From Integrated Corridor Management (ICM) to Integrated Journey Management (IJM) and Successful Connected Automated Vehicles (CAV)

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Convener, Public Transport & Emergency Management Working Group
US ITS Expert

REAAA, NZ Chapter
Auckland, Rotorua, Wellington, Christchurch & Dunedin
August 15 - 21, 2018
Agenda

- Integrated Corridor Management (ICM)
- Integrated Journey Management (IJM)
- Connected Automated Vehicles (CAVs)
What is ICM?

• The integrated management of freeway, arterial, transit, parking systems, etc. within a corridor.

• Management of the corridor as a system, rather than the traditional approach of managing individual assets.
Generic Multimodal Corridor

Local Jurisdiction 1 – Traffic Signal System

Regional Rail Agency – Train Management System

State DOT – Freeway Management System

Bus Company – AVL System

Local Jurisdiction 2 – Traffic Signal System

Source: USDOT
Corridor

- Linear geographic band.
- Movement of people, goods and services.
- Similar transportation needs and mobility issues.
- Travel patterns in and through geographic band.
- Various networks providing similar or complementary transportation functions.
- Cross-network connections.
ICM Will

- Optimize existing transportation assets within the corridor.
- Enable travelers to make informed travel decisions and dynamically shift mode.
- Reduce travel times, delays and fuel consumption.
- Increase travel time reliability and predictability.
It is all about Integration!

- **Institutional Integration**: Coordination to collaboration among all agencies and jurisdictions transcending institutional boundaries.

- **Operational Integration**: Multi-agency and cross-network operational strategies to manage corridor capacity and demand.

- **Technical Integration**: Sharing and distribution of information, and system operations and control functions supporting immediate analysis and response.
Phase I: ConOps and SysReq
Phase II: Analysis, Modeling & Simulation (AMS)
## AMS Results

<table>
<thead>
<tr>
<th></th>
<th>San Diego</th>
<th>Dallas</th>
<th>Minneapolis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annual Travel Time Savings</strong></td>
<td>246,000</td>
<td>740,000</td>
<td>132,000</td>
</tr>
<tr>
<td>(Person-Hours)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Improvement in Travel Time</strong></td>
<td>10.6%</td>
<td>3%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Reliability</td>
<td></td>
<td></td>
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<tr>
<td>(Reduction in Travel Time Variance)</td>
<td></td>
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<tr>
<td><strong>Gallons of Fuel Saved</strong></td>
<td>323,000</td>
<td>981,000</td>
<td>17,600</td>
</tr>
<tr>
<td>Annually</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tons of Mobile Emissions</strong></td>
<td>3,100</td>
<td>9,400</td>
<td>175</td>
</tr>
<tr>
<td>Saved Annually</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>10-Year Net Benefit</strong></td>
<td>$104M</td>
<td>$264M</td>
<td>$82M</td>
</tr>
<tr>
<td><strong>10-Year Cost</strong></td>
<td>$12M</td>
<td>$14M</td>
<td>$4M</td>
</tr>
<tr>
<td><strong>Benefit-Cost Ratio</strong></td>
<td>10:1</td>
<td>20:1</td>
<td>22:1</td>
</tr>
</tbody>
</table>
Phase III: Demonstration
Dallas ICM-US 75 Corridor Networks

- Freeway with continuous Frontage Roads
- Managed HOV lanes
- Dallas North Tollway
- Arterials
- Bus Network
- Light Rail
- Approx. 900 Signals
- Multiple TMCs
- Regional ATIS
ICM Applications

- Freeway & HOV Lane Management
- Arterial Street Monitoring System
- Responsive Traffic Signal System
- Parking Management
- Real-Time Transit Vehicle Information
- Weather
- Information Exchange Network
- Decision Support System (DSS)
- 511 DFW
Corridor Operational Concept

Monitor US 75 Congestion

Divert to Frontage Road

Divert to Frontage Road and Greenville Ave

Divert to Frontage Road, Arterial & LRT Line
Logical Architecture
Fusion Engine Data Feeds
Decision Support System (DSS)

- Receives data from IEN.
- Evaluates various response plan options.
- Provides recommended plan to partner agencies via IEN.
Integrated Corridor Management (ICM) Decision Support System (DSS)
Alternatives for Agencies, Options for Commuters When Incidents Occur on US 75

THE PROCESS

An incident occurs on US 75 and is entered into SmartNET by agency staff
SmartNET relays the incident information to DSS
DSS evaluates the incident and commuting alternatives using expert rules
DSS recommends solutions to multiple operating agencies
ICM coordinator recommends DSS solution implementation
Commuters receive information and make alternative travel choices
DSS reevaluates solution based on roadway conditions and incident status

Examines current roadway conditions such as: incident location, light rail utilization, lanes blocked, available capacity of alternative routes
Forecasts 30-minute impact of implementing the recommendation to ensure value added
Agency implements the recommended solution

THE BENEFITS

Improved travel time reliability for commuters
Enhanced decision making support for operating agencies
Achieves a 20:1 return ($278.8 million) on the project’s cost over 10 years
Less pollution from idling vehicles in congested traffic
Real Time Customer Information

511DFW

Alerts: There are no service alerts at this time.

Before you continue, you might want to check out these related posts:

- Richardson Festival
- Greenville Ave
- Campbell Rd
- Plano Pkwy

Last Update: 5/19/2013 2:00 AM
Creation of a Response Plan

Frontage Road Diversion Response Plan

**Traveler Info**
- Do Nothing
- Comparative TT
- DMS Plan #1
- DMS Plan #2
- DMS Plan #3
- 511 Mobile Alert

**Frontage Rd Diversion**
- Do Nothing
- Timing Plan #1
- Timing Plan #2
- Timing Plan #3
- Timing Plan #4

**Arterial Street Diversion**
- Do Nothing
- Timing Plan #11
- Timing Plan #12
- Timing Plan #13
- Timing Plan #14
- Timing Plan #15
- Timing Plan #16

**Mode Diversion**
- Do Nothing
- Divert to Red Line
- Timing Plan #21
- Timing Plan #22
- Additional Parking
- Initiate Shuttle Service
- Add Rail Car
N 75 N 202
Minor Incident
between Beltline Exit
and Arapaho Exit
J 75 N 254
Major Incident between Beltline Exit and Arapaho Exit

Not To Scale

Major Incident Diversion Route
Incident Segment
Impacted Dynamic Message Sign
Blue - TxDOT
Maroon - NTTA
Yellow – Dallas
Purple – LBJ Express

Arapaho
Belt Line
Spring Valley
Greenville Ave/K Ave
IH 635 (LBJ)
Forest
Royal
Midpark DMS
Coit DMS
Meadow DMS
Forest WB DMS

Not To Scale
J 75 N 255
Major Incident
between Beltline Exit
and Arapaho Exit

Forest
Royal
Spring Valley

Arapaho
Belt Line

Midpark DMS
Coit DMS
Meadow DMS

Greenville Ave/K Ave
Greenville Ave/Plano

IH 635 (LBJ)

Not To Scale
2015 US DOT ICM Awards
Next Gen ICM or IJM

- Region - wide
- New Payment System
- Today is Account Based
- Tomorrow maybe Transportation Market Place
Funding Opportunities: Last Decade

- ICM
- CV Pilots
- Smart Cities
- ATCMFD
Model S vs Model T
Charging vs Cranking
Legislation

- US House of Representatives: Has passed the “Self Drive Act”
- US Senate: Re-named it “AV START Act”, Passed Senate Committee
- Held Up in the US Senate since last September
Regulation & Guidance

• Development of Automated Vehicles 3.0 (AV 3.0) is underway and anticipated to be released during Summer/Fall 2018

• US DOT V2I Deployment Guidance (Phase II with 3 Working Groups)

• V2V Communications (DSRC & 5G)
States with AV Enacted Legislation & Executive Orders

Source: NCSL
Hollywood was right!!
Example: Land Use Re-Purposing
Accident in Tempe

Shoes Appear

In-View
The Driver, Moments Before
Transit ridership fell in 9 of 10 largest markets in 2017

Researchers attributed the decline to ride-hailing services, cheap fuel, and the increase of car ownership, among other factors.

<table>
<thead>
<tr>
<th>DECREASE</th>
<th>INCREASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York -1.1%</td>
<td>Seattle +3%</td>
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<tr>
<td>San Francisco  -1.3%</td>
<td></td>
</tr>
<tr>
<td>Atlanta         -2.6%</td>
<td></td>
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<tr>
<td>Boston          -3.1%</td>
<td></td>
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<tr>
<td>Chicago         -3.2%</td>
<td></td>
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<tr>
<td>Washington, DC  -3.4%</td>
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<tr>
<td>Los Angeles     -5.4%</td>
<td></td>
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<tr>
<td>Philadelphia    -7.3%</td>
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<tr>
<td>Miami           -8.7%</td>
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</tbody>
</table>

Source: TransitCenter, National Transit Database
Some of the Shuttles
<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
<th>SAE/NHTSA Level of Automation</th>
<th>Drive</th>
<th>Passenger Capacity</th>
<th>Charging</th>
<th>Wheelchair Accessible</th>
<th>AC/Heating</th>
<th>Size</th>
<th>Wheelbase</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE/NHTSA Level of Automation</td>
<td>4 – High Automation</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Drive</td>
<td>Battery Electric</td>
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<tr>
<td>Charging</td>
<td>On-board or inductive</td>
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<td></td>
<td>Yes</td>
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<tr>
<td>Range</td>
<td>3-10 hours (depends on environment and AC/heating usage)</td>
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<td></td>
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<td>L: 12-14 ft.</td>
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<td></td>
<td>W: 6-7 ft.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>H: 8-9 ft.</td>
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<tr>
<td>Recharge Time</td>
<td>2-8 hours (depends on voltage and/or charging strategy)</td>
<td></td>
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<td></td>
<td>9-10 ft.</td>
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<tr>
<td>Feature</td>
<td>Specification</td>
<td>Feature</td>
<td>Specification</td>
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<tr>
<td>Top Speed</td>
<td>25 mph (40 km/h)</td>
<td>Weight</td>
<td>3,000 lbs.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Average Operating Speed</td>
<td>12.5 mph (20 km/h)</td>
<td>Payload Capacity</td>
<td>3,000 lbs.</td>
<td></td>
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<tr>
<td>Localization</td>
<td>LIDAR, GPS</td>
<td>Gross Vehicle Weight</td>
<td>6,000 lbs.</td>
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<tr>
<td>Sensing</td>
<td>LIDAR, optical camera, RADAR, INS</td>
<td>Human-Machine Interface</td>
<td>Touchscreen, speakers/microphone, digital signage, horn, lights</td>
<td></td>
<td></td>
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<tr>
<td>Communication</td>
<td>DSRC; 4G; Wi-Fi</td>
<td>Remote Supervision</td>
<td>Emergency link and two-way communication</td>
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</table>
Transit Benefits

1. Provides for First Mile/Last Mile
2. Eliminates Wait Time
3. Provides for Seamless Transfers
4. Improves Transit Reliability
5. Improves Customer Satisfaction
6. Increases Transit Ridership
7. Reduces Operating Costs
8. Increases Total System Throughput
9. Decreases Primary & Secondary Incidents
10. Stimulates Economic Growth
11. Short Project Development/Implementation Timeframe
12. Electric Vehicles, Zero Emissions
13. Addresses Paratransit Needs
14. Enables Mobility on Demand (MOD)
Early Lessons Learned

1. Find a Passionate Champion
2. Funding is Key
3. Have Vision, Mission Statements, Strategic, Business & Marketing Plans
4. Plan Big. Start Small with the “Low Hanging Fruit”
5. Under Promise
6. Share Information
7. Media often gets it wrong
8. Do not underestimate Permitting Requirements
9. Better Insurance
10. Plan for Accidents
11. Test & Re-Test
12. Keep Going, Do Not Give-Up
13. Remember that Riders Rule
As we Continue Cleaning Up ......
Data Ownership & Spectrum Sharing
Example: Enforcement & Self-Driving Vehicles

“Speeding, officer? You’ll have to ask the self-driving car.”
There is no Interoperability without:

Standards
Drone Delivery in Canada
Drone Delivery in Portugal
Problems with Drones, France!
Automation & Jobs
Let us Not Forget:

Research suggests 50% of all new vehicles will have V2V tech by 2022. Will U.S. road infrastructure be in a state to maximize the potential safety implications this might bear?
Transferring Impacts into Opportunities

- Land Use
- Jobs
- Transit
- Public Realm Design
- Health and Safety
- Infrastructure
- Equity
- Curb Management
What Should Agencies Do?

• Participate – Do Not Wait
• Baby Steps - plan infrastructure needs and building data and computing capacity to position your agency
• Experiment & Test
• Track & Monitor federal and state developments, make your voices heard
• Gain Stakeholder & Public Confidence

Source: National League of Cities
If there is a will, there is a way
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