

Wayside Measuring Systems

- Remote Monitoring on UP - *Detector Health*



May 5, 2011



BUILDING AMERICA®

WRI 2011

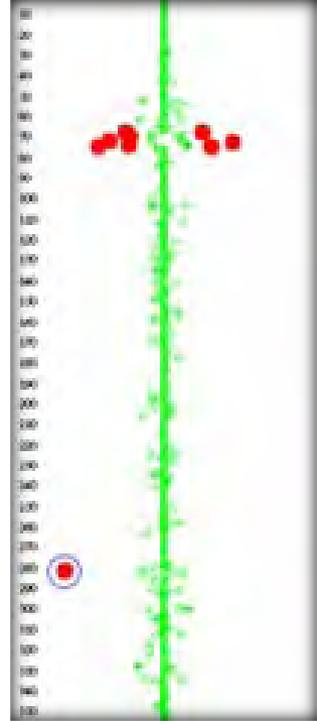
Types of Detectors

- Dragging equipment detectors – 2,837
- High / wide shifted load detectors – 106
- Bearing temperature scanners – 1,504
- Wheel impact load detectors – 16
- Wheel temperature scanners – 284
- Acoustic bearing detectors – 7
- Wheel Profile measurement – 4
- Low air hose detectors – 6
- Imaging (various) – 7



GOALS & PROCESS

- 1 - Detector Working (Taking Data)
 - Working Correctly
- 2 - Detector Communicating (Seq #)
 - Communicating Timely (GMT Clock Sync)
- IF NOT (1 AND 2) THEN ALARM
 - Troubleshoot and FIX
 - i) IT/ Signal/ Mechanical Help Desks
 - ii) **Call Bill First**, then Todd, Mike, Andy, Shawn, Nick...
 - lastly) Send Someone Out
- **Bill thinks Reliable Detectors are a Priority**



Typical Clustered Detector Infrastructure

- 10' by 14' enclosure
- 200-amp electrical service
- Single point grounding:
 - Resistance ~ 5 ohms to ground
- Redundant Heaters/AC, with lead / lag temp controller
- Concrete trunking - simplifies inspection/upgrade of cabling
- Cabling Direct Burial Sheath
- Lightning Protection/Isolation



- Catastrophe Designs
 - Derailment/Tornado/Flood
- IP-based AEI feed
- Weather Station



Gothenburg, NE (WILD, ABD, LAH, WPD, BS, WR, CS)

- Weather Station
- Simpler: Blower vs Compressed Air
- LAH Heaters
- *Rodents
- *Flooding



Bearing and Hot Wheel scanners



- Standard RR Components when possible:
Tiefenbach vs Lasers



Rufus, Oregon

WILD , ABD, AEI

- Trunking
- Broken Laser Wheel Sensor



Wheel Profile Measurement System

- Hollow Ties
- Rugged Cabling
- TRACK Maintainability ? (Tamping)



Rufus, Oregon Acoustic Bearing

- Train Blizzards, Birds & Bees



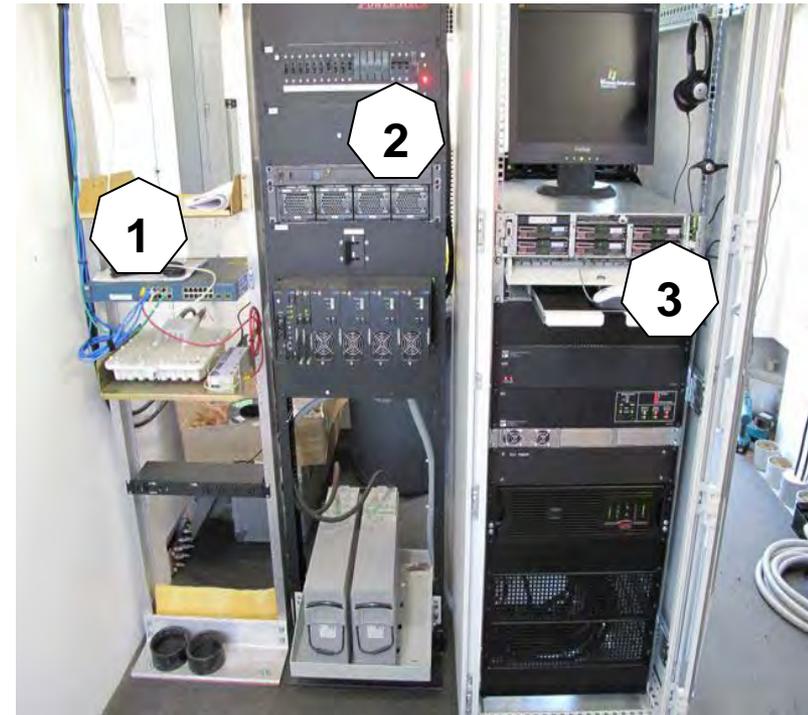
Rufus WILD Detector

- **Internal Ownership:**
Instrumented rails
built, maintained, and
calibrated in house.



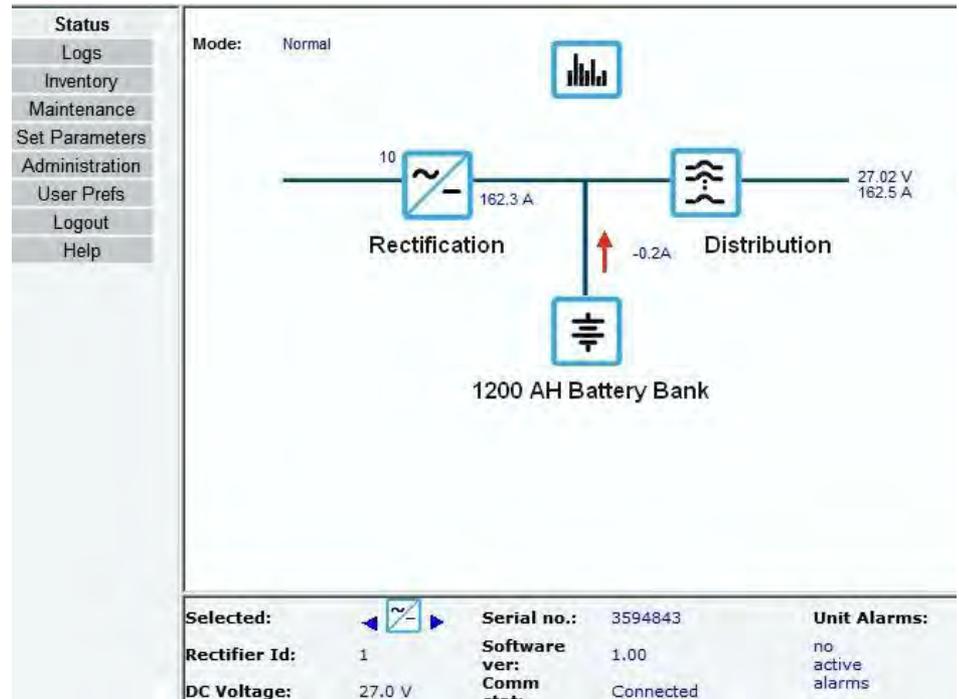
Typical UPRR Electronics

- **Communications** 1
 - Orthogon digital radio to microwave
 - Cisco 24 port router
 - Wireless access point
 - ALL UP Network
- **Custom UPS Power** 2
 - Stored as 24 VDC
 - Converted to 'clean' 110 VDC
 - Individual circuits breaker protected
- **Standard, UPRR Server** 3
 - UP Imaged / Security
 - Raid 5 drive configuration
 - ILO port monitored by OSS



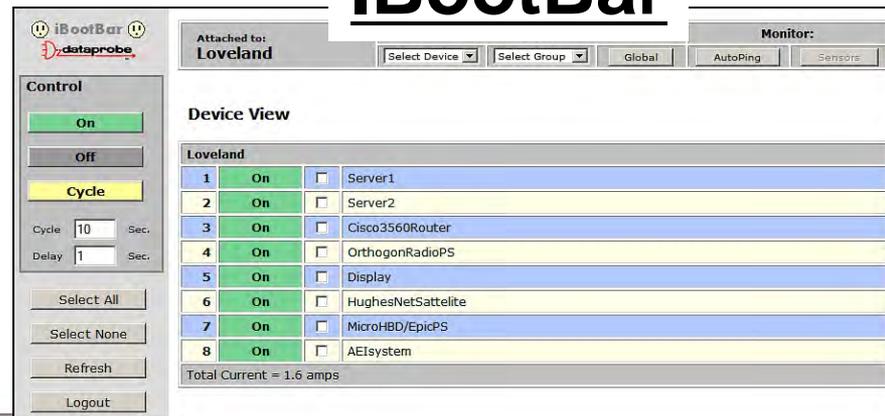
POWER

- IP interface to UPS
- Monitors System Status
 - rectifiers/ invertors
 - current draw
 - unusual event log
- Battery maintenance



- Each device on separate circuit
- Current can be cycled on/off for each device to reset
- Current draw for each device can be monitored

IBootBar



Wayside Data Path

- Raw data stored locally (a long time)
 - Raw Data = One step above analog signal
 - Root Cause Investigation (Troubleshooting)
- Raw data sent to Base (Store forever)
 - Via FTP (Fixed(old), CSV(new))
 - Via Directory Monitor (CSV)
 - Raw Data = As much as feasible to send
 - Root Cause Investigation (Troubleshooting)
- Processed Data is Integrated (Stored forever)
 - Also transmitted to InteRRIS



Wheel Profile Measurement



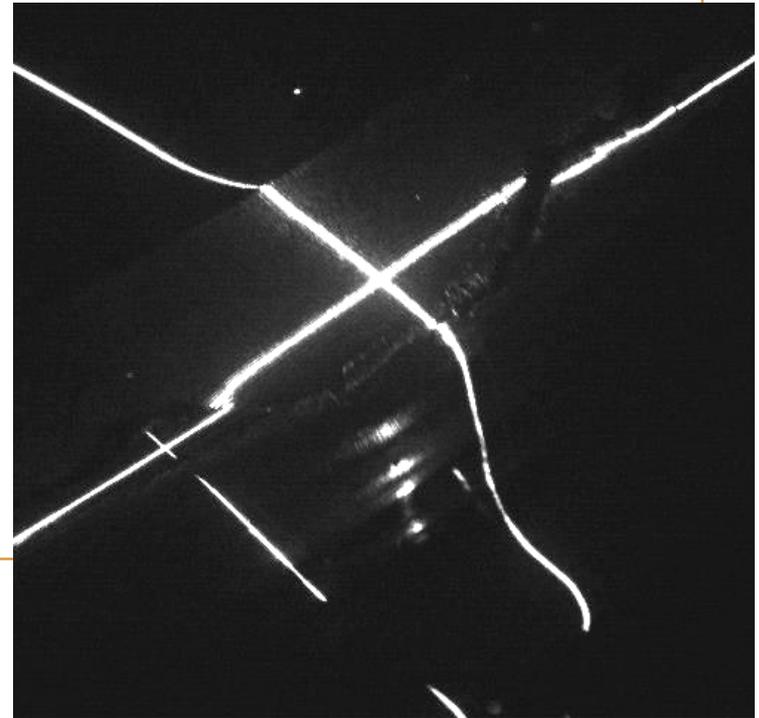
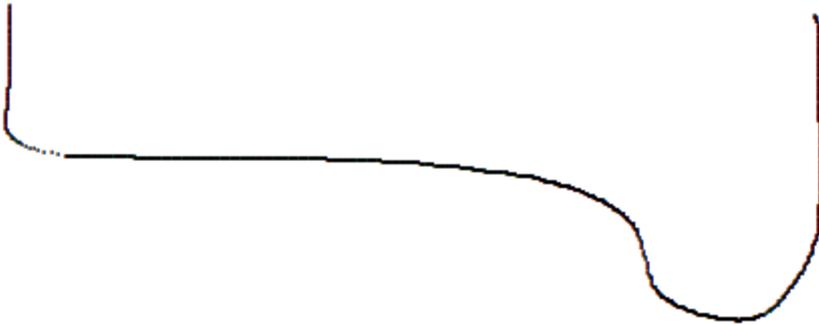
Raw Data

Train: KG2LT 21 - Car: DTTX724897 - Axle: 62 - Eqmt On Train Seq: 11 - Lcl Axle on Eqmt Seq: 3

EQMT SIDE IND	B2B GAGE	FLAN HT	FLAN THK	RIM THK	HLOW TRD MSMT
L		1.105	1.355	1.061	0
R					

TRAIN SIDE IND: L AXLE ON TRAIN: 62 EQMT SIDE IND: L

TRAIN SIDE IND: AXLE ON TRAIN: 62 EQMT SIDE IND:



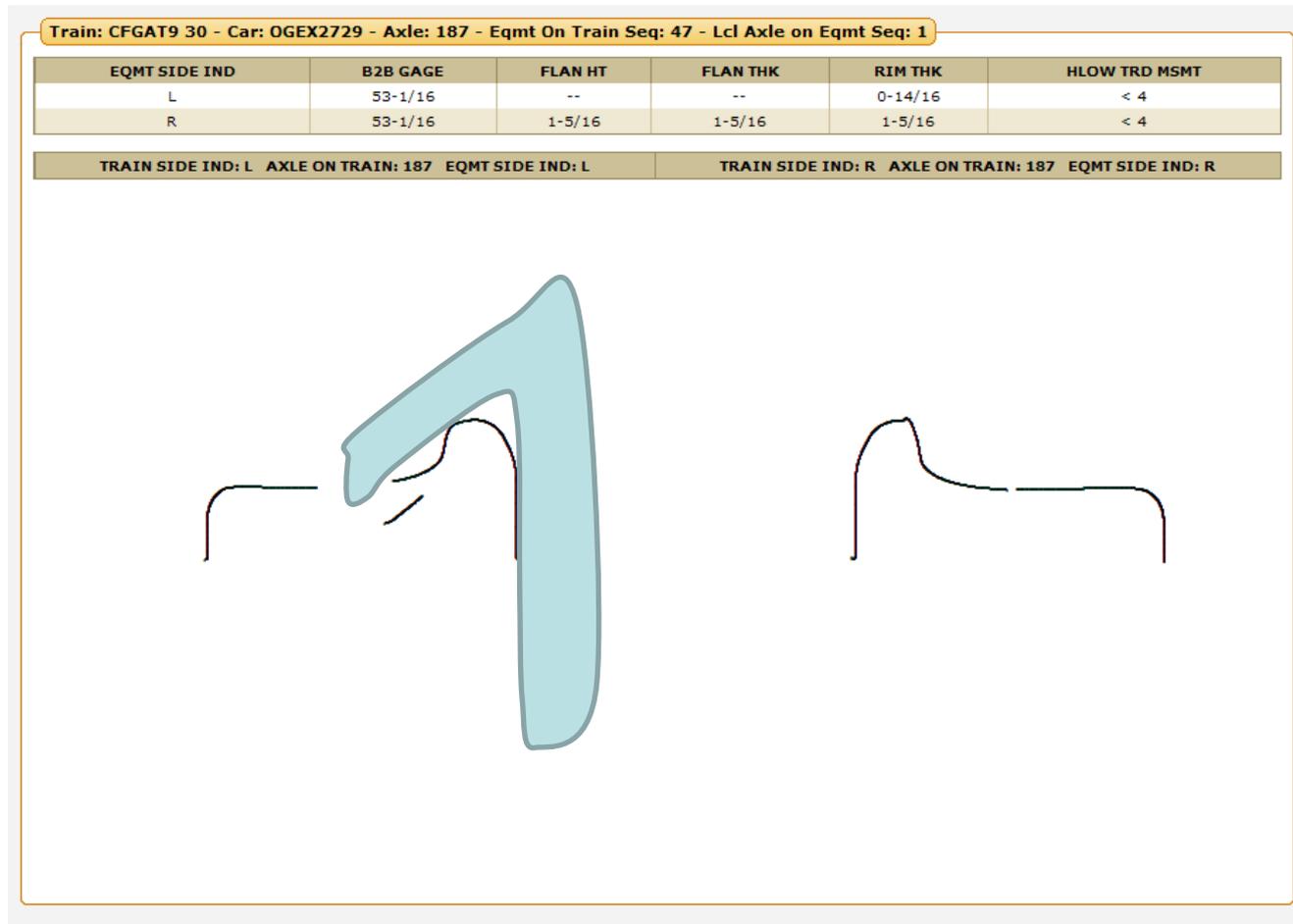
Wheel Profile Integrated Data

Trains Past Detector

TIME PASSED DETECTOR	SITE	TRAIN ID	TRAIN DIR	AXLE CNT	UT FACILITY AUTH	UT DEFECT	AAR DEFECT	FULL REPORT
07/01/09 10:11	GOTH 2	CFGAT9 30	W	556	DESK	<u>1</u>	<u>0</u>	VIEW
06/27/09 07:50	GOTH 2	GSSTY6 23	E	314	N/A	<u>0</u>	<u>4</u>	VIEW
06/27/09 02:30	GOTH 2	MNPSS 27	E	276	N/A	<u>0</u>	<u>0</u>	VIEW
06/27/09 01:07	GOTH 2	KG1LT 26	W	446	YES	<u>0</u>	<u>4</u>	VIEW
06/27/09 00:22	GOTH 2	KG1LA 26	W	526	DESK	<u>3</u>	<u>3</u>	VIEW
06/26/09 23:38	GOTH 2	MKSNP 26	W	300	DESK	<u>3</u>	<u>1</u>	VIEW
06/26/09 21:22	GOTH 2	CWTWL9 25	E	590	N/A	<u>4</u>	<u>0</u>	VIEW
06/26/09 18:01	GOTH 2	CATOV 25	E	558	N/A	<u>2</u>	<u>1</u>	VIEW
06/26/09 17:41	GOTH 2	CCANC9 25	E	514	N/A	<u>4</u>	<u>0</u>	VIEW
06/26/09 17:22	GOTH 2	IDVG1R 25	E	280	N/A	<u>1</u>	<u>2</u>	VIEW
06/26/09 17:12	GOTH 2	MNPNL 26	E	448	N/A	<u>5</u>	<u>3</u>	VIEW
06/26/09 16:54	GOTH 2	ZSEMNI 24	E	364	N/A	<u>2</u>	<u>2</u>	VIEW
06/26/09 16:40	GOTH 2	ZLTCS 24	E	274	N/A	<u>2</u>	<u>7</u>	VIEW
06/26/09 16:31	GOTH 2	CNAAE 25	E	546	N/A	<u>4</u>	<u>1</u>	VIEW
06/26/09 16:06	GOTH 2	KMNOA 25	W	186	DESK	<u>1</u>	<u>1</u>	VIEW
06/26/09 13:58	GOTH 2	IG2OA 25	W	412	DESK	<u>5</u>	<u>3</u>	VIEW
06/26/09 07:56	GOTH 2	CNAWB9 25	E	562	N/A	<u>0</u>	<u>0</u>	VIEW
06/26/09 02:11	GOTH 2	QNLNP 24	W	558	DESK	<u>1</u>	<u>1</u>	VIEW
06/25/09 17:37	GOTH 2	CBMWX 24	E	524	N/A	<u>4</u>	<u>0</u>	VIEW
06/25/09 17:05	GOTH 2	ENPALC 25	E	12	N/A	<u>0</u>	<u>0</u>	VIEW
06/25/09 17:05	GOTH 2	MNPKS 25	E	396	N/A	<u>1</u>	<u>0</u>	VIEW
06/25/09 13:17	GOTH 2	MNPNL 25	E	438	N/A	<u>0</u>	<u>0</u>	VIEW
06/25/09 09:02	GOTH 2	CCDIM9 24	E	514	N/A	<u>9</u>	<u>0</u>	VIEW
06/25/09 06:30	GOTH 2	KG1SEB 24	W	332	DESK	<u>2</u>	<u>4</u>	VIEW
06/25/09 04:54	GOTH 2	GSKREI 24	W	418	DESK	<u>1</u>	<u>0</u>	VIEW
06/25/09 04:02	GOTH 2	KG1LT 24	W	318	DESK	<u>6</u>	<u>3</u>	VIEW



Human Evaluation = OK



Systems Monitoring (Wayside & Base)

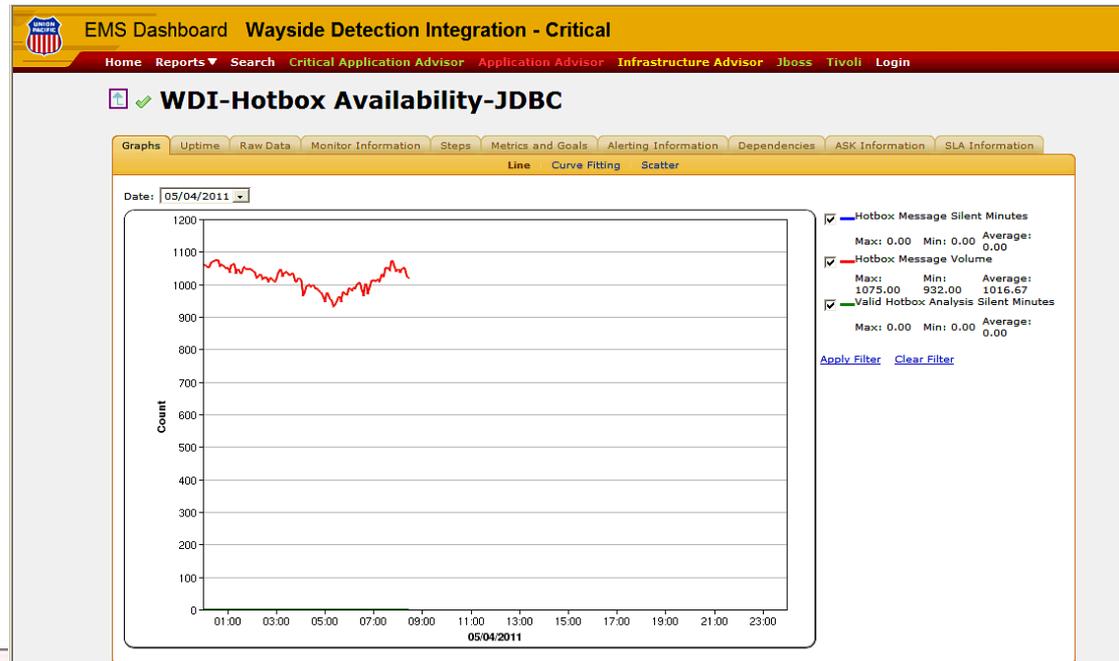
- Enterprise monitoring system
 - Dashboard / Alerts (SPC)
- CPU Load
 - ~100 Servers
- Queue Backlog
 - Data Flow
- 24/7 OSG (IT)

EMS Dashboard Application Advisor - Wayside Detection Integration

Home Reports Search Critical Application Advisor Application Advisor Infrastructure Advisor

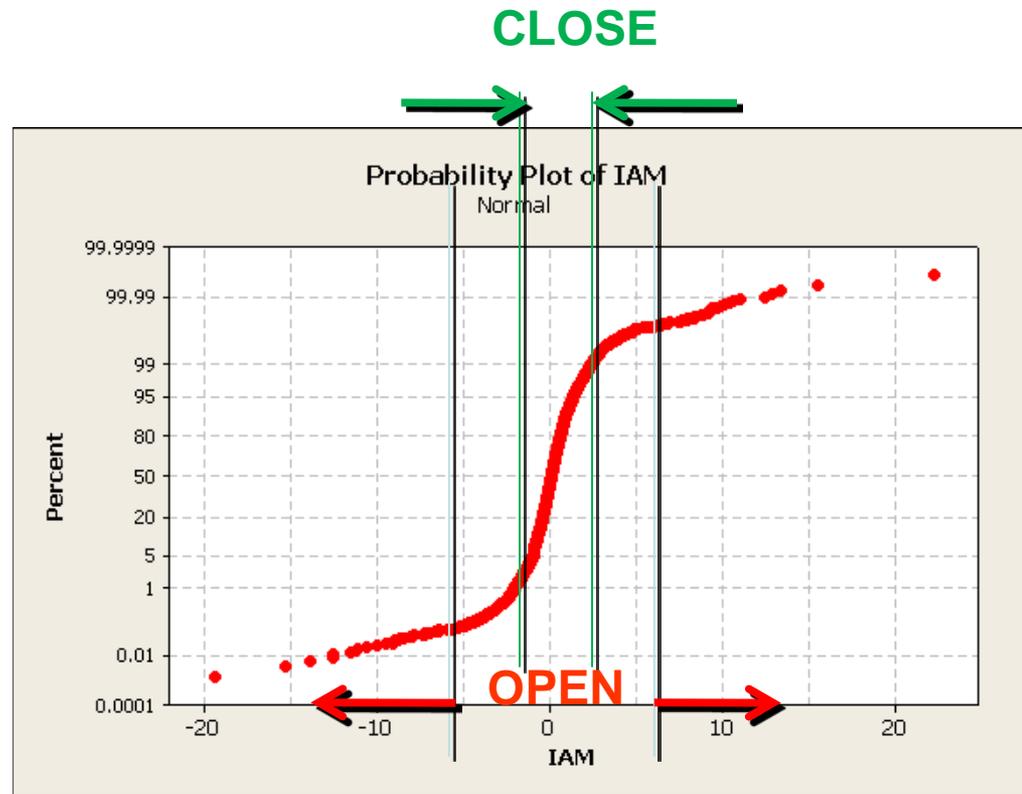
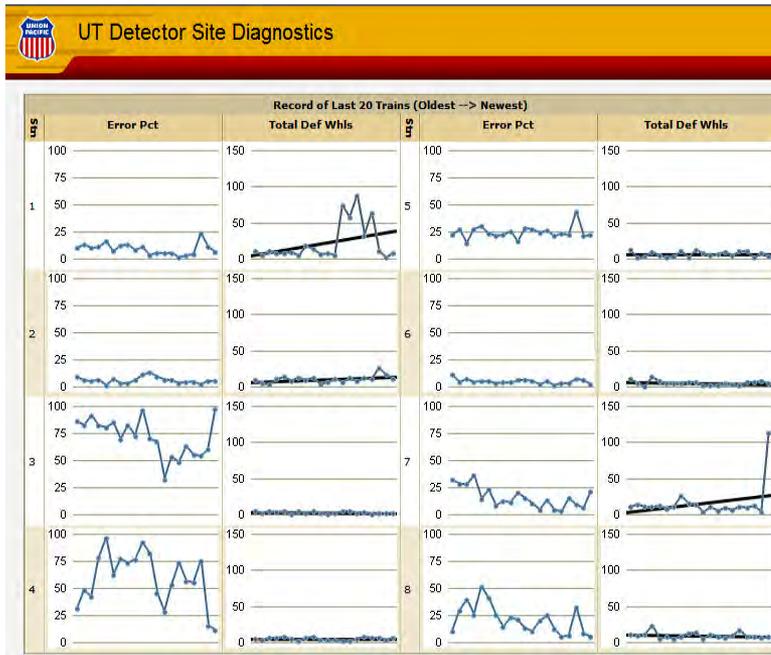
WDI - Wayside Detection Integration

- ✓ Critical
- ✓ [DIAGNOSTICS](#)
- ✓ [DSP011 VALIDATION JDBC](#)
- ✓ [HOTBOX DETECTORS](#)
- ✓ [JMS](#)
- ✓ [SITESCOPE](#)
- ✓ [T2 GUI JDBC](#)
- ✓ [WDI-WAYSIDE DIAGNOSTICS](#)



Detector Performance Monitoring

- Change over Time (Corrections)
- Train by Train Analysis – All OK?
- i.e. SPC



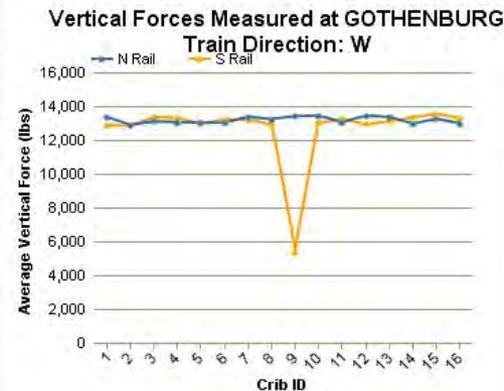
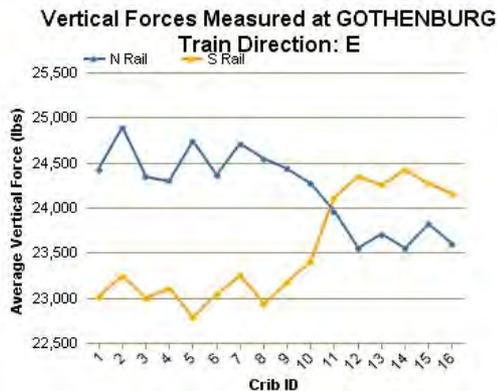
WILD Vertical Circuits



WILD Site Diagnostics

(XDEV)

GOTHENBURG - All Equipment April 10, 2010 - May 10, 2010																	
Rail Side: N									Rail Side: S								
Crib	Psnq	Inac	% Inac	Avg Vert Force	Diff OOB Rail To Rail	% Diff OOB Rail To Rail	Diff OOB Same Rail	% Diff OOB Same Rail	Crib	Psnq	Inac	% Inac	Avg Vert Force	Diff OOB Rail To Rail	% Diff OOB Rail To Rail	Diff OOB Same Rail	% Diff OOB Same Rail
1	1554	1	0.1	13393.95	741.70	5.23	320.51	2.55	1	1554	1	0.1	12866.68	741.70	5.65	447.36	2.87
2	1554	1	0.1	12913.00	592.78	4.05	442.32	3.88	2	1554	0	0.0	12866.95	592.78	4.13	457.01	4.22
3	1554	1	0.1	13121.78	651.92	4.23	364.34	2.52	3	1554	0	0.0	13357.66	651.92	4.14	419.43	3.11
4	1554	2	0.1	13086.50	643.80	4.07	308.91	1.81	4	1554	0	0.0	13321.30	643.80	4.01	361.02	2.24
5	1554	0	0.0	13033.74	580.65	4.04	366.79	2.68	5	1554	0	0.0	12962.70	580.65	4.16	370.55	3.37
6	1554	0	0.0	13036.80	749.39	4.66	380.96	2.15	6	1554	2	0.1	13242.34	749.39	4.65	350.75	2.05
7	1554	0	0.0	13389.94	797.36	5.72	367.33	2.27	7	1554	0	0.0	13226.44	797.36	5.92	442.08	3.22
8	1554	0	0.0	13250.44	811.05	5.30	346.49	1.99	8	1554	0	0.0	12911.89	811.05	5.60	469.03	3.60
9	1554	1	0.1	13437.12	997.58	7.31	465.06	3.34	9	1554	946	60.9	13799.49	997.58	5.90	815.48	5.95
10	1554	1	0.1	13459.41	960.27	7.83	531.26	4.66	10	1554	0	0.0	13022.27	960.27	8.45	393.39	3.17
11	1554	2	0.1	13086.25	744.61	4.89	367.93	2.25	11	1554	0	0.0	13255.21	744.61	4.74	388.18	2.65
12	1554	1	0.1	13466.73	741.78	5.05	360.59	2.26	12	1554	1	0.1	12957.73	741.78	5.38	367.39	2.49
13	1554	0	0.0	13373.74	615.42	3.89	305.34	1.84	13	1554	0	0.0	13098.08	615.42	3.96	349.97	2.34
14	1554	2	0.1	12993.66	702.59	6.28	407.91	3.96	14	1554	1	0.1	13350.22	702.59	5.86	374.08	3.15
15	1554	1	0.1	13271.93	713.40	6.00	342.90	2.38	15	1554	1	0.1	13573.14	713.40	5.66	530.16	4.80
16	1554	0	0.0	13003.87	592.05	4.01	353.03	2.53	16	1554	2	0.1	13330.55	592.05	3.86	322.59	2.20

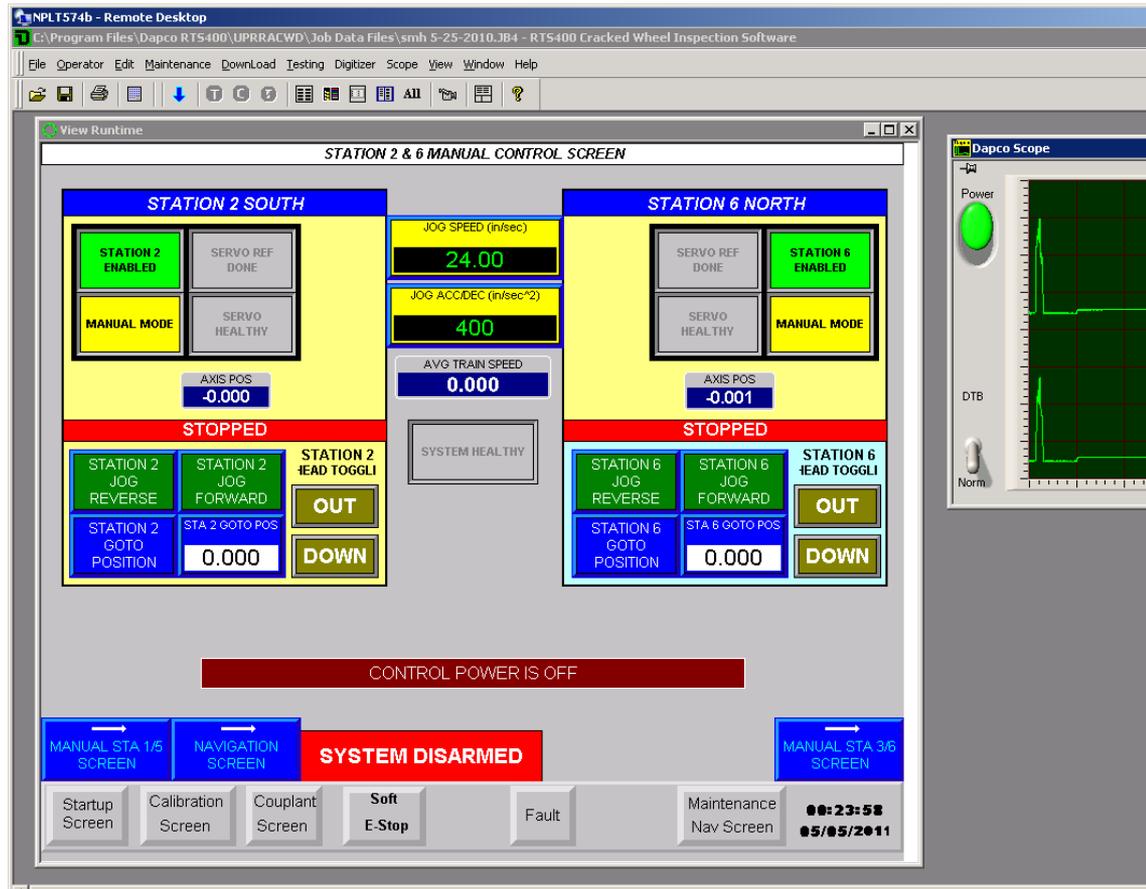


Cracked Wheel Detector



Remote Desktop

- Mechanical Control
- Water/Couplant
- UT (A-scan)
- Video



Standard Remote Video

A screenshot of a remote video control software interface. The interface is divided into several sections:

- Top Bar:** Contains system information such as 'omnc038 @ omhqpr02...', 'CPU', 'Video', and a date/time stamp '5/5/2011 12:35:33 AM'. It also shows 'Monitor: 115', 'Try: 1', and 'Screen: 238'.
- Tool Plane:** Features a 'Camera controls' button, an 'Instant replay' button, and a large blue circular control pad with directional arrows and a 'Ready' indicator.
- Camera List:** A scrollable list on the left side showing various camera locations and IDs, including 'Cracked Wheel House', 'NPLT CWH North PTZ Camera - Cam - 01 (237)', 'NPLT CWH South PTZ Camera - Cam - 01 (238)', and several 'NPLT North Station' and 'NPLT South Station' cameras.
- Video Grid:** A grid of video feeds. The top row shows two large feeds: 'NPLT CWH South PTZ Camera - Cam - 01 (238)' (left) and 'NPLT CWH North PTZ Camera - Cam - 01 (237)' (right). Below these are two rows of four smaller feeds each, showing different camera views of industrial sites. The bottom right corner of the grid shows 'Default-46 (260)' and the number '115'.



Cracked Wheel Video



Mobile Video Link



Brake Shoe/Wedge Rise



- Cameras
 - How to Clean?
 - When to Clean?
- When Data is Bad?
(wrong Answer)



Automated Safety Appliance Inspection Loveland, IA



Sliding Wheel Detector



Sliding Wheel Detector Ready for Primetime



Radiometric Thermal Image



THE ROAD TO THE FUTURE ISN'T A ROAD AT ALL.



HEAVY HAUL SEMINAR • MAY 5 - 6, 2011

WRI 2011