Traffic Control and Surveillance System (TCSS)
Infrastructure, Challenges and Trends

Ir Roman Choi
14 January 2010
Traffic Control and Surveillance System

WHAT
Traffic Control and Surveillance System

**WHAT**

Centralized
Computerized
Integrated

Traffic
Control
and
Surveillance

Freeway
System 
Design & Implement

Traffic
System
Traffic Control and Surveillance System

OBJECTIVES
Traffic Control and Surveillance System

OBJECTIVES

- Traveling time
- Congestions
- Accidents
- Fuel consumption
- Air pollution

- Accident Response Time
- Traffic Mobility
- Road Capacity
- Information
- Road Safety

14 January 2011

Ir R Choi
Traffic Control and Surveillance System

HOW
Traffic Control and Surveillance System

HOW

- Surveillance
- Lane Management
- Traffic Information Dissemination
- Tunnel Management
- Bridge Management
- Centralized Traffic Monitoring
- Speed Enforcement
Traffic Control and Surveillance System

HOW

- Surveillance
  - CCTV System
  - Overheight Vehicle Detection System
  - Vehicle Detection System and Automatic Incident Detection System
- Emergency Telephone System
- Lane Management
- Traffic Information Dissemination
- Tunnel Management
- Bridge Management
- Centralized Traffic Monitoring
- Speed Enforcement
Traffic Control and Surveillance System

**HOW**

- Surveillance
- **Lane Management**
  - Lane Use Signal
  - Traffic Plans
- Traffic Information Dissemination
- Tunnel Management
- Bridge Management
- Centralized Traffic Monitoring
- Speed Enforcement
Traffic Control and Surveillance System

HOW

- Surveillance
- Lane Management
- Traffic Information Dissemination
  - Variable Speed Limit Sign
  - Prismatic Sign
  - Fully Variable Message Sign
- Radio Re-broadcast System and Public Address System
- Tunnel Management
- Bridge Management
- Centralized Traffic Monitoring
- Speed Enforcement
Traffic Control and Surveillance System

HOW

- Surveillance
- Lane Management
- Traffic Information Dissemination
- Tunnel Management
  - 15 Tunnels with TCSS
  - 100% Surveillance Coverage
  - Contra-Flow Operation
  - Environmental Monitoring System (NO2, CO, Visibility)
- Bridge Management
- Centralized Traffic Monitoring
- Speed Enforcement
Traffic Control and Surveillance System

HOW

- Surveillance
- Lane Management
- Traffic Information Dissemination
- Tunnel Management
- Bridge Management
- Tsing Ma Bridge & Kap Shui Mun Bridge firstly opened in 1997
- Weather Management
- Centralized Traffic Monitoring
- Speed Enforcement

14 January 2011
Traffic Control and Surveillance System

**HOW**

- Surveillance
- Lane Management
- Traffic Information Dissemination
- Tunnel Management
- Bridge Management
- Centralized Traffic Monitoring
  - Traffic Management and Information Centre (TMIC)
  - ETCC in Transport Department
  - ETCC in Police and Highway Department
- Speed Enforcement
Traffic Control and Surveillance System

**HOW**

- Surveillance
- Lane Management
- Traffic Information Dissemination
- Tunnel Management
- Bridge Management
- Centralized Traffic Monitoring
- **Speed Enforcement**
  - By Police
  - By MOM Operator
  - Future integrate into TCSS
Traffic Control and Surveillance System

WHO
Traffic Control and Surveillance System

**WHO**

- Government
  - Planning new route
    - Control & Management Concepts
      - Design & Construction
        - Operation & Maintenance

Government + TCSS Consultant

TCSS Consultant + TCSS Contractor

TCSS Contractor + MOM Contractor
Traffic Control and Surveillance System

WHERE and WHEN
[1989] Eastern Harbour Crossing
[1990] Shing Mun Tunnel
[1991] Tate’s Cairn Tunnel
[1997] Lantau Fixed Crossing and Route 3
[1997] Western Harbour Crossing
[1998] Tai Lam Tunnel and Route 3 (Country Park)
[2001] Kai Tak Tunnel
[2002] Tseung Kwan O Tunnel
[2002] Tsing Yi North Costal Road
[2003] Aberdeen Tunnel
[2007] Deep Bay Link
[2007] Lion Rock Tunnel
[2008,2010] Route 8
[2010] Cross Harbour Tunnel
Traffic Control and Surveillance System

ENGINEERING
Example: Overheight Vehicle

Transmission Data Network
Public Address System
Radio Comms
CCTV
Lane Control Device
Information Signage
TCSS Central Software
Detection System (OHV Detector)
Operation Facilities
Alarm

Example: Overheight Vehicle

Transmission Data Network
Public Address System
Radio Comms
CCTV
Lane Control Device
Information Signage
TCSS Central Software
Detection System (OHV Detector)
Operation Facilities
Alarm
Example: Congestion

Transmission Data Network

CCTV

Lane Control Device

Information Signage

External Interface

Operation Facilities

Detection System (Vehicle Detector)

Alarm

AID

TCSS Central Software

Transmission Data Network
Example: Central Software Failure
Traffic Control and Surveillance System

CCTV Surveillance Development

- Analogue System → Digital System
- Tape Recording → HDD Recording
- Individual Network → Integrated Network
- Local Surveillance → Public Broadcast
- Limited monitoring points → Multiple monitoring points
- Operation Concern → Public Concern (Privacy Zone)
Traffic Control and Surveillance System

CCTV Surveillance Future

- Less Data Rate but Higher video quality
- Larger system size
- Rely more on Video Analytic and Auto-Detection
- Less Operator Patrol
- Video repeat to Public (TV, Internet, Mobile Phone)
Traffic Control and Surveillance System
Vehicle Detection and Automatic Incident Detection Development

Pavement Invasive Detector ➔ Non-Pavement Invasive Detector
Radio Frequency Detector ➔ Video Imaging Detector
Detection rely on single detector ➔ System-wide detectors
Detection based on variables ➔ intelligent algorithms
Constant logic ➔ Adaptive Logic
Traffic Control and Surveillance System
Vehicle Detection and Automatic Incident Detection
Future

- Integrate with CCTV System, share camera
- Integrate with JTIS
- Traffic Condition for General Public
Traffic Control and Surveillance System
Lane Use Signal and Info Signage Development

Light Source: Halogen ➔ LED
Routine Maintenance ➔ Maintenance Free
Proprietary Protocol ➔ Standard Protocol
Traffic Control and Surveillance System
Lane Use Signal and Info Signage
Future

- More effective employment of LUS (educated public)
- Widely use of Fully Variable Message Sign
- Introduce new kinds of signs (eg. Speed Map)
- More ad-hoc informative message
- Quantity of signs increases
Traffic Control and Surveillance System
Transmission Data Network
Development

Copper ➔ Fibre Optic
Purely wired communication ➔ Accept wireless communication
Individual Network ➔ Integrated Transmission
Low Bandwidth ➔ High Bandwidth
Serial Data Transmission ➔ Ethernet Transmission
Traffic Control and Surveillance System
Transmission Data Network
Future

- Demand on bandwidth increases (Operational demands and technical demands)
- Single, Integrated Network
- No longer limited to independent LAN
- Security Issues
- Flexible for Expansion and Integration
- Wireless Communications
Traffic Control and Surveillance System

TCSS Central Software Development

- Single Redundancy level ➔ Multi-level redundancy
- Schematic Graphical User Interface ➔ Map-based GUI
- Un-Editable Database ➔ scaleable and Expandable
- Sub-systems: Individual GUI ➔ Integrated GUI
- Pre-defined Traffic Plan ➔ Rule-based Traffic Plan
Traffic Control and Surveillance System

TCSS Central Software

Future

- More Automation, less human interfere
- Single System for multiple sites
- Operation Control share among on-site and off-site centres
- Off-site maintenance
Traffic Control and Surveillance System

Voice Communications
(Radio Comm + Emergency Telephone + Public Address System)

Development

Analogue System ➔ Digital System

Individual Network ➔ Integrated Network

Open area ET ➔ Tunnel only ET

Voice Archive no compression ➔ compression

No Redundancy ➔ Redundant PABX and self healing
Traffic Control and Surveillance System

Voice Communications
(Radio Comm + Emergency Telephone + Public Address System)

Future

- Voice Sub-systems merge into a single voice system
- Digital, Encrypted Voice System
- Integrated with Mobile Phone
- Emergency Telephone System – fade out
Traffic Control and Surveillance System

CHALLENGE
Traffic Control and Surveillance System

CHALLENGE

- Environmental
- Maintenance
- Public Awareness
Traffic Control and Surveillance System

Environmental

- Energy Saving
  Use of LED, multi-level dimming

- Equipment Saving
  Integrated system design, common network, common workstation

- Material Saving
  Replace copper by fibre, integrate data transmission, 3 in 1 signal head

- Upgrade and Expand
  Modular design, standard protocol
Traffic Control and Surveillance System

**Maintenance**

- **Maintenance and Repair**
  - Public monitor on faulty equipment
  - Public rejection on road works
- **Maintenance Free**
  - Lubricate, replace consumable parts
- **Cost**
  - Maintenance Cost, traffic impact, accident cost
Traffic Control and Surveillance System

Public Awareness

- Privacy Issue
  - Example: Electronic Road Pricing
  - Example: Journey Time Indication System
  - TCSS: Surveillance Camera
- Road Works
  - More concerns and voice on TTA
- Information dissemination
- Public Expectation vs Technical Limitation
Traffic Control and Surveillance System

Hong Kong

TCSS in Hong Kong since 1989

Quietly serve Hong Kong Traffic: the most effective and efficient road network around all neighbouring cities

Benchmark and Model for many other cities

New TCSS to come

Central-Wan Chai By-pass, Tuen Mun Road Widening, Tolo Highway Widening, Central Kowloon Route

Expand and Connect to neighbouring cities

Hong Kong – Zhuhai – Macao Bridge