Radar-Based Vehicle Detection for Four-Quadrant Gate Crossing Warning Systems

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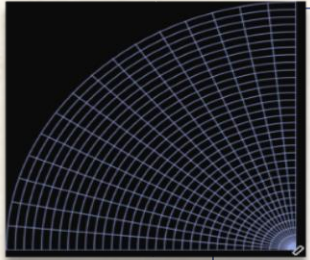# Radar-Based Vehicle Detection - History
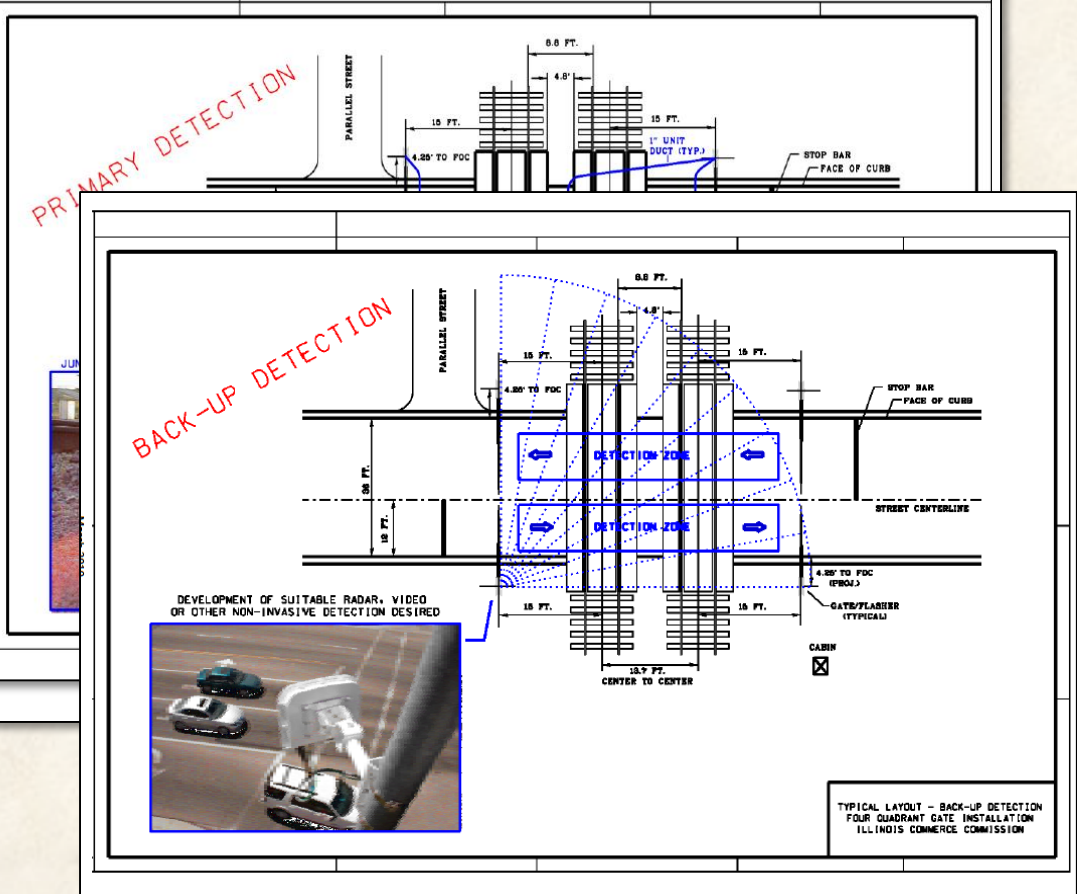
Expected Benefits

- Ease of Installation
- Work Crew Safety
- Maximize Coverage
- Longer Life
- Immunity to Elements
- Reliability
- Potential Redundancy

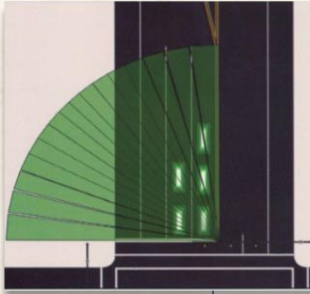# SmartSensor Matrix

Wavetronix® SmartSensor Matrix

16 separate radars in each sensor, no scanning

90° x 140-foot detection pattern – 15,386ft^2

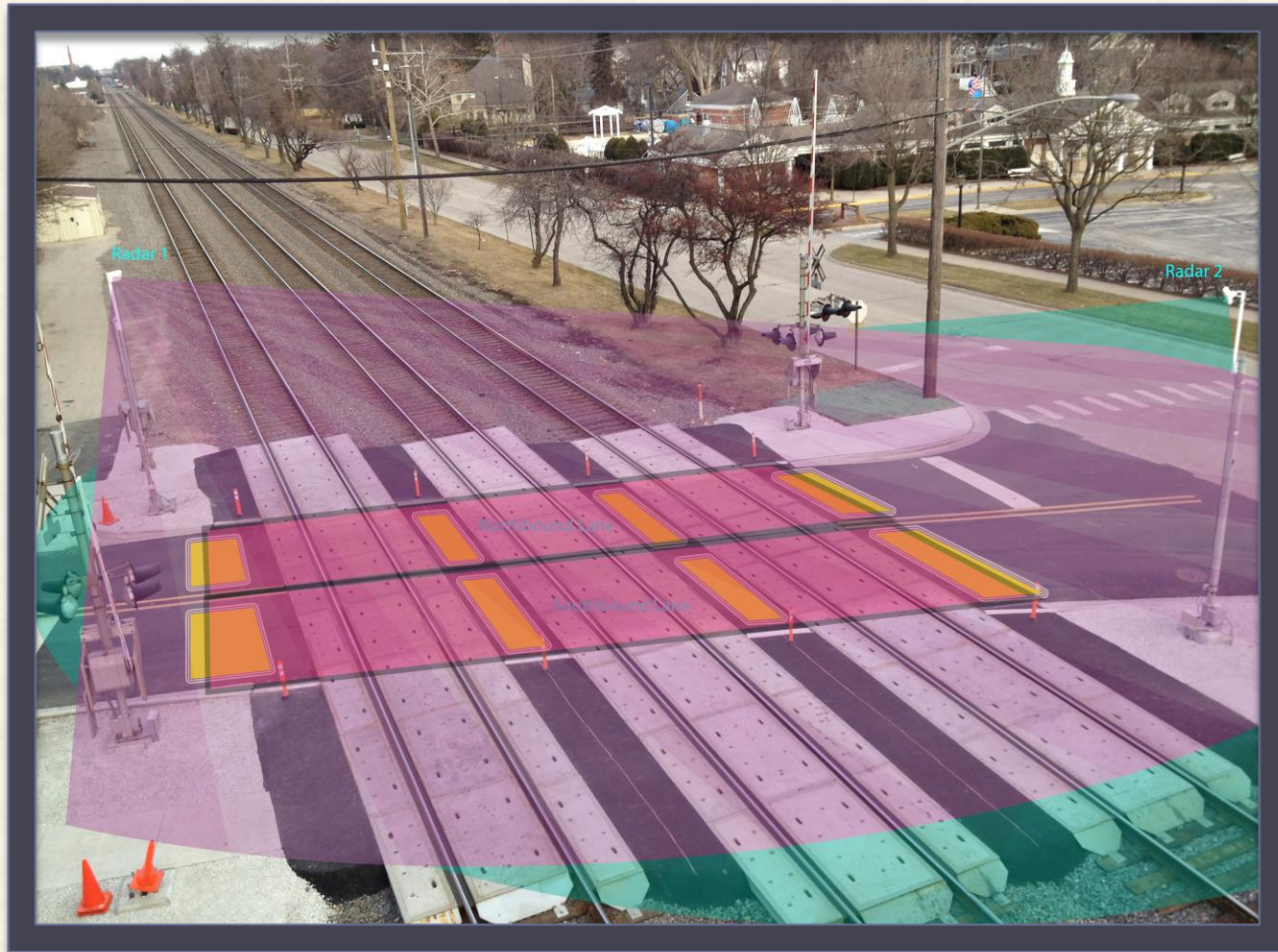MTBF>10 years, MTTR<6 hours, 99.99% Availability

Proven in ITS traffic intersection control

Moving and stationary vehicle detection

Multiple radars (up to 8) can be used together

Proposed Dual Radar Implementation
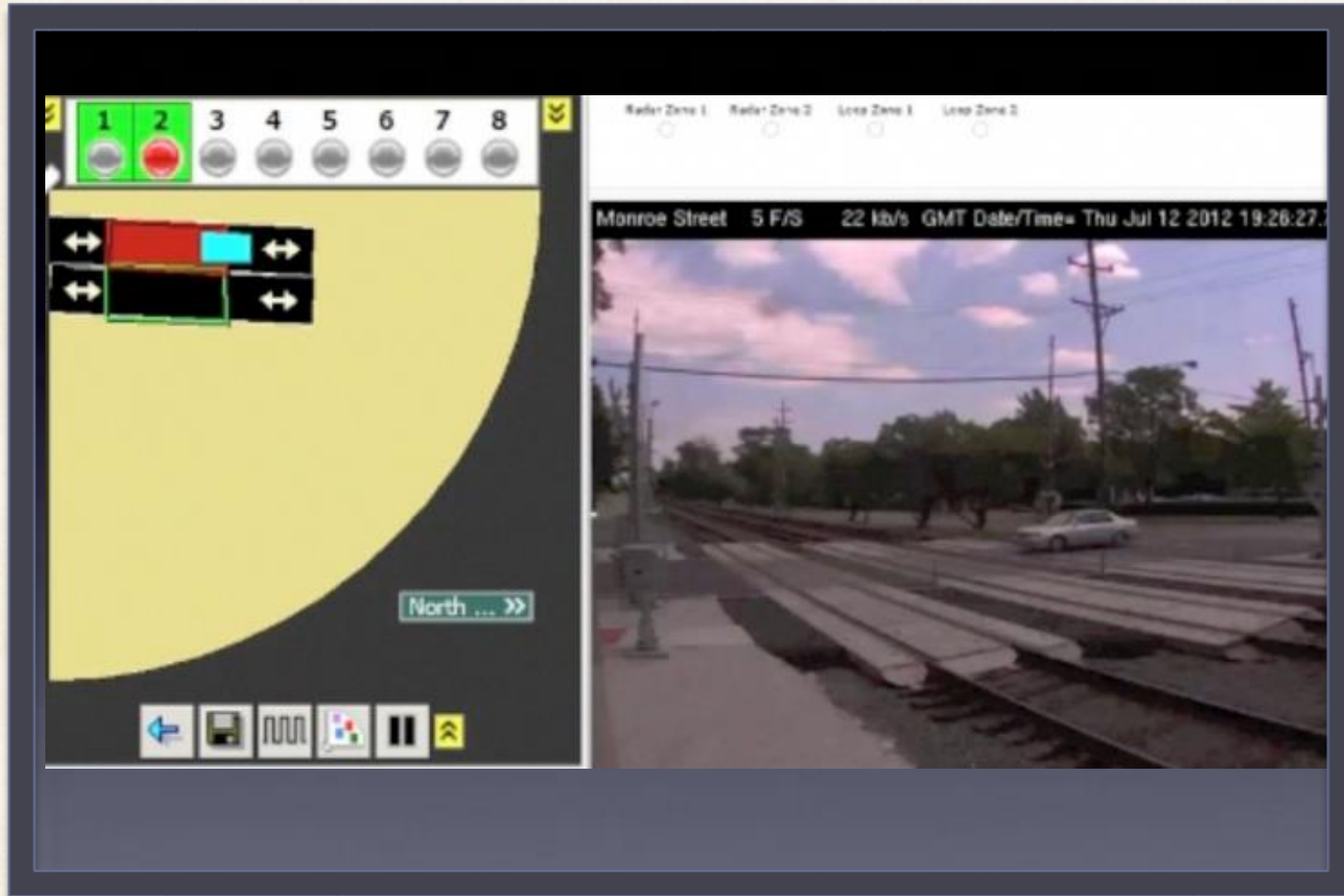
Proposed Dual Radar Implementation

Radar, Controller, and Functional Changes

AREMA Compliance per Class C Equipment	Environmental - Temperature, Humidity, Mechanical, EMI/RFI, Surge, & EFT
	Channel-to-Channel and Earth Ground Isolation
Vital Architecture	"No Single Point of Failure"
	Independent Radar Processors with Supervisory Processor
	Independent Radar Channel Health Outputs
Additional Configuration Options and Functions	Add USB and Ethernet Embedded Server
	Add Radar Response Detail (Trackers) to Configuration Application
	Add Dual Radar Tracking Metrics
Reliability Enhancements	Accelerate Message Rates
	Add Bi-Directional Vehicle Detection
	Add Sensor Movement Detection[2]
	Add Heavy Weather Optimization Features[1]
	Provision for Vital Implementation[2]
General	Eliminate Queue Forming Feature[1]
	Failsafe State Reversal
	Single, Application-Specific Enclosure vs. Open Frame Architecture

[1] Current systems under 3rd party long-term testing, still in process or results not yet reported

[2] Version 3 VDR24 hardware

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Configuring/Verifying Detection Zones

# Recent Additions and Feature Enhancements As A Result of Railroad Implementation

▸ Vital Applications

- Uses redundant radars' individual detection zone outputs
- A vital processor verifies radar correspondence

▸ Sensor Movement Detection

- FRA suggestion
- Supervisory processor senses abrupt changes in correspondence
- Provided through a separate health output
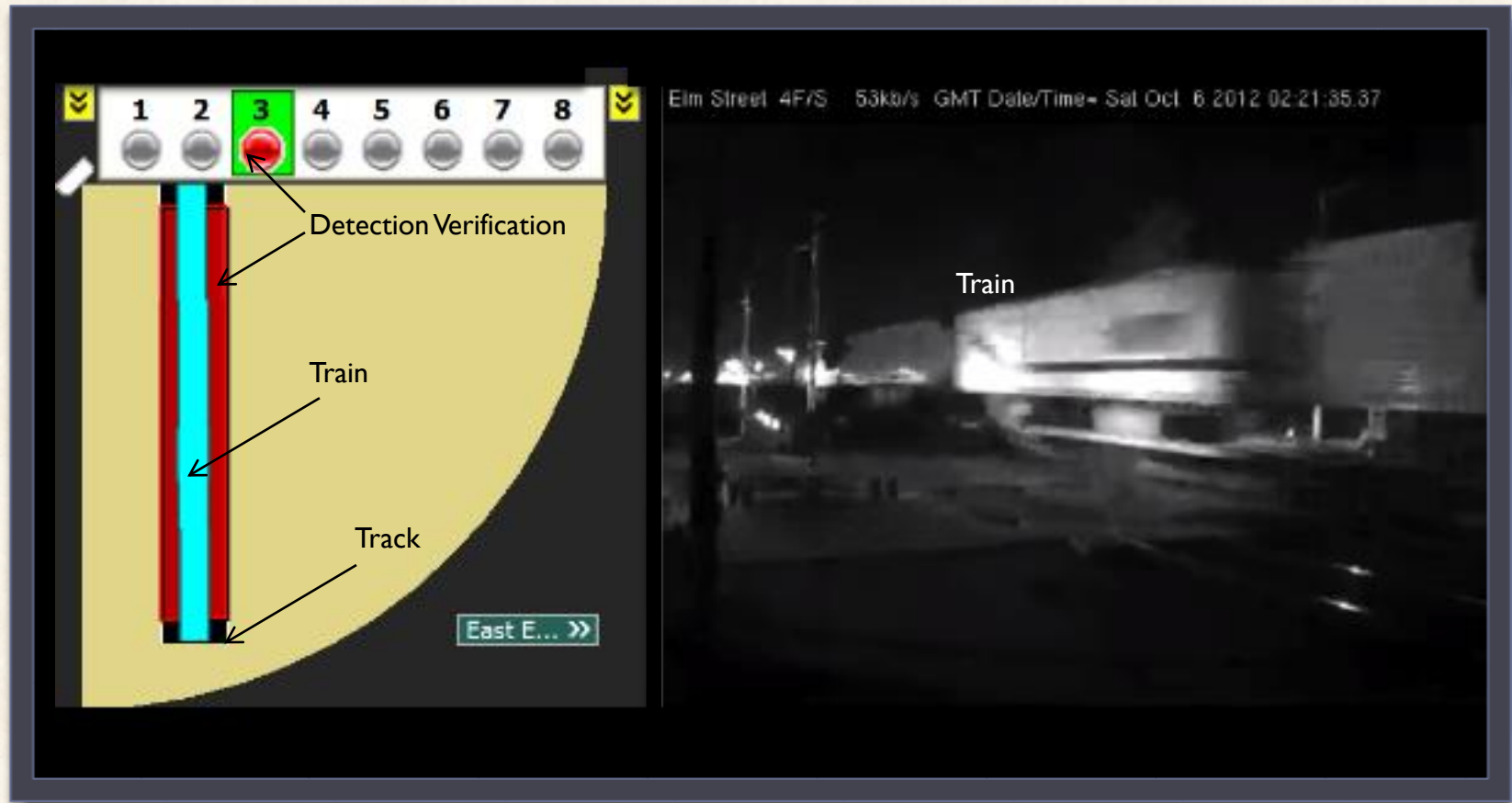

Both radars detect vehicle in zone
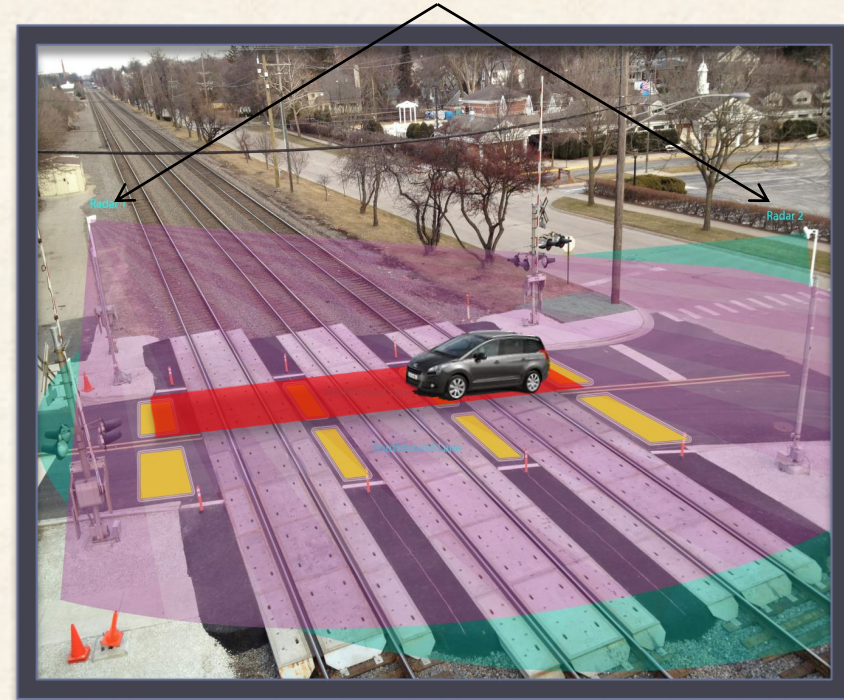
Additional Railroad Applications

- ‣ Blocked Hwy-Rail Crossing Detection and Notification
- ‣ Train Detection for Hwy-Rail Crossing Activation
- ‣ Train Detection at Rail Crossovers
- ‣ Switch Fouling Prevention in Classification Yards

Train Detection at Highway-Rail Crossings

Train Detection for Crossing Activation

Train Detection at Diamond Railroad Crossings

Train Detection in Classification Yards

Current Status

- Mature technology in the ITS sector
- Two years of development and testing for railroad
- Multiple railroad applications deployed
- Several third party validation studies in process

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