ITS ePrimer
Module 5: Personal Transportation

September 2013
Updated March 2016

Intelligent Transportation Systems Joint Program Office
Research and Innovative Technology Administration, USDOT
Instructor

Alex Skabardonis
Professor
University of California, Berkeley
Berkeley, CA, USA
Learning Objectives

1. Learn of capabilities, features, and limitations of ITS technologies for personal transportation
2. Understand deployment opportunities and constraints
3. Understand how ITS personal transportation applications impact the user and the transportation system in terms of mobility and accessibility
4. Understand emerging and future trends in ITS technologies for personal transportation
Webinar Outline

- Real-Time Travel Information
- Driver Assistance Systems
- Traveler Comfort and Convenience
- Personal Rapid Transit
- Vehicles, Internet and the Future
Real-Time Travel Information

Information types and impacts

Pre-Trip
- Trip departure time
- Mode of travel
- Route choice

En Route
- Change route
- Change mode (if alternate mode with parking available)
- Expected arrival times
Real-Time Travel Information

Dissemination

- **Web**
  - Every State DOT offers traveler information Web site
  - Pre-trip information
  - Wide geographic area coverage
  - Images from CCTV cameras on real-time conditions

- **511 Phone System**
  - More than 40 511 systems
  - Highest usage under major events
    - Extreme weather
    - Major road closures
Real-Time Travel Information

Dissemination

Changeable Message Signs (CMS)

- Expected travel times to destinations
- Alerts on incidents, inclement weather, other events
- Location important (prior to decision point)

Emergency Messages

- AMBER Alert
- LEO Alert
- SILVER Alert
Real-Time Travel Information

Dissemination

Increasing use of mobile applications and social networking

http://maps.google.com/

http://www.waze.com/livemap/
Real-Time Travel Information

Data Sources

- Fixed sensors approximately 0.5 mile apart in each travel lane (e.g., loops, radar, video)
- Event information from incident management teams, police patrols
- CCTV
- Probe vehicles
  - ETC transponders
  - Cell phones
  - Bluetooth readers
Real-Time Travel Information

Data Collection-Fusion-Utilization

Collection

Fusion (Multiple sources – Various data)

Planning - PM

Traffic Operation

Speed Information
Real-Time Travel Information

Benefits

Improve Traveler Decision Making
- Make accurate and timely decisions
  - Routing
  - Time of departure
  - Mode
  - Not make the trip
- Sense of “self control” to traveler

Reduce Frustration and Irrational Behavior
- Improve perceived level of service
Real-Time Travel Information

Benefits
Spread or Reduce Peak Traffic Demand
- Over space: alternative routes
- Over time
- Alternative modes
- Eliminating discretionary trips

Field Evaluation Results
- Traveler information users perceived time savings
- In-vehicle travel time savings are small
Parking Information

Public Agencies/Operators
- Maps with Parking Facilities
- Information on the Web: location/characteristics

Parking Lots
Space Availability

Private Service Providers
Web/Mobile Applications
- Real-time Parking Availability
- Online Reservation/Payment

City of San Francisco: Parking Information Web site
http://sfpark.org/
Parking Information

Multimodal Information

- Driving Times
- Parking Availability at Transit Stations
- Transit Information
  - Departure/Arrival Times

Influences Mode Choice
- Travel Time Savings
- Perceived Congestion
Driver Assistance Systems

- Night Vision
- Adaptive Cruise Control
- Collision Warning
- Collision Avoidance
  - Front collision
  - Lane keeping
- Precision Docking
  - Precise stopping at transit stops
  - Reduces passenger boarding and alighting times
- Driver Impairment Monitoring
- On-Board Monitoring for Commercial Vehicles
Driver Assistance Systems

Lane Capacity vs. CACC Market Penetration

With addition of “Here I Am” vehicles (“Vehicle Awareness Devices”)
Collision Warning (CW)

Available/Planned in Private Automobiles

Operational on Transit Systems

- Forward CW
  - Samtrans (San Mateo Bay Area)
- Rear Impact CW
  - Ann Arbor Transit
- Lane Change/Merge CW
  - Pittsburgh Transit
Traveler Comfort and Convenience

Electronic Toll Collection (ETC)
- Toll paid though transponders without stopping
- ETC increases toll lane capacity 4 times
- ETC transponders may operate across states/facilities
- ETC mandatory for congestion pricing implementation

Open Road Tolling (ORT): toll collection at highway speeds
- Higher capacity
- Improved safety
- Reduced fuel and emissions
Traveler Comfort and Convenience

Mobile applications for ride-share services
Traveler Comfort and Convenience

Carsharing: North American Member Growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>16,007</td>
</tr>
<tr>
<td>2003</td>
<td>32,647</td>
</tr>
<tr>
<td>2004</td>
<td>62,348</td>
</tr>
<tr>
<td>2005</td>
<td>73,590</td>
</tr>
<tr>
<td>2006</td>
<td>118,656</td>
</tr>
<tr>
<td>2007</td>
<td>211,170</td>
</tr>
<tr>
<td>2008</td>
<td>318,898</td>
</tr>
<tr>
<td>2009</td>
<td>377,597</td>
</tr>
<tr>
<td>2010</td>
<td>516,100</td>
</tr>
<tr>
<td>2011</td>
<td>639,428</td>
</tr>
<tr>
<td>2012</td>
<td>907,834</td>
</tr>
</tbody>
</table>
Personal Rapid Transit (PRT)

Concept: Alternative to Conventional Transit in Low Density Areas

- Small driverless vehicles (up to 15 passengers)
- Dedicated tracks/Off-line Stations
- High Capacity (2 seconds Headways)
- Point-to-Point Service/Passenger Comfort
- Limited Implementations

Morgantown PRT system, West Virginia. Courtesy of West Virginia University.
Cooperative Vehicle-Infrastructure Systems

Vehicle-to-vehicle (V2V)

- Communications
  - DSRC
  - Mobile Devices

- Applications
  - Active Safety Systems
    - Reduce crashes by 80%
  - Driver Alerts (Queue Warning)
Cooperative Vehicle-Infrastructure Systems

Vehicle-to-Infrastructure (V2I)

- SPaT (Signal Phasing and Timing) Message

Applications

- Safety
- Mobility
  - Improved traffic signal control
  - Dynamic route advisory

- Environment
  - Speed advisory for minimum fuel/emissions
Vehicles, Internet, Phone, and the Future

Dynamic Speed Advisory
(source: BMW)

V2I Example:
SPaT message