

# **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.**



# Case Study Outline

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- History of San Diego Trolley
- Problem
- Background on lubrication
  - Addition of rail grinding
- Results
- Summary and conclusions
- Implications



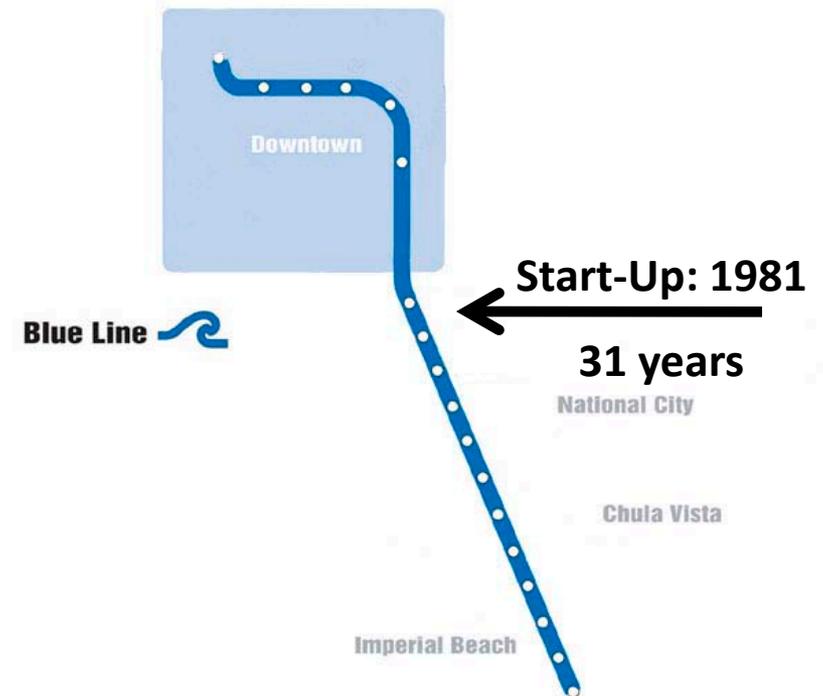
# The Light Rail Renaissance Begins

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# Growth of the Trolley System

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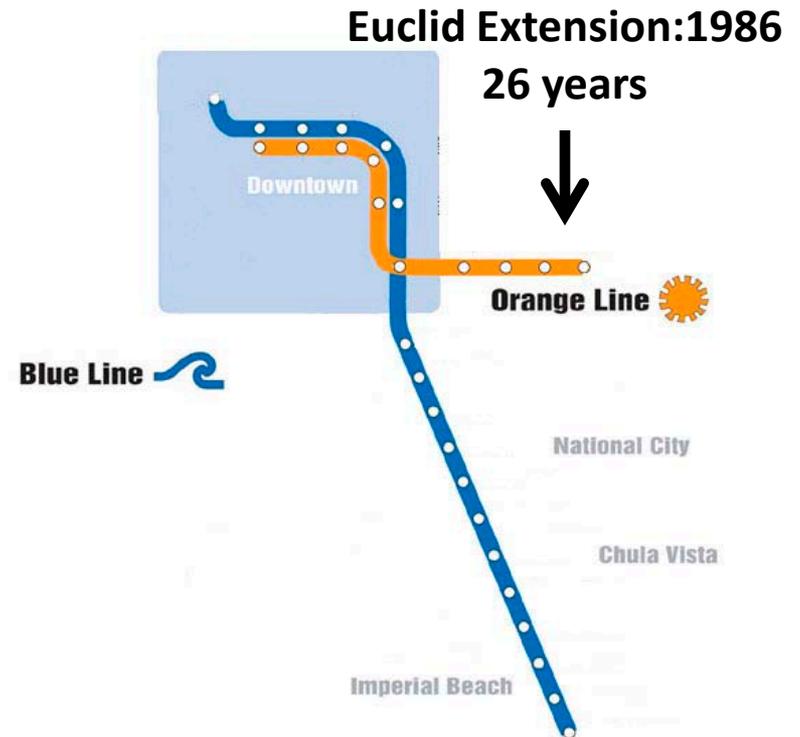


# Growth of the Trolley System

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Start-Up: 1981

31 years



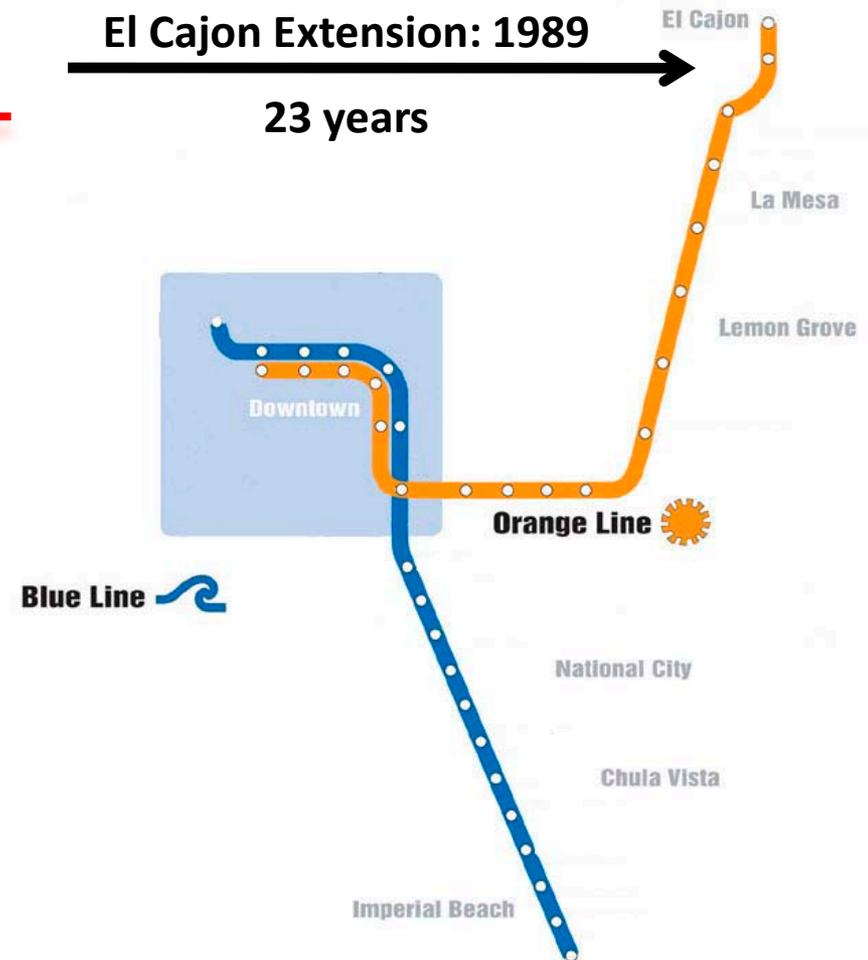
# Growth of the Trolley System

Start-Up: 1981

31 years

Euclid Extension: 1986

26 years



# Growth of the Trolley System

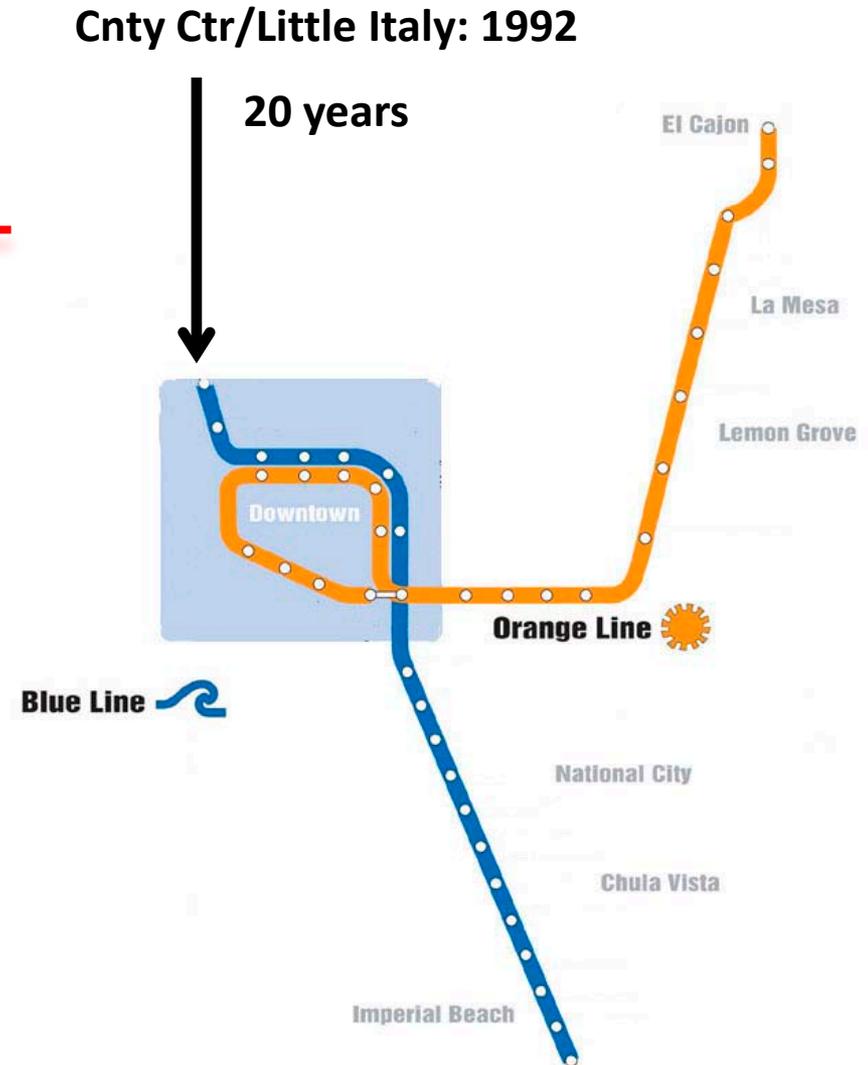
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Euclid Extension: 1986	26 years
El Cajon Extension: 1989	23 years

Bayside Extension: 1990  
22 years



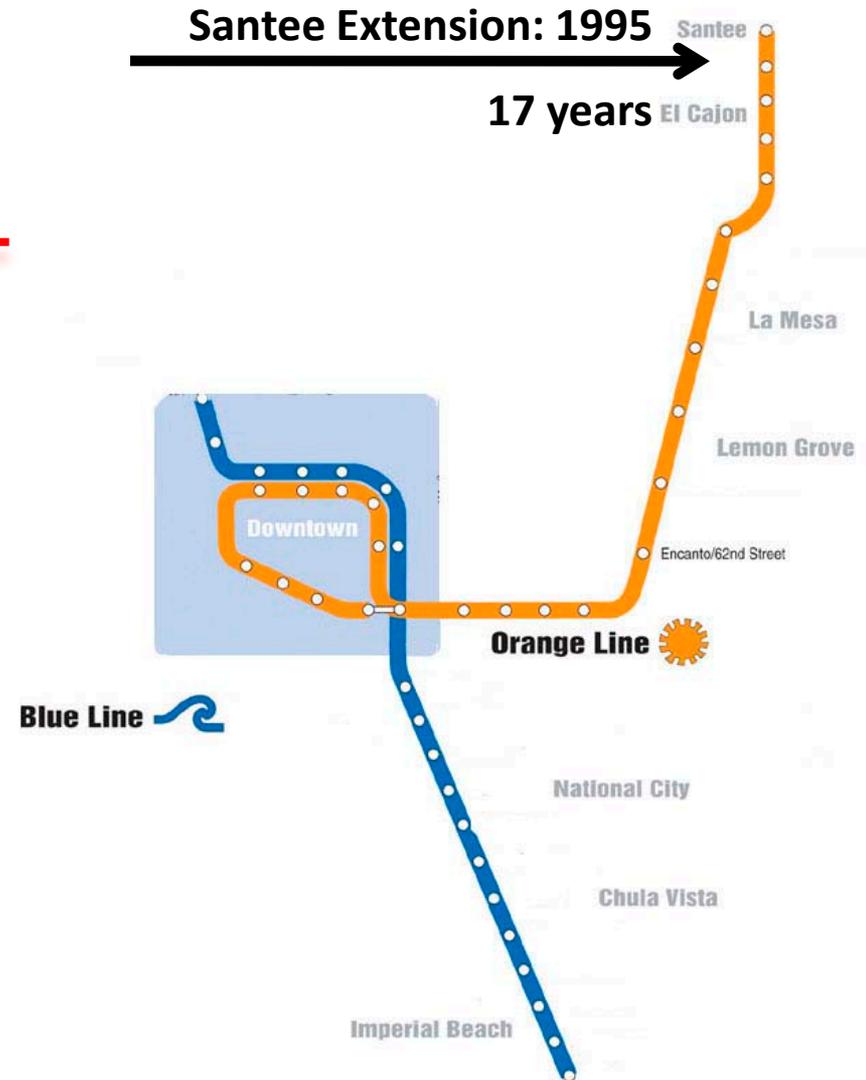
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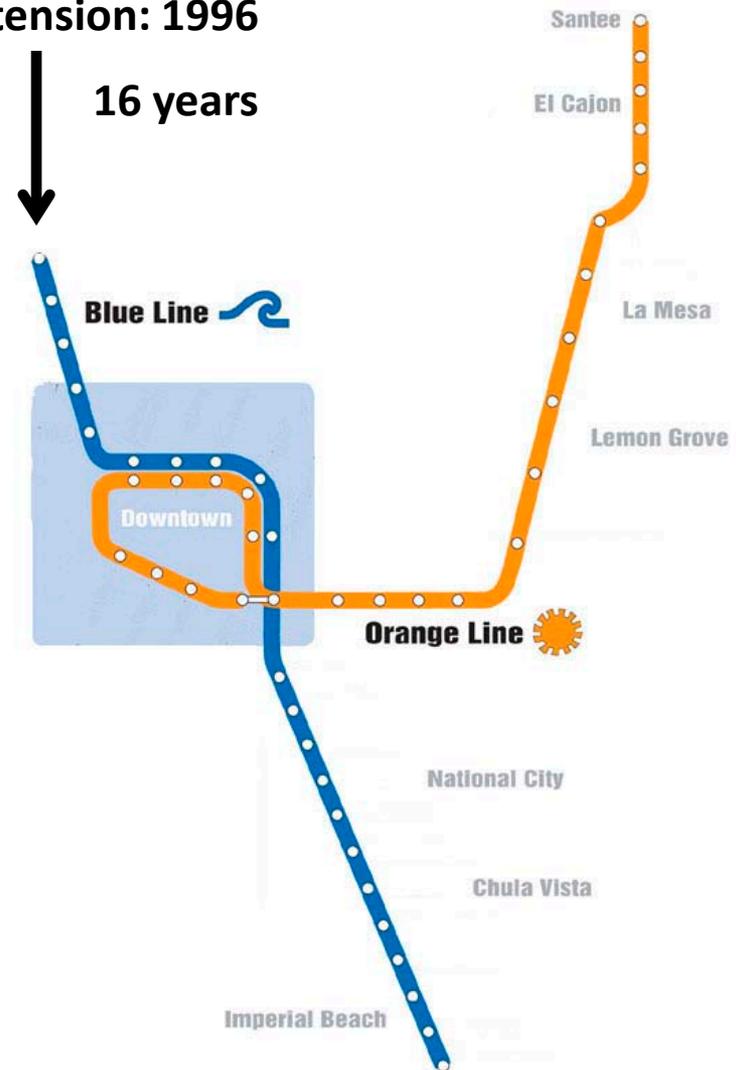


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Old Town Extension: 1996

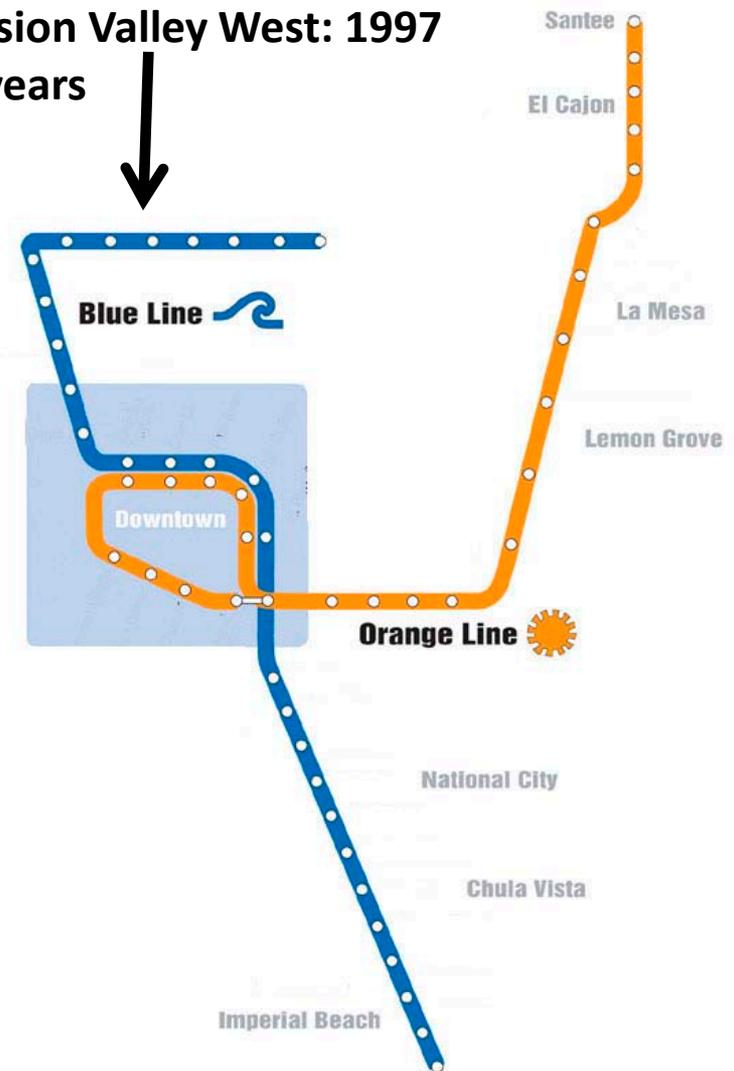
16 years



# Growth of the Trolley System

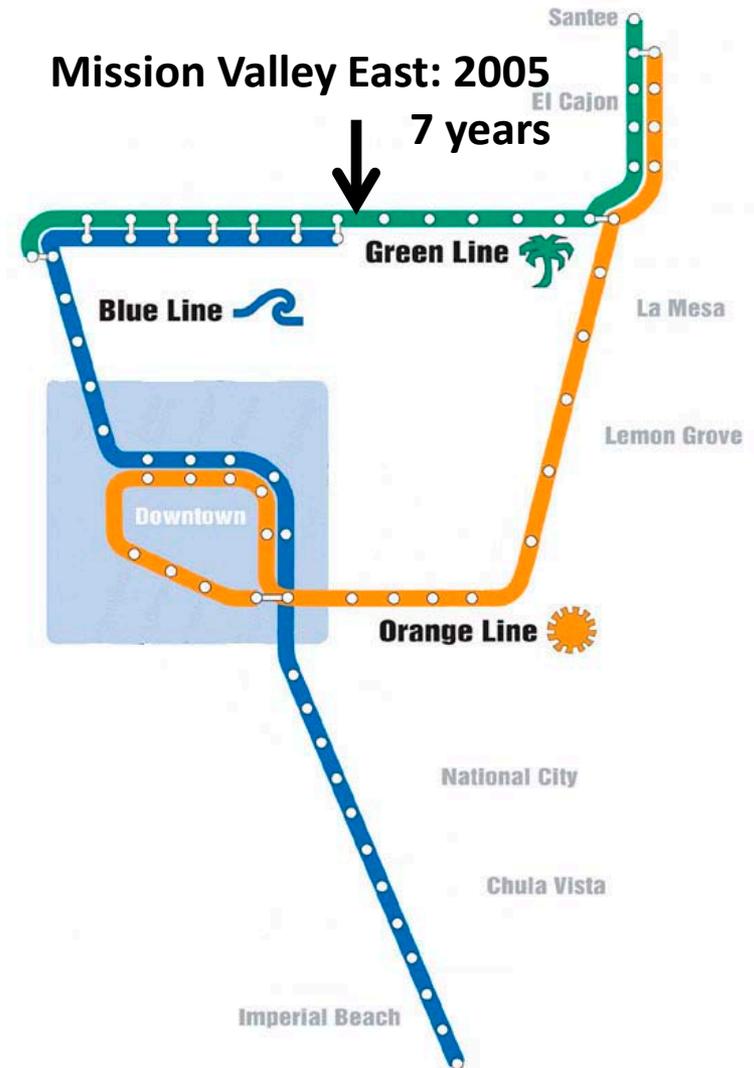
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Mission Valley West: 1997  
15 years

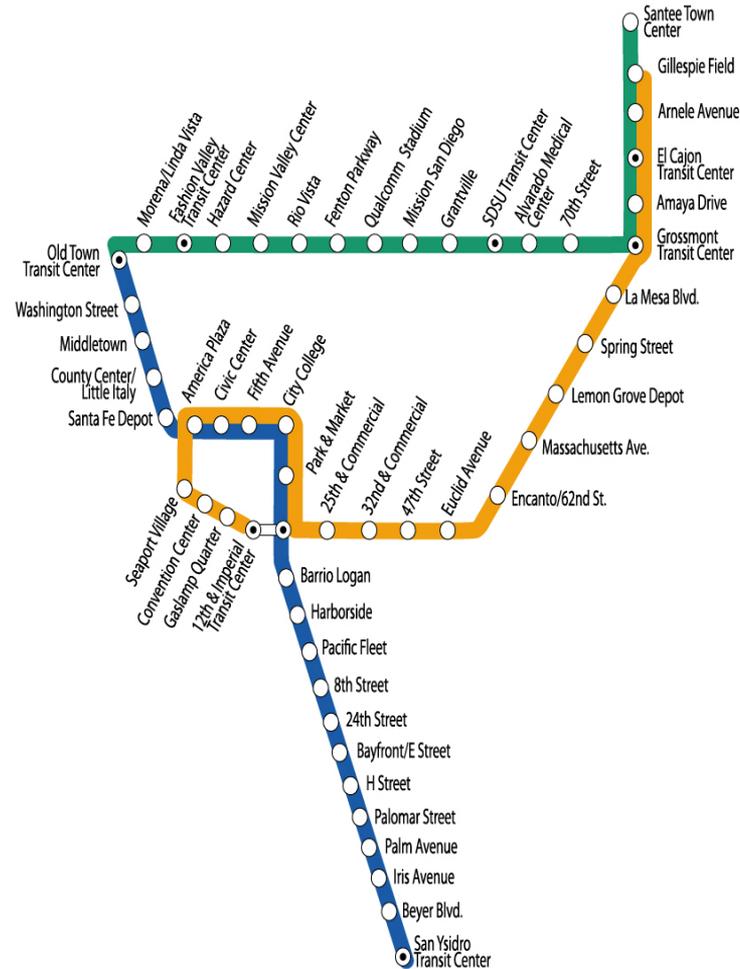


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# Trolley System Today



# Rolling Stock

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# Rolling Stock

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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



# Tonnage Per Line

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Blue Line	Orange Line	Green Line
103 x U2 / Day	72 x SD-1000 / Day	72 x S-70 / Day
4,988,856 Tons/Year	3,912,041 Tons/Year	4,345,924 Tons/Year
Freight 260 / Year	Freight 156 / Year	LRT Only
520,000 Tons/Year	315,000 Tons/Year	LRT Only
<b>5,508,856 Tons/Year</b>	<b>4,227,041 Tons/Year</b>	<b>4,345,924 Tons/Year</b>



# Problem: Noise

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- 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

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- 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

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- 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

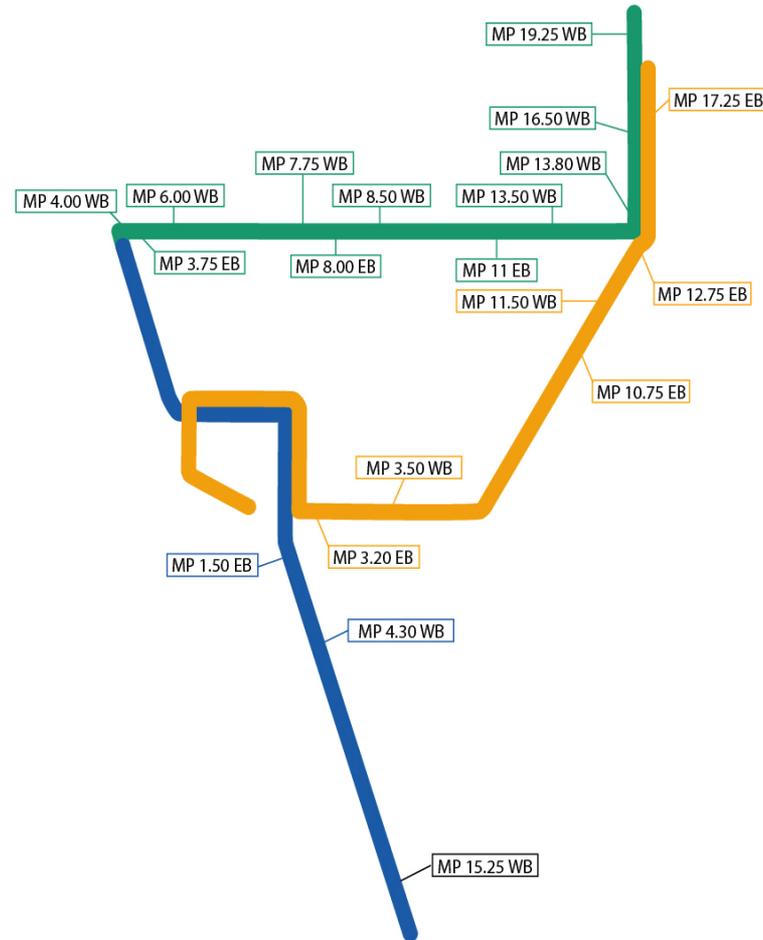


# Typical Applicator Bar

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# Location Of Lubricators



# Curves By Line Segment

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	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



# Results

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- **Significant and immediate elimination of noise**
- **Happier track staff**
- **Improved public relations**



# Results

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- **Unintended/additional benefits related to rail wear:**
- **Wear Reduction**
- **Rail**



# Results

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- Wear of new rail that has been lubricated from time the rail was placed into service

**GREEN LINE**

- Wear of existing rail that initiated lubrication processes after having been in service for an extended period of time

**BLUE LINE**

- Wear of rail that has never lubricated

**ANONYMOUS**



# Results: Scenario 1

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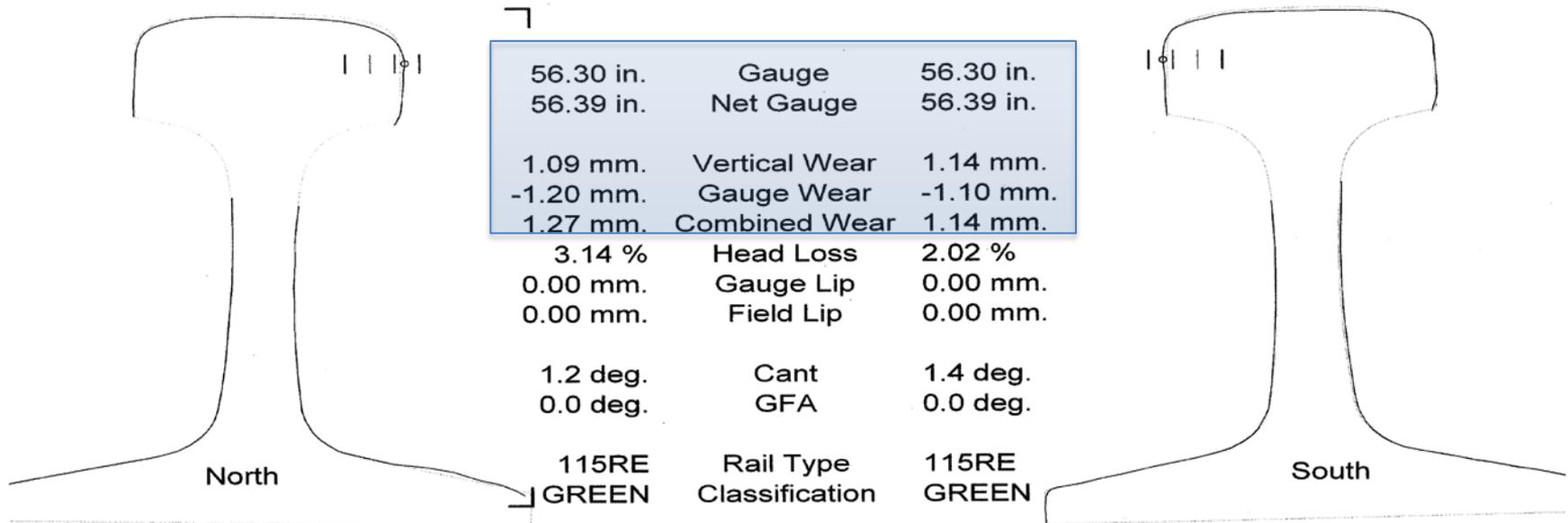
- Wear of new rail that has been lubricated from time the rail was placed into service
- Curve # 14 Curve 7.6° Right
- **GREEN LINE**



# Curve # 14 Green (2008)

MTS - SANDIEGO TROLLEY  
MTSGREEN - Track EAST

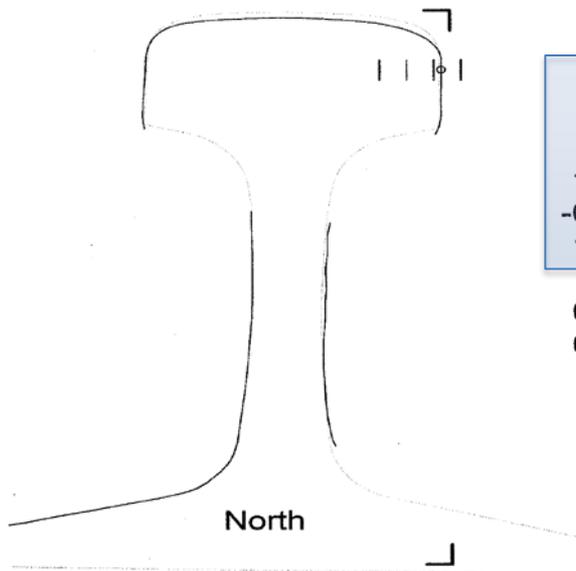
15/633 Run/Profile 15/634  
Nov 28 2008 Run Date Nov 28 2008  
3.813 Mile 3.813  
#14: 7.6 deg. R



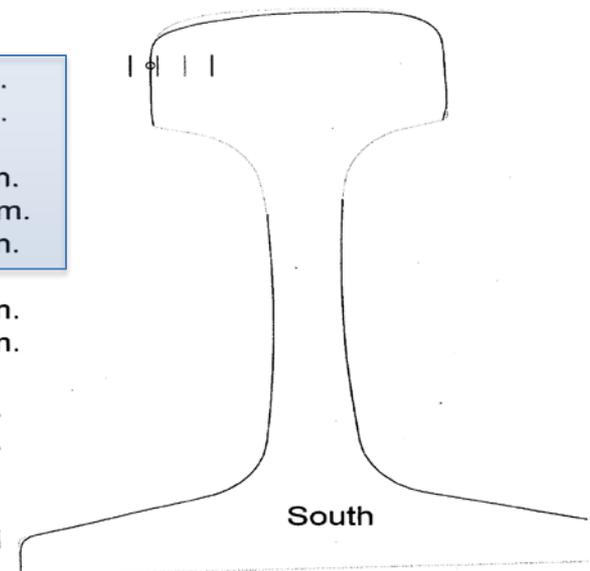
# Curve # 14 Green (2011)

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		



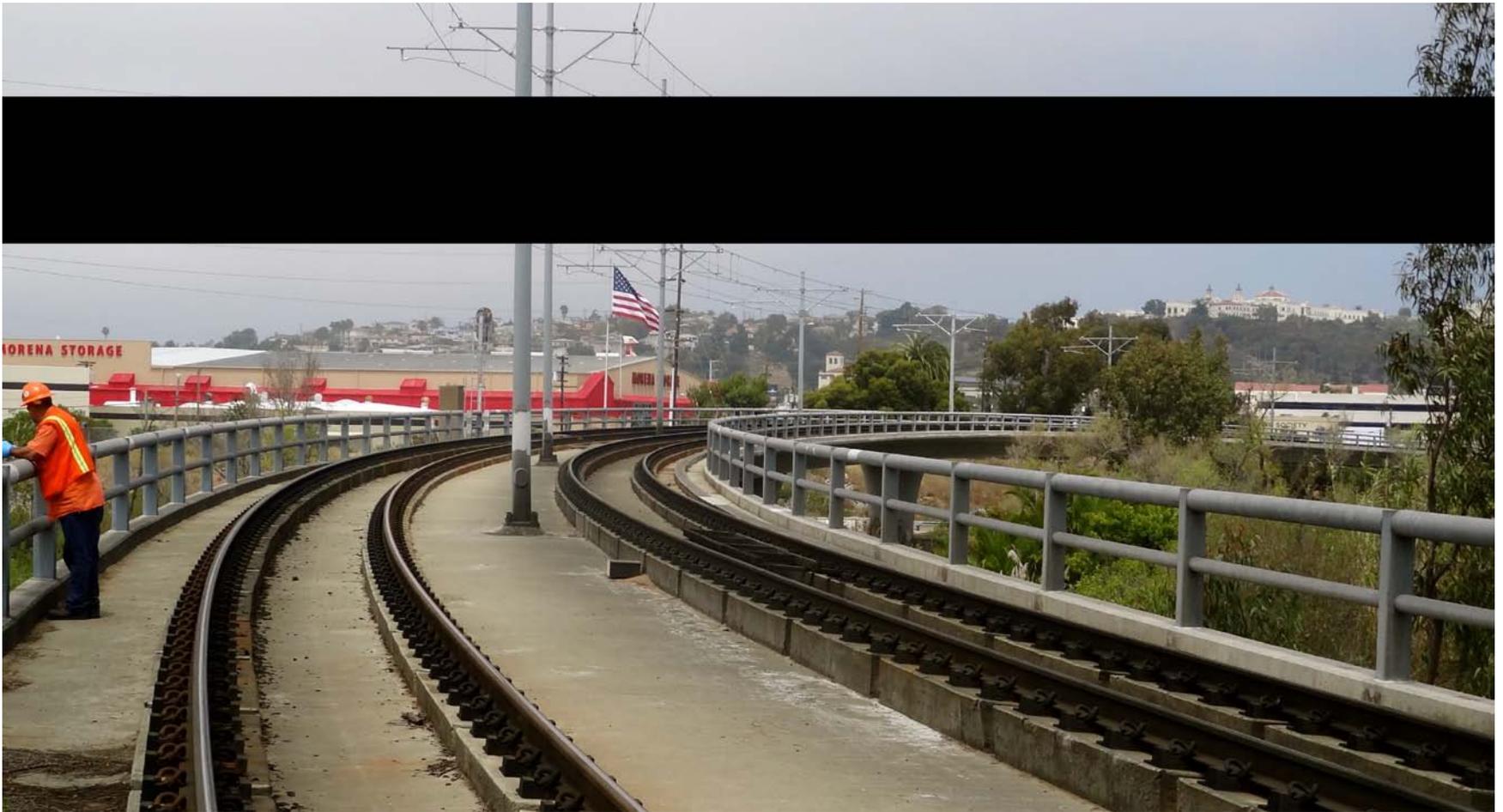
56.37 in.	Gauge	56.37 in.
56.40 in.	Net Gauge	56.40 in.
1.59 mm.	Vertical Wear	1.23 mm.
-0.48 mm.	Gauge Wear	-0.38 mm.
1.59 mm.	Combined Wear	1.23 mm.
4.55 %	Head Loss	3.23 %
0.02 mm.	Gauge Lip	0.00 mm.
0.00 mm.	Field Lip	0.00 mm.
1.2 deg.	Cant	1.6 deg.
0.0 deg.	GFA	0.0 deg.
115RE GREEN	Rail Type Classification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



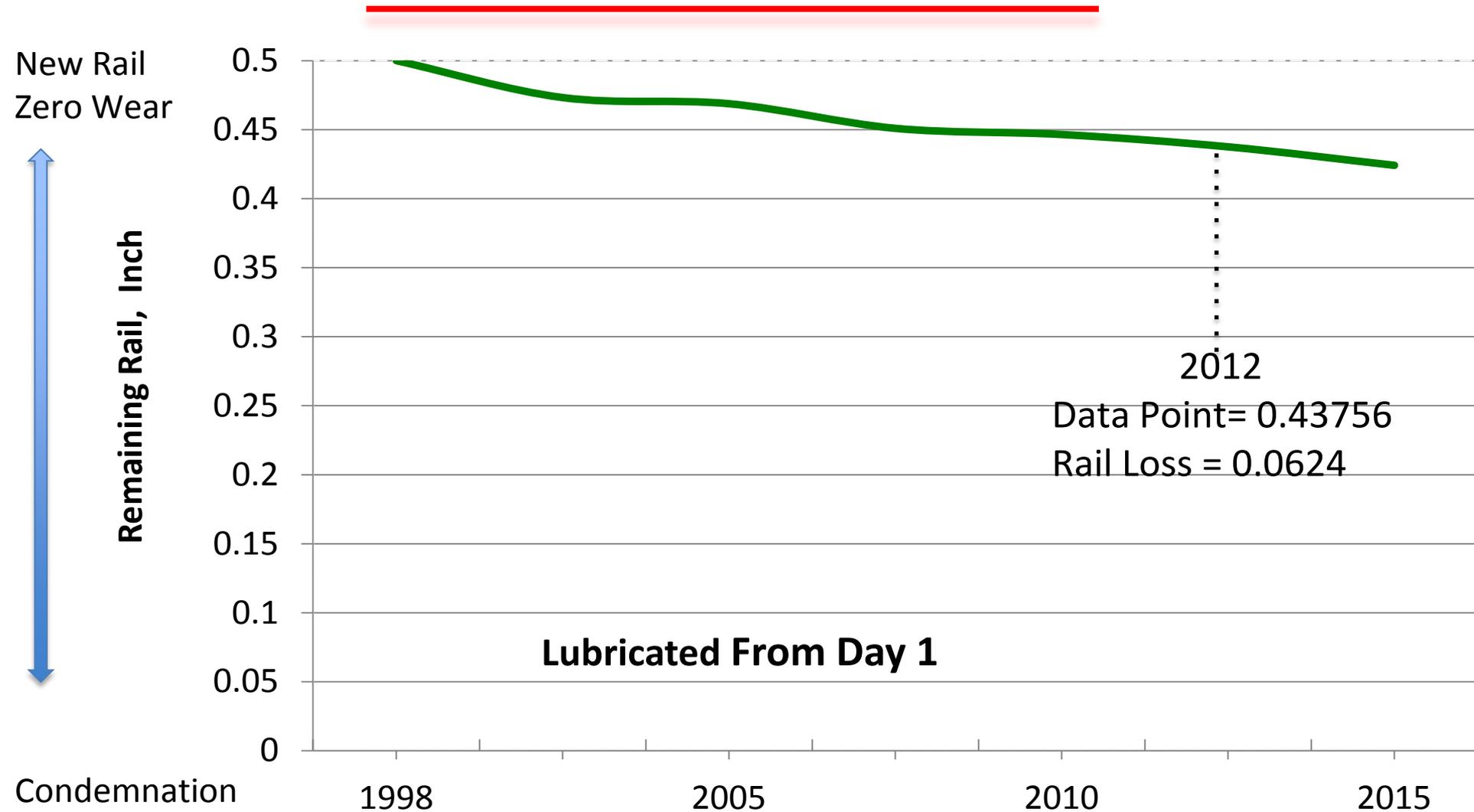
# Additional Measuring



# Curve # 14 7.6° Right



# Green Line



# Results : Scenario 2

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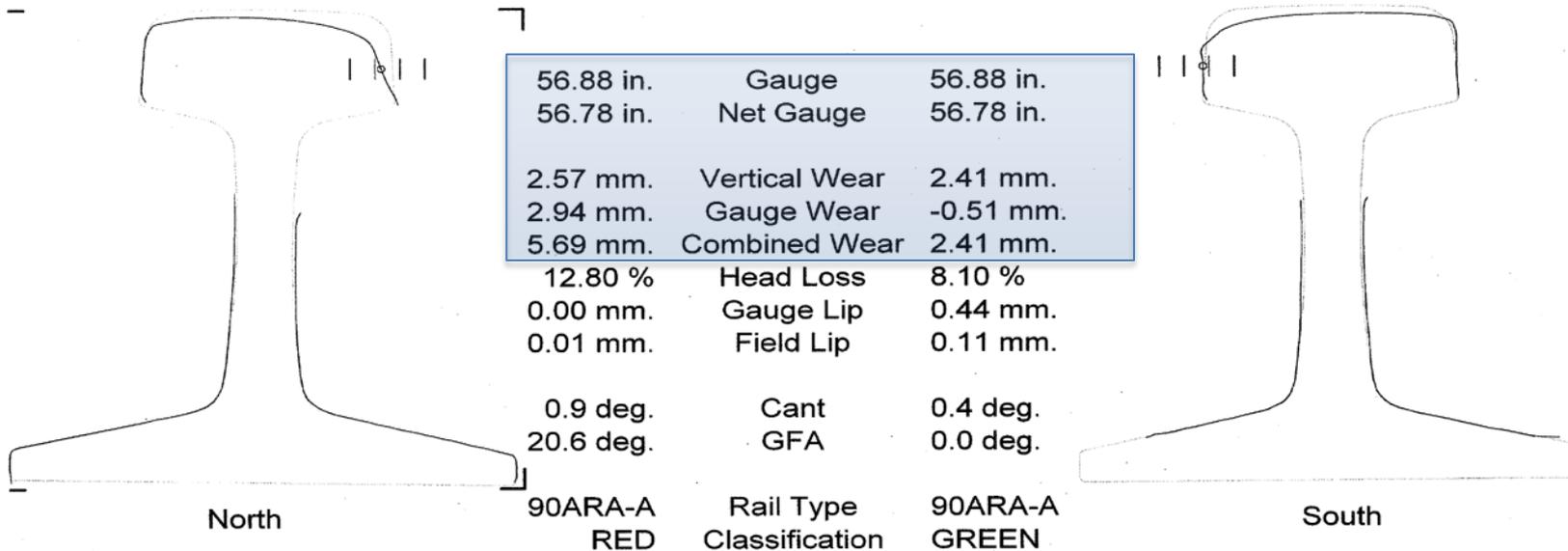
- Wear of existing rail that initiated lubrication processes after having been in service for an extended period of time
- Curve # 9 8<sup>Th</sup> Street Curve 3° Right
- BLUE LINE



# 8<sup>Th</sup> St. Curve (2005)

MTS - SANDIEGO TROLLEY  
MTSBLUE - Track EAST

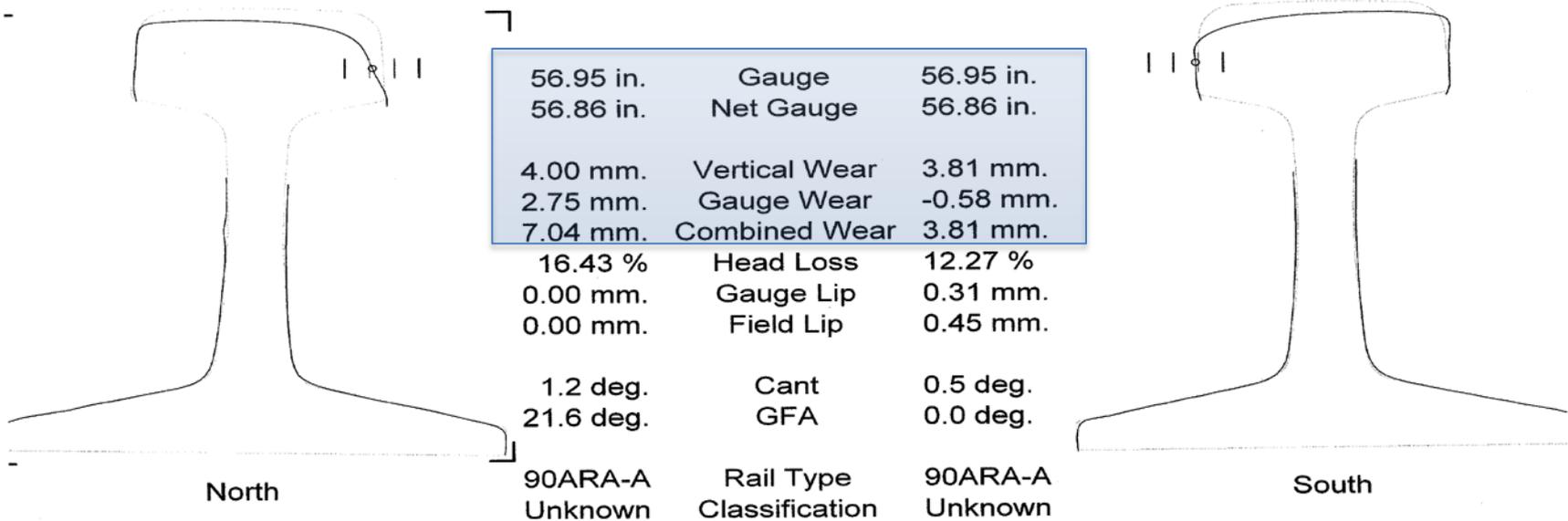
9/5233	Run/Profile	9/5234
Jul 29 2005	Run Date	Jul 29 2005
4.260	Mile	4.260
#9: 3.0 deg. R		



# 8<sup>Th</sup> St. Curve (2012)

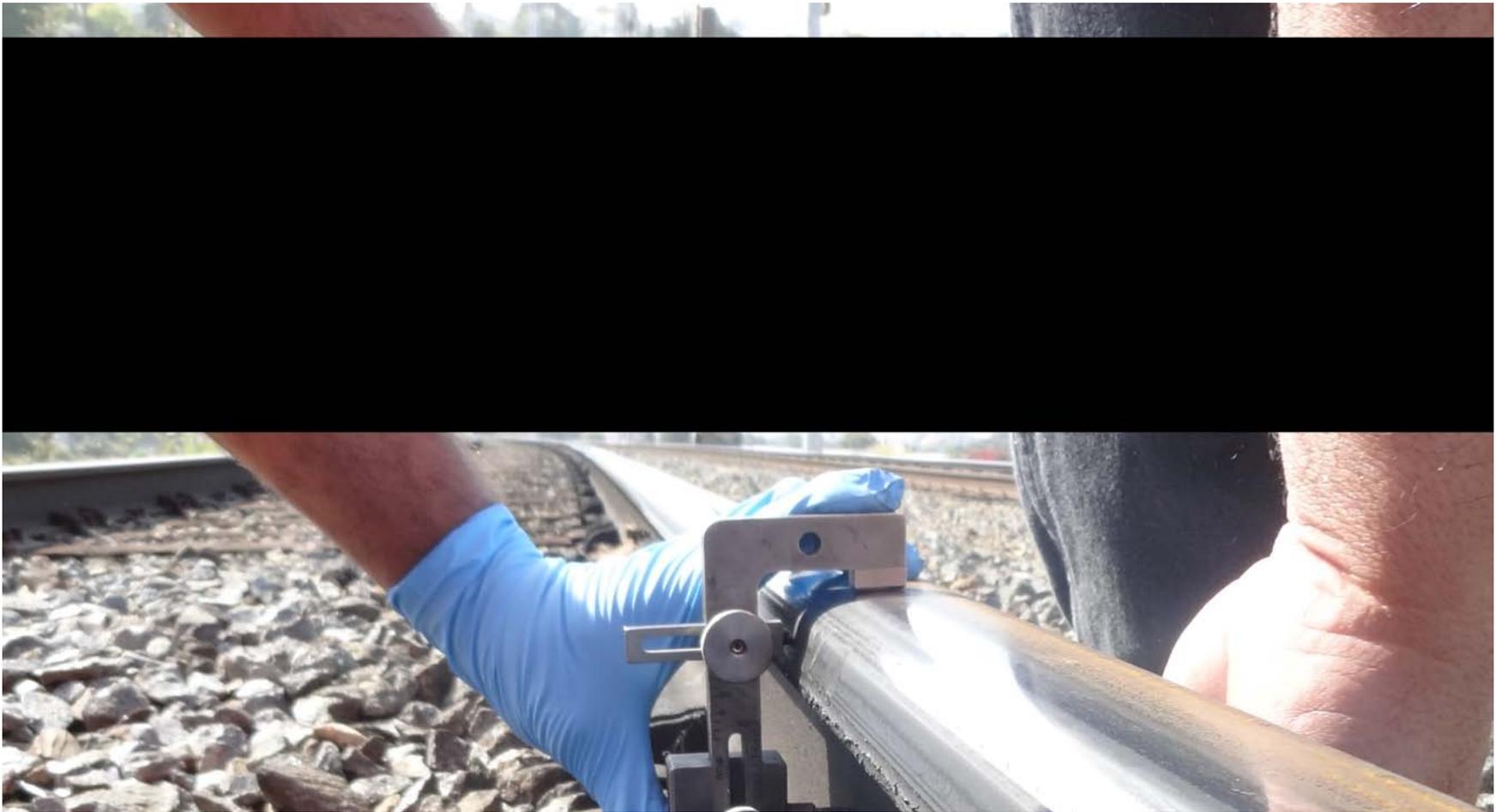
MTS - SANDIEGO TROLLEY  
MTSBLUE - Track EAST

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



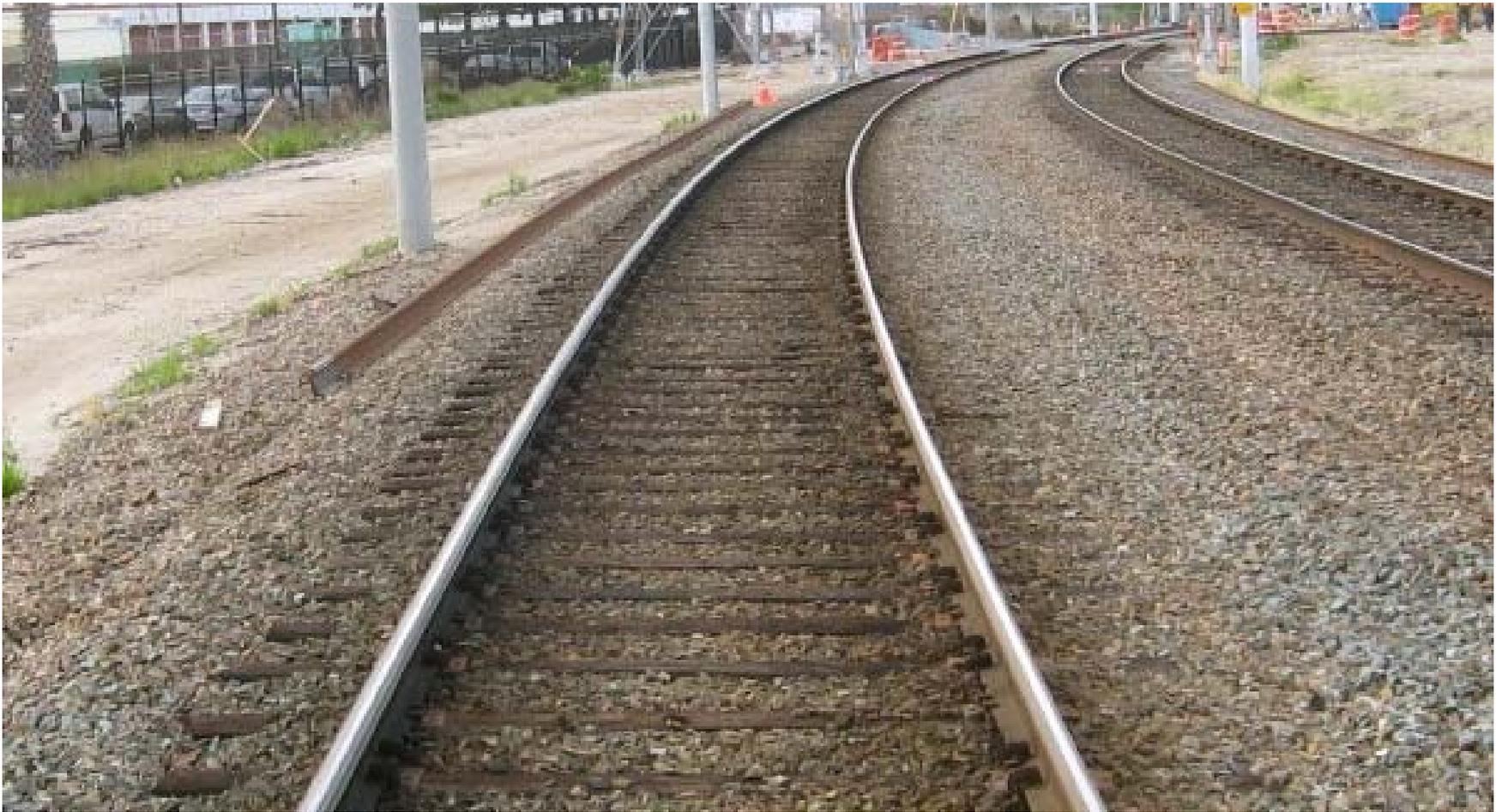
# Additional Measuring

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

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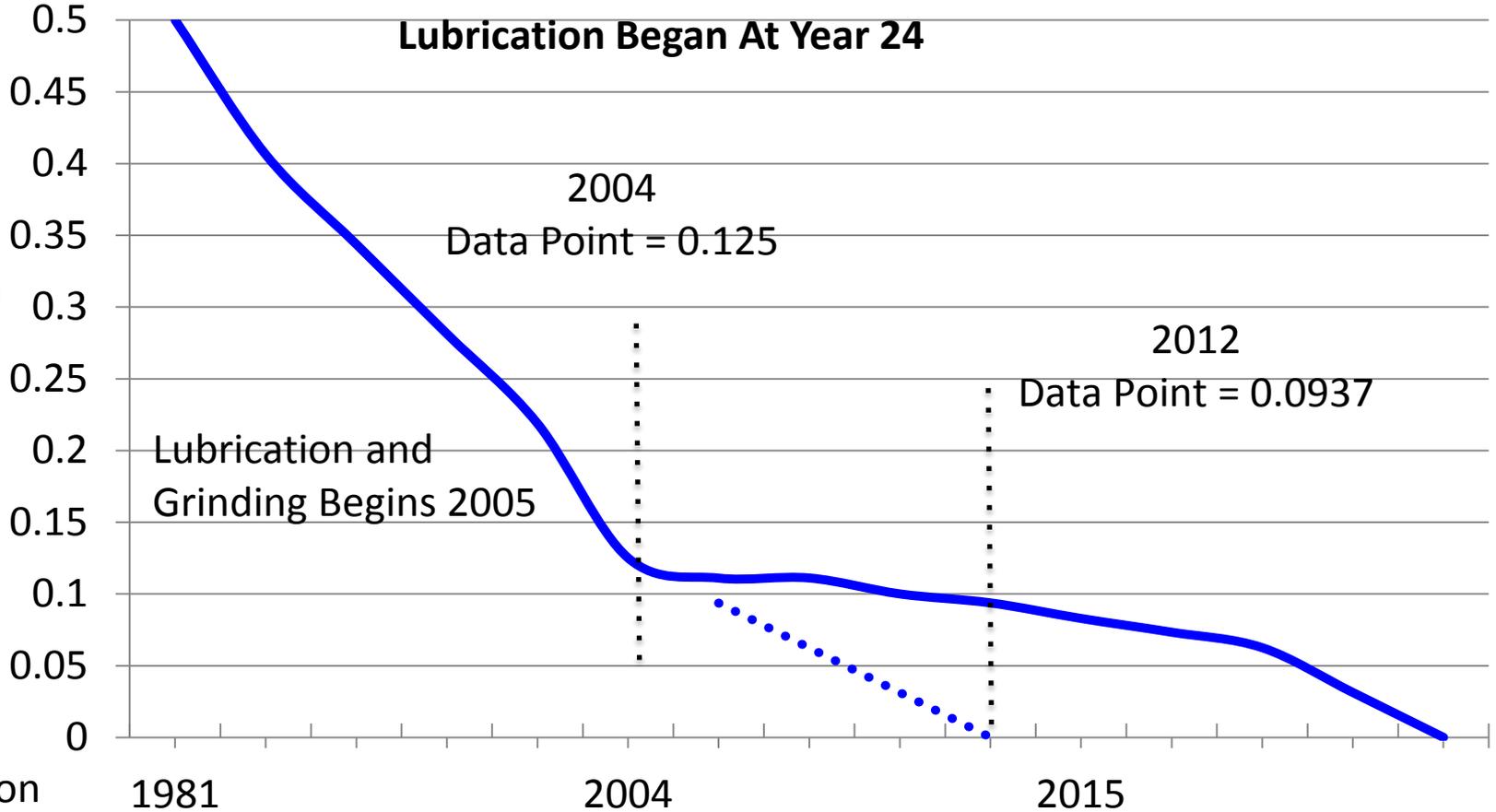


# Blue Line 8<sup>th</sup> St. Curve

New Rail  
(Zero Wear)



Rail Remaining, Inch



Condemnation  
(Worn Out)



# Results : Scenario 3

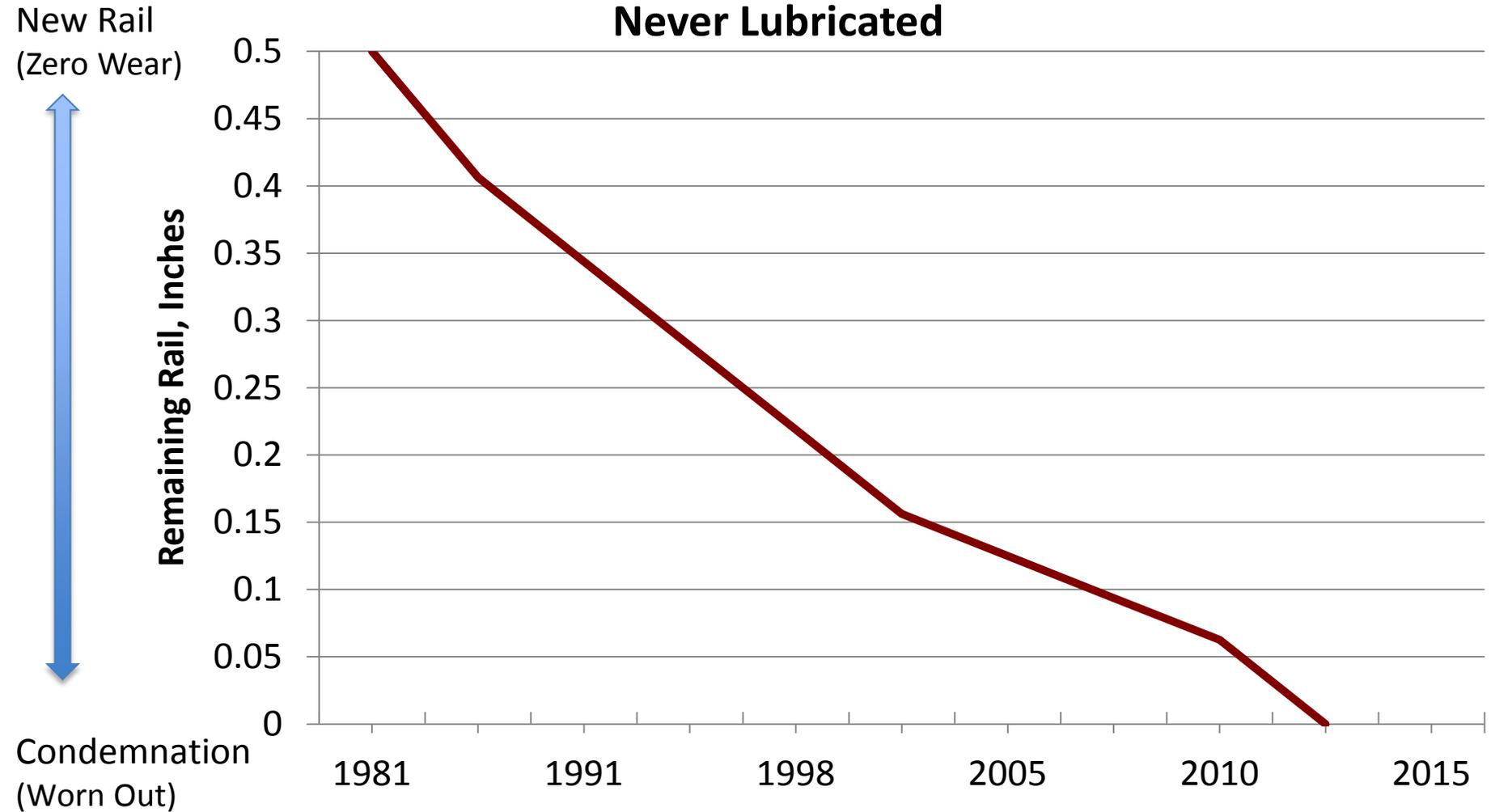
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- Wear of rail that has never lubricated
- Curve 3.7° Right
- **ANONYMOUS**

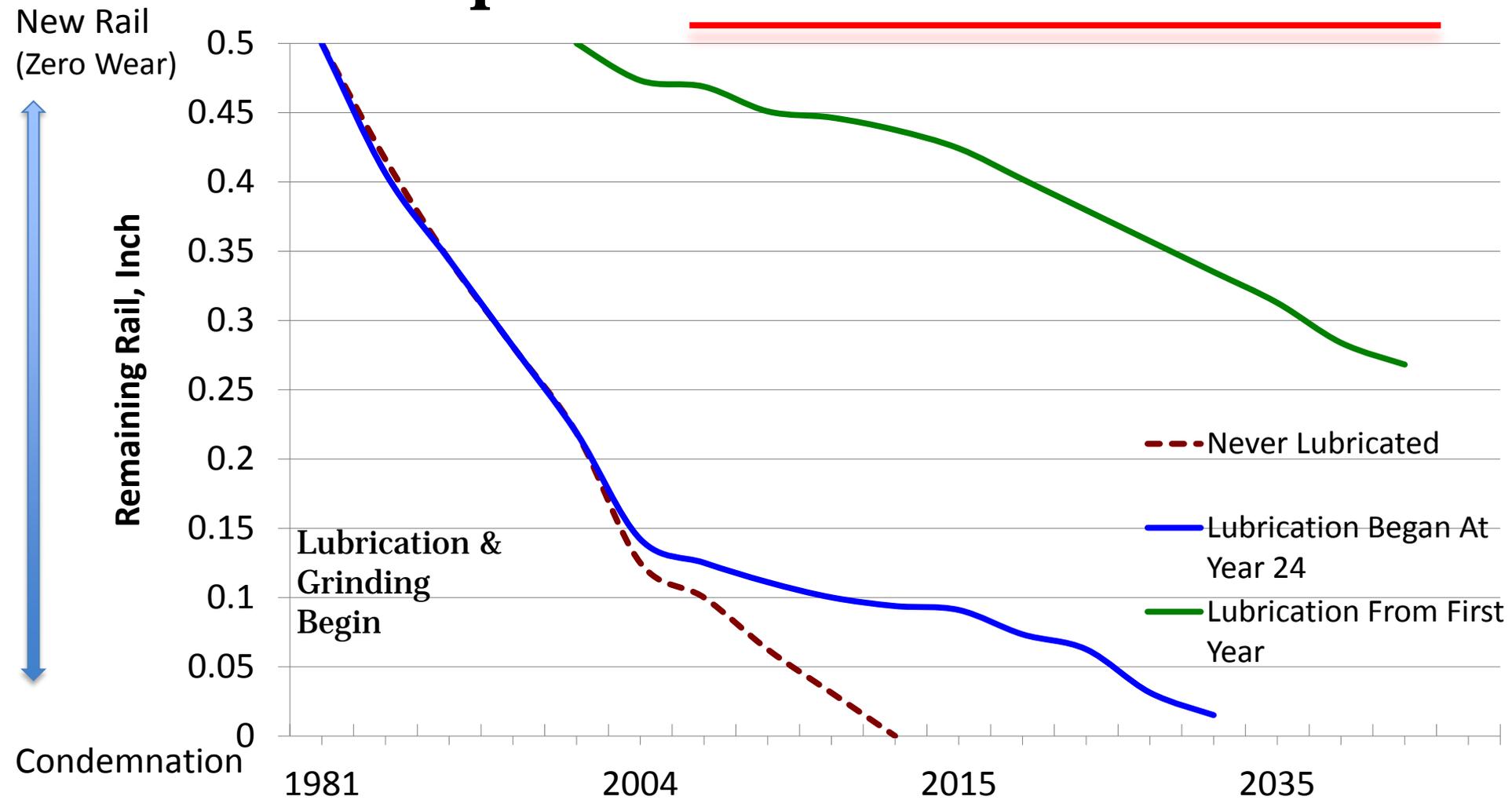


# Anonymous

Never Lubricated



# Comparison Of All Three



# Summary and Conclusions

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- Rail lubrication eliminated the noise problem
- The addition of a regular grinding/profiling program to continuous lubrication resulted in
  - Significant reduction on rail wear



# Implications

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- **Implementation of regular lubrication: Noise and squeal-free system**
  - Reduces noise pollution
  - Makes for happier consumers and tax payers
  - Fewer complaints for ROW
- **Combination of lubrication and rail grinding:**
  - Improved ride quality for customer
  - Extension of rail life
  - Extension of wheel life



# Implications

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- Significant cost savings
  - Longer intervals between rail replacement
  - Anticipate: Potential for extending life of rail 14 years/48% on Blue Line
  - Estimated life on Green Line in excess of 60 years
  - Reduces capital replacement costs.



# Charlie Coval

January 1945 - October 2008

May your hard work and  
dedication as a Construction  
Inspector on the South Bay  
Expressway be an inspiration  
to workers everywhere.

# Questions And Answers

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