A XEROX BUILDERS FIELD GUIDE

# Roofing Systems & Ice Dam Prevention

*From Materials and Ventilation to Valleys, Flashing and Ice Dam Prevention*

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INTRODUCTION

## The Roof Does More Than Shed Rain

A roof is the part of the building envelope exposed to the widest range of conditions: direct sun, driving rain, wind uplift, and in much of British Columbia, snow and ice through the winter. Our rainscreen guide already introduced kick-out flashing at the roof-to-wall intersection; this guide covers the roof system itself, from material selection through the ventilation and ice-dam-prevention details that keep a BC roof performing through the winter.

> **GUIDING PRINCIPLE**
> *Most roofing problems fall into one of two categories: water finding a way past the roofing material at a detail (a valley, a penetration, an intersection), or heat and moisture from inside the building working their way out through the roof assembly in ways that were not planned for. This guide addresses both.*

This guide covers roofing material selection, underlayment systems, ice dam formation and prevention, attic ventilation, valley construction, penetration flashing, and the details at eaves and roof-to-wall intersections that determine long-term performance.

## 1 Roofing Material Types

| REF | Material | General Characteristics |
|---|---|---|
| A.01 | Asphalt shingle | Cost-effective, widely available, moderate lifespan |
| A.02 | Metal (standing seam or panel) | Long lifespan, sheds snow well, higher upfront cost |
| A.03 | Cedar shake or shingle | Traditional appearance, requires more maintenance |
| A.04 | Concrete or clay tile | Very durable, heavy, requires structure designed for the load |
| A.05 | Membrane (low-slope roofs) | Used where slope is too low for shingled materials |

> **CODE REQUIREMENT**
> Every roofing material has a minimum slope requirement below which it is not rated to perform — confirm the manufacturer's minimum slope and the applicable code requirement before finalizing material selection for a given roof design.

## 2 Underlayment Systems

Underlayment is the secondary water barrier beneath the roofing material, and the last line of defence if wind-driven rain or ice gets past the primary roofing surface.

| REF | Underlayment Type | General Use |
|---|---|---|
| B.01 | Asphalt-saturated felt | Traditional, cost-effective, common under asphalt shingles |
| B.02 | Synthetic underlayment | Lighter, more tear-resistant, increasingly common |
| B.03 | Self-adhered (ice-and-water shield) | Fully sealed, self-sealing around fasteners, used at high-risk areas |

**BEST PRACTICE**

Self-adhered ice-and-water shield membrane is generally installed at eaves, valleys, and around penetrations — the locations most prone to ice damming and water backup — even on roofs where the field of the roof uses standard felt or synthetic underlayment.

## 3 How an Ice Dam Forms

An ice dam forms when heat escaping through the upper roof melts snow, that meltwater runs down the roof surface, and then refreezes once it reaches the colder eave overhang beyond the heated wall line — building up a ridge of ice that backs up water under the shingles behind it.

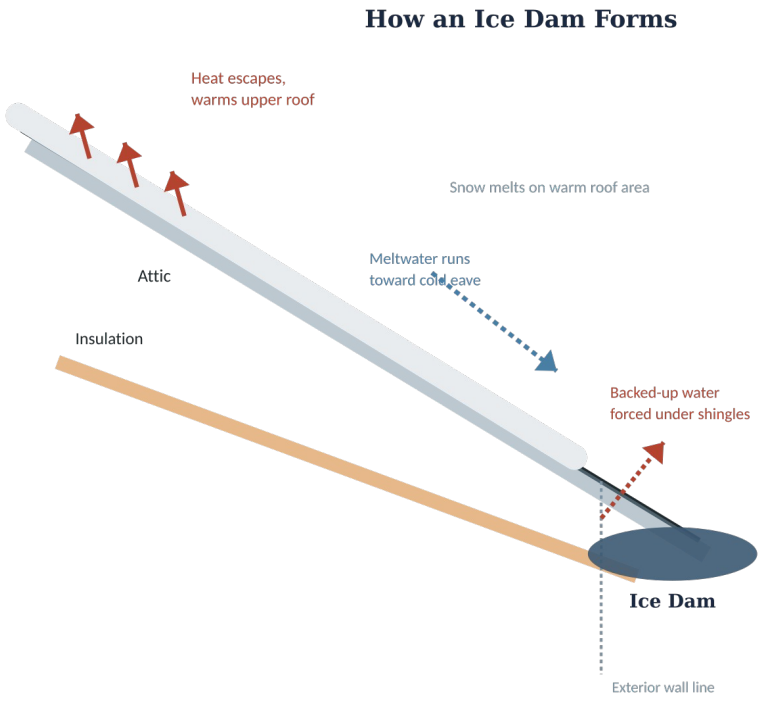


*Figure 1 — Heat loss melts snow on the upper roof; meltwater refreezes at the cold eave, forming a dam.*

**GUIDING PRINCIPLE**

*Ice dams are fundamentally a heat-loss problem, not a roofing-material problem. The roofing material and ice-and-water shield manage the consequence; insulation and air sealing address the actual cause.*

## 4 Preventing Ice Dams

Effective ice dam prevention addresses the roof assembly as a system: reduce heat loss into the attic, ventilate the attic to keep the roof deck uniformly cold, and provide a sealed backup layer at the eaves in case ice still forms.

- ☐ Attic insulation continuous, no gaps or compression
- ☐ Attic air sealing complete — no bypasses from conditioned space
- ☐ Balanced soffit-to-ridge ventilation installed
- ☐ Ice-and-water shield installed at eaves per code minimum
- ☐ Recessed lighting and other penetrations sealed and insulated
- ☐ Bath and kitchen exhaust fans vented outside, not into the attic

**CODE REQUIREMENT**

Minimum ice-and-water shield coverage at eaves is specified in the applicable building code, typically measured as a distance inward from the exterior wall line. Confirm the current requirement for the jurisdiction and roof pitch rather than assuming a standard figure applies.

## 5 Attic Ventilation

Balanced ventilation — intake low at the soffits, exhaust high at the ridge — keeps the attic and roof deck closer to outdoor temperature, reduces the chance of snow melting unevenly, and helps manage moisture that migrates into the attic from the conditioned space below.

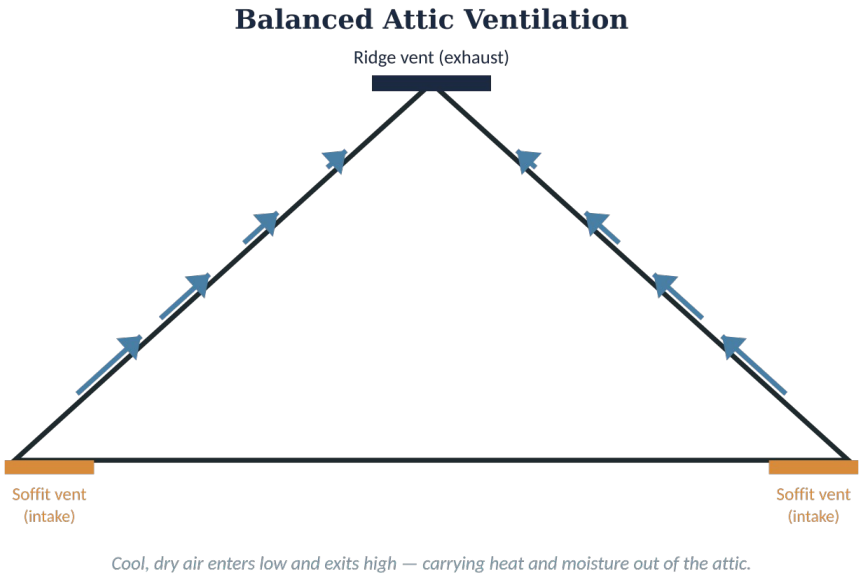


*Figure 2 — Balanced ventilation: intake at the soffits, exhaust at the ridge.*

**BEST PRACTICE**

Intake and exhaust ventilation areas should be reasonably balanced — exhaust-heavy systems can pull conditioned air out of the living space rather than drawing outdoor air in through the soffits as intended. Confirm baffles keep insulation from blocking the soffit intake path.

## 6 Valley Construction

A roof valley concentrates water from two roof planes into one channel, making it one of the highest water-volume locations on the entire roof.

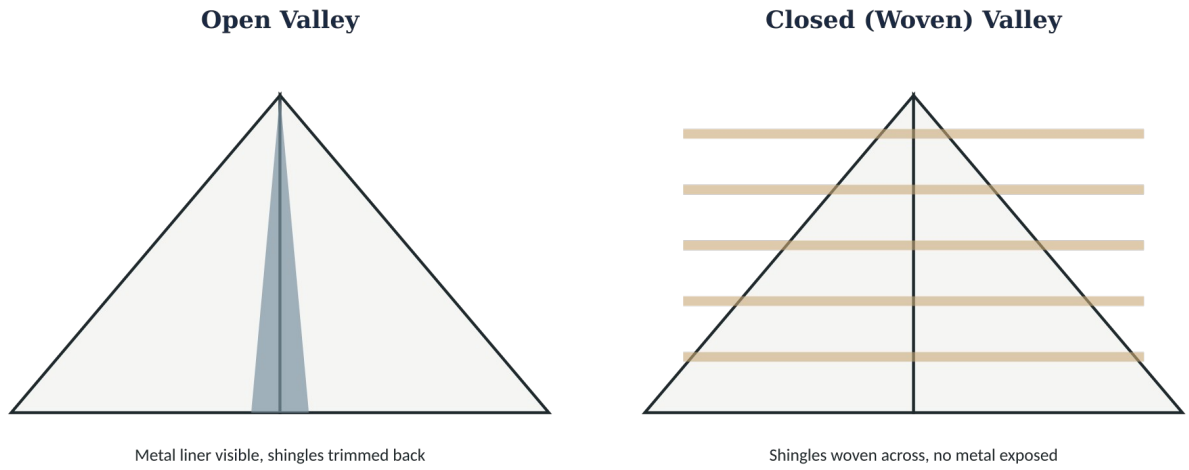


*Figure 3 — Open valley (exposed metal liner) versus closed, woven valley construction.*

An open valley uses an exposed metal liner with shingles trimmed back on each side; a closed (woven) valley interlaces shingles across the valley with no metal exposed. Both are valid, code-recognized methods — the appropriate choice depends on roofing material, manufacturer instructions, and regional practice.

> **DESIGN OPTION**
> Metal roofing and some architectural shingle products may require a specific valley method per the manufacturer's installation instructions. Confirm the required method for the selected product before framing or underlayment work assumes one approach over the other.

## 7 Penetration Flashing

Every plumbing vent, exhaust vent, and roof-mounted mechanical penetration needs a flashing detail matched to the roofing material and the penetration type.

> **GUIDING PRINCIPLE**
> *A pipe boot or flashing collar has a service life, and it is often shorter than the roofing material around it — particularly for rubber gasket boots exposed to UV. Confirm the expected service life of flashing components separately from the roofing material's warranty.*

Roof-mounted equipment — skylights, solar panel mounts, mechanical curbs — should be flashed per the equipment manufacturer's instructions, integrated with the underlayment using the same shingle-lap logic used everywhere else on the roof: upper courses lap over lower ones and over the flashing at every penetration.

## 8 Eaves and Roof-to-Wall Intersections

The eave is where a roof's drip edge, fascia, soffit ventilation, and gutter all come together, and where ice-and-water shield coverage matters most. The roof-to-wall intersection — covered in more detail in our rainscreen guide — requires kick-out flashing wherever a roof edge meets a sidewall, directing water away from the wall rather than behind the cladding.

> **GUIDING PRINCIPLE**
> *A roof detail and a wall detail meeting at the same point need to be designed together. Treating the roof-to-wall intersection as purely a roofing detail, or purely a siding detail, is how kick-out flashing gets forgotten.*

## 9 Gutters and Downspouts

Gutters collect roof runoff and, together with downspouts, carry it away from the foundation — connecting directly to the site drainage and foundation waterproofing work covered in our basement waterproofing guide.

> **BEST PRACTICE**
> Downspouts should discharge well away from the foundation, ideally connected to the site drainage system rather than simply dumping at grade next to the building — undoing exactly the separation the foundation waterproofing and drain tile were designed to maintain.

Gutter size and downspout capacity should be matched to the actual roof area draining into them; an undersized gutter can overflow during heavy rain regardless of how well it was installed.

## 10 Common Roofing Mistakes

Most roofing failures trace back to a small set of repeated errors:

- ☐ Roofing material used below its minimum rated slope
- ☐ Ice-and-water shield coverage short of code minimum at eaves
- ☐ Attic insulation gaps or compression creating uneven heat loss
- ☐ Wrong valley method used for the specific roofing product
- ☐ Pipe boots and flashing not matched to penetration type
- ☐ Kick-out flashing missing at roof-to-wall intersections

- ☐ Exhaust fans venting into the attic instead of outside
- ☐ Unbalanced ventilation, exhaust-heavy or intake-blocked
- ☐ Gutters undersized for the actual roof area
- ☐ Downspouts discharging directly against the foundation

> **GUIDING PRINCIPLE**
> *A roof is inspected constantly by the people living under it — every drip, stain, or icicle is a visible signal. That visibility is an advantage a foundation waterproofing system never gets, so use it: address a small roofing issue as soon as it appears.*

## 11 Pre-Covering Inspection

Before the finished roofing material is installed, this is the last opportunity to verify the underlayment, flashing, and ventilation details while they remain fully visible.

- ☐ Correct roofing material selected for the actual slope
- ☐ Underlayment installed per manufacturer instructions
- ☐ Ice-and-water shield coverage meets code minimum at eaves
- ☐ Ice-and-water shield installed at valleys and penetrations
- ☐ Valley method matches manufacturer requirements
- ☐ Soffit and ridge ventilation balanced and unobstructed
- ☐ Baffles installed to keep insulation clear of soffit vents
- ☐ All penetrations flashed and integrated with underlayment
- ☐ Kick-out flashing installed at roof-to-wall intersections
- ☐ Photographs taken before roofing material conceals the deck

## 12 The Most Important Lessons to Remember

If a homeowner or builder remembers only a few principles from this guide, they should be these:

1. **Every roofing material has a minimum slope**
   Confirm it before finalizing the design, not after material is ordered.
2. **Ice dams are a heat-loss problem first**
   Insulation and air sealing matter as much as the roofing material.
3. **Ice-and-water shield belongs at the high-risk spots**
   Eaves, valleys, and penetrations see the most water.
4. **Ventilation needs to be balanced**
   Intake and exhaust work together, not independently.

5. **Valleys carry more water than any other part of the roof**
   Match the method to the material and manufacturer instructions.

6. **Flashing has its own service life**
   It is often shorter than the roofing material around it.

7. **Roof and wall details at an intersection are one detail**
   Kick-out flashing belongs to both trades, and to neither by default.

8. **Gutters need to match the actual roof area**
   Undersized gutters overflow regardless of installation quality.

9. **A roof is visible every day**
   Small problems are easy to see — that visibility is worth using.

CLOSING

## Conclusion

A roof is asked to do two jobs that occasionally pull in different directions: shed water quickly, and manage the heat and moisture trying to escape the building underneath it. A well-built roof does both without anyone noticing — no stains, no ice dams, no drips at the ceiling below.

That result comes from treating the roof as a complete system: the right material for the slope, ice-and-water shield where water concentrates, balanced ventilation to keep the deck cold and dry, correctly detailed valleys and penetrations, and flashing that carries water away at every intersection.

> **GUIDING PRINCIPLE**
>
> *Almost every serious roofing problem was visible, in hindsight, at the pre-covering inspection. That stage exists specifically to catch it while the whole assembly is still open to view.*

IMPORTANT NOTICE

## Please Read Before Using This Guide

This guide is an educational resource. It does not replace, and must not be treated as a substitute for:

- The current British Columbia Building Code, National Building Code of Canada, or any other applicable code in force at the time of construction.
- Municipal or regional-district bylaws, permit conditions, and inspection requirements.
- Site-specific structural and building envelope design and engineering prepared by a licensed professional.
- Manufacturer installation instructions for any specific roofing, underlayment, flashing, or ventilation product.
- The professional and legal judgment of structural engineers, building envelope consultants, and other registered professionals engaged on a specific project.

The technical details and examples in this guide are general construction information. Actual requirements vary according to climate, snow load, roof slope, product selection, manufacturer specifications and project-specific engineering.

Where a conflict exists, the applicable building code, engineered drawings, manufacturer's installation instructions and qualified professionals take precedence over this guide.

**GUIDING PRINCIPLE**

*This guide reflects the author's own field research, training, and construction experience. It has not yet been reviewed by an independent structural engineer, building envelope consultant, or legal professional. Readers must verify every technical statement against the current, authentic codes, standards, and manufacturer instructions applicable to their project before relying on it.*



*Research and drafting assistance for this guide was provided using AI-based research and writing tools (Claude, by Anthropic), under the direction, technical judgment and final authorship of Mandeep S.*

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