Singapore Autonomous Vehicle Initiative (SAVI)
Singapore
Land area: 719 km²
Population: 5.7 mil
Density: 7,697 /km²

Source: www.singstats.gov.sg
Singapore Road Transport

- **5 km/square km**
  - Road Density

- **3,500 km**
  - Road Network

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

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

Source: LTA Publications & Research
Our Key Challenges

Increasing Travel Demand
Population increase, intensive development and change in lifestyle

Land Constraints
12% of total land used for road and land transport infrastructure

Shortage of Labour
Truck, lorry and bus drivers

Ageing Population
30% aged 65 and above by 2030
Our Key Strategies towards a Sustainable Transport Eco-System

- **Reduce Reliance on Private Transport**
  Promoting car sharing and mobility on demand

- **Increase Public Transport Usage**
  Promoting and making public transport accessible and reliable

- **Encourage Cycling and Walking**
  For first-mile and last-mile travel

Sustainable Transport Eco-System
Value Propositions of Autonomous Vehicles

Increase productivity
Autonomous buses to tackle problem of labour shortage

Increase road safety
AVs enable ageing population to maintain freedom of mobility while ensuring safe driving

Optimise road capacity
AVs enable ageing population to maintain freedom of mobility while ensuring safe driving

Enabling new mobility concept in new towns
AV Mobility-On-Demand and AV vehicle-sharing schemes to complement walking and cycling in new towns

Increase R&D Value-Add
Singapore is a Living Laboratory and is ideal for conducting test-bed for AV development and deployment
Roadmap and Progress of AV program in Singapore

**August 2014**
- Formation of CARTS
- Launch of SAVI

**June 2015**
- Launch of RFI for AV Bus, Mobility-On-Demand (MOD) and AV Centre of Excellence

**May 2016**
- Launch of RFP for AV Truck Platooning

**April 2017**
- Launch AV Bus trial with NTU and ST Kinetics

**January 2015**
- Launch of one north test-bed area for AV trial on public roads

**August 2015**
- Launch of 2 AVs live trial in one north

**August 2016**
- Launch of Centre of Excellence for Testing and Research of AVs
- Launch of AV MOD trial with nuTonomy and Delphi

**2018 – 2019**
- Operational Trial

**Beyond 2020**
- Pilot Deployment in new town

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AV and V2X Test-Bed @ one-north

**one-north public route for AV testing**
- 4 AVs granted approval

**AV Performance Evaluation System**
- Real-time AV Monitoring
- Scenario re-creation and Evaluation
- Information collection and dissemination

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

**Dedicated Short Range Communications (DSRC) beacons**
- Position augmentation
- V2I information dissemination

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Autonomous Truck Platooning Trial

How truck platooning works

The driver in the first container truck leads the three driverless trucks, to which it is linked via wireless communications.

The vehicles can be coupled and decoupled to allow other road users to cross between the vehicles in the convoy.

Vehicle detection, anti-collision and lateral control technologies are incorporated for safety reasons.

During the second phase of the trial, expected to take place between January 2018 and December 2019, the trucks will be tested along a 10km stretch of West Coast Highway between the Brani and Pasir Panjang Terminals.

Sources: MOT and PSA STRAITS TIMES GRAPHICS
Autonomous Bus Trial

R&D and trial on Autonomous bus for fixed and scheduled services for intra- and inter-town travel.

MOU signing between LTA and ERI@N on 19 Oct 2016

MOU signing between LTA and ST Kinetics on 10 April 2017
Launch of Centre of Excellence for Testing & Research of AVs-NTU (CETRAN)

Launched on 1 August 2016

Vision:
To be a leading AV Knowledge and Research Centre

Mission:
• To establish national AV testing and certification standards through R&D efforts and to contribute to international developments
• To build AV R&D testing capabilities in Singapore

CETRAN Partners:

CETRAN launched event
Launch of Centre of Excellence for Testing & Research of AVs-NTU (CETRAN)

An enclosed test circuit located at CleanTech Park is currently being developed to support all the dedicated AV testing and certification activities as well as other ITS testing.

Targeted to complete by end 2017
Other On-going AV Initiatives in Singapore

NAVYA trial at Nanyang Technological University (NTU)

Auto-Rider at Gardens by the Bay

Upcoming AV Mobility-on-Demand trial on Sentosa island
V2X Initiatives in Singapore
Next-Gen Electronic Road Pricing System

- More equitable
- Greater Flexibility
- More Driving Conveniences
- Value-added Services

Global Navigation Satellite Systems (GNSS)

4G and FM-RDS communication

DSRC 5.9 GHz (V2I communication)
V2I Cooperative ITS Applications

Enhancing Junction Safety Through V2X

Warning of blind-spot on coming vehicle

Warning of pedestrians crossing while vehicle is turning

Vehicle Priority at Traffic Junctions
Our 5.9GHz DSRC Standardisation Efforts

• A taskforce comprising government agencies, Industry players and Academic Institutions was formed in 2014 to establish and adopt the 5.9GHz DSRC standards for ITS in Singapore.

• Technical Standard for Dedicated Short-Range Communications (DSRC) in Intelligent Transport Systems (ITS) was released on 1 Oct 2016

• http://www.imda.gov.sg
Looking Ahead

• AVs provide opportunities to support a sustainable transportation eco-system within Singapore

• The convergence of Autonomous Vehicles (AVs) and Connected Vehicles (CVs) is likely to influence and change the way V2X technologies are deployed.

• Appropriate standards is key to catalyze and support the implementation of V2X technologies in future ITS applications
Thank You!!

See you at 26th ITS World Congress 2019