

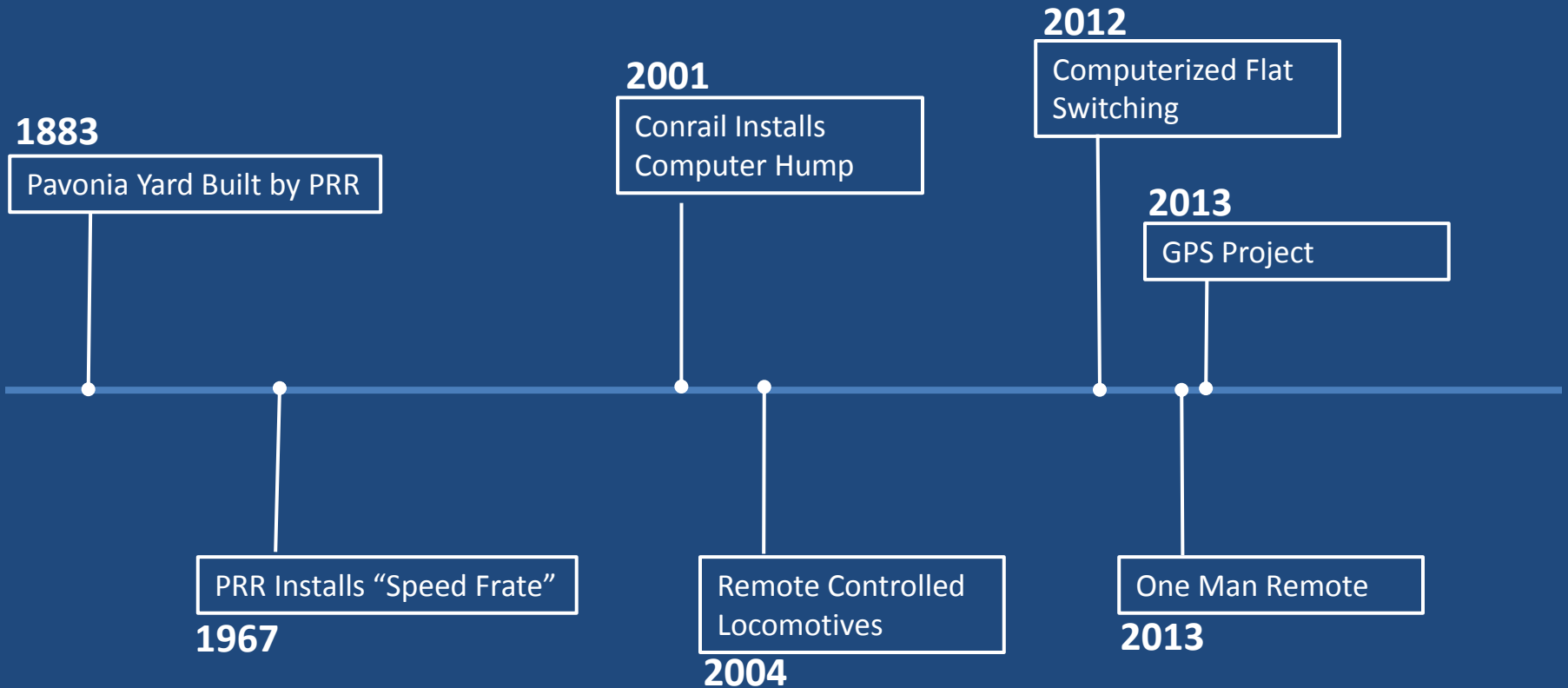
Conrail Pavonia Yard

Evolution of Process and Technological Change

Mount Laurel, New Jersey
October 2016

CONRAIL 

Timeline of Change



Process

- Pavonia Yard was originally built in 1883 by the Pennsylvania Railroad
- It was a flat switching operation with one portion having a slight gravity hump manned with car riders
- The yard remained relatively unchanged until the late 1960's

Process

- In March 1967 Pennsylvania Railroad gave Pavonia an upgrade with the installation of “Speed Frate”
- Speed Frate was a hump control system that was developed by the General Railway Signal Company
- This system and variations of it remained operation in Pavonia for the next several decades

Process

- In 2001 Conrail upgraded the hump to a computer controlled system
- After 2004 the introduction of remote control locomotives allowed crew sizes to be trimmed to a 2 man operation
- Beginning in 2012 the installation of computerized flat switching made it possible for only 1 RCO to effectively switch cars

Process

- Part of the evolution of change at Pavonia yard was the creation and implementation of a standard yard procedure book
- The book covers how to safely and efficiently operate in each section of the yard

Process

- The daily operation of switching requirements is now governed by a standardized and documented set of protocols
- This ensures that operations across the three sub yards are mirror images making it possible to float crews between areas with ease while not losing safety or efficiency

Technology

- Technology has been the cornerstone of the improvement at Pavonia starting with the remote controlled locomotives and working into the fixed and mobile asset monitoring
- Many of the safety and service improvements have been made possible by the implementation of new technology

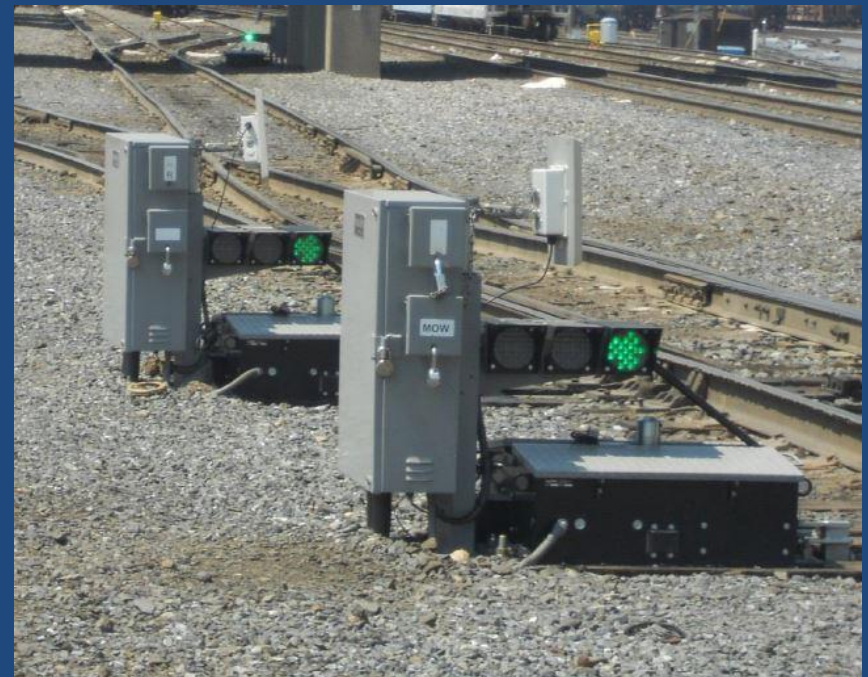
Yard Monitoring System

- Collaborated with Lat-Lon LLC to develop a Yard Monitoring System which displays GPS data from assets within Pavonia Yard
- Data sources
 - Lat-Lon Locomotive Monitoring Units
 - Lat-Lon Solar GPS Units
 - Lat-Lon wireless sensors
 - iCom GPS-equipped radios
- The entire system utilizes wireless technology

Technology

SWITCH MACHINES

In 2012 Pavonia Yard underwent a massive physical transformation. All switches on the east end of the yard were converted to electric/remote control.



Technology

SWITCH MACHINES

Kiosks were installed in the Support and Classification yards that allowed for a single conductor to line routes and switch cars with the efficiency of a previous two person crew.

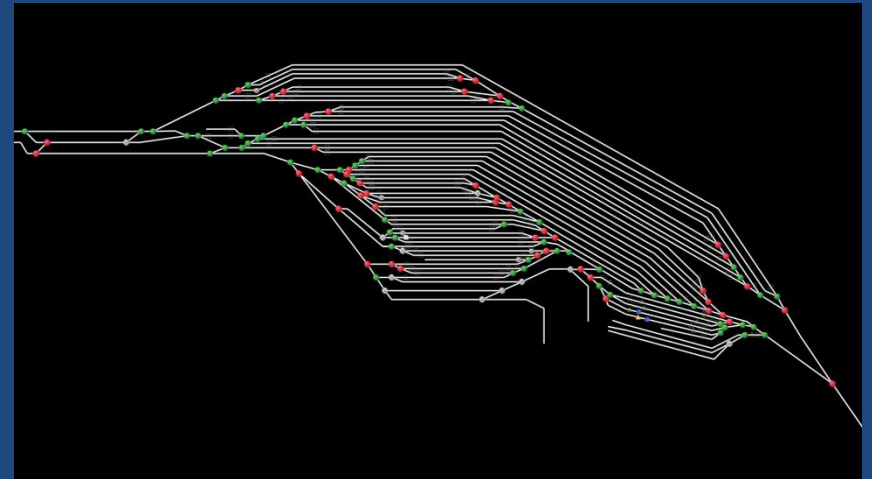


Technology

SENSORS

All fixed assets within Pavonia Yard are monitored via GPS sensors that give a real-time view of how the yard is functioning.

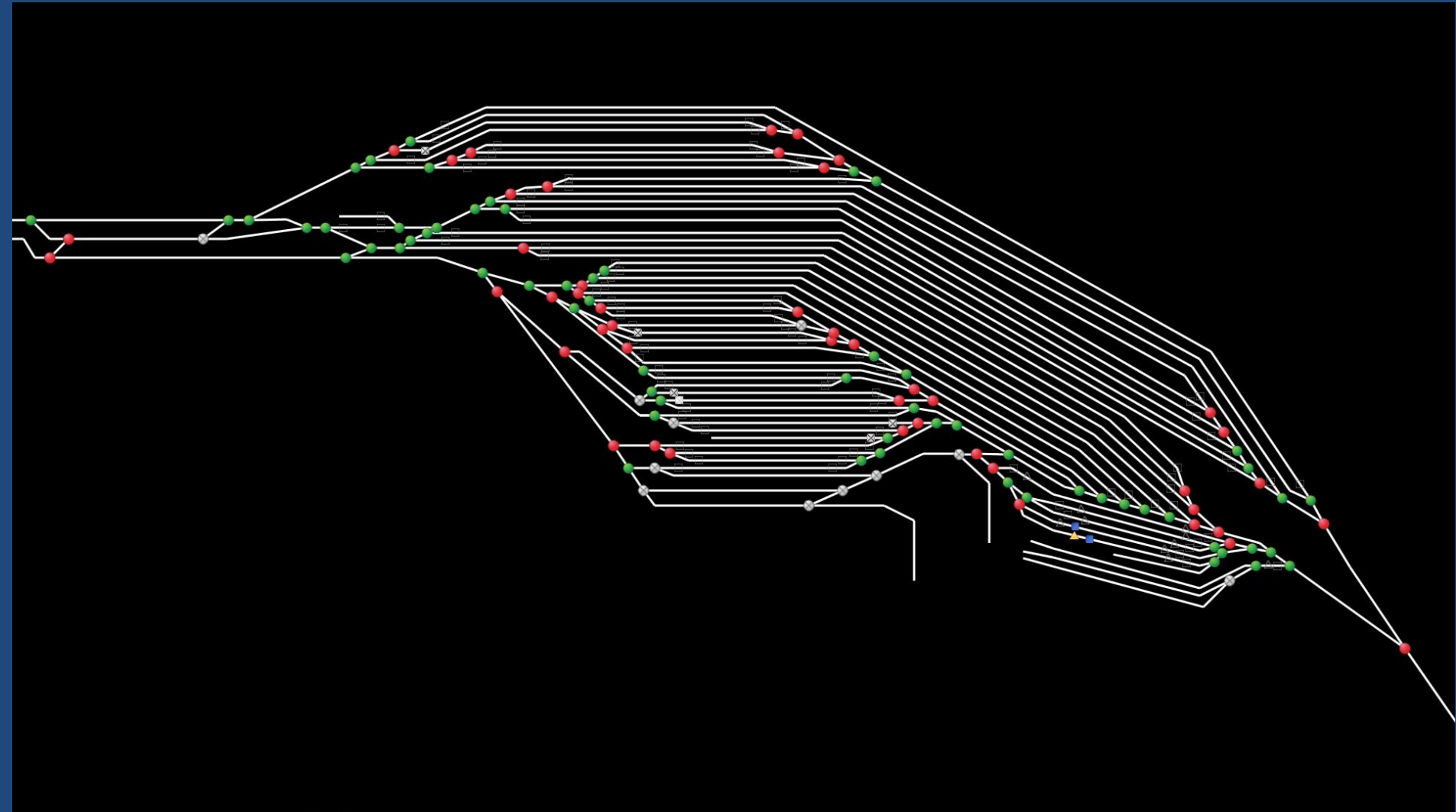
This not only provides general status of the yard but also provides valuable data into how the physical plant is utilized over time.



Static Asset Measurement

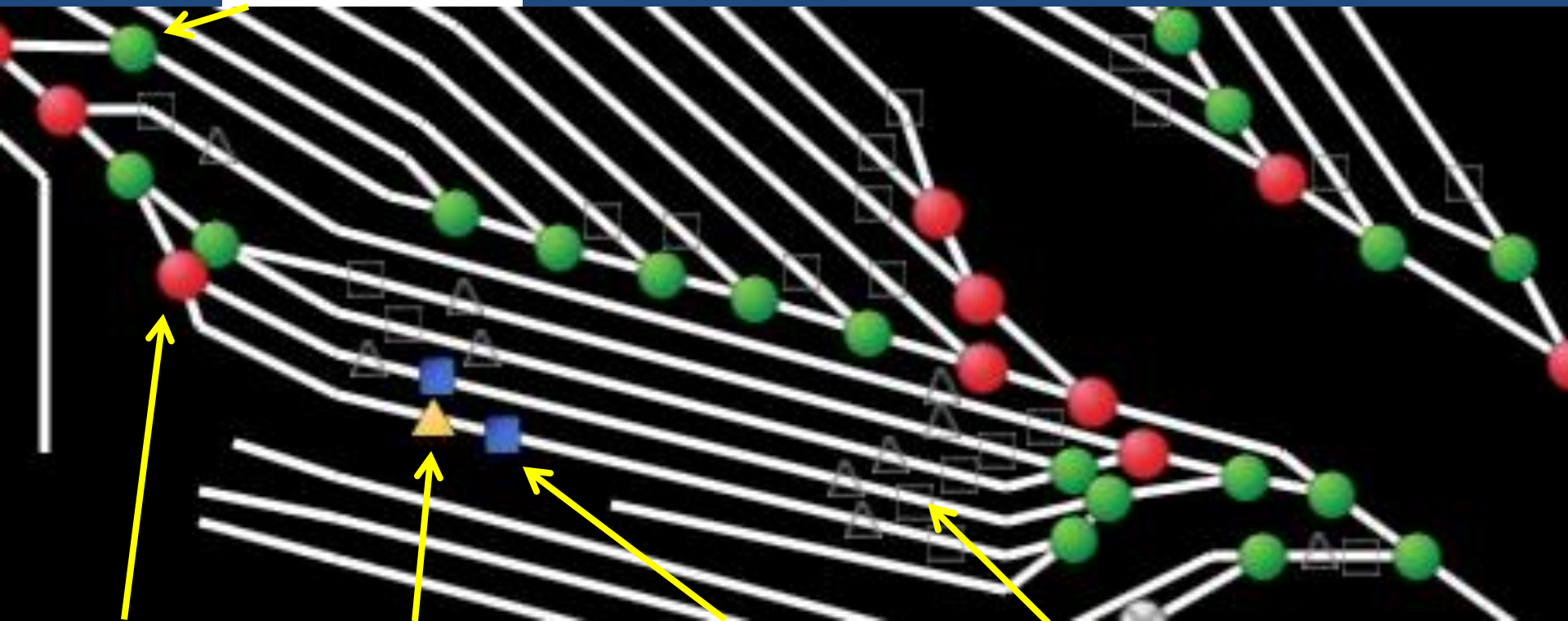
- Static binary assets are measured 24/7 in Pavonia through Lat-Lon's wireless mesh network system
- These fixed assets include:
 - Power Switches
 - Hand-Throw Switches
 - Derails
 - Blue Flags

Pavonia Static Asset Layout



Pavonia Static Asset Layout

Normal Switch



Reverse Switch

Applied Derail

Applied Blue Flag

Unapplied
Derails and Blue
Flags

Technology

SENSORS

All totaled there are 226 fixed assets being monitored 24 hours a day 7 days a week

- 112 switches
- 103 blue flags
- 11 derails



Technology

REMOTE LOCOMOTIVES

Pavonia utilizes one man remotes for switching operations. This efficiency is made possible by the integration of the switching kiosks and camera system

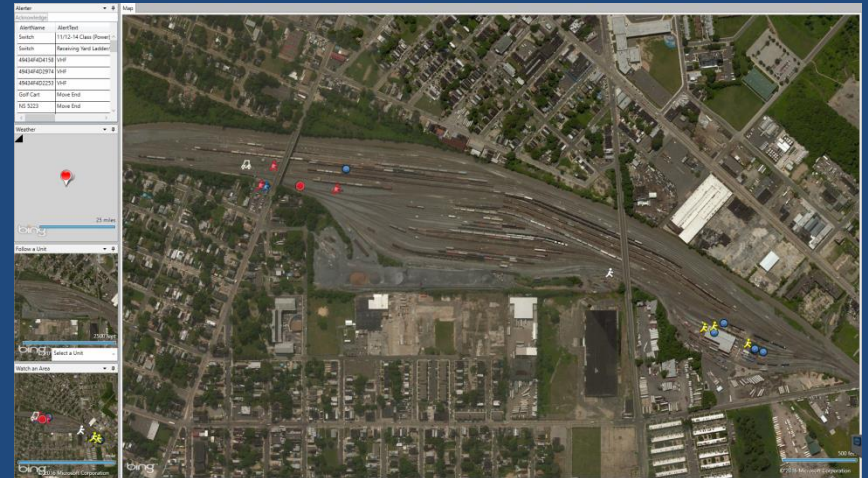


Technology

GPS FOR LOCOMOTIVE

Using the current GPS vendor that Conrail uses on all fleet locomotives, geofences were established around Pavonia Yard to help observe the safety and productivity of train crews

Up to 8 locomotives with real time monitoring



Pavonia GPS Layout

Alerter ▼ 🔍

Acknowledge

AlertName	AlertText
Switch	11/12-14 Class (Power) ^
Switch	Receiving Yard Ladder/
49434F4D4158	VHF
49434F4D2974	VHF
49434F4D2253	VHF
Golf Cart	Move End
NS 5223	Move End

Weather ▼ 🔍

bing 25 miles

Follow a Unit ▼ 🔍

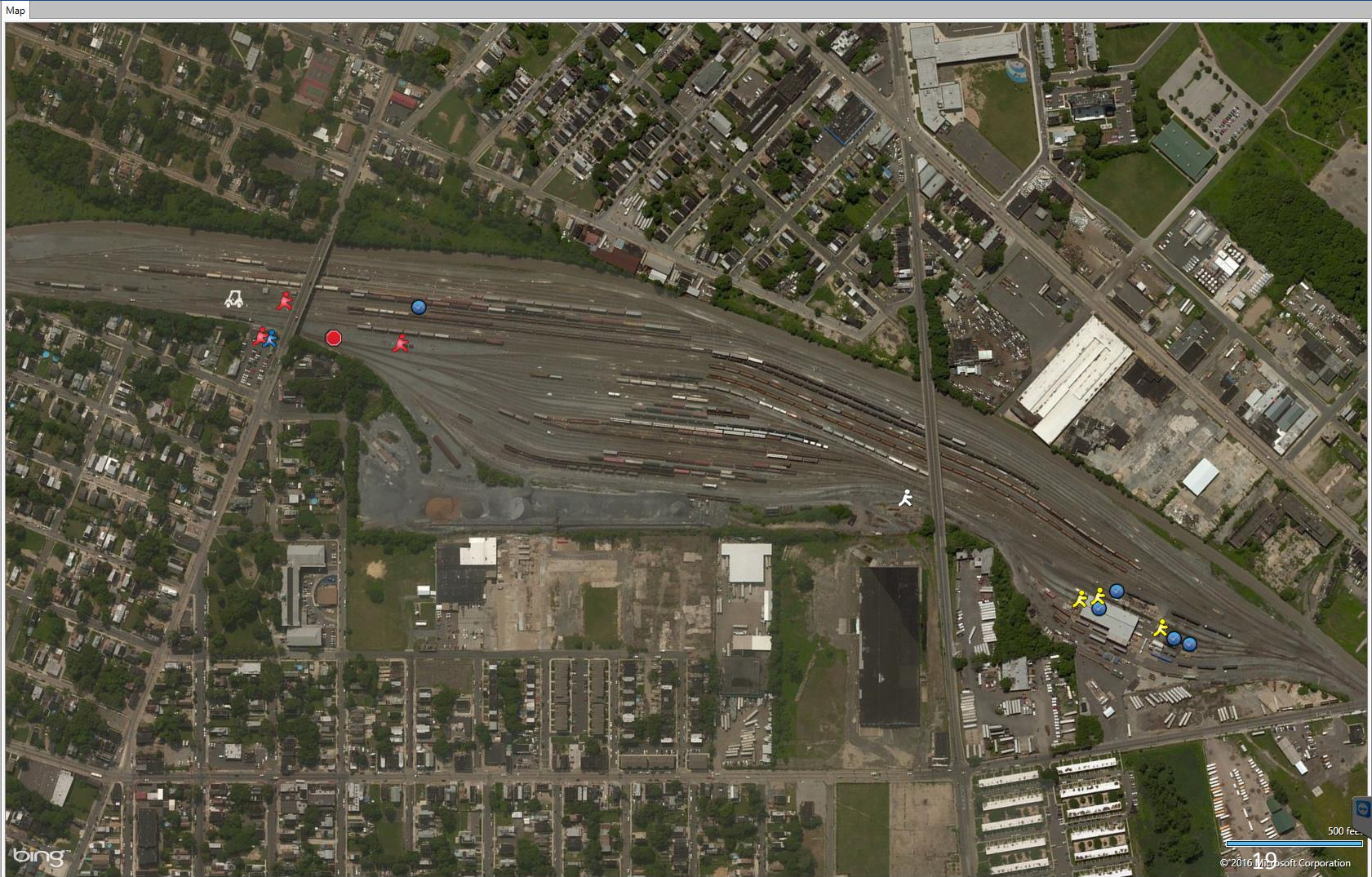
bing 2500 feet

Select a Unit ▼

Watch an Area ▼ 🔍

bing 1 mile

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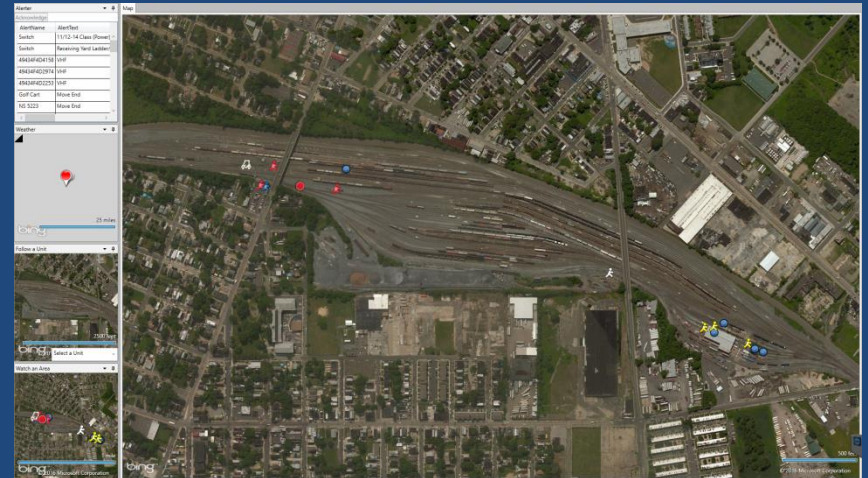


Technology

GPS FOR CREWS

Using the GPS feature of the issued hand held radios provides a means to locate all personnel walking in the yard (possible “man down” scenario)

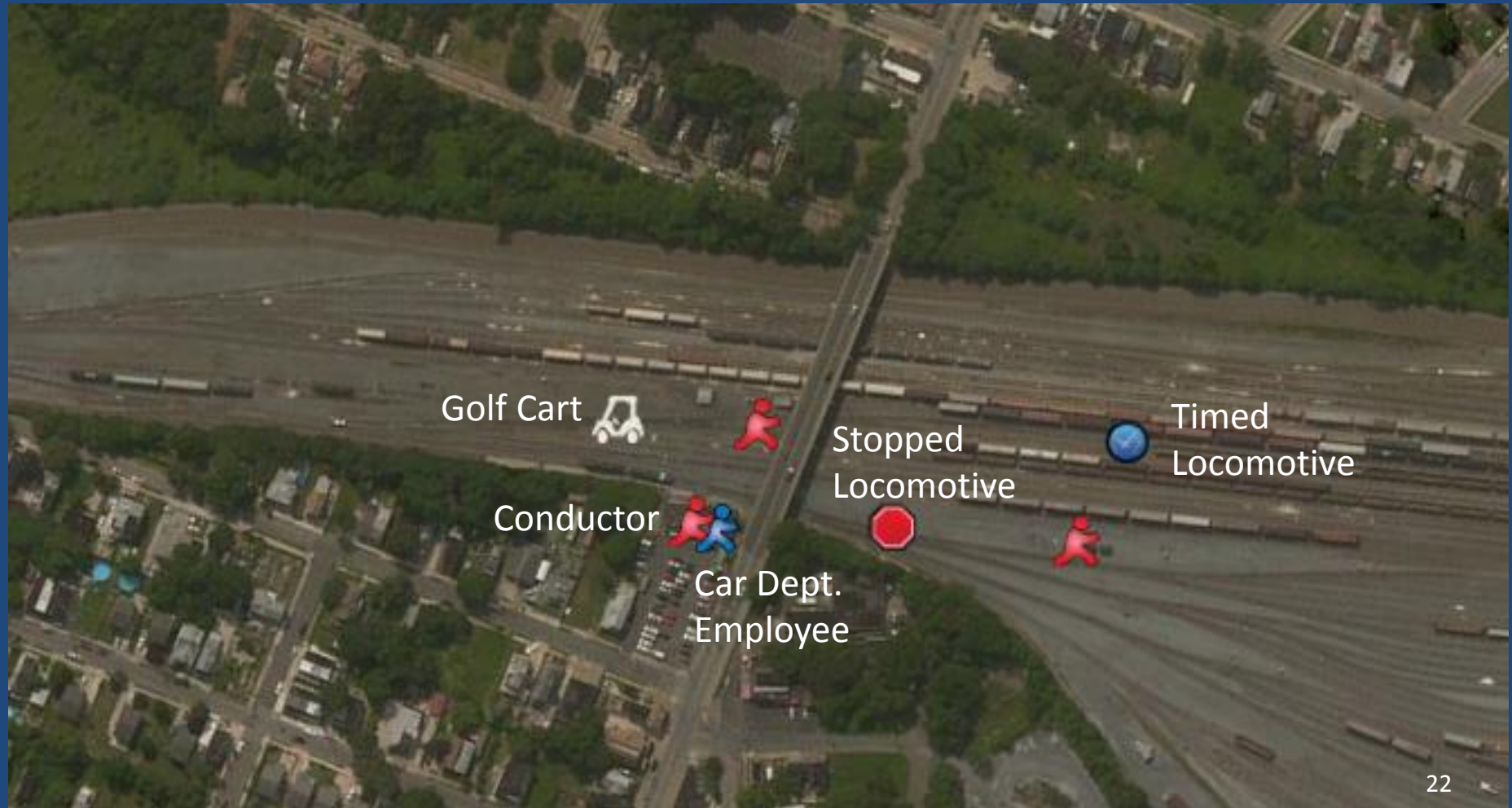
Up to 32 employees with real time monitoring



GPS Technology

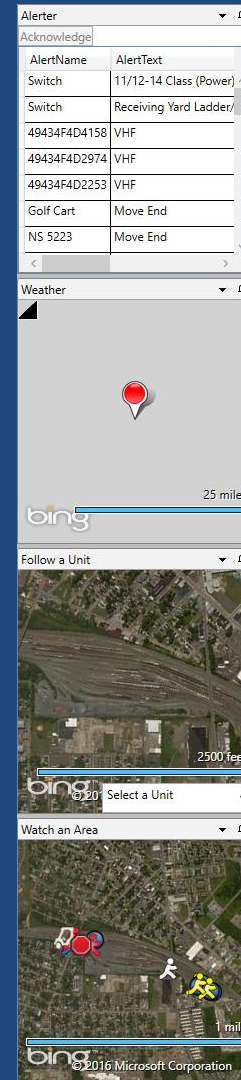
- Locomotives, crew vehicles, and employees in Pavonia Yard are monitored via GPS
- Employees are color-coded by operating department
 - Red: Train Crews
 - Blue: Car Department
 - Yellow: Engine House
 - White: Engineering

Pavonia GPS Layout



Pavonia GPS Layout

- Real-time status update messages
- Increment Weather Map
- Ability to zoom in on an individual person or locomotive
- Ability to zoom in on a specific area in the yard



Data Management

- All data in Pavonia Yard is aggregated and analyzed by Conrail
- Before installation, data on yard assets and employee behavior was based on anecdote or short-term studies
- Now, with 24/7/365 data collection, Conrail can analyze the impacts of factors such as time, car volumes, and crew size on yard utilization

Technology

CAMERA SYSTEM

Pavonia utilizes 32 cameras that are positioned throughout the yard to provide both photo analytics and intrusion detection for foul protection



Physical Change

- Considerable physical infrastructure was eliminated from Pavonia Yard during the evolution of physical change through the elimination of the computerized gravity hump system
- Augmenting this rationalization was eliminating 21% of turnouts and 16% of linear footage throughout the yard

Safety Benefits

- Safety within Pavonia yard has seen great improvement since the beginning implementation of the project
- The introduction of electronic switch machines and one man crews showed a 75% reduction in human factor derailments
- The GPS and asset monitoring is helping to provide continued reduction to human factor incidents

Safety Benefits

- The safety protocols of the NORAC, Timetable special instructions and Conrail Safety rules dovetail seamlessly into the standard operating procedure for the yard
- This allows for a consistently safe environment that limits confusion when operating within the different sub yards

Performance Benefits

- Excluding periodic increases in accommodating unit train movements the switching of manifest trains has remained constant
- Since the beginning of the improvement project, yard dwell and velocity has been steadily improving by 11%
- Existing performance has rendered an excess of 13,000 car days for use elsewhere in the rail industry annually

Cost Benefits

Significant operating and capital expenses have been reduced as result of the evolution of physical, process and technological changes at Pavonia Yard

- T&E Employees (Avg) – 70% Reduction
- Crews per year – 60% Reduction
- Labor Expense – 70% Reduction
- Hump Control System Depreciation – 100% Reduction
- Derailment Expense – 91% Reduction

Total Cost Reduction – 80.16%

Summary

- The Pavonia real time technological monitoring system is a “one of a kind” management tool comprised of fact based data
- “Without data it is just another opinion.”
 - Ronald Batory

Summary

- The Shared Asset Areas of Consolidated Rail corporation is a 21st century success story and the Pavonia Yard project is just one of many contributing components of that success that CSX and Norfolk Southern continues to enjoy from their jointly owned subsidiary