Mobility & Transport in Singapore

Presentation

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(FCL) FUTURE CITIES LABORATORY 未来城市实验室

(SEC) SINGAPORE-ETH CENTRE 新加坡－ETH研究中心

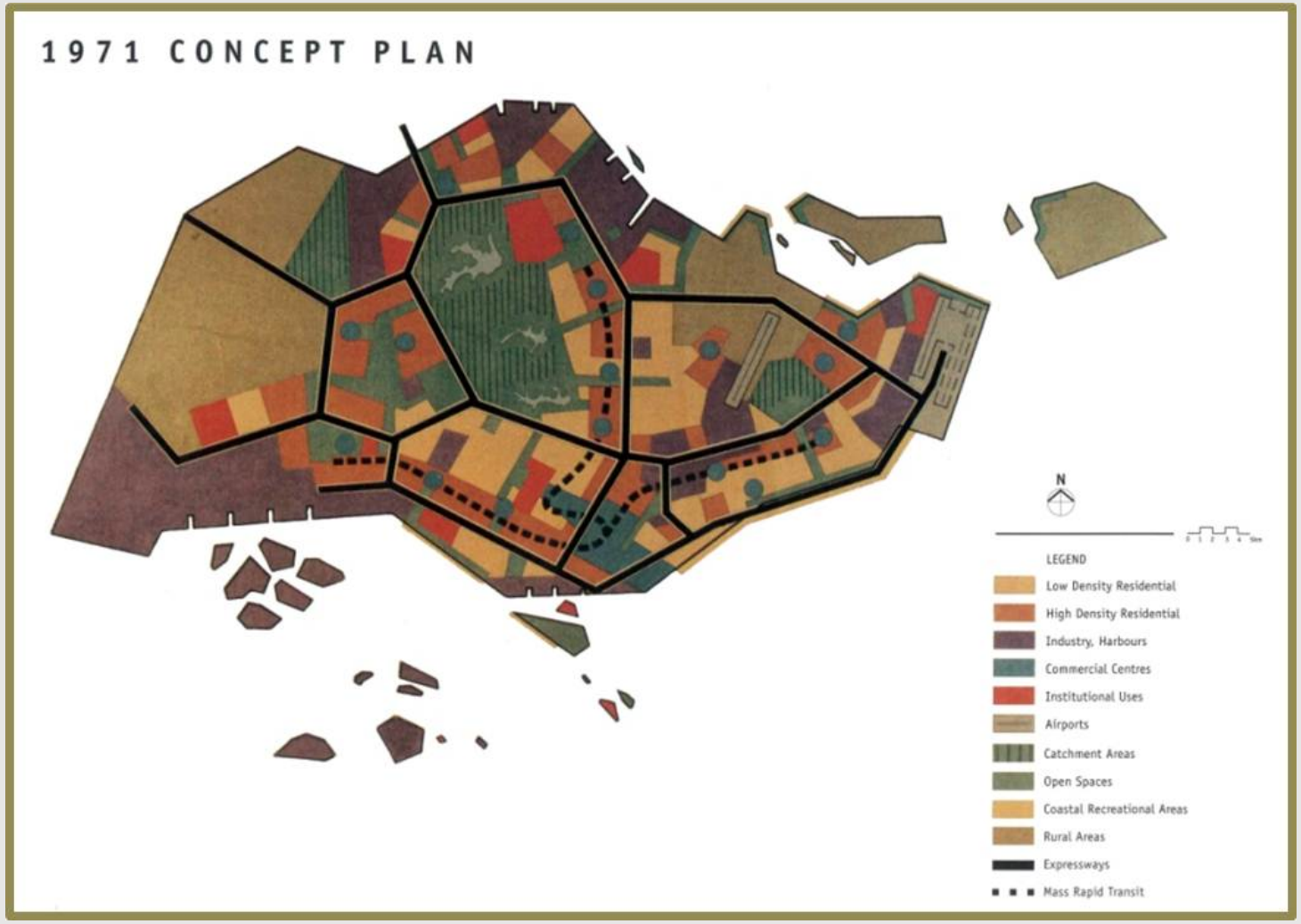
Mobility & Transport in Singapore

Pieter FOURIE

Michael VAN EGGERMOND

Future Cities Laboratory | Singapore ETH Centre

Part 1:
Background



Background
Singapore

Singapore's great strength in urban policy making:
Unusual willingness to face up the need for difficult trade-offs.

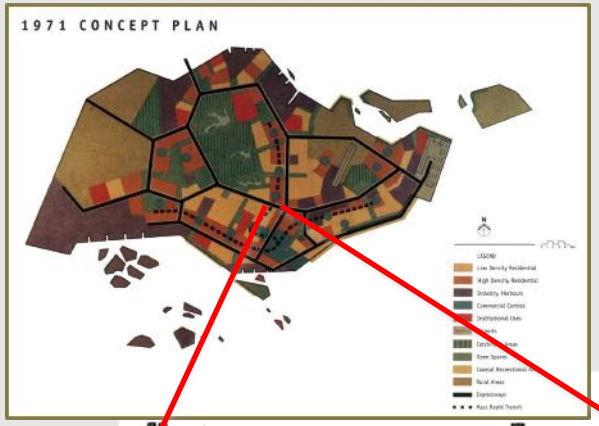
Goals
Moving people and goods space efficiently
Reduce the need for travel, especially car travel through public transport oriented planning

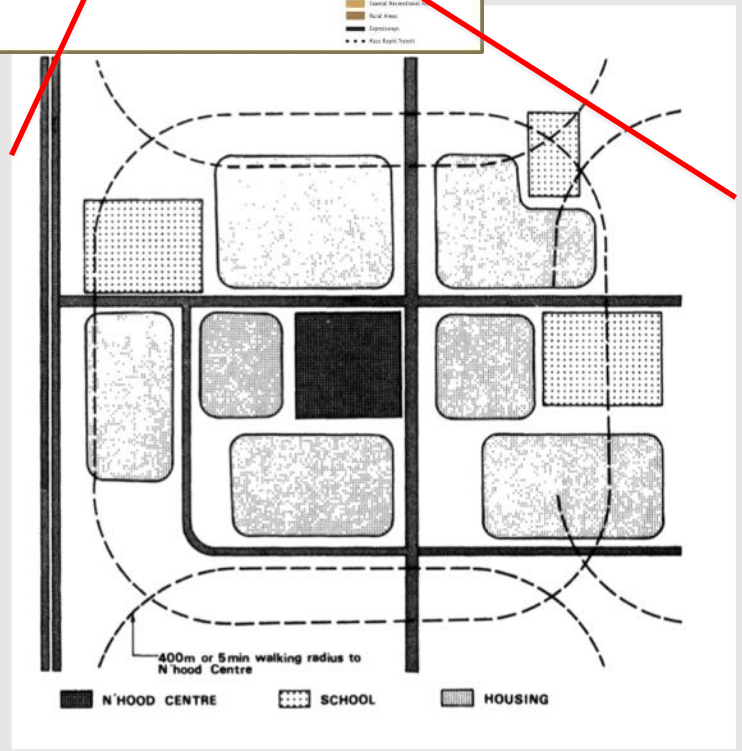
Strategic concept plan, 1971, called for:
Urban structure with strong center

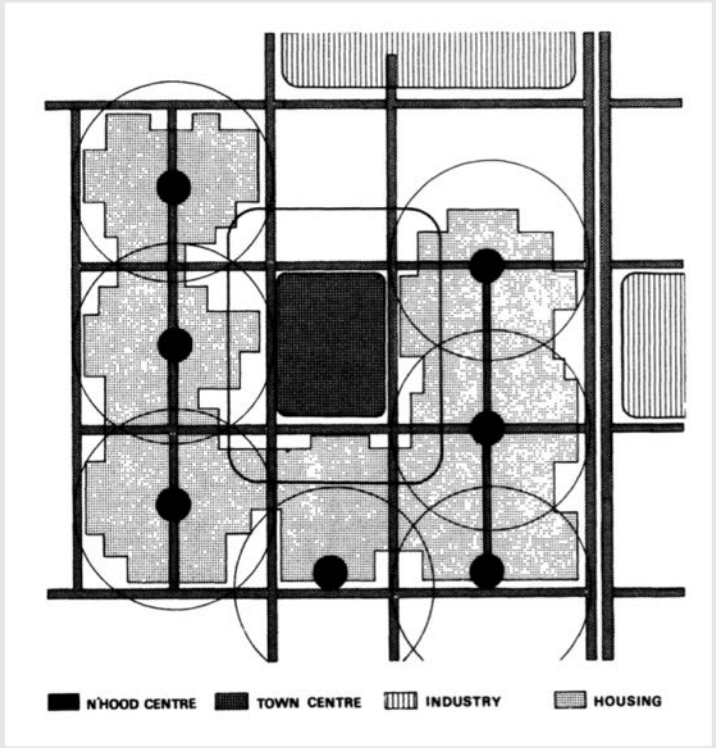
Clear corridors of high density new towns served by mass transit

Only 15% of land pass allocated for residential housing -> mass to live in high density dwellings.

Background
Town design

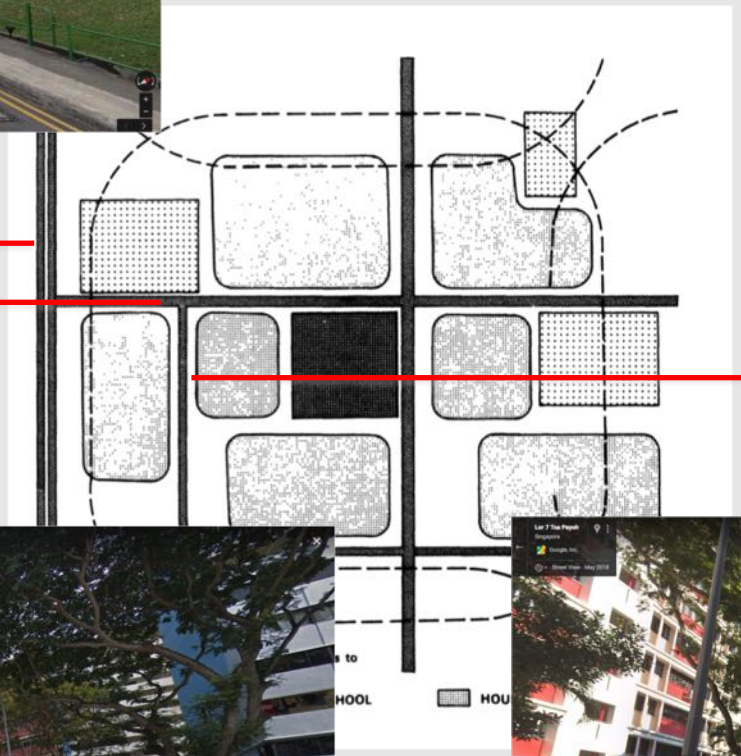




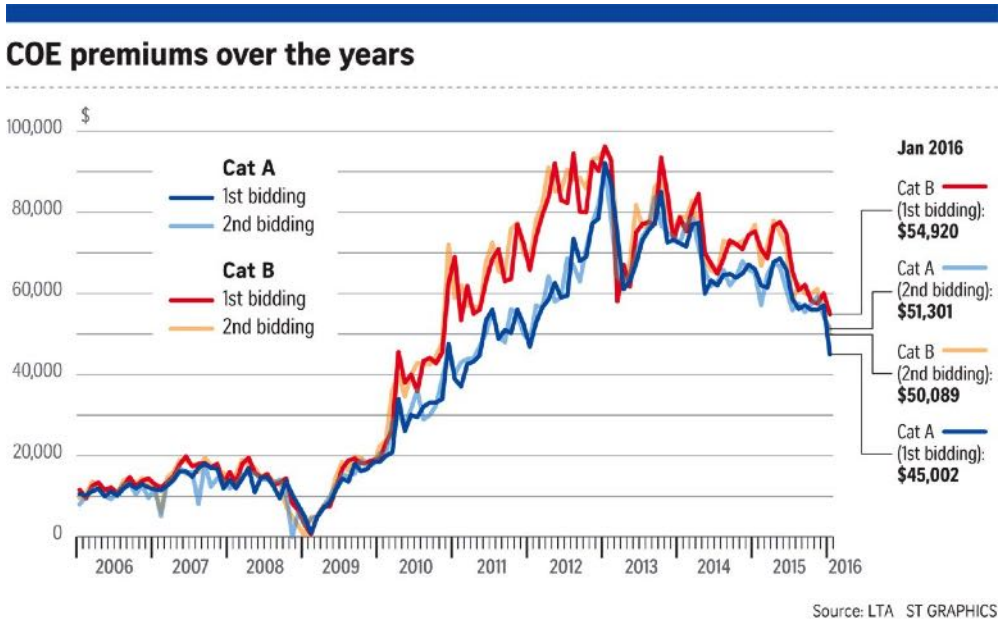


Eng, T. S. (1986) New Towns Planning and Development in Singapore, Third World Planning Review, 8 (3) 251.

Background
Town design



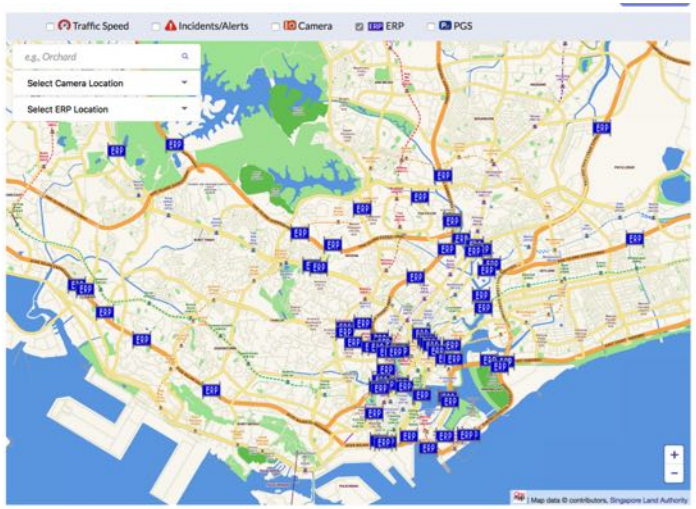
Background
Vehicle management



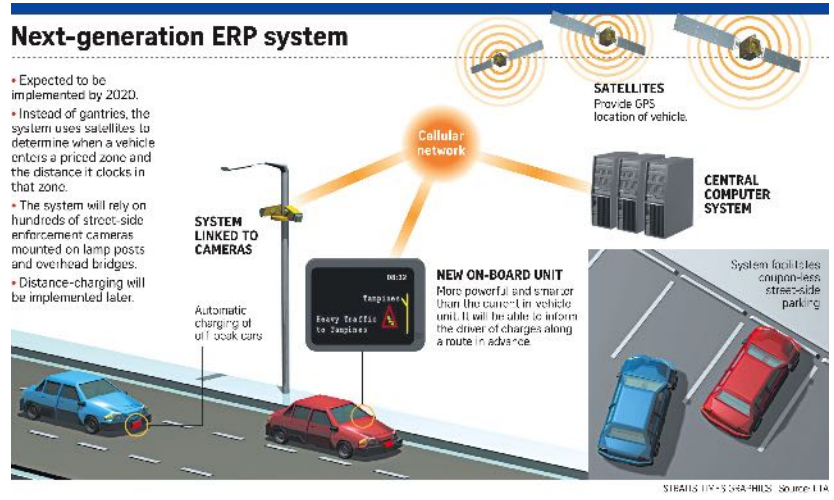
Policy

Road pricing

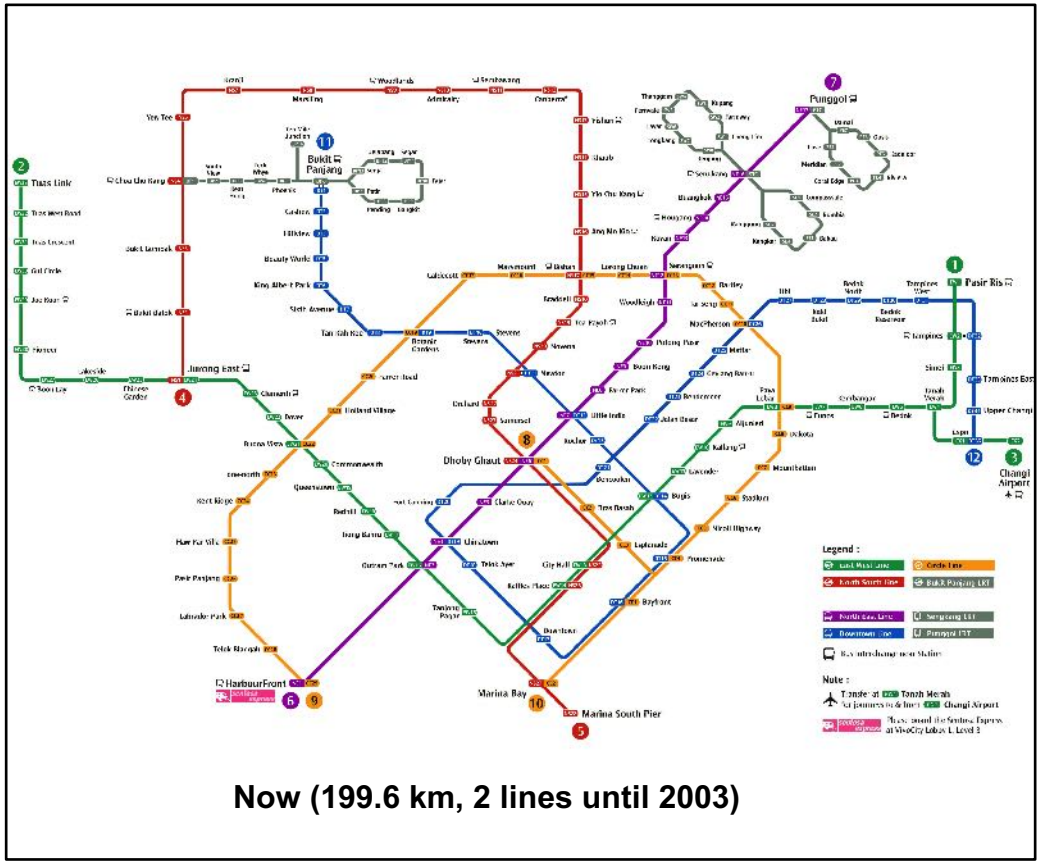
Now



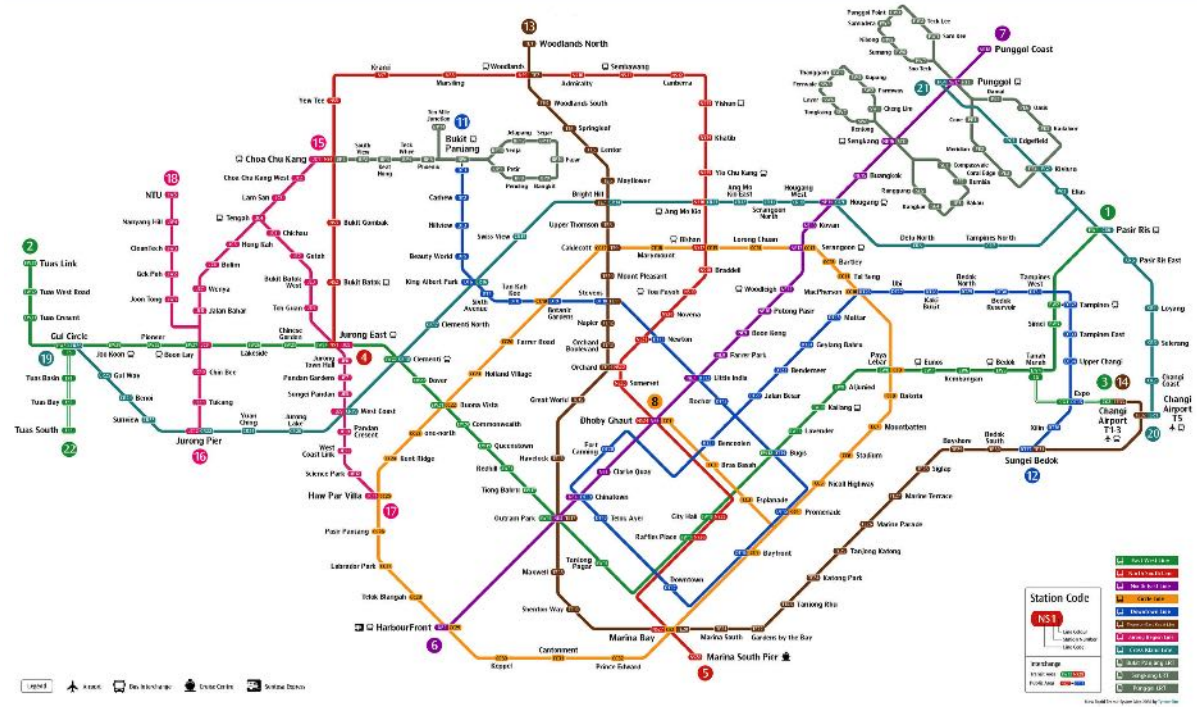
2020 onwards



Public transport
MRT / LRT



Now (199.6 km, 2 lines until 2003)



2030 (360km, 3 additional lines)

Part 2:
Active Mobility

Walking

100 meters or 2 minutes?

30 meters or 4 minutes?

Walking

Decrease perceived travel time:

Shops,

Greenery,

Cover

Increase perceived travel time:

Crossings,

Bridges

Walkability *in Singapore* **Findings**

Six out of 42 images shown to respondents in the stated preference survey. Attributes depicted in the images include greenery, road type, cover, weather and the presence of shops. The travel time shown depicts the perceived walking time; walking time through a park is taken as a reference case. For instance, walking along a minor road is perceived as 47% longer than a park, whereas the presence of cover, greenery and shops can reduce the perceived walking time by 35%.

Approx. 35% of the pedestrians participated in an online follow-up stated preference survey in which participants were shown different routes and streetscapes. We found that:

- **Pedestrians prefer** routes with **cover** in sunny and rainy weather, and tend to **avoid crossings**.
- **Covered walkways** and an **active frontage** can **reduce** the perceived **walking time** by up to **30%.**
- **Crossing** an **overhead bridge** was perceived as **5 minutes** of walking (similar to previous findings in Singapore).

Cycling

Cycling in Singapore

Current mode share of cycling is low (1%) for trip stages and trips;

However, certain residential new towns have mode shares up to 4% (HITS 2012, by authors)

Ambitious plans to make cycling a viable mode of transport

- Up to 700 kilometres cycling lanes by 2030
- Up to 360 km rail by 2030

Challenges for cycling in Singapore

Typical residential developments in Singapore are influenced by 20th century town planning:

- Segregated land-uses,
- Hierarchical road network
- Large distances between crossings
- Mainly footways with only pedestrians in mind

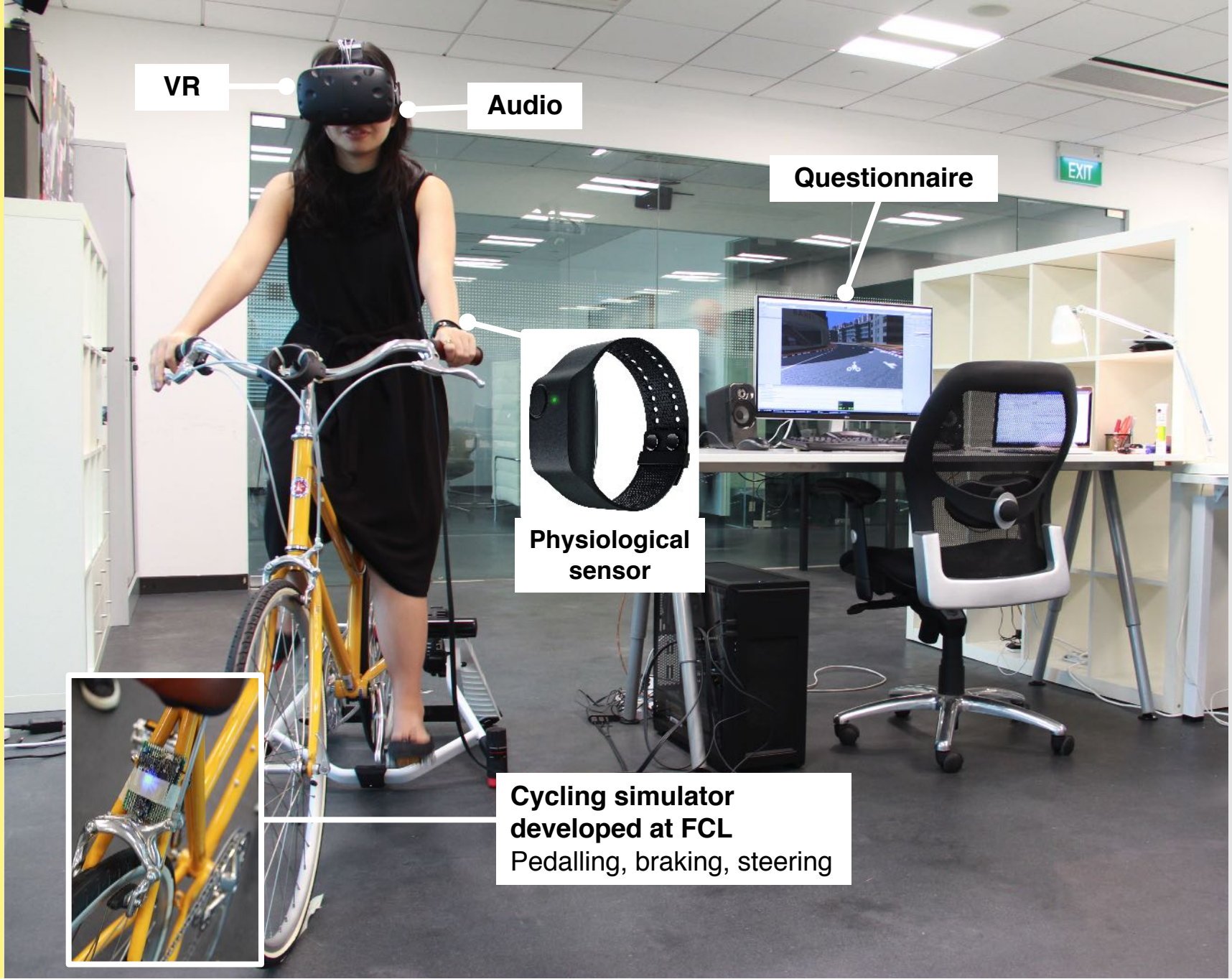
Challenges for cycling in Singapore

Main arterials are designed for high speeds and function as barriers

Lane widths are generous;

Long wait times for pedestrians at traffic lights

Tropical weather (rain / humidity)



Bike to the Future

Environment
Audio
Immersive VR
Cycling simulator

Survey duration is approx. 45 minutes.

Measurements:
Questionnaire
Cycling simulator
Physiological sensor


BIKE TO THE FUTURE
FUTURE CITIES LABORATORY
未来城市实验室
See the video here

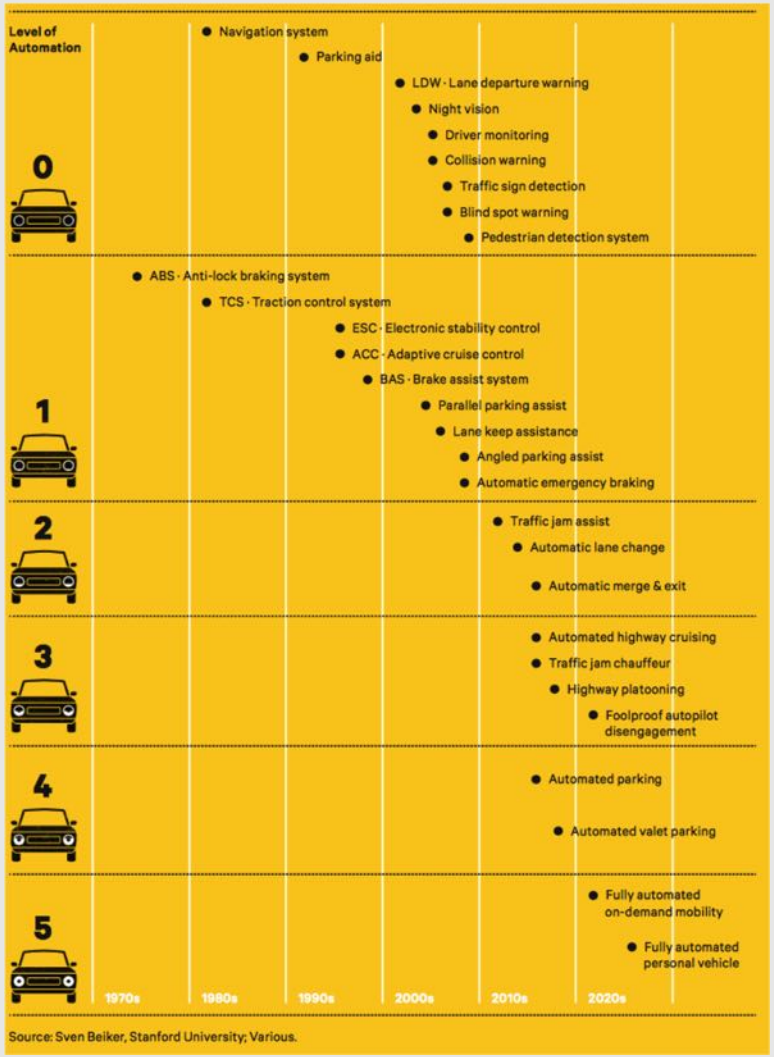
Part 3:
Future

Future
Car-lite

https://www.straitstimes.com/sites/default/files/attachments/2017/08/26/ST_20170826_LAKEDISTRICT26_3376573.pdf

https://www.ura.gov.sg/Corporate/Media-Room/Media-Releases/pr18-23

https://www.channelnewsasia.com/news/singapore/forest-town-tengah-s-first-batch-of-hdb-flats-to-be-launched-in-10229232



AV
Levels of automation

Level 0
Driver controls the car

Level 1
Driver-assistance; specific functions can be done by the car

Level 2
One driver assistance system of both steering and accelerating using environment information is automated

Level 3
Drivers are still in the car, but can shift safety-critical features to the vehicle

Level 4
Fully autonomous under certain driving conditions

Level 5
Fully autonomous under all driving conditions

Anthony Townsend (2017) Taming the Autonomous Vehicle

AV
Types of vehicles

- Uber, GM/Lyft, nuTonomy
- 4
- 4,000–6,000 lbs
- 4–6 passengers
- 25–35 mph
- Pittsburgh, San Francisco, Singapore

Autovot / Taxibot

- Navya, Local Motors, Easymile, Auro Robotics
- 4
- 6,000–8,000 lbs
- 10-12 passengers
- 25-35 mph
- Lyons, Helsinki, Washington D.C.

Driverless Shuttle

- Starship Technologies
- 6
- 40–55 lbs
- 0 passengers
- 4 mph
- Talinn, London, Bern, Redwood City, CA, Washington D.C.

Deliverybot

- Otto (Volvo), Scania
- 18
- 33,000 lbs
- 44,000 lbs cargo
- 55 mph
- Colorado, Rotterdam, EU (various)

Software Train

Anthony Townsend (2017) Taming the Autonomous Vehicle

HOW WILL ADVENT OF AUTONOMOUS VEHICLES INFLUENCE URBAN FORM

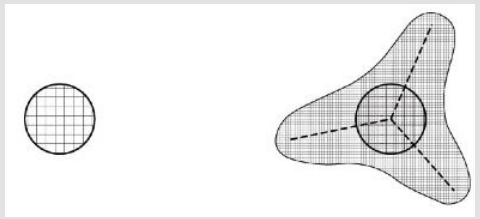
Walking-Horsecar
1800-1890

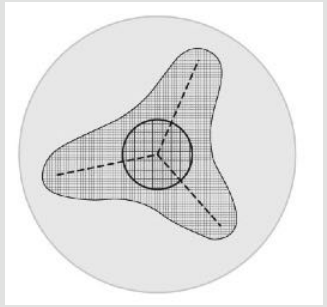
→ Electric Streetcar
1890-1920

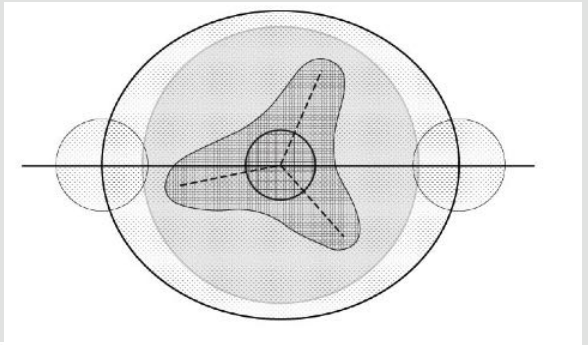
→ Recreational Automobile
1920-45

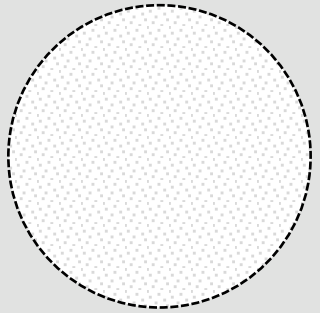
→ Freeway
1945-Present

→ Autonomous Vehicles







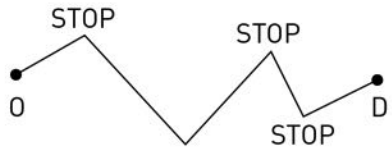


AVs will set the stage for the next major technology driven urban transformation.

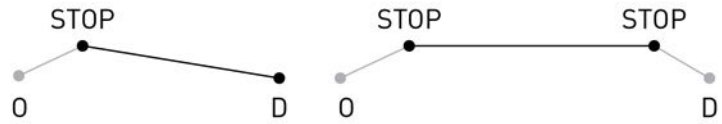
Pictures:
http://s.picture-russia.ru/wpic/l/9/b/9bc4c2405b56fcc00df114add273aaa5.jpg
https://www.6sqft.com/worlds-first-streetcar-began-operation-in-lower-manhattan-on-november-14-1832/
Diagram adapted from Peter O. Muller's Transportation and Urban Form

Automation & transport

TAXI AND RIDESHARING MODEL
Vehicle Size = 4-6 Persons

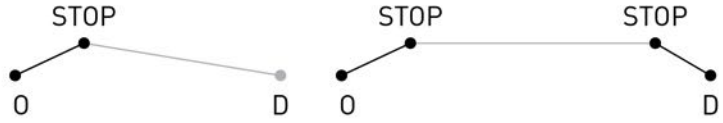


GOVERNMENT REGULATED FLEET MODEL
Vehicle Size = 20 - 50 Persons



PERSONAL OWNERSHIP MODEL
Vehicle Size = 4-6 Persons

RESTRICTED USE MODEL
Vehicle Size = 2-4 Persons



What are the parameters?

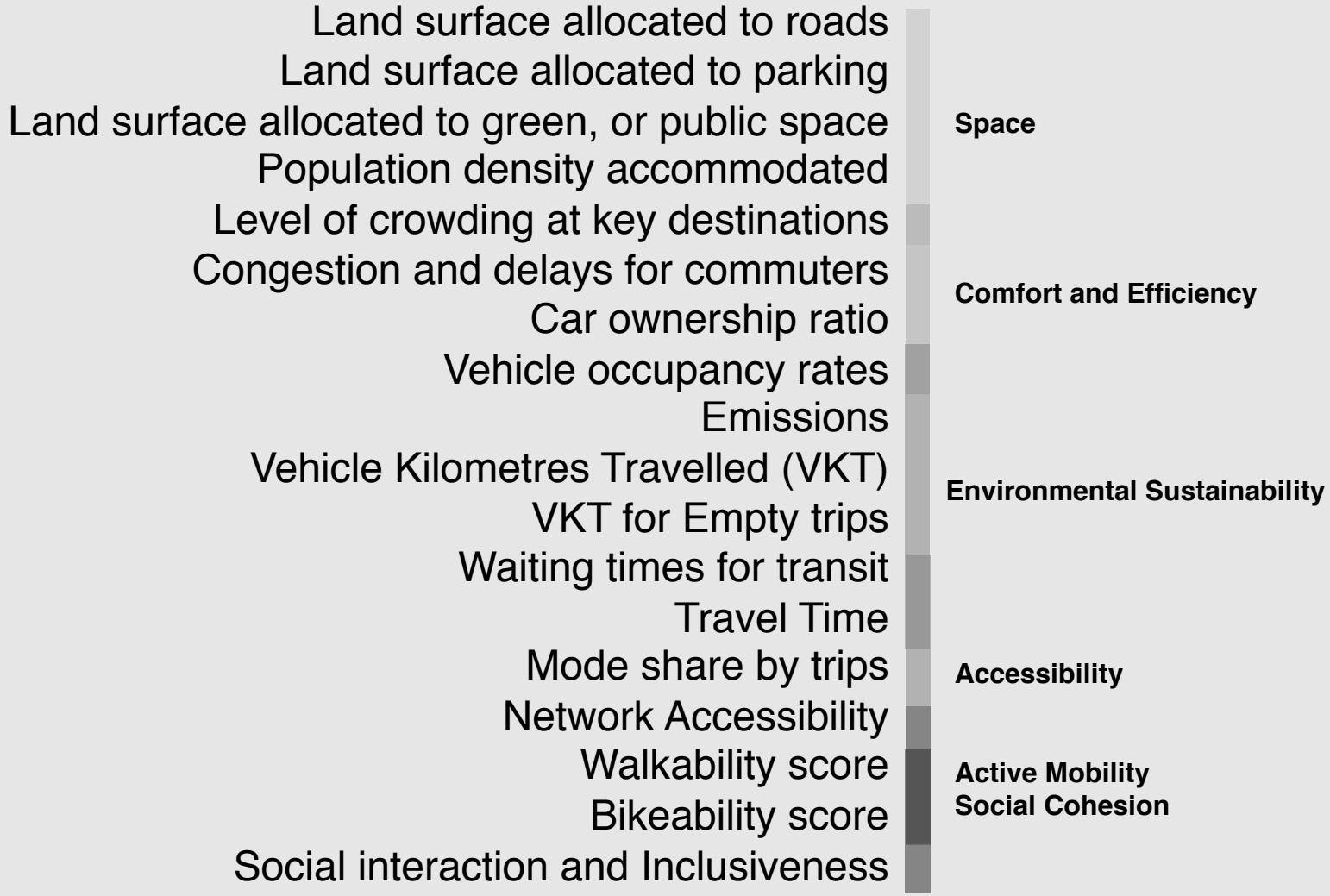
Shared or Private?

Size of Vehicles?

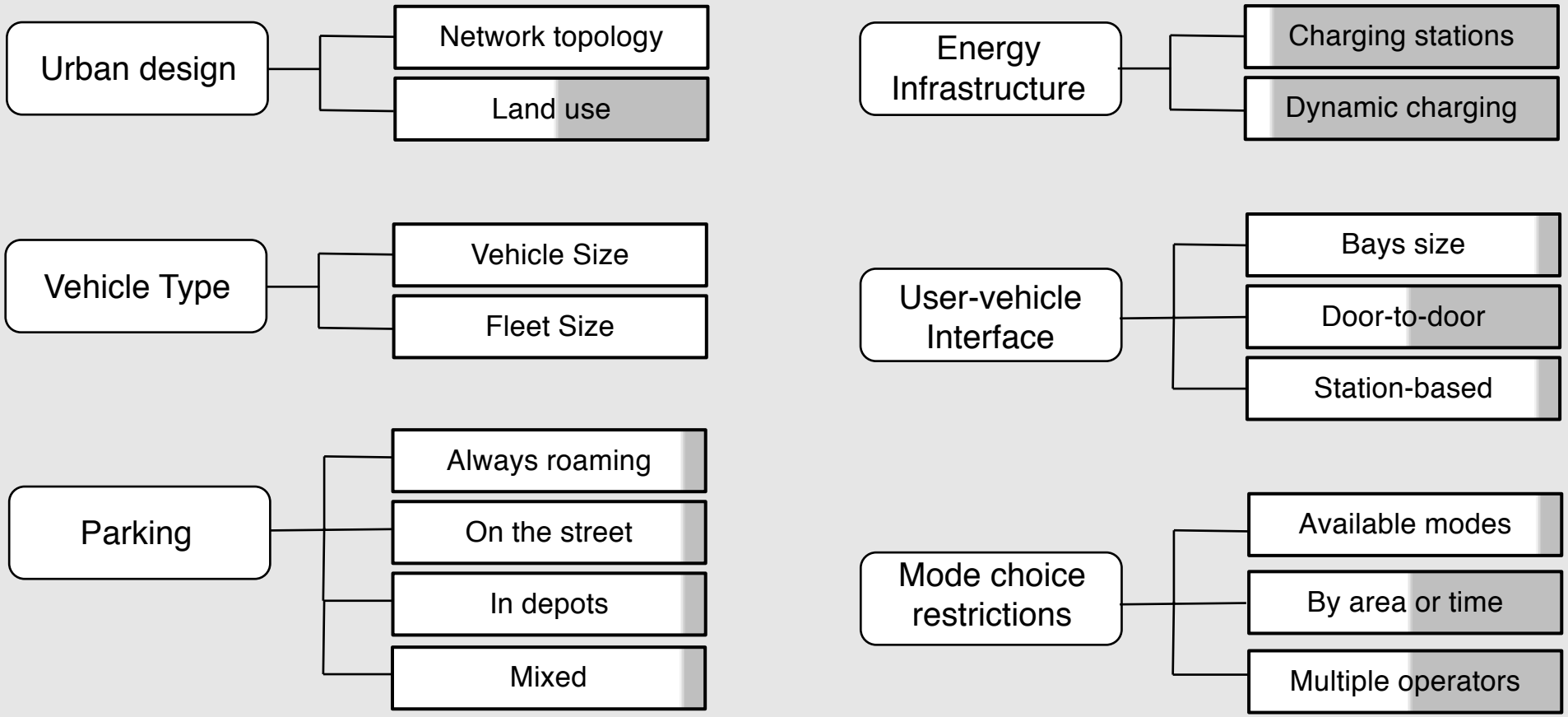
Size of Fleet?

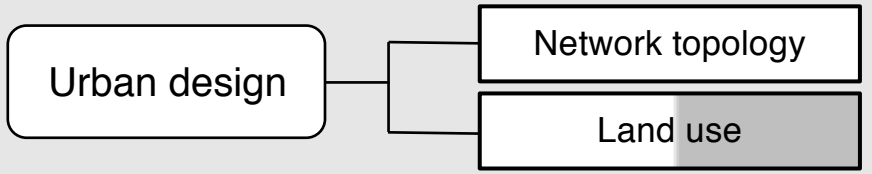
Parking Strategy?

Which performance indicators

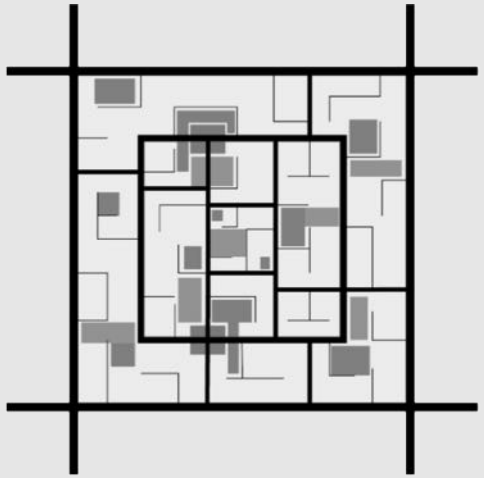


Design & simulation



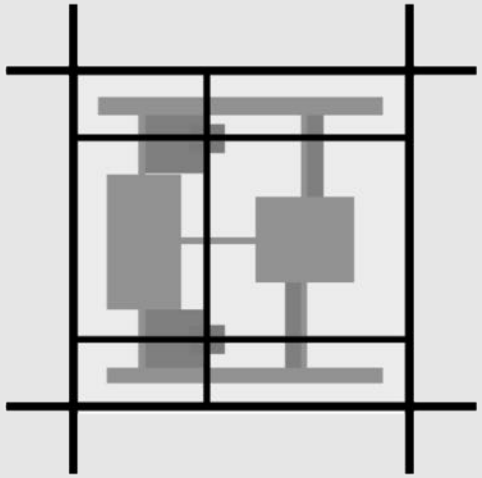


Type I
Existing cul-de-sac and loop model



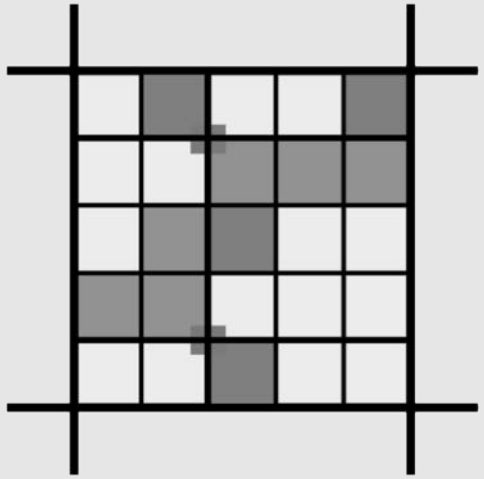
Typical HDB structure retrofitted to accommodate door-to-door AV service, maximising the use of existing Culs-de-sac and fixed route AV service through loops and X-junctions

Type II
Superblock Model



Typical HDB cell modified to remove several links and create superblocks, with no door to door service, but high speed fixed route transit and low speed micro transit in shared spaces.

Type III
Permeable Grid

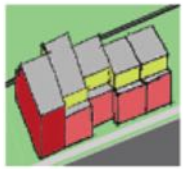


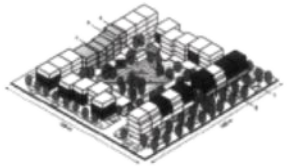
Re-imagining HDB cell, as a high density grid model, to facilitate shared rides with dynamic routing.

What Aspects of **Urban Form** Impact Transport Flows

What are the parameters?


Network Grid


Land Use Distribution

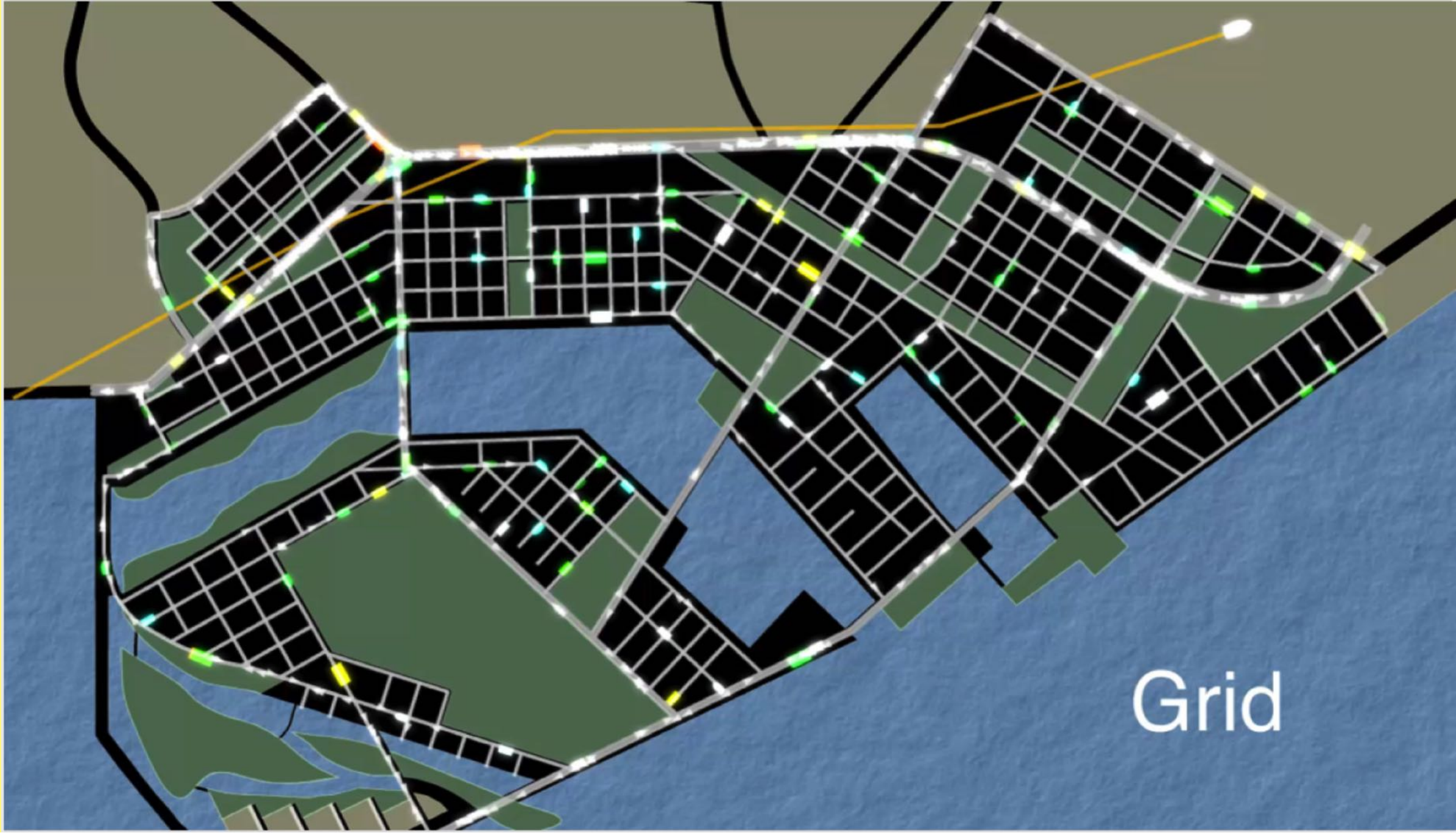

Development Intensity


Parking


Interface

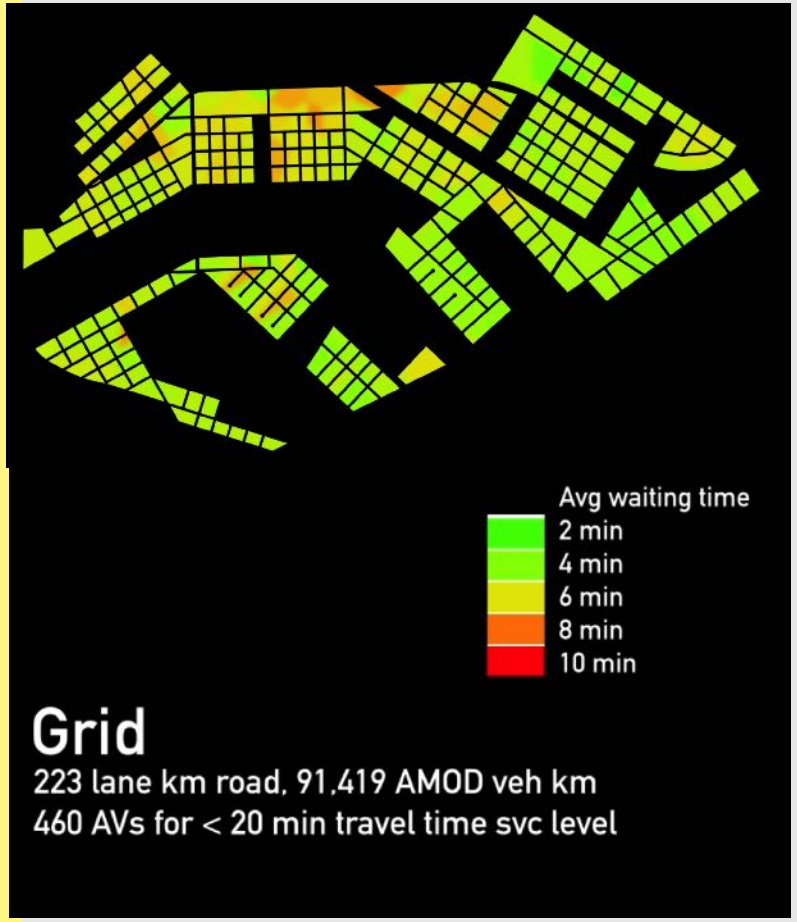

Street profile

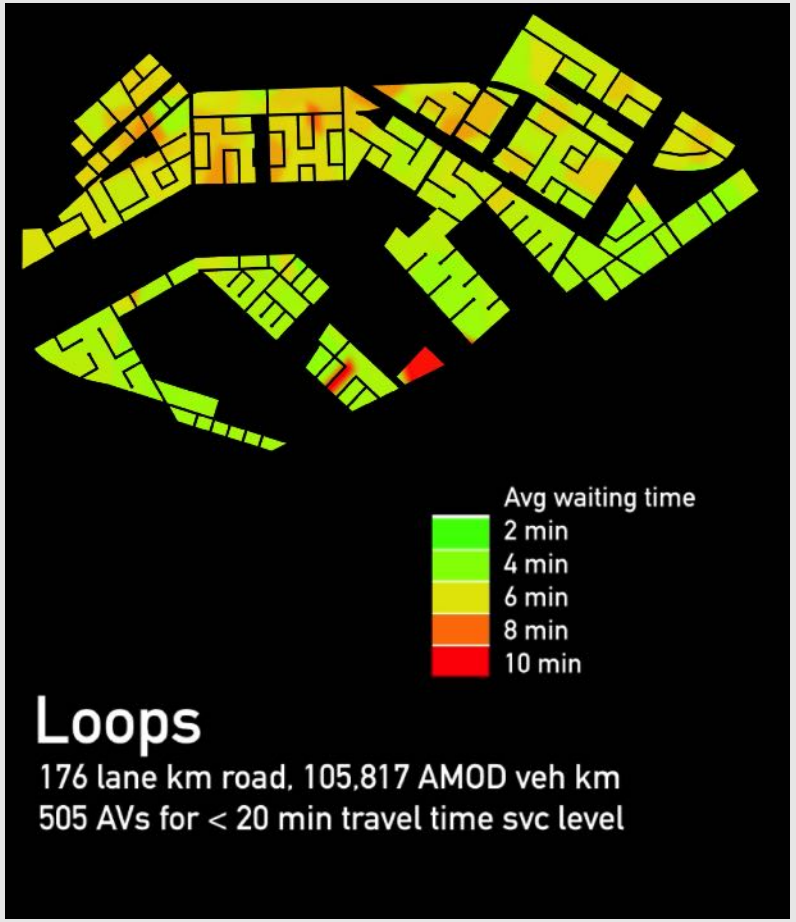
a. **First order impact** - Street sections, street capacities, public transit interface, parking,
b. **Second order impact** - Reimagining the neighbourhood unit – network design, land use distribution
c. **Third order impact** - Shape of the city - residential/job location choice, density, urban footprint

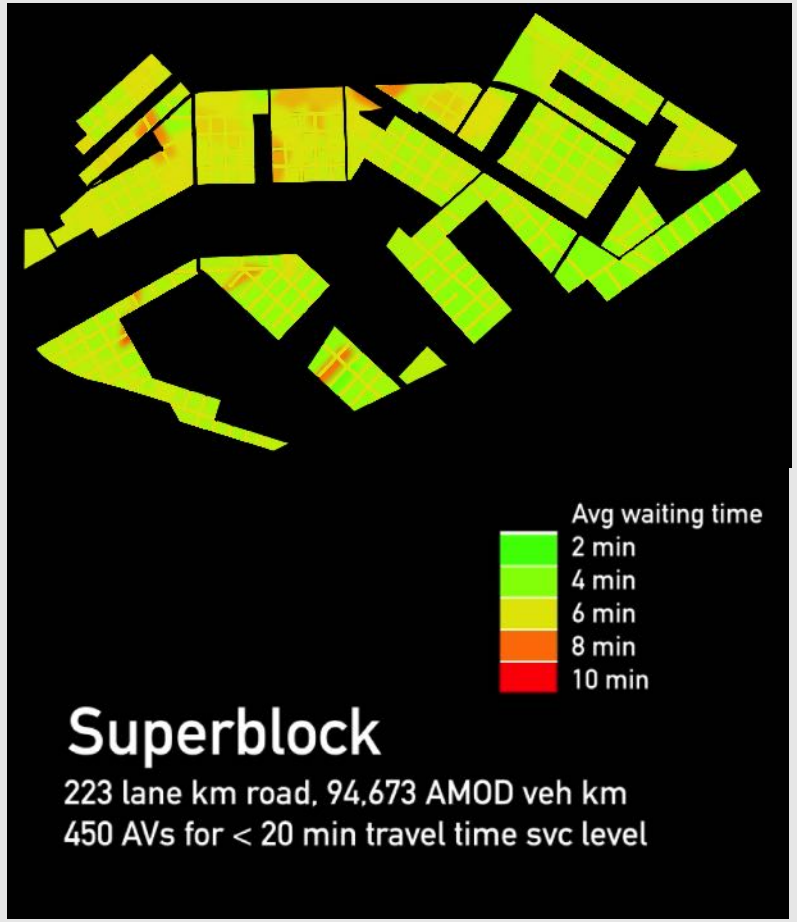

Grid

Urban design

- Network topology
- Land use








AV
Flying cars

Flying taxis

Uber.com/elevate

It’s closer than you think

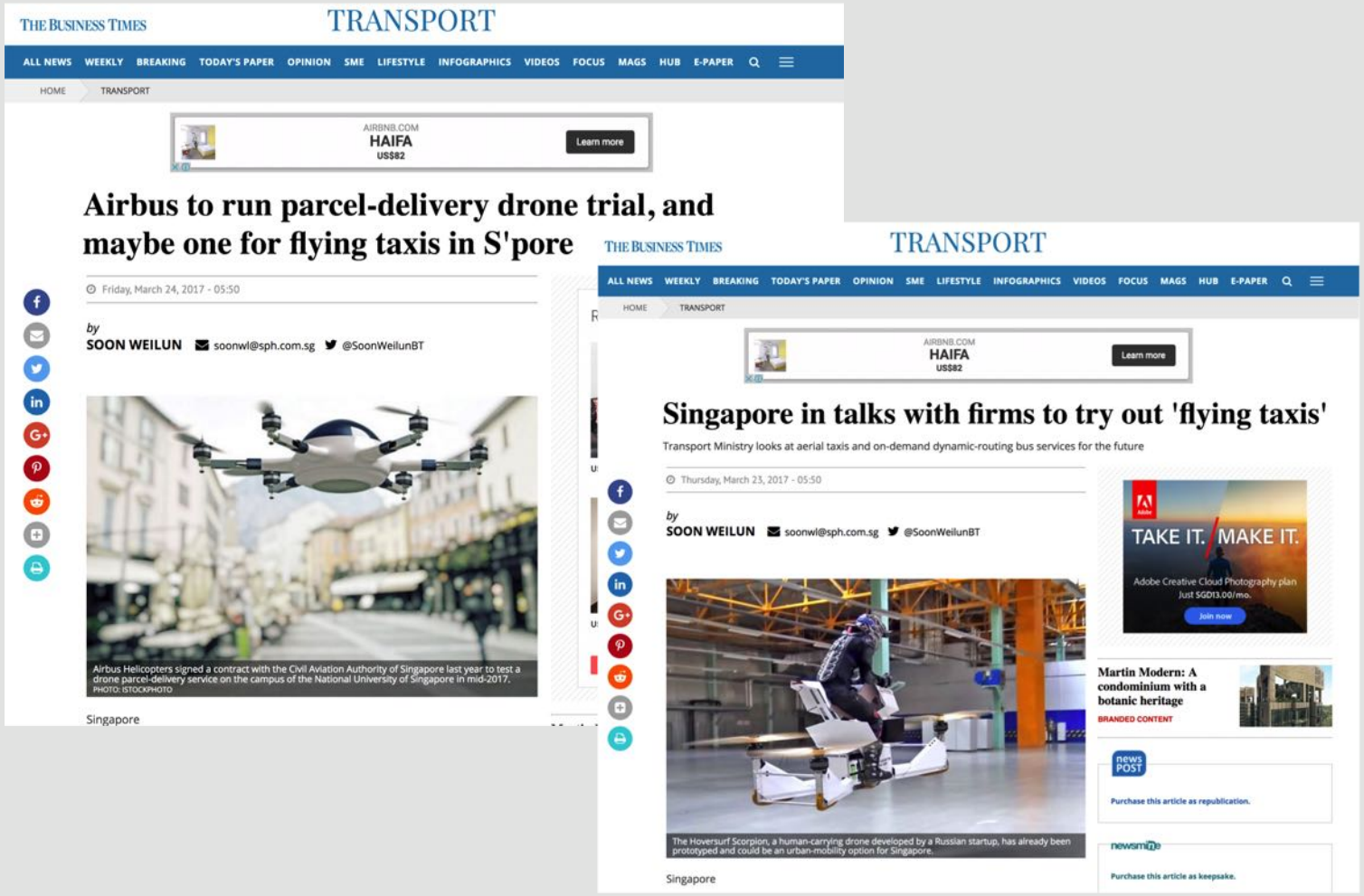
Low noise, safe, autonomous (after FAA approval), electric

Starting in 2020 in Dubai

Cheap retrofitting of existing parking structures

Typical expectation is reducing travel time by > 50%, door-to-door, of 60%+ of trips over 15km (depending on the city – see white paper)

Flying taxis



THE BUSINESS TIMES TRANSPORT

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HOME TRANSPORT

AIRBNB.COM HAIFA US$82 Learn more

Airbus to run parcel-delivery drone trial, and maybe one for flying taxis in S'pore

Friday, March 24, 2017 - 05:50

by SOON WEILUN soonwl@sph.com.sg @SoonWeilunBT

Airbus Helicopters signed a contract with the Civil Aviation Authority of Singapore last year to test a drone parcel-delivery service on the campus of the National University of Singapore in mid-2017.
PHOTO: ISTOCKPHOTO

Singapore

THE BUSINESS TIMES TRANSPORT

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HOME TRANSPORT

AIRBNB.COM HAIFA US$82 Learn more

Singapore in talks with firms to try out 'flying taxis'

Transport Ministry looks at aerial taxis and on-demand dynamic-routing bus services for the future

Thursday, March 23, 2017 - 05:50

by SOON WEILUN soonwl@sph.com.sg @SoonWeilunBT

The Hoversurf Scorpion, a human-carrying drone developed by a Russian startup, has already been prototyped and could be an urban-mobility option for Singapore.

Singapore

Attracting serious money (here)

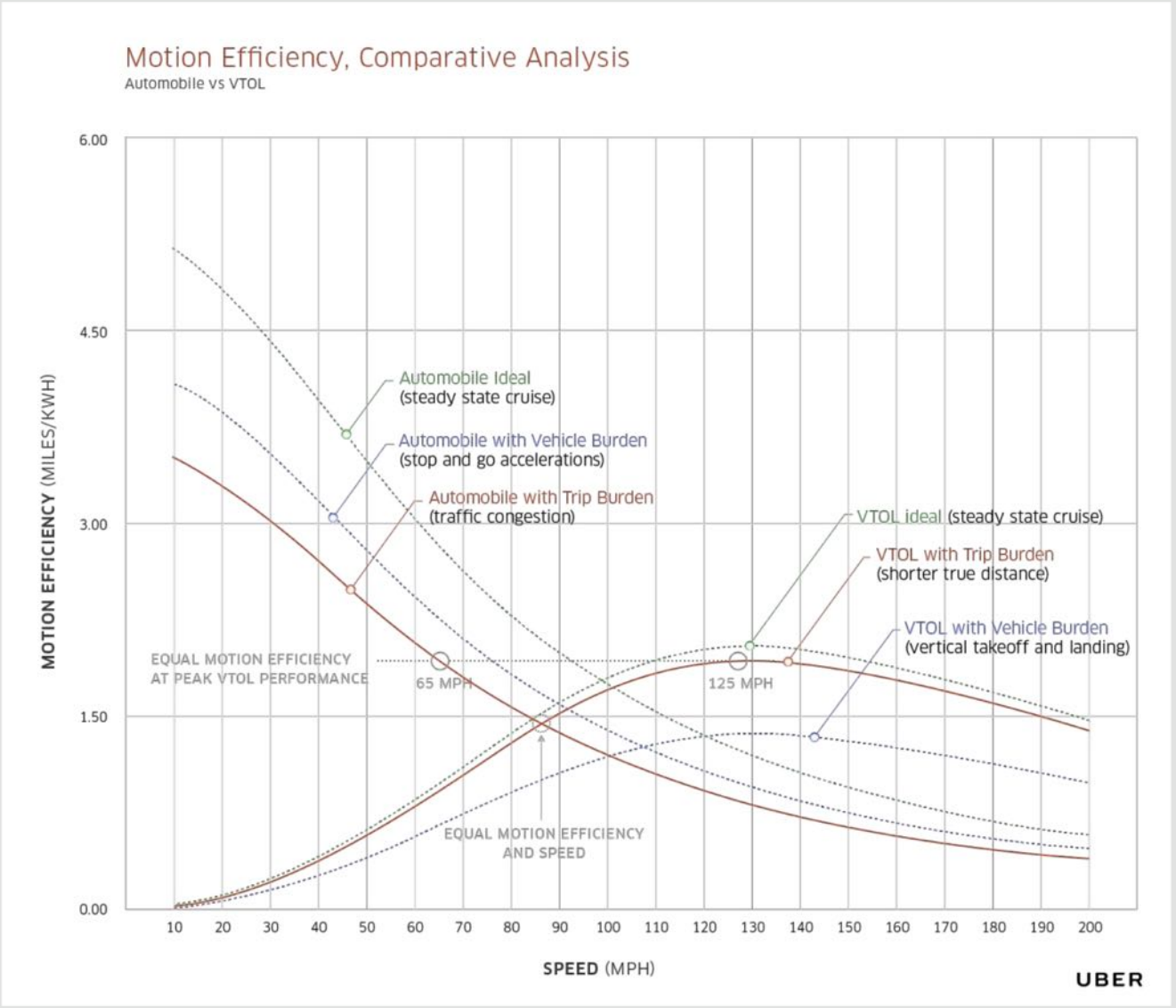
Big industry support (here)

Uber is not alone (here)

See, e.g., PM of MOT's vision of future SG (here)

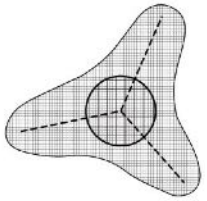
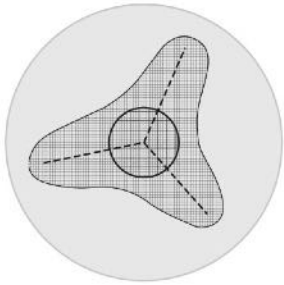
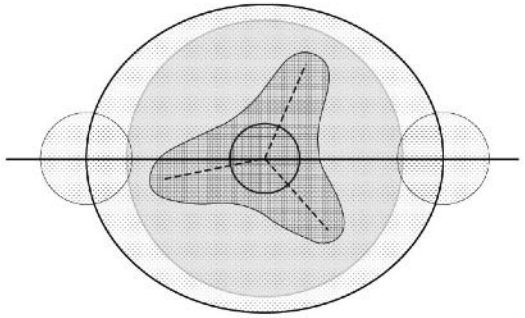
IMPLICATIONS

- Longer distance trips due to dynamics and efficiency
- (Implication on share of those trips..?)
- SG implication (high speed rail)
- The comparison is about speed, but does not highlight the implication on trip distance
- Transport equity



Implications

Walking-Horsecar 1800-1890 → Electric Streetcar 1890-1920 → Recreational Automobile 1920-45 → Freeway 1945-Present → Future




Pictures:
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https://www.6sqft.com/worlds-first-streetcar-began-operation-in-lower-manhattan-on-november-14-1832/
Diagram adapted from Peter O. Muller's Transportation and Urban Form

Source: Ministry of Transport

What transport policy and design decisions can foster more liveable and sustainable cities in the future?