

# ITS Development in Singapore

Dr Chin Kian Keong  
Chief Engineer  
Land Transport Authority of Singapore



# Singapore Road Transport

**3,500**km  
Road Network



**5**km/square km  
Road Density



**1** car / **10** persons  
Car Ownership

**960,000**  
Total Vehicles Population  
575,000 private cars



# Tackling The Challenges

- Adopt a holistic and integrated approach
- Deploy innovative technologies and advance traffic management tools to complement policies & regulations
- Close collaborations between government agencies, industries and academic institutions



# Integrated ITS Approach

## 1. Intelligent sensors and equipments

Surveillance  
Cameras



Traffic Light  
Controls &  
Green Man+



Webcams



Parking  
Guidance Info



Expressway  
Monitoring &  
Advisory System



Vehicle  
probe data



## 2. Integrated Traffic Monitoring and Control



**ITS CENTRE**

Intelligent Transport Systems Centre

**One Central ITS Platform**

Incident  
Management



Tunnel Monitoring  
& Control



Emergency  
Response



Data Analysis &  
Traffic Advisory



Unified Equipment  
Maintenance



## 3. Optimizing Traffic Operations

# Integrated Public Transport Approach

## 1. Bus IoT Sensor



Ruggedized SIM on ALL buses



Common Fleet Management System

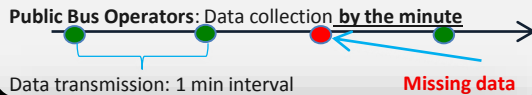
Seamless Travel with Contactless Card



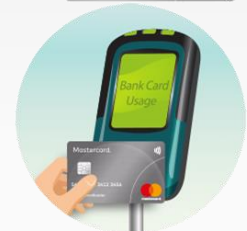
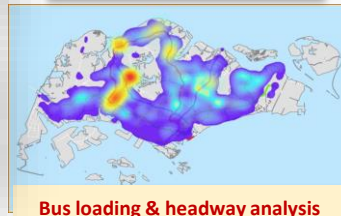
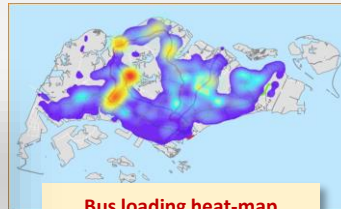
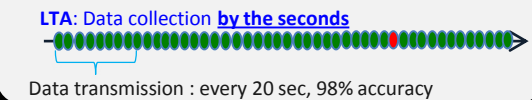
## 2. Data Analytics

Improved Data Quality

**Before**



**After**



## 3. Real-Time Transport Information



Bus Arrival Panel



A MEDIA CORP Station  
Radio broadcast of live traffic news



Smartphone traffic apps



Live traffic on social media

# Reliable Real-Time Transport Information



*Smartphone traffic apps*



*Live traffic on social media*



*Radio broadcast of live traffic news*



*On-site traffic advisory and parking info*

**Real-time info on the move – anytime, anywhere**

**Comprehensive and integrated transport info**

**Reliable, relevant and intuitive information**

# Reliable Bus Services & Timely Bus Arrivals

- **Reducing** Headways
- **Schedule** Adherence
- **Improved** Navigation
- **Real-time** Tracking
- Greater **Operational Efficiency**
- **Unified System**

## Common Fleet Management System



- **Reduced** Waiting Time
- **Accuracy of 95%** up to 4 stops away
- Powered by **5,000 IoT Sensors** across Bus Fleet
- **Innovation** and **Co-creation** with public via DataMall
- API downloads per month > **600M** from DataMall

## Bus Arrival Information



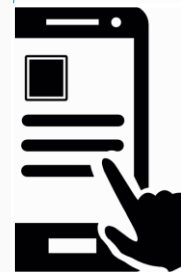
# Seamless Travel With Contactless Card



100,000  
Pilot Users



No need to top up separate fare card



Commuters can track their journey and fare payment history via the Web Portal or Mobile Services app





# Traffic Light Control Systems – Green Link DEtermining (GLIDE) System & Green-Man Plus (GM+)



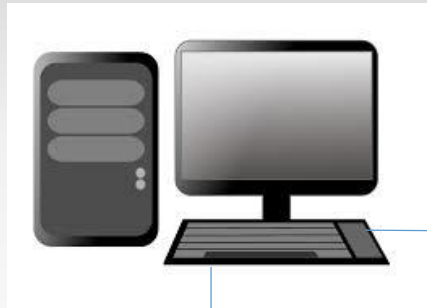
Detection of vehicles



Detection of pedestrians

\*Elderly and Mobility Challenged group of users can be detected through the use of dedicated cards

Regional Computer



Centralised Management System



Local Controller



Traffic light signals



Countdown timer for pedestrians

# Expressway Monitoring & Advisory System

- **Replacement** of existing Variable Message Signs (VMS) to full-colour matrix
- Richer **graphics** to display incident info and traffic advisory messages
- **Colours** to indicate travel time information
- **Simple** and **intuitive** messages/graphics for quicker response and decision-making
- **More cameras** for detection and monitoring



Colour-Coded Travel Times



Graphical Incident Message



Web Camera



Detection Camera



Surveillance Camera


# Vehicle Probes Data – TrafficScan



- Taxis equipped with [Global Navigation Satellite System \(GNSS\)](#) provide real-time information on their locations and speeds as they ply along roads.
- Fused with other sensor source speed data to translate to [real-time travel information](#) on roads to motorists.

# Current ITS in Summary

**500**  
signalised crossings with  
  
**Green Man Plus**

 **393** Variable Message Signs  
on Expressways & Major Arterial Roads

 **1,600** Detection Cameras with image processing technology

  
**77** ERP Gantries

 **1,600** Electronic Parking Systems



**2,200** Sets of Adaptive Traffic Signals

  
**16 million** Public Transport Transactions daily for **Data Analytics**

  
**23 million** Page-views monthly for **MyTransport.SG**

**114,000** Island-wide Lampposts with sensors



Fixed and mobile radars:

**88** Radar-based traffic data collection systems



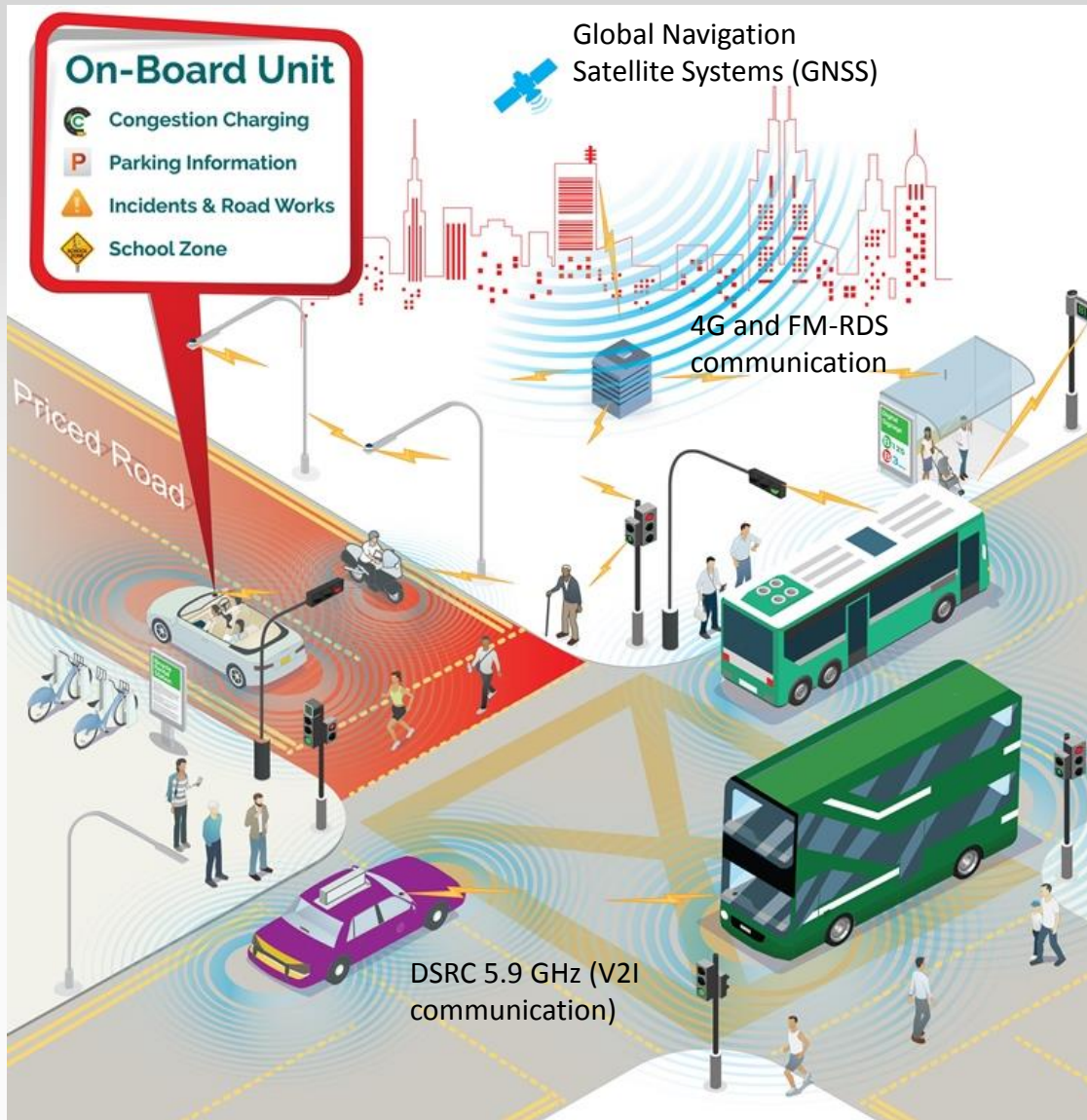
**176** MRT Stations Wifi@MRT

  
Data Transmitters on **5000** Buses

**28,000** Taxis for Data Collection



# Next Generation Electronic Road Pricing



## Greater Flexibility

Managing traffic congestion with point charging and distance-based charging on congested roads

## Driving Conveniences

Providing real-time advisories on prevailing traffic conditions to improve driving experiences

## Value-Added Services

Facilitating payment for roadside parking, toll payments (at Checkpoints) and travel-related fees

# Self-Driving Vehicles

## Self-Driving Bus

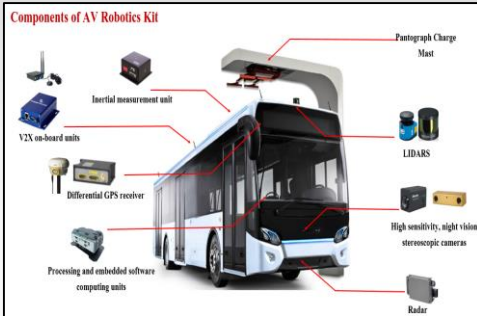


Photo by: NTU

- Improve productivity, safety and reliability of bus services
- Overcome shortage of bus drivers

## Self-Driving On-Demand Mobility



Photo by: Delphi

- First-mile Last-mile connections to public transport
- Automated Responsiveness to meet demand

## Self-Driving Truck Platoon



Photo by: SAE Off-Highway Engineering Online

- Each driver can command more trucks and carry more containers
- Encouraging more trucking activities to be carried out at off-peak hours.

## Self-Driving Utility vehicle



Photo by: The Livingstone Weekly

- Cleaning up our environment is a manpower-intensive job
- Self-move at a slow speed to clean up our environment at night.

# Self-Driving Vehicles Trial @ one-north

## one-north public route for AV testing

- 4 AVs granted approval



## Dedicated Short Range Communications (DSRC) beacons

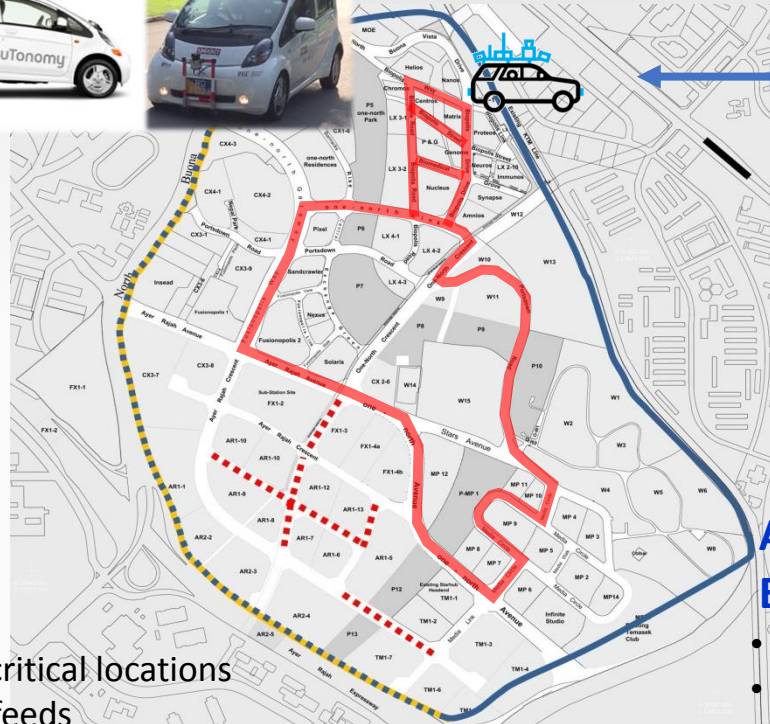
- Position augmentation
- V2I information dissemination



## Surveillance Cameras



- CCTV placed at strategic and critical locations
- Real time streaming of video feeds
- Video recording
- Enable remote monitoring



## AV Performance Evaluation System

- AV Monitoring and Evaluation
- Manage V2I information dissemination

# Centre Of Excellence for Testing & Research of AVs-NTU (CETRAN)

- A dedicated **enclosed test circuit** in CleanTech Park is currently being developed to support all the AV testing and certification activities.
- The area can also be used to **test other new ITS technologies** and **sensors**.





# Electric Vehicle (EV) Initiatives

Electric Car Sharing



A fleet of **1,000** shared electric vehicles



**2,000** charging points  
(Up to **400** for public use)

Electric Bus Trial

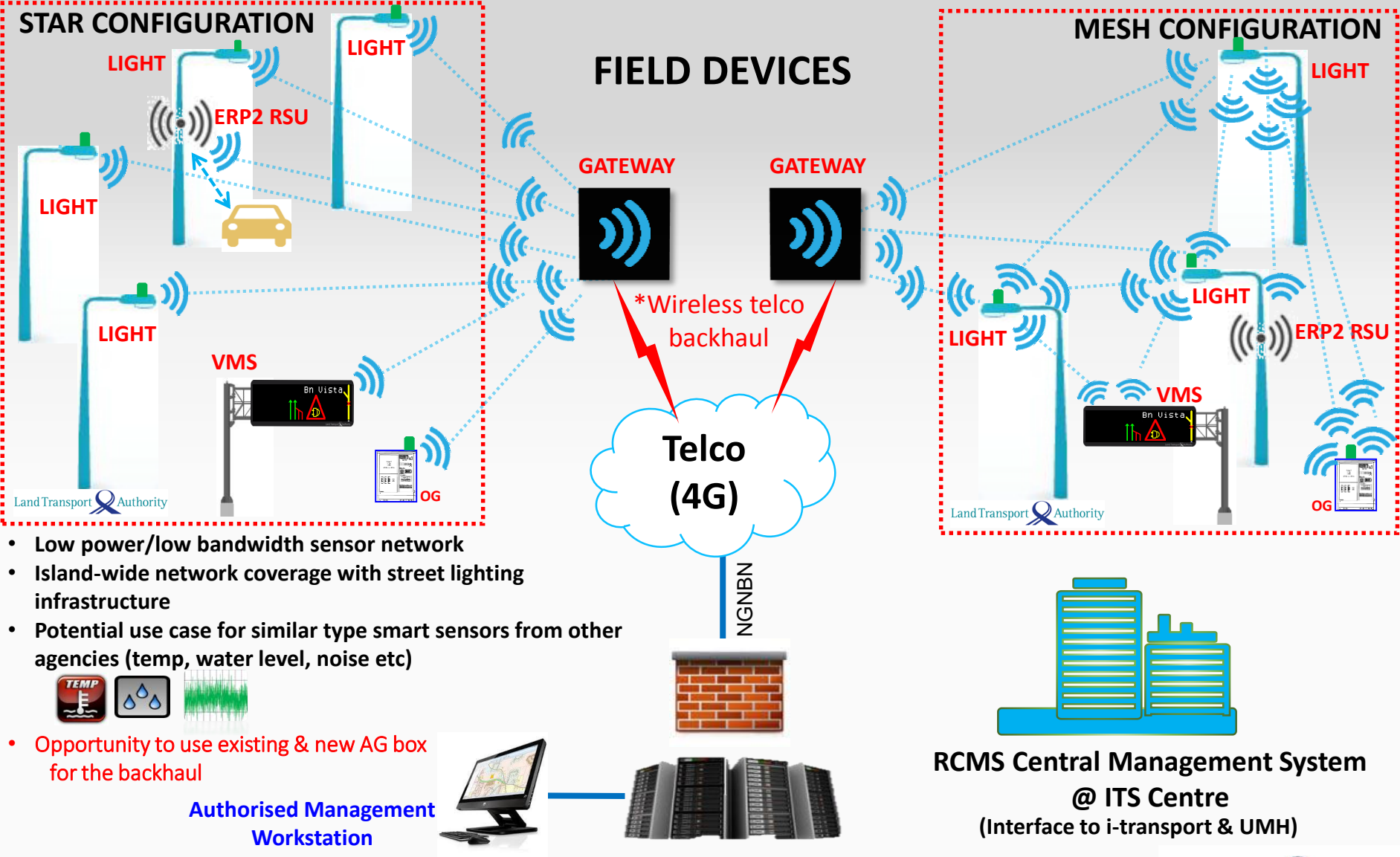


Electric Taxi Trial



# Smart Street Lighting

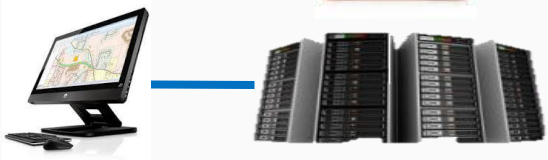
Leveraging on Smart Street Lighting Field Area Network Comms



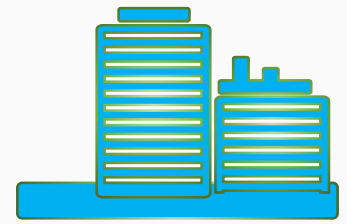
- Low power/low bandwidth sensor network
- Island-wide network coverage with street lighting infrastructure
- Potential use case for similar type smart sensors from other agencies (temp, water level, noise etc)



Authorised Management Workstation



RCMS Central Management System @ ITS Centre (Interface to i-transport & UMH)





We look forward to welcoming you to  
*Singapore*



People and Technology **in Motion**

21 - 25 October 2019