6TH ANNUAL CONFERENCE ON PLANNING RESEARCH

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FCTUC DEPARTAMENTO DE ENGENHARIA CIVIL
FACULDADE DE CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE DE COIMBRA

TURBO-ROUNDABOUT USE AND DESIGN

Session A4 – ROAD TRAFFIC MANAGEMENT

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FCT COMPETE

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BACKGROUND

Conventional roundabouts are excellent solutions for:

- Traffic regulation;
- Traffic calming;
- Urban regeneration and landscaping;
- Etc…

However, the international experience over the last years has been showing some functional problems in double-lane roundabouts:

- Lane changing on the roundabout disregarding lane markings;
- Cut the trajectory curvature;
- Achieve higher speeds.

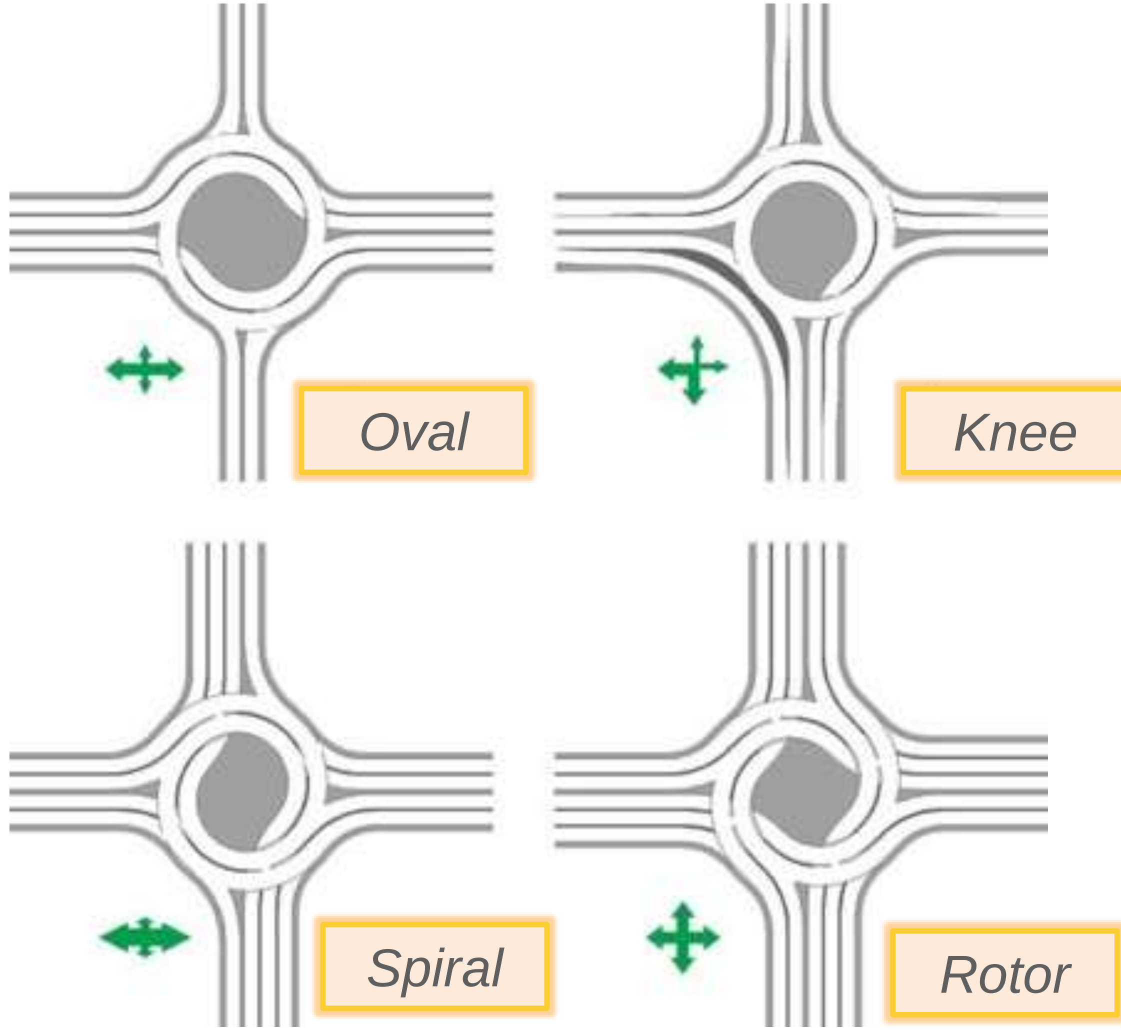
TURBO-ROUNDABOUT CONCEPT

The turbo-roundabout concept emerged in 1996 in the Netherlands.

- The first turbo-roundabout were installed in 2000, also in the Netherlands;
- Nowadays, more than 190 turbo-roundabouts are implemented in the Netherlands and some design guidelines have been published;
- No lane changing on the turbo-roundabout and near the entry and exit;
- Low driving speed near and through the roundabout.

TURBO-ROUNDABOUT CONCEPT

Turbo-roundabout layouts



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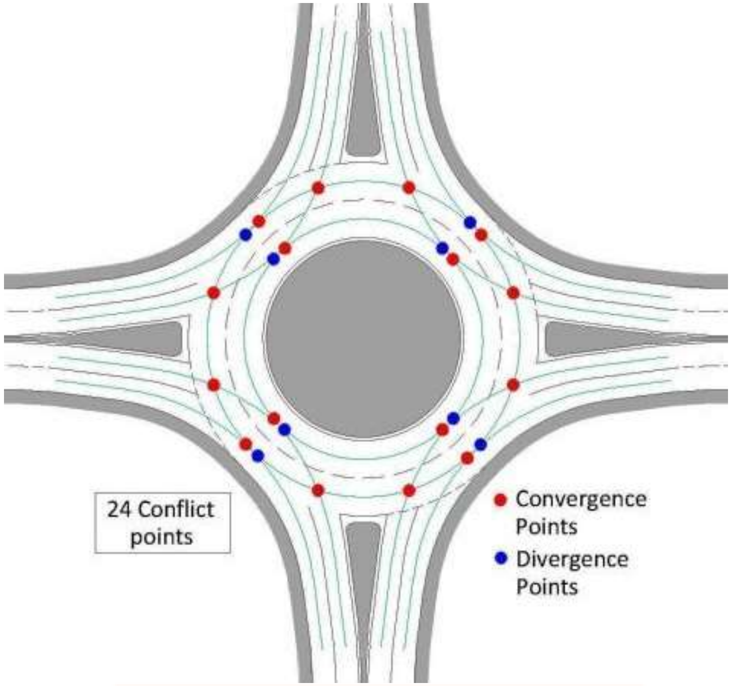
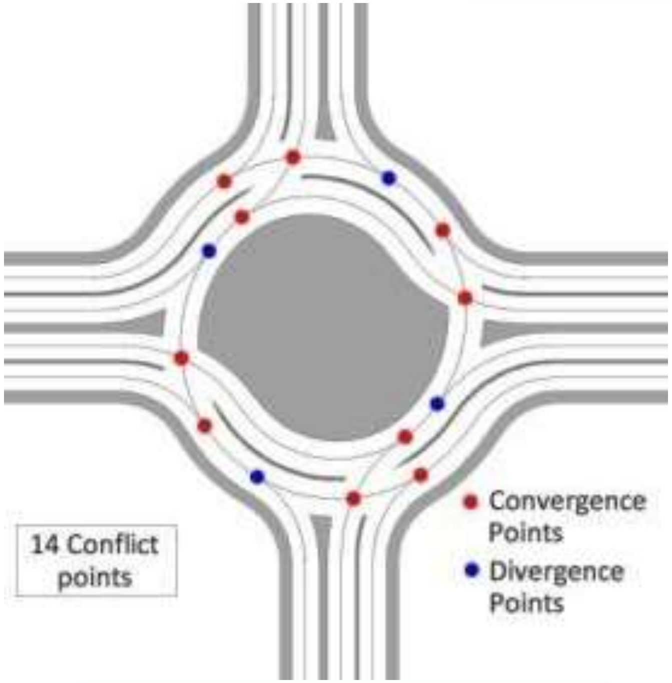
TURBO-ROUNDABOUT CONCEPT

Safety



VS



24 Pontos de Conflito

14 Pontos de Conflito

- Reduction in the number of conflicts;
- Speed reduction along the entry, circulatory and exit zones (48 to 38 km/h);
- Low risk of side-by-side accidents (80% less accidents).

TURBO-ROUNDABOUT CONCEPT

Capacity

Some authors concluded that turbo-roundabouts offer better capacity than conventional roundabouts of similar size.

However, these conclusions are not consensual in the scientific community – recent research disregards these conclusions.

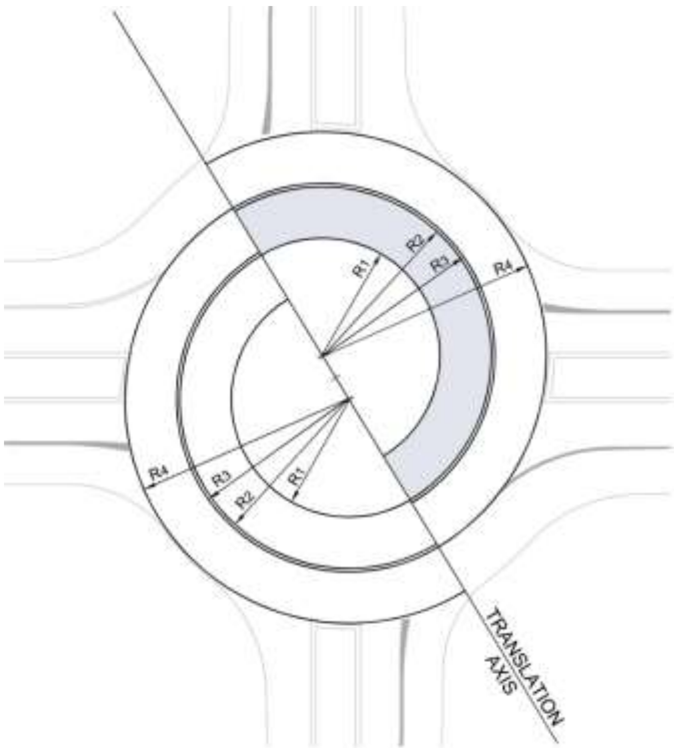
For the standard layout, the capacity in turbo-roundabouts can be slightly above the capacity in conventional double lane roundabouts, when:

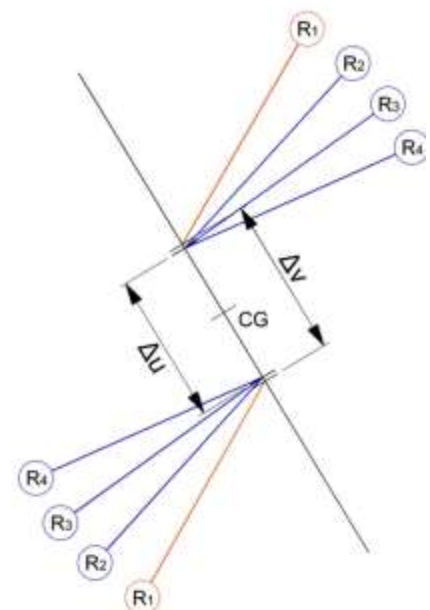
- *Increases the number of right turns on the secondary lane;*
- *Increases the go-ahead movement in the dominant flow;*
- *There is an equilibrated traffic distribution in all arms and directions of the turbo-roundabout.*

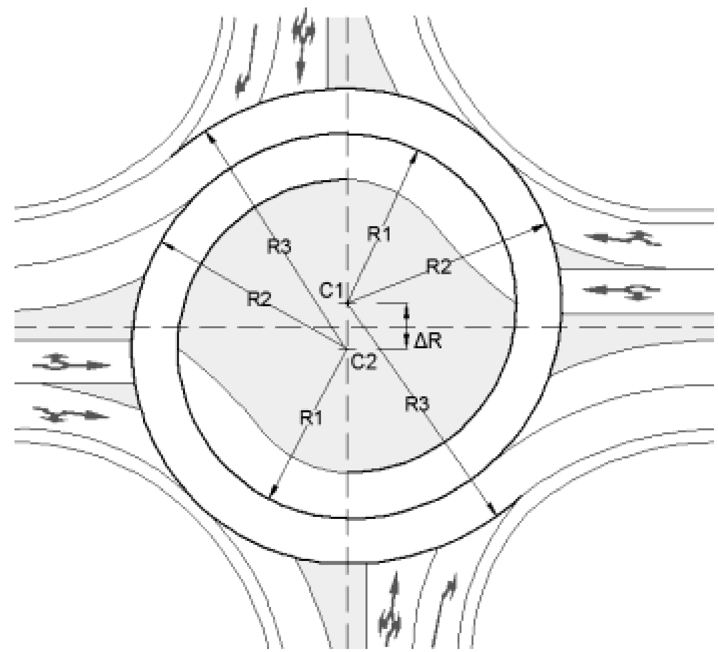
GENERAL DESIGN GUIDELINES

Geometric design

The geometrical shape of a turbo-roundabouts is given by the simultaneous development of two nested spirals.



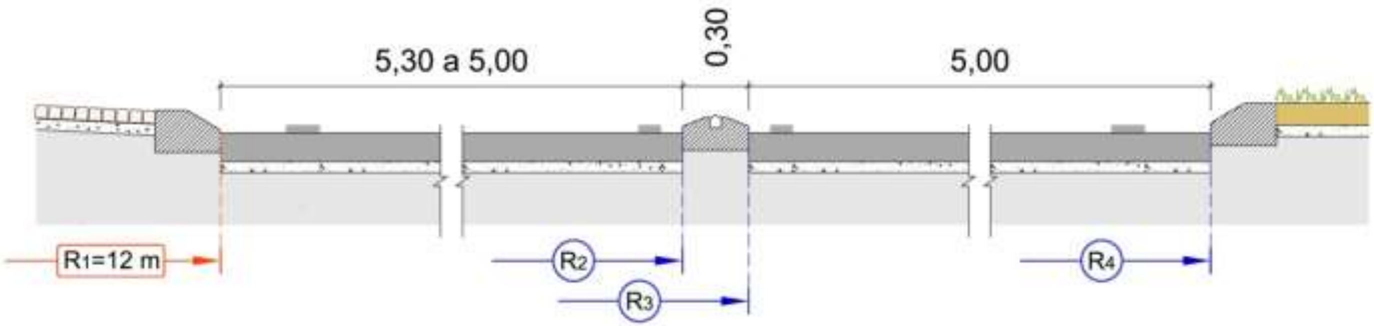




GENERAL DESIGN GUIDELINES

Geometric design

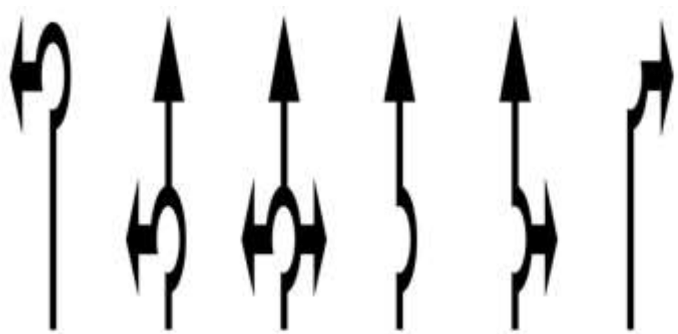
The geometrical design process begin with the definition of the basic dimensions, such as the inner radius of the inside lane (R_1), the width of the traffic lanes (L_i and L_e) and the width of the lane divider (L_s).



Element	Width (m)	
R_1	12.00	
R_2	12.00+5.15=17.15	$R_2 = R_1 + L_i$ (average)
R_3	17.15+0.30=17.45	$R_3 = R_2 + L_s$
R_4	17.45+5.00=22.45	$R_4 = R_3 + L_e$

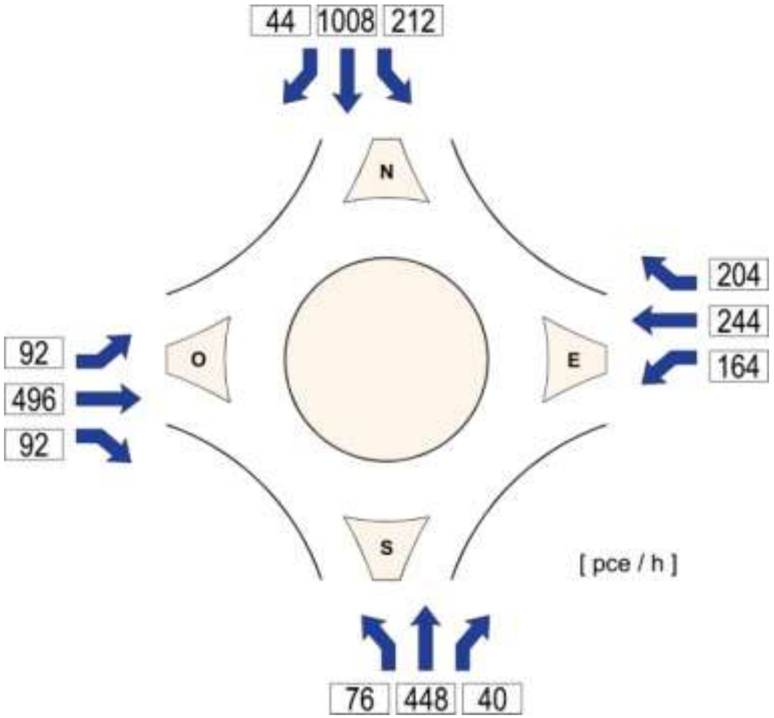
GENERAL DESIGN GUIDELINES

Signing



CASE STUDY

Baden-Powell Square, Lisbon



$$Q_e = 3600 \times \left(1 - \frac{t_{min} \times Q_c}{n_k \times 3600}\right)^{n_k} \times \frac{n_z}{t_f} \times e^{\frac{-Q_c}{3600} \times \left(t_c - \frac{t_f}{2} - t_{mín}\right)}$$

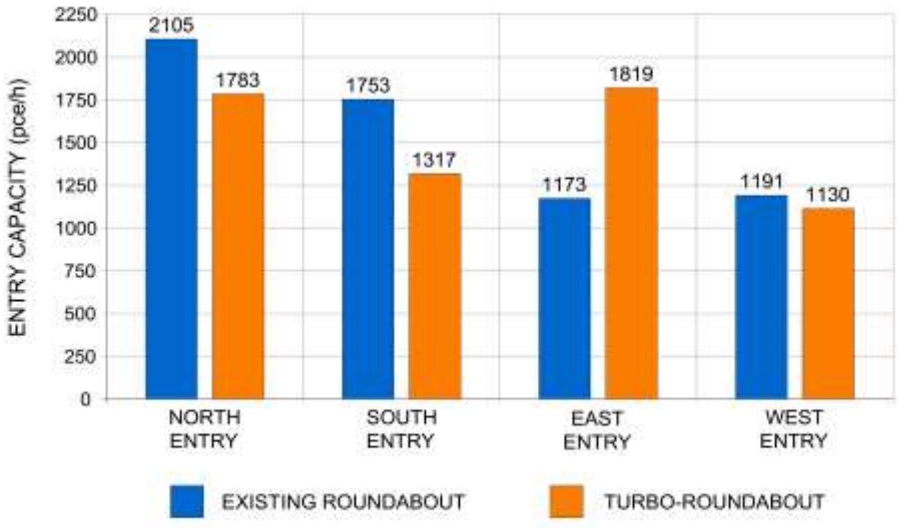
CASE STUDY

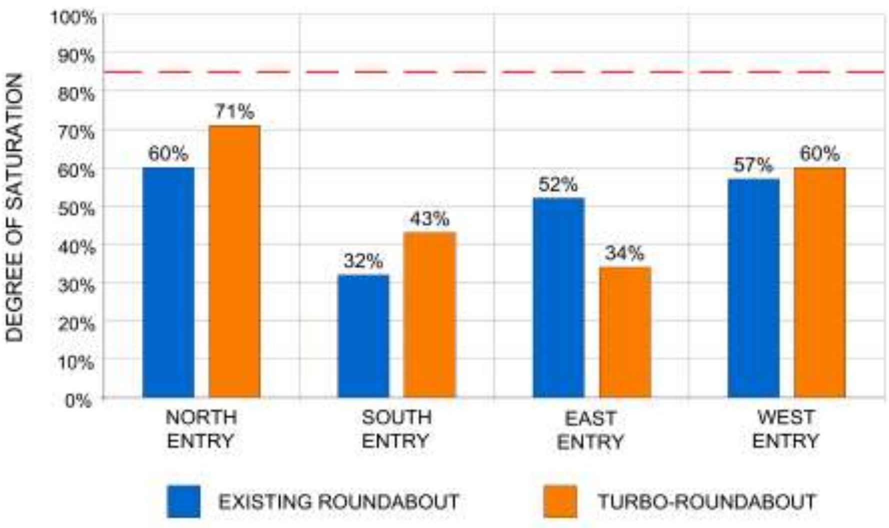
Baden-Powell Square, Lisbon

Element	Dimensions
Entry radius (R_e)	12.00 (m)
Exit radius (R_s)	15.00 (m)
Turbo-block rotation	61º (CW)
Entry/Exit lanes width	3.50 m

CASE STUDY

Baden-Powell Square, Lisbon





Entry capacity

Degree of saturation

CONCLUSIONS

- Compared to the conventional double-lane roundabout, the turbo-roundabout has a reduction of the number of conflict points and the deflexion level control justify the reduction of accidents in 80% as some literature shows.

- The performance in terms of capacity is not consensual. However, in some specific conditions the turbo-roundabout solution can be extremely useful, putting together safety and capacity benefits.

- The applicability of the concept was tested by turning a real roundabout into a turbo-roundabout. The intervention tends to be a positive change resulting in speed reductions and in additional free space.

- At the moment the construction of a real turbo-roundabout in Portugal is being considered and a more extensive study is necessary in order to improve the geometric construction knowledge.

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