A.M. Salomons

26/01/2021

Coordination of Signal Control in the Netherlands

TU Delft

Content of this presentation:

1. Introduction to urban intersection control in the Netherlands
2. Policies on intersection control
3. Arterial coordination, some methods used
4. State of the art “intelligent traffic signals”
5. Bicycle coordination
6. Blue wave

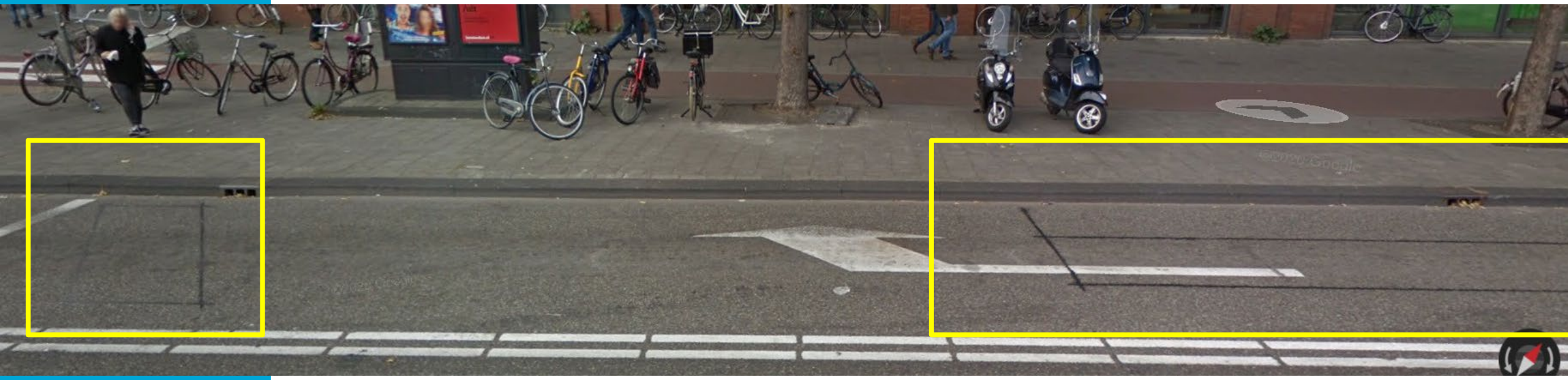
2020/2021	million
Number of inhabitants:	17.5
Number of cars:	8.7
Number of bicycles:	±23

Signal Control in the Netherlands:
> 6000 VRI's (Traffic Light Controllers)

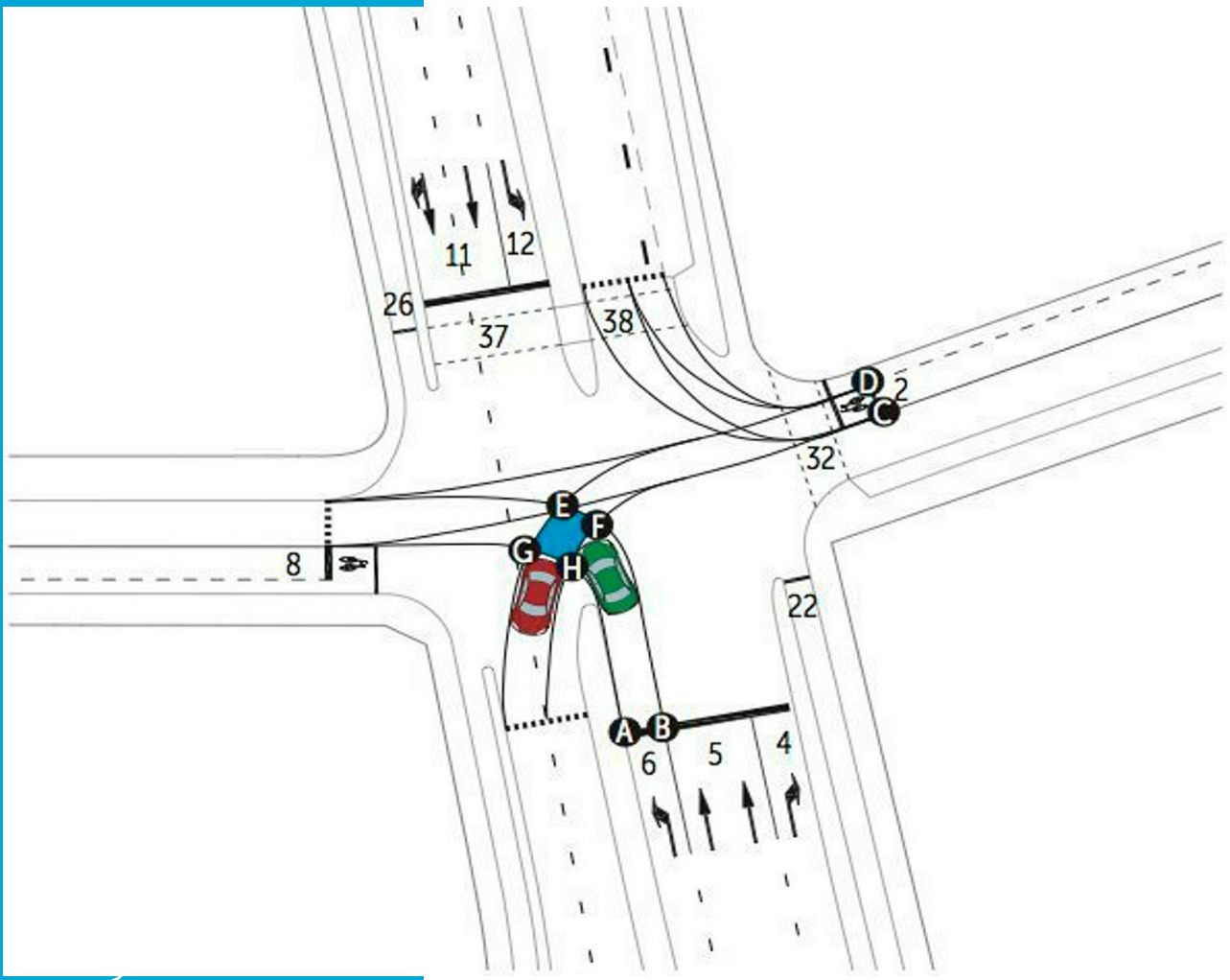
- 85% Vehicle-actuated
- 2% Traffic-dependent
- 13% "Halfstar" – semi-fixed
- ±0% Fixed-time
- ±10% iVRI ('intelligent' TLCs, 700 iVRI's in January 2021)


Amsterdam, Noord-Holland
Google
Street View

Loop detectors



- Push buttons (pedestrians/cyclists)
- Camera
- Radar
- Mobile apps


11
12
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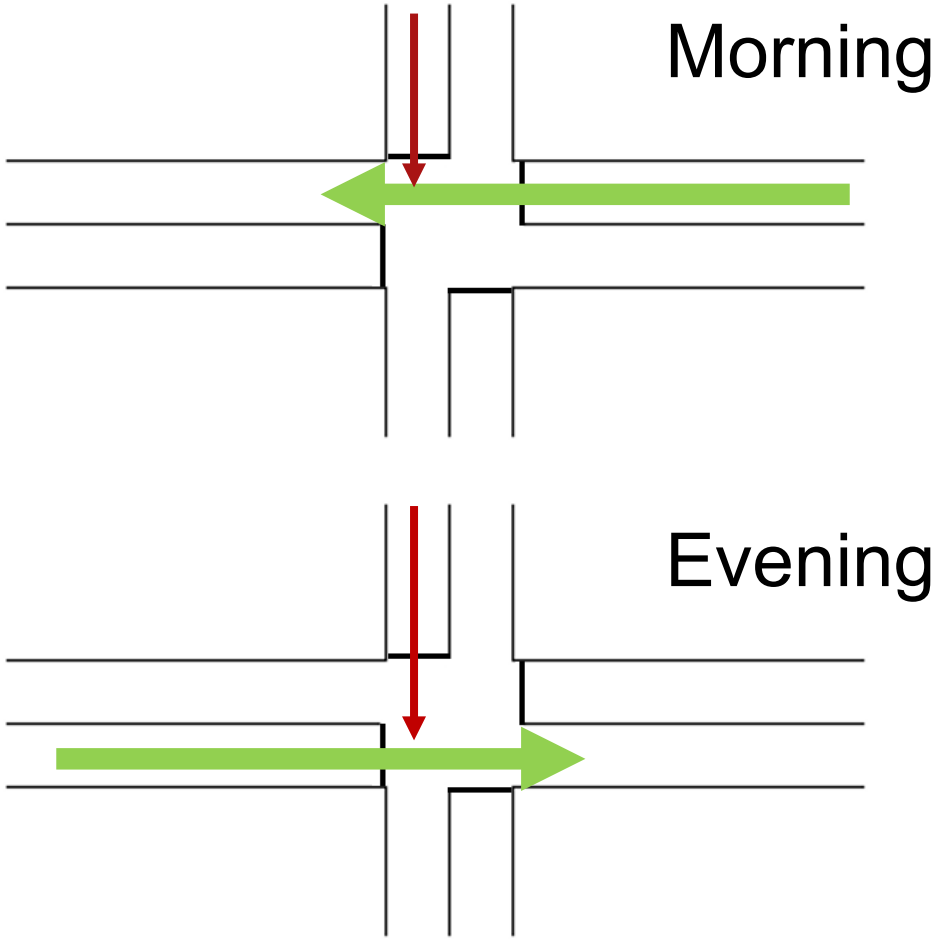

Morning
Evening

Policies on coordination:

- Intersection control should be credible and understandable
- Avoid where possible unnecessary stops/waiting
- Avoid spillback
- Balance priority (buses, trucks) and coordination
- Inform the traffic participants

Coordination for passenger cars on arterials:

- "Hard" coordination
  (coordination within one control program)
  - On the intersection
  - Between intersections < 150 m
- Green waves on arterials, platoon coordination
  - 3 or more intersections- 9, 10 intersections
- Network control (both urban and regional)

“Halfstar” – semi-fixed control

- Fixed cycle time with offset in the control between coordinated intersections
- Coordination on the main directions
- Flexible green

"Halfstar" – semi-fixed control

- Fixed cycle time
  - suitable for coordination ànd traffic demand
  - Depends on demand, speed and distance between coordinated intersections
  - Platoon dispersion
  - Offset

$$C_{0,9} = \frac{T_v}{1 - Y/_{0,9}} \quad [s]$$

Formule 15-2

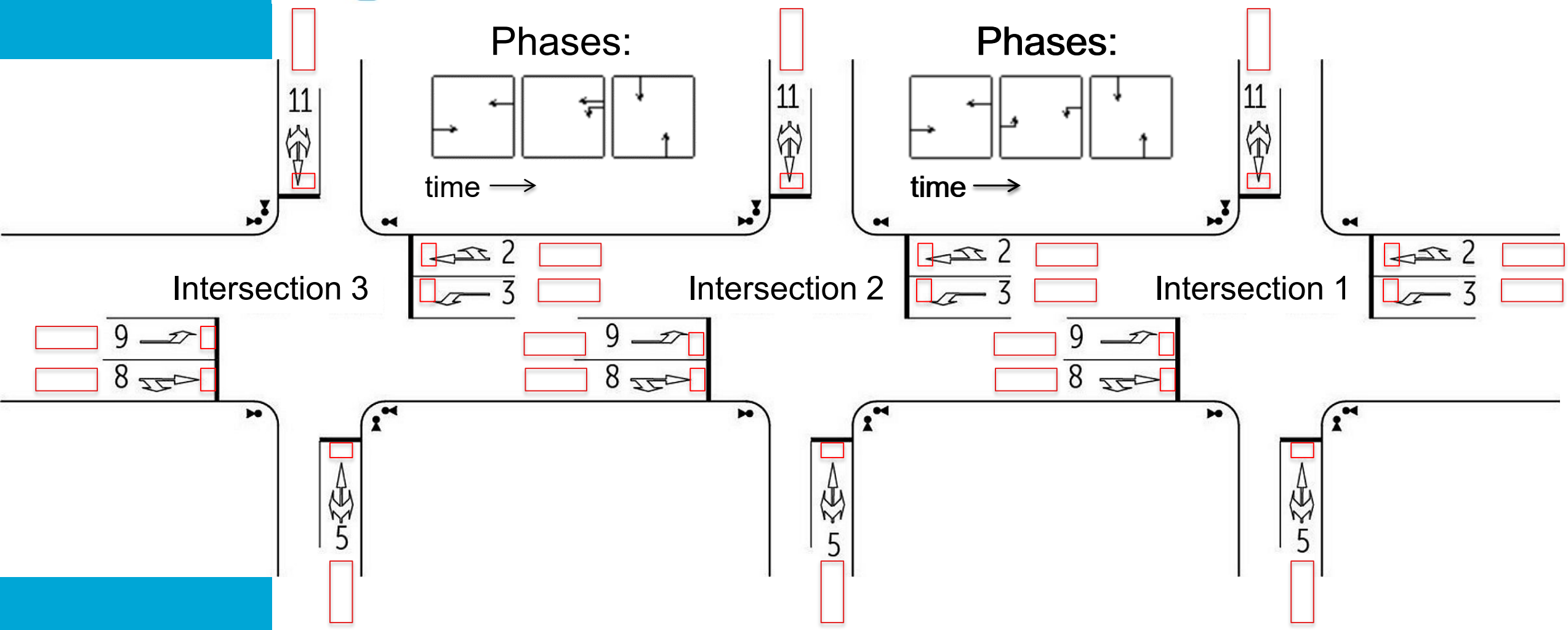
$$C = \frac{2L_{1,2}}{n_{1,2} \cdot v} = \frac{2L_{2,3}}{n_{2,3} \cdot v} = \frac{2L_{3,4}}{n_{3,4} \cdot v} \quad [s]$$

Formule 15-7

“Halfstar” – semi-fixed control

- “Semi-fixed”: Green split based on detector info
  - Optimize green wave further

  Or:
  - Limit waiting time crossing directions
    - Green time coordinated direction is limited
    - Compact platoons (less dispersion)


Phases:
time
Phases:
time
11
2
3
9
8
5
Intersection 3
Intersection 2
Intersection 1
Coordination

DTV* ODYSA

- Speed advice
- Semi-fixed control
- 70/80 km/h-roads
- Coordination up to 1000 m
- Distance speed indicators: 500 m
- Credibility
- Example location: Bergen op Zoom, 9 intersections

At lowest 50 km/h

From UTOPIA-SPOT to the Dutch approach

- UTOPIA-SPOT: combination coordination and bus prioritisation
- Not well-balanced for the Dutch situation
- Bus priority too disruptive
- Alternative:
  - Conditional priority
  - Not prioritized every cycle

Vialis* Toptrac/Flex

- Toptrac:
  - Central server
  - Based on TRANSYT-online
  - With performing indices: cost based on stops/delays
  - Effects of certain objectives can be calculated beforehand

Vialis* Toptrac/Flex

- FLEX:
  - Coordinated direction green window fixed
  - FLEXible green-time distribution at local intersections
  - vehicle dependent
  - with objective function (e.g. maximum waiting time)
- Green wave not guaranteed
  - Realised by weighing and penalties

Vialis* Toptrac/Flex

- Example location: Almere Veluwedreef

Dynniq* IMFLOW

- No central server
- Local optimisation
- Communication between nearby intersections about vehicles that arrive

Dynniq* IMFLOW

- Planning per minute
- Optimisation based on:
  weighing factors and priority
- Optimisation bounded by maximum waiting times

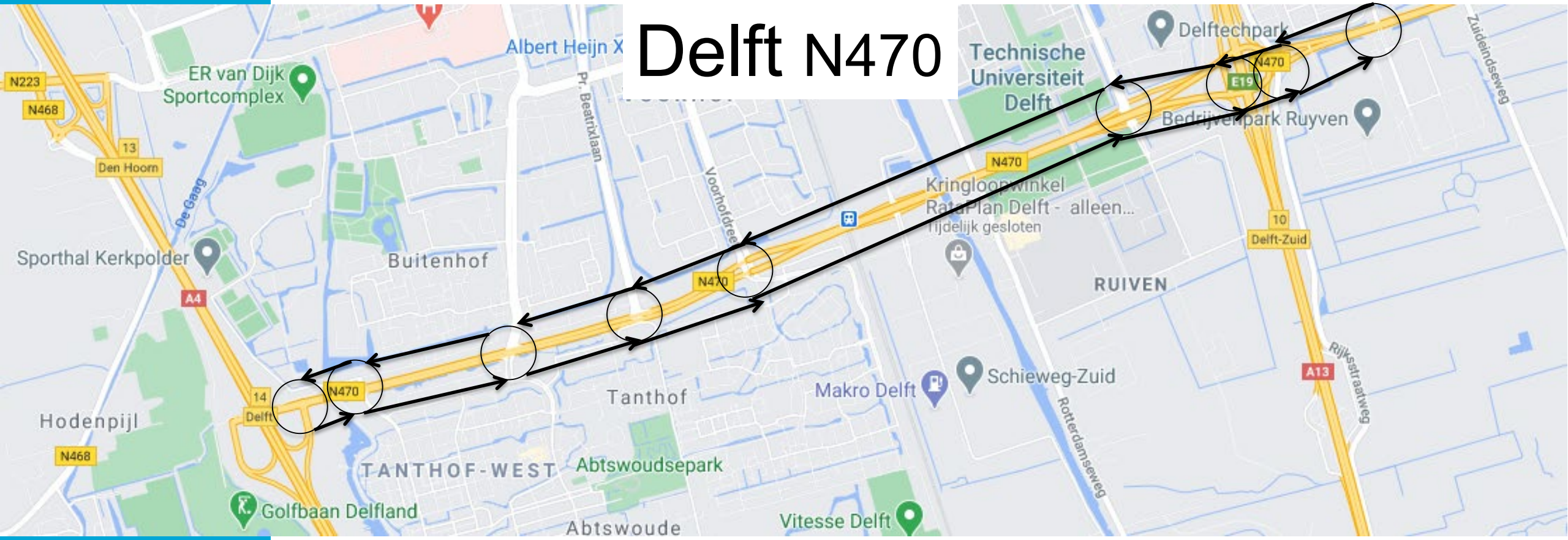
Dynniq* IMFLOW

- Priority:
  - Emergency services: KAR - short distance radio
  - Public transport: conditional priority (KAR)
  - Trucks: request priority by app
    (Greenflow/Truckmeister combined with phase information)

Dynniq* IMFLOW

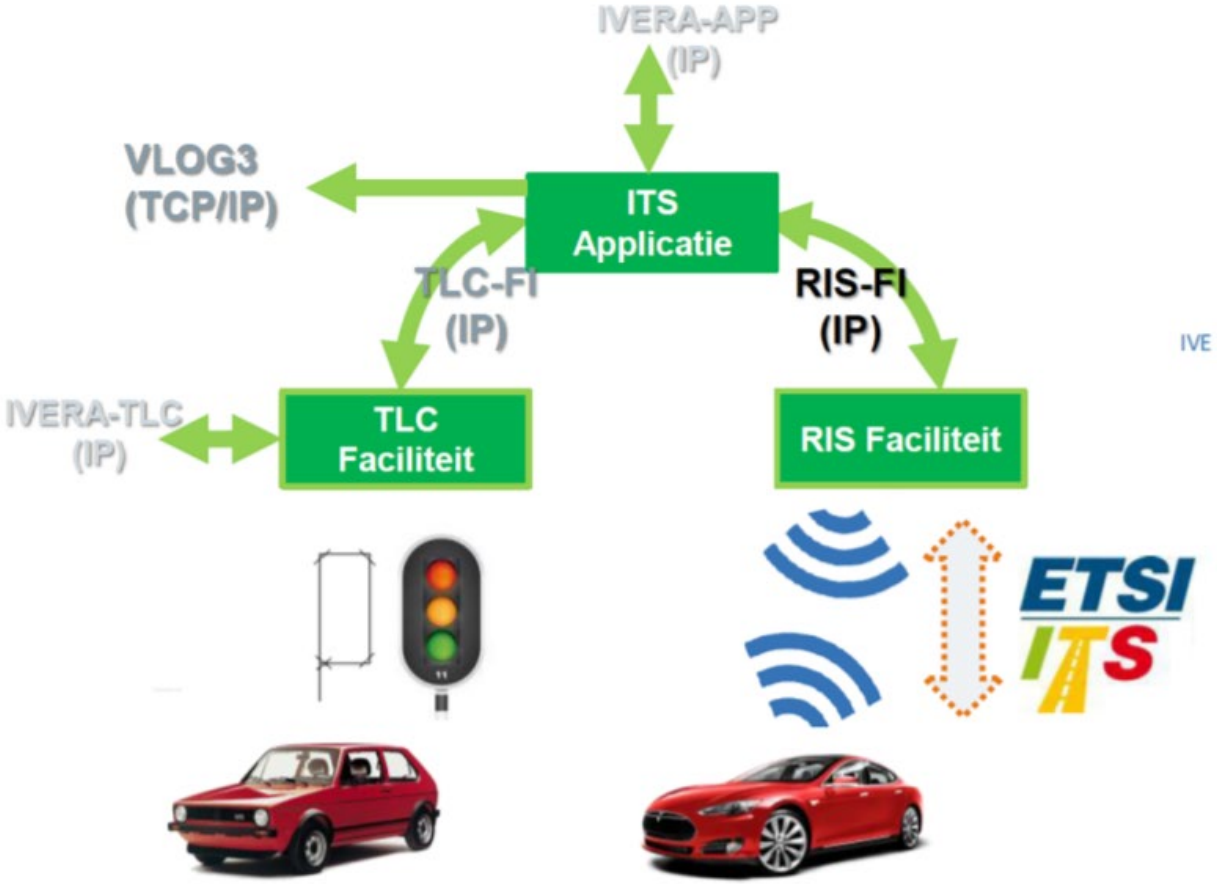
- "Soft" green waves:
  - Large distances, variable cycle times
  - Higher weight of platoons will realise semi-green wave

Delft N470



Glass fiber connection

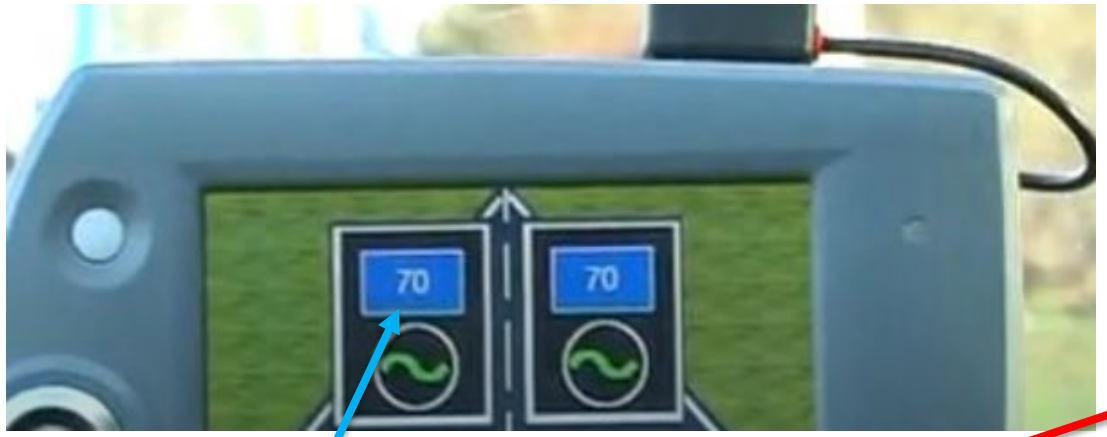
Intelligent Traffic Control iVRI – iTLC



Intelligent Traffic Control iVRI – iTLC

- “Prioritize, inform and optimise”
- More effective data communication
- V2I (although small percentage vehicles)
- TTR/TTG versus speed advice

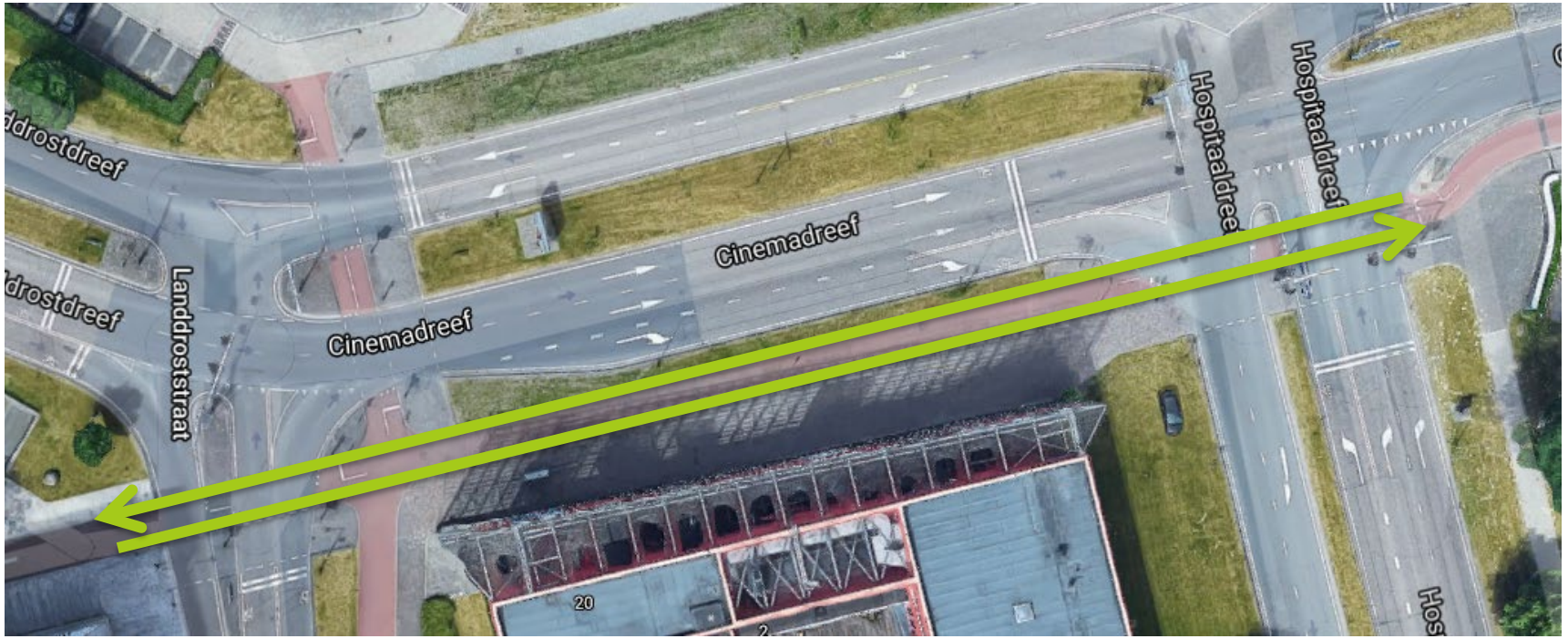
In-Car information



- Speed or TTG/TTR
- Credibility
- Drawback: More fixed timing?!

Coordination for bicycles

- Arterial coordination based on average speed 15 km/h
- Example:



Drawback: large speed differences for cyclists, so:

Speed advice for cyclist

- At intersection

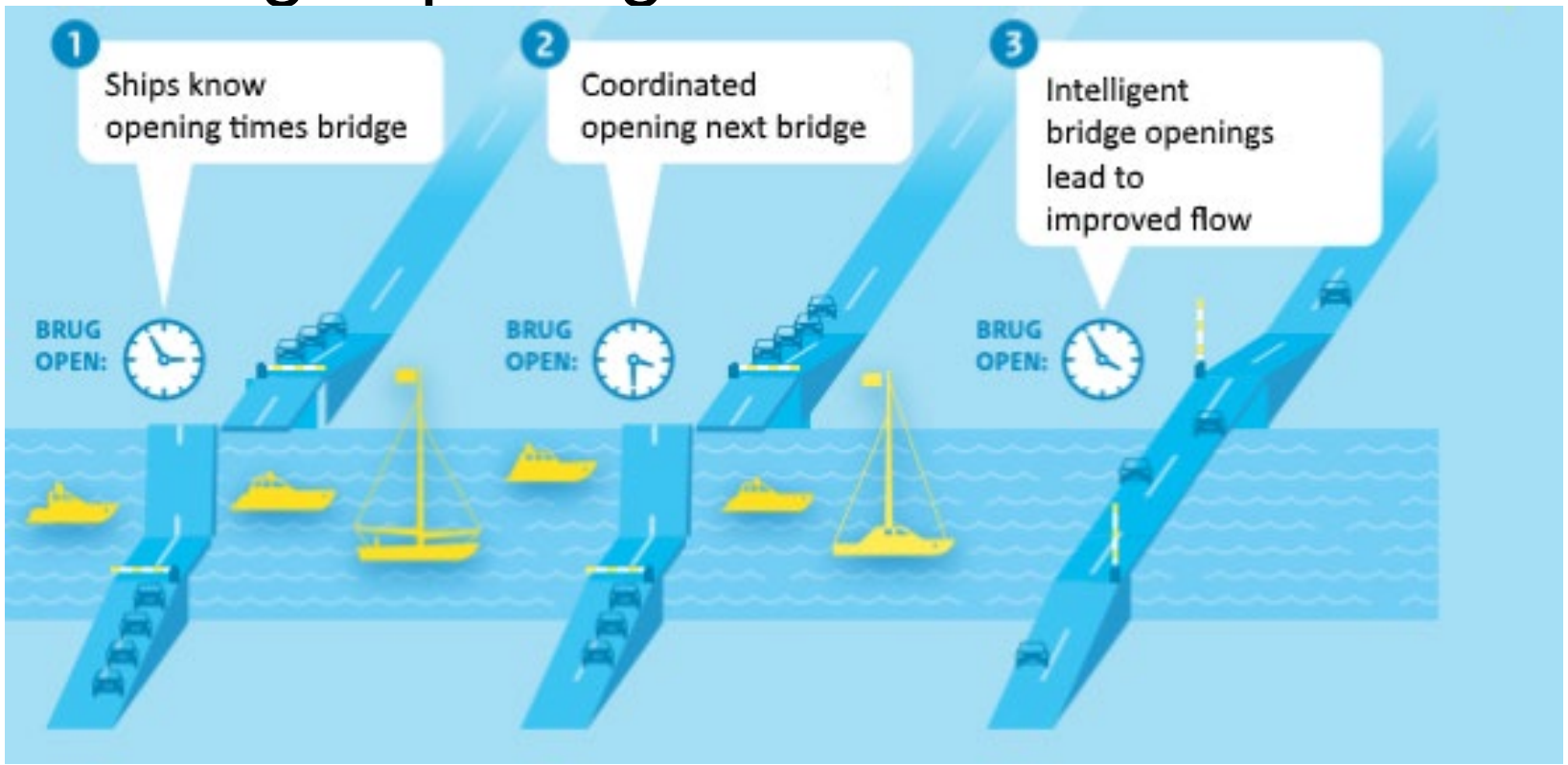
Erasmus bridge Rotterdam

Speed advice for cyclist

- Apps: Ring-ring, Schwung
  - Ring-ring: Inform cyclist
  - Schwung: Learn from cyclist behaviour

Water ways

- Also a “blue wave” for bridge coordination
- Bridge openings communicated to road traffic



- Questions?