



ROYAL HASKONING

Turbo roundabouts
a safe solution for Hungary?

Budapest, 16 October 2009

Wim van der Wijk

w.vanderwijk@royalhaskoning.com

Congratulations!



M A G Y A R Ú T Ű G Y I T Á R S A S Á G
HUNGARIAN ROAD SOCIETY • UNGARISCHE GESELLSCHAFT FÜR STRASSENWESEN





ROYAL HASKONING

Turbo roundabouts
a safe solution for Hungary?

Budapest, 16 October 2009

Wim van der Wijk

w.vanderwijk@royalhaskoning.com

Turbo roundabouts



Contents

- Experience Royal Haskoning
- Why realize a roundabout?
- Why realize a turbo roundabout?
- Characteristics / manifestations
- Experience in Hungary
- Future developments
- Conclusions





Profile

consultants, architects & engineers

4,400 professionals

established in 1881

we distinguish ourselves by our élan

independent ownership structure

professional formation

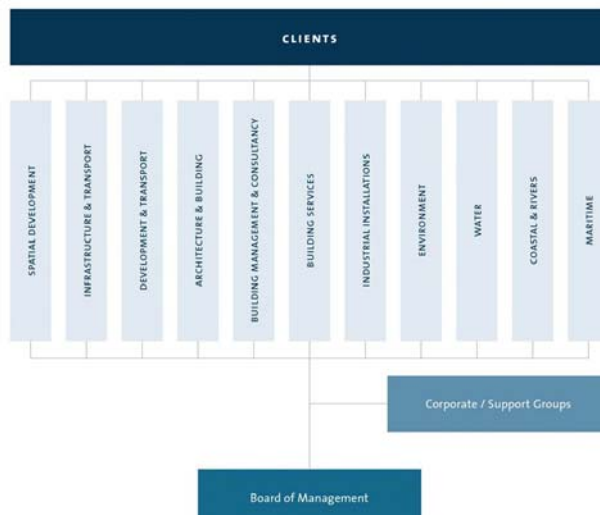
a network of knowledge, offices, partners and relations

great diversity and synergy in extensive knowhow and expertise

worldwide experience



Organisational structure





Recent road safety related projects:

- Expert meeting expressway 2/A, Vác – Budapest 2004
- Road Safety Audit road 6 / 56, Budapest – Croatian border 2005
- Training Self Explaining Roads, Győr 2007
- Training Road Safety Audit, Győr 2007
- Training Design and Planning Process, Budapest 2008
- Training Network Safety Management, Balatonföldvár 2008
- Brush-up training Road Safety Audit, Budapest 2009



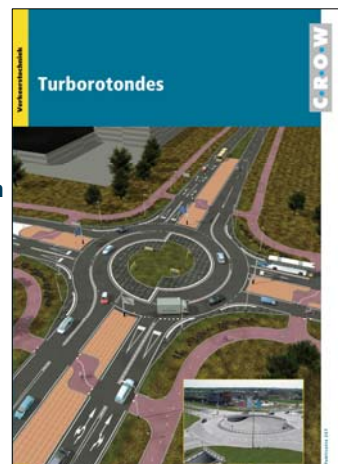
Formak for Roads
12 October 2007
Final Report
448002.A0



CROW publication 257

'Turborotondes'

- Published in April 2008
- Contains all information concerning:
 - **Consideration basic shape of junction**
 - **Consideration passage for bicycles**
 - **Design turbo roundabout**
- With CD containing mathematical software, simulations, 3D-movies, design examples



Royal Haskoning and roundabouts



Manual Roundabouts:

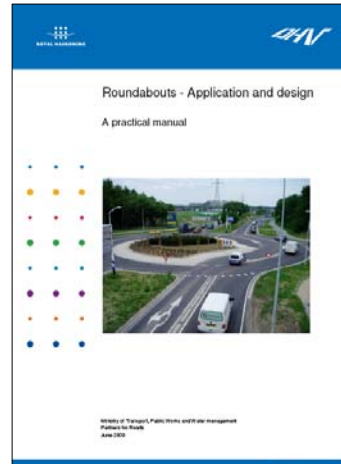
- Published in September 2009
- About all types of roundabouts
- In English
- With CD-ROM
- Useful as basis for country manuals



Partners for Roads

Initiative Dutch Ministry of Transport

- Program to exchange knowledge
 - Related to road infrastructure
 - New and future EU member states
- **Window 3: Safe Road Design**

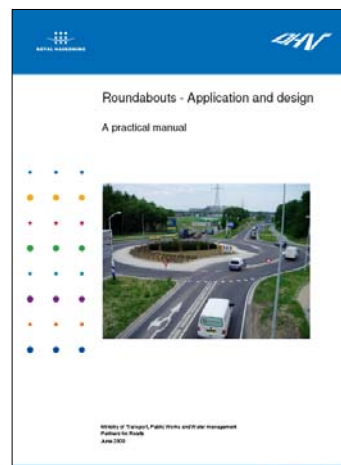


Royal Haskoning and roundabouts



Manual Roundabouts:

- Freely available from website:
www.royalhaskoning.com
- Complete link:
http://www.royalhaskoning.com/Royal_Haskoning/infrastructure_and_ports/en-GB/News/Roundababouts.htm



Royal Haskoning and roundabouts



Design of roundabouts



Why roundabouts?



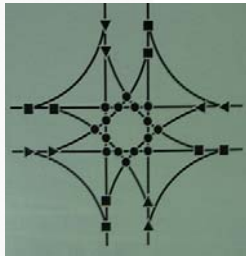
- Single lane roundabouts since 1985
- Period of “getting used to”
- Clear advantages:
 - Safe
 - High capacity (2.500 pcu/hour)

- Over 3.000 single lane roundabouts in 2007

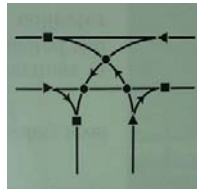
Why roundabouts?



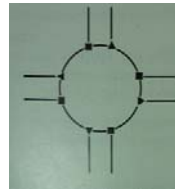
- Few conflict points
- No crossing conflicts
- Predictable behaviour (keeping lanes)
- Low speed



32 conflicts
50 – 80 km/h



9 conflicts
50 – 80 km/h



8 conflicts
30 – 35 km/h

- Crossing
- Merging
- ▲ Diverting

Why roundabouts?



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	0,13	1,21	0,04
4 legs with traffic lights	0,15	1,19	0,05
3 legs without traffic lights	0,09	1,92	0,07
4 legs without traffic lights	0,08	1,56	0,06
roundabout (without traffic lights)	0,06	1,18	0,04

Why turbo roundabouts?



- Higher capacity
- Equal safety advantages
- Two lane roundabout:
 - Disappointing capacity
 - Disappointing safety
- Turbo roundabout:
 - Solved disadvantages of two lane roundabout



- For details:
www.royalhaskoning.com



Why turbo roundabouts?



- Increase capacity of junction
 - Higher than single lane roundabout (1½ to 2 ½ x)
 - Higher than two lane roundabout (1 to 1½ x)
 - Equal or higher than signalized junction
 - Loss time and delay less than signalized junction
- Increase road safety on junction
 - Safer than give way junction (± - 70%)
 - Safer than junction with traffic lights (± - 50%)
 - But less safe than single lane roundabout (± +20 á 40%)
- Areal need (m²) about the same as signalized junction
- Investment costs
 - Construction costs higher than traffic lights
 - Life-cycle-costs less

Why turbo roundabouts?



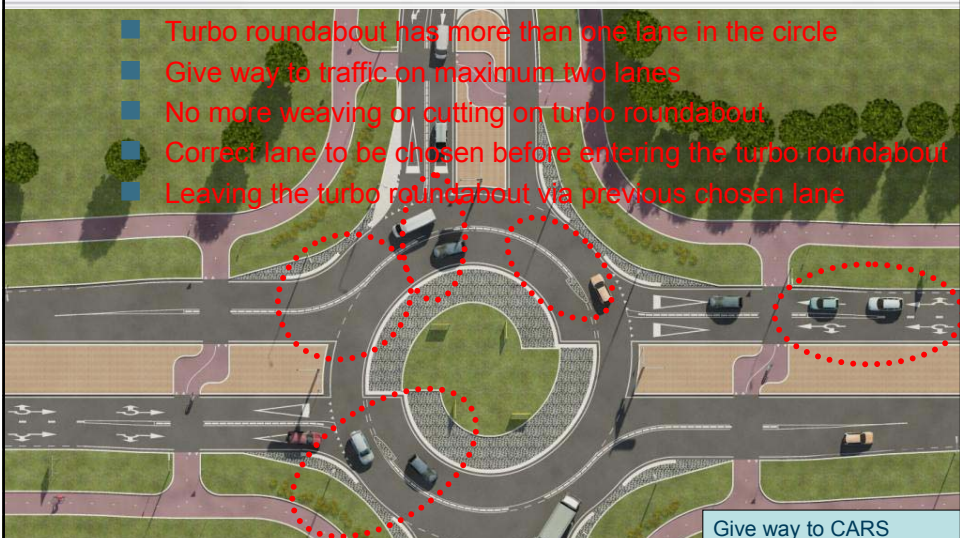
Reconstruction junction with traffic lights -> turbo roundabout



Characteristics

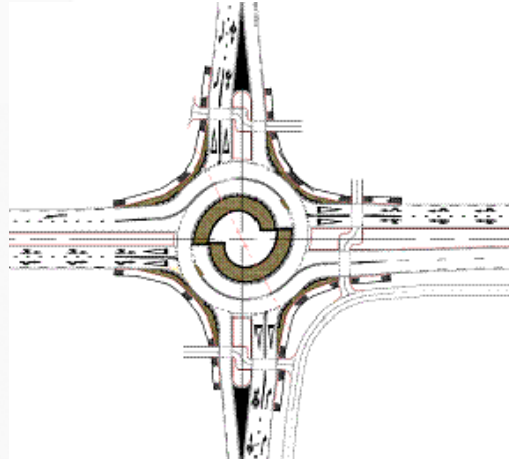


- Turbo roundabout has more than one lane in the circle
- Give way to traffic on maximum two lanes
- No more weaving or cutting on turbo roundabout
- Correct lane to be chosen before entering the turbo roundabout
- Leaving the turbo roundabout via previous chosen lane

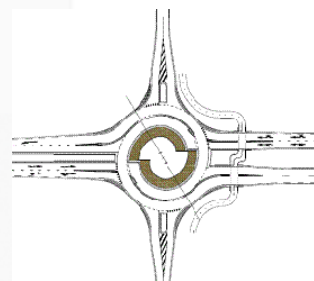




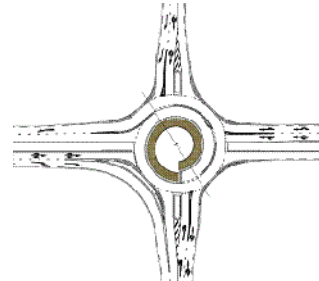
■ Turbo roundabout (basic shape)



■ Egg roundabout

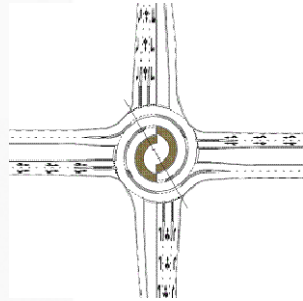


■ Knee roundabout

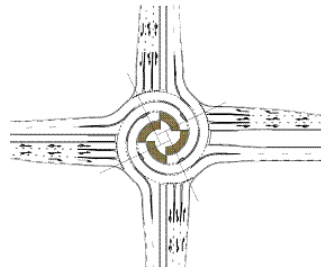




■ Spiral roundabout



■ Rotor roundabout



Characteristics



Selection criteria:

- Saturation level
- Average waiting time

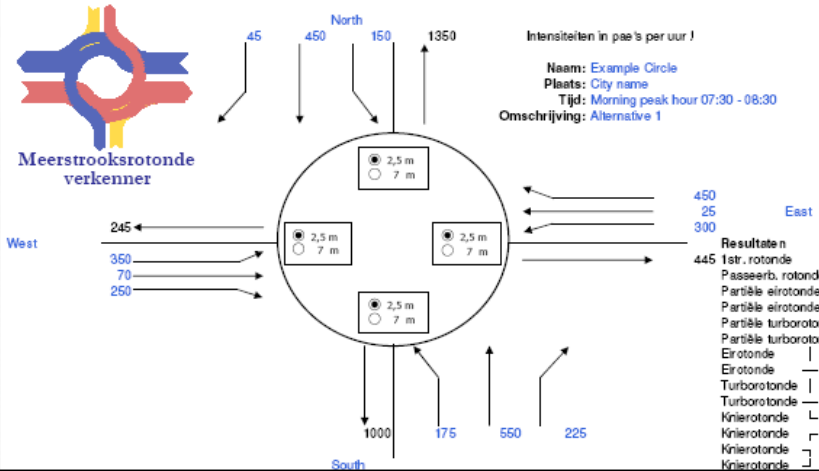
Tool (excel):
MEERSTROOKSROTONDEVERKENNER

- Areal need
- Investment costs

Characteristics



Multilane roundabout explorer: input



Characteristics



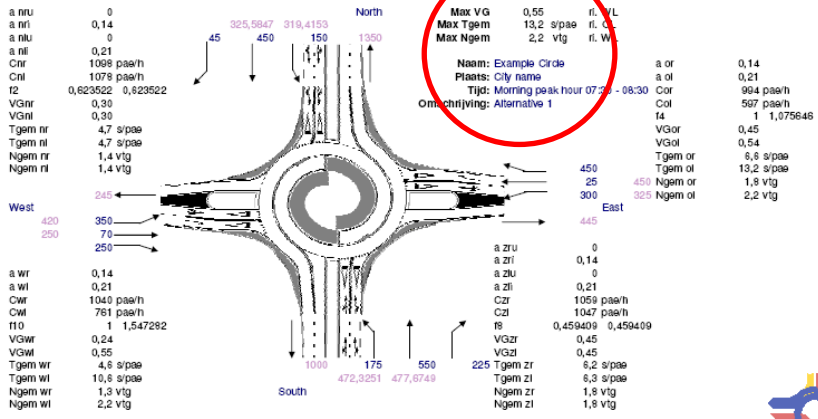
Multilane roundabout explorer: output

	Resultaten	VG	ri.	Tgem	ri.	
Single lane	1str. rotonde	1,44	O	999999,9	O	
	Passeerb. rotonde	0,81	Z	20,5	Z	
	Partiële eirotonde	1,39	O	999999,9	O	
	Partiële eirotonde --	1,11	Z	999999,9	Z	
	Partiële turborotonde	OK	0,72	ZR	15,4	OL
	Partiële turborotonde --	0,85	ZL	27,3	ZL	
Egg	Eirotonde	1,30	O	999999,9	O	
	Eirotonde --	1,11	Z	999999,9	Z	
Turbo	Turborotonde	OK	0,55	WL	13,2	OL
	Turborotonde --	0,85	ZL	27,3	ZL	
	Knierrotonde L	0,87	ZL	32,0	ZL	
Knee	Knierrotonde R	OK	0,74	OR	22,1	OR
	Knierrotonde J	OK	0,79	ZR	17,8	ZR
	Knierrotonde	OK	0,59	NL	14,0	OL
Spiral	Spiraalrotonde	OK	0,43	ZL	9,0	OL
	Spiraalrotonde --	OK	0,60	ZM	12,2	OL
	Rotorrotonde	OK	0,44	OL	9,6	OL

Characteristics



Multilane roundabout explorer: result turbo roundabout



Characteristics



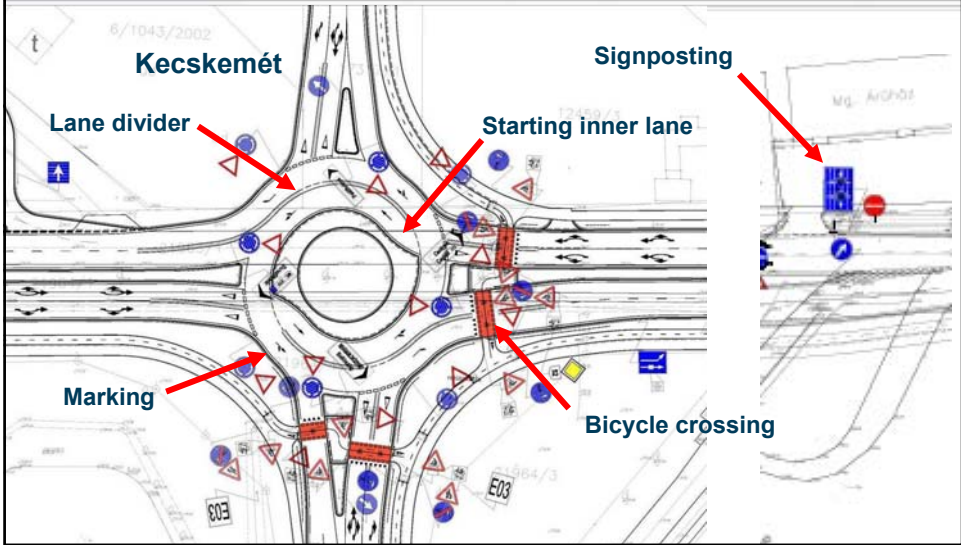
Multilane roundabout explorer: result turbo roundabout

Maximum saturation rate	Max VG	0,55	ri. WL
Maximum average delay	Max Tgem	13,2 s/pae	ri. OL
Maximum average waiting queue	Max Ngem	2,2 vtg	ri. WL

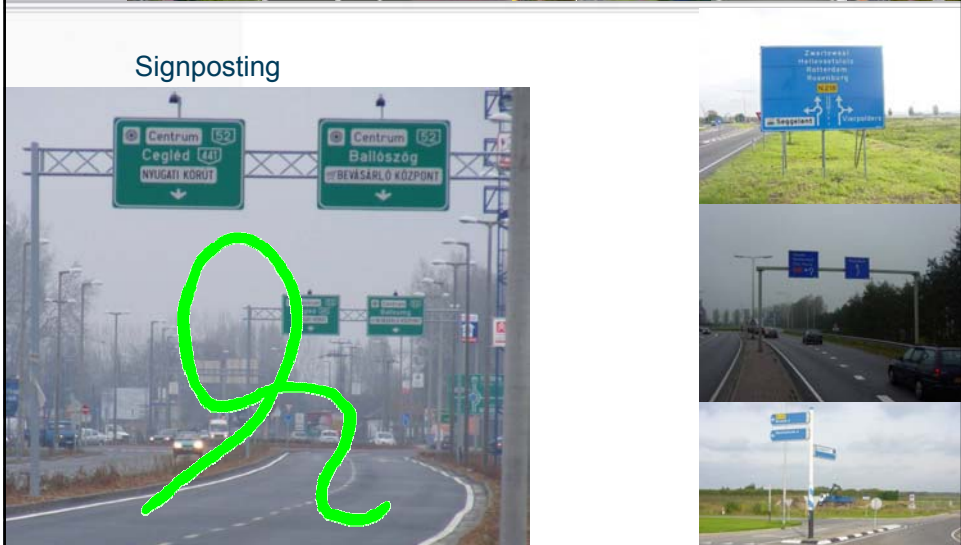
Naam: Example Circle
 Plaats: City name
 Tijd: Morning peak hour 07:30 - 08:30
 Omschrijving: Alternative 1

http://www.royalhaskoning.com/Royal_Haskoning/infrastructure_and_ports/en-GB/News/Roundabouts.htm

HU experience



HU experience





Signposting

High enough?



Signposting

Visibility of sign and approaching vehicles



HU experience



Marking

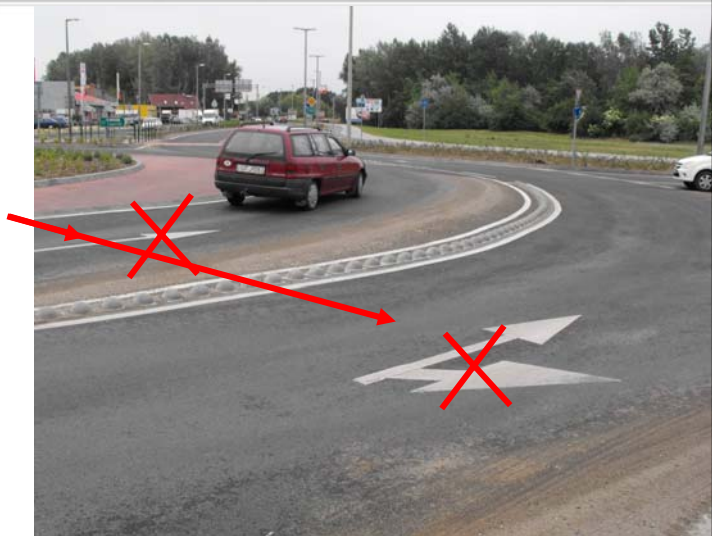


HU experience



Marking

No marking
on the circle

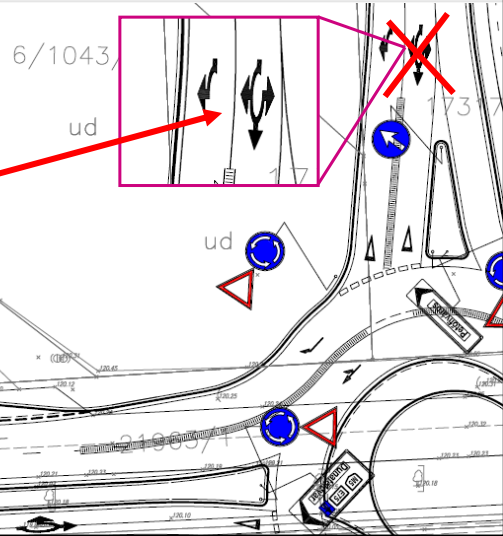


HU experience



Marking

No right turn arrow, despite the possibility



HU experience



Lane divider



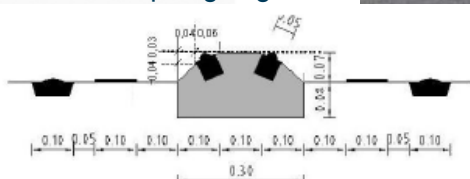
HU experience



Lane divider

Not motorcycle friendly

Reflectors for visibility
Snow ploughing



Lane divider, changed for snow ploughing

HU experience



Bicycle crossing



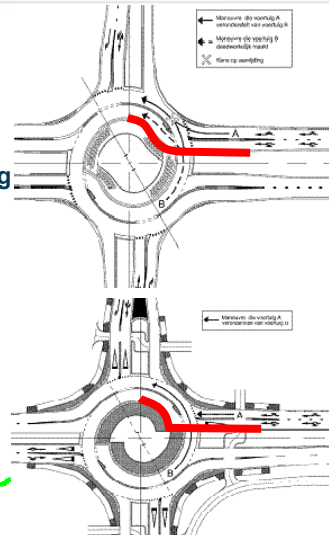
HU experience



Starting inner lane



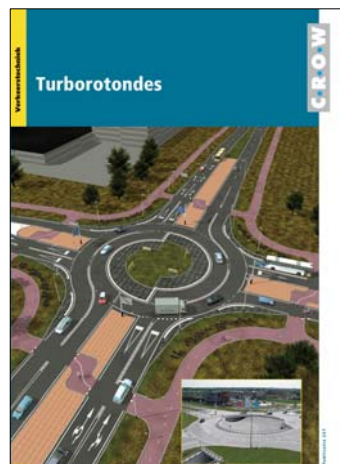
Smooth
Confusing



Future developments



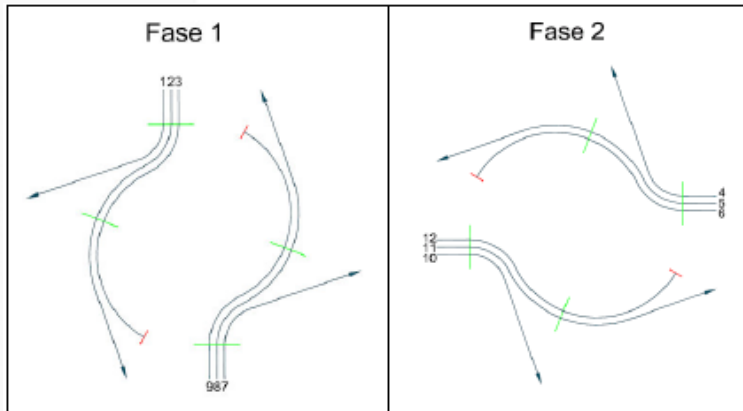
- Effect studies:
 - Road safety
 - Capacity
- Improvements
- Signalized turbo roundabouts



Signalized turbo roundabouts



- 2 phase regulation:
Big distance between exit and entrance lanes



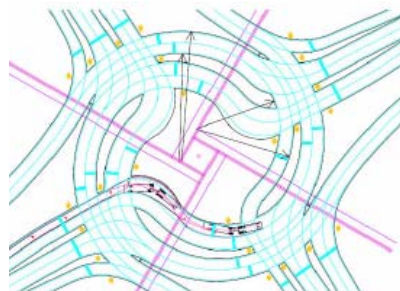
Signalized turbo roundabouts



- Characteristics:
 - Capacity: 10,000 – 12,000 pcu/h
 - Diameter \pm 110 meter
 - Road users experience normal signalized junction, with curved lanes
 - Speed is low in comparison to normal signalized junctions



- Advantages:
 - High capacity
 - Little spatial need
 - No fly over needed (low costs)
 - Possible passage by two trucks simultaneously (in all directions)



Conclusions



- Roundabout is a safe junction shape
- Turbo roundabout has high capacity
- Areal need is limited
- Safety cyclists and pedestrian point of concern
- Signalized turbo roundabouts need improvements

Recommendations



- Continue to develop turbo roundabouts in Hungary
- Evaluate the experiences
- Improve the design
- Make good use of foreign (Dutch) experience



ROYAL HASKONING

I'm sorry for my long presentation;
I didn't have the time to make it shorter.

Freely to: Blaise Pascal (1623-1662)



ROYAL HASKONING

Thank you for your attention!

www.royalhaskoning.com
w.vanderwijk@royalhaskoning.com