claim). Metal roof installed without proper ventilation and/or vapor and air barrier over conditioned warehouse. Client experienced leaks from moisture within the first 6 months. Extensive defect issues.
- **72 -unit Multi-Family Residential** in Lakewood, CO ($1.2 million defect claim). The existing buildings were re-roofed in November of 2019 and are experiencing damage due to ice dams due to inadequate intake venting not paid for by their insurance carrier.
- **5,600 SF Single Family Home** in Louvers, CO ($34K defect claim). The existing home was remodeled during which a standing seam metal roof was installed with SPF foam in the roof cavity and now ventilation. The structure experienced severe condensation within the first 6 months.
- **1,800 SF Single Family Home** in Denver, CO ($68K defect claim). Home reroofed with a single laminate shingle the same as existing only thing changed was use of synthetic felt in place of the asphalt impregnated felt. Existing roof ventilation approximately 50% of code requirement. Home exhibited black mold in the attic, on the ceiling, and in the walls in less than 5 months.
- **31,630 SF Church** in Denver Colorado (Property damage claim, amount of damage unknown) Moisture damage from improper ventilation. Hired by insurance to determine code requirements.

Who Footed the Bill for This Damage?

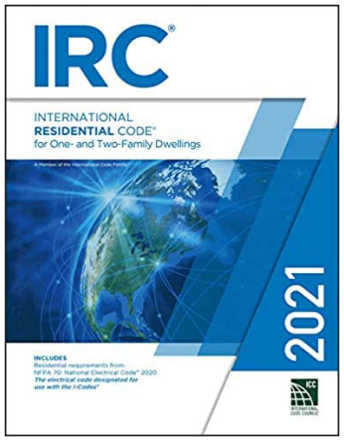
Contractors

Property Owners

How Do We Prevent Damage from Condensation on Steep Slope Reroofs?

- **Follow the Building Codes!**

- **Adequate Roof Ventilation is Required** on steep slope reroofs, unless otherwise stated in writing by the local building department or jurisdiction!



2021 IRC
(International Residential Code)

R806.1 Ventilation required.
Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow.
. . . Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air and shall be protected to prevent the entry of birds, rodents, snakes and other similar creatures.

2021 IRC

R806.2 Minimum vent area.
The minimum net free ventilating area shall be 1/150 of the area of the vented space.
Exception: The minimum net free ventilation area shall be 1/300 of the vented space provided both of the following conditions are met:

1. In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. Not less than 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically. The balance of the required ventilation provided shall be located in the bottom one-third of the attic space. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

2021 IRC

R806.3 Vent and insulation clearance. Where eave or cornice vents are installed, blocking, bridging and insulation shall not block the free flow of air. Not less than a 1-inch (25 mm) space shall be provided between the insulation and the roof sheathing and at the location of the vent.

SECTION R908 REROOFING
R908.1 General. Materials and methods of application used for recovering or replacing an existing roof covering **shall comply with the requirements of Chapter 9.**

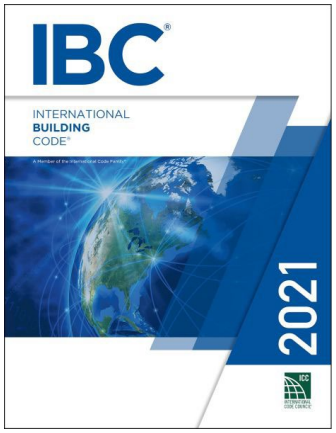
shall comply with the requirements of Chapter 9.

shall comply with the requirements of Chapter 9.

2021 IEBC
(International Existing Building Code)

CHAPTER 7 ALTERNATIONS – LEVEL 1

Section 705 Reroofing
705.1 General
Materials and methods of application used for recovering or replacing and existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code.



2021 IBC
(International Building Code)

R1202.2 Roof Ventilation.
Roof assemblies shall be ventilated in accordance with this section or shall comply with Section 1202.3.

IBC 1202.2.1 Ventilated attics and rafter spaces.
Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilation openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. An airspace of not less than 1 inch (25 mm) shall be provided between the insulation and the roof sheathing. The net free ventilating area shall be not less than 1/150 of the area of the space ventilated. Ventilators shall be installed in accordance with manufacturer's installation instructions.

2021 IBC

IBC 1202.2.1 Ventilated attics and rafter spaces.

Exception: The net free cross-ventilation area shall be permitted to be reduced to 1/300 provided both of the following conditions are met:

1. In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. At least 40 percent and not more than 50 percent of the required venting area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

2021 IBC

1202.3 Unvented attic and unvented enclosed rafter assemblies.
Unvented attics and unvented enclosed roof framing assemblies created by ceilings applied directly to the underside of the roof framing members/rafters and the structural roof sheathing at the top of the roof framing members shall be permitted where all of the following conditions are met:

1. The unvented attic space is completely within the building thermal envelope.
2. No interior Class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, not less than a 1/4-inch (6.4 mm) vented airspace separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, 6, 7 and 8, any air-impermeable insulation shall be a Class II vapor retarder or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Insulation shall comply with either Item 5.1 or 5.2, and additionally Item 5.3.

2021 IBC

1202.3 (Cont.)

5.1. Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.

5.1.1. Where only air-impermeable insulation is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.

5.1.2. Where air-permeable insulation is provided inside the building thermal envelope, it shall be installed in accordance with Item 5.1.1. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the R-values in Table 1202.3 for condensation control.

5.1.3. Where both air-impermeable and air-permeable insulation are provided, the air-impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing in accordance with Item 5.1.1 and shall be in accordance with the R-values in Table 1202.3 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

2021 IBC

1202.3 (Cont.)

5.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

5.2. In Climate Zones 1, 2 and 3, air-permeable insulation installed in unvented attics shall meet the following requirements:

5.2.1. A vapor diffusion port shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.

5.2.2. The port area shall be greater than or equal to 1/600 of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirement.

2021 IBC

1202.3 (Cont.)

5.2.3. The vapor permeable membrane in the vapor diffusion port shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.

5.2.4. The vapor diffusion port shall serve as an air barrier between the attic and the exterior of the building.

5.2.5. The vapor diffusion port shall protect the attic against the entrance of rain and snow.

5.2.6. Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (50 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.

5.2.7. The roof slope shall be greater than or equal to 3 units vertical in 12 units horizontal (3:12).

2021 IBC

1202.3 (Cont.)

5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top the attic floor, or on top of the ceiling.

5.2.9. Where only air-permeable insulation is used and is installed directly below the structural roof sheathing, air shall be supplied at a flow rate greater than or equal to 50 cubic feet per minute (23.6 L/s) per 1,000 square feet (93 m2) of ceiling.

5.3.The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

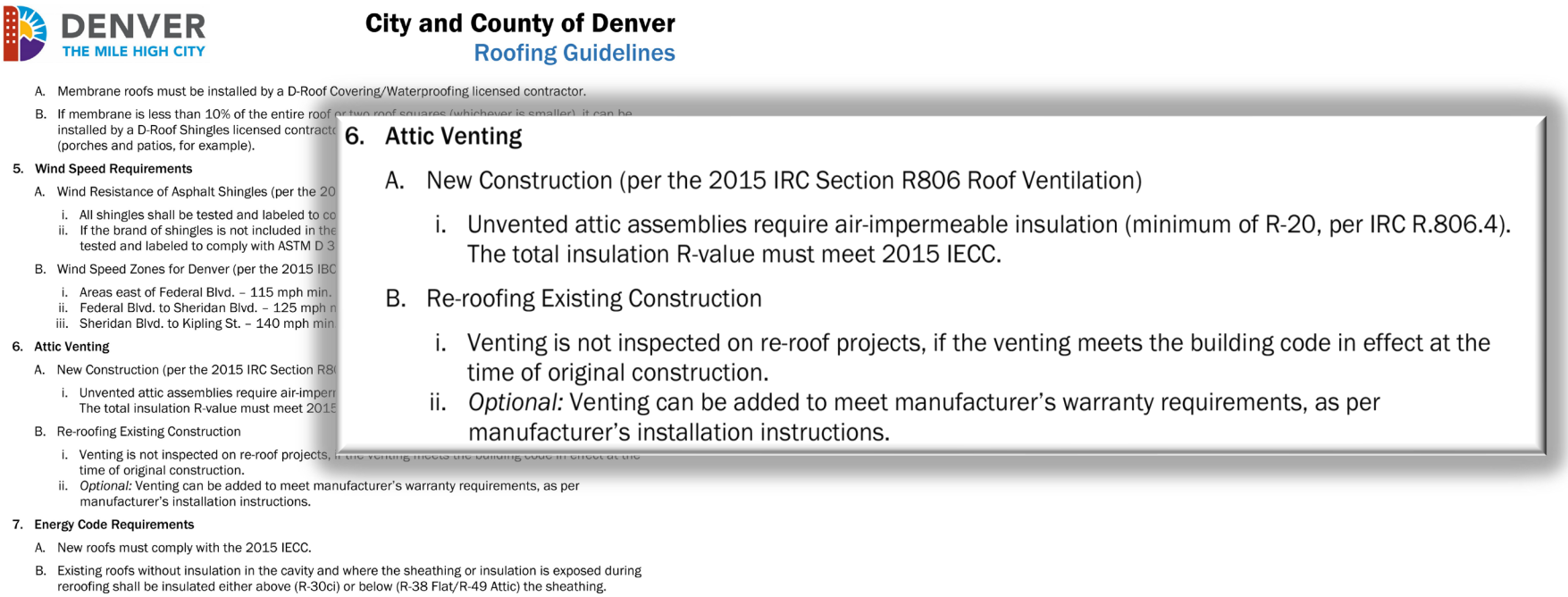
Exceptions:

1.Section 1202.3 does not apply to special use structures or enclosures such as swimming pool enclosures, data processing centers, hospitals or art galleries.

2.Section 1202.3 does not apply to enclosures in Climate Zones 5 through 8 that are humidified beyond 35 percent during the three coldest months.

Municipalities (local jurisdictions)

Local jurisdictions can adopt their own interpretation of the ventilation requirements in the building code or draft their own requirement. This is uncommon however, unless that particular code provision has an adverse effect on construction in their local climate. The ventilation provisions in the building code appears to adequately cover construction in varied climates as written. It is easier for the jurisdiction to adopt the general building code provisions



DENVER
THE MILE HIGH CITY

City and County of Denver
Roofing Guidelines

A. Membrane roofs must be installed by a D-Roof Covering/Waterproofing licensed contractor.

B. If membrane is less than 10% of the entire roof or two roof squares (whichever is smaller), it can be installed by a D-Roof Shingles licensed contractor (porches and patios, for example).

5. **Wind Speed Requirements**

A. Wind Resistance of Asphalt Shingles (per the 20

i. All shingles shall be tested and labeled to co
ii. If the brand of shingles is not included in the tested and labeled to comply with ASTM D 3

B. Wind Speed Zones for Denver (per the 2015 IBC

i. Areas east of Federal Blvd. – 115 mph min.
ii. Federal Blvd. to Sheridan Blvd. – 125 mph n
iii. Sheridan Blvd. to Kipling St. – 140 mph min.

6. **Attic Venting**

A. New Construction (per the 2015 IRC Section R8

i. Unvented attic assemblies require air-imperr The total insulation R-value must meet 201

B. Re-roofing Existing Construction

i. Venting is not inspected on re-roof projects, if the venting meets the building code in effect at the time of original construction.
ii. *Optional:* Venting can be added to meet manufacturer's warranty requirements, as per manufacturer's installation instructions.

7. **Energy Code Requirements**

A. New roofs must comply with the 2015 IECC.

B. Existing roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above (R-30ci) or below (R-38 Flat/R-49 Attic) the sheathing.

6. **Attic Venting**

A. New Construction (per the 2015 IRC Section R806 Roof Ventilation)

i. Unvented attic assemblies require air-impermeable insulation (minimum of R-20, per IRC R.806.4). The total insulation R-value must meet 2015 IECC.

B. Re-roofing Existing Construction

i. Venting is not inspected on re-roof projects, if the venting meets the building code in effect at the time of original construction.
ii. *Optional:* Venting can be added to meet manufacturer's warranty requirements, as per manufacturer's installation instructions.

Manufacturer's Installation Instructions

Shingle manufacturers typically either provide the actual ventilation requirements or refer to the building code for those requirements.

Some shingle manufacturers may fail to specify specific roof ventilation requirements or refer to the code in their installation instructions, however, almost every shingle manufacturer excludes coverage in their warranties for roofs that are improperly vented or under vented.

Manufacturer's Installation Instructions

Owens Corning Duration Storm Shingles (Installation Instructions page 1)
Ventilation: Must meet local building codes.

GAF Timberline HD Shingles (Installation Instructions page 1)
THROUGH VENTILATION: For optimal shingle life and to help prevent mold growth, all roof structures must have through ventilation to prevent entrapment of moisture-laden air behind roof sheathing. Ventilation must be designed to meet or exceed current F.H.A., H.U.D., or local code minimum requirements. Note: Minimum net free ventilation area of 1 sq. foot per 150 sq. feet (1 sq. meter per 150 sq. meters) of ceiling area is required. When vents are located at the eaves and near the roof's peak (balanced) for maximum air flow, ventilation may be reduced to 1 sq. foot per 300 sq. feet (1 sq. meter per 300 sq. meters).

Manufacturer's Installation Instructions

CertainTeed Landmark Shingles (Installation Instructions page 100) Ensure sufficient deck ventilation when DiamondDeck, RoofRunner or other synthetic underlayment is installed.

Malarkey Legacy Shingles (Installation Instructions page 1) Ventilation: To prevent harmful condensation or heat buildup, air must circulate freely under the roof deck. Install roof vents at ridges and eaves. Building codes require one square foot of free ventilation to each 150 ft2 (1 m2⁄150 m2) of attic area or one square foot/300 ft2 (1 m2⁄300 m2) if 50% ventilation is provided near the ridge. All roof structures must have thorough ventilation to prevent entrapment of moisture-laden air behind roof sheathing. Ventilation provisions must meet or exceed current FHA or HUD requirements and adopted building codes.

Manufacturer's Installation Instructions

Tamko Heritage Shingles (Installation Instructions page 1)
Inadequate ventilation of attic spaces can cause accumulation of moisture in winter months and a build-up of heat in the summer. These conditions can lead to:

1. Vapor condensation
2. Buckling of shingles due to deck movement.
3. Rotting of wood members.
4. Premature failure of roof.

Ventilation

To ensure adequate ventilation and circulation of air, the ventilation system must include inlets and outlets. This may be accomplished with a combination of ridge and soffit vents or by using gable end vents. FHA minimum property standards require one square foot of net free ventilation area to each 150 square feet of space to be vented. This may be reduced to one square foot of ventilation area per 300 square feet if at least 40% and not more than 50% of venting is provided not more than 3 feet below the ridge or if a Class I or II vapor barrier is installed on the warm–in–winter side of the ceiling in climate zones 6, 7, and 8 as recommended by the 2015 International Residential Code. For more information consult your design professional. If the ventilation openings are screened, the total area should be doubled.

Warranty Exclusions

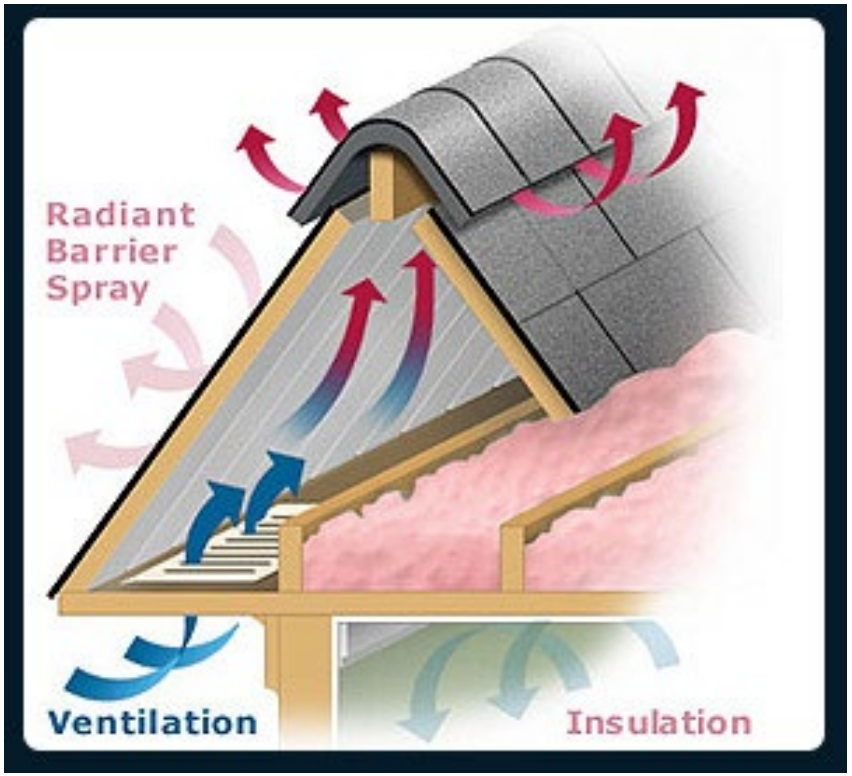
Installation instructions vary from one manufacturer to another. Some of these installation instructions may not specify the required roof ventilation. However, every manufacturer has warranty language that excludes warranty coverage on roofs that are not properly vented to meet the international building codes.

<u>A typical warranty exclusion is as follows:</u>
GAF Standard Shingle and Accessory Warranty
Inadequate venting of the roof voids the shingle warranty as shown in the GAF Standard Shingle and Accessory Warranty in appendix G on page 2 What is Not Covered item (1) (c) Inadequate attic ventilation.

Therefore, if you design and/or install a reroof that does not meet the applicable code requirements for roof ventilation, and that roof covering fails prematurely. It is very likely that it will not be covered under the manufactures warranty and your company could be liable not only for premature wear of the roof covering and loss of use. But also, for any damage caused to the building from condensation caused by the inadequate roof venting.

Balance Intake and Exhaust Venting

You can only exhaust as much air as can be taken in



50%
EXHAUST
Upper Portion of Roof

50% INTAKE
Lower Portion of Roof

Ventilation Calculations

Options for Calculating Roof ventilation

1. Online Calculator

   https://www.lomanco.com/vent-resources/vent-calculator

   http://www.airvent.com/ventilation-resources/attic-ventilation-calculator

   https://www.gaf.com/en-us/for-professionals/tools/ventilation-calculator

   https://www.owenscorning.com/en-us/roofing/components/vent-calculator

2. Charts
3. Spreadsheet
4. By Hand

Ventilation Calculations Example

Use R806.2 Minimum vent area 1/300 of the vented space in Climate Zone 6

1. Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. Not less than 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space.

50% Intake and 50% Exhaust

2145 SF roof area

2145 SF roof area
- 133 SF (12" soffits + 6" walls) x 88.7 ft
= 2012 SF (roof area over attic)
6:12 Slope (1.118 slope factor)
2012 / 1.118 = 1,800 SF Attic Space

Total Venting Required = 1,800 / 300 = 6 SF
Intake Venting = 3 SF (432 sq. in.)
Standard 8" x 16" register vent with 6" x 12" opening = 72 sq. in. x 70% = 50 sq. in.
432 sq. in. / 50 sq. in. = 8.64 or 10 intake vents (5 each side)

Exhaust Venting = 3 SF (432 sq. in.)
Standard Turtle, or slant back vent with 8"dia. opening = 50 sq. in.
432 sq. in. / 50 sq. in. = 8.64 or 9 exhaust vents

Roof Ventilation Calculations

Example Spreadsheet

	Item	Unit	Size (IN)	Areas Building	Notes
	Roof Area	SF		2,152	Sloped roof area
	Horizontal Area	SF		2,042	
Deductions	Eaves	SF	12	180	24" front and sides, 0" back
Deductions	Rake	SF	6	43	50% of the rakes have 12" soffits and the other 50% has none.
Deductions	Walls	SF	8	178	
Deductions	Garage	SF		0	The garage is at the first story with living space on top
Deductions	Total Ded.	SF		401	
	Roof Cavities	SF		1,641	Net area to be vented
Required Ventilation		Venting required to meet code			
	Total Venting	SF		5.5	Total vented areas required by the 2018 IRC Chapter 8
	Exhaust	SF		2.7	Based on at least 50% intake venting
	Intake	SF		2.7	Requires 8 register vents (4 at the first story plus 4 at the second).
Existing Ventilation		Venting currently existing on the buildings			
	Roof Vent (exhaust)	EA	10	6	Area per vent equals 0.60 SF per 10-in round opening.
	Exhaust (total)	SF		3.6	All roof exhaust vents are installed on the upper 2nd story gable.
	Soffit Venting	LF		2	8" x 16" register vents with maximum 4" x 12" opening
	Intake (total)	SF		1.0	There is no intake venting on the back of the home.
Net Ventilation		Existing venting in excess of the code requirement			
	Exhaust	**SF**		**0.8**	**There is sufficient venting for the 2nd story only**
	Intake	**SF**		**-1.7**	**There is insufficient intake venting**

Roof Ventilation Calculations

Example Spreadsheet

Scope	Quantity	Unit	Notes
Vented Area (Attics)	176,321	SF	Total attic space in all units. Excludes garages.
Total Venting Required	**588**	**SF**	**Based on 1/300 with at least 40% as intake at eaves**
Exhaust Venting Required	294	SF	Based on 50% as exhaust venting at or close to the ridge
Exhaust Vents Existing	202	EA	Includes slant back and DECRA Vents
Venting Existing	55	SF	Total vented area with half of the existing vents blocked
Add'l Exhaust Venting Required	239	SF	Balance of net free vented area required
Add'l Roof Vents Needed	**629**	**EA**	**Slant back roof vents equal to 0.38 SF per vent**
Intake Venting Required	294	SF	Based on 50% as intake venting located at the eaves
Intake Vents Existing	664	EA	Existing breather vents are insufficient to meet intake requirements
Intake Venting	32	SF	Intake venting through existing 2-inch breather vents at soffits
Add'l Venting Required	262	SF	Balance of net free intake venting required
Add'l Intake Vents Needed	**690**	**EA**	**6" x 16" register vents. Additional exhaust venting could be used.**

NOTES

1 Additional roof vents can be installed to meet the 1/300 requirement as long as they do not exceed 60% of the net free vented area

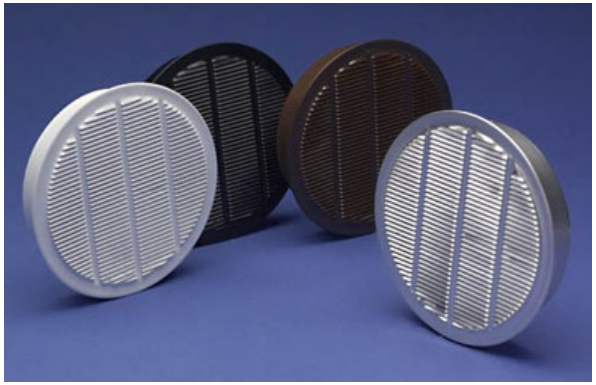
2 The area of the soffits are limited. Intake broan or LP vents can also be installed on the roof within 40-inches of the eave.

Solutions for Intake and Exhaust Venting

There is a wide variety of intake and exhaust venting solutions for all types of steep slope roofs including those without eaves.

Images of some of these options are provided on the following pages.

Roof Intake Ventilation



Breather Vents

Register Vents

Low Profile Intake Vents

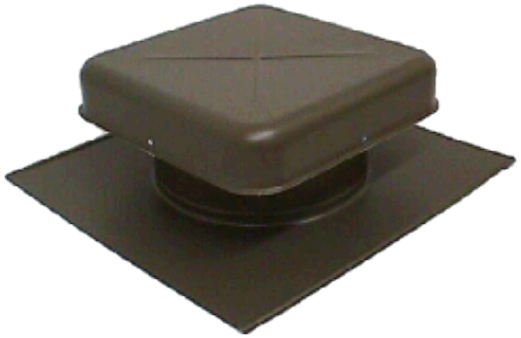
Continuous Soffit Vents

Continuous Roof Intake Ventilation

On roof intake ventilation

Vertical Intake
Venting at Fascia

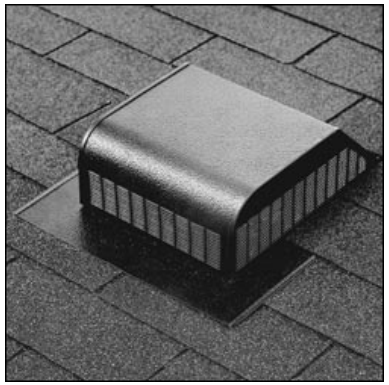
Roof Exhaust Ventilation



High Profile Vents

Solar Vents

Turbine Vents



Louver Vents

Louver Vents

Continuous Roof Exhaust Ventilation

Continuous Roof Exhaust Ventilation

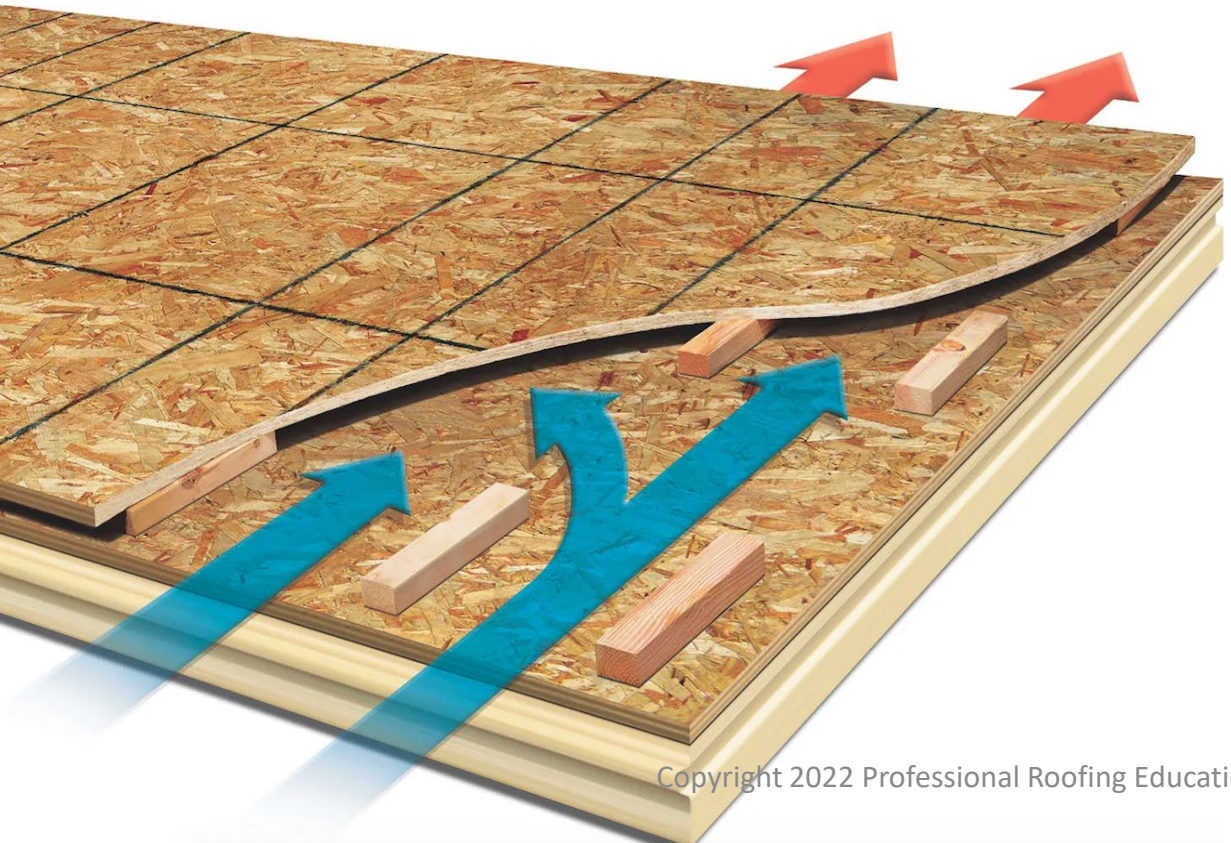
Ridge Roll Vent

Corrugated Plastic
Ridge Roll Vent

Rigid Ridge Vent

Premium
Ridge Vent

Vented Nail Base



Continuous Hip Ventilation

REFERENCES

- International Code Council (https://shop.iccsafe.org/)
- 2021 International Building Code (IBC)
- 2021 International Existing Building Code (IEBC)
- 2021 International Energy Conservation Code (IECC)
- 2021 International Plumbing Code (IPC)
- Colorado General Assembly (https://leg.colorado.gov/bills/hb22-1362)
- A Compendium of Changes Mark Graham, NRCA Professional Roofing April 2021
- A New Standard “Guidelines for synthetic underlayments” Mark Graham, NRCA Professional Roofing Aug 2021

RESOURCES

- 2021 International Building Codes: 2021 I-Codes (ICCSafe.org)
- Denver’s Green Buildings Ordinance: denvergov.org/greenroofs
- Colorado House Bill HB22-1362: https://leg.colorado.gov/bills/hb22-1362
- Copy of Presentation: https://colorado.iibec.org/about-us/chapter-archives/

Final comments:

- Thank you Dan, Kade & John!
- A survey will be sent after the seminar, please take the time to respond. Your feedback helps us plan future webinars and seminars.
- Thank you for staying on the webinar the full time.
- If you held the seminar as a group with one log-in today, please send Debbie the photo with list of all in attendance.
- **Please answer this final question to earn your CIU/CEUs.** Then, you are free to hop off and end your session.