



## SESSION 4.8 INTERSECTION AND INTERCHANGE DESIGN

CONDUCTING ROAD SAFETY AUDITS & APPRAISALS

PRESENTED BY: RTS & AGTT

24 – 28 JULY 2023



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### Factors Influencing intersection design

#### Control of conflicting traffic flows

- in space or time or both

#### Hierarchy of control

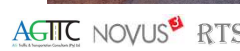
- Uncontrolled
- Yield control
- Priority control
- All way stop control
- Geometric control (mini roundabout)
- Geometric control (roundabout)
- Traffic signal control
- Grade separation with interrupted flow conditions
- Grade separation free flow conditions



SOURCE: WHO



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### Factors influencing intersection design for safety

#### Road users

- Commuters
- Rural travelers
- Holiday / recreational travelers
- NMT users
- People with disabilities
- Traffic volumes

#### Vehicle factors

- Heavy goods vehicles
- Abnormal loads

#### Roads design factors

- Visibility and sight distance
- Intersection angle
- Curves
- Crests/Sags
- Number of basic lanes
- Auxiliary lanes
- Medians and shoulders
- Slip lanes
- Street furniture
- Signage and marking
- Control
- Design speeds

SOURCE: WHO

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### Examples of factors that makes intersections unsafe

- **Road**
  - Width
  - Gradient
  - Alignment
  - Intersection angle
  - Surroundings
  - Layout Markings
  - Surface quality
- **Vehicle**
  - Heavy goods vehicles
  - Length
  - Width
  - Encroachment

- **Environment**
  - Weather
  - Surface condition
  - Natural light
  - Road lighting
  - Signs
  - Traffic signal heads
  - Lack of enforcement
- **Traffic**
  - Volume / Density
  - Speed

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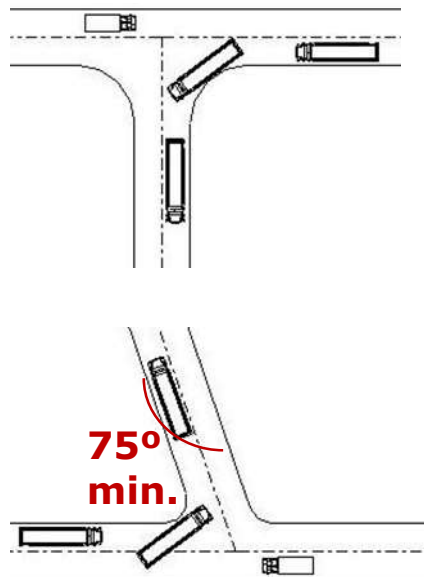
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## INTERSECTIONS

Streets shall be designed to intersect at right angles whenever possible.

Many road codes will not allow streets to intersect at angles less than 75 degrees.

A heavy goods vehicle turning swings out over the other lane when the radius is less than 90 degrees.

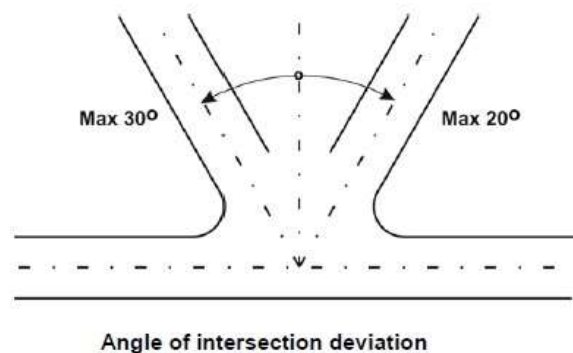


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## INTERSECTION ANGLES THE THEORY



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## INTERSECTION ANGLES IN PRACTICE



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## Modern roundabouts



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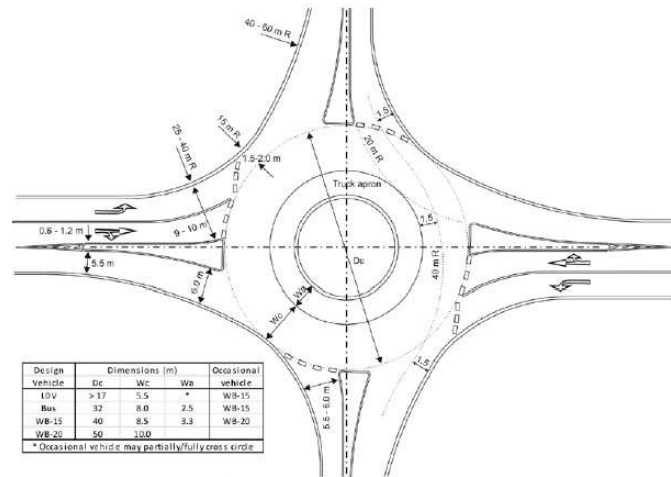


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## Modern roundabouts



Single-lane roundabout



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## Why is the modern roundabout promoted?

- Operational benefits:
- Reduced delay
- Partial stops / gap acceptance
- Self regulating
- Lower speeds
- Angle of conflict less
- Need mature road users
- Not NMT friendly

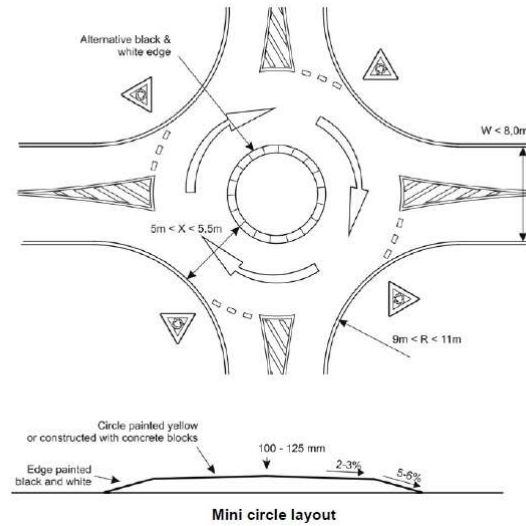


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## Mini circles?



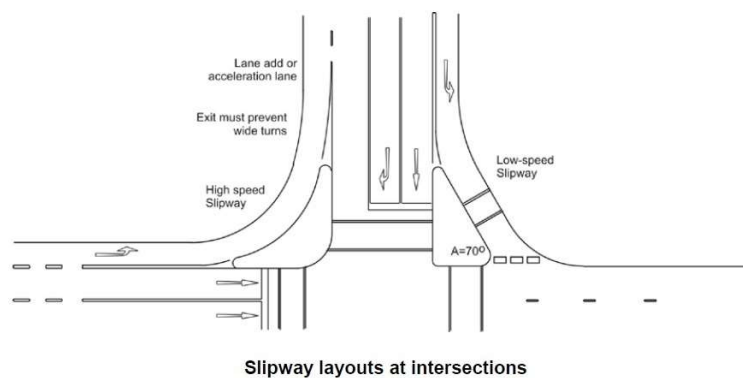
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## Slip lanes: high versus low speed



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## Slip lanes: high versus low speed



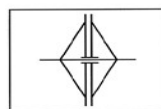
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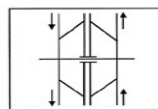
SOURCE: RSM

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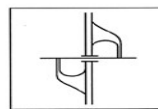
## Interchanges on freeways



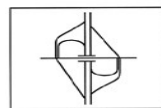
Full Diamond



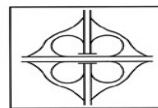
Full Diamond with Slip Ramps



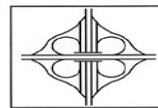
Partial Cloverleaf (Parclo)



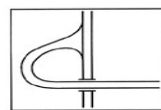
Parclo (4-Quad)



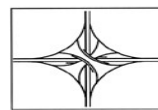
Full Cloverleaf



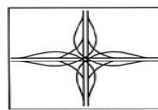
Full Cloverleaf with Collector/Distributor Roads



Trumpet



Directional



Directional

970000-1



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SOURCE: RSM

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## The most complex interchange in South Africa: Koeberg: M5 /N1 Provincial Government Western Cape

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## High speed directional ramp

SOURCE: RSM



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## High speed directional ramp



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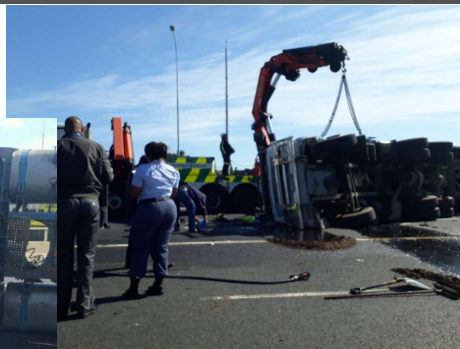


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## High speed directional ramp



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## Safety issues at intersections: discussion

### NMT consideration

#### Users

Pedestrians

Cyclist

Other

Grade separation

Intersections (also under universal access)

Mid block crossings

Double right turn lanes

Median

Railway level crossings



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## Intersection phased interventions: revisit

### Solomon Mahlangu Dr/ Garstfontein Road, Pretoria

#### Short Term Interventions

#### Medium Term Interventions

#### Long Term Interventions

1	Provide advance warning of southern approach on downhill	8	Improve vertical alignment to enhance visibility on Garstfontein west approach
2	Provide pedestrian crossing on downhill southern approach	9	Improve vertical alignment to enhance visibility on Garstfontein west approach
3	Enhance lighting levels at intersection to improve time visibility	15	Provide a compulsory truck stop and dedicated truck lane marking & construct heavy vehicle arrester bed
4	Repair edge break and shoulder in Garstfontein Road		
6	Move directional sign obstructing the signal head on southern approach on Solomon Mahlangu		
7	Advance warning signs & road markings of lane merge at taper on Solomon Mahlangu		
10	Re-activate the existing red light enforcement camera		
11	Replace all intersection lane road markings & mark all stop lines with thermo plastic		
12	Replace W413 signs on splitter islands		
13	Provide COSBI road marking		
14	Daylight embankment by removing bush to improve visibility on Solomon Mahlangu southern approach		



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IDENTIFICATION OF ROAD SAFETY RISKS

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