Commercial Vehicle Infrastructure Integration (CVII) Program

ITS New York Annual Meeting

June 9th -10th , 2011

Office of Modal Safety & Security Services
New York State Department of Transportation
What is Connected Vehicle/CVII?

- Also known as connected vehicles, vehicle infrastructure integration, cooperative vehicle or highway systems
- Combination of technologies and software applications that use wireless communication technology to provide integrated connectivity:
  - Between all vehicles
  - Between vehicles and the roadway infrastructure
  - Among vehicles, infrastructure and wireless consumer devices
Communication Technologies

Latency (in seconds)

- Two-Way Satellite (60+ secs)
- Terrestrial Digital Radio & Satellite Digital Audio Radio (10 - 20 secs)
- WiFi 802.11 (3 - 5 secs)
- Cellular (1.5 - 3.5 secs)
- Bluetooth (3 - 4 secs)
- WiMax (1.5 - 3.5 secs)

Active Safety Latency Requirements (secs)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Signal Violation Warning</td>
<td>0.1</td>
</tr>
<tr>
<td>Curve Speed Warning</td>
<td>1.0</td>
</tr>
<tr>
<td>Emergency Electronic Brake Lights</td>
<td>0.1</td>
</tr>
<tr>
<td>Pre-Crash Sensing</td>
<td>0.02</td>
</tr>
<tr>
<td>Cooperative Forward Collision Warning</td>
<td>0.1</td>
</tr>
<tr>
<td>Left Turn Assistant</td>
<td>0.1</td>
</tr>
<tr>
<td>Lane Change Warning</td>
<td>0.1</td>
</tr>
<tr>
<td>Stop Sign Movement Assistance</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Least stringent latency requirement for Active Safety (1 sec)

Most Stringent latency requirement for Active Safety (.02 sec)

5.9 GHz DSRC (.0002 secs)
CVII Program

- Why connected vehicle program?

Safety
- 33,808 highway deaths in 2009
- 6 million crashes/year (average)
- Leading cause of death for ages 4 – 34!
- Dramatically reduce accidents/fatalities/injuries through greater situational awareness by:
  - Driver Advisories
  - Driver Warnings
  - System control of vehicle
Connected Vehicle/CVII

Background

- Dedicated Short Range Communication
- 5.9 GHz (FCC & $$$!)
- Extremely high speed, high capacity, low latency, highly secure data transmission
- “Smart vehicles, smart highways”
- “Internet” for the highway/transportation system
- Vehicle crash avoidance capabilities
- NHSTA Rulemaking 2013
Concept of VII W/CVII!

On Board Equipment (OBE) – Carriers, Fleet managers, OEMs, Private Companies, Service & Telematics Providers, etc.

Road Side Equipment (RSE)

Vehicle to Vehicle (V2V)

Network Management Center

Public Sector

Private Sector
CVII Program

Background

- Funded by I-95 Corridor Coalition
- Winning Team led by Volvo Technology of America
- Started program May, 2009
- 3 Year Schedule (Phase I & II)
- $1.45 Million (I-95 CC)
- Additional $500K Available for Phase III
CVII Program

Requirements

- Past national 5.9 GHz DSRC Connected Vehicle research & development for passenger vehicles only!

- Complete interoperability!

- Communicate with *any* compliant vehicle or infrastructure

- Non-proprietary core system design capable of duplication/scalable!

- Integrate VII communications device w/SAE J1708 commercial vehicle databus using SAE J2735 & J1939
CVII Program
Advisory Team

- I-95 Corridor Coalition
- FHWA
- ITS JPO/RITA
- FMCSA
- NYS Thruway Authority
- NYS Bridge Authority
- Washington State DOT
- Commercial Vehicle Safety Alliance
- AASHTO
- NYS Energy Research and Development Authority
- NYS Motor Truck Association
- American Transportation Research Institute
- VII Consortium (Auto OEM)
- Michigan DOT
- Intelligent Transportation Systems of America
- U. of North Carolina Highway Systems Research Center
- American Trucking Association
CVII Program

Commercial Vehicle Data Bus
CVII Program

Status

- Develop/Test CV VII compliant 5.9 GHz DSRC OBE system including Driver Interface - Complete

- Develop/Test CVII DSRC Applications:
  - CV Driver I.D and Verification - Complete
  - Test Wireless Vehicle Safety Inspection (brake condition, tire pressure, light status, etc.) - Complete
  - CV to Maintenance Vehicles Communication - Complete
CVII Program

Volvo Truck Interior with Card Reader
Vehicle to Infrastructure (V2I)

Task #3 - Wireless Driver Identification & Verification

- Driver inputs ID information; sent to roadside device
- Roadside sends message to driver indicating CDL is valid, inactive, revoked, or suspended
- Driver unable to start vehicle if driver’s CDL is inactive, revoked, or suspended
- Driver ID integrated with existing e-screening information (weight, credentials, etc.) for expanded 5.9 GHz DSRC screening
- Coordinated with FMCSA’s WRI program
Vehicle to Infrastructure (V2I)

Task #4 – Vehicle Safety Data from Databus

- Vehicle Safety Data – from databus via 5.9 GHz DSRC
- Includes brake, lights and tire data
- Data integrated with existing e-screening information (weight, credentials, etc.) for expanded 5.9 GHz DSRC screening
- Coordinated with FMCSA’s WRI program
CVII Program

Wireless Roadside Inspection Operation

- Enhances existing screening information (weight, credentials, etc.) with driver and vehicle level data
- WRI requested by roadside device (RSE)
- Vehicle sends data to RSE
- Validated against network information (NYS CVIEW/SAFER)
- Results sent to driver & enforcement
- Driver follows in-cab instructions based on screening results (pull in/by pass)
- Inspections results sent to carrier, state and federal backhaul systems as appropriate
Detailed OBE/MMC Information
(click on events or truck icons for info)

FAIL!!

Identification Information
- Carrier Name: Volvo Truck - North America, Inc.
- USDOT#: 335611
- Address: 7900 National Service Road
- City, State, Zip: Greensboro, NC 27409-9416
- Phone Number: 336-393-2060
- Screening ID: X123
- Location: New York, I-495, Ext 51
- VIN: 1VINZ9829VIN12345
- License Plate: NC/LK9999
- Veh. Make/Model/Color: VOLVO/VHD/BLUE

Screening Result
- Fail

Vehicle Status
- Out-of-Service Order IRR: Pass
- OS/OW Permit: Pass
- Off-Route: Pass

Carrier Status
- Out-of-Service Order IFTA: Fail
- ISS-2: Pass
- PRMS: Pass
- URC: Pass

Driver Status
- CDL Status: Pass
- Seat Belt User: Fail
- Driver Safety Screening: Pass

(Click red hyperlinks for more detailed information)
CVII Program
Vehicle to Vehicle (V2V) Communication

Prototype Design
Task #5 – Maintenance Vehicle to Commercial Vehicle Communications (V2V)

- A moving maintenance vehicle (snow plow) broadcasts a heartbeat-like message with its vehicle type, position and heading.
- Vehicles following the snow plow receive and display a warning to the driver about the snow plow operations ahead.
- Broadcasts work zone operations to approaching vehicles.
CVII Program
Additional Scope Items

- Phase 2 – Underway
- Complete December, 2011
- Heavy Vehicle to Light Vehicle Driver Safety Warnings
- Grade Crossing Driver Warnings
CVII Program
Light Vehicle to Heavy Vehicle
Phase 2 - V2V Active Safety Driver Warnings

- Passenger vehicles/CV exchange heartbeat messages
- Warning scenarios:
  - Potential Blind Spot Warnings
  - Hard Braking Events (multiple vehicles ahead)
  - Tailgate Warning
  - Unsafe to Pass/Unsafe to Merge
CVII Program
Phase III

- Phase III – Funding Obtained/ Start 2012
- Potential Scope Items
  - Routing information & restriction warnings w/Vehicle Disabling
  - Wrong way driver warnings w/VD
  - Add more fleet management/Clarus/AERIS data to V2I
  - Integrate EOBR hours of service w/wireless roadside inspection
RSEs can be installed at vehicle depots, parking facilities, etc. for fleet management
NYSDOT INFORM I-495
CVII Test Bed
CVII Corridors - NYC/Long Island

CVII Business Plan (One to Five Years)

Pending Integrated E-Screening/Virtual Weigh Station
1. Newburgh Beacon Bridge
2. I-87 Northbound - Newburgh/Exit 17 Interchange
3. I-84 Westbound - Wallkill Rest Area

Proposed Integrated E-Screening/Virtual Weigh Station
1. I-84 Eastbound - Wawayanda Rest Area
2. I-87 Southbound - Yonkers Toll Plaza
3. George Washington Bridge
4. Verrazano-Narrows Bridge

NYS IntelliDrive/CVII Corridors & Proposed Expansions
- Existing VII Corridors (Completed 2008)
- Pending VII Corridors (Completion 2010 - 2011)
- Proposed VII Corridors - Near Future
NYSERDA/Kapsch Aftermarket Device Development Project

- NYS Energy Research & Development Authority funded
- Kapsch to develop/commercialize aftermarket OBE
- Relatively low cost, simple to install
- Use CVII V2I & I2V applications
- NYSDOT receives 20 devices January, 2012
- $2.3 million project
NYSERDA/Kapsch Aftermarket Device Development Project

- Deploy in vehicles that use CVII corridors
  - NYSDOT/NYSTA vehicles
  - Trucking company
  - Buses (School, Transit, For Hire)
- NYSDOT provides device and installation
- NYSDOT partner ship with operators to evaluate technology
- Operators provide unique opportunity to develop useful applications and use of data for both partners
Aftermarket System Concept

Task # X.
Develop Aftermarket 5.9 GHz DSRC In-Vehicle Systems with Vehicle Databus Integration Using Smart Phones for Driver Communication (Human Machine Interface)