Applications and Data Environments Breakout

Group II: Freeway Data Environment

Gene McHale
Federal Highway Administration
Office of Operations Research and Development

Kate Hartman
ITS Joint Program Office

Mike McGurrin
Noblis

Mobility and Environment Workshop - November 30, 2010
Today’s Exercise
(Part 1) Scorecards

• Feedback materials provided in the breakout rooms
  – Application scorecards
  – 3 poker chips (for voting)
• Facilitators will brief assumptions about the data environment that applications can draw upon
• Facilitators will clarify application evaluation criteria
• Consider a set of (up to 12) IntelliDrive application concepts
  – Facilitators provide one slide that describes the application
  – Field questions and clarifying discussion
  – Individually, you rate the application (HIGH, MEDIUM, LOW) against the criteria on your scorecard
Today’s Exercise (Part 2) Voting

- Once you have scored each application, each participant votes for the three most promising applications
  - **“Most promising”**: strong potential for transformative impact, low deployment risk, and clear alignment with IntelliDrive program goals
  - BLUE = 3 points (top priority)
  - RED = 2 points (second-highest priority)
  - WHITE = 1 point (third-highest priority)
  - Deposit your chips in the voting bins identified for each application (also turn in your scorecards)
- Quick break (5 minutes) to tabulate the results
- Reconvene to consider results within each breakout
  - Discuss the implications of your group process
  - Identify a presenter from your group for the breakout report at 3 PM
Exercise Ground Rules

• For today’s exercise, these items can’t be changed
  – Evaluation criteria
  – Data Environment assumptions
  – Application concepts (no altering or adding new ones)
• Policy-related issues are NOT in play for discussion
  – If these topics come up, we will park the discussion until tomorrow, when we have special session to deal with these in turn
Data Environment Assessment
Scorecard Activity
**Freeway Data Environment Description**

- Organizes multi-source data along a uninterrupted flow (freeway) facility up to 15 miles in length
  - Vehicles (light, transit, freight, non-motorized, public safety)
  - Mobile devices
  - Roadside/wayside infrastructure
- Federated with related data environments
  - Can pull in federated data to assist in local control decisions
Freeway Data Environment Assumptions

• Single freeway facility, bi-directional in nature
• Data environment encompasses data from all interchanges along the facility, including ramps and arterial segments providing ramp access
• Lanes on the mainline facility may have access restrictions that may vary by time of day and day of week (e.g., HOV or Truck Only)
• Tolls may be collected on some or all lanes along the length of the facility
• Travel demand is highly variable by time of day and day of week
• Periods of high traffic demand associated with events held at venues along the facility
• Some sections of the freeway may experience partial or complete flooding during intense rain events
Vehicle and Traveler Data Source Assumptions

- Nearly all travelers carry GPS-enabled mobile devices
- Some travelers opt-in to configure their mobile devices to contribute data regarding position, time and trip characteristics
- Many light vehicles opt-in to contribute data, some broadcast HIA messages
- Many transit vehicles contribute position, passenger count, and other data, some broadcast HIA
- Many freight vehicles provide data on position, credentials and other data, some broadcast HIA
- Most emergency vehicles broadcast HIA and vehicle type data
Infrastructure
Data Source Assumptions

- Road Weather sensors, loop detectors, other roadside sensors as currently deployed (2010 baseline)
- Many signalized intersections act as advanced intersections
  - DSRC-capable roadside equipment for 2-way communication with enabled devices and vehicles
  - Broadcast Signal Phase and Timing (SPaT) data via DSRC
- Some transit and curbside parking facilities provide utilization data (spaces used/remaining), every minute
Application Assessment Scorecard Activity
Application Evaluation

Criteria

• Next, we’re going to go through application concepts that utilize data from the freeway data environment

• We will present each concept on a single slide
  – You can ask clarifying questions, or offer suggestions about how data might be leveraged
  – But the concept itself cannot be altered, modified or enhanced in discussion
  – Please record notes or comments on each concept on your scorecard

• You rate each application on three criteria (High, Medium, Low)
  – Potential Impact: will this application have transformative impact?
  – Deployment Readiness: if we assume the data is available, can this application be developed, tested and widely deployed by 2025?
  – Program Alignment: does the application align with program objectives and is there a clear federal role in its development and deployment?
• Dynamic Speed Harmonization

• Problem Addressed:
  – Improve throughput and reduce risk of collision by optimizing for lane-specific speed limits on a freeway facility

• Description
  – Monitor traffic and weather data captured from multiple sources, and calculate a target speed for vehicles
  – Target speeds may be advisory or enforced, and may vary by location, e.g., distance upstream of a recurrent bottleneck, and by lane
  – Communicate target speeds through overhead dynamic signage, via DSRC to enabled vehicles with range (I2V) and from vehicle to vehicle (V2V)
Application #2: CACC

- Cooperative adaptive cruise control
- Problem Addressed:
  - Significantly improve throughput by increasing capacity and efficiency, and increase safety by minimizing the number of interactions between vehicles
- Description
  - A traffic manager sets a gap policy to form or break-up platoons of vehicles
  - Speeds are automatically adjusted by the vehicle based on communications from the traffic management center
  - Ad hoc or managed platoons of vehicles moving on the facility
  - Management of gaps, flows and arrival rates
  - Systematically accounts for differing vehicle weight and performance

PARTICIPANTS: ON YOUR SCORECARDS, PLEASE RECORD NOTES/COMMENTS – CRITERIA RATING
Application #3: Q-WARN

• Queue Warning

• Problem Addressed:
  – Warn motorists of existing or imminent downstream queues or shockwaves to increase safety by reducing rear-end collisions (and resulting congestion)

• Description
  – Monitor traffic data to check for presence of a stopped or slow moving queue
  – Predict queue formation and shockwave propagation
  – Alert motorists to reduce speeds thereby avoiding abrupt stops
  – Possibly implemented in conjunction with speed harmonization to provide target speeds by lane in approach to congested area

PARTICIPANTS: ON YOUR SCORECARDS, PLEASE RECORD NOTES/COMMENTS – CRITERIA RATING
Multi-modal Real-Time Traveler Information

Problem Addressed:
- Improve precision and accuracy traveler information with respect to travel times, cost, or availability on alternate routes or modes

Description
- Considers real-time and historical travel conditions for the traveler’s trip (pre-specified origin, destination, and time of departure)
- Suggests potential routes and modes (e.g., HOV, general purpose, tolled lanes) with travel times, travel time reliability, and costs for each alternative
- Predicts travel times based on existing and expected traffic patterns, weather conditions, incident locations, and work zone locations and timings

PARTICIPANTS: ON YOUR SCORECARDS, PLEASE RECORD NOTES/COMMENTS – CRITERIA RATING
Application #5: ETC

• Electronic Toll Collection System

• Problem Addressed:
  – Increase interoperability among ETC devices for vehicle-to-roadside communication using 5.9 GHz bandwidth

• Description
  – Current 915 MHz ETC systems rely on proprietary vehicle-to-roadside communications, limiting interoperability
  – Enable toll authority to accept electronic payments from vehicles equipped with electronic-payment services (EPS), regardless of EPS account ownership
  – Presents payment instructions to the driver, receives driver input, send payment authorization and display toll payment status to the driver
  – Could be implemented in conjunction with managed or HOT lane concepts

PARTICIPANTS: ON YOUR SCORECARDS, PLEASE RECORD NOTES/COMMENTS – CRITERIA RATING
Application #6: INC-ZONE

- Incident Scene Work Zone Alerts for Drivers and Workers
- Problem Addressed:
  - Public safety work zones (e.g., incidents, traffic stops) are dynamic and confusing for drivers -- and are high risk areas for vehicle-worker collisions
- Description
  - Warns drivers of lane closings and unsafe speeds for the temporary work zones that surround any traffic incident or law enforcement traffic stop
  - In-vehicle messaging would also provide merging and speed guidance
  - Warn on-scene workers of vehicles with trajectories or speeds that pose high risk to their safety

PARTICIPANTS: ON YOUR SCORECARDS, PLEASE RECORD NOTES/COMMENTS – CRITERIA RATING
Application #7: RAMP

• IntelliDrive-Driven Ramp Metering System

• Problem Addressed:
  – Improve current ramp metering systems capability to respond to changing traffic conditions in real time

• Description
  – Leverage new mobile source data to calculate optimal ramp metering rates resulting in improved throughput and reduced emissions
  – Broadcast timing information (analogous to SPaT data) allowing vehicles to decelerate or accelerate
  – Integrate with HOV bypass, arterial signal coordination and dynamic speed harmonization applications deployed in same interchange

PARTICIPANTS: ON YOUR SCORECARDS, PLEASE RECORD NOTES/COMMENTS – CRITERIA RATING
Application #8: WX-MDSS

- **Enhanced MDSS Communications**
- **Problem Addressed:**
  - Reduce reliance on (potentially expensive) commercial wireless networks to communicate with snowplows or other maintenance vehicles
- **Description**
  - MDSS equipped maintenance vehicles utilize DSRC hot spots to download treatment recommendations and upload recent maintenance activities
  - In many rural areas access to commercial networks is limited and/or expensive
  - Utilize DSRC hot spots to reduce costs and improve communications latency for state DOTs

Participants: On your scorecards, please record notes/comments – criteria rating
Voting
Breakout Exercise (Part 2) Voting

• Now that we’ve worked through all the applications, vote for the three most promising applications
  – “Most promising”: strong potential for transformative impact, low deployment risk, and clear alignment with IntelliDrive program goals
  – BLUE = 3 points (top priority)
  – RED = 2 points (second-highest priority)
  – WHITE = 1 point (third-highest priority)
  – Deposit your chips in the voting bins identified for each application (also turn in your scorecards)
• We’ll take a quick break (5 minutes) to tabulate the results
• One Bin, One Participant, One Chip rule
  – Do NOT dump all of your chips in a single bin
  – We want your individual priority of the top THREE applications
Quick Break
Exercise Results
Results Discussion

• Were similar or dissimilar applications selected during voting?

• Did the highest ranking applications align in the same quadrants of the impact/deployment readiness chart?

• Regarding the top 6 applications:
  – Are they highly overlapping? Or independent?
  – Do they require coordinated research?
  – Will they require coordinated deployment?

• Who would like to volunteer to report out the breakout group findings?
Exercise Complete