Digital Infrastructure for Automated Vehicles: Challenges and International Collaboration
U.S. Viewpoint

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Content

• Navigation Systems
  – Geospatial Information
  – Navigation Systems
  – Road Design & Construction

• Dynamic Data
  – Weather
  – Traffic Conditions & Incidents
  – Work Zones

• International Collaboration
  – Automation in Road Transport (ART) Working Group
Evolution of Geospatial Information

- Map databases provide geospatial relationship between points of interest
- Initially developed by surveyors working from “known” points
- Today’s technologies include Lidar, aerial photolithography and GPS position recording
Evolution of Navigation Systems

- Paper maps: read by people
- Etak: computed vehicle position through map matching and dead reckoning using digitized map database
- GPS: independent position on map database, often using Etak map matching algorithms
- New technology to take advantage of AV capabilities?
Road Design & Construction

• TRB Committee AFB80 – Geospatial Data Acquisition Technologies in Design and Construction
  – Oregon DOT has demonstrated ability to use planning data for fully automated road construction
  – Electronic plans and data now supersede paper plans
Dynamic Data

- Weather (FHWA-JPO-13-047)
  - Enhanced Maintenance Decision Support
  - Weather-Responsive Traffic-Management
  - Motorist Advisories and Warnings

- Traffic Conditions & Incidents
  - 511 Systems
  - Commercial Services

- Work Zones
  - Traveler Information
Motorist Advisories & Warnings

1. Connected vehicles gather road-weather data transmit to roadside equipment
2. Roadside equipment sends connected vehicle road-weather data to VDT
3. VDT quality checks data and applies motorist alert algorithm to determine short time horizon warning
4A. Short time horizon warnings are provided to participating motorists
4B. Data from VDT are provided to a secondary processing system for assimilation with other data to determine medium and long time horizon alerts
5. Medium and long time horizon alerts are provided to various participating users
Motorist Advisories & Warnings
Advance Message Concept Development

- Twenty month project (8/31/15 to 4/28/17) with Crash Avoidance Metrics Partners, Ltd., to:
  - evaluate vehicle’s ability to generate,
  - infrastructure’s ability to collect and provide
    - Basic Safety Message (BSM),
    - Probe Data Message (PDM), and
    - Basic Mobility Message (BMM) alternatives
  - using cellular and DSRC communications under simulated Dynamic Interrogative Data Collection (DIDC) control in real world driving conditions for non-safety critical applications.
The Smart City Challenge

- Encourage cities to put forward their best and most creative ideas for innovatively addressing the challenges they are facing.

- Demonstrate how advanced data and intelligent transportation systems (ITS) technologies and applications can be used to reduce congestion, keep travelers safe, protect the environment, respond to climate change, connect underserved communities, and support economic vitality.
SMARTCOLUMBUS

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International Research Exchange

- The European Commission, United States and Japan work to foster cooperative international ITS research and to support international harmonization of ITS standards through international research exchange activities.
- This exchange was formalized in 2009 and 2010 with a series of three bilateral agreements among the three parties, officially authorizing exchange activities among them.
Automation in Road Transport

- Automation in Road Transport Working Group – Topic Areas
  - Human factors
  - Evaluation of Benefits
  - Digital infrastructure
  - Connectivity (V2V / V2I / I2V)
  - System Reliability and Security (to include cybersecurity)
  - Roadworthiness/Testing and Certification
Conclusions

• Industry will develop new concepts in Navigation Systems for Highly Automated Vehicles
• Government databases may provide source of information for underlying maps
• Development of protocols for traffic management (government) provide opportunity for dynamic, real-time traveler advisories that can be injected into navigation system (industry)
• USDOT/CAMP work on Road Weather and AMCD are items for potential international coordination
• Smart City projects also provide opportunities for new data streams
Questions and Contacts

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