Intelligent Vehicles and Roads: the VII Program and the SafeTrip-21 Initiative

Greg Larson
Division of Research and Innovation
California Department of Transportation
Outline of the Presentation

• What is Vehicle-Infrastructure Integration (VII)?
• What is SafeTrip-21?
• The Mobile Millennium Project
• The Networked Traveler Project
What is VII?

Basic Concept:

• All new vehicles will be equipped with DSRC radios at 5.9GHz, and GPS receivers.
• A nationwide, roadway-based communications network will be created.
• Wireless data will be exchanged between the vehicles and the roadside.
• A “Backhaul” network will transport this roadside data to/from a central location.
Caltrans Improves Mobility Across California
Scope of VII

• 15 Million new vehicles every year will have VII installed by the manufacturer

• A Nationwide Communications Infrastructure
  – A network of 250,000 “Hot Spots” (Similar to Wi-Fi)
  – Interstate & Urban Freeways -- 55,000 miles
  – Major Rural Roads -- 100,000 miles
  – 454 Largest Urbanized areas with Pop. > 50,000
    – Will Serve 70% of Total US Population

• A set of national VII standards for interoperability will be developed
Examples of V2I Applications

- **Safety**
  - Intersection Collision Avoidance
  - Roadway Departure Warning
  - Emergency Brake Lights
  - Cooperative Forward Collision Warning
  - Rail Crossing Warning
  - Emergency Vehicle Signal Preemption

- **Mobility**
  - In Vehicle Signage
  - Traffic Signal Control
  - Ramp Metering
  - Winter Maintenance
  - Traveler Information
  - Electronic Toll Collection

- **Consumer & Commercial**
  - Drive-Through Payment
  - Remote Diagnostics
  - Customer Relations Management
A Change in Strategy

• Previous approach
  – Deployment decision by OEMs, US DOT, state transportation agencies in 2010 with synchronized deployments beginning around 2012
  – Key technology for vehicle to infrastructure communications was Dedicated Short Range Communications (DSRC)
  – Expectation that the infrastructure build out could be substantially funded by the Federal government

• Current approach
  – Open up the architecture to allow for non-DSRC technology
  – Work with aftermarket suppliers to enable V2I capabilities sooner
  – Demonstrate a subset of capabilities that V2I can provide in a few, high concentration operational test sites
  – Support growth in geographic coverage and functionality over time
  – Leverage new technologies and private industry developments
  – Learn from related state and university research
SafeTrip-21 is Phase I of the redefined USDOT VII Program

SafeTrip-21 embraces traditional VII concepts with a new emphasis on:

- Near term possibilities
- DSRC alternatives
- Consumer electronics
- Intermodal integration
- Energy / Environment
SafeTrip-21: New Horizon

• Accelerate VII research into “real-world” experience

• Emphasize near-term VII possibilities that don’t require extensive “build-out”
  – Deliver VII benefits through consumer electronics (quickly, cheaply)
  – Exploit existing communications technologies as pathways to DSRC

• Expose travelers and decision makers to VII benefits in terms of:
  – Safety improvement
  – Congestion mitigation
  – Motor freight operations
  – E-Payment convenience
  – Energy conservation
  – Environmental footprint

• Obtain real world perspectives on VII plans/deployment strategies
SafeTrip-21 Components

- **Information Gathering**
  - ITS America / industry representatives
  - Transportation and transit agencies
  - University Transportation Centers
  - VII research groups / sites
  - Request for Information

- **Field Test and Evaluation**
  - ITS World Congress Launch
  - Year-long test and evaluation
  - Interim findings throughout 2009
  - Summary Results - January 2010

- **Business Model Assessment**
Initial Projects

• “Mobile Millennium”
  – Builds upon the success of the “Mobile Century” Experiment
  – Relies on a “Private Sector” business model
  – Public Sector becomes just another consumer of the traffic data

• “Networked Traveler”
  – A “Gateway” connects the consumer mobile device in the vehicle to roadside infrastructure
  – The Gateway enables new transit services too
    • Several transit agencies are very interested in these services
  – The Public Sector seeks to be the catalyst in triggering additional Private Sector development
Public-Private Partnership

• Public Partners
  – USDOT
  – Caltrans
  – Metropolitan Transportation Commission (MTC)
  – Santa Clara Valley Transportation Authority (VTA)
  – San Mateo County Transit District (SamTrans)

• Private Partners
  – Nokia
  – NAVTEQ
  – Nissan

• Academic Partners
  – California Center for Innovative Transportation (CCIT)
  – Partners for Advanced Transit and Highways (PATH)
Budget

Total Project Budget: $12.4 million

- Federal Share: $2.9 million
- Caltrans Share: $4.2 million
- Nokia Share: $2.5 million
- NAVTEQ Share: $2.0 million
- UC Berkeley Share: $700 thousand
- Nissan Share: $30 thousand
Mobile Millennium: mobility tracking using cellular phones

UC Berkeley – CCIT – Nokia – Navteq
Convergence of multimedia, sensing and communication

- **N95 is a good example of the convergence of multimedia, sensing, and communication platforms**
  - GPS
  - MP3 and movie player
  - Multiple sensors (accelerometers, tiltmeter, light)
  - Radio, wireless, Bluetooth, various ports, infrared, etc.
  - 5 megapixel camera

- **Smart phones enable:**
  - Location based services
  - Situational awareness
  - Mobility tracking

- **Ubiquitous Sensing Platform (Nokia)**
  - 3 billion mobile devices by 2009
  - 1.5 million devices per day
Mobile Millennium

• Project Description
  – For a six-month period, equip thousands of cars on a roadway network, including arterials
  – Participating drivers agree to share position and speed data
  – Collect unprecedented traffic data, covering 500+ miles of freeway and arterials
    o Demonstrate the added value of this traffic data on freeways, and especially on arterials that are not currently monitored
  – Drivers receive real-time traveler information through a map application on their phone
  – Demonstrate privacy protection
  – Mobile Millennium is the precursor to a real, mainstream product

• SafeTrip-21 Demos
  – ITS World Congress: Live broadcast of Mobile Millennium capabilities, and [tentative] subset of Mobile Millennium technology directly showcased for New York arterial network.
Architecture for global traffic monitoring

- Public (phones)
- Network provider
- Nokia / Navteq
  - Data collection
  - Traffic.com
  - Historical data
  - Maps
- UC Berkeley
  - Highway traffic models
  - Arterial traffic models
  - Travel time, congestion, weather, accidents...
Interactive maps
Software client on the phone
http://traffic.berkeley.edu

- **Mobile Millennium website**
  - Presentation of the project
  - Background material
  - Videos (previous experiments)
  - Media report (more than 100 entries)
    - CBS, NBC, ABC, CNET, BBC...
    - NPR, KGBO
    - More than 100 web outlets.
    - Team, milestones, contact

- **Upcoming**
  - Live data feed
  - Software upload
Networked Traveler

- Provide real-time traveler information for safety, multi-modal mobility, parking, etc.
- Services can be easily downloaded from a web site into a “smart” mobile device
- Gateway uses multiple communications modes, such as cell phone network, Wi-Fi, and DSRC, to connect the traveler to the information
- Independent of vehicle type
I want *some* safety alerts. Hmm… I want *a lot of* transit connection information, too.

www.connected-traveler.org/tellmeaboutmytrip
www.connected-traveler.org/tellmeabouttheroad
www.connected-traveler.org/watchoutforme
Networked Traveler Services
Will be demonstrated in NYC

- **Tell me about my trip**
  - *Trip Planner* (cell phone with Internet connectivity; multimodal services)
  - *Dynamic Route Advisory*
- **Tell me about the road**
  - *Traffic Signal Countdown* (as a safety and information enabler)
  - *Public Signage – Situational Awareness*
  - *Pedestrian Assistant (location and other apps)*
- **Watch out for me!**
  - *Heartbeat/watch out for me* (confederate driver near the bus; situational awareness, left/right?)
  - *Pedestrian Assistant (safety apps)*
- **System Operator / Agency Applications**
  - *Transit Signal Priority* (LCD on bus with signal phase countdown)
  - *Dynamic Passenger Information* (On-board display, arrival countdown, and bus station, arrival time)
Networked Traveler

Next Year:

Field Test and Evaluation of Safety (Situational Awareness) and Mobility Applications in the San Francisco Bay Area
Thank You!

Please refer to: viicalifornia.org

Caltrans Improves Mobility Across California
Multi-Network

(All solid lines already working)
Multi-Network Gateway

- Gateway has Wi-Fi and DSRC radio interfaces
- Also has Bluetooth interface to cell phones