Session 4.8 Intersection and Interchange design

Conducting Road Safety Audits & Appraisals

Presented by: RTS & AGTT

January 2022

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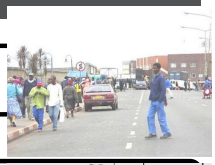
Factors Influencing intersection design

Source: WHO

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

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Factors influencing intersection design for safety

SOURCE: WHO

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

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Examples of factors that makes intersections unsafe

SOURCE: WHO

- **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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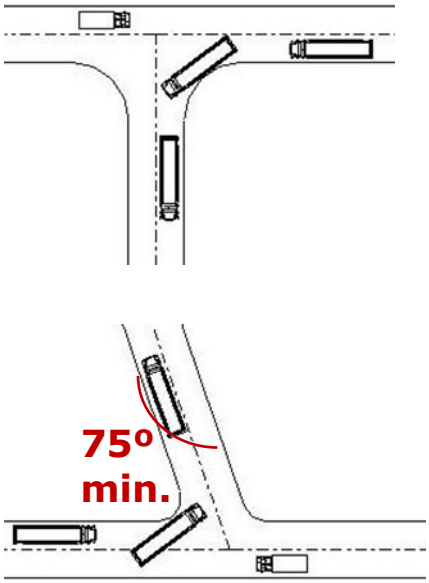
INTERSECTIONS

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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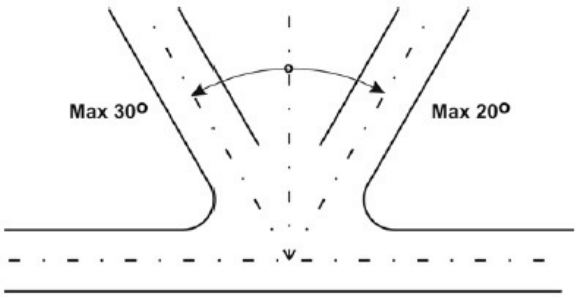
INTERSECTION ANGLES THE THEORY



Angle of intersection deviation

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INTERSECTION ANGLES IN PRACTICE

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Modern roundabouts

SOURCE: RSM

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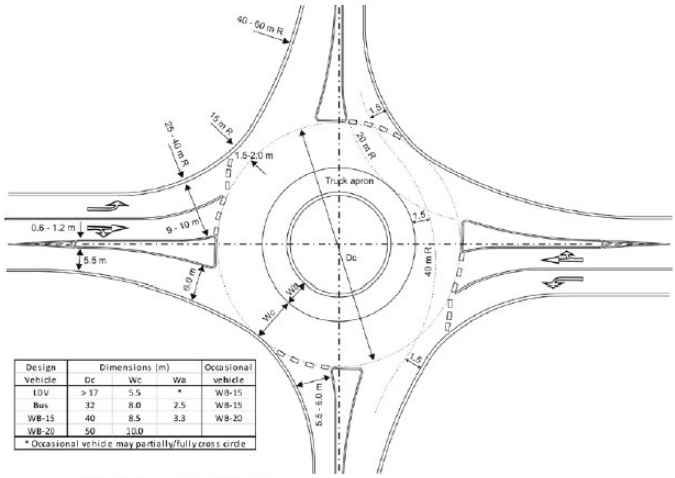
Modern roundabouts

SOURCE: RSM



Design Vehicle	Dimensions (m) Dc	Wc	Wa	Occasional vehicle
LDV	> 17	5.5	*	WB-15
Bus	32	8.0	2.5	WB-15
WB-15	40	8.5	3.3	WB-20
WB-20	50	10.0		

* Occasional vehicle may partially/fully cross circle

Single-lane roundabout

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Why is the modern roundabout promoted?

SOURCE: RSM

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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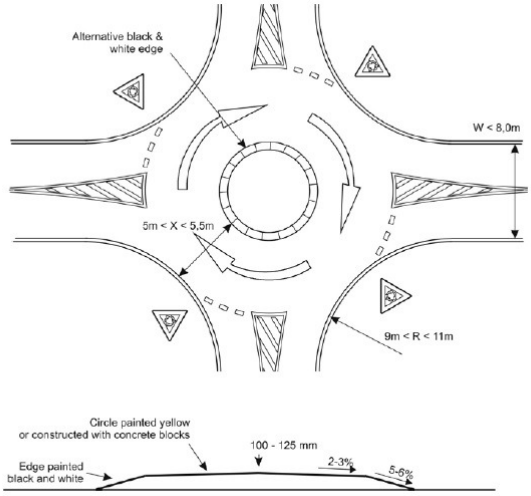
Mini circles?

SOURCE: RSM



Mini circle layout

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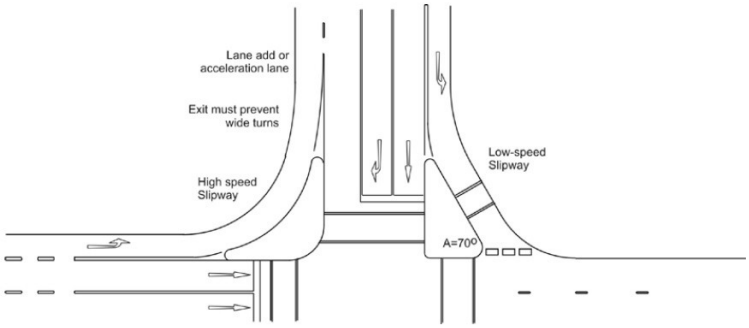
Slip lanes: high versus low speed

SOURCE: RSM



Slipway layouts at intersections

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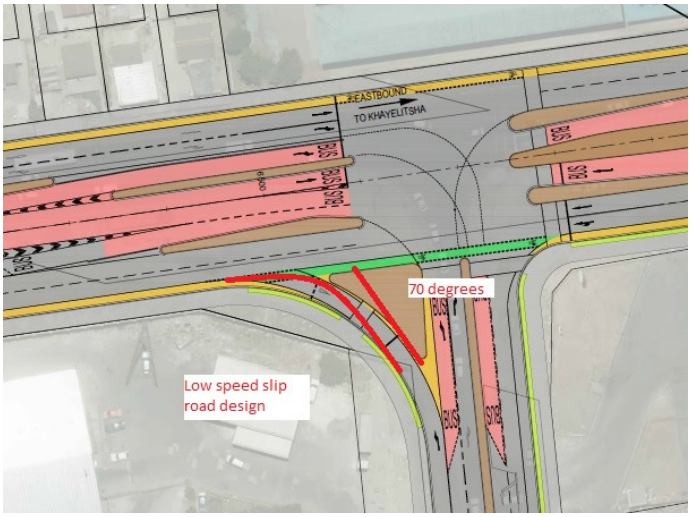
Slip lanes: high versus low speed



SOURCE: RSM

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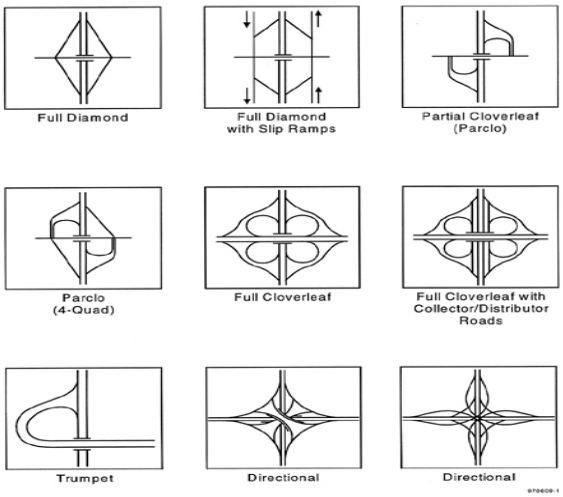
Interchanges on freeways



SOURCE: RSM

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

SOURCE: RSM

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High speed directional ramp

SOURCE: RSM

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High speed directional ramp

SOURCE: RSM

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High speed directional ramp

SOURCE: RSM

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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

1	Provide adv[illegible] on downhill southern a[illegible]
2	Provide per[illegible] downhill sou[illegible]
3	Enhance ligh[illegible] time visibility
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

Medium Term Interventions

8	Imp[illegible]
9	Incr[illegible] (sub[illegible] approach

Long Term Interventions

5	Improve vertical alignment to enhance visibility on Garstfontein west approach
15	Provide a compulsory truck stop and dedicated truck lane marking & construct heavy vehicle arrester bed

IDENTIFICATION OF ROAD SAFETY RISKS

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