Renewal Procedures and Performance Measures for Railway/Highway Crossing Surfaces

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AREMA Committee 1 Meeting

Omaha, Nebraska
February 12 & 13, 2007
Keller Dam
George’s Branch
Chestnut St. – S. Charleston
US 25 Richmond

9/13/2000 – 5/2/2006
US 60 Stanley
Coal Dock

Figure 20. CMG 6.6 Kentucky Coal Terminal 8/7/06

Figure 21. CMG 6.6 Kentucky Coal Terminal 8/21/06
US 129 Alcoa/Maryville, TN
State St.-- Ann Arbor, MI
State St – Ann Arbor, MI

Before

After
Strengthens Trackbed Support

Waterproofs Underlying Roadbed

Confines Ballast and Track
Goals and Attributes
Rail/Highway Crossing Management

• Cost Effective Crossing
  – Safe
  – Smooth
  – Servicable
  – Long life

• Stable and Smooth
  – No costly disruption
  – Can be skipped over

• Accomplish
  – Minimum of time
  – 4-hour train curfew
  – 8 to 12-hour highway closure

• Utilize Cooperative Approach
  – Railroad company (contractor)
  – Local highway/governmental agency
Planning Meeting

• All Entities Must:
  – Select a date
  – Assign responsibilities
  – Share cost
<table>
<thead>
<tr>
<th>Local Highway/Governmental Agency</th>
<th>Railroad Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Public Announcements</td>
<td>• Remove and Replace the Track and Crossing</td>
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<td>• Traffic Control</td>
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<td>• Asphalt Paving</td>
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Trackbed Materials Classifications
• Roadbed/Subgrade Moisture Contents
  – At or Near Optimum
  – Thus, HMA Mat not Trapping Moisture
  – For Design - Use Unsoaked Condition

• HMA Cores
  – No Significant Weathering or Deterioration
  – No Loss of Fatigue Life
Quantities

- 6 in. thick, 12 ft. wide, 140 lb/ft³
- 0.42 tons/track foot (0.50 tons/ft.)
- $40/ton = $20/track foot
Pressure Cell

- Geokon Model 3500-2
- 9 in. Diameter
- Strain Gage
- Snap-Master
- Thermistor
Cell Placement on Asphalt
Cell Location at Richmond
Loaded Coal Train at Richmond

P-Cell 819 Beneath Rail in Crib

2 6-Axle Locomotives  Initial 2 Cars

Pressure (psi)

Time (s)

P-Cell 820 Beneath Rail and Tie

2 6-Axle Locomotives  Initial 2 Cars

Pressure (psi)

Time (s)

P-Cell 821 C/L Track in Crib

2 6-Axle Locomotives  Initial 2 Cars

Pressure (psi)

Time (s)

P-Cell 822 C/L Track and Tie

2 6-Axle Locomotives  Initial 2 Cars

Pressure (psi)

Time (s)
Loaded Auto Train at Richmond

P-Cell 819 Beneath Rail in Crib

P-Cell 820 Beneath Rail and Tie

P-Cell 821 C/L Track in Crib

P-Cell 822 C/L Track and Tie

Initial 2 Cars

Loco

1 6-Axle Loco

1 4-Axle Loco

Initial 2 Cars

Pressure (psi)

Time (s)
Empty Coal Train at Conway

P-Cell 209 on 5 in. HMA Layer

Pressure (psi) vs. Time (s)

- Initial 5 Cars
- 4 6-Axle Locos

Graph showing pressure changes over time with annotations.
Reduction of Dynamic Stresses

![Graph showing stress over time for 8 in. HMA surface and Subgrade surface.](image-url)
Loaded Concrete Truck at Richmond

![Image of a loaded concrete truck at Richmond with a pressure-time graph showing pressure (psi) on the y-axis and time (s) on the x-axis. The graph indicates pressure increases at specific time intervals.]
Loaded Coal Truck at Lackey

P-Cell 510 Beneath High Rail and Tie

Time (s)

Pressure (psi)
• Matrix-based array of force sensitive cells
• Silver conductive electrodes
• Pressure sensitive ink – Conductivity varies
• Crossing of ink – strain gauge
Rear Tires of Tractor of a 151,000 lb Loaded Coal Truck on Concrete Crossing of Kentucky Coal Terminal, Mile Post 6.6. May 25, 2004

9842 lb

135 psi

72.93 in^2
Front Tire of a CSXT Suburban on Asphalt Parking Lot in Ashland Oil Company. May 25, 2004

1652 lb

75 PSI

22.15 in\(^2\)

Force vs. Frames

Pressure vs. Frames
Rear Tire of a CSXT Suburban on Asphalt Parking Lot in Ashland Oil Company. May 25, 2004

- Force: 2197 lb
- Pressure: 81 PSI
- Contact Area: 27.15 in\(^2\)
Top-of-Rail Settlements
Top-of-Rail Settlements

- Procedures of Measurement
  - Conventional Rod and Level
  - 19-20 Fixed Stations at Each Location
  - Crossing Area = Stations 9-12
Top-of-Rail Settlements

US 60 Stanley
Top-of-Rail Settlements

KY Coal Terminal

Graphs showing top-of-rail settlements with data points for different dates and months.
Top-of-Rail Settlements

Isom
Top-of-Rail Settlements

Flag Spring

Station Elevation (ft.) Settlement (in.)

<table>
<thead>
<tr>
<th>Station</th>
<th>Elevation (ft.)</th>
<th>Settlement (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB</td>
<td>99.75</td>
<td>0.62</td>
</tr>
<tr>
<td>EB</td>
<td>99.75</td>
<td>1.74</td>
</tr>
</tbody>
</table>

Avg. approach settlement (both rails) 0.969 in 1.491 in 1.727 in
Avg. crossing settlement (both rails) 0.812 in 1.245 in 1.680 in
Note: Bold lines indicate crossing area
Pavement Profiles
Pavement Profiles

• Procedures of Measurement
  – Total Station Instrument With Prism
  – Fixed Benchmark Assigned at 100.000 ft.
  – Vehicle Travel Paths Used as Lines of Measurement
  – Measurements Taken at Regular Intervals and Points Where Deviations Occurred
Pavement Profiles

- Highway Centerline
- Outside Wheelpath Line
- Inside Wheelpath Line
- Crossing material
Rosemont Garden

Before

After
Excavating trackbed and checking grade

Removing old crossing 08:30

Began excavating

Excavating trackbed and checking grade
Dumping and spreading ballast

Spreading asphalt

Compacting asphalt and dumping ballast

Dumping and spreading ballast
Regulating ballast 12:40

Compacting hand-spread approaches

Finished compacting asphalt approaches 16:50

3 weeks later