## 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

- Post and pre-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

<table>
<thead>
<tr>
<th>Treatment Type</th>
<th>Section 1 – 60 mm ACP</th>
<th>Section 2 – 70 mm ACP</th>
<th>Section 3 – 100 mm two lifts (50 on 50)</th>
<th>Section 4 – 90 mm two lifts (40 on 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both Directions Before</td>
<td>Mean: 4.27</td>
<td>Min: 2.34</td>
<td>Mean: 3.52</td>
<td>Mean: 4.43</td>
</tr>
<tr>
<td>After</td>
<td>Mean: 2.11</td>
<td>Max: 6.53</td>
<td>Mean: 1.32</td>
<td>Max: 4.43</td>
</tr>
<tr>
<td>% Improvement</td>
<td>50%</td>
<td>44%</td>
<td>62%</td>
<td>32%</td>
</tr>
</tbody>
</table>

## 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