Hot-In-Place-Recycling
A Valuable Tool For Denver Pavement Preservation

Pat Kennedy, PE
Denver Street Maintenance

Rocky Mountain West
Pavement Preservation Partnership

Annual Meeting, Oct 2015
Denver

- Population 663,000 – Metro area 2.5M
- Street network 6,000 lane miles
- Capital Maintenance Budget $23M annually

- 2015 paving program;
  - Self performed Mill and Overlay; 210 ln-mi 55%
  - Hot-In-Place-Recycle; 94 ln-mi 24%
  - Chip Seal; 80 ln-mi 21%
Agenda

- Unique Considerations
- Life Cycle
- Sustainability
- Economics
Minor Treatment
Major Treatment
Mid-Range Treatment
Unique Considerations

- Traffic Control- No special needs
- Street selection- No cul-de-sacs or tight curves, uniform width, x-slope
Unique Considerations

- **Traffic Control** - No special needs
- **Street selection** - No cul-de-sacs or tight curves, uniform width, x-slope
- **Vegetation** - Minor protection of street side plants
Unique Considerations

• Traffic Control- No special needs
• Street selection- No cul-de-sacs or tight curves, uniform width, x-slope
• Vegetation- Minor protection of street side plants
• Specialized mixes
  – SMA
  – AR
  – RAS
Specialized Mixes

2006 SMA- Major Arterial- 20,000+ AADT each direction

Current PCI ~75
Specialized Mixes

2007 AR - Major Arterial - 10,000 AADT each direction

Current PCI ~70
Specialized Mixes

2010 RAS- Minor Arterial- 5,000 AADT one way

Current PCI ~85
Denver Asphalt Plant

- City owned Astec asphalt plant
- Standard HMA and specialty mixes
- Less expensive
  - Production costs
  - Wait times
  - Hauling costs
Life Cycle

Arterials- Track record of 10 years on

2005
Process
10,000 AADT
PCI ~75

2003
Process
10,000 AADT
PCI ~70

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Collectors- Track record of 10 years on collectors

- 2003 Process
- 3,000 AADT
- PCI ~70
Locals- ??? Haven’t seen full life, some sites covered with chip seal at 7 years

Local streets, 2003 HIPR, average PCI 75
Sustainability

• **Less disruption**

• **Smooth surface**
  - 40% IRI improvement, 265 in/mi to 165 in/mi

• **Less use of raw materials**
  - One half existing pavement reuse
  - One half added pavement at 25% RAP

**Final product 60%+ recycled material**
Economics

- Reduced Mill/Prep
- Reduced raw materials
- Reduced hauling
- Unit cost $1 to $2 per sy less than m&o

Life cycle cost savings of 6%-10%

Compared to mill and overlay
<table>
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<th>Year</th>
<th>Ln-Mi</th>
<th>Cost/sy</th>
<th>15yr cost</th>
<th>M&amp;O</th>
<th>17yr cost</th>
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Questions?

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