ROYAL HASKONING

How to design Bicycle facilities?

April 2, 2011, Prilep, Macedonia

Wim van der Wijk

How to design Bicycle facilities

How to design:

- Bicycle path or lane
- Junction or crossing
- Bicycle parking

Take into account:

- Function
  (main route / secondary / school / recreational)
- Also for other road users (cars / pedestrian)
- Volumes

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

Sections

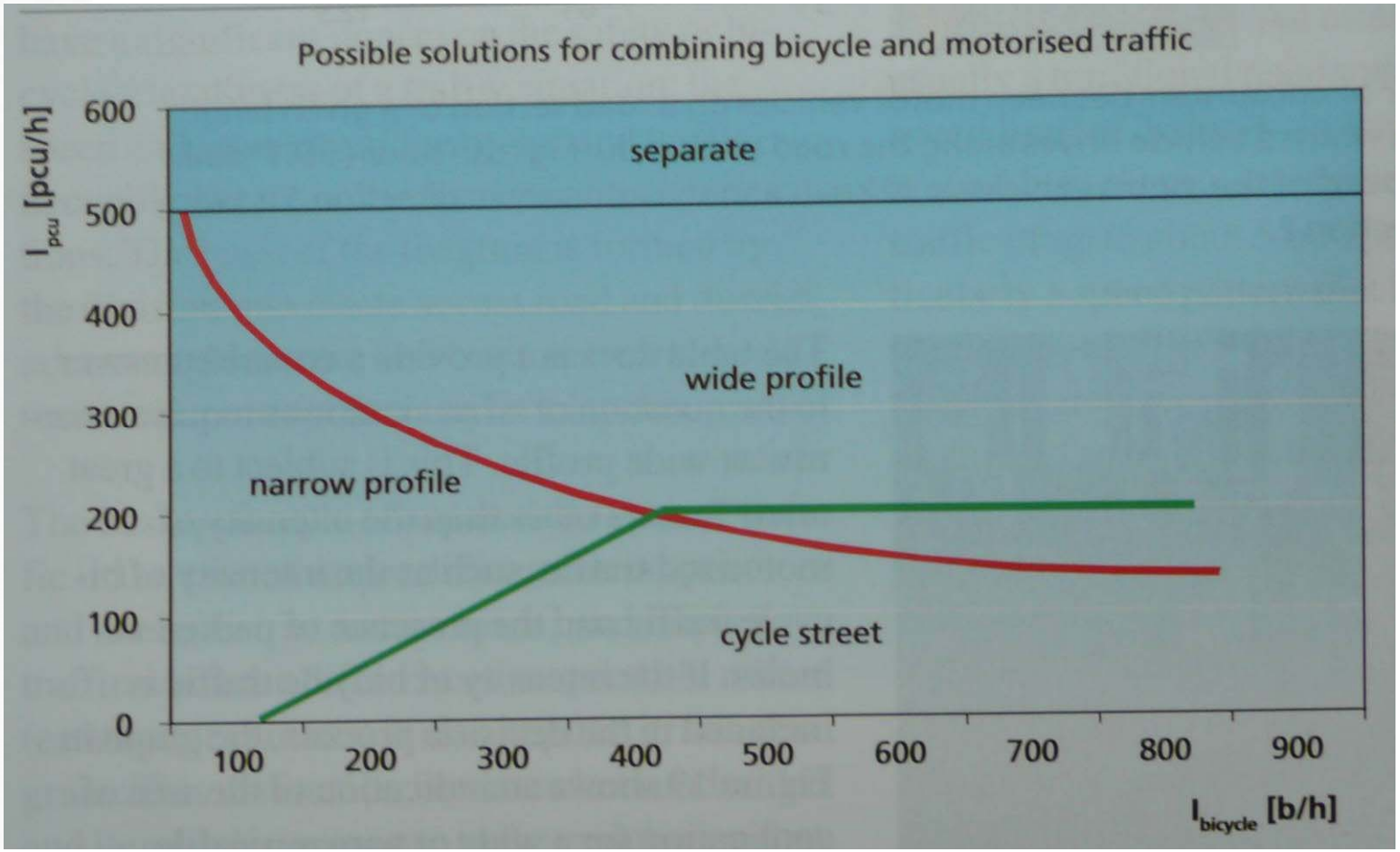
Separation

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

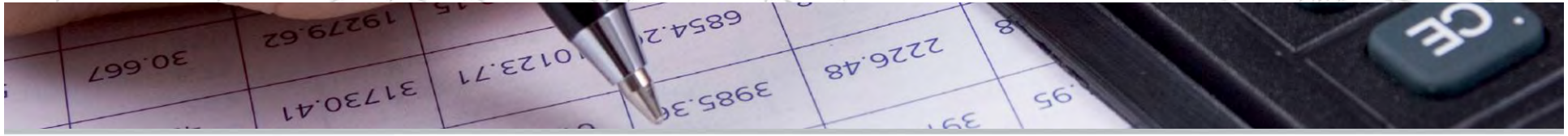
Road category	Max. speed of motorised traffic (km/h)		Motorised traffic intensity (pcu/day)	Cycle network category: basic network ($I_{bicycle}$ > work 750/day)	cycle route ($I_{bicycle}$ 500-2500/day)	main cycle route ($I_{bicycle}$ > 2000/day)
	n/a		0	solitary track		
Estate acces roead	walking pace or 30 km/h		1 - 2.500	combined traffic		cycle street or cycle lane (with right of way)
			2.000 - 5.000			
			> 4.000	cycle lane or cycle track		
District acces 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		

Sections

Separation / combined use



How to design path / lane



Separate path:

- Function ►width, surface
- Volume of cyclists ►width
- Mopeds ►width
- One or two way ►width
- Physical space ►separation
- Car parking ►separation

- Surface (material, colour)
- Public lighting
- Bollards

How to design path / lane

Width:

- without mopeds

- width of cycle track

One-way track		Two-way track	
rush hour intensity in one direction (b/h)	width (b)	rush hour intensity in two directions	width (b)
0 – 150	2.00 m	0 – 50	2.50 m
150 – 750	3.00 (2.50) m	50 – 150	2.50 to 3.00 m
> 750	4.00 (3.50) m	> 150	3.50 to 4.00 m

- with mopeds

One-way track		Two-way track	
rush hour intensity in one direction (b/h)	width (b)	rush hour intensity in two directions	width (b)
0 - 150	2.00 m	0 - 50	2.50 m
75 - 375	3.00 m	50 - 150	3.00 m
> 375	4.00 m	> 100	4.00 m

How to design path / lane

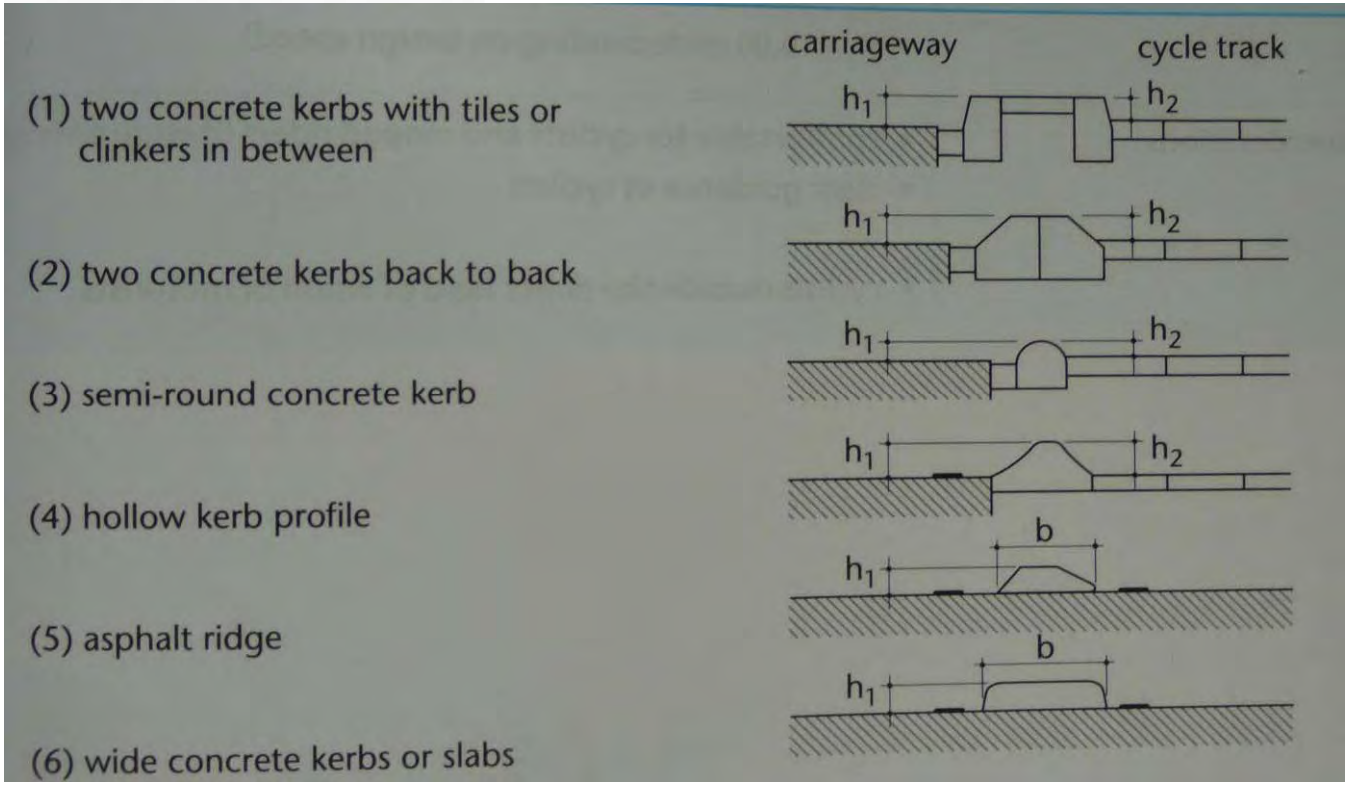
Partition verge

- 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

How to design path / lane

Partition verge (insufficient space)

- width varies
- $h_1 \leq 0.10$ to 0.12 m
- $h_2 = 0.05$ (0.07) m; if 0.07 m, choose a profile that prevents pedals striking the separation



How to design path / lane

Bicycle lane: Juridical difference:

- Bicycle lanes:
  - cars may not hinder cyclists
  - juridical protection
- Suggestion lanes:
  - cars may hinder cyclists
  - no juridical protection

- Juridical protection needs enforcement

- Only when insufficient physical space for path
- Only one way direction

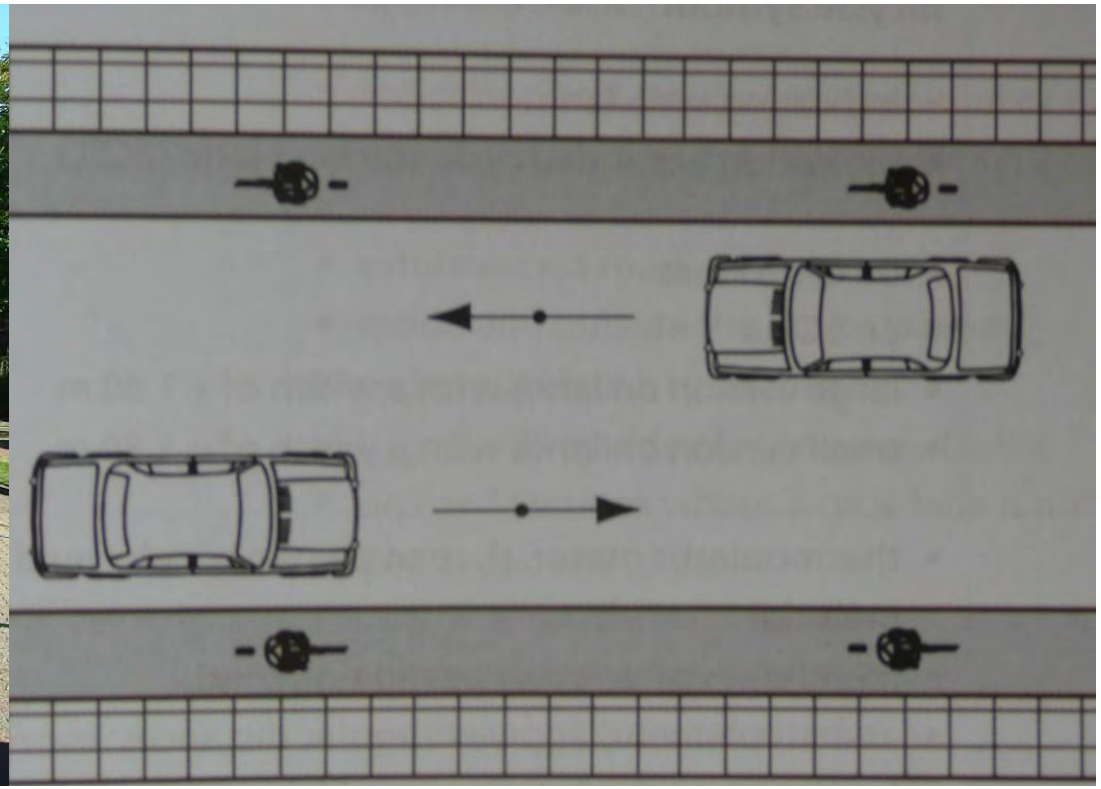
How to design path / lane

Bicycle lane:

- Function ►width
- Volume of cyclists ►width
- Mopeds ►only suggestion lanes
- Car parking ►too high → no lanes

How to design path / lane

Bicycle lane



How to design path / lane

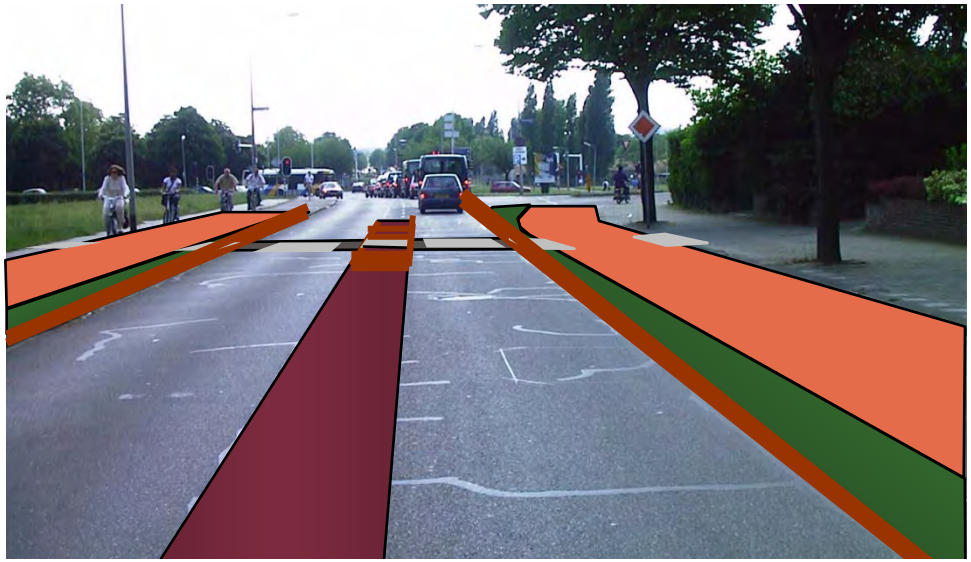
Bicycle lane:
- Bicycle symbol
- Red colour
- Continuous line: 2.00 – 2.50
- Interrupted line: 1.50 – 2.00

Suggestion lane:
- No bicycle symbol
- No red colour
- Width: 1.50
- Only with interrupted line

How to design path / lane

Up grade from lane to path:

- without using extra space



How to design path / lane

Bicycle street:

- Two directions
- Red colour
- No signs

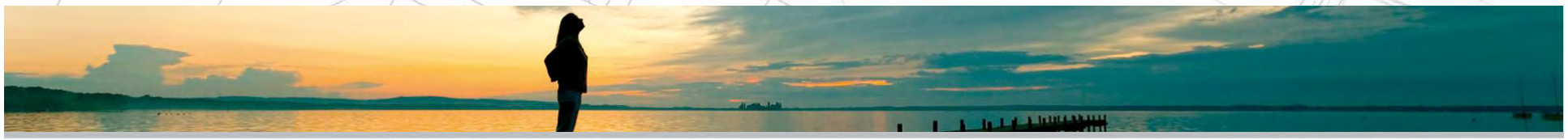
- Max 200 pcu/hr
- Speed reduction

How to design junction / crossing

Different crossing situation:

	Access road	Distributor road	Solitary Cycle track
Access road			
Distributor road			
Solitary Cycle track			

How to design junction / crossing



Choose type of solution:

- Give way + additions
  (refuge island, speed hump, narrowing)
- roundabout
- traffic lights
- grade separate (bridge, tunnel)

Junctions / crossings

Type of junction

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			
	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

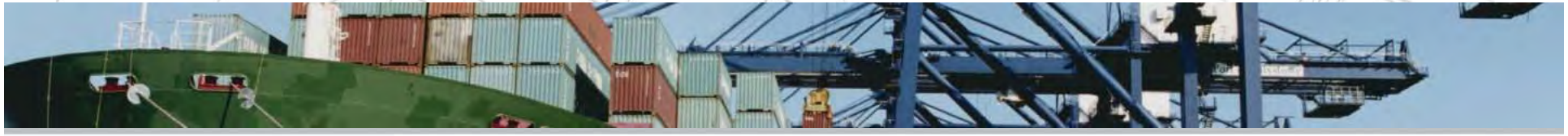
Junctions / crossings

Type of junction

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

How to design junction / crossing



Give way + additions:

- Function ►type additions
- Volume of cyclists ►type, measures
- Physical space ►type

	A	D	S
A		X	X
D	X	X	X
S	X	X	

- Material, colour
- Public lighting

How to design junction / crossing

Additions:

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

	A	D	S
A		X	X
D	X	X	X
S	X	X	

How to design junction / crossing

Additions: Speed hump / plateau

How to design junction / crossing

Additions: Refuge island

How to design junction / crossing

Additions: Narrowing

How to design junction / crossing

Additions: Bollards

How to design junction / crossing

Additions: Bollards

How to design junction / crossing

Additions: Public Lighting

How to design junction / crossing

Additions: Continuous material, colour

How to design junction / crossing

Roundabout:

- Function ►single lane, turbo
- Location ►give way
- Volume of cyclists ►width
- Physical space ►separation

	A	D	S
A		X	
D	X	X	
S			

How to design junction / crossing

Single lane roundabout:

Outside build-up area
Priority to cars

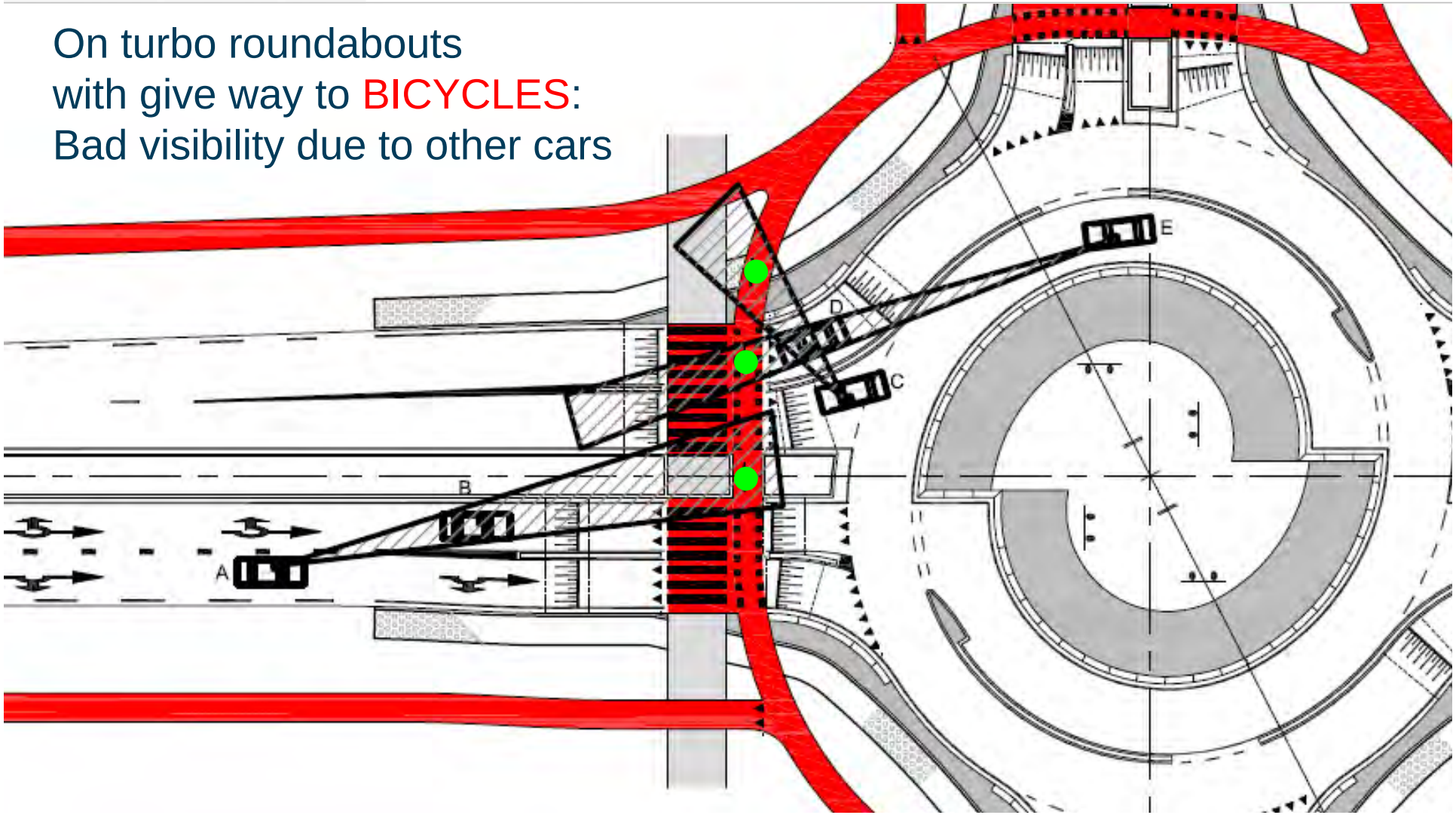
Inside build-up area
Priority to bicycles

How to design junction / crossing

Turbo roundabout:

Typical accident type

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



How to design junction / crossing

	A	D	S
A		X	
D	X	X	X
S		X	

Traffic lights:

- Function ►dividing green time
- Volume of cars and cyclists ►green time
- Physical space ►number of phase

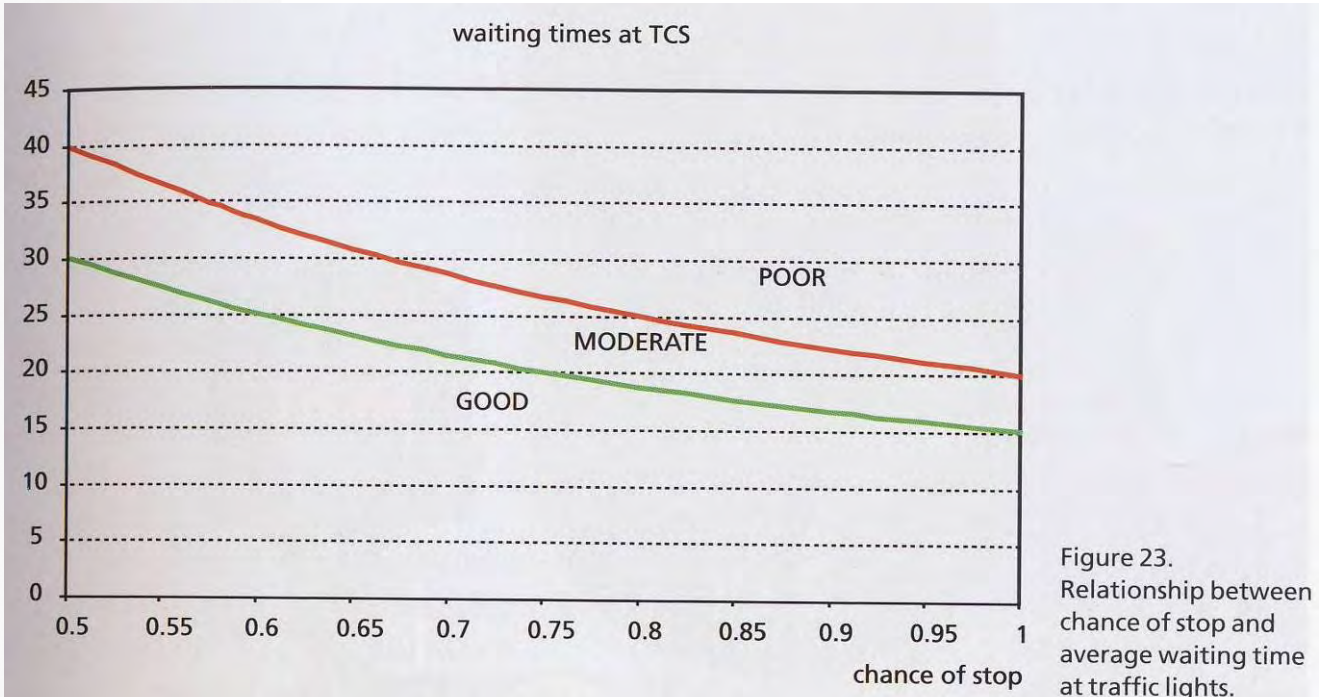


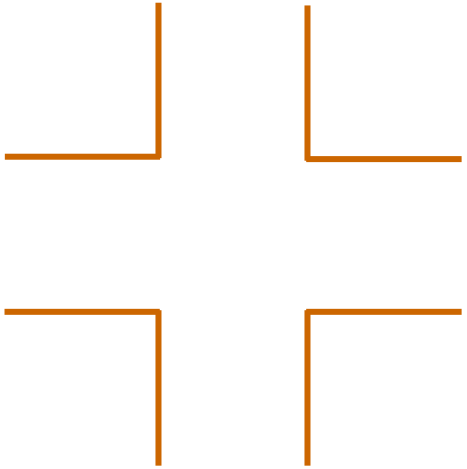
Figure 23. Relationship between chance of stop and average waiting time at traffic lights.

How to design junction / crossing

Traffic lights, additional:

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

	A	D	S
A		X	
D	X	X	X
S		X	



How to design junction / crossing

Traffic lights, examples

Green wave

Rain sensitive traffic lights

How to design junction / crossing

Traffic lights, examples

All directions green

Waiting time predictors

How to design junction / crossing

Grade separate:

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

	A	D	S
A		X	
D	X	X	X
S		X	

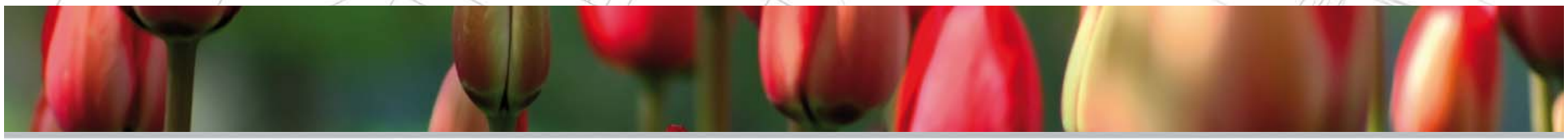
How to design junction / crossing

Bridge or tunnel?

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

Option: half bridge, half tunnel

How to design junction / crossing

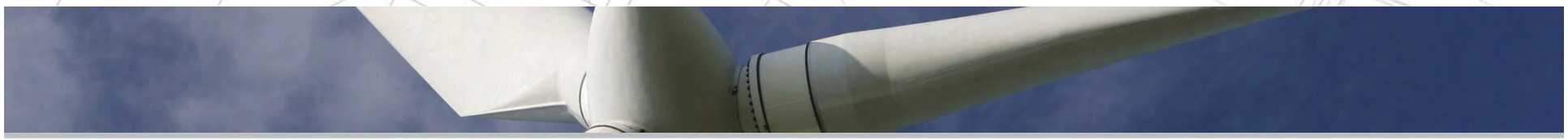


Do nothing

Or add plateau

	A	D	S
A	X		
D			
S			

How to design bicycle parking



Choose type of solution, based on:

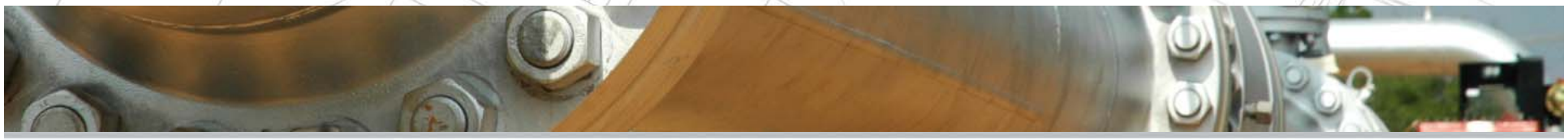
- Type of location
- Needed capacity
- Needed type of facility

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

How to design bicycle parking



Location typology:

- 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”)

How to design bicycle parking

Needed capacity

- depends on type of use

Table 36. Guidelines for determining the capacity of bicycle parking facilities for visitors to solitary facilities

Type of facility		Unit	Guideline	Explanation: elect lower limit for
shopping centre	main shopping centre	100 m^2 gfa	5 - 10	
	large district shopping centre	100 m^2 gfa	5 - 7	peripheral location and shopping base aimed at bulk purchasing
	local shopping centre	100 m^2 gfa	6 - 8	
office	without counter function	100 m^2 gfa	1 - 3	peripheral location and strong PT competition
	with counter function	per counter	2 - 4	
edu-cational institute	day-care centre	10 children	1 - 3	large 'supradistrict' function
	primary school	100 pupils	30 - 40	
	secondary education	100 pupils	60 - 70	large regional function and strong PT competition
	higher education	100 students	40 - 60	strong PT competition
sports complex	sports hall	100-visitor capacity	35 - 45	peripheral location
	sports field with stands	100-visitor capacity	20 - 30	
	sports field without stands	competition field	20 - 30	
	swimming pool	100 m^2 water-surface area	15 - 20	
places to go out	theatre	100-visitor capacity largest hall	20 - 25	large regional function and strong PT competition
	concert hall	100-visitor capacity largest hall	25 - 35	
	cinema	100-visitor	25 - 30	

How to design bicycle parking

Needed type of facility:
What is important:

- ease of use?
- stability?
- theft prevention?
- clean and dry storage?

How to design bicycle parking

Fietsparkeur