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XIII INTERNATIONAL WINTER ROAD CONGRESS

QUÉBEC, FEBRUARY 8 TO 11, 2010

SUSTAINABLE WINTER SERVICE FOR ROAD USERS

THE WINTER MODEL – A FIRST TEST CALCULATION

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FINDING A BETTER WAY

THE OBJECTIVE OF THE WINTER MODEL

- To assess the most important socio-economic effects of different road maintenance strategies for optimising strategies and activities

START CRITERION AND ACTION TIME

- A start criterion states at which snow depth on the road the action will start
- The action time dictates the length of time the action pass should take

START CRITERIA AND ACTION TIMES FOR STANDARD CLASSES SUBJECT TO COMBINED ACTION

Standard Class 3

- Snow depth = 1.0cm
- Action time = 4 hours

Standard Class 3 minus

- Snow depth = 2.0cm
- Action time = 4 hours

Standard Class 3 minus minus

- Snow depth = 2.0cm
- Action time = 5 hours

DIFFERENT START CRITERIA AND ACTION TIMES AFFECT START AND FINISH OF THE ACTION PASSES

Hour	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Snow intensity (mm/h)	0	0.3	0	1.4	6.6	8.9	13.0	3.0	0.8	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0

Standard class 3 = 1.0 cm and 4 hours

Action time			12.8			21.5			0.3
Action type			Start pass 1	CRC		Finish pass 1 Start pass 2	CRC		Finish pass 2

Standard class 3 minus = 2.0 cm and 4 hours

Action time		23.7			10.8			0.0
Action type		Start pass 1	CRC		Finish pass 1 Start pass 2	CRC		Finish pass 2

Standard class 3 minus minus = 2.0 cm and 5 hours

Action time		23.7		10.8		0.0
Action type		Start pass 1	CRC	Finish pass 1 Start pass 2	CRC	Finish pass 2

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ROAD CONDITION MODEL

- Input data to the Road Condition Model are weather, traffic and maintenance actions
- The road conditions, dry, wet, icy, snowy etc, are assessed on an hourly level for a whole winter season
- The road conditions are calculated individually for five strips of the lane

– Edge of lane
– Right wheel track
– Between wheel tracks
– Left wheel track
– Middle of the carriageway

ROAD CONDITIONS FOR DIFFERENT STANDARD CLASSES

Hour	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Snow intensity (mm/h)	0	0.3	0	1.4	6.6	8.9	13.0	3.0	0.8	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0

Standard class 3 = 1.0 cm and 4 hours

Action time						12.8				21.5				0.3									
Action type						Start pass 1		CRC		Finish pass 1 Start pass 2		CRC		Finish pass 2									
Road condition																							
middle of the road	DB	SL 0.2	SL 0.2	SL 0.9	SL 4	SL 9	LS 5/PS	LS 4/PS	LS 4/PS	LS 4/PS	SL 9	SL 3	SL 3	SL 3	SL 3	WB	WB	WB	WB	MB	MB	DB	DB
left wheel track	DB	WB	MB	WB	WB	WB	PS	SL 5	WB	WB	WB	WB	MB	MB	MB	DB	DB	DB	DB	DB	DB	DB	DB
between wheel tracks	DB	SL 0.2	SL 0.2	SL 0.9	SL 4	SL 9	LS 5/PS	LS 3/PS	LS 3/PS	LS 3/PS	SL 8	SL 2	SL 2	SL 2	SL 2	WB	WB	WB	MB	MB	DB	DB	DB
right wheel track	DB	WB	MB	WB	WB	WB	PS	SL 5	WB	WB	WB	WB	MB	MB	MB	DB	DB	DB	DB	DB	DB	DB	DB
edge of lane	DB	SL 0.2	SL 0.3	SL 2	SL 8	SL 17	SL 30	SL 6	SL 6	SL 7	SL 7	SL 4	SL 4	SL 4	SL 4	SL 4	SL 4	WB	WB	WB	WB	WB	WB

Standard class 3 minus = 2.0 cm and 4 hours

Action time							23.7			10.8			0.0										
Action type							Start pass 1		CRC	Finish pass 1 Start pass 2		CRC	Finish pass 2										
Road condition																							
middle of the road	DB	SL 0.2	SL 0.2	SL 0.9	SL 4	SL 9	LS 5/PS	LS 7/PS	LS 3/PS	LS 3/PS	SL 8	SL 8	SL 3	SL 3	SL 3	SL 3	WB	WB	WB	WB	MB	MB	DB
left wheel track	DB	WB	MB	WB	WB	WB	PS	SL 5	WB	WB	WB	WB	MB	MB	MB	DB	DB	DB	DB	DB	DB	DB	DB
between wheel tracks	DB	SL 0.2	SL 0.2	SL 0.9	SL 4	SL 9	LS 5/PS	LS 7/PS	LS 3/PS	LS 3/PS	SL 8	SL 8	SL 2	SL 2	SL 2	SL 2	WB	WB	WB	MB	MB	DB	DB
right wheel track	DB	WB	MB	WB	WB	WB	PS	SL 5	WB	WB	WB	WB	MB	MB	MB	DB	DB	DB	DB	DB	DB	DB	DB
edge of lane	DB	SL 0.2	SL 0.3	SL 2	SL 8	SL 17	SL 30	SL 33	SL 4	SL 5	SL 5	SL 5	SL 4	SL 4	SL 4	SL 4	SL 4	SL 4	WB	WB	WB	WB	WB

Standard class 3 minus minus = 2.0 cm and 5 hours

Action time							23.7			10.8			0.0										
Action type							Start pass 1		CRC	Finish pass 1 Start pass 2		CRC	Finish pass 2										
Road condition																							
middle of the road	DB	SL 0.2	SL 0.2	SL 0.9	SL 4	SL 9	LS 5/PS	LS 7/PS	LS 7/PS	LS 3/PS	SL 8	SL 8	SL 8	SL 8	SL 3	SL 3	SL 3	SL 3	WB	WB	WB	WB	MB
left wheel track	DB	WB	MB	WB	WB	WB	PS	SL 5	WB	WB	WB	WB	MB	MB	MB	DB	DB	DB	DB	DB	DB	DB	DB
between wheel tracks	DB	SL 0.2	SL 0.2	SL 0.9	SL 4	SL 9	LS 5/PS	LS 7/PS	LS 7/PS	LS 3/PS	SL 8	SL 8	SL 8	SL 8	SL 2	SL 2	SL 2	WB	WB	MB	MB	DB	DB
right wheel track	DB	WB	MB	WB	WB	WB	PS	SL 5	WB	WB	WB	WB	MB	MB	MB	DB	DB	DB	DB	DB	DB	DB	DB
edge of lane	DB	SL 0.2	SL 0.3	SL 2	SL 8	SL 17	SL 30	SL 33	SL 34	SL 5	SL 5	SL 5	SL 5	SL 5	SL 4	SL 4	SL 4	SL 4	SL 4	SL 4	WB	WB	WB

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ROAD CONDITION DISTRIBUTION

Road condition	Standard class 3 (number of hours)	Standard class 3- (number of hours)	Standard class 3-- (number of hours)
Dry bare ground	189	191	188
Moist + wet bare ground	56	55	55
Black ice + hoar frost	5	5	5
Hard-packed snow + thick ice	6	6	6
Loose snow + slush	80	79	82
Total	336	336	336

EFFECTS OF DIFFERENT ROAD CONDITIONS ARE ASSESSED IN THE FOLLOWING SUB-MODELS

- The Accident Model
- The Accessibility Model
- The Fuel Consumption Model
- The Corrosion Model
- The Environmental Model – effects of salting on vegetation and ground water
- The Road Administrator Model – the costs for measures taken

TOTAL SOCIO-ECONOMIC COSTS
NETWORK = 100 KM. PERIOD = 14 DAYS. AADT = 5,000

Costs (million SEK)	Standard Class 3
Accident costs	4.5
Travel time costs	12.0
Fuel costs	3.1
Corrosion costs	1.5
Environment costs	1,5
Action costs	0.2
Total costs	22.8

EXPERIENCES FROM THE TEST CALCULATION

- The differences between the tested standards were unexpectedly small
- One single snow fall can have a substantial impact on the road condition distribution for a shorter period of for example 14 days
- A more realistic difference between tested standard classes can probably be obtained if the road condition calculation is done at a level of ½ hour

THANK YOU FOR YOUR KIND ATTENTION!!

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