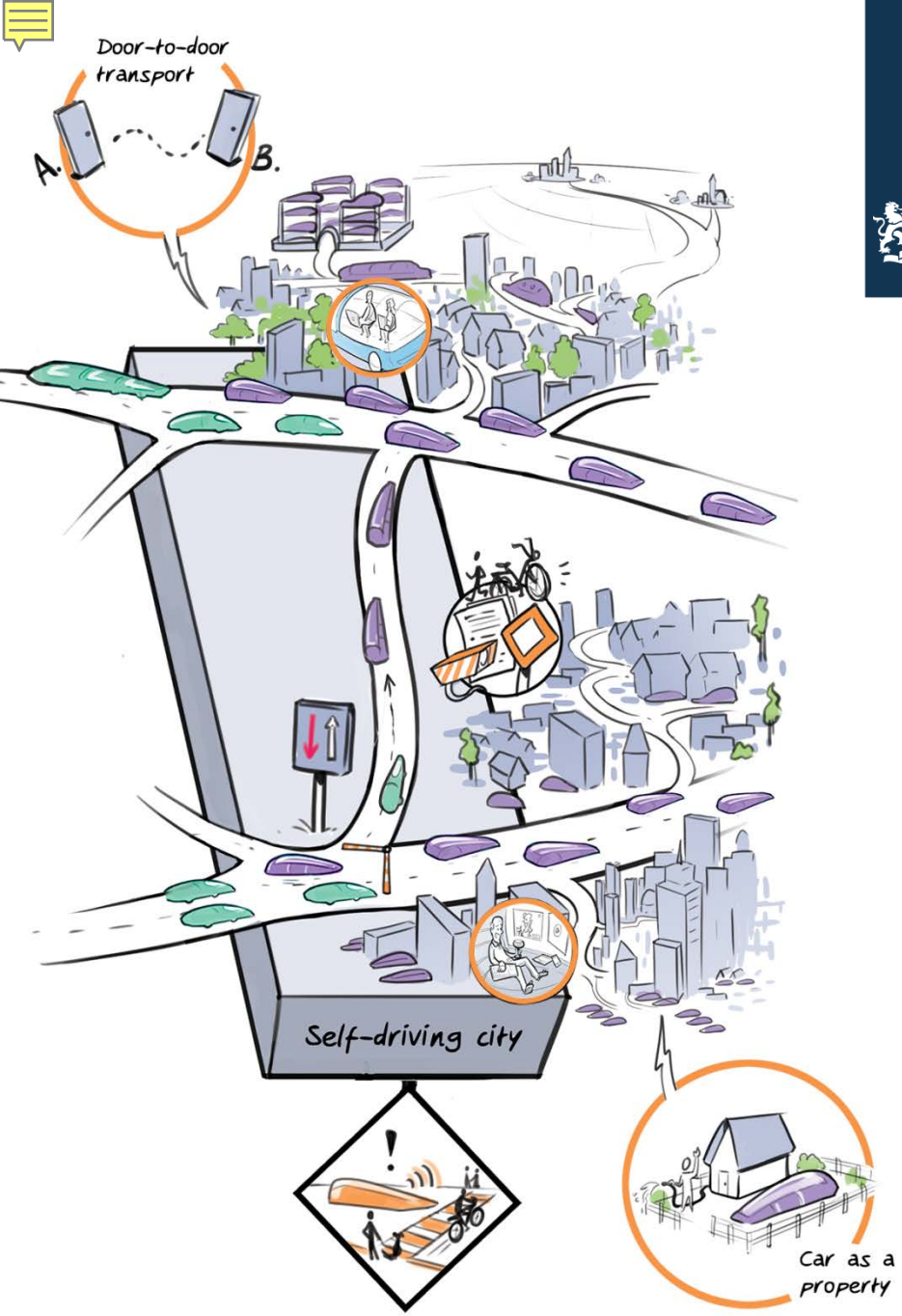


Ministry of Infrastructure and the Environment

KiM | Netherlands Institute for Transport Policy Analysis

Towards a self-driving future

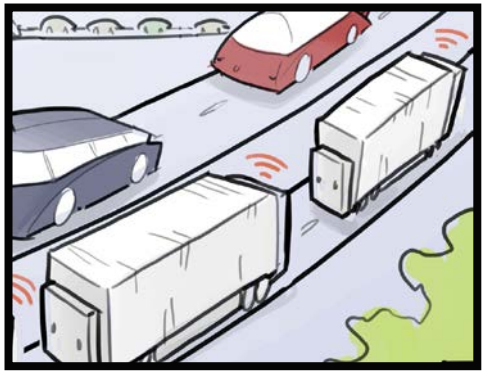
Taede Tillema, George Gelauff, Jan van der Waard

ITF-OECD round table
Ottawa, December 6, 2016

Preliminary and confidential

Research program

1. '*Driver at the wheel?*': scenarios for a future traffic and transport system with automated vehicles
   - Uncertainties, vision and interactions
   - Broad societal consequences
   - No specific time horizon: four final stages



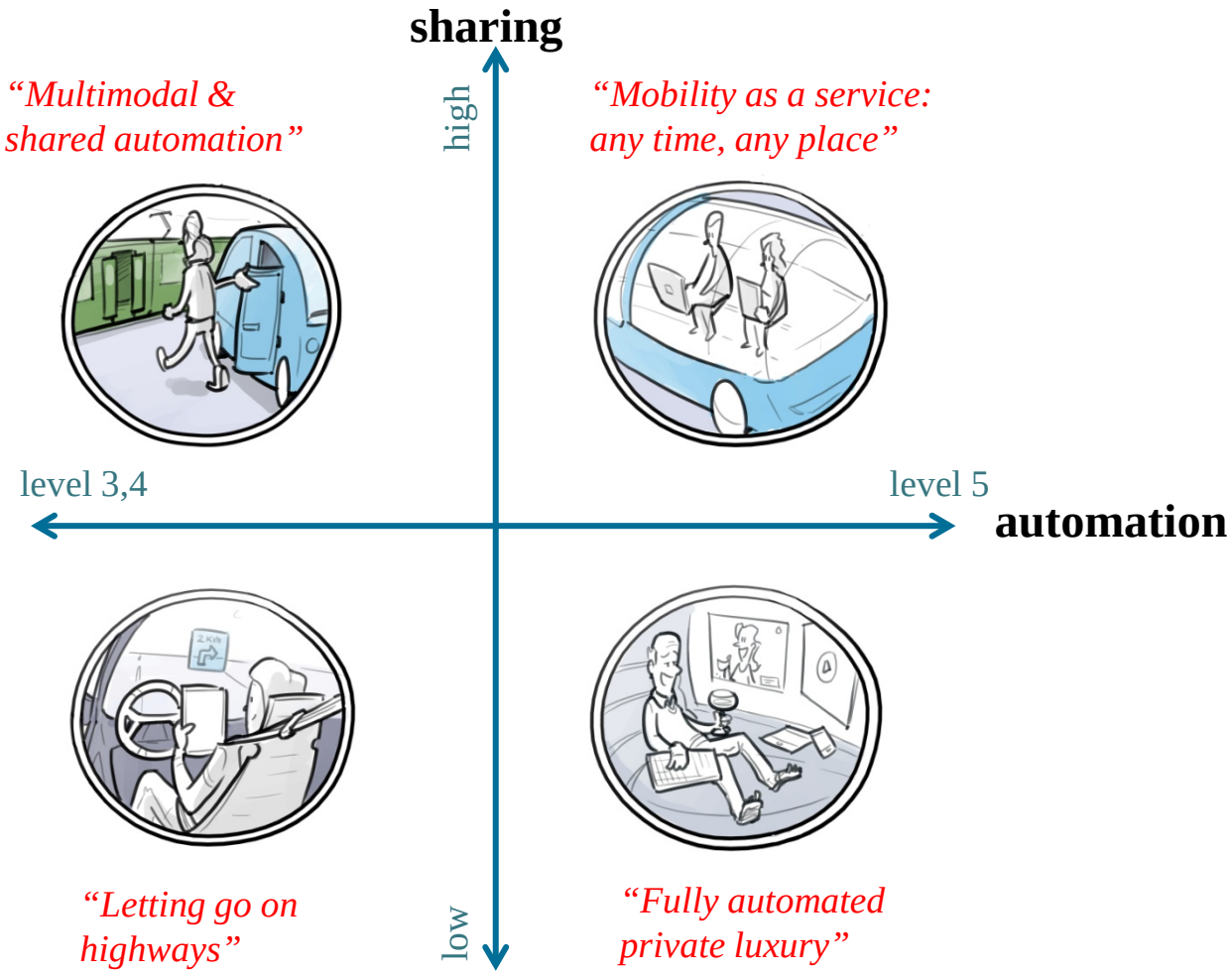
2. Transition paths (fore- and backcasting)
   - challenges over time

3. Perspective on policy options (in progress)

Definition: SAE-levels of automation

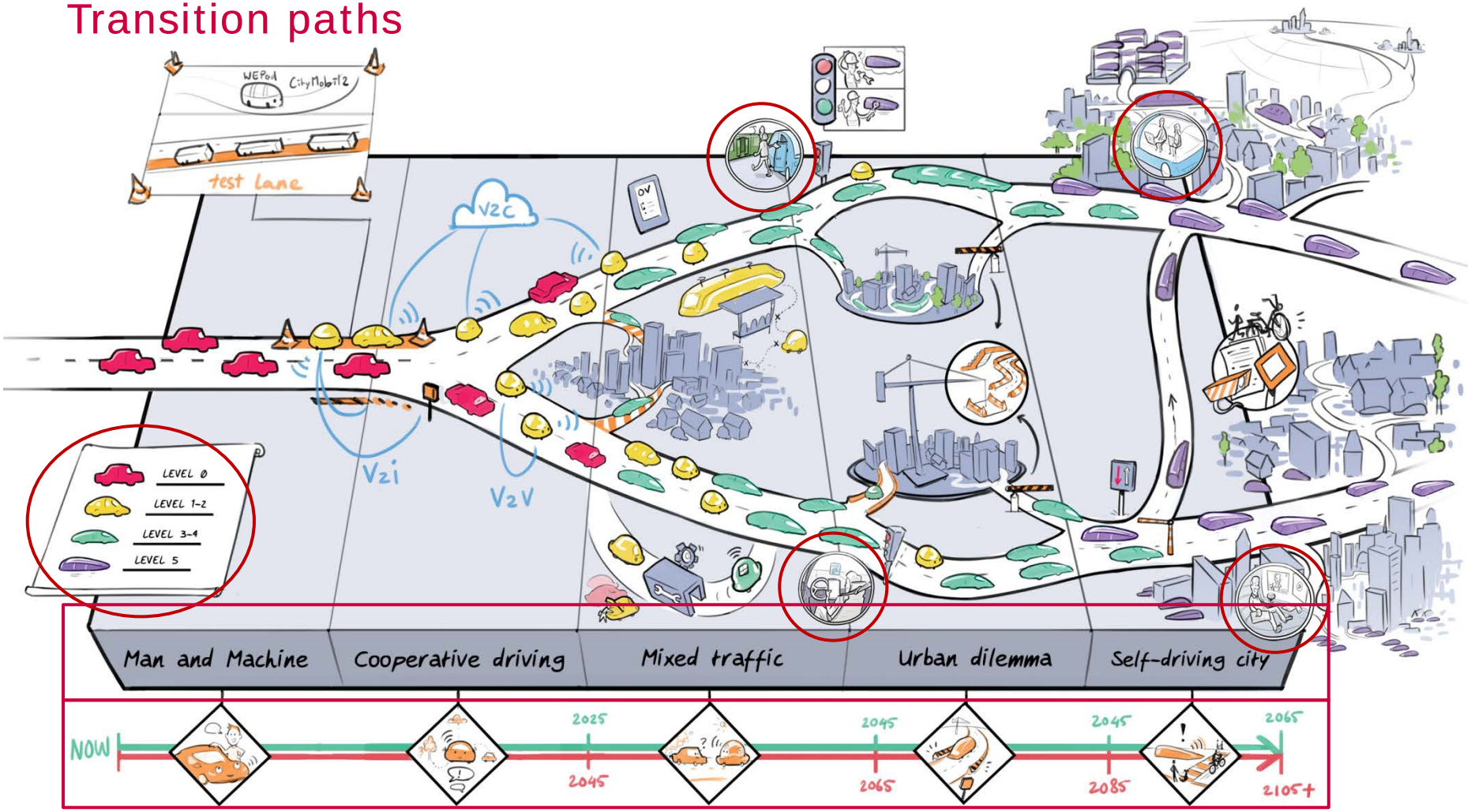
Level	Name	Example
Human driver monitors the driving environment		
0	No automation	Lane Departure Warning
1	Driver assistance	Adaptive Cruise Control
2	Partial automation	Parking Assistance
Automated driving system monitors the driving environment		
3	Conditional automation	Highway Chauffeur
4	High automation	Parking Garage Pilot
5	Full automation	Robot Taxi

Driver at the wheel? Uncertainties and scenarios

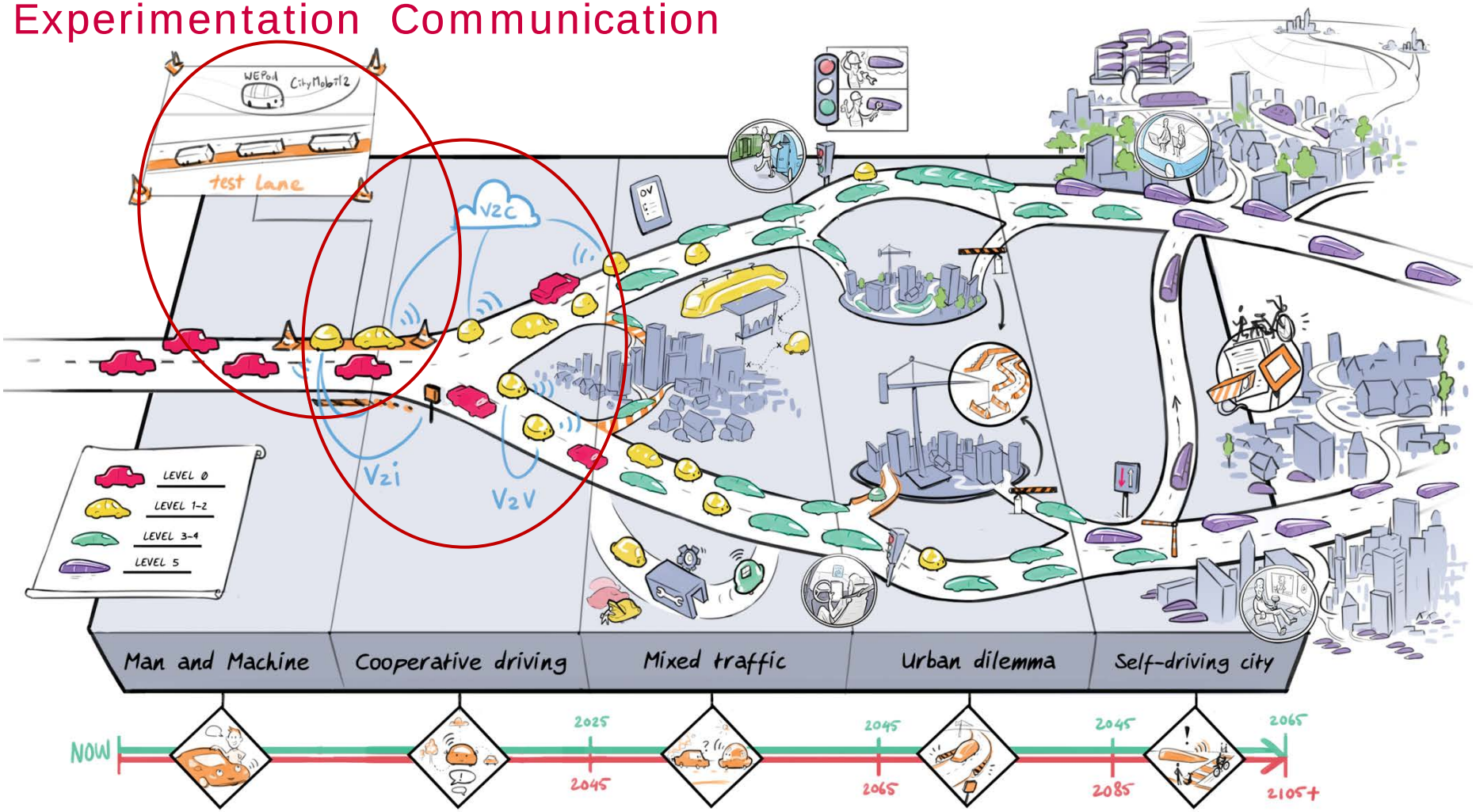


Transition paths

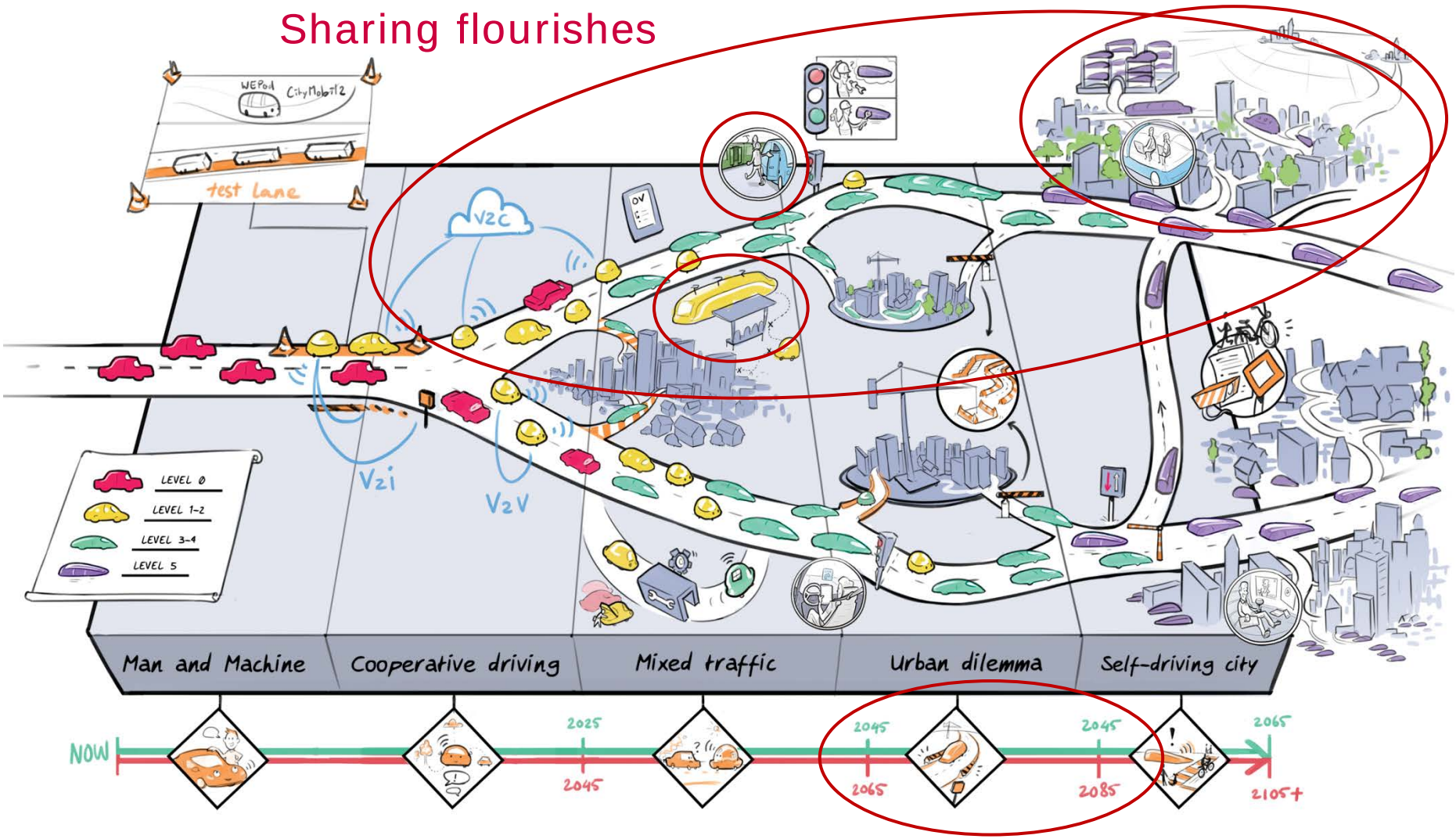
Transition paths



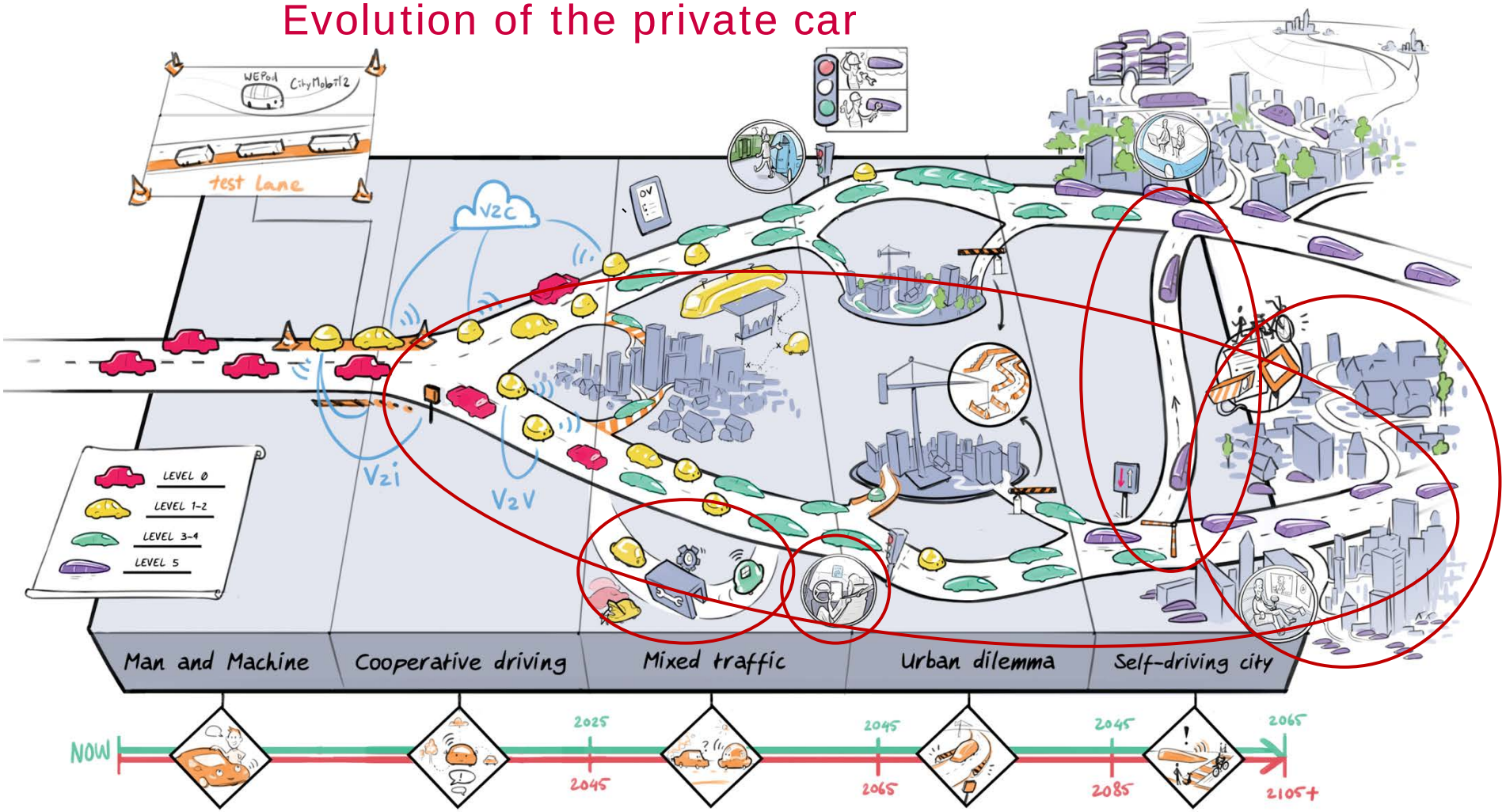
Experimentation Communication



Sharing flourishes



Evolution of the private car

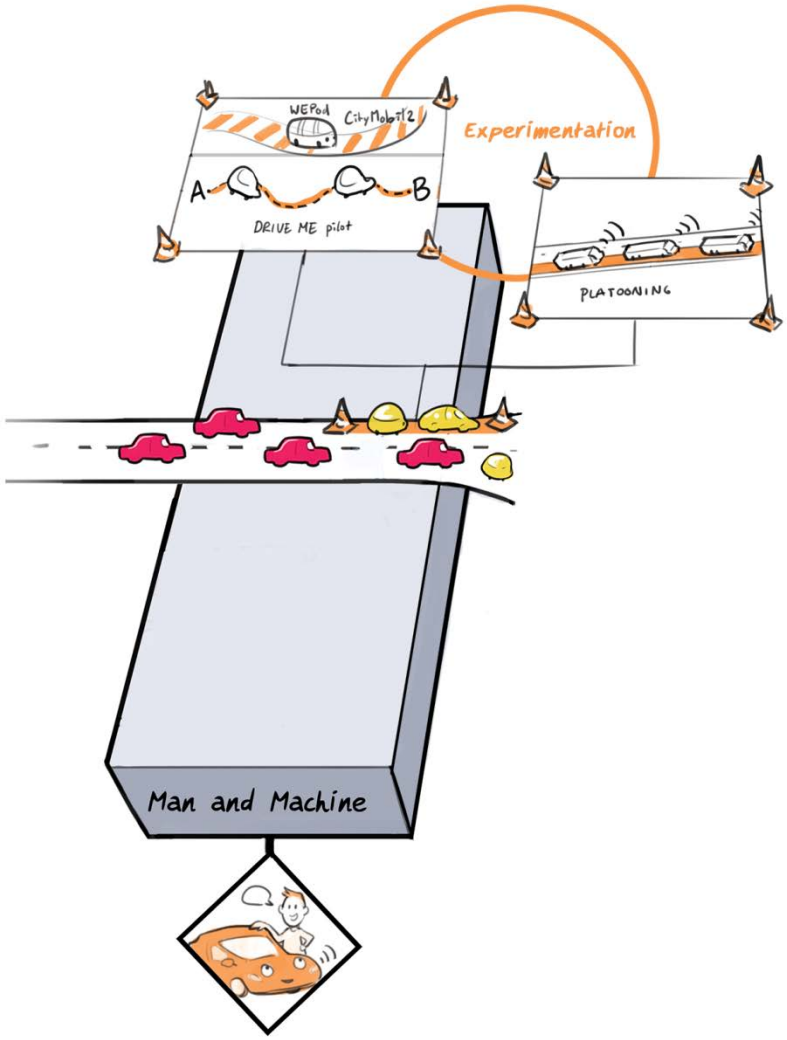


Transition challenges

Man and machine (I 1/2)

- Best of two worlds?
  - human beings excel in complex unexpected circumstances
  - technology supports driver
  - higher traffic safety
  - improved traffic flow

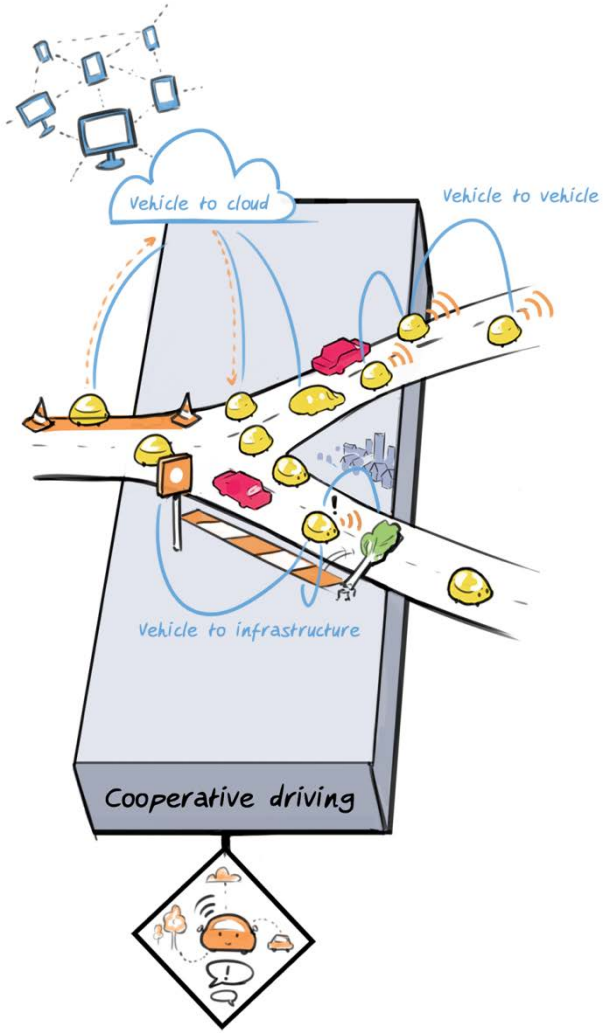
- Or not?
  - driver looses attention: accidents
  - trust in technology undermined



Cooperative driving (I 1/2)

- Holy grail?
  - Efficient road use
  - Higher traffic safety
  - Less congestion
  - Less CO_2

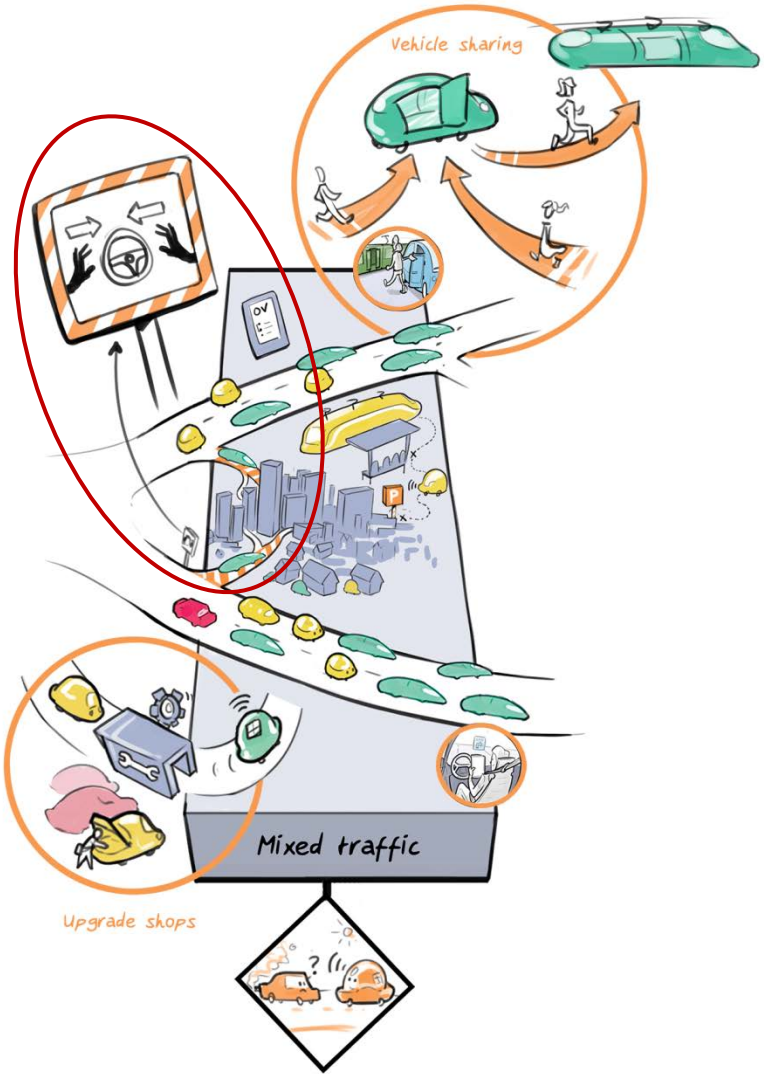
- Or bridge too far?
  - Sensor and software reliability
  - Cyber security: hacks, privacy



Mixed traffic (I 3/4)

- Solves itself?
  - consumers appreciate safer traffic and efficient road use
  - investments in transition zones between highway and city

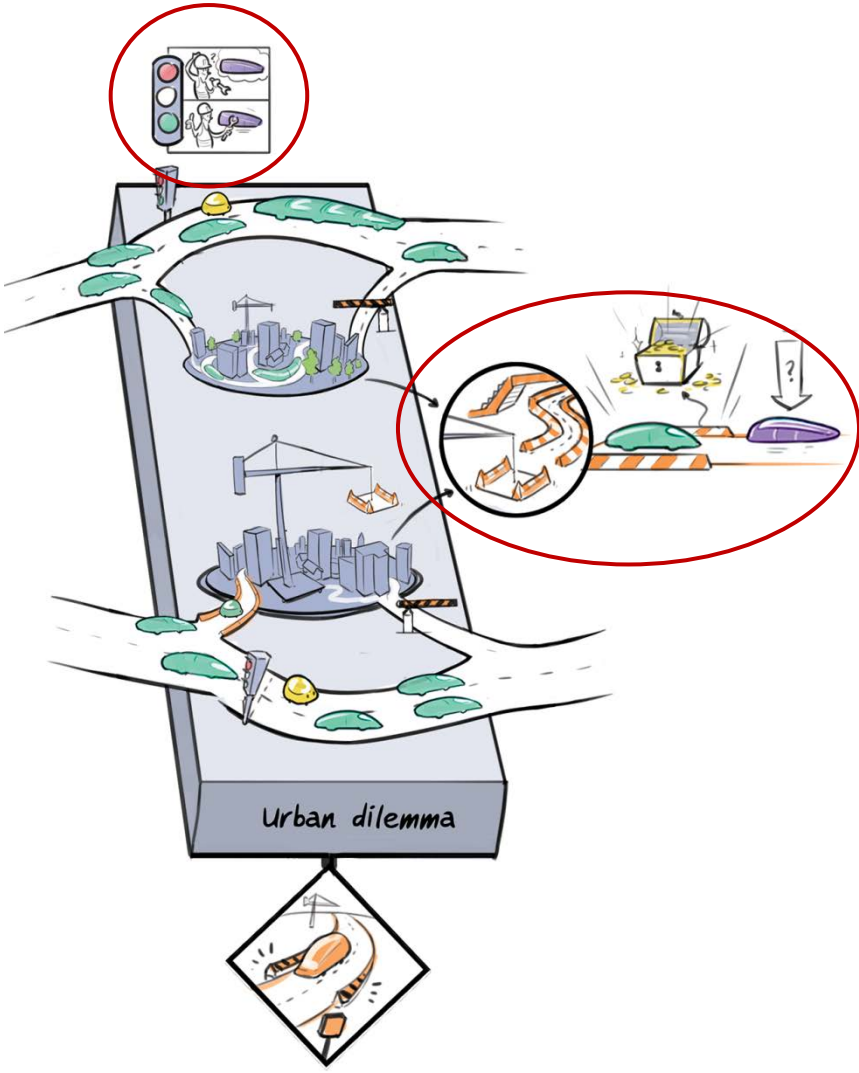
- Or showstopper?
  - consumer prefers to be in control
  - dangerous interaction



Urban dilemma (l 3/4)

- Separate modes?
  - l5 technology far away
  - Adjust city infrastructure
  - l 3/4 lanes

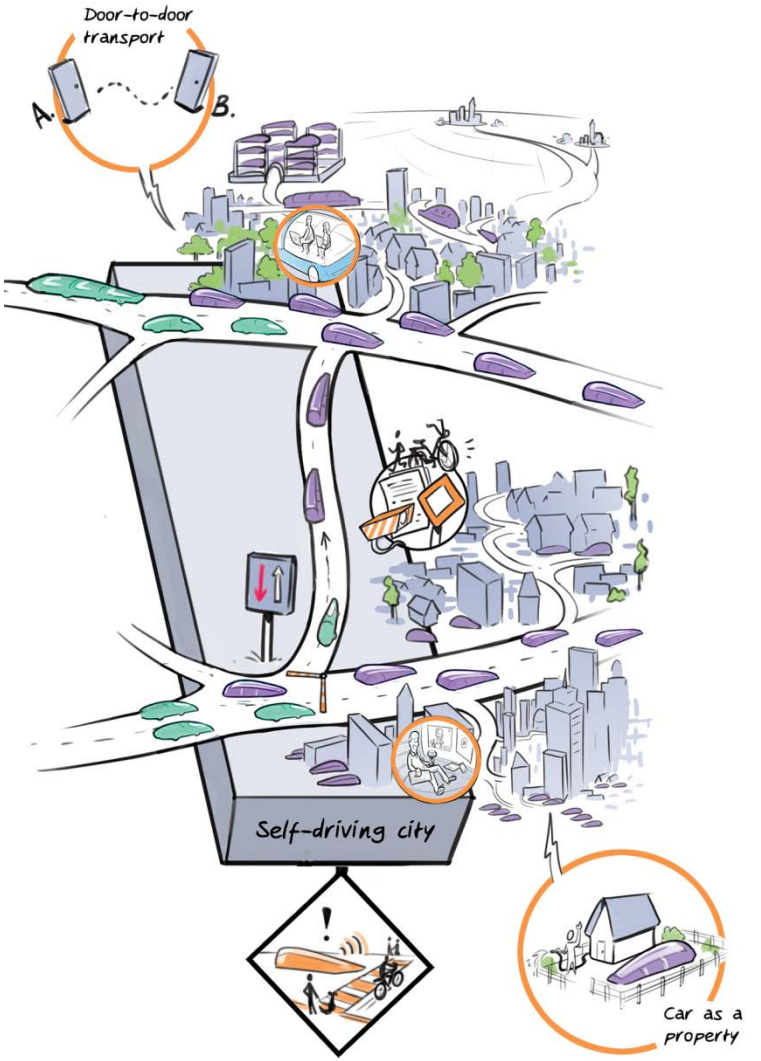
- Or driver in control?
  - l5 technology nearby
  - Separate modes to costly



Self driving city (I 5)

- Contested space?
  - bikers and pedestrians take the road
  - car traffic comes to a standstill

- Or flexible interaction?
  - physical separation
  - technology
  - ‘pushy’ automated vehicle
  - culture



Transition highlights

- Full transition will take quite some time: 2060 - 2100
  - technology, consumers, government, stock of cars, infrastructure

- Path towards a future of sharing cars and rides
  - requires major shift on short and medium term
  - probable on long term

Level	Subject	Major transition challenges
1/2	man and machine	best of both worlds or not?
1/2	cooperative driving	holy grail or bridge too far?
3/4	mixed traffic on highway	solves itself or showstopper?
3/4	city infrastructure	separate modes or driver in control?
5	self-driving city	contested space or flexible interaction?

Thank you for your attention

Scenario study *Driver at the wheel?*:
english.kimnet.nl/publications/reports/2015/10/14/driver-at-the-wheel

Or google: ‘Driver at the wheel? KiM’