Delivering World Class ITS Operations

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Outline

Overview of best practice in Intelligent Transport Systems (ITS), and the role of public private partnerships in delivering innovative transport solutions that support smart, connected and liveable cities
Setting the Scene
The Mobility Challenge

High Population Rates
8 billion (2025)
Urban base
• 51% live in cities
• 70% by 2050
Growth rates
• 5.0% developing countries
• 0.7% developed countries

High Motorisation Rates
190 vehicles per 1,000 people (2015)
Growth rates twice as high in developing countries
The Cost Problem

**Congestion**

Social, Economic and Environmental Costs
- New Zealand - $1.0 billion per year
- Auckland - $700 m
- Wellington - $101 m
- Christchurch - $77 m
- Australia - $9.4 billion ($20 billion by 2020)
- US - $115 billion per year
- EU – more than 1% of GDP

**Road Safety**

- 3,500 fatalities each day worldwide
- Economic Cost: $100 billion per year
- New Zealand: 284 fatalities per year (2011)
- Global annual fatalities – 1.9 million by 2020
The Funding Challenge

- Ability of governments to effectively respond to congestion is increasingly being challenged by limited budgets/resources

- Solutions which focused only on increasing physical capacity have been met with limited success

- New approaches are needed to fund, manage, operate and optimise utilisation of transport infrastructure

Source: OECD Factbook
Intelligent Transport Systems
Integration of communication, control and information technologies with transport infrastructure, vehicles and users

Convergence of the real and digital worlds [data]
Benefits of ITS

- Improving Business and Operational Outcomes
- Increasing Safety
- Improving Utilisation of Assets
- Enhancing Mobility and Convenience
- Delivering Environmental Benefits
- Delivering Proactive Traffic Management
- Boosting Productivity and Economic Growth

More for Less

BCR 9:1 (ITS) versus BCR 3:1 (Adding Lanes)

BCR 9:1 (ITS) versus BCR 3:1 (Adding Lanes)
ITS Strategic Planning

Roads ACT

Strategy for Deployment of ITS in Canberra
ITS Strategy for Canberra

**Needs**
- Limited capability to effectively manage traffic
- Forecast 17% increase in population (362,000 by 2020)
- Congestion costs
  - $110m per year (2005)
  - $200m per year (2020)
- Road Safety Costs
  - $224m per year (2011)

**Features**
- Staging of work on corridors
  - Priority 1: 2-3 years
  - Priority 2: 3-5 years
  - Priority 3: 5-10 years
- CCTV Cameras on arterials
- VMS on arterials
- Managed Motorways elements on high speed roads
- Ramp signalling
- ITS Platform
- TMC
- Communications network
- Travel time and passenger information systems

**Benefits**
- Vision and strategy for deployment of ITS in Canberra
- Savings $132m per year in congestion and safety costs
- Reduced dependence on building new roads
- Improved utilisation of road capacity
- Better management of traffic
- Reduced costs through sharing of fibre communications
Emergency Management

Emergency Command Centre

Rio de Janiero Operations Centre
# Emergency Command Centre

## Needs
- Extreme weather events
- Motivated by the 2010 floods and landslides that killed more than 70 people in Rio de Janeiro
  - Slow response times
  - Lack of coordination between authorities
  - Poor data integration
  - Inadequate response plans
- Ageing infrastructure

## Features
- Intelligent Operations Centre – Smart City digital command control
- Integrated transport, water, energy and security systems
- Streamed video from vital infrastructure
- Weather and flood forecasting
- Maps showing locations of accidents and power failures
- Data integration software, communications technologies and analytics software

## Benefits
- Improved public safety
- Improved coordination between 30+ agencies and private companies
- Improved utilisation of vital city infrastructure
- Quick detection and response to infrastructure failures
- Advanced warning of potential breakdowns
- Fast information dissemination
- Enhanced preparedness for future events (2016 Olympics)
Network Management and Safety
Active Traffic Management

Managed Motorways - Melbourne
<table>
<thead>
<tr>
<th>Needs</th>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended periods of congestion</td>
<td>Coordinated ramp metering</td>
<td>Improved operational outcomes</td>
</tr>
<tr>
<td>• 3-8 hours per day</td>
<td>• 62 entry ramps</td>
<td>42% reduction in travel times</td>
</tr>
<tr>
<td>Key freight link</td>
<td>• HERO algorithm</td>
<td>30% reduction in crashes</td>
</tr>
<tr>
<td>• 160,000 vehicles per day</td>
<td>• Balancing of queues</td>
<td>11% reduction in emissions</td>
</tr>
<tr>
<td>• 20,000 commercial vehicles</td>
<td>Variable speed limits</td>
<td>$2m savings per day</td>
</tr>
<tr>
<td>Declining peak hour throughput</td>
<td>Automated incident detection</td>
<td>Improved utilisation of asset</td>
</tr>
<tr>
<td>Longer/less reliable travel times</td>
<td>Incident management</td>
<td>Minimised flow breakdown</td>
</tr>
<tr>
<td>Reduced level of service</td>
<td>Traveller information</td>
<td>Enhanced traffic flow recovery</td>
</tr>
<tr>
<td>Greater risk of incidents and reduced safety</td>
<td>STREAMS ITS Platform</td>
<td>Optimised speed and throughput</td>
</tr>
<tr>
<td>Lost productivity</td>
<td></td>
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</tbody>
</table>
## Needs
- Manual methods limit effectiveness of response
- Lack of linkages between public and private systems
- Limited effectiveness of arterial incident management systems
- Lack of integration and data sharing
- Need to maintain Hong Kong’s competitiveness as an international city

## Features
- Computerised system to automate incident detection
- Generates recommended traffic and transport plans
- Provides a common view of traffic information
- Streamlines dissemination of information to the public
- Includes off-line and on-line traffic modelling capability
- Coordinates legacy and future traffic control systems

## Benefits
- Improved operational outcomes
- Quicker responses and flow recovery
- Reduce time to detect incidents by up to 40%
- Reduce incident duration and travel times
- Disseminate information to the public in a timely manner
- Reduce resources to operate Transport Management Centre
- BCRs greater than 6.0 have been reported
Travel Information
En-Route Traveller Information

Travel Time Information

EXIT  MAINS ROAD  5 MIN
EXIT  BIRDWOOD ROAD  10 MIN
EXIT  TURBOT STREET  20 MIN
## En-Route Travel Information

<table>
<thead>
<tr>
<th>Needs</th>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased congestion on urban roads and motorways</td>
<td>Enhanced Variable Message Signs</td>
<td>Improved travel time reliability</td>
</tr>
<tr>
<td>Unreliable travel times</td>
<td>Cumulative travel times (minutes) to each exit</td>
<td>Motorists have access to accurate real-time information</td>
</tr>
<tr>
<td>Lack of information on travel options and alternative routes</td>
<td>Colour bands to indicate congestion levels</td>
<td>Motorists are informed of conditions on congested roads</td>
</tr>
<tr>
<td>Inaccurate [real-time] information on travel conditions</td>
<td>Combination of static and dynamic message elements</td>
<td>Motorists can choose alternative routes which can reduce congestion</td>
</tr>
<tr>
<td>Provide opportunities to choose less congested routes</td>
<td>Travel time and incident management</td>
<td>Advanced warning of potential breakdowns</td>
</tr>
</tbody>
</table>

BCRs around 25 have been reported in different studies
# Virginia 511 Traffic Information

## Needs
- Increased congestion on urban roads and motorways
- Unreliable travel times
- Lack of mobile travel information tools which meet traveller expectations
- Inaccurate [real-time] information on travel conditions
- Improved utilisation of roads by providing opportunities to choose less congested routes

## Features
- P3 Project
- VDOT paid for software development
- Operations and maintenance paid by advertising
- Real-time travel times
- Traffic maps showing incidents
- Dynamic message signs
- Traffic cameras
- VDOT Twitter messages
- Traffic and weather alerts
- Traffic speeds on major routes
- Google-based maps

## Benefits
- Improved operational outcomes and more reliable travel times
- Motorists have access to mobile real-time, accurate and reliable travel time information
- Motorists are informed of travel conditions on congested corridors
- Motorists have opportunities to choose alternative routes which can reduce congestion
- Advanced warning of events
- Fast information dissemination
- BCRs of 25 have been reported in different studies
Freight Efficiency

Port Operations

Access Control and Traffic Management
# Port Access Control and Traffic Management

## Needs
- Truck queues spilling onto adjacent road network
- Better management of vehicle movements within ports
- Faster processing of freight vehicles
- Manage the risks of vehicle collisions
- Improve turnaround times and reduce queuing within sites

## Features
- Vehicle identification, detection and guidance using ALPR and RFID
- Technologies for truck marshalling area
- Monitoring of site operations
- Booking system
- Back office systems for data processing, calculation of tenant KPIs and invoicing

## Benefits
- Improved operational outcomes
- Improved information and measures to manage the overall supply chain operation
- Improved utilisation of port facilities
- Improved safety and security
- Improved compliance with port policies including pricing
- Positive industry exposure and best practice port operations
### Needs
- High population growth
  - 45 percent (30 years)
- High traffic growth
  - ADT: 290,000 (2000)
  - ADT: 360,000 (2030)
- Low travel speeds (peak hour)
  - General use lanes: 20 mph
  - HOV lanes: 20 mph
- High bus service demand
- Poor travel time reliability

### Features
- Congestion (traffic responsive) priced tolls
- Electronic toll collection
- Two EL each direction – Free for HOV
- Ramp Metering
- Incident Management
- Bus Rapid Transit
- Enhanced Enforcement
- Peak Toll: $2.18 (Average)
- Design-Build contract

### Benefits
- Improved business and operational outcomes
- Improved travel speeds
  - Average 45 mph (99.4%)
  - Peak: 59 mph (EL)
- Increased availability
  - 93% (EL Open)
- Improved utilisation of asset
- Monthly Revenue
  - $1.61 million
Procurement and Finance Trends
## Private Sector ITS Services

### Trends

<table>
<thead>
<tr>
<th>Service</th>
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</thead>
<tbody>
<tr>
<td>Transport Management Centre (TMC) Operations</td>
</tr>
<tr>
<td>ITS Maintenance</td>
</tr>
<tr>
<td>Contract Management</td>
</tr>
<tr>
<td>TMC Information Technology</td>
</tr>
<tr>
<td>Public Relations and Information</td>
</tr>
<tr>
<td>Traffic Operations and Engineering</td>
</tr>
</tbody>
</table>
Trends

Service Level Agreements cover O&M, reliability and quality control

Performance based contracts, or penalty provisions to address non-compliance

Models widely implemented across the USA
Reported Benefits – FDOT D4

2010 SMART SunGuide ITS Annual Report
Florida Department of Transportation, District Four
Fort Lauderdale, Florida

Benefit-Cost Ratio

- 2004: 7.86
- 2005: 10.44
- 2006: 14.94
- 2007: 16.19
- 2008: 15.60
- 2009: 13.91
- 2010: 12.99
Revenue Generation and Financing Tools

Trends

Pricing e.g. Managed Lanes

R&D: test-bed for innovations and funding from government and private sector

Annual fees for access to data by third party providers (e.g. smartphone apps)

Fibre sharing

Website advertisement

Sponsorship of service patrol vehicles

Infrastructure naming rights
Policy Principles
Emerging Trends
## Connected Mobility Principles

<table>
<thead>
<tr>
<th>Conventional Approaches</th>
<th>Future Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building additional infrastructure capacity (focus on supply)</td>
<td>Maximising efficiency, resilience, and sweating of assets (focus on managing demand)</td>
</tr>
<tr>
<td>Vehicle-oriented</td>
<td>People-oriented</td>
</tr>
<tr>
<td>Focus on reacting to congestion</td>
<td>Customer-centric</td>
</tr>
<tr>
<td>Emphasis on “knowing and seeing”</td>
<td>Focus on positive business and operational outcomes</td>
</tr>
<tr>
<td>Spending on physical infrastructure</td>
<td>Emphasis on “predicting and anticipating in order to avoid”</td>
</tr>
<tr>
<td></td>
<td>Spending on data fusion, predictive analytics, integration, decision support systems and adaptive tools</td>
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Road Safety: eCall

1. Emergency Call
A 112 emergency call (eCall) is made automatically by the car as soon as on-board sensors (e.g., airbag sensors) register a serious accident. By pushing a dedicated button in the car, any car occupant can also make an eCall manually.

2. Positioning
Via satellite positioning and mobile telephony caller location, the accurate position of the accident scene is fixed and then transmitted by the eCall to the nearest emergency call centre. More information is given in the eCall, e.g., the direction of travel and the vehicle type.

3. Emergency call centre (PSAP)
The eCall’s urgency is recognized, the accident’s location can be seen on a screen. A trained operator tries to talk with the vehicle’s occupants to get more information. If there is no reaction, emergency services are sent off without delay.

4. Quicker help
Due to the exact knowledge of the accident’s location, the emergency services (e.g., ambulance, fire fighters, police) arrive much quicker at the crash site. Time saved translates into lives saved.

eCall: The crashed car calls 112!

http://ec.europa.eu/
Road Safety - **Cooperative Mobility**

**V2V and V2I**

Create cooperation amongst drivers, their vehicles and the road and transport infrastructure

IntelliDrive (USA) safety applications estimated to result in 80 percent reduction in crashes involving unimpaired drivers

www.cvisproject.org
Dynamic Online Simulation

Platform for testing effectiveness of incident management scenarios in real-time
Road Safety – **Intelligent Speed Assist**

**“Pay As You Speed”**

Extension of ISA technologies by linking speeding profile to insurance premiums

Measured through automatic count of penalty points whenever the speed limit is exceeded
Electric Vehicles

Smart Infrastructure
Integrating EV charging network into a coherent transport management and smart infrastructure plan, designed to enhance mobility and improve air quality
ITS solutions have potential to support the three pillars of sustainable development:

- Environment – reducing the emissions footprint
- Economics – improving efficiencies
- Equity – more equitable pricing of trips

Substantial benefits can be achieved at lower costs than investment in new infrastructure

- Private sector increasingly playing key role in provision of ITS
- Must be part of holistic vision that address key strategies for integrating broad social, environmental and economic goals