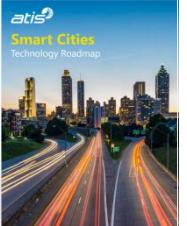


Smart Mobility

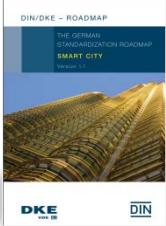
Ricky HO
**Chief Engineer / Smart Mobility
Transport Department**
06 Jan 2021

What is Smart Mobility

Smart City Roadmaps around the World



Smart City, Technology Roadmap
(Washington, DC, 2017)



Smart City Roadmap,
version 1.1
(Germany, 2015)



Smart City Roadmap 1.0
(Saratoga Springs, NY, 2016)



Better mobility in Copenhagen
(Copenhagen, Denmark 2016)



WHAT IS SMART DUBLIN?
Smart Dublin is an initiative of the Four Dublin Local Authorities to engage with smart technology providers, research institutions and the public to improve our city life.
Our mission is to work better for the enjoyment of Dublin's citizens, along with the city region it serves.

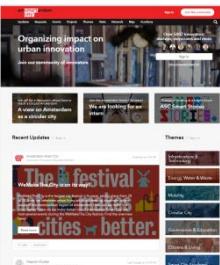
MISSION

- Provide Better Services – To develop, analyse and facilitate public services which are better, more efficient and accessible for citizens and better suited to their needs.
- Create a Smarter City – To support rapid economic development by helping to create an ecosystem that attracts and retains skilled people, promotes innovation and creativity, and creates opportunities for business and investment.
- Increase Collaboration and Engagement – To create effective internal and external partnerships between government agencies, businesses, individuals and international partners.

Smart Dublin (Dublin, Ireland,
<http://smartdublin.ie/>)



Stavanger Smart City –
roadmap and projects
(Stavanger, Norway, 2017)



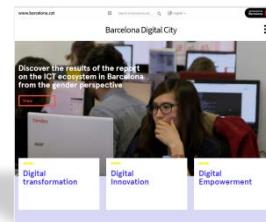
Amsterdam Smart City
(Amsterdam, Netherlands,
<https://amsterdamsmartcity.com/>)



Smart Nation (Singapore,
<https://www.smartnation.sg/>)



Smart Seoul (Seoul, Korea,
<https://jamesgreography8f.weebly.com/>)



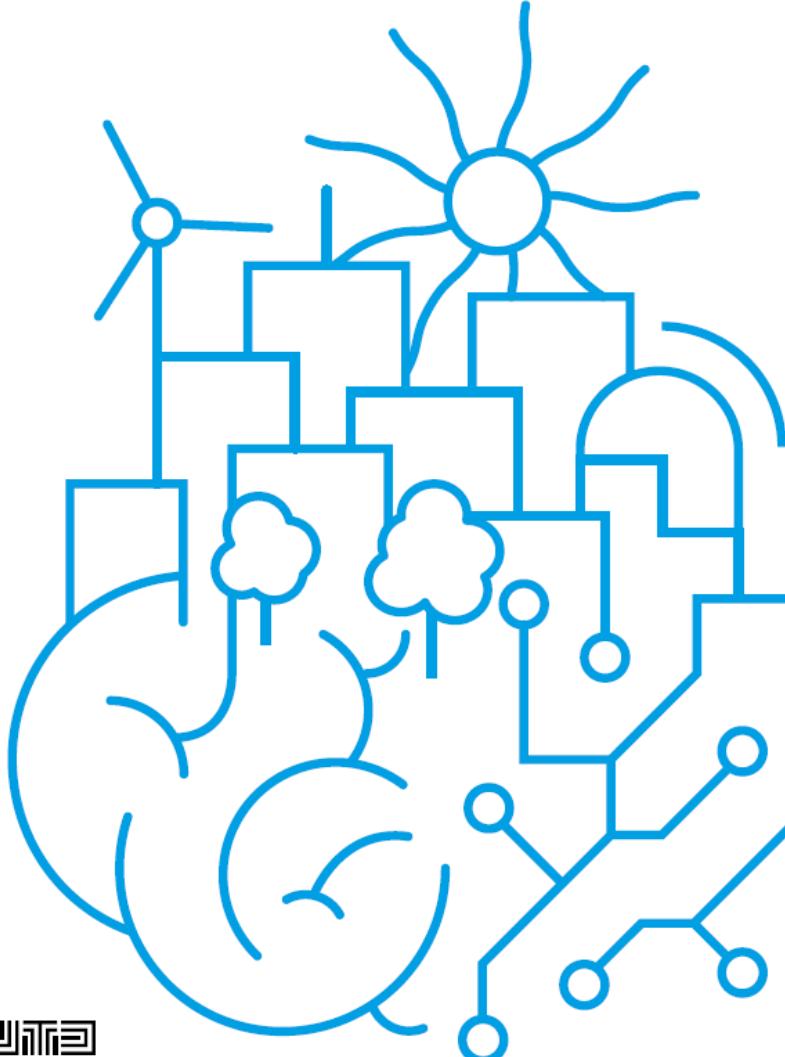
Barcelona Digital City (Barcelona, Spain,
<https://ajuntament.barcelona.cat/digital/en>)

What is Smart Mobility

Smart City Index 2020

A tool for action, an instrument for better lives for all citizens.

A collaboration between:

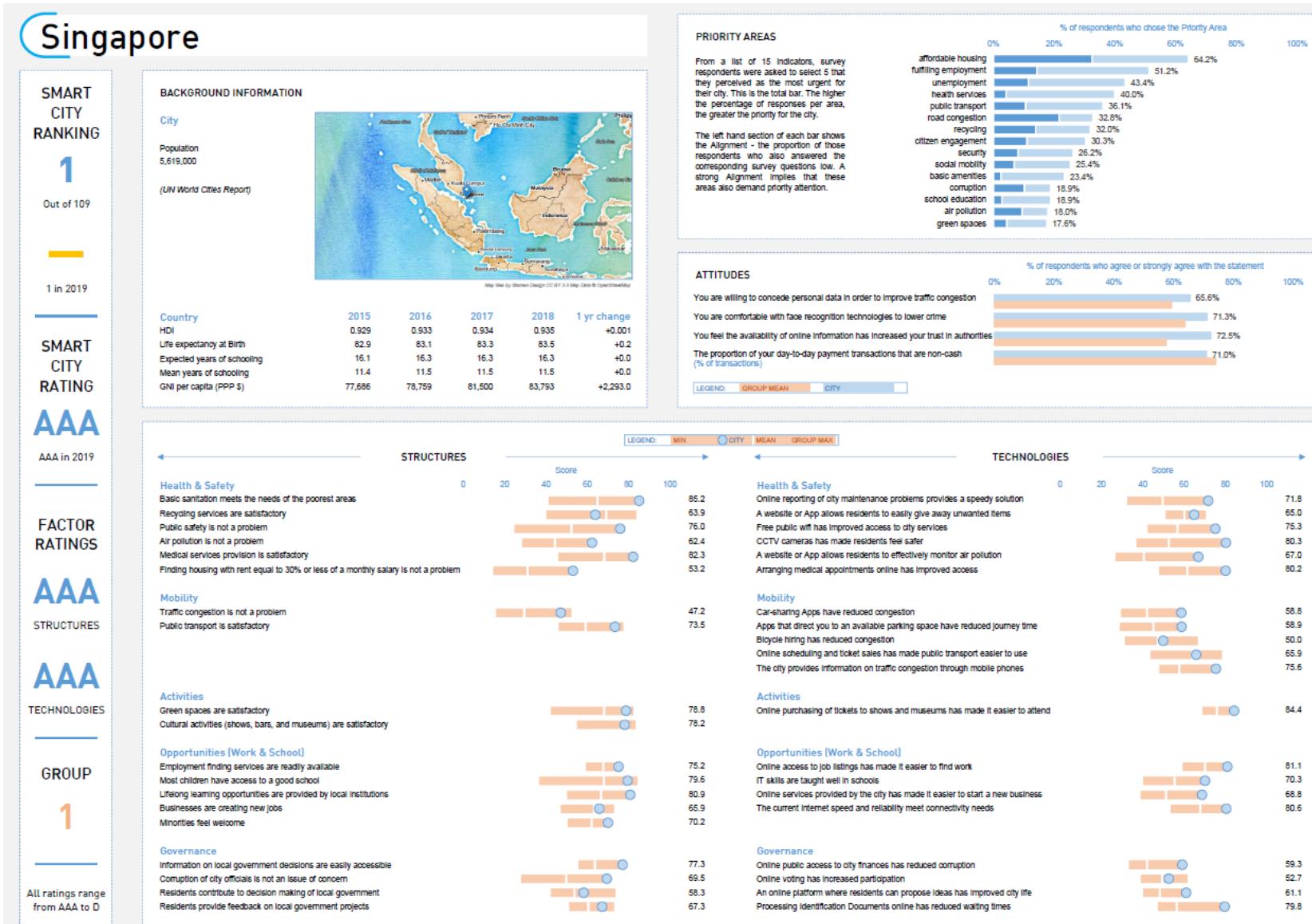


By the Institute for Management Development, in collaboration with Singapore University for Technology and Design (SUTD) – Sep 2020

(<https://www.imd.org/smart-city-observatory/smart-city-index/>)

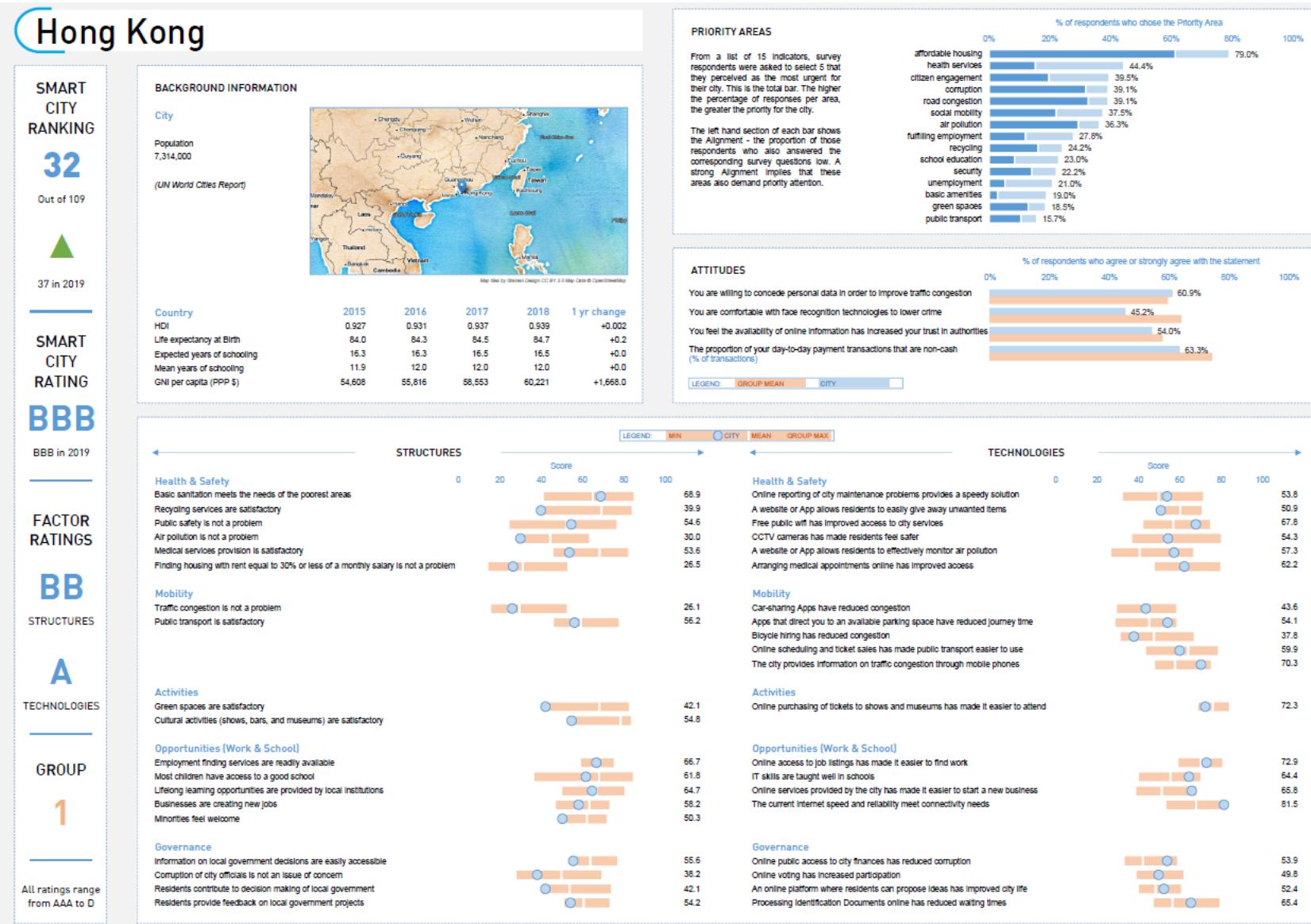
What is Smart Mobility

From Smart City Index 2020



What is Smart Mobility

From Smart City Index 2020

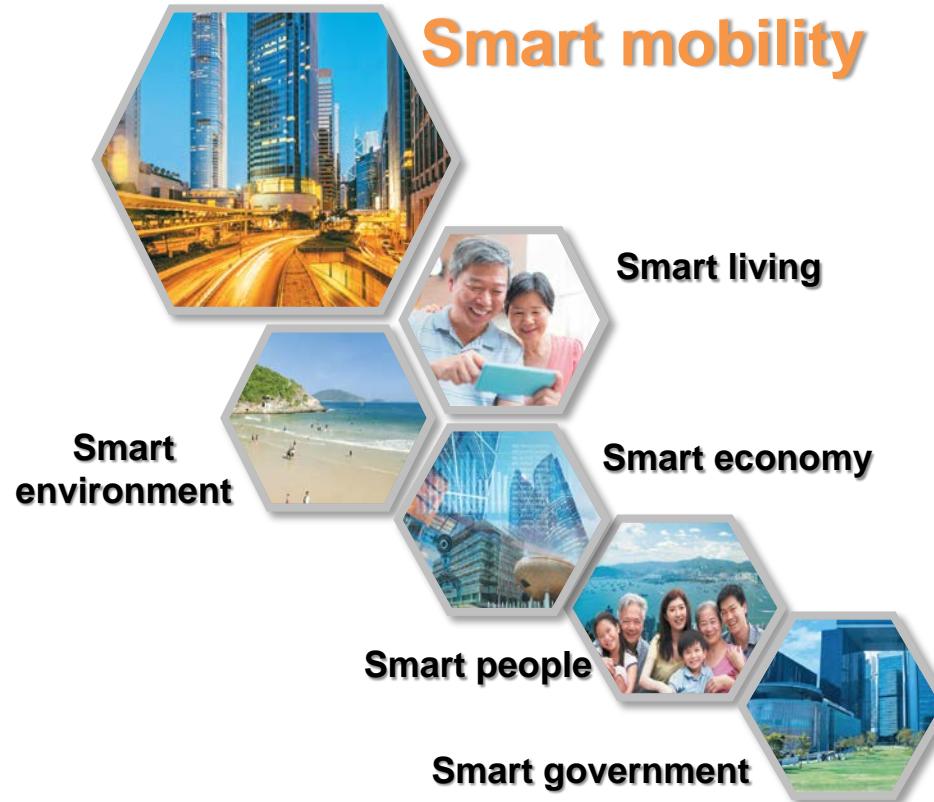
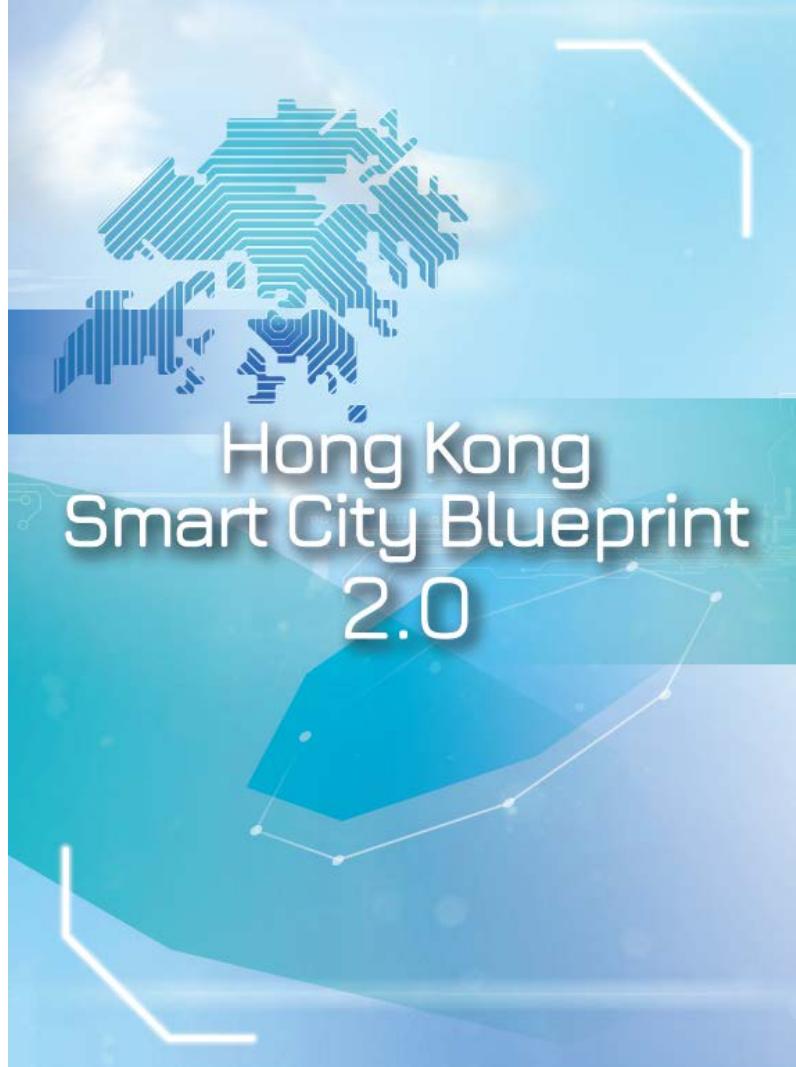


What is Smart Mobility

From Smart City
Index 2020

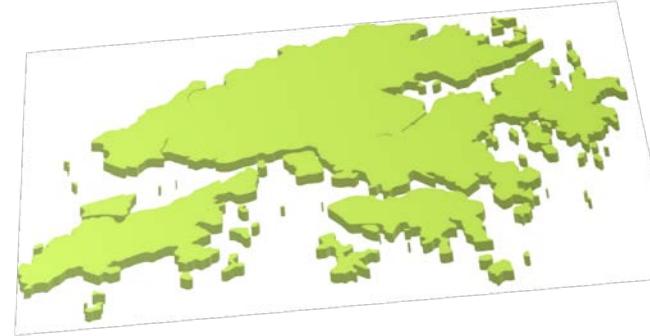
Mobility	Hong Kong	Singapore
Priority Areas		
Road congestion	39.1% (5 th)	32.8% (6 th)
Public transport	15.7% (15 th)	36.1% (5 th)
Attitudes		
You are willing to concede personal data in order to improve traffic congestion	60.9%	65.6%
You are comfortable with face recognition technologies to lower crime	45.2%	71.3%
You feel the availability of online information has increased your trust in authorities	54.0%	72.5%
The proportion of your day-to-day payment transactions that are non-cash	63.3%	71.0%
Mobility		
Car-sharing Apps have reduced congestion	43.6	58.8
Apps that direct you to an available parking space have reduced journey time	54.1	58.9
Bicycle hiring has reduced congestion	37.8	50.0
Online scheduling and ticket sales has made public transport easier to use	59.9	65.9
The city provides information on traffic congestion through mobile phones	70.3	75.6

What is Smart Mobility



- + Use of I&T in combating COVID-19
- + Smart village pilot

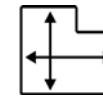
Hong Kong Situation - A vertical city



Hong Kong



7.49
million
population



275
 km^2
built-up area

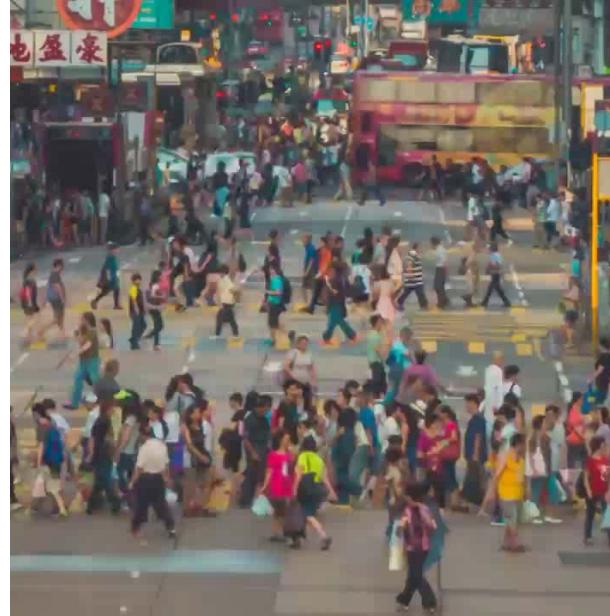


355
no. of building
 $>150\text{m}$

The dense and heavily-trafficked city



Central

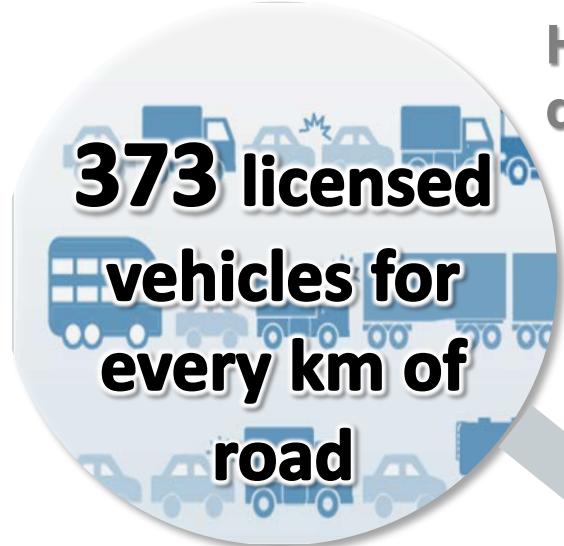


Mongkok

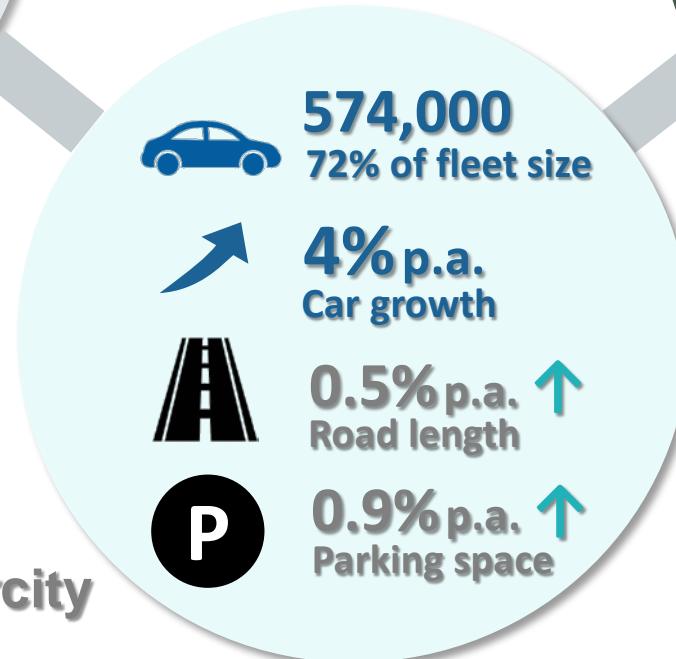


Causeway Bay

Challenges



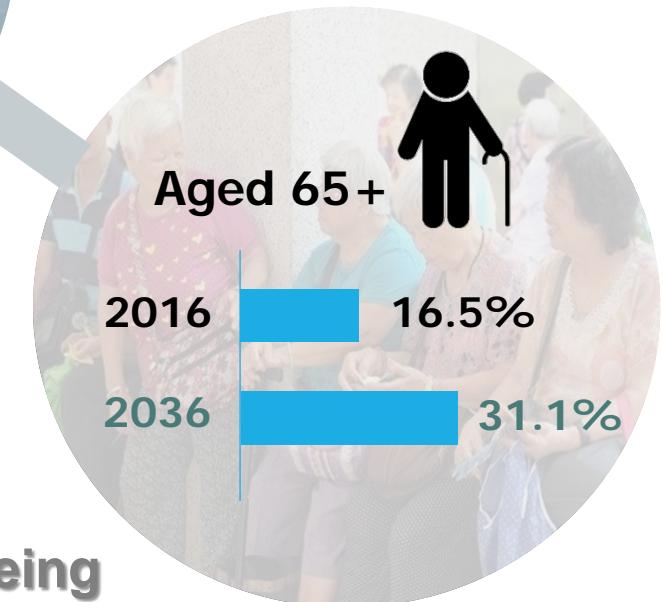
High vehicle density



Land scarcity

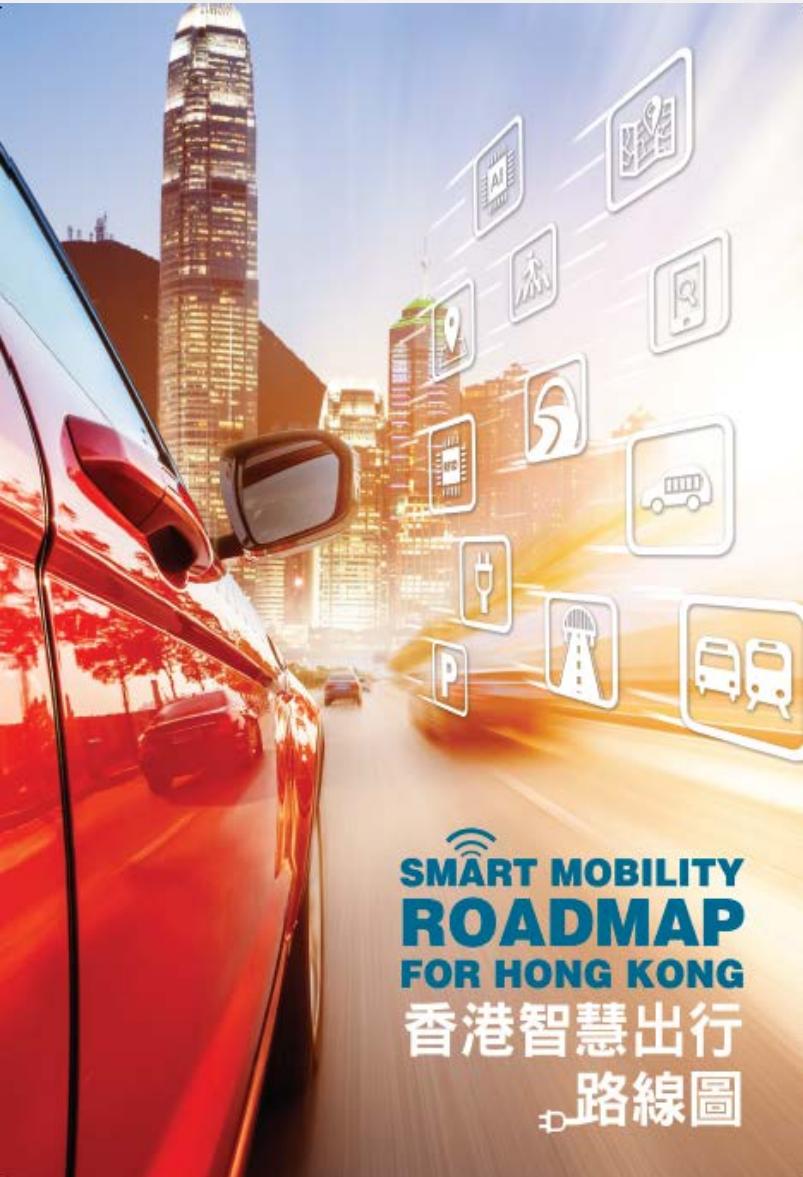


Resilience for a highly compact city

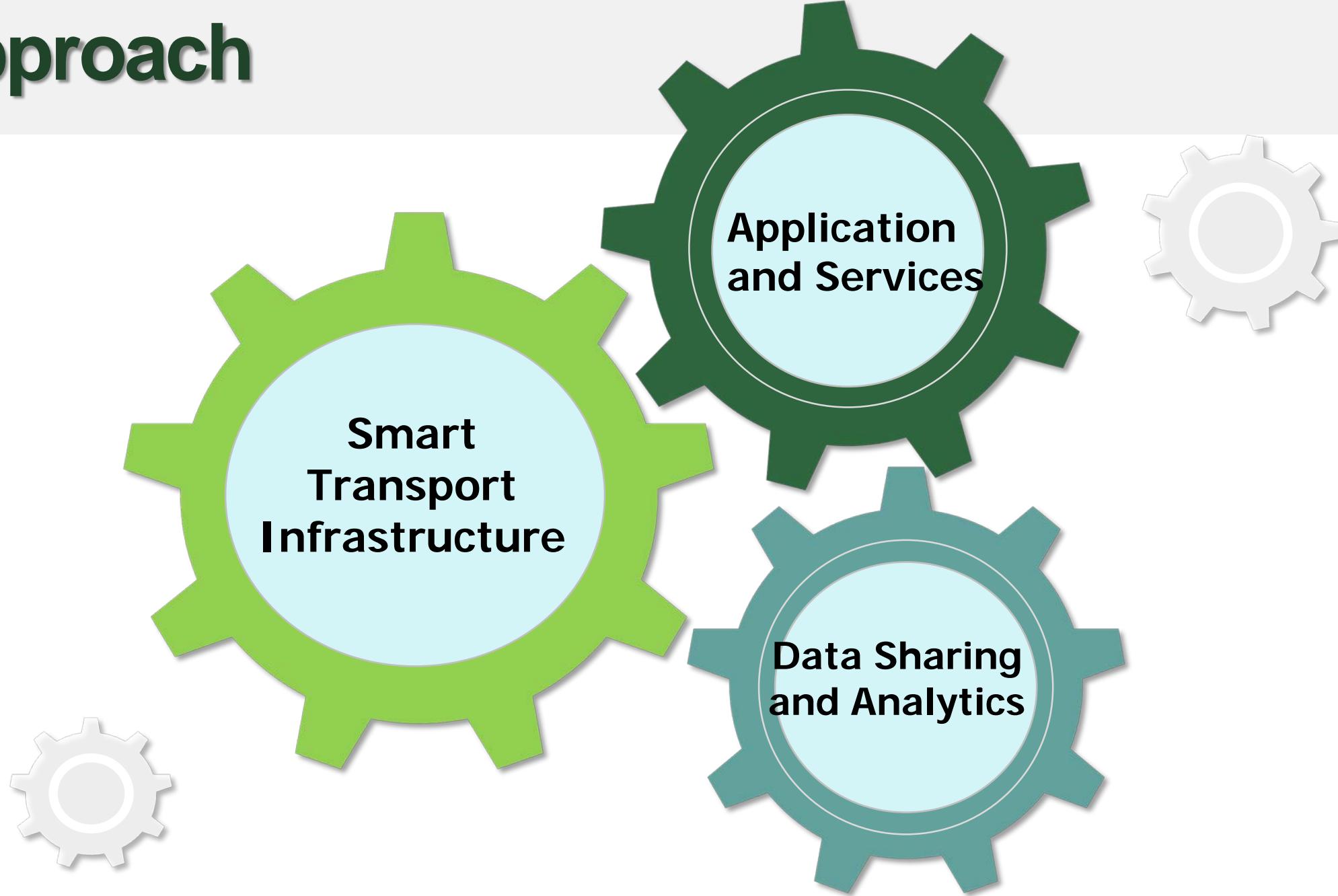


Ageing population

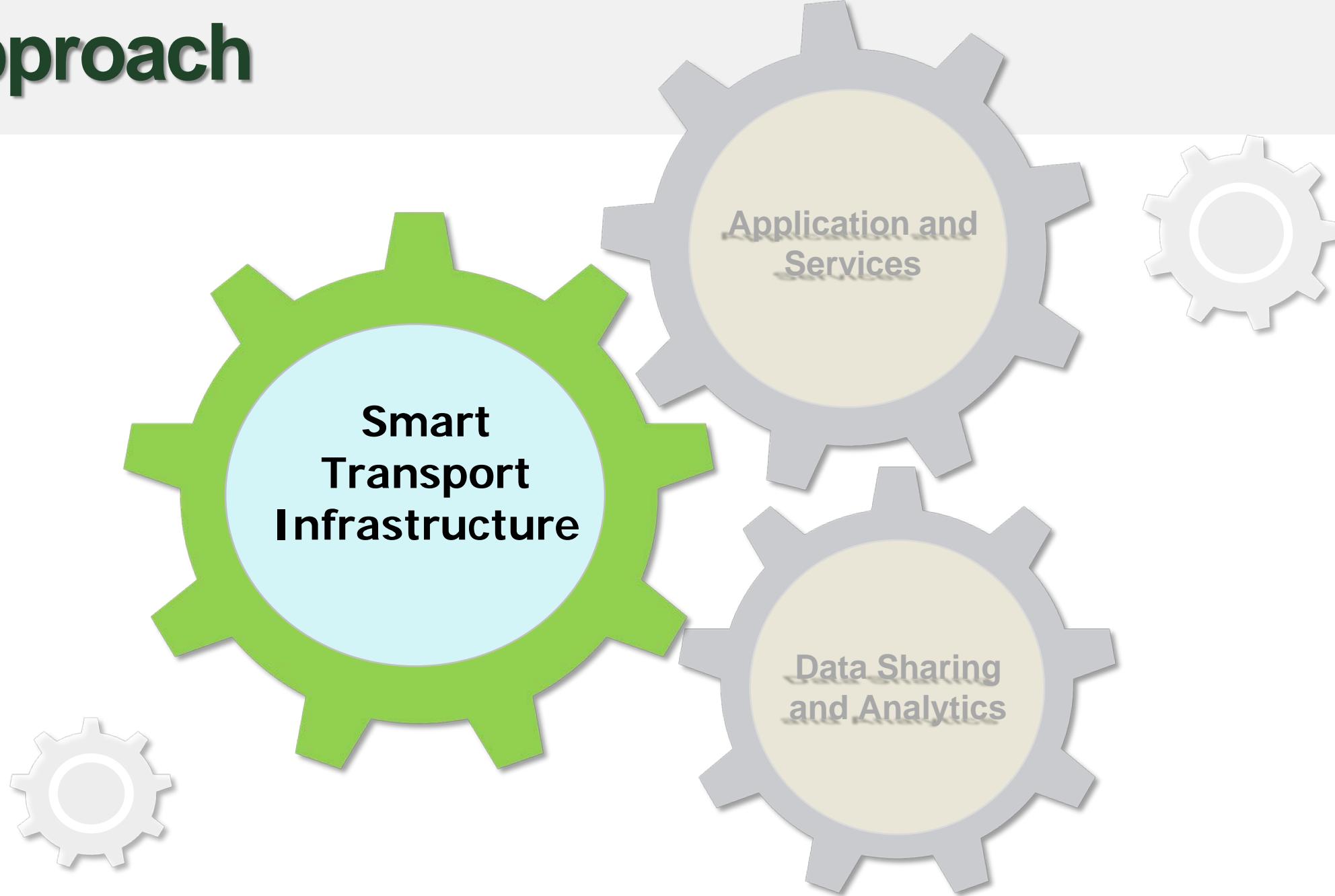
Approach



Approach



Approach



Sensing and Analytic Technology

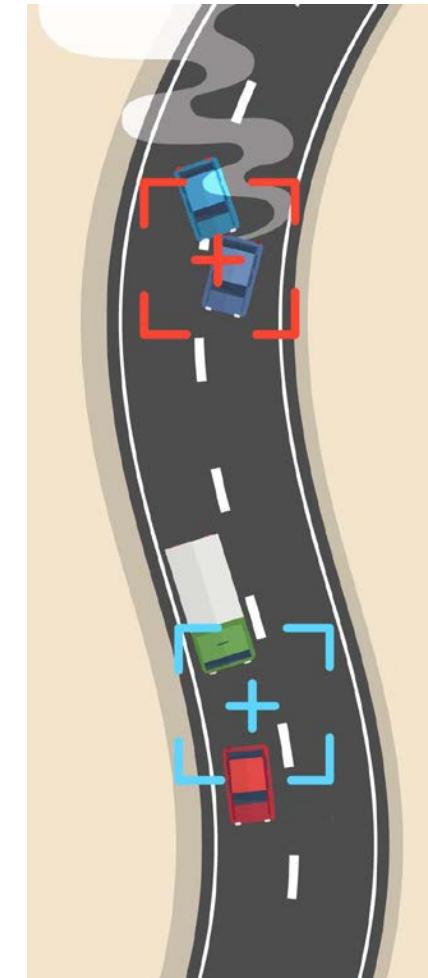
Video detectors (Visual & Termal)
Traffic snapshots
Traffic speed & volume
Automatic incident detection



Automatic Licence Plate Recognition detectors
Traffic volume in different vehicle classes



Bluetooth detectors
Average car journey speed and time



Sensing and Analytic Technology



Journey Time
Indication System



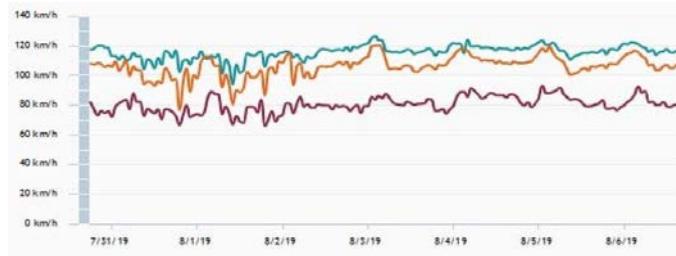
Traffic Snapshots



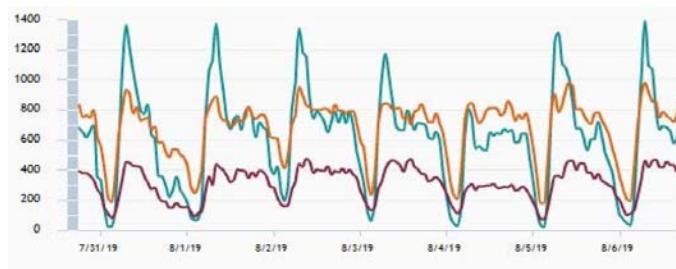
Automatic Incident
Detection



Traffic Speed Map



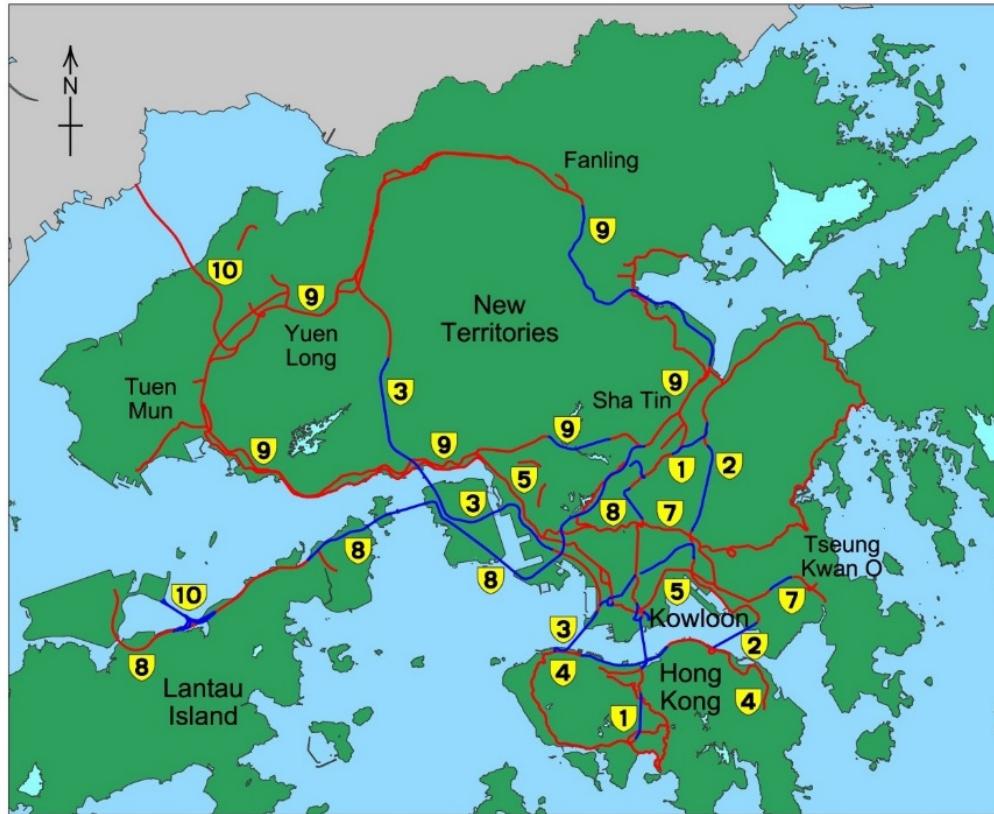
Hourly Speed



Hourly Flow

Sensing and Analytic Technology

Traffic Detectors on Strategic Routes and Major Roads



Automatic incident
detection

Traffic volume & vehicle
classification survey

Journey time survey

Sensing and Analytic Technology

Real-time Adaptive Signal System

Optimise allocation of green times ➤ Reduce congestion and delay



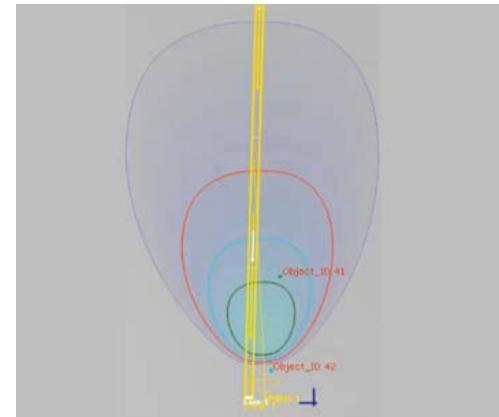
Sensing and Analytic Technology

Real-time Adaptive Signal System

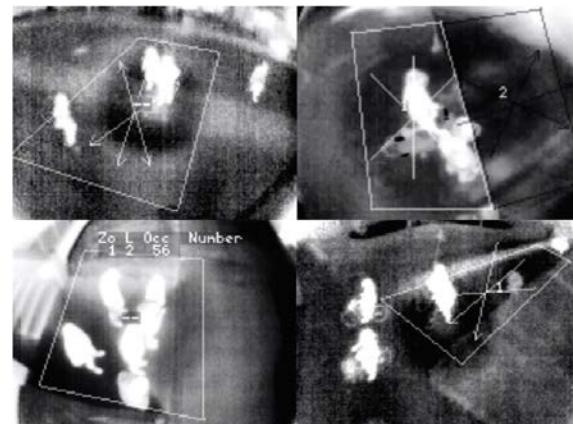
Detection Technologies



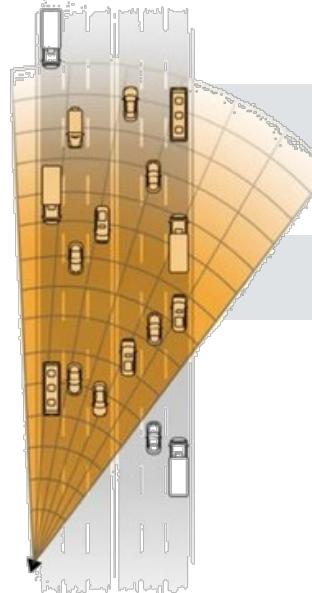
Radar



Thermal Detection

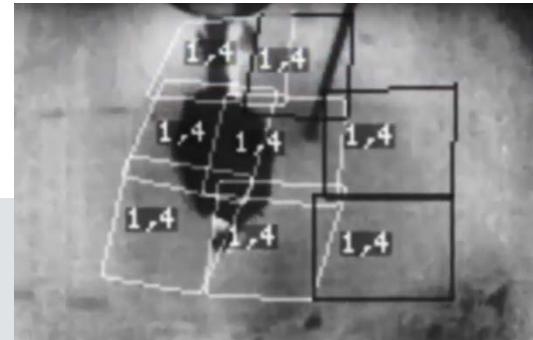


Data Collection



Queue Length

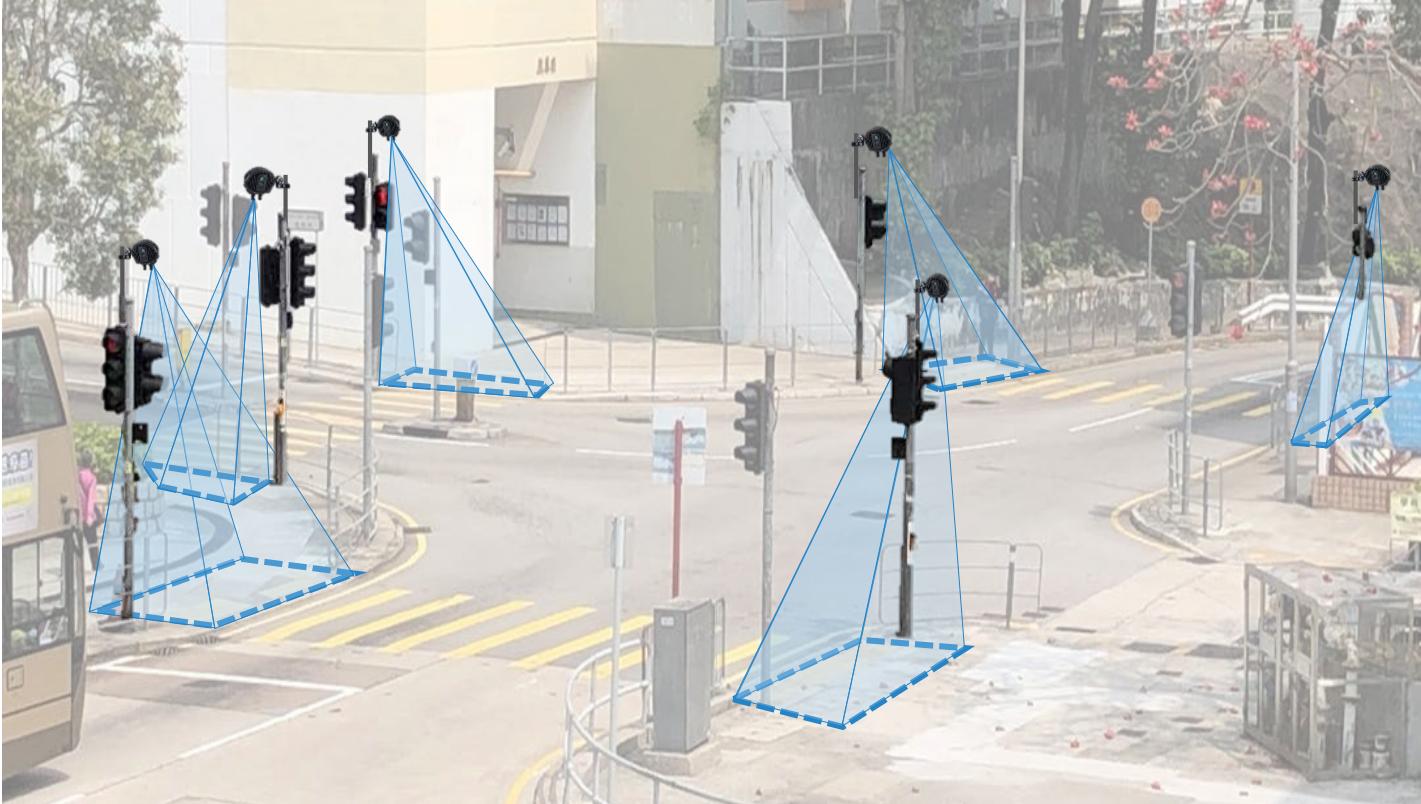
Number of vehicles



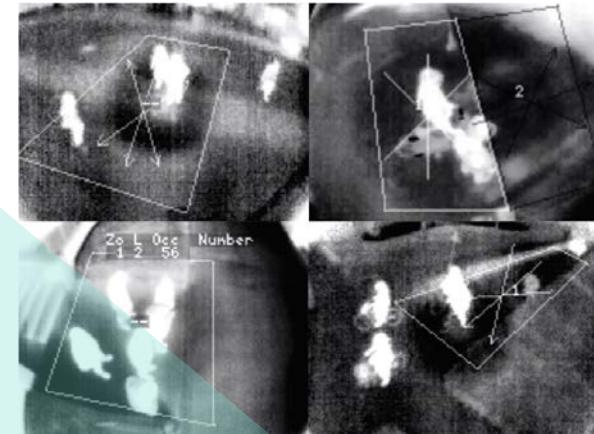
Number of waiting
pedestrians

Sensing and Analytic Technology

Real-time Adaptive Signal System

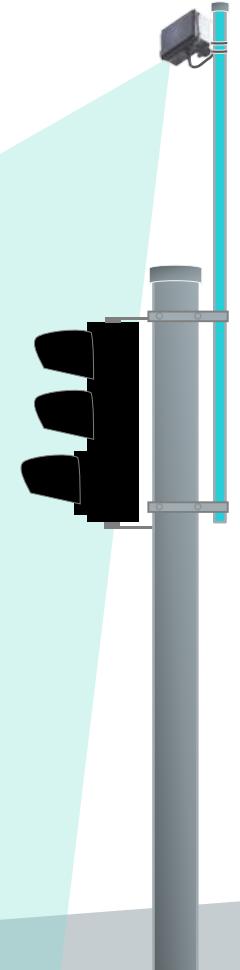
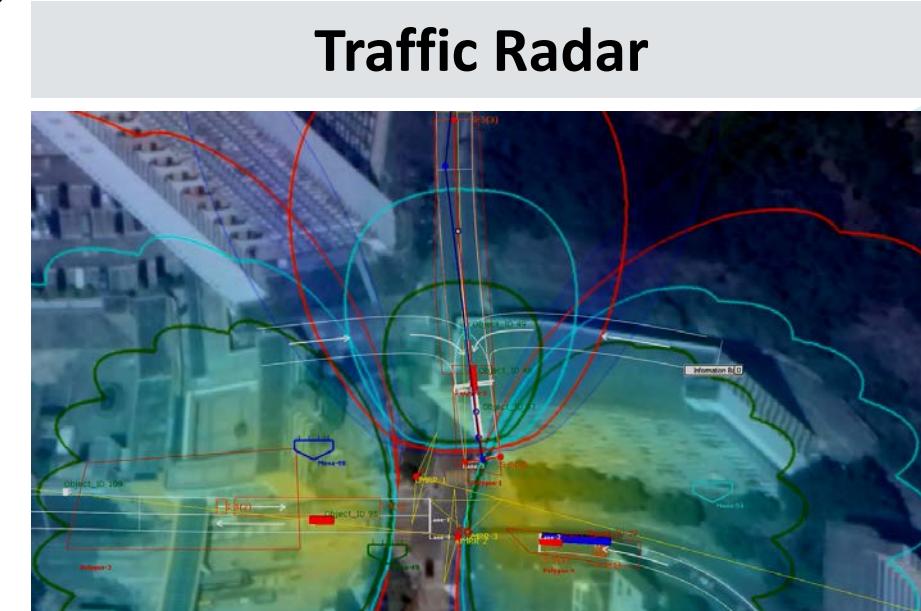
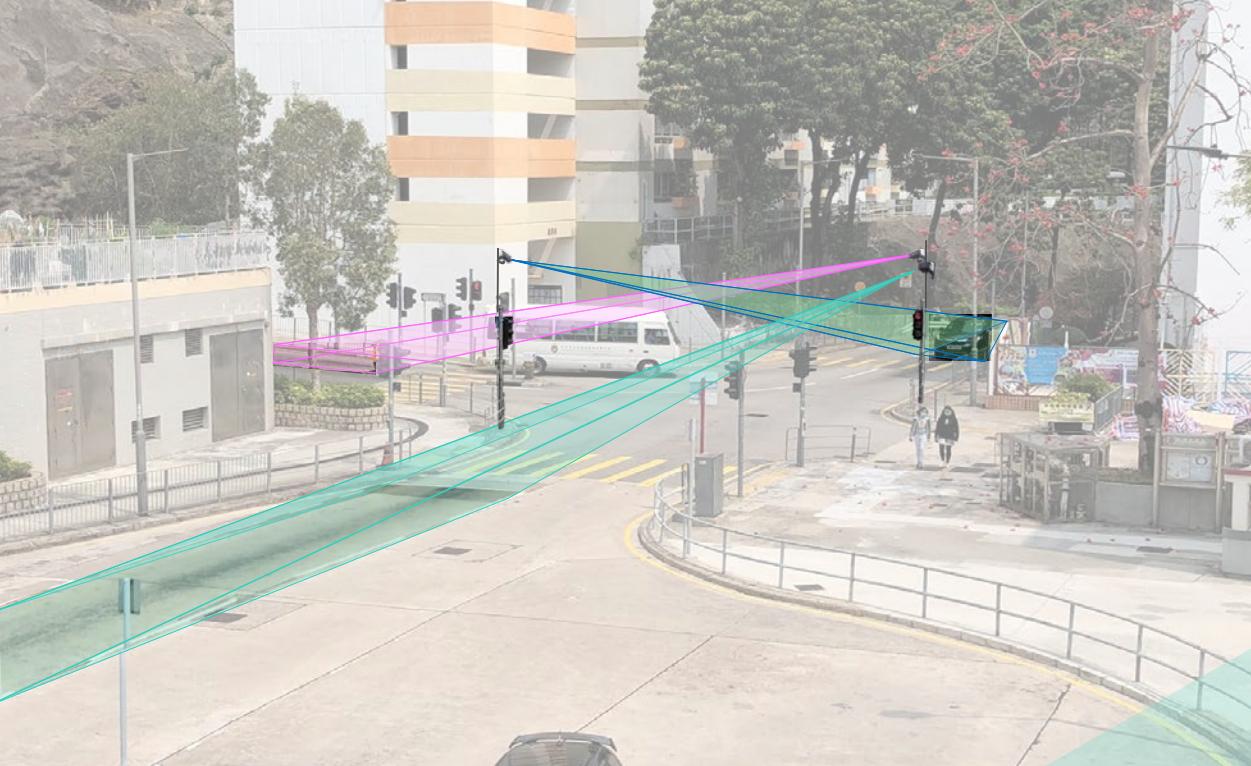


Thermal Detection



Sensing and Analytic Technology

Real-time Adaptive Signal System



Sensing and Analytic Technology

Multi-functional Smart Lamppost Scheme



400

Pilot Smart Lampposts in urban areas



LED road light



Air quality data



Traffic data



Meteorological
data



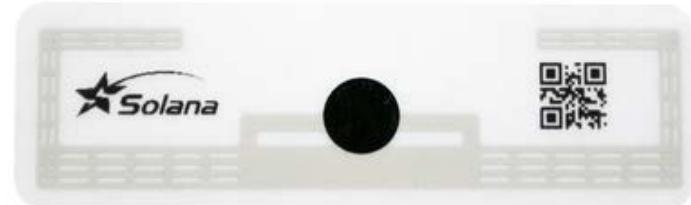
Positioning
information



5G base
station

In-Vehicle Unit (IVU) Technology

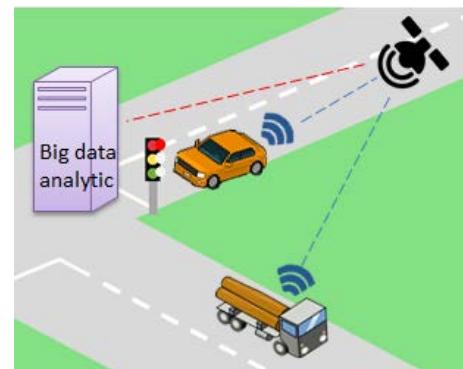
- Radio Frequency Identification (RFID)



- Dedicated Short Range Communication (DSRC)

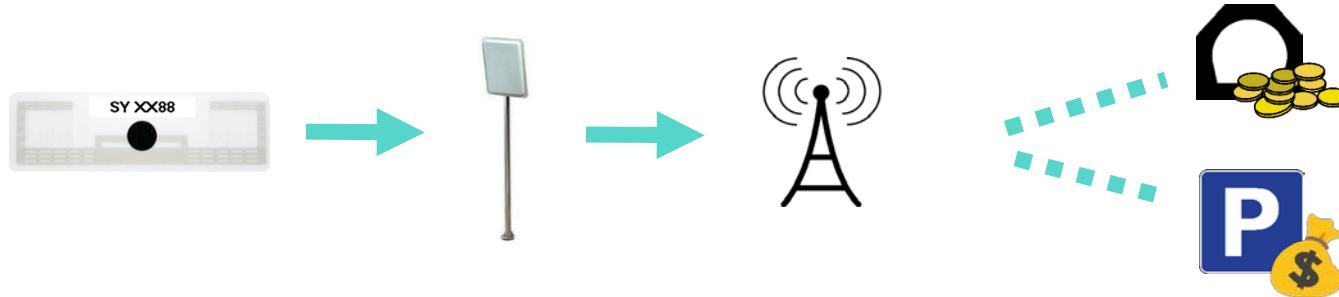


- Global Navigation Satellite System (GNSS)

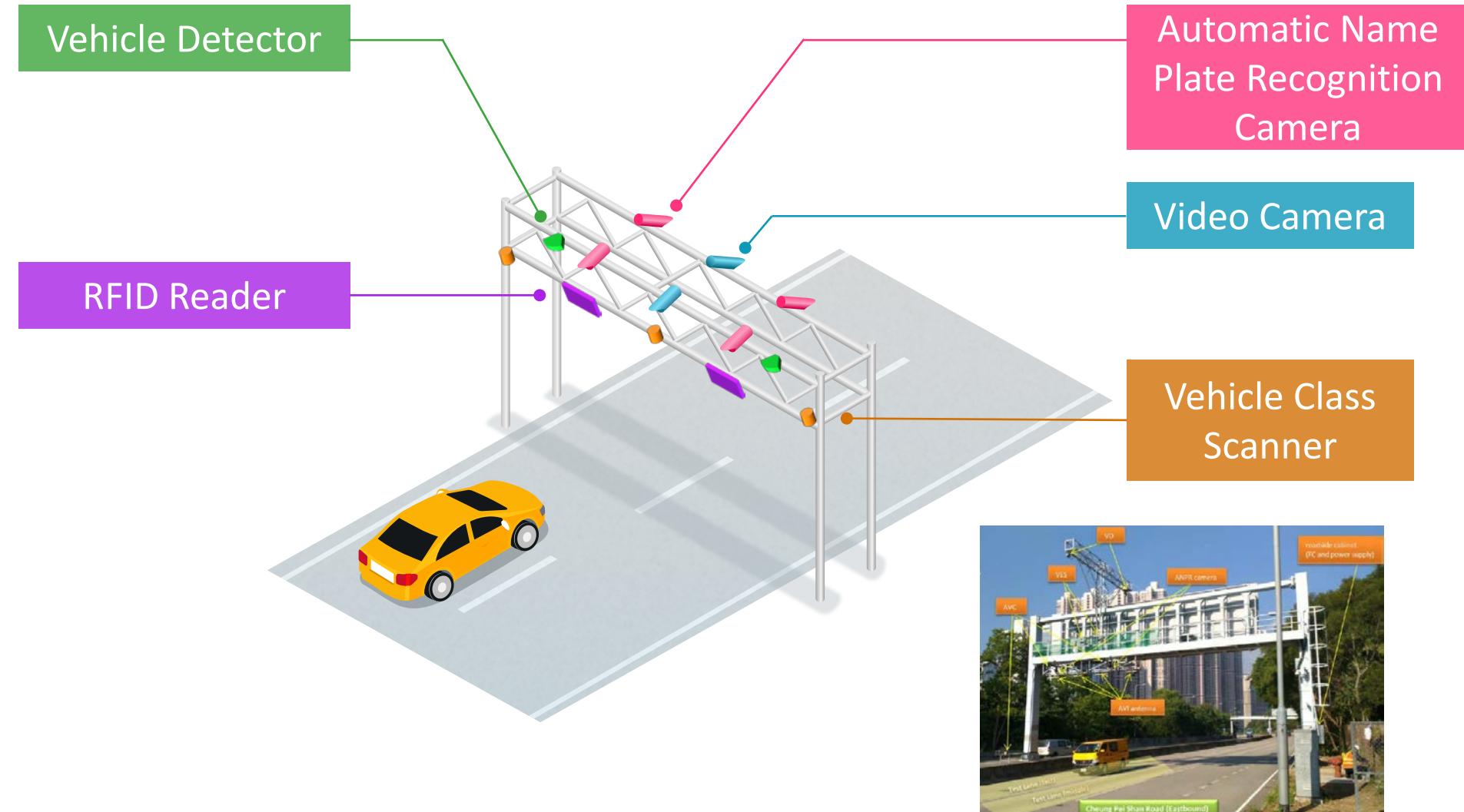


IVU Technology

Radio Frequency Identification (RFID)	
Cost \$	Low
Reliability	High
Regular maintenance	Minimal
Infrastructure (e.g. Gantry)	Needed

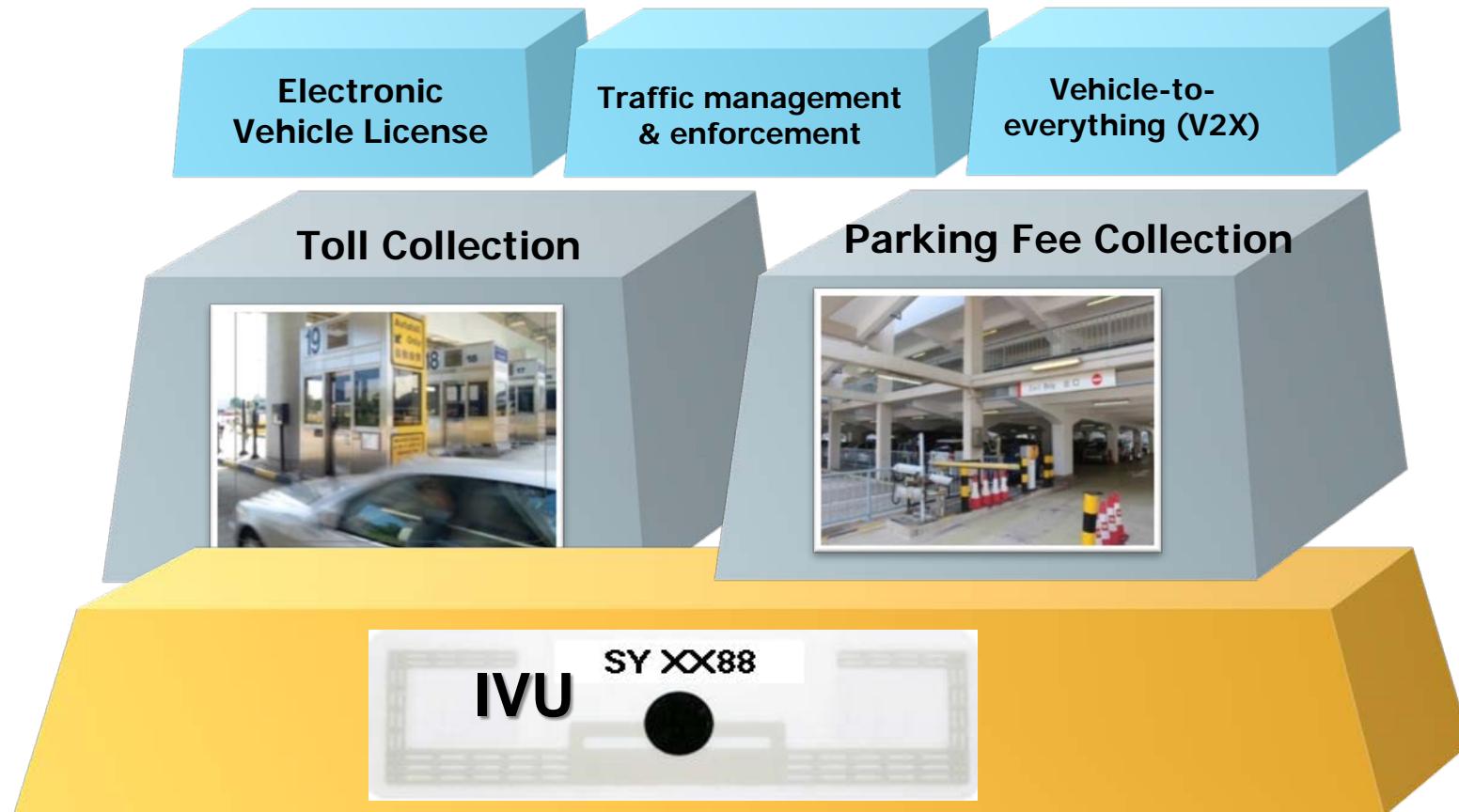


IVU Technology – Free Flow Tolling System (FFTS)



IVU Technology

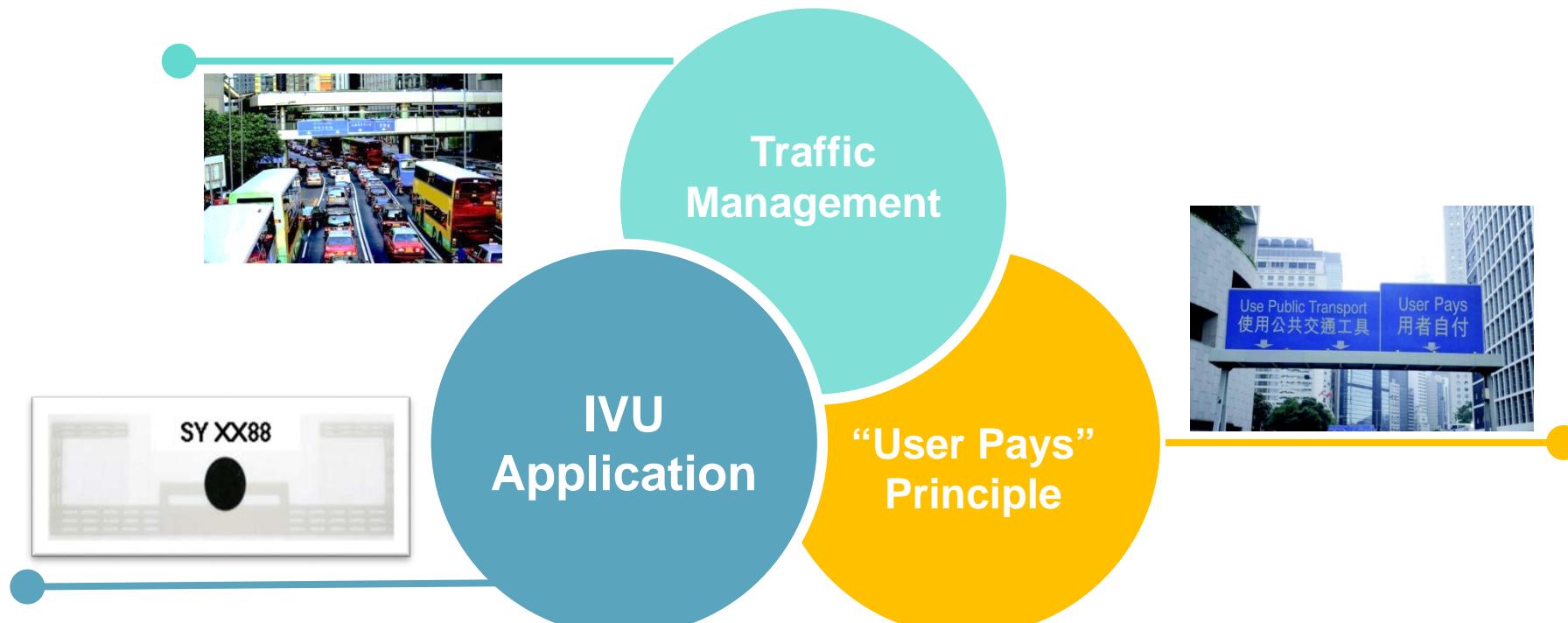
In-vehicle units (IVU)



Building block of future intelligent transport system

IVU Technology

Electronic Road Pricing (ERP) - Pilot Scheme in Central and its adjacent areas



Vehicle Technology

Geo-fencing technology

GNSS Receiver



Speed reader,
3D compass



Camera



Position Signal
compare with
TD speed limit database



Prevailing speed on roads



Vehicle Technology

Long-term plan – Connected and autonomous vehicles

Enhanced safety by
minimising human error



Increased road efficiency

Reduced emission

Vehicle Technology

SAE Level of Automation

SAE Level	Definition	Example	Current use in Hong Kong
0	No Automation	Automatic transmission, lane departure warning	Allowed
1	Driver Assistance	Cruise control, lane keep assist system	Allowed
2	Partial Automation	Park assist system, automatic emergency brake	Allowed
3	Conditional Automation	Remote control parking, motorway assist	Being driverless, remote control parking is not allowed while motorway assist is allowable
4	High Automation	Full motorway pilot	Not allowed
5	Full Automation	Driverless car	Not allowed

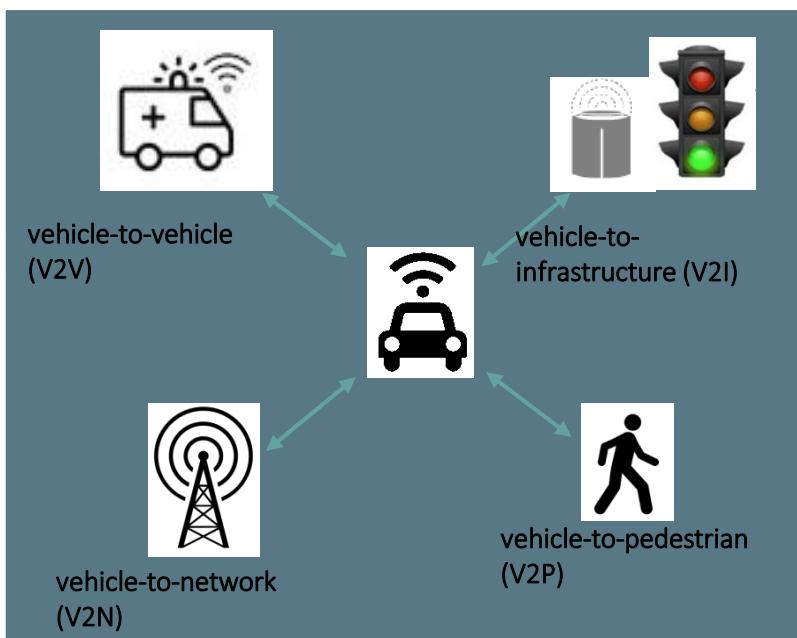
Current Progress

- Published a new set of "Guidance Notes on the Trials of AVs"
- Facilitated trials (32 trials conducted)
- Review and amend the relevant legislation to provide legal backing for wider trial and use

Vehicle Technology

V2X (Vehicle-to-everything)

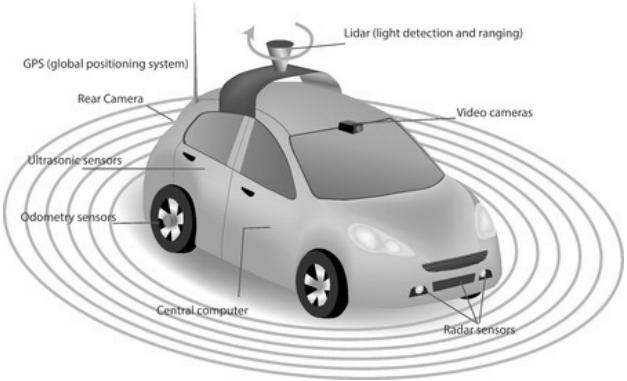
- A wireless technology to enable data exchange between a vehicle and its surroundings



- ✓ Optimise traffic flows
- ✓ Reduce congestion
- ✓ Improve road safety
- ✓ Minimise emissions

Vehicle Technology

Role of V2X in supporting autonomous driving



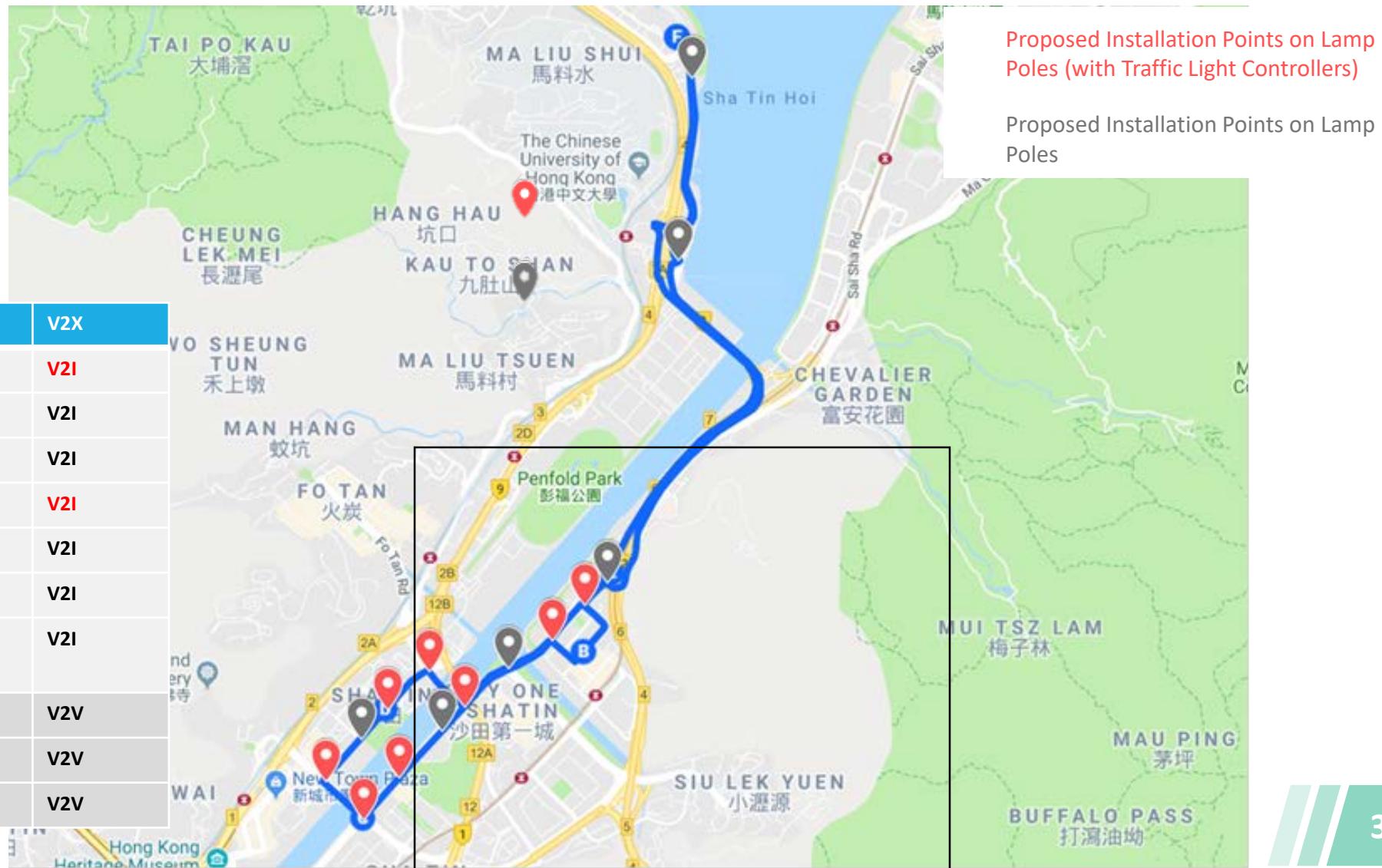
- Major technologies used in AV: camera, radar, and LiDAR
- Given their physical nature, these technologies only detect **line-of-sight objects and events**
- To advance the level of autonomous driving, an increasing amount of sensory data is necessary to enable the vehicle to make the right decisions.

- V2X can support safety systems with **non-line-of-sight** and **latency-sensitive collision-avoidance** capabilities, and **predict the path** of surrounding vehicles, and is **not susceptible to weather conditions, poor lighting or sensor's sensitivity**

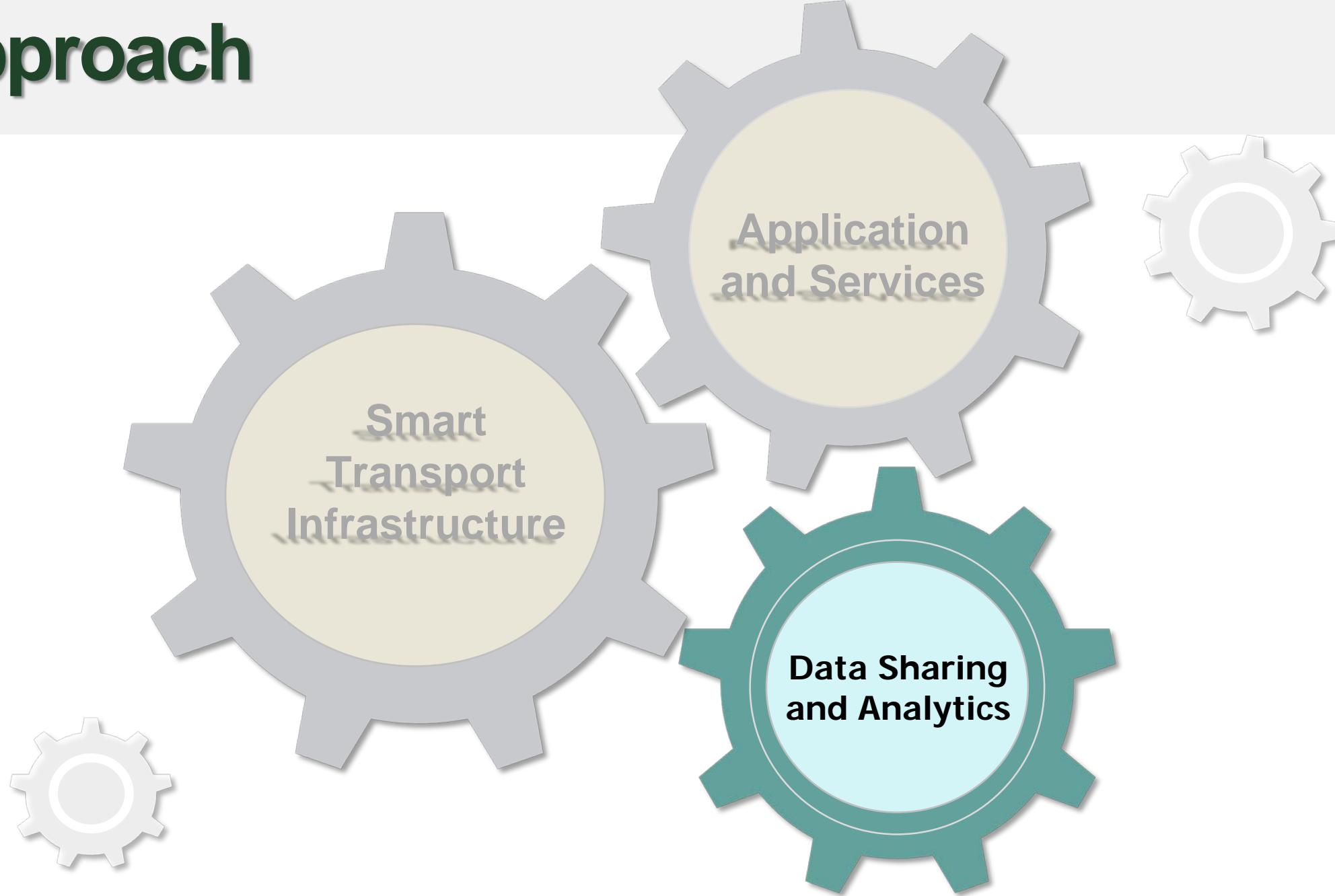
Vehicle Technology

V2X Trial at Shatin in 2021

Index	C-V2X Use Cases (TBC)	V2X
1	Traffic Light Info	V2I
2	Pedestrian Warning	V2I
3	Intersection Warning	V2I
4	Roundabout Warning	V2I
5	Speed Alert (50km/h)	V2I
6	Road Works Alert	V2I
7	Congestion/Traffic Control Warning	V2I
8	Forward Collision Warning	V2V
9	Blind Spot/ Lane Change W	V2V
10	Emergency Stop Warning	V2V



Approach



Opening up Public Transport Operation Data



Encourage PT operators
to open up their ETA data



Installation of display panels
at 1300 bus stops / PTIs



Provision of real-time
arrival information of GMB

Mobile Apps - HKeMobility™

Over
2,000,000
accumulated
downloads



iphone/Android 手機下載



Route Search

Ride Drive Walk

KING'S ROAD PLAYGROUND Swap Tseung Kwan O Station (Tseung...)

Start Time: Now Edit

MTR Transfer Fare Time

MTR

Arrival Time - North Point (Tsuen Kwan O Line - To Po Lam):
1 min (Po Lam),
5 min (Po Lam),
9 min (Po Lam)

Last update: 11:06:27

\$12.3 25 min.

85 → **694**

2 Arrival Time - Tin Chiu Street : 3, 11, 27 min.

Last update: 11:06

\$13.4 65 min.

ETA of public transport

Next tram: 18,20,30 min.

14 choices

← MTR Hong Kong Station Car Park

At : 2018-10-12 20:02

Parking available 118

Drive from this car park Drive to this car park

Address MTR Hong Kong Station, Man Cheung Street, Central

Phone 28818888

Headroom 2.1m

m(n)

Website <http://www.mtr.com.hk/en/customer/main/>

Real-time vacancy of public car parks

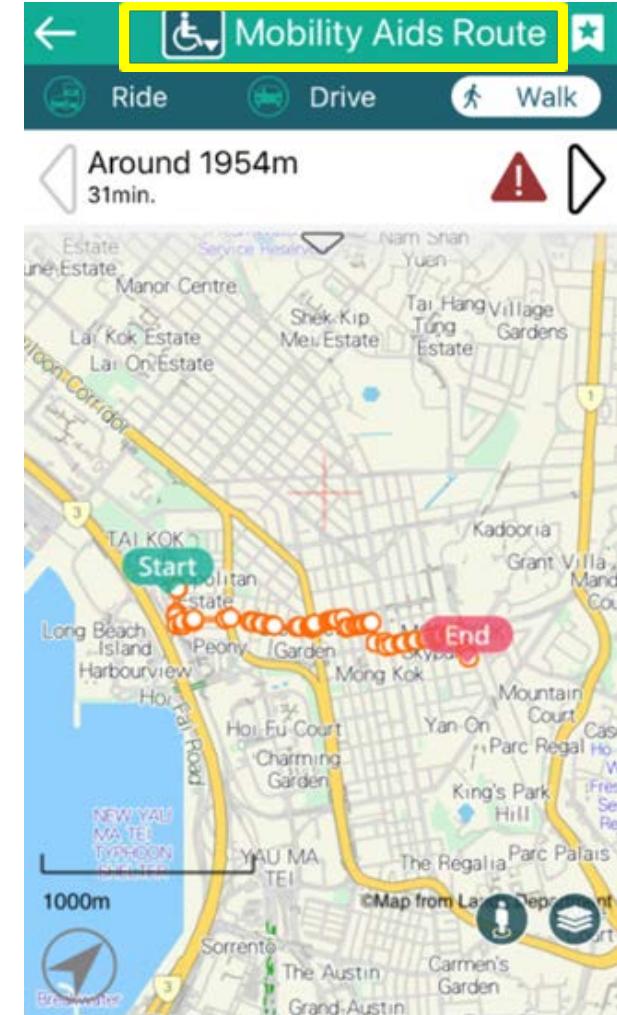
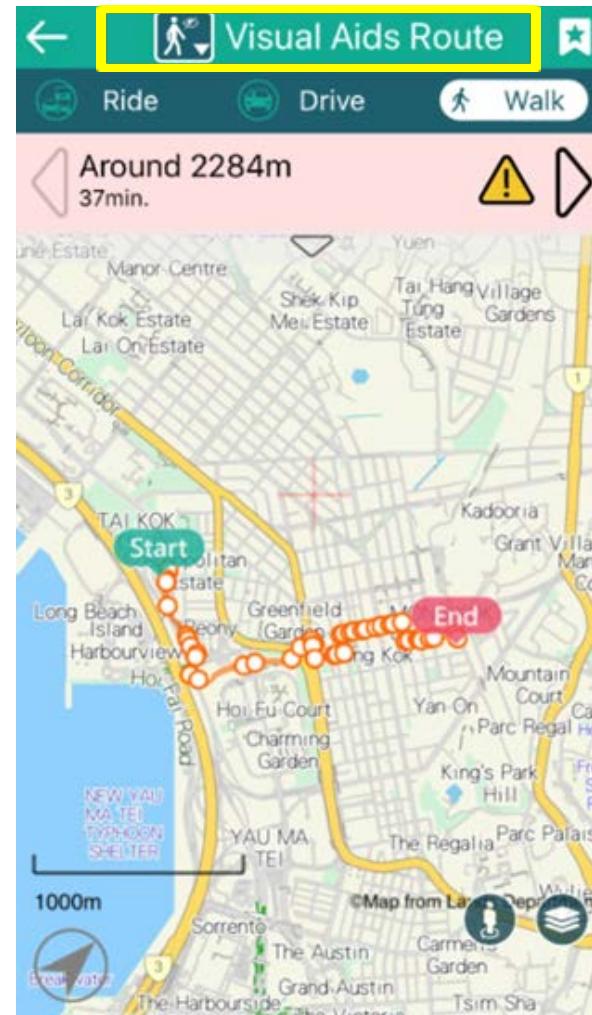
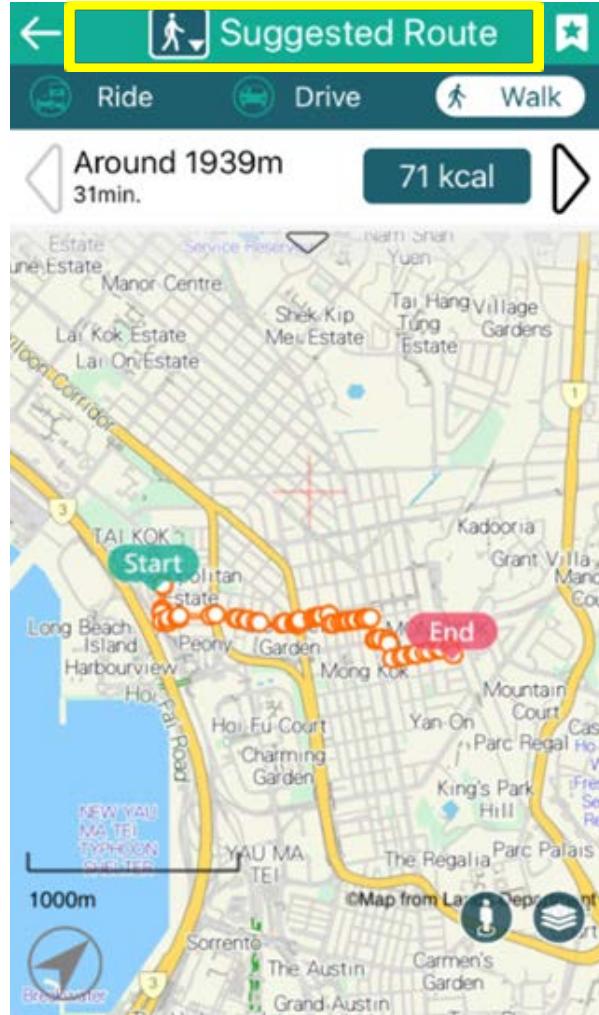
← Visual Aids Route

Ride Drive Walk

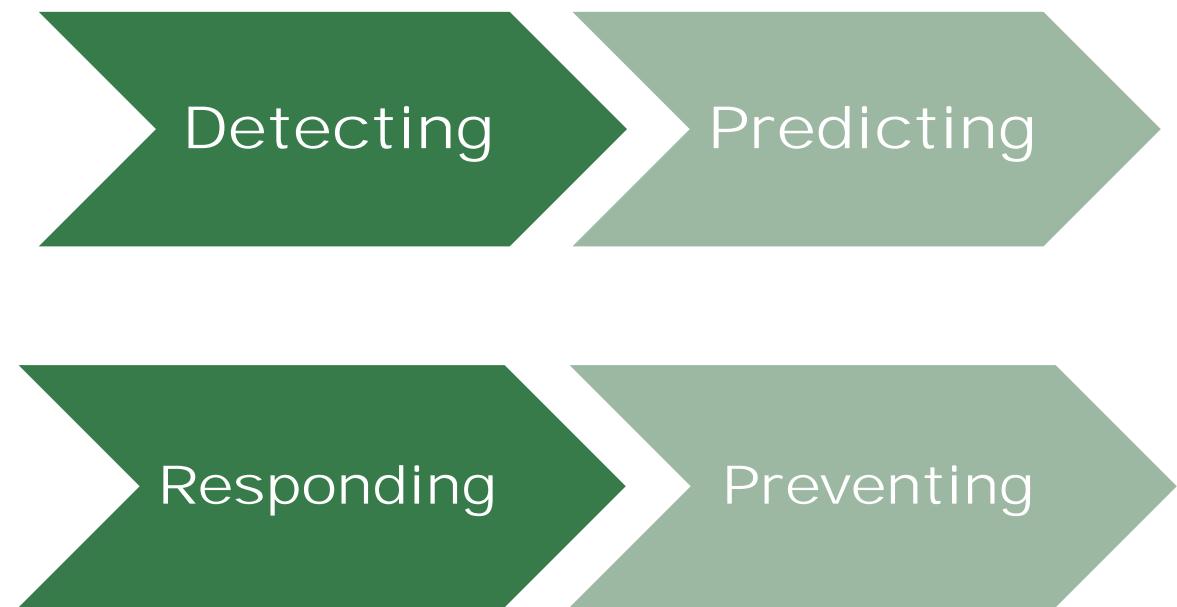
Around 1119m 22min.

Walking Route

Mobile Apps - HKeMobility”



Long-term Plan – Big Data Platform



Traffic Data Analytics System

Traffic conditions based
on:

- Real-time arrival data
- GMB arrival information
- Traffic detectors

Weather conditions

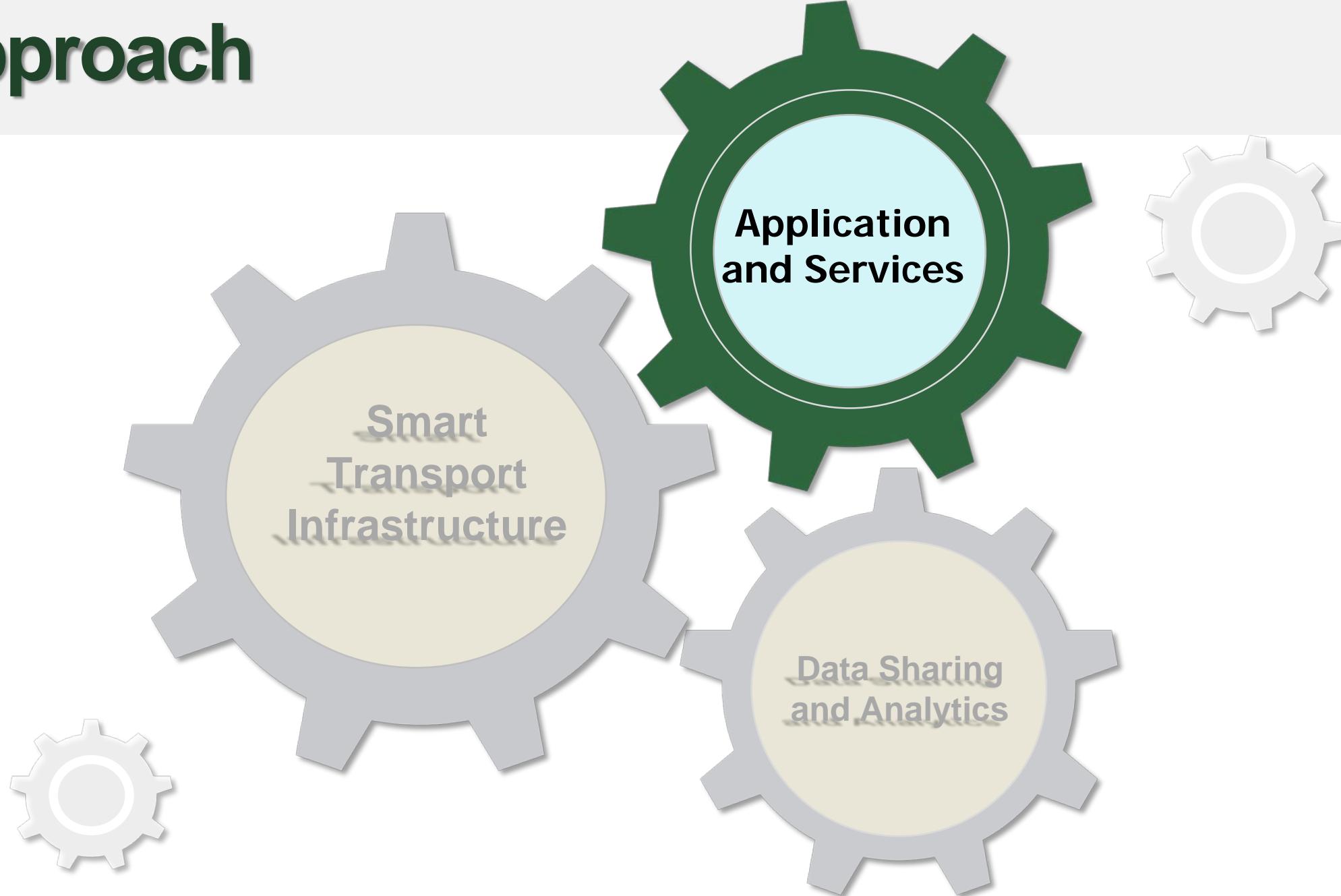
Incident reports

Accident records



- A. Visualisation of real-time traffic condition (to cover road without traffic detectors)
- B. Prediction of journey time impact due to inclement weather and traffic incidents
- C. Prediction of traffic patterns for traffic signal adjustment
- D. Finding factors relating to traffic accident occurrence

Approach



Smart Public Transport Interchange



Estimated Time of Arrival



Traffic news and weather services



Air-conditioning



Wi-Fi services



Provision of seats



Mobile phone charging facilities



Renovate Ma On Shan Town Centre Public Transport Terminus

New Generation of On-street Parking Meters



Multiple payment means

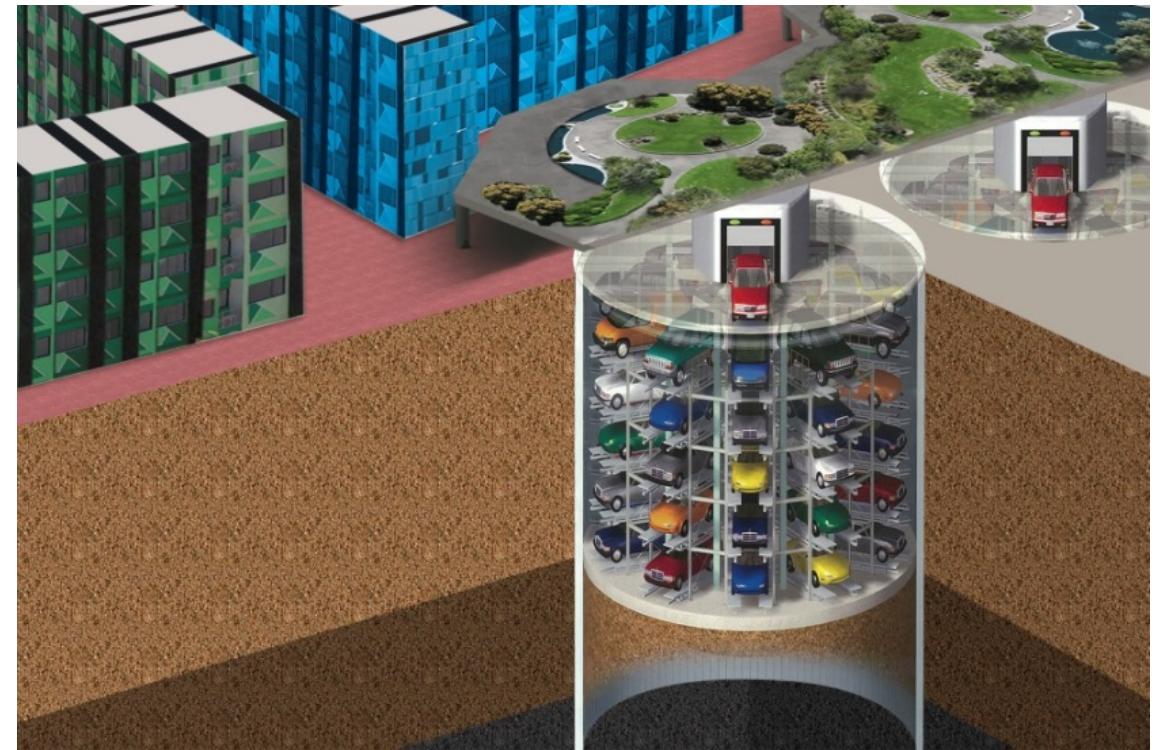


Sensors for detecting
real-time occupancy
of metered parking
spaces

Automated Parking System

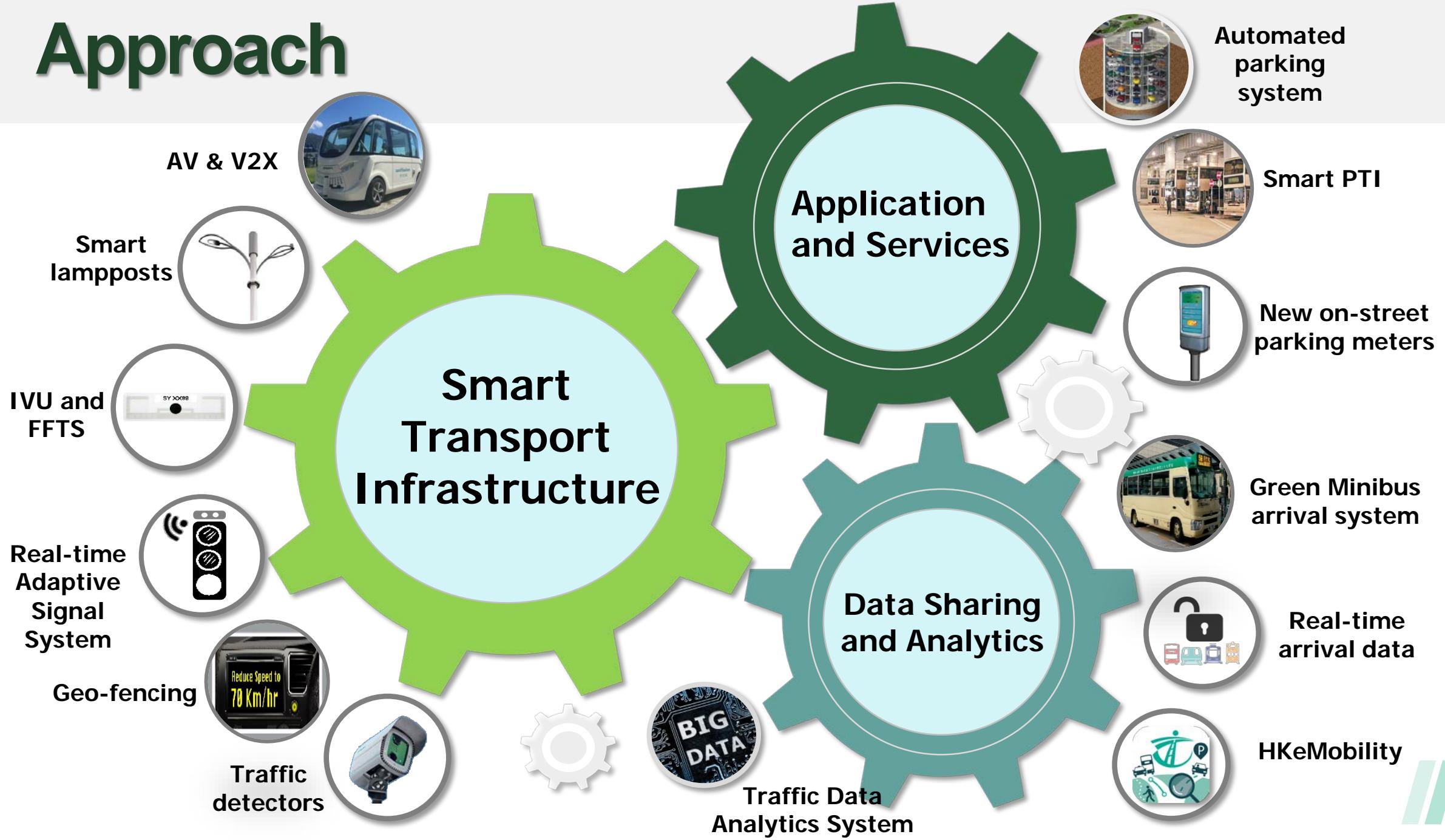


Short Term Tenancy site in Tsuen Wan

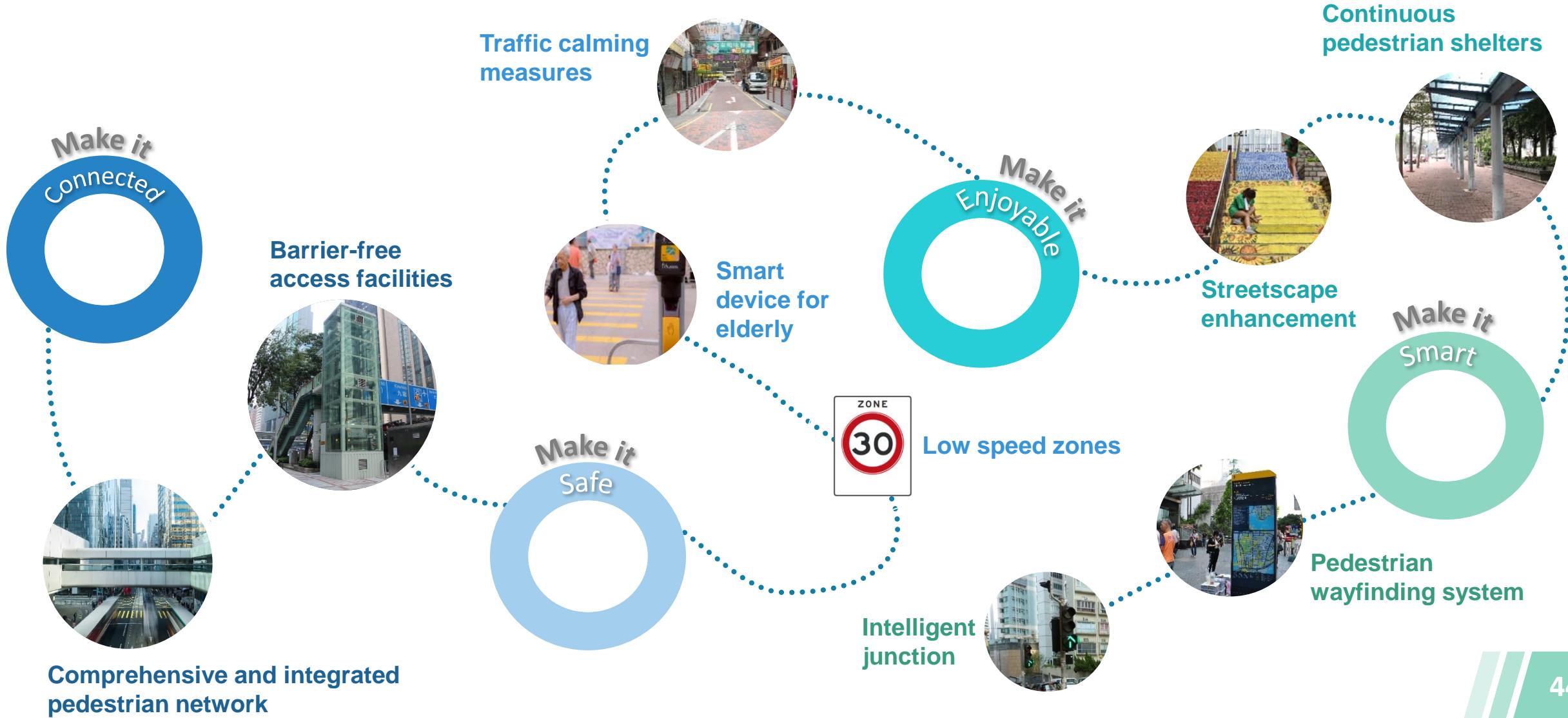


Open space in Sham Shui Po

Approach



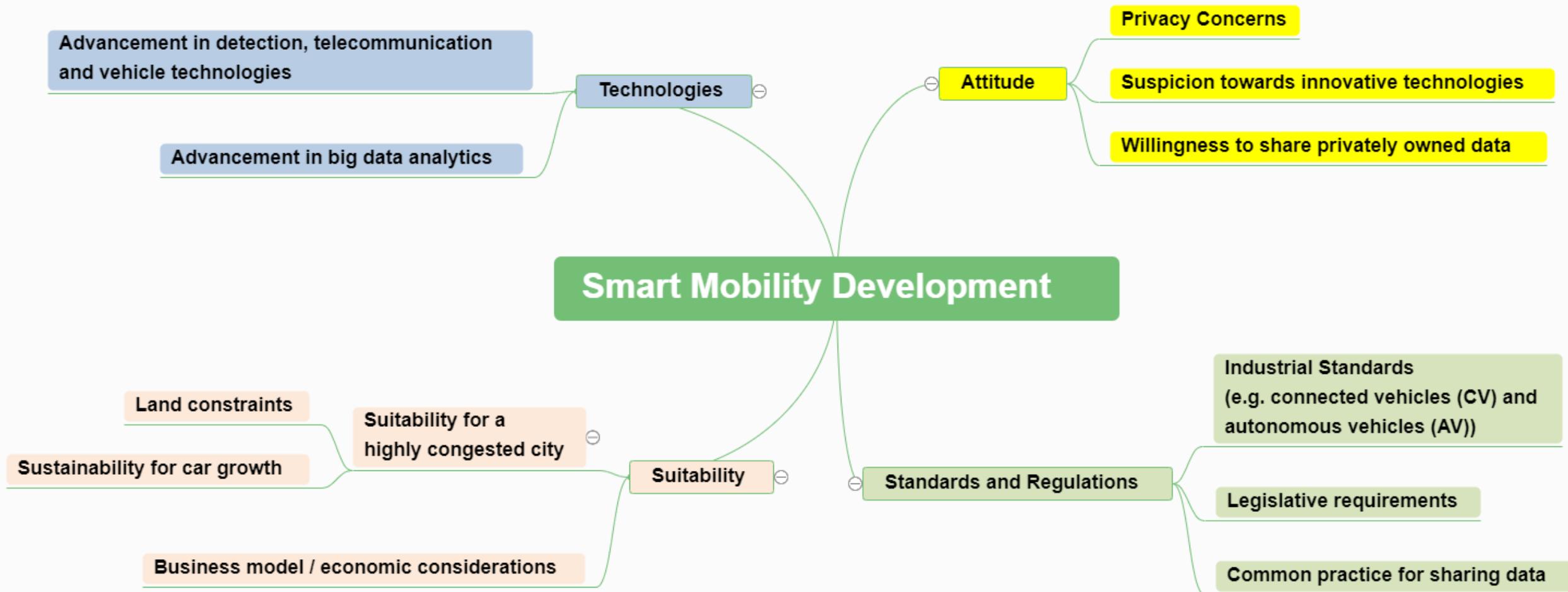
Promoting Walkability



Alternative Riding Mode

	Legal Status	Potential Impacts
Car pooling	No illegal if car drivers do not charge for sharing a ride	<ul style="list-style-type: none">• reduce car trips• increase car occupancy• <i>as a viable alternative to PT services?</i>• may release some suppressed car trips
Car sharing (self-driven)	No legislation prohibiting car sharing operation	<ul style="list-style-type: none">• reduce car• <i>mixed views on whether it can reduce / induce car?</i>• require many parking spaces for a free floating scheme
Ride sharing (e.g. Uber)	Illegal for vehicles without hire car permit	<ul style="list-style-type: none">• reduce car ownership, especially from occasional drivers• <i>mixed views on whether it can reduce / induce car trips?</i>• reduce ridership on public transport• prone to illegal kerbside activities and illegal waiting

Considerations



From Mobility to Liveability

