26/09-2019

Emil Tin / Traffic
Technical and Environmental Department

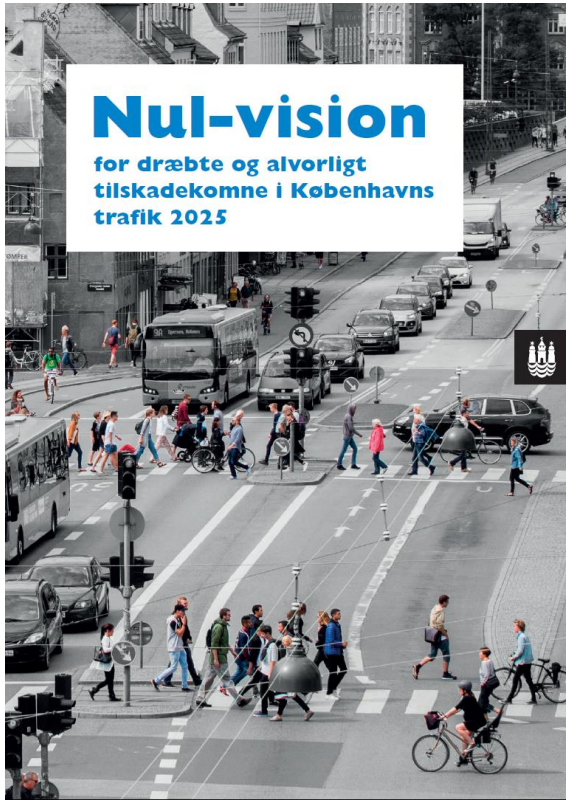
Traffic Light, Cyclist and Safety in Copenhagen

Emil Tin

Agenda

- Copenhagen Context
- Separate phases for Cyclists
- ITS Solutions
- Summary

Strategies



AUGUST 2014

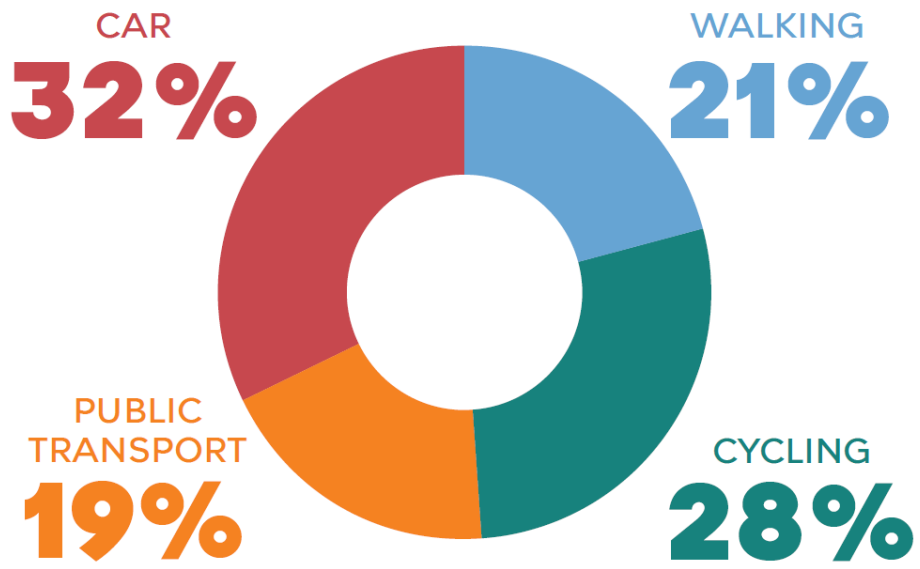
Københavns Kommunes administrationsgrundlag for trafikledelse 2014-2018

KØBENHAVNS KOMMUNE RAMBØLL

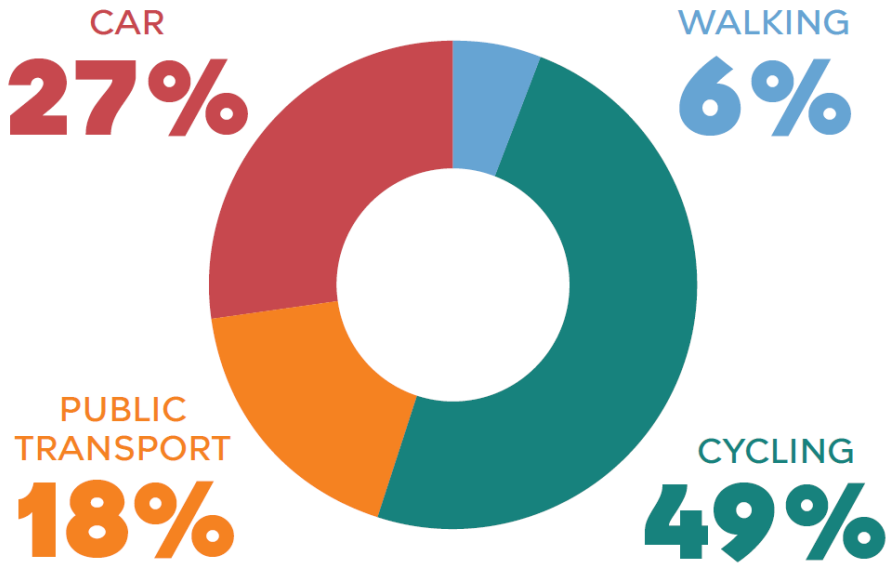
Cycling: Serious Traffic

1,44 mio. kilometers cycled per weekday

ALL TRIPS TO, FROM, AND IN COPENHAGEN, 2018



TRIPS TO WORK AND EDUCATION IN COPENHAGEN, 2018



Infrastructure

- Mostly dedicated bicycle paths.
- No bicycles on sidewalk.
- No push buttons for cyclists.

Infrastructure

- Very few bidirectional cyclepaths - we avoid them whenever possible.

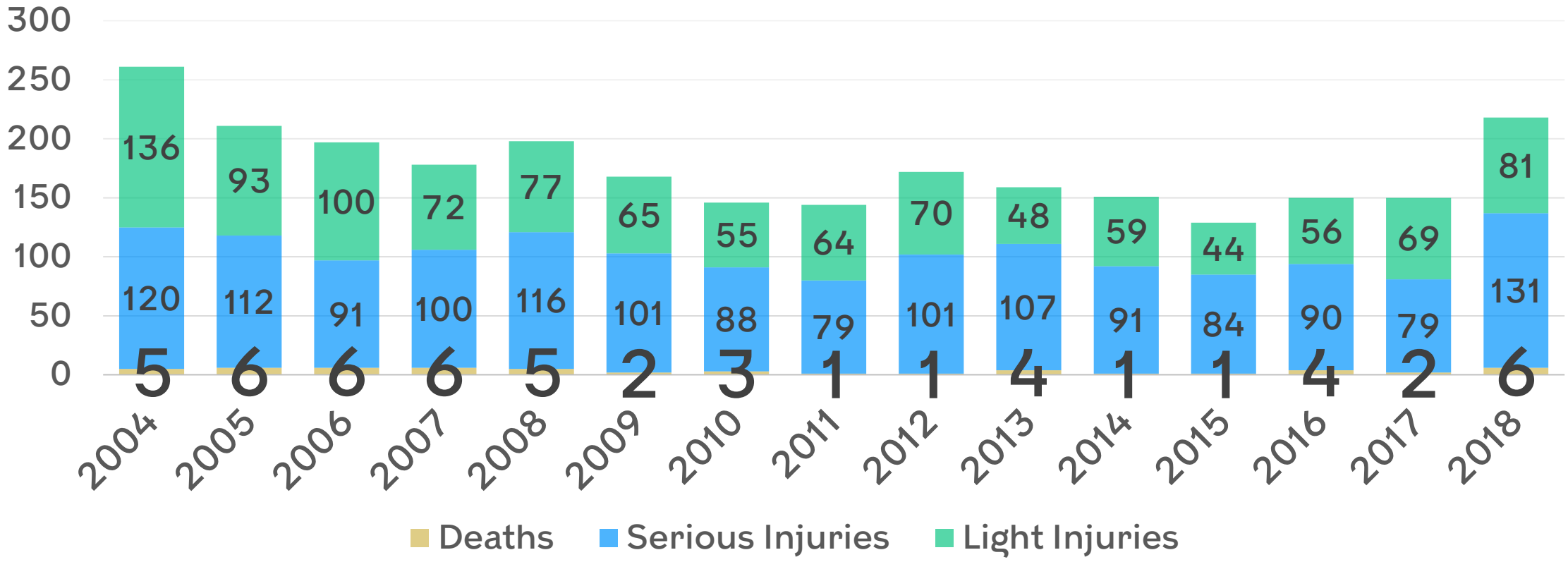
Infrastructure

- A lot of cyclist for many years.
- Only limited separate bicycle infrastructure – mainly bridges and green cycle network.
- => Other road users are used to bicycles.

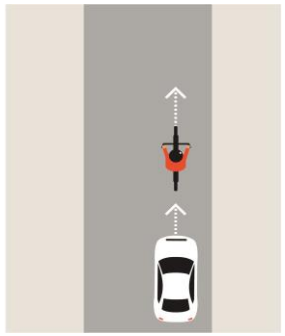
Infrastructure

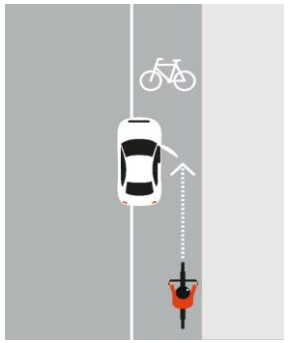
- Few adaptive intersections.
- Most are fixed time with a bit of local traffic control.
- Focus on strategic traffic management, rather than local optimization.

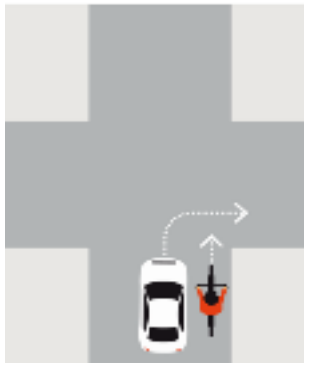
Bicycle Accidents

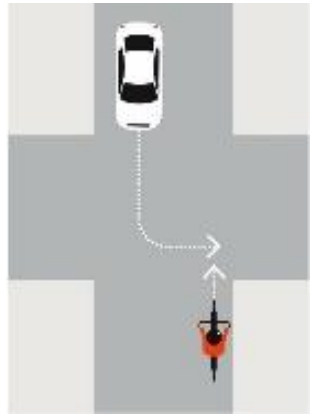


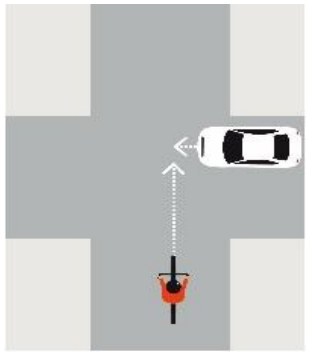
Accident Types

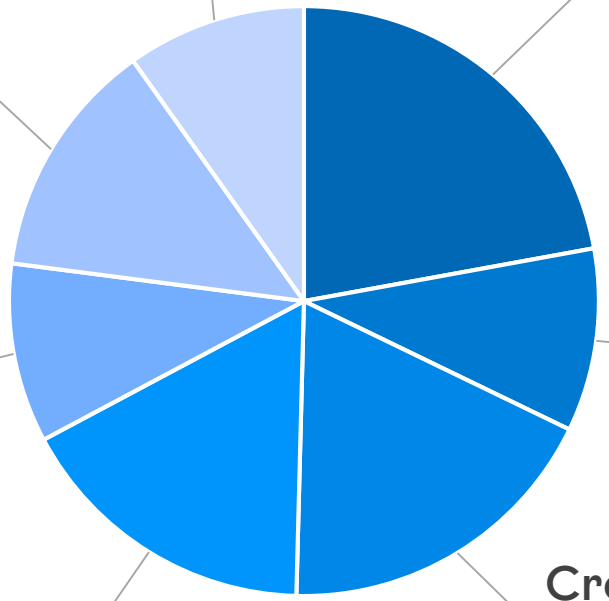












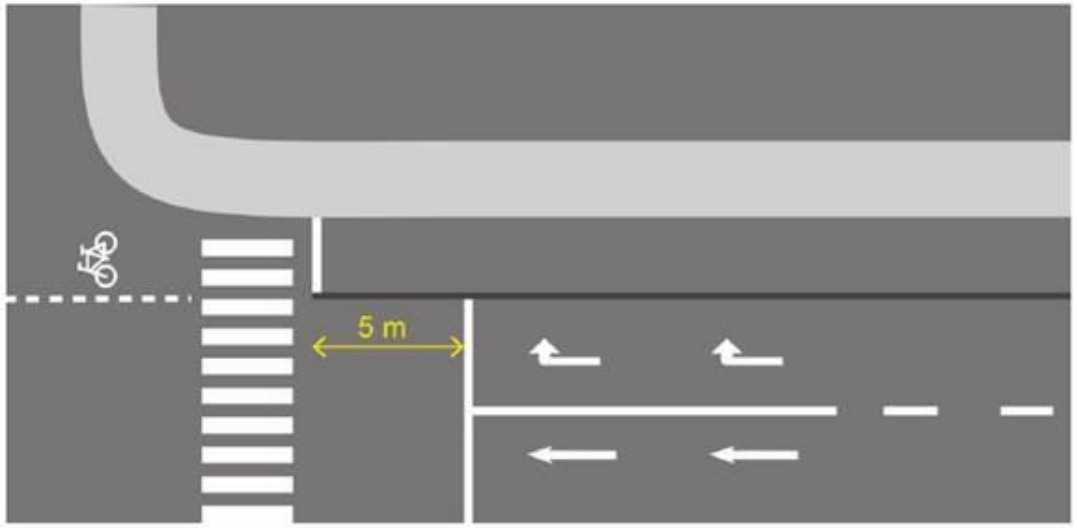
City of Copenhagen

Shared stop line

- Cars and cyclist stop at the same stop line.
- Bicycle lane extend to stop line.
- Preferably pre-green.

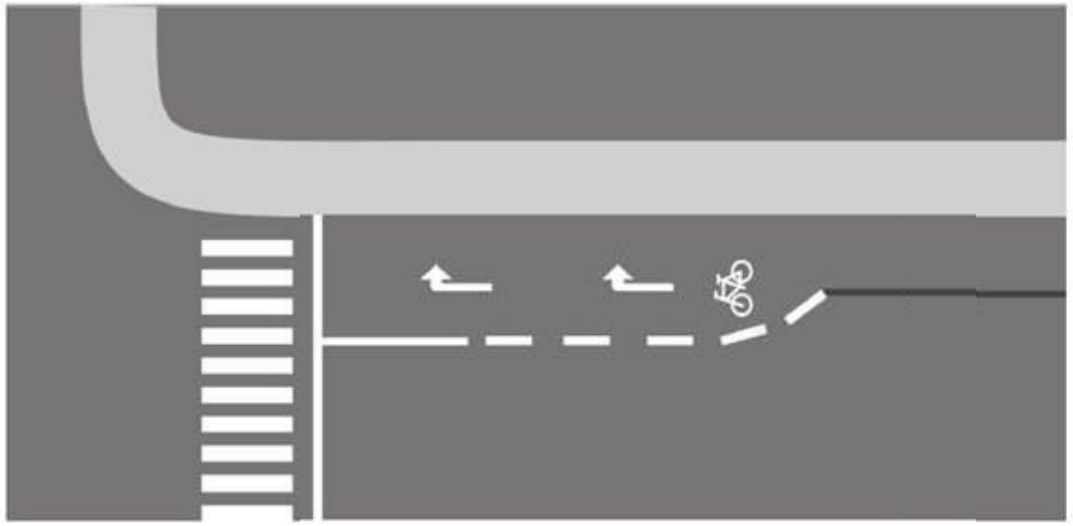
Retracted stop line

- Cars stop 5 meters behind bicycles.
- Pre-green usually not needed.



Shortened bicycle lane

- Bicycle lane ends before shared stop line.
- Cyclist mix with other traffic before the stop line.

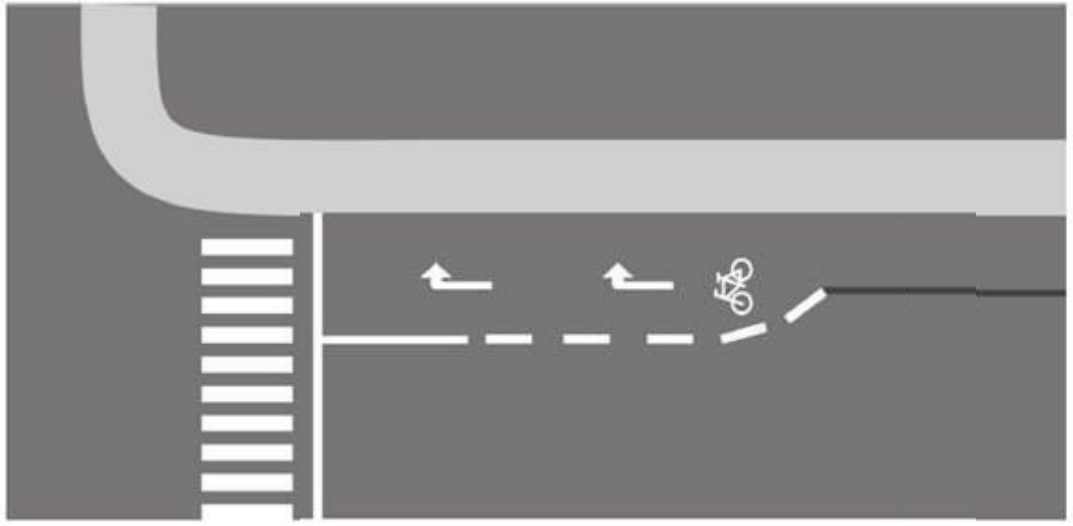


Study of 15 intersections

Shortened Bicycle Lane

Total data period: 60 years

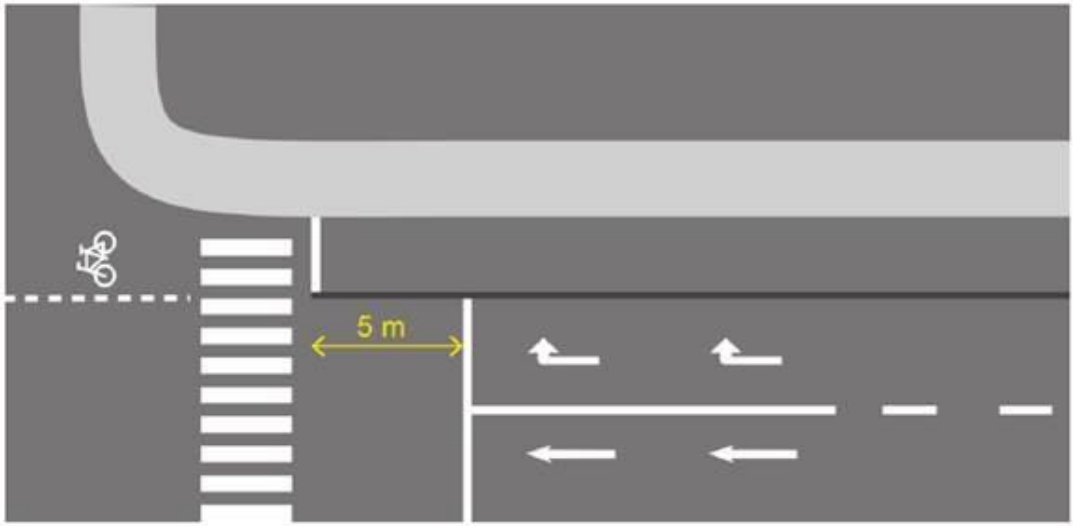
Accidents: 0



Retracted Stop Line

Total data period : 35 years

Accidents: 15, of these 4 serious injuries



Insights

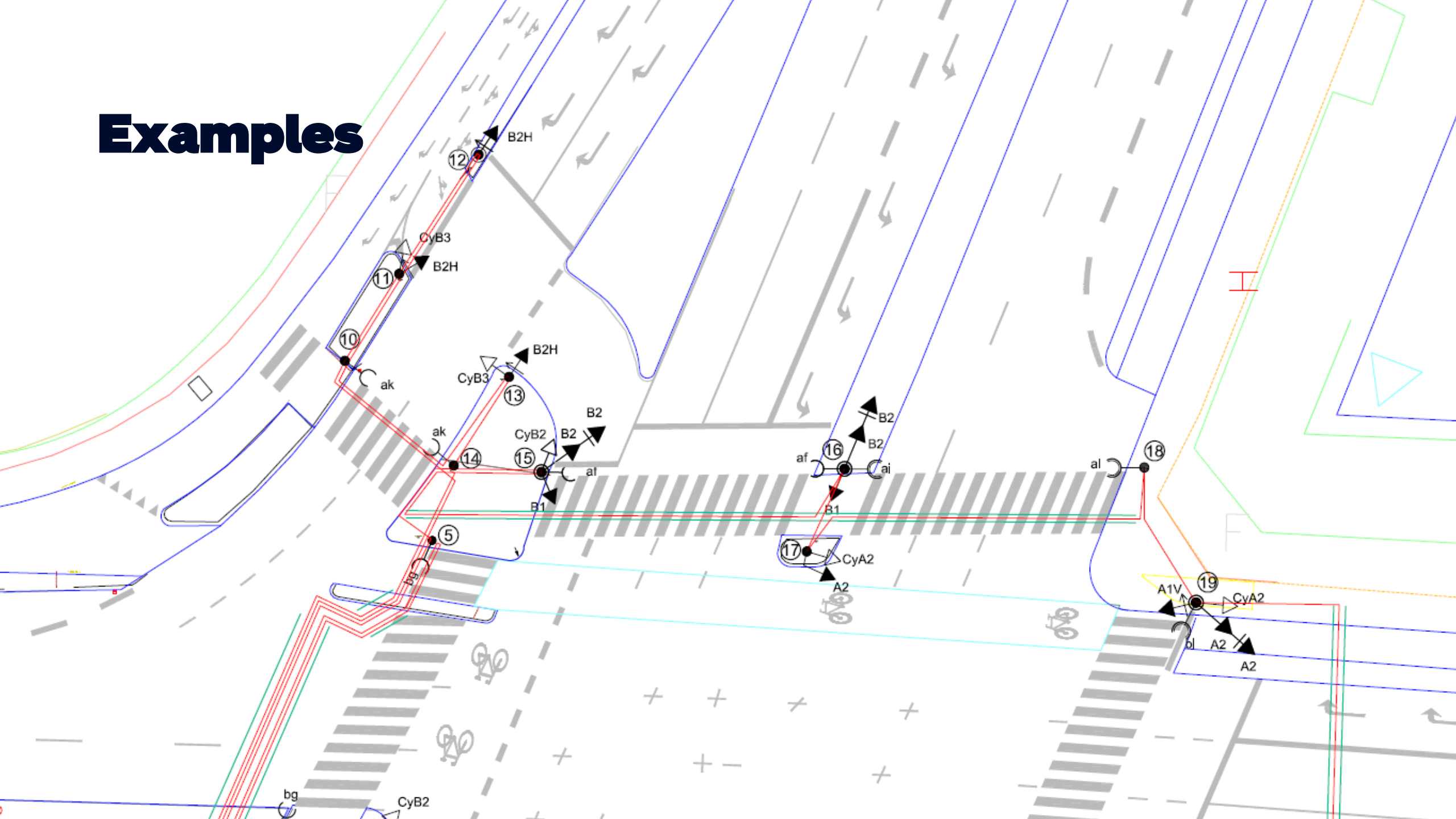
- Pre-green prevents accidents when cyclist wait for red and then start.
- Accidents probably happened when cyclist arrive at green, because cyclist and motorist both have a dedicated lane and thus pay less attention to each other.
- (But it's a small study.)

- What's safest?

- Separate phases for cars and bicycles (best)
- Retracted bicycle lane without pre-green
- Advanced bicycle lane with pre-green
- Shared stop line with pre-green
- Shared stop line (worst)

- **Separate pre-green phase for cyclist helps, but a retracted bicycle lane might be better.**

Examples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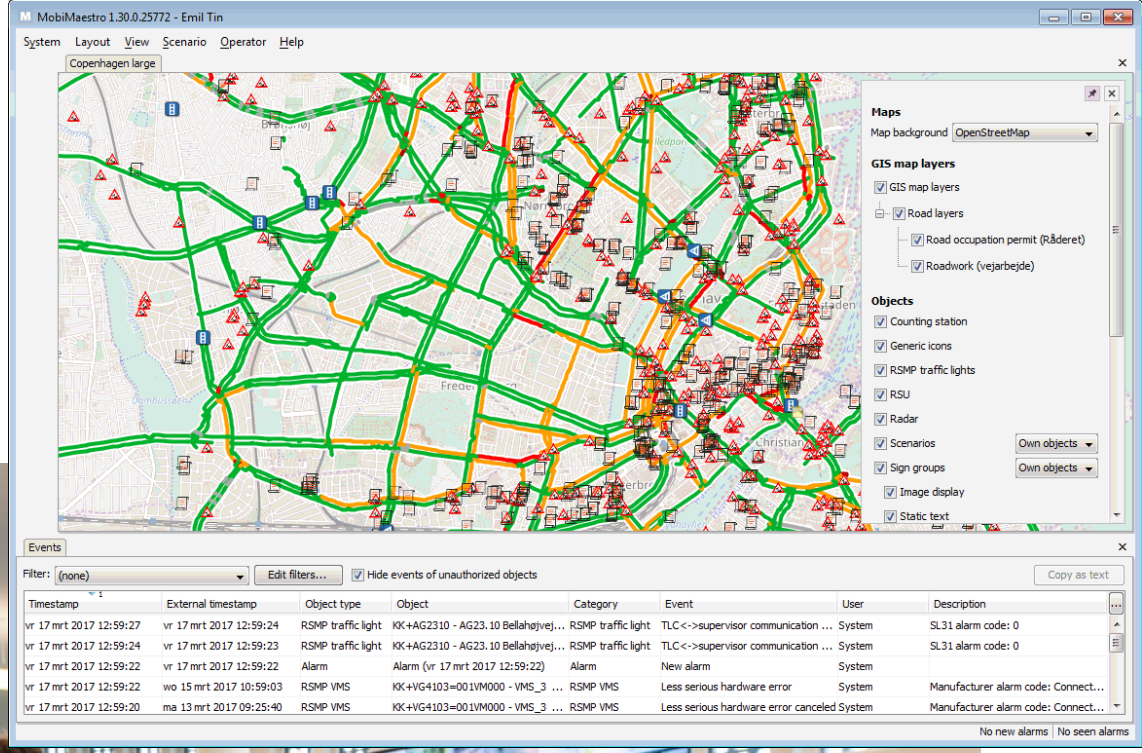
CyB2

Types of Dedicated Phases for Cyclists

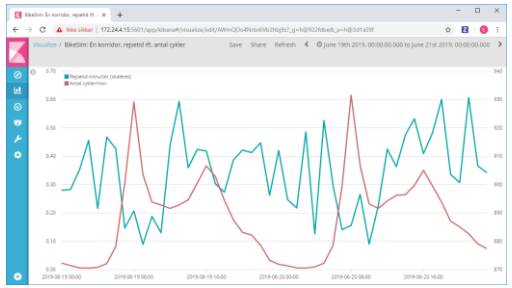
- Pre-green for cyclists
- Pre-red for cyclists – mainly to improve capacity for cars
- Left turning arrows for cyclists
  - Cyclist first go straight to the corner and then cross – as such no left turn phase
- Separate phases for bidirectional bicycle paths
  - We avoid bidrectional bicycle paths in intersections whenever possible.
- "Prison Islands"
  - Safe, but often requires cyclist to stop twice.
  - Can be improved by detection

Where is the Intelligence?

- Some local traffic control (priority), but otherwise intersections just follow the clock.
- Only few adaptive intersections.
- Focus istead on strategic traffic management, corridors and scenarios.

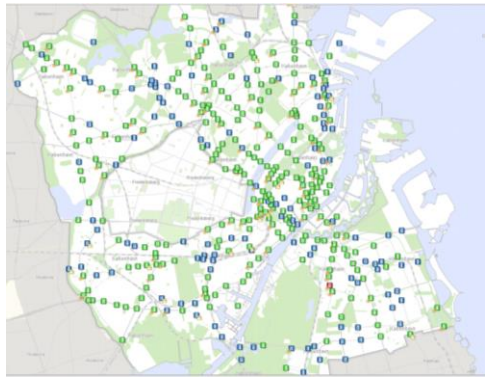


MobiMaestro

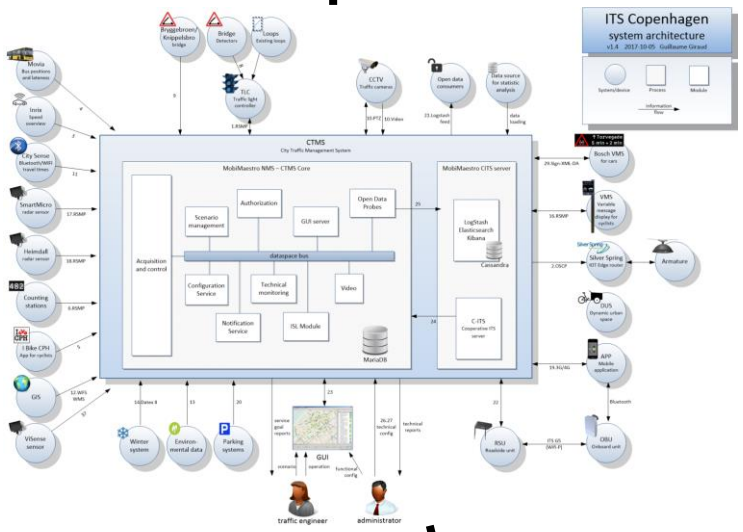


Historic Data & Analysis

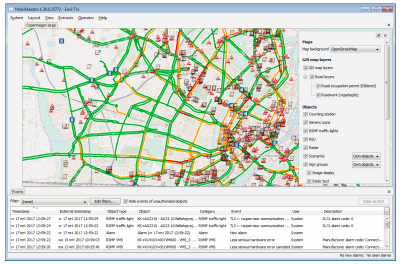
Sensors



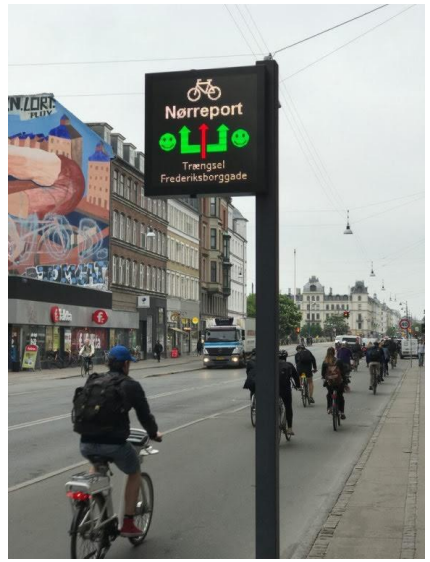
Roadworks and Events



Traffic Lights



Travel times



VMS'es

ITS Projects

- Projects that involve traffic lights to reduce travel time or otherwise improve service for cyclist.
- Most involve MobiMaestro.
- No data on safety impact, except overall statistics, which shows no adverse effect on safety.

City of Copenhagen

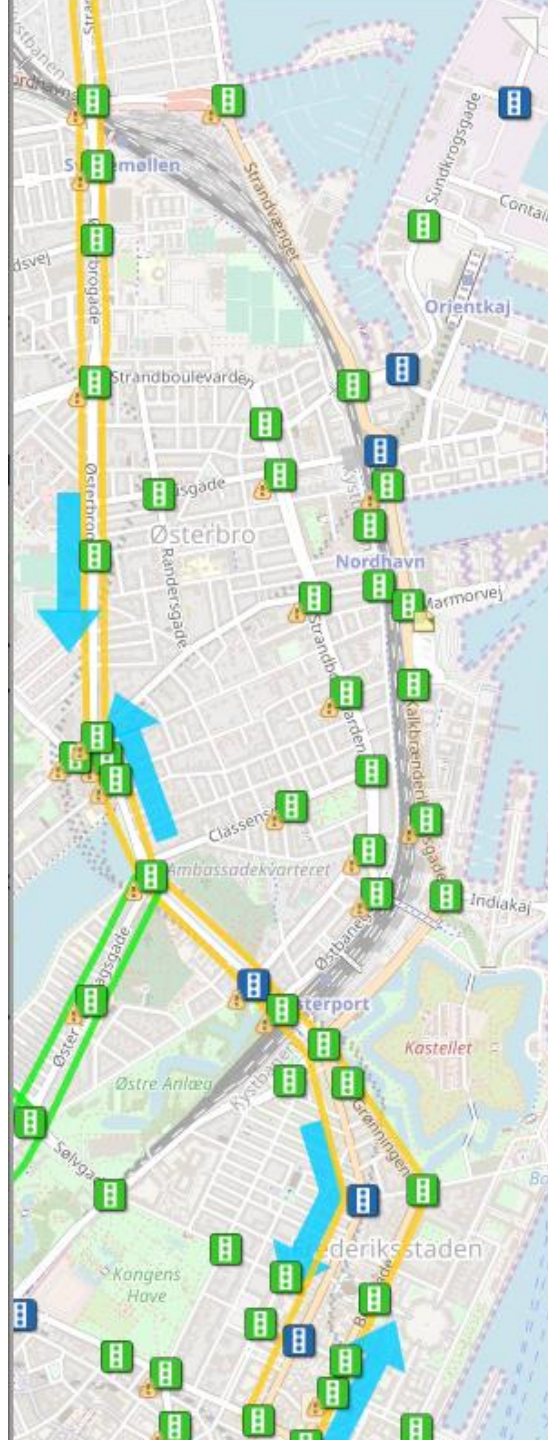
Green Waves for Cyclists

- Østerbrogade and Nørrebrogade.
- Signals are coordninated, based on a fixed average speed of 20 km/h.
- Separate morning and afternoon directions.
- 20 km/h => no stops!

Østerbrogade Green Wave Results

	Duration	Speed	Stops
Before	31:46 min	16.7 m/s	12.5
After	28:11 min	18.3 m/s	3.7
Result	-11%	9%	-70%

- Simple adjustment of offset times – very cheap!
- Simulation of advanced adaptive system showed no results (but big costs for sensors..)
- Traffic lights are a powerful tool – how you use them depends on political will. Who do you want to prioritize?



Lane Lights

- LEDs warn cyclist and drivers to prevent right turning accidents.
- Lights up during green phase - no sensors.
- Not enough data to conclude about safety impact.
- Cyclist don’t understand them.
- Costly to maintain.

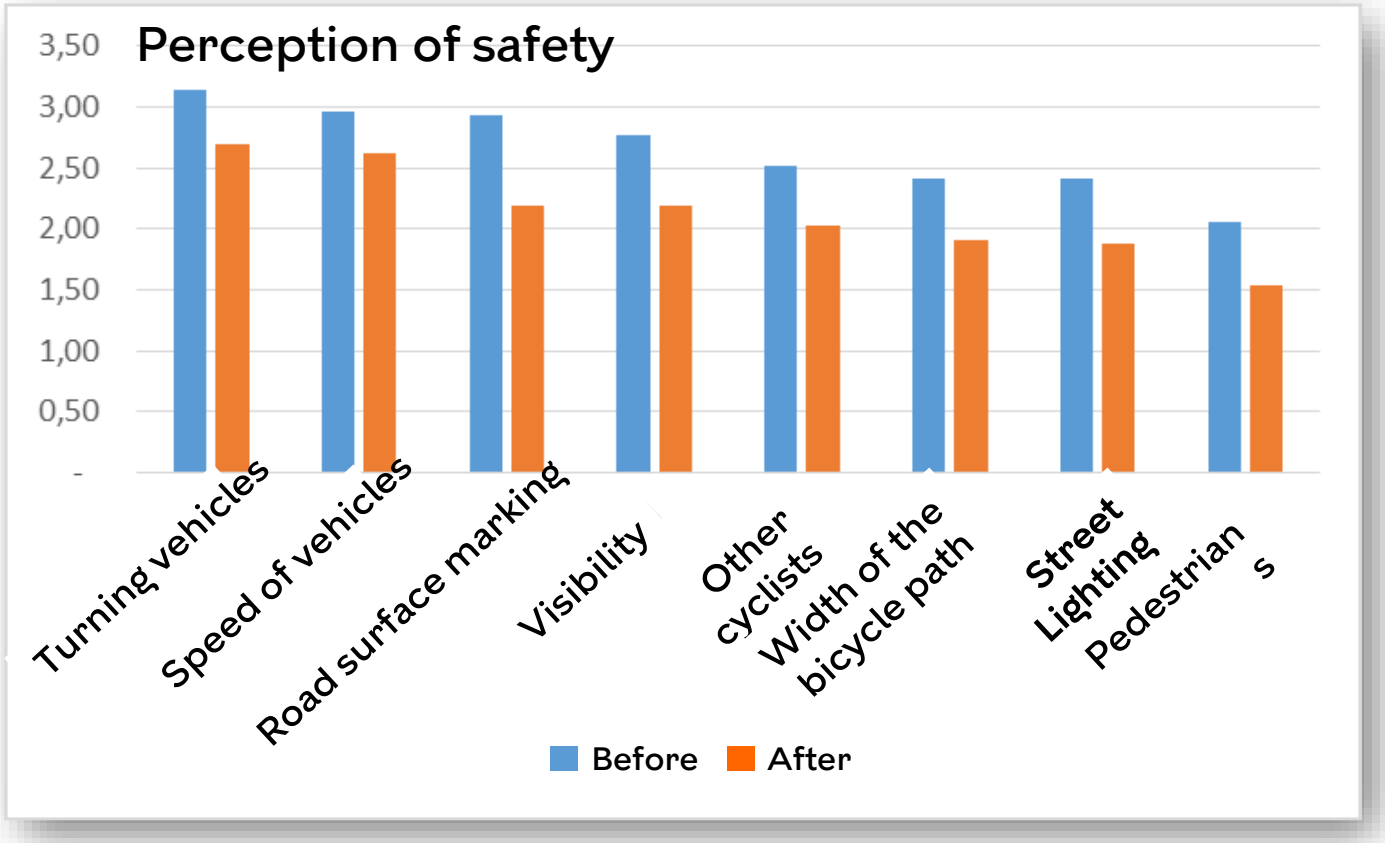
City of Copenhagen

Intelligent Street Light

- Late at night street light is turned down to 50% to save energy.
- Turn up light when sensors detect cyclists arriving at intersection.
- Possible due to a digital mesh network for controlling street lights individually.

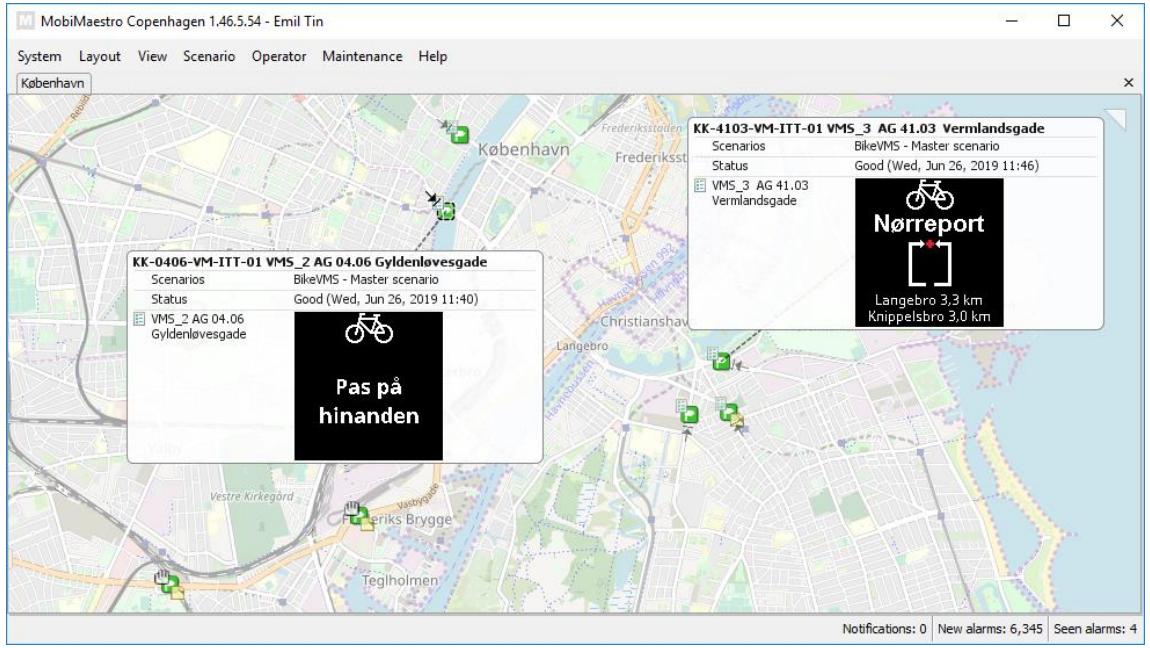
Intelligent Street Light

- Cyclist feel more safe.
- But.. No data on accidents.



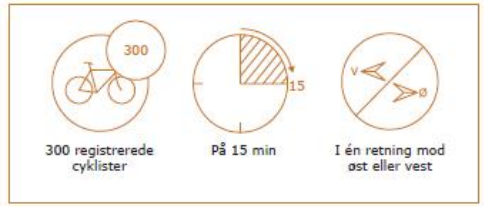
VMS for Bicycles

- Automatically update content from MobiMaestro based on e.g. travel times.
- Help cyclist pick shorter (and safer?) routes.



Automatic Traffic Scenarios

- Scenarios are configured in MobiMaestro, and can use conditions, e.g:
  - IF service goals is met on the corridor
  - AND more than 300 cyclist / min for at least 15 minutes on side street
  - THEN change signal programs to prioritize side street
- Not just local traffic control – can consider the big picture and use multiple inputs.



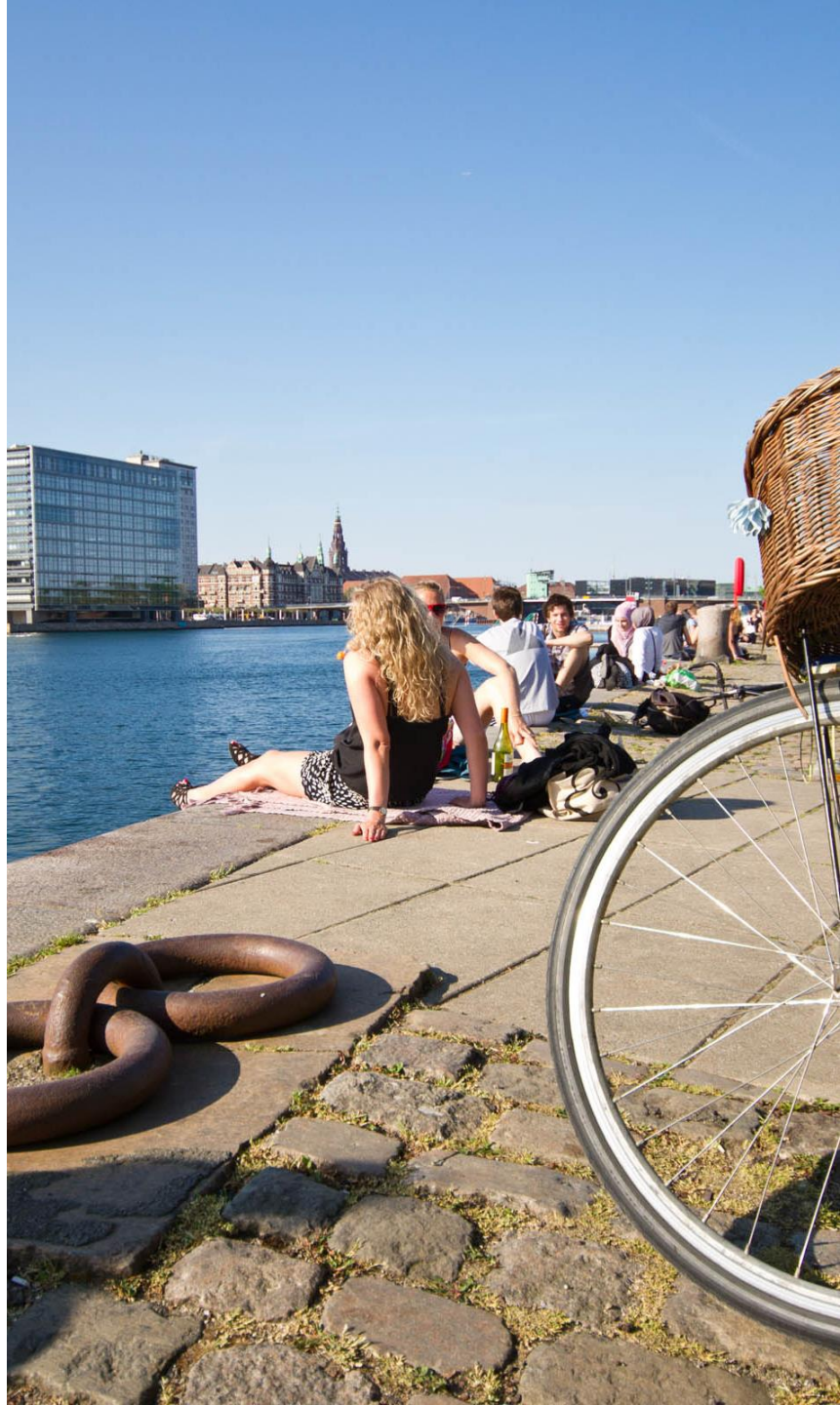
GLOSA/Info for Bicycles

- Real-time speed advice to cyclist (and drivers).
- Based on real-time data from traffic lights.
- Selected corridors.
- Discrete guidance in headphones – no need to look at the screen.

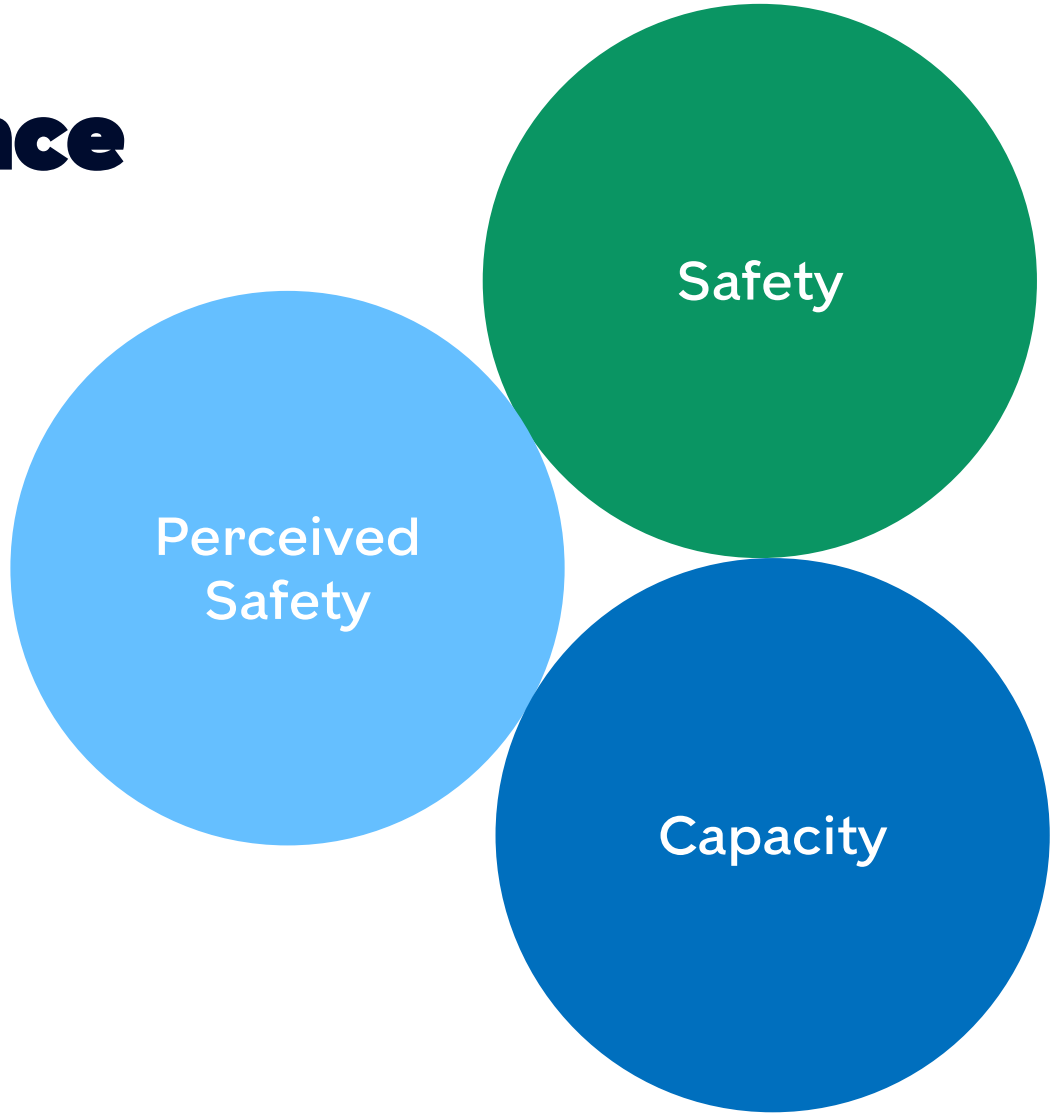
- Road warnings

Conclussions

- Safety is a complex issue. Signals are just one part.
- Signal phasing for cyclist in Copenhagen is mostly fixed and uses few separate phases. Intelligence is centralized, with a focus on strategic traffic management.
- Pre-green is good, but not always the best.
- Is mixing traffic safer? Then we should perhaps look more at shared space and bicycle streets?
- Goals for emission reduction and city life can lead to less cars & more bicycles, which will probably improve safety.



It's a balance



Thank you

Emil Tin
Project Manager

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