

### Snow/Ice Melting Systems

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Calcs

Academic  
Exercise

### Snow/Ice Melting Systems

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Client

5W

### Snow/Ice Melting Systems


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- Client
- Who are they?
- What do they expect?
- Where do they expect it?
- When do they expect it?
- Why do they expect it?

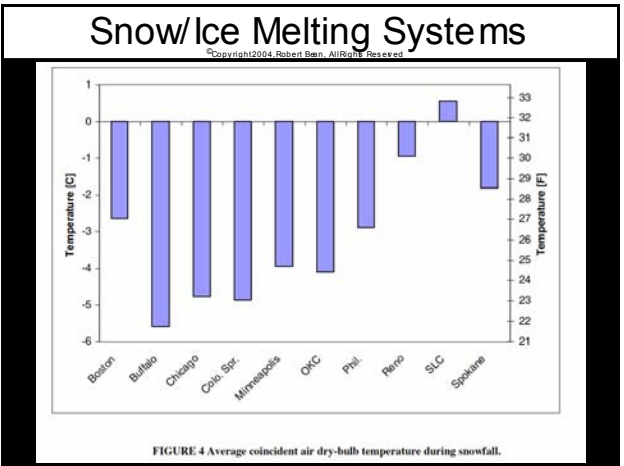
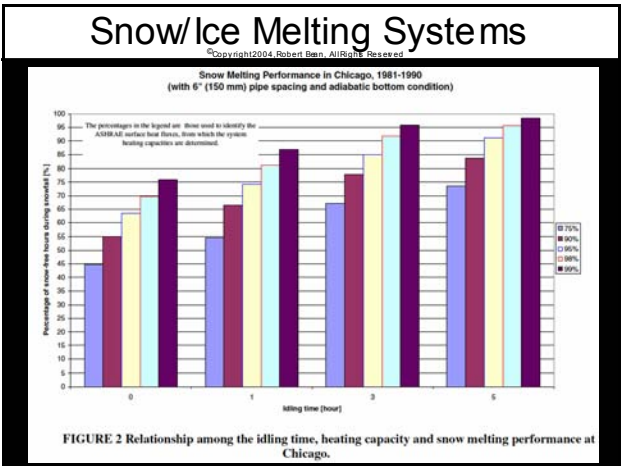
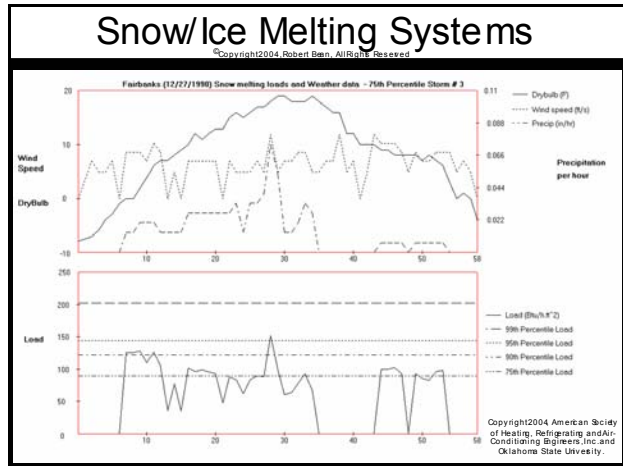
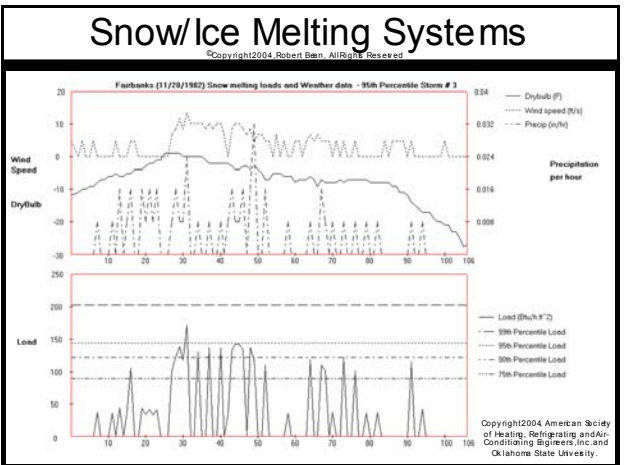
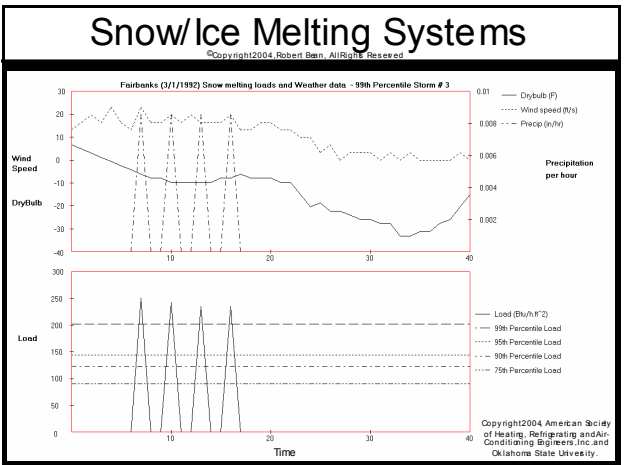
### Snow/Ice Melting Systems

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- Client
- Residential
- Commercial
- Institutional
- Industrial
- Agricultural



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### Snow/Ice Melting Systems

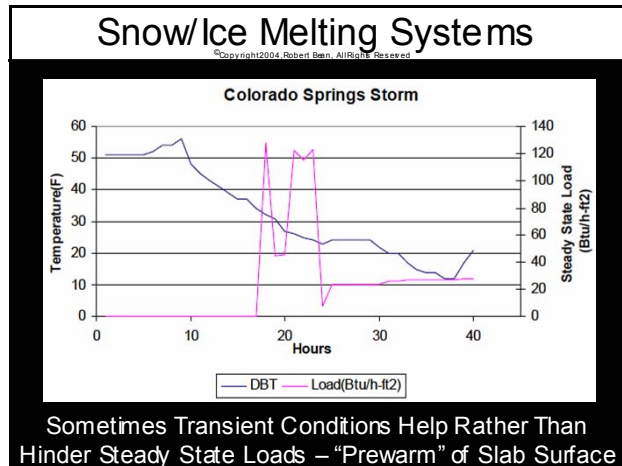
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		Ar = 1.0				Ar = 0.0				
		Spokane	Reno	S.L.C.	Spring	Spokane	Reno	S.L.C.	Spring	
No insulation	Kiss=0.5 Btu/h-ft <sup>2</sup>	Spacing=6"	150	137	120	219	67	113	104	112
		Spacing=8"	367	227	146	364	161	146	127	83
		Spacing=12"	437	258	157	432	193	157	146	75
		Depth=4"	736	372	191	704	319	219	201	89
		Depth=8"	523	295	167	567	316	210	172	140
Depth=12"	599	301	167	614	312	213	180	139		
Depth=12"	654	353	184	631	319	200	261	130		

**Loads are Location and System Specific**

Transient Loads vs Steady State Loads

		Spokane	Reno	S.L.C.	Spring	Spokane	Reno	S.L.C.	Spring	
with 2" insulation layer	Kiss=0.5 Btu/h-ft <sup>2</sup>	Spacing=6"	367	212	133	372	178	146	123	79
		Spacing=8"	429	242	135	429	204	157	134	72
		Spacing=12"	687	317	161	642	347	208	178	84
		Depth=4"	494	240	138	511	333	188	151	123
		Depth=8"	532	242	135	544	334	193	154	121
Depth=12"	717	281	146	704	342	229	211	122		



### Snow/Ice Melting Systems

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- Spacing
- Striping
- Storm
- Depth
- Temps
- Insulation

Fig. 17. Driveway area shown in Fig. 15, but taken after a 7 inch snowfall

Fig. 18. Driveway area 45 minutes after Fig. 17.

### Snow/Ice Melting Systems

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		Ar = 1.0				Ar = 0.0				
		Spokane	Reno	S.L.C.	Spring	Spokane	Reno	S.L.C.	Spring	
No Insulation	Kiss=0.5 Btu/h-ft <sup>2</sup>	Spacing=6"	16.4	18.1	16.6	12.89	18.1	15.1	16.7	9.7
		Spacing=8"	17.1	18.7	16.8	13.86	19.0	15.6	18.3	8.1
		Spacing=12"	16.6	19.0	16.7	15.32	19.9	16.2	20.3	9.6
		Depth=4"	22.5	23.9	24.3	21.82	25.3	23.1	24.2	16.5
		Depth=8"	21.6	24.4	24.6	22.50	25.7	23.5	25.0	16.8
Depth=12"	21.0	24.6	24.6	23.22	25.8	23.8	26.3	19.5		

**Back Losses with or without insulation**

Transient Loads, Btu/hr • ft<sup>2</sup>

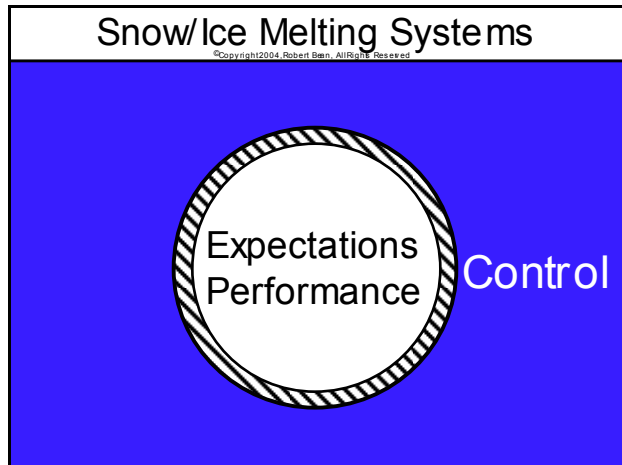
		Spokane	Reno	S.L.C.	Spring	Spokane	Reno	S.L.C.	Spring	
with 2" insulation layer	Kiss=0.5 Btu/h-ft <sup>2</sup>	Spacing=6"	2.3	2.4	2.2	1.97	2.1	1.5	2.4	0.6
		Spacing=8"	2.5	2.4	2.2	2.13	2.3	1.6	2.5	0.4
		Spacing=12"	2.5	2.4	2.4	2.29	2.7	1.8	2.8	0.9
		Depth=4"	3.6	3.3	3.2	3.23	3.7	2.7	3.6	2.1
		Depth=8"	3.5	3.3	3.3	3.34	3.7	2.7	3.7	2.2
Depth=12"	3.6	3.5	3.4	3.42	3.7	2.9	3.8	2.5		

### Snow/Ice Melting Systems

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- Client
- Establish
- Expectations

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### Snow/Ice Melting Systems

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- Controls
- Climate
- Consumption
- Btu Release
- Production
- Btu Generate

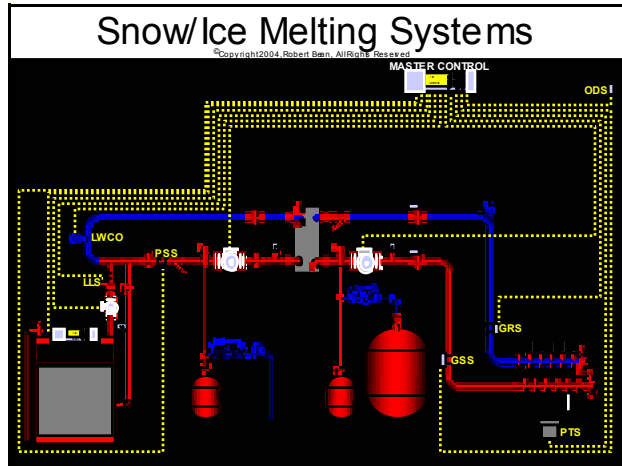
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- Controls
- Manage
- Expectations
- Performance

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Snow/Ice Melting Systems

Heat Container

Construct

Snow/Ice Melting Systems

Snow/Ice Melting Systems

- Construct
- On Grade Btu Container
- Without a lid
- Controlling and Directing Heat
- Heat Transfer Principals
- Reducing Parasitic Losses

Snow/Ice Melting Systems

- Construct
- Sub grade
- Moisture
- Insulation
- Structure
- Surface

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Snow/Ice Melting Systems

- Construct
- Sub grade
- Excavation
- Undisturbed
- Compacted
- Drainage

Snow/Ice Melting Systems

- Construct
- Moisture
- Water Table
- Run Off
- Melted Snow
- Splash

Snow/Ice Melting Systems

- Construct
- Insulation

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Snow/Ice Melting Systems

- Construct
- Structure

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Snow/Ice Melting Systems

- Construct
- Structure
- Tube

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### Snow/Ice Melting Systems

- Construct
- Surface



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### Snow/Ice Melting Systems

Calcs Academic Exercise

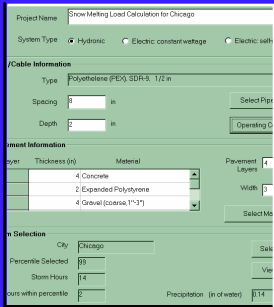
### Snow/Ice Melting Systems

- Calcs
- Melting Snow
- Releases Btu's
- How?
- Upward Loss
- Downward Loss



### Snow/Ice Melting Systems

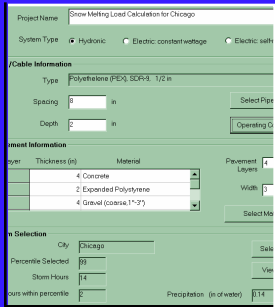
- Calcs
- Software
- Weather
- Construction
- Expectations
- Controls



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### Snow/Ice Melting Systems


- Calcs
- Software
- Weather
- Construction
- Expectations
- Controls



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### Snow/Ice Melting Systems


- Calcs
- Idle
- On



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### Snow/Ice Melting Systems

- Calcs
- Fluid Temp



### Snow/Ice Melting Systems

- Calcs
- Radiant Loss
- Cloud Cover



### Snow/Ice Melting Systems


- Calcs
- Back Losses



### Snow/Ice Melting Systems

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- Calcs
- Idle
- On
- Idle




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### Snow/Ice Melting Systems

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- Calcs
- Wind

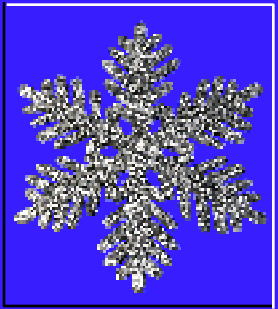
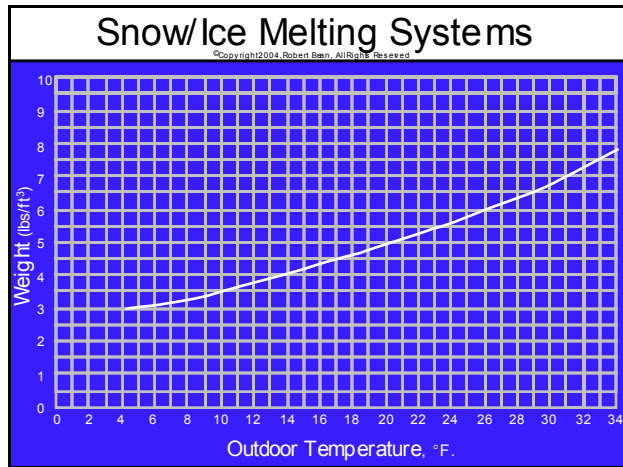


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- Calcs
- Snow Density

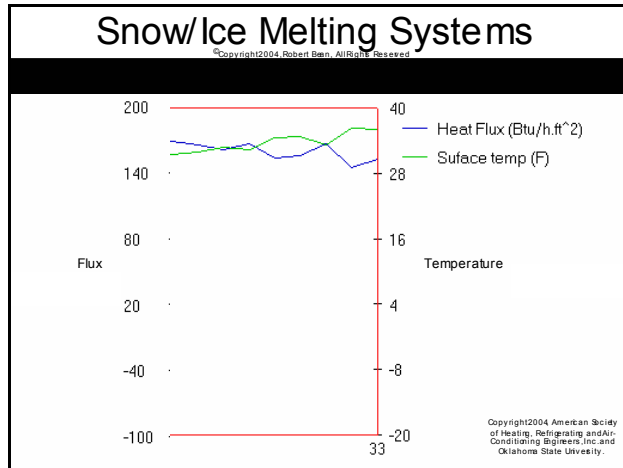
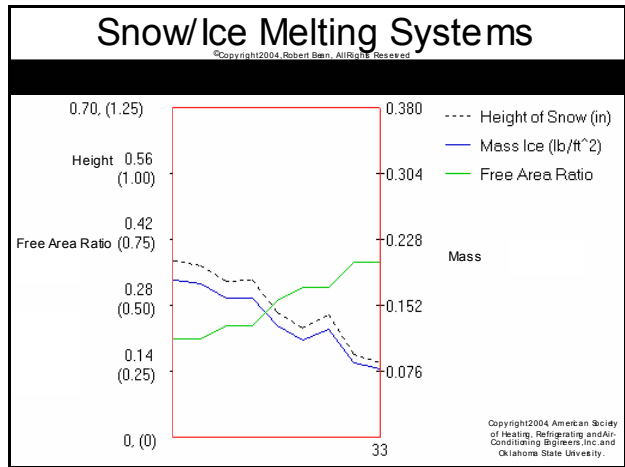
### Snow/Ice Melting Systems

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- Calcs
- One Example
- 2" Depth
- 8" Spacing
- 130°F avg.




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### Snow/Ice Melting Systems

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#### Applications Other Than Snow



### Snow/Ice Melting Systems

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