Roundabouts & Access Management

7 July 2016
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  – Welkom
  – Cape Town
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• Summary and Comparison with TRH 26
Why talk about it?

• Signals well established and spacing needs are well understood, at least in theory.
• Roundabout spacing along major arterials, theory and application is not clear.
• Roundabouts within a signalised arterial network and grid network
• Minor intersections and driveways near roundabouts
• It is less about lower order roads and spacing to driveways/minor accesses and more about spacing between major intersections!
Local Research/Guidelines - General

• General Guidelines about Roundabouts:
  – Gautrans: Modern Roundabouts

• Specific Local guidelines addressing Roundabout Spacing:
  – Western Cape:
    • Road Access Guidelines (2002)
    • Access Management Guidelines (July 2016)

• All local guidelines: Spacing of roundabouts similar to that of signals.
International Guidelines (General)

• Germany
• Netherlands
• Spain
• UK
• France
• USA
• Australia
A Martian view of Intersection Spacing on Earth
Welkom, Free State
<table>
<thead>
<tr>
<th>City/Town</th>
<th>General Information</th>
<th>Number of Roundabouts</th>
<th>Typical Spacing (m)</th>
<th>Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Population (1000 ha)</td>
<td>Area (1000 ha)</td>
<td>People/ha</td>
<td>On Major Roads</td>
</tr>
<tr>
<td>Welkom</td>
<td>210 000</td>
<td>59.0</td>
<td>36</td>
<td>35</td>
</tr>
</tbody>
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Milton Keynes, UK
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<tr>
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<td>350 - 800</td>
<td>1.2</td>
</tr>
<tr>
<td>Milton Keynes</td>
<td>230 000</td>
<td>101.0</td>
<td>23</td>
<td>43</td>
<td>258</td>
<td>450 - 1000</td>
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<td>258</td>
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<td>6.0</td>
<td>900</td>
<td>2.6</td>
</tr>
<tr>
<td>Cape Town</td>
<td>3 740 000</td>
<td>1090.0</td>
<td>34</td>
<td>25</td>
<td>315</td>
<td>- 260 - 350</td>
<td>12.6</td>
<td>11 900</td>
<td>0.3</td>
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<td>Typical Spacing (m) On Major Roads</td>
<td>On Minor Roads</td>
<td>All / Major</td>
<td>People / Rdbt</td>
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<td>315</td>
<td>-</td>
<td>260 - 350</td>
<td>12.6</td>
<td>11 900</td>
</tr>
<tr>
<td>Madrid</td>
<td>6 490 000</td>
<td>2 015</td>
<td>32</td>
<td>393</td>
<td>1967</td>
<td>350</td>
<td>220</td>
<td>5.0</td>
<td>3 300</td>
</tr>
</tbody>
</table>
23% ↑ 2%  
Extra travel time

World rank compared to other large cities 1  104/174
Highways (extra travel time) 1  14%
Non-highways (extra travel time) 1  28%
Extra travel time per day 1  25 min
Extra travel time per year 1  96 hr
Most congested day 1  Mon 05 Oct 2015

30% ↑ 1%  
Extra travel time

World rank compared to other large cities 47/174
Highways (extra travel time) 1  25%
Non-highways (extra travel time) 1  32%
Extra travel time per day 1  40 min
Extra travel time per year 1  152 hr
Most congested day 1  Fri 27 Nov 2015
Detail Statistical Analysis of Spacings in each City/Town
Spacing Distribution (Roundabout to Any Intersection) - All Roads

- Cape Town
- Welkom
- Milton Keynes
- Madrid

Distance between Intersections (m)

Percentage Distribution

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800
Closest Spacings – Milton Keynes

Furthest Spacings – Welkom

Few minor roundabouts in Welkom
Unlikely to find any intersection within 50 meters of a roundabout on any road.

Bound to find intersection within 250m Not in Welkom.
Spacing Distribution (Roundabout to Any Intersection) – High Order Roads

Closest Spacings – Milton Keynes
Furthest Spacings – Welkom
Mostly on Major Roadways
Authors Freedom
Fit typical and ignore Milton Keynes
Unlikely to find intersections within 75 meters of a roundabout on any road

80% of accesses / intersections are spaced less than 300m away

90% of accesses / intersections are spaced less than 430m away

Most (>50%) intersections are spaced more than 125m away
So What? High Order Roads

If you need to go closer than 125 m be careful if you go closer than 75 m. Not impossible to go closer but keep that for low order/access roads and low volume accesses.

It is not good practice to allow another intersection within 125 m of a roundabout.
Spacing Distribution (Roundabout to Roundabout) – All Roads

Percentage Distribution

Distance between Intersections (m)

Authors Freedom
Ignore Cape Town and Welkom. Learn from Spain and UK.

Cape Town
Welkom
Milton Keynes
Madrid
Spacing Distribution (Roundabout to Roundabout) – All Roads

Unlikely to find roundabout within 80 meters of a roundabout on any road

80% of roundabouts are spaced closer than 260 m apart

90% of roundabouts are spaced closer than 400 m apart
Spacing Distribution (Roundabout to Roundabout) – Major Roads

- Cape Town
- Welkom
- Milton Keynes
- Madrid
Spacing Distribution (Roundabout to Roundabout) – Major Roads

Step – around 20%:
- Welkom 80% > 200 m
- Milton Keynes 80% > 450 m
- Cape Town 80% > 600 m
- Madrid (no step) 80% > 250 m
- Recommend (min) > 250 m

Careful:
- Welkom – small sample size
- Cape Town: Impact of RAG
Step – around 45 – 50%:

- Welkom: 50% > 500 m
- Milton Keynes: 50% > 600 m
- Cape Town: 50% > 650 m
- Madrid (no step): 50% > 450 m
- Typical (Avg): > 550 m
On major roadways avoid going closer than 250 m. In general, aim for a spacing of 550 – 600 m, which is good practice.
Summary – High Order Roads

• Spacing to any Intersection:
  – Minimum: 50 metres
  – Not an issue if within: 250 metres

• Spacing to another Roundabout:
  – Minimum: 80 metres
  – Not an issue if within: 280 metres
  – Unlikely to be more than: 400 metres

Table 4 Minimum Spacing Recommendations for Intersections on Access Streets

<table>
<thead>
<tr>
<th>Class</th>
<th>Rural</th>
<th>Urban signals</th>
<th>Urban roundabouts and priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 4a</td>
<td>600 - 800 m</td>
<td>200 - 300 m</td>
<td>200 – 300 m</td>
</tr>
<tr>
<td>Class 4b</td>
<td>600 - 800 m</td>
<td>150 - 250 m</td>
<td>150 – 250 m</td>
</tr>
<tr>
<td>Class 5a</td>
<td>450 - 600 m</td>
<td>150 - 250 m</td>
<td>150 – 250 m</td>
</tr>
<tr>
<td>Class 5b</td>
<td>450 - 600 m</td>
<td>150 m</td>
<td>75 - 150 m</td>
</tr>
</tbody>
</table>
Summary – All Roads

• Spacing to any Intersection:
  – Minimum: 75 metres
  – But typically more than: 125 metres
  – Not an issue if within: 300 metres

• Spacing to another Roundabout:
  – Minimum: 250 metres
  – Typical: 550 – 600 metres

<table>
<thead>
<tr>
<th>Class</th>
<th>Rural</th>
<th>Urban signals(*)</th>
<th>Urban roundabouts and priority(*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>8.0 km</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Class 2</td>
<td>5.0 km</td>
<td>800 m ± 15%</td>
<td>800 m ± 15%</td>
</tr>
<tr>
<td>Class 3</td>
<td>1.6 km</td>
<td>600 m ± 20%</td>
<td>600 m ± 20%</td>
</tr>
</tbody>
</table>

(*) These values can be halved for the leg of T-junctions and for one-way streets.