

APPENDIX A
DECISION TOOL SOFTWARE SCREEN CAPTURES

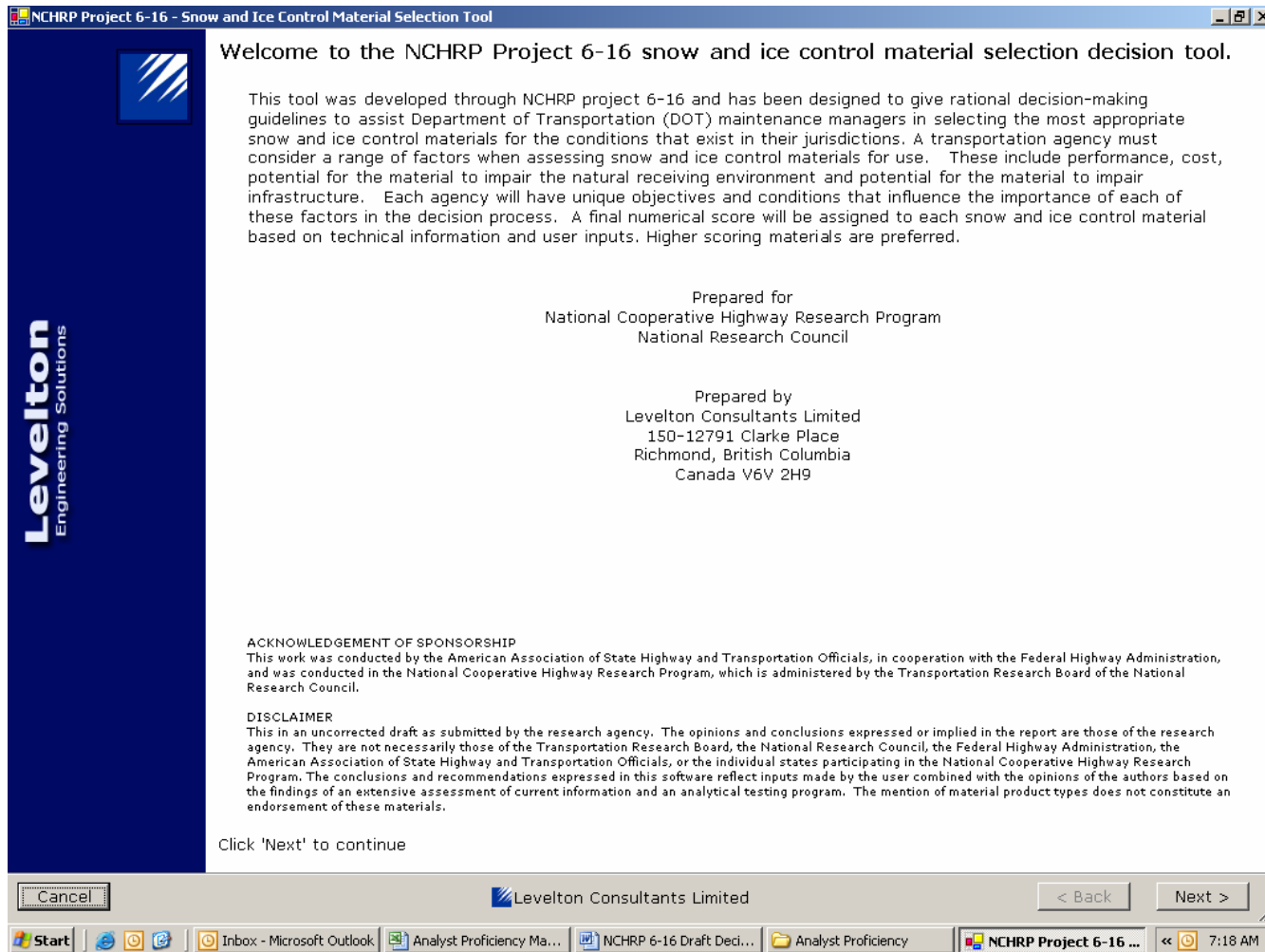


Figure A-1 – Decision Tool Software - Introduction Page

NCHRP Project 6-16 - Snow and Ice Control Material Selection Tool

Enter agency and temperature information
 Input the xth percentile (85th is recommended) cold winter temperature experienced in the maintenance area. This will be based on an assessment of historic winter pavement temperatures. Air temperatures may be used if pavement temperature is not available.

Agency

Name: State DOT
 Maintenance Area: Region 1
 Assessor: John Doe
 Date: 6/1/2005

Address

Street: 12345 67th Street
 City: Anytown
 State / Province: State
 Zip / Postal Code: 12345
 Country: USA

Temperature

Temperature: 10.00
 Scale: Fahrenheit
 Percentile: 85
 Based On: Pavement

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Figure A-2 – Decision Tool Software - Agency and Temperature Information

NCHRP Project 6-16 - Snow and Ice Control Material Selection Tool

Prioritize agency objectives
 Prioritize agency objectives using percentages for Cost, Performance, Environmental Impact and Infrastructure Impact. The sum of these priorities must equal 100%. Prioritize the Environmental Impact and Infrastructure Impact subcategories using percentages.

Objective	Priority	Operational Objective	Priority
Cost	25.00		
Performance	25.00		
Environmental Impact	25.00	Air Quality	27.00
		Aquatic Life	20.00
		Drinking Water	20.00
		Soil	0.00
		Terrestrial Fauna	13.00
		Vegetation	20.00
		Environmental Impact Sub Item Total*	100
Infrastructure Impact	25.00	Concrete Corrosion	30.00
		Concrete Degradation	20.00
		Metal Infrastructure	28.00
		Vehicles	22.00
		Infrastructure Impact Sub Item Total*	100
Grand Total*	100		

*** All totals must equal 100 before you can proceed to the next step**

It is required that the Performance category priority not be less than 25%. It is recommended that the Aquatic Life subcategory priority not be less than 25%.

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Figure A-3 – Decision Tool Software - Agency Objectives

NCHRP Project 6-16 - Snow and Ice Control Material Selection Tool

Identify one snow and ice control strategy material combination for assessment
 This step establishes the material selection for subsequent assessment. Only primary materials will be selected. For example, if deicing with a solid is selected, only NaCl, CaCl₂, MgCl₂ and CMA will be assessed. Leave all boxes unchecked to assess all materials.

Name	Strategy	Check One	NaCl	CaCl ₂	MgCl ₂	CMA	KA	OrganicMatterFromBiomass	Abrasives
Deicing	Solid Only	<input type="checkbox"/>	P	P	P	P			
	Liquid Only	<input type="checkbox"/>	P	P	P	P	P	S	
	Pre Wet Solid	<input type="checkbox"/>	P,S	S	S	S	S	S	
Anti Icing	Solid Only	<input type="checkbox"/>	P	P	P	P			
	Liquid Only	<input type="checkbox"/>	P	P	P	P	P	S	
	Pre Wet Solid	<input type="checkbox"/>	P,S	S	S	S	S	S	
Abrasive Use	Abrasive Only	<input type="checkbox"/>							P
	Pre Wet Abrasive	<input type="checkbox"/>	S	S	S	S	S	S	P

P = Primary, S = Secondary

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Figure A-4 – Decision Tool Software - Strategy Selection

NCHRP Project 6-16 - Snow and Ice Control Material Selection Tool

Maintenance area conditions
Identify the conditions that exist in the maintenance area by checking the boxes in the 'Exists' column that apply.

Concrete Corrosion									
Conditions	Exists?	NaCl	CaCl2	MgCl2	CMA	KA	Organic Matte	Abrasives	
Reinforcing Steel Bar	<input checked="" type="checkbox"/>	1	1	1	5	5	5	5	
Sum of selected conditions		1.00	1.00	1.00	5.00	5.00	5.00	5.00	
Average of selected conditions		1.00	1.00	1.00	5.00	5.00	5.00	5.00	
Concrete Degradation									
Conditions	Exists?	NaCl	CaCl2	MgCl2	CMA	KA	Organic Matte	Abrasives	
Concrete Pavement And Structures	<input checked="" type="checkbox"/>	4	3	3	3	4	5	5	
Sum of selected conditions		4.00	3.00	3.00	3.00	4.00	5.00	5.00	
Average of selected conditions		4.00	3.00	3.00	3.00	4.00	5.00	5.00	
Drinking Water									
Conditions	Exists?	NaCl	CaCl2	MgCl2	CMA	KA	Organic Matte	Abrasives	
Shallow Groundwater Used For Drinking	<input checked="" type="checkbox"/>	3	5	5	4	4	3	5	
Sum of selected conditions		3.00	5.00	5.00	4.00	4.00	3.00	5.00	
Average of selected conditions		3.00	5.00	5.00	4.00	4.00	3.00	5.00	
Metal Infrastructure									
Conditions	Exists?	NaCl	CaCl2	MgCl2	CMA	KA	Organic Matte	Abrasives	
Steel Bridges	<input checked="" type="checkbox"/>	1	1	1	4	4	5	5	
Other Metal Infrastructure Of Concern	<input checked="" type="checkbox"/>	1	1	1	4	4	5	5	
Sum of selected conditions		2.00	2.00	2.00	8.00	8.00	10.00	10.00	
Average of selected conditions		1.00	1.00	1.00	4.00	4.00	5.00	5.00	
Soil									
Conditions	Exists?	NaCl	CaCl2	MgCl2	CMA	KA	Organic Matte	Abrasives	
Poor Soil Structure Within 10m Of The Roadway	<input type="checkbox"/>	2	4	4	5	5	5	5	
Sum of selected conditions		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Average of selected conditions		0.00	0.00	0.00	0.00	0.00	0.00	0.00	

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Figure A-5 – Decision Tool Software - Maintenance Area Conditions



NCHRP Project 6-16 - Snow and Ice Control Material Selection Tool

Input material information
 Optionally add additional candidate materials by clicking the 'Insert Candidate Material...' button. Phase and concentration data must be input in a subsequent step for each candidate material added.

+ Insert Candidate Material... - Delete Candidate Material...

Material Information	Materials from strategy selection						User defined
	NaCl	CaCl2	MgCl2	CMA	KA	Abrasives	MgCl2+OMB
Concentration, if liquid (% w/w)	23.00	30.00	28.00	25.00	50.00		25.00
Cost per tonne (\$)	50.00	130.00	120.00	1150.00	1000.00	80.00	180.00
Saturated Concentration (%)						N/A	1.00
Purity, if solid (% w/w)						99.00	
Moisture, if solid (% w/w)						1.00	
Matrix	Liquid	Liquid	Liquid	Liquid	Liquid	Solid	Liquid

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Figure A-6 – Decision Tool Software - Material Information

NCHRP Project 6-16 - Snow and Ice Control Material Selection Tool

Input phase data information
 Enter the EC(%) for each candidate material, the values for MP will be calculated. To change user defined EC(%) values, click the corresponding column header.

Temperature		NaCl		CaCl2		MgCl2		KA		CMA		MgCl2+OMB	
		BC(%) = 23.0		BC(%) = 30.0		BC(%) = 28.0		BC(%) = 50.0		BC(%) = 25.0		BC(%) = 25.0	
F	C	EC(%)	MP	EC(%)	MP	EC(%)	MP	EC(%)	MP	EC(%)	MP	EC(%)	MP
30.00	-1.11	2.0	10.50	2.0	14.00								
29.00	-1.67	3.0	6.67	3.0	9.00								
28.00	-2.22	4.0	4.75	4.0	6.50								
27.00	-2.78	5.0	3.60	5.0	5.00								
26.00	-3.33	6.0	2.83	5.7	4.26								
25.00	-3.89	7.0	2.29	6.4	3.69								
24.00	-4.44	7.5	2.07	7.0	3.29								
23.00	-5.00	8.0	1.88	8.0	2.75								
22.00	-5.56	8.5	1.71	9.0	2.33								
21.00	-6.11	9.0	1.56	9.5	2.16								
20.00	-6.67	9.6	1.40	10.0	2.00								
19.00	-7.22	10.3	1.23	10.5	1.86								
18.00	-7.78	10.9	1.11	11.0	1.73								
17.00	-8.33	11.4	1.02	11.5	1.61								
16.00	-8.89	11.9	0.93	12.0	1.50	10.8	1.59	17.0	1.94	17.2	0.45		
15.00	-9.44	12.4	0.85	12.5	1.40	11.1	1.52	17.5	1.86	17.7	0.41		
14.00	-10.00	12.9	0.78	13.0	1.31	11.4	1.46	18.0	1.78	18.3	0.37		
13.00	-10.56	13.4	0.72	13.5	1.22	11.9	1.35	19.0	1.63	18.8	0.33		
12.00	-11.11	14.2	0.62	14.0	1.14	12.3	1.28	19.5	1.56	19.4	0.29		
11.00	-11.67	14.8	0.55	14.5	1.07	12.7	1.20	20.0	1.50	19.9	0.26		
10.00	-12.22	15.3	0.50	15.3	0.96	13.1	1.14	20.5	1.44	20.6	0.21	13.1	0.91
9.00	-12.78	15.8	0.46	15.6	0.92	13.4	1.09	21.0	1.38	21.3	0.17		
8.00	-13.33	16.4	0.40	16.0	0.88	13.7	1.04	21.5	1.33	21.8	0.15		
7.00	-13.89	17.0	0.35	16.5	0.84	14.0	1.00	22.0	1.28	22.3	0.13		

Input Required

Enter the Eutectic Concentration % (EC) value that corresponds to the material at the assessment temperature of 10.00 degrees Fahrenheit.

Material	Value (%)
MgCl2+OMB	13.10

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Figure A-7 – Decision Tool Software - Phase Data



NCHRP Project 6-16 - Snow and Ice Control Material Selection Tool

Summary and recommendations.
 For Environmental and Infrastructure objectives weighted scores, input the most conservative (lowest) value for candidate materials contributing to the blend.

Evaluation Temperature: 10 Fahrenheit

Economic Objectives		Info	NaCl	CaCl2	MgCl2	CMA	KA	Abrasives	MgCl2+OMB
Cost	25.00	Purity/Concentration	23.00	30.00	28.00	25.00	50.00	99.00	25.00
		Cost per tonne (\$)	50.00	130.00	120.00	1150.0	1000.0	80.00	180.00
Performance	25.00	Purchase price per dry pound (\$/lb)	0.10	0.21	0.21	2.30	1.00	0.04	0.36
		MeltingPotential (MP)	0.50	0.96	1.13	0.21	1.43	0.00	0.90
		MP/(Purchase price/lb)	4.63	4.43	5.30	0.09	1.43	0.00	2.52
Weighted Economic Score			43.61	41.77	50.00	0.87	13.55	0.00	23.76

Environmental Objectives		Operational Objective	Info	aCl2	MgCl2	CMA	KA	Abrasives	OrganicMatter	MgCl2+OMB
Environmental Impact	25.00	Air Quality	27.00	3.00	3.00	2.50	2.50	3.00	1.00	
		Aquatic Life	20.00	5.00	5.00	4.00	4.00	5.00	3.00	
		Drinking Water	20.00	5.00	5.00	5.00	5.00	5.00	5.00	
		Soil	0.00	5.00	5.00	5.00	5.00	5.00	5.00	
		Terrestrial Fauna	13.00	3.00	3.00	5.00	5.00	4.00	5.00	
		Vegetation	20.00							
Total Score			4.20	4.20	4.30	4.30	3.32	3.80		
Max Score			5.00	5.00	5.00	5.00	5.00	5.00		
Weighted Env. Score			1.00	21.00	21.50	21.50	16.60	19.00		19

Infrastructure Objectives		Operational Objective	Info	NaCl	CaCl2	MgCl2	CMA	KA	Abrasives	Or
Infrastructure Impact	25.00	Concrete Corrosion	30.00	1.00	1.00	1.00	5.00	5.00	5.00	21
		Concrete Degradation	20.00	4.00	3.00	3.00	3.00	4.00	5.00	5.00
		Metal Infrastructure	28.00	1.00	1.00	1.00	4.00	4.00	5.00	5.00
		Vehicles	22.00	1.00	1.00	1.00	4.00	4.00	1.00	5.00
Total Score			1.60	1.40	1.40	4.10	4.30	4.12	5.00	
Max Score			5.00	5.00	5.00	5.00	5.00	5.00		

Final Product Score	68.61	69.77	78.00	42.87	56.56	Too Cold	Too Cold	42.7
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Figure A-8 – Decision Tool Software - Summary and Recommendations

