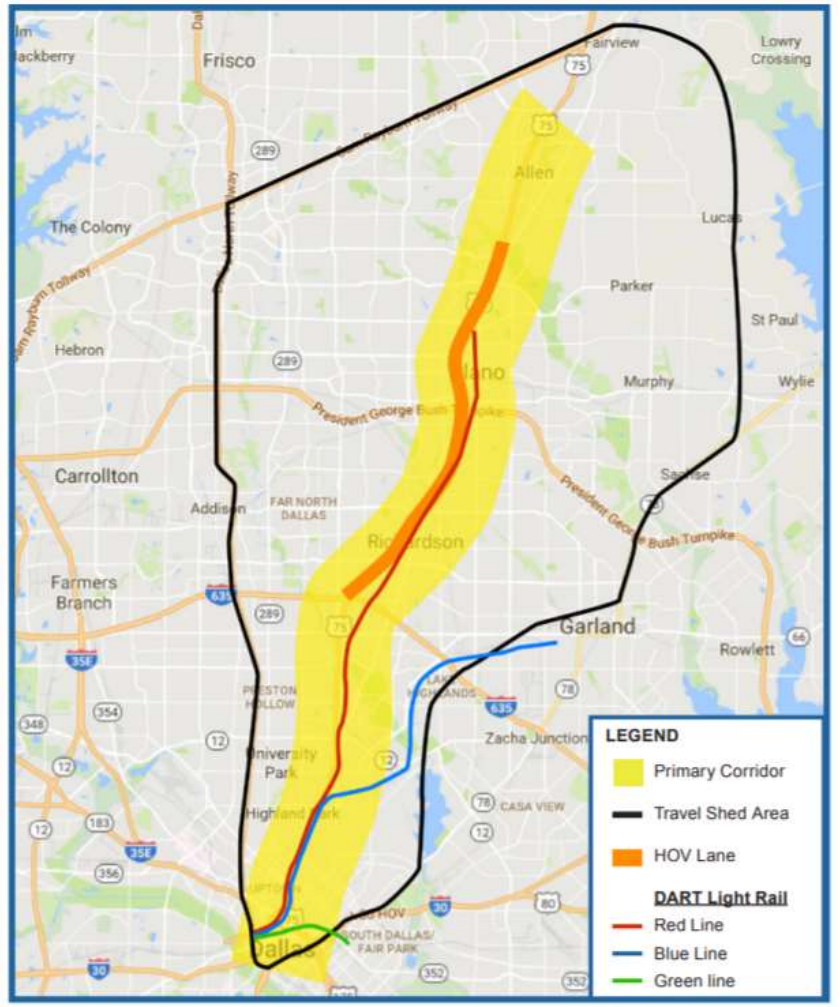
Lessons Learned, Benefits, and Strategies for Implementing ICM

ITS Canada Annual Meeting 2018
Niagara Falls
Tuesday June 19, 2018
Breakout Session T1 – Smart Cooperation ICM

What is Integrated Corridor Management (ICM)?

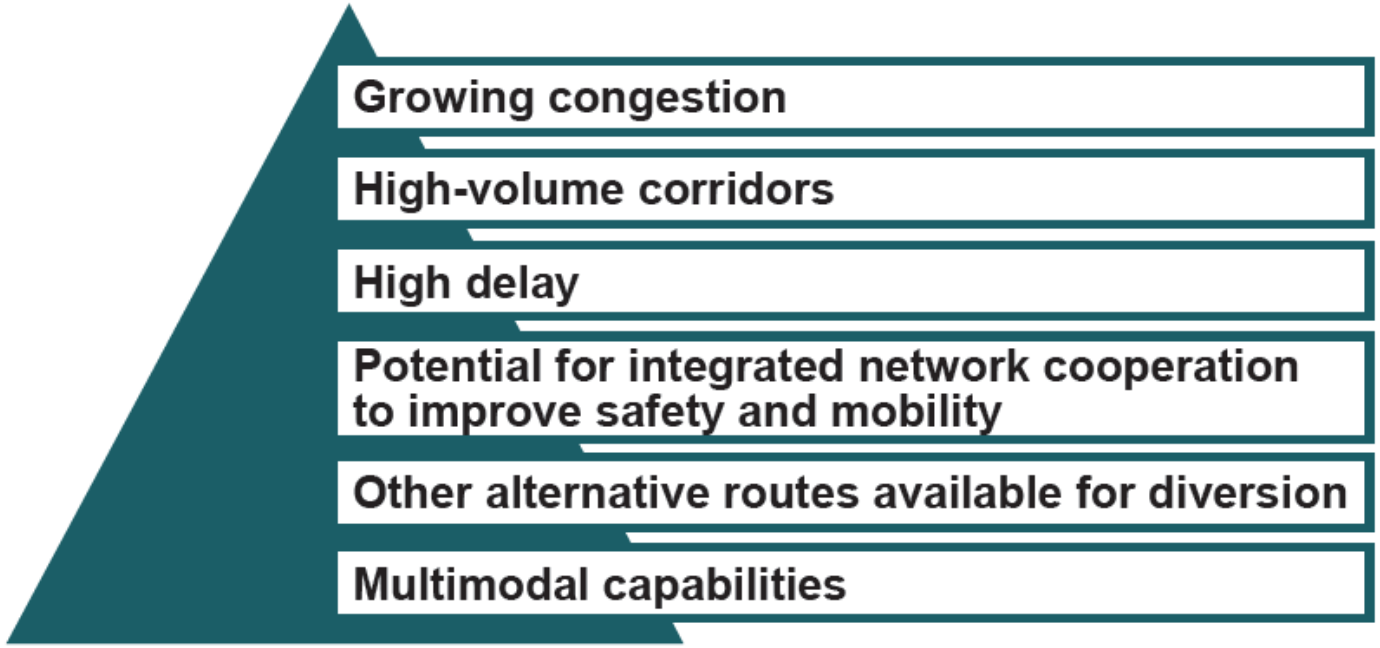
Coordinated Management and Operations

ICM is the coordination of individual transportation network operations of adjacent facilities across all government or other operations agencies that creates a unified, interconnected, and multimodal system capable of sharing cross-network travel management to safely and efficiently improve the movement of people and goods.



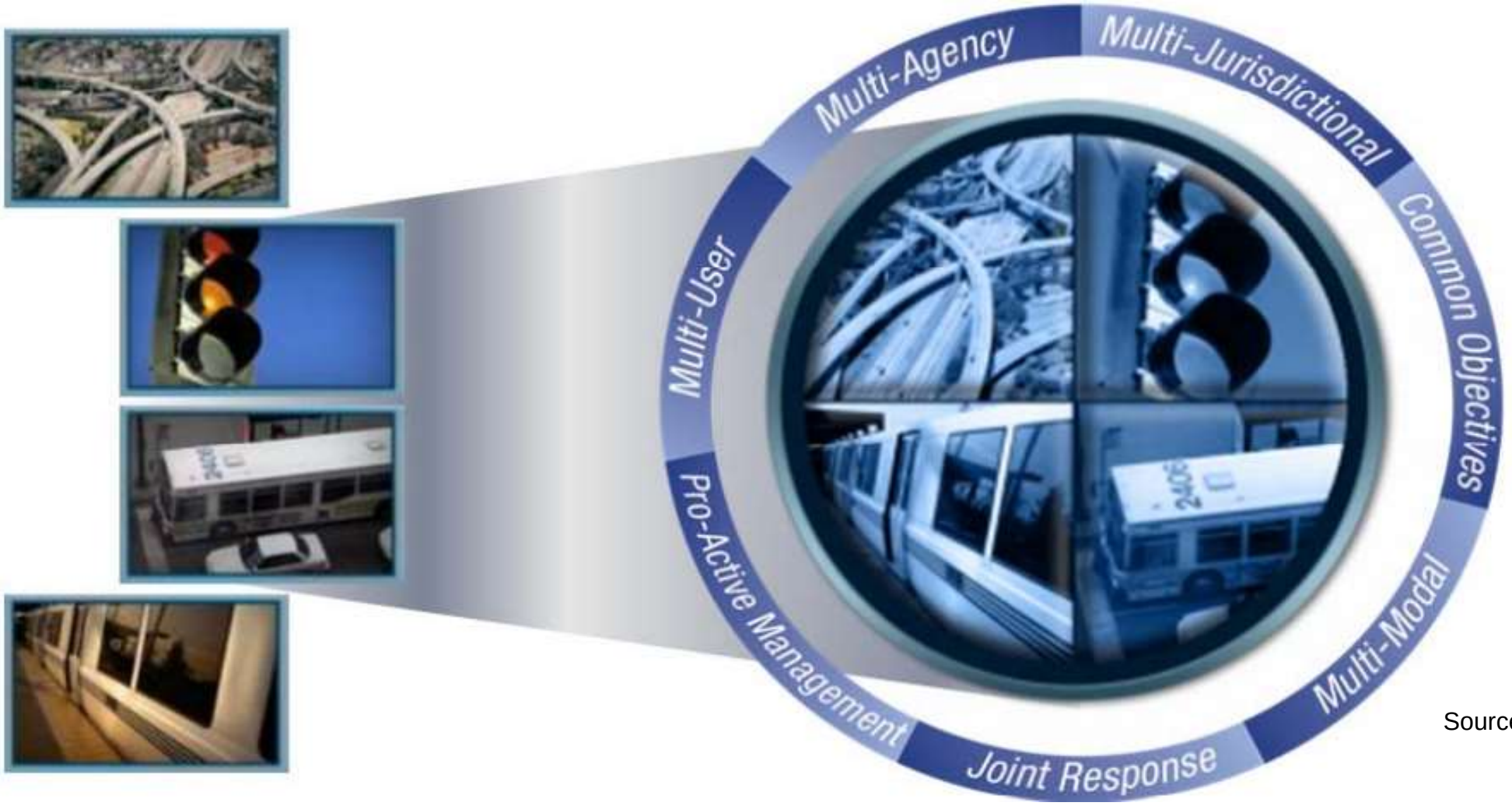
Approach to Integrated Corridor Management

- Manage a corridor as a multimodal system
- Make operational decisions for the benefit of the corridor as a whole.
  - Transportation corridors often contain underutilized capacity in the form of parallel roadways, single-occupant vehicles, and transit services.
  - Facilities and services on a corridor are often independently operated.



Source: FHWA-HOP-17-027

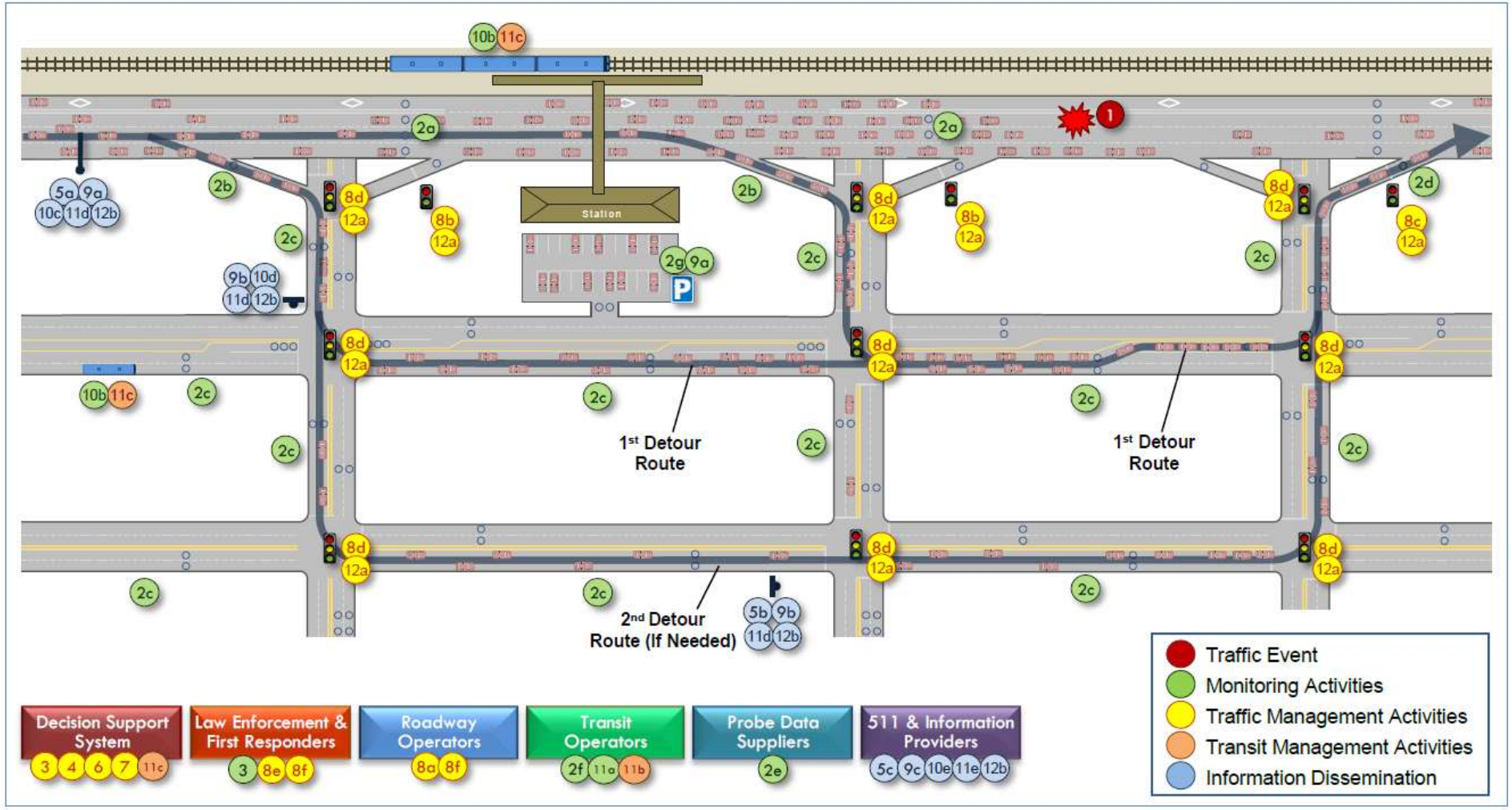
Viewing Assets through a Single Lens



Source: Federal Highway Administration

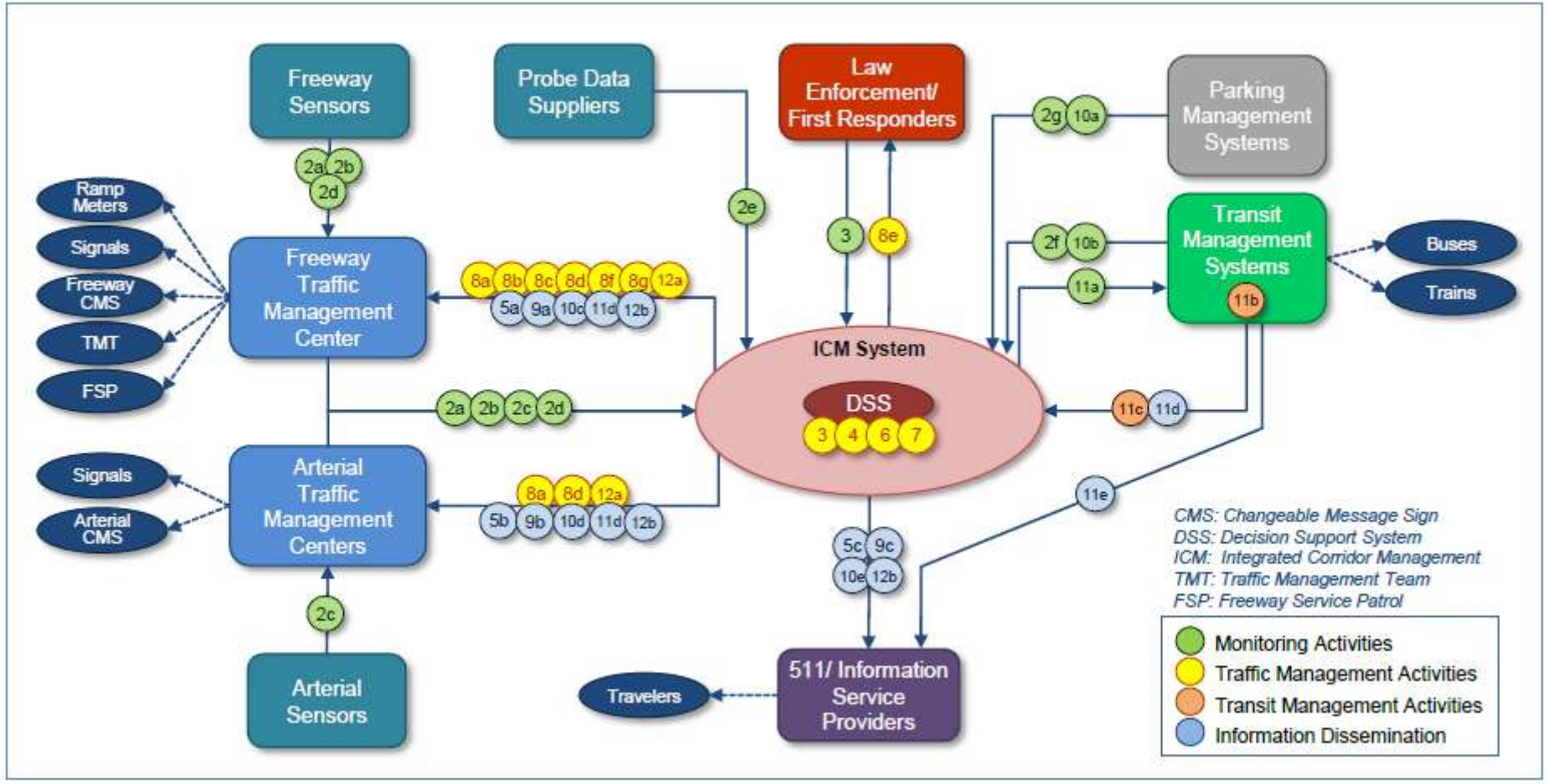
Sample Use Case – Major Freeway Incident Scenario

Source: I-210 Concept of Operations



Information Flow

Source: I-210 Concept of Operations



Lessons Learned

1. Integration and Capability Maturity
2. Planning for ICM
3. Performance Metrics
4. Technology Best Practices
5. Post-Deployment Maintenance, Evaluation, and System Enhancements

Lesson #1 - Three Degrees of Integration

Institutional

Coordination to collaboration between various agencies and jurisdictions that transcends institutional boundaries.

Operational

Multi-agency and cross-network operational strategies to manage the total capacity and demand of the corridor.

Technical

Sharing and distribution of information, and system operations and control functions to support the immediate analysis and response.

ICM Capability Maturity Model

Source: ICM Scan Tour- NCHRP20-68A_12_02

		Level 1 Silo	Level 2 Centralized	Level 3 Partially Integrated	Level 4 Multimodal Integrated	Level 5 Multimodal Optimized
Institutional Integration	Inter-agency Cooperation	Agencies do not coordinate their operations	Some agencies share data, but operate their networks independently	Agencies share data, and some cooperative responses are done	Agencies share data, and implement multi-modal incident response plans	Operations are centralized for the corridor with personnel operating the corridor cooperatively
	Funding	Single Agency	MPO tracks funding	Coordinated funding through MPO	Cooperatively fund deployment projects	Cooperatively fund deployment and operations and maintenance of projects
Technical Integration	Traveler Information	Static information on corridor travel modes	Static trip planning with limited real-time alerts	Multimodal trip planning and account based alerts	Location-based, on-journey multimodal information	Location-based, multimodal proactive routing
	Data Fusion	Limited or Manual	Near real-time data for multiple modes	Integrated multi-modal data (one-way)	Integrated multi-modal data (two-way)	Multi-source multi-modal data integrated and fused for operations
Operational Integration	Performance Measures	Some ad-hoc performance measure based on historic data	Periodic performance measures based on historic data	High-level performance measures using real-time data	Detailed performance measures in real-time for one or more modes	Multi-modal performance measures in real-time
	Decision Support System	Manual coordination of response	Pre-agreed incident response plans	Tool selection of pre-agreed plans	Model based selection of pre-agreed plans	Model based creation of incident response plans

Lesson #2 – Proactive Planning for ICM

Stakeholder Collaboration and Concept of Operations

- Full commitment of regional partners and stakeholders
  - Project Champion and Project Leader
  - Identify critical resources
  - Prepare regional agreements and policies in advance
  - Agreement for long-term funding and O&M

- Systems Engineering-Centric Process
  - Analyze Issues to Identify Corridor Needs
  - Define Vision to Address Needs
  - Determine Goals to meet Vision
  - Develop Objectives based on Vision

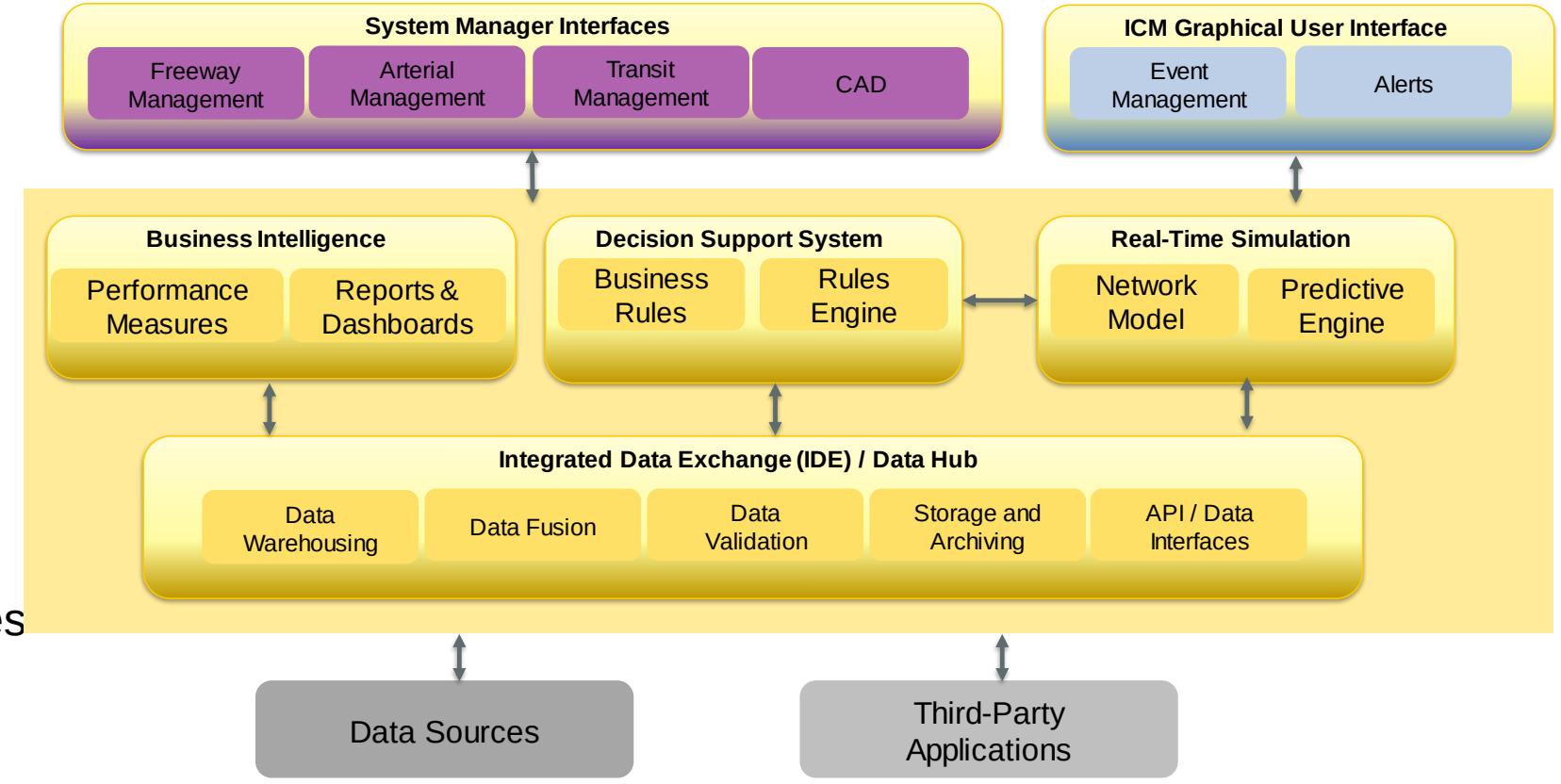
Lesson #3 – Performance Driven Approach

- Define Performance Measures that are easily calculated
- Provide Success thresholds
- Revisit Performance Measures as system evolves

Performance Measure	Performance Measure Success Threshold
Travel Time Index	Reduce Index by 2% per year
Corridor Throughput	Increase overall throughput – increase person/trips per hour by 2%
Clearance time for an Incident (based on Jurisdiction and Corridor)	Emergency Responder Training - 75% of agencies trained on Incident Management response.
Response time	Response to Incidents - target is consistent response between jurisdictions (within 5 minutes)
Parking Lot Volume at Transit locations	Parking Lot Capacity – 90% utilization
Ridership per vehicle (Transit)	Increase of ridership – 2% (year to year increase)
Provide ATIS information to public on incident	Information to Regional 511 System – 10 minutes of Incident entered into SmartNET
Public Perception	Public Perception – Awareness of ICM and perceived benefits (survey based)
ICM Response Plan deployment	ICM Response Plan activated - 95% of plans were deployed correctly

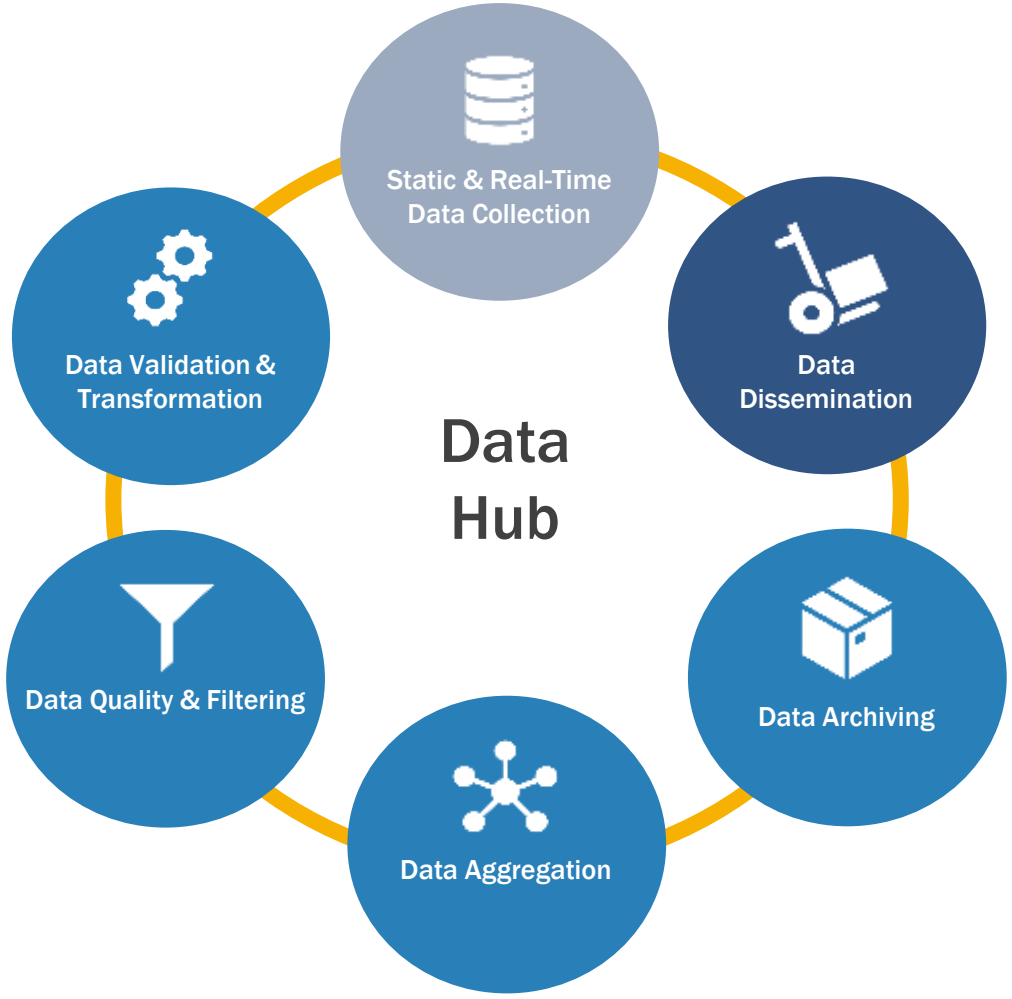
Lesson #4 – Open, Modular Architecture

- Basic Components of an ICM
  - Integrated Data Exchange
  - Decision Support System
  - Business Intelligence
  - Forecasting & Prediction (Simulation)
- Practical Considerations
  - Standards-based data interfaces
  - Open, modular architecture
  - Extensible platform



Integrated Data Exchange (IDE) / Data Hub

- Open
  - Standards based
  - Enable center-to-center data exchange as well as open data portal for external users
- Secure
  - Access-controlled
- Managed
  - Requirements driven
  - Scalable to expand capacity over time
- Governed
  - Data governance
  - Cloud-based so it is easily accessible by all stakeholders

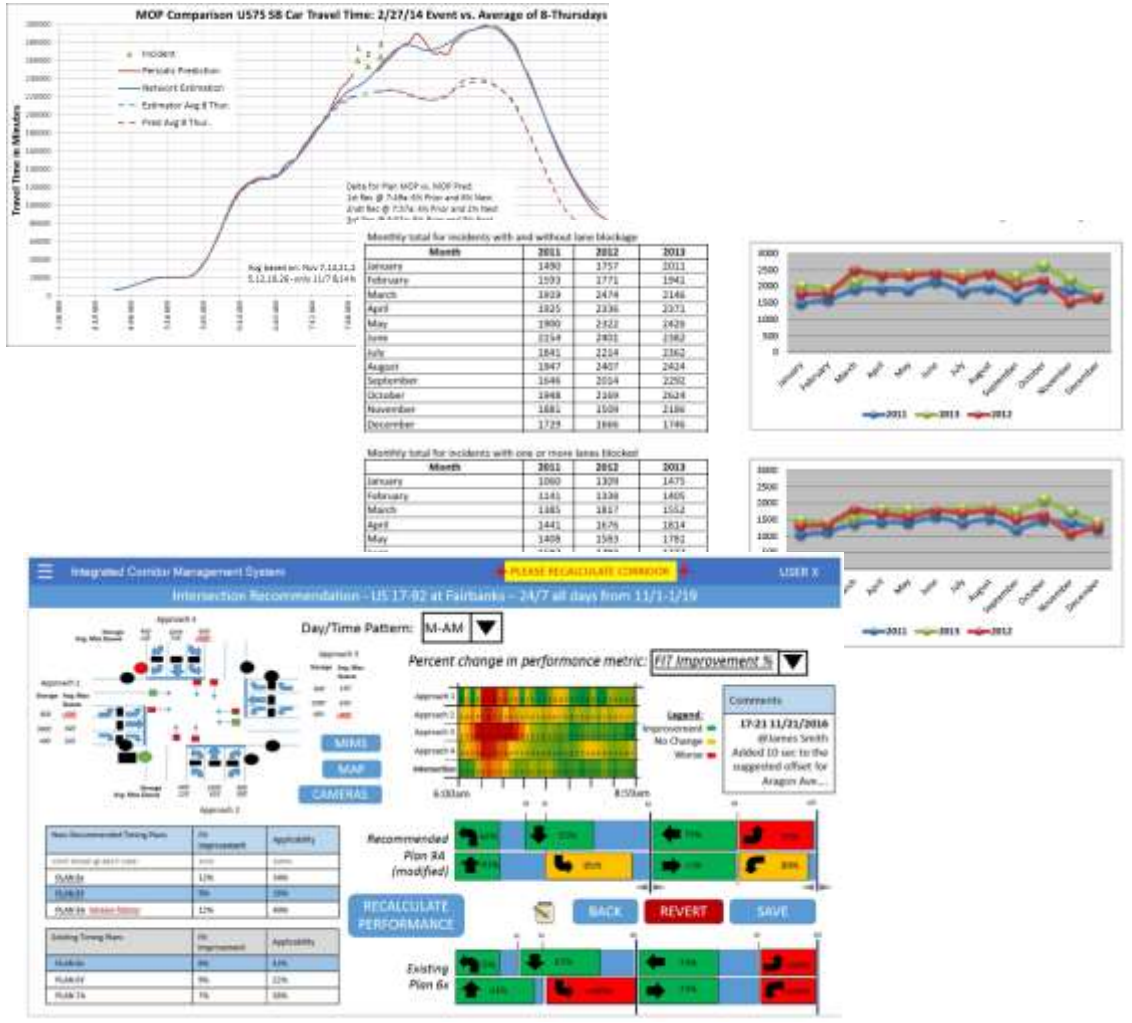


Business Intelligence - Performance Reporting

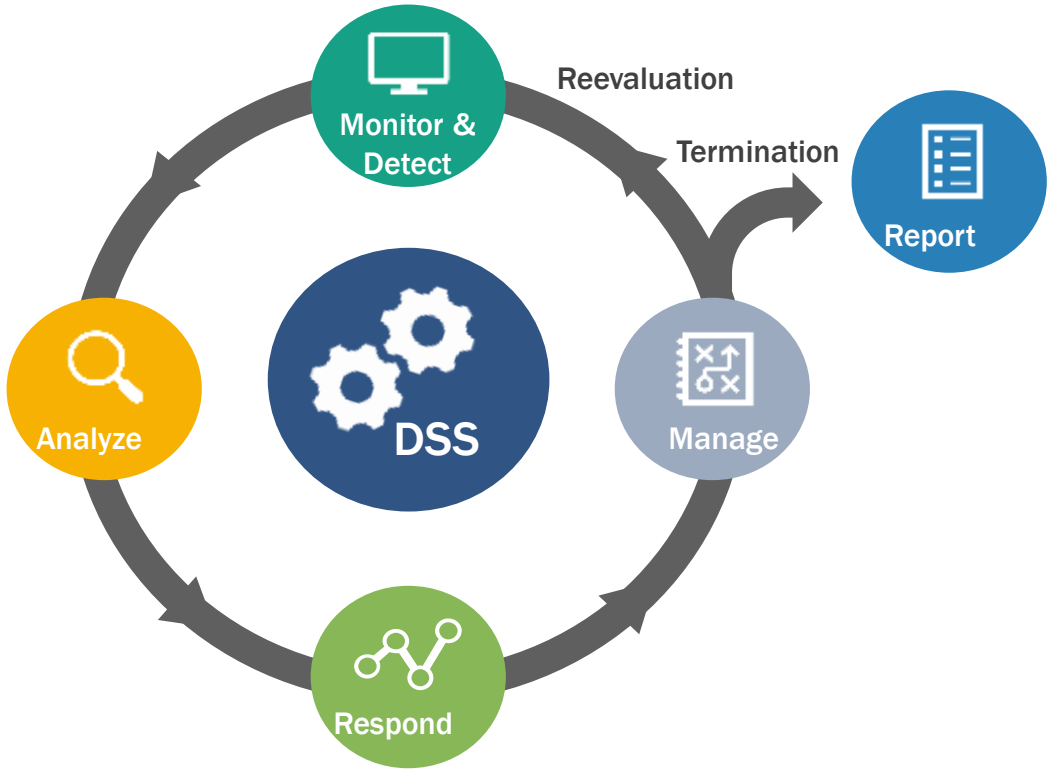
Select Performance Measures that are meaningful to your Operation and you have the Data.

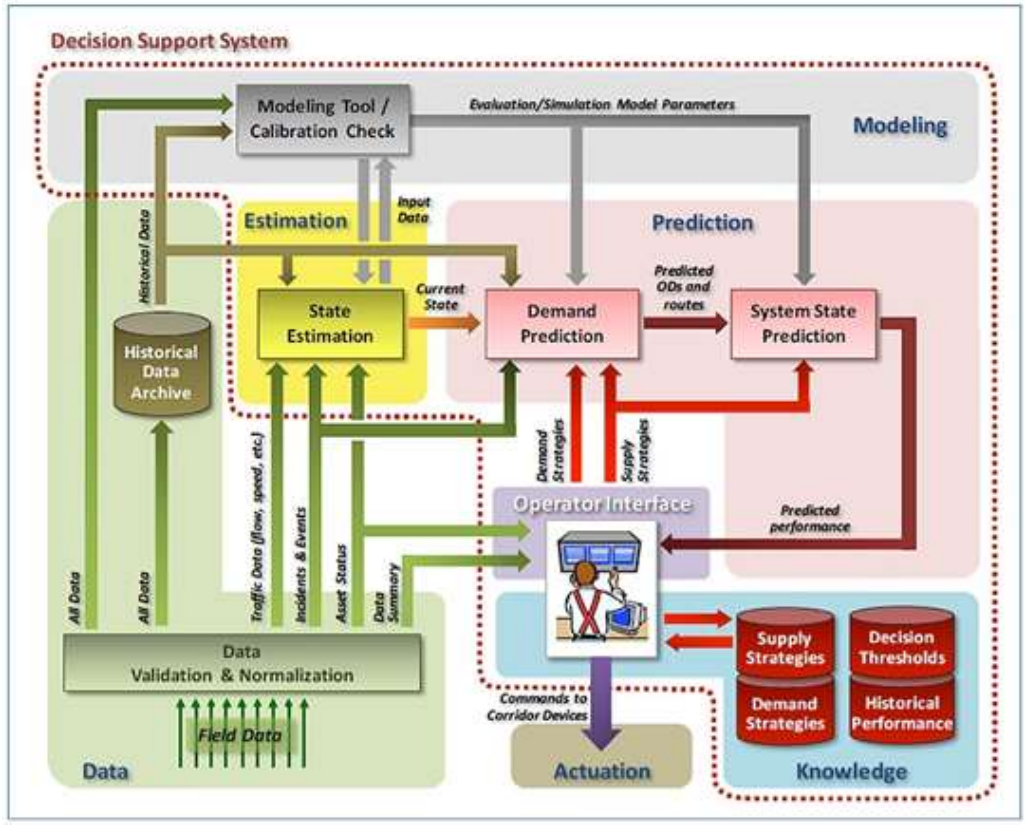
Consider standard performance measures:

- Travel Time Index – The ratio of the actual travel rate to the ideal travel rate
- Total Delay – The excess travel used on a trip, facility, or freeway segment beyond what would occur under ideal conditions
- Buffer Index – The difference between the 95th percentile travel time and the average travel time, normalized by the average travel time
- Planning Time Index – The 95th percentile travel time
- Number and duration of Incidents



Decision Support System





Source: I-210 Concept of Operations

Response Plans

Strategies	No. Affected Lanes General Purpose and HOV	Main Lanes		Speed Frontage Road (on Diversion Route) (mph)	Speed Greenville Ave. (on Diversion Route) (mph)	Prediction Measures of Performance	Park and Ride Utilization	Light Rapid Transit Utilization	Weather
		Speed (mph)	Queue Length Derived from Avg. speed (mi.)						
Minor Incident: Short Diversion to Frontage Road (FR.)	≥ 1	< 30	0.5 < Q <1	> 20	N/A	N/A	N/A	N/A	(2)
Major Incident: Long Diversion to FR.	≥ 1	< 30	Q ≥ 1	> 20	N/A	(1)	N/A	N/A	(2)
Major Incident: Diversion to FR. and Greenville Avenue (GV.)	≥ 2	< 30	Q ≥ 1	< 20	> 20	(1)	N/A	N/A	(2)
Major Incident: Diversion to FR. and GV., Transit	≥ 2	< 30	Q ≥ 4	< 20	< 20	(1)	< 85%	< 85%	(2)
Major Incident: Diversion to FR. and GV., Transit	≥ 2	< 30	Q ≥ 4	< 20	< 20	(1)	> 85%	> 85%	(2)
Return to Normal	< 1	> 30	Q < 0.5	NA	NA	NA	NA	NA	NA

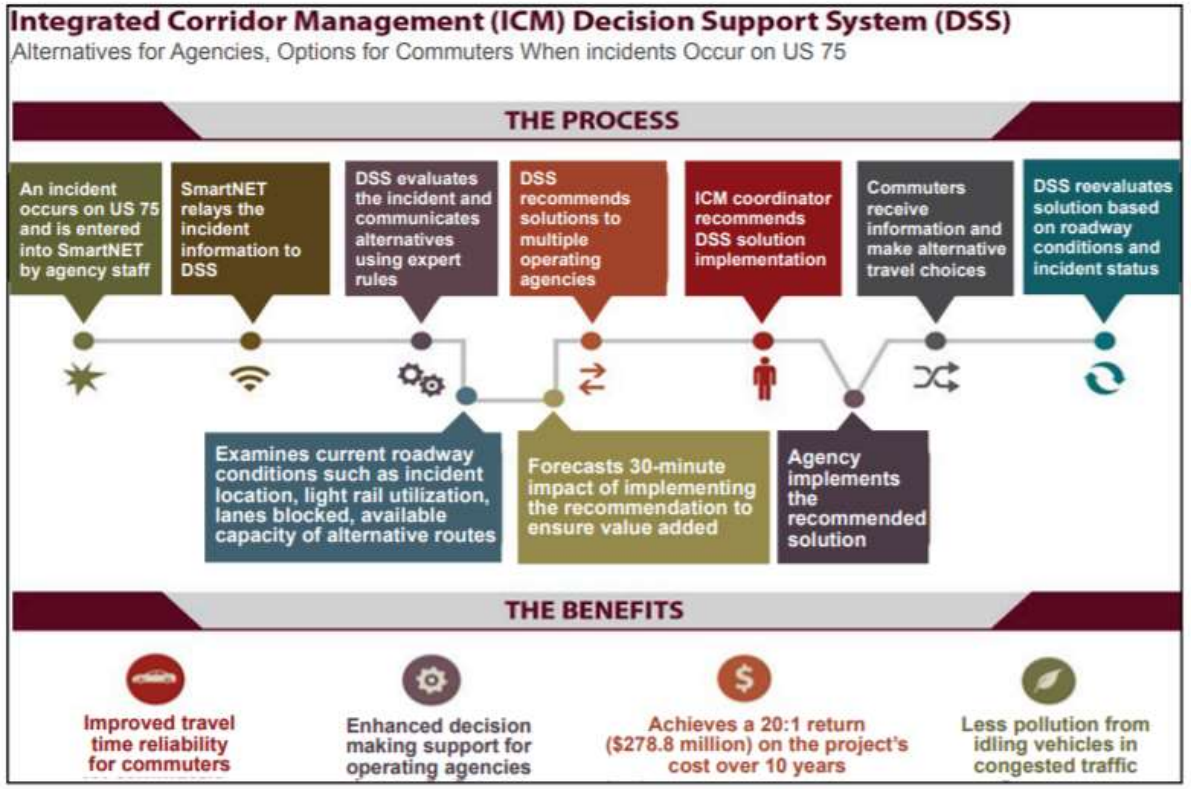
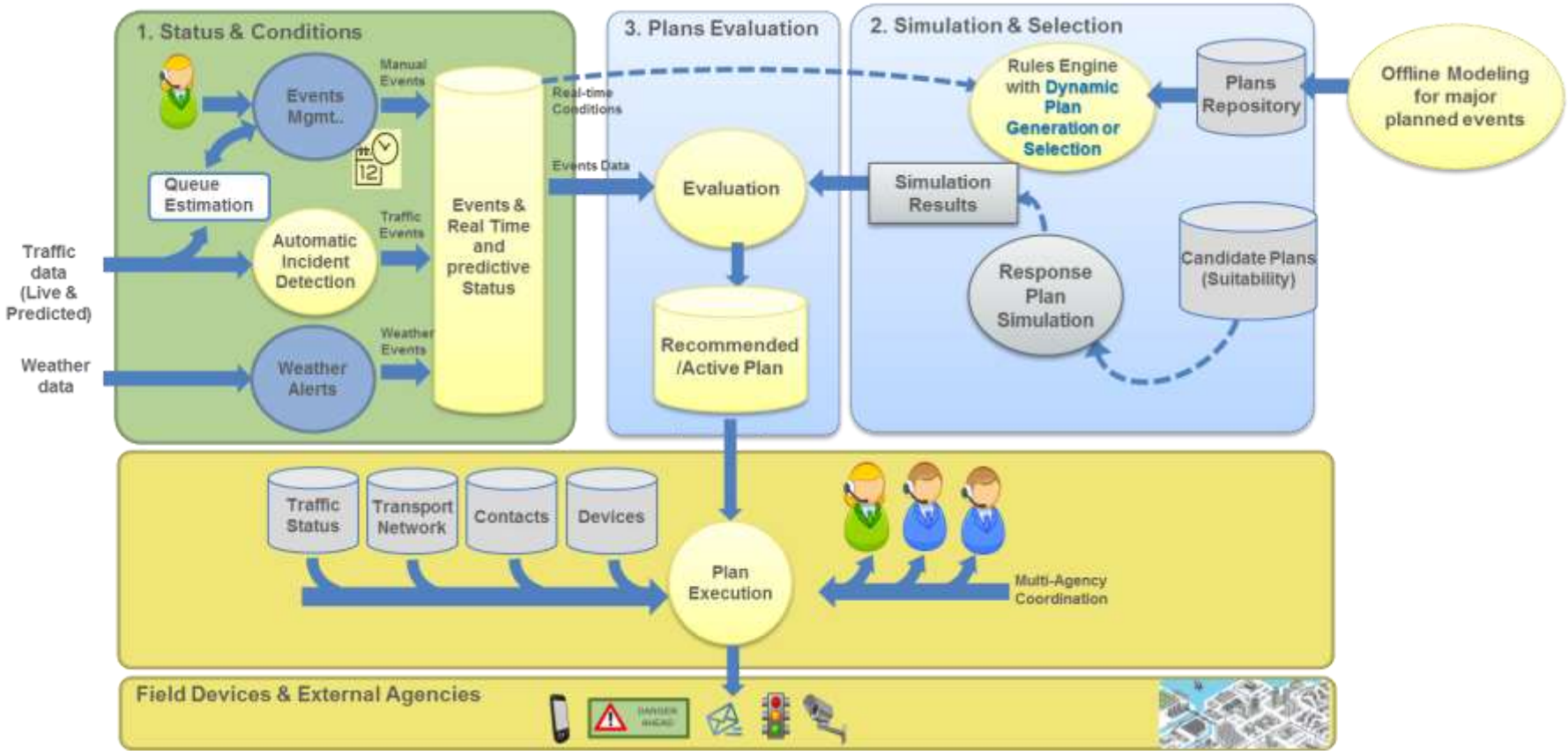


Figure 10. Diagram. Decision support process used by Dallas Area Rapid Transit.
(Source: Miller et al. 2015, Final Report-Dallas Integrated Corridor Management (ICM) Demonstration Project)

Analysis and Prediction

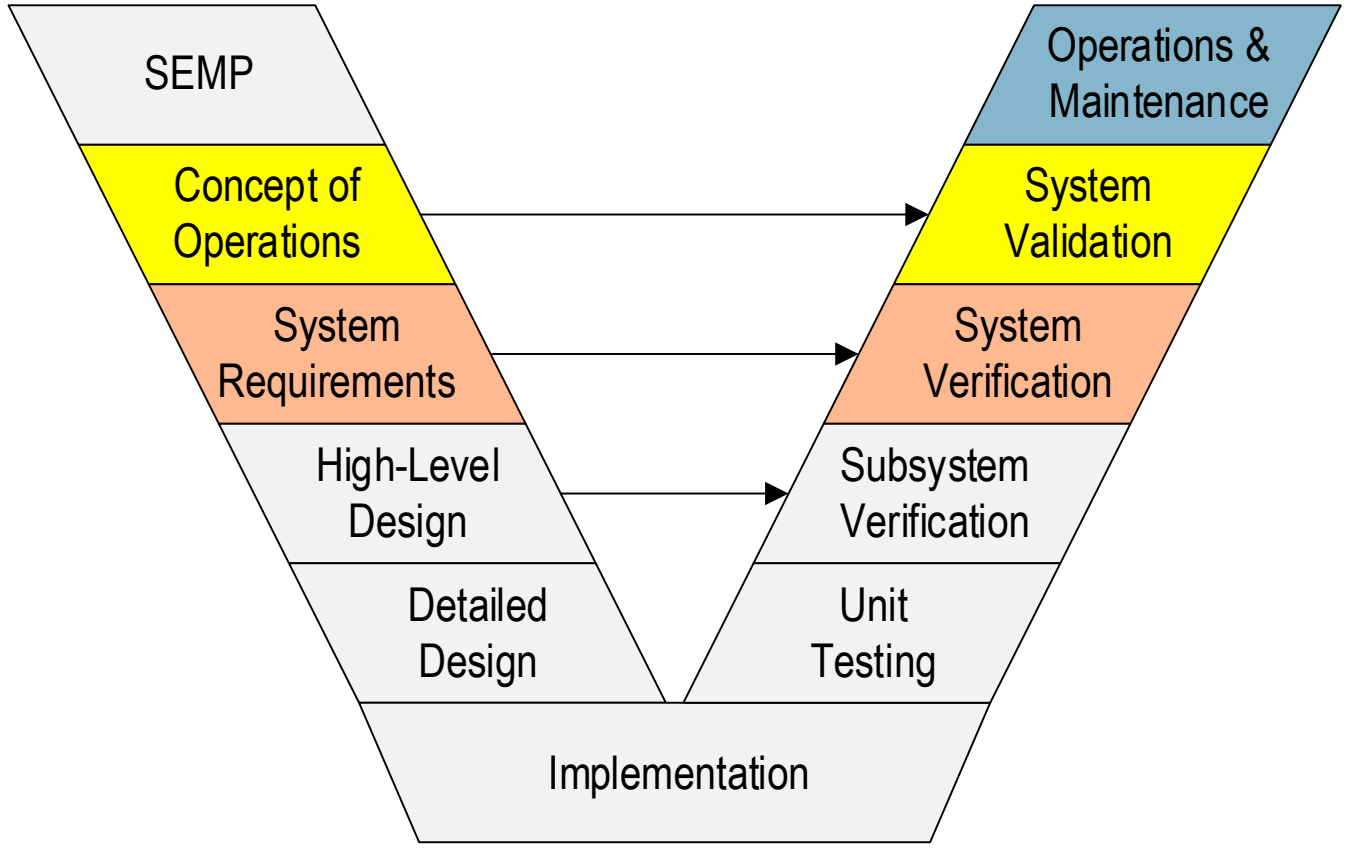
Predict near-term changes in traffic with and without response plans

- Application
  - Congestion monitoring
  - Response plan selection
  - Response plan evaluation
- Techniques
  - Simulation
  - Machine Learning/AI
  - Historical trend analysis



Lesson #5 – Post-Deployment Calibration

- System Verification:
  - Verify requirements with acceptance testing
- System Validation
  - Validate ConOps against real-world
  - Soft Launch



ICM System Enhancements

- Assess and evaluate ICM against performance measures
- Continually seek to refine and expand the ICM
  - Geographic
  - Systems
  - Agencies
  - Applications
- Secure funding to support O&M
  - Adding new stakeholders
  - Incorporating new data
  - Calibrating the simulation and decision support system
  - Data mining and analytics

Summary

- ICM is a tool to facilitate cooperative, holistic traffic management
- Opportunities for small to medium regional areas, not just limited to large corridors
- Prioritize needs and implement incrementally
- Be driven by performance measures
- Obtain full commitment of regional partners and stakeholders.
- Design ICM outside of standard operational systems – it is a shared system
- Follow system engineering best practices
- Adhere to standards and best practices for open architecture
- Secure funding for Design/Build and O&M

Kapsch ICM Activities

- Consulting
  - NCHRP ICM Scan
  - FDOT D5 – Orlando Regional ICM System ConOps & Requirements
  - Dallas ICM ConOps & Requirements
  - Montgomery County MD ICM ConOps & Requirements
  - Northern VA East-West Travel Shed ICM Planning Grant
  - I95/395 ICM Implementation Plan
- System Design
  - FDOT D5 – Orlando ICM DSS / Response Plan Development
- Systems Integrator
  - Dallas ICM Demonstration Project
  - MDX (Miami) Information Exchange Network
  - NCTCOG Data Connectivity

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