

# **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

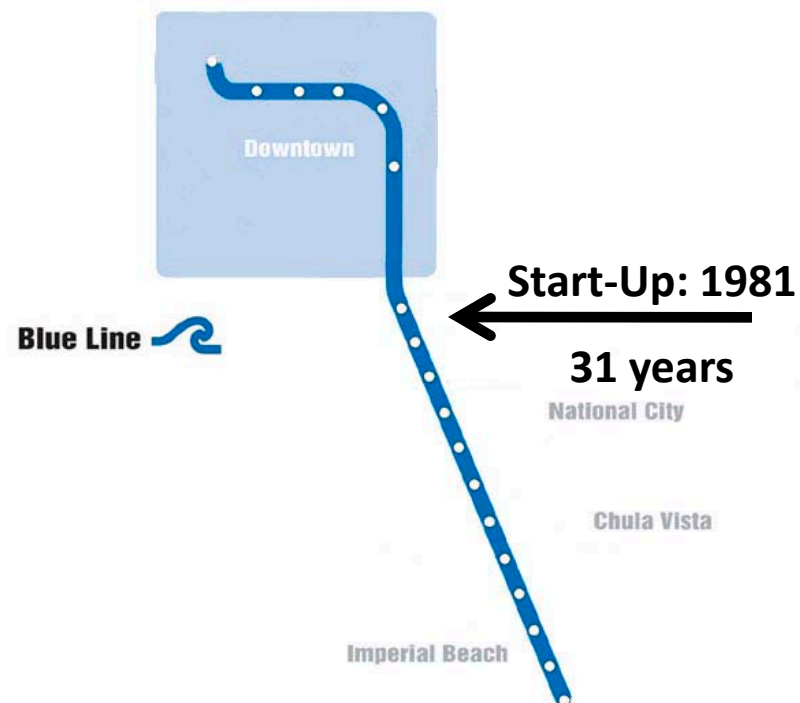
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# Growth of the Trolley System

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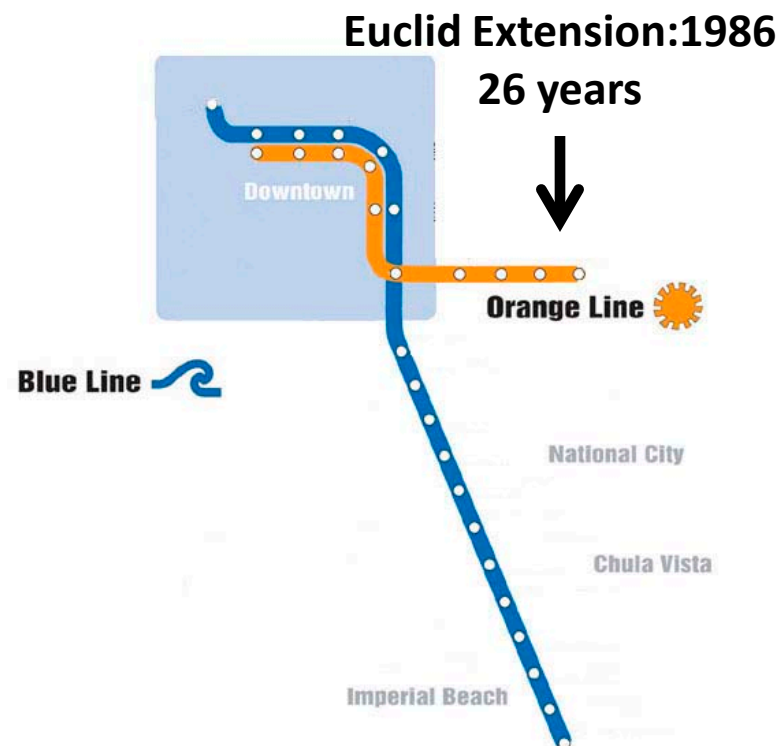


# Growth of the Trolley System

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Start-Up: 1981

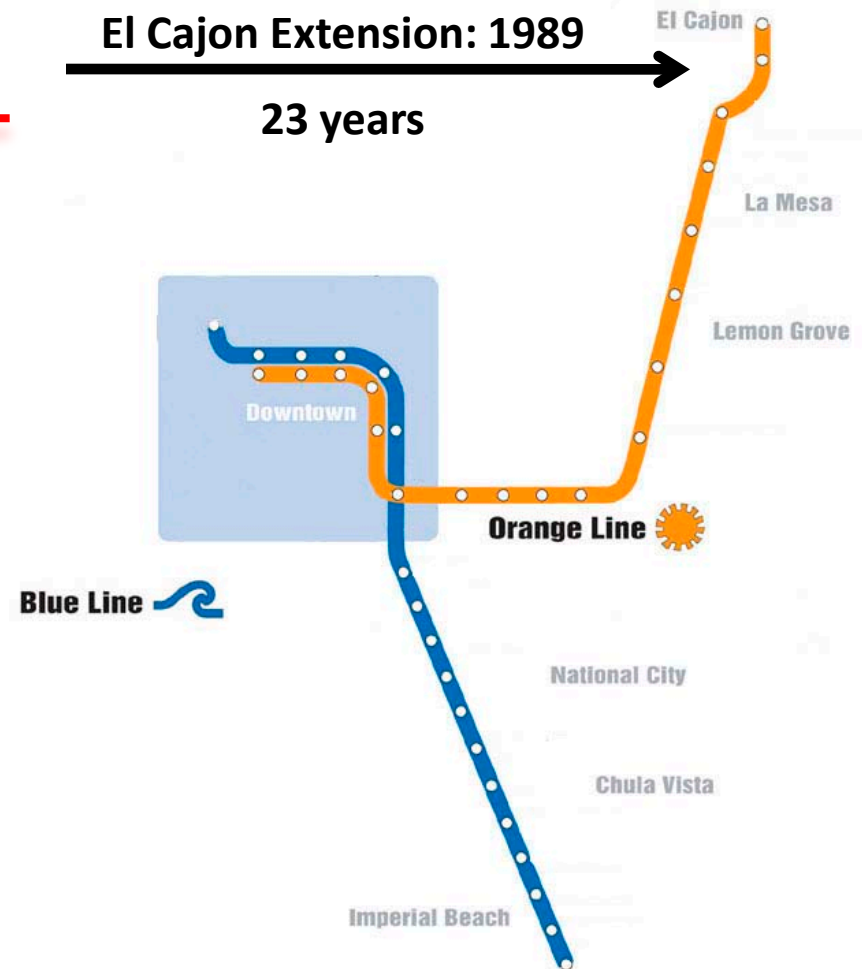
31 years





# Growth of the Trolley System

Start-Up: 1981      31 years  
Euclid Extension: 1986      26 years



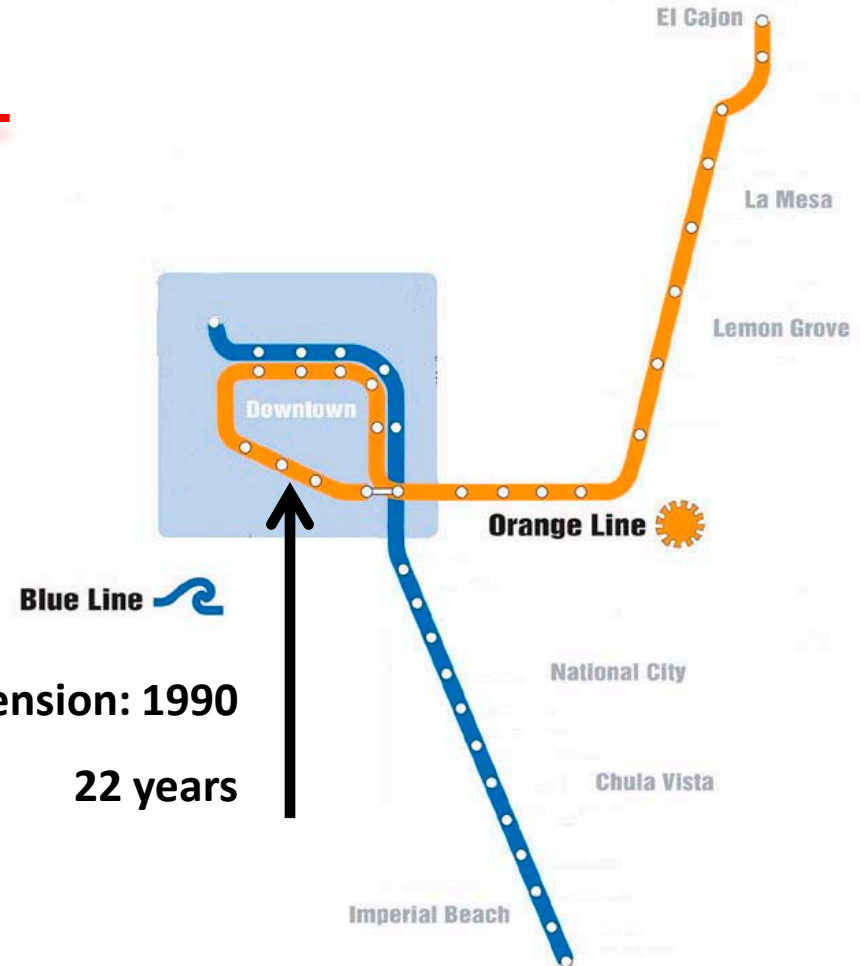


# Growth of the Trolley System

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**Start-Up: 1981**      **31 years**  
**Euclid Extension: 1986**      **26 years**  
**El Cajon Extension: 1989**      **23 years**

**Bayside Extension: 1990**  
**22 years**

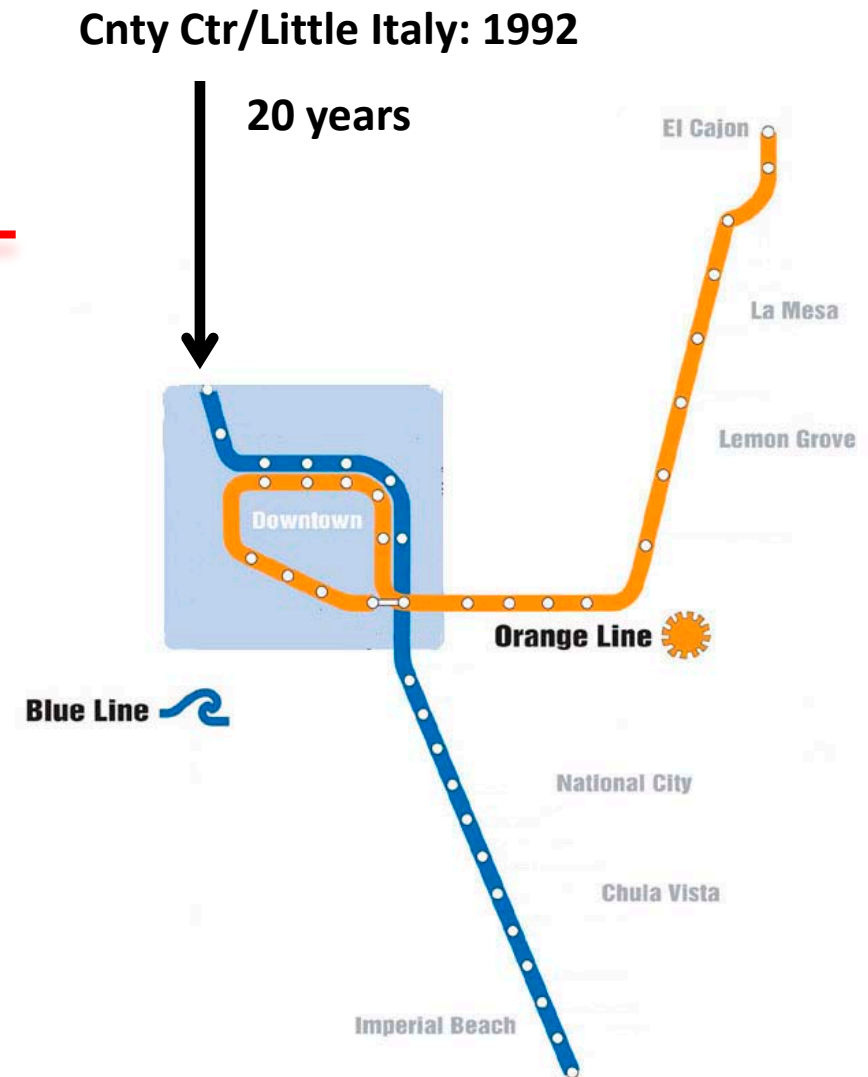




# Growth of the Trolley System

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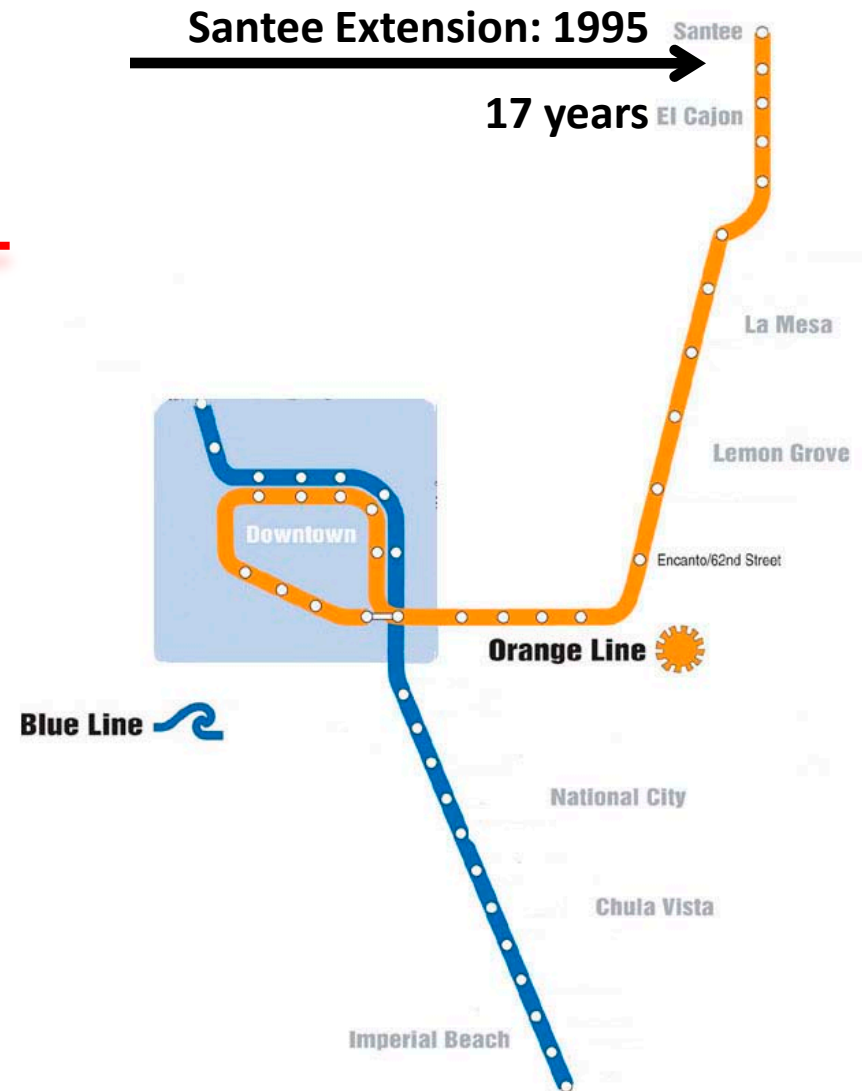
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# Growth of the Trolley System

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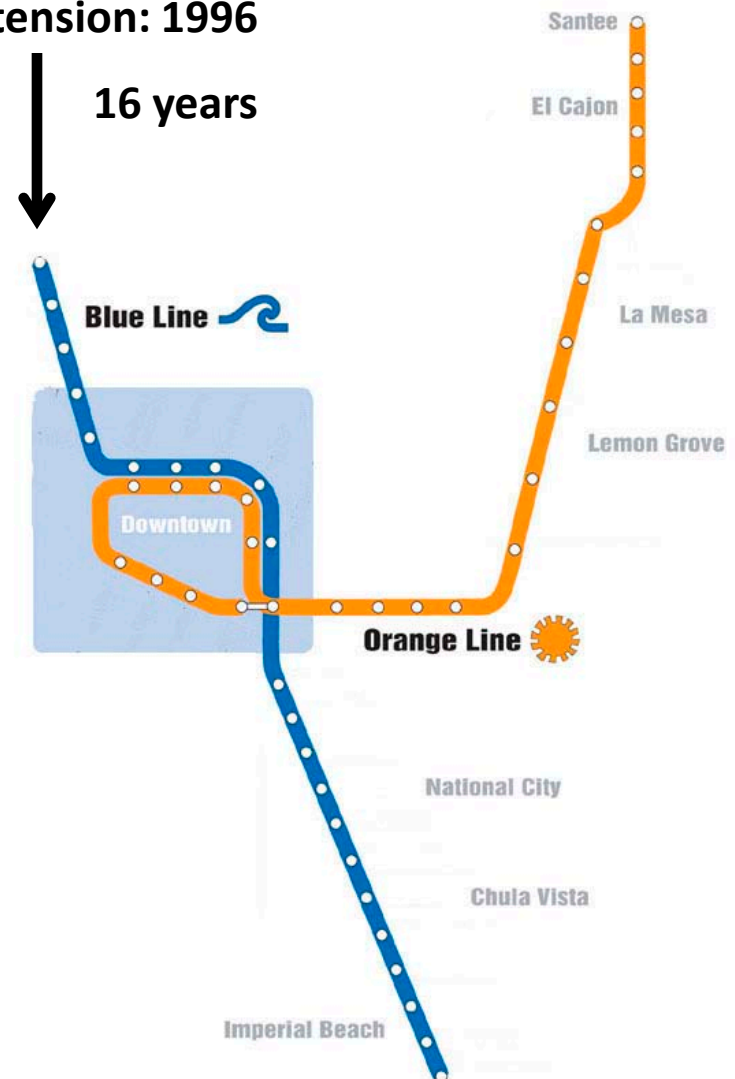


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Santee Extension: 1995	17 years

Old Town Extension: 1996

16 years

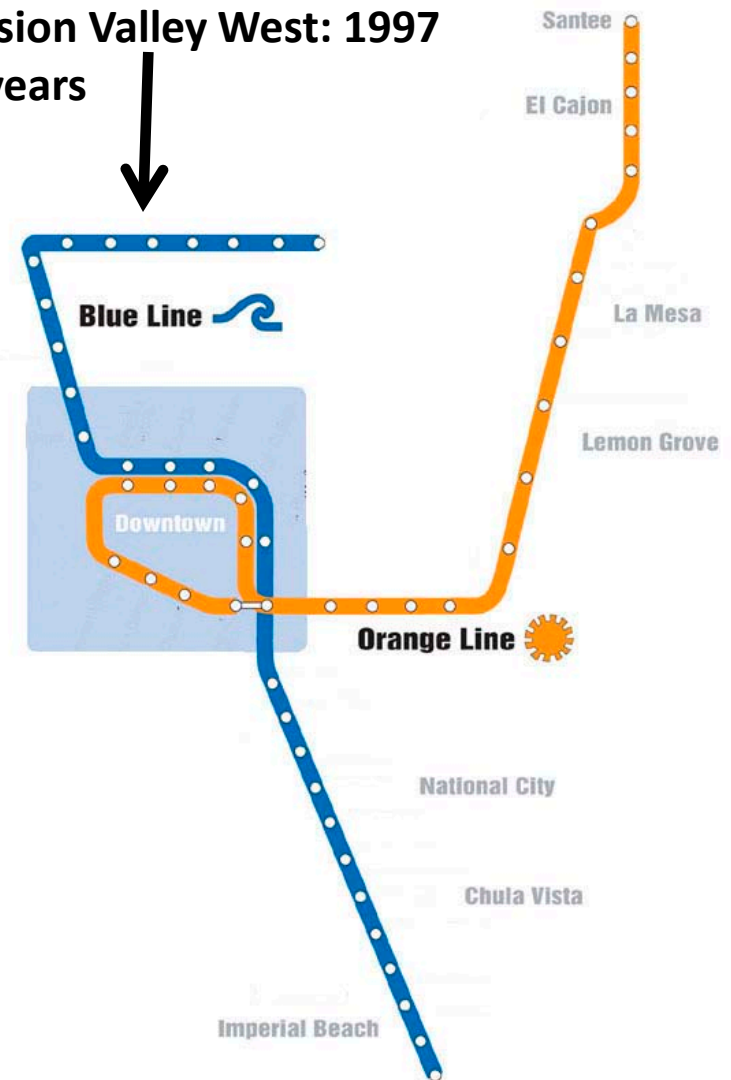




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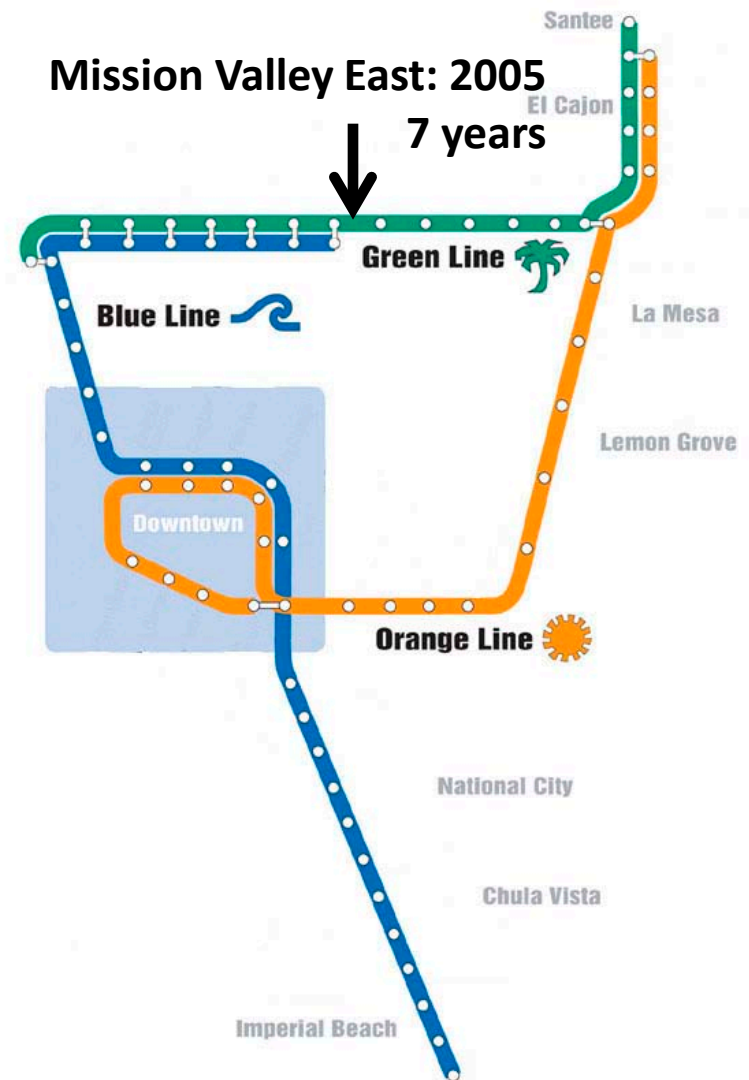
Mission Valley West: 1997  
15 years





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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

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





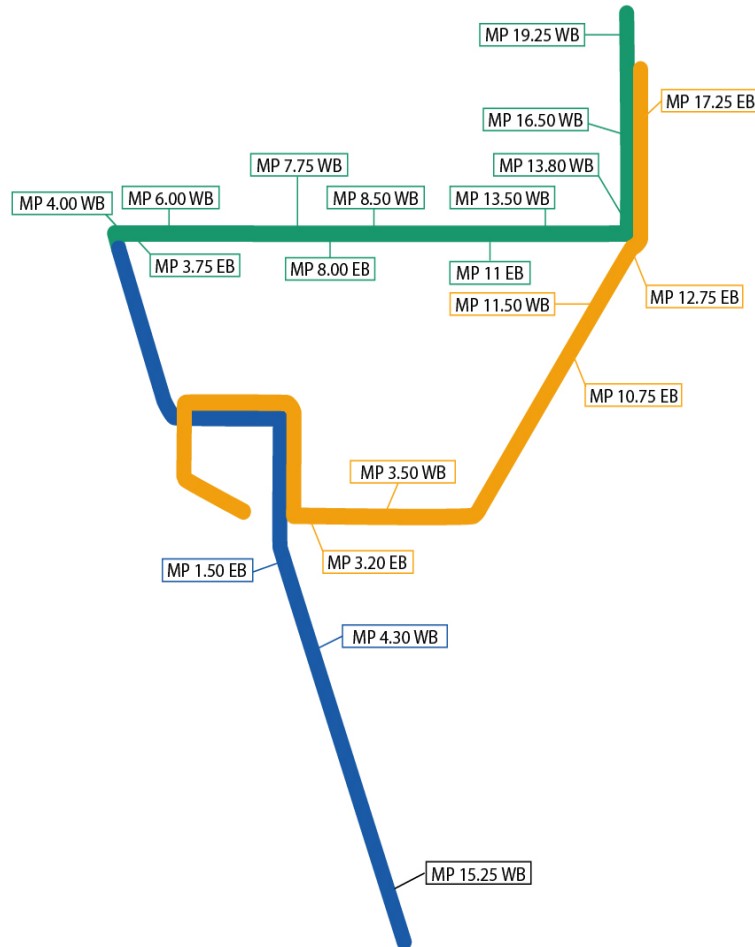
# Typical Applicator Bar

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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



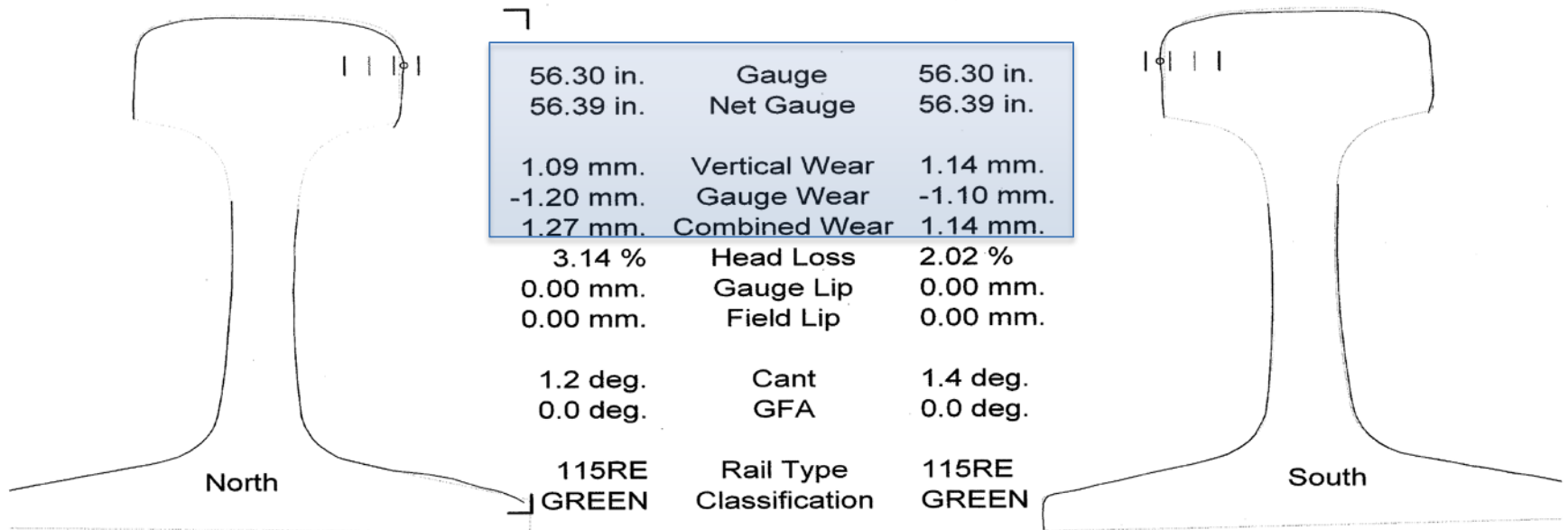


# Curve # 14 Green (2008)

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

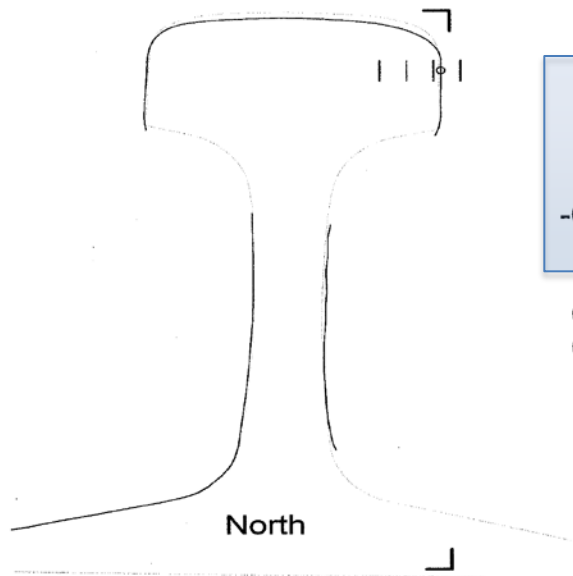




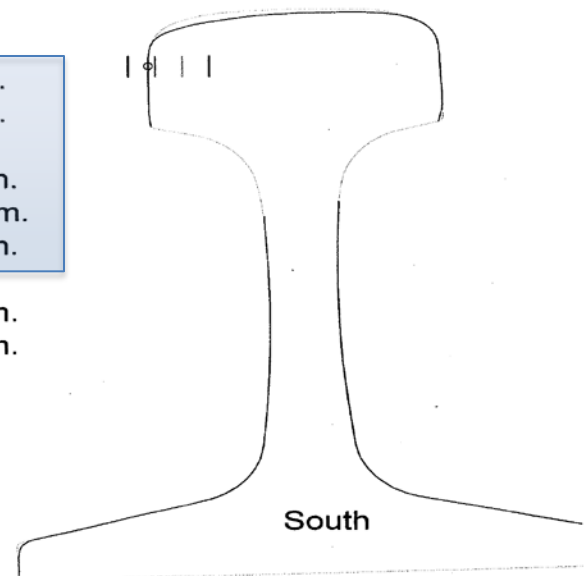
# Curve # 14 Green (2011)

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



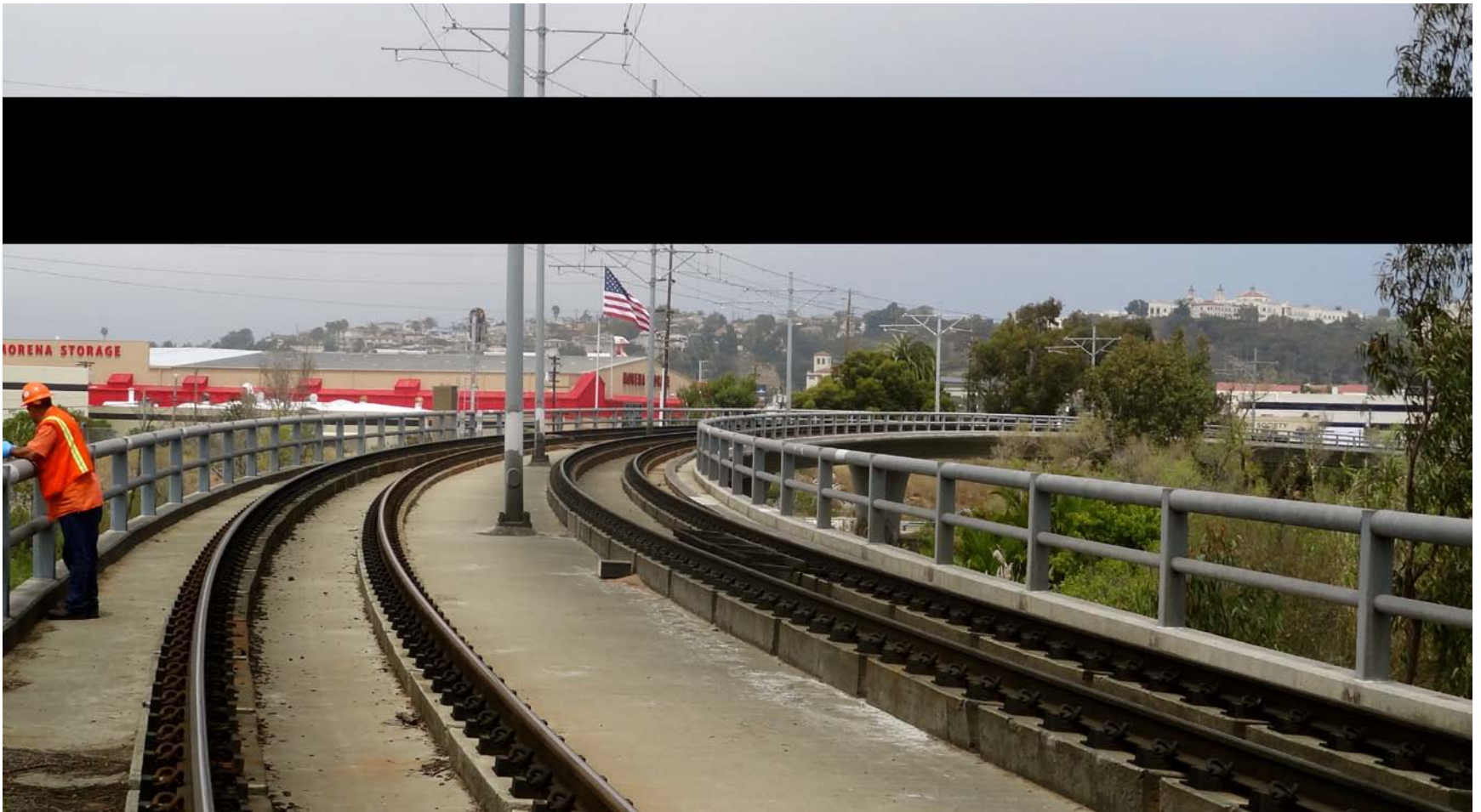


# Additional Measuring



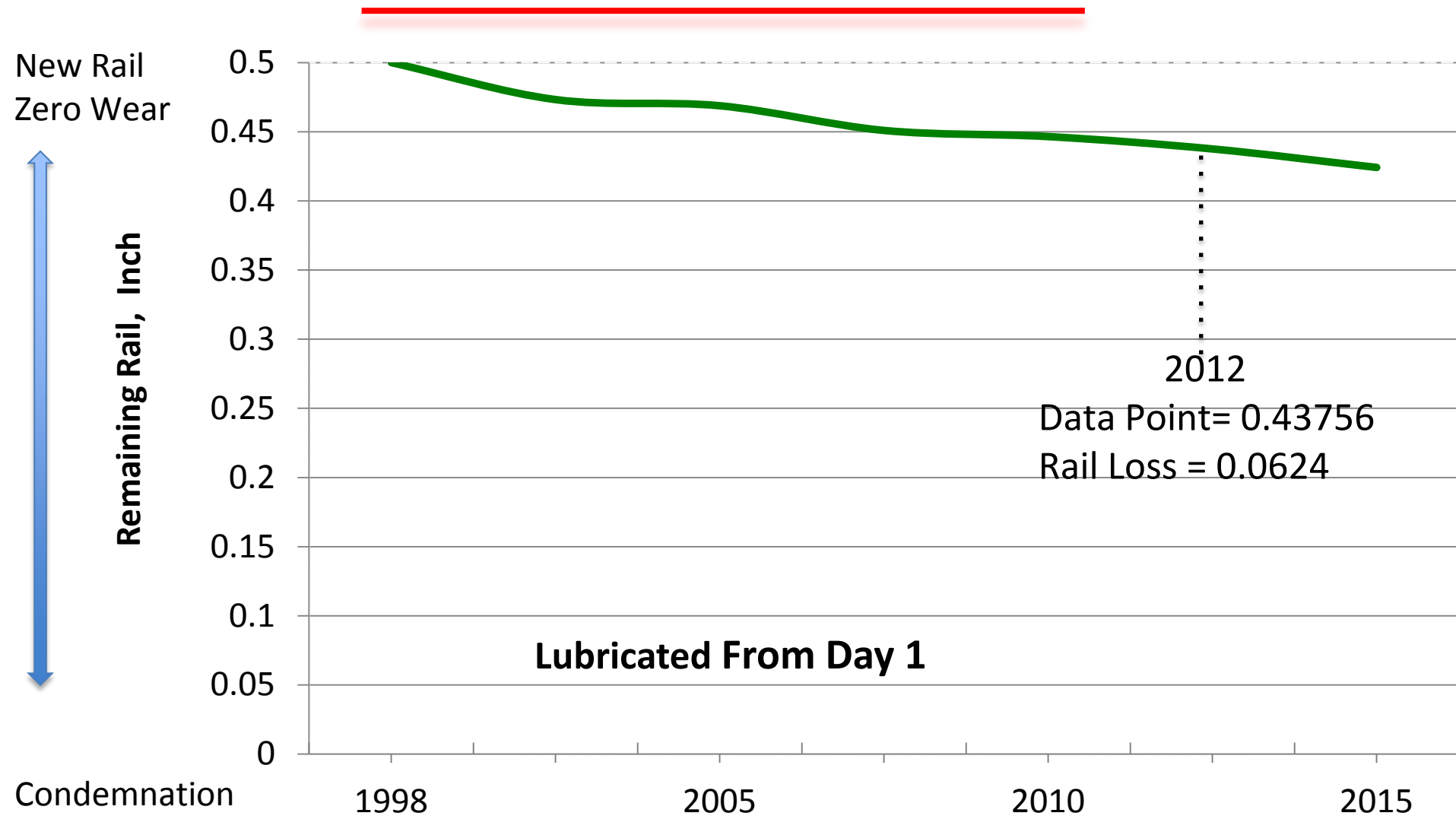


# Curve # 14    7.6° Right





# 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

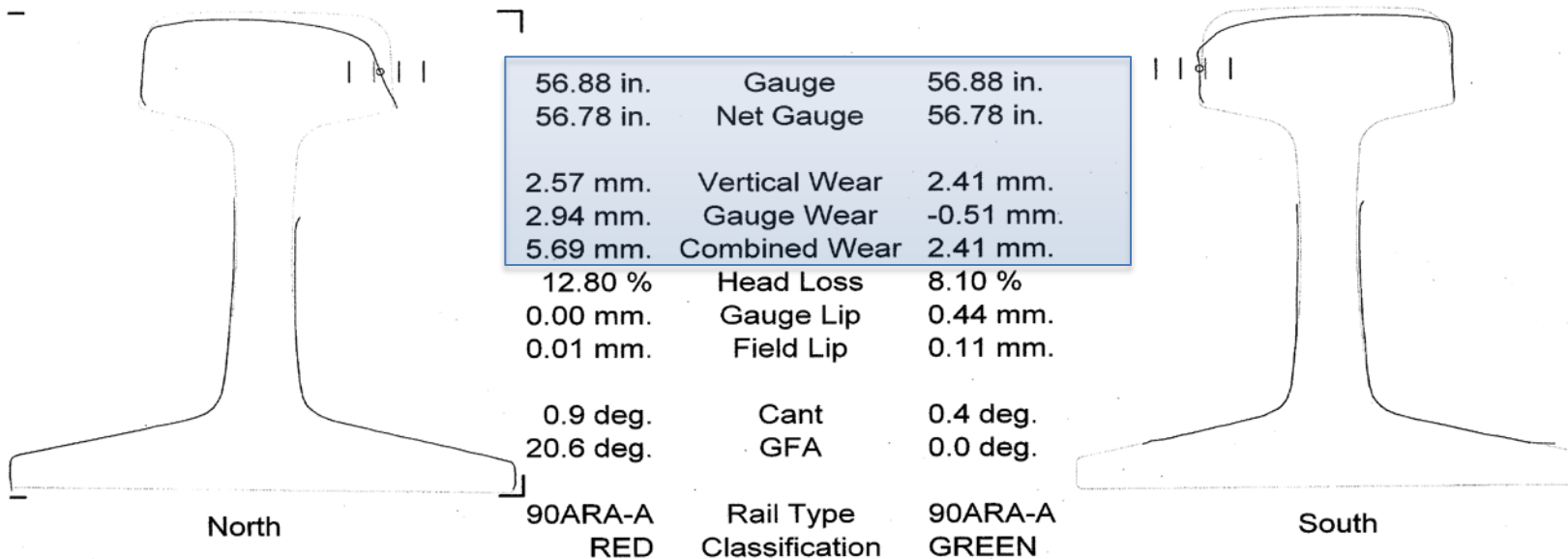




# 8<sup>Th</sup> St. Curve (2005)

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		



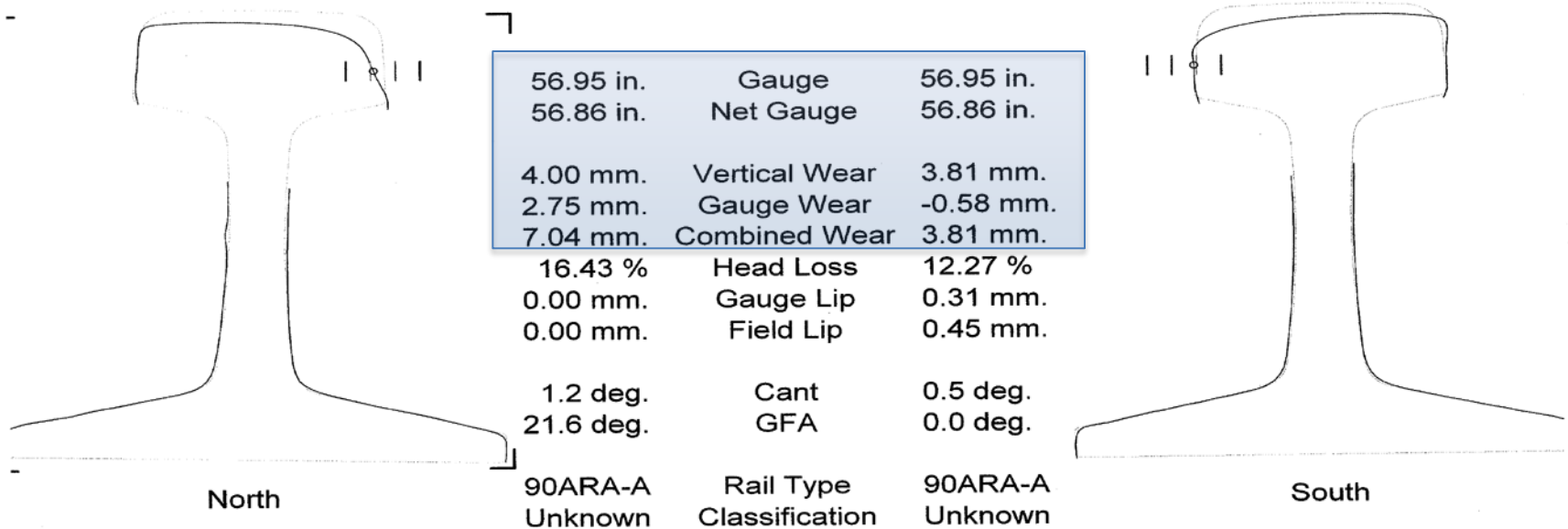


# 8<sup>Th</sup> St. Curve (2012)

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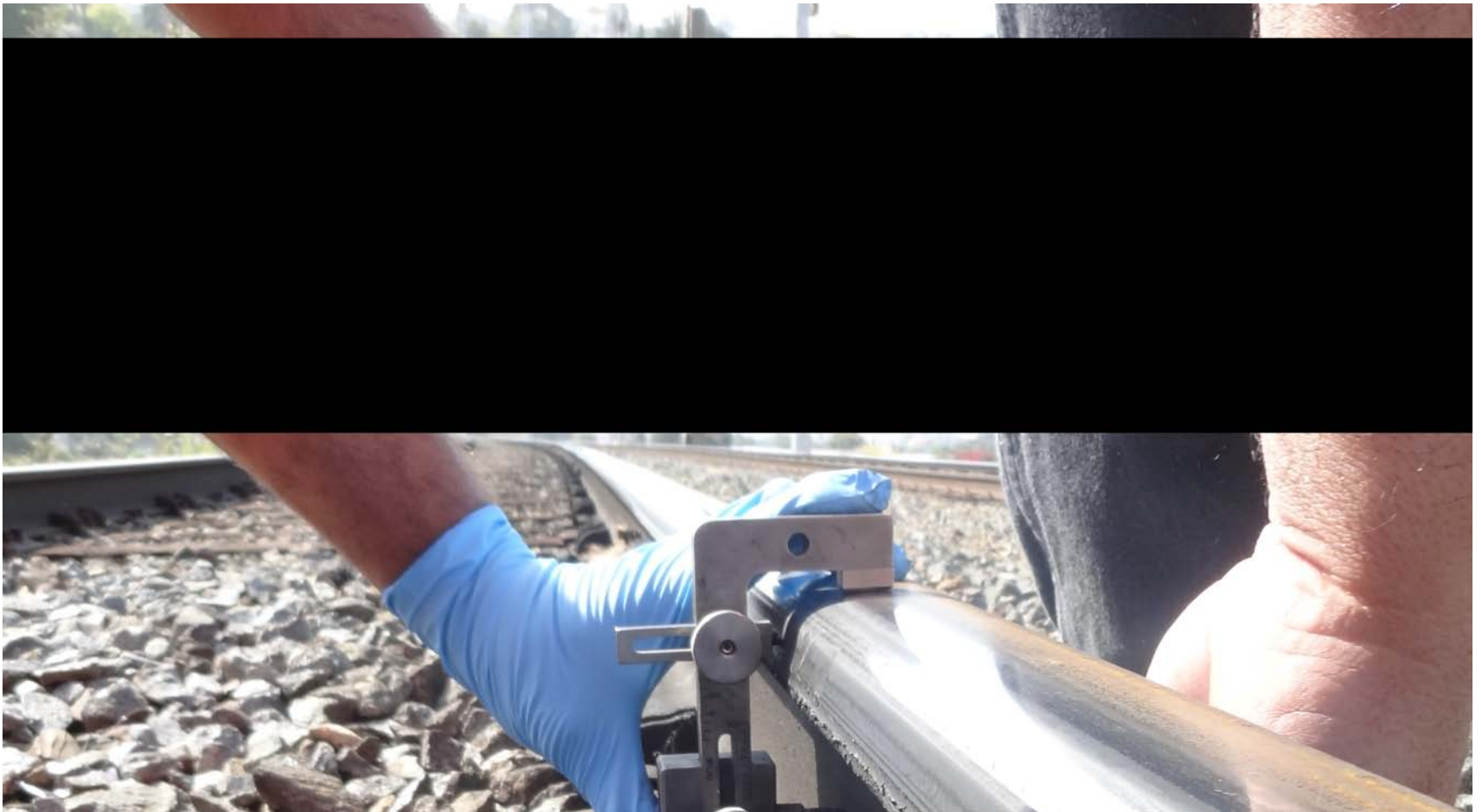
## MTS - SANDIEGO TROLLEY MTSBLUE - Track EAST

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





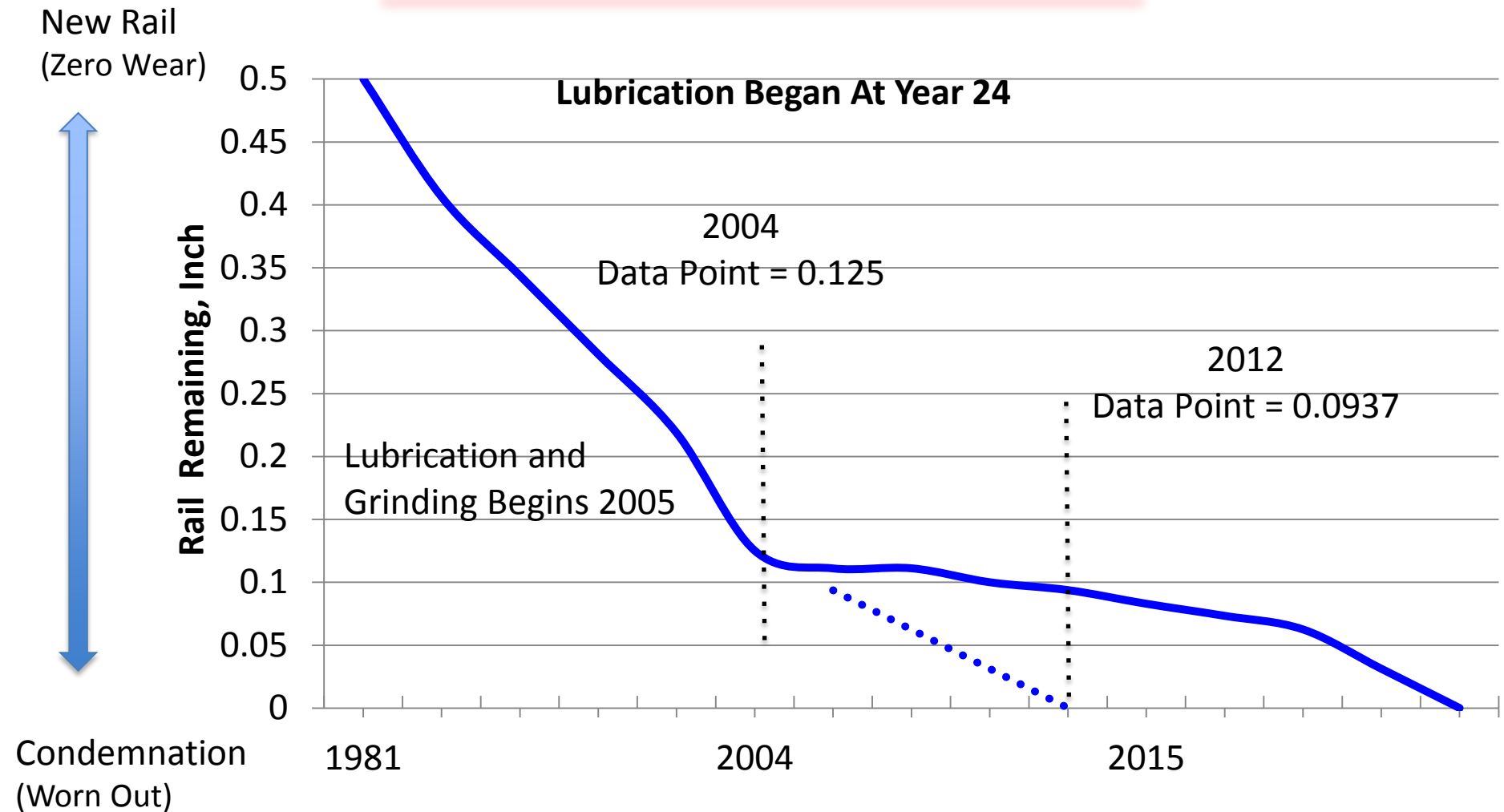
# 8<sup>Th</sup> St. Curve

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





# Results : Scenario 3

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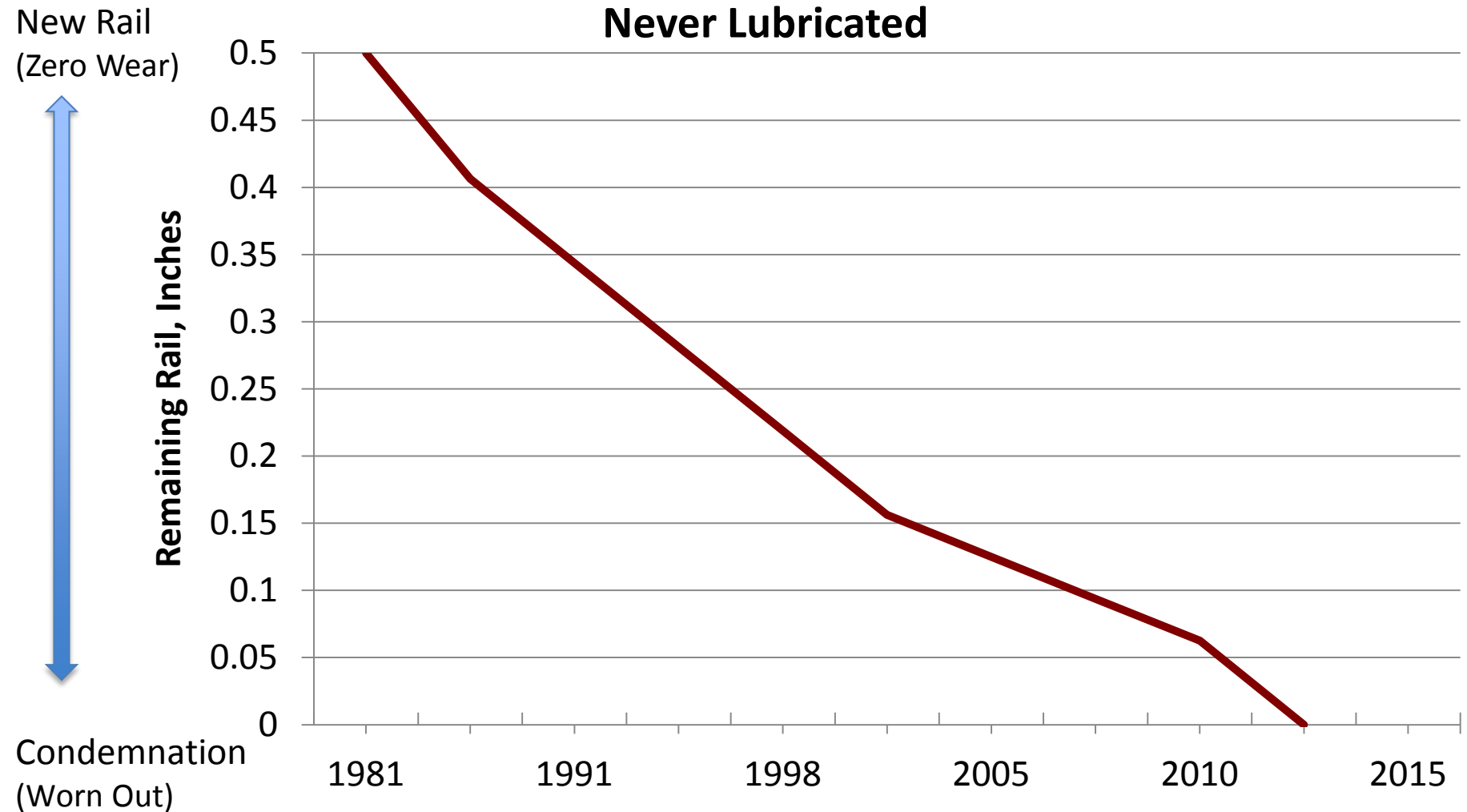
- Wear of rail that has never lubricated
- Curve 3.7° Right
- **ANONYMOUS**





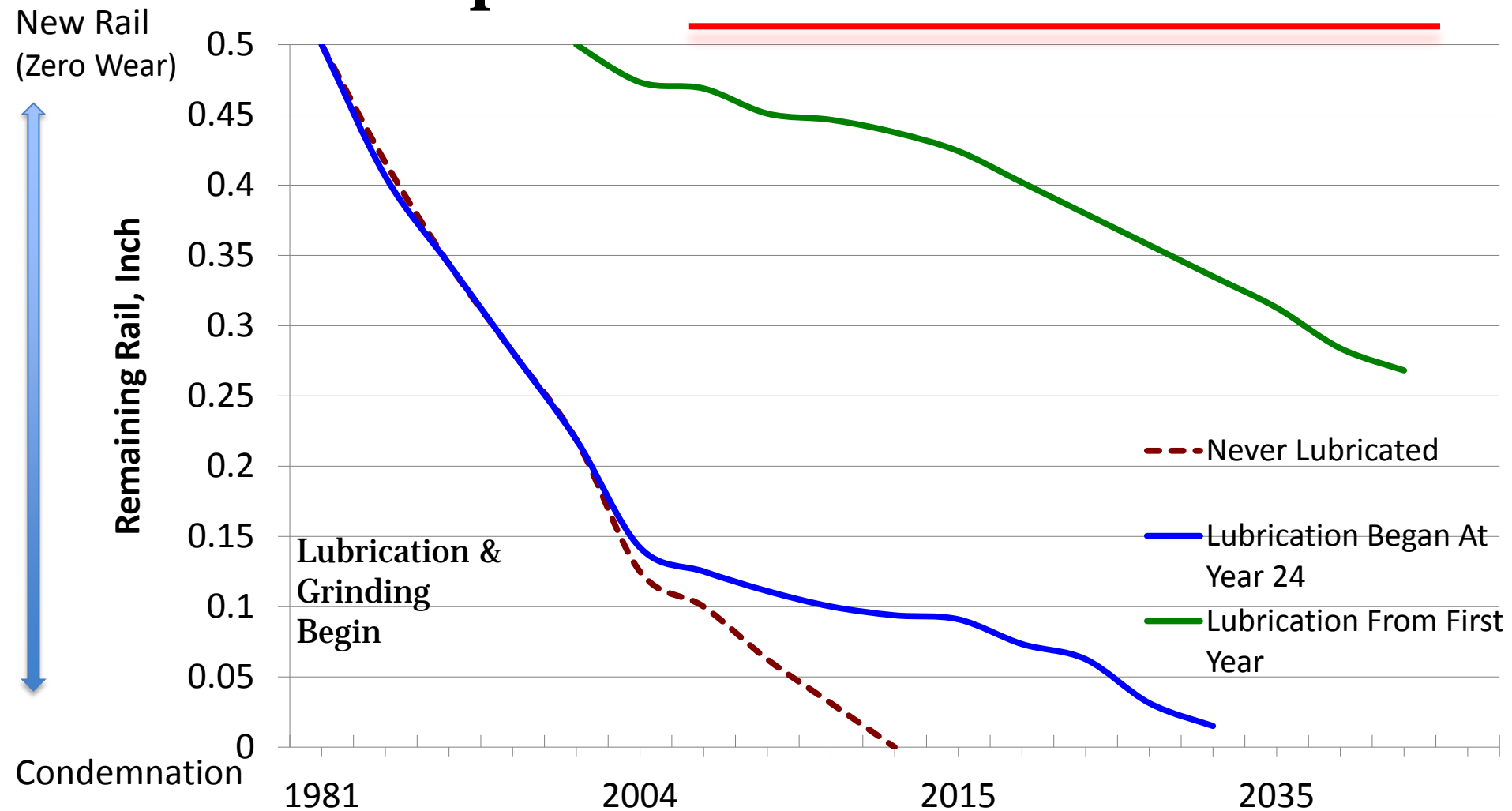
# Anonymous

**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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