



Intelligent Transport for City of Tomorrow

Dr Jacob Kam,
Managing Director – Operations & Mainland Business
17 November 2016

MTR Corporation Limited 香港鐵路有限公司

Will the City of Tomorrow be like...this?

Mega Trends for City of Tomorrow



Demographic and social change



Shift in global economic power



Rapid urbanisation



Climate change and resource scarcity



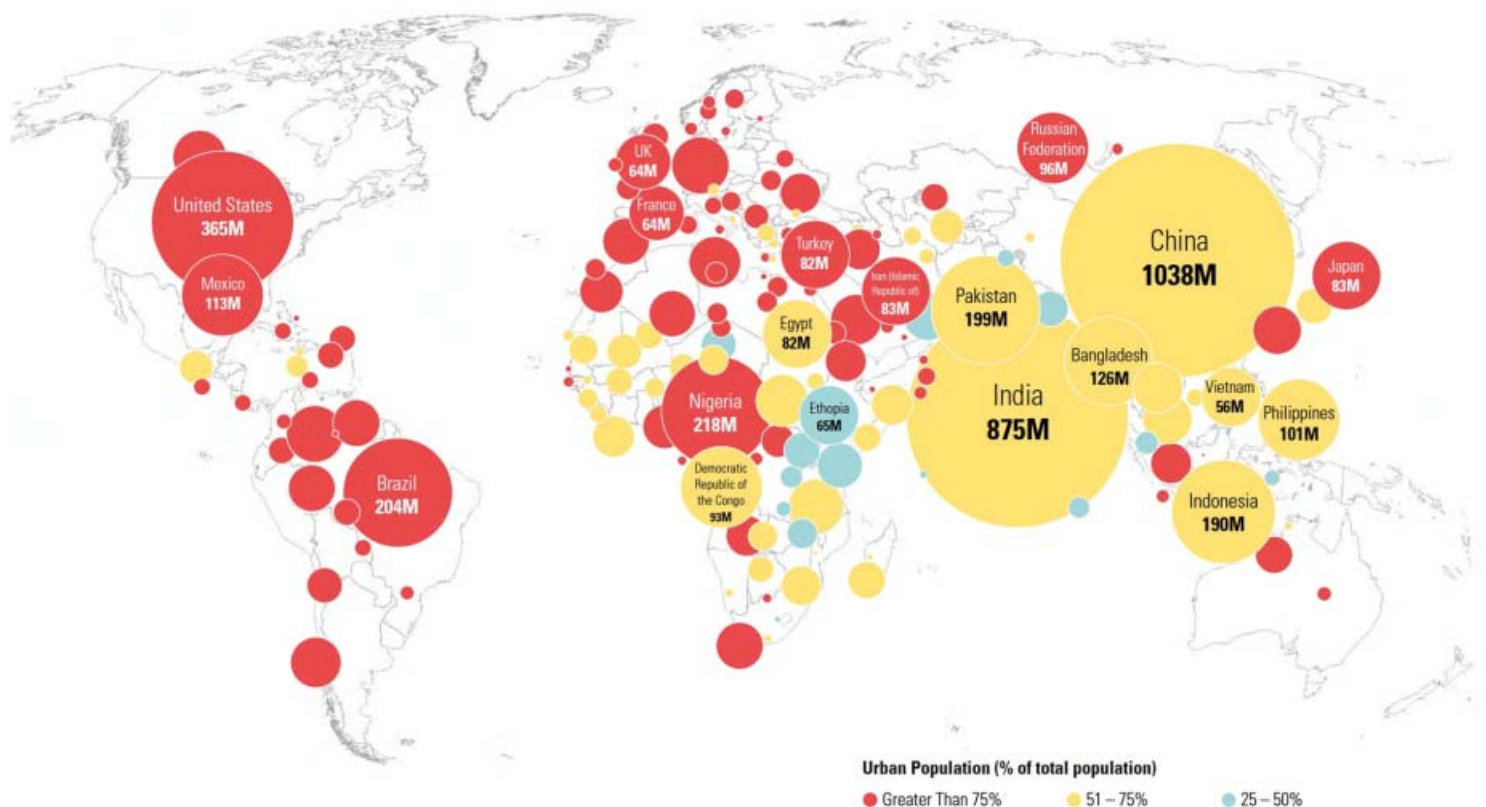
Technological breakthroughs



Rapid urbanization

Urban Populations 2050

This graphic depicts countries and territories with 2050 urban populations exceeding 100,000. Circles are scaled in proportion to urban population size.
Source: UNICEF (2012).



Compact City – Accessibility

Cities with a projected 2030 population of more than 10 million

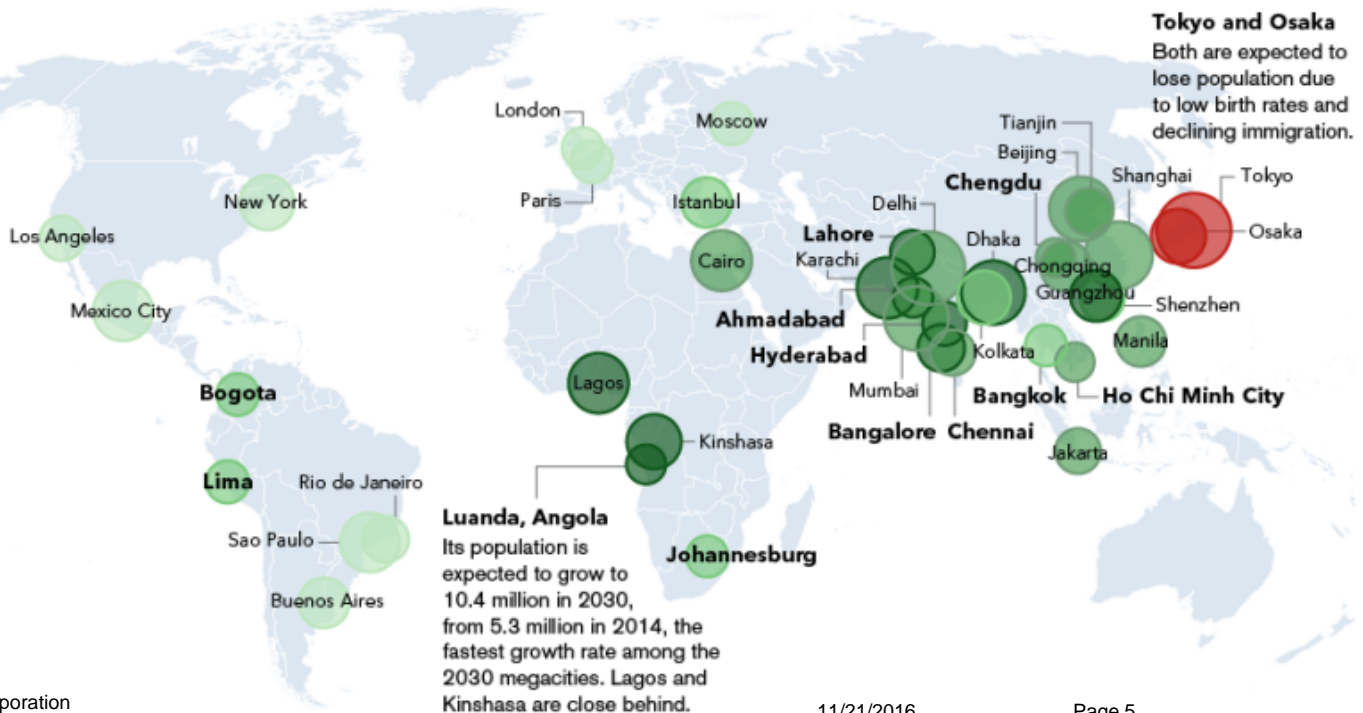
2030 population



Change in population from 2014 to 2030



Bolded cities: projected to surpass 10 million people between 2014 and 2030



Compact City – Road Congestion



~3%*
Private vehicles



> ~1.7%
Domestic households



> ~0.8%
Population

Private Vehicle Average Annual Growth Rate (1995 – 2015)

Source: Extracted from the strategic plan "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030"

Imbalance growth of private vehicles

Private vehicles to continue year-on-year growth of 3% - total number reaches 1.23m by 2041, more than double that of 2015



Hong Kong



Beijing

New strategic connectivity for Compact City

Transport

About **90%** of passenger trips
(12.6 million average daily
passenger trips)
by public transport



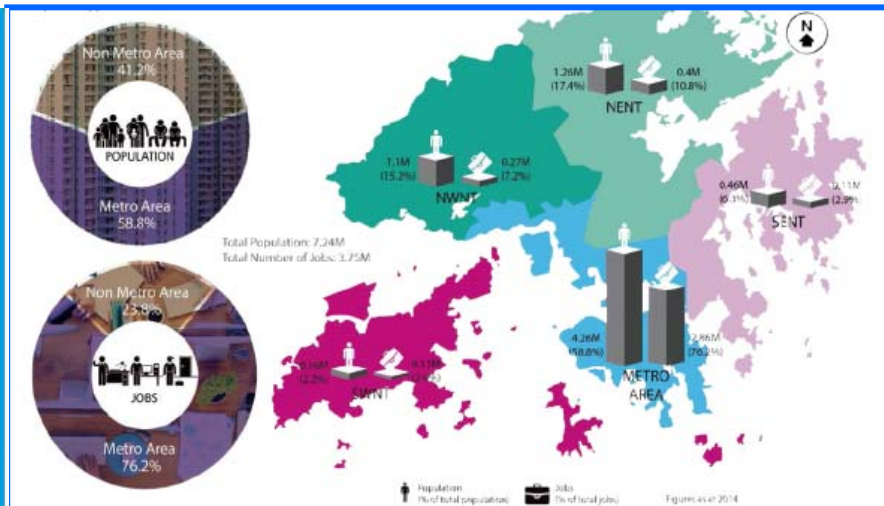
Rail share of passenger
trips by public transport
>40%



Within 500m from
a rail station



77% of commercial/office GFA
45% of living quarters



Imbalance in home-job spatial distribution

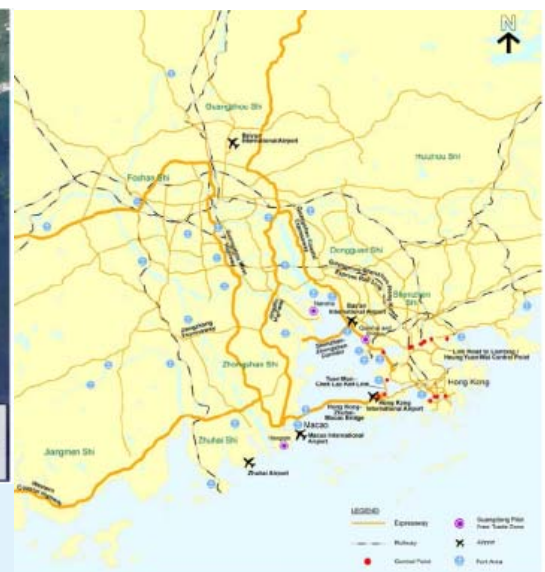
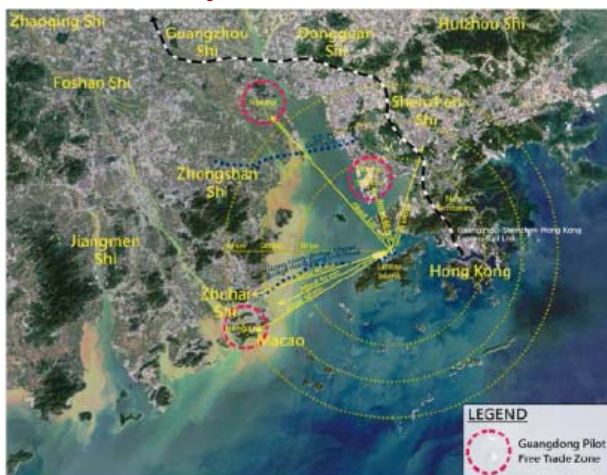
- Congestion of key commuting corridors
- Long home-to-work journeys
- More energy consumed, more carbon emission
- Less family and leisure time
- Lower productivity
- Deterring people from joining labour force

Source: Extracted from the strategic plan "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030"

Economic Shifts – A new globalization order

Gateway to the Mainland and the World

1-hour
intercity Traffic
Circle



Reaching Half of the
World's Population within
5-Hours
Flying Time



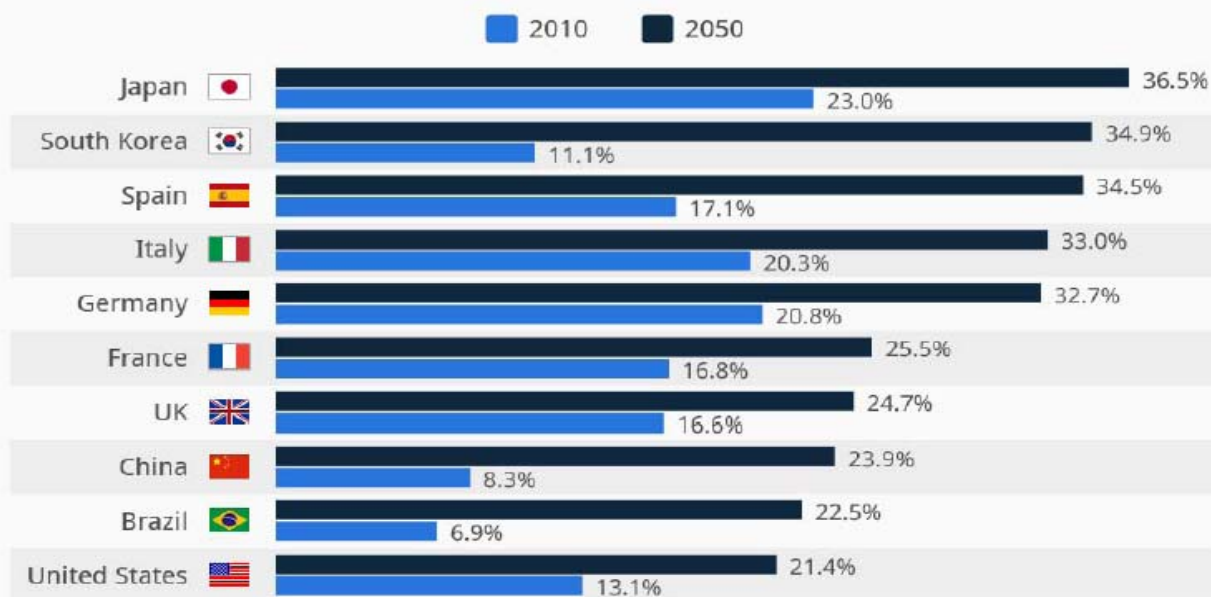
3-hour living circle
Infra-structure in the Greater PRD Region

Source: Extracted from the strategic plan "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030"

Demographic shift and social change

Rapid Aging Will Become a Major Problem in East Asia

Proportion of people estimated to be aged 65 and older in 2010 and 2050 (%)

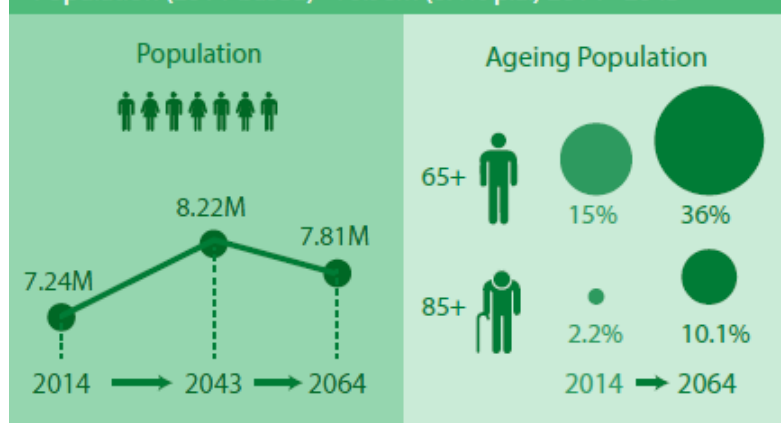


Change in demography

→ Implication on shift of market segment

Demographic Change – Aging customers

Population (2014-based)* +0.98M (0.4% p.a.) 2014 - 2043



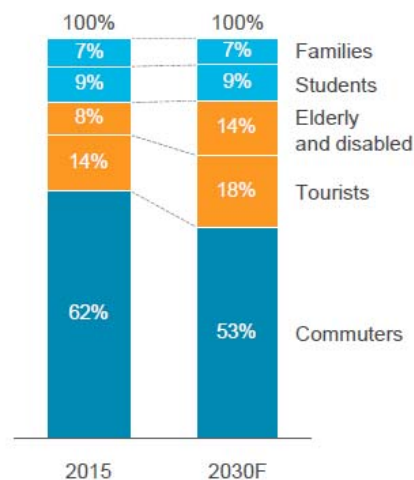
* C&SD: Baseline population projections up to 2064

Source: Extracted from the strategic plan "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030"



Increasing share of PASSENGERS THAT NEED ASSISTANCE

MTR passenger mix, 2015 – 2030F



By 2030, 26% of the Hong Kong population will be aged 65+, compared to only 15% in 2015. Elderly will demand easy wayfinding, high accessibility, necessary facilities, and more assistance. Tourists also demand more assistance.

Go Greener – Be more friendly to our World

Climate Change



Annual mean sea level
+30mm per decade
on average during
1954-2015



Annual mean temperature
+0.17°C per decade
on average during
1986-2015

Annual greenhouse gas
emission (2013)

Total:
44.4 million tonnes

Per capita:
6.2 tonnes

Carbon intensity:
**0.021 kg CO₂-e per
Hong Kong Dollar GDP**



Greenhouse gas sources (2013)
**68% from electricity
generation** (90% of electricity
consumed in buildings)



17% from transport



6% from waste 05
9% from others

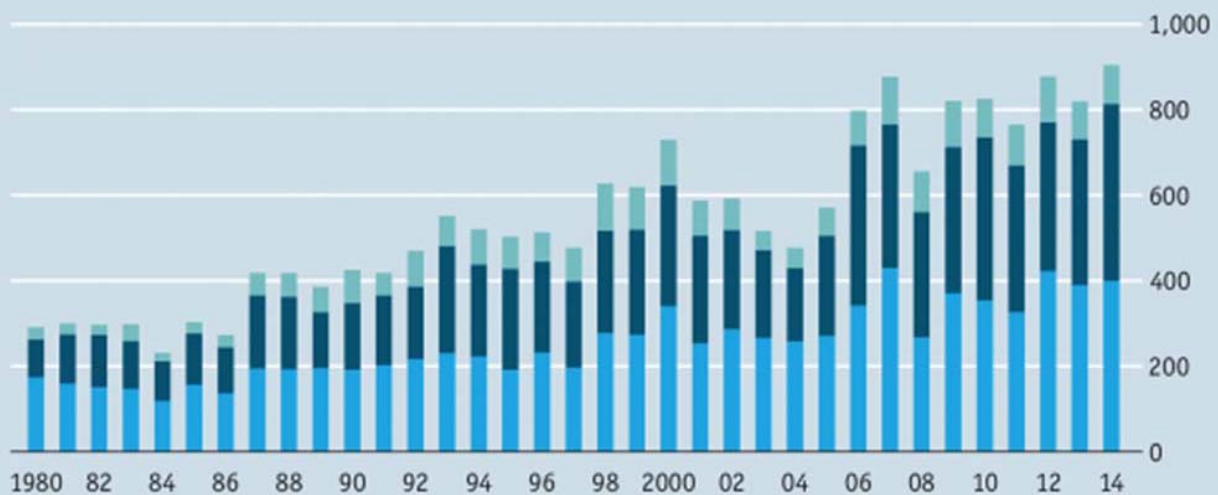
Source: Extracted from the strategic plan "Hong Kong 2030+: Towards a Planning Vision and Strategy Transcending 2030"



Increasing Climate Challenges

Disasters caused by weather and climate

- Meteorological events (*Storms*)
- Hydrological events (*Floods, landslides and avalanches*)
- Climatological events (*Extreme temperatures, droughts, forest fires*)



Source: Munich Re

Climate change

→ Driver of more energy and cost efficient solutions

Intelligence transportation –

We are moving forward now

鐵路
RAILGEN 2.0

Next generation rail,
connecting you to a better future



Scan the QR Code

For details, please visit www.mtr.com.hk

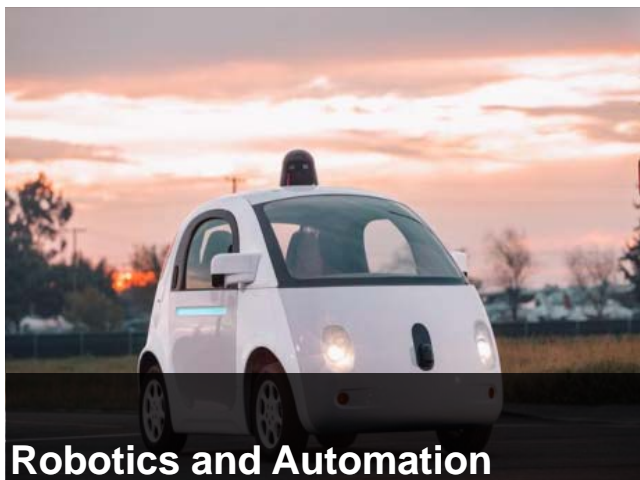
caring for life's journeys



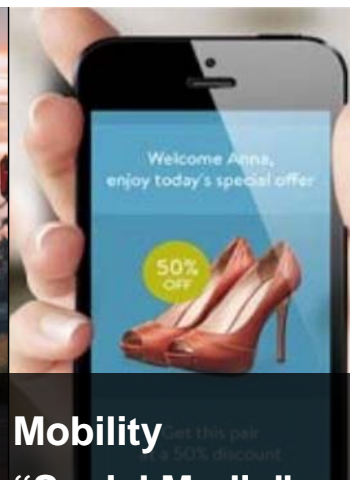
MTR Corporation

11/21/2016

Page 13



Robotics and Automation



Mobility
“Social Media”

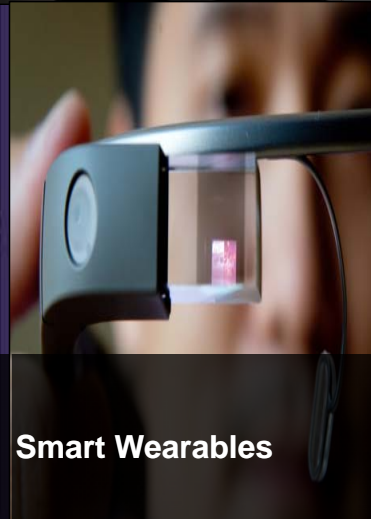


All Things Connected



Big Data and Analytics

Artificial Intelligence

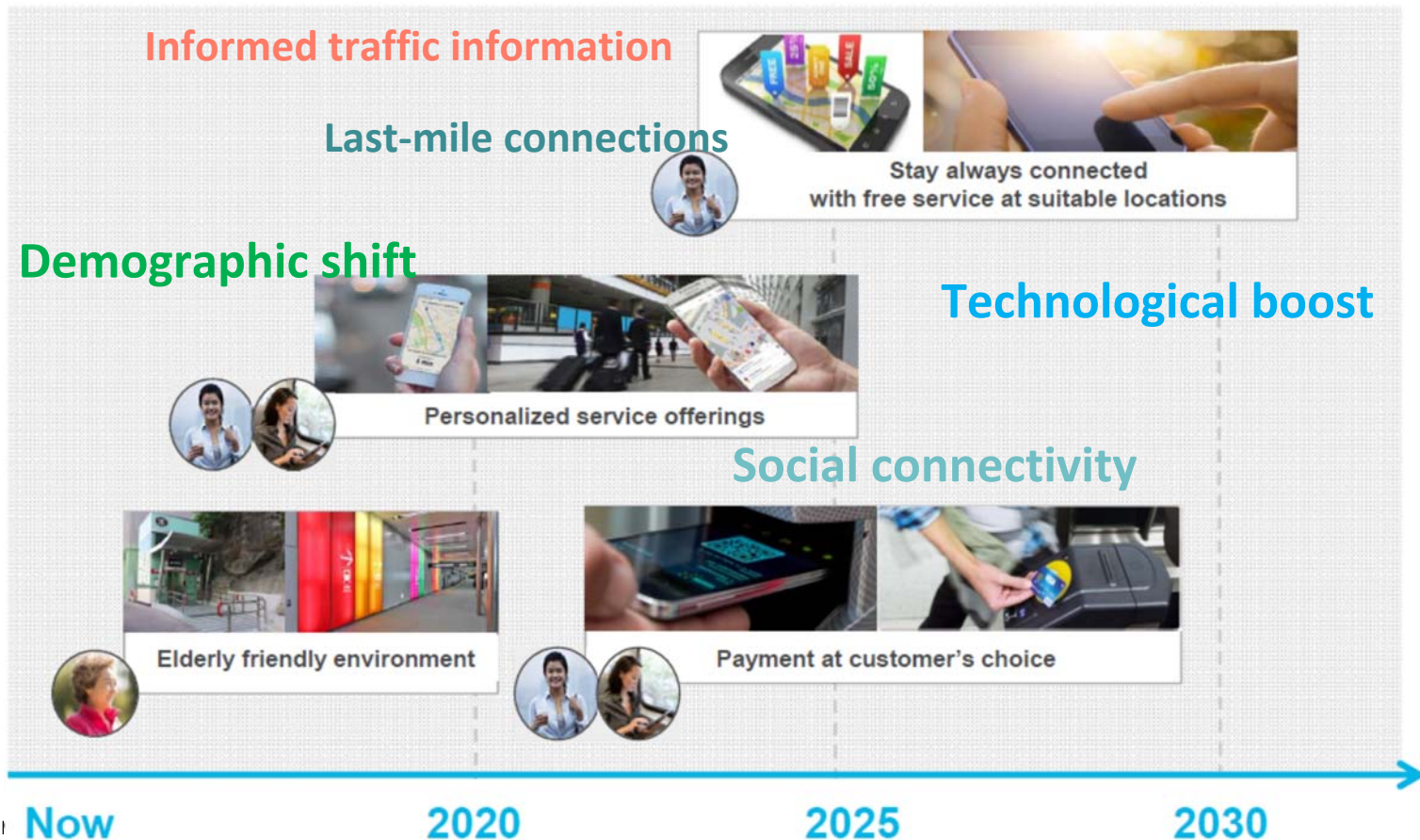


Smart Wearables



Virtual Reality

Customer-centric services responding to megatrends



City of Tomorrow: time and space capacity

- ✓ Providing and releasing **transportation capacity, infra-structure capacity and time & space capacity** to customer through **innovative** ways in constructing and operating the railway **smartly** in terms of both efficiency and effectiveness



Readying and enabling connectivity as Smart Railway

Future assets



Stations

- Ticketless travel
- Gates open for normal services
- Tailored for customer segments needs



Train services

- FAO and FAO-ready
- >99.9% reliability



Customer connectivity

- Personalized
- End to end / Total journey
- Value added services

Enabled by



Asset connectivity

- Integrated real-time data
- Interconnected hardware
- Mobile workforce solutions



Modularisation

- Plug & play
- Standardisation
- Efficient design and maintenance



Maintenance

- Automatic diagnostics and recovery
- Predictive and preventive
- Analytics & modelling



Resilience & continuity

- Resilience to extreme weather
- Obsolescence management
- Low energy consumption

Supported by



People

- Rewarding careers
- Multiskilling
- Attracting talent
- Global MTR family



Managing the assets for the smart railway

By Foresight-driven Asset Strategy FAST 2030+ engine

driven through 9 Strategic Priorities

To Achieve



Customer-Centric Asset Management

- Focus on What Matters Customer Most



Foresight-driven Demand Management

- Capacity & customer demands
- Leading performance indicators



Cost Optimisation & Control

- Holistic asset planning
- Supported by Value Engineering
- Enable cost allocation and optimisation

Enabled by



Technology & Innovation Management

- Demand driven
- Technology radar enabling timely technology applications



Disruption Management & Foresight Asset Maintenance

- Critical failure analysis
- Predict & prevent
- Respond & recover



Partner Management

- New ways working with partners
- Influence technology development



Asset Information Management (Big Data)

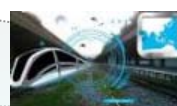
- Fully integrated, real time asset information
- Enable data analytic

Supported by



Competence Management

- Foresight competence demands



New Technologies

- Influence technology development

Under Foresighted Asset Strategy 2030 (FAST 2030+)

IoT

Simulation

GPS

Sensor technology

Statistical analysis

Predict & Prevent



Laser scanning

RFID

Respond & Recover

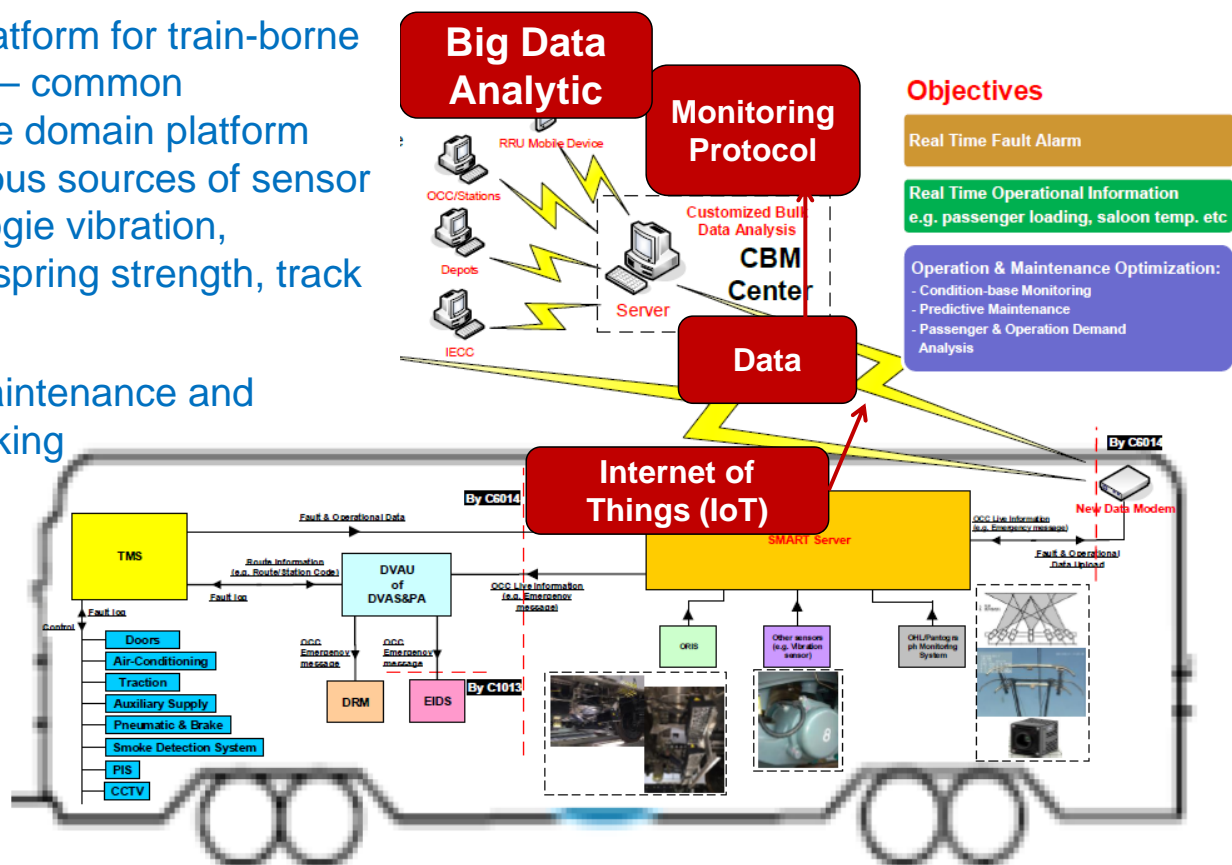
Big Data Analytics

Imaging technology

Artificial intelligence

Intelligence Train

- Universal platform for train-borne sensor data – common time/distance domain platform hosting various sources of sensor data (e.g. bogie vibration, pantograph spring strength, track height etc.
- Facilitate maintenance and decision making



Asset Intelligence – Predict & Prevent / Respond & Recover



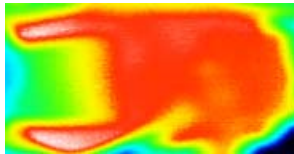
Building Wall Cladding Condition Monitoring



Pantograph Wear Monitoring



Smart Sensor for Rail Integrity Monitoring



Axle Bearing Temperature Monitoring



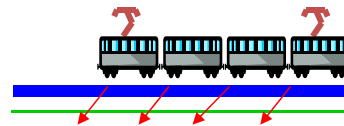
Wheel Profile Monitoring



Axle Box Temperature



Brake Pad Wear Monitoring



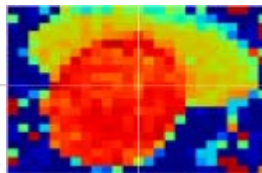
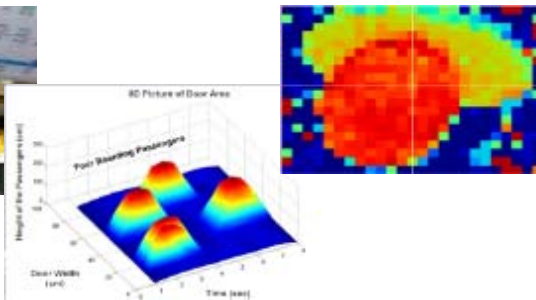
Remote Capturing of Stray Current Data in Tunnels



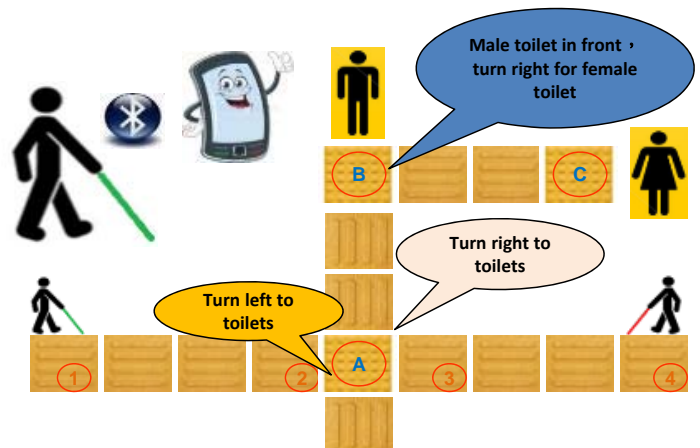
(Tech watch) use of VR for remote investigation / training

Technology enablers boost customer experience

Automatic Passenger Counting System



RFID Path-finding for Visually-Impaired



Using iBeacon to remind passengers to get off trains



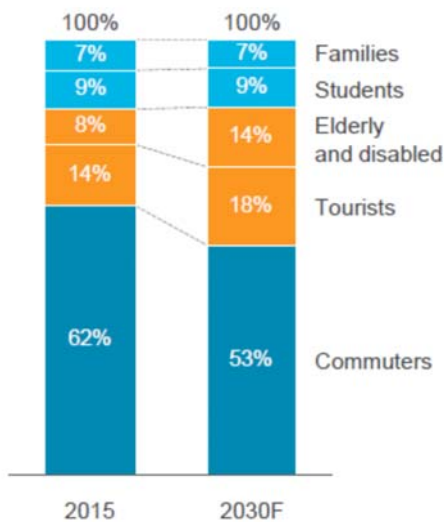
Windows-Embedded LCD Screens for Trains



Customer expectation foresighting

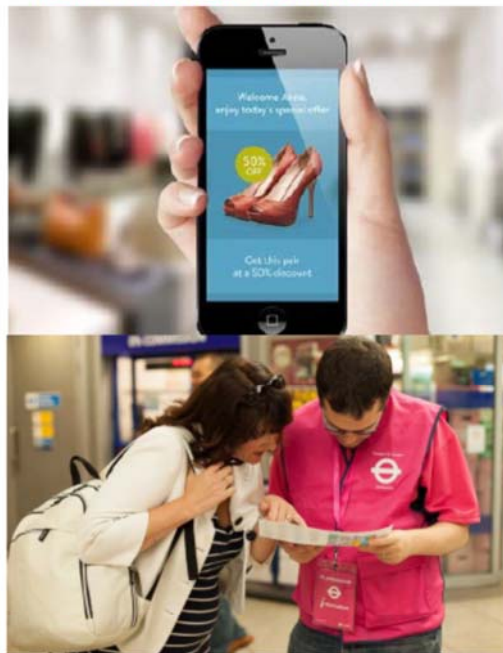
Increasing share of PASSENGERS THAT NEED ASSISTANCE

MTR passenger mix, 2015 – 2030F



By 2030, 26% of the Hong Kong population will be aged 65+, compared to only 15% in 2015. Elderly will demand easy wayfinding, high accessibility, necessary facilities, and more assistance. Tourists also demand more assistance.

Increasingly USER-CENTERED and PERSONALIZED experiences



Predictive/real-time connectivity and two-way exchange of information will be expected. Delivery of **more individualized information** will become the norm.

Increasing role of DIGITIZATION



Utilization of **modern information channels** will be key. Shifts in the way time is optimized (i.e. 'always on') will matter to users.

Extra caring to Elderly

Pre-journey



I receive an alert when the facility in the station near my community is out of service

Entering station



I can easily enter the station, even though I am less mobile



I can walk through the station at my own pace and feel safe



I can easily find a public toilet in stations and can use the toilet safely

Point of journey



I can always find a seat



It is easy to approach MTR staff whenever I have questions and need help



I can alight the train easily at my own pace

Exiting station



I can talk to someone who understands my needs and can assist me

Elderly



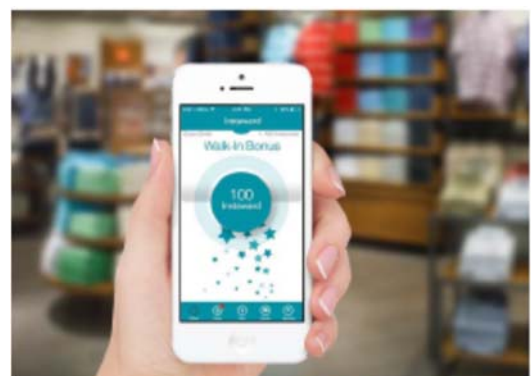
**Hassle-free
& easy travel**

Exploring added-experience value



Service Assistant and Open Payment

Exploring added - experience value



Real Time Service Information via App

Social Connectivity – Improving Inter-modality

Focusing on customer mobility needs

Mobile Convergence –
personalised real time info on
demand



Open Data



Data Proliferation – big data,
crowd sourcing



City of Tomorrow: A new Smart Mobility total solution

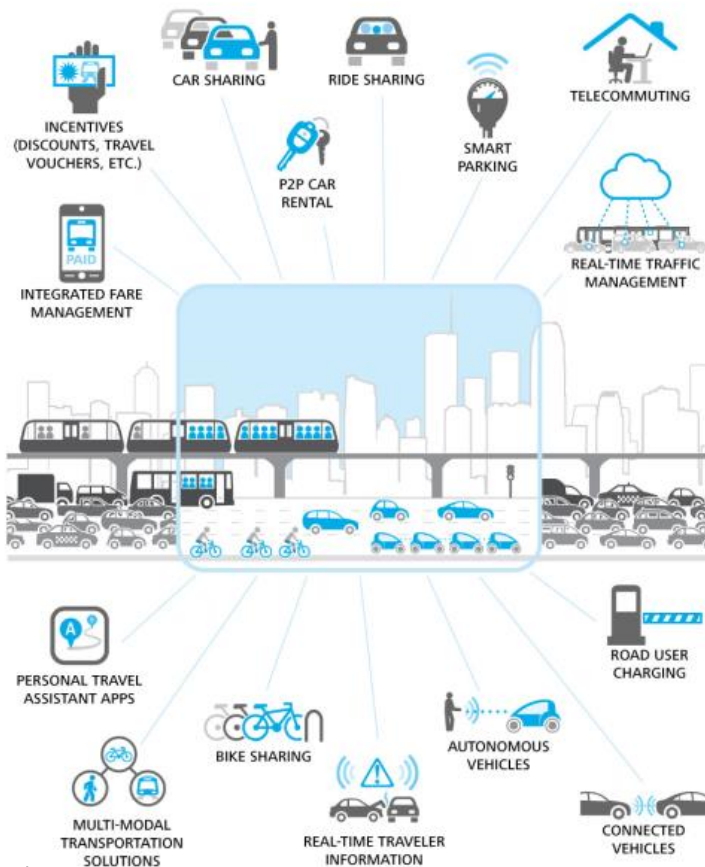
**Removing the Mass from the Mass
Transit Railway, with total
Personalised travel - Freedom of choice
of transportation with enjoyment and
offering societal benefits** through mixing of
various mobility options, resulting in

- Enhancing efficiency and utilisation of transportation capacities (including those un-used)
- balanced support between transportation means
- empower the population to behave based on open traveling data in having a smart travel



Social Connectivity becomes one of the key transportation
strategies to integrated intermodal transportation seamlessly to the
point of **omni-modality**

City of Tomorrow: total connected transportation



MTR Corporation

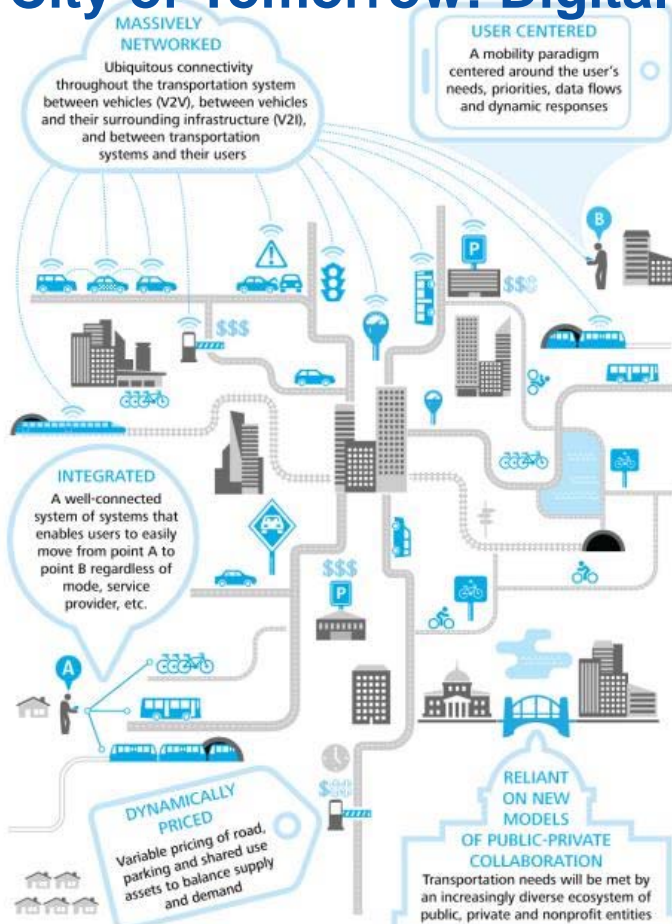
Source: Extracted from the article "Digital-Age Transportation, The Future of Urban Mobility" Deloitte University Press

11/21/2016

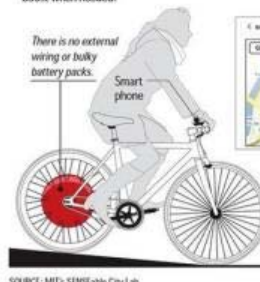
Page 29



City of Tomorrow: Digital-age transportation system



EXTRA POWER
The energy dissipated while cycling and braking is saved in batteries. That power can later be used to give the rider an extra boost when needed.



SOURCE: MIT's SENSEable City Labs

WHEEL'S BRAIN
Hub sensors and GPS allow riders to get information on air and noise pollution, congestion, and road conditions via a smartphone.



MTR Corporation

Source: Extracted from the article "Digital-Age Transportation, The Future of Urban Mobility" Deloitte University Press

11/21/2016

Page 30



Thank you

MTR Corporation Limited 香港鐵路有限公司