COLD IN-PLACE RECYCLING

Southeast Pavement Preservation Partnership

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Thursday, May 8, 2008

Presentation Overview

- Definition of Cold In-Place Recycling (CIR)
- Advantages of CIR
- Candidate selection criteria
- Pavement analysis
- Sample tender forms and specifications
- Construction
- Performance of CIR

Definition of CIR

CIR is a component of the overall pavement structure which is produced by mining the existing asphalt pavement layers to create a new pavement layer.

Definition of CIR

- *From a Pavement Preservation perspective, CIR is not designed to enhance the structural capacity of the pavement*
- *CIR is predominantly (preferred 80 - 100%) working in the existing asphalt pavement structure. Essentially recycling asphalt coated particles.*

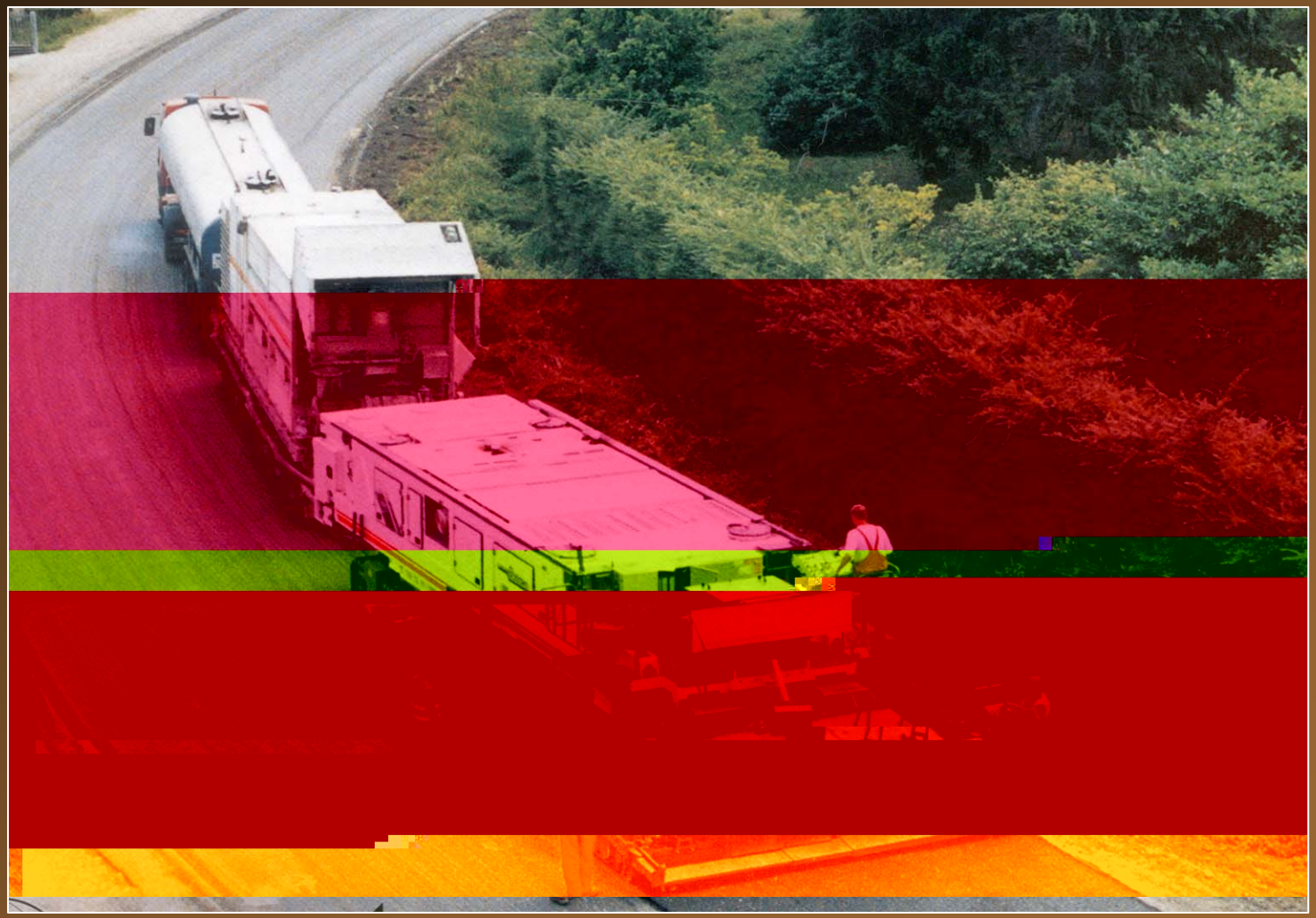
Three Unit CIR Train

Three Unit CIR Train

Two Unit CIR Train

Single Unit CIR Train

Single Unit CIR Train



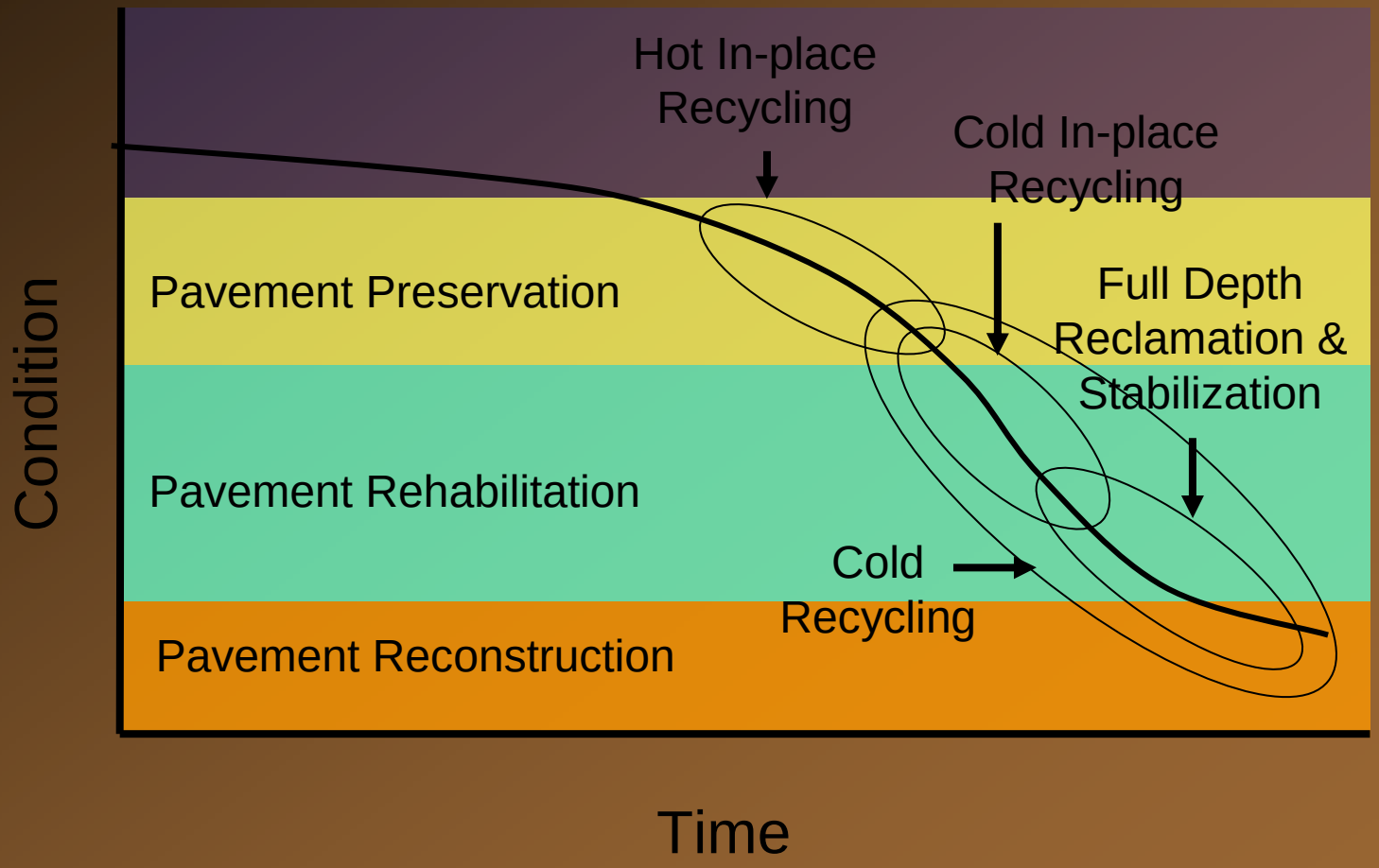
Advantages of CIR

- In order to be useful it must:
  - Be cost effective
  - Produce a new pavement that will perform under future traffic conditions

  It also provides:

  - Convenient Construction
  - Environmentally Beneficial Construction

Engineering – Condition Curve



Candidate Selection Criteria

- Existing pavement's structural capacity
- Underlying pavement bearing capacity
- Material quality
- Longitudinal and transverse profile

Pavement Analysis

- A complete pavement analysis organized by the owner typically includes consultation from the owner agency's staff, contractors and consulting engineers to perform a:
  - Preliminary visual inspection
  - Coring and laboratory analysis of existing materials
  - Structural assessment

Pavement Analysis – Preliminary Visual Inspection

- Construction limits
- Structural adequacy level
- Longitudinal and transverse profile
- Historical review of in-place materials
- Constructability
- Traffic loading
- Cost effectiveness

Candidate Selection Criteria - Visual

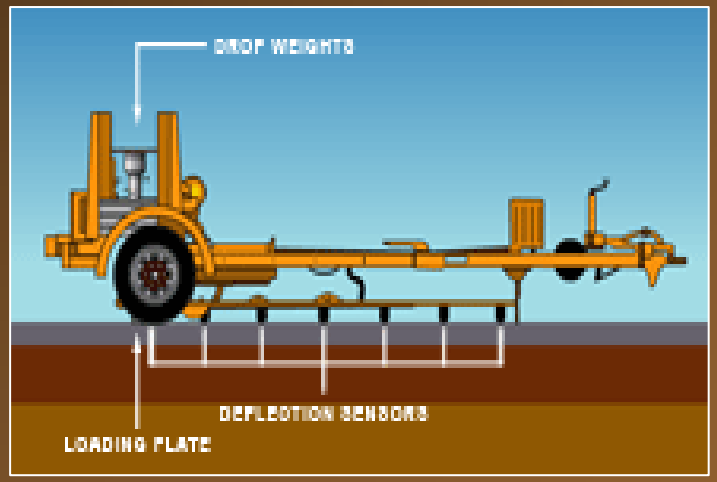
Candidate Selection Criteria - Visual

Candidate Selection Criteria - Visual

Coring and Lab Analysis

- Depths of pavement layers
- Extracted Asphalt cement
  - Content
  - Penetration
- Recycled Asphalt Pavement (RAP) aggregate
  - Extracted gradation
  - Physical properties

Structural Assessment



- Load bearing capacity tests
- Characteristics of supporting pavement layers
- Falling Weight Defelctometer (FWD)
- Dynamic Cone Penetrometer (DCP)

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Sample Tender Forms and Specifications

- Governing document is Ontario Provincial Standard Specification for CIR (OPSS 333)
  - https://www.raqsb.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage

Sample Tender Forms and Specifications

- Ministry of Transportation Ontario

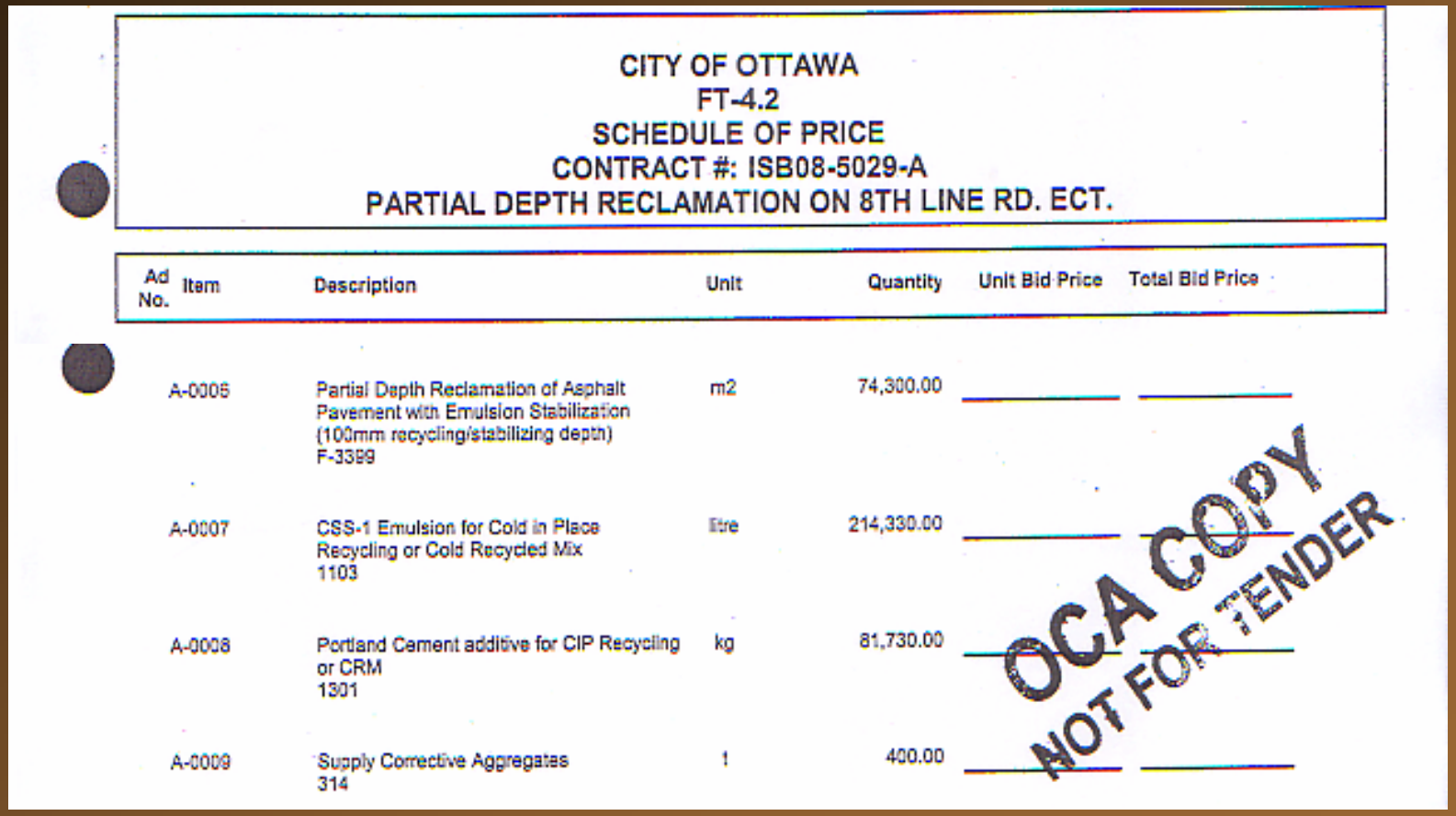
7	0313-1374	SP	Superpave 12.5 FC1	t	17,211		
8	0313-1376	SP	Superpave 19.0	t	17,895		
9	0313-1380	SP	Tack Coat	m2 (P)	234,670		
10	0314-0071	SP	Granular A	t	16,363		
11	0314-0130	SP	Granular B, Type I	t	6,696		
12	0333-0010	SP	Cold In-Place Recycled Mix	m2 (P)	107,802		

Sample Tender Forms and Specifications

County of Northumberland — Tender 16-08

ITEM NO.	SPEC. NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
ITEM NO. 3 - County Rd. 28 – 800 m south of 6th Line to 500 m south of 7th Line						
3.1	310, SP	Grinding	Sq. m	480	$_____	$_____
3.2	333, SP	Cold-In place Recycling Mix	Sq. m	16,000	$_____	$_____
3.3	310, 532, SP	Hot Mix HL8	Tonnes	2,000	$_____	$_____
3.4	310, 532, SP	Hot Mix HL3	Tonnes	1,800	$_____	$_____
3.5	314, SP	Granular 'A' – on shoulder	Tonnes	4,400	$_____	$_____
3.6	543, SP	Traffic Control	LS	1	$_____	$_____

Sample Tender Forms and Specifications



CITY OF OTTAWA
FT-4.2
SCHEDULE OF PRICE
CONTRACT #: ISB08-5029-A
PARTIAL DEPTH RECLAMATION ON 8TH LINE RD. ECT.

Ad No.	Item	Description	Unit	Quantity	Unit Bid Price	Total Bid Price
	A-0006	Partial Depth Reclamation of Asphalt Pavement with Emulsion Stabilization (100mm recycling/stabilizing depth) F-3399	m2	74,300.00		
	A-0007	CSS-1 Emulsion for Cold in Place Recycling or Cold Recycled Mix 1103	litre	214,330.00		
	A-0008	Portland Cement additive for CIP Recycling or CRM 1301	kg	81,730.00		
	A-0009	Supply Corrective Aggregates 314	t	400.00		

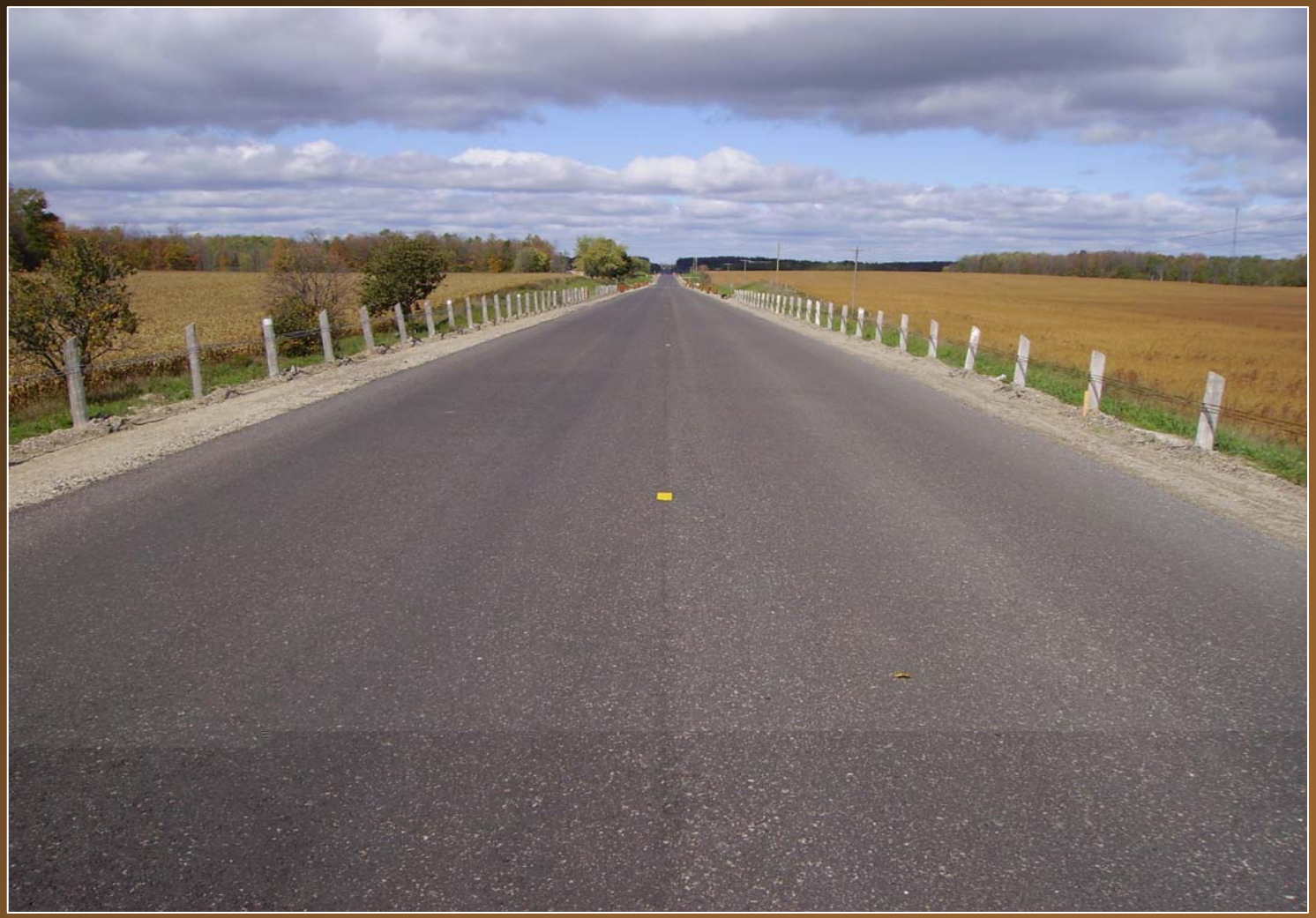
OCA COPY
NOT FOR TENDER

Construction

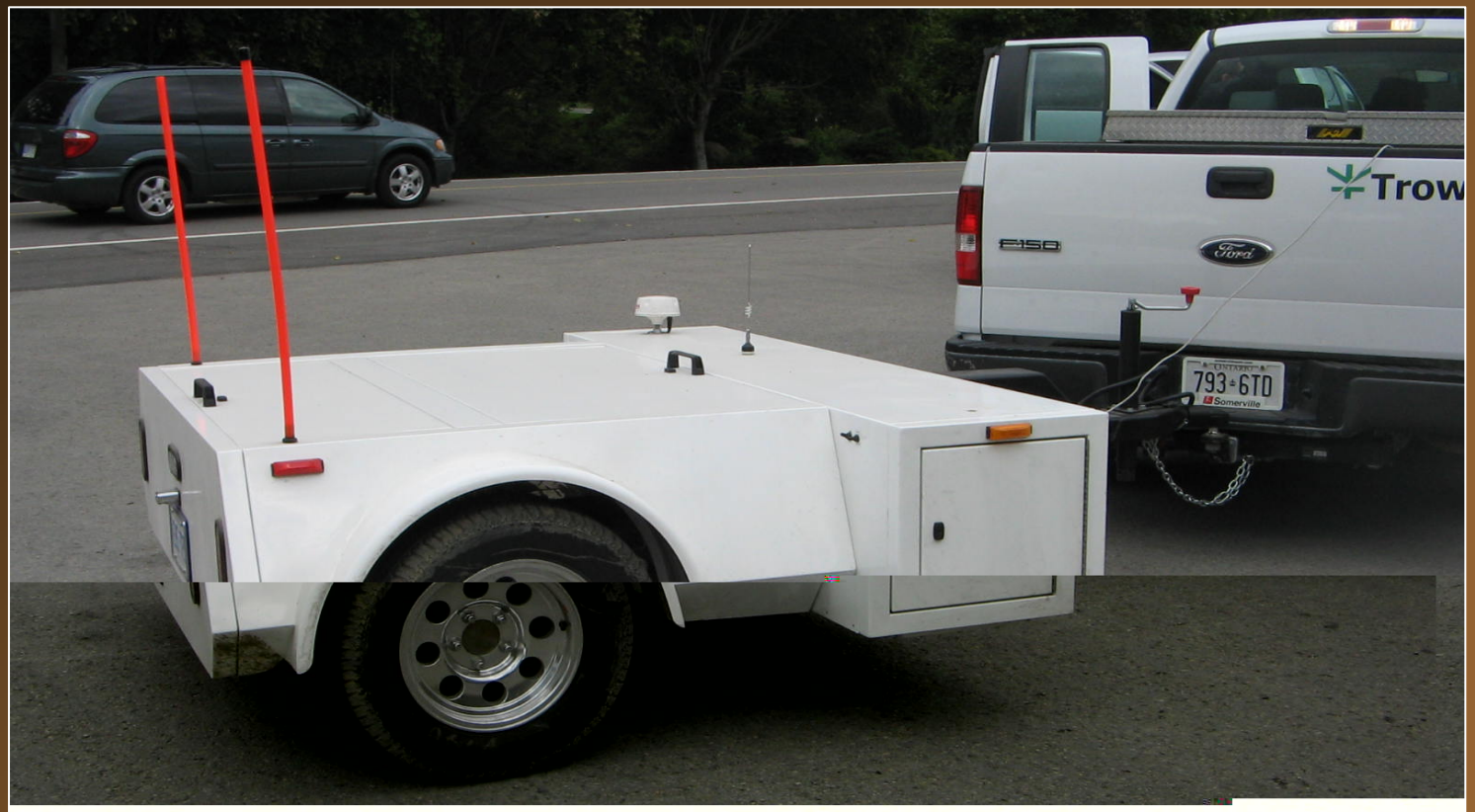
Construction

Construction

Post Construction



Post Construction



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	LElev.	RElev.
Interval (m)	IRI (m/km)	IRI (m/km)
0 to 500	1.71	1.67
500 to 1,000	1.54	1.36
1,000 to 1,500	1.55	1.59
1,500 to 2,000	1.79	1.5
2,000 to 2,500	1.78	1.41
2,500 to 3,000	1.57	1.39
3,000 to 3,500	1.49	1.3
3,500 to 3,646	1.91	1.85

IRI on CIP before simulating a grinder pass at approx. 10mm

%age improvement proval simulator indicates through software.

Roughness Range (m/km)	Percent of Pavement Before Grinding (%)	Percent of Pavement After Grinding (%)
Above 1.894	5.73	0
1.894 to 1.736	14.39	0
1.736 to 1.578	27.11	0
1.578 to 1.420	45.8	0
1.420 to 1.263	6.97	0
1.263 to 1.105	0	15.95
1.105 to 0.947	0	66.81
0.947 to 0.789	0	17.24

Grinding simulation results

Location (m)	Max IRI Before Grinding (m/km)	Max IRI After Grinding (m/km)
0.00to 3646 Profilograph	1.668 Approx 780	1.022 Approx 435

Post Construction

ProVAL Report - Hwy 23

COLD IN PLACE PROFILE NB

Analysis - Ride Statistics at Intervals

Channel Title	IRI (m/km)	AVG
LElev.	1.668	1.564
RElev.	1.460	PI=740

Analysis - Ride Statistics at Intervals

Interval (m)	LElev. IRI (m/km)	RElev. IRI (m/km)
		1.6m)

ProVAL Report - HWY 23

SP12.5 FC1

ONE LIFT PAVING ON CIP

HIGHWAY23-NB- 0.0 to 3500.0

Channel Title	IRI (m/km)	AVG
LElev.	0.87	0.855
RElev.	0.84	PI=350

Analysis - Ride Statistics at Intervals

Interval (m)	LElev. IRI (m/km)	RElev. IRI (m/km)

Performance of CIR – Reflective Cracking

Performance of CIR – Reflective Cracking

CIR 5 Years Later

Cold in Place Recycling

- CIR Pavement Preservation Project – 20,000 AADT

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