



RCI Western Canada Chapter 2012 Winter Seminar

Single-ply Membrane Sloped Roof Retrofit

Presentation by
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Agenda

- A little history of the project
- The Assessment Phase
 - - Findings
 - - Cause of roof failure
- The Design Phase for the roof replacement
- Construction Phase
- Q & A portion



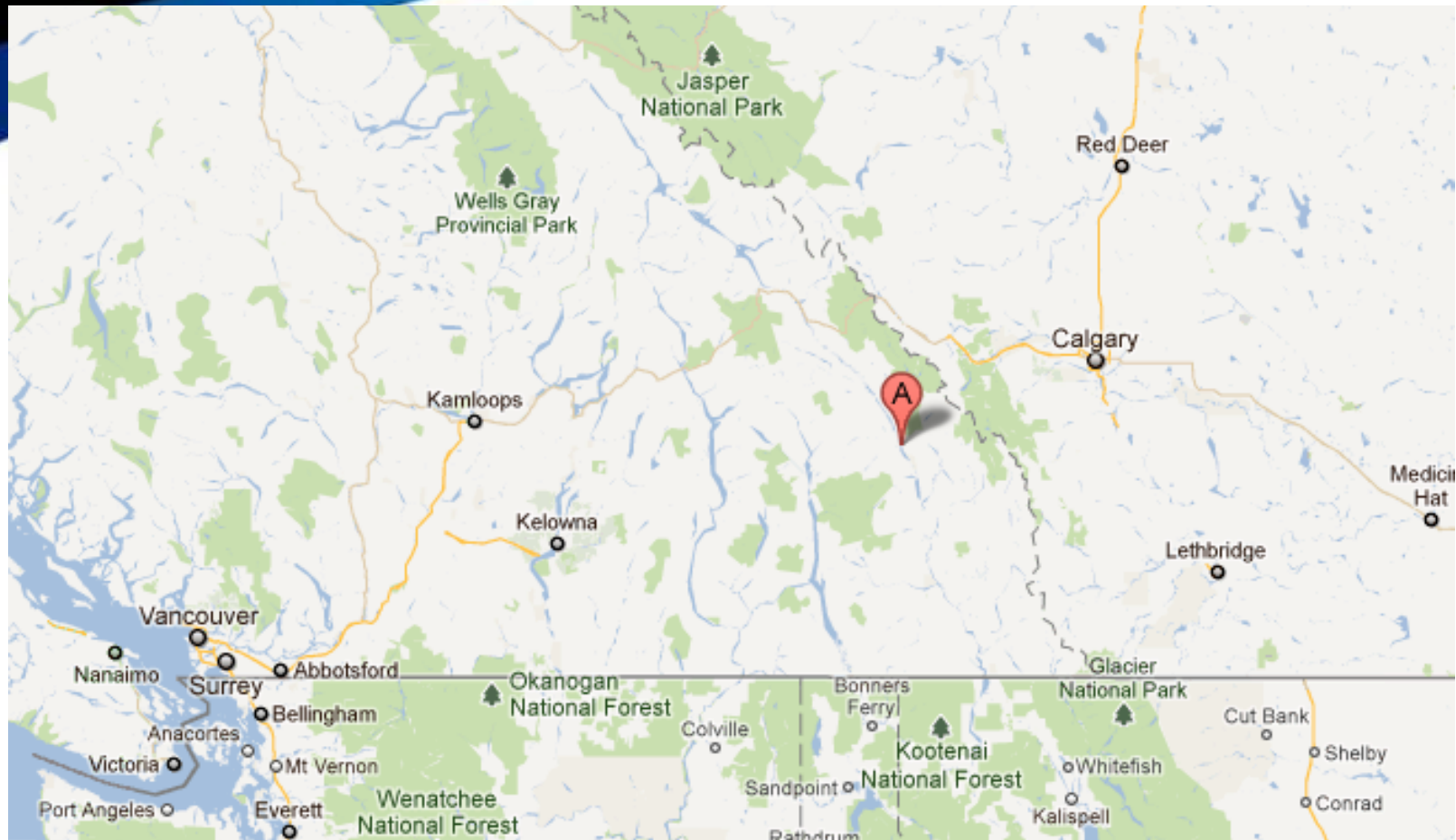
Project History

The building is a school located in Invermere, BC.

Invermere is in eastern BC. The climate is different than in the coastal areas of BC. The winters are colder with more snow and less rain.



Project History





History

- The Building is approximately 19 years old.
- The Original roof was metal with a 2/12 slope.
- A history of leaks due to ice damming with the original roof prompted the initial investigation.





History





History

Levelton project Team:

- Investigation Phase:
 - Hugh Walker, AScT, Jeff Vermette, AScT, RRO and David Evans, P.Eng
- Design and Construction Phases:
 - Hugh Walker, AScT, Jeff Vermette, AScT, RRO and Shakir Rashid, P.Eng
 - Technical Input from Guillaume Vadeboncoeur, P.Eng, Alex McGowan, P.Eng and Jeong-Sik Jeong, P.Eng.
- Structural Engineer: Cam Robinson, P.Eng



Assessment Phase



Assessment

- Another consulting firm performed an initial assessment and determined that the roof had issues and would be in need of replacement in the near future.
- They also determined that there were other issues with the exterior walls.



Assessment

- Levelton performed its own investigation which involved exploratory openings.
- Metal roof panels were removed to allow for a review of the underlying roof components.



Assessment

- The original roof assembly consisted of the following:
 - 22 ga metal roof panels (standing seams),
 - 75 mm Z-girts (18 ga),
 - 75 mm of phenolic foam insulation,
 - Self-adhered membrane,
 - Gypsum Board,
 - Steel decking.



Assessment





Assessment





Assessment



Water appeared to penetrate past the metal panels at the following locations:

- Roof crickets
- Skylight details,
- Eave (ice damming)
- Through the standing seams at the eave.



Assessment





Assessment





Assessment

- The metal panels were corroded at several locations. Temporary repairs were performed throughout the years as the top surface of the panels was corroding at some locations.



Assessment





Assessment

- While there were some evidence and reports of roof leaks, the main reason for the premature failure of the roof was the corrosion of the metal panels and supporting Z-girts.
- Although there was a fully supported and adhered vapour barrier membrane, any imperfections could lead to condensation. There was little to no gap between the insulation and the underside of the metal panels for drying.



Assessment

- Explaining the corrosive potential of phenolic foam insulation:
 - 1) When phenolic foam absorbs water, it dissolves chemicals such as sulfonic acid.
 - 2) This creates a highly acidic and corrosive compound (1.5 to 3.5 pH).
 - 3) The steel in contact begins to corrode.



Assessment

- Corrosion:
- Water leaching out of the phenolic foam may have chloride and sulfur. Typically, more sulfur.
- The limited coatings on the steel components in roof assemblies (thin galvanized coatings or primers) are not enough to protect against these acidic compounds.



Other Documented Failures

- Toronto





Other Documented Failures



- New York

Other Documented Failures



- South-East, USA



Design Phase

- Option 1:
- Replace the existing metal roof assembly with a new metal roof assembly (without the phenolic foam...).



Design Phase

- Option 1:
- RCABC would not warrant a metal roof assembly with a 2/12 slope.



Design Phase

- Option 2:
- Replace the existing metal roof assembly with a new 2-ply roof assembly.



Design Phase

- Option 2:
- RCABC would warrant such an assembly.
- The Client, however, did not appreciate the aesthetic of a 2-ply membrane system.



Design Phase

- Back to the drawing board...
- Levelton proposes option 3: A single ply PVC membrane with PVC battens which have the appearance of a metal roof.



Design Phase

- Client appreciates the look and the RCABC will provide a warranty.



Construction Phase



Construction Phase

- During the demolition:
- It was discovered that the metal decking was not corroded. The existing vapour barrier (SAM) had protected the decking. The corrosion was limited to the girts and mainly the metal roof panels.



Construction Phase





Construction Phase





Construction Phase





Construction Phase

- New Assembly:
- Existing Metal decking
- Densdeck
- SAM
- Girts with 2 layers of Polyiso insulation (increased thickness)
- Densdeck
- PVC membrane with ribs for metal look



Technical items during installation

- To help ensure adequate coverage of adhesive, buckets were left near the area to allow our site personnel to ensure the amount was as per the manufacturer's requirements.

- Air/Vapour Barrier SAM
- A lot of effort and detailing was necessary to ensure the continuity of the self-adhered membrane to prevent potential condensation within the assembly.
- Measurements were taken by the Contractor to ensure fasteners were not installed at the low-point of the steel deck.



Technical items during installation

- Tricky details between the new sloped roof and the existing low-sloped roofs.



Technical items during installation

- Tricky details between existing sloped roof and new roof. (PVC coated flashing)





Technical items during installation

- Snow Guards. Our structural engineer did some pretty robust details...
- Stacked 2 x 10 plates...





Completion





Completion





Completion





Completion

- Early indications show an energy savings of nearly 45% with regards to heating costs.
- This is due to tightening the air barrier and increasing the level of insulation.



QUESTIONS?



Thank You

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