

Relationship Between Asphalt Lift Thickness and Pavement Smoothness – A Case Study

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Smoothness Specifications

- ❑ The City of Calgary is among very few Canadian municipalities to implement Pavement Smoothness Specifications for new and rehabilitation works
- ❑ Applied to major roads, consist of nearly 28% of the network
- ❑ Smoothness Specifications are based on International Roughness Index (IRI) measured using inertial profilers
- ❑ Annually, The City rehabilitates about 1.5% (225 lane-km) of the network using a combination of treatments such as: mill and inlay, partial reconstruction and in-place recycling



Study Objectives

- ❑ Impact of asphalt lift thickness on pavement smoothness
- ❑ Assess the degree of smoothness improvement using IRI as reference

Methodology

- ❑ Pre and post-treatment IRI data was analysed to calculate the finished surface IRI improvement
- ❑ Four study sections for Asphalt Concrete Pavement (ACP) Mill & Inlay treatment:
 - Section 1 – 60 mm in 1 lift
 - Section 2 – 70 mm in 1 lift
 - Section 3 – 100 mm in 2 lifts (50 on 50)
 - Section 4 – 90 mm in 2 lifts (40 on 50)
- ❑ Two study sections for Reconstruction:
 - Sections 5 & 6 – 300 mm Granular Subbase, 100 mm Granular base, 250 mm ACP (100 mm wearing course and 150 mm base course)

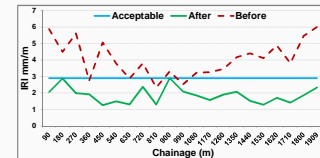
Before and After Observations

Treatment Type: Single Lift Mill & Inlay ACP (Mix: SuperPave 12.5 NMS)

Treatment Type: Two Lift Mill & Inlay ACP (Mix: SuperPave 12.5 NMS)

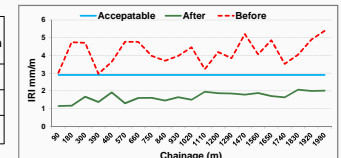
Section 1 – 60 mm ACP

Both Directions	Before MIRI	After MIRI	% Improvement
Mean	4.17	2.1	50%
Min	2.34	1.30	44%
Max	6.0	2.90	51%



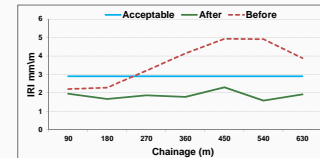
Section 3 – 100 mm ACP two lifts (50 on 50)

Both Directions	Before MIRI	After MIRI	% Improvement
Mean	4.17	1.61	61%
Min	2.96	1.15	61%
Max	5.39	2.07	61%



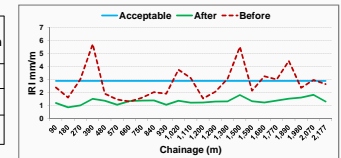
Section 2 – 70 mm ACP

East Bound	Before MIRI	After MIRI	% Improvement
Mean	3.65	1.87	44%
Min	2.21	1.58	12%
Max	4.93	2.30	68%



Section 4 – 90 mm ACP two lifts (40 on 50)

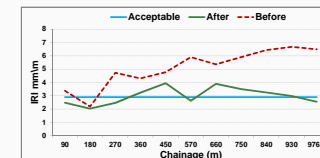
Both Directions	Before MIRI	After MIRI	% Improvement
Mean	3.52	1.35	62%
Min	1.32	0.87	34%
Max	5.73	1.84	68%



Treatment Type: Reconstruction with two lift ACP, 100 mm (50 on 50) (Mix: SuperPave 12.5 NMS)

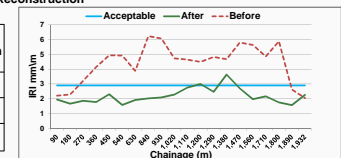
Section 5 – Reconstruction

Both Directions	Before MIRI	After MIRI	% Improvement
Mean	4.43	3.00	32%
Min	2.19	2.04	7%
Max	6.67	3.94	41%



Section 6 – Reconstruction

East Bound	Before MIRI	After MIRI	% Improvement
Mean	4.14	2.60	37%
Min	2.05	1.57	23%
Max	6.23	3.64	42%



Conclusion and Next Steps

- ❑ Asphalt lift thickness & number of lifts affects pavement smoothness and Percent IRI improvement
- ❑ As expected, Sections 3 & 4 shows asphalt placed in two lifts improves the smoothness in excess of 60%, compared to single lift inlay (Sections 1 & 2) by 44 to 50%
- ❑ Base re-construction challenges due to utilities likely impacted surface lift smoothness on Sections 5 & 6
- ❑ Lift thickness greater than 60 mm should be paved in two lifts to achieve smoother pavement surface
- ❑ Percent IRI improvement can be used as an indicator of the smoothness improvement for future projects
- ❑ Original IRI condition indicates what is achievable
- ❑ Stringent Specifications and penalties for reconstruction projects & roads with limited utility or manholes

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