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Vacuum insulation panels (VIPs) arrive in northern Canada : institutional building pilot retrofit in Yukon

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VACUUM INSULATION PANELS (VIPS) ARRIVE IN NORTHERN CANADA:

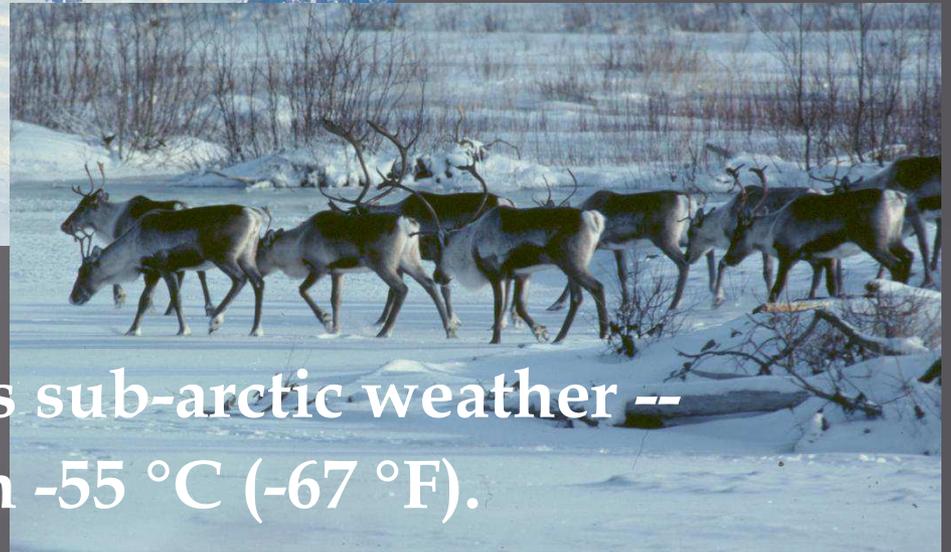
Institutional Building Pilot Retrofit in Yukon

10th International Vacuum Insulation Symposium 15 - 16 2011
Ottawa, Ontario

Doug MacLean, Juergen Korn, Phalguni Mukhopadhyaya



Introduction



Yukon is known for its sub-arctic weather -- temperatures can reach $-55\text{ }^{\circ}\text{C}$ ($-67\text{ }^{\circ}\text{F}$).

Use of Vacuum Insulation Panels (VIPs)

... can be an attractive option compared to other alternatives such as ...



... a larger boiler or furnace,



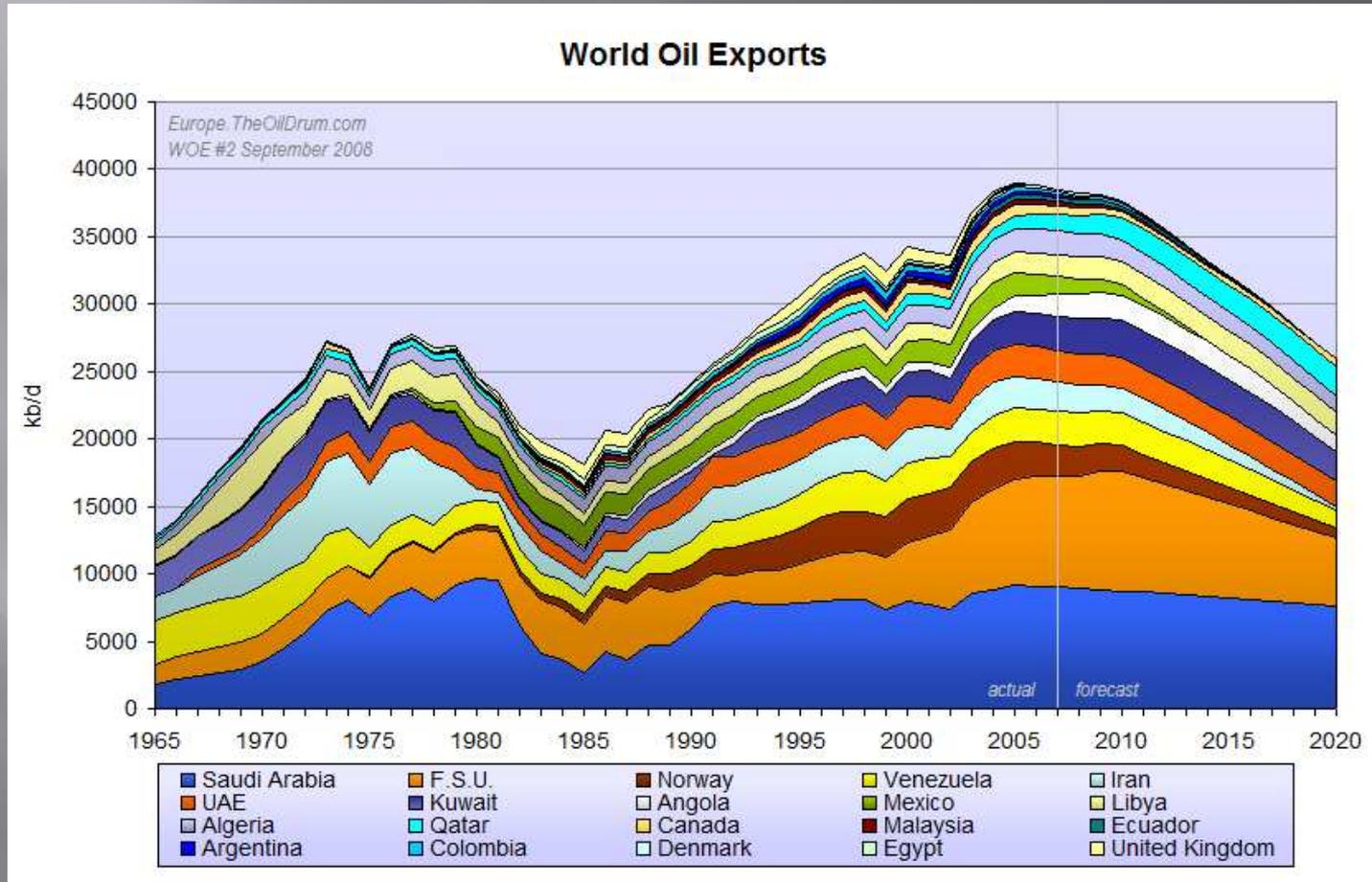
... or thicker insulation.

Vacuum Insulation Panels (VIPs)

... lower volume, weight & thinness offers the North:

- lower transportation cost,
(transportation cost can equal material cost),
- lower construction cost (e.g., less framing & labour),
- less construction time (important weather benefit), and
- potential higher customer satisfaction.

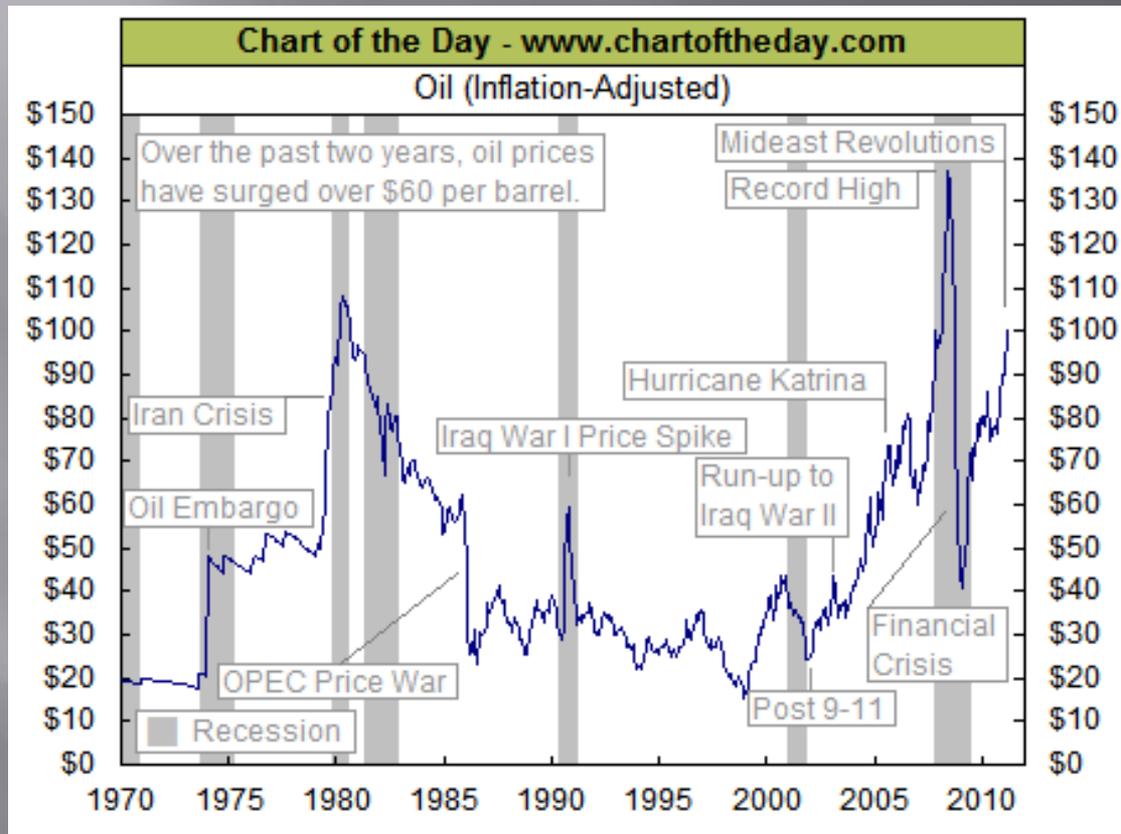
History



Expected declining world oil production is a concern.

Source: http://www.theoil Drum.com/files/WOE%5B02%5D_September2008.png

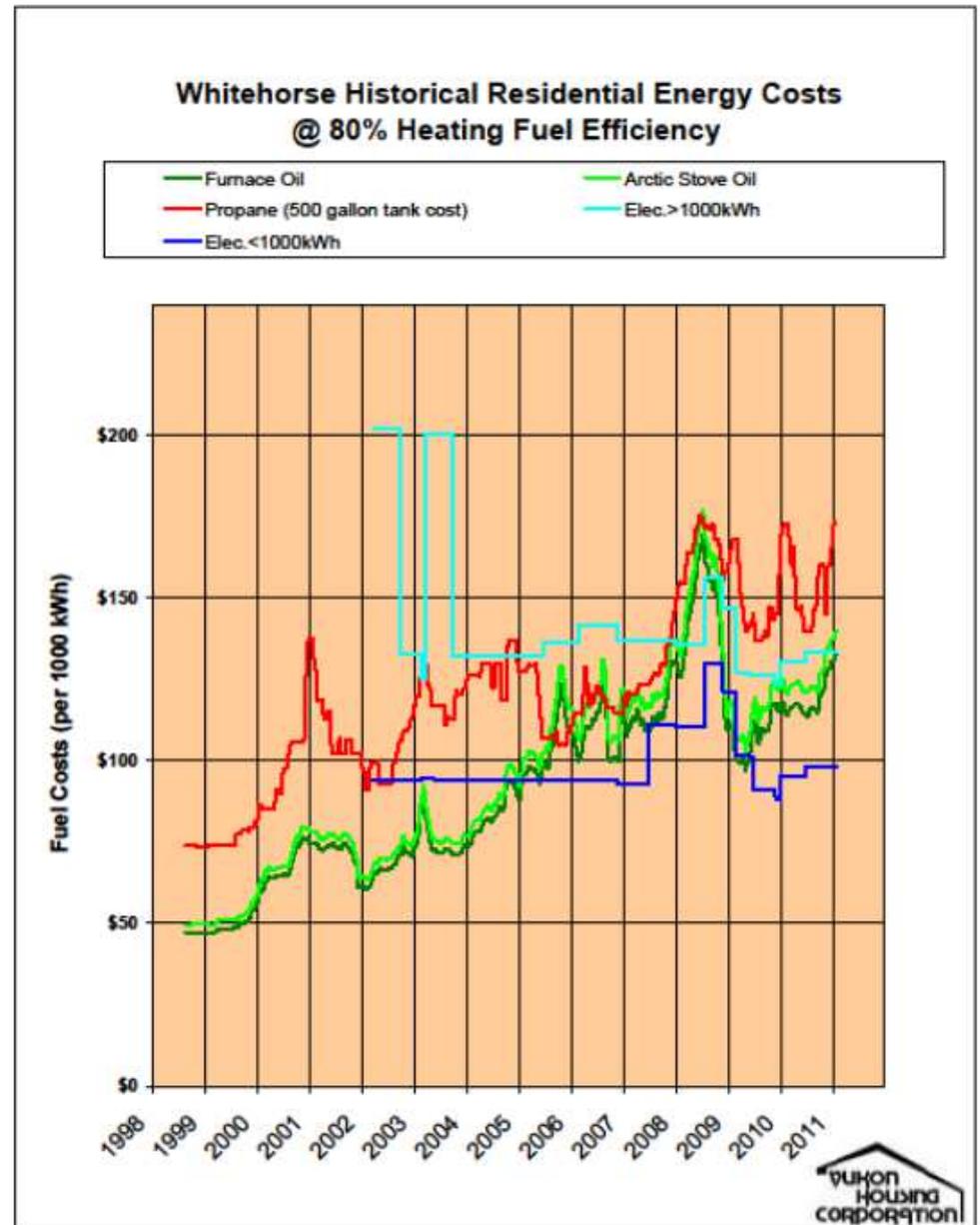
History



- Oil prices rose to over \$140/barrel in 2008.
- Source: <http://www.online-stock-trading-guide.com/chart-of-the-day-03042011-crude-oil.html>

History

Rising heating energy costs have increased interest in reducing heat loss in buildings.



Source:

http://www.housing.yk.ca/pdf/13_Graph.pdf

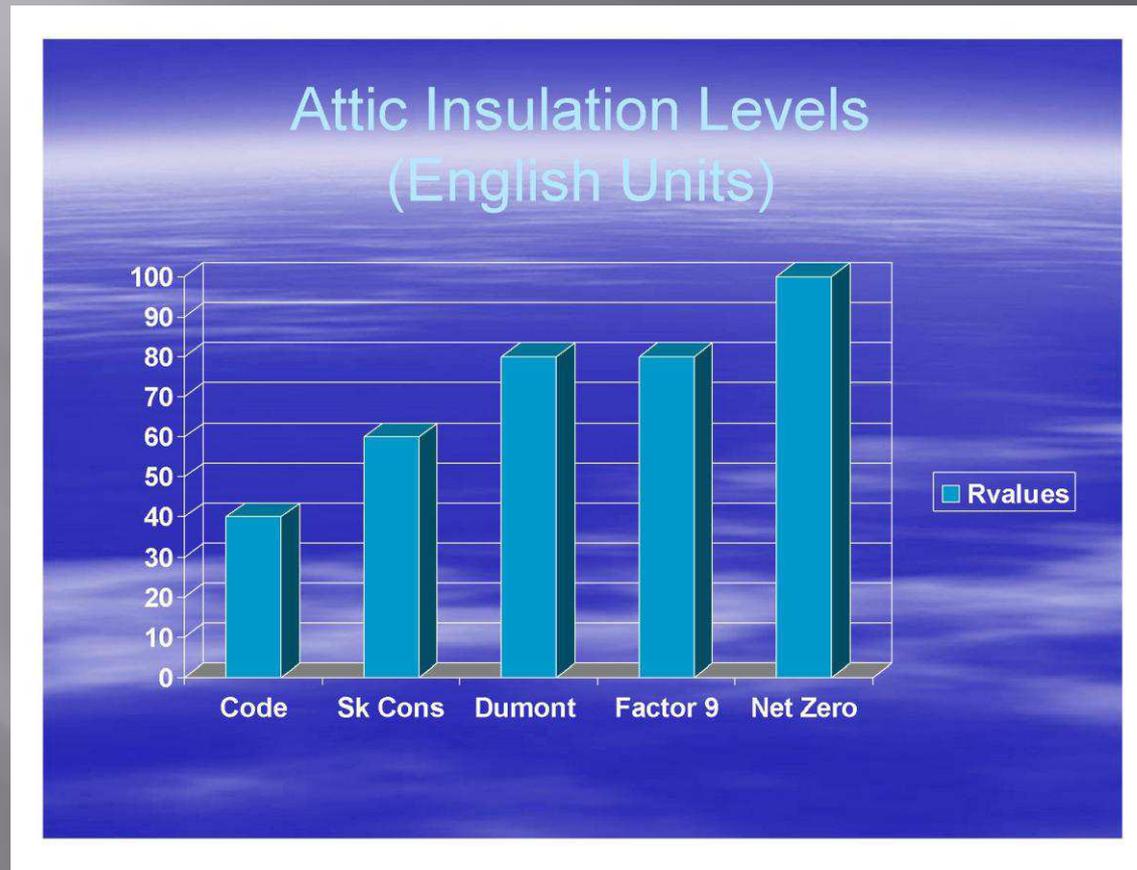
History

There was:

- an interest in improving insulation payback, and cost/benefit ratio, and
- a recognized need for pilot/demonstration projects for promising new products to see what local adaptations may be needed, and to encourage their adoption.

History

Economic Insulation Level



Minimum recommended insulation levels are increasing.

Source: <http://www.cchrc.org/docs/sns/Dumont.pdf>

Design

Condensation was not expected to be an issue as:

- a 0.15 mm (6 mil) vapour barrier was added,
- the design conforms to NBC Part 9 requirements (Section A-9.26.1.1(2), Table A-9.25.5.2), and
- foam board on the outside surface preempts possible condensation there.

Table A-9.25.5.2.
Minimum Thicknesses of Low-Permeance Insulating Sheathing

Celsius Heating Degree-days	Min. RSI Ratio	38 x 89 Framing				38 x 140 Framing					
		Min. Outboard Thermal Resistance, RSI	Min. Sheathing Thickness, mm				Min. Outboard Thermal Resistance, RSI	Min. Sheathing Thickness, mm			
			Sheathing Thermal Resistance, RSI/mm					Sheathing Thermal Resistance, RSI/mm			
			0.0300	0.0325	0.0350	0.0400		0.0300	0.0325	0.0350	0.0400
≤4999	0.20	0.46	10	10	9	8	0.72	19	17	16	14
5000 to 5999	0.30	0.69	18	17	16	14	1.07	31	28	26	23
6000 to 6999	0.35	0.81	22	20	19	16	1.25	37	34	32	28
7000 to 7999	0.40	0.92	26	24	22	19	1.43	43	39	37	32
8000 to 8999	0.50	1.16	34	31	29	25	1.79	55	50	47	41
9000 to 9999	0.55	1.27	37	34	32	28	1.97	61	56	52	45
10000 to 10999	0.60	1.39	41	38	35	31	2.15	67	61	57	50
11000 to 11999	0.65	1.50	45	42	39	34	2.33	73	67	62	54
≥12000	0.75	1.73	53	49	45	40	2.69	85	78	72	63

Design

Mechanical rubbing, a known potential issue, was addressed using:

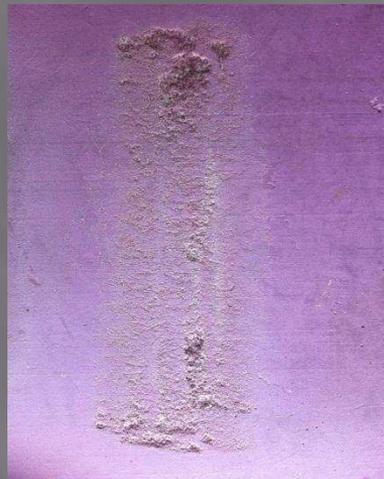
- 25 mm (1") polystyrene foam board inside of the VIPs, and
- 6 mm (1/4") soft foam (Domfoam 1095) over the exterior surface of the VIPs.

Design

Adhesives are known to:

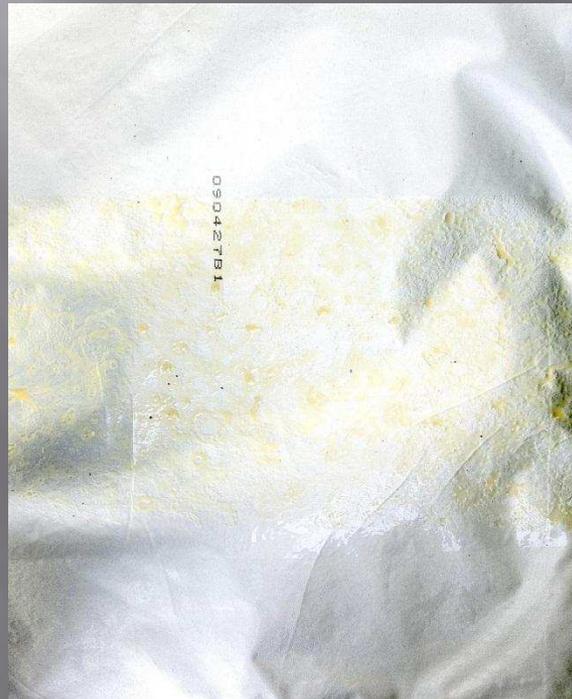
- be a potential source of abrasion, and
- may chemically attack the cover of the VIP.

However, testing readily identified suitable commercially-available adhesives.



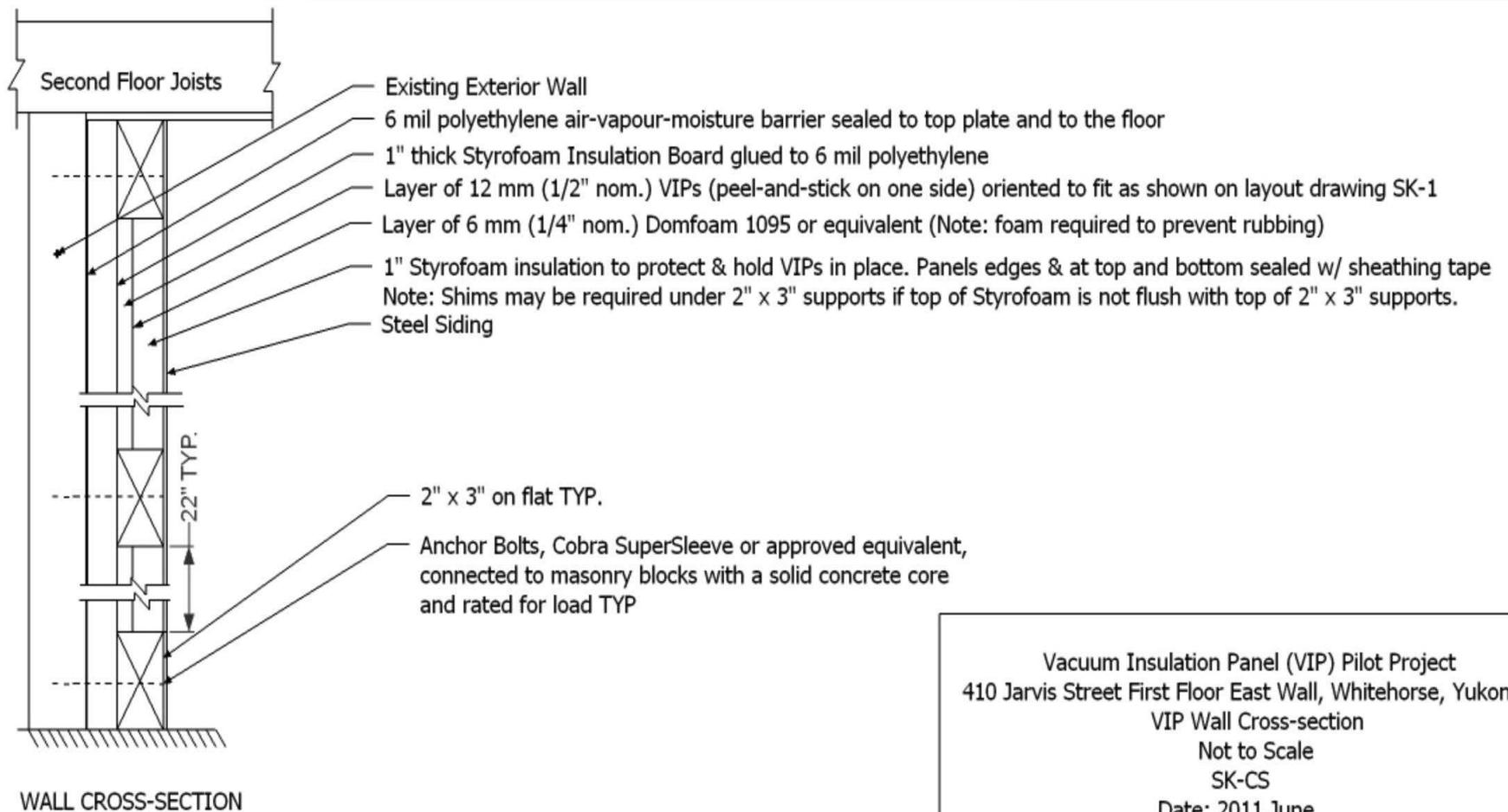
Design

A thermal stress test was done with 3 adhesives.



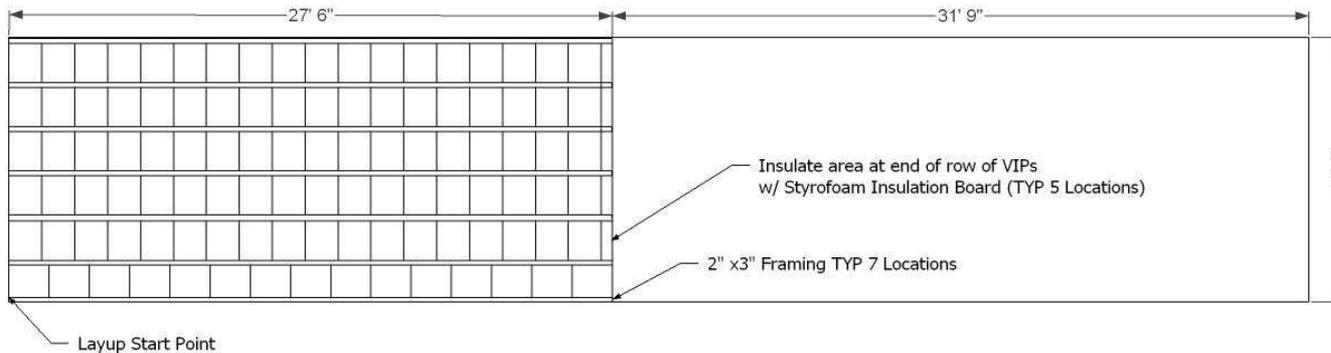
There was no visible damage with any adhesive tested.

Final Design

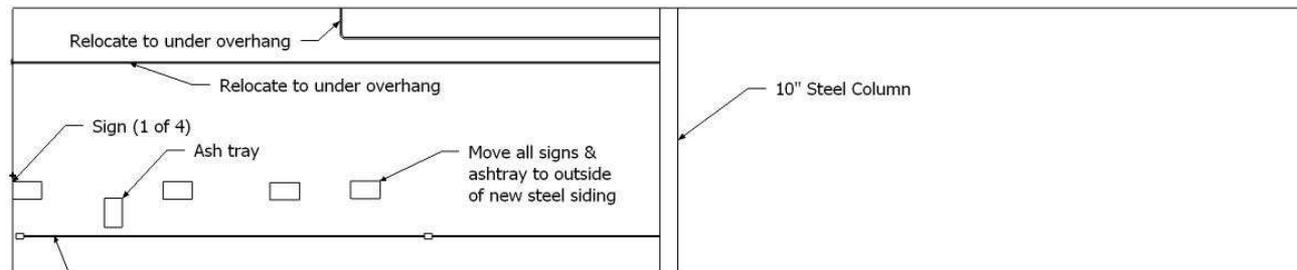


Vacuum Insulation Panel (VIP) Pilot Project
410 Jarvis Street First Floor East Wall, Whitehorse, Yukon
VIP Wall Cross-section
Not to Scale
SK-CS
Date: 2011 June

Final Design



Vacuum Insulation Panel Layout
 East wall at 410 Jarvis (ground floor)
 (details shown for left side of wall only)

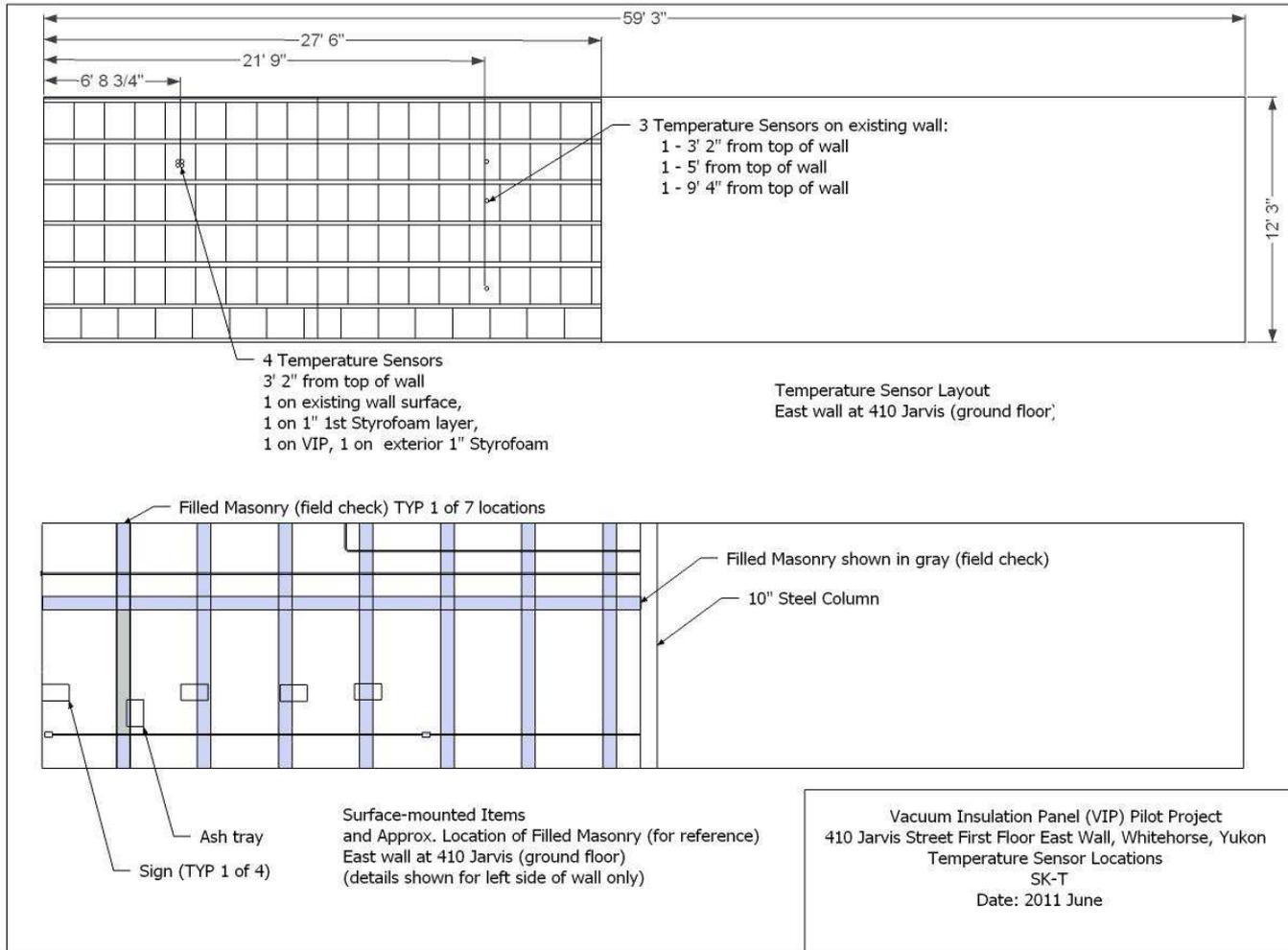


Move electrical outlets and conduit away from wall
 and mount over new siding over 2" x 3" supports located 21" above grade
 (field check)
 See Vacuum Insulation Panel Layout (above) for location

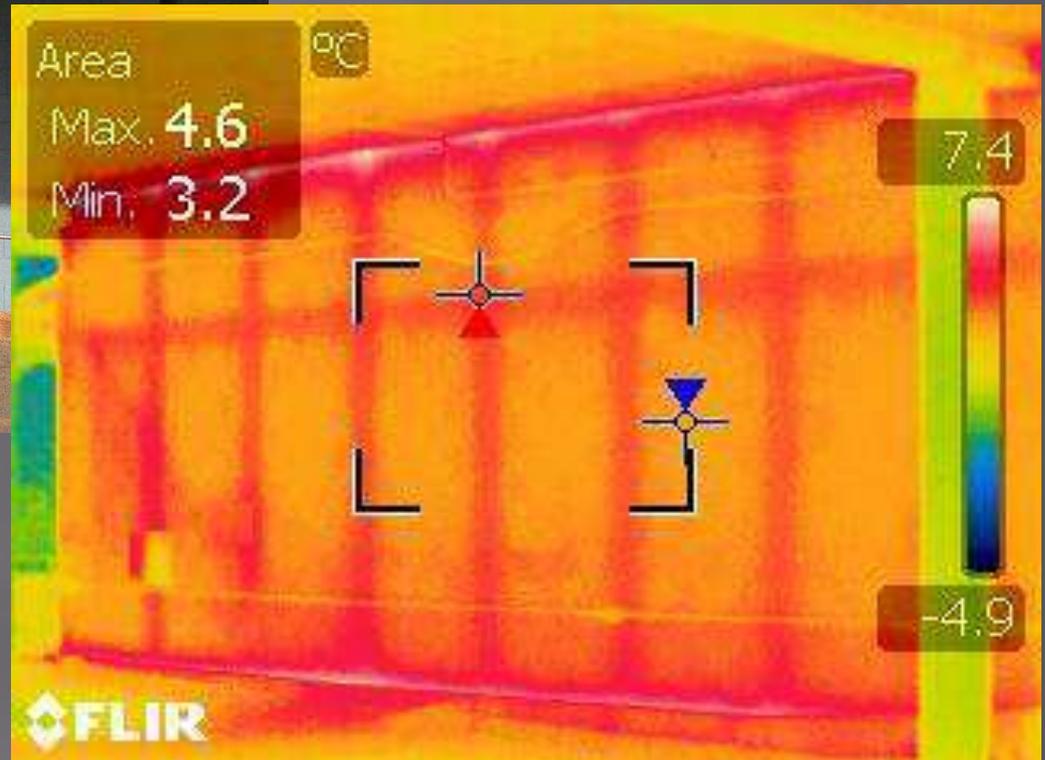
Surface-mounted Items
 East wall at 410 Jarvis (ground floor)
 (details shown for left side of wall only)

Vacuum Insulation Panel (VIP) Pilot Project
 410 Jarvis Street First Floor East Wall, Whitehorse, Yukon
 VIP Layout
 Number of 18" x 22" Panels: 105
 SK-1
 Date: 2011 June

Monitoring Plan



Monitoring Baseline



Construction Preparation

Sample excerpt from the scope of work:

14. Begin work by preparing the existing masonry block wall surface where necessary by chiselling or grinding down any rough surfaces to help prevent damage to the air-vapour barrier or the VIPs. Grinding shall be done with a HEPA filter on the grinder to minimize the amount of dust produced. Minimal chiselling or grinding should be needed.

15. Install a 0.15 mm (6 mil) polyethylene air-vapour barrier on the existing masonry wall using a compatible sealant spread over the entire wall surface to be insulated and seal it at the top of the first floor wall, at the foundation, and around any openings with sealant or sheathing tape, Tuck 20502 Contractor's Sheathing Tape, or approved equivalent

A generic version of the scope of work is provided in the companion conference paper.

Construction Experience



- ▣ Installation of the air/vapour/moisture barrier proceeded smoothly as was expected, as such construction is routine.
- ▣ Similarly, installation of the 25 mm (1") polystyrene foam board layer over the air/vapour/moisture barrier also proceeded without incident.

Construction Experience



Installation of the 50 x 75 (2 x 3s) proceeded almost flawlessly.

Construction Experience Anchors



At this stage, a minor problem was encountered ...
... and was unrelated to VIPs

Construction Experience



Installation of the VIPs proceeded quickly.

Construction Experience



Installation of the flexible foam layer proceeded smoothly.

Construction Experience



- ▣ Installation of the second layer of 25 mm (1") foam board also proceeded smoothly.

Construction Experience

- ▣ An exterior air/ weather barrier:
 - ▣ was not required by the authority having jurisdiction to meet code requirements at this location, but would be required for most installations.
 - ▣ its omission may facilitate infrared temperature measurements.

Construction Experience

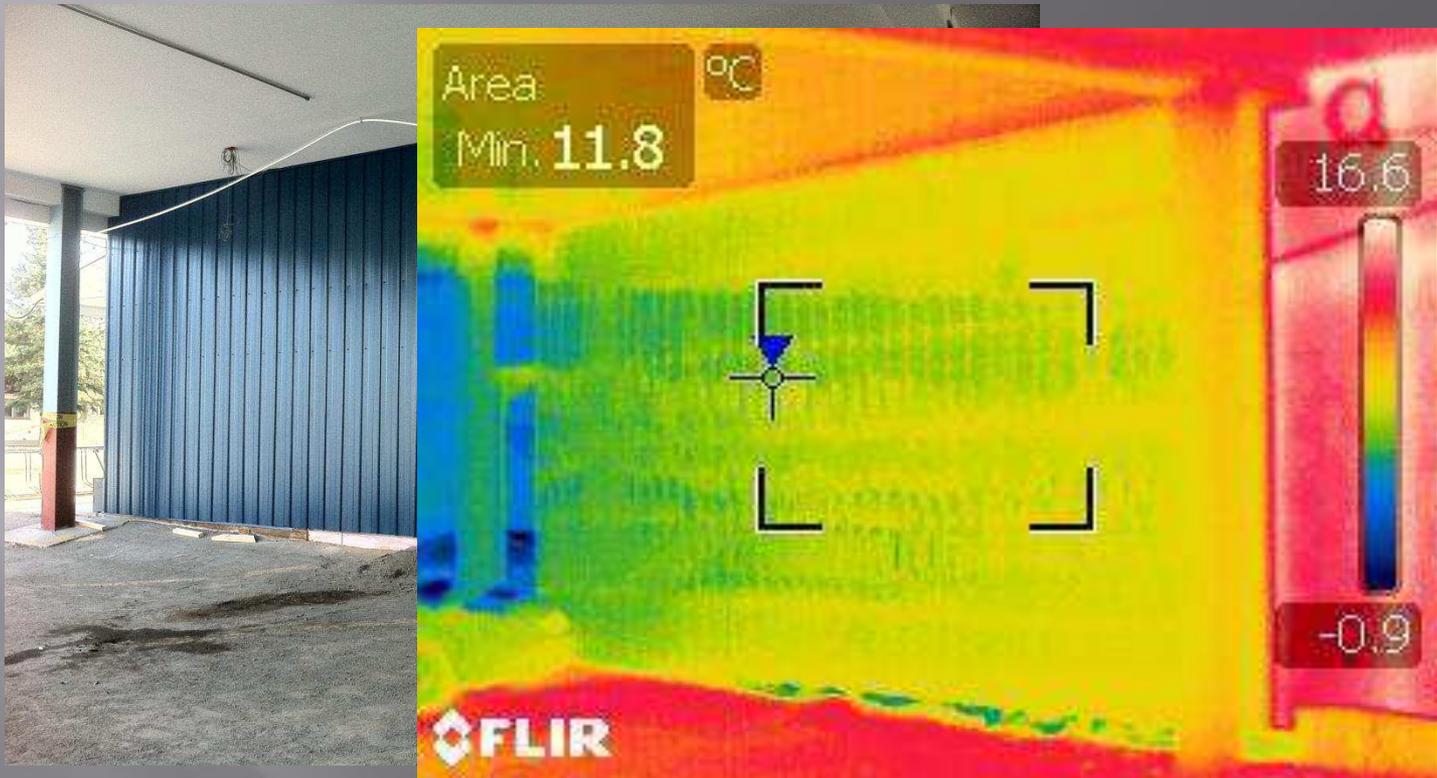


Siding Installation

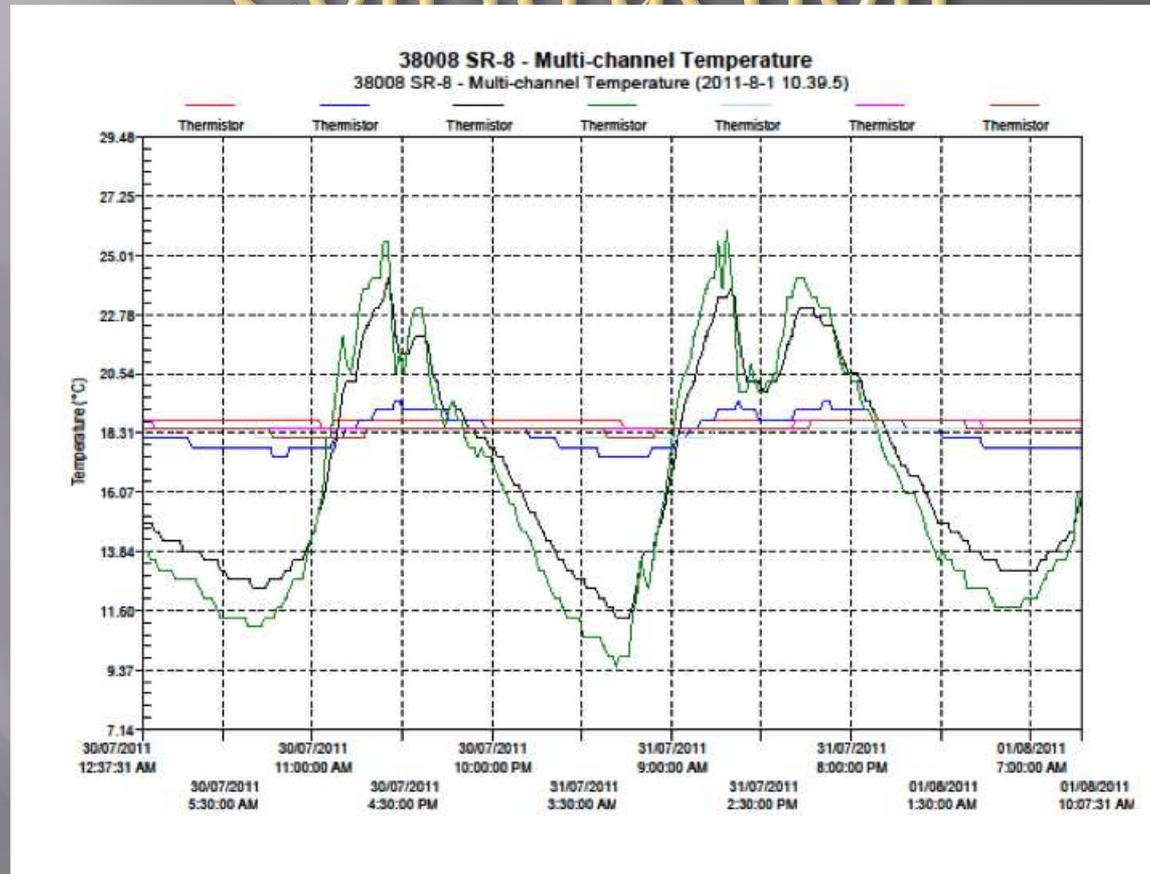
- Pre-drilling siding was very effective.

Overall, construction experience was more positive than expected.

Monitoring After Construction



Monitoring After Construction



- Initial results were consistent with expectations.

Summary

- ▣ The motivations for this pilot were:
 - ▣ increases in heating energy costs in North, and
 - ▣ interest in the desirable features of VIPs.
- ▣ Construction experience was positive.
- ▣ Monitoring is providing useful data.
- ▣ Local interest has been generated by the pilot even though the results are not available yet.
- ▣ Results to date are encouraging.

Finally, ...

Acknowledgements

We are very appreciative of the support of:

- ▣ Panasonic Canada Inc. and Panasonic Corporation -- for supplying the vacuum insulation panels used for this pilot project and for their technical expertise and cooperation,
- ▣ Yukon Housing Corporation -- for allowing us to use a wall of one of their buildings for this pilot project and for providing monitoring equipment, and
- ▣ Yukon College -- for financial help and technical contributions.

Thank you!