

# Experiences with Turbo-Roundabouts in Germany

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#### What is a Turbo-Roundabout ?



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Variable number of lanes in the circle (maximum 2)

No lane changes in the circle

Presorting in the entries

New lanes in the circle are added on the inner side



### **Roundabout with spiral marking - Steinen**





#### **Baden-Baden**

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Developed by Werner Brilon in 2003

Finished in 2006

DTV 32.000 veh./24h

Diameter 60 – 65m







#### Markdorf



Finished in 2008

DTV 22.000 veh./24h

Diameter 40 m



#### Zweibrücken



#### Finished in 2008

#### DTV 25.000 veh./24h

#### Diameter 60 m





#### **Research projects**

#### Brilon, Bondzio et al. (2010)

Wissenschaftliche Begleituntersuchung des Turbokreisverkehrs in Zweibrücken.

Accompanying scientific study of the turbo in Zweibrücken

#### Brilon, Geppert (2011)

Verkehrsqualität an zweistreifigen Kreisverkehren unter Berücksichtigung der Abbiegebeziehungen und aktueller Grenz- und Folgezeitlücken.

Comprehensive study on safety and capacity of 2-lane-roundabouts, includes also some turbo roundabouts



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#### Guideline

für Verkehrswesen mbH



Notes on Turbo Roundabouts

Draft 2014



#### Contents

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Application

Properties (Safety, traffic flow)

Capacity

Design

Pedestrians and cyclists



#### **Application**

Turbo Roundabouts are recommended only outside builded areas.

Inside builded areas Turbo Roundabouts are only possible in situations where no cyclists and pedestrians are allowed.



### Safety





#### Safety - Zweibrücken









$$G = \frac{3600}{t_{f}} \cdot \left(1 - \frac{t_{\min} \cdot q_{k,outside}}{3600}\right) \cdot \left(1 - \frac{t_{\min} \cdot q_{k,inside}}{3600}\right) \cdot e^{-\frac{q_{k,outside} + q_{k,inside}}{3600} \cdot \left(t_{g} - \frac{t_{f}}{2} - t_{\min}\right)}$$

| G                     | = | capacity for each entry lane | [pcu/h] |
|-----------------------|---|------------------------------|---------|
| <b>q</b> <sub>k</sub> | = | circulating traffic          | [pcu/h] |
| t <sub>c</sub>        | = | critical headway             | [s]     |
| t <sub>f</sub>        | = | follow-up time               | [s]     |
| $t_{min}$             | = | minimum gap on the circle    | [S]     |



|   | entry type          | critical<br>headway<br>t <sub>c</sub> [s] | follow-up<br>time<br>t <sub>f</sub> [s] | Min. gap on<br>the circle<br>t <sub>0</sub> [s] |
|---|---------------------|---|---|---|
|   | IN1                 |   |   |   |
| 1 | left and right lane | 4,5                                       | 2,5                                     | 1,9   |
|   | IN2                 |   |   |   |
| 2 | single lane         | 4,5                                       | 2,5                                     | 1,9   |
|   | IN3                 |   |   |   |
| 3 | single lane         | 4,3                                       | 2,8                                     | 2,0   |
|   |                     |   |   |   |
| 4 | left lane           | 4,0                                       | 2,6                                     | 1,9   |
| 5 | right lane          | 4,5                                       | 2,7                                     | 2,0   |



| urbo-Kreisverkehr an<br>urbo_Beispiel_KREIS<br>600 / Grünweg<br>lachmittagsspitzenstu  | der B 600<br>EL<br>nde |       |        |       |  |           |         |            |         |         | Fil<br>Tu | e:<br>ırbo_b600.kr | \$   | - 1 | 1 |
|--|------------------------|-------|--------|-------|--|-----------|---------|------------|---------|---------|-----------|--------------------|------|-----|---|
| Capacity, average delay, and queue length - only motorized traffic   |                        |       |        |       |  |           |         |            |         |         |           |                    |      |     |   |
|  | Type of                | q-e-l | q-e-r  | q-c-l | q-c-1  | q-e-dema. | q-e-max | ×          | Reserve | av. dly | L         | L-95               | L-99 | LOS |   |
| Name   |                        | pcu/h | pcu/h  | pcu/h | pcu/h  | pcu/h     | pcu/h   | -          | pcu/h   | \$      | pcu       | pcu                | pcu  | -   |   |
| 1 B 600 West (Rich<br>BAB)   | ung                    | 657   | 986    | 0     | 359  | 1643      | 2040    | 0,81       | 397     | 9       | 2,8       | 12                 | 18   | Α   |   |
| 2 Grünweg  | -                      | 177   | 43     | 666   | 1090   | 220       | 308     | 0,71       | 88      | 39      | 1,7       | 7                  | 9    | D   |   |
| 3 B600 Ost (Richtur<br>City)   | a ᅷ                    | 632   | 948    | 0     | 494  | 1580      | 1799    | 0,88       | 219     | 15      | 4,8       | 18                 | 27   | В   |   |
| 4 Gewerbering  | - fr                   | 178   | 0      | 640   | 1016   | 178       | 314     | 0,57       | 136     | 26      | 0,9       | 4                  | 6    | C   |   |
| 4 Bypass   | -                      | 22    | 2<br>2 | -     | 2  | 784       | 1400    | 0,56       | 616     | 6       | 1         | -                  | 20   | A   |   |
| Aesult: Definition : Geometry of the Turbo-Boundabout   Dverall performance level: D   Calculation settings Image: Bit in the setting in |                        |       |        |       |  |           |         |            |         |         |           |                    |      |     |   |
| KREISEL  |                        |       |        |       | 4<br>4<br>4<br>6<br>7<br>6<br>6<br>7<br>6<br>7<br>6<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7 | 3         | × 44    | ○ 3<br>○ 4 |         |         |           |                    | P    | 1   |   |
|  |                        |       |        |       |  | -         | 1       | C 5        |         |         |           |                    |      |     |   |





### **Geometric design**





Bad experience with multi-lane roundabouts

Restricted view on large roundabouts has influence on the design



#### **Geometric design**







#### **Entry design**

#### Sketch Characterisation Туре ",Turbo-Entry" $(2 \rightarrow 1)$ IN1 IN2 $(1 \rightarrow 1)$ $(1 \rightarrow 2)$ IN3 The entering driver must select his lane on the circle. $(2 \rightarrow 2)$ IN4



#### **Exit design**

| Туре | Sketch | Characterisation                     |
|------|--------|--------------------------------------|
| EX1  |        | "Turbo-Exit"<br>With lane separation |
| EX2  |        |                                      |
| EX3  |        |                                      |
| EX4  |        | Lane reduction                       |

#### Lane separation



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Netherlands: Lane separation with curbs

Germany: Lane separation with marking

curbs impede snow removal for winter service

risks for motor cyclists





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### Lane separation

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#### Lane separation with marking





### Marking



# Fishhooks like in the Netherlands are not allowed in Germany.





#### **Pedestrians and cyclists**

Pedestrian and cyclist crossings are only allowed at single lane entries and exits of Turbo-Roundabouts.





## Thank you for your attention!



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#### Safety – Baden-Baden

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#### **Erfahrungen in Deutschland**



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#### Etwa 10 bis 15 Anlagen realisiert

**Baden-Baden** 

Markdorf

Viernheim

Offenburg

Cottbus

Lennestadt

Zweibrücken

Blieskastel

Webenheim

Singen



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#### Viernheim

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#### Etwa 170 Anlagen realisiert

Positive Erfahrungen hinsichtlich der Kapazität und der Verkehrssicherheit

Merkblatt "Turborotondes" 2008



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