Congratulations!

MAGYAR ÜTÜGYI TÁRSASÁG
HUNGARIAN ROAD SOCIETY • UNGARISCHE GESELLSCHAFT FÜR STRASSENWESEN

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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
Royal Haskoning in Hungary

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

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
Manual Roundabouts:
- Published in September 2009
- About all types of roundabouts
- In English
- With CD-ROM
- Useful as basis for country manuals
- Initiative Dutch Ministry of Transport
  - Program to exchange knowledge
    - Related to road infrastructure
    - New and future EU member states
    - Window 3: Safe Road Design

Freely available from website:
www.royalhaskoning.com

Complete link:
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

### Risk figures:

<table>
<thead>
<tr>
<th>Type of junction</th>
<th>Accidents with injuries per million motor vehicle kilometers</th>
<th>Victims per accident with injuries</th>
<th>Fatalities per victim</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 legs with traffic lights</td>
<td>0,13 0,15 0,09 0,08</td>
<td>1,21 1,19 1,92 1,56</td>
<td>0,04 0,05 0,07 0,06</td>
</tr>
<tr>
<td>4 legs with traffic lights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 legs without traffic lights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 legs without traffic lights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roundabout (without traffic lights)</td>
<td>0,06</td>
<td>1,18</td>
<td>0,04</td>
</tr>
</tbody>
</table>
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 à 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

Give way to CARS
Manifestations

- Turbo roundabout (basic shape)

- Egg roundabout

- Knee 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

<table>
<thead>
<tr>
<th>Single lane</th>
<th>VG</th>
<th>ri</th>
<th>T_{gem}</th>
<th>ri</th>
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<tbody>
<tr>
<td>1st rotonde</td>
<td>1.44</td>
<td>O</td>
<td>9999999.9</td>
<td>O</td>
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<tr>
<td>Passeerb. rotonde</td>
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<td>20.5</td>
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<tr>
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<td>27.3</td>
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<tr>
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<td>15.4</td>
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<tr>
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<td>Z</td>
<td>32.0</td>
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<td>O</td>
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<td>0.85</td>
<td>ZL</td>
<td>27.3</td>
<td>ZL</td>
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<td>22.1</td>
<td>OR</td>
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<td>17.8</td>
<td>ZR</td>
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<td>9.0</td>
<td>OL</td>
</tr>
</tbody>
</table>
Multilane roundabout explorer: result turbo roundabout

Characteristics

Maximum saturation rate
Max VG 0.55
Max Tgem 13.2 s/paeg
Max Ngem 2.2 vtg

Maximum average delay
Tijd: Morning peak hour 07:30 - 08:30
Omschrijving: Alternative 1

Maximum average waiting queue

HU experience

Signposting

High enough?

Visibility of sign and approaching vehicles

HU experience
HU experience

Marking

No right turn arrow, despite the possibility

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
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Signalized turbo roundabouts

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

Characteristics:
- Capacity: 10,000 – 12,000 pcu/h
- Diameter ± 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
I'm sorry for my long presentation; I didn't have the time to make it shorter.

Freely to: Blaise Pascal (1623-1662)

Thank you for your attention!

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