

**Prentice**

# An Operational Comparison between the Larry C. Hardy & Old Town Parking Garages

*Traverse City, MI*

*Larry C. Hardy Parking Garage*

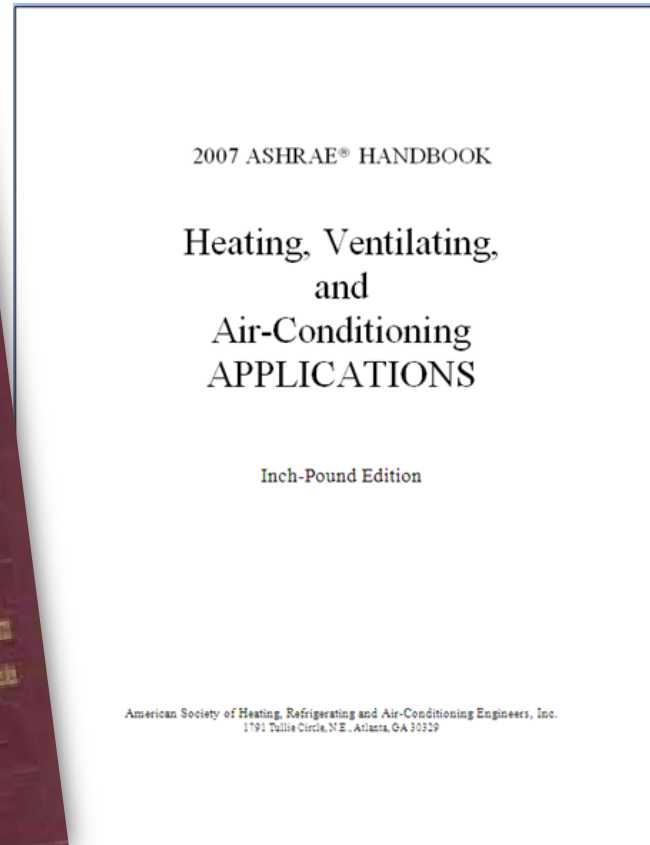
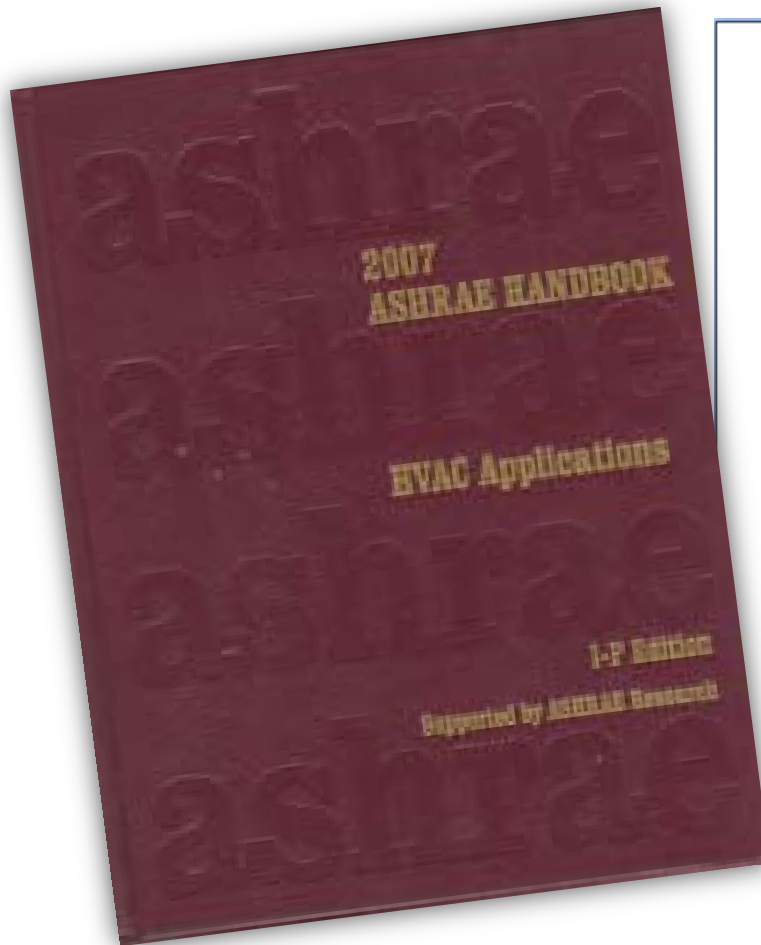


*Old Town Parking Garage*



## Typical Snowmelt Design Basis:

These next few pages from the 2007 ASHRAE Handbook illustrate typical snow fall, energy requirements for surface snow melting, snow free ratios for electronic and idling hydronic snow melt systems.



CHAPTER 50

## SNOW MELTING AND FREEZE PROTECTION

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**T**HE practicality of melting snow or ice by supplying heat to the exposed surface has been demonstrated in many installations, including sidewalks, roadways, ramps, bridges, access ramps, and parking spaces for the handicapped, and runways. Melting eliminates the need for snow removal by chemical means, provides greater safety for pedestrians and vehicles, and reduces the labor and cost of slush removal. Other advantages include eliminating piled snow, reducing liability, and reducing health risks of manual and mechanized shoveling.

This chapter covers three types of snow-melting and freeze protection systems:

1. Hot fluid circulated in slab-embedded pipes (**hydronic**)
2. Embedded electric heater cables or wires
3. Overhead high-intensity infrared radiant heating

Detailed information about slab heating can be found in Chapter 6 of the 2004 *ASHRAE Handbook—HVAC Systems and Equipment*. More information about infrared heating can be found in Chapter 15 of the same volume.

Components of the system design include (1) heat requirement, (2) slab design, (3) control, and (4) hydronic or electric system design.

### HYDRONIC AND ELECTRIC SNOW-MELTING SYSTEMS

#### SNOW-MELTING HEAT FLUX REQUIREMENT

The heat required for snow melting depends on five atmospheric factors: (1) rate of snowfall, (2) snowfall-coincident air dry-bulb temperature, (3) humidity, (4) wind speed near the heated surface, and (5) apparent sky temperature. The dimensions of the snow-melting slab affect heat and mass transfer rates at the surface. Other factors such as back and edge heat losses must be considered in the complete design.

#### Heat Balance

The processes that establish the heat requirement at the snow-melting surface can be described by terms in the following equation, which is the steady-state energy balance for required total heat flux (heat flow rate per unit surface area)  $q_s$  at the upper surface of a snow-melting slab during snowfall.

$$q_s = q_i + q_m + A_s(q_a + q_r) \quad (1)$$

where

- $q_s$  = heat flux required at snow-melting surface,  $W/m^2$
- $q_i$  = sensible heat flux,  $W/m^2$

The preparation of this chapter is assigned to TC 6.5, Radiant and Convective Space Heating and Cooling.

- $q_m$  = latent heat flux,  $W/m^2$
- $A_s$  = snow-free area ratio, dimensionless
- $q_a$  = convective and radiative heat flux from snow-free surface,  $W/m^2$
- $q_r$  = heat flux of evaporation,  $W/m^2$

**Sensible and Latent Heat Fluxes.** The sensible heat flux  $q_i$  is the heat flux required to raise the temperature of snow falling on the slab to the melting temperature plus, after the snow has melted, to raise the temperature of the liquid to the assigned temperature  $t_l$  of the liquid film. The snow is assumed to fall at air temperature  $t_a$ . The latent heat flux  $q_m$  is the heat flux required to melt the snow. Under steady-state conditions, both  $q_i$  and  $q_m$  are directly proportional to the snowfall rate  $r$ :

**Snow-Free Area Ratio.** Sensible and latent (melting) heat fluxes occur on the entire slab during snowfall. On the other hand, heat and mass transfer at the slab surface depend on whether there is a snow layer on the surface. Any snow accumulation on the slab acts to partially insulate the surface from heat losses and evaporation. The insulating effect of partial snow cover can be large. Because snow may cover a portion of the slab area, it is convenient to think of the insulating effect in terms of an effective or equivalent snow-covered area  $A_s$ , which is perfectly insulated and from which no evaporation and heat transfer occurs. The balance is then considered to be the equivalent snow-free area  $A_f$ . This area is assumed to be completely covered with a thin liquid film; therefore, both heat and mass transfer occur at the maximum rates for the existing environmental conditions. It is convenient to define a dimensionless snow-free area ratio  $A_s$ :

$$A_s = \frac{A_f}{A_s} \quad (2)$$

where

- $A_f$  = equivalent snow-free area,  $m^2$
- $A_s$  = equivalent snow-covered area,  $m^2$
- $A_s = A_f + A_s$  = total area,  $m^2$

Therefore,

$$0 \leq A_s \leq 1$$

To satisfy  $A_s = 1$ , the system must melt snow rapidly enough that no accumulation occurs. For  $A_s = 0$ , the surface is covered with snow of sufficient thickness to prevent heat and evaporation losses. Practical snow-melting systems operate between these limits. Earlier studies indicate that sufficient snow-melting system design information is obtained by considering three values of the free area ratio: 0, 0.5, and 1.0 (Chapman 1952).

**Heat Flux because of Surface Convection, Radiation, and Evaporation.** Using the snow-free area ratio, appropriate heat and mass transfer relations can be written for the snow-free fraction of the slab  $A_s$ . These appear as the third and fourth terms on the right-hand side of Equation (1). On the snow-free surface, maintained at

#### ASHRAE Handbook—HVAC Application: (S1)

- = characteristic length of slab in direction of wind, m
- = Prandtl number for air, taken as  $Pr = 0.7$
- = Reynolds number based on characteristic length  $l$ .

$$Ra_L = \frac{l^3 \rho \beta \Delta T}{\nu \alpha} \quad (7)$$

- = design wind speed near slab surface, km/h
- = kinematic viscosity of air,  $m^2/s$
- =  $1000 \text{ m/km} \times 1 \text{ h/3600 s} = 0.278$

hour specific wind data for winter, the extreme wind data in § 25 of the 2005 *ASHRAE Handbook—Fundamentals* may be used to actual measured data. If the snow-melting surface is horizontal, the convection heat transfer coefficient might be different in many applications, this difference is negligible.

In Equations (6) and (7), it can be seen that the turbulent convection heat transfer coefficient is a function of  $L^{-0.7}$ . Because of windship, shorter snow-melting slabs have higher convective transfer coefficients than longer slabs. For design, the shortest slab should be used (e.g., for a long, narrow driveway or sidewalk the width). A snow-melting slab length  $L = 6.1 \text{ m}$  is used for transfer calculations that resulted in Tables 1, 2, and 3. mean radiant temperature  $T_{mr}$  in Equation (5) is the wet blackbody temperature of the surroundings of the snow-free slab. Under snowfall conditions, the entire surroundings are usually at the ambient air temperature (i.e.,  $T_{mr} = T_a$ ). When no snow precipitation (e.g., during idling and after snowfalls on days  $A_s < 1$ ), the mean radiant temperature is approximated by the following equation:

$$T_{mr} = (T_{cloud}^4 F_{rc} + T_{sky}^4 F_{rc}(1 - F_{rc}))^{1/4} \quad (8)$$

- = fraction of radiation exchange that occurs between slab and clouds
- = temperature of clouds, K
- = temperature of clear sky, K

equivalent blackbody temperature of a clear sky is primarily a function of the ambient air temperature and the water content of the atmosphere. An approximation for the clear sky temperature is given by the following equation, which is a curve fit of data in Ramsey (1982):

$$T_{sky} = T_a - (1.1058 \times 10^3 - 7.562 T_a + 1.333 \times 10^{-7} T_a^3 - 31.2926 + 14.580 T_a^3) \quad (9)$$

- = ambient temperature, K
- = relative humidity of air at elevation for which typical weather measurements are made, decimal

cloud-covered portion of the sky is assumed to be at  $T_{cloud}$ . Height of the clouds may be assumed to be 3000 m. The size of the clouds at 3000 m is calculated by subtracting duct of the average lapse rate (rate of decrease of atmospheric pressure with height) and the altitude from the atmospheric pressure  $P_a$ . The average lapse rate, determined from the tables of Standard Atmosphere (COESA 1976), is 6.4 K per 1000 m of air (Ramsey et al. 1982). Therefore, for clouds at 3000 m,

$$T_{cloud} = T_a - 19.2 \quad (10)$$

be calculated using appropriate equations. Both are presented in Chapter 6 of the 2005 *ASHRAE Handbook—Fundamentals*.

**Heat Flux Calculation.** Equations (1) to (14) can be used to determine the required heat fluxes of a snow-melting system. However, calculations must be made for coincident values of snowfall rate, wind speed, ambient temperature, and dew-point temperature (or another measure of humidity). By computing the heat flux for each snowfall hour over a period of several years, a frequency distribution of hourly heat fluxes can be developed. Annual averages or maximums for climatic factors should never be used in sizing a system because they are unlikely to coexist. Finally, it is critical to note that the preceding analysis only describes what is happening at the upper surface of the snow-melting surface. Edge losses and back losses have not been taken into account.

**Example 1.** During the snowfall that occurred during the 8 hr (on December 26, 1985, in the Detroit metropolitan area, the following simultaneous conditions existed: air dry-bulb temperature =  $-8.3^\circ\text{C}$ , dew-point temperature =  $-10^\circ\text{C}$ , wind speed =  $31.7 \text{ km/h}$ , and snowfall rate =  $2.54 \text{ mm}$  of liquid water equivalent per hour. Assuming  $l = 6.1 \text{ m}$ ,  $Pr = 0.7$ , and  $Sc = 0.6$ , calculate the surface heat flux  $q_s$  for a snow-free area ratio of  $A_s = 1.0$ . The thermo-dynamic and transport properties used in the calculation are taken from Chapters 6 and 39 of the 2005 *ASHRAE Handbook—Fundamentals*. The entrance of the wet surface of the heated slab is 0.5.

**Solution:**

By Equation (3),

$$q_i = 1000 \times \frac{2.54}{3.6 \times 10^3} (2100(0 + 8.3) + 4290(0.56 - 0)) = 14.0 \text{ W/m}^2$$

By Equation (4),

$$q_m = 1000 \times \frac{2.54}{3.6 \times 10^3} \times 334.000 = 235.6 \text{ W/m}^2$$

By Equation (7),

$$Ra_L = \frac{31.7 \times 6.1 \times 0.278}{1.3 \times 10^{-6}} = 4.13 \times 10^8$$

By Equation (8),

$$T_{mr} = 0.037 \left( \frac{0.0235}{6.1} \right) (4.13 \times 10^8)^{0.8} (0.7)^{1/3} = 24.8 \text{ W/(m}^2 \cdot \text{K)}$$

By Equation (5),

$$q_a = 24.8(0.56 + 8.3) + (5.670 \times 10^{-9})(0.9)(273.7^4 - 264.9^4) = 218.8 \text{ W/m}^2$$

By Equation (12),

$$h_m = \left( \frac{0.7}{0.6} \right)^{1/3} \frac{24.8}{133 \times 1000} = 0.0206 \text{ m/s}$$

Obtain the values of the saturation vapor pressures at the dew-point temperature  $-10^\circ\text{C}$  and the film temperature  $0.56^\circ\text{C}$  from Table 3 in Chapter 6 of the 2005 *ASHRAE Handbook—Fundamentals*. Then, use Equation (13) to obtain  $W_s = 0.00160 \text{ kg}_{\text{water}}/\text{kg}_{\text{air}}$  and  $W_f = 0.00393 \text{ kg}_{\text{water}}/\text{kg}_{\text{air}}$ . By Equation (11),

$$q_r = 1.33 \times 0.0206(0.00393 - 0.00160) \times 2499 \times 10^3 = 159.5 \text{ W/m}^2$$

By Equation (1),

$$q_s = 14.0 + 235.6 + 1.0(218.8 + 159.5) = 664 \text{ W/m}^2$$

Note that this is the heat flux needed at the snow-melting surface of the slab. Back and edge losses must be added as discussed in the section on Back and Edge Heat Losses.

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2007 ASHRAE Handbook—HVAC Applications (SI)

Table 1 Frequencies of Snow-Melting Surface Heat Fluxes at Steady-State Conditions<sup>†</sup>

Location	Snowfall Hours per Year	Snow-Free Area Ratio, $A_f$	Heat Fluxes Not Exceeded During Indicated Percentage of Snowfall Hours from 1982 Through 1993, W/m <sup>2</sup>					
			75%	90%	95%	98%	99%	100%
Bismarck, ND	227	0.5	203	282	302	308	403	708
		0	71	104	142	188	215	315
		1	474	627	729	867	949	1504
Bismarck, ND	158	0.5	263	338	390	464	520	767
		0	30	95	122	189	230	269
		1	183	250	314	398	460	849
Boise, ID	85	0.5	118	145	207	254	280	517
		0	71	97	127	166	195	317
		1	303	431	519	654	724	1152
Boston, MA	112	0.5	207	299	353	470	601	1152
		0	118	235	292	380	544	1152
		1	364	525	664	871	1040	1799
Buffalo, NY	292	0.5	314	305	399	517	594	1227
		0	72	123	174	294	355	781
		1	288	410	485	580	632	1081
Burlington, VT	204	0.5	182	247	289	358	405	1081
		0	72	125	173	247	298	1081
		1	375	542	635	721	823	1117
Chayenne, WY	224	0.5	219	305	351	413	469	906
		0	32	118	165	241	317	900
		1	303	386	482	586	740	1843
Chicago, IL, O'Hare International Airport	124	0.5	184	242	297	358	431	835
		0	72	120	168	235	262	474
		1	287	391	494	613	726	1383
Cleveland, OH	188	0.5	185	229	291	373	465	741
		0	71	118	149	217	259	713
		1	281	425	525	637	692	1031
Colorado Springs, CO	159	0.5	178	258	311	392	442	687
		0	72	141	191	274	354	721
		1	303	317	389	471	553	1035
Columbus, OH, International	66	0.5	143	180	233	274	306	580

		1	92	130	156	192	212	360
Detroit, MI, Metro Airport	153	0.5	57	77	94	118	134	227
		0	23	38	47	75	89	194

		0	72	143	212	306	353	758
		1	185	247	434	520	539	704
Eugene, OR	18	0.5	149	242	292	373	385	517
		0	95	166	220	321	379	517
		1	287	382	494	549	639	1232
Fairbanks, AK	288	0.5	185	214	247	297	342	630
		0	48	74	99	126	152	295
		1	276	439	542	740	891	1581
Baltimore, MD, BWI Airport	56	0.5	219	342	465	631	751	1142
		0	145	264	374	571	677	964
		1	289	358	610	734	869	1237
Great Falls, MT	233	0.5	224	292	337	407	453	663
		0	53	98	143	190	238	452
		1	300	421	498	613	678	897
Indianapolis, IN	96	0.5	184	254	304	366	391	658
		0	71	118	165	261	312	658

<sup>†</sup>Heat fluxes are at the snow-melting surface only. See text for calculation of back and edge heat loss fluxes.

50.4

2007 ASHRAE Handbook—HVAC Applications (SI)

Table 1 Frequencies of Snow-Melting Surface Heat Fluxes at Steady-State Conditions<sup>a</sup>

Location	Snowfall Hours per Year	Snow-Free Area Ratio, $A_f$	Heat Fluxes Not Exceeded During Indicated Percentage of Snowfall Hours from 1982 Through 1993, W/m <sup>2</sup>					
			75%	90%	95%	98%	99%	100%
Milwaukee, WI	161	0.3	194	263	320	404	465	777
		1	73	145	214	309	379	732
		0	376	532	608	722	801	1048
Minneapolis-St. Paul, MN	199	0.3	230	312	360	434	481	904
		1	74	143	192	266	355	773
		0	287	423	518	654	700	1051
New York, NY, JFK Airport	61	0.3	199	284	372	437	517	1024
		1	119	214	270	356	450	995
		0	370	529	677	811	820	1021
Oklahoma City, OK	35	0.3	226	320	389	419	453	655
		1	74	145	213	247	355	796
		0	342	468	598	702	817	1143
Omaha, NE	94	0.3	204	281	350	405	425	786
		1	72	121	189	283	315	429
		0	299	439	525	634	717	1376
Peoria, IL	91	0.3	183	260	313	375	410	789
		1	72	119	167	239	291	718
		0	298	406	487	637	777	1038
Philadelphia, PA, International Airport	56	0.3	204	282	353	411	582	942
		1	119	197	249	350	474	711
		0	262	393	502	613	690	1335
Pittsburgh, PA, International Airport	168	0.3	160	238	297	349	406	681
		1	49	97	144	214	244	428
		0	377	530	613	738	837	1349
Portland, ME	157	0.3	239	342	418	530	628	1185
		1	122	212	285	409	479	1021
		0	159	246	321	358	755	934
Portland, OR	15	0.3	122	175	256	360	411	627
		1	72	141	188	246	321	404
		0	438	641	793	964	1107	1719
Rapid City, SD	177	0.3	245	349	416	519	578	773
		1	49	95	121	166	204	564
		0	158	227	280	385	431	604

Sault Ste. Marie, MI	1	112	153	183	216	249	439
	0.5	66	88	104	125	142	239
	0	23	37	47	68	83	188

Spokane, WA	144	0.3	191	271	329	398	459
		1	72	118	141	170	210
		0	348	490	566	677	707
Springfield, MO	58	0.3	220	299	348	449	518
		1	101	171	238	362	407
		0	397	468	537	608	715
St. Louis, MO, International Airport	62	0.3	207	284	330	399	454
		1	97	169	214	306	329
		0	323	482	607	738	773
Topeka, KS	61	0.3	201	291	347	415	458
		1	73	122	165	213	244
		0	364	517	660	782	900
Wichita, KS	60	0.3	225	302	367	432	481
		1	74	143	179	237	260
		0	438	641	793	964	1107

<sup>a</sup>Heat fluxes are at the snow-melting surface only. See text for calculation of back and edge heat loss fluxes.

## Snow Melting and Freeze Protection

50.9

Table 3 Annual Operating Data at 99% Satisfaction Level of Heat Flux Requirement

City	Time, h/yr		2% Min. Snow Temp., °C	Annual Energy Requirement per Unit Area at Steady-State Conditions, <sup>a</sup> kWh/m <sup>2</sup>					
				System Designed for $A_r = 1$		System Designed for $A_r = 0.5$		System Designed for $A_r = 0$	
	Melting	Idling		Melting	Idling	Melting	Idling	Melting	Idling
Boston, MA	112	1273	-8.8	24.3	246.0	17.2	245.7	10.1	245.2
Buffalo, NY	292	1779	-15.7	75.5	333.8	46.5	332.8	17.5	321.5
Burlington, VT	204	2215	-15.4	41.6	464.0	26.8	453.6	11.9	424.6
Chattanooga, TN	224	2152	-26.5	63.3	399.7	37.6	396.3	11.9	381.4
Chicago, IL, O'Hare International Airport	124	1854	-15.7	26.8	368.0	17.0	355.7	7.1	316.7
Cleveland, OH	188	1570	-12.9	36.0	272.9	23.2	269.6	10.1	255.0
Colorado Springs, CO	159	1925	-22.6	35.1	306.1	22.4	305.5	9.5	303.6
Columbus, OH, International Airport	92	1429	-10.7	14.4	224.1	9.4	214.5	4.3	193.7
<b>Detroit, MI, Metro Airport</b>	<b>153</b>	<b>1,781</b>	<b>11.3</b>	<b>10,199</b>	<b>104,404</b>	<b>6,467</b>	<b>102,289</b>	<b>2,704</b>	<b>95,777</b>
Ely, NV	153	2445	-10.4	23.4	445.6	16.6	439.2	9.8	431.8
Eugene, OR	18	481	-9.0	2.7	53.7	2.0	53.6	1.4	53.6
Fairbanks, AK	288	4258	-26.5	62.5	1083.9	36.9	1005.7	11.2	612.6
Baltimore, MD, BWI Airport	56	957	-8.8	12.1	142.3	9.4	142.3	6.7	142.3
Great Falls, MT	233	1907	-26.5	62.1	390.5	37.0	380.4	11.8	320.8
Indianapolis, IN	96	1475	-11.8	20.7	255.3	15.0	247.7	5.4	239.5
Lexington, KY	50	1106	-10.4	8.5	170.6	5.4	164.9	2.3	144.6
Madison, WI	161	2308	-14.9	36.0	471.1	23.0	464.0	9.8	441.9
Memphis, TN	13	473	-10.7	3.2	68.6	2.2	67.9	1.2	66.6
Milwaukee, WI	161	1980	-13.8	36.8	401.3	23.9	391.0	10.8	378.3
Minneapolis-St. Paul, MN	199	2513	-17.6	52.1	580.3	32.6	563.0	12.9	526.5
New York, NY, JFK Airport	61	885	-7.6	13.2	159.8	9.4	159.2	5.7	157.9
Oklahoma City, OK	35	686	-14.0	9.3	129.2	5.8	125.3	2.3	120.8
Oxnard, NE	94	1981	-19.0	23.4	392.0	14.5	377.1	5.6	355.5
Peoria, IL	91	1748	-16.5	20.6	329.2	12.9	317.2	5.1	294.6
Philadelphia, PA, International Airport	56	992	-7.6	11.9	159.3	8.4	159.0	5.0	158.3
Pittsburgh, PA, International Airport	168	1514	-12.6	31.6	250.1	20.0	245.2	8.3	228.2
Portland, ME	157	1996	-13.8	42.0	363.5	28.3	363.3	14.6	362.2
Portland, OR	15	329	-5.7	2.0	42.3	1.5	41.6	1.0	40.7
Rapid City, SD	177	2154	-20.4	53.3	433.7	30.7	425.9	8.0	334.6
Reno, NV	63	1436	-8.8	7.2	172.6	5.7	172.5	4.1	172.5
<b>Sault Ste. Marie, MI</b>	<b>425</b>	<b>2,731</b>	<b>-0.3</b>	<b>34,249</b>	<b>176,517</b>	<b>20,779</b>	<b>174,506</b>	<b>7,250</b>	<b>155,508</b>
Seattle, WA	27	480	-7.9	3.8	53.1	2.0	52.0	2.1	52.0
Spokane, WA	144	1832	-11.8	21.8	255.5	14.9	249.7	7.9	235.6
Springfield, MO	58	1108	-14.0	13.9	180.3	9.3	179.6	4.7	177.4
St. Louis, MO, International Airport	62	1150	-14.0	14.2	204.0	9.4	200.1	4.6	191.7
Topeka, KS	61	1409	-18.8	14.2	238.4	8.9	235.5	3.6	215.7
Wichita, KS	60	1223	-17.6	15.6	218.2	9.8	213.9	3.9	192.4

<sup>a</sup>Does not include back and edge heat losses

## Idle vs. Non-Idle

*An Operational Differences between the Larry C. Hardy & Old Town Parking Garages*

Larry C. Hardy Parking Garage



Idle System

Old Town Parking Garage



Non-Idle System



## Size Comparison



### Larry C. Hardy Parking Garage

- 8930 sq. ft. – Ramp
- 9015 sq. ft. – Sidewalk / Entrance
- 17,945 sq. ft. – Total sq. ft.

### Differences

- Entrance – 150 btu / sq. ft.
- Sidewalks – 150 btu / sq. ft.
- Ramp – 200 btu / sq. ft.
- Entrance – Concrete



### Old Town Parking Garage

- 8640 sq. ft. – Ramp
- 6200 sq. ft. – Sidewalk / Entrance
- 14,840 sq. ft. – Total sq. ft.

### Differences

- Brick Entrance – 300 btu / sq. ft.
- Sidewalks / Drive – 250 btu / sq. ft.
- Ramp – 250 btu / sq. ft.
- Entrance – Brick

## Larry C. Hardy Garage



The Larry C. Hardy Garage is a traditional idling snowmelt system that uses a universal snow controller, operating in (2) modes: 1. Snowmelt Mode & 2. Idle mode. The idle mode is in continual operation throughout the snow melt season, maintaining a set temperature, until such point it is called on to melt snow.

- In-slab Snow Detector (38 degrees)
- Start Temp “Warm Weather Shutdown” (40 degrees)
- Idle Mode (28 degrees  $\pm$  )
- Snow Occurrence (40 degrees) slab temperature
- "Cold Weather Cut Out" (10 degrees)

## Old Town Parking Garage

The Old Town Parking Garage is equipped with a non-idling Snow-Tech snowmelt system. There is no idle mode in this system, it operates only when called on to melt snow.

- No-Idle
- Provides Considerable Energy Savings
- Roof Top Sensor
- Capable of Cold Start Up
- No "Cold Weather Cut Out"
- Will Not Crack Concrete
- Output Backs Down Once Slab Is Warm



## Old Town Parking Garage



# 2011/2012 Seasonal Comparison

## Larry C. Hardy Deck

Sq ft 17945

## Old Town Deck

Sq ft 14,840

Season 2011/2012	Days	Usage in CCF	Dollars	\$ / day	\$ / Sq. ft.	CCF / Sq. ft.
September			\$ -			
October	61	717	\$ 762.34			
November	29	1296	\$ 1,313.79			
December	35	4374	\$ 4,381.70			
January			\$ -			
February	30	8742	\$ 8,519.60			
March	33	6689	\$ 6,523.29			
April	29	720	\$ 724.47			
May						
June						
July						
August						
<b>Totals</b>	<b>217</b>	<b>22538</b>	<b>\$22,225.19</b>	<b>\$102.42</b>	<b>\$ 1.24</b>	<b>1.255948732</b>

Season 2011/2012	Days	Usage in CCF	Dollars	\$ / day	\$ / Sq. ft.	CCF / Sq. ft.
September			\$ -			
October	62	66	\$ 107.45			
November	28	191	\$ 183.60			
December	31	1014	\$ 845.77			
January	33	2549	\$ 2,008.25			
February			\$ -			
March	34	2631	\$ 2,065.31			
April	29	505	\$ 424.20			
May			\$ -			
June			\$ -			
July			\$ -			
August			\$ -			
<b>Totals</b>	<b>217</b>	<b>6956</b>	<b>\$ 5,634.58</b>	<b>\$25.97</b>	<b>\$ 0.38</b>	<b>0.468733154</b>

### Comparisons\*:

1. \$/Day  $\$25.97 / \$102.42 = .25$  – Old Town 75% less per day
2. \$/Sq. Ft.  $\$.38 / \$1.24 = .31$  – Old Town 69% less per Sq. Ft.
3. CCF/Sq. Ft.  $.47 / 1.26 = .37$  – Old Town 63% less gas usage \*

\* Gas is purchased at different rates for each of these parking decks so, for the best comparison, look at gas usage. As we know, this past winter was very mild . These figures illustrate the extreme cost of idling, as we did not have a number of snow storms this past season.

## Additional Cost

Outside of gas usage, there are additional cost differences between an idle and non-idle snow melt system

- Electrical Costs – continual operation of pumps in an idling system
- Maintenance – wear and tear on pumps, boilers and other components that operate more frequently



## The Larry C. Hardy Garage – Idling System



- There are (2) 7.5 hp pumps at the garage
- The pumps turn on and run continuously once the controller comes out of Warm Weather Shut down
- The pumps turn off in the spring when the weather gets warm again
- The next page details the cost of running the pumps during idle mode. The Old Town Parking Garage does not operate with an idle, so this addition cost is only seen with the idling system

## The Math

Full amp load for a 7.5 hp pump is 9.07 amps

9.07 full amp load  
x 480 volts  
x the square root of 3 (1.732)  
7532 watts

7532 watts/ 1000 = 7.53 Kw

7.53 kw x \$0.1035/kw hr (cost of electricity)  
x 2256 hours per year\*  
\$1758/year operating cost for each pump

The Larry C. Hardy Garage, with its (2) 7.5 hp pumps is  
\$1758 x 2 = \$3516

\*ASHRAE – Table 3. Annual Operating Data at 99% Satisfaction Level of Heat Flux Requirement.

Because there is not an actual Time, hr/yr idle measurement for Traverse City, MI, within the ASHRAE Handbook, an approximation was derived by combining Sault St. Marie and Detroit, Michigan data and averaging those totals.





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Most of us in the trade readily see the value of snowmelt systems. Yet, many building and facility owners have yet to embrace them.

### Warming up to Snowmelt Technology

**Operating cost. Snowmelts themselves are not that expensive to operate**, since they're only activated occasionally. The biggest cost incurred with a snowmelt system is the up-front cost. Glycol antifreeze is required for all systems, because system fluid is either dormant or could go dormant for a period of time. Relatively large pumps may be required to move slushy water-glycol mixture on initial system startup. Larger heat sources are required to deliver the 100 – 300 Btu/hr-sq ft. Supply and return piping is required to get the energy from the boiler to the manifolds for the tubing buried in the slab. With all these factors, including a larger heat source, a snowmelt system can typically cost between \$6 – \$12 per square foot.

**• On-off systems. The cheapest systems to operate are on-off snowmelts**, because they are only used five or 10 times a year. As an example, a Class II system in Buffalo, N.Y. may cost about \$0.21 per square foot per year. The same system in Chicago may cost \$0.12 per square foot per year. In Minneapolis, cost of operation might be \$0.25 per square foot per year.

**• Idled systems. Idled systems cost more to operate**, because they operate any time the temperature is below 38 F. These typically consume up to 100 Btu/hr-sq ft whenever they are idling and up to 300 Btu/hr-sq ft. during full operation. Whether you're trying to eliminate snow in Lowell, Ark.— or warming a hospital entrance in Nome, Alaska, a snowmelt system, could be the answer you are seeking.

## Conclusion

This information is a quick look into the potential savings of using a non-idling hydronic snow melt system over an idling system. The Dale Prentice company would be happy to discuss this information in greater detail. Prentice also represents TYCO Thermal Controls and their electronic snowmelt systems. Whether it is hydronic, electronic or a hybrid of both, our associates are here to offer you the best solutions for your surface, roof and gutter snow melting needs.