Unit 4: Transport Operations Control Strategies and Systems

Module 4-3

Unsignalised Intersections – Stop, Give Way and Roundabouts

Austroads

Today's presenter

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Outline of this Module

- Types of intersections

- Selection of intersection devices

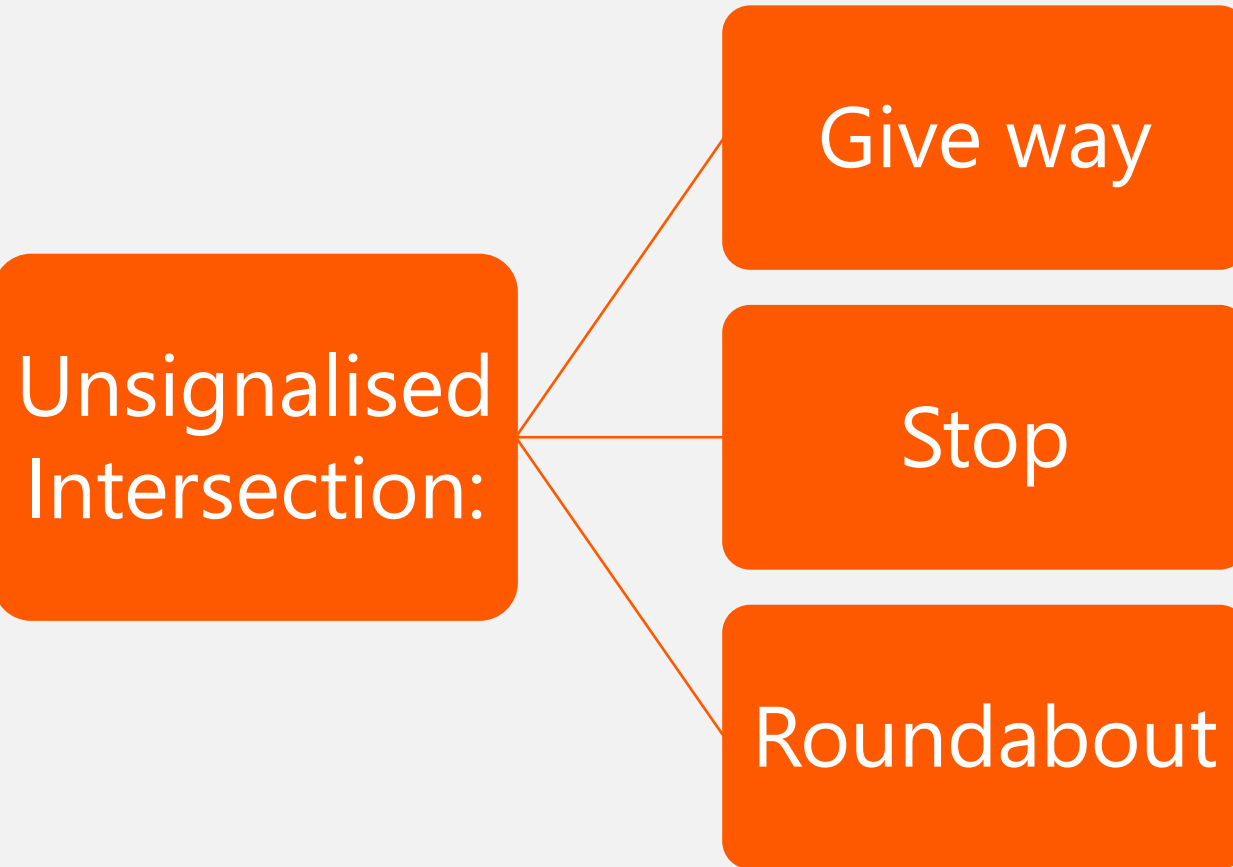- Intersection performance

- Other signage

- Line markings

Types of Intersections

Types of Unsignalised Intersections

Unsignalised Intersection:

- Give way
- Stop
- Roundabout

Types of Intersections - Give way

Give way intersections indicate priority to a particular movement

Type 1: Via a give way sign on the minor road at a junction

- Indicates clear priority to the major through traffic movement

Type 2: Natural give way priority at a T-intersection on local roads

- The need for a give way sign is unnecessary as the entering minor road must give way to the through road

Source: Transport Tasmania (2017)

Types of Intersections – Stop

Stop intersections facilitate traffic safety by instructing drivers to come to a halt at an intersection before seeking out a gap in traffic.

They are generally used in the following situation:

Low visibility intersections where the sight distance onto the major road is blocked considerably.

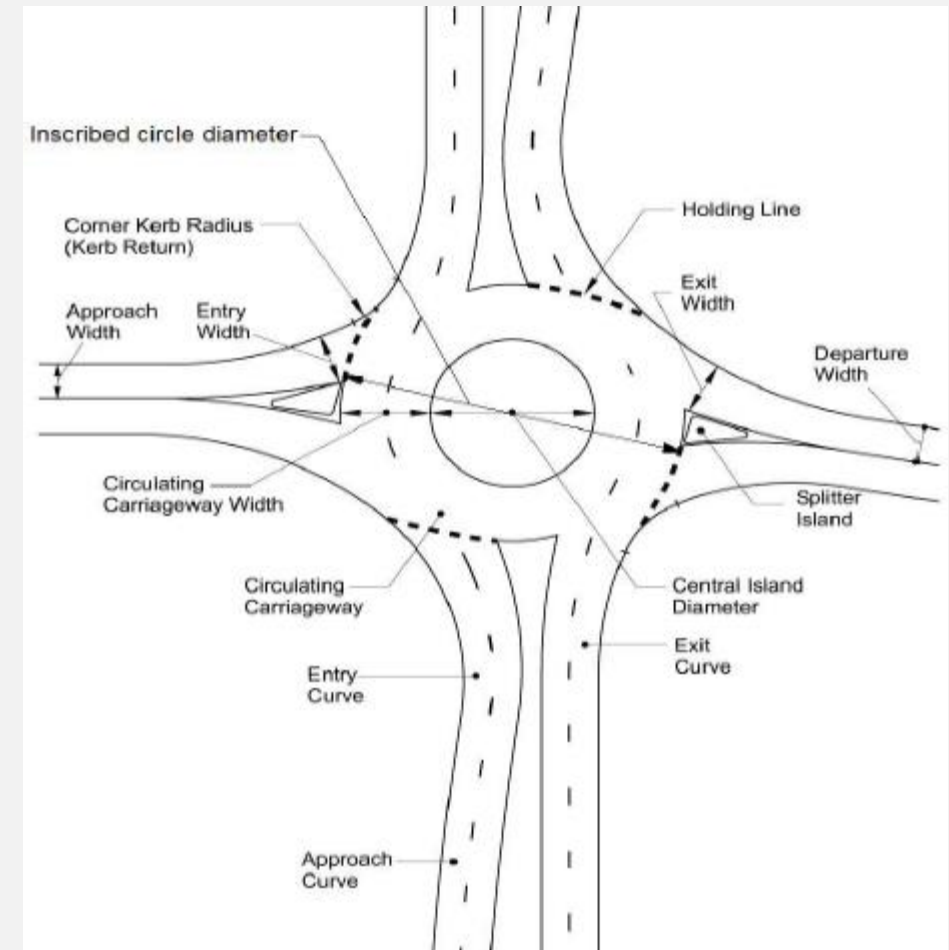- Used when a give way intersection is inadequate.

See Figure 5.2, Austroads (2019)

Types of Intersections - Roundabout

'Channelized intersection where vehicles travel clockwise around a central island' (MRWA 2015).

The most elaborate of the three unsignalised intersection types.

- Multiple give way T-intersections

- Entering drivers need to consider both circulating and oncoming traffic (MRWA 2015).

Inscribed circle diameter

Corner Kerb Radius (Kerb Return)

Approach Width   Entry Width

Circulating Carriageway Width

Circulating Carriageway

Entry Curve

Approach Curve

Holding Line

Exit Width

Departure Width

Splitter Island

Central Island Diameter

Exit Curve

Source: MRWA (2015)

Roundabout Design Recommendations

- Number of approach legs should be limited to four (MRWA 2015)
- Legs should intersect at close to 90 degrees
- Clearly visible from a far distance
- Built on a sag or flat rather than a crest (MRWA 2015)
- Gradients should be limited to a maximum of -5%
- Radius of central island should be an adequate size for the desired speed

Roundabout Approach Geometry

Approach geometry benefits

- Slows drivers down

- Alerts drivers of oncoming roundabout

- Reduces entrance angle

Approach geometry options

- Kerb extensions on the left side of entry lane

- Raised median islands

- Approach splitter island

- Reverse radius curves

Example of reverse radius curve approach. Source: MRWA (2015)

See Section 3.5.4, Austroads (2019)

Selection of Intersection Devices

General considerations

General intersection considerations

- Long-term requirements
- Number of legs
- Land availability
- Gradient of the road
- Road speeds
- Traffic volumes
- Road users
- Cost

T-Intersection

Give way

- The most basic intersection priority device

Stop

- Used only when there is poor visibility

Roundabout

- Used when high traffic volumes/speeds are present

See Figure 5.2, Austroads (2019)

Source: Google Earth (2020)

Examples of T-intersections

- The figure to the right utilises a stop intersection due to the building obscuring the view.

Source: Bike Exchange (2017)

- The figure to the left depicts a situation where a three-leg roundabout would be utilised due to high traffic volumes and speeds.

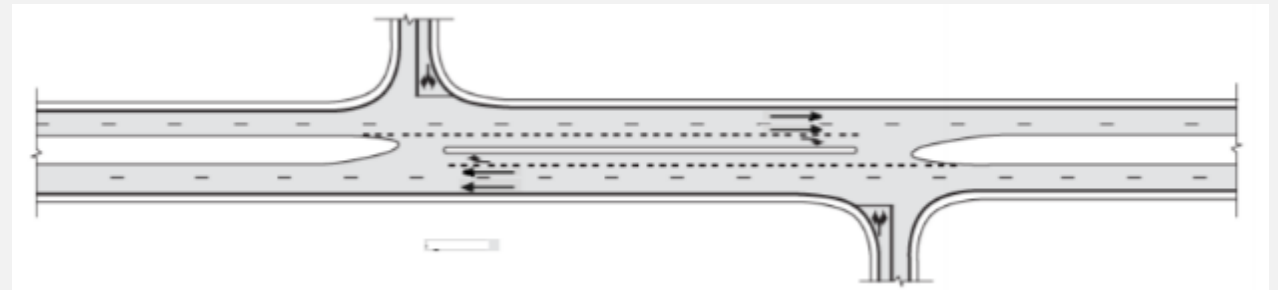Source: Google Earth (2020)

Four-way Intersection

Roundabout

- Only use when there are balanced traffic volumes on all legs

- Otherwise a signalised intersection is preferred

Give way/Stop

- Used when a staggered intersection can be implemented. See figure for example intersection.

See Section 3.2.7, Austroads (2020)

Divided road staggered intersection diagram. Source: Austroads (2020)

Multi-leg (more than four leg) Intersections

Source: Greater Auckland (2013)

Give way/Stop

- Unsuitable as right of way priority is unclear

Roundabout

- Single lane roundabout is effective

- Multi-lane roundabouts can be confusing, however have been shown to be effective especially if coupled with signalised approaches

Intersection Performance

Stop/Give way Performance

Stop/Give way benefits

- Low cost

- Minimal land use

- Low maintenance

- Stop signs improve safety where line of sight is obscured

- Stop signs should only be used where warranted to avoid a false sense of security and increased driver frustration
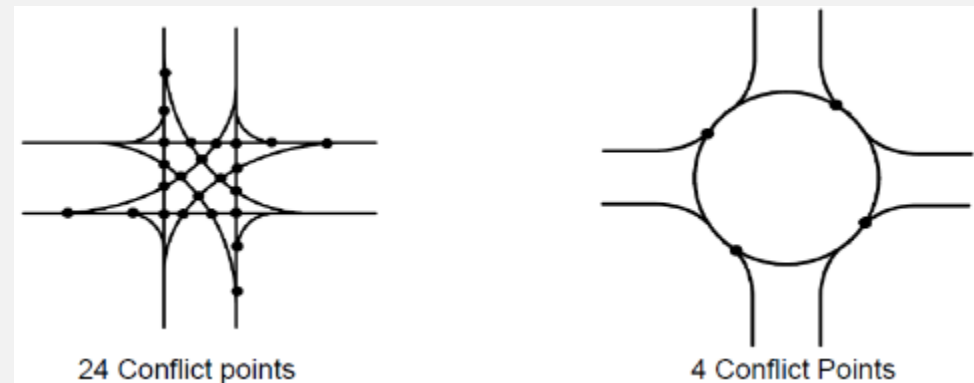
Roundabout Performance

Safety

- '*Generally align better with safe system principles than other forms of intersections*' – Austroads (2019)

- Reduced number of crashes compared to signalised intersection (see figure top)

- Reduced severity of crashes by minimising the angle of conflict and speed

- Reduced number of conflicts (see figure bottom)

- Poor safety for bicycles when the entering and circulatory speeds are high (i.e. > 30 km/h)

- Perceived pedestrian safety issues despite very low incident rates of 0.02 ped-crashes/per roundabout/year (VicRoads 2015)

Arterial Road / Arterial Road Intersections	Mean Casualty Crash Frequency [1] (Crashes / Intersection / Year)	
	Traffic Signals	Roundabouts
Inner Melbourne [2]	2.11	1.08 [4]
Outer Melbourne [3]	2.00	1.01
Country Victoria (rural cities and towns)	0.95	0.47

Source: VicRoads (2015)

24 Conflict points   4 Conflict Points

Source: VicRoads (2015)

Roundabout Performance

Heavy vehicle wide apron example. Source: MRWA (2015)

Efficiency

- No 'lost time' between cycles due to continuous flow

- Unsuitable for unequal leg volumes

- Signal linking is unavailable

Other

- No ongoing costs

- Aesthetically pleasing

- Not ideal for heavy vehicles due to their low acceleration and swept path (see figure left)

Signage

Roundabouts Signage

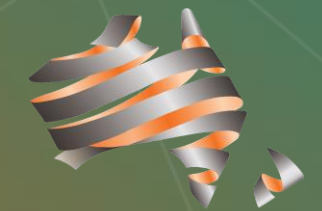The complex nature of multiple legged roundabouts requires clear information signs.

• Especially for multi-lane roundabouts.

High speed roads can benefit from a 'reduce speed' sign approximately 50-100 m before the roundabout.

Roundabout information sign. Source: MRWA (2015)
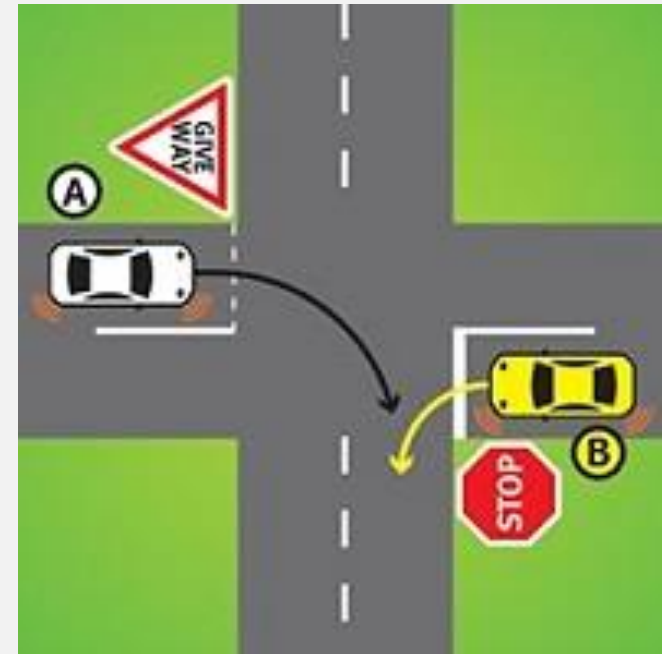
Line Markings

Line Markings – Stop/Give way

Give way

Broken lines indicate that a driver must give way to the entering road.

Stop

Unbroken lines indicate the legal requirement for road users to stop before crossing.

Give way and stop line markings. Source: Qld Gov (2018)
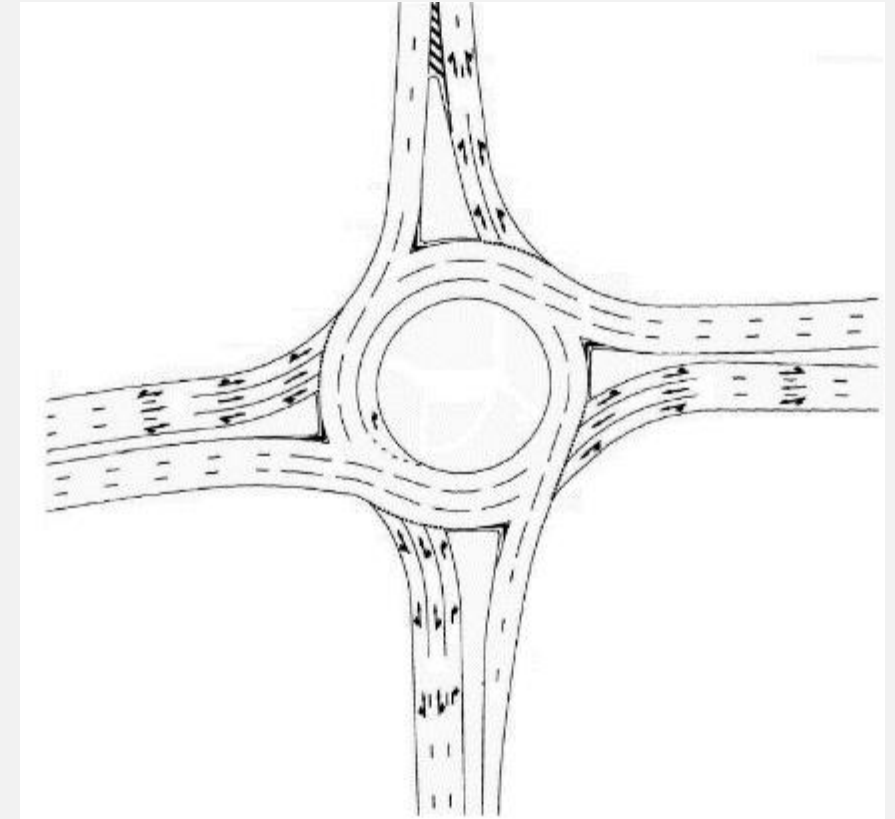
Line Markings – Roundabouts

Wide inner lane markings

- Accommodates through and turning movements (MRWA 2015)

- Heavy vehicles swept path

Entry curvature line marking (MRWA 2015)

- Used in place of physical median strips when they are unavailable

Rumble strips upon entry

- Provide audio-tactile warnings to drivers upon approach

- Reduces speed by an estimated 5 km/h (Austroads 2020)

- Common on rural highways

Major urban roundabout line markings. Source: Austroads (2020)

Line Markings – Spiral Line Marking

Lane change

Lane gain

Spiral roundabout line markings. Source: MRWA (2015)

Multi-lane roundabouts may utilise a spiral line system

• Series of lane gains/losses

• Clear line markings assist with motorists recognising the required lane for their exit

• A series of hatched and unbroken lines assist with drivers understanding where to exit or remain in the roundabout (RTE 16)

Quiz Questions

Time to Reflect

Q1. What are three contributing factors to the increased safety at roundabouts?

A. Reduced collision angle, lower traffic volumes and increased visibility.

B. Reduced collision angle, more suitable for cyclists, safer mode share.

C. Reduced number of potential conflicts, reduced collision angle and reduced speeds.

Explanation:

Answer C is correct! All three factors increase safety at roundabouts.

Answer A contains lower traffic volumes and increased visibility which are not *always* true.

Answer B claims that roundabouts are more suitable for cyclists, this is actually the opposite.

Time to Reflect

Q2. What topography should roundabouts be placed on for optimum safety and why?

A. In a sag. It slows down exit speeds as the vehicles have to drive uphill.

B. In a sag. It ensures that the roundabout is highly visible upon approach.

C. On a crest. The lighting allows drivers to better see the risks.

D. On a crest. Water will drain away from the roundabout and ensure the road isn't slippery.

Explanation:

Answer B is correct!

Answer A may be true but it also increases speeds upon approach to the intersection.

Answer C and D indicate that a crest is the most appropriate. Despite the outlined benefits, the risk of the roundabout being obscured due to its layout is far greater.

Time to Reflect

Q3 True or False? Using stop signs at an unsignalised intersection will always increase safety?

A. True

B. False

Explanation

The answer is False.

Stop signs should only be used when warranted. Studies have shown that the inappropriate use of stop signs will not only cause drivers to ignore the road rules but may cause them to speed up quickly after the intersection to make up for lost time.

References

ARRB (2016). Traffic Management 101 Session 8, ARRB, Port Melbourne, VIC.

Austroads (2020). Guide to Traffic Management Part 6, AGTM06-20, Austroads, Sydney, NSW, available at: https://austroads.com.au/publications/traffic-management/agtm06. Accessed: 22 April 2020.

Austroads (2017). Guide to Road Design 4A, AGRD04A-17, Austroads, Sydney, NSW, available at: https://austroads.com.au/publications/road-design/agrd-set. Accessed: 22 April 2020.

Bike Exchange (2017). The Australian Cycling Road Rules to Know, available at: https://www.bikeexchange.com.au/blog/australian-cycling-road-rules-to-know. Accessed 22 April 2020

Google Earth (2020). Google, accessed 22 April 2020.

Greater Auckland (2013). The worst roundabouts in Auckland, available at: https://www.greaterauckland.org.nz/2013/08/04/the-worst-roundabouts-in-auckand/. Accessed 24 June 2020.

MRWA (2015). Road and Traffic Engineering; Module 16 – Roundabouts, MRWA, WA, accessed: 22 April 2020.

Qld Gov (2018). Giving Way, Queensland Government, Queensland, available at https://www.qld.gov.au/transport/safety/rules/road/give-way, accessed 20 April 2020.

VicRoads (2015). VicRoads Supplement to Austroads Guide to Traffic Management, Part 6: Intersections, Interchanges and Crossings, TEM Vol 1 Part 26, VIC, accessed 15 April 2020.

Transport Tasmania (2017). Tasmanian Road Rules, Department of State Growth, Tasmanian Government, available at: https://www.transport.tas.gov.au/__data/assets/pdf_file/0019/152425/Tasmanian_Road_Rules_2017.pdf. Accessed: 24 June 2020.

Thank you for participating