



outline

1. why cycle?
2. (safety | health)
3. safe system
4. what next



In a city of many cyclists, why do they ride?

Copenhageners' reasons for cycling to and from work (multiple answers)

56% it's faster

37% more convenient

29% healthy

26% inexpensive

12% well-being, good start to day

9% new job/ relocation

5% environmental concerns







for people in a hurry







10-15 km/hr

Average speed in European urban centres at peak periods



12-14 km/hr (Dublin)

15 km/hr (Lyon)

15.5 km/hr (Copenhagen)



for people who can't afford to be late





for local shops

Revenue in Copenhagen shops and supermarkets by mode of transport (DKK billion/yr)



15.4



15.3



11.0



6.8



Expenditure, Portland (shops, restaurants, bars) by mode of transport (USD person/month)



76



61



66



58



Retail revenue per square foot and per hour of occupied parking, Melbourne, AUS.

\$A 0.69



\$A 0.19

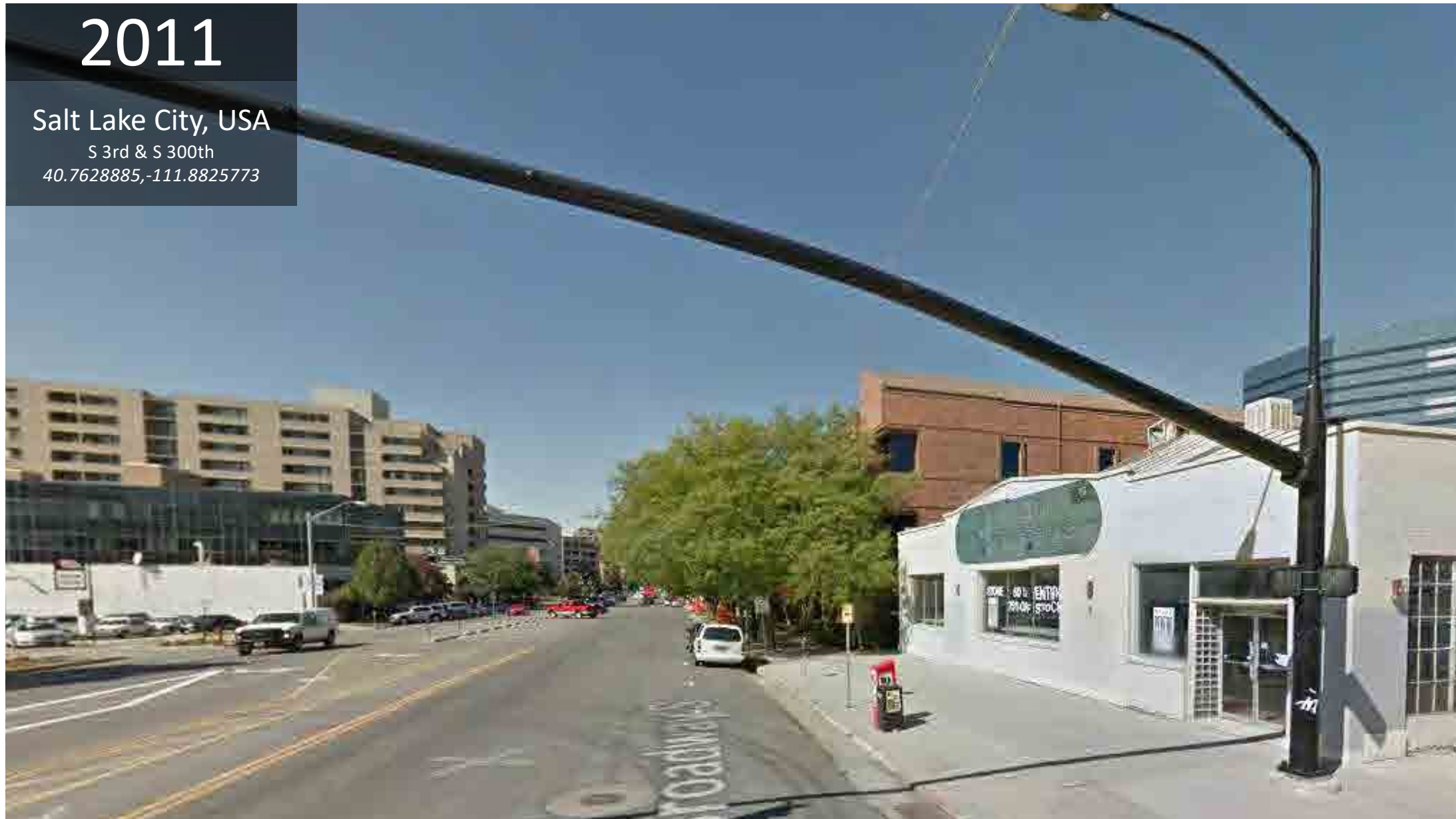


2011

Salt Lake City, USA

S 3rd & S 300th

40.7628885,-111.8825773



2015

Salt Lake City, USA

S 3rd & S 300th

40.7628885,-111.8825773

300 South Street Reconfiguration

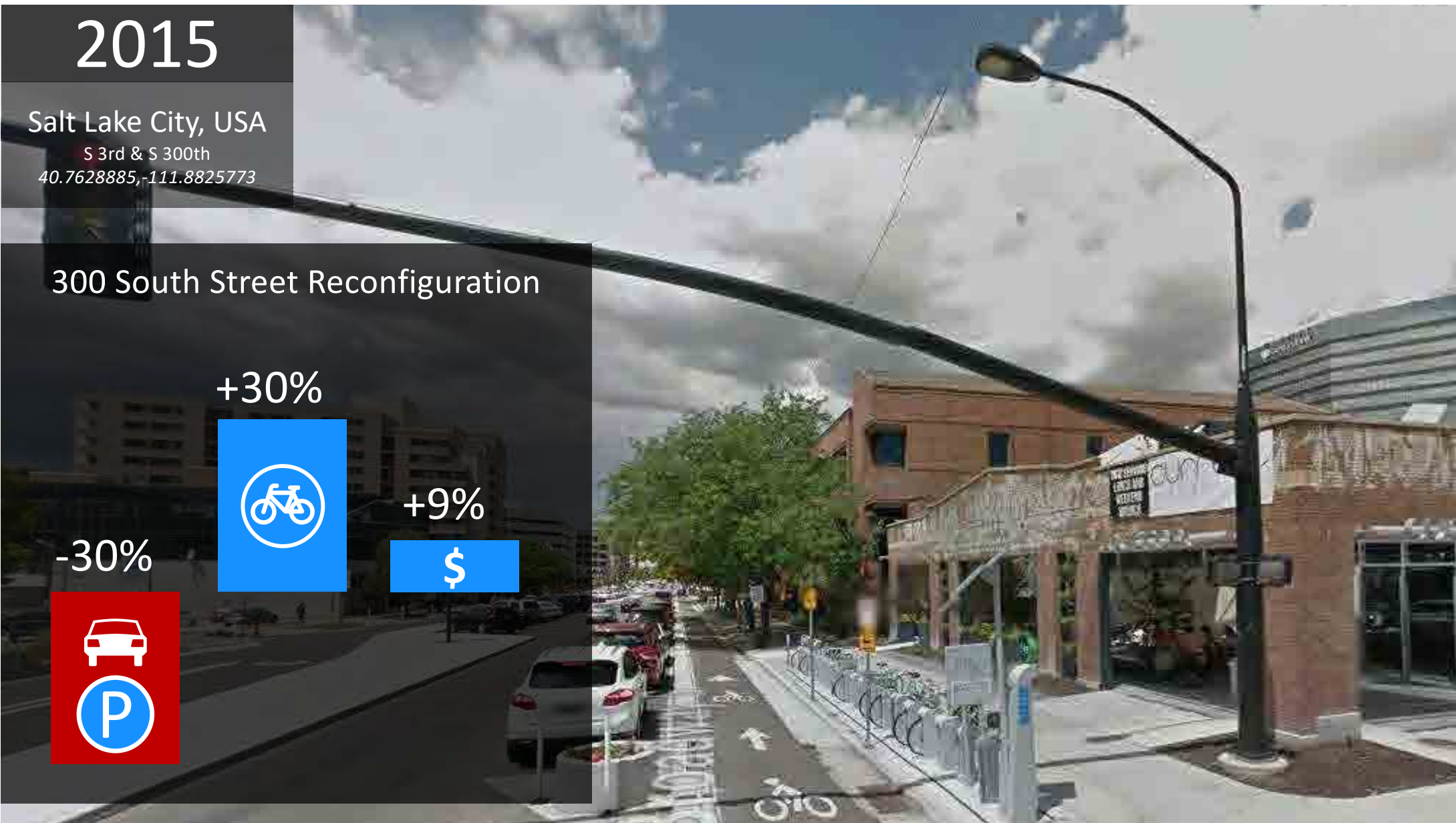
+30%



+9%

\$

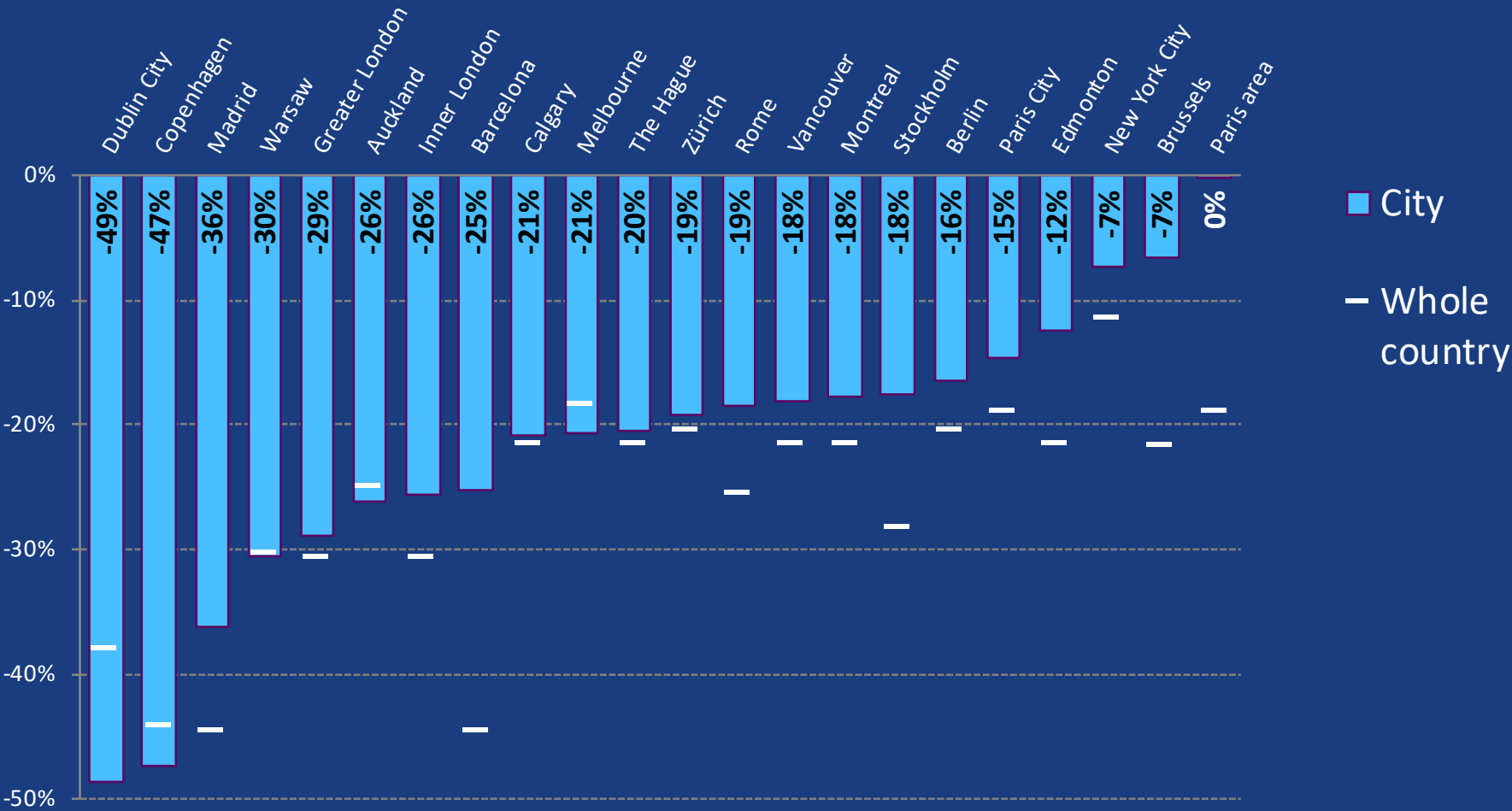
-30%





for safety?

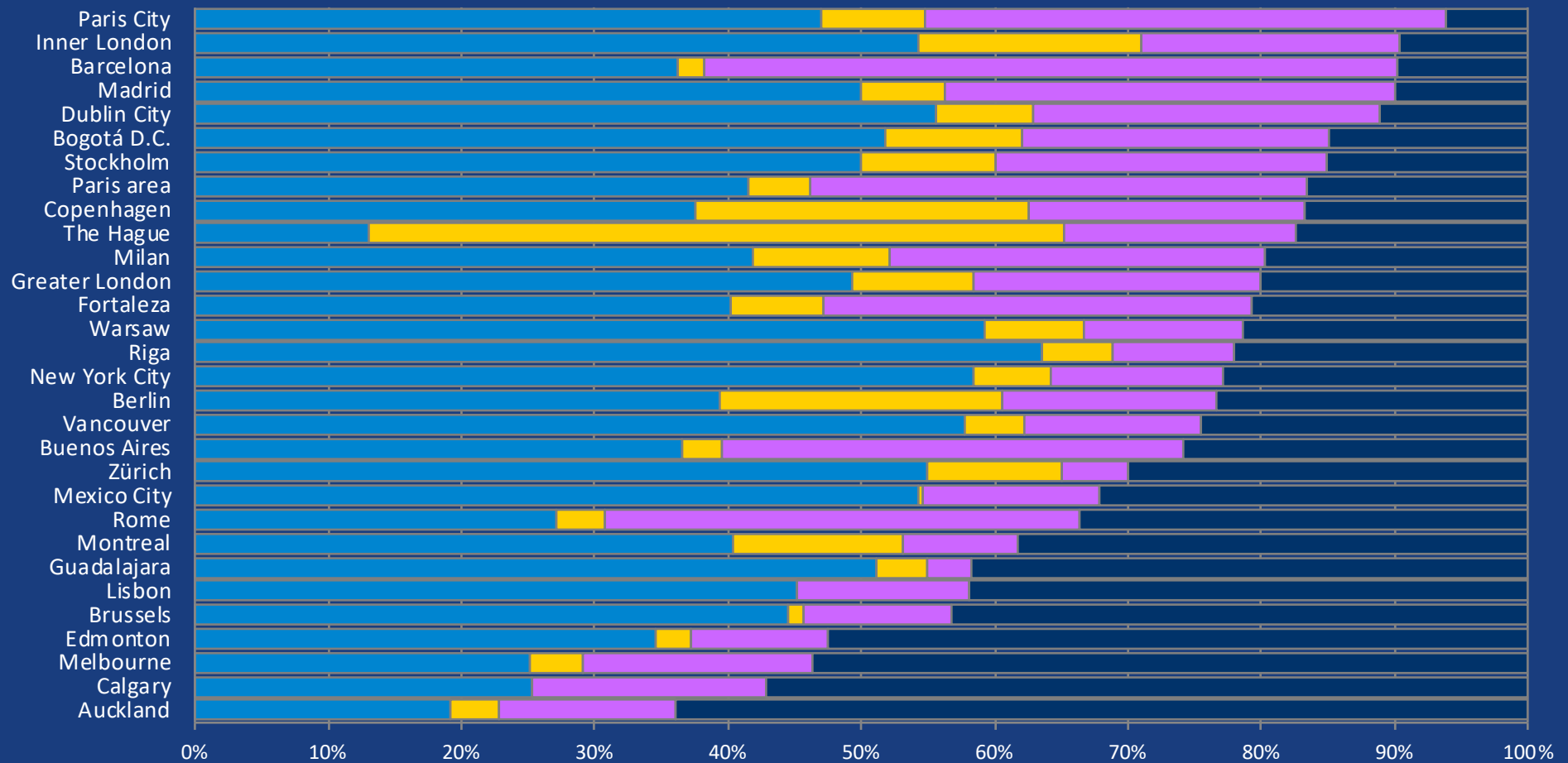
Road fatalities, changes from 2006-10 to 2011-15





Modal shares of road fatalities, 2013-2015

■ pedestrian
 ■ bicycle
 ■ powered-2-wheeler
 ■ other road users



Relative risk by mode



Relative risk of death/km
bicycle vs. car

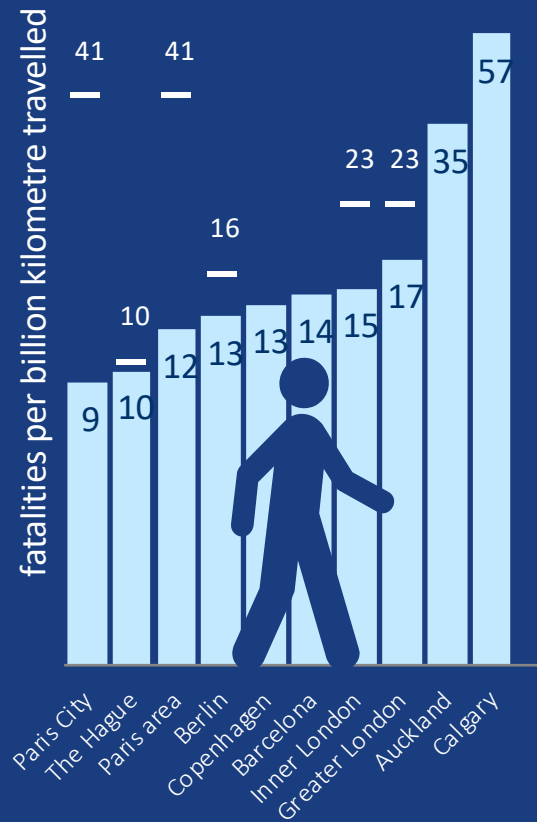
14	UK
11	Switzerland
6	Norway
6	Netherlands

Relative risk of death/hr
of travel:

UK:	4
Belgium:	1

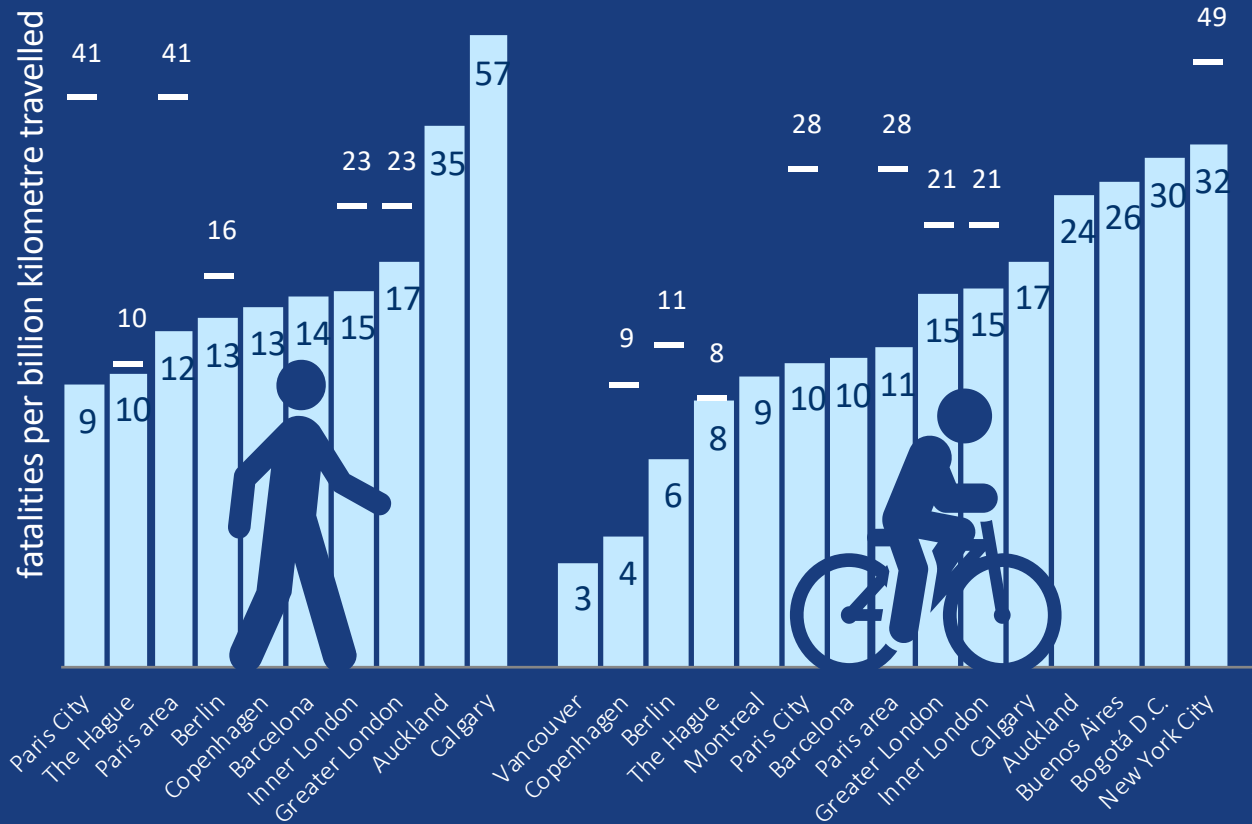
Risk of fatality per unit distance travelled, 2011-2015

■ City — Whole Country



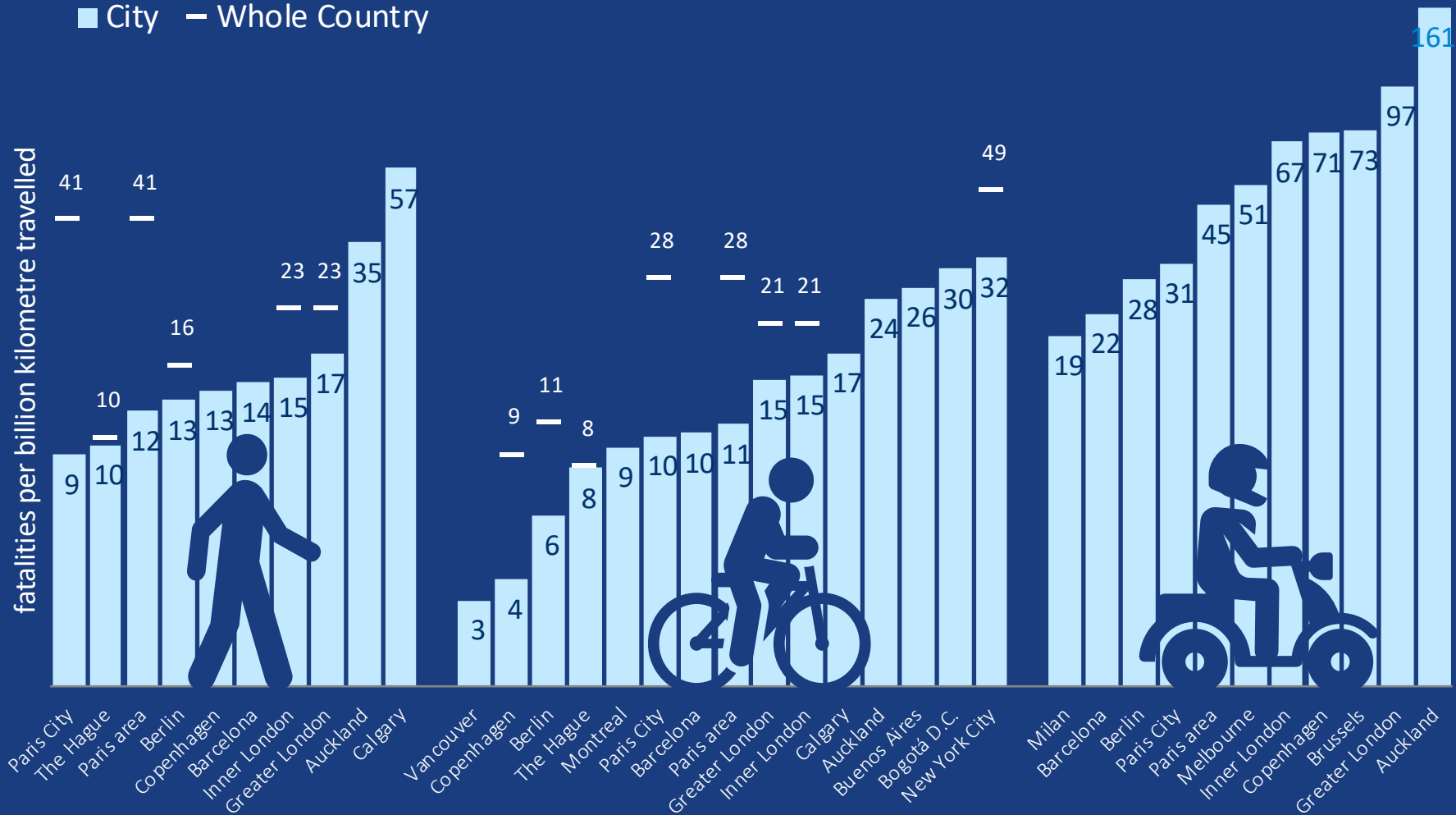
Risk of fatality per unit distance travelled, 2011-2015

■ City — Whole Country



Risk of fatality per unit distance travelled, 2011-2015

■ City — Whole Country





Heavy vehicle collisions



% fatal bicycle crashes involving truck, bus, coach

33%	Ireland:
33%	Denmark
25%	Belgium
25%	UK
20%	Netherlands
20%	France
12%	Germany
11%	Spain
4%	Italy

Single crashes



Single bicycle crashes –
e.g. with no crash
opponent are significant
and under-reported

Single bicycle crash
involvement as % of all
bicycle crash victims

Flanders/Brussels: 87%

Belgium: 73%

Netherlands: ~75%

Elderly cyclists



The elderly are especially vulnerable

% of all bicycle crash deaths
60yrs and older:

Japan: 70%

Korea: 65%

Italy: 57%

Netherlands: 55%

Denmark: 49%

France: 45%

UK: 21%

Electric bicycles?

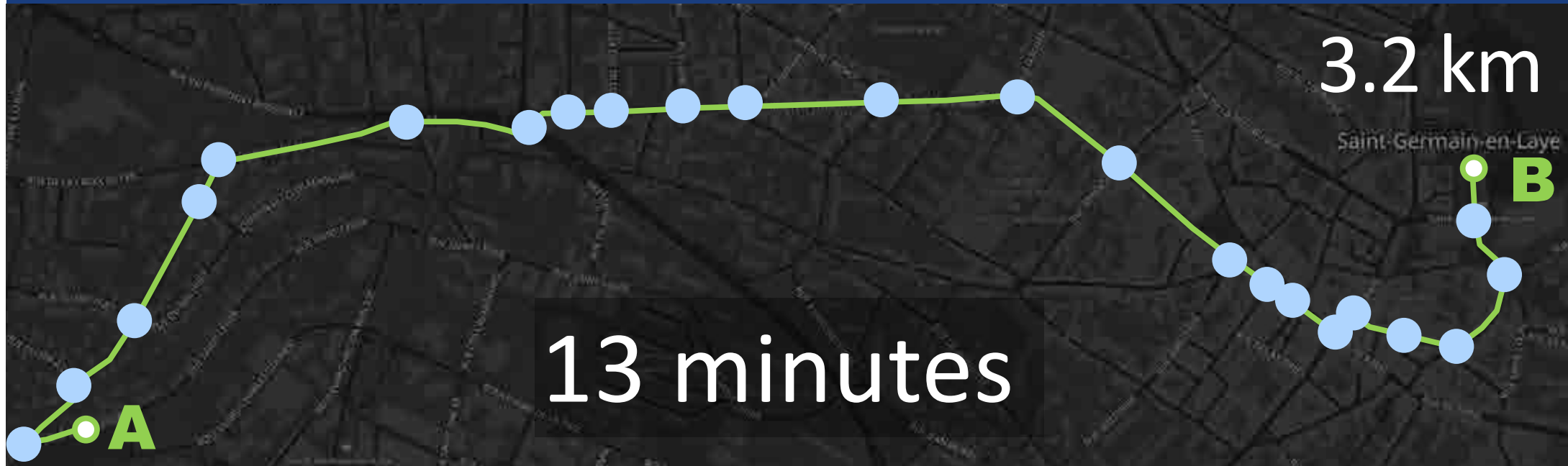


After controlling for distance travelled and other potential confounders there is:

- no difference in crash likelihood and injury severity between EB and CB users
- crashes on EBs and CBs to be equally severe

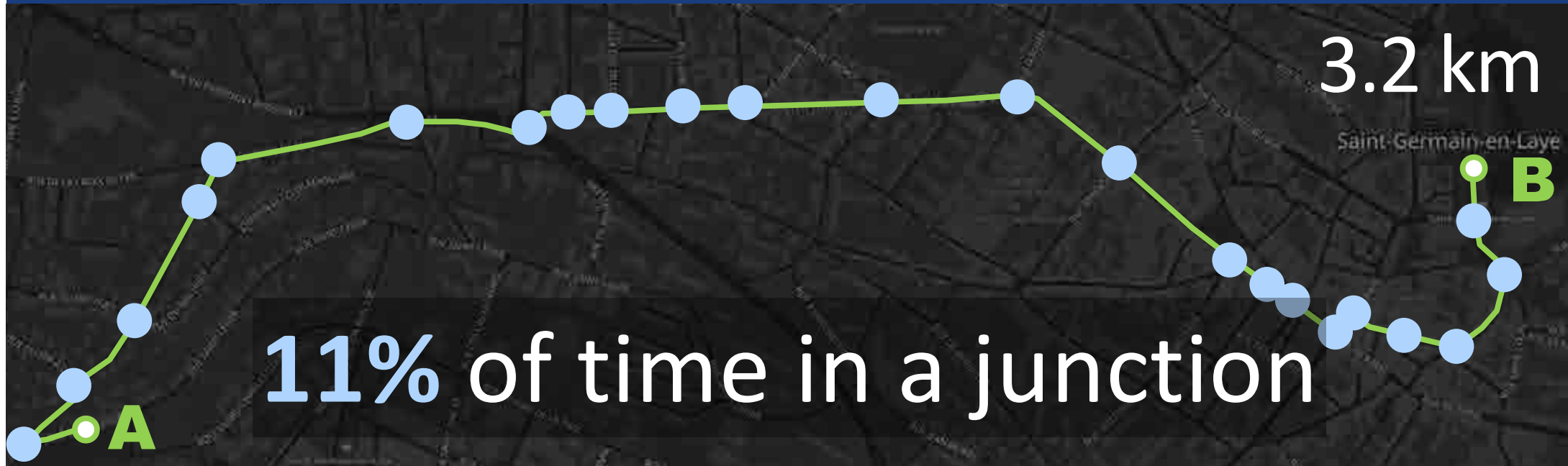


Junctions and safety



11% of time in a junction

Junctions and safety of fatal crashes



29%

EU

36%

Korea

35%

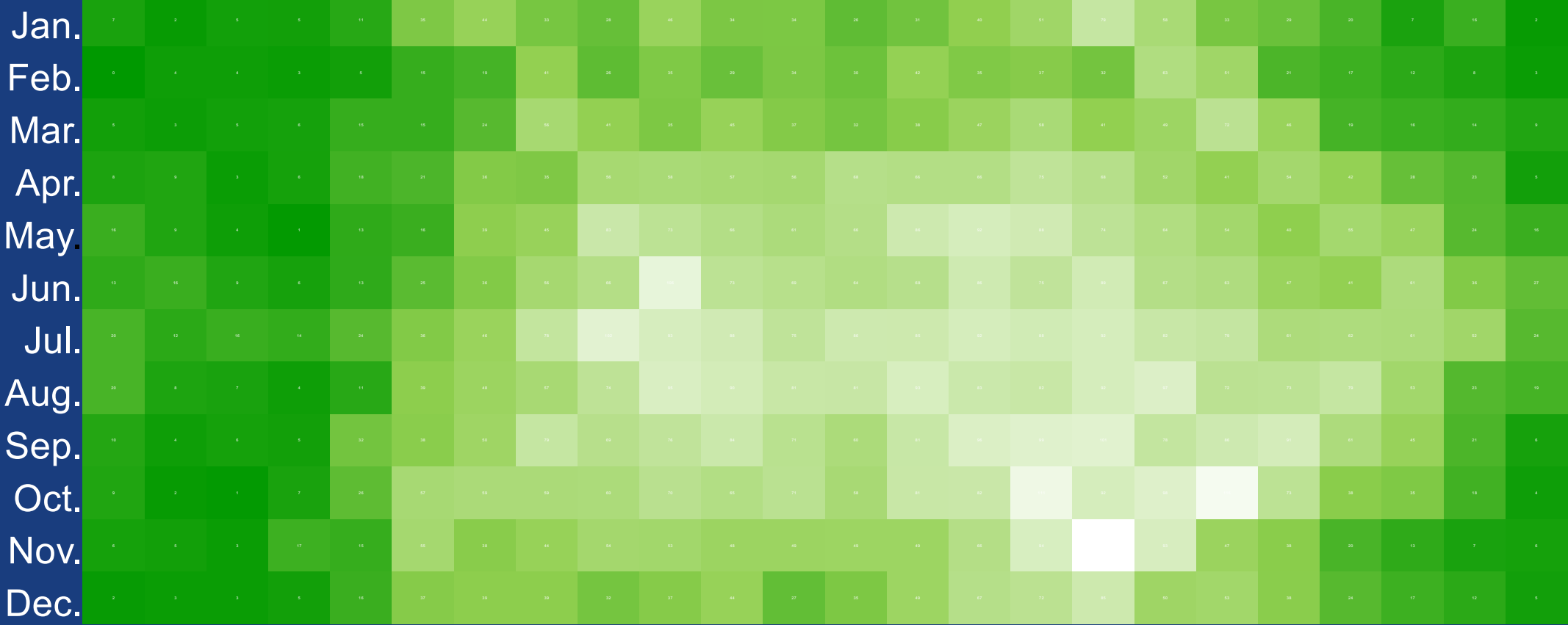
USA

EU Fatal crashes by hour and month

absolute numbers , 2005-2010, n=12 554

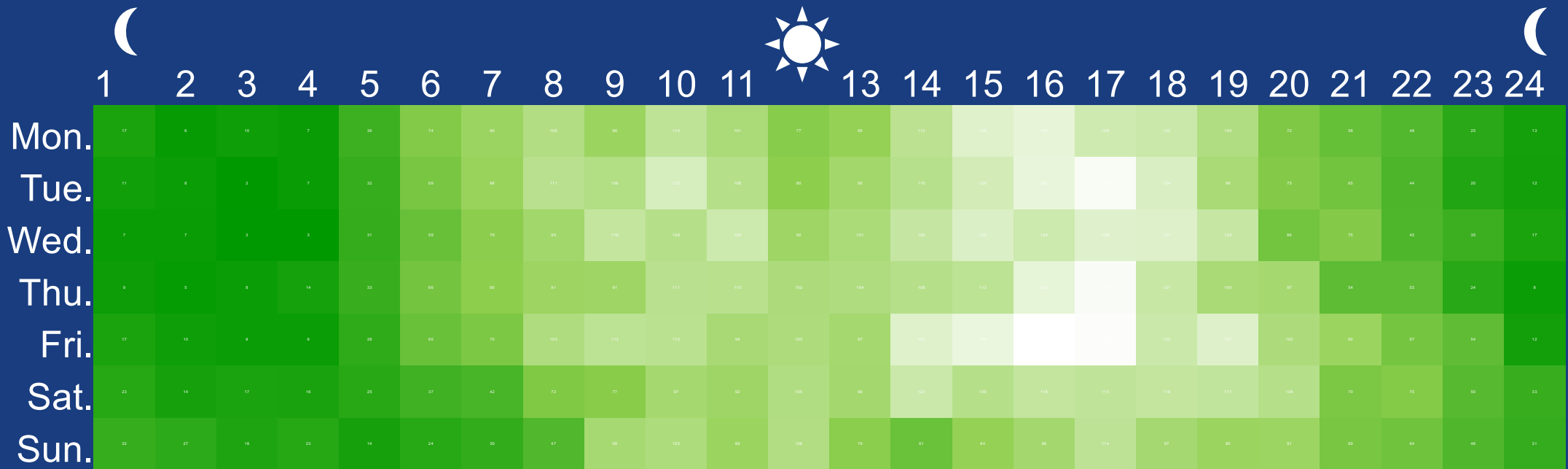


1 2 3 4 5 6 7 8 9 10 11 13 14 15 16 17 18 19 20 21 22 23 24



EU Fatal crashes by hour and day of the week

absolute numbers , 2005-2010, n=12 554





for ~~safety~~ health

Air pollution

Accounting for ventilatory effort, cyclists register 2 to 8 times more pollutant intake than car occupants




Health



Cycling, as a moderate physical activity can significantly reduce mortality and morbidity due to:

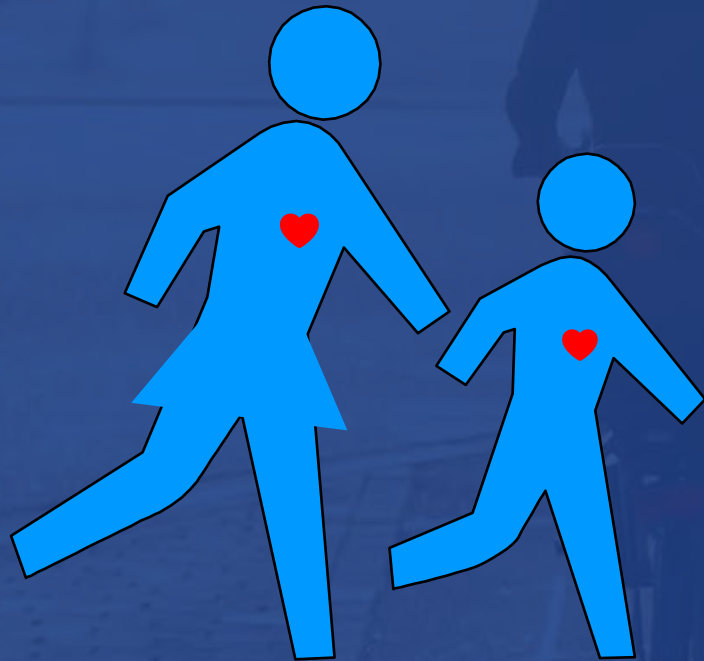
- Cardiovascular disease
- Type-2 diabetes
- Cancer (Colon, breast)
- Osteoporosis
- Depression

Impact greatest when 1st becoming active

A blurred background image of a city street. In the foreground, a person is riding a bicycle with a basket on the front. Other people and vehicles are visible in the background, all slightly out of focus to create a sense of motion. A dark blue semi-transparent banner is overlaid across the middle of the image, containing white text.

on balance, the monetised benefits from improved health
are up to
20x
greater than the combined health impacts of crashes and
exposure to air pollution





-15%

Today's childrens'
cardiovascular fitness
compared to 30 years ago



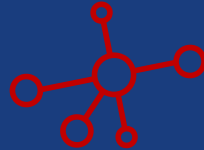
for the **economy**



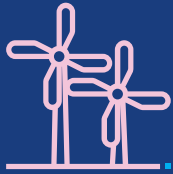
Environment & climate



Economy



Social Affairs



Energy + Resources



Technology + Design



Mobility



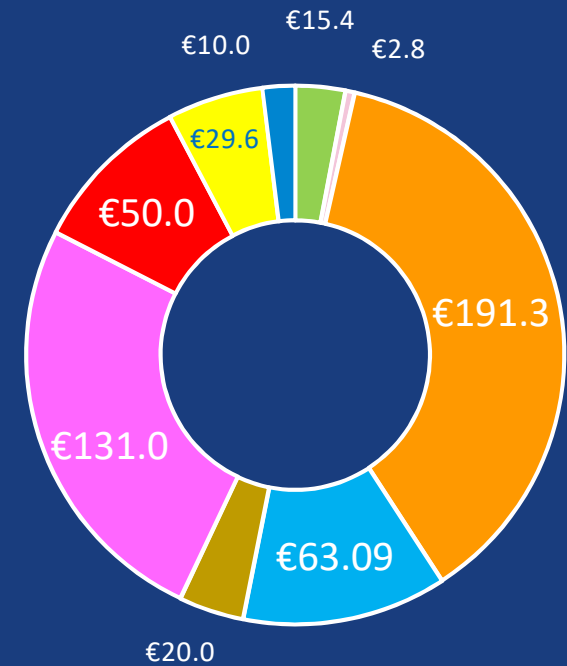
Health



Time + Space



Diversity of cultures




€513,190,000,000/yr

Economic impact cycling, European Union

Source: European Cyclists Federation

Copenhagen at peak hour



Every kilometre cycled saves society €0.22
Every kilometre driven in a car costs society €0.76

Australia

Every 20mn bicycle commute to work and back
saves Australia more than AUD21



Utrecht



The total social benefit of all kilometres cycled
in Utrecht is €250 million



more, safer, cycling

Many authorities cannot adequately assess whether or not policies improve safety

$$\text{safety (crash rate)} = \frac{\text{crashes (\#) ?}}{\text{exposure (km, trips) ?}}$$

(mis)reporting



Police (official) records and hospital records do not concur.

Under-reporting is significant and widespread, especially for less severe injury crashes.

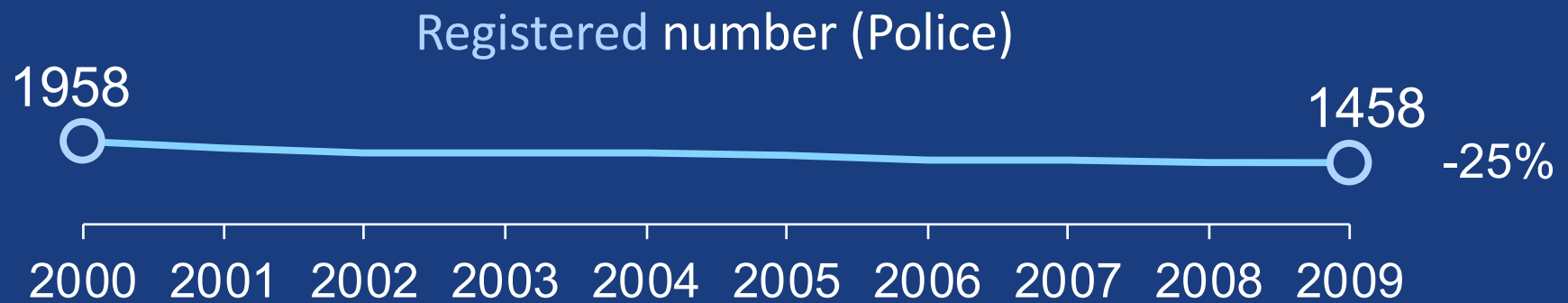
Austria bicycle injury crashes 2009:

5 495 (police)

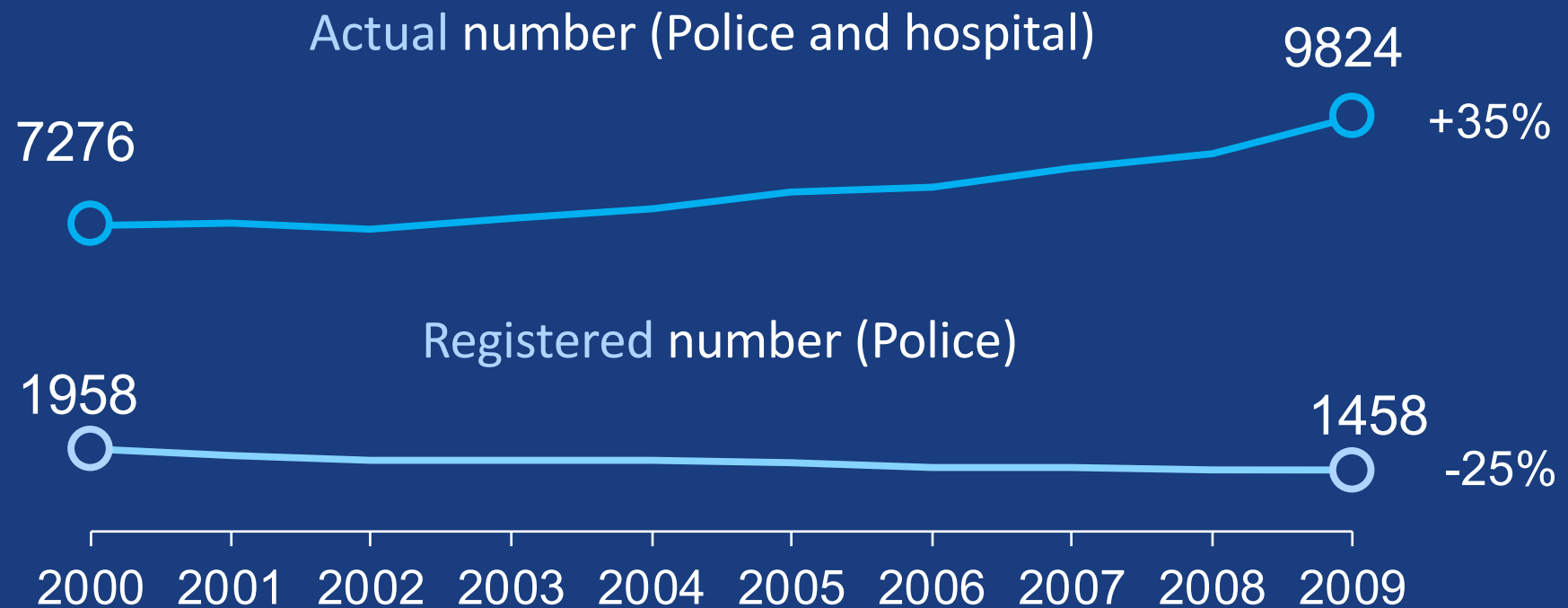
28 200 (hospital)

37 000 (total, adjusted)

Police registered vs. real Cyclist serious injuries Netherlands (3 yr. avg.)



Police registered vs. real Cyclist serious injuries Netherlands (3 yr. avg.)



Do we make cyclists safe in the current traffic system?



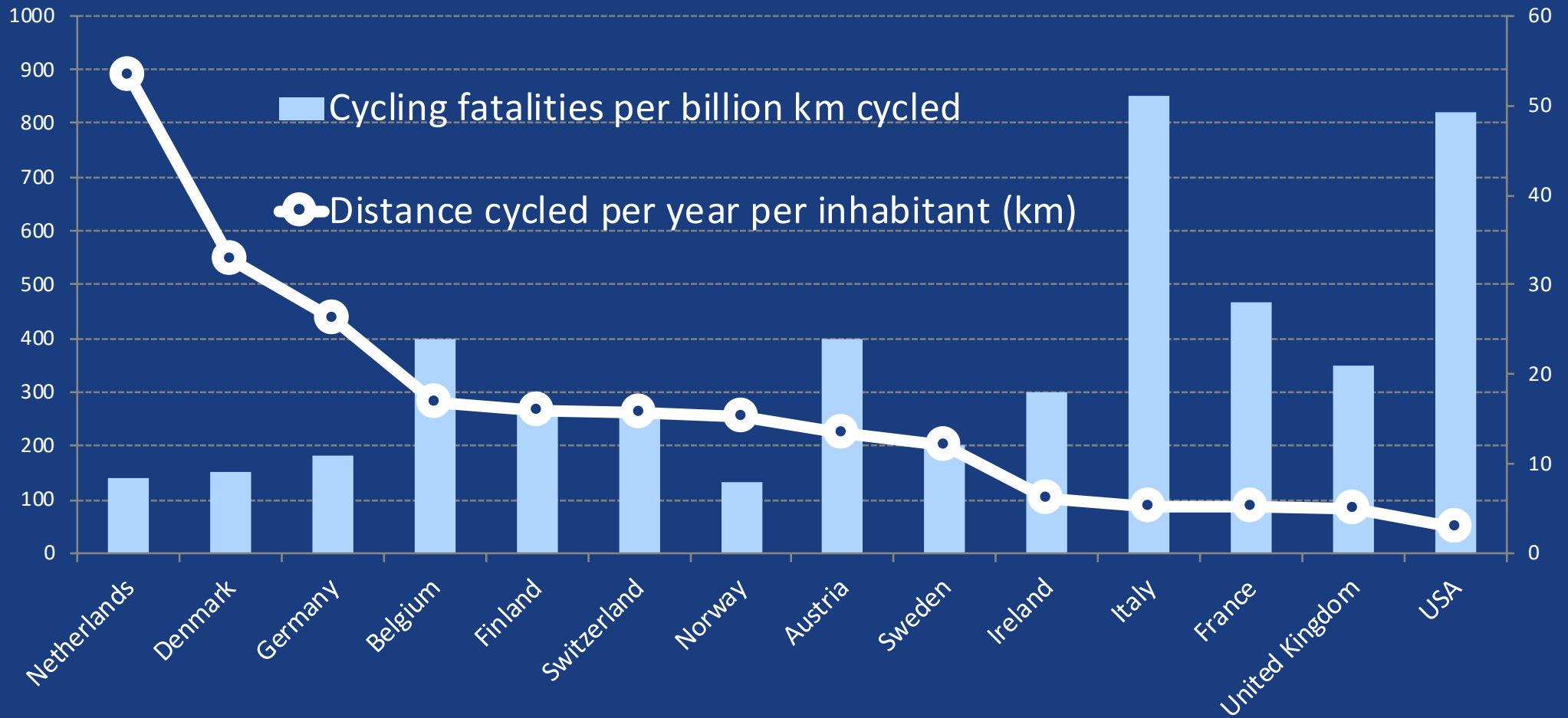
or...do we make the traffic system safe for people cycling?



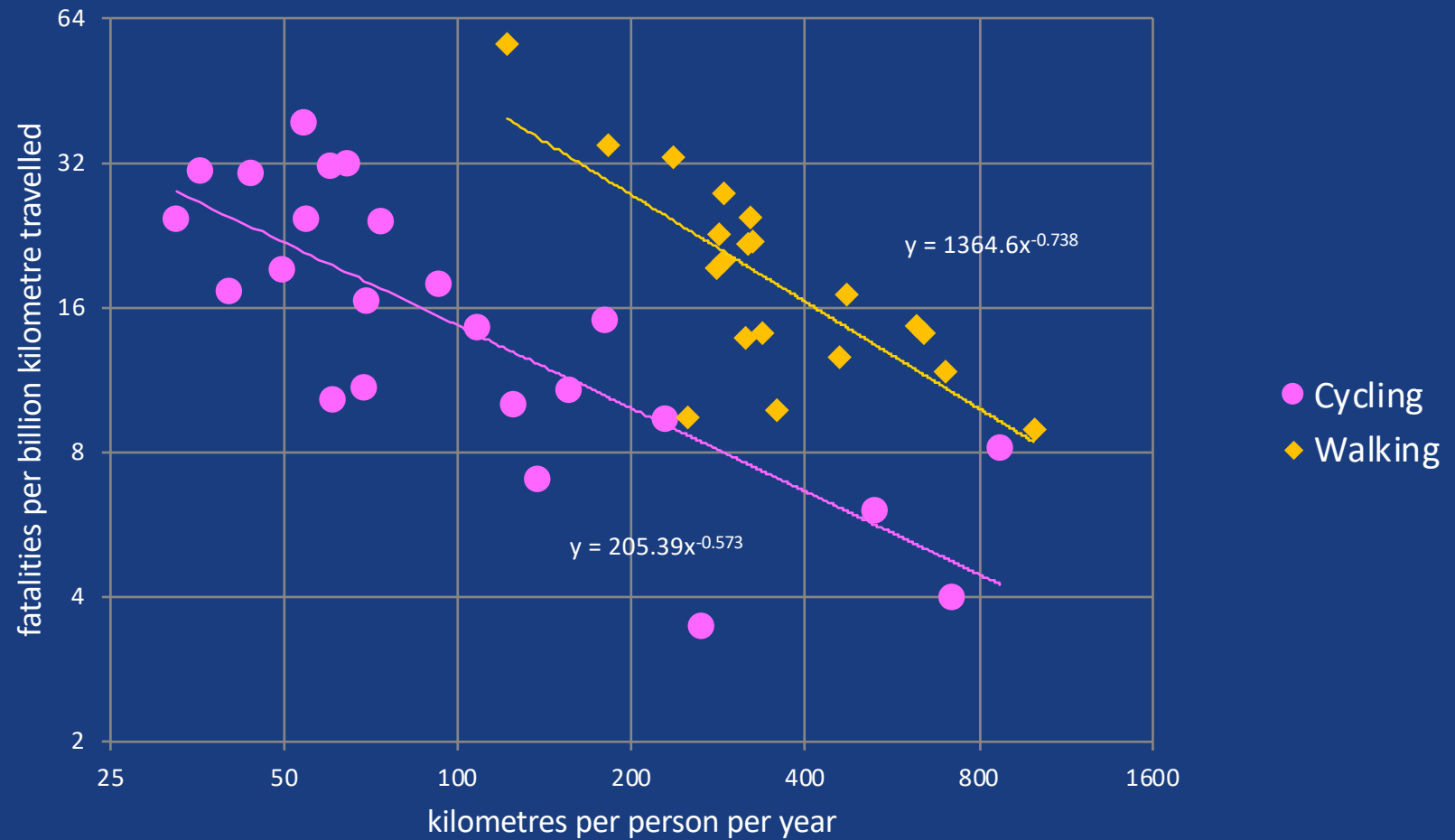
Do policies that increase the number of cyclists lead to more crashes?



Cycling fatalities and distance cycled by country



Cycling fatalities vs. distance cycled by city



Do policies that increase the number of cyclists lead to more crashes?

Safety in numbers?

or

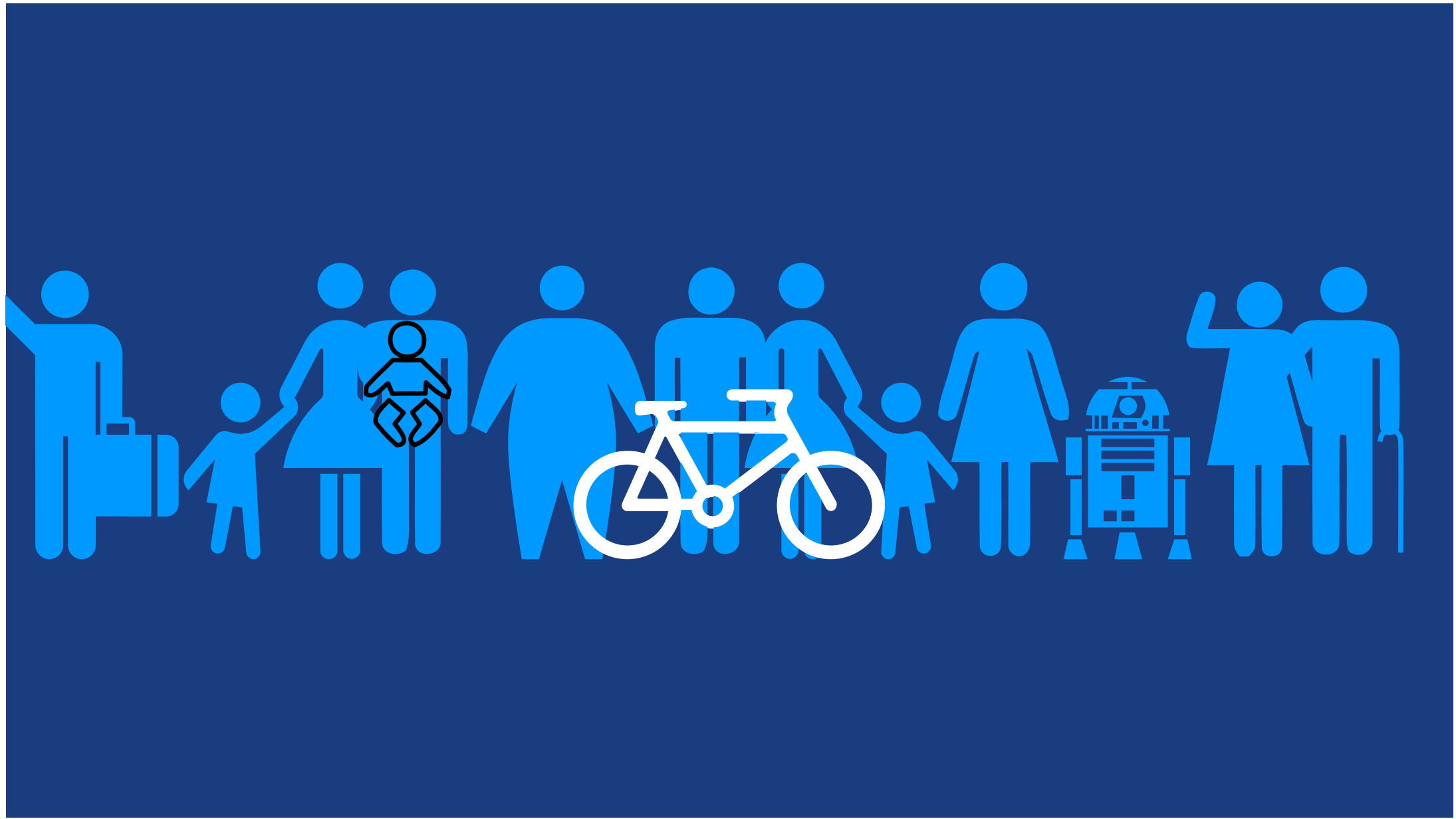
Numbers because of safety?











Safe system



Functionality: Road design matches desired usage

Homogeneity: Speed management, Separation

Predictability: Avoid unexpected situations

Forgivingness: Minimise crash outcomes

Safe system

Functionality: Road design matches desired usage



Safe system

Homogeneity: Speed management



Safe system

Homogeneity: Speed management



Safe system

Homogeneity: Separation: essential to manage crash risks at intersections or high traffic situations.



Safe system

Homogeneity: Separation:
essential to manage crash
risks at intersections or
high traffic situations.



Safe system

Homogeneity: Separation: essential to manage crash risks at intersections or high traffic situations.




Safe system

Homogeneity: Separation: essential to manage crash risks at intersections or high traffic situations.





Perceived safety | Real safety



Continuous cycle network of high standard on routes and at intersections, improve cyclist safety, security and accessibility, and is thus an important basis for increasing bicycle use.

Safe system

Predictability: Avoid unexpected situations



Safe system

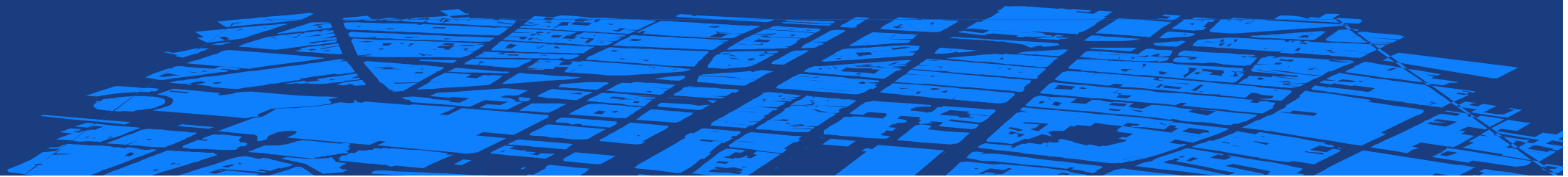
Forgivingness: Minimise
crash outcomes





what next?

mobility in the city





trucks/vans



walk



cycle

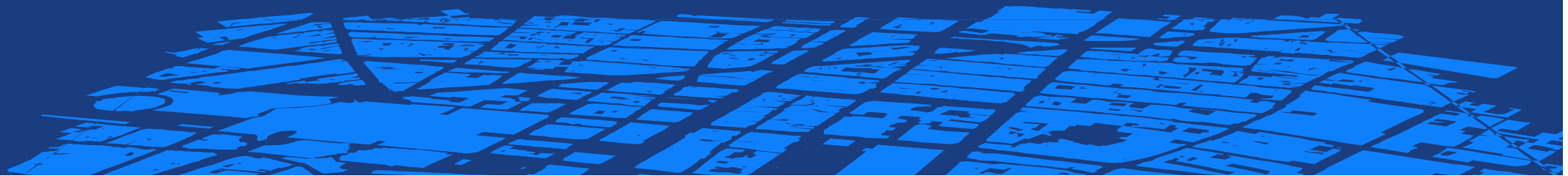


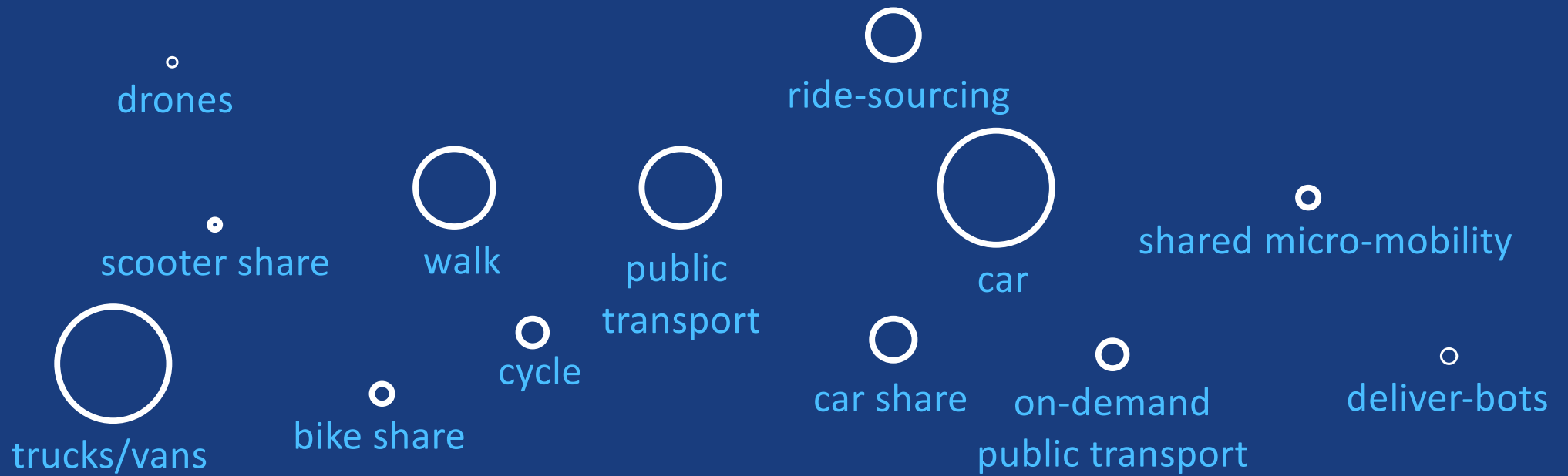
public
transport



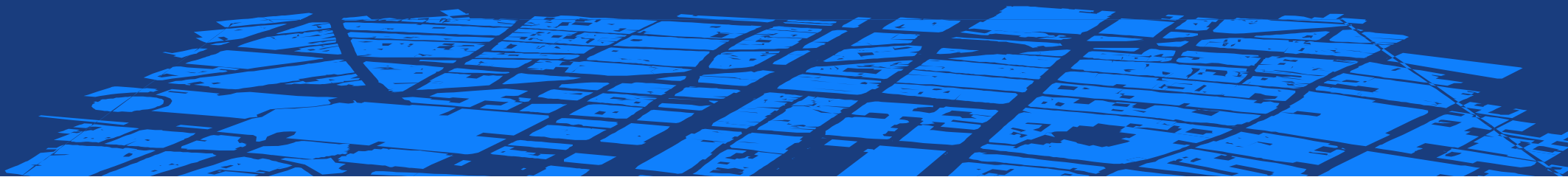
car

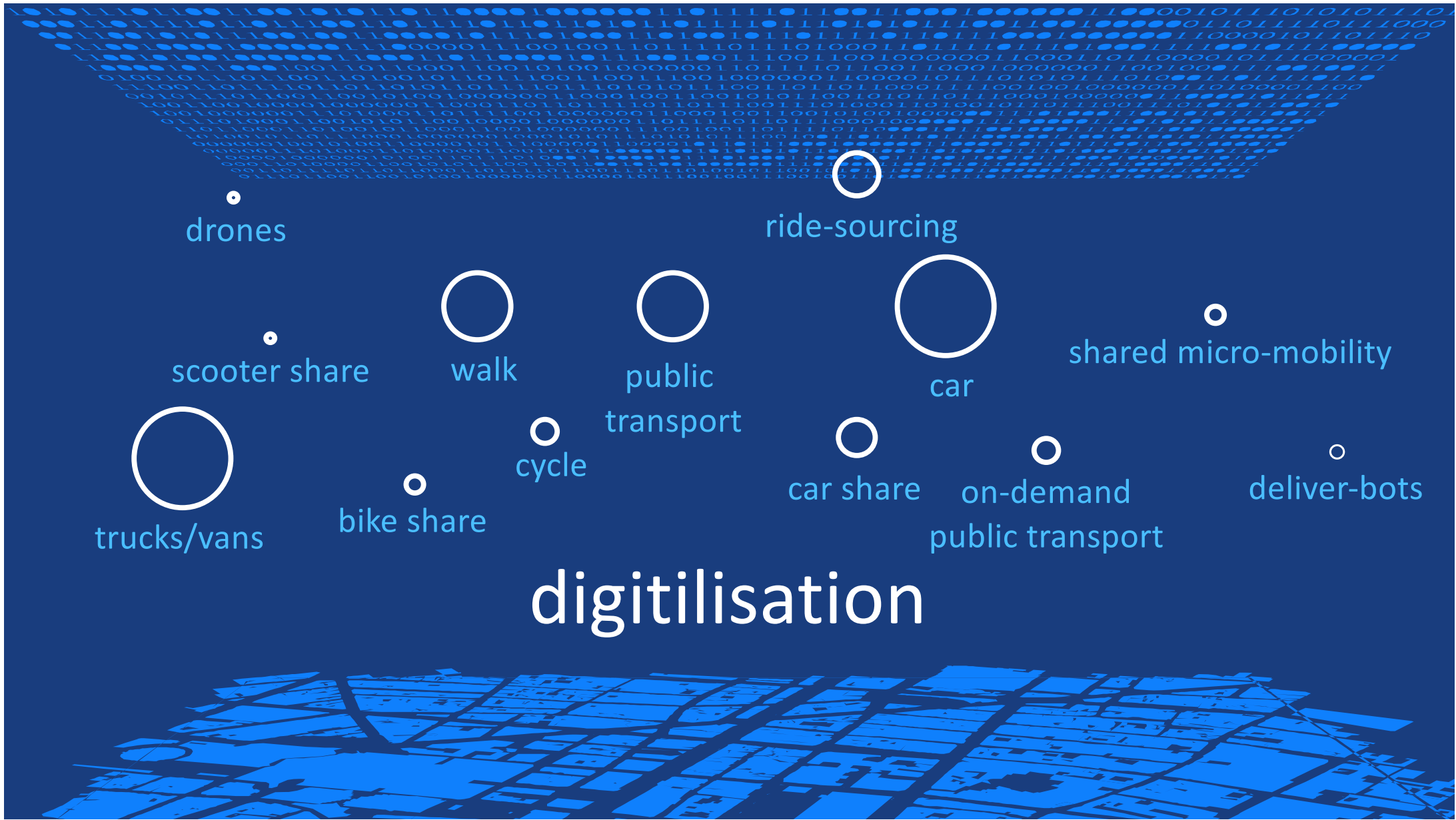
mobility in the city

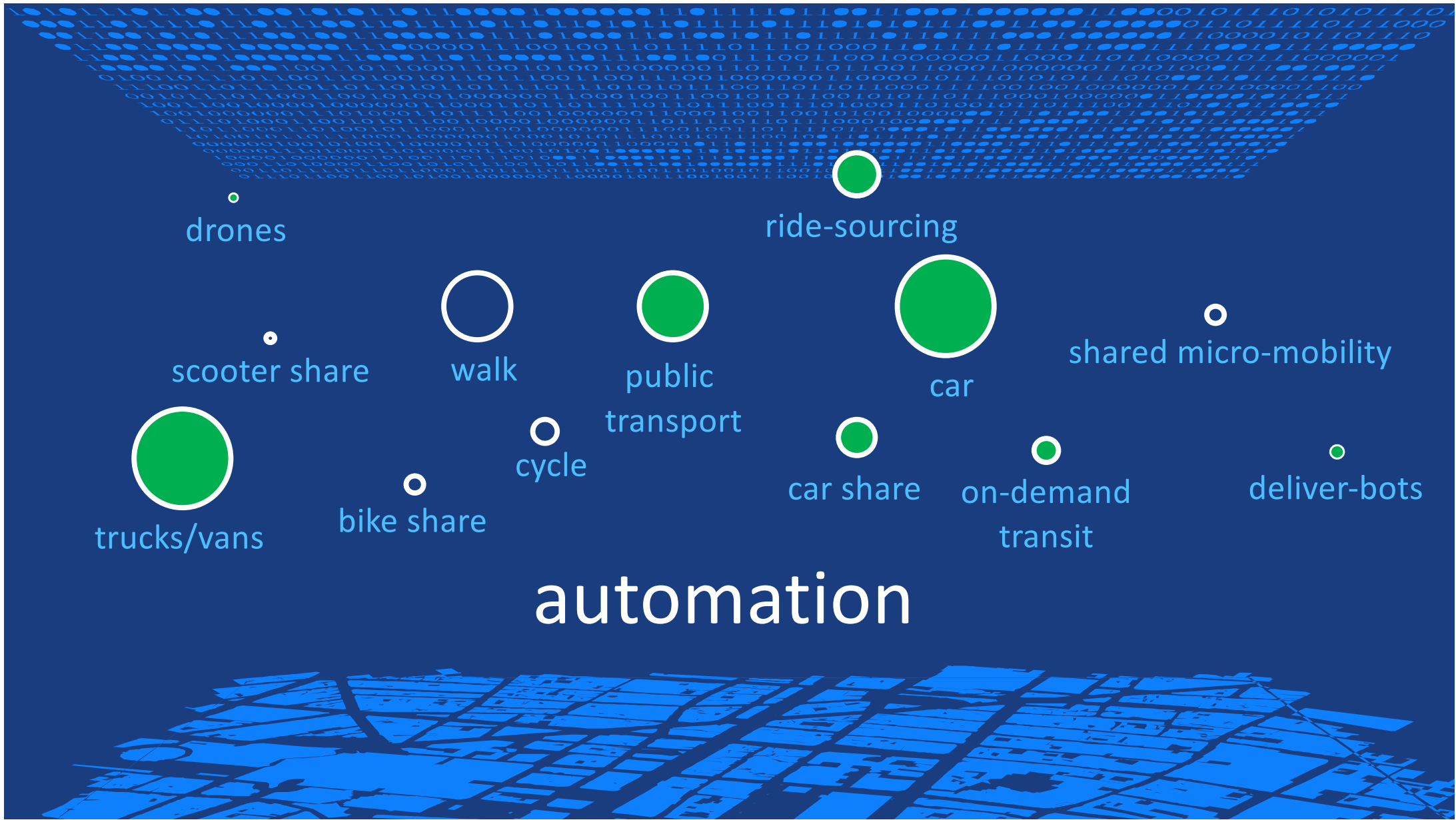


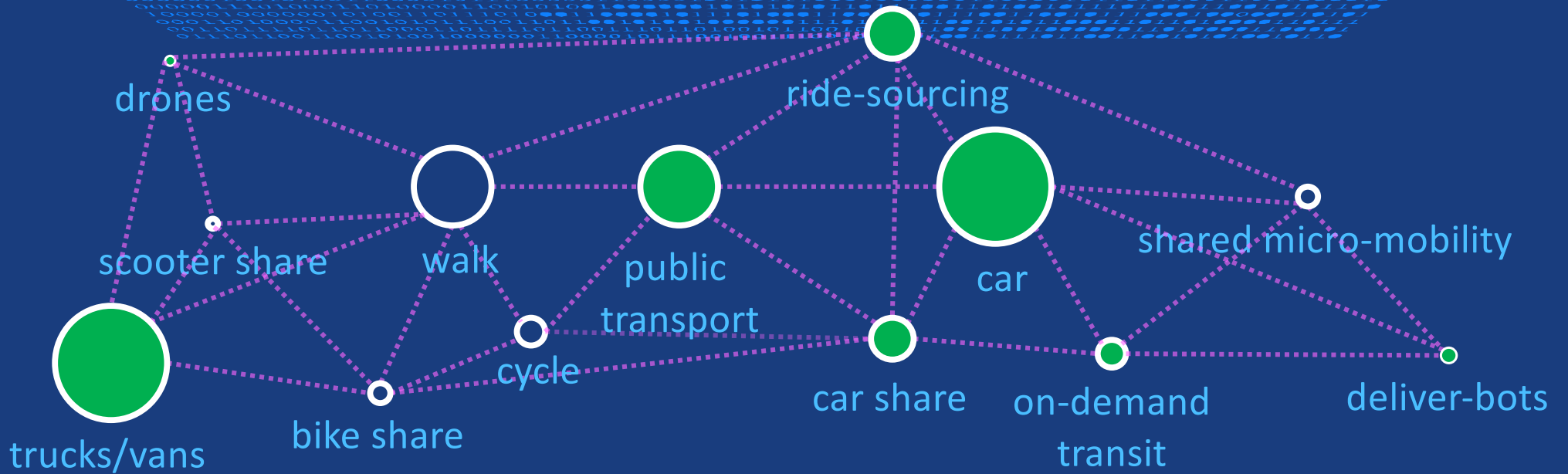


mobility in the city

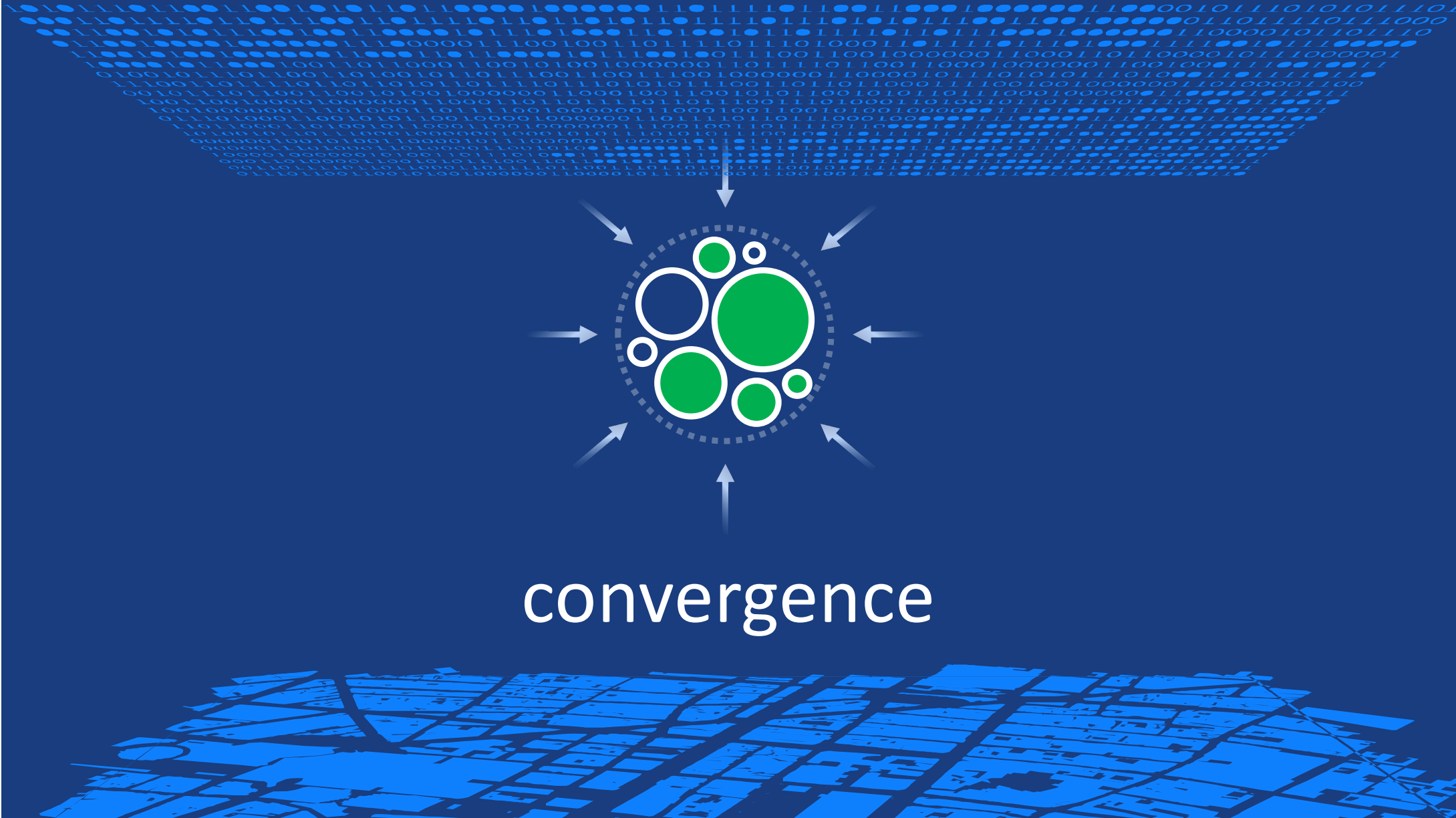




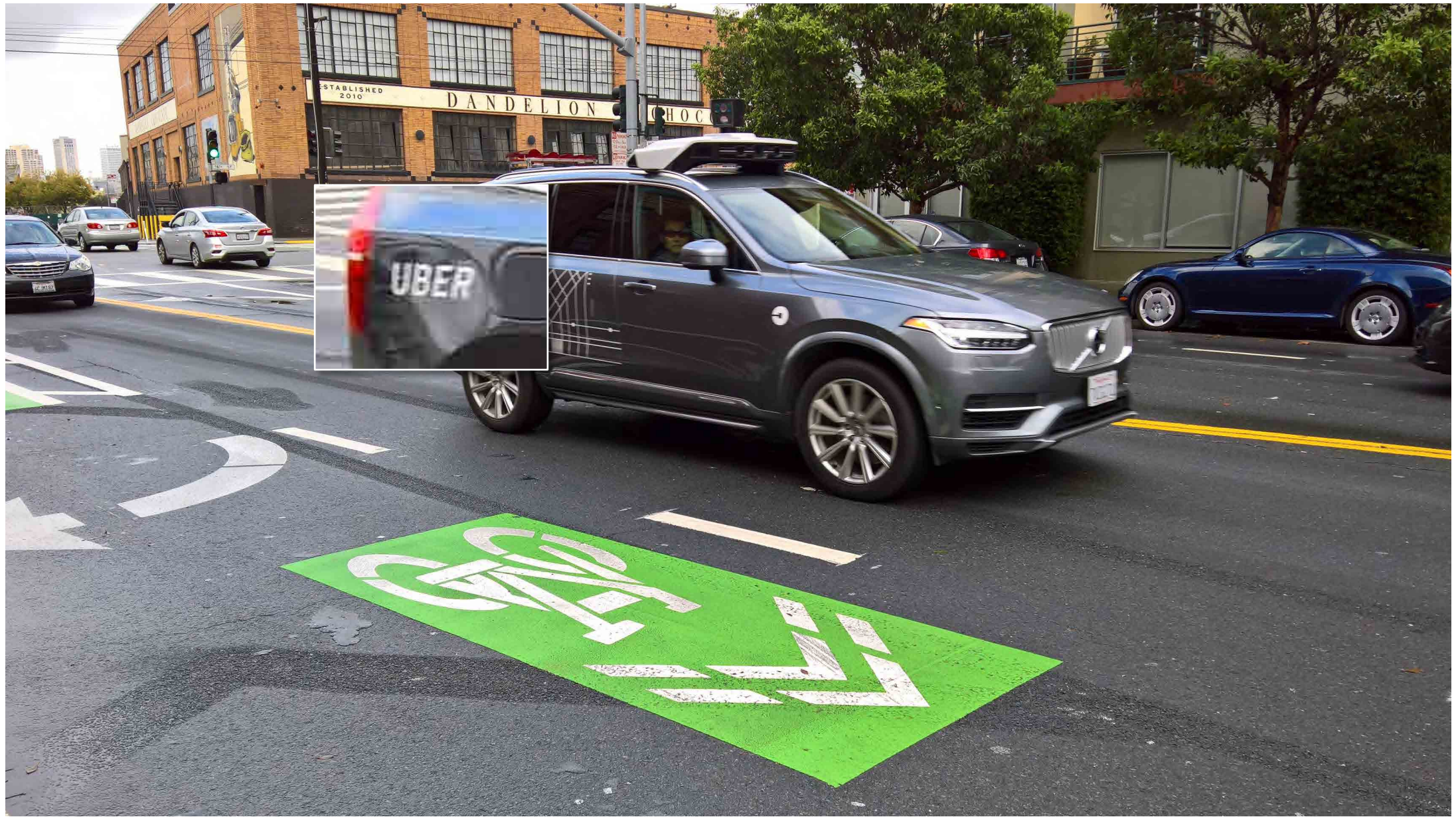




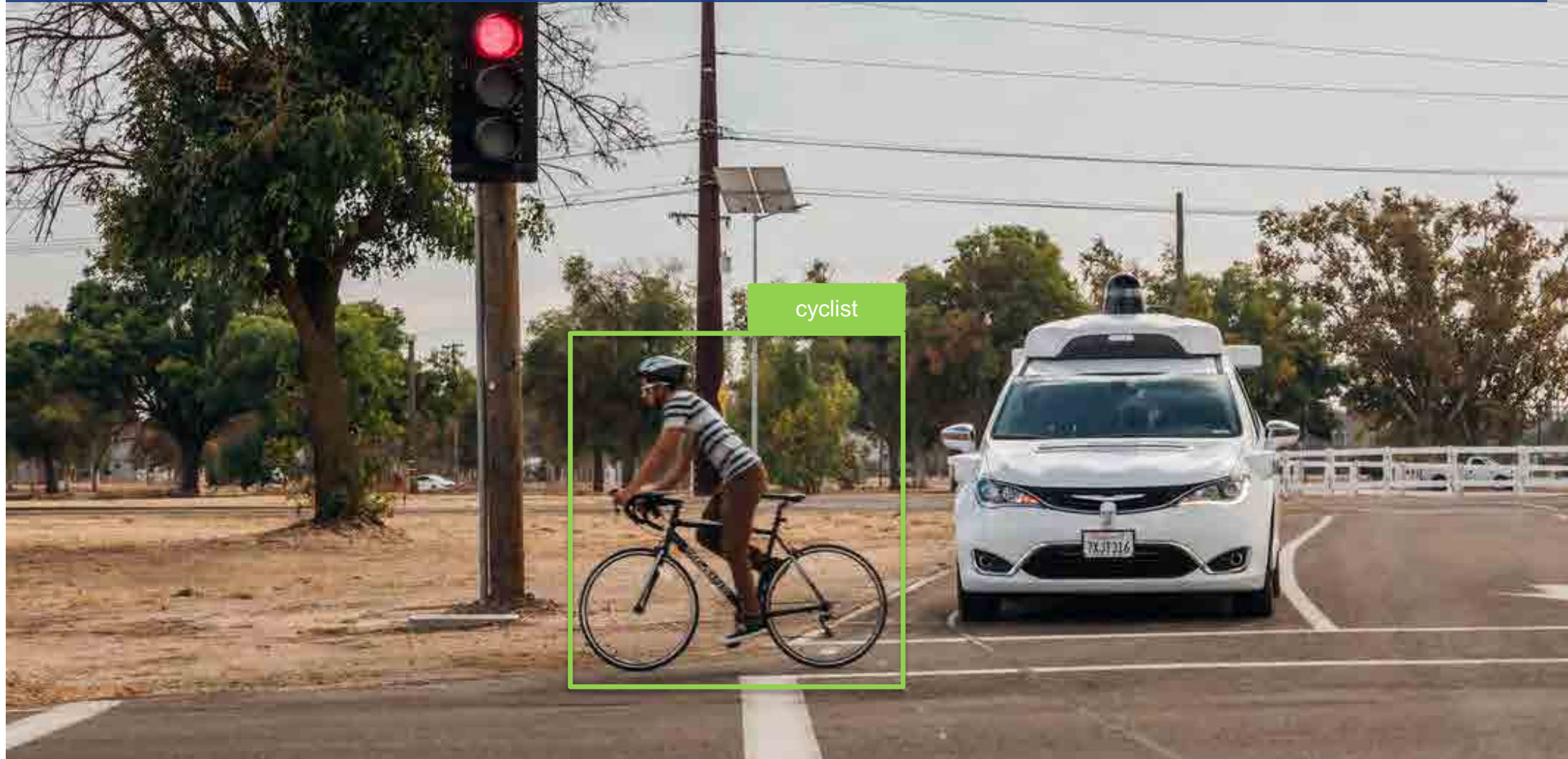
artificial intelligence



convergence



detected, not connected



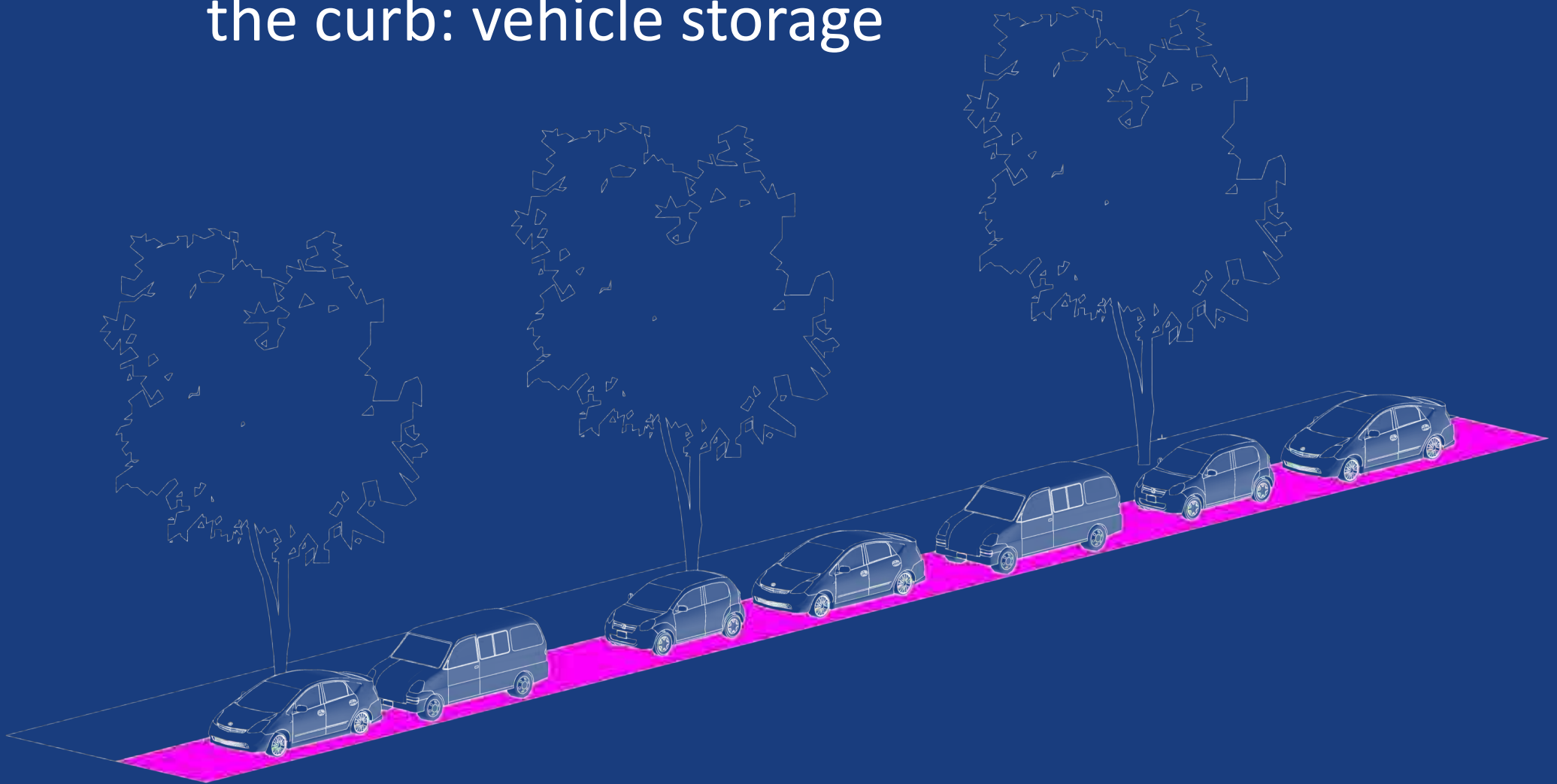


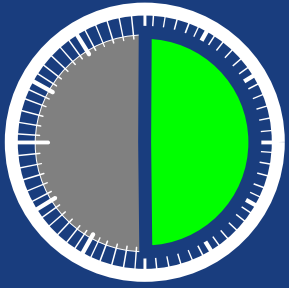






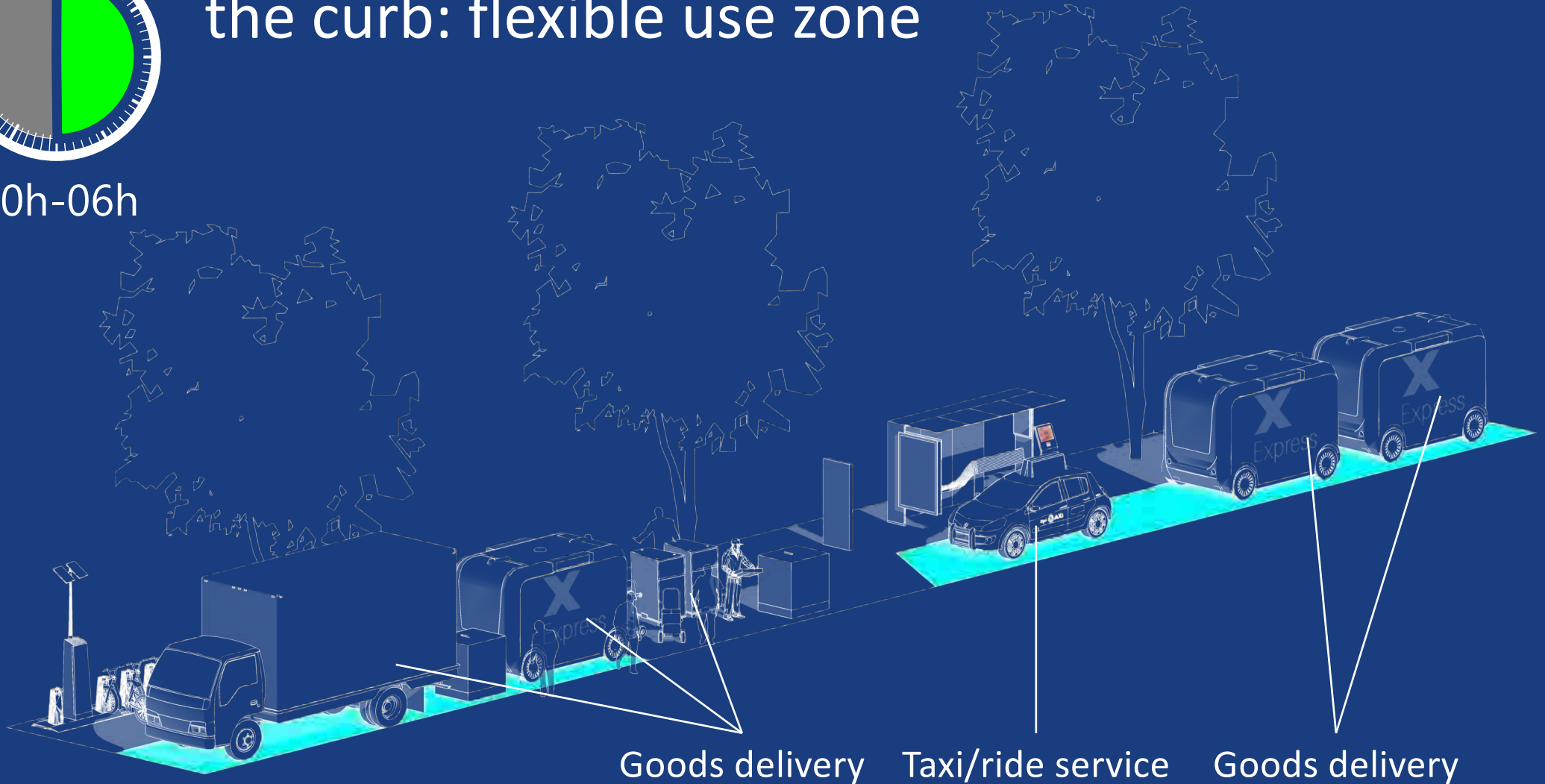
the curb: vehicle storage





the curb: flexible use zone

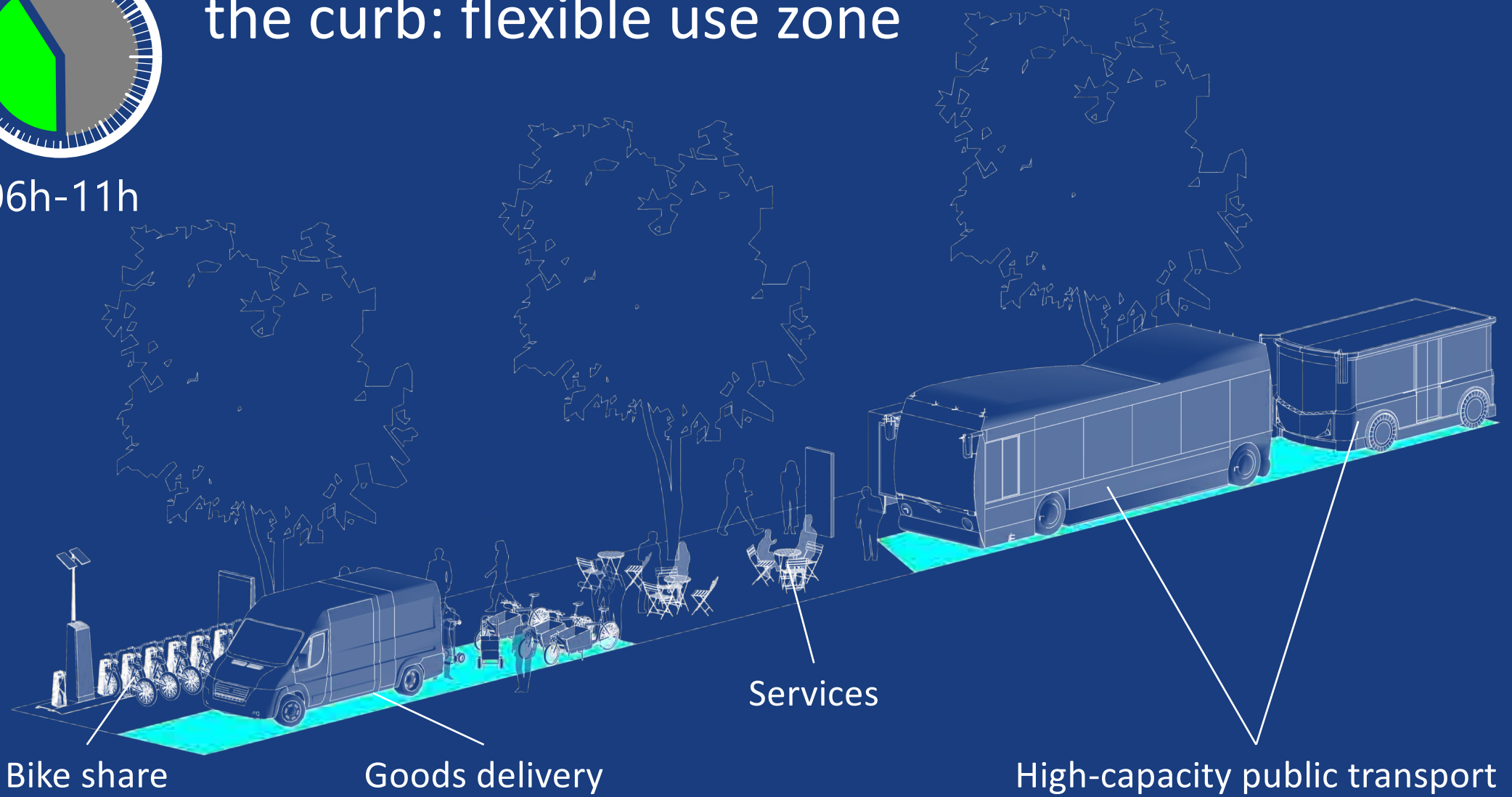
00h-06h





the curb: flexible use zone

06h-11h

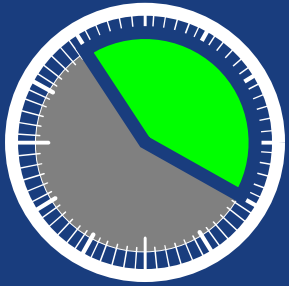


Bike share

Goods delivery

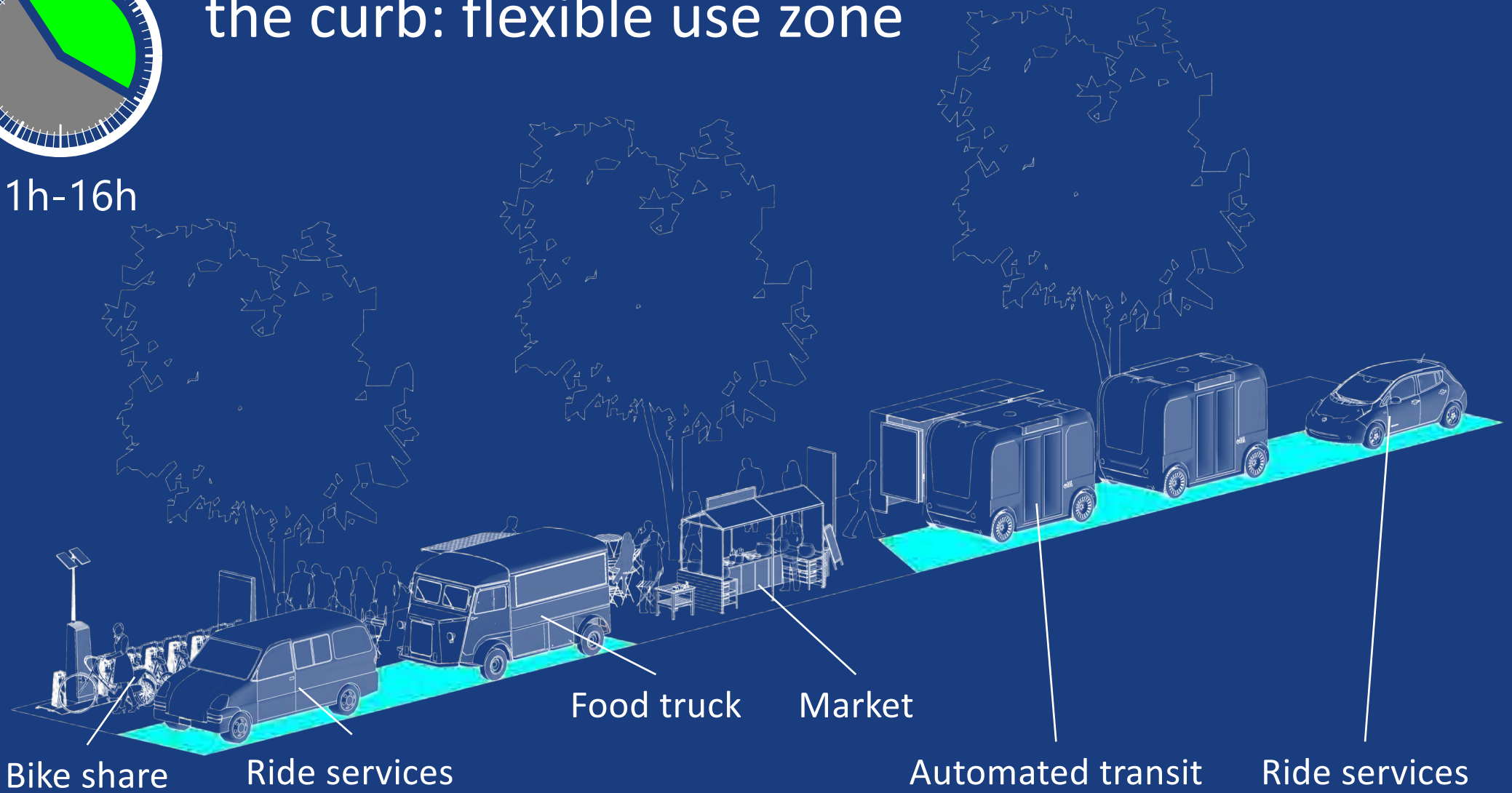
Services

High-capacity public transport



the curb: flexible use zone

11h-16h



Bike share

Ride services

Food truck

Market

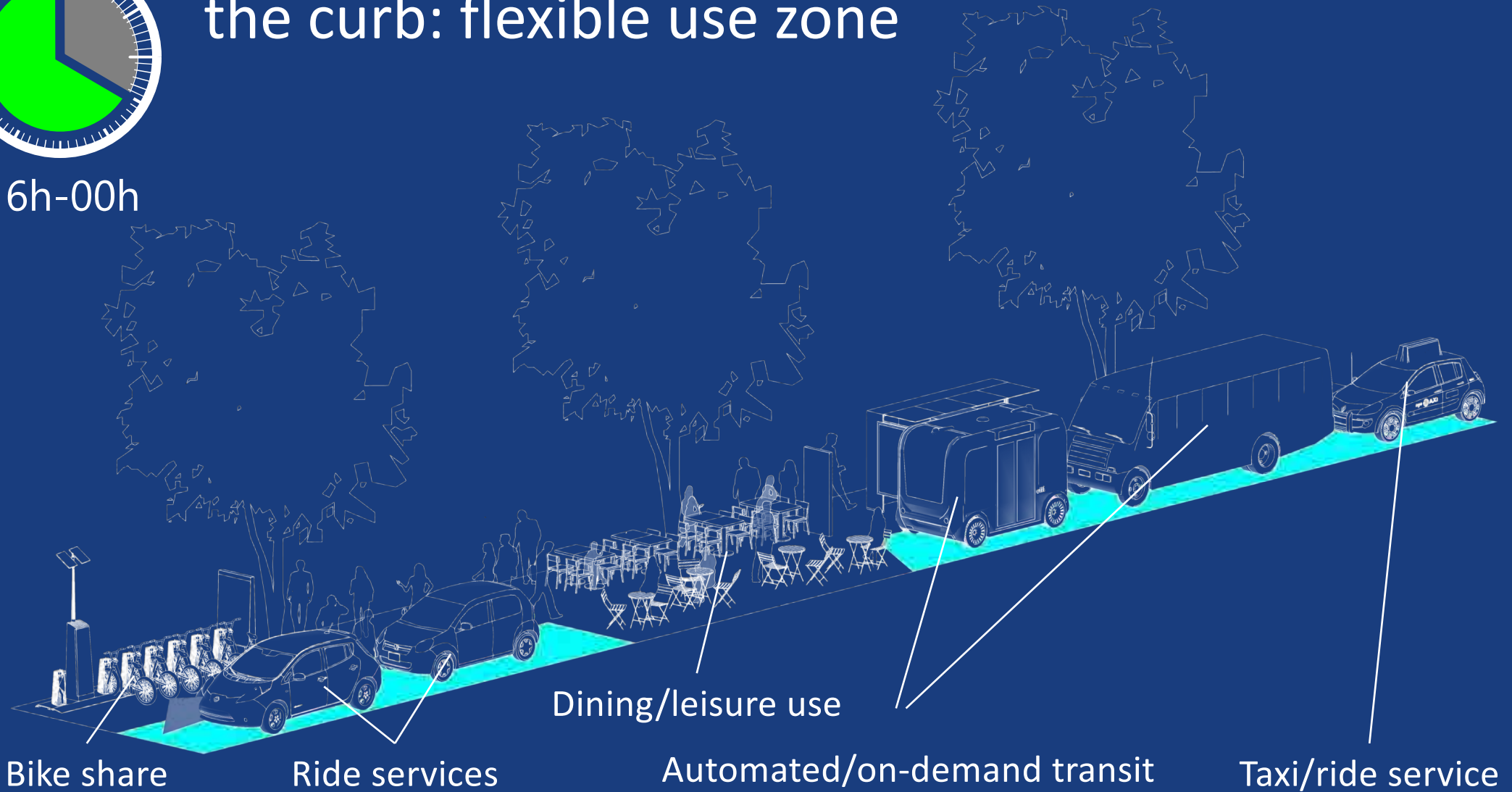
Automated transit

Ride services



the curb: flexible use zone

16h-00h



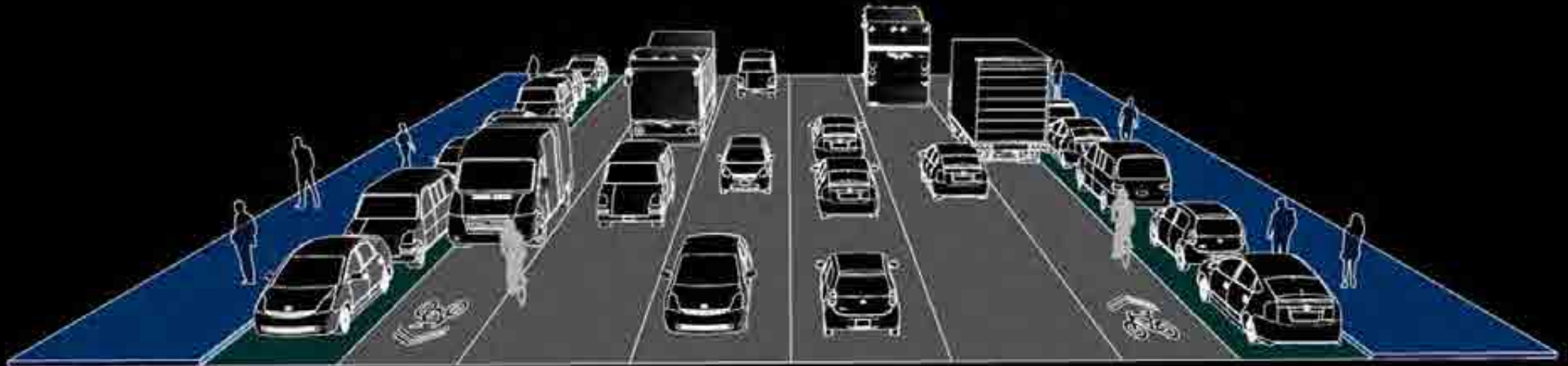
Bike share

Ride services

Dining/leisure use

Automated/on-demand transit

Taxi/ride service



Sidewalk
9 000/hr

Car storage

On-street
bikeway
1000/hr

Mixed traffic lane
frequent buses
1000-2800/hr

Mixed traffic
lane
600-1600/hr

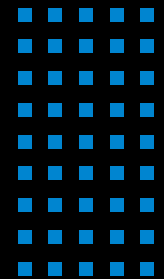
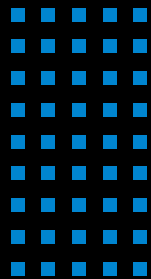
Mixed traffic
lane
600-1600/hr

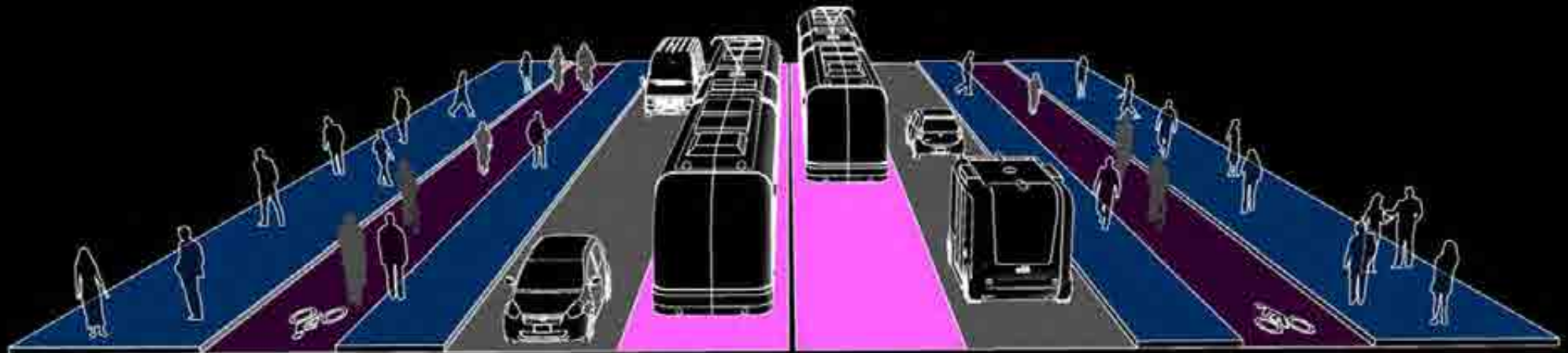
Mixed traffic lane
frequent buses
1000-2800/hr

On-street
bikeway
1000/hr

Car storage

Sidewalk
9000/hr





Sidewalk
9000/hr

Separated
bike track
4000/hr

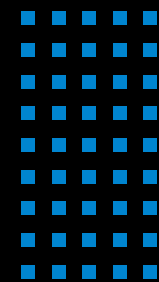
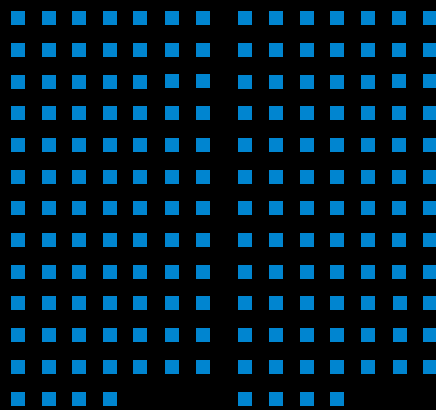
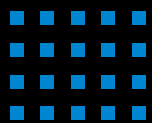
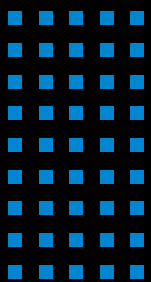
Mixed traffic
with frequent
micro-buses
1000-2800/hr

High-capacity on-street
bus or rail lane
10000-25000/hr per lane


Automated
vehicle lane
600-1600/hr

Separated
bike track
4000/hr

Sidewalk
9000/hr







When you prioritise active mobility, it makes getting around easier for everyone, including drivers.

If you design a city for cars, it fails for everyone, including drivers...

Brent Toderian. TODERIAN UrbanWorks, former Director of City Planning, Vancouver





