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Enhancing Society Together

DUTCH CYCLING EMBASSY

Thinkbike workshop Australia

Arie Vijfhuizen
13-29 March

Contents

Who am I?

- Arie Vijfhuizen
- 52 years
- Married and two children (girl 16 and boy 13)

Leisure activity →

- Running, internet, reading, photography, walking/cycling in the nature etc.

Work →

- 6 ½ years RHDHV + about 20 years experience in: road design, road safety, spatial planning and project managing
- 24 years working for various Governments such as Ministry and various municipalities (including Amsterdam)

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Royal HaskoningDHV
Who we are, what we do

Corporate Presentation
March 2015

What we do → *Enhancing Society Together*

Our Mission	Contribute
Our Culture	Care
Our Ambition	Inspire
Our Vision	Enable

Where could you ask us about?

- Road design (also in 3D)
- Road safety
- Self explaining roads (with psychology)
- Save school environments
- Modelling (prognoses in traffic – now and the future)
- Traffic lights and simulations
- Infrastructure
- Seconded at location
- Project managing
- A lot more about buildings, water, environment, etcetera…..

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Background

- Best practices from ‘cycling country’ the Netherlands
- Royal HaskoningDHV: market leader cycling in the Netherlands
- Royal HaskoningDHV: member of the Dutch Cycling Embassy

The Netherlands & The World

DUTCH CYCLING EMBASSY

MATCH = GATEWAY FOR EXPORT

> Independent
> Organized
> High quality
> Translated
> **Dutch**
> **Cycling Knowledge & expertise**

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Participants (members)

MLA+

Berenschot

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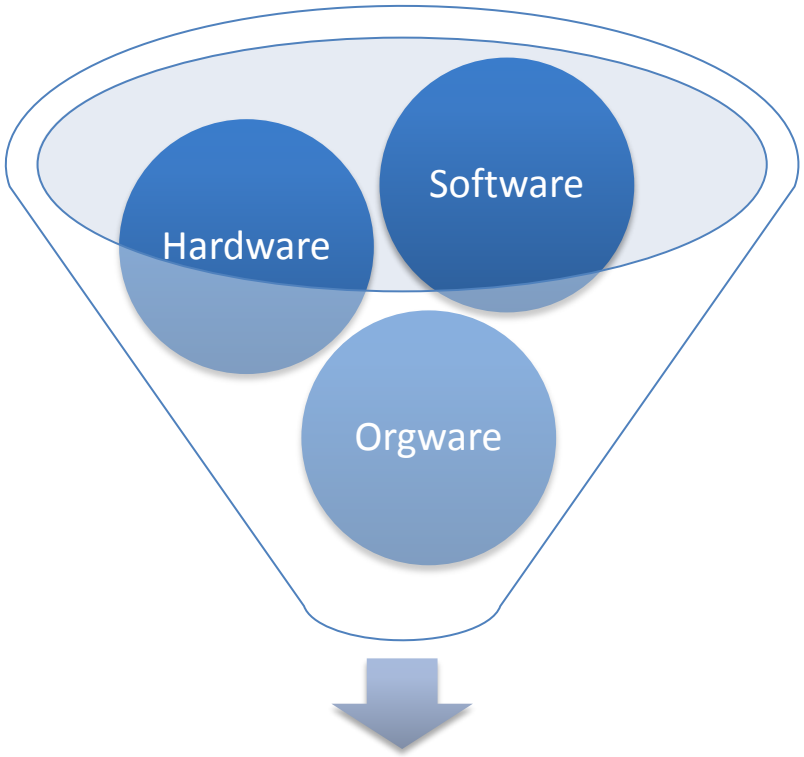
Policy making

Cycling mobility needs a package of measures



Integrated cycling promotion

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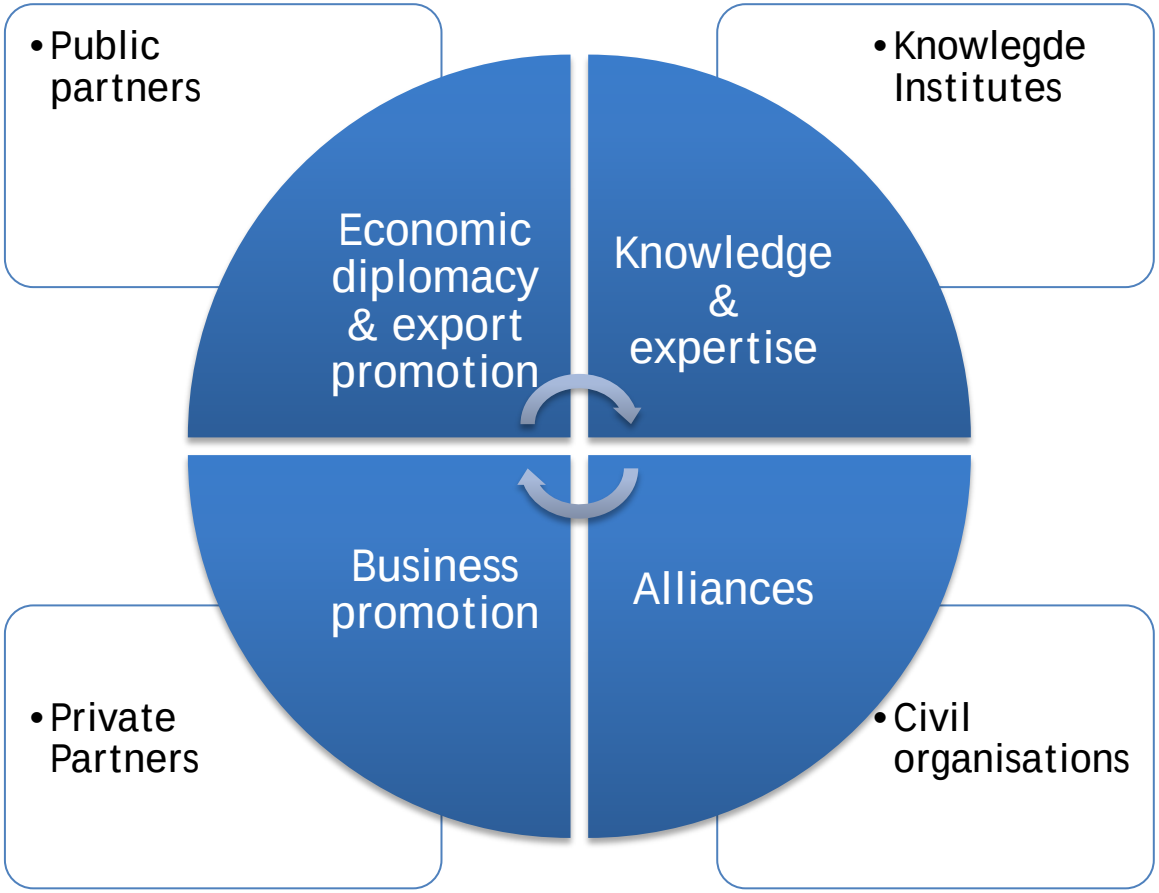
Integral team of experts



Policy making for cycling (1)

- Make use of a trigger (e.g. air quality, traffic flow, road safety, sustainability, …)
- Make use of the 3 pilars:
  - Hardware
  - Software
  - Orgware

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Policy making cycling (2)

- When you start making policy for cycling you have to realise:
  - To put the cyclist in the center
  - Cycling is part of a broader transport and traffic system

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Basic Principles

Basic principles

Human being as measure of things →
→ design from cyclists' point of view

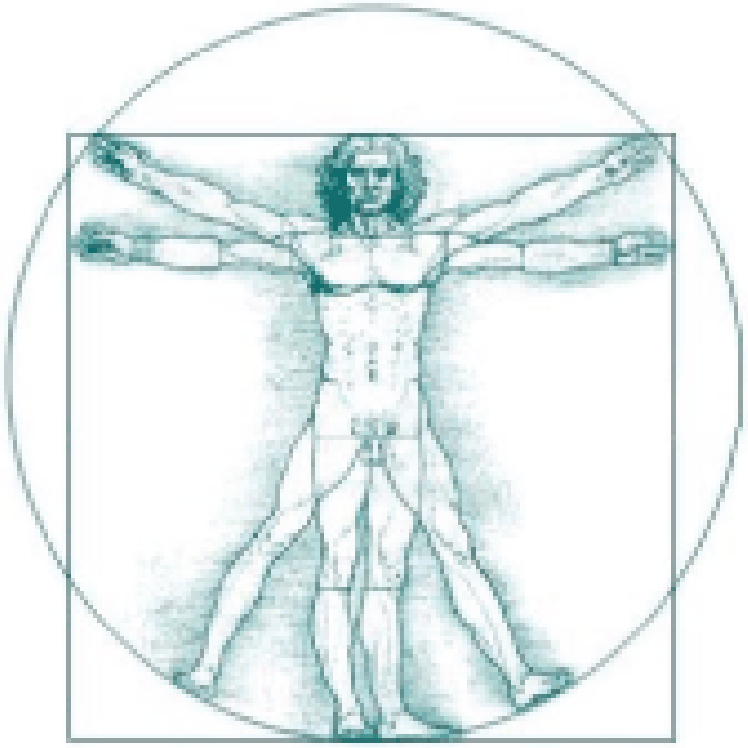
- Characteristics
- Integral design
- Function, form and use
- 5 main requirements

Basic principles

Human being as measure of things →
→ design from cyclists' point of view

Differences:

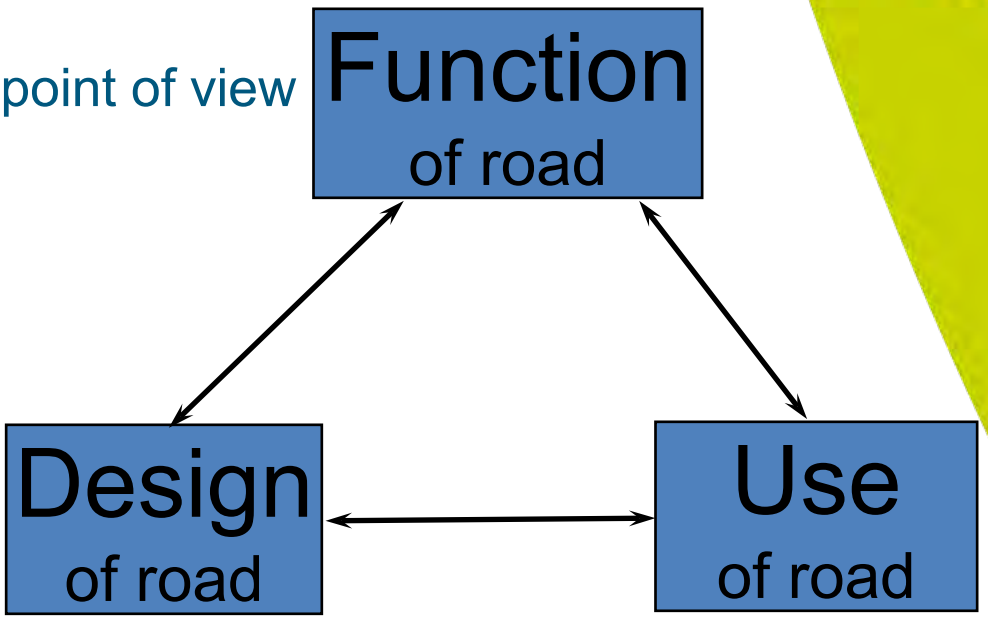
- Age
- Gender
- Physical capacities
- Reason for cycling



Basic principles

Function, form and use

- In balance, from road safety point of view



function:	use of the road as intended by the road authority
design:	the physical design and layout properties of the infrastructure
use:	actual use of the infrastructure and behaviour of the road user

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DUTCH CYCLING EMBASSY

Main requirements

Main requirements

NEEDED = DOOR TO DOOR MOBILITY POLICIES

Safety

Comfort

Cohesion

5 main requirements

Directness

Attractiveness

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Main requirements

Cohesion

Cohesive whole
(network / route)

From origin to destination

- availability
- ease
- quality
- freedom

Main requirements

Cohesion

Complete network:
- parallel routes

Complete routes:
- centres / main destinations
- high potential main routes

Recognisability:
- route as such is clearly ongoing

Main requirements

Directness

As direct as possible
(route)

From origin to destination
Minimum travel time

- traffic flow speed
- stops (number and length)
- detours (distance)

Main requirements

Directness

Distance:
- minimal detours
- minimal bending and winding
- avoid illegal movements

Time:
- minimal number of stops or delay

Main requirements

Safety

Vulnerability
- (mass / speed / no technical provisions)

Save conditions:
- Separation in time or space

- big residential areas
- avoid dangerous routes
- short journeys
- shortest = safest
- ease
- avoid conflicts
- reduce speed

Main requirements

Safety

Crossing traffic conflicts:
- minimal number of meetings

Vehicle separation:
- in case of major speed differences

Speed reduction:
- at level crossings main traffic routes

Road categories:
- recognizable, uniform solutions

Sufficient visibility (day and night)
Avoid obstacles

Project 'The Forgiving Bicycle Path'

Client
Ministry of Infrastructure and Environment

Location
The Netherlands

Completion
2015

Value (€)
0,5 < 1M

Project Manager
Peter Morsink

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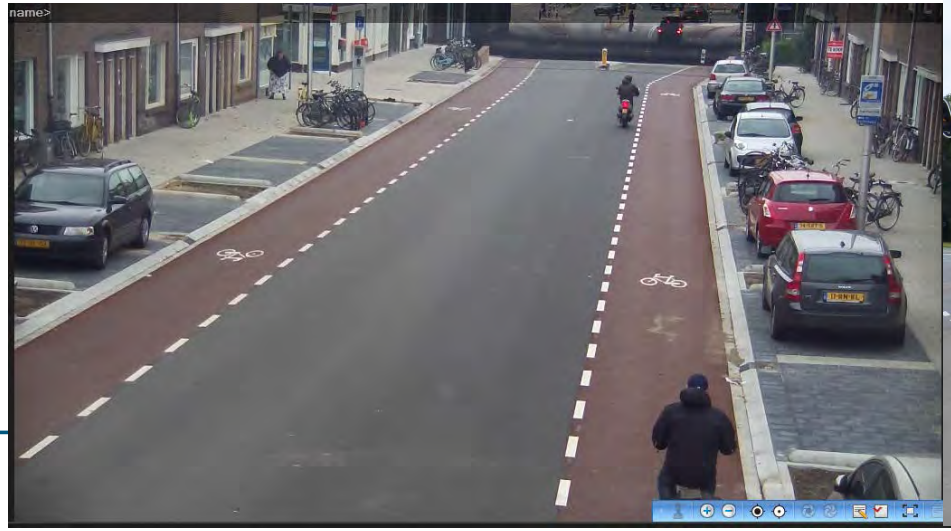
Innovations in the Netherlands



Main requirements

Comfort

Minimum nuisance and delay (journey)

Avoid additional physical effort

- smoothness of pavement
- hilliness
- chance of stopping
- weather
- traffic

Main requirements

Attractiveness

Cycling has to be pleasant (journey)

Varies per person and per motif;
Psychological: perception

e.g.:
- quiet
- smooth
- safe
- beauty (nature / buildings)

Also: social safety

Main requirements

Attractiveness

Social safety:

- social control at busy routes
- safe alternative
  - visibility (surroundings)
  - public lighting
  - maintenance

Traffic nuisance:

- separation with busy traffic (motor vehicles) related to surroundings

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Network

How to design a network?

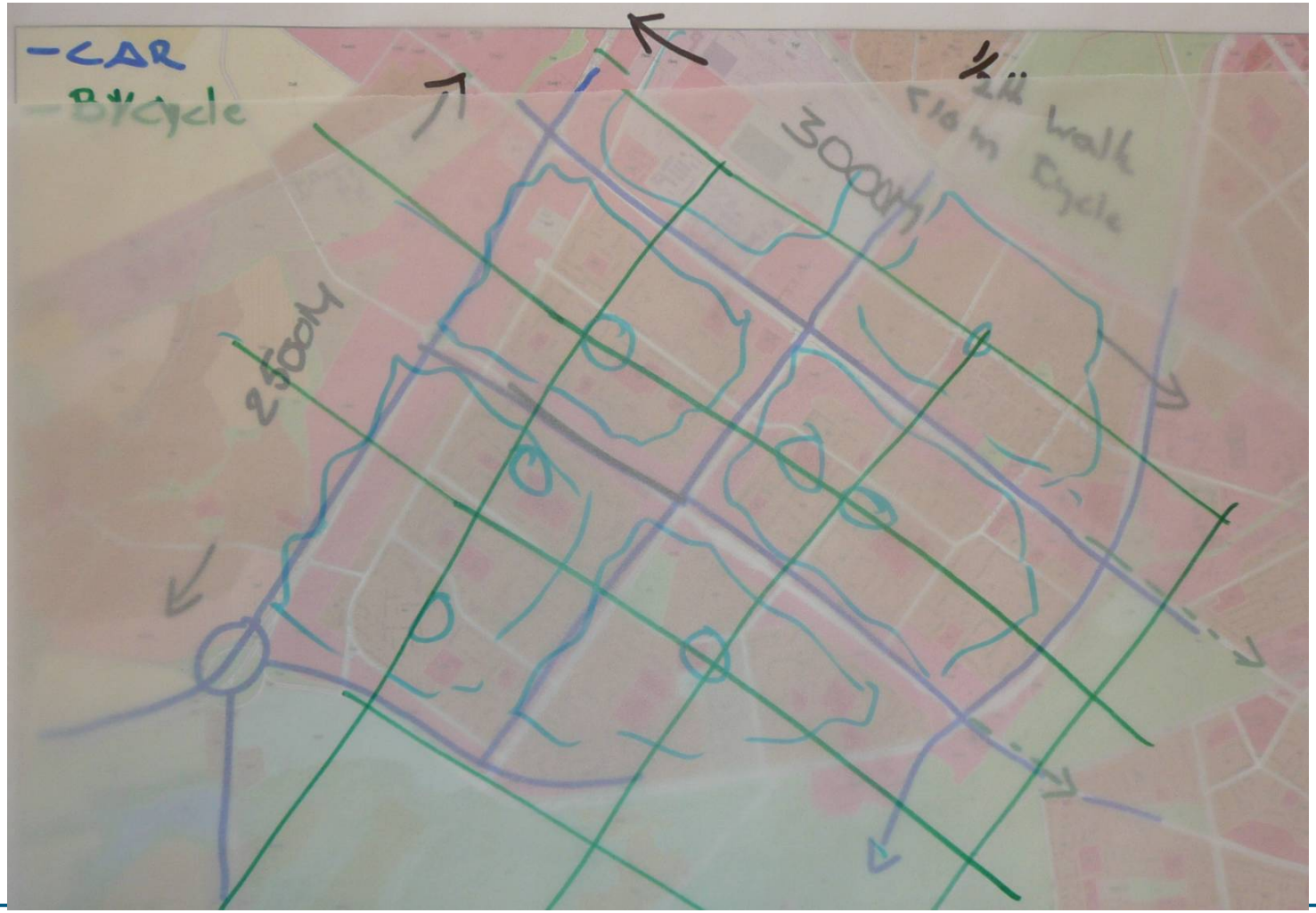
- Define the area
- Select Origins and Destinations
- Distinguish O and D by importance
- Connect Origins and Destinations
- Distinguish main routes
- Cover the whole area
- Connect to surrounding areas

Network: example Skopje

Network: example Sofia

Network: example Sofia

Network: example Sofia



Network: example Sofia

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Routes

How to design a route?

- Define Origin(s) and Destination(s)
- Find and compare possible routes
- Advise related to main objectives
- Weight alternatives
- Think in opportunities
- Connect to other routes (existing and planned)

Cycleway Feasibility Study Associated With High Speed 2

Client
Department for Transport

Location
England, UK

Completion
2014

Project Manager
Paul Stephens

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Feasibility study and Design
High Speed Bicycle Route ‘RijnWaalpad’

Client
City Region Arnhem Nijmegen

Location
The Netherlands
Arnhem - Nijmegen

Completion
2011

Value (€)
100 < 250 k

Project Manager
Wim van der Wijk

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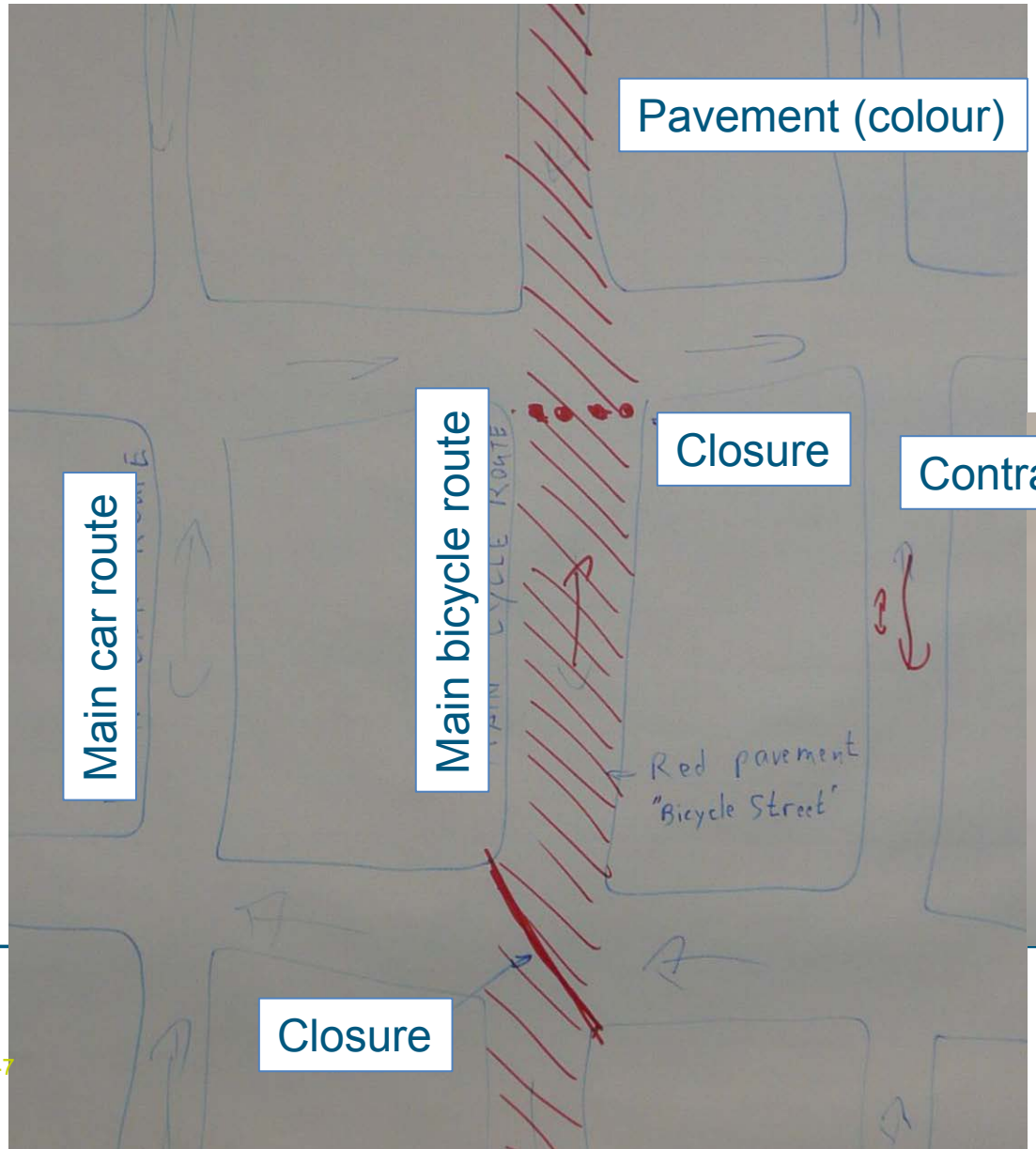
Routes: where to implement

Along (existing) arterial or back streets?

- Arterial:
  - Usual straight
  - Destinations
  - Mental map
  - Social controlled
- Back streets (residential areas, parks):
  - Safe (except crossings)
  - Attractive
  - Relatively cheap

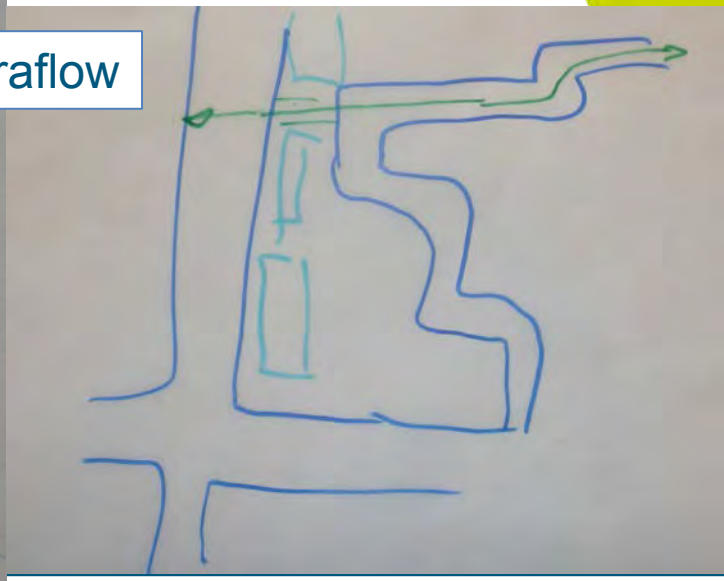
- Disadvantages back streets more easily to compensate
- Arterials always available as alternative

Routes: example backstreets



Shortcut

Contraflow



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Routes: example pavement

Routes: example pavement

Routes: example closure

Routes: example contra flow

- Common practice
- Still legal exception

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uitgezonderd

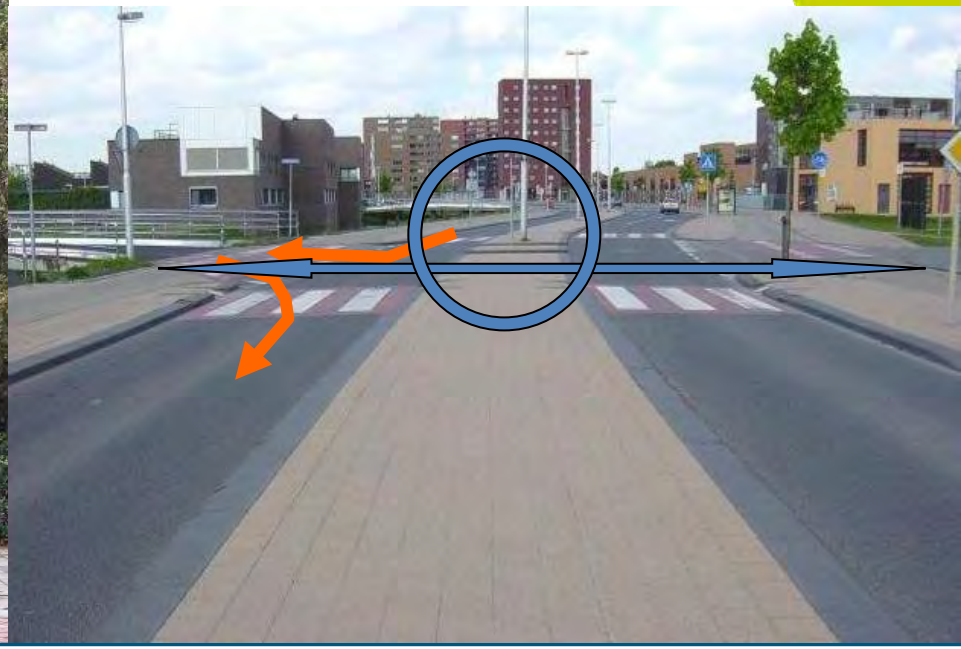

uitgezonderd


uitgezonderd


uitgezonderd
De Harmoni

Routes: example shortcut

Routes: example shortcut



Routes: example shortcut / closure

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Sections and Junctions

Bicycle Traffic Planning and Design

Special attention to:

Sections:

- Bicycles and pedestrians
- Buses and bicycles

Junctions / crossing:

- Priority crossings
- Roundabouts

How to design Bicycle Facilities

- Road categorization
- Through roads: Long distance traffic
- Distributor roads: Connects areas
- Access roads: Access to properties

- Urban area:

Consequences:
- Network
- Routes
- Sections
- Junctions

Distributor road

Access road

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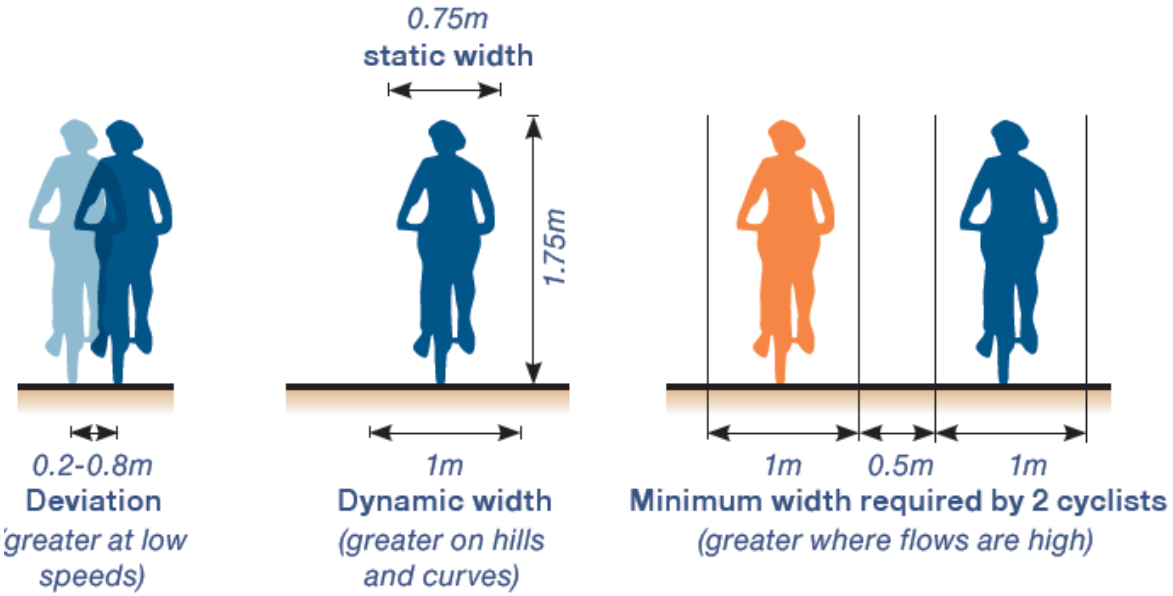
Sections

Design Basics – width requirements

- The dynamic width (actual width plus deviation) of a cyclist on the road may be taken as **1 metre** (LTN 02/08)



TfL - 2.0 metres minimum width for overtaking with care, 2.5 metres for safe or social cycling, **at least 3 metres needed for comfortable two-way cycling**

Sustrans Handbook, 2014

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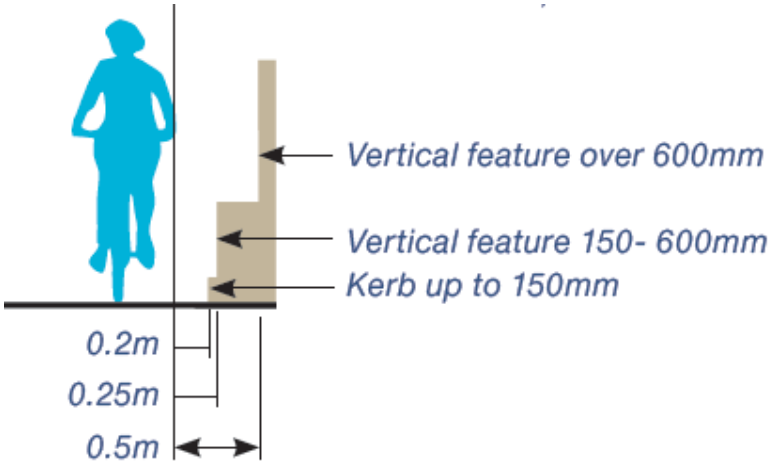
Clearance to kerb / boundary



Sustrans, 2014 – provides parameters for a 1.2 metre to 1.5 metre on-carriageway cycle lane

Table 2.1 Minimum clearances

Object	Distance from wheel to object (metres)
Kerbs under 50 mm	0.25 m
Kerb over 50 mm	0.5 m
Sign posts, lamp columns, etc.	0.75 m
Continuous features, e.g. walls, railings, bridge parapets	1 m

LTN 02/08 – provides parameters for a 1.25 metre to 2.0 metre cycle lane – **UNCLEAR, SUPERSEDED BY LTN 1/12 TABLE 7.4, WHICH REFLCTS SUSTRANS HANDBOOK**

How to design Path / lane

Choose type of solution:
- Bicycle path or lane or bicycle street
- With or without mopeds
- One or two way bicycle traffic

Most important aspects:
- Separation
- Width
- Surface

Bicycle path / track

Separate path:
Distributor roads
Main bicycle routes
Car parking
Physical space

- Function ▸width, surface
- Volume of cyclists ▸width
- Mopeds ▸width
- One or two way ▸width

Bicycle path / track

Examples: Separate bicycle path

Bicycle path / track

Partition verge

- at least 0.35 m
- in the presence of lamp posts and/or two-way cycle track > 1.00 m
- in the case of vegetation or parking > 2.30 m
- from 30 m before side road < 0.35 m (for roads with V_{max} < 70 km/h)
- with fence > 0.70 m
- with barrier > 1.10 m

Bicycle lane

Bicycle lane:

- Little space ▸low volume / speed
- Car parking ▸too high → no lanes
- Function ▸width
- Volume of cyclists ▸width

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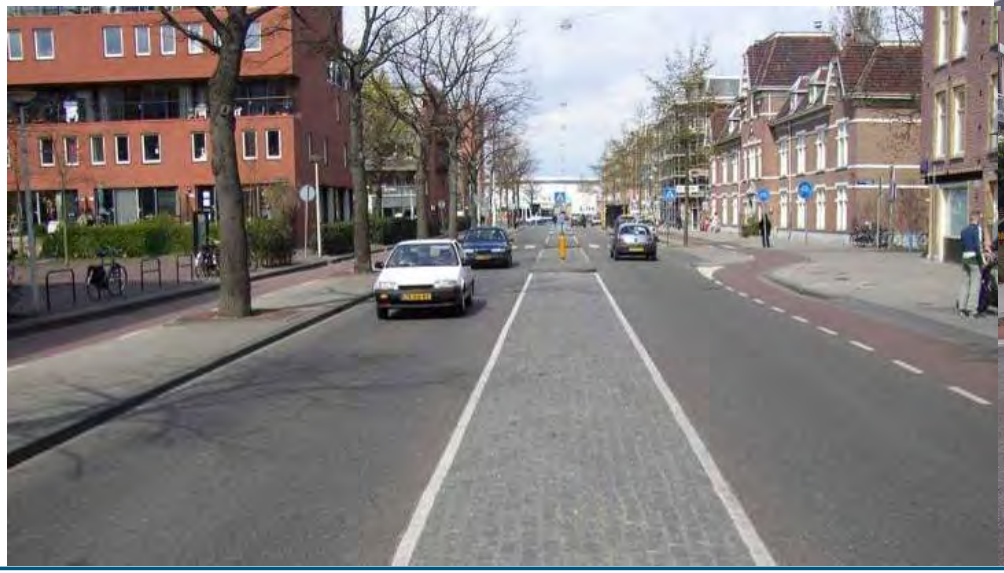
Bicycle lane

Bicycle lane:
- Red colour
- Continuous line: 2.00 – 2.50
- Interrupted line: 1.50 – 2.00

Bicycle lane

Examples: Bicycle lanes



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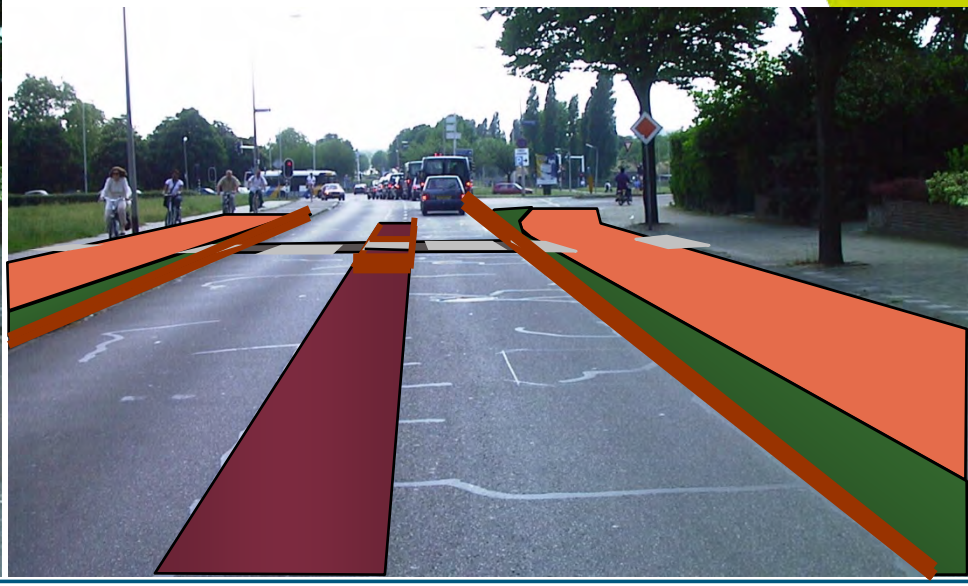
Bicycle lane

Up grade from lane to path:
- without using extra space



Bicycle street

Bicycle street:
- Two directions
- Red colour
- No signs

- Max 200 pcu/hr
- Speed reduction

Bicycle street

Examples: Bicycle street

See also: RijnWaalpad

Shared use

Alternative: do nothing
(combined use)
• Speed reduction

30 km/h zone

- Traffic calming
  - Speed
  - Volume
- When is shared use acceptable?

Table 14. Option diagram for road sections inside the built-up area

Road category	Max. speed of motorised traffic (km/h)		Motorised traffic intensity (pcu/day)	Cycle network category: basic network ($I_{bicycle}$ > work 750/day)	cycle route ($I_{bicycle}$ 500-2500/day)	main cycle route ($I_{bicycle}$ > 2000/day)
	n/a		0	solitary track		
Estate access road	walking pace or 30 km/h		1 - 2.500	combined traffic		cycle track or cycle lane right of way)
			2.000 - 5.000			
			> 4.000	cycle lane or cycle track		
District access road	50 km/h	2x1 lanes	irrelevant		cycle track or parallel road	
		2x2 lanes				
	70 km/h			cycle track, moped/cycle track or parallel road		

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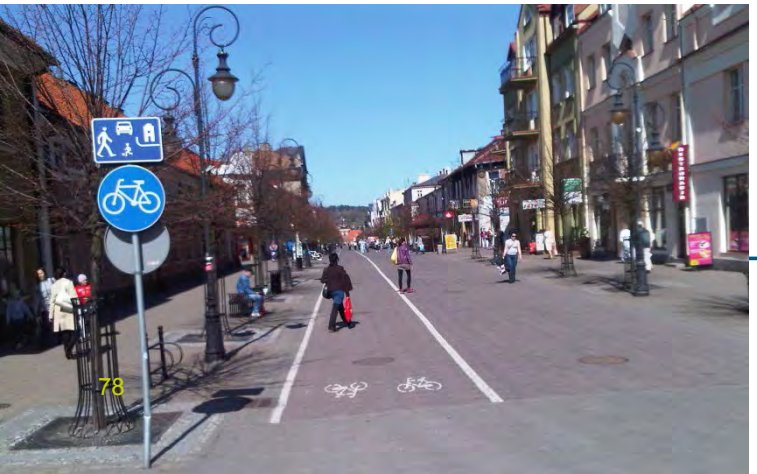
Bicycles and Pedestrians

Pedestrian area

- When is shared use acceptable?

Pedestrian area



Pedestrian area

- Bicycles / cyclists can raise attractiveness
- Usually not in indoor shopping centres
- Enforcement

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Greenways

- How to combine different usage?
  - Commuter cyclists: heading for home
  - Strolling pedestrians: leisure

- Expose potential conflicts
- Natural feeling separation (It is logic)
- Social security

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Cyclists and pedestrians – hotels 1

Cyclists and pedestrians - hotels 2

Cyclists and pedestrians – hotels 3

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Busses and Bicycles

Busses and Bicycles

Bus lane ➔
Separate
Bicycle path

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Busses and Bicycles

Exception

Busses and Bicycles

Exception

Busses and Bicycles

Combined use:
Slow down speed

Busses and Bicycles

Combined use:
Slow down speed

Busses and Bicycles

Without bus lane:
1. Separate path

Busses and Bicycles

2. Bus stop
on bicycle lane

Busses and Bicycles

3. Bus bay
(no bicycle lane)

Busses and Bicycles

4. Continuous bicycle lane

Busses and Bicycles

4. Continuous bicycle lane

Busses and Bicycles

5. Bicycle passage

Busses and Bicycles

5. Bicycle passage

Busses and Bicycles

5. Bicycle passage (accessibility bus stop)

Busses and Bicycles

6. Combined use
Bus stop

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Junctions

Main requirements

Applies to:

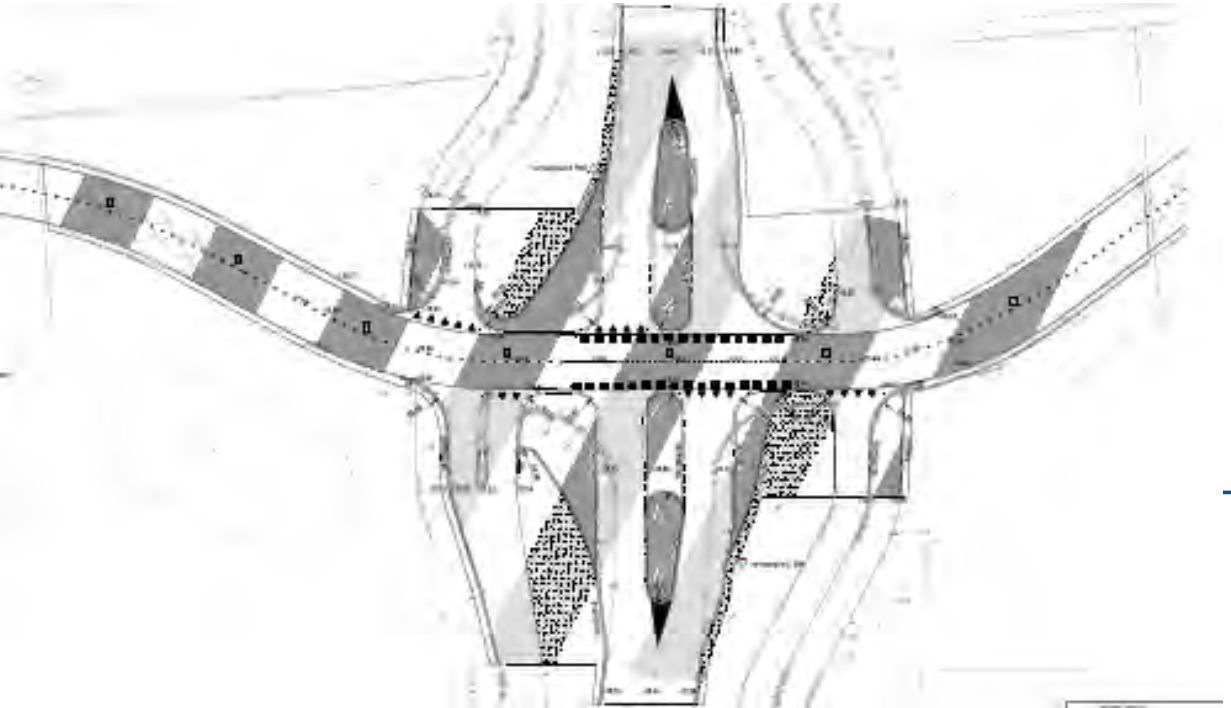
- Network
- Routes
- Sections
- Junctions

Function, form and use:

- Comprehensible
- Minimum number of conflicts
- Low traffic speed

Design requirements:

- Cohesion not applicable



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How to design junction / crossing

Choose type of solution:

- Give way + additions
  (refuge island, speed hump, narrowing)
- Roundabout
- Traffic lights
- Grade separate (bridge, tunnel)
- Do noting (or minor adjustments)

Junction / crossing

Type of junction: Distributor road – access road

Distributor road

Table 24. Option table: district access road – estate access road intersection solutions

Section 1: district access road, with or without (main) cycle route	Section 2: estate access road or solitary path — Access road			
	I_{pcu} < 500 pcu/h			I_{pcu} > 450 pcu/h
hourly intensity	no cycle route	cycle route	main cycle route	all situations
1-1,000 pcu/h	right of way intersection		right of way intersection + supplementary measures or roundabout	roundabout
800 - 1,500 pcu/h	right of way intersection + supplementary measures			
1,200 - 1,750 pcu/h	right of way intersection + supplementary measures, roundabout, intersection with TCS or grade-separated intersection (only for main cycle route where appropriate)			
> 1,500 pcu/h	intersection with TCS or grade-separated (only for main cycle route where appropriate)			roundabout, intersection with TCS or grade-separated solution

Junction / crossing

Type of junction: Distributor roads

Distributor road

Distributor road

Table 25. Option table: district access road – district access road intersection solutions

Section 1: district access road, with or without (main) cycle route	Section 2: district access road, with or without cycle route ($I_2 \leq I_1$)			
	I_2 < 1,200 pcu/day			I_2 > 1,000 pcu/day
hourly intensity (I_1) pcu/h	no cycle route	cycle route	main cycle route	all situations
500 - 1,500		single lane roundabout		roundabout (if necessary with bypass or two-lane) or TCS
1.200 - 1,750		roundabout (if necessary with bypass or two-lane) or TCS		(multi-lane) roundabout with cycle tunnel in busiest lateral direction (or TCS)
> 1,500		(multi-lane) roundabout or TCS	(multi-lane) roundabout with cycle tunnel in busiest lateral direction (or TCS)	TCS or grade-separated

Junction / crossing

Additions:

- Speed hump / plateau
- Refuge island
- Narrowing
- Bollards
- Public Lighting
- Continuous material, colour

Junction / crossing: Give way

Give way + additions:

- Function ▸type additions
- Volume of cyclists ▸type, dimensions

Junction / crossing: Give way

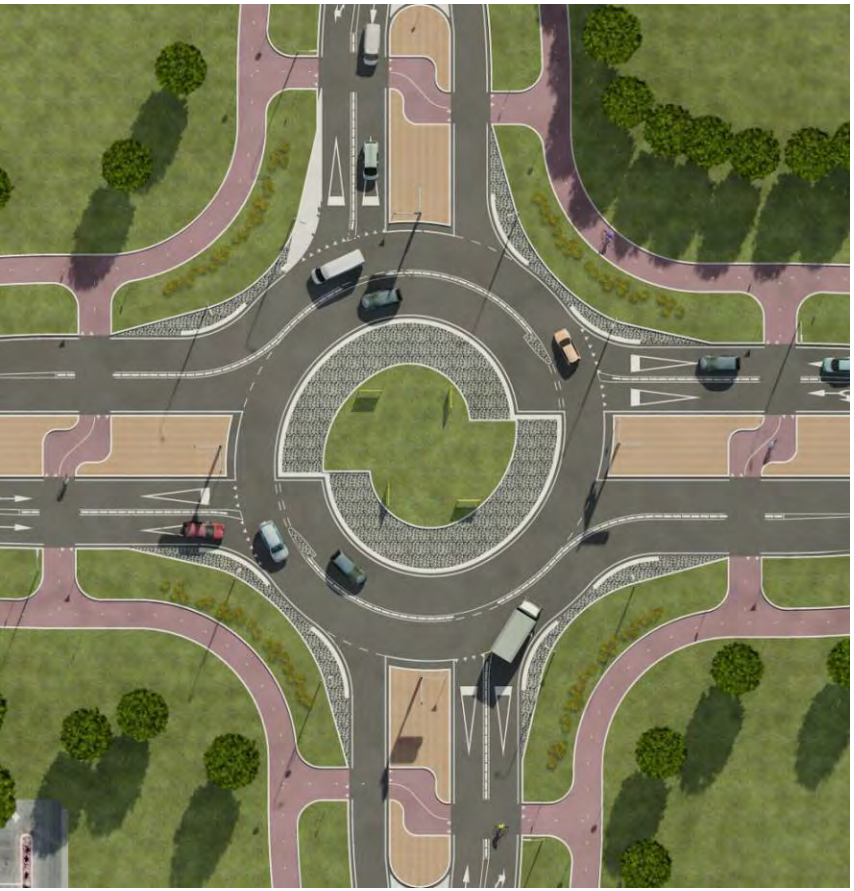
Examples: Separate crossing

Junction / crossing: Give way

Examples: Give way

Junction / crossing: Roundabout

Multi lane roundabout:



Single lane roundabout:

Junction / crossing: Traffic lights

Traffic lights

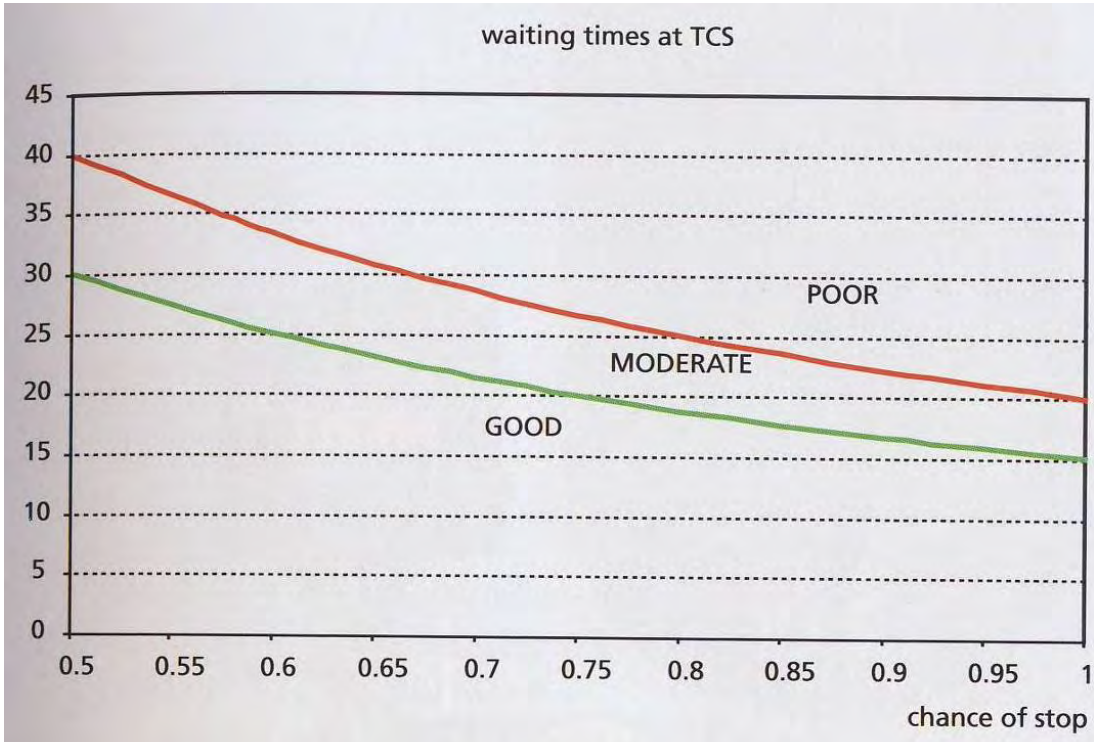
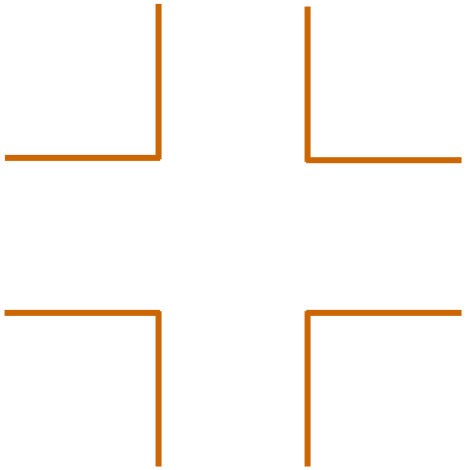


Figure 23. Relationship between chance of stop and average waiting time at traffic lights.

Junction / crossing: Traffic lights

Bicycle friendly additions:



1	shorten cycle time
2	include additional green light options for cyclists
3	permit right turn through red
4	give all cycling directions a green light at the same time
5	accept motorised vehicle/ bicycle sub-conflicts
6	set favourable standby time for cyclists
7	increase cycling directions with priority along with public transport
8	increase cycling directions with priority along with other directions
9	set favourable phase sequence for cyclists turning left
10	set green wave for bicycle traffic
11	keep mutual conflicts between slow traffic outside of the control
12	implement right turn through red
13	introduce long distance detection/pre-request for cycle traffic
14	introduce ECSL
15	increase flow capacity for motorised traffic
16	set two-way green light

Junction / crossing: Traffic lights

Examples bicycle friendly adds

Green wave

Rain sensitive traffic lights

Junction / crossing: Traffic lights

Examples bicycle friendly adds

All directions green

Waiting time predictors

Junction / crossing: Traffic lights

Examples bicycle friendly adds

Junction / crossing: Grade separate

Bridge or tunnel?

- Bridging ▸tunnel
- Comfort ▸tunnel
- Ecological ▸tunnel
- Social safety ▸bridge
- Costs ▸bridge
- Spatial fit
  - ▸tunnel: “invisible”
  - ▸bridge: architectural pleasing

Option: half bridge, half tunnel

Junction / crossing: Grade separate

Examples bridge / tunnel

Junction / crossing: Do nothing

Or add plateau /
raised junction table

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Priority

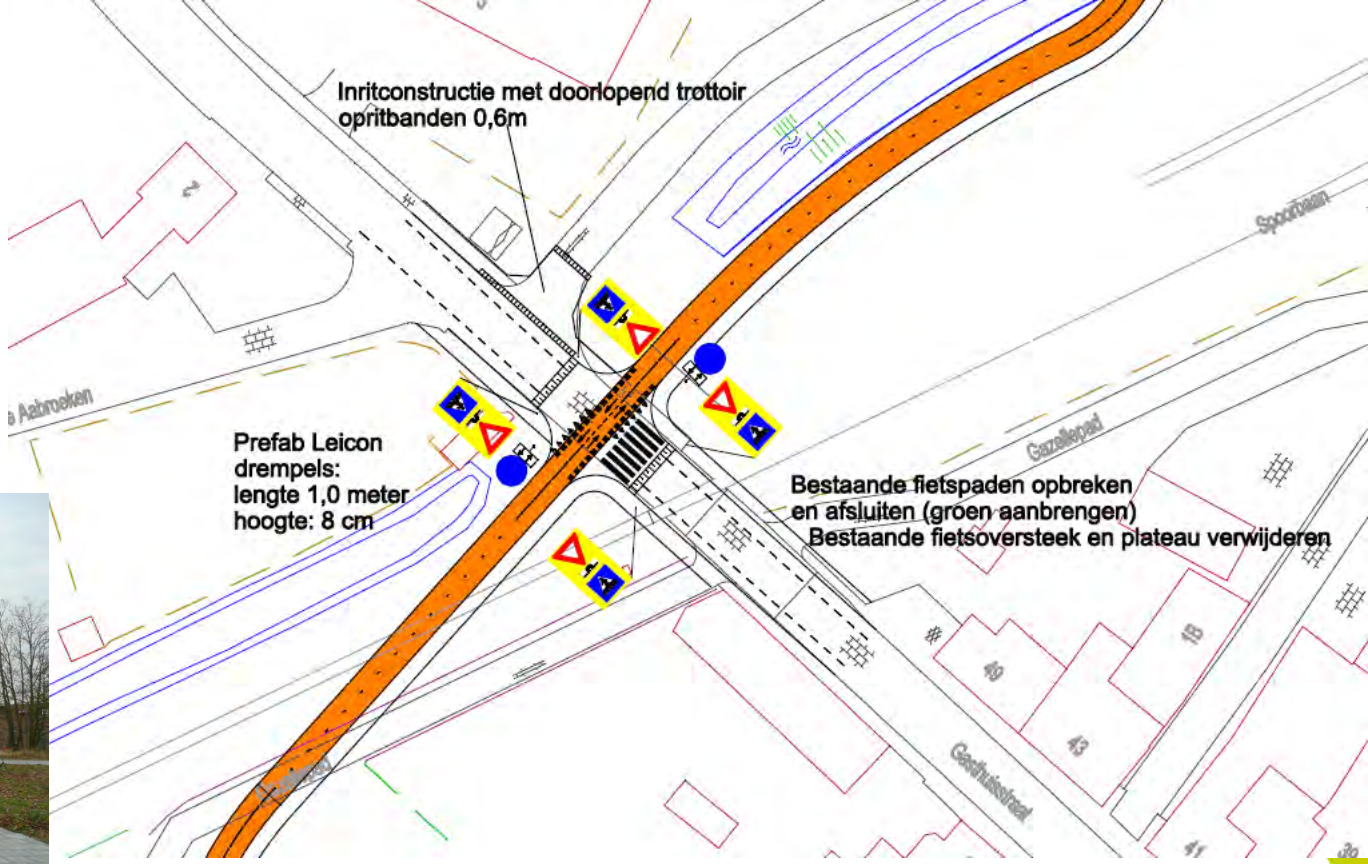
Priority

- Can cyclists have priority to cars?
- Main issue: safety

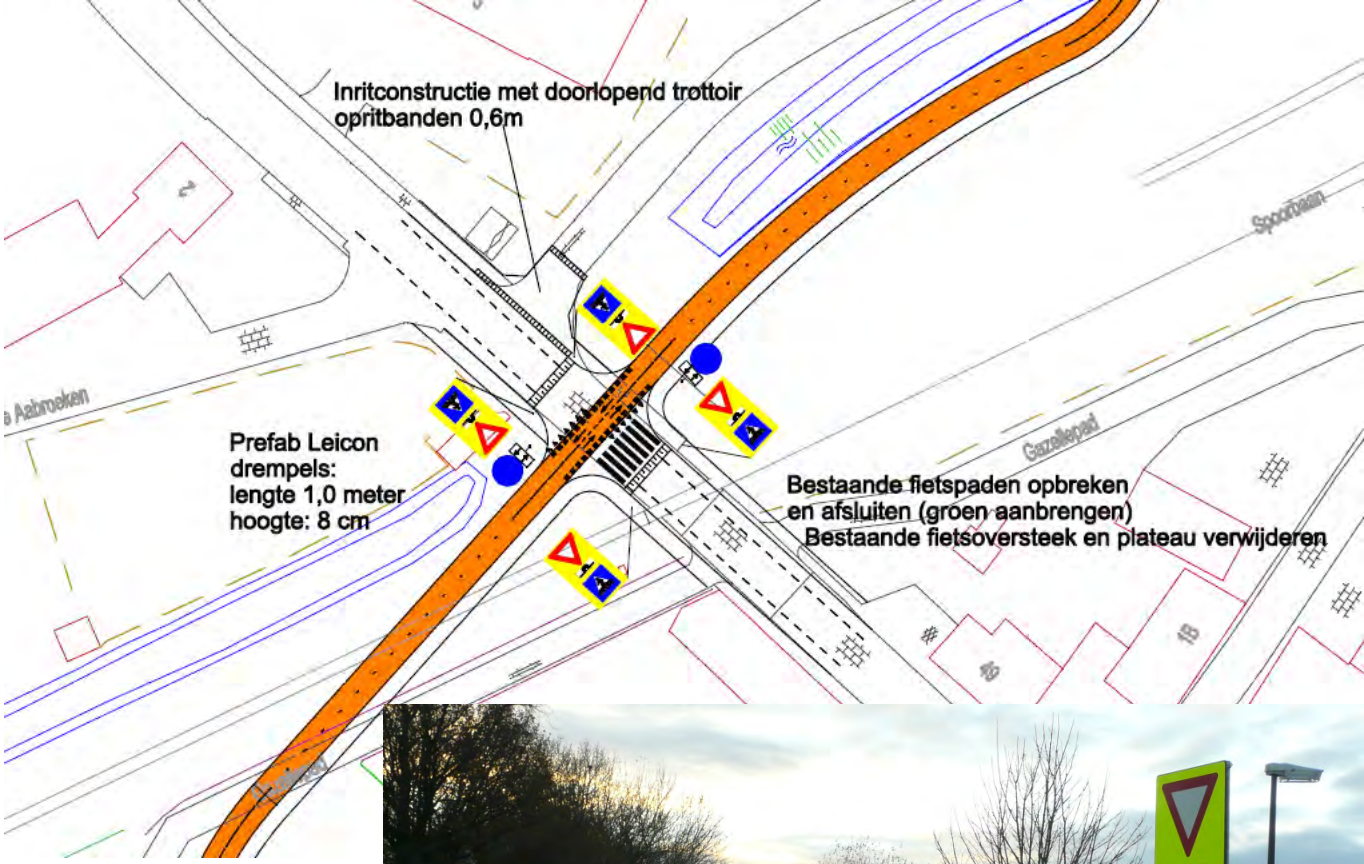
Priority

Priority

Priority


Inritconstructie met doorlopend trottoir
opritbanden 0,6m
Prefab Leicon
drempels:
lengte 1,0 meter
hoogte: 8 cm
Bestaande fietspaden opbreken
en afsluiten (groen aanbrengen)
Bestaande fietsoversteek en plateau verwijderen
Spoorlaan
Gazellepad
Gasthuisstraat

Priority


Inritconstructie met doorlopend trottoir
opritbanden 0,6m
Prefab Leicon
drempels:
lengte 1,0 meter
hoogte: 8 cm
Bestaande fietspaden opbreken
en afsluiten (groen aanbrengen)
Bestaande fietsoversteek en plateau verwijderen
Gazellepad

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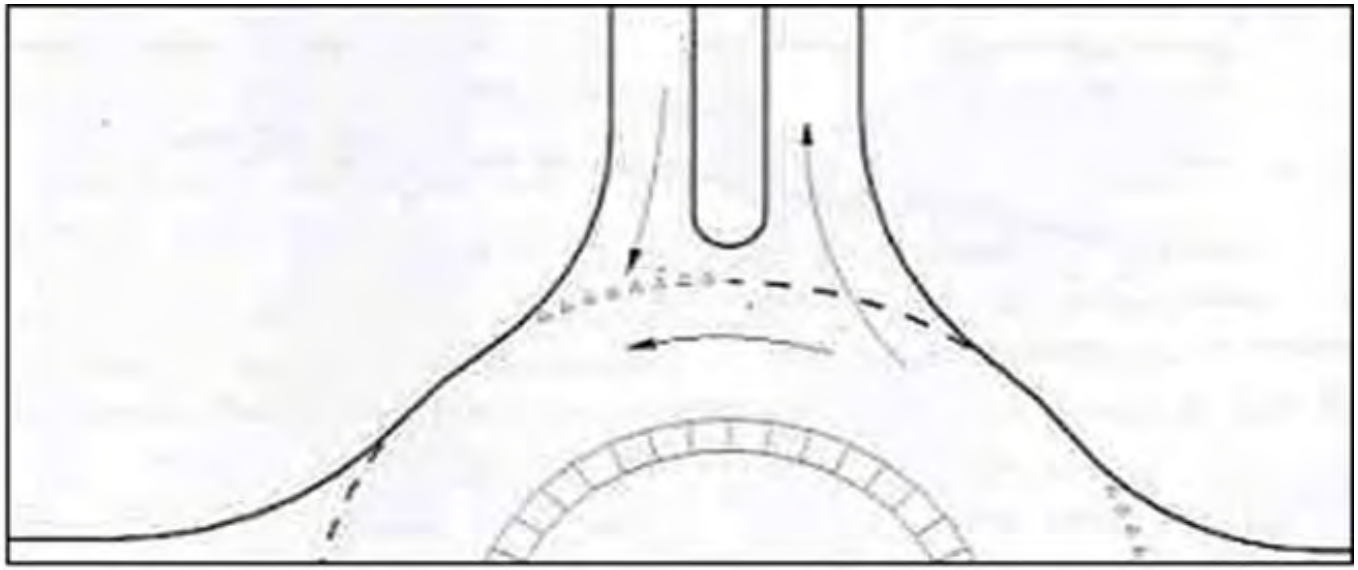
Roundabouts

Why built roundabouts?

- High capacity
- Safe

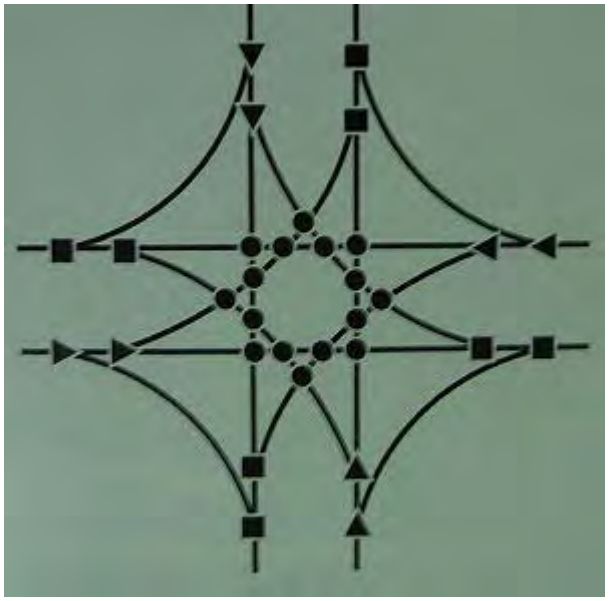
Capacity

- Typical capacity per type of roundabout
  - single lane roundabout 25.000 veh/24h
  - two-lane roundabout, single lane exits 30.000 veh/24h
  - two-lane roundabout, two-lane exits 40.000 veh/24h
  - turbo roundabout 60.000 veh/24h

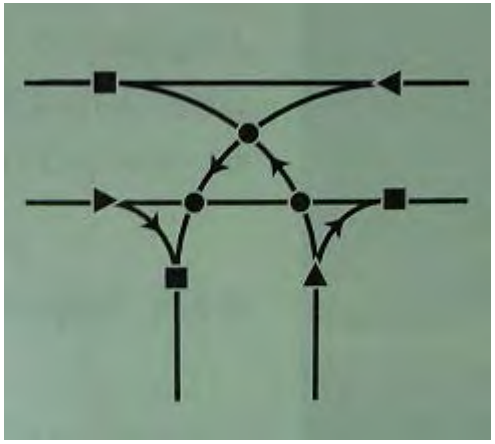


Safety

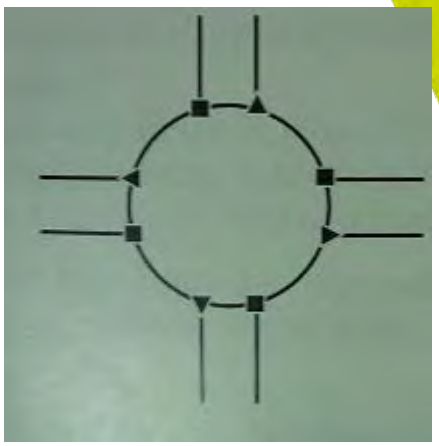
- Main safety advantages of roundabouts
  - actual speed is low
  - the number of conflicts is reduced
  - no crossing conflicts
  - predictable behavior (keeping lanes)



32 conflicts



9 conflicts



8 conflicts

▲ diverging ■ merging ● crossing

Safety

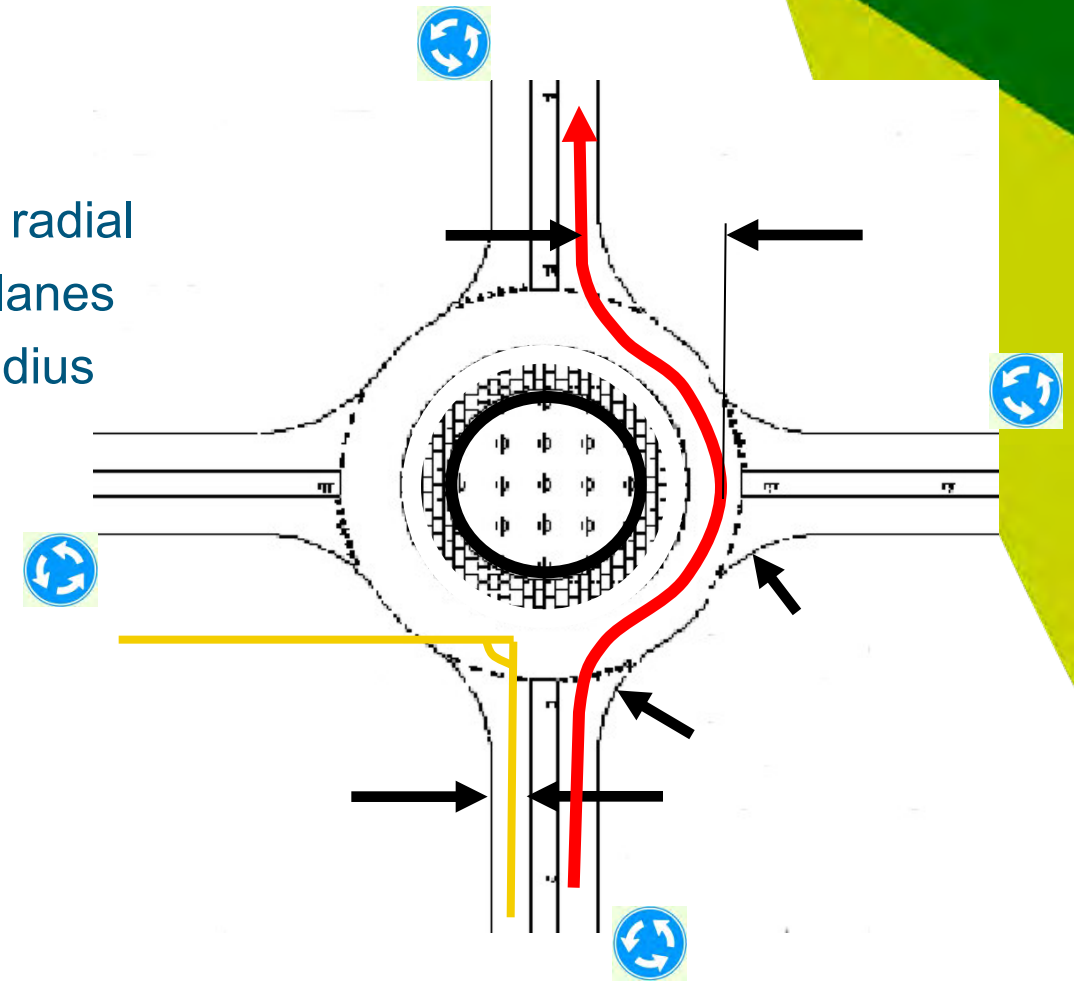
- Risk figures

Type of junction Inside build up area	Accidents with injuries per million motor vehicle kilometers	Victims per accident with injuries	Fatalities per victim
3 legs with traffic lights 4 legs with traffic lights 3 legs without traffic lights 4 legs without traffic lights	0,13 0,15 0,09 0,08	1,21 1,19 1,92 1,56	0,04 0,05 0,07 0,06
roundabout (without traffic lights)	**0,06**	**1,18**	**0,04**

Safety

Important aspects:

- Inform road user in time
- Entrances should connect radial
- Narrow entrance and exit lanes
- Small entrance and exit radius
- Wide bend out
- Raise central island



Safety

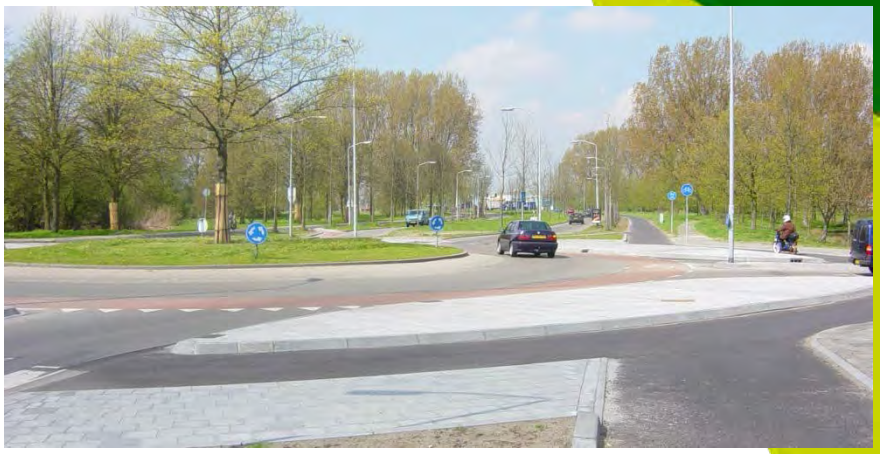
Example

Bicycle friendly roundabout design

- Safe: Low speed
  - Speed hump

Bicycle friendly roundabout design

- Safe: Blind spot



Bicycle friendly roundabout design

- Priority: Single lane roundabout

Outside build-up area
Priority to cars

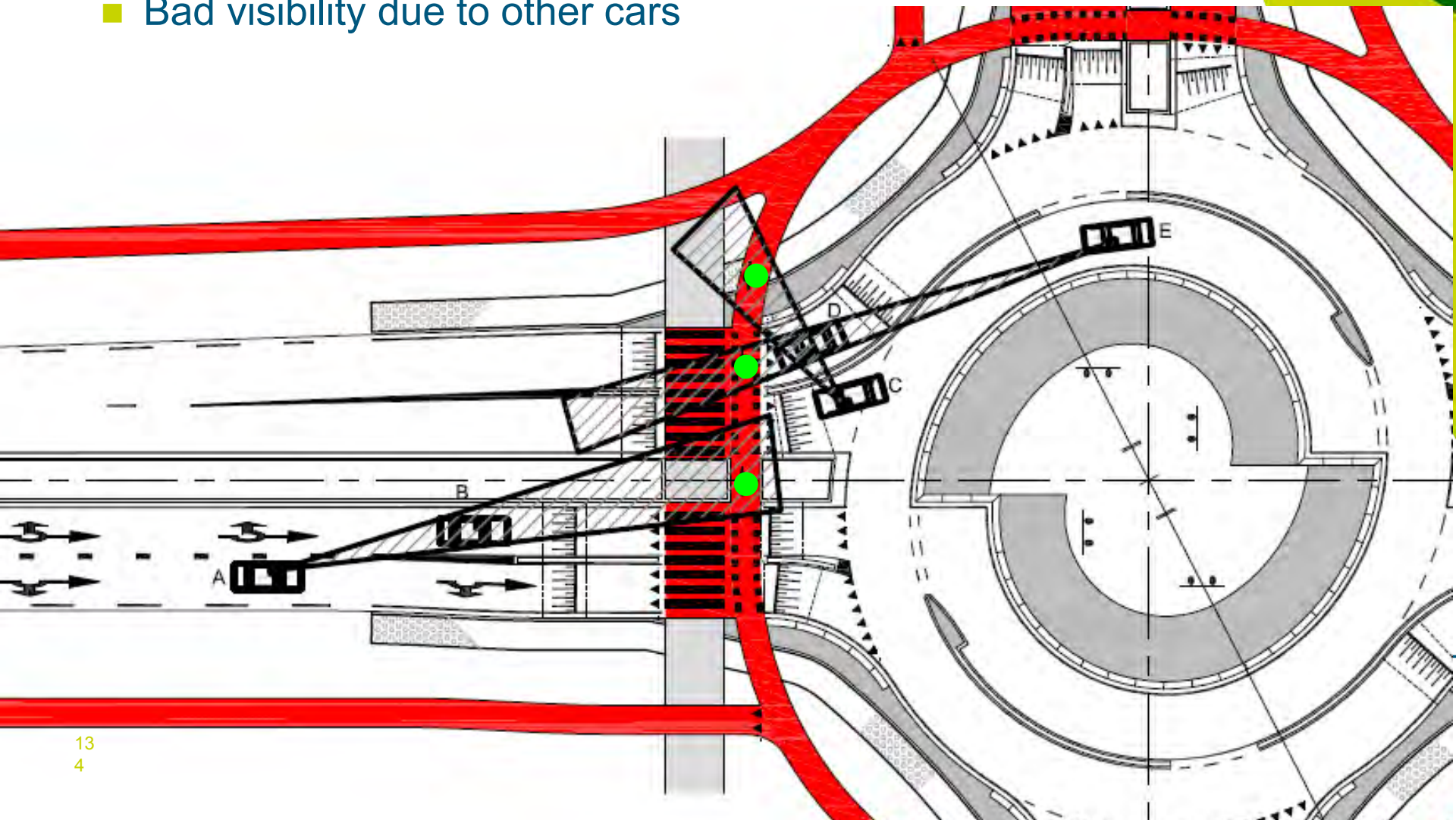
Inside build-up area
Priority to bicycles

Bicycle friendly roundabout design

- Priority: Turbo roundabout

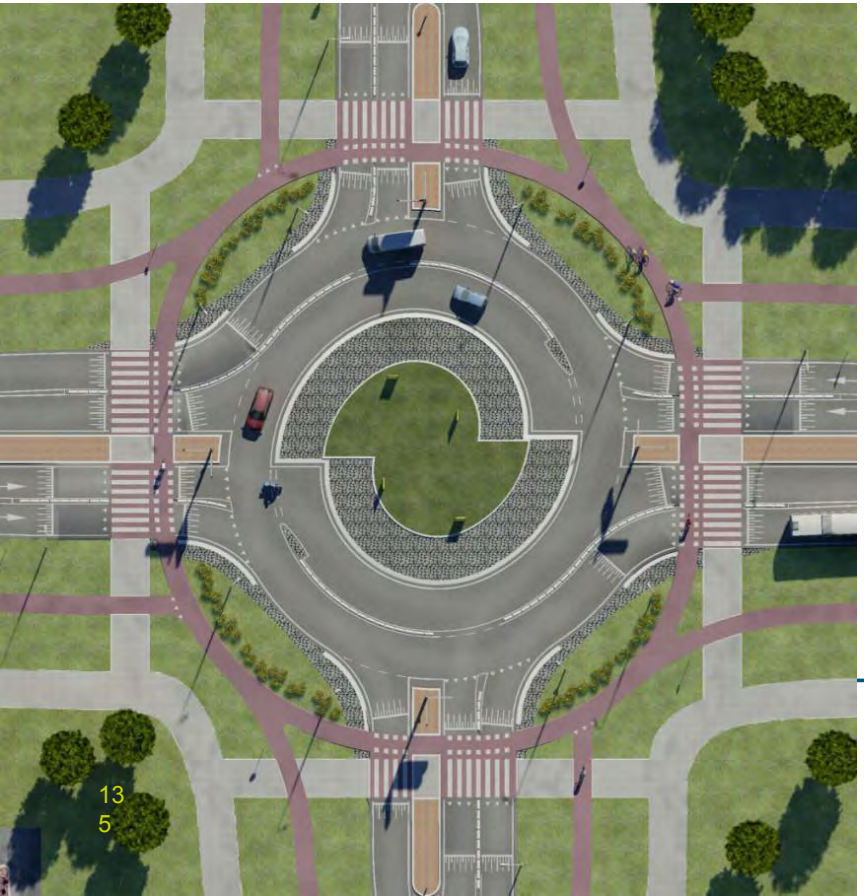
Typical accident type

- On turbo roundabouts with give way to BICYCLES:
- Bad visibility due to other cars



Bicycle crossing

- With give way to Bicycles:
  - Smooth flow
  - On going coloured surface



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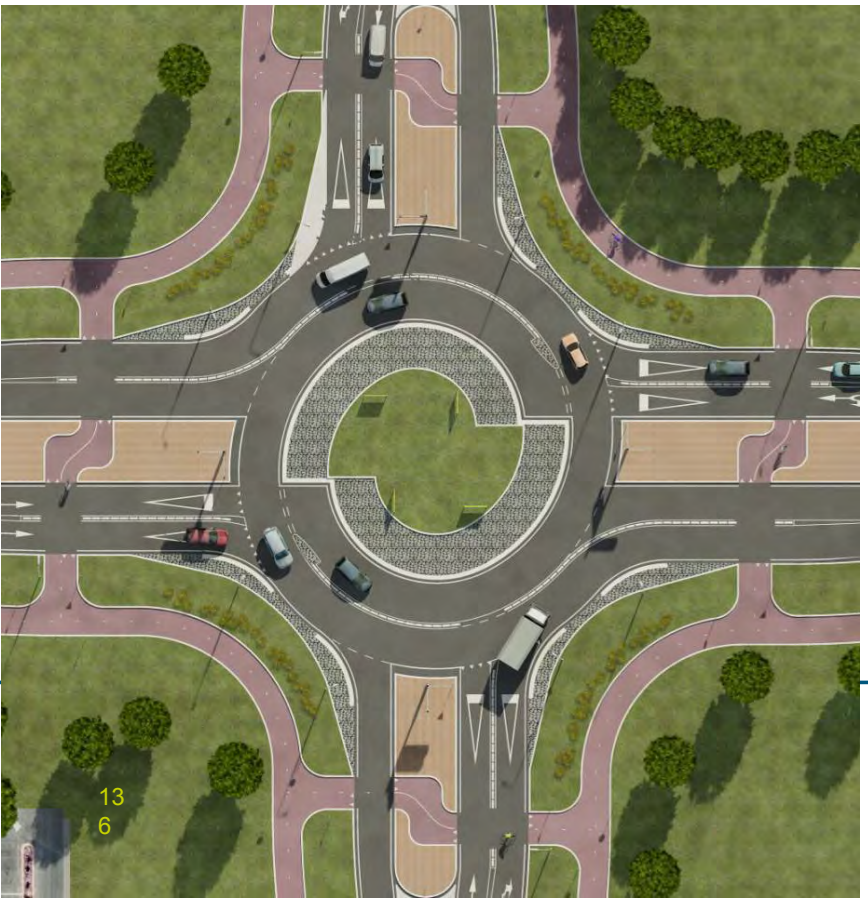
Bicycle crossing

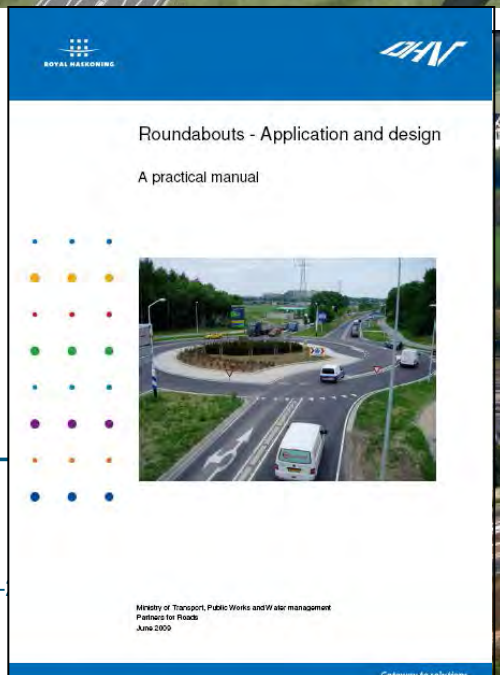
- With give way to CARS:
  - Zig zag
  - No coloured surface



Spatial need turbo roundabout

- Reconstruction junction with traffic lights → turbo roundabout

Royal HaskoningDHV and roundabouts



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DUTCH CYCLING EMBASSY

Bicycle Parking

Main requirements

Applies to:

- Network
- Routes
- Sections
- Junctions
- Parking

Level of quality related to function and (expected) use

Function, form and use:

- User convenience
- Theft prevention

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Bicycle parking

Essential for stimulating use of bicycle

Cyclists' point of view:
- Theft prevention
- Damage prevention
- Clean and dry storage

Road authority point of view:
- Preventing blockage / nuisance for pedestrians
- Appearance public area

Bicycle parking

Origin: Individual dwelling

- Balcony
- Neighbourhood storage
- Lockable storeroom

Destination:

- Private storage / parking
- Public parking
    - Free or paid
    - Supervised or unattended

Bicycle parking

Examples origin:

- Balcony
- Lockable storeroom
- Neighbourhood storage

Bicycle parking

Examples destination:

- Private storage / parking
- Public parking
    - Free or paid

How to design bicycle parking

Location typology:

- City centre:
  - shopping
  - night life
  - culture visits
  - working
  - living
- Old residential areas:
  - no indoor facilities
  - little public space
  - high dwelling density
- New residential areas:
  - indoor facilities?
  - more public space
  - lower dwelling density
- Companies / institutes:
  - workers
  - visitors
- Public transport stops:
  - “in a hurry”
  - theft prevention

Bicycle parking

- Usage, e.g.:
- shopping:
  - relatively short stay
  - easy use
  - secure
- working:
  - long stay
  - comfortable (dry, secure)
  - indoor / own property
- public transport:
  - long stay
  - close by (“hurry”) & on the way

Bicycle parking

Needed type of facility:

What is important:
- ease of use?
- stability?
- theft prevention?
- clean and dry storage?

Bicycle parking

Fietsparkeur

Bicycle Parking Facility Utrecht Central Station

Client
Ector Hoogstad Architecten

Location
Utrecht, The Netherlands

Completion
ongoing

Value (€)
0,1 < 0,5 M

Project Manager
Wim van der Wijk

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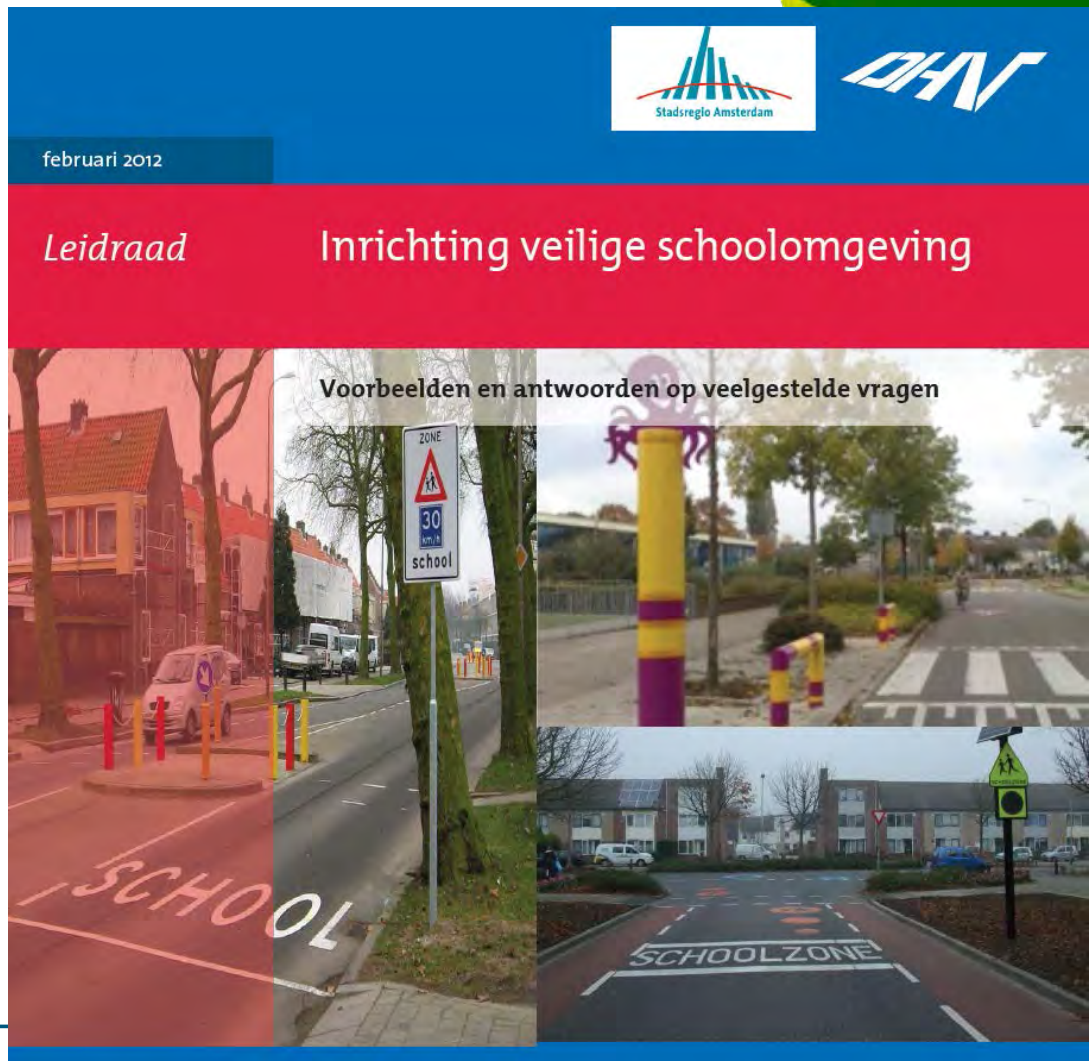
DUTCH CYCLING EMBASSY

Manual design safe school environment

Manual design safe school environment

Cliënt: Amsterdam Urban Region

- Examples and answers to frequently asked questions
- To use for each location



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Stakeholders

- The school, teachers
- The children and their parents
- The municipality
- The police and other emergency services
- Public transport society
- Residents
- Consultancies
- Businesses and shops in the vicinity, etc.

Working group

Actions:

- Determining the boundary of the school zone
- Analysing school environment
- Home-school routes

Goal and tasks:

- Safe school environment
- Self explaining roads → Infrastructure
- Agreement on measures

General mindset

Research

- Inventory the traffic school-home unsafe points on the route

Design school environment

- Street for school is completely car-free (or at times when school starts and goes out)
- Entrance school never in a 50 km/h street
- If possible use multiple school entrances (walkers, cyclists and motorists)
- Children not directly from schoolyard on the road (running or cycling) → use for instance number signs

School-Home routes

- Safe walking / cycling routes to school → important

Follow-up

Implementation of measures

- In the holidays
- Communication

Evaluation (monitoring)

- Speed Measurements
- Behaviour in Traffic
- Enforcement

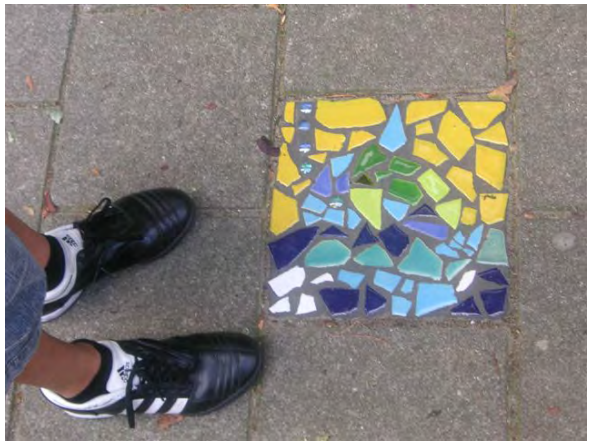
Method safe school environments

Method “Octopus”

Method “Julie”

Method safe school environments

Method “Child Ribbon”



Method “School zone”

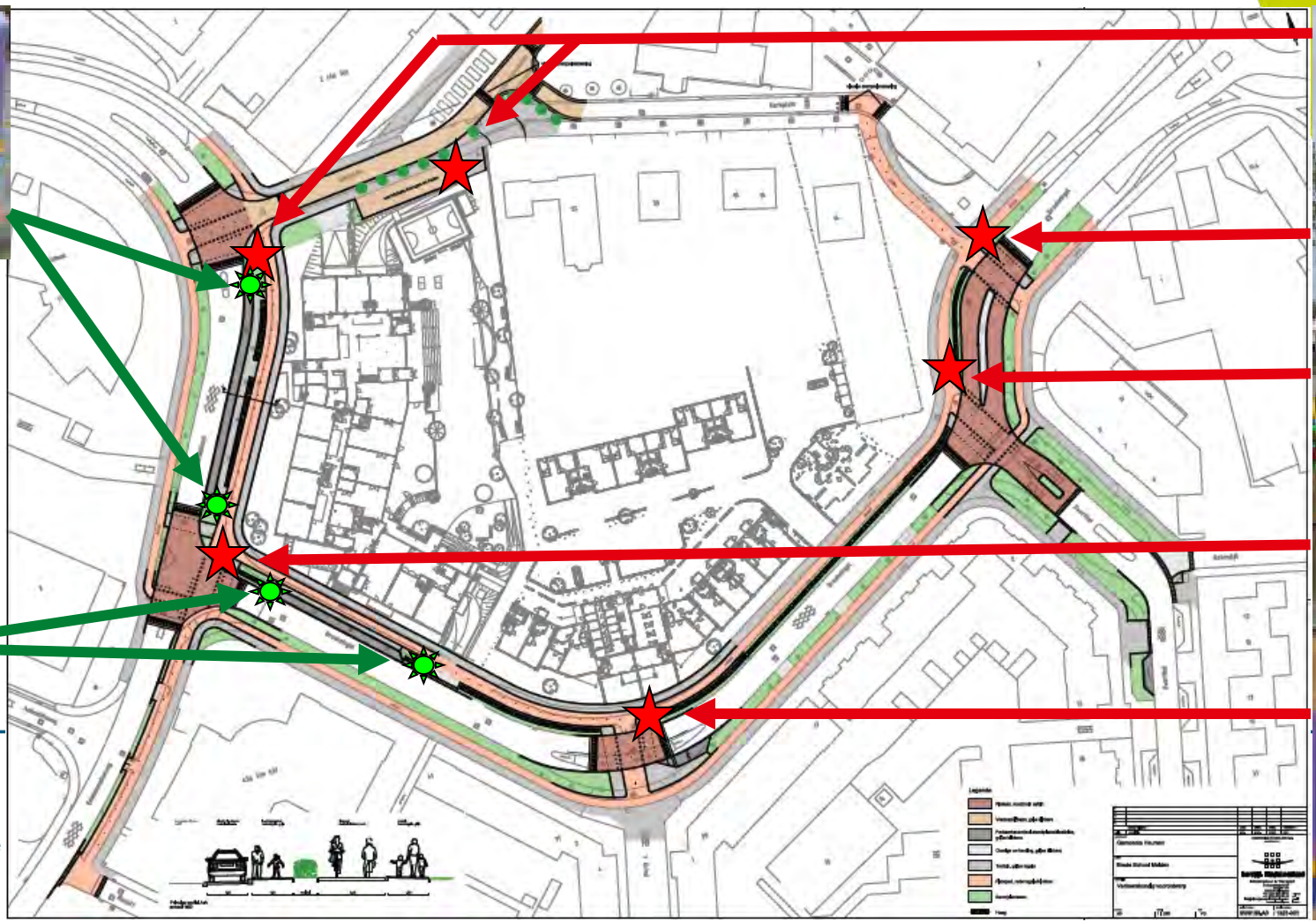
10 rules for a safe school environment

1. Safe route to school
2. Schoolyard entrance is safe
3. Safe crosswalk
4. There is a safe school exit
5. Children have unobstructed view
6. Sufficient waiting area for parents
7. Bike racks for parents
8. Sufficient bike storage for children
9. If applicable: the school bus gets the best parking space
10. (Traffic parent and) traffic Commission

Julie - concept

- Apply limited
- Attention function
- Crosswalks
- Kiss & Ride
- School side

Julie - concept



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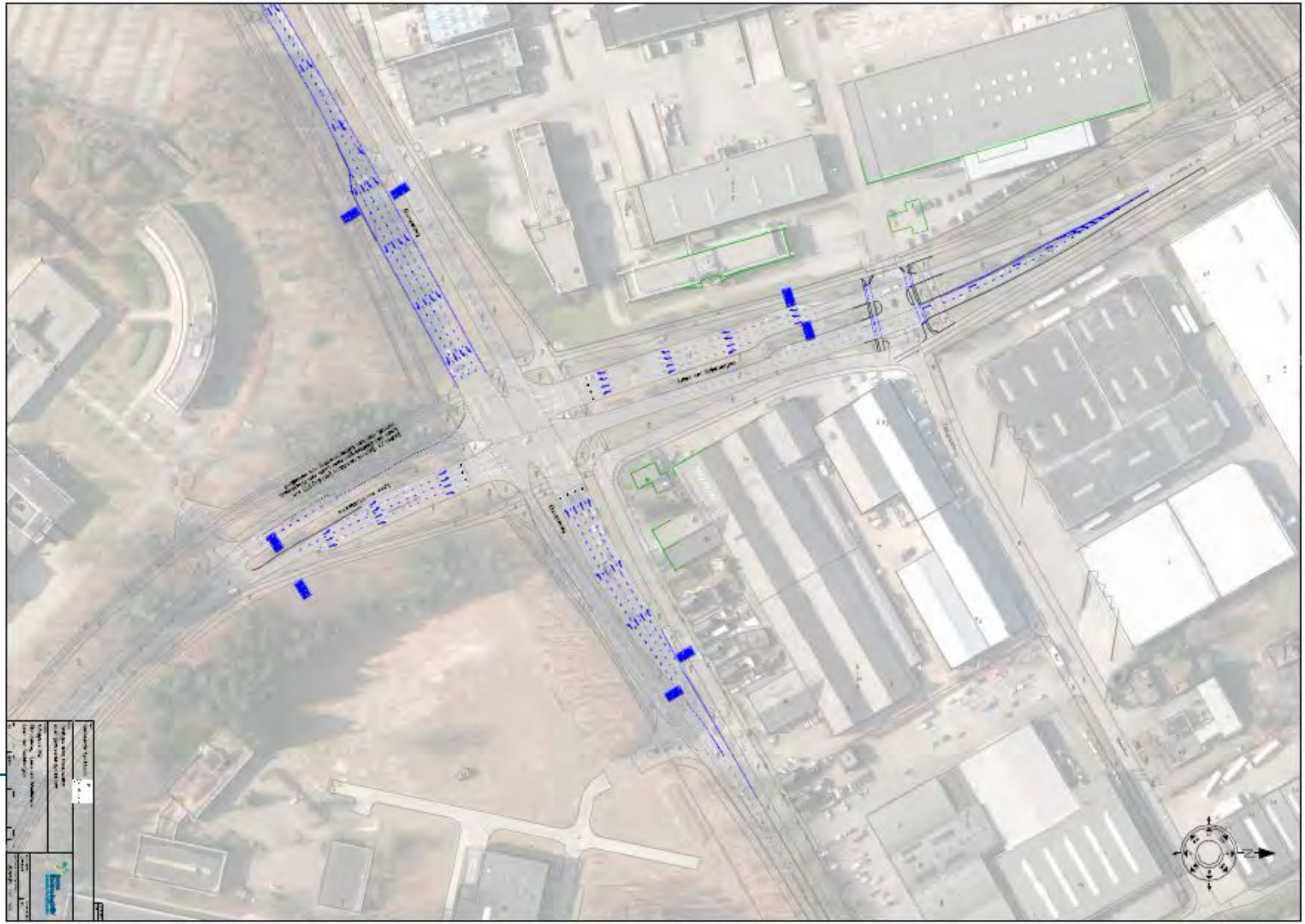
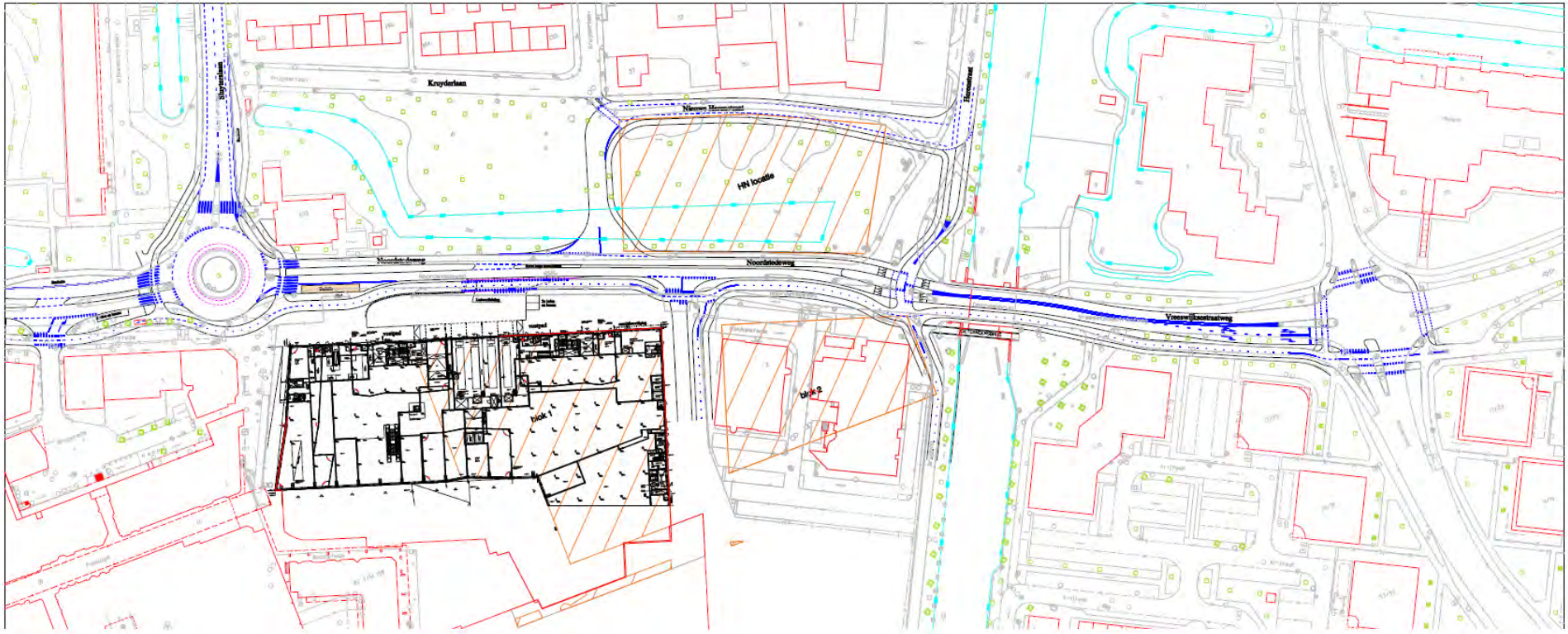
DUTCH CYCLING EMBASSY

Busy arterials

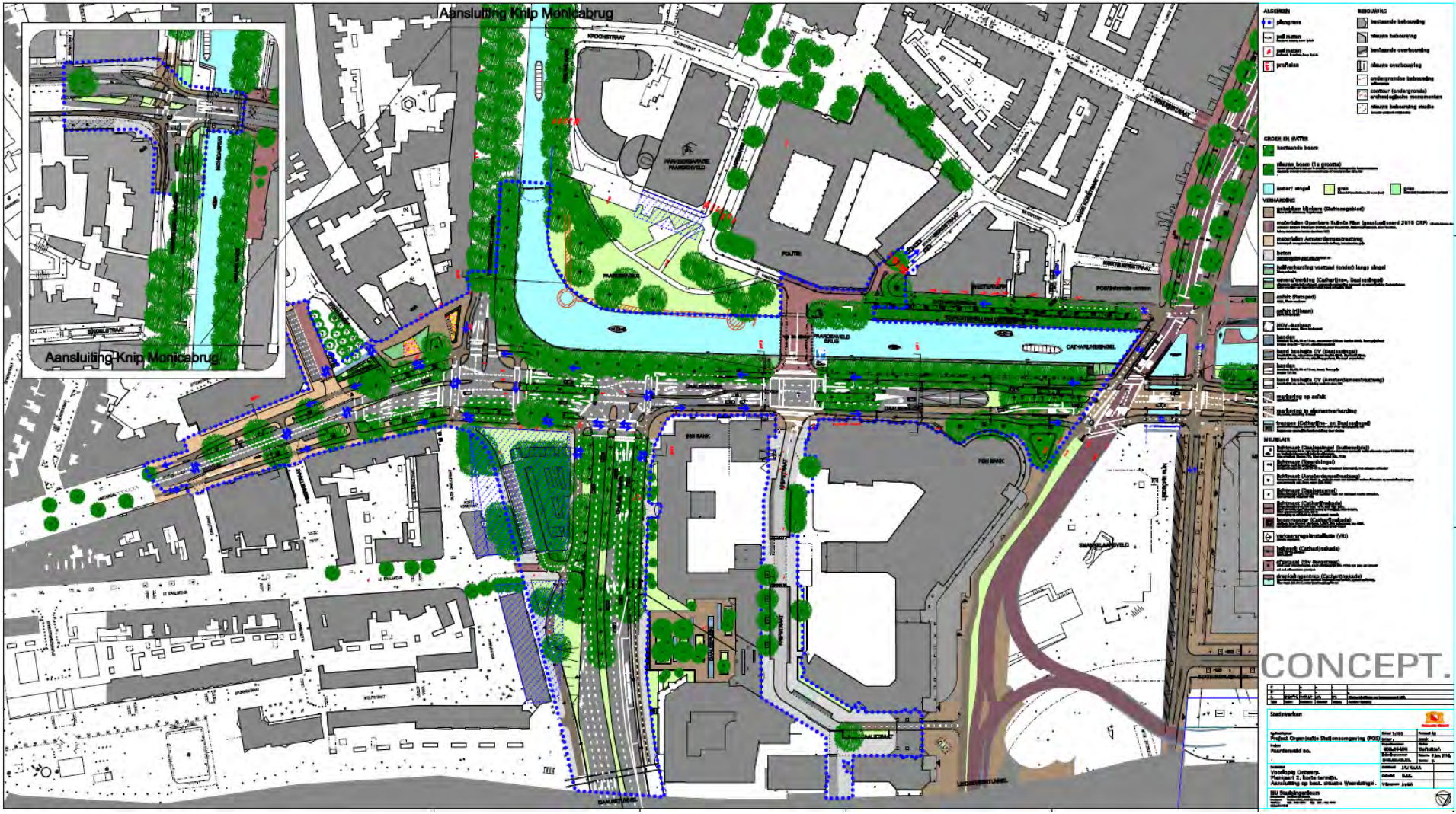
Example



Example


Kruyderlaan
Nieuwe Hemweg
HN locatie
Noordelaadweg
Noordelaadweg
Vroesenlaantweg
brick 1
brick 2

Example


Aansluiting Knip Monicabrug
Aansluiting Knip Monicabrug
CONCEPT.

Questions