TECH SOLUTIONS 605.0
Calculating Insulation Needs to Fight Frost Heave by Comparing Freezing Index and Frost Depth

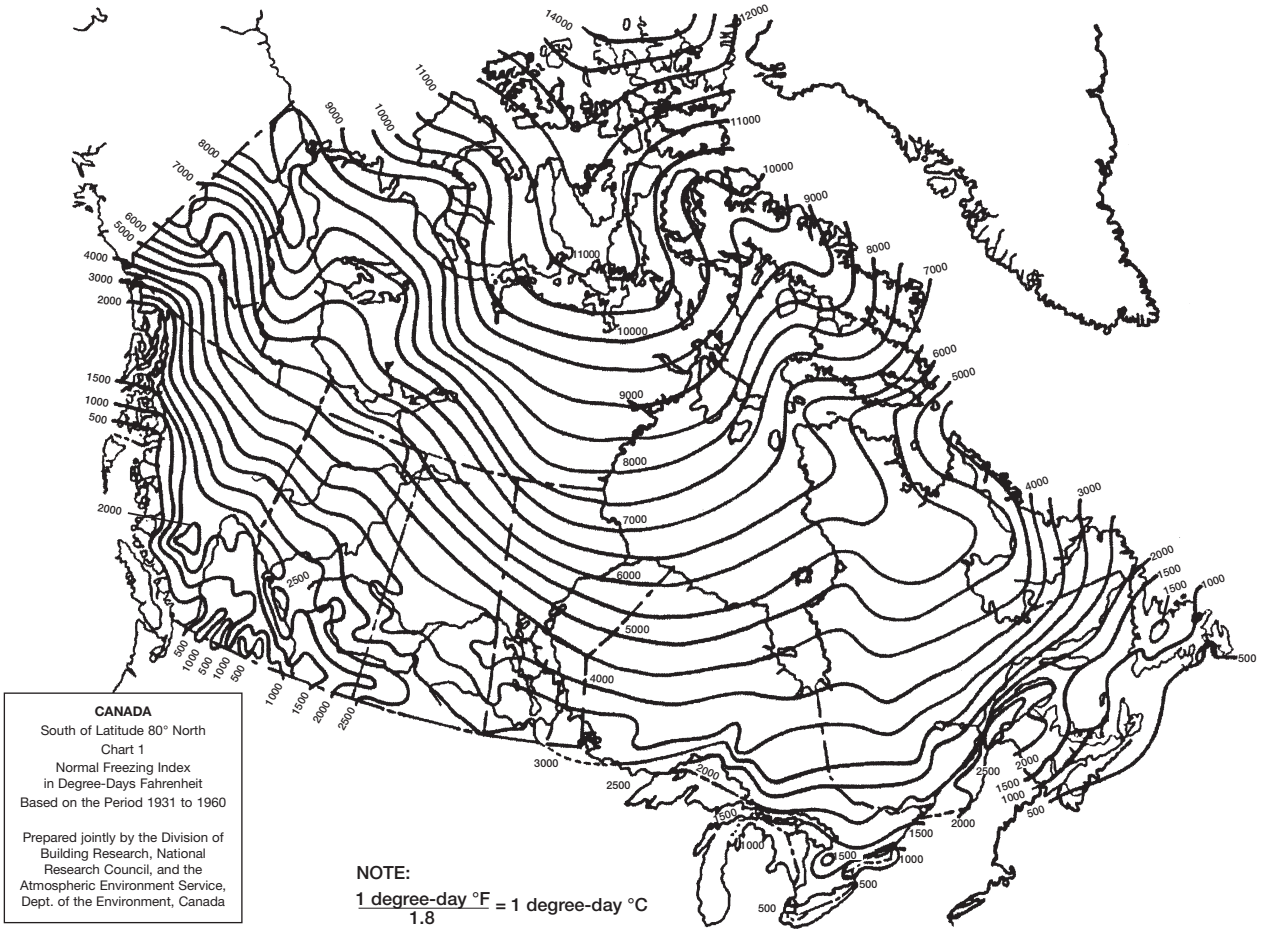
To calculate the amount of insulation needed to protect highways, railroads, airport runways, utility lines and building foundations against frost heave, it's important to know the amount of frost penetration. There are two ways to calculate frost penetration: theoretically or actual field monitoring. Dow uses both methods. A theoretical formula that predicts frost depth with freezing index information provides a quick estimate. Obtaining actual field data provides the most accurate information.

The freezing index is defined as the number of degree-days (above and below 32°F [0°C]) between the highest point in the autumn and the lowest point in the spring on the cumulative degree-day time curve for one winter season. Or, simply the total number of degree-days of freezing for a given winter.

To help with calculations, this information sheet includes:

- maps of Canada showing the normal (mean) value of freezing index
- listings of normal freezing index data for major areas across Canada
- charts showing the relationship between freezing index and frost penetration as prepared by the Ministry of Transportation of Ontario

Figure 1: Freezing Index Map for Canada



Calculating Insulation Needs to Fight Frost Heave by Comparing Freezing Index and Frost Depth

Figure 2: Freezing Index Map for Southern Ontario

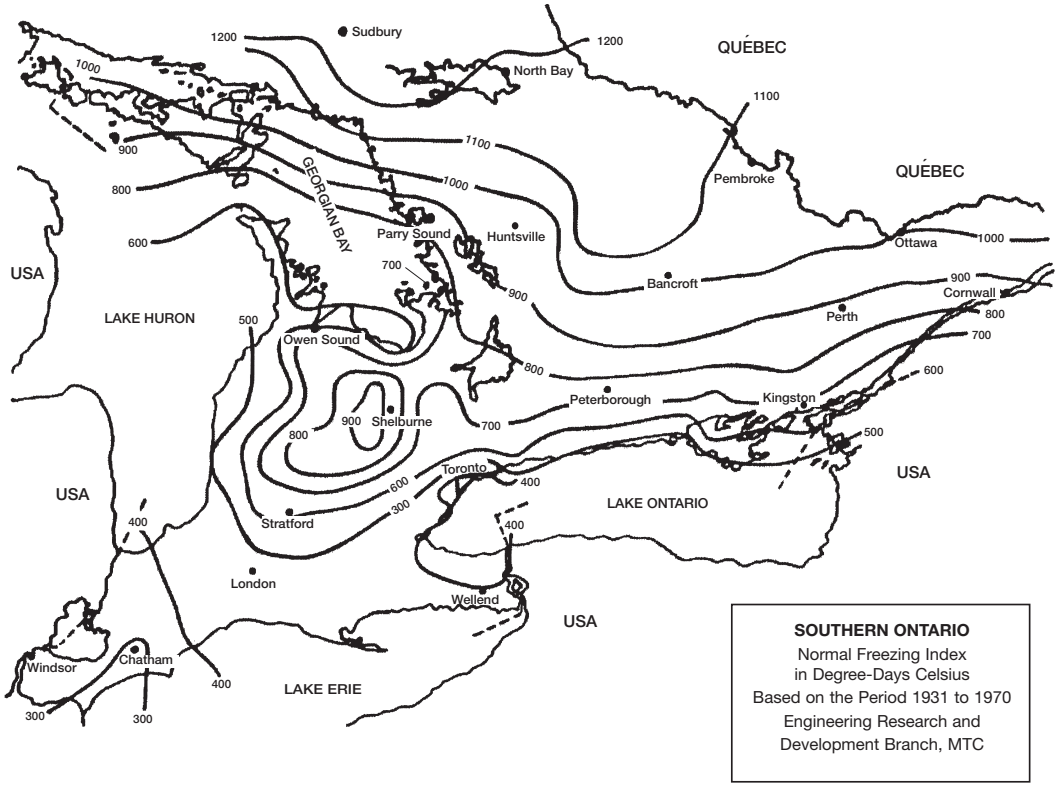
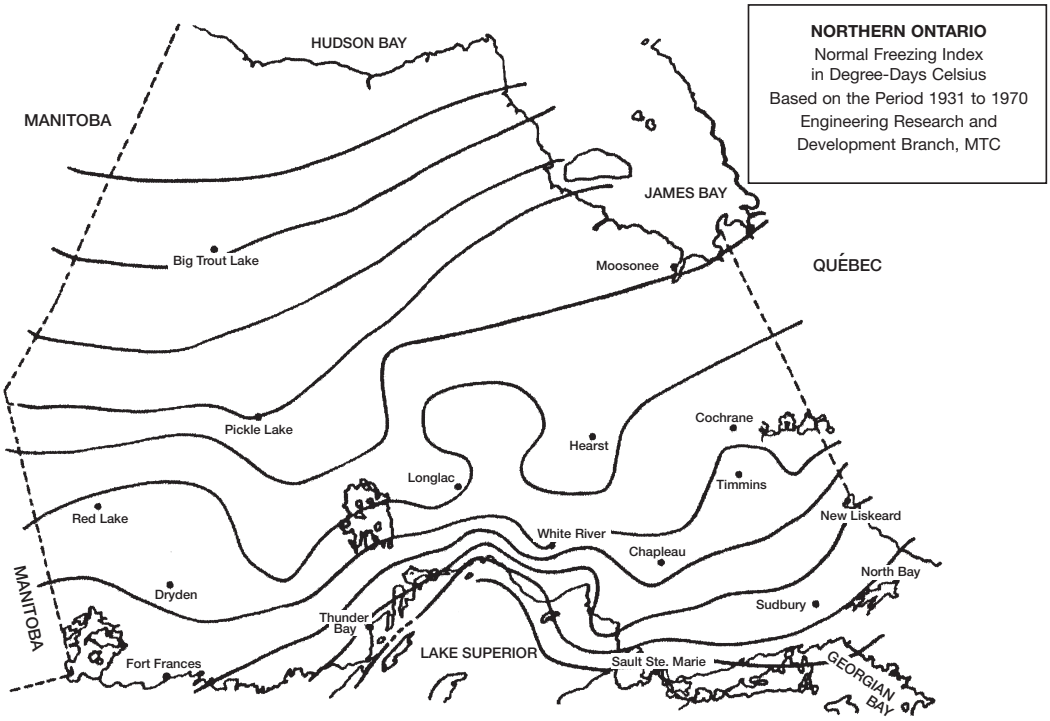


Figure 3: Freezing Index Map for Northern Ontario



Calculating Insulation Needs to Fight Frost Heave by Comparing Freezing Index and Frost Depth

Figure 4:

Relationship between air freezing index, surface cover and frost penetration into homogeneous soils

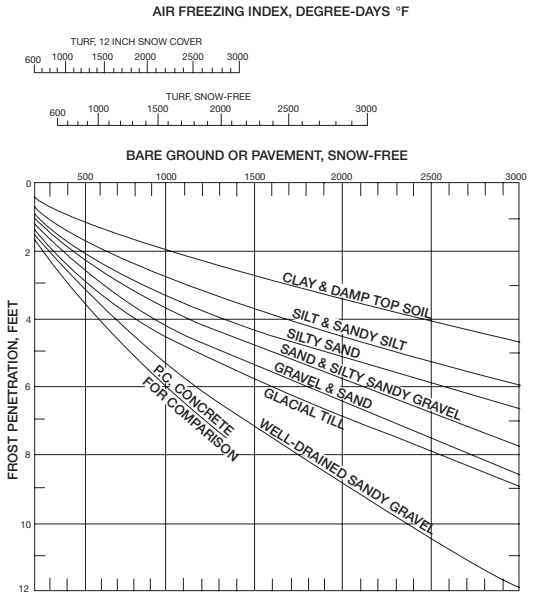


Figure 5:

Relationship between air freezing index, surface cover and frost penetration into a granular soil overlying a fine-grained soil

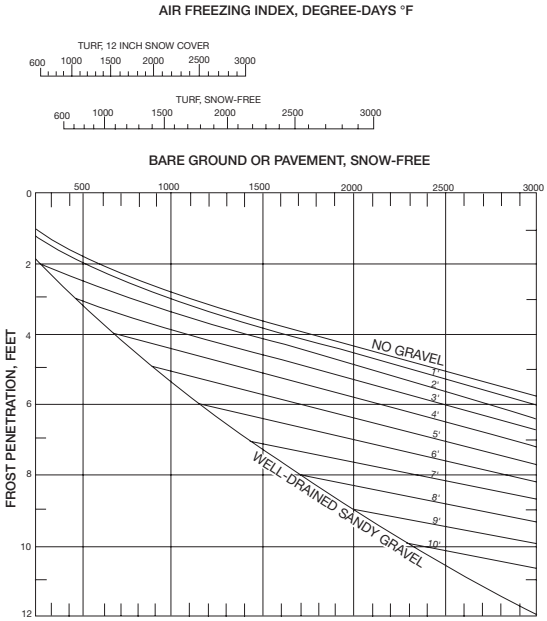
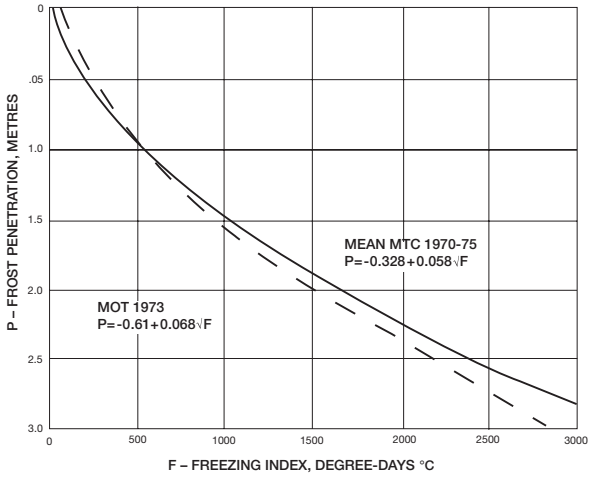


Figure 6:

Frost Penetration in Ontario 1970-1975



Calculating Insulation Needs to Fight Frost Heave by Comparing Freezing Index and Frost Depth

Table 1: Freezing Indices for Canada

Station	Freezing Index Degree-Days °F	Freezing Index Degree-Days °C
British Columbia		
Abbotsford A[1]	45	25
Beatton River A	3,893	2,164
Comox A	596	331
Cranbrook A	1,314	730
Dog Creek A	1,457	809
Fort Nelson A	4,523	2,513
Fort St. John A	2,848	1,582
Kamloops A	603	335
Kimberley A	1,434	797
New Westminister	35	19
Penticton A	313	174
Port Hardy A	33	18
Prince George A	1,670	928
Prince Rupert A	64	36
Princeton A	1,111	617
Quesnel A	1,457	809
Sandspit A	35	19
Smithers A	1,498	832
Smith River A	4,866	2,703
Terrace A	637	354
Tofino A	20	11
Vancouver A	31	17
Victoria A	28	16
Williams Lake A	881	489
Yukon Territory		
Aishihik A	5,038	2,799
Dawson	6,174	3,430
Haines Junction	4,498	2,499
Mayo	5,454	3,030
Snag A	6,477	3,598
Teslin A	3,754	2,086
Watson Lake A	3,281	1,823
Whitehorse	3,574	1,986
Northwest Territories		
Cape Dyer A	7,058	3,921
Coral Harbour A	8,552	4,751
Fort McPherson	7,747	4,304
Frobisher Bay A	7,026	3,903
Hay River A	5,512	3,062
Inuvik A	8,424	4,680
Norman Wells A	7,026	3,903
Resolute Bay A	11,166	6,203
Tuktoyaktuk	8,855	4,919
Yellowknife A	6,506	3,614
Alberta		
Banff	1,963	1,091
Calgary A	1,791	995
Cold Lake A	3,174	1,763
Cowley A	1,413	785
Edmonton A	2,593	1,441
Embarras A	4,439	2,466
Fort McMurray A	4,024	2,236
Grande Prairie A	2,967	1,648
Jasper	1,885	1,047
Lake Louise	2,810	1,561
Lethbridge A	1,326	737
Medicine Hat A	1,809	1,005
Peace River A	3,805	2,114

(1) A indicates an airport data station.

Table 1: Continued

Station	Freezing Index Degree-Days °F	Freezing Index Degree-Days °C
Alberta – continued		
Penhold A	2,586	1,437
Red Deer	2,382	1,323
Suffield A	2,259	1,255
Vermilion A	3,222	1,790
Saskatchewan		
Broadview A	3,244	1,802
Dafoe A	3,722	2,068
Estevan A	2,646	1,470
Moose Jaw A	2,555	1,419
North Battleford A	3,378	1,877
Prince Albert A	3,739	2,077
Regina A	3,175	1,764
Saskatoon A	3,284	1,824
Swift Current A	3,323	1,846
Uranium City A	5,551	3,084
Yorkton A	3,563	1,799
Manitoba		
Brandon A	3,388	1,882
Churchill A	6,698	3,721
Flin Flon	4,279	2,377
Gimli A	3,417	1,898
MacDonald A	3,038	1,688
Neepawa A	3,282	1,823
Portage La Prairie A	2,855	1,586
Rivers A	3,315	1,842
Winnipeg A	3,251	1,806
Ontario		
Algonquin Park	2,147	1,193
Belleville	1,143	635
Brampton	1,026	570
Brantford	790	439
Chalk River	2,096	1,164
Chatham	531	295
Cochrane	3,309	1,838
Collingwood	975	542
Dryden	3,395	1,886
Georgetown	1,084	602
Guelph	1,055	586
Hamilton	663	368
Huntsville	1,656	920
Iroquois Falls	3,388	1,882
Kapuskasing A	3,439	1,911
Kenora A	3,172	1,762
Kingston	1,220	678
Kirkland Lake	3,244	1,802
Kitchener	983	546
Lindsay	1,445	803
London A	863	479
Moosonee	4,081	2,267
Niagara Falls	684	380
North Bay	2,210	1,228
Orangeville	1,423	791
Orillia	1,495	831
Ottawa A	1,829	1,016
Owen Sound	995	553
Parry Sound	1,517	843
Peterborough	1,365	758
Port Arthur (Thunder Bay)	2,541	1,412

Continued on next page

Calculating Insulation Needs to Fight Frost Heave by Comparing Freezing Index and Frost Depth

Table 1: Continued

Station	Freezing Index Degree-Days °F	Degree-Days °C
Ontario – continued		
St. Catharines	506	281
St. Thomas	710	394
Sarnia	670	372
Sault Ste. Marie A	1,663	924
Simcoe	751	417
Sioux Lookout A	3,450	1,917
Stratford	1,072	596
Sudbury A	2,401	1,334
Timmins A	3,160	1,756
Toronto	629	349
Toronto A	897	498
White River	3,344	1,858
Windsor A	565	314
Woodstock	929	516
Québec		
Bagotville A	2,867	1,593
Baie Comeau A	2,518	1,399
Chicoutimi	2,536	1,409
Drummondville	1,827	1,015
Gagnon A	4,216	2,342
Gaspé	2,012	1,118
La Malbaie	2,043	1,135
Mont Laurier	2,325	1,292
Montréal A	1,583	879
Québec	1,822	1,012
Québec A	2,059	1,144
Sept-Iles A	2,746	1,526
Sherbrooke	1,581	878
Sorel	1,997	1,109
Tadoussac	2,038	1,132
Three Rivers	2,139	1,188
New Brunswick		
Edmundston	2,219	1,233
Fredericton A	1,561	867
Moncton A	1,397	776
Pennfield Ridge A	1,178	654

Table 1: Continued

Station	Freezing Index Degree-Days °F	Degree-Days °C
New Brunswick – continued		
Sackville	1,174	652
St. George	1,115	619
Saint John	1,002	557
Saint John A	1,137	632
Sussex	1,337	743
Woodstock	1,701	945
Nova Scotia		
Annapolis Royal	593	329
Cheticamp	955	531
Debert A	1,136	631
Greenwood A	815	453
Halifax	556	309
Halifax A	856	476
Ingonish Beach	828	460
Liverpool	453	252
Shearwater A	699	388
Springfield	933	518
Sydney A	811	451
Truro	1,025	569
Yarmouth A	415	231
Prince Edward Island		
Alliston	1,000	556
Charlottetown A	1,201	667
Summerside A	1,242	690
Newfoundland		
Argentia A	475	264
Bonavista	853	474
Buchans A	1,724	958
Churchill Falls A	4,818	2,677
Corner Brook	1,120	622
Gander International A	1,207	671
Goose A	3,268	1,816
Grand Falls	1,394	774
St. John's	648	360
Stephenville A	925	514
Wabush Lake A	4,688	2,604

For Technical Information: 1-866-583-BLUE (2583) (English) 1-800-363-6210 (French)
For Sales Information: 1-800-232-2436 (English) 1-800-565-1255 (French)
DOW CHEMICAL CANADA ULC . Dow Building Solutions . 450 – 1st St. SW . Suite 2100 . Calgary, AB T2P 5H1
www.dowbuildingsolutions.com

Republished November 2008

Form No. 178-00754-1108P&M