Empowering Traffic Operators Through Modular Decision-Making

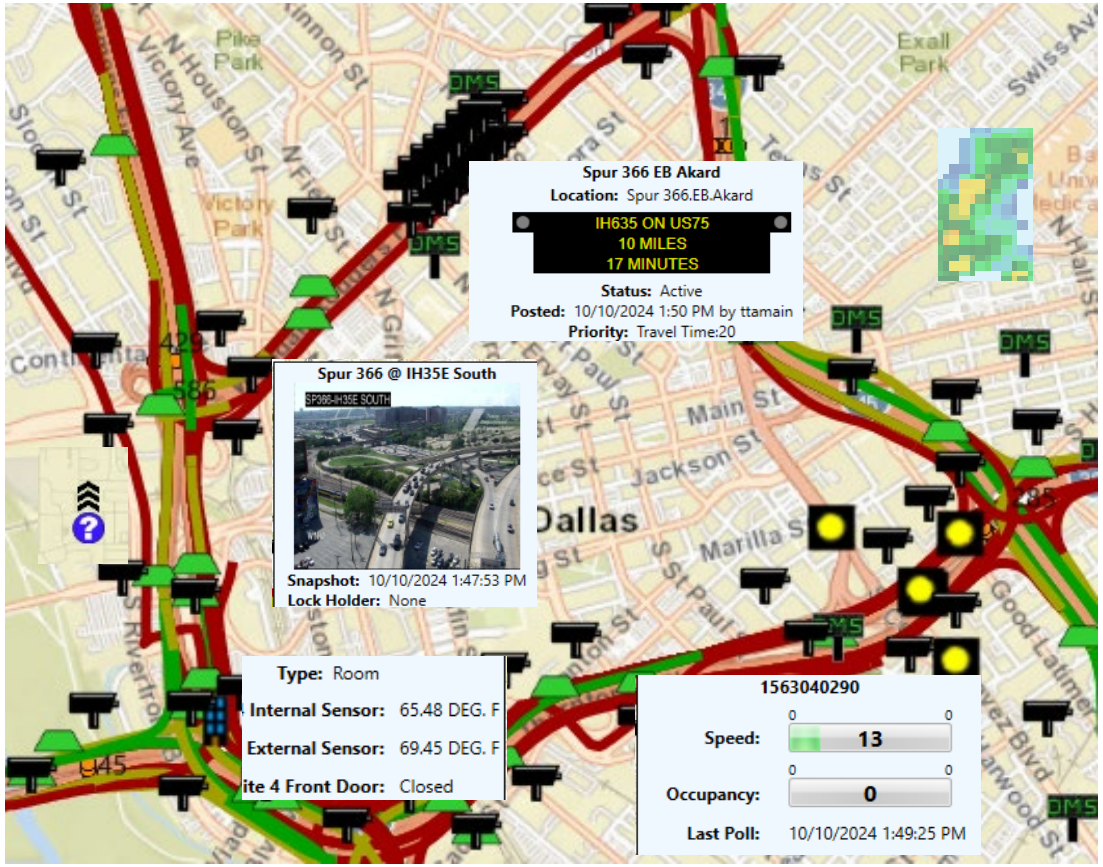
Transforming Data into Action in Advanced Traffic Management Systems

Why Do We Need Modular Decision-Making?

- Challenges in traffic management
  - Increasing amounts of data available
    - Traffic speeds
    - Crowd sourced data
    - Incident reports
  - Increased workload demands
    - Increased responsibilities
    - Staff shortages
- Leading to
  - Data overload
  - Decreased numbers of incidents detected
  - Delayed responses

Increasing Amounts of Data Leads to Cognitive Overload

- Large number of data sources including:
  - →Events
  - →Traffic speeds
  - →Weather
  - →Message boards
  - →Camera snapshots
  - →Satellite buildings
  - →Beacons
  - →Device status indicators
- Can make it hard to see what data is important



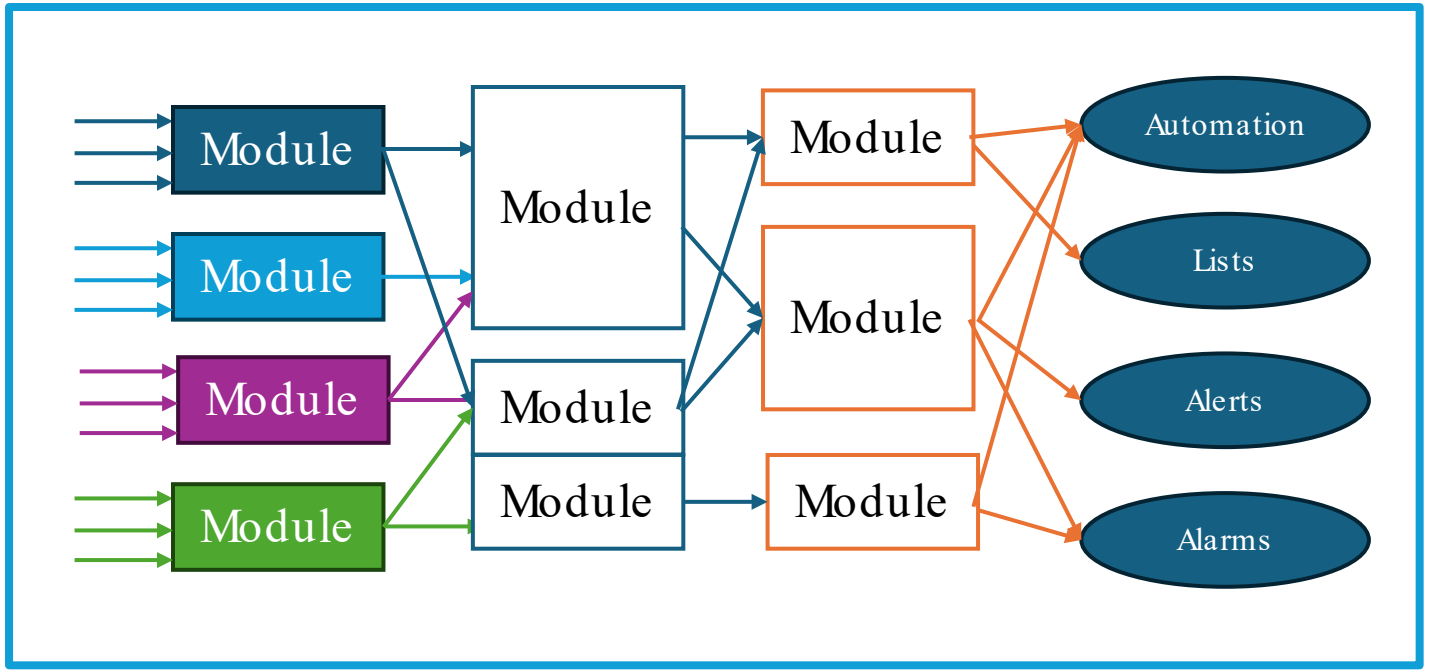
What Is Modular Decision Making?

What it is not:

- All data processed at a single point and automated

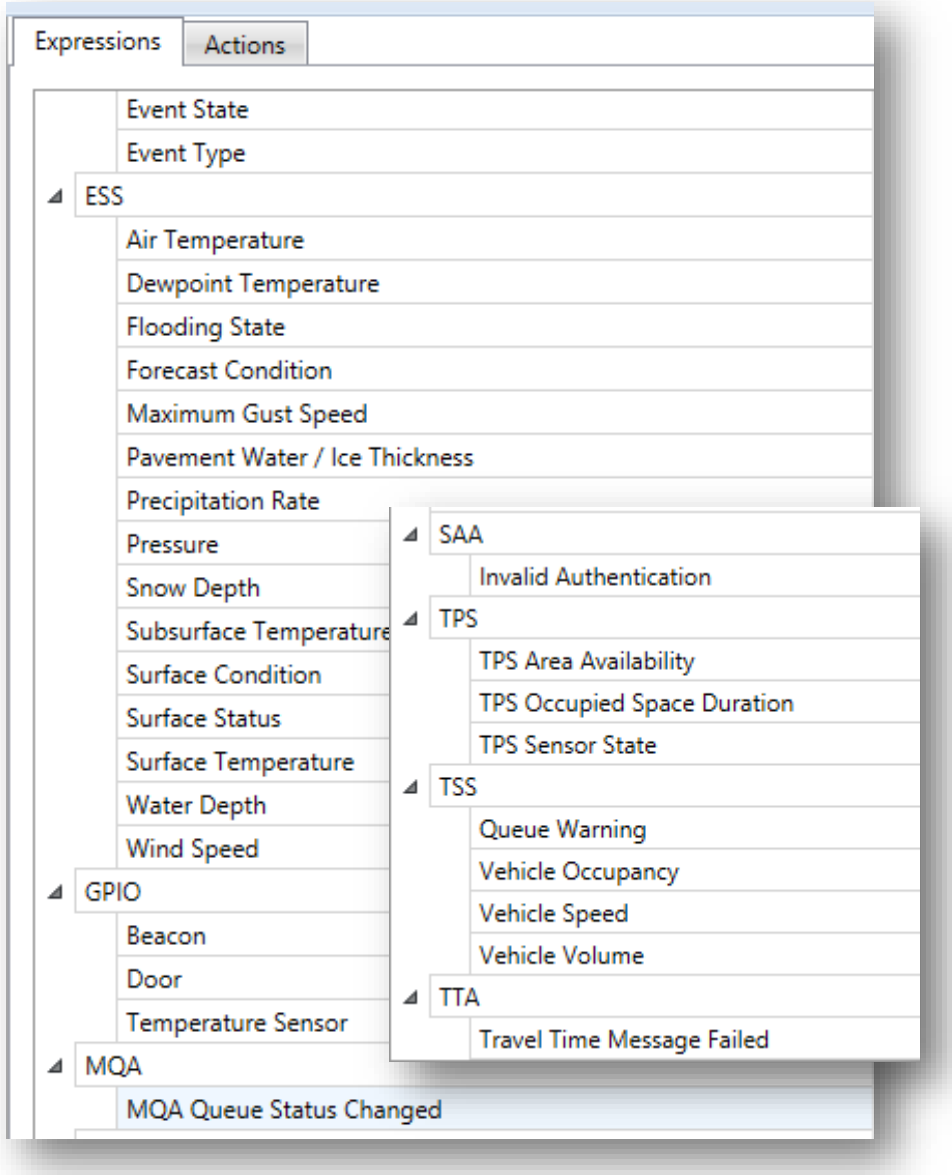
What it is:

- Complex decision processes are broken down into smaller modules or actions
- Each point is a focused decision or task (e.g., monitoring a specific device or responding to a specific type of incident)
- Goal: streamline decision-making, making operations more flexible, efficient, and adaptable
- Bonus: Data sources can be isolated and turned off if inaccurate



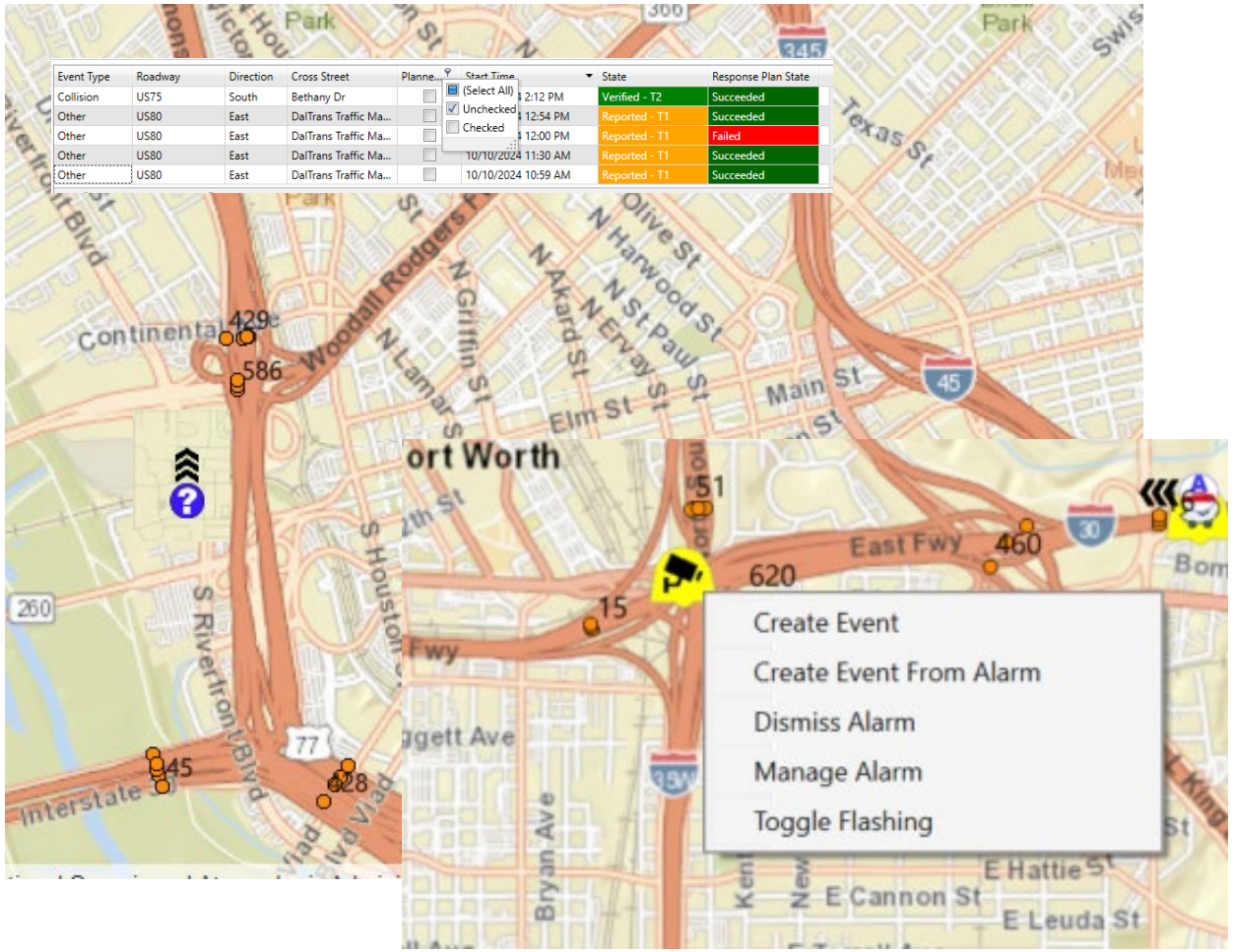
Modular Decision Making: Lonestar

- Multiple decision-making systems supporting automation
  - Event management
  - Scheduling
  - Travel times
  - Variable speed limits
  - Decision support system (DSS)
- Rules-based DSS
  - Includes devices, external events, status changes
  - Granular settings for specific devices, roads, radius
  - Configure to alert (emails, Lonestar popups), alarm, create events, automate messaging
- Can be used to transition from low to high automation
  - Start with alerts or alarms
  - Once data and processing build trust, increase automation



Modular Decision-Making Focuses Attention

- Data source layers do not need to be visible
- Focus is on viewing important data
- Filtered lists views (currently managed events)
- Alarms for:
  - Crowd-sourced events (e.g., Waze)
  - Slow speeds
- Alerts for:
  - Device status problems
  - Variable speed limit activations
  - Wrong way driver detection
- Automation



Improving Efficiency With Automation

Initial Stage: Manual Decision-Making

- Operators manually handle alarms and incidents, analyze data, and post messages
- No automation as trust in the system's accuracy and processing is not yet established

Intermediate Stage: Partial Automation

- Data generation and alarms are automated, but operators still review and manually approve actions (e.g., posting to DMS or adjusting speed limits)
- Modular decisions help filter relevant data for the operator, increasing efficiency but requiring manual intervention.

Advanced Stage: Full Automation

- The system automatically performs actions based on modular alarms and events (e.g., automatic DMS messages, variable speed limit adjustments)
- High trust in data and modular processes allows more tasks to be handled by the system with minimal operator input

Accuracy and Trust = Increased Automation

We have seen this before, travel time messaging automation increased with trust in data and the systems

Manual travel time creation

- Prior to any automation
- Data manually determined
- Users posted those messages

Automated generation of travel times, manually posted

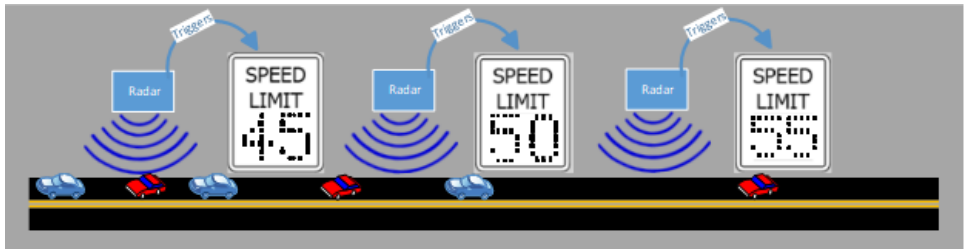
- Travel time generation was automated
- Lack of trust in the data accuracy
- Users reviewed generated data
- Messages were manually posted

Travel times is now an automated background process

- Generally, accuracy of data is trusted
- Messages are automatically posted
- Users may review and validate

Building Trust for More Automation

Variable Speed Limits

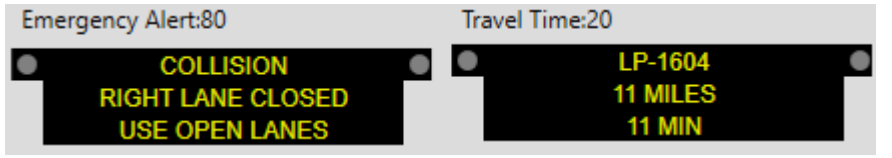


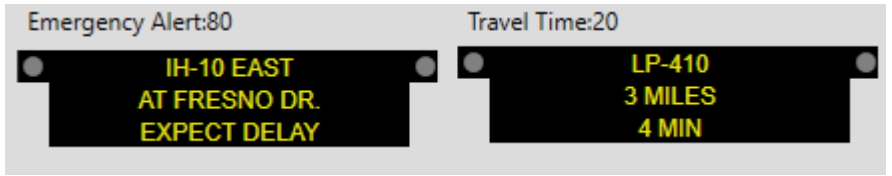
Fog or Icy Conditions

Roadway Conditions	Advisory & Control Strategies		
	DMS	CSLS	HAR
Case 1 - Vehicle Speeds Below 45 mph	"CAUTION" alternating with "SLOW TRAFFIC AHEAD"	N/A	N/A
Case 2 - Fog Detected With Visiblity Greater Than 1,320 feet (402.3 meters)	"CAUTION" alternating with "FOG AHEAD TURN ON LOW BEAMS"	"FOG" Displayed, & Flashing Warning Lights Activated	N/A

Train Detection

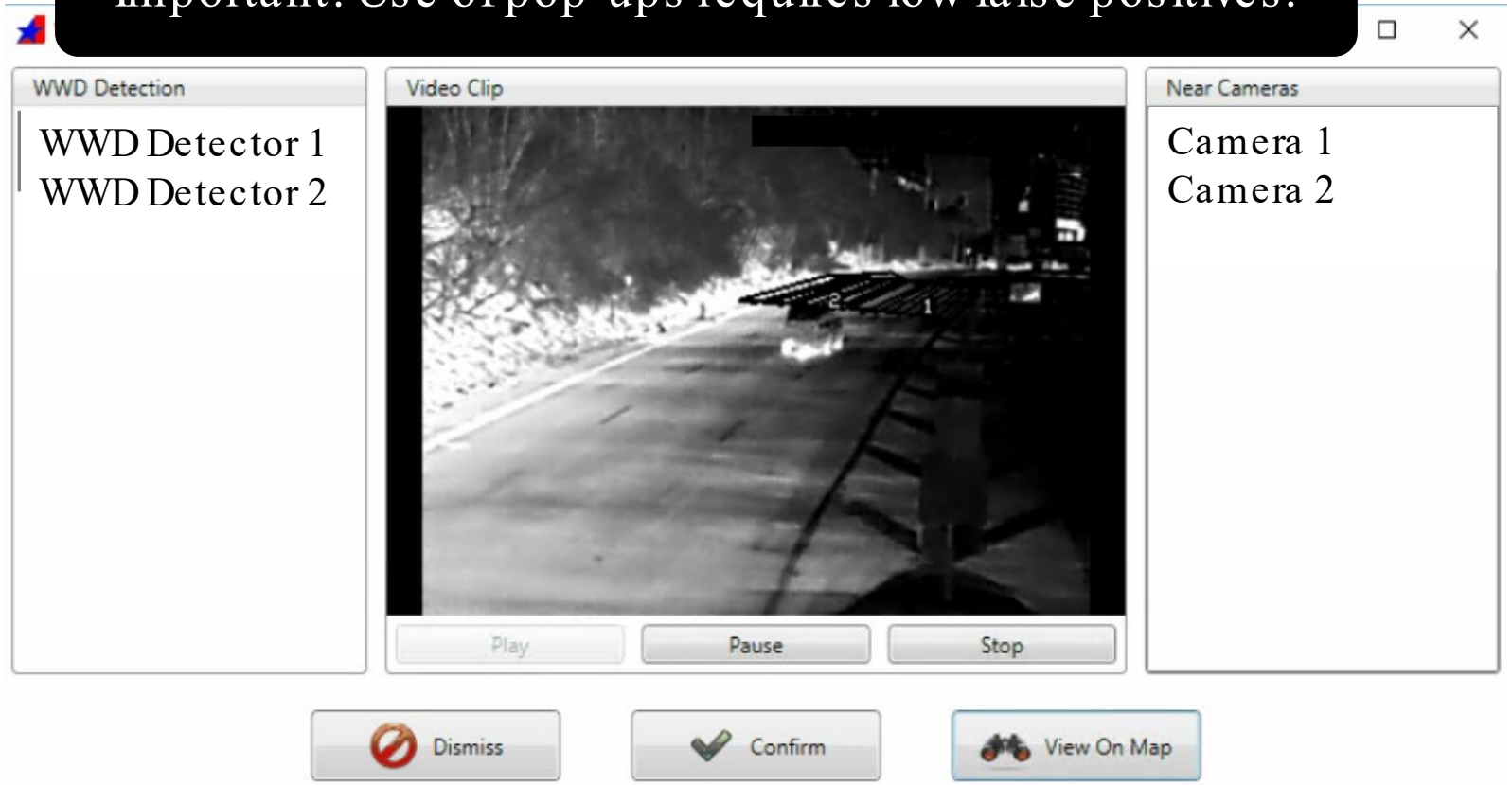
Event Response Plans





Wrong Way Driver Alerts

Important! Use of pop-ups requires low false positives.



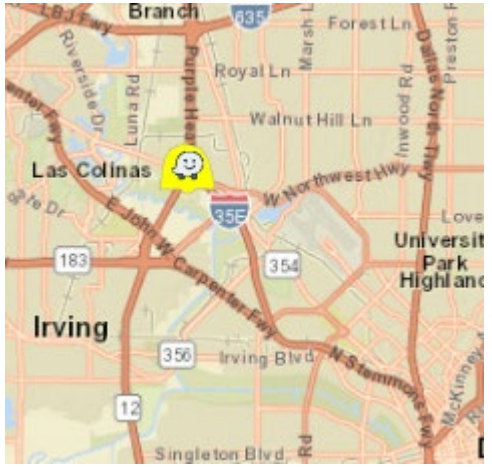
- Provides visuals for easy confirmation and event creation
- Lists closest cameras and can launch PTZ control

Data-Driven Decisions

Decision Support Data Flow

- Speed
- Equipment State/Status
- Incidents

- Processing expressions
  - Queue warnings
  - Location of the detection.
  - Device readings



Data

Module

Module

Module

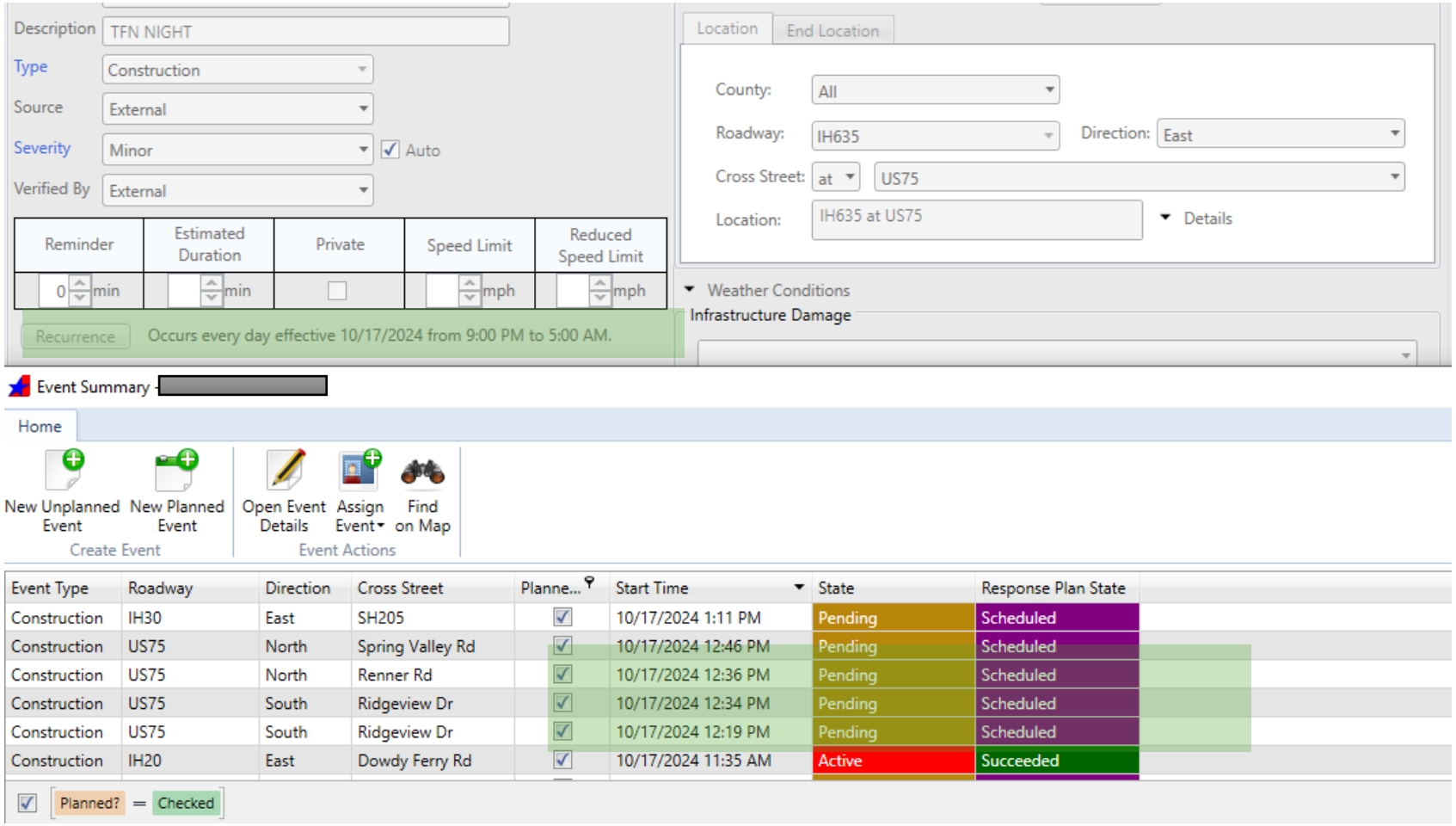
DSS

Alarm

User Interface

Long-Term Benefits

- Reduces repetitive, easily automated tasks like recurring messages
- Allow operators to focus attention where needed
- Results in safer, more efficient operations



Where Do We Go From Here?

- Data sources
  - Improve accuracy and reliability.
  - Add other data sources that have been proven reliable.
- AI and predictive analytics
  - Accurate and timely data is required for good results.
  - Currently, the trend is for products to claim AI and predictions.
- Extend to include more automation as data source reliability and processing is proven out.
- Remember we want to improve operators' experiences.
  - Provide highly reliable, trustworthy automation.
  - Reduce operator overload.

Questions?

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