# How Well Does Your Lubricant Track

## An Effective Demonstration On San Diego Trolley

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# Introduction

- Wear Reduction Study
- Reasons For Lubricating

  -Noise Issues

  -Wear Issues

  -Reduced Risk Of Low Speed Climb Outs
- Establishing Test
- Observance of tracking

# Introduction

- Empirical Evidence
- Material being used
- Rail condition
- Summary
- Implications/Conclusion
- Questions

# Noise Solutions
# Rail Wear Reduction
# The San Diego Trolley Experience

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## Rail Lubrication Strategy

## Fred Byle, Superintendent Of Wayside Maintenance, San Diego Trolley

## Paolo DiBenedetti, V.P. Neleco, Inc.

# Problem: Noise

- ## San Diego Trolley had a problem with noise
  - Noise is a significant problem for most transit systems
  - Creates wear  on rail
  - Wreaks havoc on ROW and Track staff
  - Constant complaints from public
  - Potentially, leads to threat of lawsuits

- ## SDTI was a pioneer in reducing noise
  - One of first systems to implement a formal process for addressing noise issues

# Problem Solving

- To address the noise issues, San Diego Trolley tried numerous ways of eliminating noise, including:
  - Water
  - Hand applying lubrication
  - Manual Grinding
  - Sound barrier walls

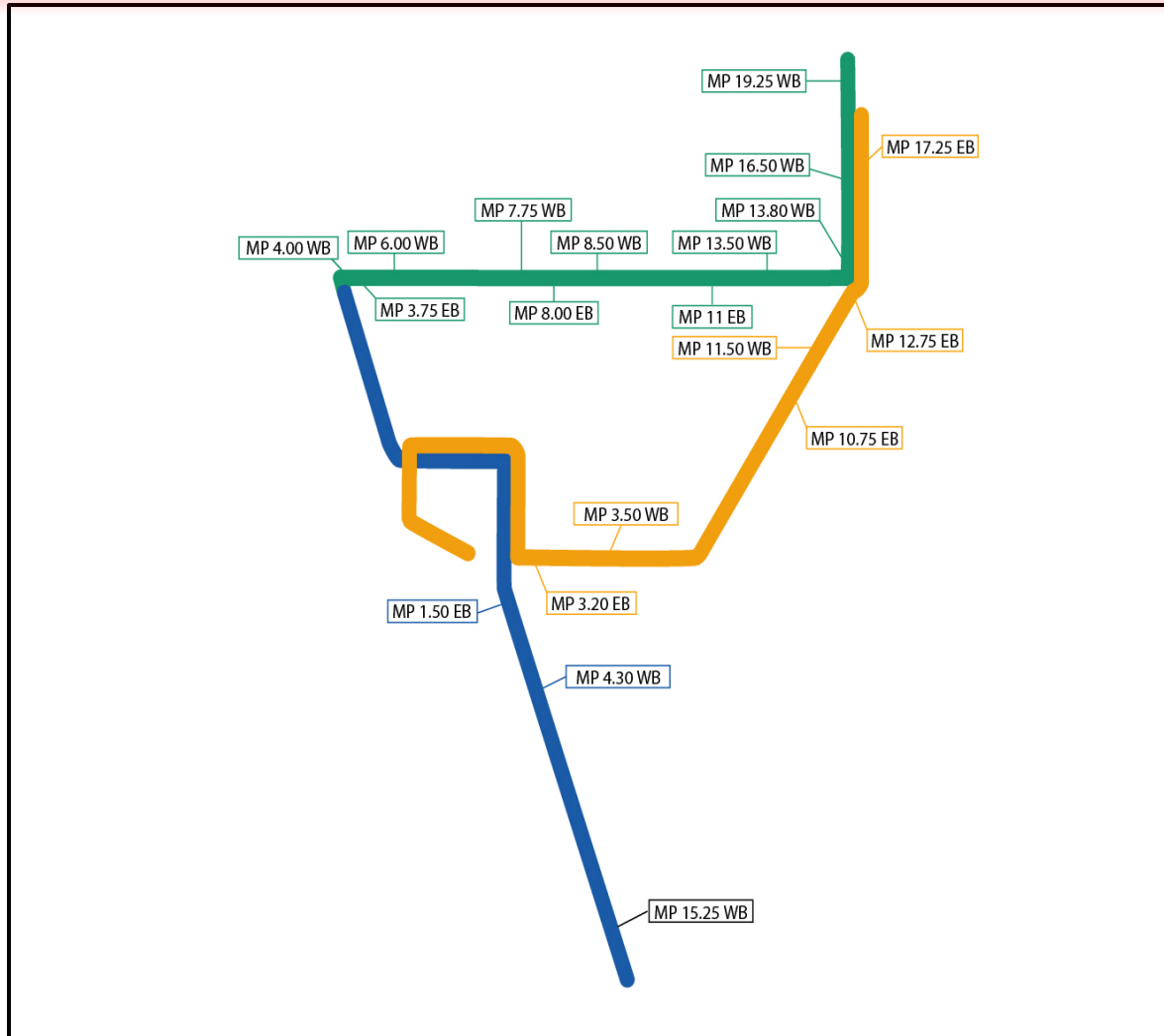- These all proved unsuccessful, or not cost effective

# Problem Solving

- After examining and testing multiple possibilities, SDT then came to gauge face lubrication.  After testing and acceptance, Trolley implemented a gauge face lubrication program to address noise issues.

- This gauge face lubrication protocol was implemented in 1998

# Location Of Lubricators

# Measuring Wear

- Data Collected Over 14 Years
- Optical Measurements
- Manual Measurements

# Rolling Stock

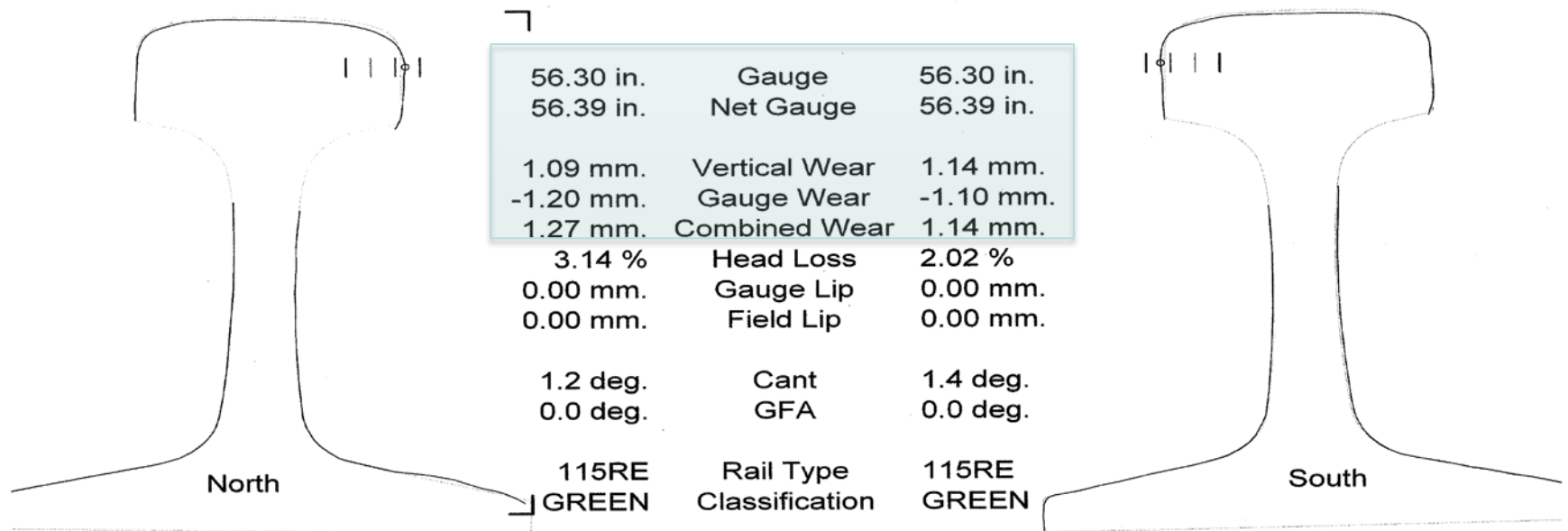| Model | Acquired | Weight Empty Pounds / Tons | Weight Loaded |
|---|---|---|---|
| Siemens U2 | 1981 | 81,500 / 40.75 | 95,400 / 47.7 |
| Siemens SD 1000 | 1993 | 92,000 / 46.0 | 106,500 / 53.25 |
| Siemens S 70 Long | 2004 | 102,000 / 51.0 | 118,560 / 59.25 |
| Siemens S 70 Short | 2012 | 98,000 / 49.0 | 116,840 / 58.4 |
| Low Emission Diesel Locomotive | Rail America | 260,000 / 130 | 2,000 Tons/20 Car Train |

# Additional Measuring

# Curve # 14 Green (2008)

MTS - SANDIEGO TROLLEY
MTSGREEN - Track EAST

| 15/633 | Run/Profile | 15/634 |
|---|---|---|
| Nov 28 2008 | Run Date | Nov 28 2008 |
| 3.813 | Mile | 3.813 |
| | #14: 7.6 deg. R | |

| North | | South |
|---|---|---|
| 56.30 in. | Gauge | 56.30 in. |
| 56.39 in. | Net Gauge | 56.39 in. |
| 1.09 mm. | Vertical Wear | 1.14 mm. |
| -1.20 mm. | Gauge Wear | -1.10 mm. |
| 1.27 mm. | Combined Wear | 1.14 mm. |
| 3.14 % | Head Loss | 2.02 % |
| 0.00 mm. | Gauge Lip | 0.00 mm. |
| 0.00 mm. | Field Lip | 0.00 mm. |
| 1.2 deg. | Cant | 1.4 deg. |
| 0.0 deg. | GFA | 0.0 deg. |
| 115RE | Rail Type | 115RE |
| GREEN | Classification | GREEN |

# Curve # 14 Green (2011)

MTS - SANDIEGO TROLLEY
MTSGREEN - Track EAST

| 56/651 | Run/Profile | 56/652 |
|---|---|---|
| Mar 12 2011 | Run Date | Mar 12 2011 |
| 3.812 | Mile | 3.812 |
| | #14: 7.6 deg. R | |

| North | | | South |
|---|---|---|---|
| 56.37 in. | Gauge | 56.37 in. | |
| 56.40 in. | Net Gauge | 56.40 in. | |
| 1.59 mm. | Vertical Wear | 1.23 mm. | |
| -0.48 mm. | Gauge Wear | -0.38 mm. | |
| 1.59 mm. | Combined Wear | 1.23 mm. | |
| 4.55 % | Head Loss | 3.23 % | |
| 0.02 mm. | Gauge Lip | 0.00 mm. | |
| 0.00 mm. | Field Lip | 0.00 mm. | |
| 1.2 deg. | Cant | 1.6 deg. | |
| 0.0 deg. | GFA | 0.0 deg. | |
| 115RE | Rail Type | 115RE | |
| GREEN | Classification | GREEN | |
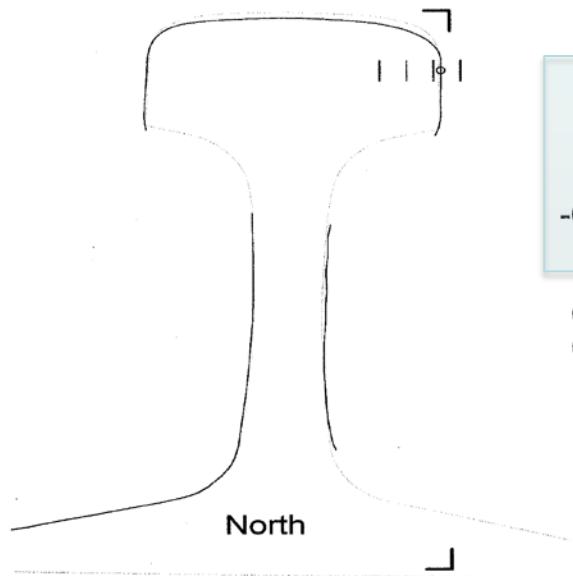
North | South

# Green Line

New Rail
Zero Wear

**Remaining Rail, Inch**

0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0

2012
Data Point= 0.43756
Rail Loss = 0.0624

**Lubricated From Day 1**

Condemnation

1998          2005          2010          2015
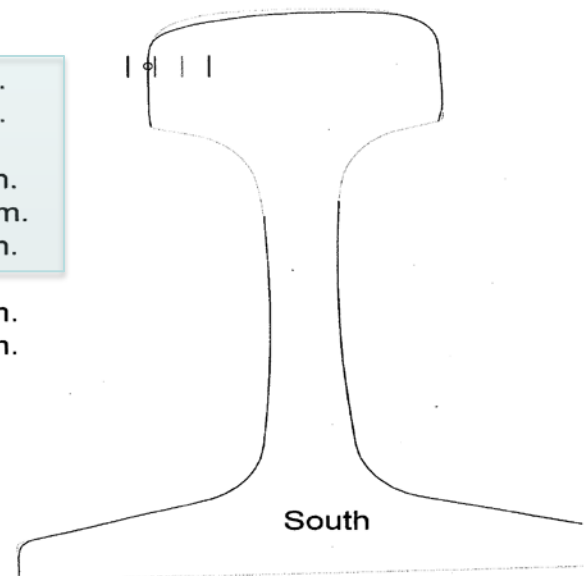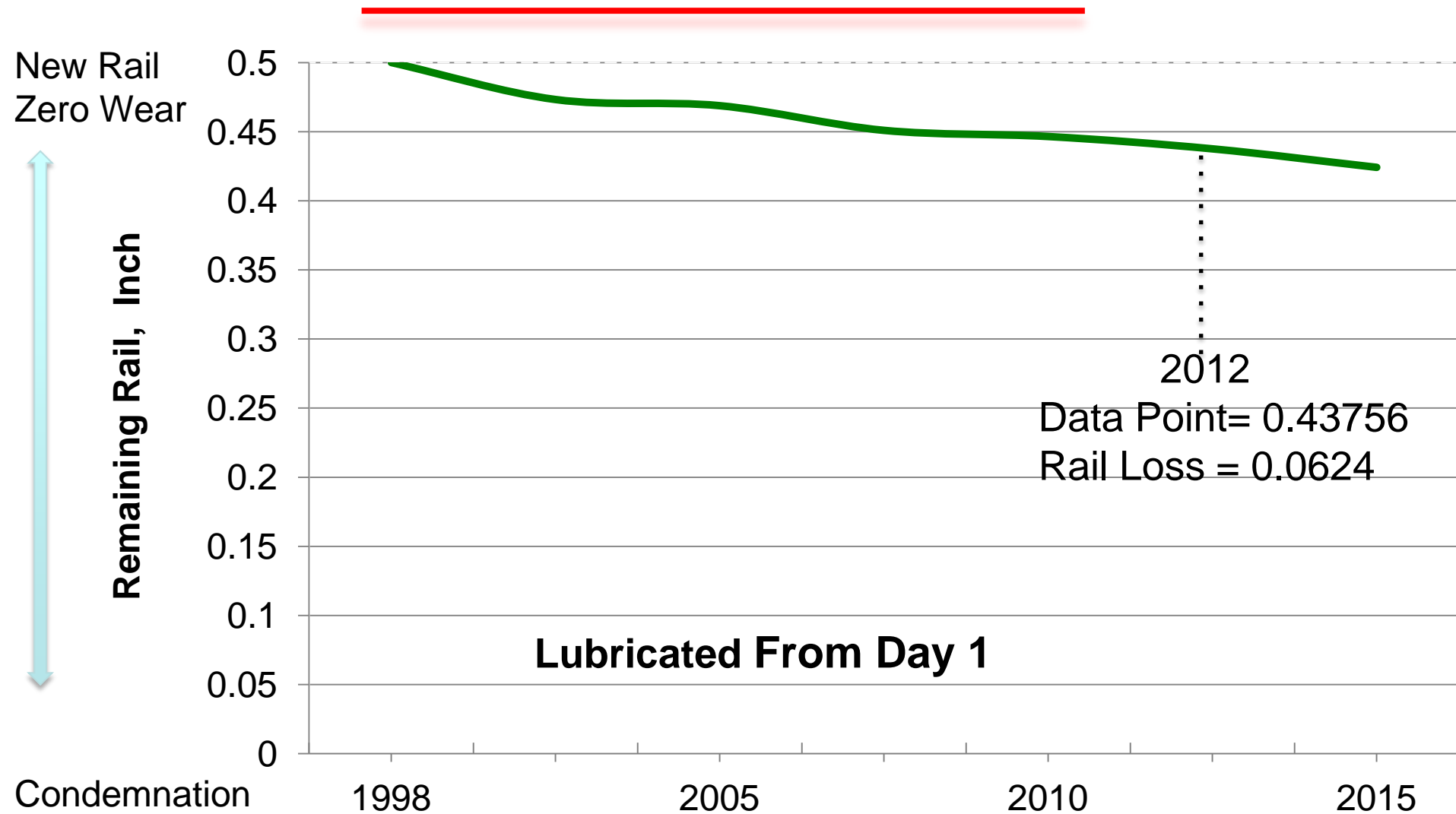
# 8$^{Th}$ St. Curve (2005)



MTS - SANDIEGO TROLLEY
MTSBLUE - Track EAST

| 9/5233 | Run/Profile | 9/5234 |
|---|---|---|
| Jul 29 2005 | Run Date | Jul 29 2005 |
| 4.260 | Mile | 4.260 |

#9: 3.0 deg. R

| North | | South |
|---|---|---|
| 56.88 in. | Gauge | 56.88 in. |
| 56.78 in. | Net Gauge | 56.78 in. |
| 2.57 mm. | Vertical Wear | 2.41 mm. |
| 2.94 mm. | Gauge Wear | -0.51 mm. |
| 5.69 mm. | Combined Wear | 2.41 mm. |
| 12.80 % | Head Loss | 8.10 % |
| 0.00 mm. | Gauge Lip | 0.44 mm. |
| 0.01 mm. | Field Lip | 0.11 mm. |
| 0.9 deg. | Cant | 0.4 deg. |
| 20.6 deg. | GFA | 0.0 deg. |
| 90ARA-A | Rail Type | 90ARA-A |
| RED | Classification | GREEN |
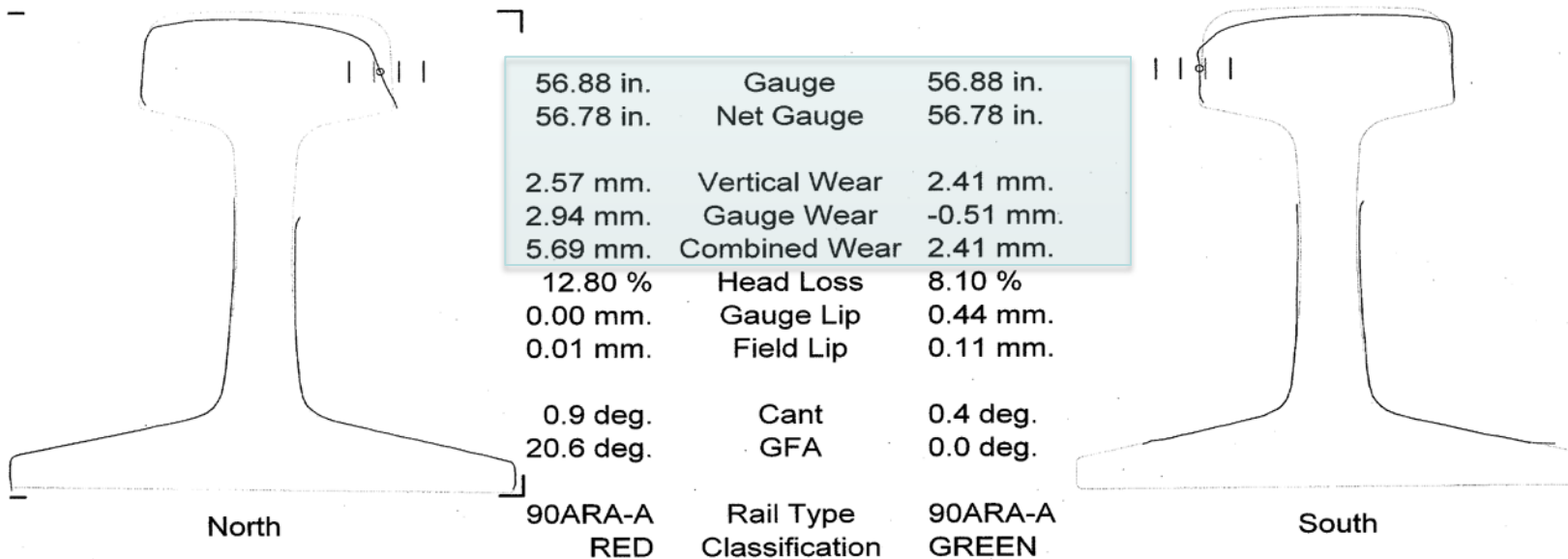
# 8<sup>Th</sup> St. Curve (2012)



MTS - SANDIEGO TROLLEY
MTSBLUE - Track EAST

| North | | | South |
|---|---|---|---|
| 57/4811 | Run/Profile | 57/4812 | |
| Jan 31 2012 | Run Date | Jan 31 2012 | |
| 4.260 | Mile | 4.260 | |
| | #9: 3.0 deg. R | | |

| | | |
|---|---|---|
| 56.95 in. | Gauge | 56.95 in. |
| 56.86 in. | Net Gauge | 56.86 in. |
| | | |
| 4.00 mm. | Vertical Wear | 3.81 mm. |
| 2.75 mm. | Gauge Wear | -0.58 mm. |
| 7.04 mm. | Combined Wear | 3.81 mm. |
| 16.43 % | Head Loss | 12.27 % |
| 0.00 mm. | Gauge Lip | 0.31 mm. |
| 0.00 mm. | Field Lip | 0.45 mm. |
| | | |
| 1.2 deg. | Cant | 0.5 deg. |
| 21.6 deg. | GFA | 0.0 deg. |
| | | |
| 90ARA-A | Rail Type | 90ARA-A |
| Unknown | Classification | Unknown |

North

South

# Blue Line 8<sup>Th</sup> St. Curve



Chart: Rail Remaining, Inch (vertical axis, New Rail (Zero Wear) at top 0.5 to Condemnation (Worn Out) at 0) versus years 1981, 2004, 2015.

**Lubrication Began At Year 24**

2004
Data Point = 0.125

2012
Data Point = 0.0937

Lubrication and Grinding Begins 2005

# Establishing A Tracking Test
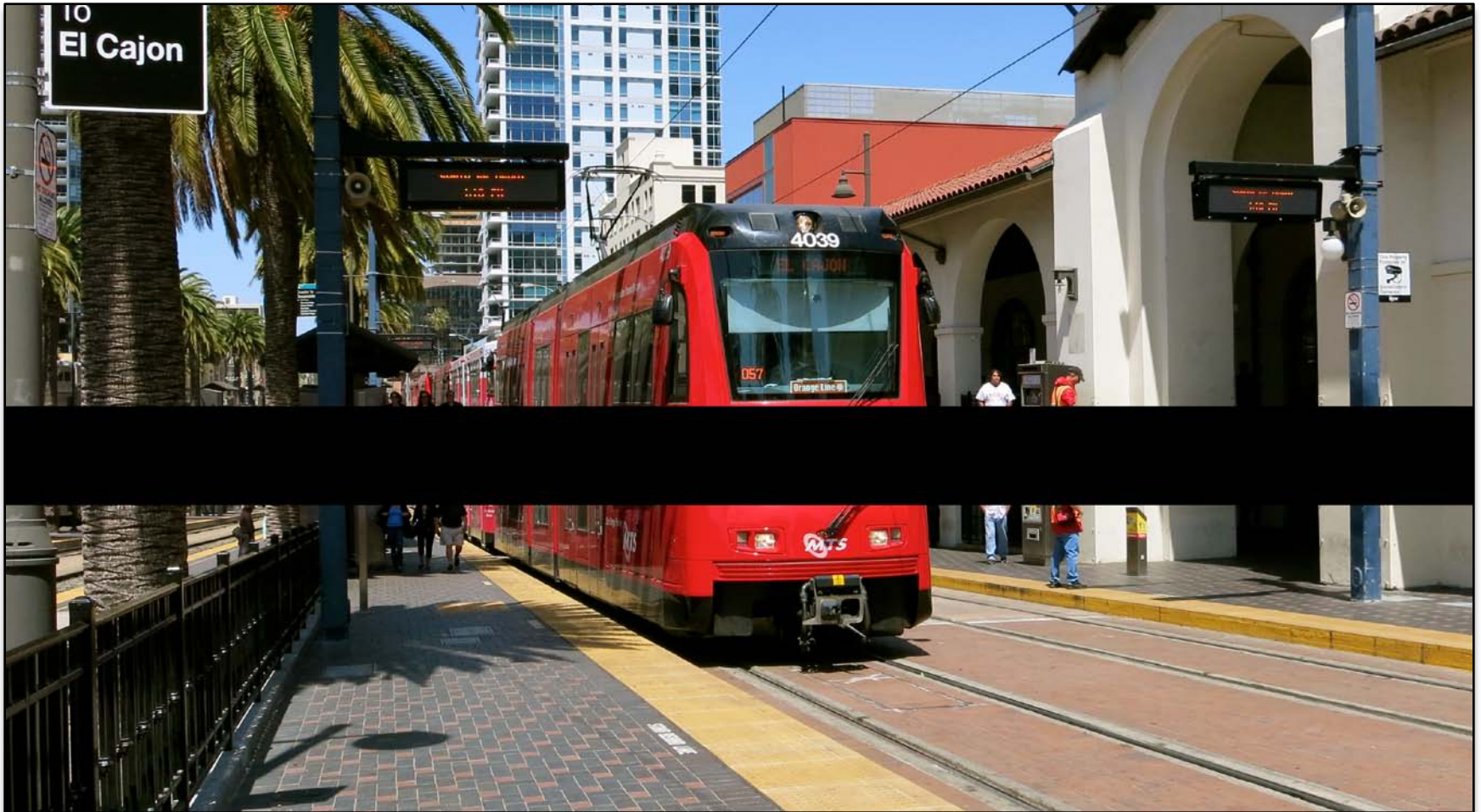
# Establishing A Test

# Curves By Line Segment

| | Blue Line | Green Line | Orange Line |
|---|---|---|---|
| Number Of Curves | 13 | 35 | 36 |
| Range Of Curves ° | 1°to 12° | 1° to 21° | 1° to 14° |
| Ruling Grade | .9% | 4% | 3.5% |
| Miles Per Line | 15 | 12 | 21 |

# Location Of Lubricators
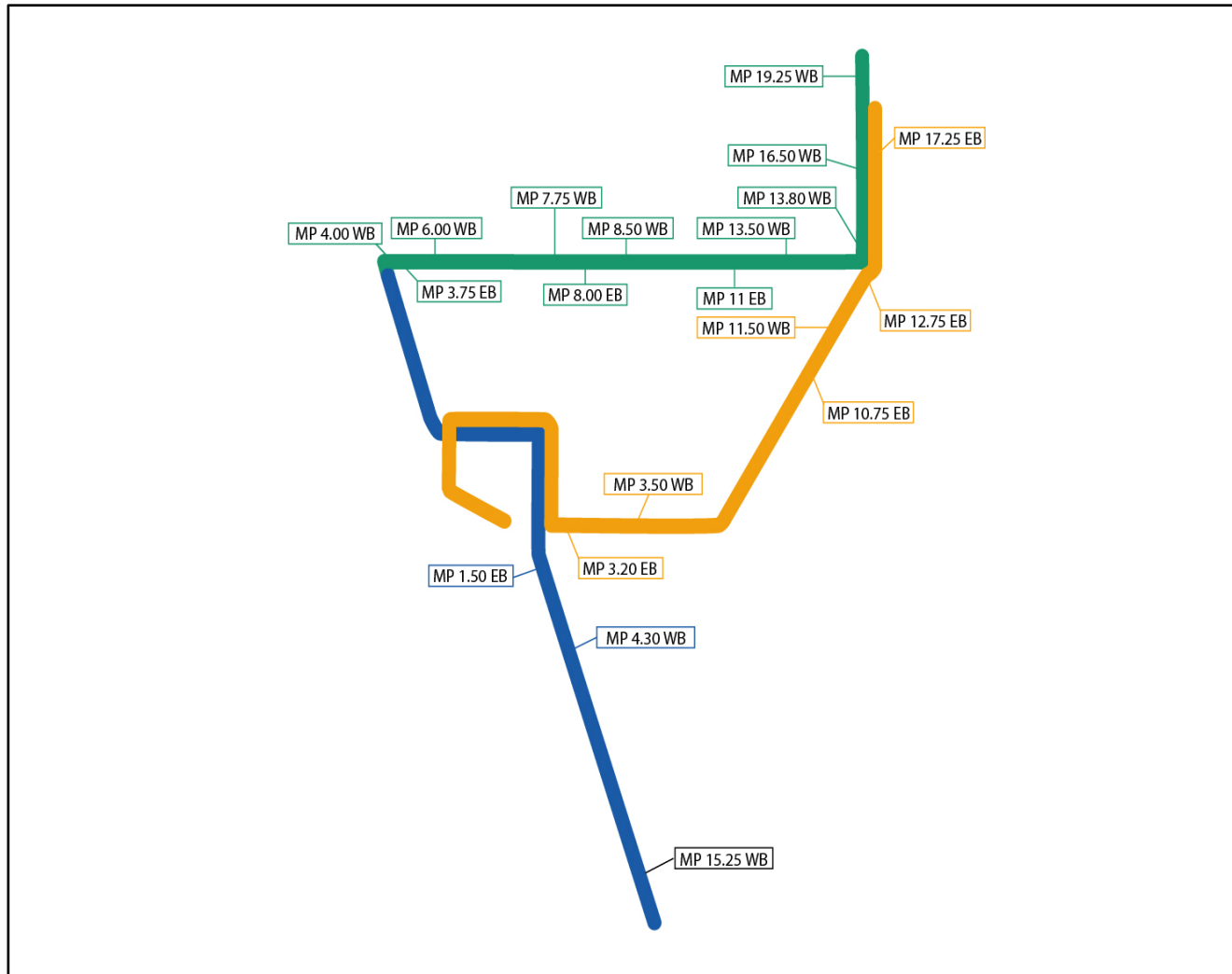
# Lubricator Installation

# Applicator Bar

# Applicator Bar

# Lubricator Settings Volume Applied

| Axle Count Setting Run Time | Train Passes Day | Volume Lubricant Applied Per Pass | Total Axle Count | Total Volume Applied |
|---|---|---|---|---|
| 16 Axles 4 Seconds | 72 | 0.4 cu. inch | 1,152 | 28.8 cu. in |
| 34 Days | 2448 | | 39,168 | 979.2 cu. in. |

# Horse-Shoe Curve

# Fluorescent Lubricant

# Testing
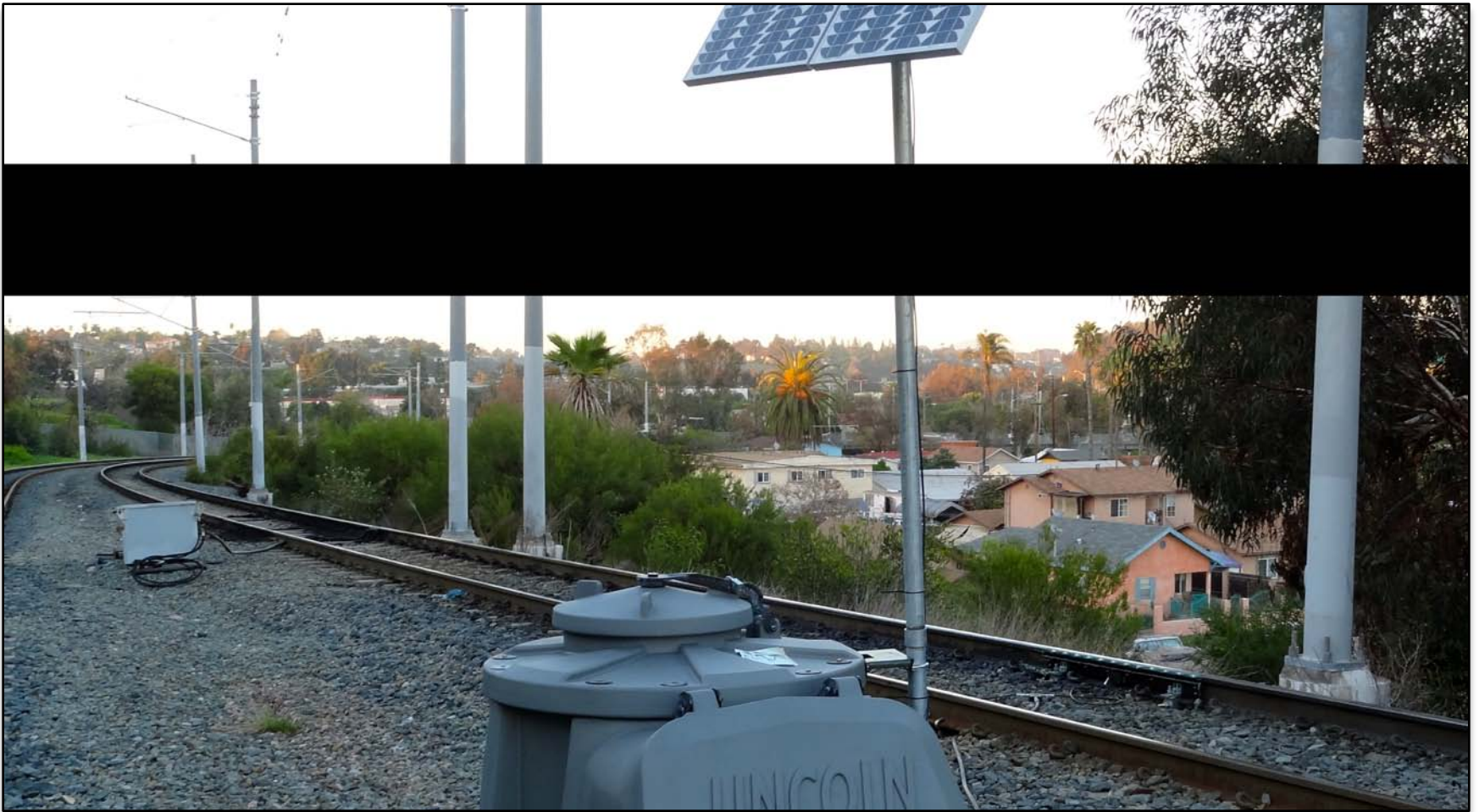
# Testing

# Initial Finding

- Lubricator was installed March 6
- First observance March 8
- Next Check March 11
- Tracked 1.05 miles in 5 days

# Dyed Lubricant In Reservoir
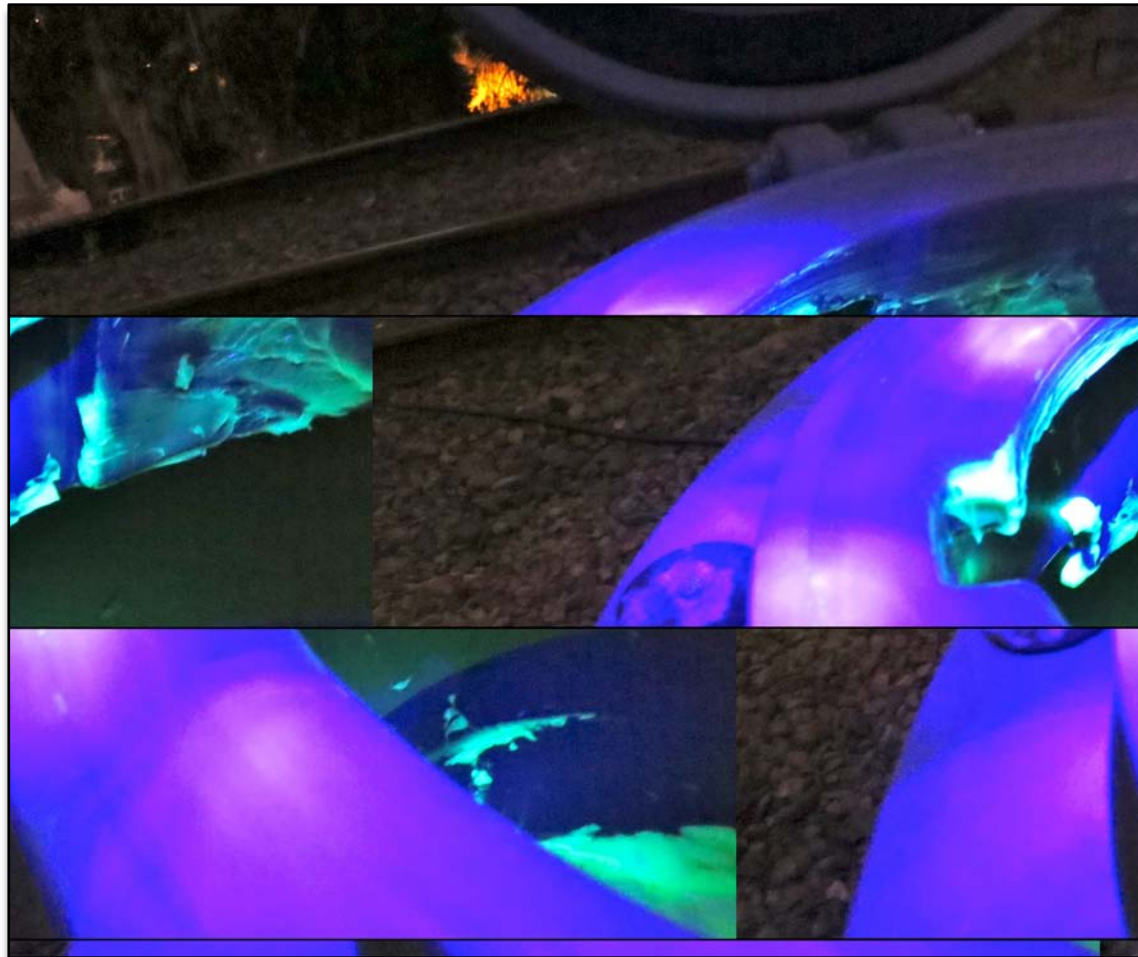
# Photographic Evidence

- April 8 and April 9
- Strong Evidence Of Lubricant
- Fluorescent Dye Overwhelmed
- Swipe Test

# Photographic Evidence

# Swipe Test
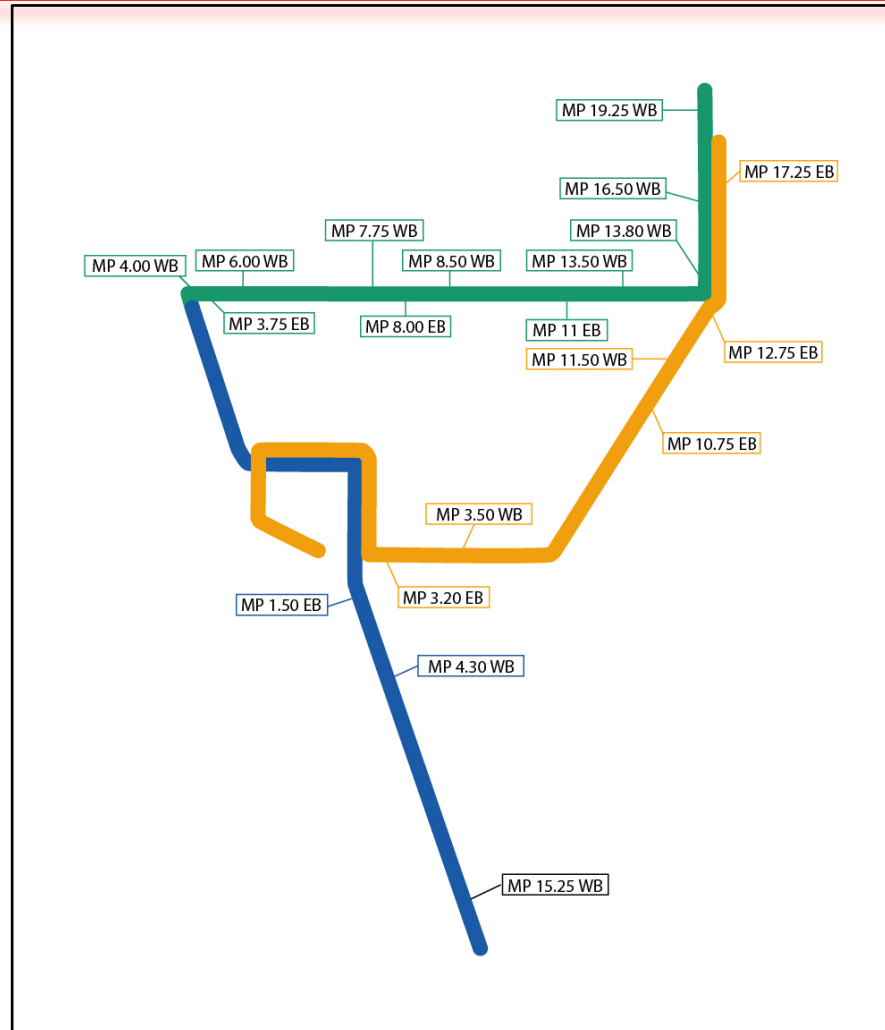
# Swipe Test

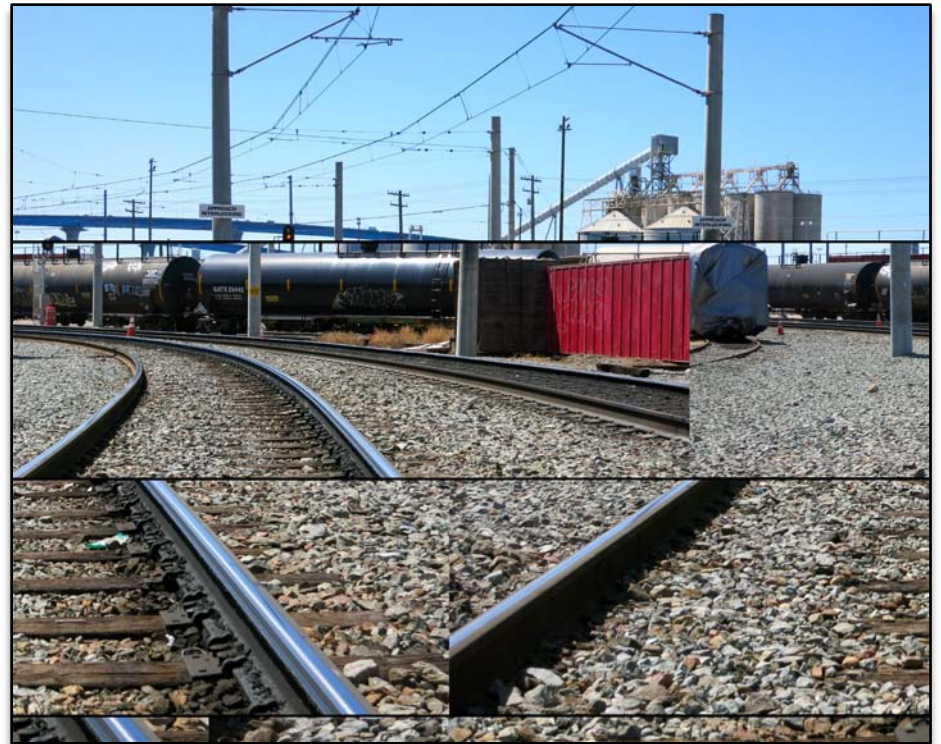# Evidence Of Lubricant

# Evidence Of Lubricant
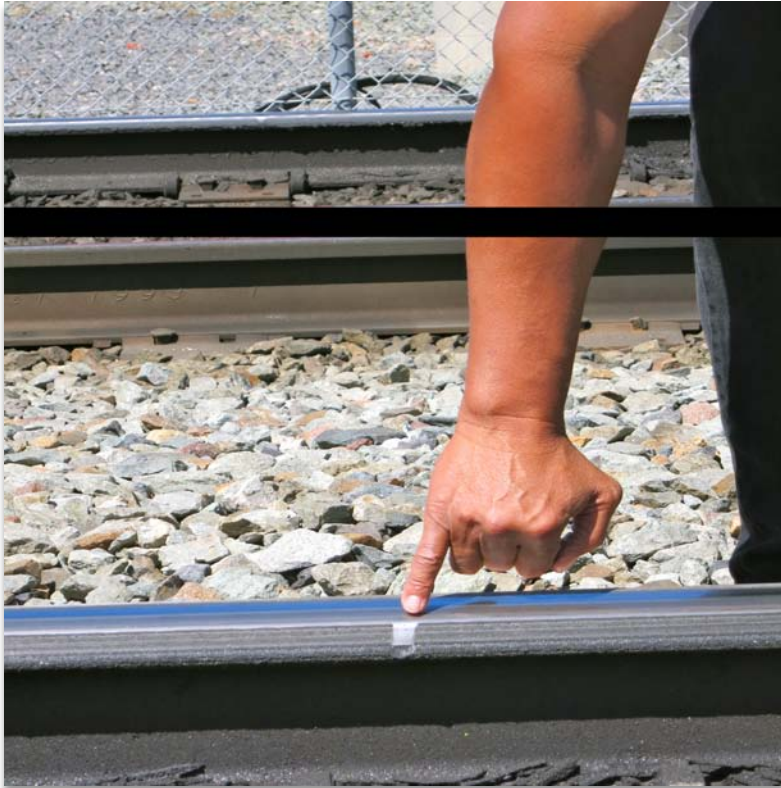
# Evidence Of Lubricant

# End Of Test Track
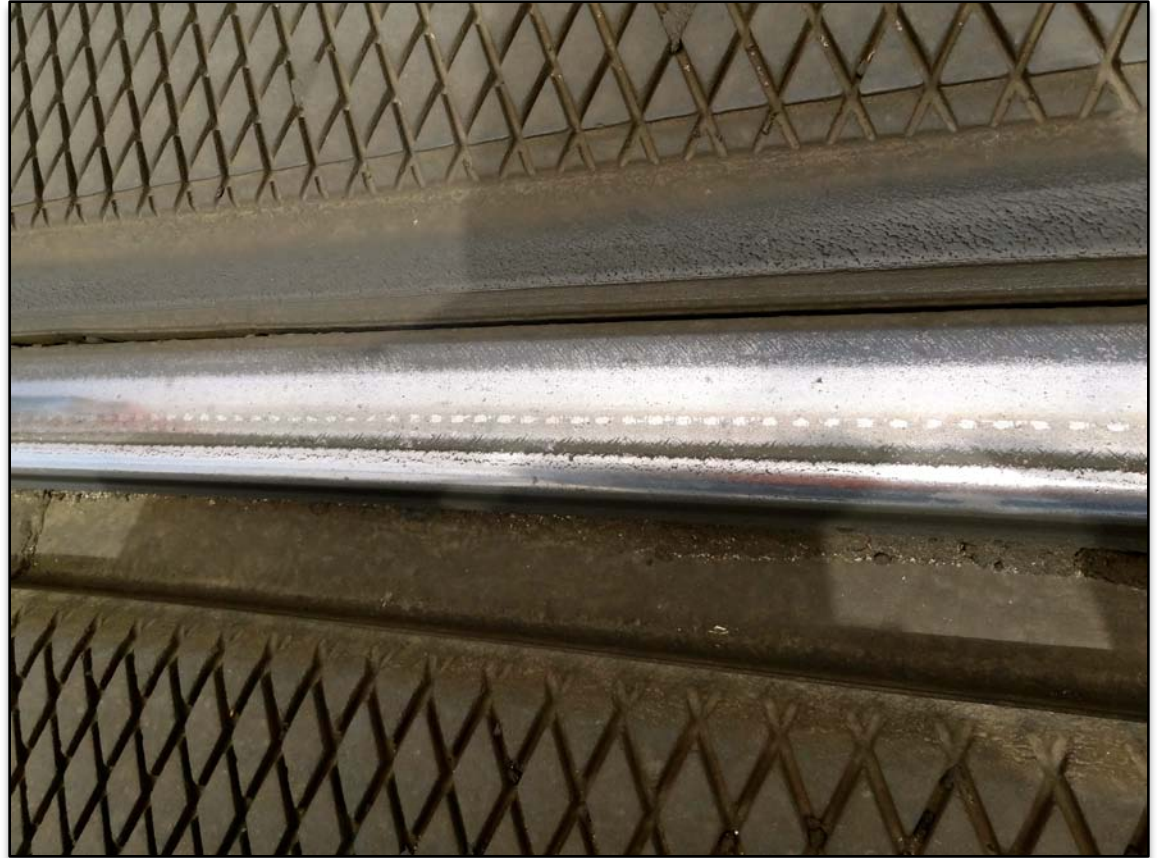
# Additional Observation Area's

# At 12ᵀʰ And Imperial

# Old Town TC

# Rail Condition

- Maintenance
- Grinding
- Profiling
- Lubricant
- Lubricators

# Tracking Distance Summary

| **Location** | **Miles Of Tracking** |
|---|---|
| • Test Site Orange Line | • 9.55 Miles |
| • Blue Line 12$^{Th}$ And Imperial | • 13.75 Miles |
| • Green Line Old Town Transit Center | • 11.0 Miles or more |

# Summary

- Reduction Of Wear
- Noise Abatement
- Effective Collection Of Evidence
- Effectiveness Elsewhere on Trolley
- Conditions For Maximum Effectiveness

# Implications/Conclusions

- Extended Life Of Rail

- Noise Abatement

- Rail Maintenance

- ROI

- Protection Of Asset

# Questions