

Design / Construction Problems in the Arctic Nunavut

Presentation Outline

- * Where, What, Who is Nunavut
- * Permafrost
- * Climate
- * Logistics
- Costs
- Closure





WHERE, WHAT, WHO

Where, What, Who

- st Located entirely north of the 60th parallel
- st Furthest Mainland Southerly Point Manitoba Border
- st Furthest Northerly Point North Pole
- st Spans Three Time Zones
- st Includes 21% of Canada's Entire Landmass (2M Sq Kms)
- st Includes 0.1% of Canada's Entire Population (32,000)
- st 83.6% of Persons Identify Themselves as Inuit
- * Number of Communities: 25
- st Number of Communities Population < 1000 = 14
- * Number of Communities Population > 2000 = 3
- *Furthest Northern Settlement CFS Alert 82. 28 Lat
- st Kms of Roads Connecting to Southern Canada: 0.00
- * Kms of Roads Between Communities: 0.00





IMAGES FROM NUNAVUT PLACES, PEOPLE, THINGS



PERMAFROST

Permafrost

* Definition:

Permafrost Layer of soil or rock, at some depth beneath the surface, in which the temperature has been continuously below 0°C for at least some years. It exists where summer heating fails to reach the base of the layer of forzen ground.

- *Could be Rock
- *Could be Granular Materials
- ***Could be Organic**
- *Could be lce
- *Could be Fresh Water Ice or Could be Saline Ice
- *Could be Ice & Some Other Materials
- *Usually an Upper Active Layer That Thaws in Summer
- ***Below Active Layer It is Permanently Frozen**







PERMAFROST DEGRADATION

HEATED CRAWLSPACE, STRIP FOOTINGS, CONTINUOUS PONY WALLS, DRAINAGE PROBLEMS



PERMAFROST SWELLING

SLAB ON GRADE; 20 FEET GRANULAR FILL; DRAINAGE ISSUES; WATER LEAKAGE INTO SUBGRADE



PERMAFROST VARIOUS ISSUES

CONSTRUCTION SEQUENCING; PILE SLIPPING; DRAINAGE ISSUES; THAWING UNDER SLAB, STUPIDITY



Climate

* Keep in Mind:

Despite what the rest of Canada has been telling you all your life, as a Winnipeger, you are a Southerner. In the Arctic, the snow is different, the wind is different and the cold is different.

- *Sustained Cold Weather (-65c for weeks)
- *Sustained High Winds (Week Duration Storms Common)
- *Snow Can be Like Talcum Powder (Gets into Everything)
- *Snow Can be Like Concrete Hard Packed
- *Low Snow Fall (arctic desert) BUT High Accumulations
- *Long Winters + Snow Accumulation = Clearing Issues
- stSnow and Ice Can Remain Year Round
- *High Tides (Iqaluit Has Second Highest Tides on Earth)





SNOW UNDER, OVER, AROUND AND INSIDE





Daily Average	Winnipeg	Rankin	Alert
January	-17.8	-31.9	-32.4
February	-13.6	-30.1	-33.4
March	-6.1	-25.2	-32.4
April	4	-16.3	-24.4
Мау	12	-5.9	-11.8
June	17	4.2	-0.8
July	19.5	10.4	3.3
August	18.5	9.5	0.8
September	12.3	3.4	-9.2
October	5.3	-5.3	-19.4
November	-5.3	-17.8	-26.4
December	-14.4	-26.7	-30.1
Year Average	2.6	-11.8	-18
Precipitation (Annual)	513.7	270.4	150

CLIMATE DATA

Logistics

- st0.00 Kms of Roads to Southern Canada
- stEstimated Total of 853 Kms of Roads in Nunavut
- st0.00 Kms of Roads Between Communities
- *0.00 Kms of Rail
- **∗Two Paved Air Strips**
- *Jet Service to Rankin Inlet & Iqaluit Only
- *Each Community Has an Air Port
- stAir Transport Difficult due to Weather (Wind, Snow & Vis)
- *All Communities on Ocean (High Tides)
- stOcean Freezes in Winter
- stShipping Season Usually August to September





TRANSPORTATION OF GOODS AIR; SEA BARGE

Costs

 \pm 4 litre of Milk = \$16.00

*Hamburger & Fries = \$29.00 *1 Kilowatt of Electricity = \$ 0.50 *Return Air Ticket Winnipeg to Rankin = \$2,200.00 *Return Air Ticket Winnipeg to Resolute = \$4,400.00 *Charter Aircraft to Gjoa Haven = \$22,000.00 *****One Sheet of 16mm T&G Plywood = \$60.00 (Arviat) *Cost of New Correctional Centre = \$12,000 per Sq Metre *Cost of New Community Hall = \$7,500 per Sq Metre *Cost of One Bedroom Apartment (Rankin) = \$1,400 / Mo *Cost of Engineering MistakesPriceless



GH A TURKEY S-7K

14-14-5 Th (14-1279-75)		
11.115 kg	\$18.00.14	\$200.07

Closure

*There are Huge Challenges to Working in Nunavut *Many Mistakes Have Been Made in Past *What Works in Winnipeg May Not Work in Nunavut *There are Additional Rules and Regulations *Construction Techniques Are Different *Must Consider All Stages of Development & Effects *Skills of Workers, and Operators are Limited *Staff Turnover is Severe *There are No (or few) Redundant Services ***Very Short Construction Season** *Reliability, Durability, and Redundancy of Systems



Thank You

Ken Drysdale, P.Eng., P.E. President & CEO Accutech Engineering Inc.

605 - 287 Broadway Winnipeg, Manitoba R3C 0R9

(204) 944 - 1555

drysdale@accutecheng.ca



