BRINGING THE TURBO ROUNDABOUT TO THE USA

WELCOME

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WELKOM

2 Oktober 2018

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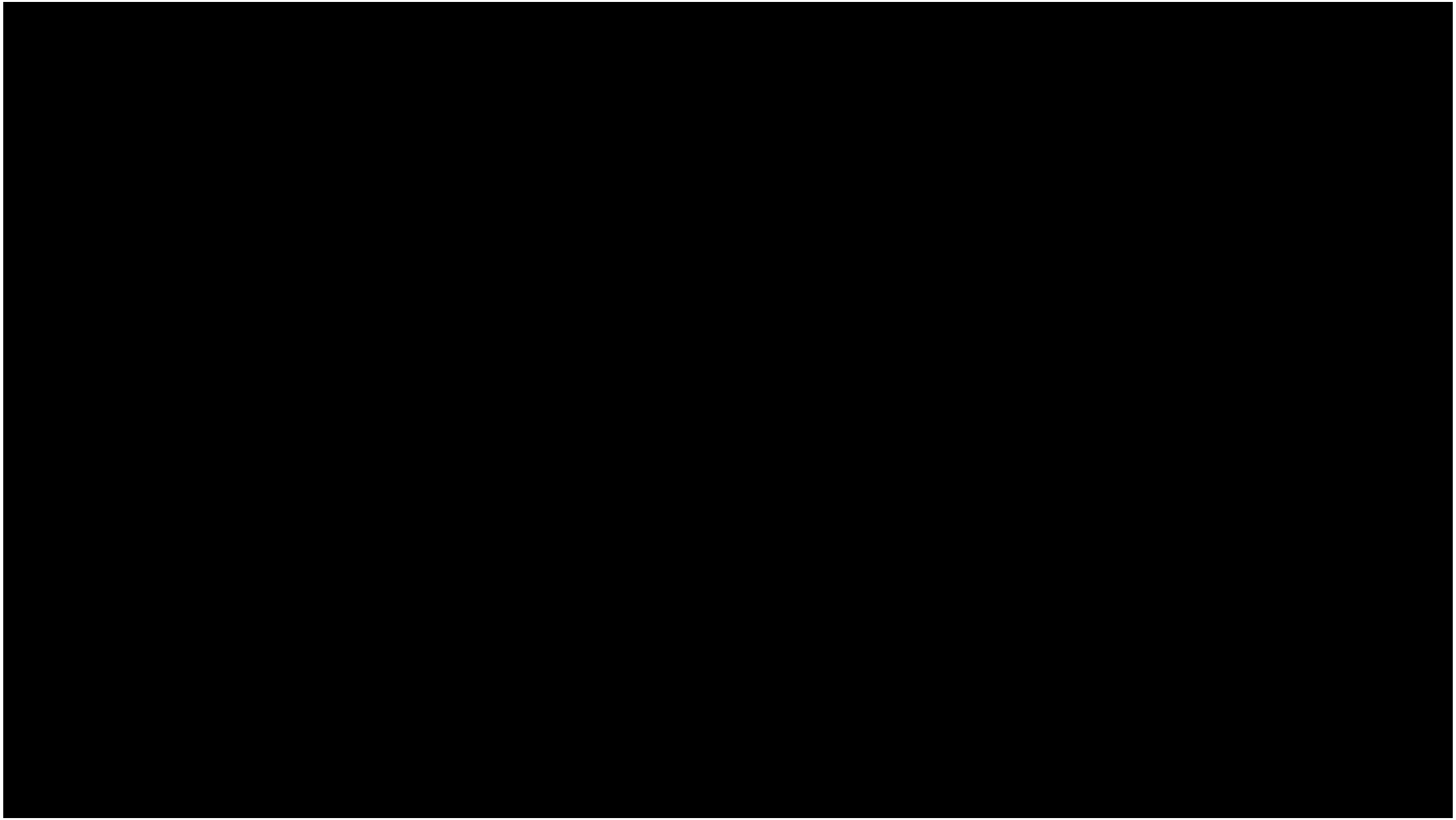
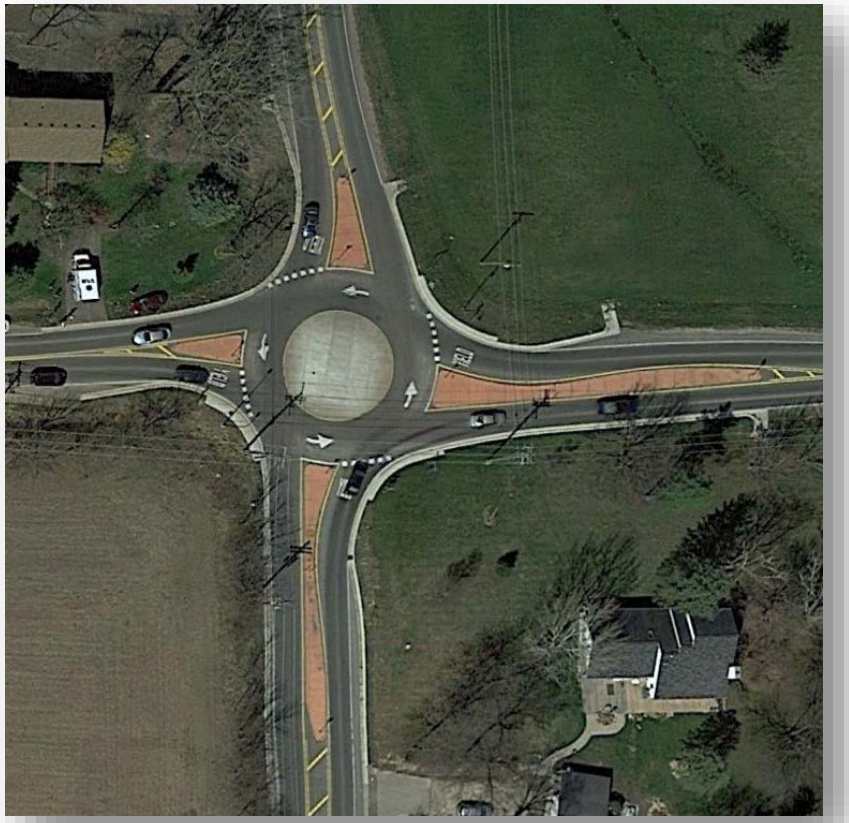
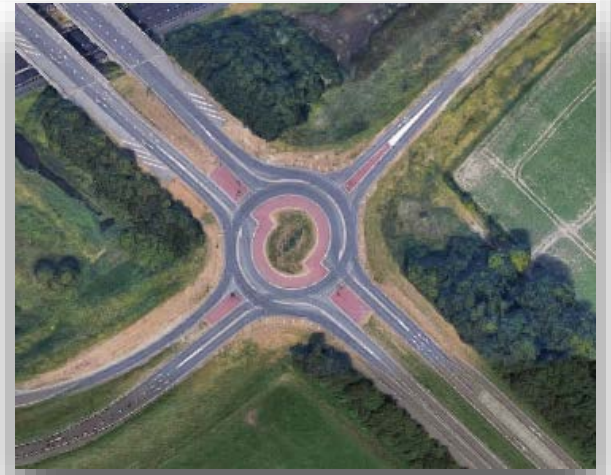
Evolution of Roundabouts



Compact (Mini)



What next?



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Turbo Roundabout Basics

Turbo Roundabout Basics

Turbo Roundabout characteristics:

- No lane changing on the Turbo Roundabout
- Lane choice upstream Turbo Roundabout
- Spiral layout
- Radial approaches

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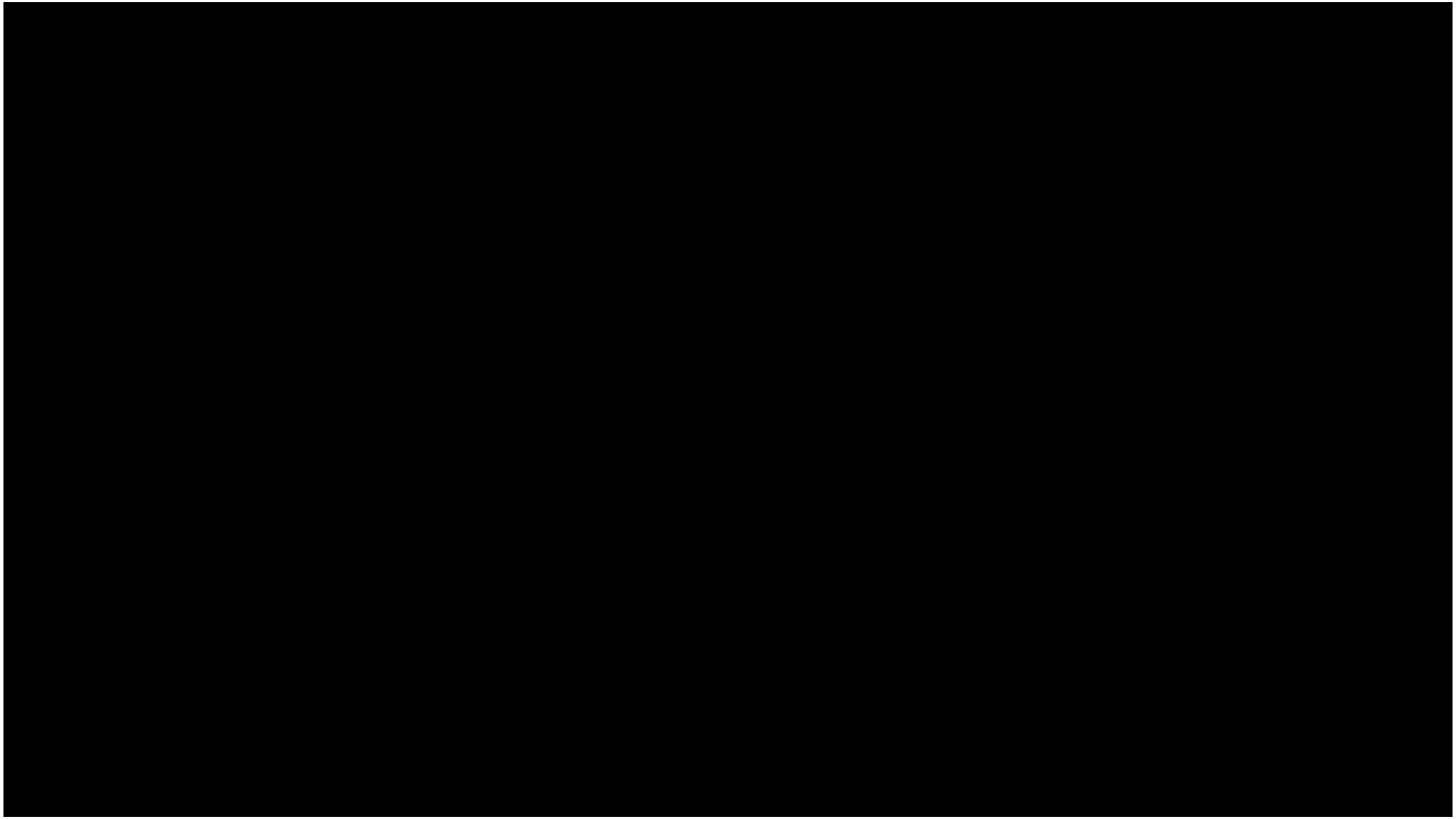
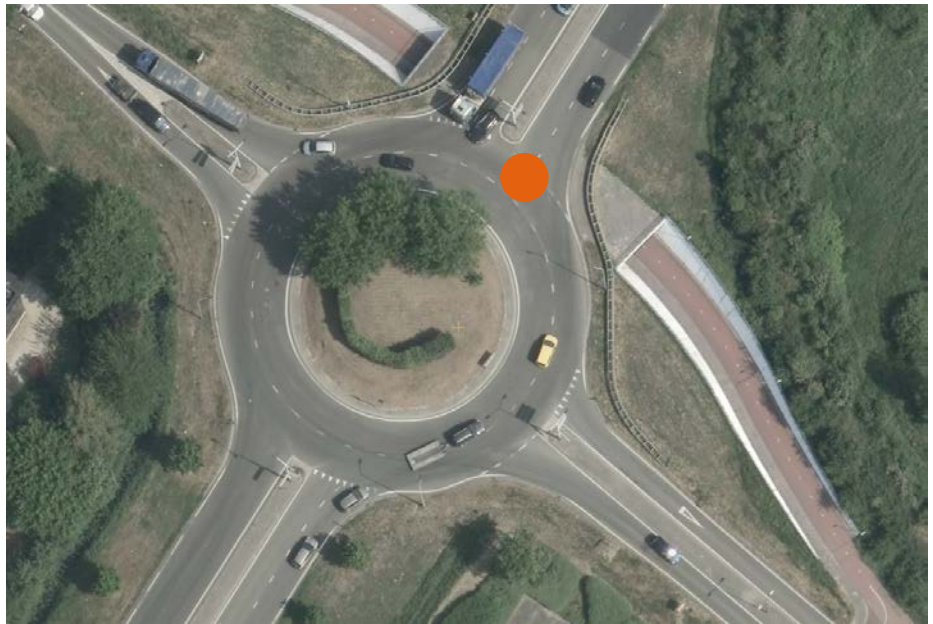
Let’s take a drive



Why Turbo Roundabouts?

Why Turbo Roundabouts?

- Single lane roundabouts introduced in the eighties in the Netherlands
- With the increase of traffic volumes, single lane roundabouts replaced by multilane roundabouts
- Standard multilane roundabout has safety issues: weaving conflicts

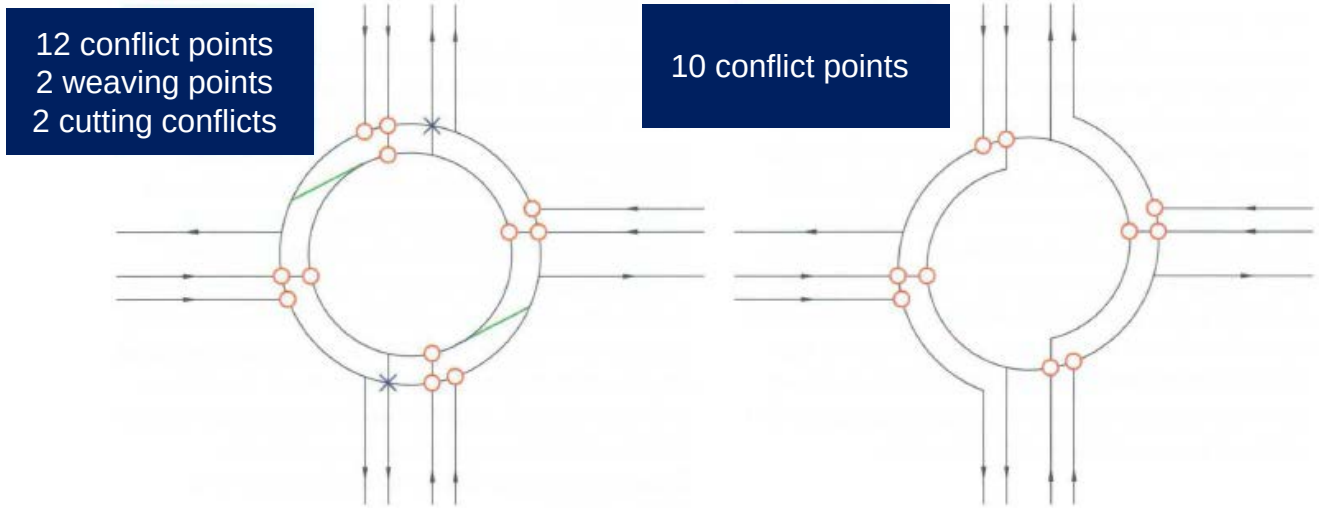


Why Turbo Roundabouts?

- **Challenge:** design a layout which eliminates the safety conflicts and increases capacity
- **Result:** spiral shaped Turbo Roundabout without lane changing on the roundabout
- **Why the name Turbo Roundabout?** Refers to the improved traffic flow (compared to a standard multilane roundabout)

Why Turbo Roundabouts?

- Turbo Roundabout reduces the number of conflict points
- Weaving and cutting conflicts are eliminated
- 2016 study by Christiaan Vos
  - 53% reduction in crashes
  - Multilane roundabout to turbo roundabout



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From multilane roundabout to turbo roundabout

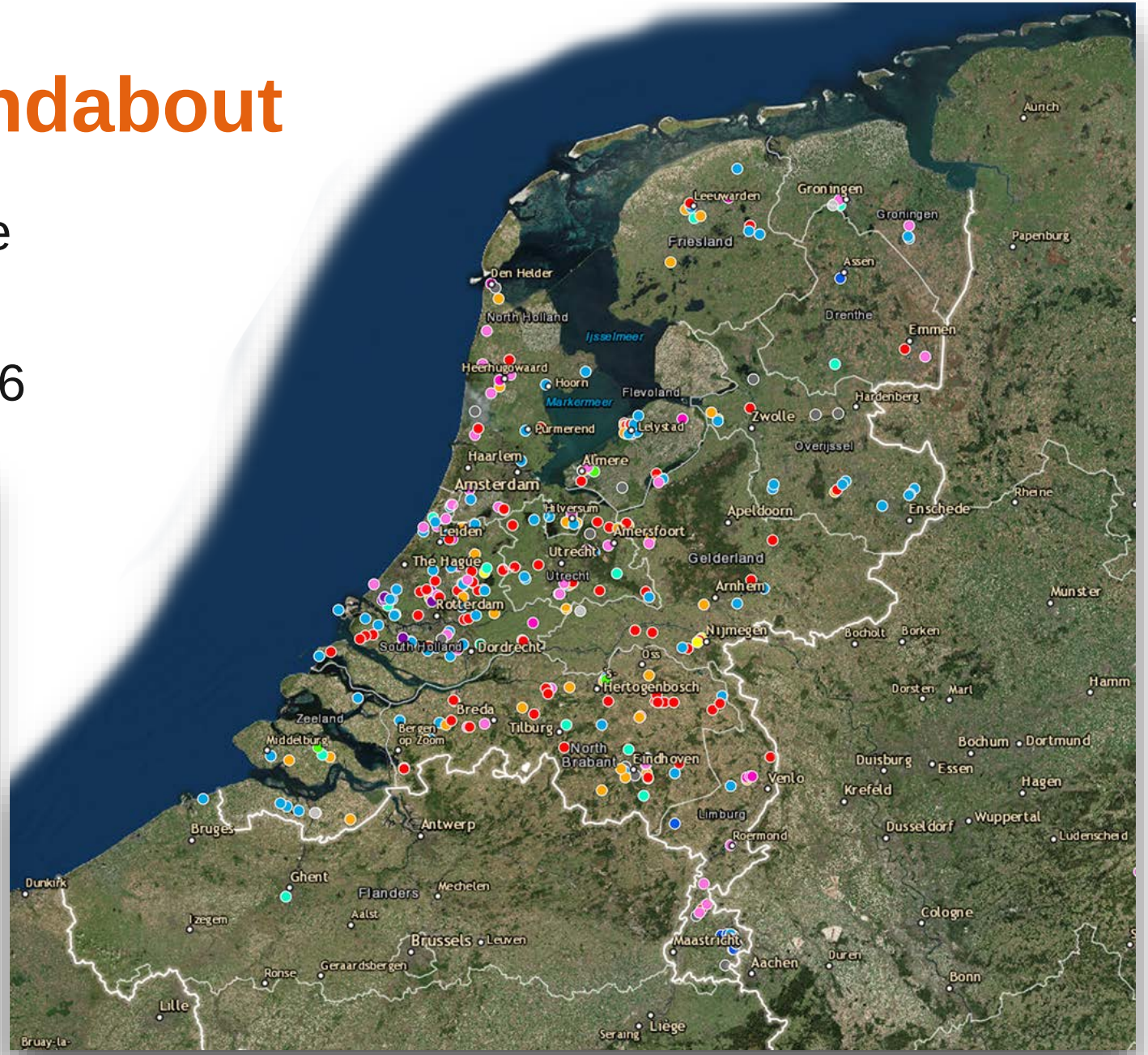
2004-2011		3 jaar VOOR	3 jaar NA	Totaal
		Type kruispuntvorm		
Slachtoffer ongevallen		Tweestrooks / meerstrooks rotonde	Turbo-vorm	
Aantal rotondes in selectie	Ni	17	17	34
Aantal Slachtoffer ongevallen	Oi	17	8	25

-53%

History of Turbo Roundabout

History of Turbo Roundabout

- Over 300 turbo roundabouts in the Netherlands
- Invented by Bertus Fortuijn in 1996



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Design

Design

- Design criteria incorporated in the Dutch national guideline for Turbo Roundabouts:
- CROW publication 257

Design

Number of entry lanes

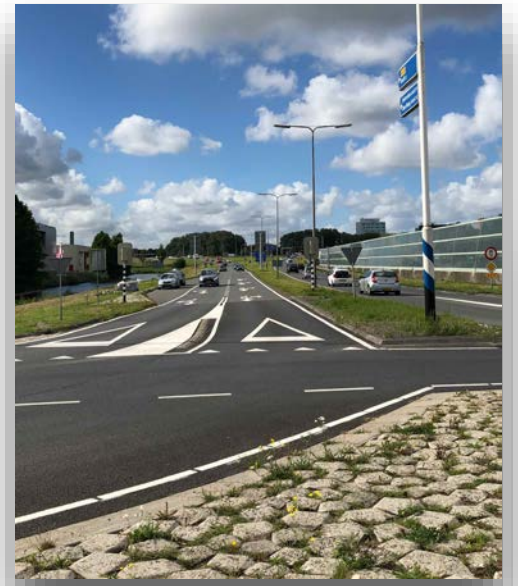
- 1, 2 or 3 entry lanes is common
- Some with up to 7 lanes

Design

Number of exit lanes

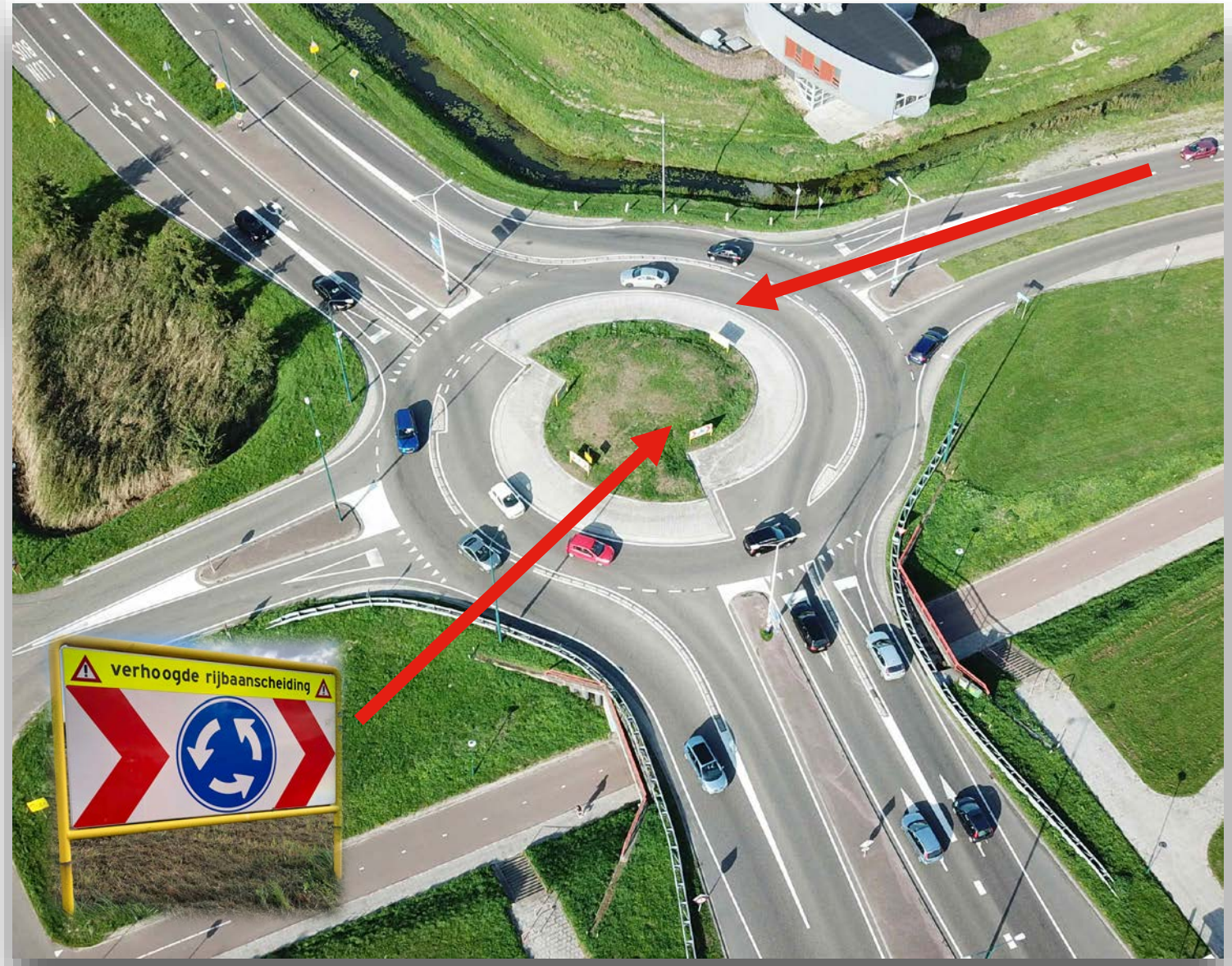
- One or two

Design



Radial Design

- Smaller crossing than most in the US
- Signage in front of driver is important
- Use on low speed and high speed approaches



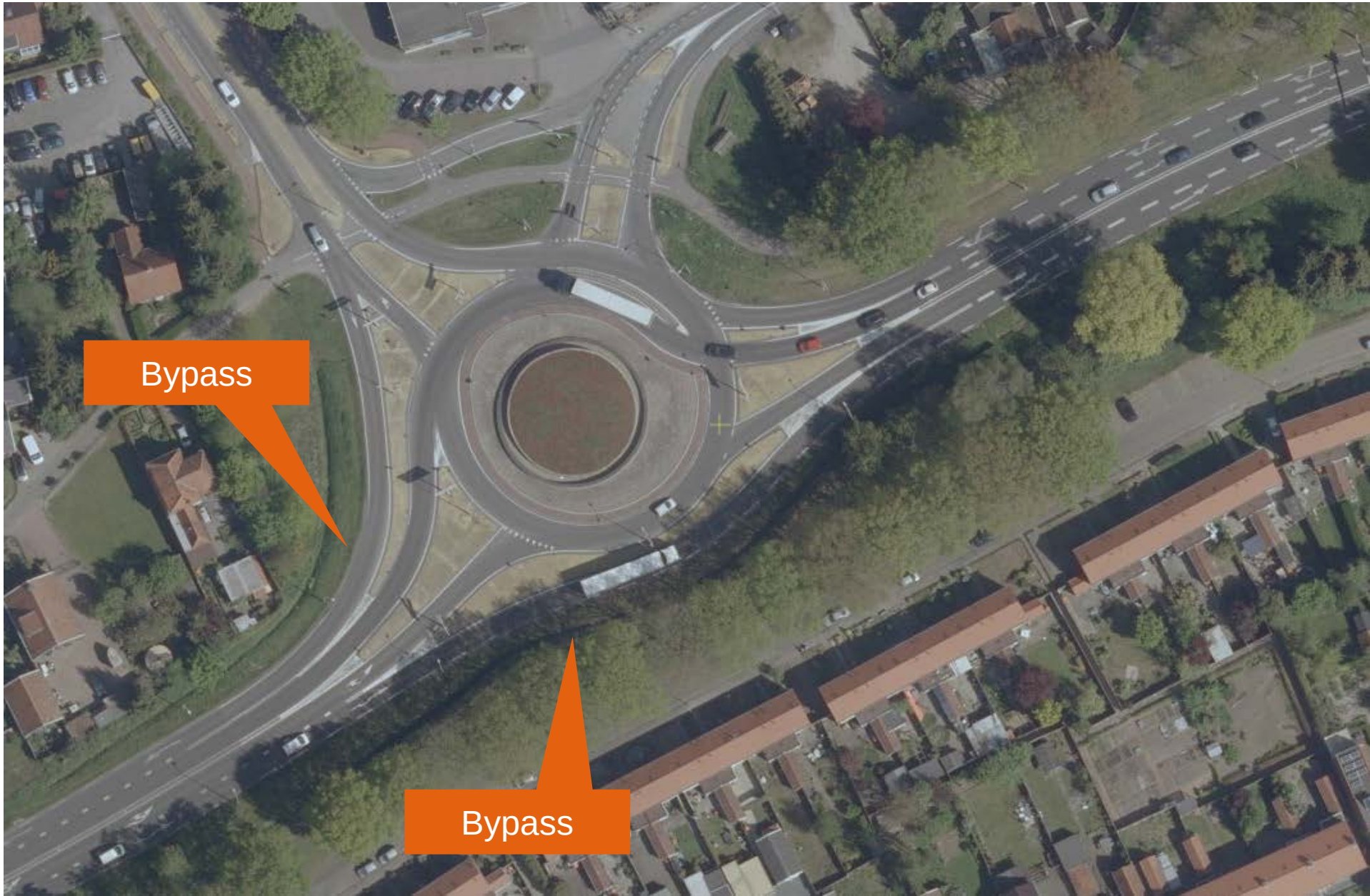
Traffic safety

Design philosophy:

- A safe design by geometry
- Radial design results in:
  - Short crossing distance to the middle lane of the Turbo Roundabout
  - Small conflict area
  - Good sight lines (don’t need to look over the shoulder)
- Low speeds on the Turbo Roundabout and a short crossing distance are also beneficial for capacity!

Design

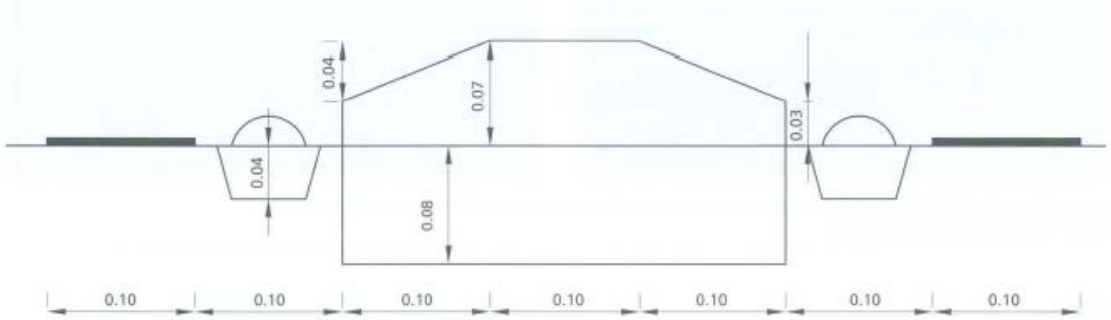
Bypass



Design

Lane separation

- Elevated separation



Figuur 67. Verhoogde scheidingsband met belijning en reflectoren [N218 Brielle]

Figuur 68. Het is duidelijk wat de consequenties zijn als de scheidingsbanden niet worden verzonken in het wegdek, maar erop geplakt worden [Veghel Corridor-Kennedylaan]

Figuur 69. De voorkeursoplossing, met reflectoren op de scheidingsband en tussen de scheidingsband en de belijning

Design

Marking

Figuur 109. Als tegenover de toerit een nieuwe binnenste rijstrook ontspringt, begint de belijning van het overrijdbare gedeelte tussen de rijstroken bij de verkeersdruppel [N472 Bergschenhoek]

Figuur 110. Als het verkeer een reeds gekozen rijstrook moet volgen, wordt een combinatie van een doorgetrokken en een onderbroken streep toegepast [N218 Oostvoorne]

Figuur 111. Belijning vóór de rotonde, langs de rijstrookscheiding [N218 Oostvoorne]

Figuur 112. Belijning op de rotonde, aan beide zijden van elke rijstrook [Heerlen Imstenraderweg – N281]

Bikes and Peds

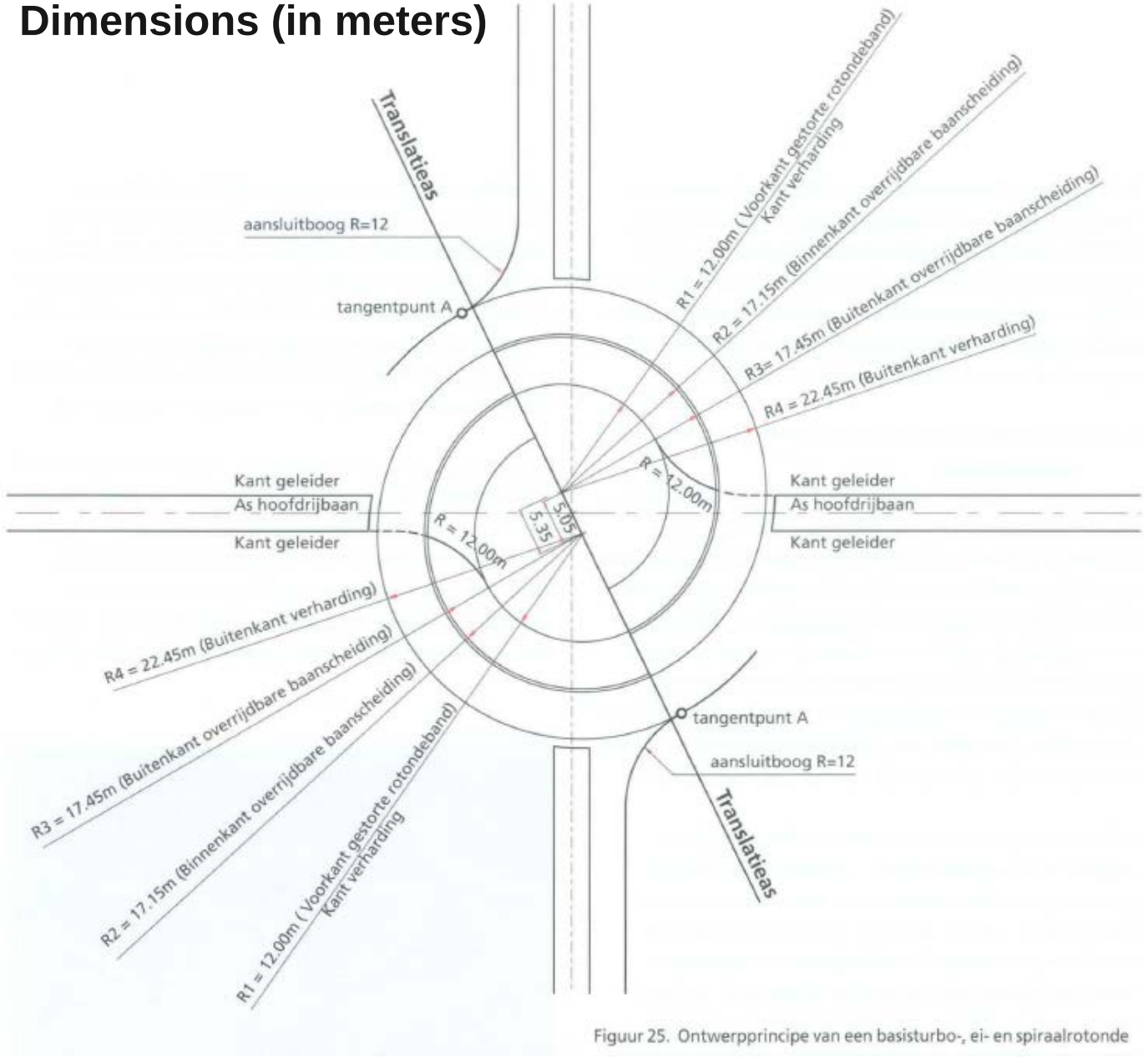
Bikes and Peds

Design

Size

- Dependent on:
  - Number of lanes
  - Design vehicle
- Single lane: ~120-feet
- Two lane: ~170-feet
- Typically design speeds between 20 and 25-mph

Dimensions (in meters)

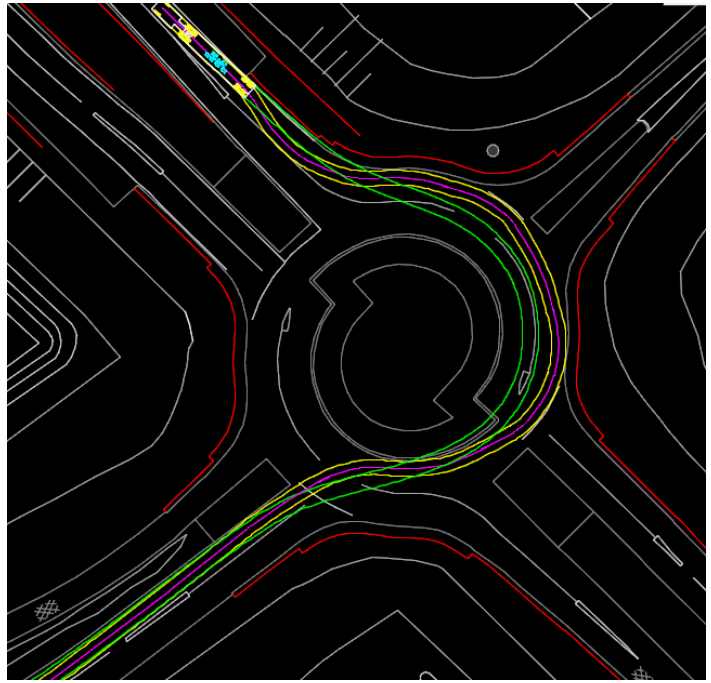


Figuur 25. Ontwerpprincipe van een basisturbo-, ei- en spiraalrotonde

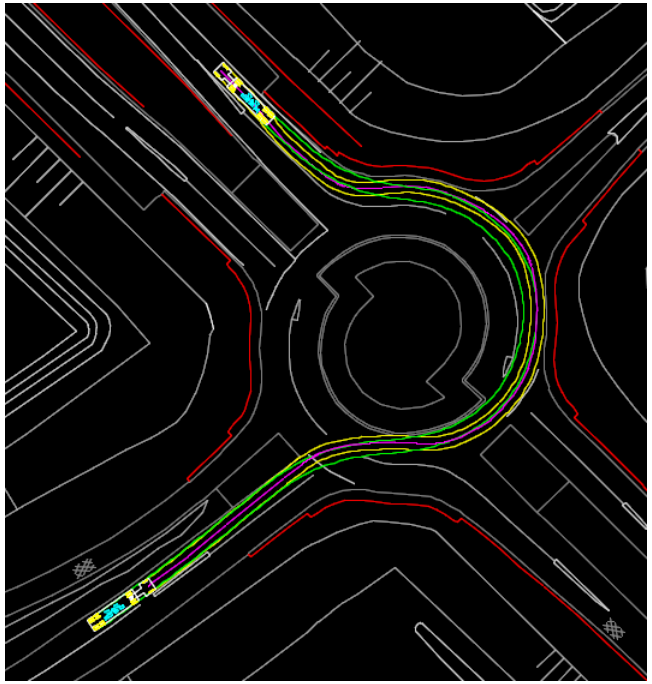
Trucks

Trucks

- Typical Dutch truck ~WB-50
- WB-62 truck through a Dutch roundabout (165’ diameter)
  - WB-40 works well
  - WB-62 requires a slightly larger diameter (180’)



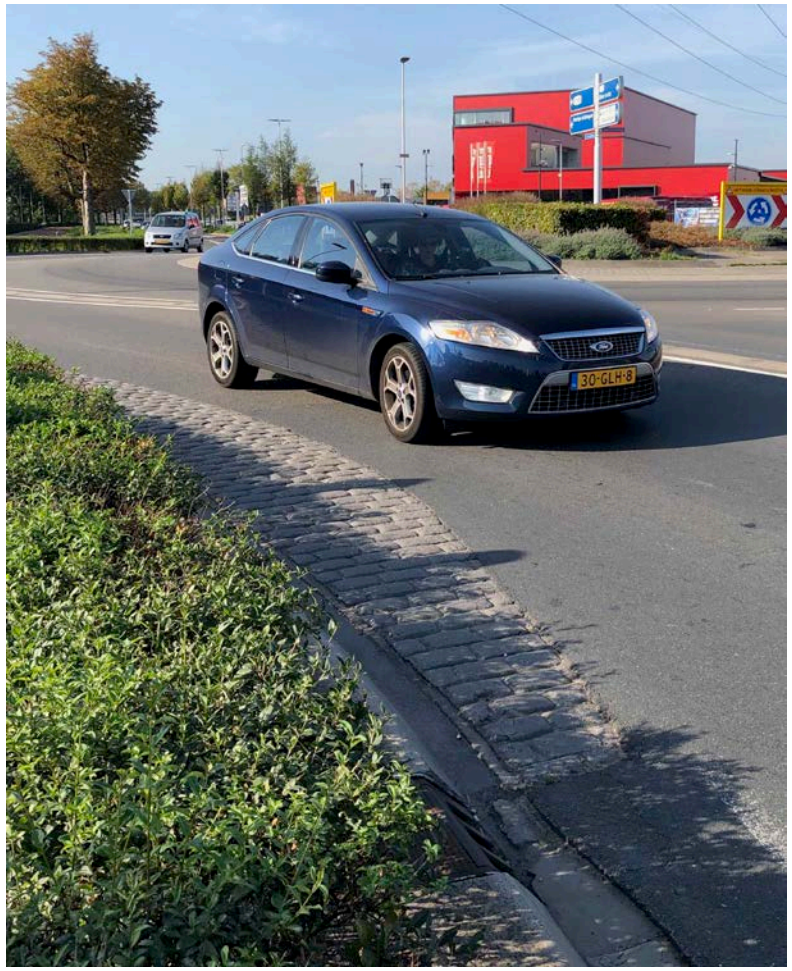
WB-62



WB-40

Trucks

- Different type of material for trucks
- Cars stay off



Traffic flow

Capacity of intersection alternatives

Theoretical capacity (sum of all approaches)

Entering and conflicting volumes

1-lane roundabout

2-lane roundabout

Turbo Roundabout

(Signalized) intersections

Tabel III.1. Praktische en theoretische capaciteit van verschille[n] kruispuntvormen [14, 31]

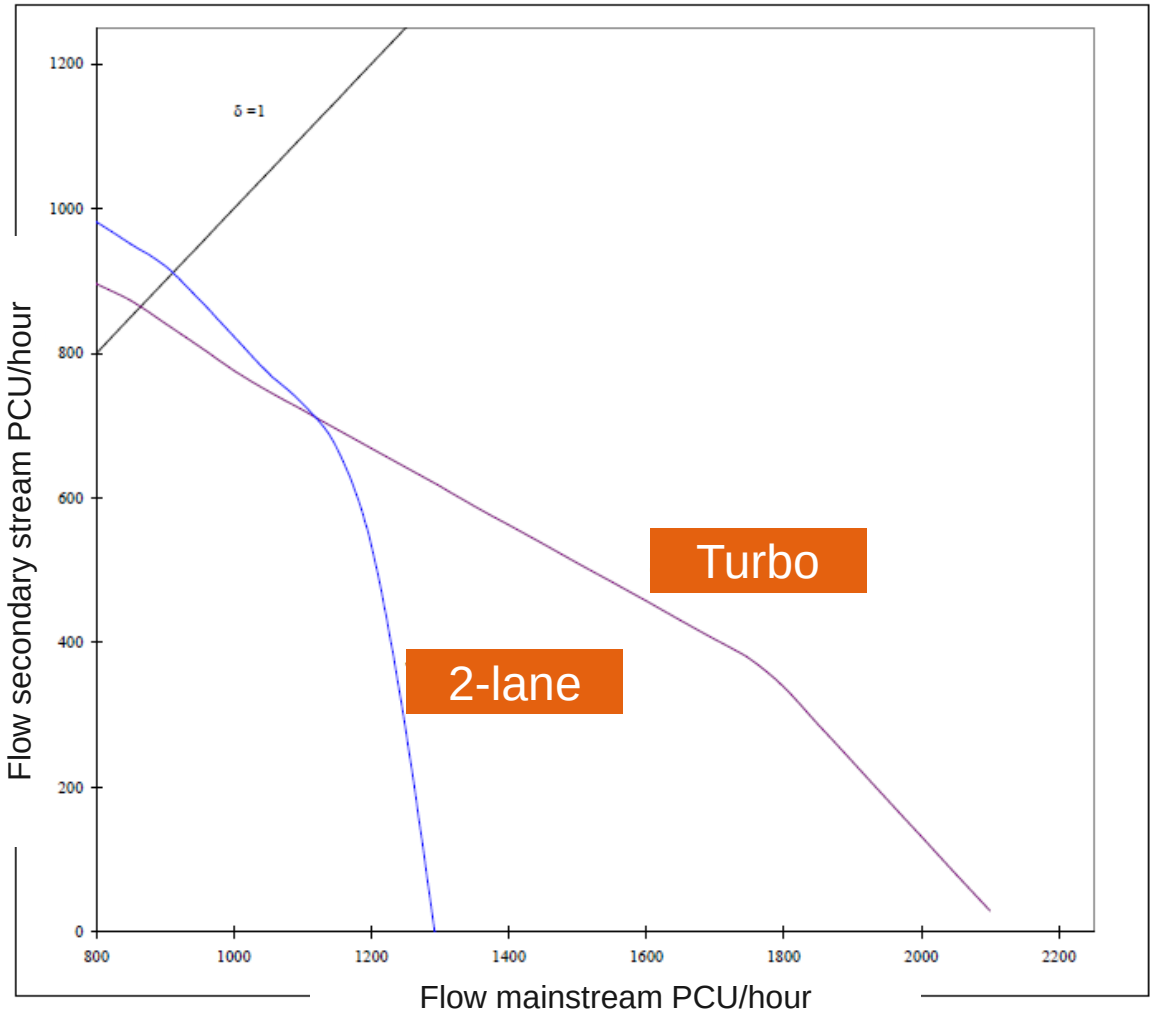
Kruispuntvorm	Capacite[it] in spitsuur van alle toeritten [s]amen, in mvt/h (≈10% van de etma[a]lcapaciteit)		Maat[g]evende conflic[t]belasting toerit + rotondetak, in pae/h
	praktisch	theoretisch	
Enkelstrooksrotonde	2.000	2.700	1.100 - 1.500
Tweestrooksrotonde met eenstrookstoeritten en -afritten	2.200	3.600	1.500 - 1.800
Tweestrooksrotonde met tweestrookstoeritten en eenstrooks-afritten	3.000	3.600	1.800 - 2.000
Tweestrooksrotonde met tweestrookstoeritten en -afritten	3.500	4.000	2.100 - 2.400
Turborotonde basisvorm (zie figuur 12)	3.500	3.800	1.900 - 2.100
Spiraalrotonde (zie figuur 12)	4.000	4.300	2.000 - 2.300
Rotorrotonde (driestrookstoeritten, tweestrooks-afritten, zie figuur 12)	4.500	5.000	2.500 - 2.800
Turboverkeersplein (per toevoertak 3 × 2 rijstroken, zie hoofdstuk 7)	8.500	11.000	4.200
Voorrangskruispunt (met eventueel linksafvakken)	1.500	1.800	1.100
Viertakskruispunt met VRI (per toevoertak 3 × 1 rijstrook)	3.500	4.000	3.800
Viertakskruispunt met VRI (per toevoertak 3 × 2 rijstroken)	7.500	8.000	3.800

Traffic flow

Comparison:

Turbo roundabout vs Two-lane roundabout

- Turbo Roundabout has higher capacity in situations where volume on **main** road is larger than volume on **secondary** road



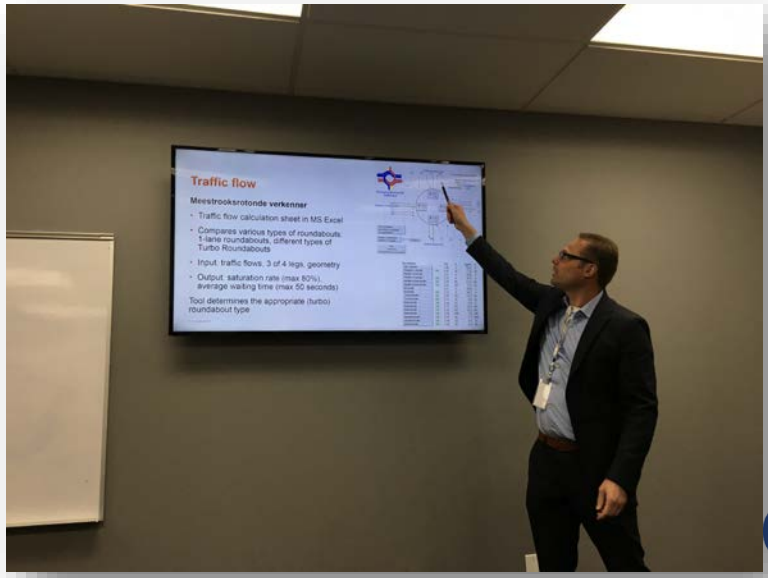
Turbo Roundabout Implementation in US

Steps for implementing in the US:

- Minor adjustments to fit US design vehicles
- Calibration and validation of US driving behavior (calculation sheet and simulation)
- Look at specific conditions (snow plowing, etc.)
- Introduction of the concept: understanding of the concept by the drivers
- Monitoring and evaluation of driving behavior, traffic safety and traffic flow (capacity)
- Start with a simple turbo roundabout

The Future of Turbo Roundabouts in the US

- FHWA Advancing Turbo Roundabouts in the US project
- FHWA Multi-Lane Roundabout Crash Pooled Fund project
- Florida DOT Turbo Roundabout project



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Federal Highway Administration

FHWA Advancing Turbo Roundabouts in the US

- Literature and Synthesis of Practice
- Design Guidance Translation
- Exploration of Transferability to US
  - Trucks
  - Raised Channelization
  - Approach Alignment (lack of deflection)

'Turbo Roundabout' coming to Arlington intersection

http://www.jacksonville.com/news/metro/2017-11-24/turbo-roundabout-coming-arlington-intersection

Roundabout Projects to Watch

NCHRP 03-130, Guide for Roundabouts
https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4354

FHWA Pooled Fund Study – Drivers Failing to Yield at Multi-Lane Roundabout Exits

https://www.pooledfund.org/Details/Study/634

NCHRP 17-70, Development of Roundabout Crash Prediction Models and Methods

http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3663

Roundabout and Channelized Turn Lane Accessibility Workshops

http://intersectionaccess.org/websites/43