



Roofing Application Best Practices

Low Slope < 2:12

The Colorado Roofing Association (CRA) recommends the following roofing application standards for roofing in Colorado. These standards are designed for Colorado's extreme climate where standard roofing installation instructions, application requirements, and uniform code may not account for the effect the Colorado climate can have on roofing systems. *Code references apply to the 2015/2018 International Residential Code (IRC) and International Building Code (IBC).*

These Installation guidelines are recommended for use by Roofing Industry Professionals as a supplement to or in the absence of local building codes and the manufacturer's installation instructions. These guidelines are recommended for installation in Colorado's climate to potentially mitigate issues that might otherwise occur. Contractors have a legal obligation to comply with the building code and the manufacturer's installation instructions which are part of the code. When in doubt on any particular application, the CRA recommends applying the stricter application.

General Best Practice Considerations

1. Safety Considerations

- a. Provide necessary fall prevention equipment and training to installers. Have a safety program in place - one that protects from falls and is in compliance with current Occupational Safety & Health Administration (OSHA) federal guidelines. A safety plan should be in place that is particular to each job and includes a Job Hazard Analysis.
 - Job Hazard Analysis (JHA) - Roofing dangers can be avoided with a thorough job hazard analysis. Assessment of fall and other hazards should be an integral part of every project and the site safety planning process. There is not one document that covers everything and you should use a JHA to document step by step how you are going to do a particular job.

Example:

For each site and situation state the problem, a description of the risk, level of risk and final assessment. For example, how are you going to access the roof? Are you going to access the roof via a ladder or via a scaffold? Maybe you are going to access the roof via a fixed roof access ladder or from a scissor lift? How are you going to load materials, by crane or pulling them up by hand? The steps in undertaking each of these tasks and all others on a jobsite are very different. Not only are the steps different, but the potential hazards and the hazard control measures are very different

as well. Always look at the height at where the task will be done, time spent above the ground level, slope of the work platform, guarding of the platform edges, surface of the work platform, etc.

2. Fire Resistance

- a. Install a low slope system that complies with an authoritative local jurisdiction fire code rating. Consult with a code official.

3. Proper Inspection, Supervision Field Inspections & QA

- a. It is good practice to properly inspect and supervise jobs. Contractors should have at least one supervisor or foreman on each job who is a full-time employee with the experience and training to manage the job.

4. Temporary Roofs

- a. During the planning phase of a project, a determination should be made to include or not include a temporary roof system in order to maintain a construction schedule or due to poor weather conditions. The decision to reclassify a temporary roof as a vapor retarder or air barrier in the new completed roof assembly shall be done by the roof membrane and/or roof guarantee supplier, local code official and roof designer. Check with the manufacturer to verify that the temporary roof is part of the warranted roof system and then follow manufacturer warranty requirements.

5. Job Site Clean-up

- a. On a daily basis and to the best of everyone's ability, keep job sites clean. This could include but is not limited to laying down tarps and having a dumpster on-site to remove debris, protecting landscaping and shrubbery and sweeping the site with a magnet.

6. Roof Maintenance

- a. Keep these records on file: the warranty, inspection reports, repair & maintenance bills, and original construction specs and invoices.
- b. Conduct semi-annual inspections (Spring and Fall are optimal) or as required by the manufacturer. Maintain an inspection log with documentation and pictures.
- c. Maintain a rooftop access log to track parties that access the roof from other trades.
- d. Inspect after severe weather such as after storms that produce hail, heavy rain and high wind.
- e. In order to maintain the warranty, ensure repairs are performed by an authorized contractor and follow the manufacturer's recommendations
- f. Always remove debris from the roof. Branches, leaves, rocks, and trash can cause a safety hazard, as well as clog roof drains and harm the roofing system.
- g. Inspect metal at the same time the roof is inspected. Examine all the flashings for rust, damage, or deterioration, as these are common points for water entry.
- h. Follow the manufacturer's requirements when placing or installing any accessories or structures onto the roof surface.
- i. Inspect masonry to ensure it is in good condition. Examine walls for cracks, loose stones, or deteriorated sealant.

- j. Maintain rooftop equipment. Check rooftop HVAC units, vents, ductwork, skylights, penetrations, satellite dishes and antennas.
- k. Eliminate or protect the roof from spills of coolant, oils, or grease and repair if necessary.
- l. Minimize rooftop traffic. Long-term foot traffic can prematurely age a roof and cause damage. Use designated walkways or walk pads when provided.

7. Wind Speed Warranty

- a. This is a warranty given on a roof system by the manufacturer of the system products. The warranty is typically in a “Total System” fashion.
- b. This is **NOT** the same as complying with local wind speed design criteria as defined by local building code.
- c. This is a warranty typically given to manufacturer approved contractors and is installed with manufacturer defined minimum parameters. These parameters are typically more stringent than code compliant systems.

8. System Warranty

- a. Often referred to as NDL (No Dollar Limit). If available, we recommend that all commercial roof installations are installed by an authorized applicator and accompanied by a manufacturer's system warranty. A system warranty gives the manufacturer oversight to help alleviate potential problems; as the manufacturer has an obligation to uphold the terms, conditions and limitations of that warranty.

Low Slope Considerations

1. Ballasted Roofs

- a. Ballasted roofing assemblies are to be designed in accordance with manufacturers specifications and American National Standard Institute (ANSI)/Single Ply Roofing Industry (SPRI) RP-4 in accordance with the current IBC requirements. Ballast is to be water worn gravel complying with the American Society for Testing and Materials (ASTM) standard outlined in this standard. If the ballast contains fine or sharp ballast, install a protective mat between the ballast and membrane.
- b. If ballast pavers are to be installed, a protective mat should be installed. Pavers should be installed at points of access, including doors, walkways, and around mechanical units.
- c. Walk pads should not be installed within perimeter areas.
- d. Roof slopes should not exceed 2-inches per foot.
- e. High density boards (greater than 80 psi) are not to be installed under the roofing membrane.
- f. If the ballast is to be removed from the structure, a structural engineer should be involved to determine if the ballast is required to maintain the structural integrity of the deck to wall juncture.
- g. A structural engineer evaluation is required if changing from a ballasted system to any other type of non-ballasted roof system.

2. Rooftop Amenities

- a. Walkable decks, plaza decks and walkways over living space are treated differently than other roof areas. These areas should be assembled with a higher compressive strength insulation board as well as an adhered cover board. The roofing material should be covered with an additional layer of protection above the roof; such as a slip sheet, pavers, or some other form of compatible protection.
- b. Due to the inherent challenge of tracking leaks on areas covered by pavers or rocks, it's also recommended you install a leak detection system in the roof system in these areas.
- c. Door thresholds should be installed at a predetermined height above the waterproofing. It is best to work with a design professional and/or the manufacturer when installing these.

3. Green Roofs and Garden Systems

- a. Do not install a green or vegetative roof system without the expertise of a qualified design professional and the manufacturer in order to ensure that it meets code and performs correctly.

4. High Altitude Recommendations (8000 Ft & Above)

- a. Roofs installed at elevations over 8,000 feet are at greater risk of condensation. A vapor and air barrier in combination with the proper amount of insulation is a critical component of any roof installed at high elevation.
- b. Due to the formation of ice dams, snow maintenance, deicing/heat cable and insulation per code should all be addressed.
- c. Be aware of rapid flash-off of solvent based adhesives.
- d. Be cautious of rooftop equipment and skylights being covered with snow.

5. Wind Speed Design

- a. Ensure the roof system is designed by a roofing professional to meet the uplift pressures for the required **design wind speed** for that jurisdiction.
- b. Verify the attachment for the specified roof system with the manufacturer and/or code official.
- c. Due to recent revisions to the building code, the minimum commercial roof system requirements have been modified to account for increased **wind design** parameters. Manufacturers should be able to provide assembly information verifying this compliance.
- d. **This is not to be confused with a manufacturer's total system warranty that includes wind speed coverage.**

6. Impact Performance

- a. For roof slope < 2:12, roof coverings installed shall conform with the appropriate material standard and resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4272 or the "resistance to Foot Traffic Test in Factory Mutual (FM) 4470.
- b. We recommend a minimum hail rating of Several Hail (SH) rated roof assembly.
- c. Colorado's Front Range and further east is recognized as a Very Severe Hail (VSH) zone. Consider following FM guidelines for VSH rated roofing assemblies as these systems go through extensive testing for hail resistance.

- d. It is not always required for a low slope roofing system to include a cover board, but it is good roofing practice to include some type of board to enhance the roofing system's impact performance and foot traffic resistance.

7. Metal roofs

- a. Consult the manufacturer for specifics regarding metal selection and metal panel type given the roof slope limitations.
- b. Inquire with the manufacturer regarding warranty ramifications that may arise because of the slope, location of structure, etc.
- c. Consider using a snow retention system to control the rapid release of snow and/or ice where there is pedestrian traffic and bodily and/or property damage can arise.

8. Decking

- a. **Structural Concrete** - Currently no industry standard exists for concrete dryness. The concrete industry commonly states 28-day cure time is not necessarily an indication of dryness. This suggested length of time originated from the concrete industry's recommendation for the appropriate amount of time for concrete to cure and develop adequate compressive strength. Waiting the 28-days does not necessarily mean the moisture content is low enough to allow for correct application of the roofing membrane.
 - CRA recommends the designer of record clearly specify concrete's dryness parameters. ASTM F2170 can be used for this purpose. The National Roofing Contractors Association (NRCA) suggests a minimum of 75% internal relative humidity. Avoid roof system components with organic content.
 - If construction schedules do not allow for the time to achieve the recommended dryness, CRA suggests installing a high-quality Type I vapor barrier as recommended by the manufacturer or project specifier. The dryness of the concrete surface should follow the manufacturers recommendations and should be verified by the owner's designated representative. In cooler conditions where it is anticipated the vapor barrier may drop below the dew point, only install enough vapor barrier that can be covered by the completed roofing assembly by the end of the day.
 - The concrete's surface should have a smooth troweled or light broomed finish free of fines and protrusions. Raked finishes are not acceptable.
 - CRA does not recommend specifying lightweight aggregate for use within structural concrete.
- b. **Wood Decks** – CRA recommends wood decking should be a minimum 5/8" nominal APA rated plywood decking or wood planking. If thinner plywood or OSB decking is used, pullout tests should be completed to determine fastening to confirm with the specified American Society of Civil Engineers (ASCE) 7 uplift pressures. Contact the roofing material manufacturer for appropriate fastening density.
- c. **Metal Decks** – Should be minimum 22-gauge and fastened to the structure to adequately resist the specified ASCE 7 uplift pressures. The roofing assembly should be secured to the top flute. Mechanically attached roofing systems roofing membranes should be fastened perpendicular to the flutes.

- d. **Metal Retrofit** - Should be structurally sound. A pullout testing following ANSI/SPRI FX-1 (Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners) should be performed. Submit results to the roofing material manufacturer for acceptance. It is not recommended to mechanically attach the roofing membrane to the existing metal roof deck. Fastening should be into the structural purlins. Metal retrofit requires a structural analysis & certification to meet building code requirements per ASCE 7.

9. Existing Roof Coverings/Layers Roof Recovers

- a. All recover installations shall be in accordance with the 2018 IBC Section 1507
- b. When considering installing a new low slope roof system over an existing system, refer to the local adopted building code and ordinance regarding numbers of allowed existing layers.
- c. Before any new work can be applied over an existing system, a structural analysis should be performed to determine that the additional weight of the new roofing materials is within the design parameters of the existing construction.
- d. Repairs to the existing roof system should be identified and repaired before a recovery can take place. If this is not performed, leaks in the new roof system can easily find their way into old problem areas.
- e. Moisture in the existing roof membrane, surfacing, and insulation should be identified by performing a moisture scan and physical core samples.
- f. Any identified moisture should be remedied, ensuring a dry sound substrate for the recovery to take place. Introducing mechanical fasteners or chemical adhesives into a moisture rich environment can result in premature failures.
- g. Engage a design professional/roofing consultant anytime an overlay/recovery takes place over existing BUR/ Asphaltic/ or coal tar pitch applications. These roof systems may be chemically harsh environments, and special design considerations should be followed for a successful recovery.
- h. A thorough inspection of the deck and the roof system structural components from the interior of the building should be performed prior to roofing operations. Any sign of inferior conditions should be investigated and repaired.

10. Positive Roof Drainage

- a. If the roof slope does not drain over roof edges, roof drains should be installed at each low point of the roof. Secondary (or emergency) drains or scuppers can be added as needed.
- b. If the roof deck does not provide adequate slope for drainage, a taper system should be designed to shed water to roof drains/scuppers.
- c. Crickets installed upslope of rooftop equipment and saddles positioned along a low-point between drains can help prevent water ponding
- d. Per 2015 International Plumbing Code 1101.7, roof design requires the roof drainage to be designed to meet the published storm runoff data for that area. This applies to new roofs and reroofs to ensure there is adequate drainage.

11. Insulation/R-Value (min. vs. avg.)

- a. Insulation is required to be installed to meet the current building codes. Most of Colorado is operating on 2015-IBC or later, which dictates you should install a minimum R-30 on new construction projects. Newly installed insulation should not have gaps greater than 1/8". If

tapered insulation is needed on the project, the tapered insulation's average thickness can not be used towards the minimum R-value requirement.

- b. Multiple layers of insulation should be installed with the joints staggered to prevent deflection at the seams, thermal bridging and to reduce the possibility of condensation.
- c. Insulation is also a key component in preventing condensation. The roof should be installed with insulation on top of the roof deck that exceeds the R-value of any interior insulation by 2/3 with a minimum R-value of 18.

12. Vapor/Air Barriers

- a. A vapor and air barrier along with the required insulation is required by the energy code on most low slope roofs. The combination of these roof components can also prevent condensation when installed correctly. Good industry practice includes an air, vapor, or combination air and vapor barrier at the roof deck to prevent moisture in the roof system.
- b. The roofing system should be designed by a professional roofing consultant, architect, or engineer. The design professional should perform an analysis of the existing roofing system to calculate and identify the dew-point, and include a section-detail of the roofing system.
- c. To reduce the risk of condensation on the roof cavity on low sloped roofs, consider incorporating a vapor retarder with the required air barrier at the roof deck. The roof should be installed with insulation on top of the roof deck that exceeds the R-value of any interior insulation by 2/3 with a minimum R-value of 18.
- d. Vapor and air barriers are highly advised in combination with white or light color surfaced systems. When changing the color of a roof to a reflective cool roof the risk of condensation can be greatly increased.

13. Adhesives

- a. **Store materials in a weather-protected environment**, clear of the ground and moisture, in accordance with manufacturer's standard instructions.
 - Whenever possible store all materials in a heated warehouse.
 - In cooler weather, store materials in warming boxes or use warming equipment specifically designed for the materials being stored.
 - Use materials as soon as possible after they are removed from the weather-protected environment.
 - Prevent all water based adhesives, coatings, sealants and caulks from freezing. Any water based materials that have been frozen must be discarded.
- b. At low temperatures, adhesives, coatings, sealants and caulks can be difficult to apply correctly and may not adhere or cure as they do in more temperate weather.
 - Follow the manufacturer requirements for cold weather application and minimum application temperature and storage.
 - Allow adhesives to adequately cure. **NOTE:** cure times depend on the ambient temperature and humidity; colder weather usually requires a longer cure time.
 - Do not heat containers with torches or other high temperature devices.
 - Do not attempt to thin these products.

14. Drains/Scuppers

- a. The roof drainage requirements in the 2015 and 2018 International Plumbing Code have increased with the 100-yr 1-hour rainfall design requirement. Ensure that roof drains,

scuppers, and/or gutters and downspouts are designed to meet these requirements. You can obtain drainage calculations from an engineer or design professional.

- b. The code also requires secondary overflow drains or scuppers on all low slope roofs without gutters.

15. Gutter Systems

- a. As per the 2021 IBC, introduction of the GT-1 commercial roof gutter code requirement takes effect. This adds, “Gutter should be tested and documented to meet ANSI/SPRI GT1 in accordance with 2021 IBC 1504.5.1” Because the gutter edge is often a method of membrane termination for a low slope roof, it is recommended (and soon to be required) to install both ES-1 compliant edge metal and now GT-1 compliant gutters.

16. Edge Metal (ANSI/SPRI/FM 4435 ES-1 Code)

- a. Low slope roof system edge metal securement shall be installed in accordance with **ANSI/SPRI/FM 4435 ES-1** code AND tested by a certified independent testing agency. This information is available from the manufacturer or specifier.
- b. We recommended to follow the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) minimum metal and cleat gauge guidelines and fastener placement.

17. Coatings

- a. Coatings should be used as a means to prolong the life of a roof and not as means to repair poor or failing roof systems. Any and all leaks should be addressed by industry accepted repair techniques prior to installing a roof coating.
- b. Familiarize yourself with the type of coating you are using and the correct application method. Follow the manufacturer's installation instructions to ensure proper performance, compliance with code and warranty provisions.
- c. Understand that coatings are not waterproofing and should not be represented or installed as such.
- d. Exercise caution when applying silicone coatings in Colorado’s climate as we experience a much higher number of freeze thaw cycles than anywhere in the United States. As a result, materials may wear faster and it is possible that the coating you apply will not perform the same as in a moderate climate.
- e. It is extremely difficult to successfully **recoat** silicone coatings, as their surface tension decreases significantly over time. As such, silicone coatings should be applied in a thicker application as the opportunity to recoat is typically limited.
- f. Inspect the roof surface to ensure it is dry, clean and debris free or adhesion may not occur and/or may end with a system failure. CRA cannot emphasize enough that contractors spend the time to properly prepare the roof surface. The level of preparation depends on the roof and can include sweeping, priming, repairing seams, infrared scan for moisture, etc. Refer to the manufacturer instructions.
- g. Coatings should be installed within a 2-day period of optimal weather. Temperature changes that cause frost or dew can jeopardize the installation of the coating.