Transit ITS and Connected Vehicles: Developments, Opportunities and Challenges

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Agenda

- Transit ITS: Functionalities
- Benefits and Challenges
- Recent and Latest Developments in Transit ITS
- Transit Traveler Information Systems
- Future Directions
- Connected Vehicle Environment
Back to the Future....
tomorrow's transportation
Design of the automated dual mode bus would give particular attention to passenger comfort on the longer express trips.
A satellite city fast intracity transit link station.
A personal rapid transit dual mode vehicle station showing a small car entering the network through an inspection point, a destination encoder and an automatic fare collector.
A suburban personal rapid transit station showing turnouts for vehicles stopped to pick up or discharge passengers.
A Dial-a-Bus, with its position established by automatic vehicle monitoring, can be routed by computer and a communication link to collect passengers who have called for service.
Customers desiring Dial-a-Bus service could telephone the controller from home and indicate their desired starting time, origin and destination. A signal on the panel might announce the approach of the Dial-a-Bus.
Dial-a-Bus call stations could be located at convenient intervals throughout a suburban area.
Transit ITS Functionalities

- Communications (voice and data)
- Computer Assisted Dispatch (CAD)
- Automatic Vehicle Location (AVL)
- Security Alarms
- Schedule Adherence Monitoring
- Passenger Counting (APC)
- Transit Signal Priority (TSP)
- Customer Information (pre-trip, at stop, on-board)
- Analysis using Archived Data
- Automated Vehicle Monitoring (AVM) - mechanical
- Advanced Fare Collection (AFC)
Typical Transit ITS Architecture

- Purchased as capital project
- Integrated voice and data communications
  - Flexibility in radio comm: individual, by route, entire fleet
  - Data: canned messages
  - Location position reported by exception
  - Most logged data downloaded at end of day in garage
- Private radio infrastructure for voice on own channels
  - Ensures reliability in emergency operations
- Data communications: cellular

- Alternative business models exist (e.g. hosted applications)
Bus Rapid Transit (BRT) and ITS

- Greater stop spacing
- Reserved right of way
- Stations and Vehicles
- Branding

ITS
- CAD/AVL
- Real-time information
- Transit signal priority
- Advanced fare collection
Why ITS Technology?

- Sometimes reduces costs
  - Computerization of data logging (e.g. incidents)
  - Reduced recovery time in schedules (using running time data)
- But more importantly, enhances service to customers
  - Improved reliability of service
  - Improved security and safety
  - Better data for design of service
  - Enhanced information to customers (before and during trip, through multiple media)
  - Customer relations (investigation of complaints)
- Public Expectations / Image
Challenges

- Dilemma of technological innovation in transit
- Implications for organization
  - Expertise and staffing
  - Management of technology
  - Effective use of technology
- Changes to business practices
- Customer implications
- Labor implications
- Coordination with other departments, agencies
Latest Transit ITS Developments

- TSP: slowly growing acceptance in traffic control
- Specialized Transit - reservation, scheduling, and operations
- Effective use of AVL / APC / AFC data for planning and management (Business Intelligence)
- Deployment of ITS Standards (TCIP, NTCIP)
- Integration between different ITS technologies
- Audio/visual Next Stop announcements (AVA)
- Transit Traveler Information Systems (TTIS)
Transit Traveler Information Systems

TTIS

- Trip Planners (In-house, Google Transit, 3rd party, multi-modal, open source)
- Social Media
- Next Stop announcements (AVA)
- Real-Time Information ETA via multiple media (including texting)
- Export of data and open-source software development
- Mobile applications for customers with special needs
- Custom Smartphone Applications
- Experimentation with Peer to Peer applications
Issues Related to TTIS Strategy Development

- Lack of resources
  - IT, Specialized staff, expertise
  - Cost of SMS texting
- Lack of focus on market research, and lack of surveys to inform strategy
- Digital Divide: Smart Apps don’t replace traditional means for all customers
- Use of social media and strategy
- The debate about controlled versus open data
- Real-time data for 3rd party developers
Future Directions of Transit ITS

- New approaches to Advanced Fare Collection
  - Contactless credit card, Payment by cell phone
- New Transit ITS applications
  - Real-time transit control decision support (TODSS)
  - General public demand-responsive systems (FlexBus)
- Integrated Corridor Management
- Connected Vehicle Environment
Integrated Corridor Management (ICM)
Connected Vehicle Environment

- Connected Vehicle is a suite of technologies and applications that use wireless communications to provide **connectivity**:
  - Among vehicles of all types
  - Between vehicles and roadway infrastructure
  - Among vehicles, infrastructure and wireless consumer devices

*All Roads, All Modes, All The Time!*
Connected Vehicle Environment: Benefits for Transit Systems

- Refinements in performance for important applications through earlier detection and continuous monitoring:
  - TSP
  - On-board / wayside traveler information,

- More frequent communications and data transfers
  - CAD/AVL: Supplement the system-wide data radio with additional bandwidth for more frequent location polling on BRT corridors.
  - AFC: support stand-alone off-board fare equipment
  - Security video could be streamed to the control center during an emergency incident along equipped corridors

- New applications that may be created / enhanced:
  - Smart parking
  - Dynamic Transit Dispatching (real-time)
  - Use of smart devices for more personalized traveler information
  - Applications for persons with special needs
US DOT Connected Vehicle Research Program

Applications

- Safety
  - V2V
  - V2I
  - Safety Pilot

- Mobility
  - Real Time Data Capture & Management
  - Dynamic Mobility Applications

- Environment
  - AERIS
  - Road Weather Applications

Technology

- Harmonization of International Standards & Architecture
- Human Factors
- Systems Engineering
- Certification
- Test Environments

Policy

- Deployment Scenarios
- Financing & Investment Models
- Operations & Governance
- Institutional Issues
CV Transit Safety Research

- **Safety Pilot**
  - Michigan, suburbs of Detroit
  - 3,000 vehicles
  - Includes 70 buses with Basic Safety Message
  - 3 buses equipped with transit-specific safety retrofit

- **High Priority Transit Safety Scenarios**
  - Right turn in front crash
  - Pedestrian vs. turning bus crash
Integrated Dynamic Transit Operations (IDTO)

- Dynamic Transit Operations (T-DISP)
- Connection Protection (T-CONNECT)
- Dynamic Ridesharing (D-RIDE)
Transit ITS: An exciting future, with many opportunities, but with many challenges as well!

Thank You!