Wayside Detection
The Detroit Edison Experience

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Discussion Topics

- The Detroit Edison Strategy
- WILD Issues
- Financial Issues
- Conclusions and Recommendations

Wheel Failures and WM Codes

- WM 66, Flange Cracked or Broken
- WM 68, Cracked Rim
- WM 71, Shattered Rim
- WM 72, Spread Rim
- WM 83, Cracked Plate
- **WM 75, Shelling, Spalling, Thermal-Mechanical**
- **WM 65 and 67, Out of Round (WILD or Gage)**
- WM 76, Built-Up Tread
- WM 78, Slid Flat

Recent AAR Rule Changes

- WM 65 Wheel Impact Load Detector
  Removal at Impact Greater Than 90 Kips
- 97% of the Benefit Falls to Class I RR's
- Rim Thickness Credit – Removed
- Window of Opportunity - Stress State

The Detroit Edison Strategy

- The Theory
- The WILD Program
- 50+ Kip Maintenance Strategy

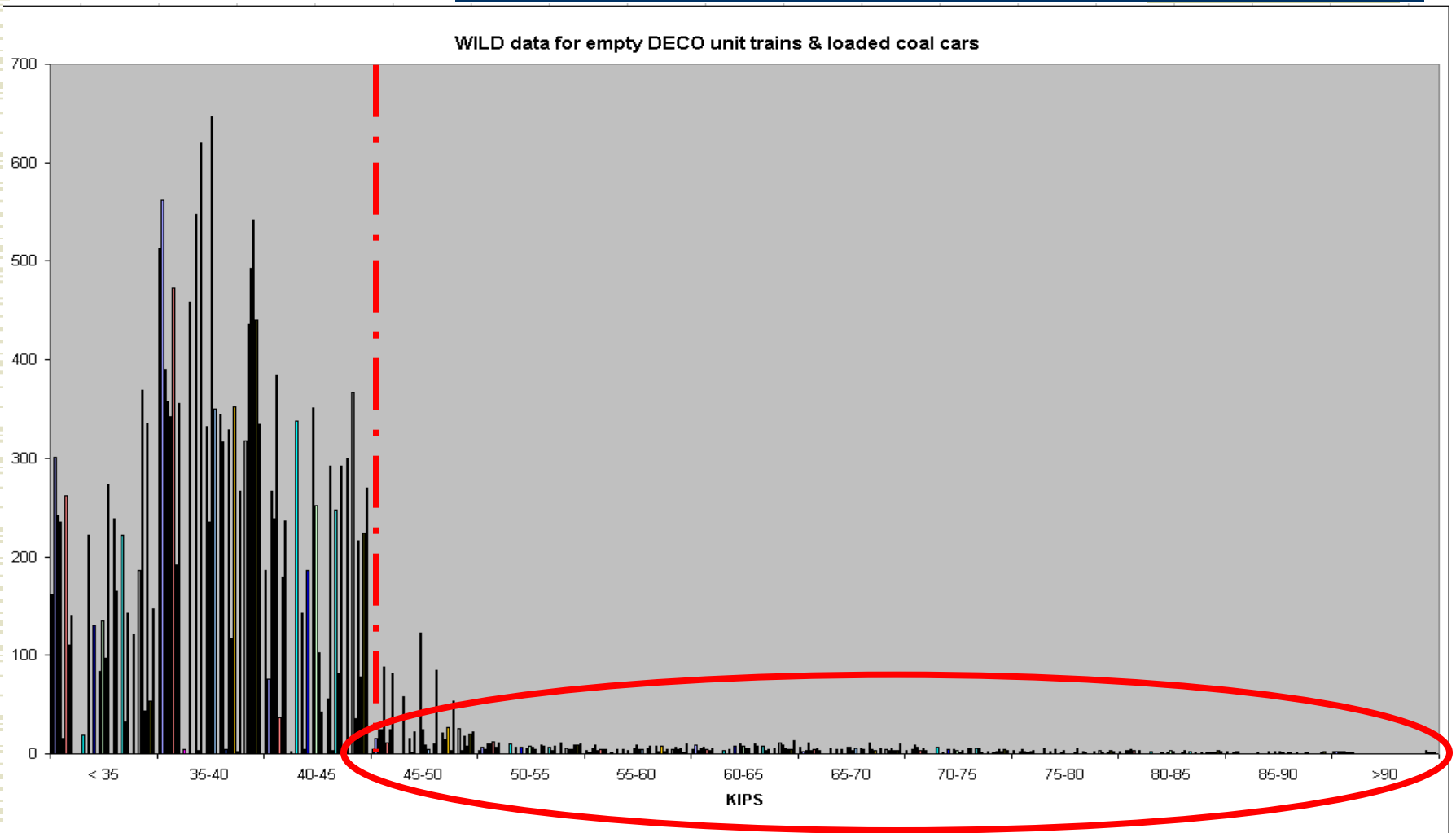
The Theory

The private car owner can effectively manage the life and performance of heavy haul-high mileage wheel sets, by developing a proactive maintenance strategy based upon way-side detection methodologies in combination with Class I Railroads, private railcar maintenance providers, and railway suppliers.

The WILD Program

- Data Purchased from TTCI
- By Train
- By Railcar
- By Wheel Location
- By Graph
- Proactive Maintenance Strategy

WILD Data


WILD data for empty DECO unit trains & loaded coal cars
700
600
500
400
300
200
100
0
< 35
35-40
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
80-85
85-90
>90
KIPS

Oracle Forms Runtime - [Train Health Condition]

File Edit Record Query Application Setup Utilities Reports Window Help

Selection Criteria

Destination: ALL Loaded/Empty: All Railroad: ALL Refresh

Active Trains with Latest Loaded KIPS Readings

Deco	Ship Date	Unit Train#	Number of Wheels <40	40	50	60	70	80	90	100	110	>120	>90	Railroad	Last Location	Destination
>>> MV	04/30/2004 16:38	D536	605	146	14	5	4	2	3	2	1	2	8	CSX-CN	ECORSE, MI 05/06/2004 23:05 FROM T	RIVERROUC
WC	05/07/2004 12:01	CATDT004	165	695	25	7	6	8	2	1	2	1	6	UP-NS	GRAISLAND, NE 05/14/2004 02:55 FRO	MONROE
M	05/05/2004 11:14	CBTGT020	437	356	17	9	4	4	3	1	1	0	5	UP-CN	LANG, OH 05/12/2004 22:30 FROM TRA	MONROE
MT	05/07/2004 18:54	CNRMSUD034	452	410	18	18	6	3	4	0	1	0	5	BN-BN	RAVENNA, NE 05/14/2004 00:19 FROM	SUPERIOR
Z	05/12/2004 14:13	D519	737	59	8	6	2	0	1	2	0	1	4	CSX-CN	LANG, OH 05/13/2004 17:33 FROM TRA	RIVERROUC
AW	05/06/2004 06:28	CBTMCGM023	476	357	14	5	6	3	1	2	0	0	3	BN-CN	LANG, OH 05/13/2004 02:23 FROM TRA	MONROE
WD	05/07/2004 08:41	CNRMSUD033	370	393	13	9	1	3	2	1	0	0	3	BN-BN	WILLMAR, MN 05/13/2004 21:43 FROM	SUPERIOR

Empty Loaded Report for MV, D536 of cars with KIPS 50 and above Preview E-Mail Excel

Car Details

Car Details for: MV, 04/30/2004 16:38

Car	Reading Date
DEEX005392	01/24/2004 12:19
DEEX001033	01/31/2004 01:01
DEEX008784	01/31/2004 01:01
DEEX008801	01/31/2004 01:01
DEEX980101	01/31/2004 01:01

# of Cars: 98 Maintenence and Mileage

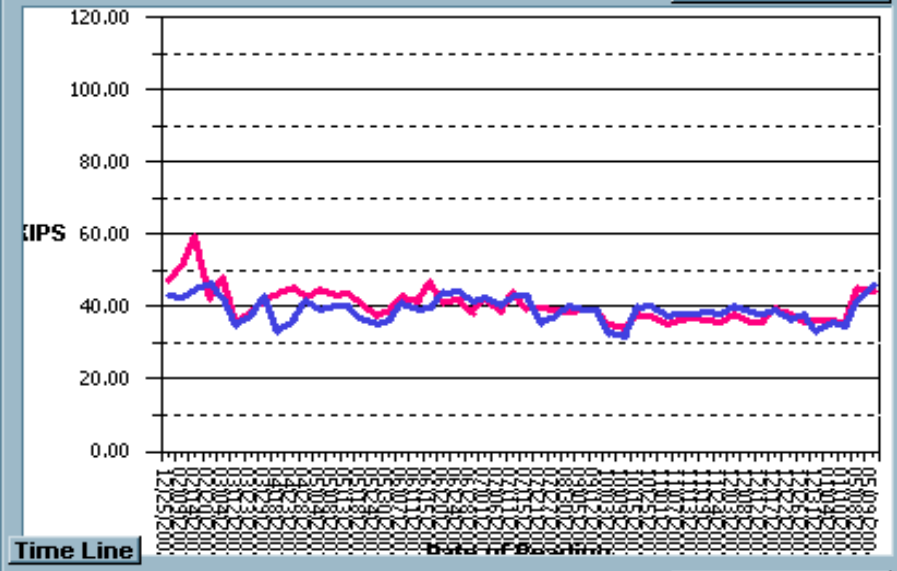
WILD info shown for Car: DEEX005392, 01/24/2004 12:19

Lead End	Axle No.	Car Side	Max. Vertical	Avg. Vertical	Dyn. Vertical	PCT Load
A	1	L	37.63	30.44	7.19	1.03
A	1	R	35.81	32.18	3.63	1.03
A	2	L	34.04	31.44	2.60	1.03
A	2	R	35.24	33.11	2.13	1.03
A	3	L	38.00	35.36	2.64	1.03
A	3	R	38.81	35.15	3.66	1.03

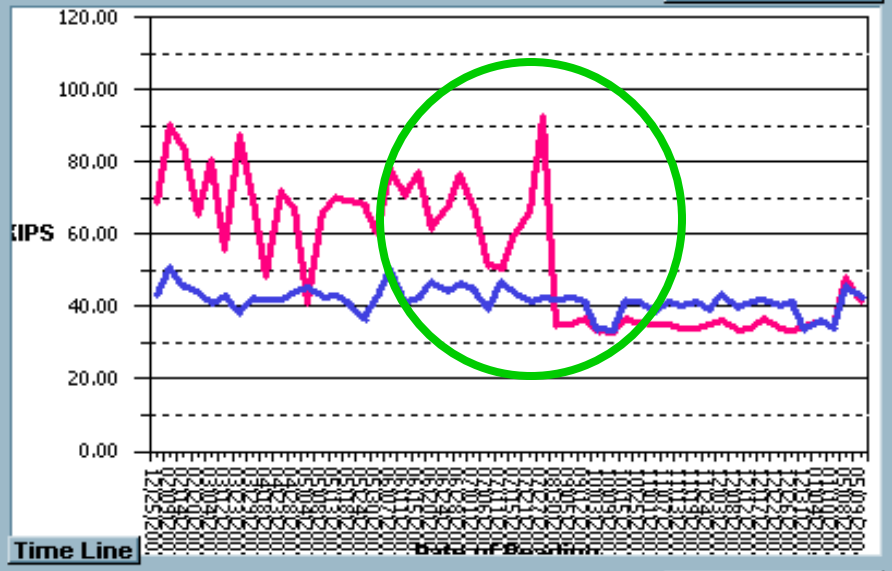
Car: DEEX004629

DEEX004629 Refresh

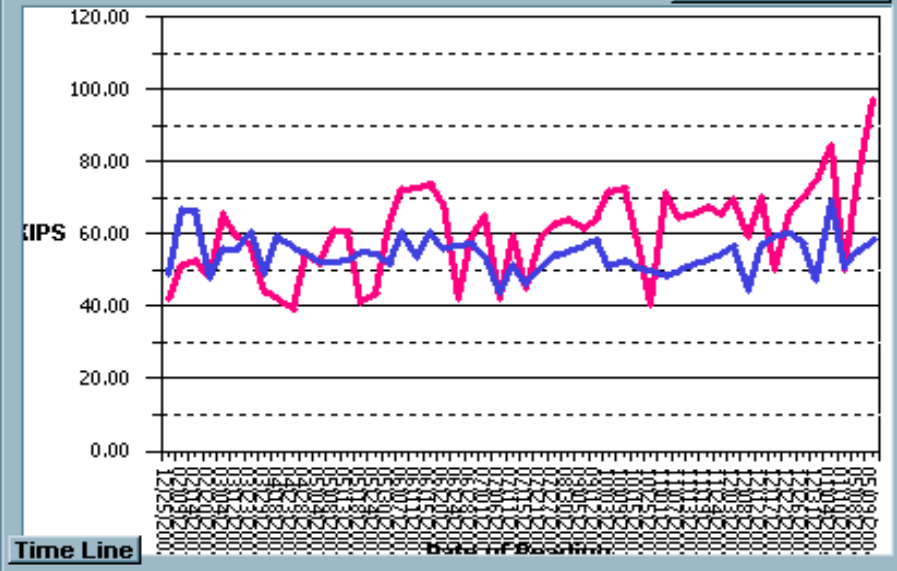
First Axle Car Location



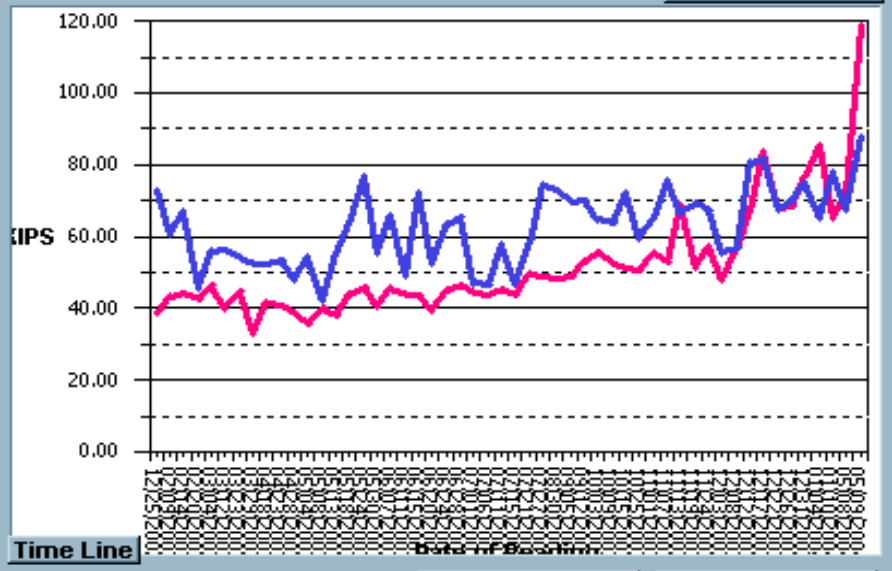
Second Axle Car Location



Third Axle Car Location



Fourth Axle Car Location



Right

Left

First Half Last Half

Close

Maintenence and Mileage

50+ Kip Maintenance Strategy

- Wheels Replaced Above 85 kips (3Pt. MA)
- 50+ Kips - Complete Visual Inspection
- Install Cobra Tread Guard Brake Shoes
- Computerized SCAT and Date Stencil
- Constant Contact Measurement

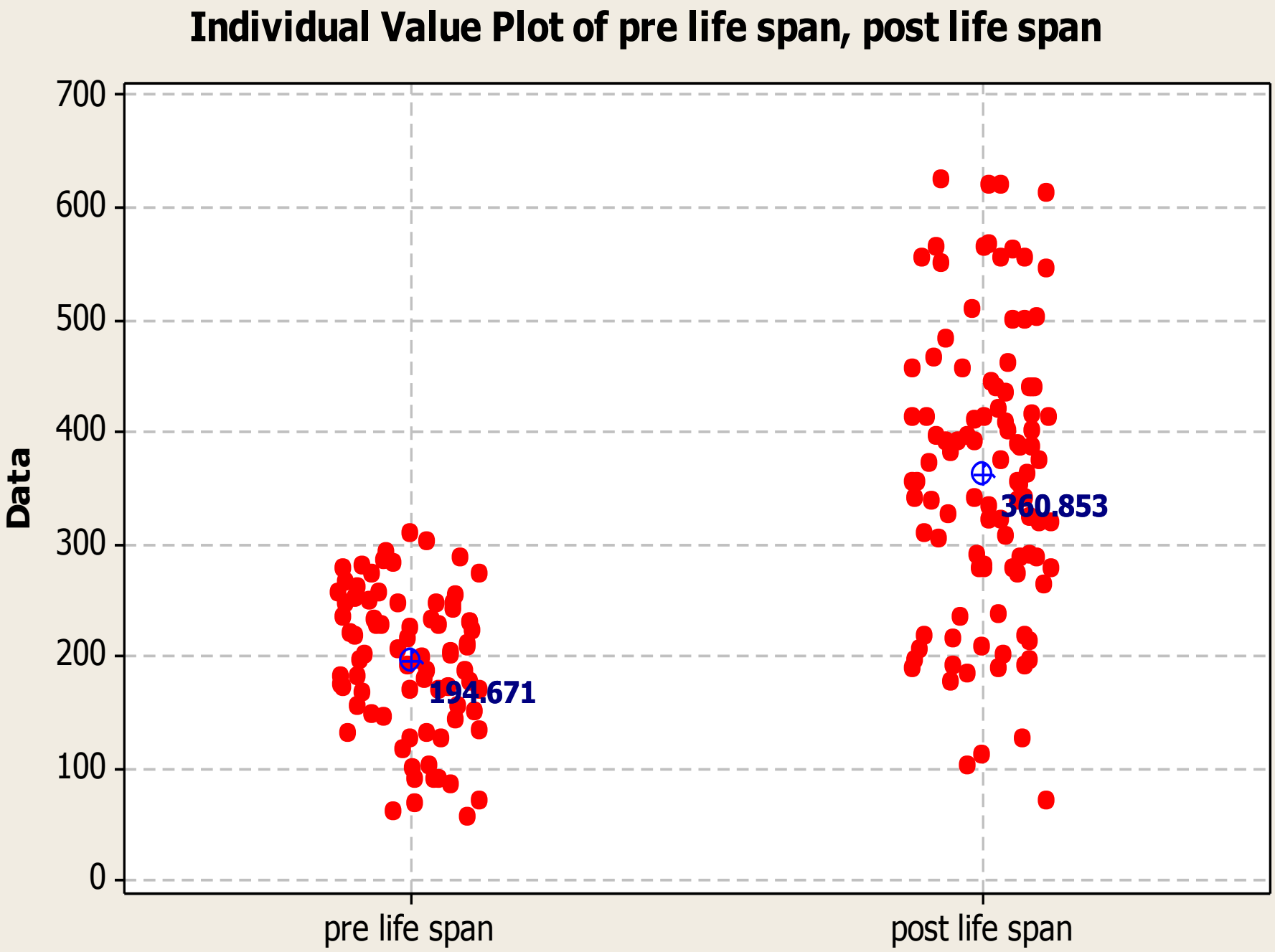
50+ Kip Maintenance Strategy

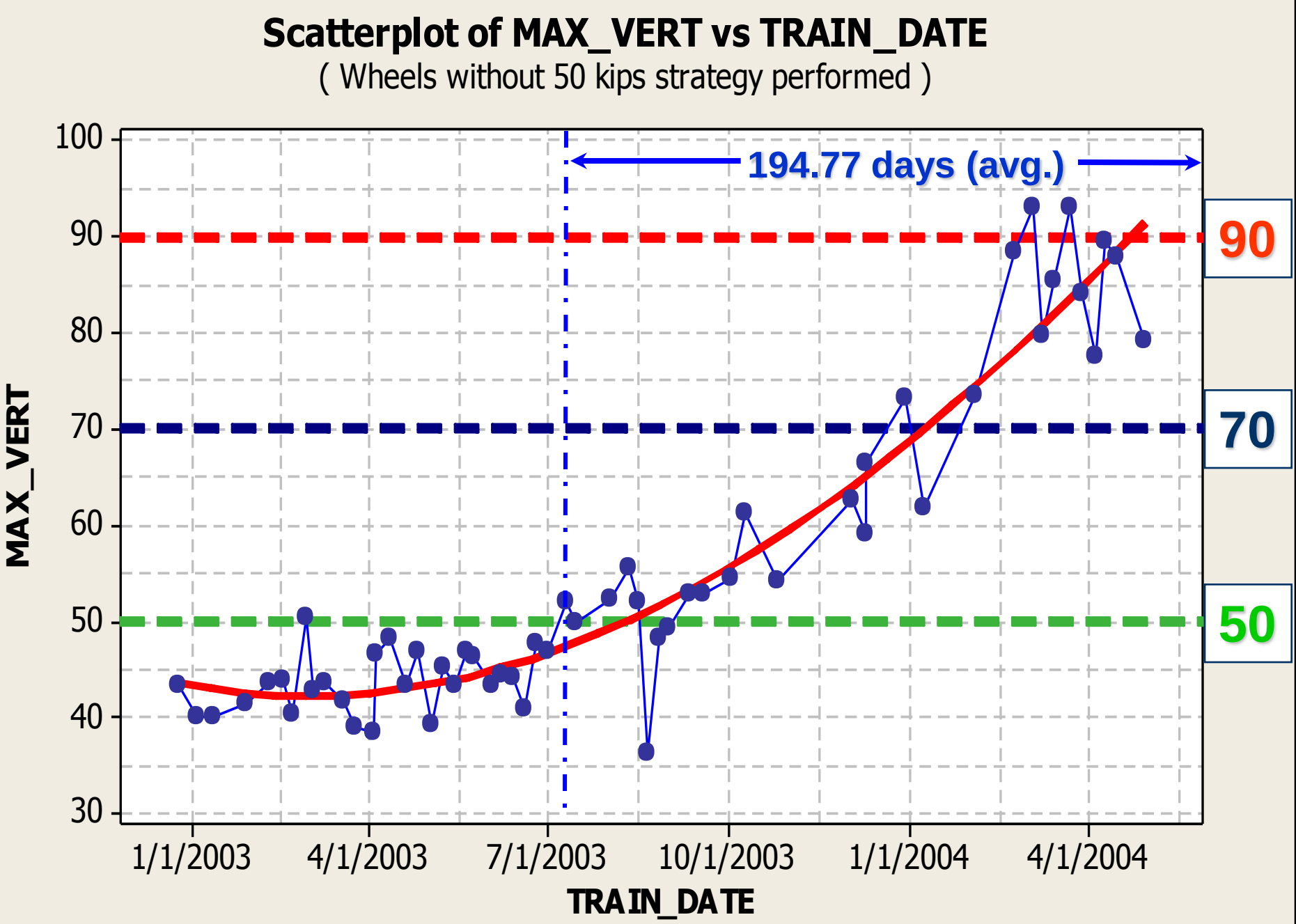
- Brake Beam & Polymer Slides
- Springs & Truck Mechanisms
- Re-torque Bolts - Air Valve & Structural
- Inspect Relief on Bearing Adaptors
- AAR Condemnable Criteria (1/8 WM 64)
- Modified NCTA Wheel Specification

Wheel Life Trend Analysis

Without 50+ Kip Strategy
01/01/03…11/14/03
80 Randomly Selected Wheel Sets

With 50+ Kip Strategy
11/15/03…12/31/03
102 Randomly Selected Wheel Sets

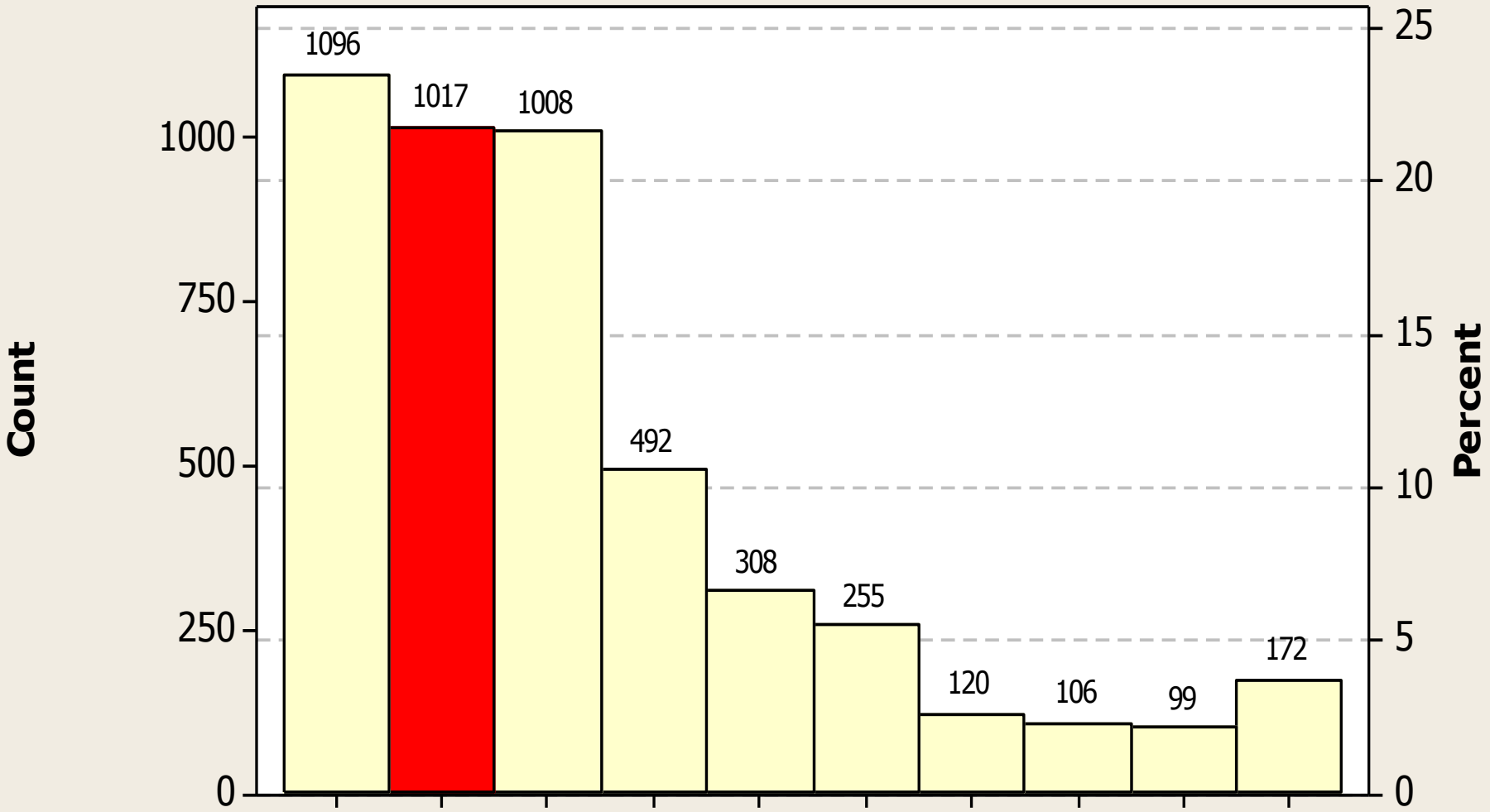

Individual Value Plot of pre life span, post life span
Data
700
600
500
400
300
200
100
0
194.671
360.853
pre life span
post life span


Scatterplot of MAX_VERT vs TRAIN_DATE
(Wheels without 50 kips strategy performed)
194.77 days (avg.)
90
70
50
MAX_VERT
100
90
80
70
60
50
40
30
1/1/2003
4/1/2003
7/1/2003
10/1/2003
1/1/2004
4/1/2004
TRAIN_DATE

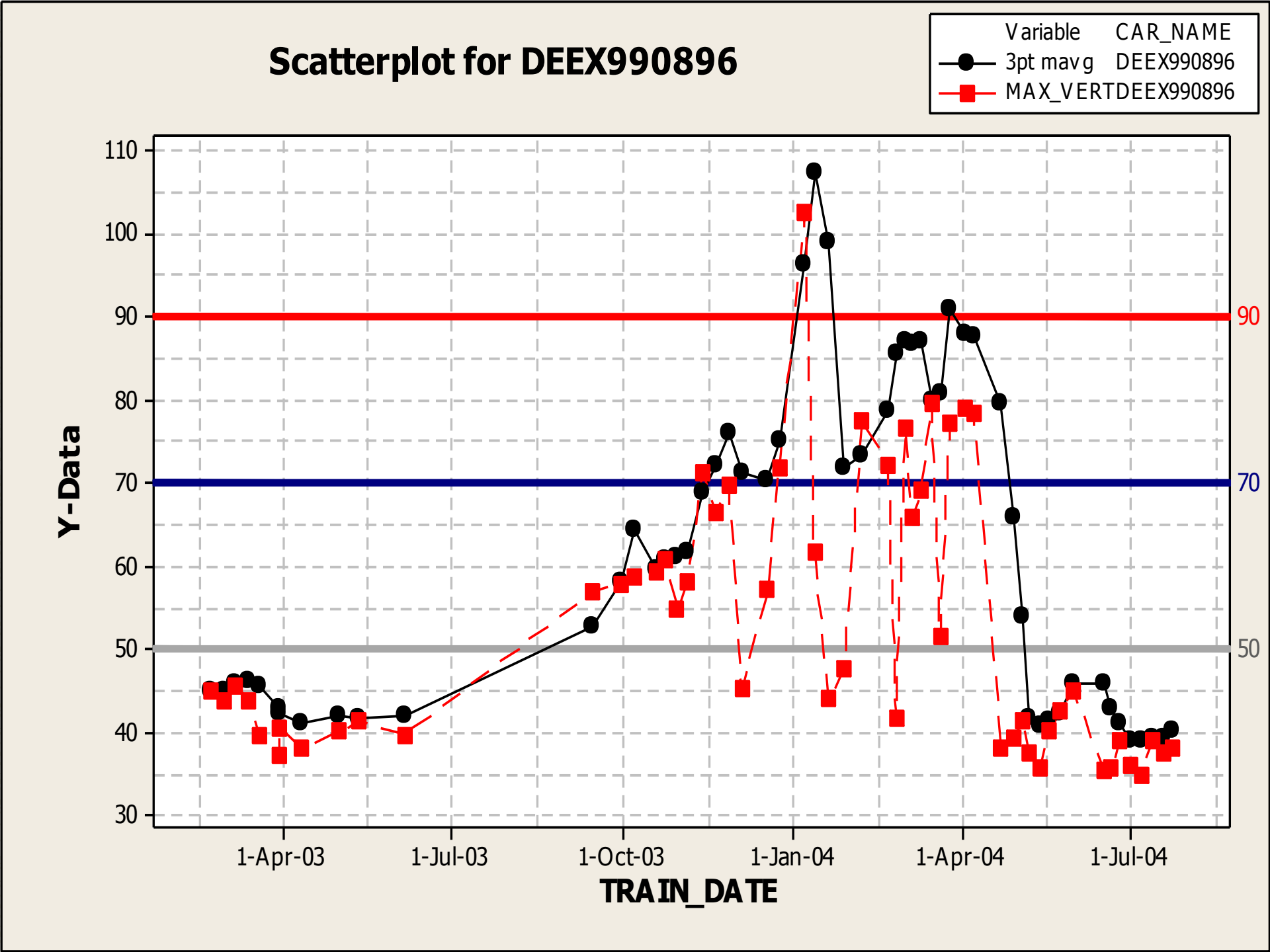
WILD Issues

- WILD Calibration: Frequency & Uniformity
- Effects of Train Speed
- Effects of Track Structure & Sub-grade
- Effects of Concrete Ties
- WILD Reading Variation
- Etc.

Pareto Chart of WHYMADE since 2003

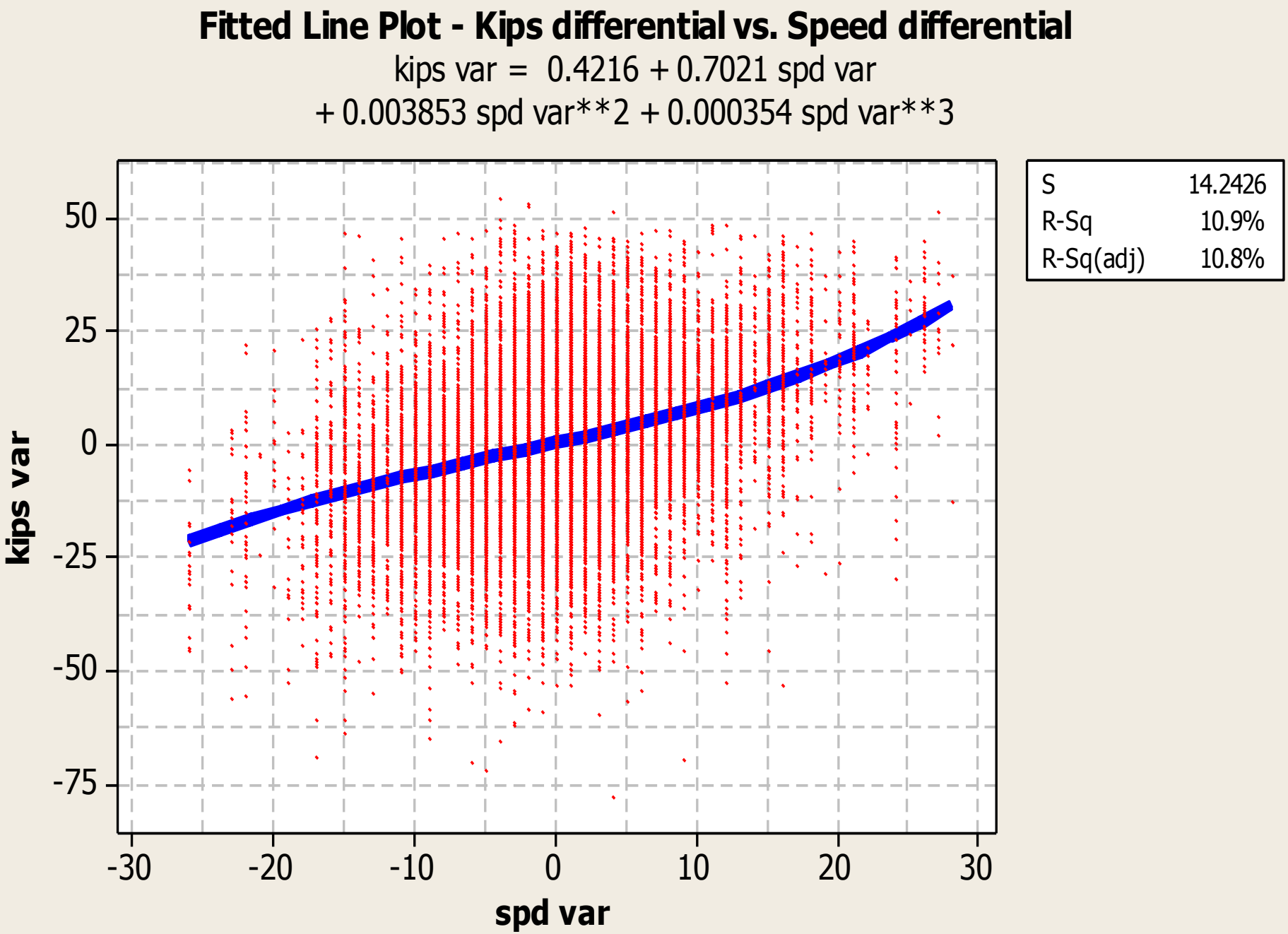


WHYMADE	64	65	75	60	90	97	73	4	93	Other
Count	1096	1017	1008	492	308	255	120	106	99	172
Percent	23.5	21.8	21.6	10.5	6.6	5.5	2.6	2.3	2.1	3.7
Cum %	23.5	45.2	66.8	77.3	83.9	89.4	91.9	94.2	96.3	100.0


Scatterplot for DEEX990896
Variable CAR_NAME
3pt mavg DEEX990896
MAX_VERT DEEX990896
Y-Data
110
100
90
80
70
60
50
40
30
90
70
50
1-Apr-03
1-Jul-03
1-Oct-03
1-Jan-04
1-Apr-04
1-Jul-04
TRAIN_DATE

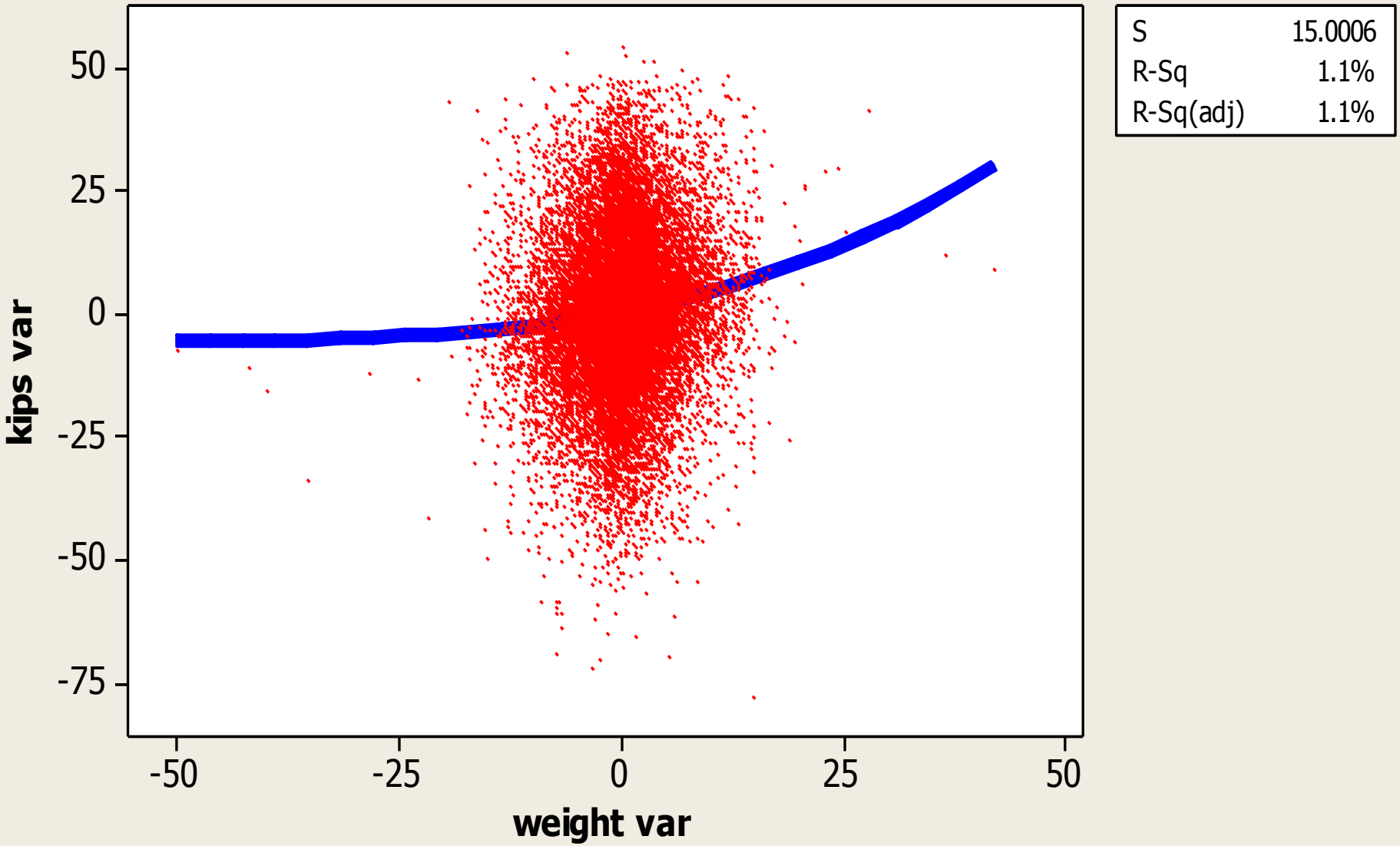
Hypothesis

- Kips variation vs. Speed change?
- Kips variation vs. Car weight?
- Kips variation vs. Site change?


Fitted Line Plot - Kips differential vs. Speed differential
kips var = 0.4216 + 0.7021 spd var
+ 0.003853 spd var**2 + 0.000354 spd var**3
S 14.2426
R-Sq 10.9%
R-Sq(adj) 10.8%
kips var
spd var
50
25
0
-25
-50
-75
-30
-20
-10
0
10
20
30

Fitted Line Plot - Kips differential vs. Car Weight differential

kips var = 0.5704 + 0.3448 weight var
+ 0.006886 weight var**2 + 0.000047 weight var**3

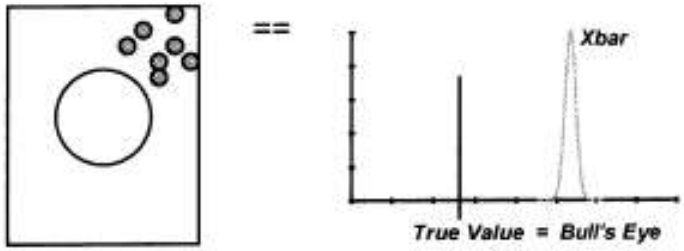


Observations

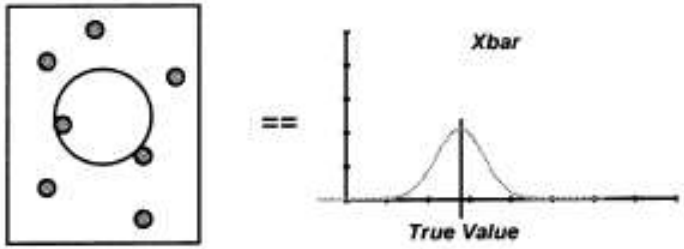
- Kips variation vs. Speed variation – small correlation.
- Kips variation vs. Weight variation – none.
- Kips variation vs. different sites – small correlation.

Precision & Accuracy

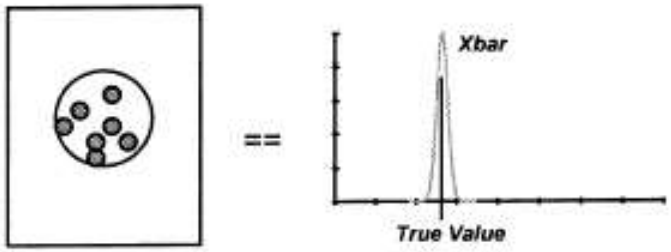
Target Analogy



I. Precise, not accurate



II. Accurate, not precise



III. Precise and accurate

Rules Of Thumb

Step 4: Analyzing Gage R&R Results

A. R&R% of Tolerance

1. R&R less than 10%–Measurement System "acceptable"

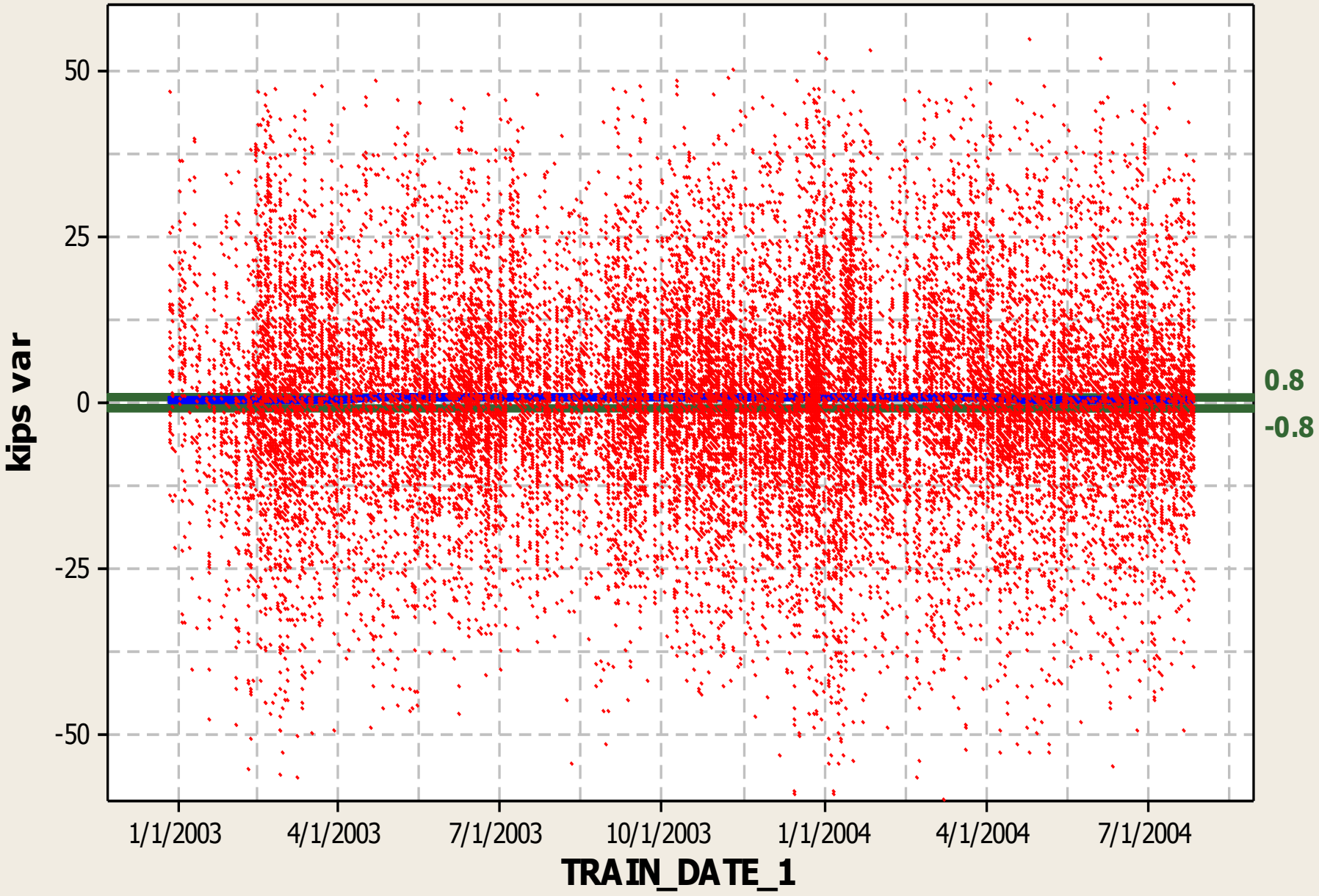
2. R&R 10% to 30%–May be acceptable–make decision based on classification of Characteristic, Application, Customer Input, etc.

3. R&R over 30%–**Not acceptable**. Find problem, re-visit the Fishbone Diagram, remove Root Causes. Is there a better gage on the market, is it worth the additional cost?

Measuring gage tolerance vs. Process tolerance example

- Process Tolerance = +/- 7.5 kips, 70 – 85 kips.
- Measurement Tolerance is 1/10th of Process Tolerance, = +/-.75 kips.

Scatterplot of kips variation vs. train date



Financial Impact

- WM 65, 67 and WM 75
- Wheel Changes 2002, 2003 and 2004
- 2002 65-0 67-490 75-1,279 **Total - 1,769**
- 2003 65-938 67-80 75-1,179 **Total - 2,179**
- 2004 65-973 67-19 75-1,013 **Total - 2,005**
- AAR Labor Rates per wheel switch $1,000.00
  - Total Cost 2002 - $1,769,000
  - Total Cost 2003 - $2,179,000
  - Total Cost 2004 - $2,005,000

Financial Impact

- Train days lost equals number of wheels pulled.
- One train cycle equals seven days (52 cycles per train per year
- Total number of cycles lost
  - 2002 - 253 (5 sets)
  - 2003 – 311 (6 sets)
  - 2004 – 286 (5.5 sets)
- At current lease rates ($500 pcpm), cost to Detroit Edison is approximately $3,600,000.00

Summary

- The 50+ Kip Strategy Extends Wheel Life.
- WM65 Exhibits Shortest Life Span.
- What's the contribution of variation by the measuring system? - What are the variation contributions from the Repeatability & Reproducibility tests of the measuring devices?

Recommendations

- Root Cause of Wheel Defects WM 65 & WM 75
- Computerized SCAT at <u>All Repair Tracks</u>
- Rail Maintenance Management Forum
- WILD Calibration Should be Standardized and Meet AAR M-1003 Quality System
- Improved Efforts to Share Costs and Benefits Within the Railroad Industry
- Private Railcar Owner - Voting AAR Member

The Final Thought

Our greatest challenge as an industry is to get the departments responsible for the vehicle performance and the track maintenance to work together and define a wheel rail interaction strategy to obtain synergy between the vehicles, track and the long term profitability of the heavy haul operation.

Source: International Heavy Haul Association (2001)