Roundabouts Design: *Why, Where, How?*

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From the Dutch Standards to an International Translation

WHAT I'VE LEARNED THIS CONFERENCE

Some key observations from day 1

- We still have a big road safety problem
- More enforcement is not the solution
- We have a large funding problem
- Construction is overly expensive
- We need innovation

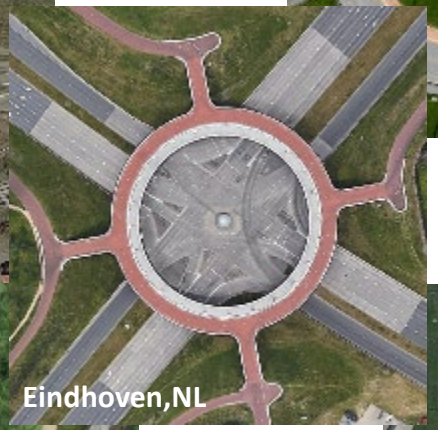
Will be discussed in this session…

1. WHAT?
2. WHY?
3. WHEN?
4. HOW?

DID YOU SAY “ROUNDABOUTS”?

WHAT

DID YOU SAY “ROUNDABOUTS”?



WHAT

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WHAT DO YOU SEE?

INTERSECTION | MODAL MIX | DIRECTION

PRIORITY | MARKINGS | MATERIALS

SLOW but CONTINUOUS EXCHANGE OF TRAFFIC FLOW

WHAT

“AN INTERSECTION IS WHERE ROADS AND TRAFFIC FLOWS ***CROSS ONE ANOTHER OR SPLIT*** *AND WHERE ROAD USERS MAY* ***CHANGE DIRECTION.***

“Roundabouts and other intersections”
Swov Factsheet, June 2022

- *ROUNDABOUT IS AN **AT-GRADE** INTERSECTION ON WHICH TRAFFIC FLOWS IN A **UNIDIRECTIONAL*** AND **CIRCULAR** MOVEMENT*

- *TRAFFIC ON THE CIRCLE HAS **RIGHT OF WAY*** AND THE ROADS HAVE RADIAL CONNECTIONS.*

"Basiskenmerken kruispunten en rotondes"
CROW, 2015

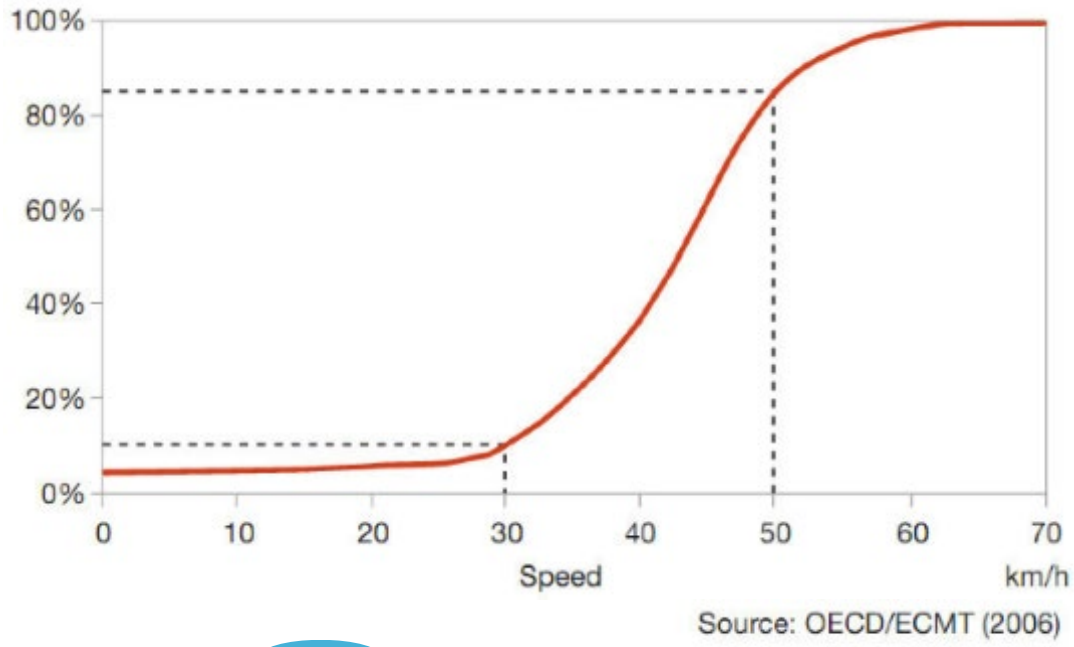
INTERSECTION DESIGN – KEY ISSUES

- The function of a junction is to allow **interchange**.
- Intersections are the **bottlenecks** in a transport network.
- The **majority** of crashes happen in intersections.

INTERSECTION DESIGN – LOWER THE SPEED

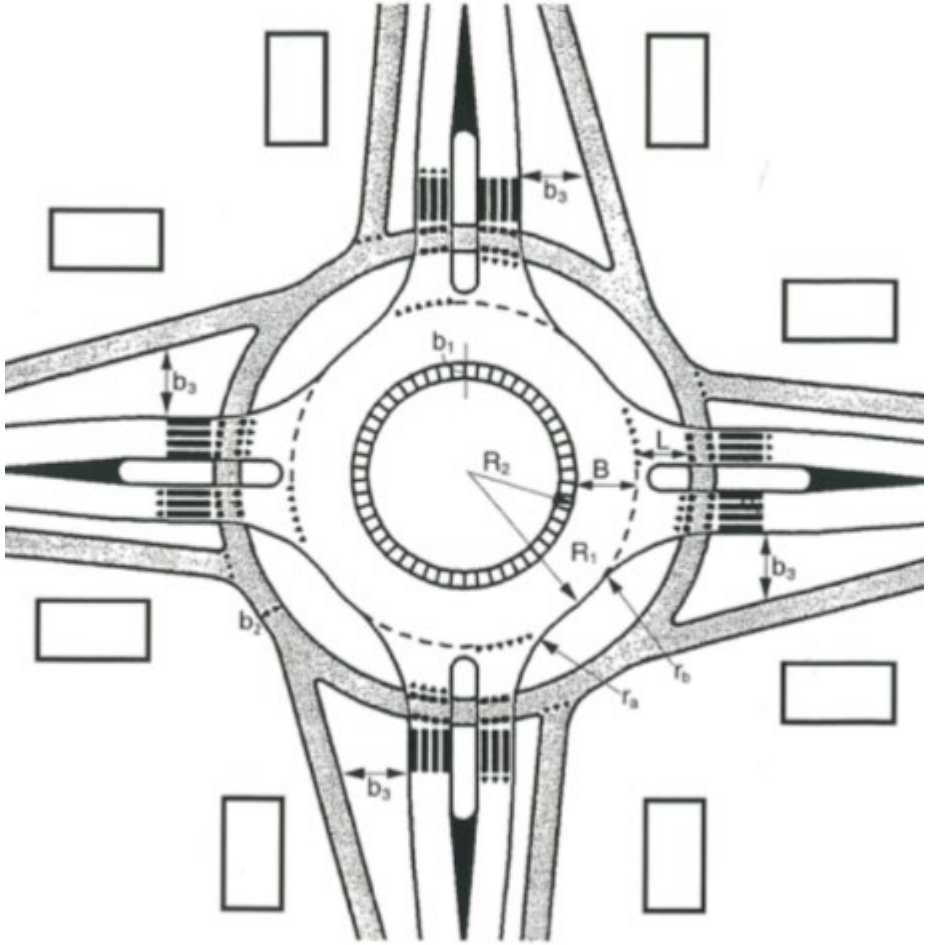
Sustainable Safety Framework

1. Eliminate the physical possibility of dangerous situations to happen
2. Reduce the exposure to risk
3. **Limit consequences**



Source: OECD/ECMT (2006)

3 GOOD REASONS TO CHOOSE ROUNDABOUTS



Traffic Safety

Trafic Flow

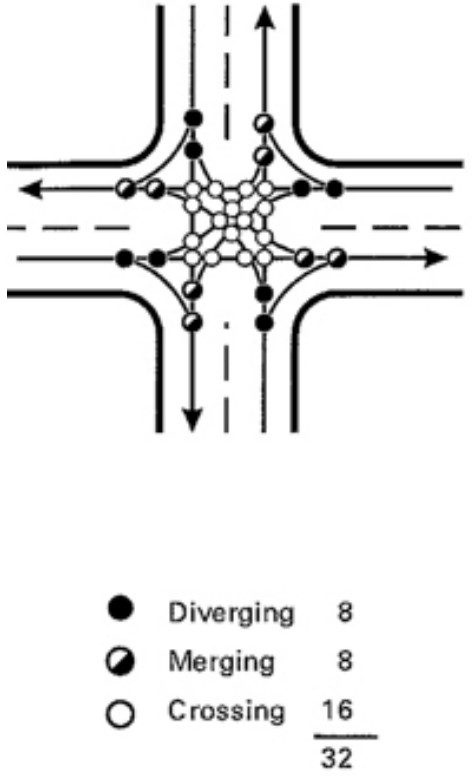
Environmental Impact

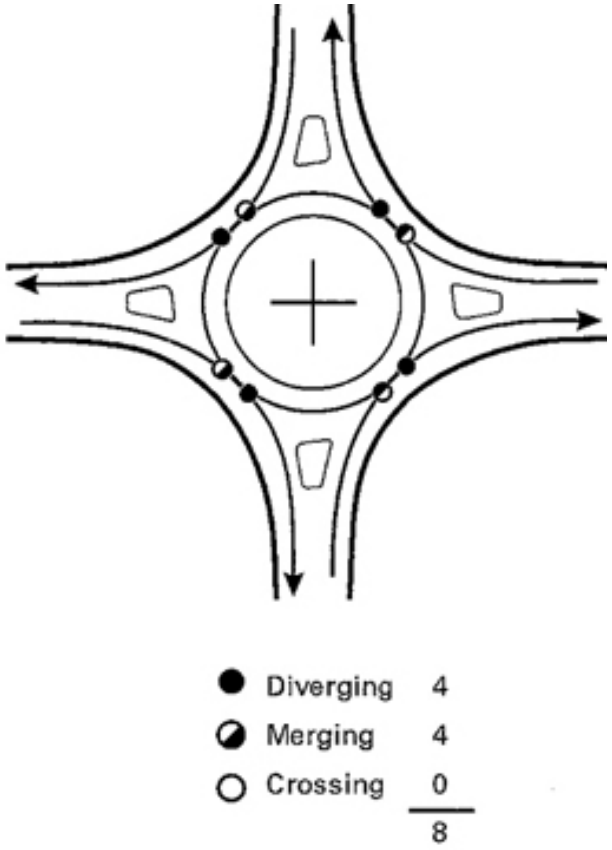
WHY

TRAFFIC SAFETY

- 76 % traffic fatalities
(Churchill et al., 2010)

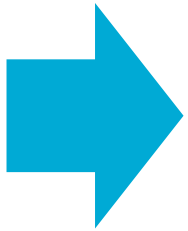
- Reduced number of **potential conflict points**
- Lower **driving speed**
- Smaller **impact angles**
- Eliminate **head-on collisions**
- Rely on **engineering, not compliance**





WHY

TRAFFIC FLOW *(CROW NUMBERS)*



Single-lane :

25,000 PCU/day *(sum of the incoming arms) ;* **max. 1500 cars/h**

Two-lane with double access/exit ramps:

up to **35,000 – 40,000 cars/day** *(more capacity but less safe)*

Turbo:

up to **50,000 cars/24h** but less safe for other modes

Shorter waiting time than at **signalised junctions**

WHY

ENVIRONMENTAL IMPACT

- **NOISE & GAS EMISSION**

  *- **29%** CO and - **21%** No_x compared to a signalized intersection.*

  Less noise

- **FOOTPRINT***

ROUNDABOUT IS

THE SAFEST

KIND OF INTERSECTIONS

… BUT NOT ALL ROUNDABOUTS ARE CREATED EQUAL

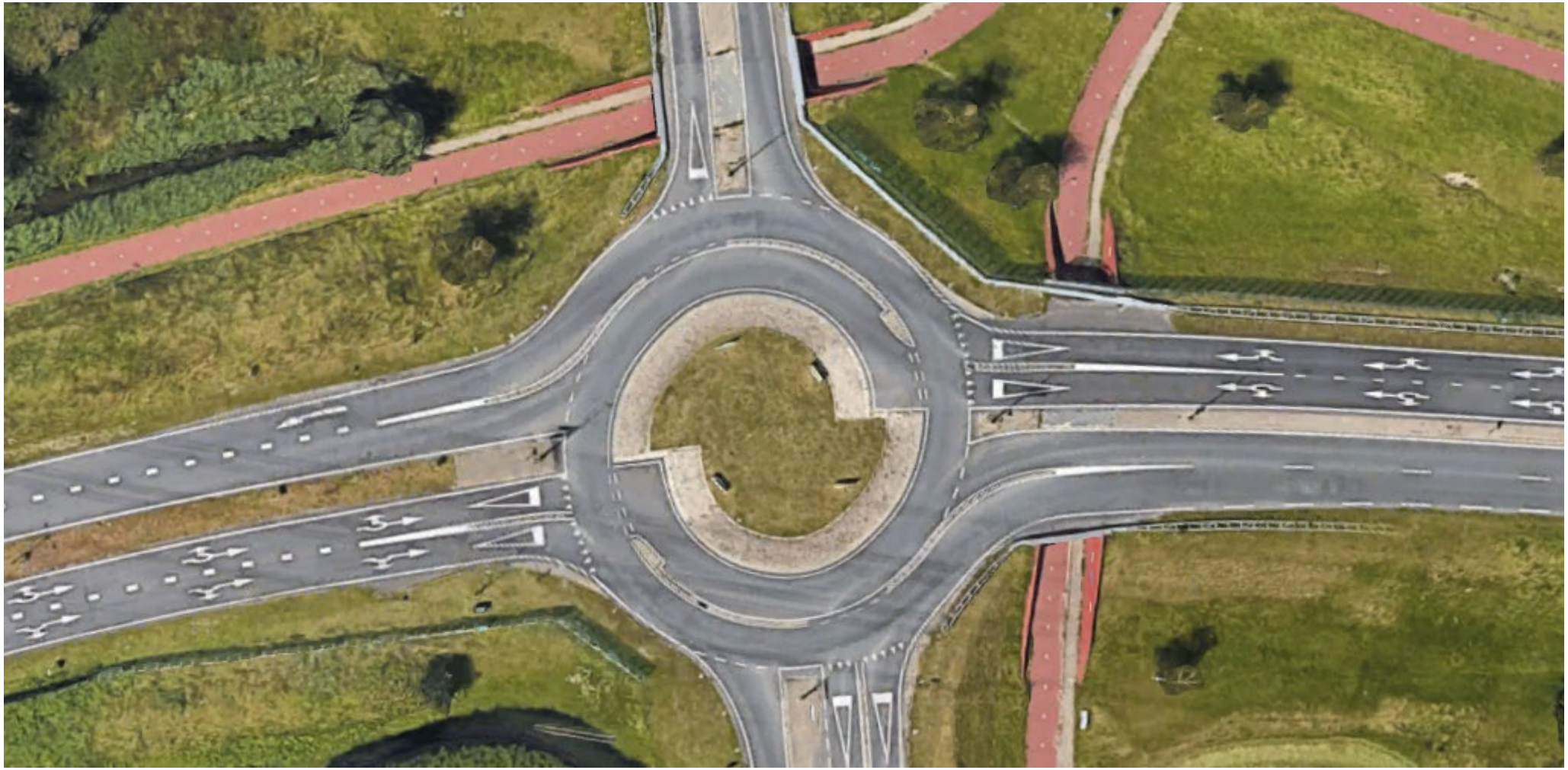
DIFFERENT TYPES OF ROUNDABOUTS

Without bike facilities
< 6000 PCU/day

With bike priority
Within built-up areas

Without bike priority
Outside built-up areas

DIFFERENT TYPES OF ROUNDABOUTS



WHERE


Lawful Good
Neutral Good
Chaotic Good
Lawful Neutral
True Neutral
Chaotic Neutral
Lawful Evil
Neutral Evil
Chaotic Evil
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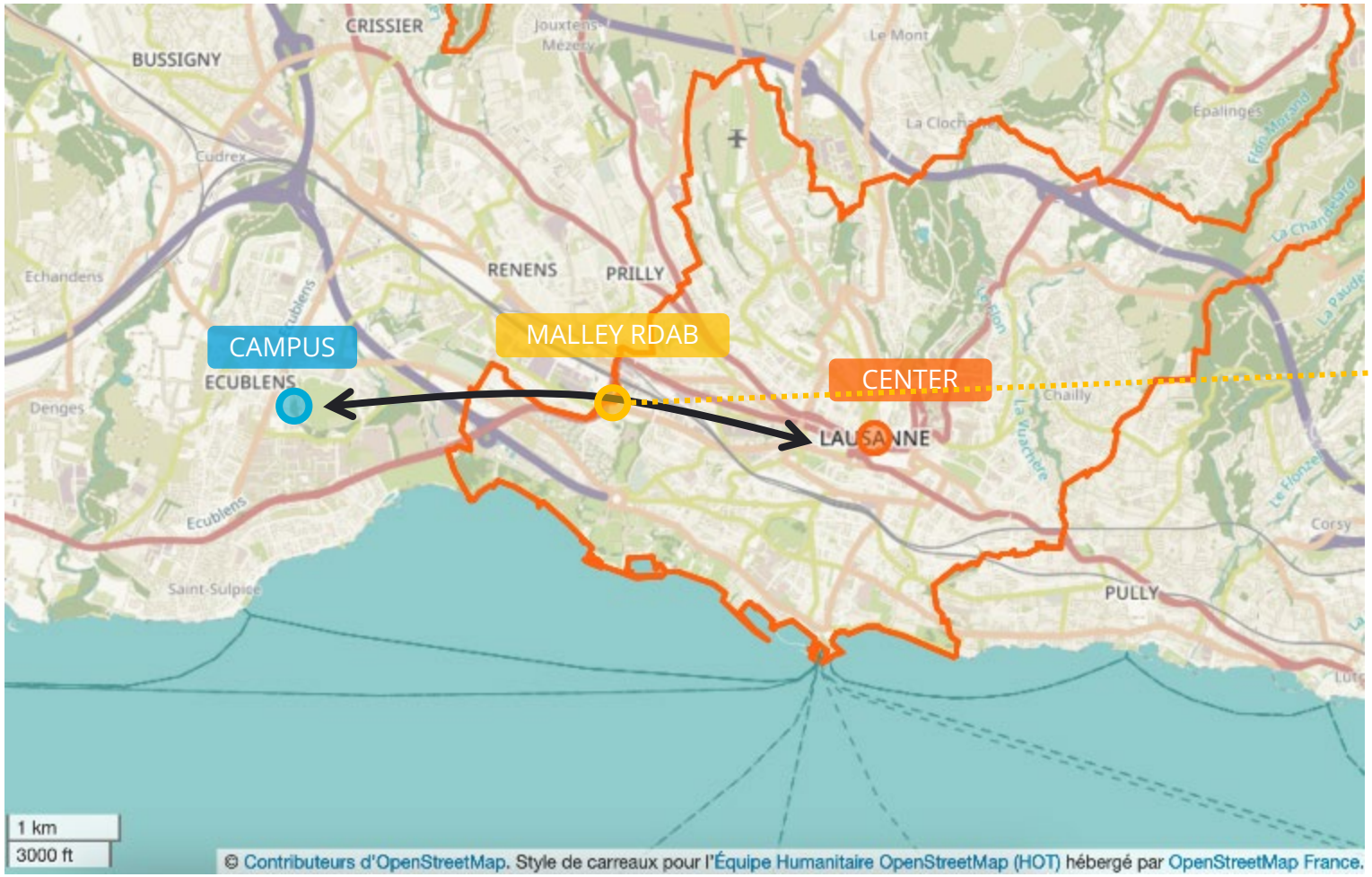
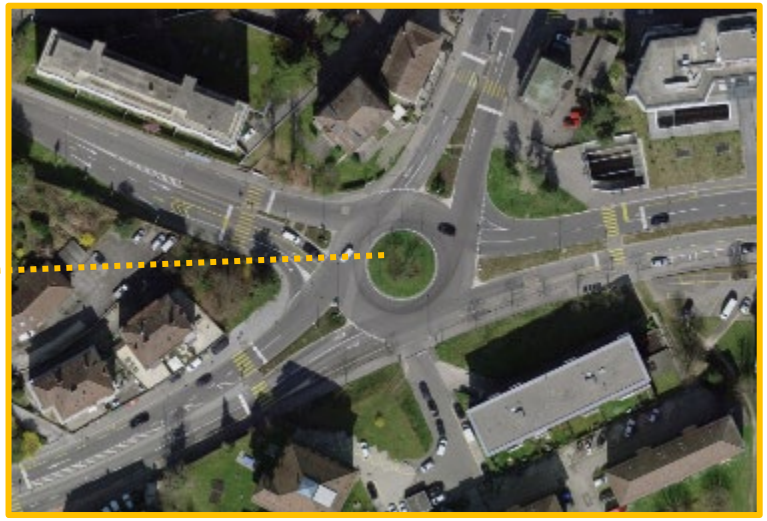
*OK... BUT WHAT DOES IT MEAN **CONCRETELY**?*

DESIGN PRINCIPLES - TODAY'S EXAMPLE





A central location:

- Campus <> City-Center
- Public Transit Connexion
- Urban Development Project
- Regional Cycling Network

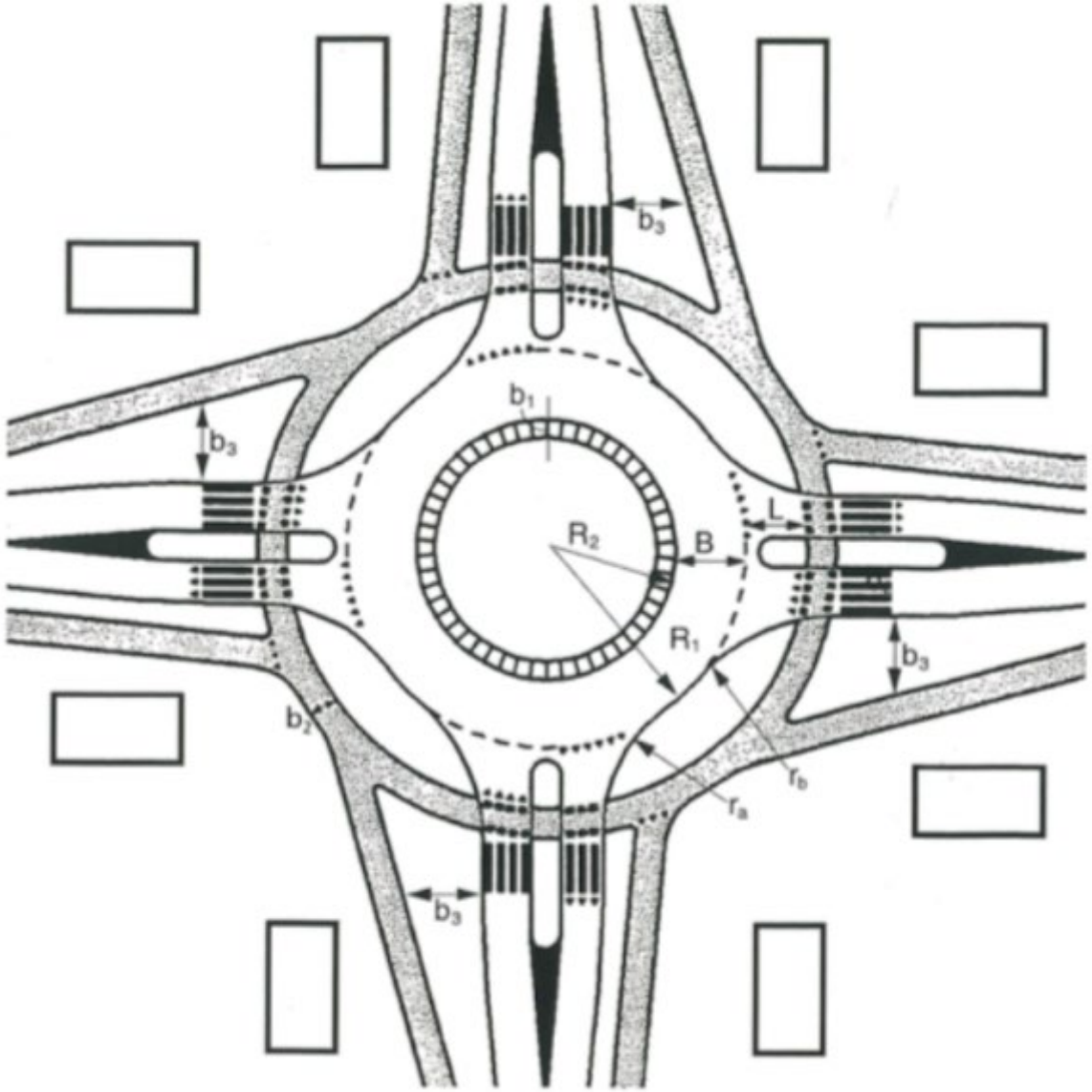
HOW

Malley Roundabout, Lausanne

Current State

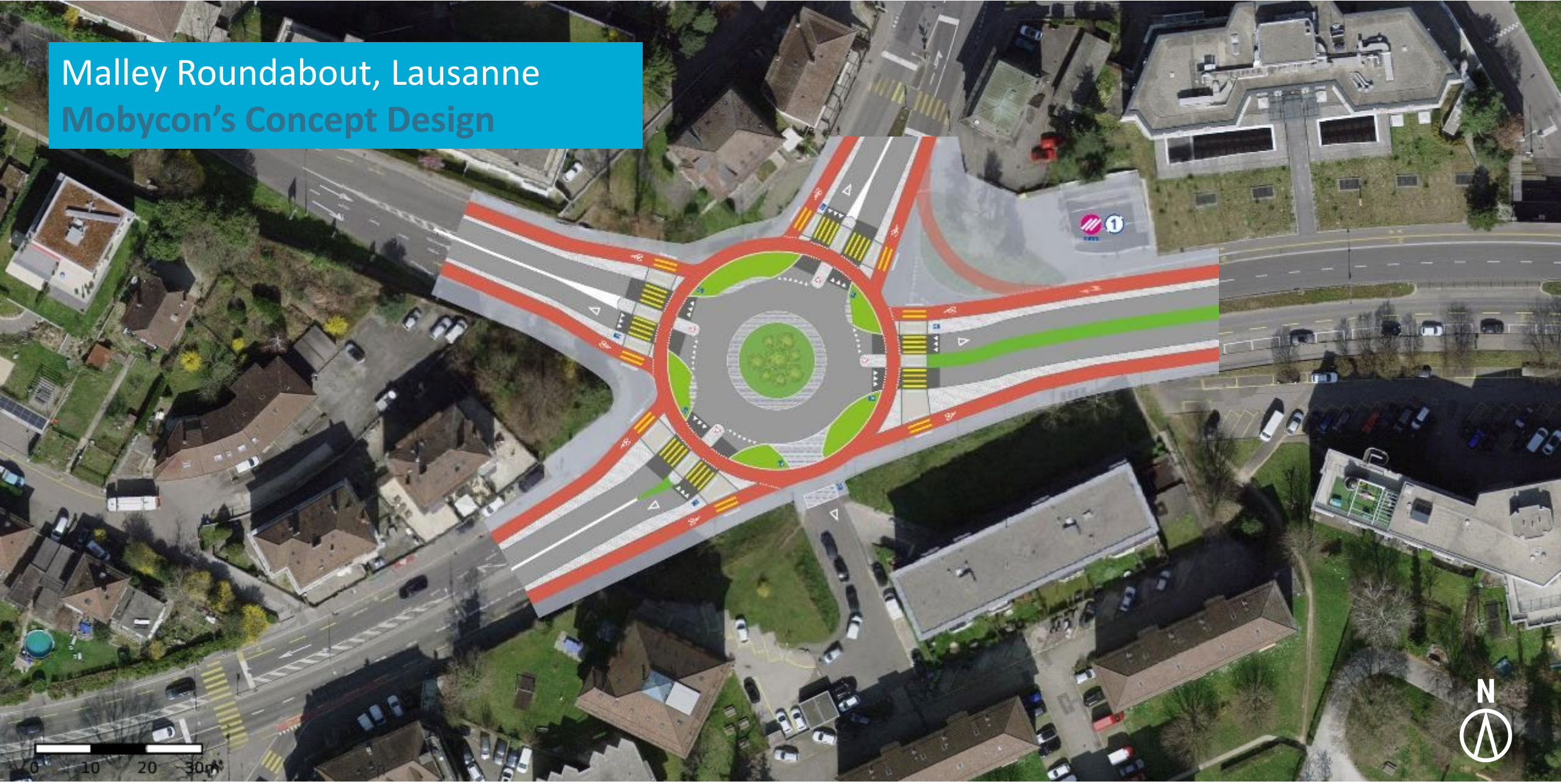
PRINCIPLES

- Radial Approach
- Clear priority
- Predictable Behaviour



HOW

Malley Roundabout, Lausanne
Mobycon's Concept Design



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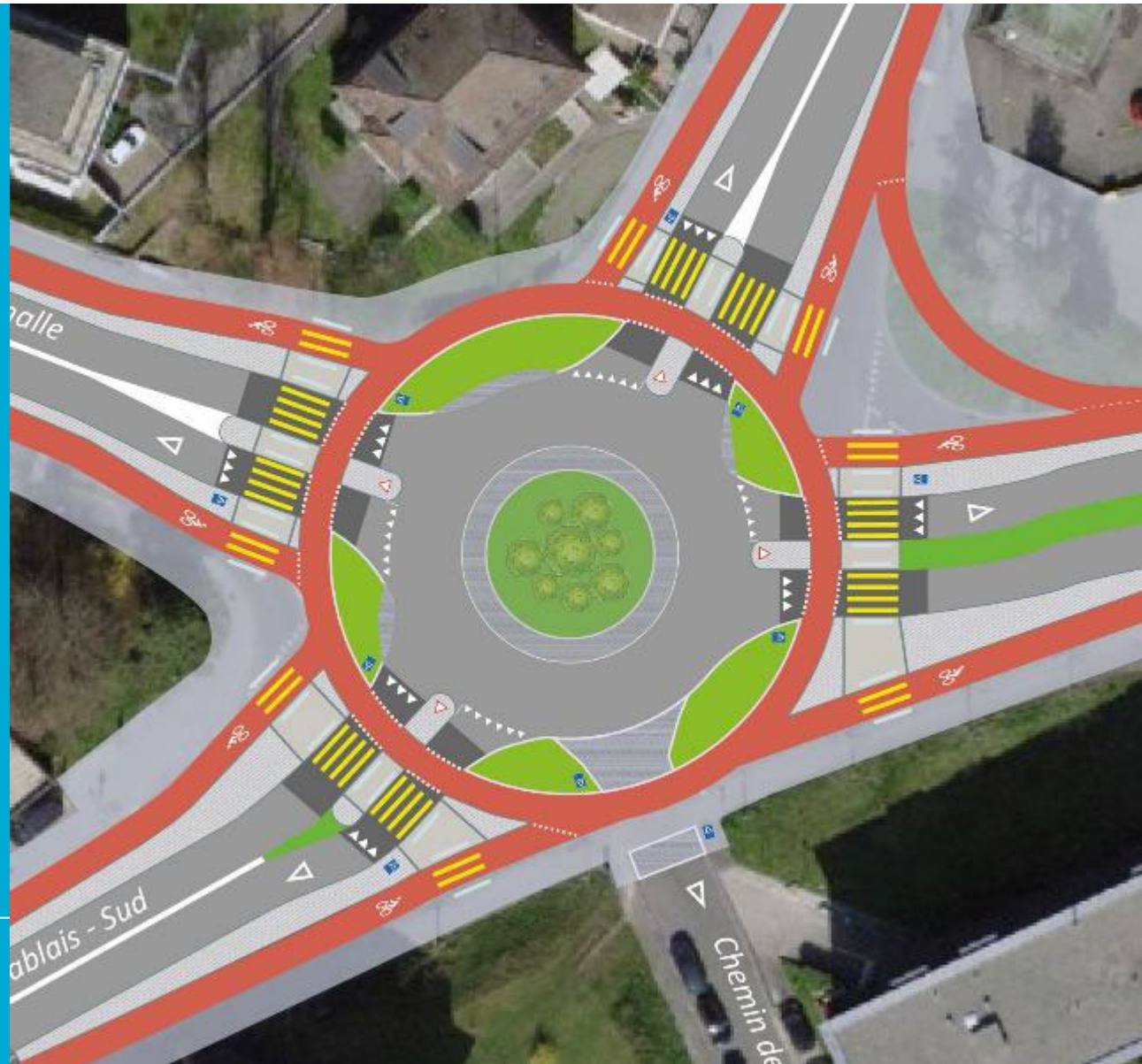
RADIAL VS TANGENTIAL

Safety



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RADIAL VS TANGENTIAL

Safety

WHY RADIAL?

- Ottawa study on radial roundabout
  - Operating speed of 30 kph at entry, through circle, and at exit
  - At tangential roundabouts, drivers accelerated 8 kph between circulating and exit speed
- At radial roundabouts, drivers **maintained** their speed until after the exit crossing

COMPARISON OF OTTAWA ROUNDABOUTS

Larger **inscribed diameter** and **radial geometry** translate to **higher give-way rates.**

	Approx. Inscribed Diameter (ft)	Radial Geometry	Driver Yield Rate to Pedestrians (%)	Driver Yield Rate to Cyclists (%)	Avg. Yield Rate to Ped + Cyclist (%)
Portobello & Valin	130	No	70	78	74
Brookfield & Flannery	140	No	74	76	75
Abbott & Robert Grant	140	No	87	89	88
Cresthaven & Waterbridge	160	Yes	100	100	100

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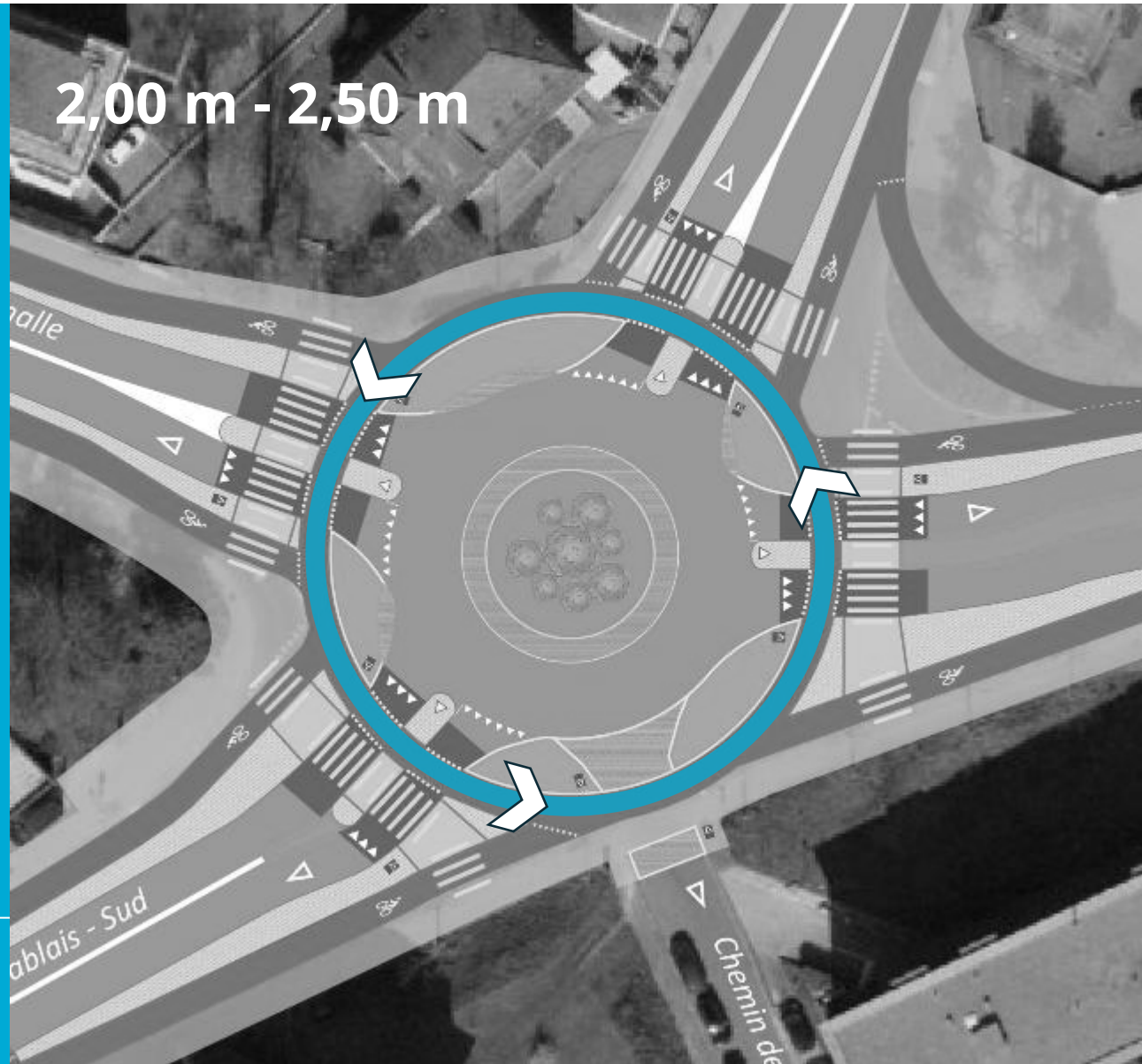
CYCLE RING: UNIFORM, UNIDIRECTIONAL & WITH PRIORITY

Safety & Comfort



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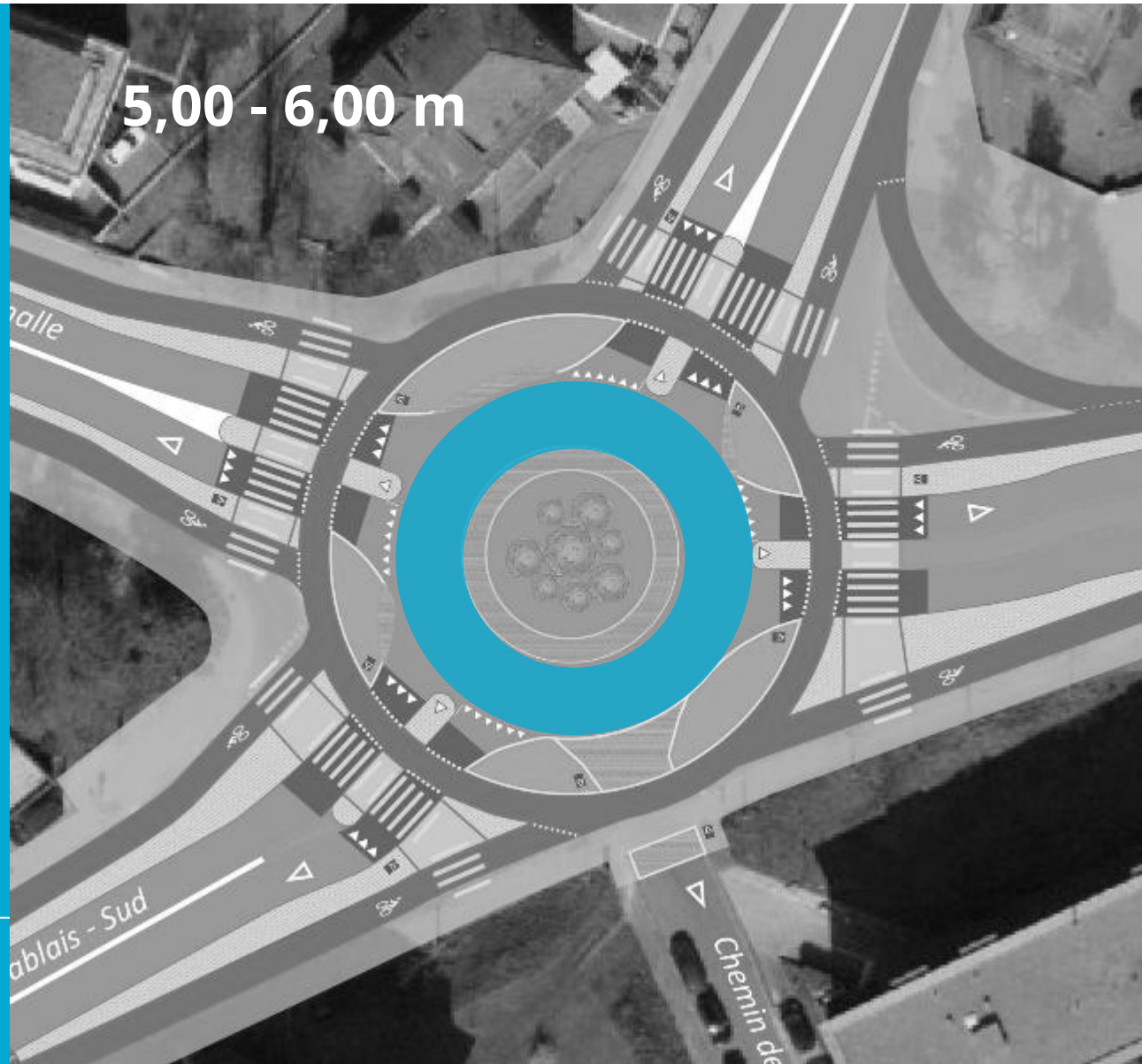
SINGLE LANE FOR VEHICLES

Safety & Comfort



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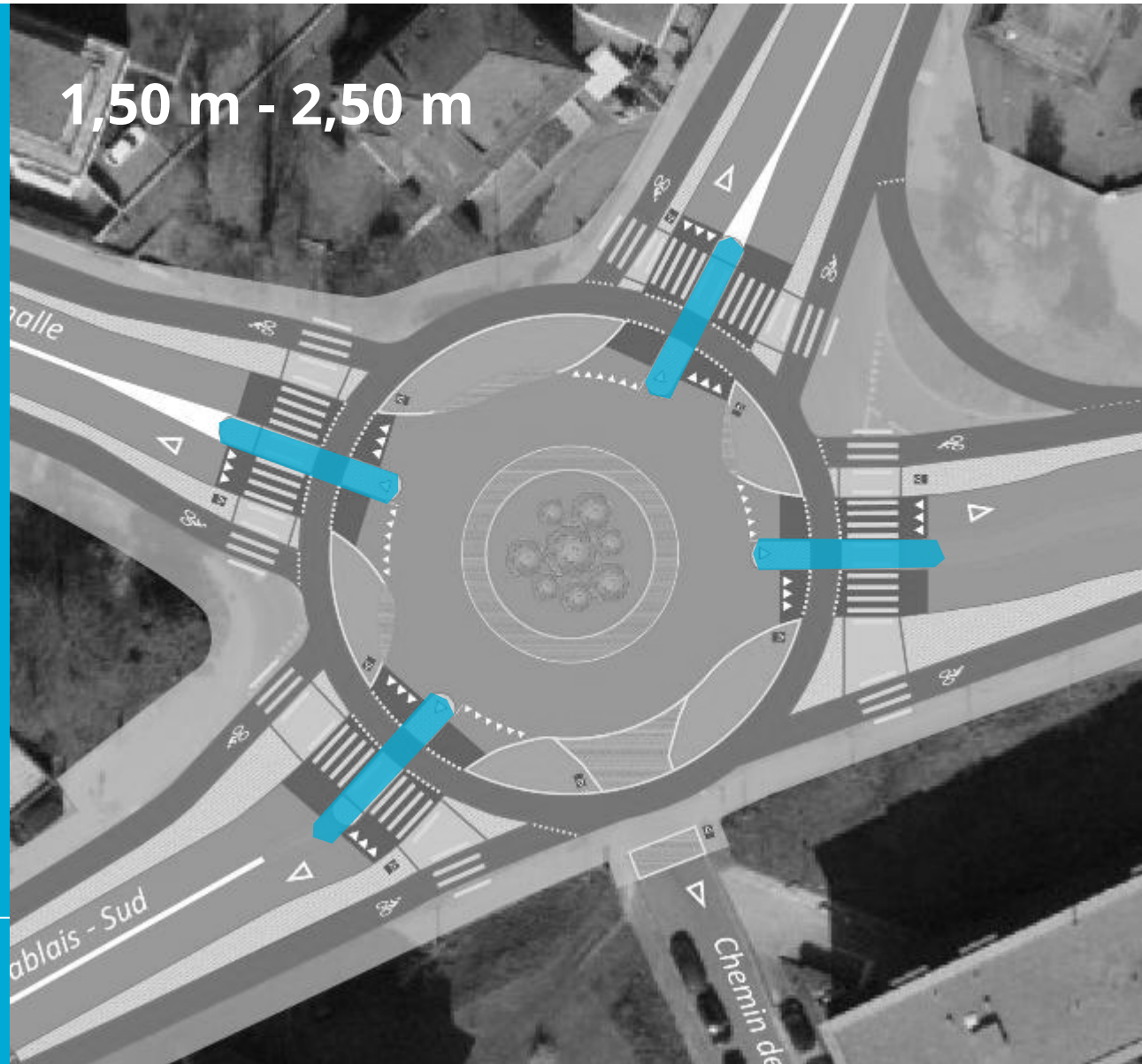
REFUGE ISLANDS / MEDIANS

Safety & Comfort



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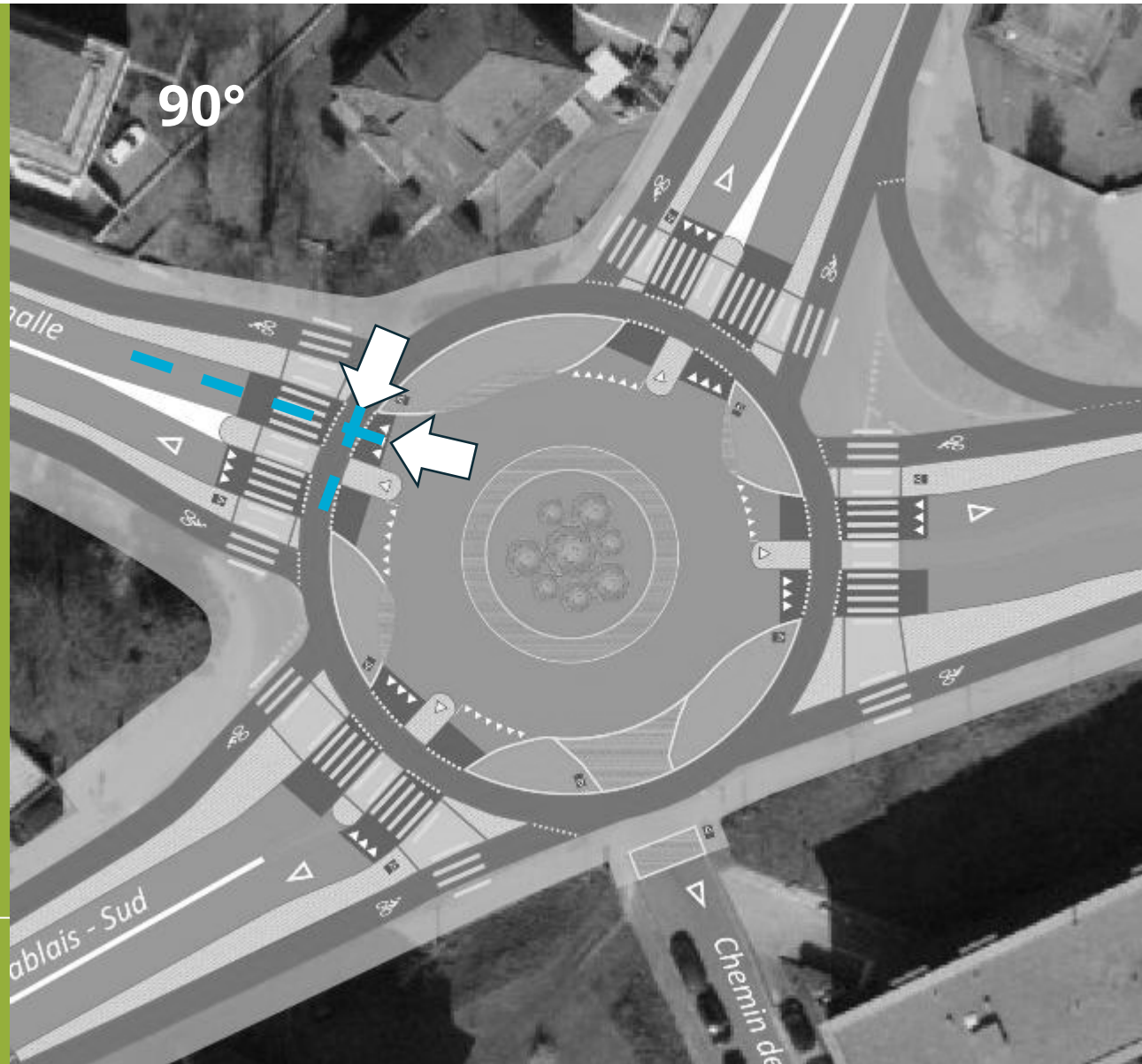
BUFFER SPACES & PERPENDICULAR CROSSINGS

Visibility



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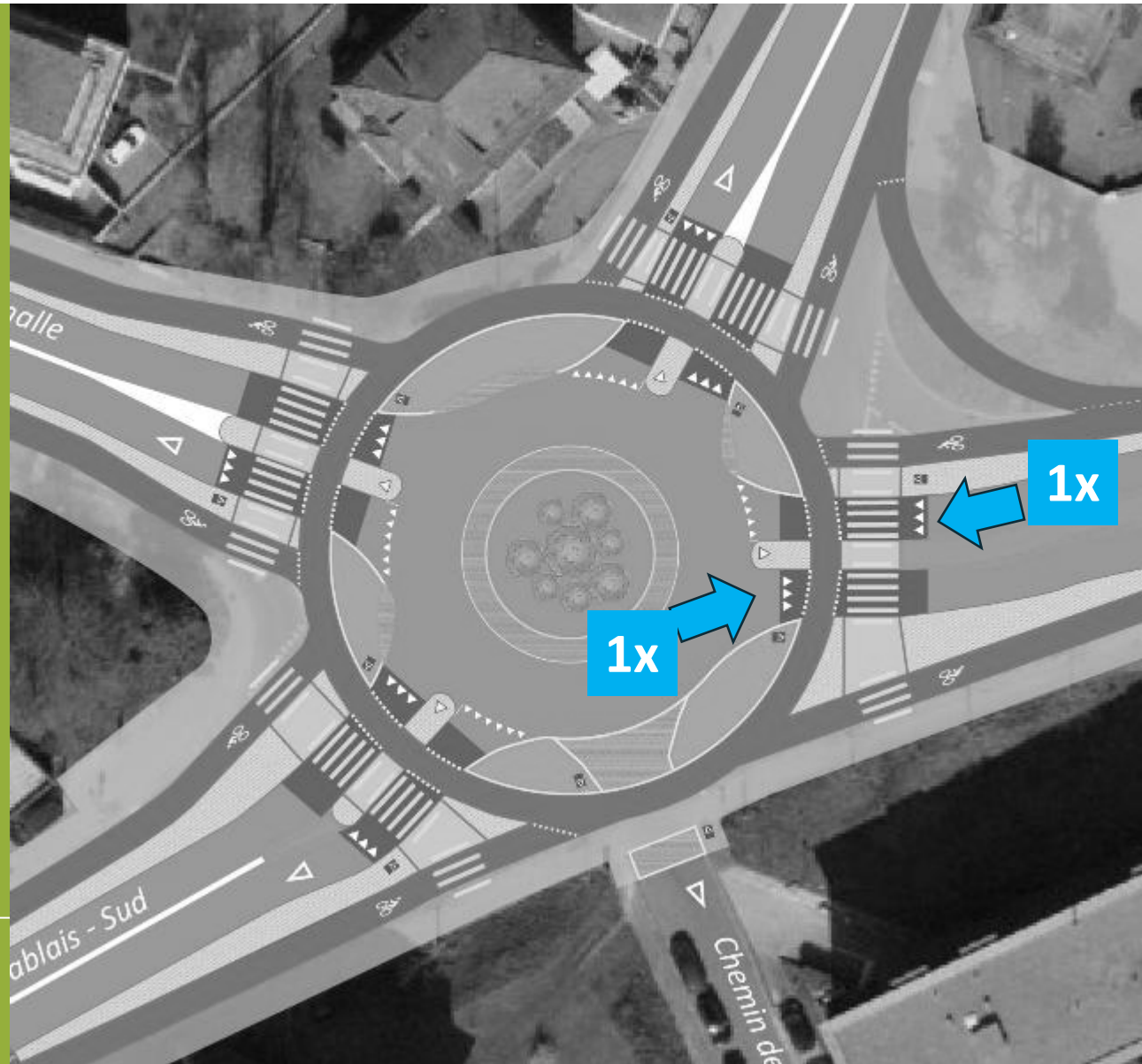
SIMPLIFIED ENTRANCE/EXIT LANES

Visibility



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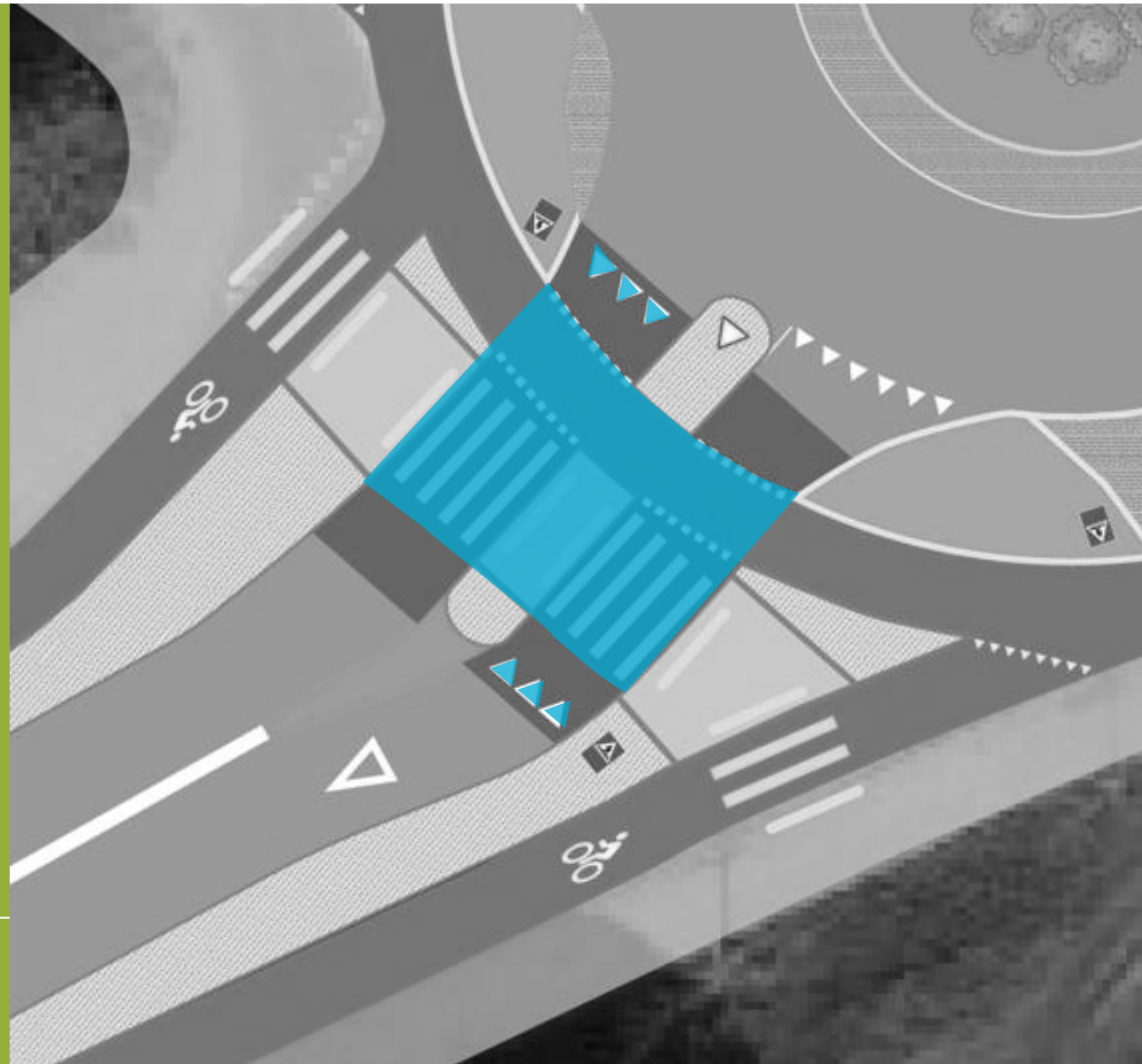
RAISED CROSSINGS

Visibility



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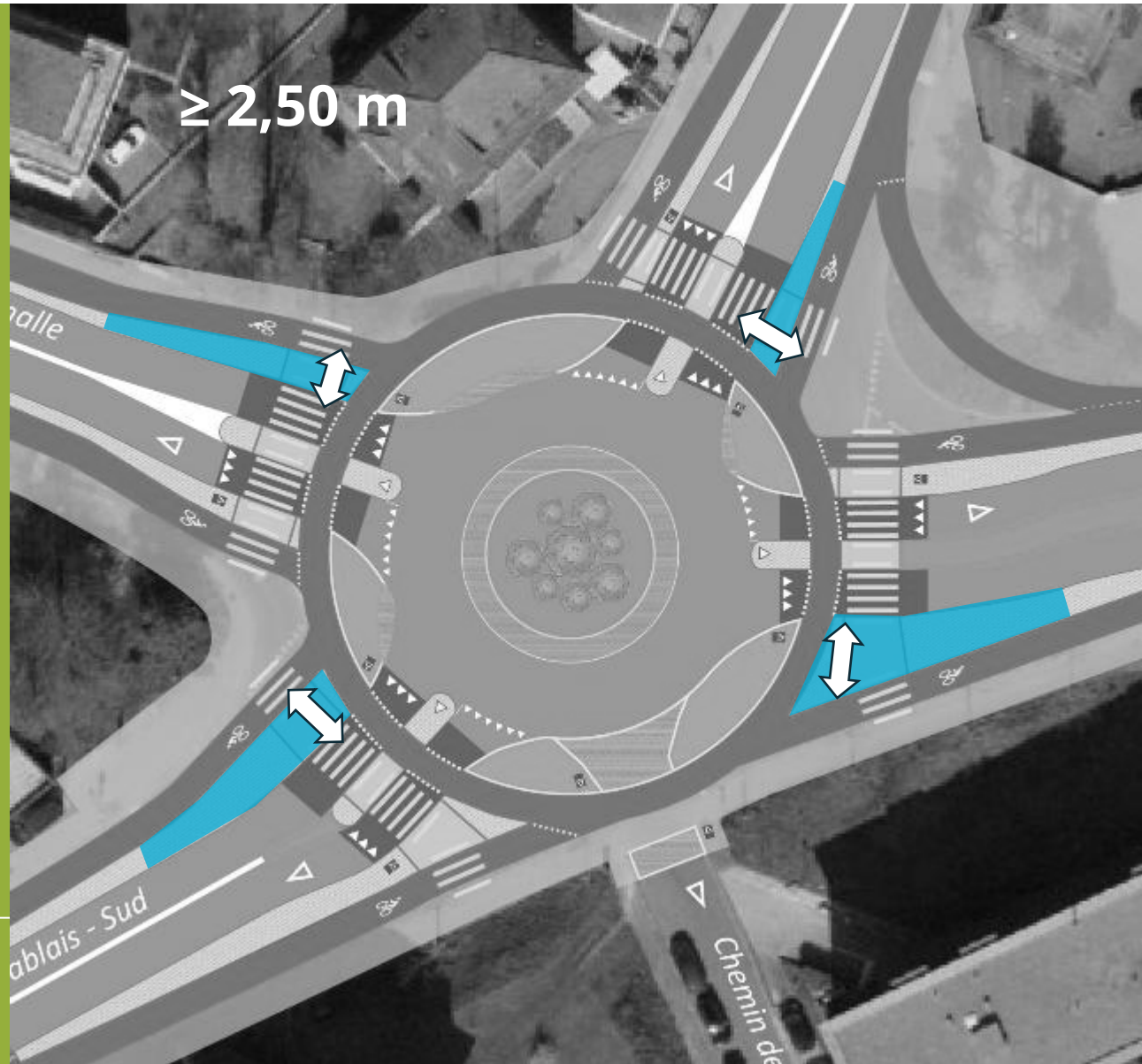
SET BACK OF THE CYCLE PATH

Visibility



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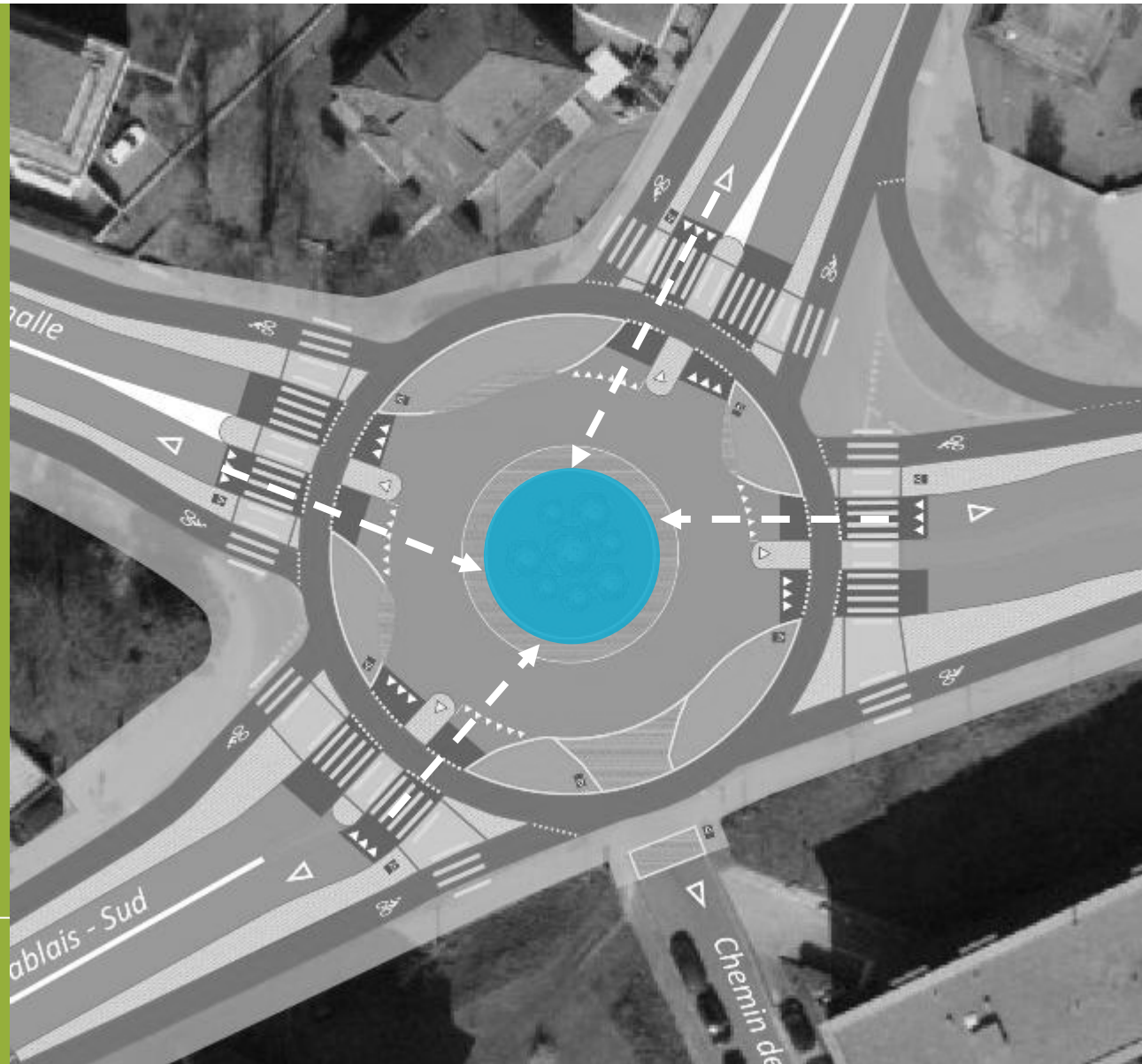
SIGHT LINES

Visibility



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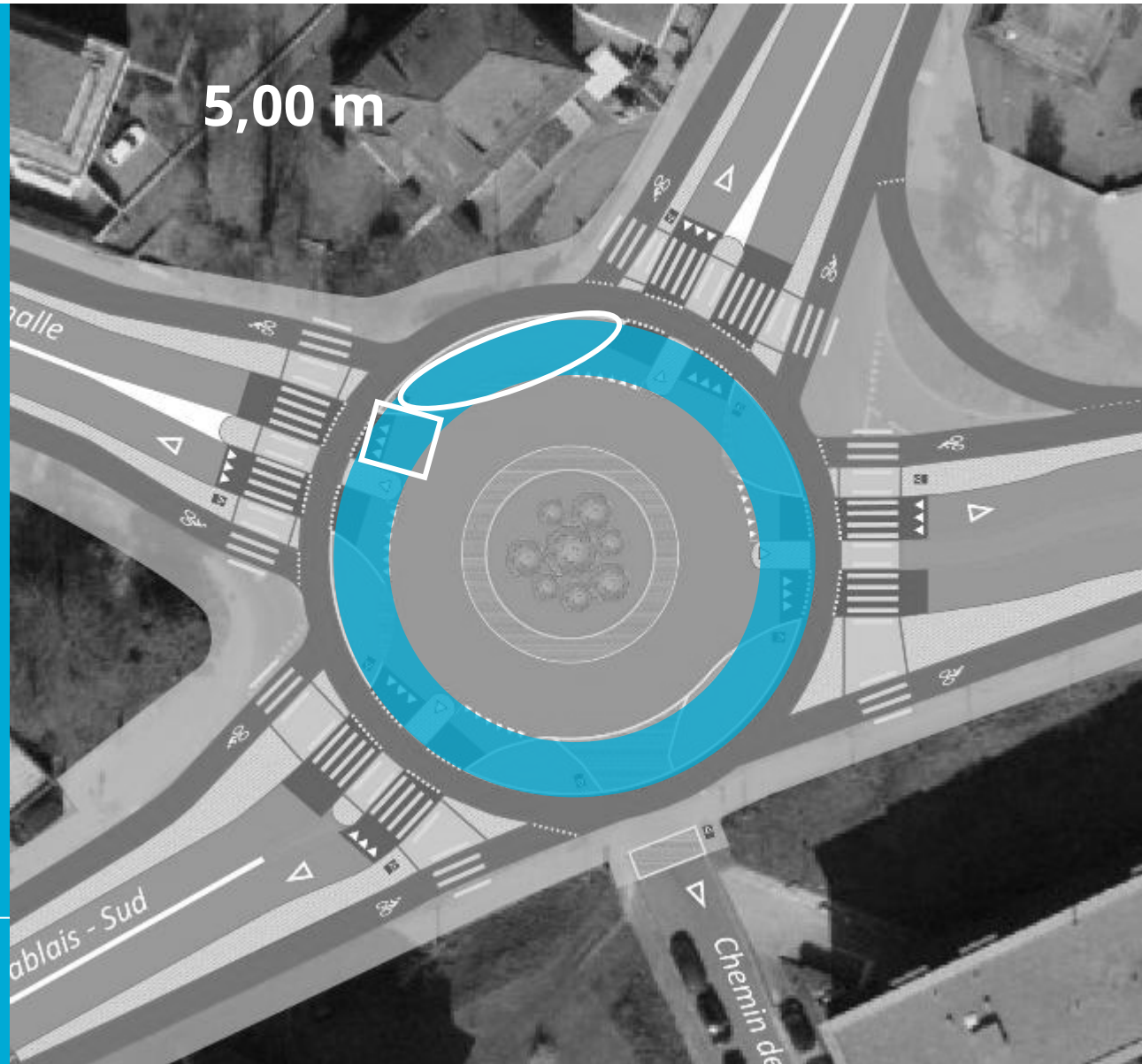
BUFFER SPACES

Accessibility & Traffic Flow



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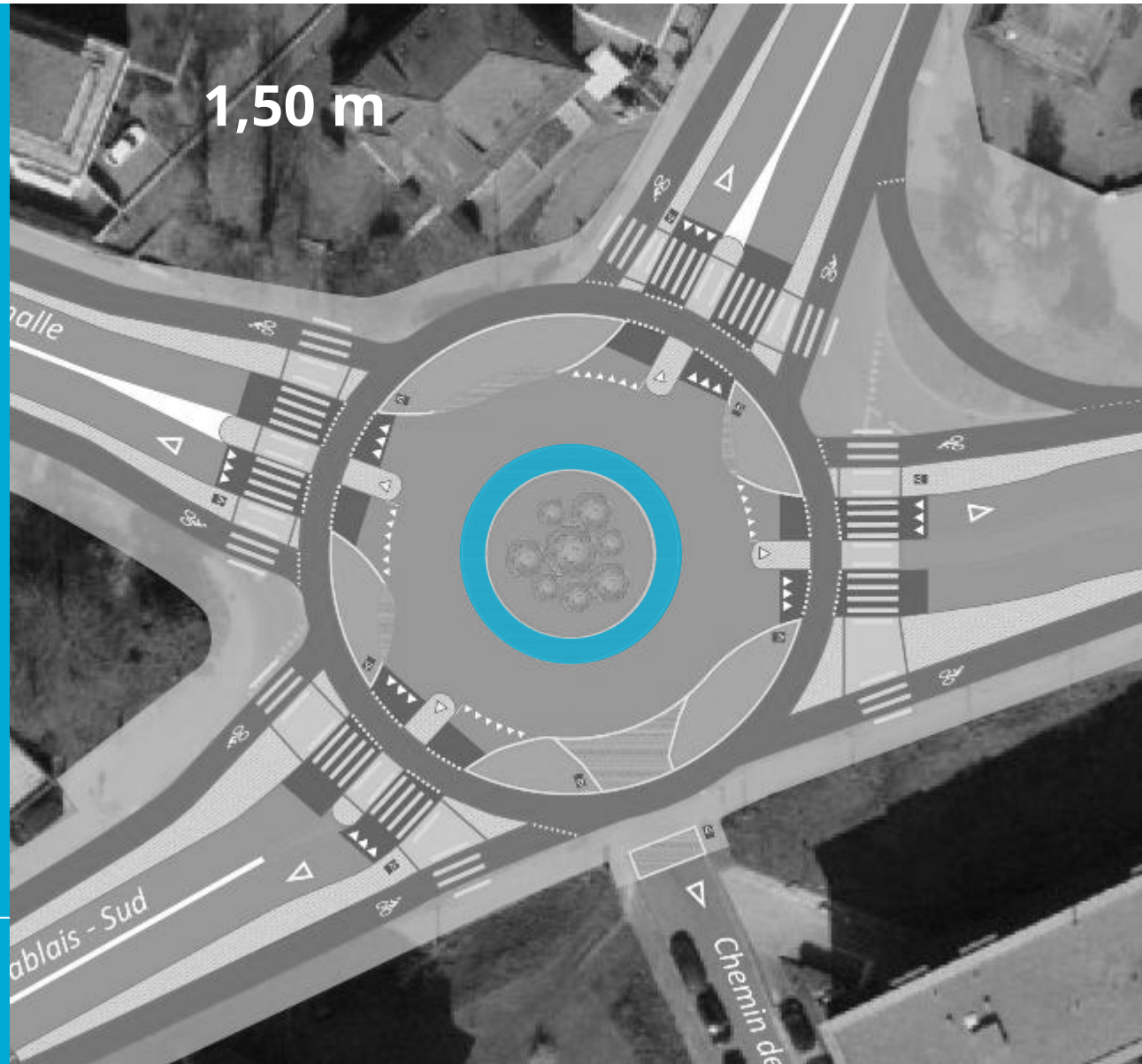
APRON

Accessibility & Traffic Flow



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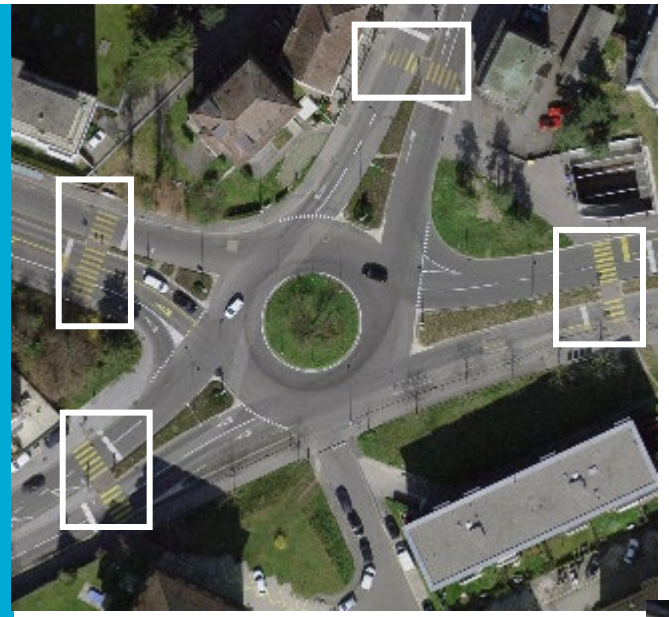
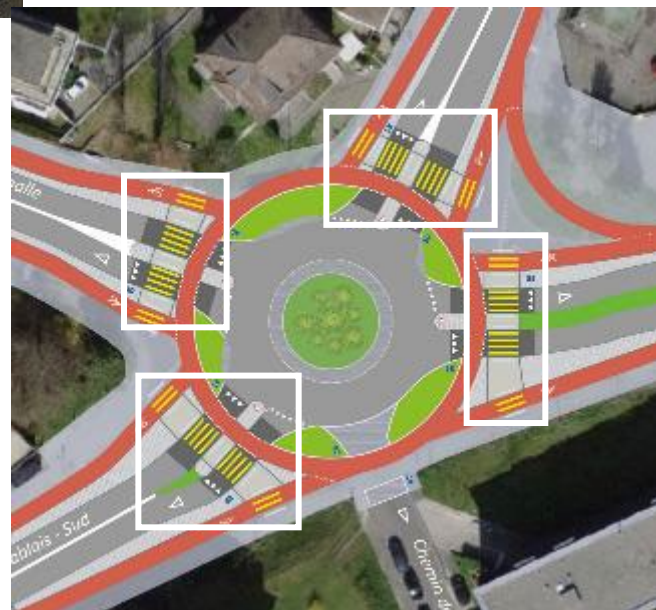
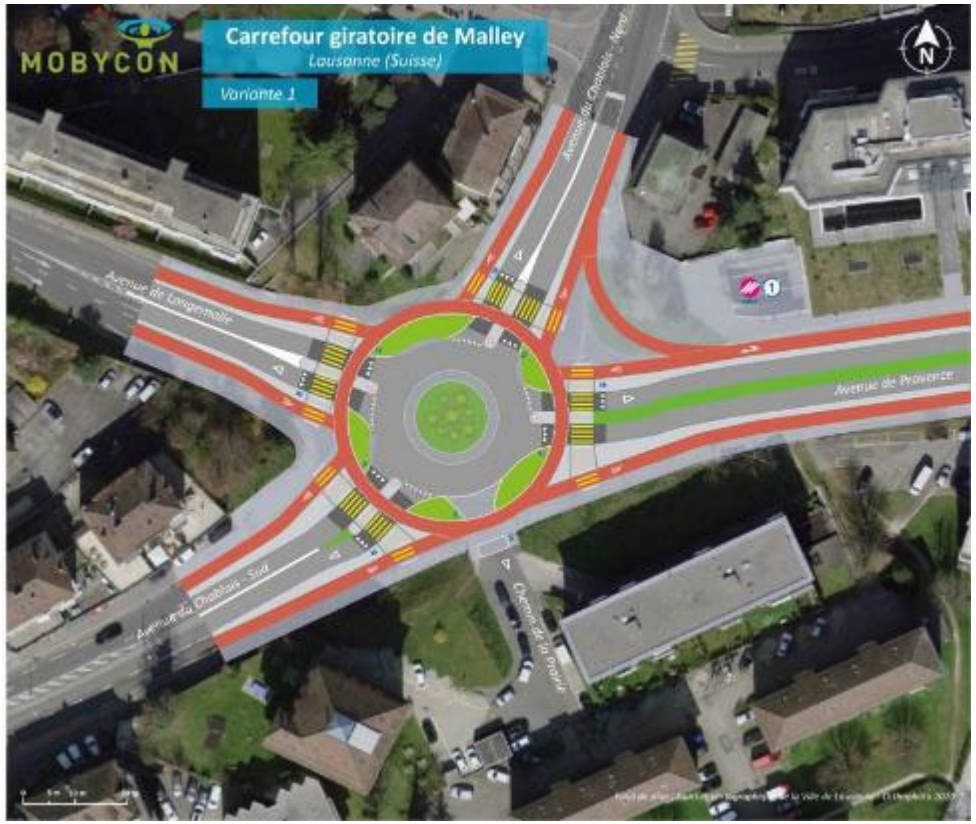
CLOSER CROSSING OPPORTUNITIES

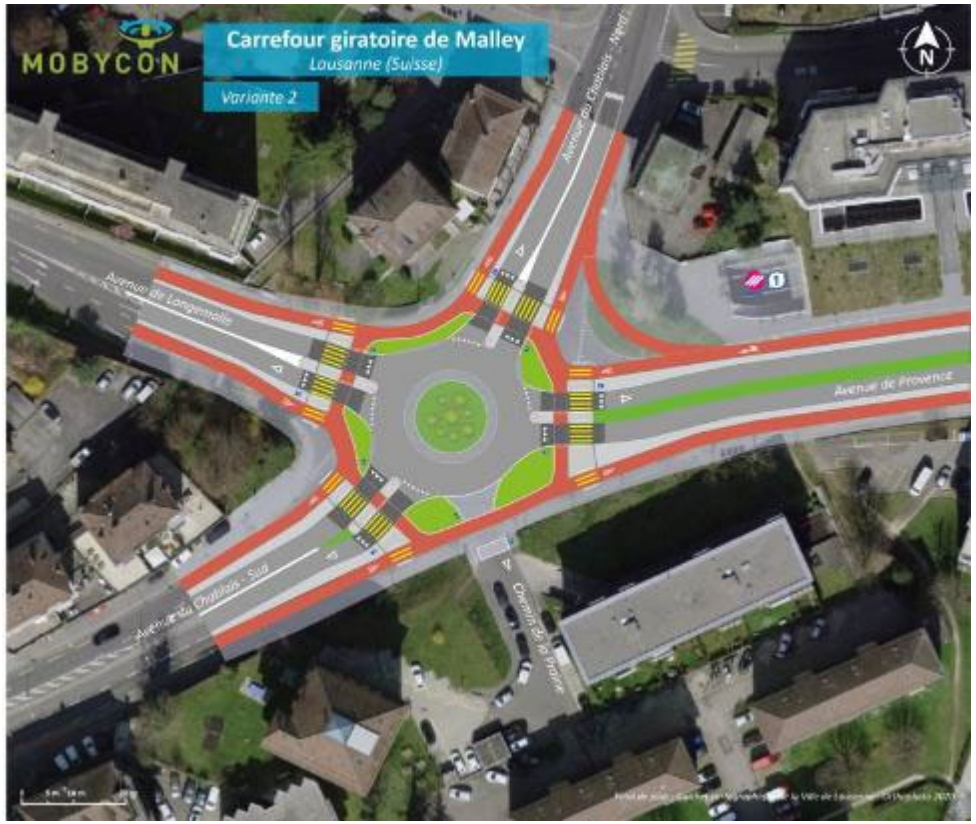


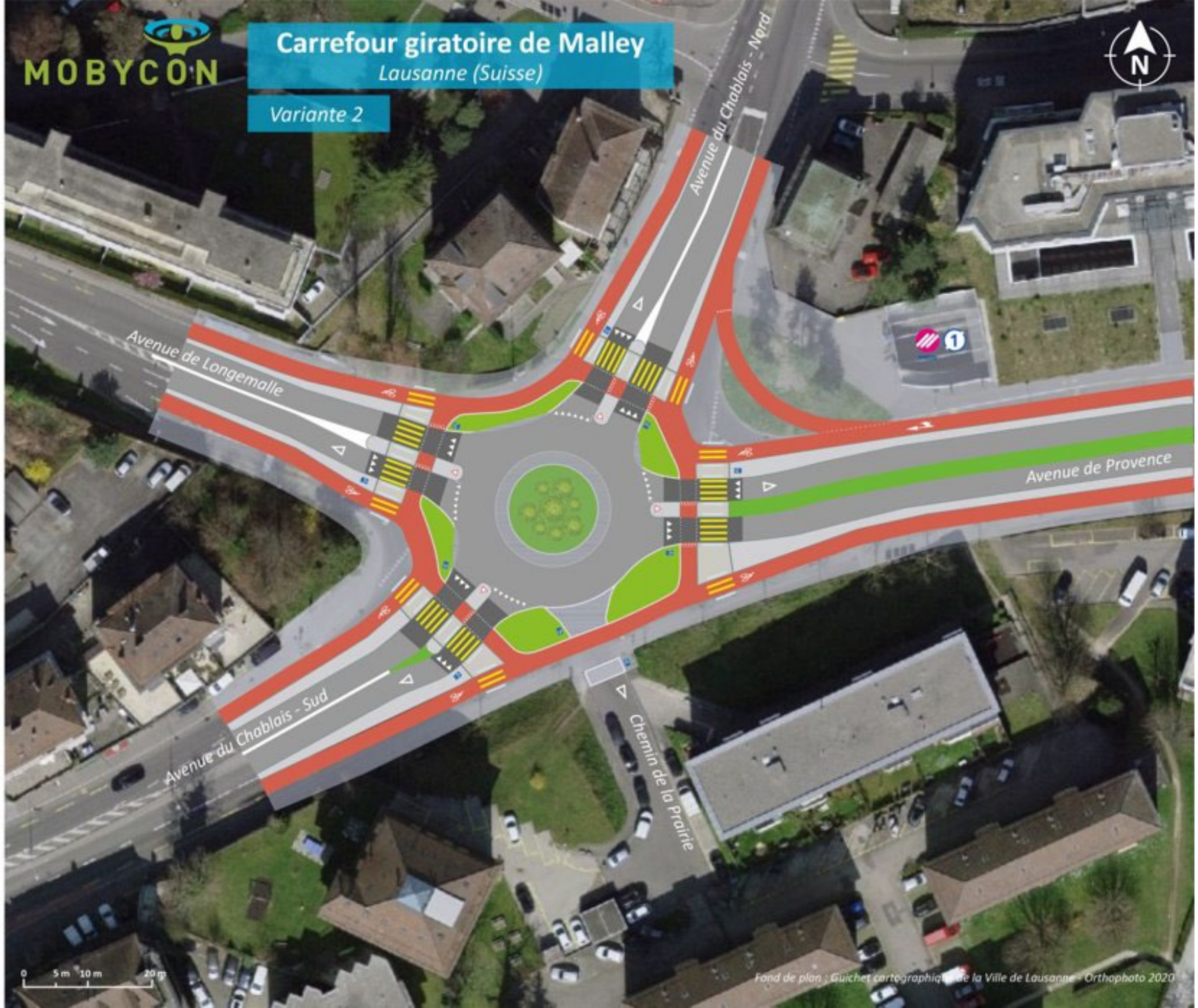


Accessibility & Traffic Flow

TAILORED DESIGN FOR ROUNDABOUTS



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Carrefour giratoire de Malley
Lausanne (Suisse)
Variante 2
N
Avenue du Chablais - Nord
Avenue de Longemalle
Avenue de Provence
Avenue du Chablais - Sud
Chemin de la Prairie
0 5 m 10 m 20 m
Fond de plan : Guichet cartographique de la Ville de Lausanne - Orthophoto 2020

PREFAB CONSTRUCTION

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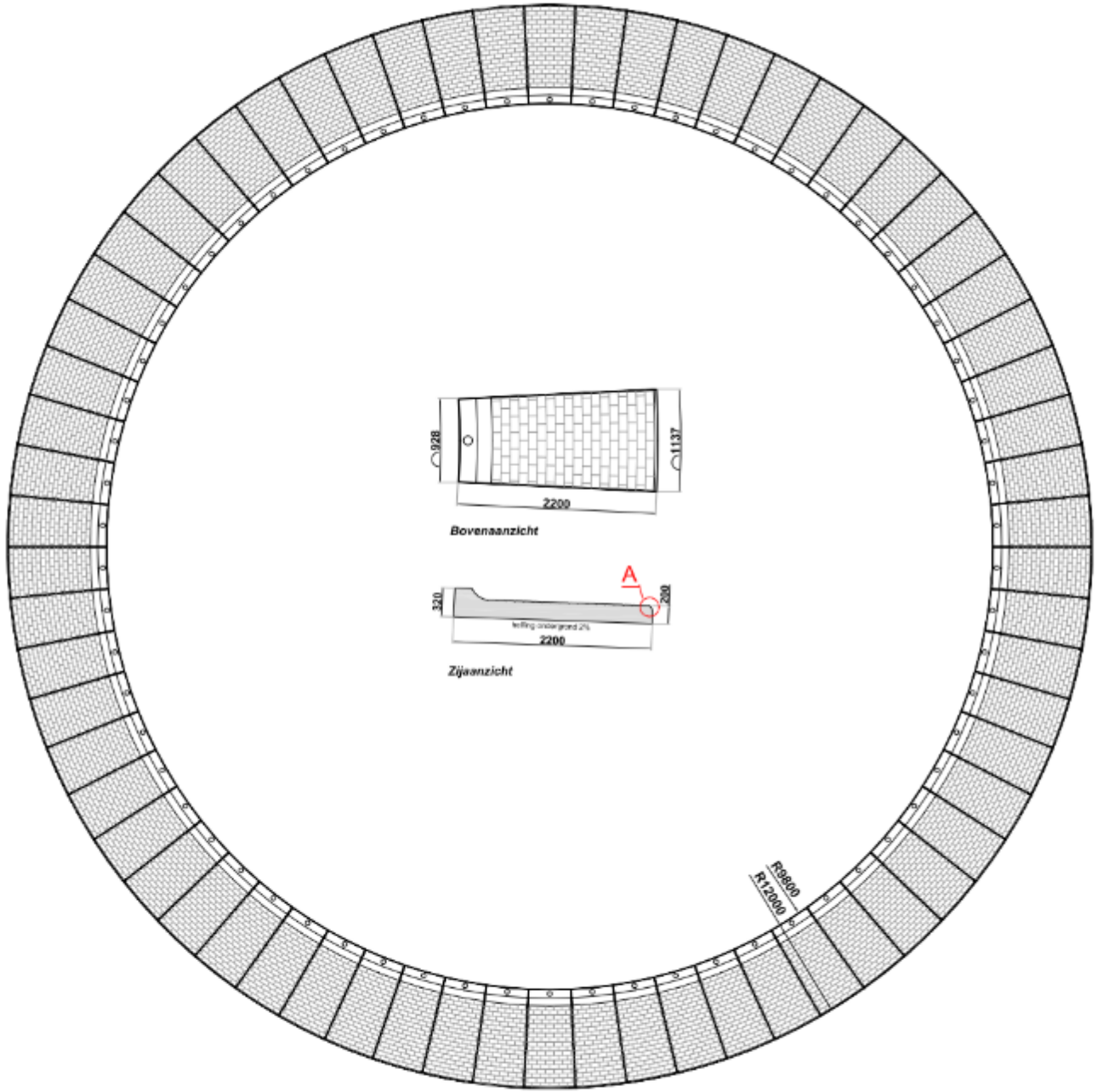
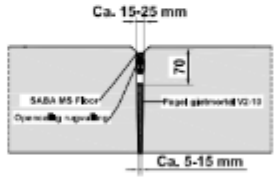
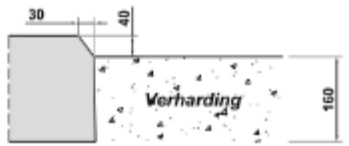
heijmans





Detail voeg
(schaal 1:10)



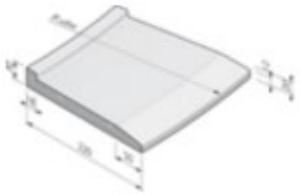
Detail A
(schaal 1:10)

- ***Aantal elementen: 66 stuks***
- ***Afmetingen elementen: 2200*928/1137*200/320 mm***
- ***Gewicht element: ca. 1155 kg***
- ***Betonkwaliteit: C45/55, gewapend***
- ***Milieuklasse: XF4***
- ***Inclusief 1 glasbolreflector per element***

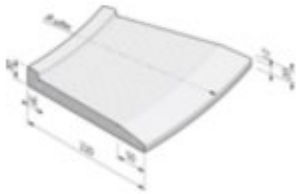
Project:
Rotonde Rammelstrook

Onderdeel:
R=12.00 m, Lengte 220 cm,
1 glasbolreflector

Getekend : RB	Project - bladnr.
Datum : 17-8-2011	1630
Revisie B : 26-3-2018	11
Schaal / formaat : 1:100 / 1:50 / A3-L	
Maatvoering in mm	



Rotondeplateaus 220 ribbelmotief

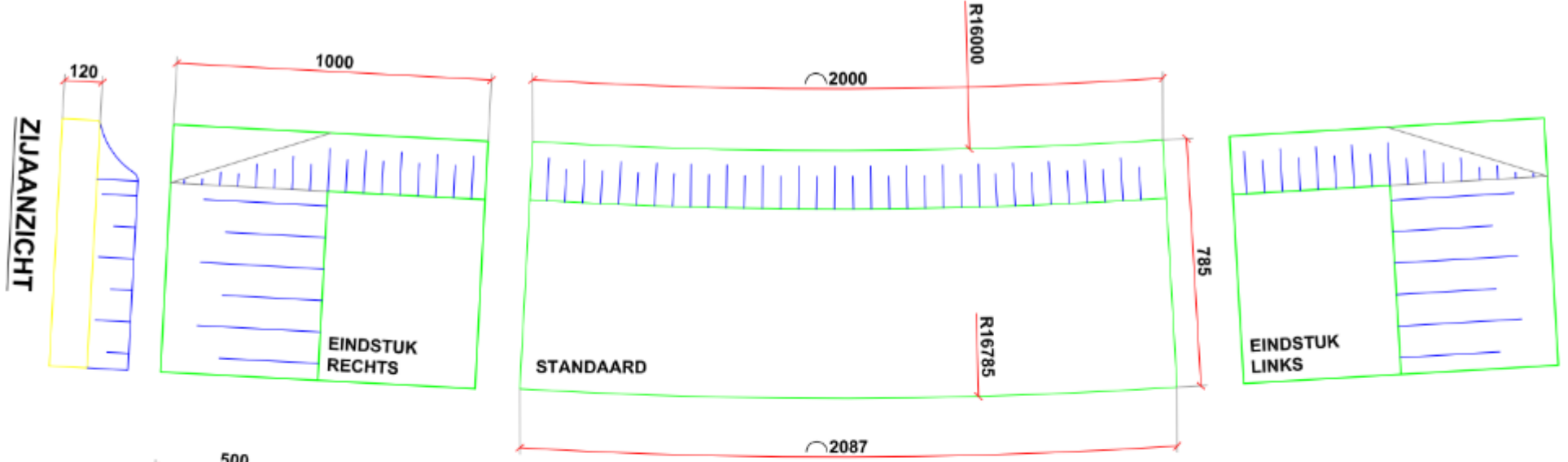


Rotondeplateaus 220 straatsteenmotief

Rotondeplateaus 250 cobblestonemotief

Rotondeplateaus 320 ribbelmotief

Rotondeplateaus 420 ribbelmotief



ZIJAANZICHT

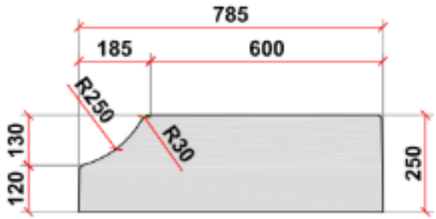
BOVENAANZICHT

STANDAARD

afmeting	: lxbxh = 200x78.5x25/12 cm
volume	: 0,36 m3
gewicht	: 864 kg / st
betonkwaliteit	: C45/55, gewapend
milieuklasse	: XF4
maattoleranties	: + / - 5 mm

EINDSTUK

afmeting	: lxbxh = 100x78.5x25/12 cm
volume	: 0,17 m3
gewicht	: 408 kg / st
betonkwaliteit	: C45/55, gewapend
milieuklasse	: XF4
maattoleranties	: + / - 5 mm



DOORSNEDE

OPMERKING:
STANDAARDLENGTE VAN GELEIDEBAND BOCHTBESCHERMING IS 2 METER, AFHANKELIJK VAN SITUATIE ZIJN PASSTUKKEN LEVERBAAR

LEICON VERKEERSGELEIDING

Project: Geleideband Bochtbescherming

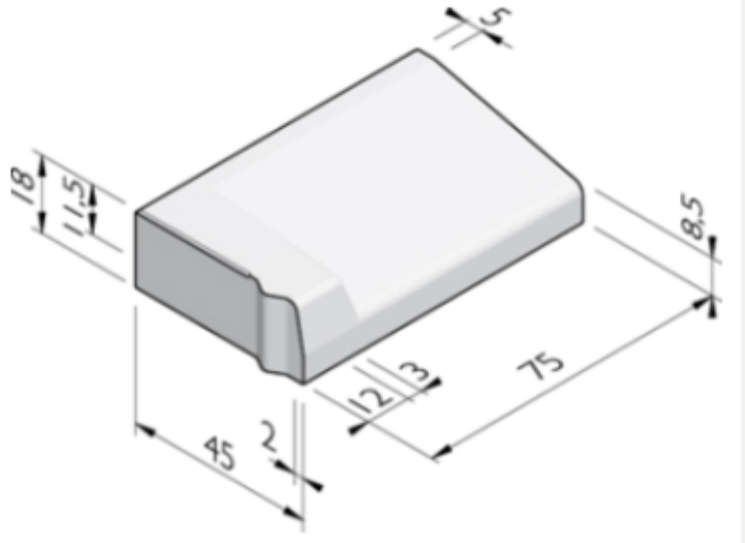
Onderdeel: R=16,00 m inwendig

Getekend	: DH
Datum	: 12-09-2014
Revisie	:
Schaal	: 1:20
Formaat	: A3-L

Project - bladnr.
5810
V-14
-bestektekening-

Leicon Steenwijk, tel.:0521 - 52 42 24

Inritbanden 45x18x75 vb

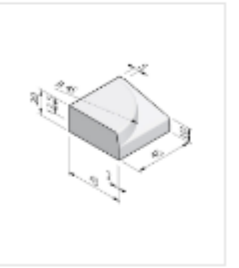


Uitvoeringen

afmetingen (cm)	lengte (cm)	uitvoering	gewicht (kg)
45x18	75	links	115,14
45x18	75	midden	110,70
45x18	75	rechts	115,14

Andere modellen uit deze productlijn





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DESIGN EXERCISE

- Split up into small groups
- Redesign one of the following roundabouts using protected roundabout design principles.
  - Auckland
  - Wellington
  - Nelson

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LAKE ROAD/ EXMOUTH ROAD

Northcote, Auckland

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BROADWAY/ IRA STREET

Strathmore Park, Wellington

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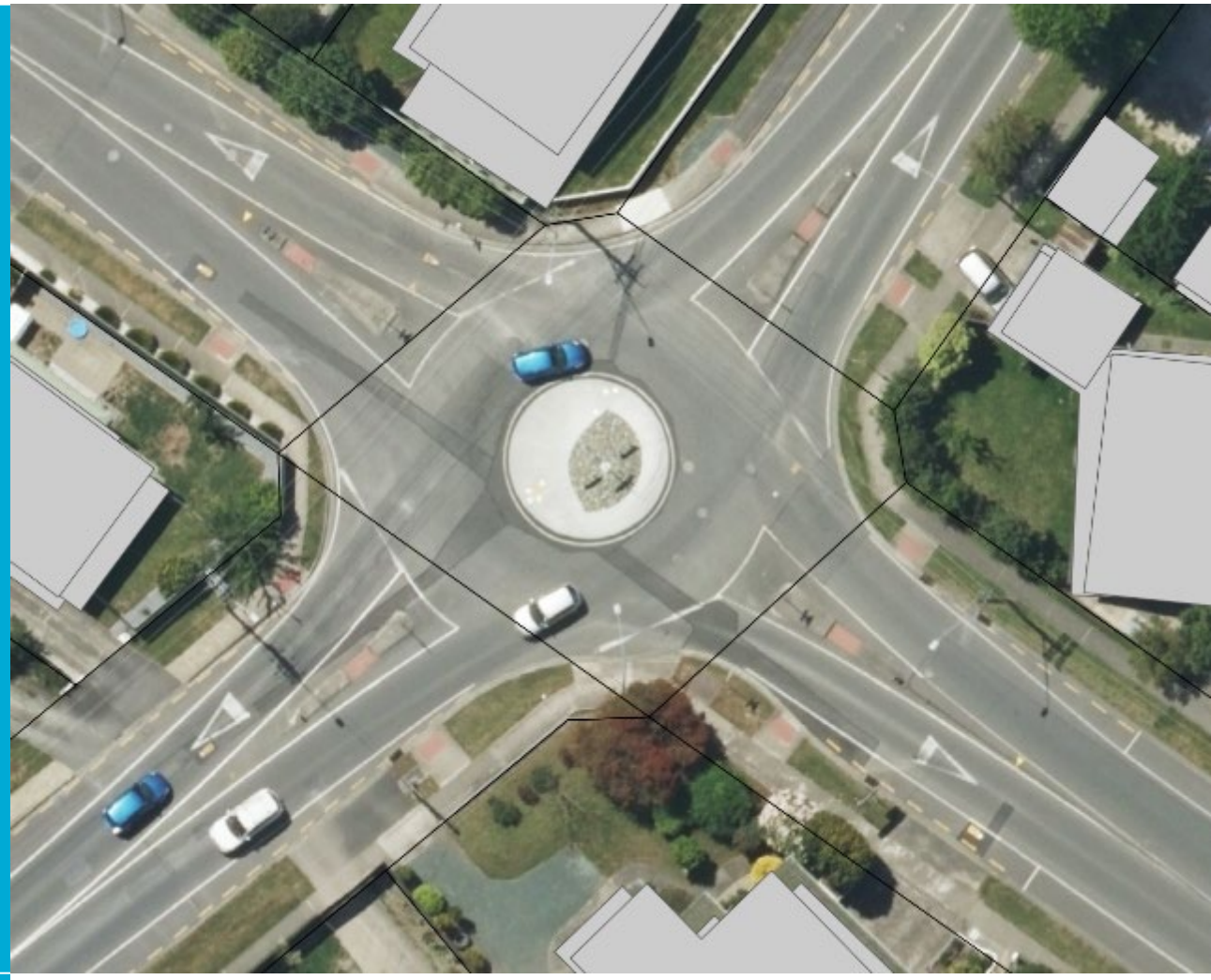
NAYLAND/ SONGER STREET

Stoke, Nelson



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DESIGN STEPS

- Design from the inside out
- Consider central island placement
- Align approaches
- Trace each of the elements
- Compromise where needed(!)
- Consider trade-offs
- Added bonus points for artwork

- Don’t worry about traffic volumes!
- It’s all flat.
- No property purchase (unless absolutely necessary)

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REPORT BACK

- Did it fit
- Did you make trade-offs
- Any key concerns?
- Why can’t we do this?

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028 8514 8050

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