Integrated Corridor Management (ICM)
Project-level Vehicle Emissions and
Air Quality Analysis

US-75 Corridor, Dallas, TX

Battelle & Eastern Research Group
ICM Program Background

- Congestion continues to be a major problem, specifically for urban areas, costing businesses an estimated $200 billion per year due to freight bottlenecks and drivers nearly 4 billion hours of time and more than 2 billion gallons of fuel in traffic jams each year.

- ICM is a promising congestion management tool that seeks to optimize the use of existing infrastructure assets and leverage unused capacity along our nation’s urban corridors.

- Strategies include motorists shifting their trip departure times, routes, or modal choices, or transportation managers dynamically adjusting capacity by changing metering rates at entrance ramps or adjusting traffic signal timings to accommodate demand fluctuations.

- In an ICM corridor, travelers can shift to transportation alternatives—even during the course of their trips—in response to changing traffic conditions.
ICM Program Background

- ICM Program Objectives:
  - Demonstrate how operations strategies and Intelligent Transportation Systems (ITS) technologies can be used to efficiently and proactively manage the movement of people and goods in major transportation corridors through integration of the management of all transportation networks in a corridor.
  - Develop a toolbox of operational policies, cross-network operational strategies, integration requirements and methods, and analysis methodologies needed to implement effective ICM systems.
  - Demonstrate how proven and emerging ITS technologies can be used to coordinate the operations between separate multimodal corridor networks to increase the effective use of the total transportation capacity of the corridor.
US-75 Corridor

- The U.S. 75 ICM project is a collaborative effort led by Dallas Area Rapid Transit (DART) in collaboration with USDOT; the cities of Dallas, Plano, Richardson, and University Park; the town of Highland Park; North Central Texas Council of Governments (NCTCOG); North Texas Tollway Authority (NTTA); and the Texas Department of Transportation (TxDOT).

- U.S. 75 is a north-south radial corridor that serves commuter, commercial, and regional trips, and is the primary connector from downtown Dallas to the cities to the north. Weekday mainline traffic volumes reach 250,000 vehicles, with another 30,000 vehicles on the frontage roads. The corridor has 167 miles (269 kilometers) of arterial roadways.

- The U.S. 75 corridor has two concurrent flow-managed, high-occupancy vehicle (HOV) lanes, light rail, bus service, and park-and-ride lots. The corridor sees recurring congestion and a significant number of freeway incidents.
US-75 Corridor
Dallas ICM Corridor Strategies

- Provide comparative travel times to the public and operating agencies for the freeway, HOV lanes, frontage roads, arterial streets, and light-rail transit line.
- Use simulations to predict travel conditions for improved incident response.
- Implement interdependent response plans among agencies.
- Divert traffic to strategic arterials with adaptive control that can adjust signal timing in response to real-time traffic demands.
- Shift travelers to the light-rail system during major incidents on the freeway.
# USDOT ICM Hypotheses

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Description</th>
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</table>
| The Implementation of ICM will:        | **Improve Situational Awareness**  
Operators will realize a more comprehensive and accurate understanding of underlying operational conditions considering all networks in the corridor. |
|                                         | **Enhance Response and Control**  
Operating agencies within the corridor will improve management practices and coordinate decision-making, resulting in enhanced response and control. |
|                                         | **Better Inform Travelers**  
Travelers will have actionable multi-modal (highway, arterial, transit, parking, etc.) information resulting in more personally efficient mode, time of trip start, and route decisions. |
|                                         | **Improve Corridor Performance**  
Optimizing networks at the corridor level will result in an improvement to multi-modal corridor performance, particularly in high travel demand and/or reduced capacity periods. |
### USDOT ICM Hypotheses

<table>
<thead>
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<tbody>
<tr>
<td><strong>Air Quality</strong></td>
<td>ICM will affect air quality through changes in Vehicle Miles Traveled (VMT), person throughput, and speed of traffic, resulting in a small positive or no change in air quality measures relative to improved mobility.</td>
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<tr>
<td><strong>Safety</strong></td>
<td>ICM implementation will not adversely affect overall safety outcomes, and better incident management may reduce the occurrence of secondary crashes.</td>
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<td><strong>Have Benefits Greater than Costs</strong></td>
<td>Because ICM must compete with other potential transportation projects for scarce resources, ICM should deliver benefits that exceed the costs of implementation and operation.</td>
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<tr>
<td><strong>Decision Support Systems</strong></td>
<td>Decision support systems provide a useful and effective tool for ICM project managers through its ability to improve situational awareness, enhance response and control mechanisms and provide better information to travelers, resulting in at least part of the overall improvement in corridor performance.</td>
</tr>
</tbody>
</table>
Evaluation Timeline

X = Site visit
X = Results document

NTP

National Evaluation Framework & Briefing
Test Plans & Briefing
6-month Shakedown
12-month Analysis
Baseline Data Collection (12 mo.)
Post-Deployment Data Collection (18 mo.)

SITE GOES LIVE

Interim Memo 1 briefing
Interim Memo 2 briefing

Final Report & Briefing
ICM will affect air quality through changes in Vehicle Miles Traveled (VMT), person throughput, and speed of traffic, resulting in a small positive or no change in air quality measures relative to improved mobility.

**Primary Data Sources**
- Mobility Data (VMT, Trajectories, Volumes)
- Drive Cycle Data (MOVES)
- Network Information (Link, Corridor Information)

**Design**

**Evaluation Methods**
- MOVES Analysis Scenarios Model Runs - Dallas
- MOVES Analysis Scenarios Model Runs - San Diego

Multiple scenarios (time periods, congestion levels) data permitting
Air Quality Analysis Overview

- **Hypothesis:** *ICM will affect air quality through changes in Vehicle Miles Traveled (VMT), person throughput, and speed of traffic, resulting in a small positive or no change in air quality measures relative to improved mobility*

- We will use the latest version of EPA’s MOVES model to assess the effect of the ICM on local air quality
  - Derived primarily from by-link vehicle activity and throughput
  - Modeled at the MOVES project level for individual hours
  - Analyze selected representative scenarios deriving from the mobility analysis

- Model both baseline case and other scenarios, as dictated by field data, and reflected in:
  - Changes in volume by link/road type
  - Changes to speed distribution
  - Changes to source type distribution

- All changes in activity will be derived from AMS model outputs
  - AMS models assumed to be calibrated based on field data collected during study

- Other inputs to the analysis will generally consist of MOVES defaults, or distributions available from NCTCOG or TCEQ, as discussed below
## Data Availability, Sources, and Formats

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Data Granularity</th>
<th>Source</th>
<th>Static/Variable</th>
<th>Format</th>
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<tbody>
<tr>
<td>Link Lengths</td>
<td>Miles for each link</td>
<td>AMS modeling</td>
<td>Variable</td>
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<tr>
<td>Link Throughput</td>
<td>Vehicle volume, per link</td>
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<tr>
<td>Average Link Speed</td>
<td>Mi/hr average per link</td>
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<tr>
<td>Source Type Distributions</td>
<td>Source type fractions, per link</td>
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<td>Variable</td>
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</tr>
<tr>
<td>Vehicle Trajectories</td>
<td>Second-by-second speed profiles (mi/hr) associated with individual links</td>
<td>AMS modeling</td>
<td>Variable</td>
<td>Flat Files</td>
</tr>
<tr>
<td>Fuel Formulation</td>
<td>Physical characteristics of gasoline and diesel</td>
<td>NCTCOG or TCEQ</td>
<td>Static</td>
<td>Model Defaults or Spreadsheet</td>
</tr>
<tr>
<td>Fuel Market Share</td>
<td>Fuel fractions, area-wide</td>
<td>NCTCOG or TCEQ</td>
<td>Static</td>
<td>Model Defaults or Spreadsheet</td>
</tr>
<tr>
<td>Age Distribution</td>
<td>Age fractions from 0-30 years, per source type, area-wide</td>
<td>NCTCOG or TCEQ</td>
<td>Static</td>
<td>Flat Files</td>
</tr>
<tr>
<td>I/M Program Data</td>
<td>Applied I/M factors by model year, area-wide</td>
<td>NCTCOG or TCEQ</td>
<td>Static</td>
<td>Model Defaults or Spreadsheet</td>
</tr>
<tr>
<td>Meteorological Data</td>
<td>Hourly temperature and humidity, area-wide, by season</td>
<td>National Weather Service</td>
<td>Static</td>
<td>Flat Files</td>
</tr>
</tbody>
</table>
Conclusion

- Any additional questions or comments?
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