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<p>Hierdie verslag verskaf riglyne aan plaaslike owerhede en verkeersingenieurs, ten opsigte van 'n eenvormige benadering vir die ontwerp en implementering van minisirkels. Dit word aanbeveel dat hierdie verslag in samehang met die verslag 'National Guidelines for Traffic Calming' gebruik word.</p> <p>Konsepte en beginsels rakende die gebruik van minisirkels as 'n vorm van kruispunt-beheer, en ten opsigte van verkeerskalmering, word bespreek. Regverdigingsmaatstawwe vir die implementering van minisirkels en ontwerpstandaarde word verskaf om 'n eenvormige ontwerppraktyk te bevorder.</p>		<p>This report presents guidelines to assist local authorities and traffic engineers with a uniform approach to the design and implementation of mini-roundabouts. It is recommended that these guidelines be read in conjunction with The National Guidelines for Traffic Calming.</p> <p>Concepts and principles relating to the use of mini-roundabouts as a form of intersection control and in the traffic calming context are discussed. Warrants for the implementation of mini-roundabouts and design standards are provided to encourage consistent design practice.</p>	
KEY WORDS TREFWOORDE		Mini-roundabouts, intersection control, traffic calming measure, warrants, implementation procedure, signs and road markings, deflection islands, priority.	
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REVIEW STATEMENT

This report has been reviewed internally by the CSIR but not yet by the Department of Transport.

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1. INTRODUCTION

With a greater utilisation of mini-roundabouts in traffic calming schemes and as an effective form of intersection control, the need to ensure uniform design and implementation of these measures is essential. The Division of Roads and Transport Technology (DRTT), CSIR, recognised this need, and as part of its ongoing investigation into traffic calming, undertook to provide guidelines to assist traffic engineers and local authorities with the implementation of mini-roundabouts.

The definitive physical difference between the conventional roundabout and the mini-roundabout (also commonly referred to as a 'mini circle') is one of size and type of central medium; the conventional roundabout having a kerbed (non mountable) central island with a diameter greater than 4 metres, while the mini-roundabout consists of a flush or slightly raised (mountable) circular medium less than 4 metres in diameter. The circumstances dictating the appropriate use of these two forms of intersection control also differ considerably, and are dependent on traffic flow characteristics, physical constraints of the location, and cost constraints. This report deals specifically with the design and use of mini-roundabouts, and not the conventional roundabout.

The use of mini-roundabouts on the European continent, and particularly in the UK, is widespread^{1,2}. Their success as efficient forms of intersection control and traffic calming devices has long been acknowledged amongst traffic engineers in these countries. Only in the last decade have the operational advantages of mini-roundabouts over 4-way and 3-way stop controls, and their space and cost benefits over conventional roundabouts, led to them gaining favour amongst the local traffic engineering and management fraternity. Initially they were employed as intersection controls, but their appropriateness in the traffic calming context has also been recognised and their use in such schemes has increased.

The objectives of these guidelines are:

- to provide traffic engineers, local authorities and town planners with the relevant background to the use of mini-roundabouts;
- to provide warrants and limitations for the implementation of mini-roundabouts;
- to provide standard designs for mini-roundabouts: and
- to highlight additional aspects (signing and road markings) that need to be considered when implementing mini-roundabouts.

The use of mini-roundabouts in isolation is applicable only when they are used as a form of intersection control. If they are to be implemented as part of a traffic calming scheme, it is recommended that these guidelines be read in conjunction with The National Guidelines for Traffic Calming³.

The aim of this document is to provide the necessary background and design criteria to encourage the standardisation and successful implementation of mini-roundabouts.

2. BACKGROUND

This chapter introduces concepts and principles important to the use of mini-roundabouts. As this document is intended essentially as a design guideline, these issues are not discussed in great detail, but are briefly highlighted to bring them to the attention of planners and traffic engineers. For a greater understanding of these issues reference should be made to the National Guidelines for Traffic Calming³ and other literature covering traffic calming and the use of mini-roundabouts.

2.1 Function of Mini-roundabouts.

The mini-roundabout can serve two functions; it can either be used as a form of intersection control, where it is more appropriate than a conventional roundabout and more efficient than other forms of intersection control or, as a traffic calming measure in a traffic calming scheme.

The aim of implementing a roundabout as a form of intersection control is to improve the operational level at the intersection. They have clear operational advantages over 3-way and 4-way stop controls under most traffic volumes, reducing both speeds and delays/stops at the intersection. By reducing speeds of vehicles entering and circumnavigating the roundabout, they assist in making the task of judging gap acceptance easier for drivers, and therefore improve the intersection in terms of safety. Mini-roundabouts have the added advantage of requiring less physical space and are more affordable than conventional traffic roundabouts. These benefits have contributed to their popularity amongst the traffic engineering fraternity locally and internationally.

Mini-roundabouts, like conventional roundabouts, operate more efficiently when there are equal traffic flows on all links, and when there are high proportions of right turning traffic. Under these conditions they reduce delays and stops and therefore have a greater capacity than 3-way and 4-way stop-controlled intersections. The use of flared entries, when physical and cost constraints allow, and deflection islands to guide vehicles into the curvature of the roundabout, improve flow conditions and thus increase capacity at the intersection. Adequate deflection, by changing horizontal realignment, is imperative to ensure that vehicles approach and negotiate the roundabout at safe speeds.

Although they are still essentially a form of intersection control when used in a traffic calming context, their desired influence on traffic flow characteristics through the intersection is different to that of a pure intersection control function. As the objective of traffic calming is to reduce speeds and discourage through traffic, the function of a mini-roundabout in a traffic calming scheme is to limit capacity and vehicle speed through the intersection. This is achieved by inducing significant deflection of vehicles negotiating the intersection. This condition is generally easy to obtain at 4-way

intersections, with the central positioning of the circular island, but not always possible at T-junctions, where physical and cost constraints often result in the inability to place the central island in the ideal position to ensure adequate deflection of vehicles. In such cases the need for approach treatments (deflection islands, channelisation and speed humps) are required to control entry speeds (particularly along the straight through movement, which is typically the main road). Although there are other traffic calming intersection control measures available, the affordability of mini-roundabouts, their ease of construction, and the added benefits of reducing speeds and improving safety at the intersection, have made them a popular choice.

2.2 Mini-roundabout Alternatives

The mini-roundabout is defined as a roundabout having a one way circulatory carriageway around a flush or slightly raised circular island, with semi-circular profile, less than four metres in diameter, and with or without flared approaches⁴. Figure 2.1 shows the elements of a mini-roundabout.

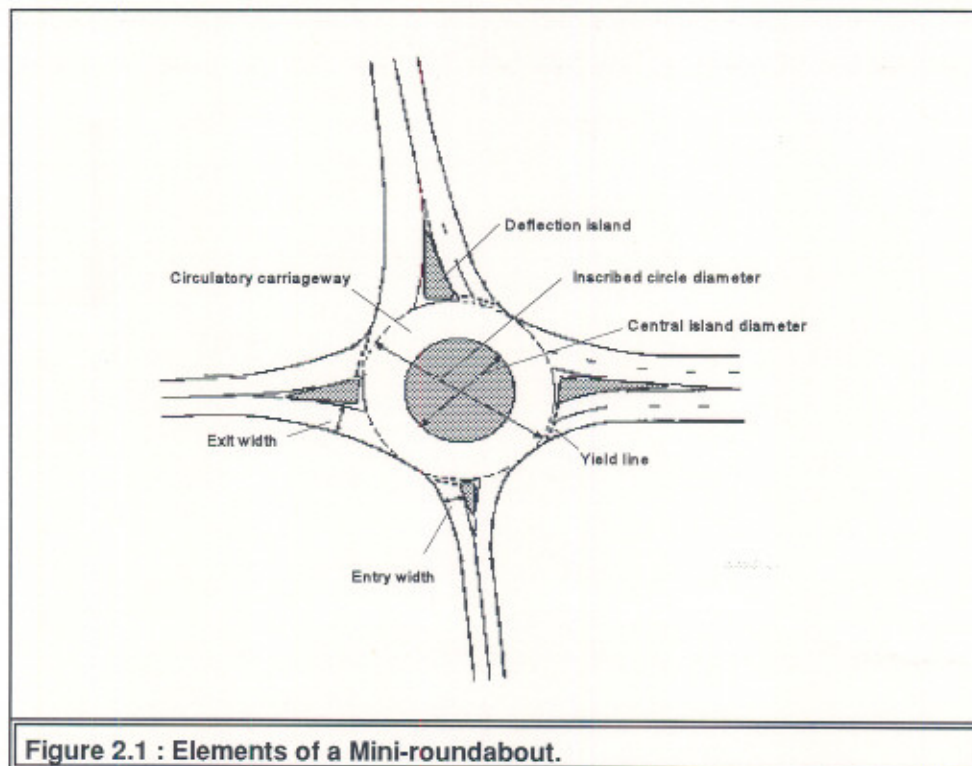


Figure 2.1 : Elements of a Mini-roundabout.

Initially, due to cost implications, painted road markings constituted the circular central medium, but as these are not self-enforcing, it was common for motorists to ignore the road markings and drive over the circle, and thus the intention to encourage circulatory flow was lost. As the effectiveness of these painted mini-roundabouts is in question, they are not recommended for use in traffic calming schemes. However, they can be considered for control purposes where intersection approach geometry is such that deflection is obtained.

By using a raised circular island, with the same semi-circular profile as that of a speed hump, motorists are encouraged to circumnavigate the central island. Because of the restrictive dimensions of mini-roundabouts (specifically the inscribed circular diameter) it is essential for the central island to be mountable so as to accommodate larger vehicles that may otherwise have difficulty in negotiating the tight curvature.

A 25mm high lip around the circumference of the island creates an added perception amongst motorists that deters them from scaling the island. Unfortunately the considerable wear inflicted on mini-roundabout islands by heavy vehicles often results in a rapid deterioration of the premix asphalt and a 'chipping away' at the lip. A common practice in Pretoria is to attach a 25mm high steel ring around the circular island to 'protect' the lip, but it is absolutely imperative that the ring is sufficiently fastened to the island and checked regularly, as it will prove a safety hazard if it comes loose. If finances allow, it is recommended that interlocking paving blocks rather be used to create the lip (see chapter 4).

When a mini-roundabout is adopted as an intersection control, the aim is to increase the capacity of the intersection. In such cases flared approaches and wide carriageway widths, achieved by increasing the inscribed circular diameter and decreasing the central island dimensions, are encouraged. When implemented as a traffic calming device, restrictive dimensions and entries are encouraged.

2.3 Deflection Islands

The use of deflection islands on all approaches is encouraged. Not only do they assist in clearly defining the entry and exit lanes by separating flow directions, but they have the added advantage of controlling entry speeds, guiding traffic into the roundabout and discouraging right-turners from taking dangerous 'wrong way' short cut movements through the intersection. If large enough, they also provide shelter for pedestrians, and are an ideal place to situate the relevant traffic signs.

If physical and cost constraints allow, it is recommended that deflection islands be built-up, kerbed traffic islands. As pointed out previously, painted islands are not self enforcing and are often ignored. It is recommended that traffic islands are made large enough to ensure that they are easily detected by motorists and do not prove a dangerous hazard themselves. A minimum area of 5m² is recommended.

The use of appropriate road markings and road studs 'upstream' of deflection islands is recommended, to forewarn motorists of their presence. Road markings must be of a high quality, retro-reflective paint to ensure adequate visibility.

2.4 Priority Rule

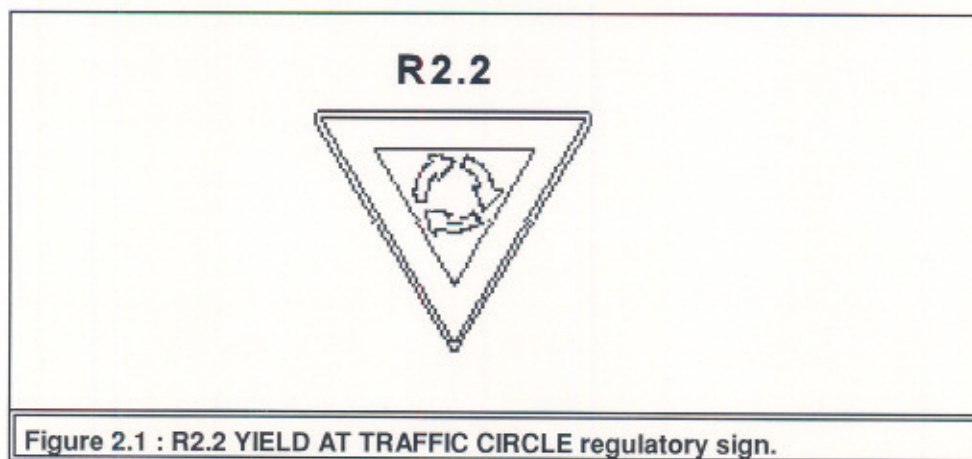
The rules governing right-of-way at mini-roundabouts have often proved confusing to motorists. As stated in the South African Road Traffic Signs Manual, "the 'rules of the road' given in the Road Traffic Act, Act 29 of 1989 (Section 94) prescribe the action required by drivers entering a junction containing a traffic island". The section states:

*"The driver of a vehicle on a public road shall, when he intends entering any portion of a public road which constitutes a junction of two or more public roads where vehicular traffic is required to move around a traffic island within such a junction, **yield the right of way to all vehicular traffic approaching from his right within such junction, unless his entry into such junction is controlled by an instruction given by a traffic officer or a direction conveyed by a road traffic signal requiring him to act differently.**"*

Thus, unless entry is controlled by a road traffic sign, motorists are obliged to yield to any traffic approaching from their right within the mini-roundabout. The road traffic sign recommended for use at mini-roundabouts is the R2.2, "YIELD AT TRAFFIC CIRCLE" regulatory sign (see figure 2.2). Although a traffic circle may be installed without a R2.2 sign, it is recommended that, due to the novelty of mini-roundabouts in South Africa and the confusion amongst motorists as to the correct right-of-way at roundabouts, the R2.2 is used. The directive in the Act pertaining to the R2.2 road traffic sign reads:

*"Indicates to the driver of a vehicle approaching a traffic circle that he **shall yield right of way to any vehicle which will cross any yield line at such junction before him and which, in the normal course of events, will cross the path of such driver's vehicle.**"*

The regulatory road marking RTM2 YIELD LINE should be used in conjunction with the R2.2 traffic sign.



An article, written by FJJ Labuschagne, intended to provide clearer guidelines on the correct behaviour of motorists at mini-roundabouts, is provided in Appendix A. As confusion regarding the correct use of mini-roundabouts exists amongst motorists, it is critical to communicate to motorists the desired priority to be adopted (local press, pamphlets, radio broadcasts etc).

2.5 Visibility and Warning

It is critical that mini-roundabouts are sufficiently visible to approaching motorists. They should be visible at a distance no less than the Decision Sight Distance (DSD) determined by the operational or design speed along the specific approach (see table 2.1). Careful attention should be given to providing adequate visibility in the vicinity of the mini-roundabout. A driver of a vehicle approaching a mini-roundabout must be able to see an adequate distance up each of the other approaches. Any object unnecessarily obstructing the field of vision of motorists should be removed.

Table 2.1 : Decision Sight Distance on level roads.	
Design Speed (km/h)	Decision Sight Distance (m)
50	135-195
60	170-235
70	200-275
80	235-315
90	270-355
100	300-395

source : UTG1 : Guidelines for the geometric design of urban arterial roads⁵.
The shorter distance is calculated using operational speed, the longer calculated using design speed.

It is essential that adequate lighting is provided so that the mini-roundabout is sufficiently visible at night.

The relevant signs and recommended positioning of signs are given in Chapter 4. Where deflection islands are installed, it is recommended that yellow road markings be painted in the vicinity of the island, and a solid white barrier line extending 50 metres upstream of the island. The circular traffic island in the centre of the mini-roundabout shall be painted yellow. In the case of traffic calming, painted islands on the approaches should be used to try and create a perception amongst motorists of restricted entry widths. All road markings should be of a high quality retro-reflective paint with good skid resistance properties, and the use of road studs to reinforce the road markings, and to improve visibility at night, is recommended.

2.6 Impact on Pedestrians and Cyclists

Mini-roundabouts have negative implications for both cyclists and pedestrians. Circulation of traffic through a mini-roundabout is not straightforward and the need for vehicles to stop at the intersection is reduced. The opportunities for pedestrians to cross at a mini-roundabout therefore diminish and the task of pedestrians in judging acceptable gaps is made more difficult. Mini-roundabouts are hazardous for cyclists. This is because the circulatory flow and lesser carriageway width offer less protected space for cyclists. In addition, motorists are seldom prepared to concede a cyclist's right-of-way.

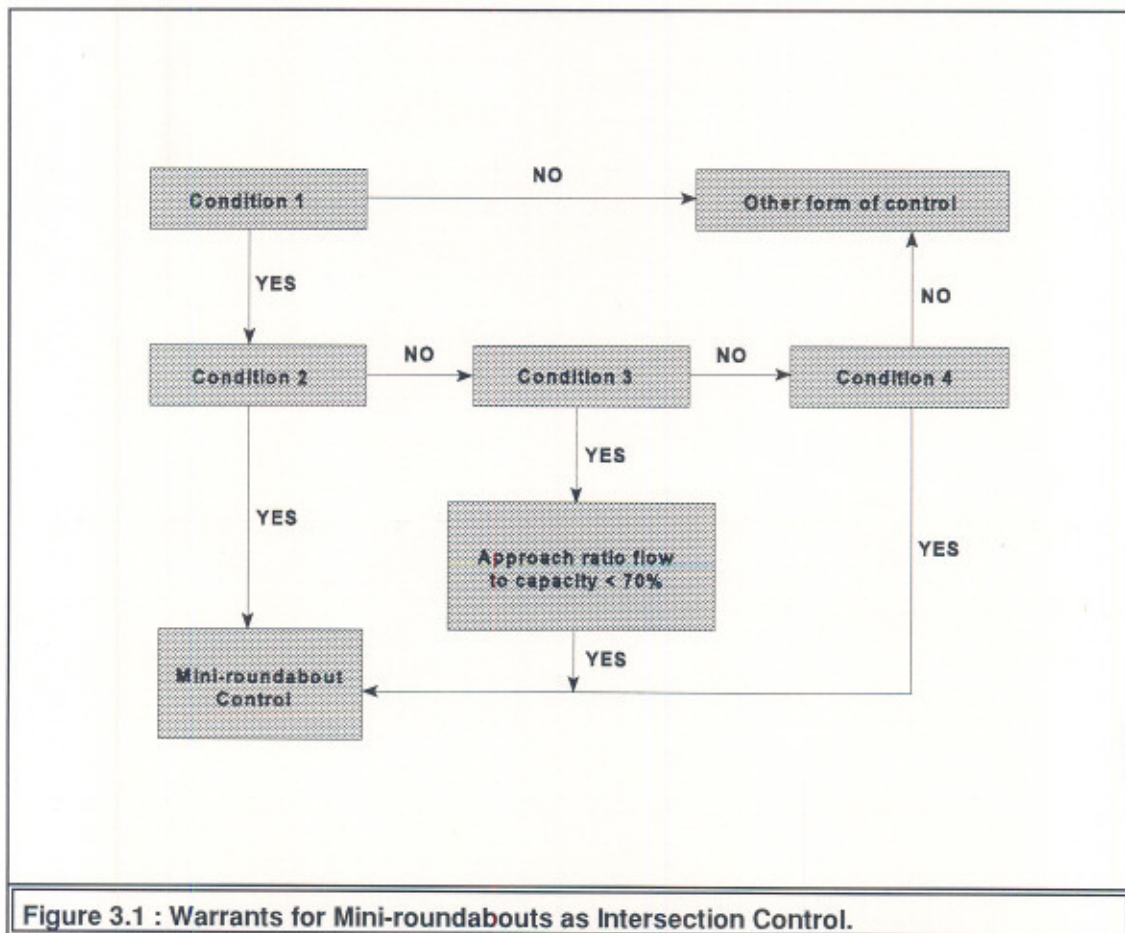
When designing a mini-roundabout, careful consideration must be given to these two types of road users and, where possible, provision must be made to accommodate them.

3. WARRANTS AND LIMITATIONS

This chapter provides proposed warrants, limitations and implementation procedures for the use of mini-roundabouts. The warrants and implementation procedure to be adopted depend on the intended function of the mini-roundabout; whether it is an intersection control or a traffic calming measure. In calculating the warrants, existing data should be used wherever possible and when required, supplemented with minor traffic surveys and site visits. It is important to apply sound engineering judgement when employing these warrants, as it is impossible to accommodate the uniqueness of each situation in them. They are intended as a guideline and, in certain cases, may be outweighed by a particular set of circumstances.

3.1 Warrants for Mini-roundabouts as a form of Intersection Control

The warrants proposed in 'Roundabouts - An Alternative To Intersection Control'⁴ are recommended. Figure 3.1 illustrates how the warrants should be applied, and the conditions are addressed below.



- Condition 1: Intersection volumes less than :
 - 3000 vph for 3-leg intersection
 - 4000 vph for 4-leg intersection
- Condition 2 : Recommended major/minor proportional split :

Number of Approaches	Intersection Volume (vph)	Split %
3	<1500	70/30
	>1500	60/40
4	<2000	70/30
	>2000	60/40

- Condition 3 : One major movement has a predominant through movement which is :
 - $50\% \leq \text{approach volume} \leq 80\%$
 - $25\% \leq \text{intersection volume} \leq 40\%$
- Condition 4 : Intersections with right-turning movements which are more than 25% of the approach volume and which experience :
 - Long delays (>15 seconds per vehicle)
 - High incidence of right angle accidents

Although mini-circles are used on class 1 roads in the U. K., in South Africa they are only recommended for use on class 3, and lower roads (Appendix B). This is mainly due to the driver behavioural characteristics experienced locally.

The implementation procedure to be followed in these circumstances, is an adaption of the implementation procedure provided in the Design and Implementation of Speed Humps⁶, and is given in Appendix C.

3.2 Warrants for Mini-roundabouts in a Traffic Calming Context

It is not appropriate, when using mini-roundabouts as a traffic calming measure, to implement them in isolation. They should be employed as part of an overall traffic calming scheme. Therefore the warrants and implementation procedure outlined in the National Guidelines for Traffic Calming³ should be adopted. These warrants apply to the greater concept of traffic calming, and not specifically to mini-roundabouts, and are therefore not discussed in great detail in this document.

Appendix D provides the warrants score sheet and the recommended implementation procedure for traffic calming.

After collecting and assessing data regarding the criteria stated on the warrants score sheet, weighted scores for each criterion are calculated (using the given weights stated on the score sheet), and a weighted total score for the specific site is calculated using the following method:

- Criteria with the same weights are grouped together (e.g. all criteria with weighting equal to three, namely criteria 1, 2, 6, 7 and 16). Based on this grouping of weights, there are four weight groups to be considered in the calculation. An averaging process is then applied to each weight group separately (to accommodate situations when certain criteria are omitted), and the weighted scores for each weight group are added together to arrive at a total weighted score for the site. The following equation applies:

$$TS = \sum_{j=1}^5 \left(\sum_{i=1}^{n_j} P_{ij} W_{ij} \times \frac{n_j}{N_j} \right)$$

Where :

- TS = weighted total score for the site in question
- P_{ij} = point score for criterion I in weighting group j
- W_{ij} = weight for criterion I in weighting group j
- n_j = number of criteria in weighting group j
- N_j = number of criteria under consideration in weighting group j
- j = various weighting groups - 1, 2, 3 and 5

note: This equation cancels out any bias towards criteria with a higher weighting.

Once a total weighted score for the site in question is arrived at, the following warrants apply:

- Condition 1 : weighted total score of 32 points and below - traffic calming not warranted.
- Condition 2 : weighted total score between 32 and 43 - further investigation.
- Condition 3 : weighted total score of 43 or above - implementation warranted.

It is stressed that traffic calming measures, and therefore mini-roundabouts in a traffic calming context, are not recommended for implementation on class 4 and above roads, and only in certain circumstances should they be considered for use on class 4 roads⁹. The national guidelines also recommend the following two limitations for mini-roundabouts:

- Peak hour volumes through the intersection < 600 vph; and
- 85th percentile speeds < 60 kph.

Higher approach speeds will require other measures to be implemented before, or at the same time, the mini-roundabout is introduced. Failure to do this may result in a dangerous situation and it is therefore recommended that operating speeds on existing, lower order roads be below 60 km/h.

4. DESIGN AND SIGNING

This chapter introduces the various design options available and relevant dimensions for mini-roundabouts. As stated before, the specific physical restrictions imposed at the site, and possible cost constraints, often dictate in the design process. Compromising the given recommendations should be avoided. Sound engineering judgement should be applied during this phase. The appropriate use of traffic signs and road markings is also given.

4.1 Mini-roundabout Construction Alternatives

There are three recommended construction alternatives for mini-roundabouts. All have a semi-circular profile, similar to that of a standard semi-circular (round top) speed hump. The basic difference between the three options is the presence of a lip around the circumference of the island. In all cases the circular segment can be constructed from premix asphalt, concrete or interlocking brick paving.

4.1.1 Asphalt Mini-roundabout with Edge Flush on Road Surface

Figure 4.1 shows the design profile of the basic mini-roundabout central island with the edge circumference of the island flush with road level. The centre of the island should be between 75 and 100 mm high, above the road level. Although not essential, it is recommended that a circular segment, between 100 and 200mm wide, be removed from the existing road surface, so that the island is keyed in the road surface and the risk of distortion reduced.

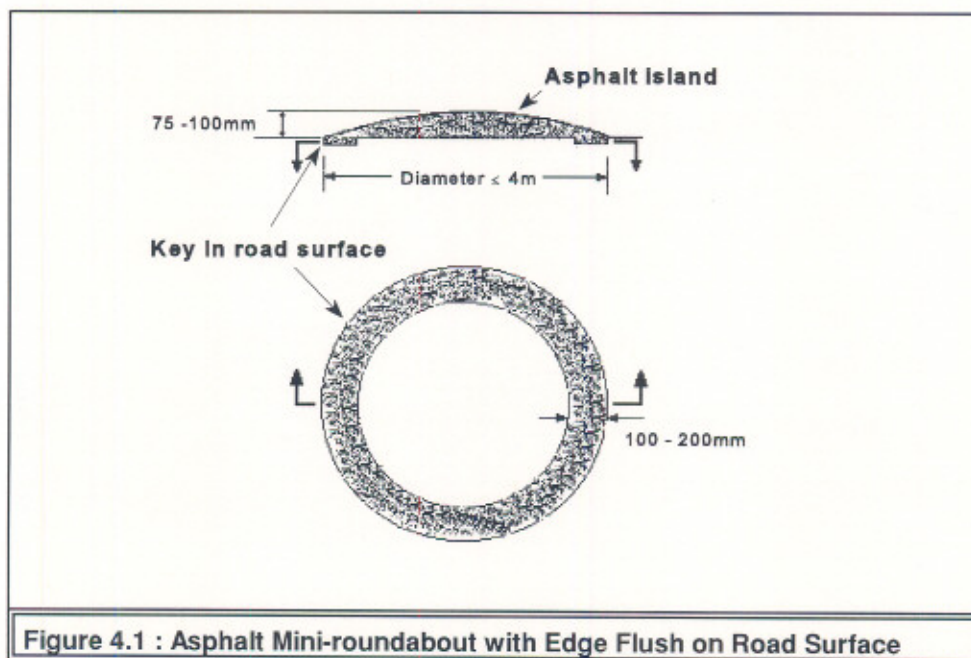


Figure 4.1 : Asphalt Mini-roundabout with Edge Flush on Road Surface

4.1.2 Asphalt Mini-roundabout with 25mm High Edge and Retaining Steel Ring

As stated before, the presence of a lip, 25mm high, around the circumference of the island creates an added perception amongst motorists that discourages them from mounting the island. Option 2, illustrated in figure 4.2, has the same profile as option 1, except that the outer circumference of the island is cut away to provide a 25mm high lip. Due to considerable wear inflicted on mini-roundabout islands by heavy vehicles, a metal ring is attached on the lip (as shown in Figure 4.2) to protect the premix asphalt of the island. It is absolutely imperative that the ring is sufficiently fastened to the lip and regularly monitored, to ensure it does not come loose. This practice has been known to create problems, with the ring becoming detached from the asphalt and causing damage, so local authorities lacking resources to ensure that the ring is correctly fixed and monitored should avoid its use.

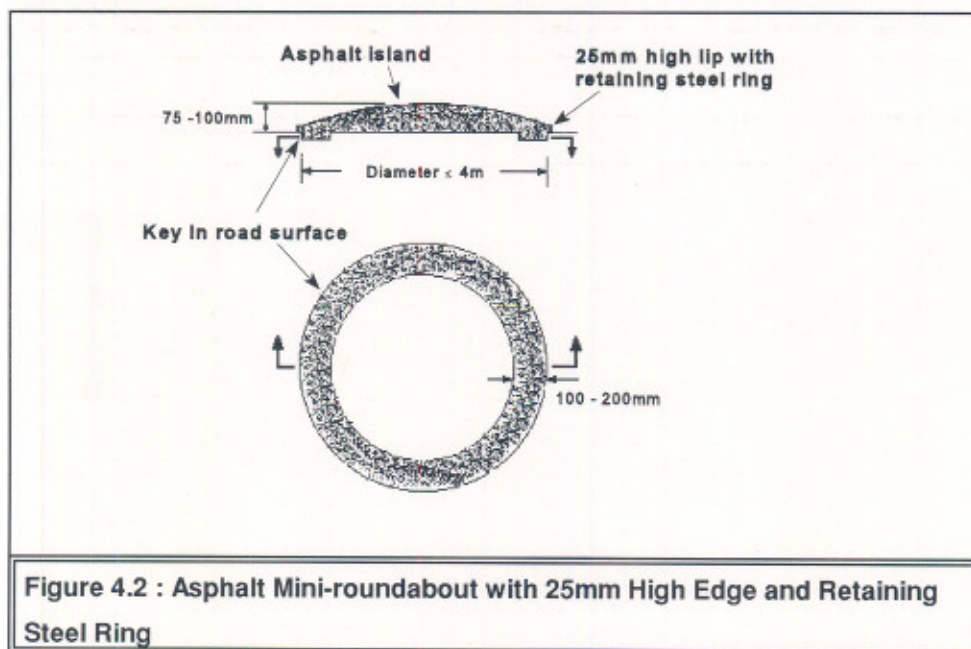
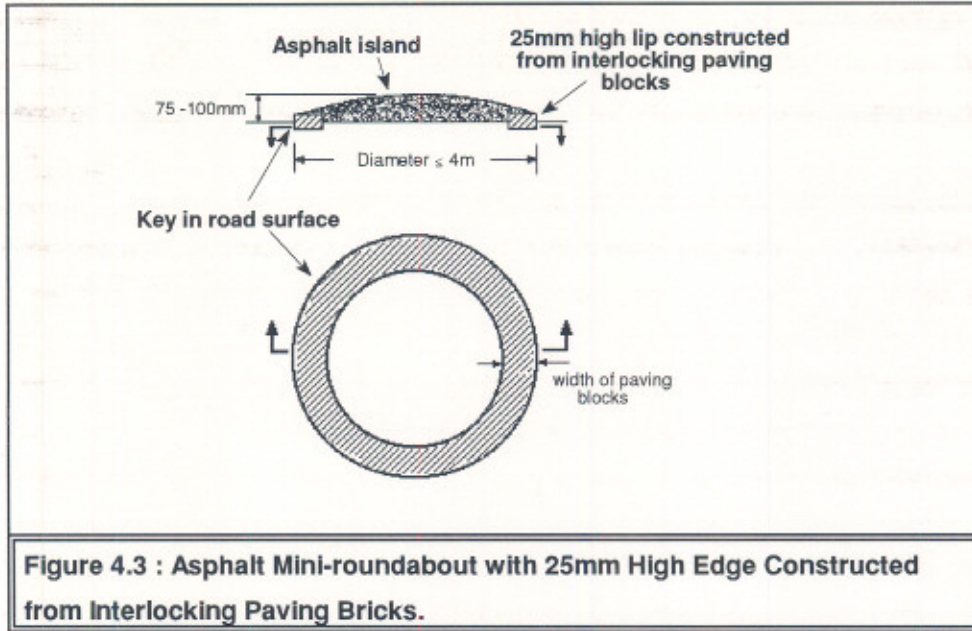


Figure 4.2 : Asphalt Mini-roundabout with 25mm High Edge and Retaining Steel Ring

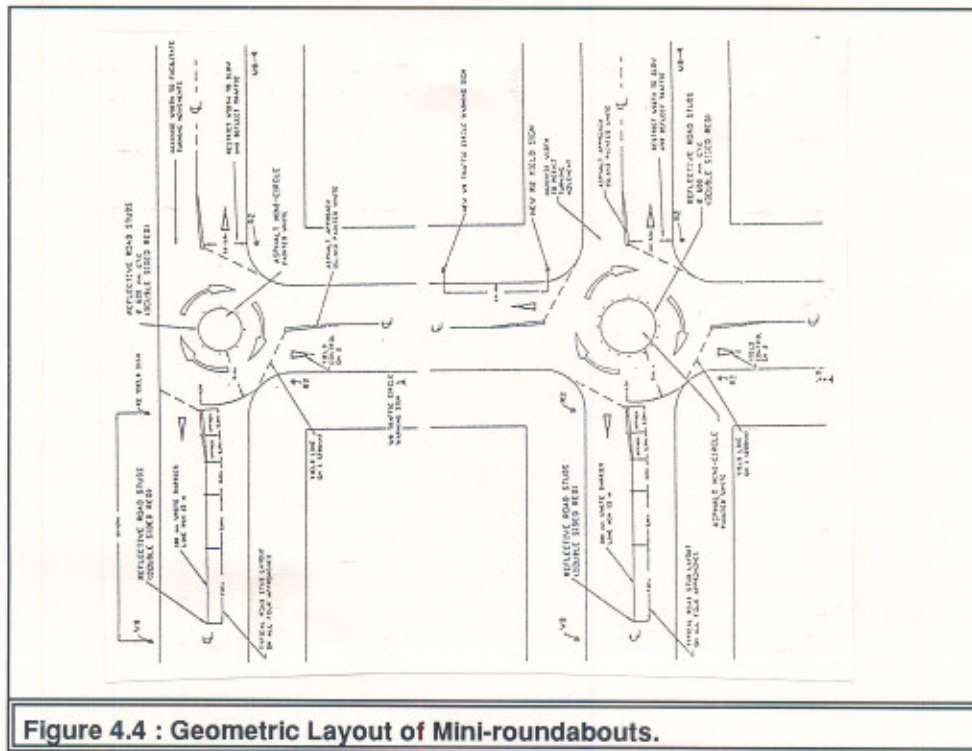
4.1.3 Asphalt Mini-roundabout with 25mm Edge Constructed from Interlocking Paving Blocks

Although this option has higher cost implications than the previous two, it is recommended as the preferred option. With the third option, the lip is created using interlocking paving blocks. A circular segment, the same width as the paving blocks to be used is removed from the existing road surface to a depth such that, when the paving blocks are placed in the constructed groove (key), they protrude 25mm above the road surface. A typical interlocking paving block is 50mm high, so the groove constructed in the road surface should be approximately 25mm deep). Figure 4.3 shows the design profile for option 3.



2 **Layout**

The geometric layout of a mini-roundabout is determined by the existing layout of the intersection and the physical restrictions of the site. Figure 4.4 shows a typical layout for a 3-leg and 4-leg intersection. Although each situation is unique, the design criteria discussed in this chapter should be adhered to as far as possible.



4.2.1 Intersection Control

- The central island should be 4 metres in diameter (if necessary the diameter can be reduced, but to no less than 3 metres, to facilitate turning movements).
- The inscribed circle diameter (ICD) is determined by the design vehicle. The British⁷ and Australian⁸ standards recommend an ICD of 28 metres (for a 15,5 metre design vehicle). This is generous for a normal passenger car, so a minimum ICD of 14 metres is recommended (Island diameter:ICD ratio of 1:3.5) for a single lane approach and a minimum ICD of 25m (ratio of 1:8.25) is recommended for a double lane approach.
- The circular carriageway between 5 and 6 metres is encouraged (although this may be increased to facilitate turning movements, particularly for larger heavy vehicles and buses).
- Physical deflection islands are recommended on all approaches, positioned such that illegal right turns are discouraged and vehicles are guided into the curvature of the mini-roundabout. These islands should exceed 5m² in area.
- Where possible, approaches should be flared (ideally single lane approaches should be expanded to two lanes). A minimum approach lane width of 4 metres is recommended.
- Where it is not possible to obtain sufficient deflection for straight through movements, semi-circular speed humps on these approaches are recommended.

4.2.2 Traffic Calming

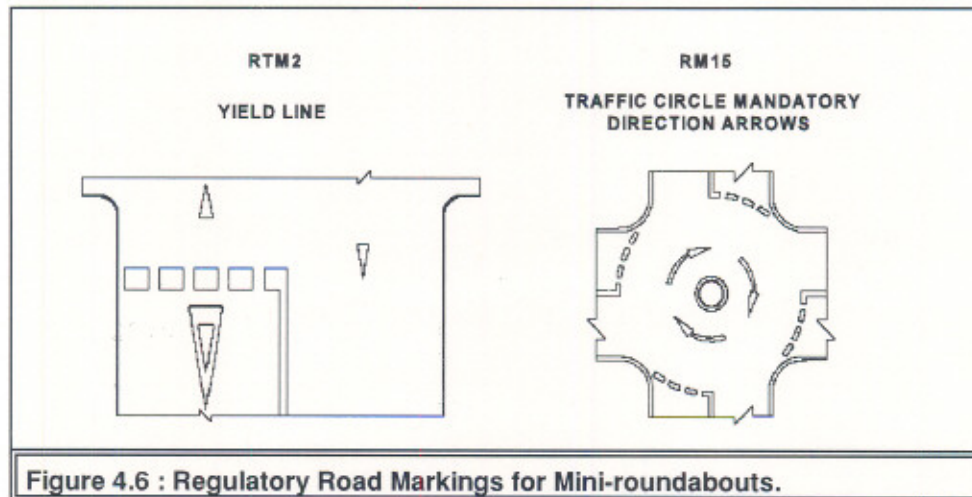
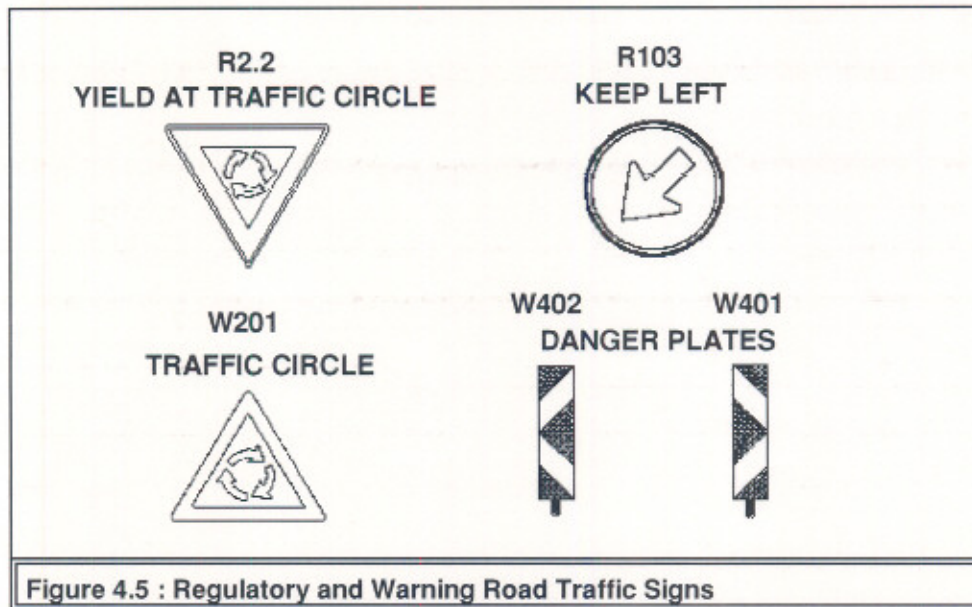
- The diameter of the central island should be 4 metres.
- As with an intersection control mini-roundabout, an ICD of 14 metres for a single lane approach is recommended. If the intersection is not to be frequently used by heavy vehicles and buses, the ICD may be decreased to a minimum of 12 metres.
- The circular carriageway width of no more than 6 metres is encouraged.
- The positioning of deflector islands on all approaches is recommended. These should be designed (and supplemented with road markings and road studs) to restrict the width of the approach lanes (to a recommended width of 3 metres).
- Semi-circular speed humps are recommended on approaches where sufficient deflection through the intersection can not be ensured in the design.

Some local examples of mini-roundabout geometric layouts are shown in Appendix E.

4.3 Traffic Signs and Road Markings

The appropriate road signs and markings, and their relevant positioning, are given in the South African Road Traffic Signs Manual (SARTSM)⁹, and the relevant pages are provided in Appendix F. They are illustrated in figure 4.5 and figure 4.6. The regulatory R2.2, YIELD AT TRAFFIC

CIRCLE, traffic sign and the regulatory RTM2, YIELD LINE, are recommended at each entry. The W201, TRAFFIC CIRCLE, warning sign should be placed at a distance of 60 to 120m (determined according to the SARTSM procedure) 'upstream' of the mini-roundabout on each approach. DANGER PLATES W402 and W401 should be positioned at each entry on the deflection islands, and should incorporate a R103, KEEP LEFT, control sign. The RM15, TRAFFIC CIRCLE MANDATORY DIRECTION ARROWS, should also be applied (see figure 4.6).



The recommended layout of traffic signs and road markings in the vicinity of a mini-roundabout is given in Appendix F.

5. Conclusions

Calculating the warrants for, and designing a mini-roundabout are influenced by a unique set of circumstances. It is important that reasonable engineering judgement be applied when implementing these guidelines. Although the recommendations given in this document should be adopted whenever possible, the unique circumstances of each situation may override them.

A summary of the relevant points highlighted in this document is given below.

- The mini-roundabout is defined as a one-way circulatory carriageway around a flush or slightly raised circular island equal to or less than four metres in diameter, and with or without flared approaches.
- The mini-roundabout has two possible functions. It can either be used as a form of intersection control (where it is more efficient than 4-way or 3-way stops, and requires less space and costs less than a conventional roundabout), or it can be used as a traffic calming intersection control device. When implemented purely as an intersection control, its objective is to improve capacity and operation of the intersection. When implemented in a traffic calming context, its objective is to limit the capacity and restrict traffic speeds through the intersection. It is recommended that if a mini-roundabout is implemented as a traffic calming device, it should be part of an overall traffic calming scheme.) The design of a mini-roundabout depends on the desired effect to be achieved.
- A central circular traffic island consisting of a painted road marking is not recommended, as it is not self enforcing. A 75 to 100mm high circular island, with the same profile as that of a semi-circular speed hump, should be used. This encourages the intended circulatory flow through the mini-roundabout. The island must be mountable so as to accommodate larger vehicles. A 25mm lip should be incorporated around the circumference of the island to further dissuade motorists from mounting the island.
- Deflection islands are recommended on all approaches to help guide motorists into the curvature of the mini-roundabout and discourage illegal right turn movements. Islands have the added advantage of separating vehicles entering and exiting the mini-roundabout and are also a suitable place to position relevant traffic signs.
- The priority rule governing the right-of-way at mini-roundabouts is given in the Road Traffic Act, Act 29 of 1989 (Section 94), and roughly interpreted gives right-of-way to any vehicle entering the mini-roundabout first and that will cross the path of any other vehicle yet to enter the mini-roundabout. The relevant regulatory traffic sign (R2.2 YIELD AT TRAFFIC

CIRCLE) and road markings (RTM2 YIELD LINE) should be appropriately applied. Road markings must be of a high quality retro-reflective paint, having good skid resistance properties. The relevant warning signs are also recommended.

- It is imperative that a mini-roundabout is sufficiently visible to motorists at a distance (Decision Sight Distance) determined by the operational or design speed along the approach in question. The relevant warning signs, as recommended in the SARTSM, should be appropriately positioned along the approaches. Careful consideration must be given to ensuring adequate lighting in the vicinity of the mini-roundabout so that it is sufficiently visible at night. The need for a clear field of vision in the vicinity of a mini-roundabout should also be ensured.
- Mini-roundabouts have negative implications for pedestrians and cyclists, and these two road users should be carefully considered in the planning and design phase, providing appropriate facilities to accommodate them whenever possible.
- The warrants and implementation procedure to be adopted depend on the context in which the mini-roundabout is to be implemented; whether it is an intersection control or a traffic calming measure.

6. References

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Appendix A: About Mini-roundabouts.

Appendix A: About Mini-roundabouts

ABOUT MINI-CIRCLES

Since the first mini-circle was introduced in Lynnwood Manor, Pretoria in 1989, various changes in the appearance of this once controversial method of traffic control have been witnessed. With the current design of the mini-circle, as applied in Pretoria, which evolved through the evaluation of the behaviour of motorists, it has been endeavoured to develop a traffic control device which will induce correct usage and which is inherently self-regulating, as well as being an efficient traffic control and traffic calming device.

The evolutionary development of the mini-circle has to some extent led to the current confusion among motorists regarding the correct behaviour at a mini-circle. Most of the confusion must however be attributed to the aggressive attitude, as well as the undisciplined behaviour of motorists. The issue is further exacerbated by the perception that road traffic rules are exact in its definition of what correct or what incorrect driving behaviour is. Road traffic rules can however never be that precise since the task of the driver of a vehicle is a complex one where aptitude, attitude, perceptions, traffic conditions, the psychological state of the driver, etc. all play significant roles. The acceptance of responsibility by each individual driver of a vehicle with regard to personal safety as well as the safety of other road users, is therefore heavily relied upon. The adjudication of correct driver behaviour should always include consideration of attitude towards other road users, although their actions may be perceived as wrong.

The road traffic rules at traffic circles similarly place the onus for responsible behaviour on the driver of a vehicle.

At a conventional traffic circle, i.e. traffic circle with a large physical inner island not controlled by any traffic control device like a yield sign or robot, the general road traffic rule as defined in the Road Traffic Act, is that traffic in the circle has right-of-way. This may in effect be interpreted as giving right-of-way to vehicles approaching from the right since vehicles in the circle will always approach from the right hand side of the vehicle approaching the traffic circle.

In Pretoria mini-circles, i.e. traffic circles with a smaller inner island, are controlled by a traffic circle yield sign. The traffic circle yield sign is relatively new and was promulgated in October 1993. The use of this sign at the mini-circle changes the general road traffic rule at traffic circles mentioned above. The regulation pertaining to the traffic circle yield sign, as defined in the Road Traffic Regulations, reads as follows:

"Indicates to the driver of a vehicle approaching a traffic circle that he shall yield right of way to any vehicle which will cross any yield line at such junction before him and which, in the normal course of events, will cross the path of such driver's vehicle."

Close inspection of this regulation may suggest an interpretation of "first-come-first-served" since the vehicle crossing the yield line first is given the right-of-way over other vehicles which may cross its path and which are still to cross any of the other yield lines at the mini-circle. This interpretation appeals to many motorists since it is simplistic in its application. The problem with this interpretation, however, is that some motorists regard this rule as an allocation of a right to demand right-of-way which in a road traffic environment cannot be tolerated. Road traffic rules do not allocate rights but only pass an obligation onto the driver

of a vehicle to act in a prescribed manner when facing a particular traffic control device and/or traffic conditions.

So, how should one act at a mini-circle?

One of the characteristics of a mini-circle is that it provides a deviation in an intersection of roads which may allow more than one vehicle into the intersection, without the vehicles being in conflict with each other.

Therefore, when approaching a mini-circle controlled by traffic circle yield signs, reduce speed to less than 30 km/h, depending on circumstances, and observe your position in relation to other vehicles already in the mini-circle area or vehicles approaching the mini-circle to determine which of the vehicles are already in circle area or which will cross the yield line before you.

If you are not passing straight through the mini-circle, use your indicators well in advance to give clear notice of your intended movement through the mini-circle.

Slow down sufficiently to allow vehicles already in the mini-circle and which may cross your path of entry to pass through the mini-circle.

Enter the mini-circle (ie., cross the yield line) if your manoeuvre is not in direct conflict with any other vehicle already in the mini-circle.

*** A driver of a vehicle entering the mini-circle may allow another driver to also enter by slowing down sufficiently so that such a driver may manoeuvre his vehicle into the mini-circle and clear the path of the entering vehicle without effecting undue delay for any one of the drivers. This is purely a gesture of mutual indulgence and will contribute much to good traffic flow. This however requires good eye contact between the respective drivers and care must be taken of the prevailing traffic conditions. If there is doubt about the way in which the respondent will react to such a gesture, remain with the basic rule and always take the safe option. It will take time to cultivate this culture of gentleman-like driver behaviour, but it may be found to be very contagious once the example is set.*

Approach the mini-circle in a positive manner and pace your entry into the mini-circle so that you can slot into the appropriate gaps in the paths of movements of other vehicles into and around the mini-circle.

*** Do not rush onto the mini-circle to gain the advantage to arrive first or force your way into the mini-circle by sticking close behind the vehicle busy entering. Only enter the mini-circle directly after the vehicle in front of you if there are no other vehicles on any of the other approaches which may enter the mini-circle before you or if your entry will not be in conflict with any other movements through or around the mini-circle.*

*** If the vehicle in front of you has just entered the mini-circle, always consider affording some other vehicle or vehicles on the other approaches of the mini-circle to enter and complete its movement through the mini-circle. By slowing down sufficiently, pacing your entry with the necessary consideration of other traffic, other drivers may well be in a position to respond positively. The application of the "first come first served" rule in this manner will certainly contribute to the improvement of driver behaviour.*

Pedestrians always have right of way and this should be kept in mind at all times. Some mini-circles include pedestrian crossings which are slightly removed from the circle itself. This is done to separate the interaction between vehicles and vehicles from the interaction between vehicles and pedestrians. Always act correctly at

pedestrian crossings, even if they are part of the mini-circle.

Cycles share the roadway with other motor vehicles and are also vehicles which have right-of-way. Cycles at mini-circles must be regarded the same as any other vehicle but with much more consideration for the safety of the cyclist. Do not enter the mini-circle at the same time as the cyclist if there is any chance of conflict. Care should however always be exercised where pedestrians and cyclists are involved.

Because of the limited geometry of mini-circles, heavy vehicles in most cases need to cross over the centre island of the mini-circle and go through the mini-circle at very slow speeds. Always allow the heavy vehicle all the space needed to complete its movement through the mini-circle.

This article is intended to provide clearer guidelines on correct behaviour at mini-circles. Correct behaviour should however always be judged in relation to what happens as a result thereof. If any more information is needed, please contact Kobus Labuschagne at the Traffic Flow Division, Transportation Engineering and Roads Department, Central Pretoria Metropolitan Substructure, at tel (012) 313 7648.

Appendix B: Road Class Classification

Appendix B: Road Class Classification

Class 1 - Trunk roads (National and regional distributors)

Generally these are rural roads whose function is to facilitate the regional distribution of traffic. They can be national or provincial roads and include freeways, expressways, dual carriageways and single carriageway main roads. Continuous sections of these roads in urban areas should be designed as by-pass routes. Route continuity is important.

Class 2 - Primary distributors or major arterials

These roads constitute the primary road network for the urban area as a whole. All long distance traffic movements to, from and within the city should be accommodated on these roads. They are characterised by high traffic volumes, limited access and fairly high speeds. Route continuity is again important.

Class 3 - District distributors or minor arterials

These roads form the link between the primary road network and roads within the residential and other land use areas. They distribute traffic between the various residential, commercial and industrial districts of the urban area. They should connect areas without passing through them. These roads are characterised by high traffic volumes, restricted access and moderate speeds. The major public transport movement is accommodated by these roads which therefore must also provide the necessary supporting infrastructure (preferably off the travelled roadway). Once again route continuity is important.

Class 4 - Local Distributors

These are local through routes which distribute traffic within communities and link district distributors and access roads. Local bus services can be accommodated on these roads and therefore they should be open ended. Local distributors should accommodate traffic generated by between 400 and 1200 dwelling units. The road layout should discourage extraneous traffic (i.e. there should be no available short-cuts between adjacent class 2 or 3 roads). Access to individual properties should not be encouraged.

These roads should not be continuous between adjacent neighbourhood cells (e.g. through the provision of staggered intersections etc.)

Class 5 - Residential access roads

These roads provide direct access to property within the residential area. Access for motor vehicles is not their only function and the roads are also used by inhabitants for recreational purposes (running, cycling, walking etc.). They also accommodate the provision and maintenance of services and stormwater management.

These roads are minor roads serving a maximum of 200 dwelling units. They do not require continuous alignments and form part of a closed network. In descending order of priority, the hierarchy of these roads is as follows:

Class 5a (residential access collector) :

These provide a link between the local distributor and any other access roads. They service up to 200 dwelling units and should not provide short cuts for any traffic using the local or district road network. They may be part of an open system or a closed system with one outlet onto the local distributor (i.e. functions as an access way). Access to properties is allowed where sight distances are not a problem.

Class 5b (Access loop) :

These carry traffic from about 120 dwelling units, providing a short link for cul-de-sacs, access courts and private roads to a residential access collector. They should not be linked with local distributors. Separate paved footways may be justified in high density, low income areas with high pedestrian volumes. These roads should be designed for joint use by pedestrian and vehicles.

Class 5c (Access cul-de-sac) :

These are small informal roads providing direct frontage access to between 6 and 60 dwelling units. They should generally not exceed 150 m in length. They are ideally suited to low to medium density (< 500 m²) developments with open plan front gardens and where parking is provided on the property. Again these roads should be for joint use by pedestrians and vehicles. To emphasize joint use contrasting design features (e.g. block paving) can be incorporated. Vehicle speeds should be restricted to 20 km/h.

Class 5d (Access way) :

These are closed road systems with an exit on only one end. It may have variable width (3 to 5 m) and typically carrying traffic generated by up to 60 dwelling units. They may link access courts to each other and/or to other class 5 roads. These roads are not intended to provide direct access to single buildings (this is not advised where road width is less than 4,5 m). The design should ensure consistent low speed and be clearly marked at its entry to demarcate its' special character.

Class 5e (Access court) :

These give access to about 30 dwelling units with contrasting design to indicate shared use. The design should ensure low speed, especially since these roads may be used by children for playing. Access courts are particularly suited to be used in conjunction with access ways at developments where the net density exceeds 16 dwellings/hectare. Access courts may provide links between adjacent access ways to accommodate emergency and service vehicles. However, general use should be discouraged.

Class 5f (Access strip):

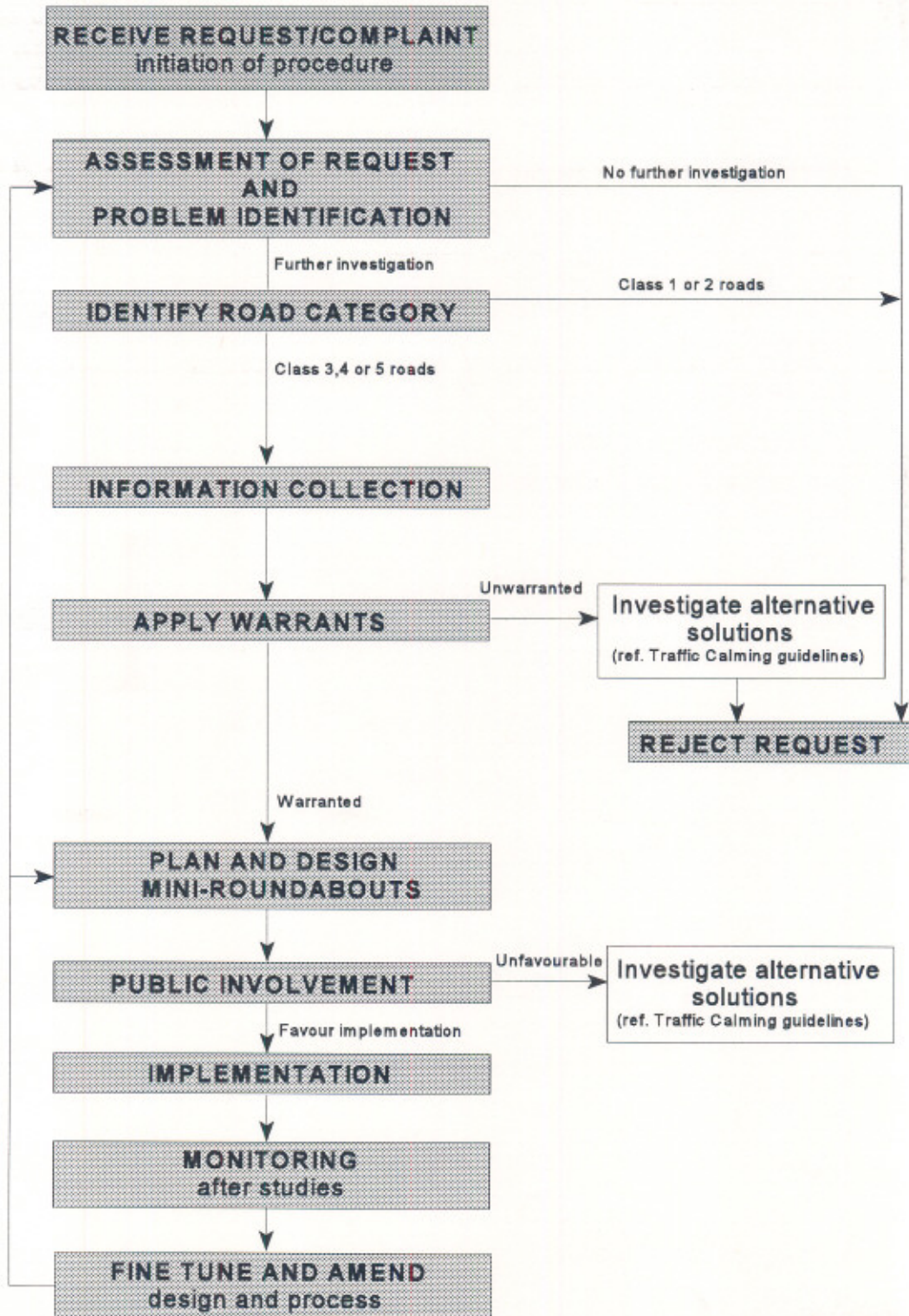
These are also known as double panhandles and provides access to a maximum of 4 dwelling units. No turning circle is provided and the roads can be either public or private. Parking must be provided on each property.

Private roads:

These are not the property of the authorities and the road reserves are determined by the owners of such property. However, these roads should be designed to be consistent with public roads of similar function.

Appendix C: Implementation procedure for intersection control mini-roundabouts

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Appendix D: Warrants Sheet and Implementation Procedure for Traffic Calming

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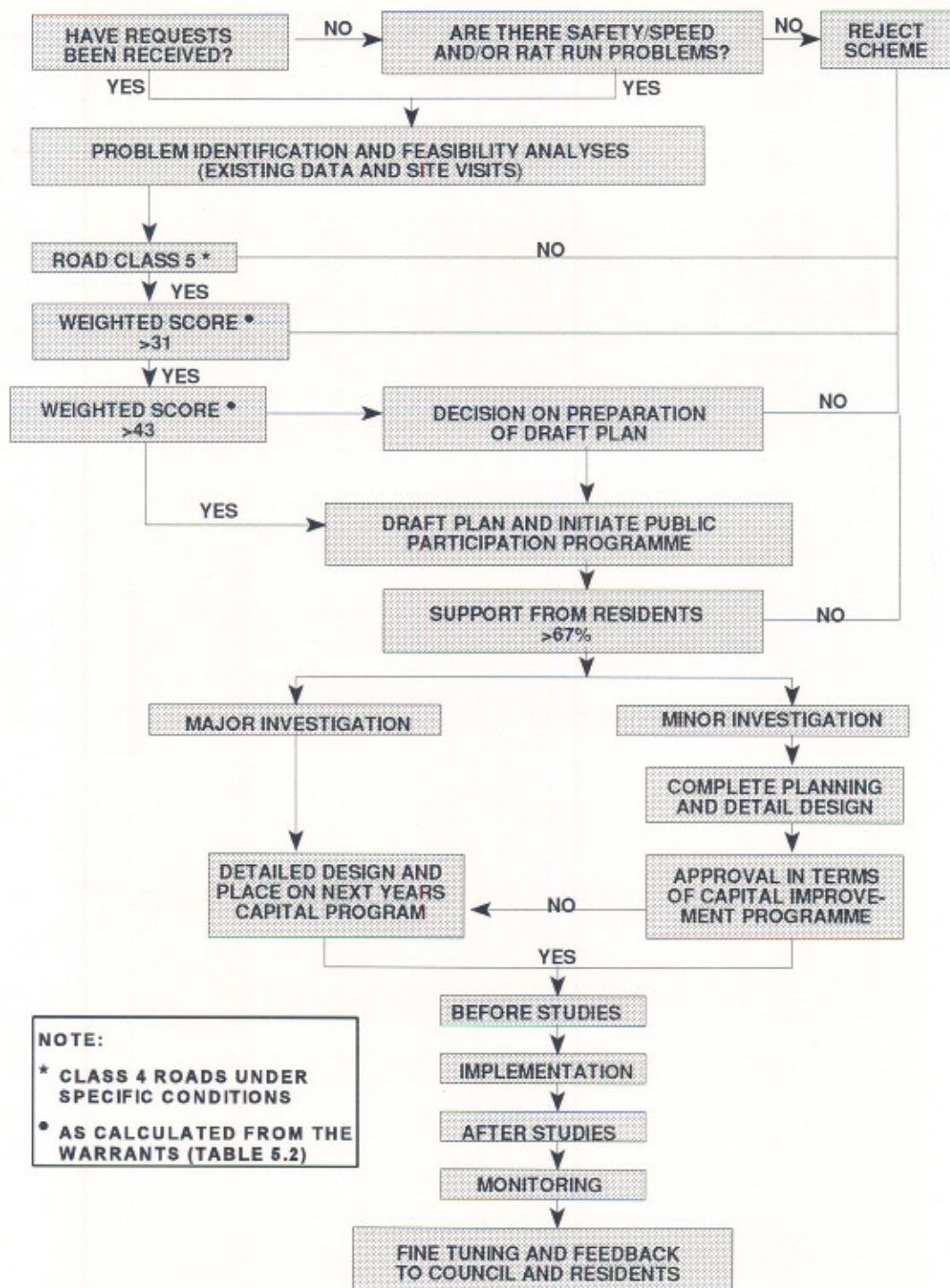
Guidelines for evaluating feasibility						
CRITERIA	Given Score	Point score			Weight	Weighted Score
		0	1	2		
1 Traffic volumes		< 50 vph	50-150 vph	>150 vph	3	
2 EAN (per 10 ⁶ veh-km)		<10	11 - 70	>70	3	
3 Public service vehicles		> 5 vph	3 - 5 vph	< 3 vph	-1	
4 Pedestrian/vehicle conflicts		Low	Medium	High	2	
5 85th percentile speed		< 40 km/h	40 - 59 km/h	>59 km/h	5	
6 Through traffic volume		< 5 %	5 - 50 %	> 50 %	3	
7 Pedestrian volumes (Vol/4h over 150 m)		< 250/4h	250 - 499/4h	>500/4h	3	
8 Parking/loading movements		<100/h/km	100 - 200/h/km	>200/h/km	1	
9 Schools/playgrounds		No	-	Yes	2	
10 Footway/verges		Made	Rough	None	2	
11 Frontage/accesses spacing		>75 m	50 - 75 m	<50 m	2	
12 Sensitive area		No	Slightly	Yes	1	
13 One or two way		One		Two	1	
14 Stopping sight distance		>130 m	50 - 130 m	< 50 m	1	
15 Gradient		>5%	3 - 5%	<3 %	1	
16 Road type		5(b)-(e)	5(a)	4	3	
					Total (Weighted score)	

Where :	Traffic volumes	=	average hourly off peak traffic volumes between 06:00 and 18:00
	EAN	=	Equivalent accident number
	Public service vehicles	=	Average peak hour volumes
	Pedestrian/vehicle conflict	=	The potential for, or observed, conflicts at the site. These are based on judgement and can be subjectively assessed, (e.g brake lights, swerving etc.)
	85th percentile speed	=	The speed at or below which 85 per cent of the vehicles travel.
	Through traffic volume	=	That proportion of traffic that has neither an origin or destination along the road, or within the area, under study.
	Pedestrian volumes	=	The volume of pedestrians crossing a road over a four hour period and measured over a 150 metres roadway length
	Schools/playgrounds	=	The presence of schools/creches/playgroups, etc. within the study area.
	Footway/verges	=	The provision of pedestrian facilities (pavements, etc) within the verges
	Frontage/access spacing	=	The average distance between accesses to properties within the studied area/road
	Sensitive area	=	The presence of hospitals, old age homes, clinics etc. and other facilities that may be sensitive to traffic, traffic noise, fumes, etc.

D-3

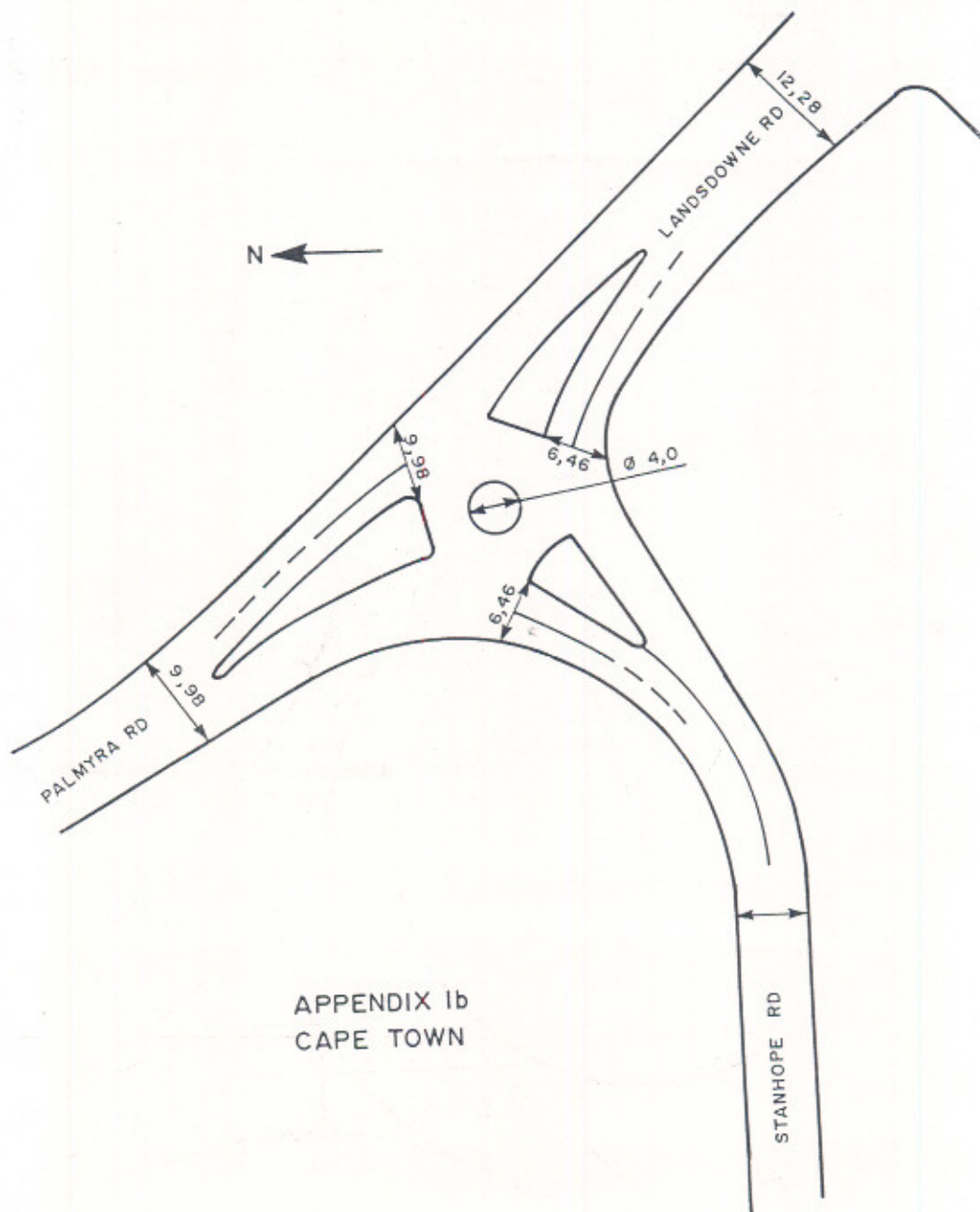
- One or two way = Whether roads accommodate two or one way traffic flow
- Stopping sight distance = The minimum distance required for a driver to bring his vehicle to a standstill and based on speed, driver reaction time and skid resistance.
- Gradient = The vertical rise or fall of the roadway measured from the base to the apex and expressed as a percentage.

Appendix D: Implementation framework for traffic calming.

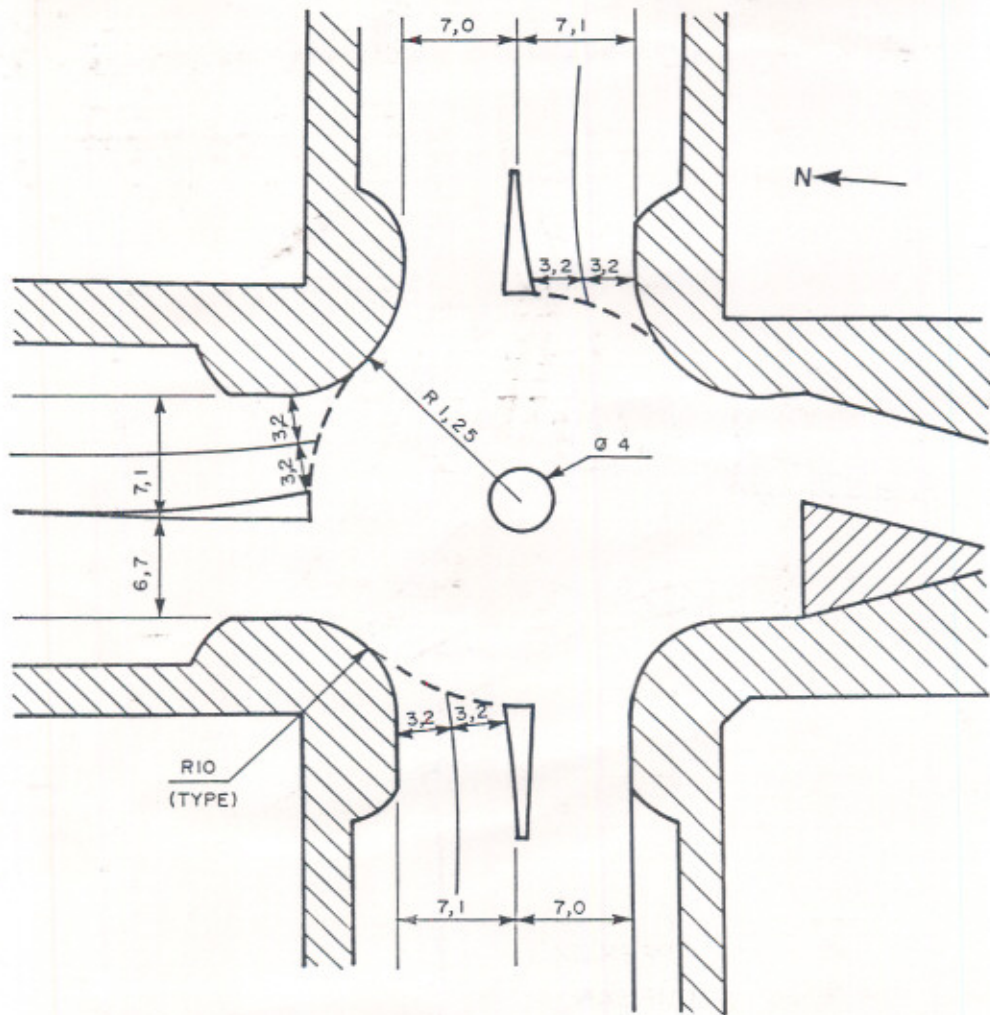


Appendix E: Examples of Mini-roundabout Layouts

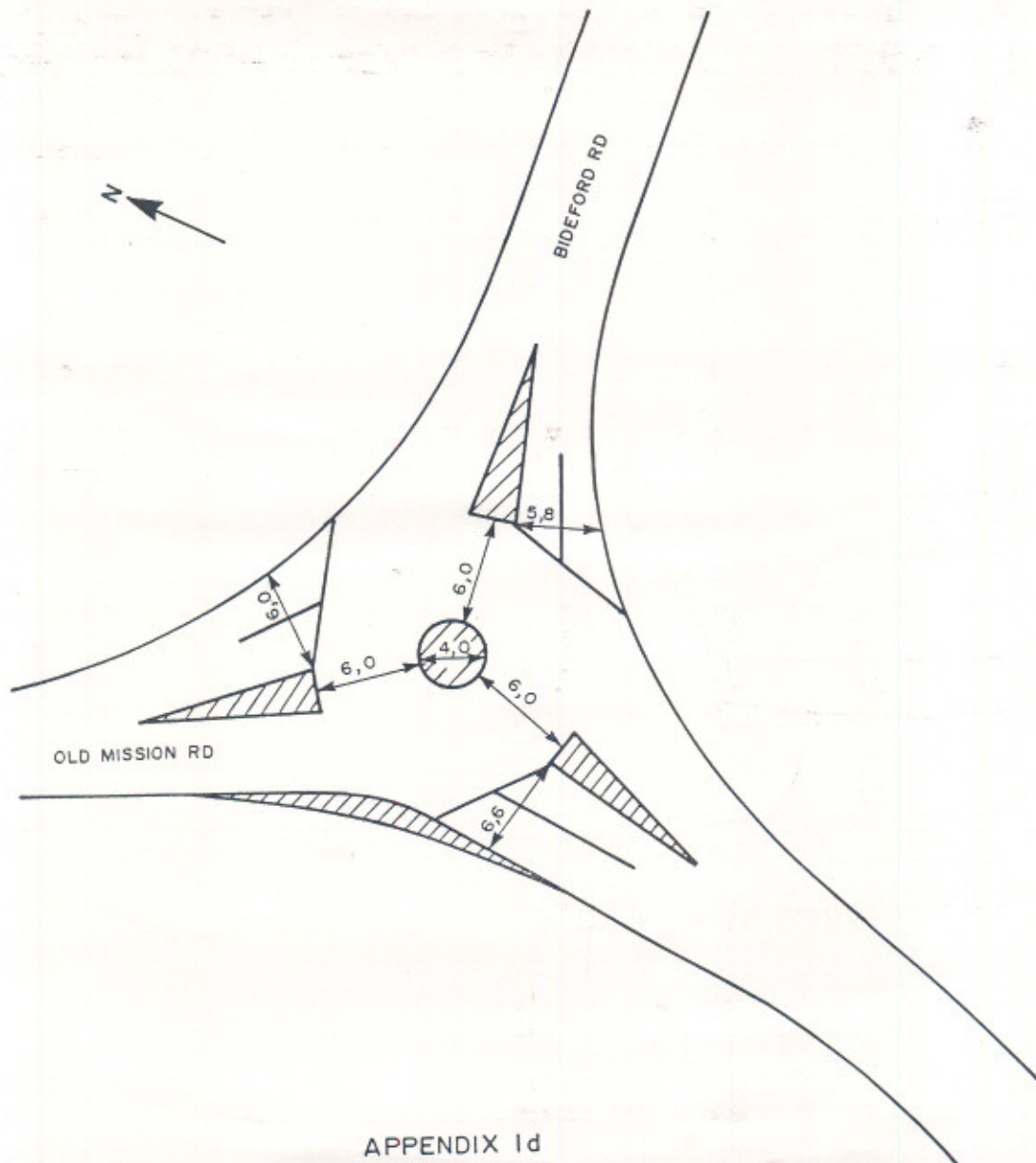
Appendix E: Examples of Mini-roundabout Layouts



APPENDIX 1b
CAPE TOWN

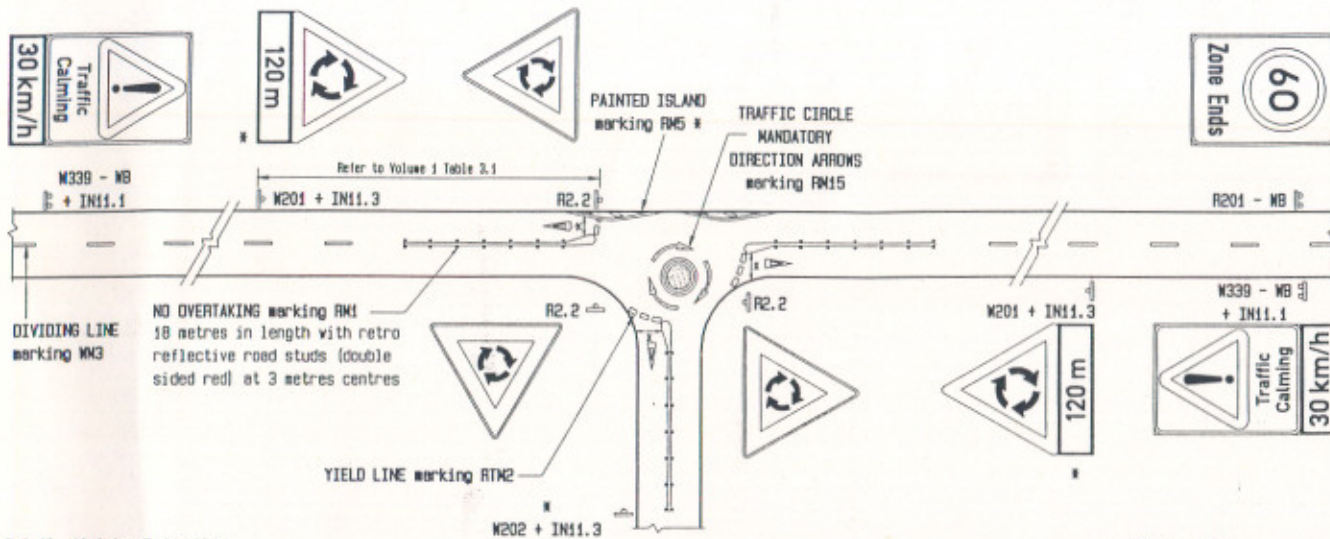


APPENDIX 1c
PLETTENBERG BAY

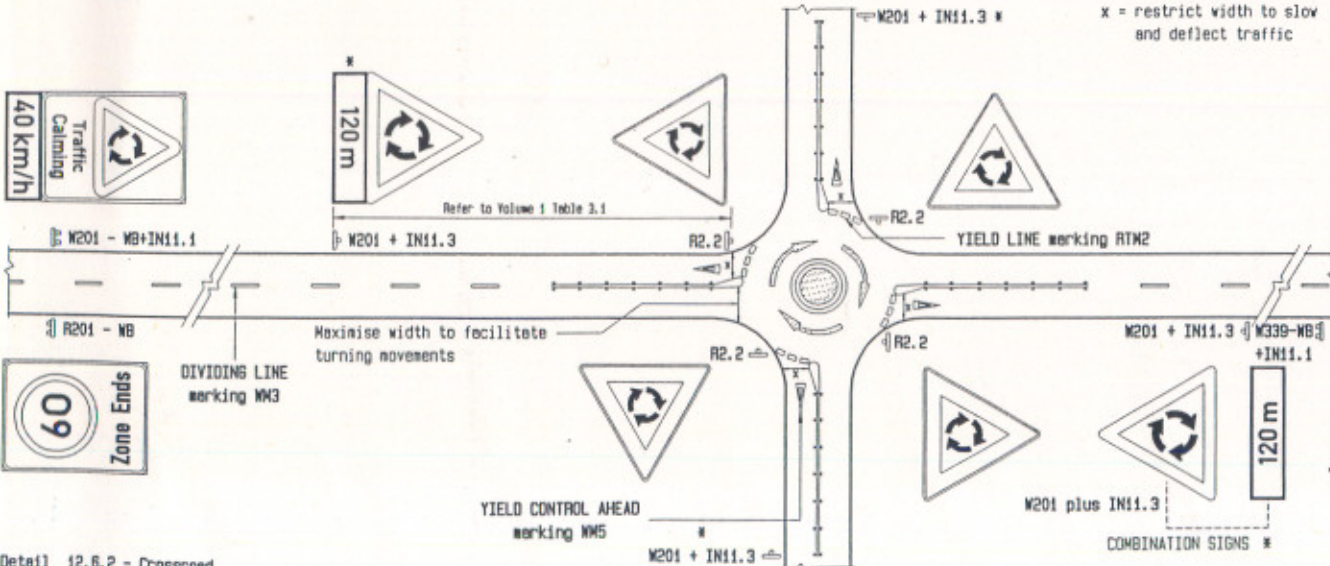


APPENDIX 1d
DURBAN

Appendix F: Traffic Signs and Road Markings for Mini-roundabouts



Detail 12.6.1 - T-Junction



Detail 12.6.2 - Crossroad

12.4.3 Notes on Figure 12.6

(1) Signs and Markings per Approach

Quantity	Type	Min External Dimension (mm)
1	R2.2	900 side
1	W201	900 side
1	IN 11.3	900 wide
1	RTM2	200 wide
1	WM5	2500 or 1250
1	RM1	18 metres
1	RM5	varies
14	Red roadstuds	-

PLUS per mini-circle

1	RM15	varies
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- (2) When several mini-circles comprise an area traffic calming treatment the use of high visibility signs W201-WB+IN11.1 at the main entry points to the area is recommended. The normal size of such signs is 1600mm x 1200mm but 1200mm x 900mm may be specified. If a reduced speed limit is imposed within such an area the use of high visibility "Zone Ends" R201-WB signs may be warranted on leaving the area.
- (3) If the area is subject to a variety of traffic calming measures sign W201-WB+IN11.2 may be replaced by one of signs W339-WB+IN11.2 or W332-WB+IN11.1 as appropriate (see Figure 12.2).
- (4) Checklist

- The following factors should be checked when considering signing for traffic calming measures which include speed humps:
- are any mini-circles in the area difficult to see, either by day or by night?
 - is the use of retroreflective roadstuds advisable?
 - are SUPPLEMENTARY PLATE signs IN11.3 required with sign W201 or is the entry point to the circle, and therefore sign R2-2, clearly visible?
 - is the mini-circle one of several? If yes, is use of sign W201-WB+IN11.1 advisable?
 - is the mini-circle one of several types of traffic calming measure in the area? - if yes, is the use of sign W339-WB+IN11.1 appropriate?

Fig. 12.6 Typical Road Sign Layout For Mini-Circles

YIELD AT TRAFFIC CIRCLE TOEGEE BY VERKEERSIRKEL

COLOURS/KLEURE:

PERMANENT AND TEMPORARY

Outer border:	White retroreflective
Inner border:	Red retroreflective
Symbol:	Black semi-matt
Background:	White retroreflective

PERMANENTE EN TYDELIKE

Buiterand:	Wit truikaatsand
Binnerand:	Rooi truikaatsand
Simbool:	Swart halfdoel
Agragrond:	Wit truikaatsand

R2.2



For dimensions
vir afmetings
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2.2.7

2.2.4 Yield at Traffic Circle

- 1 The YIELD AT TRAFFIC CIRCLE regulatory sign R2.2 imposes a *mandatory requirement that drivers of vehicles approaching a traffic circle shall yield right of way to any vehicle which will cross any YIELD LINE marking RTM2 at such junction before them, and which, in the normal course of events, will cross the path of such drivers' vehicles.* YIELD LINE markings RTM2 shall be applied to permanent road surfaces on all approaches to a traffic circle when YIELD AT TRAFFIC CIRCLE signs R2.2 are used. A YIELD CONTROL AHEAD marking WM5 may be marked on surfaced approach roadways for additional emphasis. (See Chapter 7).
- 2 The "rules of the road" given in the Road Traffic Act, Act 29 of 1989 (Section 94) prescribe the action required of drivers entering a junction containing a traffic island. A traffic circle may therefore be installed without YIELD AT TRAFFIC CIRCLE signs R2.2. Such an installation will be more appropriate within residential areas where traffic volumes are low. If traffic volumes exceed 150 vehicles per hour on two or more conflicting approaches during any hour of the day then the use of signs R2.2 is recommended. R2.2 signs may be used for traffic circles of all sizes, including mini-circles.
- 3 When advance visibility of a YIELD AT TRAFFIC CIRCLE sign is inadequate, or the traffic circle may be unexpected, the use of TRAFFIC CIRCLE warning sign W201 within the provisions of Subsection 3.3.1 is recommended. The use of a distance SUPPLEMENTARY PLATE sign IN11.3 with the warning sign is also recommended. The distance displayed should take into account the stopping distance requirements of approaching vehicles.
- 4 Sign R2.2 should be displayed on the left side of the road as near as possible to the point at which the driver is required to stop when yielding right of way. The preferred location is 1.5m in advance of the yield line. If the approach to the traffic circle is provided with a median island sign R2.2 may be repeated on the right side of the approach roadway.

2.2.4 Toegee by Verkeersirkel

- 1 Die TOEGEE BY VERKEERSIRKEL-Regelingssteken R2.2 stel 'n *verpligte vereiste aan bestuurders van voertuie wat 'n verkeersirkel nader, reg van voorrang moet toegee word aan enige voertuig wat hulle by enige TOEGEESTREEP-merk RTM2 by sodanige aansluiting oorstee en wat in die gewone loop van sake die weg van sodanige bestuurder se voertuig sal oorstee.* TOEGEESTREEP-merke RTM2 moet op permanente padoppervlakke van alle aanlope na 'n verkeersirkel aangebring word waar TOEGEE BY VERKEERSIRKEL-tekens R2.2 gebruik word. 'n TOEGEEBEHEER VOOR-merk WM5 vir addisionele klem op aanloopadbane met 'n deklaag gemerk mag word. (Sien Hoofstuk 7).
- 2 Die "reels van die pad" soos in die Padverkeerswet, Wet 29 van 1989 (Afdeling 94) beskryf die verlangde aksie van bestuurders wat 'n aansluiting met 'n verkeersland binnegaan. 'n Verkeersirkel mag ingestel word sonder 'n TOEGEE BY VERKEERSIRKEL-tekens R2.2. So 'n instelling sal meer van toepassing wees in geboude gebiede waar verkeersvolumes laag is. Indien verkeersvolumes meer is as 150 voertuie per uur op twee of meer konflik aanlope gedurende enige uur van die dag word die gebruik van tekens R2.2 aanbeveel. R2.2 tekens mag gebruik word vir enige grootte sirkel insluitende mini sirkels.
- 3 Waar die vooraf sig na 'n TOEGEE BY VERKEERSIRKEL onvoldoende is, of waar 'n sirkel onverwags mag wees, word die gebruik van 'n VERKEERSIRKEL-waarskuwingsteken W201 volgens die bepalings van Onderafdeling 3.3.1 aanbeveel. Die gebruik van 'n AANVULLENDE AFSTANDPLAAT-teken IN11.3 saam met die waarskuwingsteken word ook aanbeveel. Die vertoonde afstand behoort die stopafstand vereistes van naderende voertuie in aanmerking neem.
- 4 Die R2.2-teken behoort aan die linkerkant van die padbaan vertoon te word, so na moontlik aan die punt waar daar van bestuurder vereis word om stil te hou as hy ryvoorrang toegee. Die voorkeur posisie is 1,5m voor die toegeestreek. Indien die aanloop na die verkeersirkel voorsien is met 'n mediaan eiland mag die R2.2-teken aan die regterkant van aanloop padbaan herhaal word.

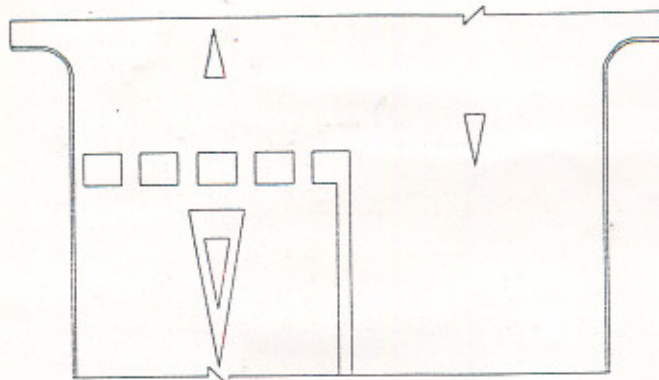
REGULATORY

7.2.3

YIELD LINES
TOEGEESTREPE

COLOUR/KLEUR:

White/Wit

For dimensions/
vir afmetings
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7.2.2 Yield Lines

- 1 A YIELD LINE regulatory marking RTM2 imposes a mandatory requirement upon drivers of vehicles that they shall yield right-of-way at the point marked by the line:
 - (a) to all traffic on the public road which is joined by the road on which they are travelling;
 - (b) to all rail traffic on the railway line which is crossed by the road on which they are travelling;
 - (c) to pedestrians and/or cyclists crossing the roadway, or waiting to cross the roadway at a crossing marked with PEDESTRIAN CROSSING LINES marking RTM3 and/or BLOCK PEDESTRIAN CROSSING marking RTM 4;

AND such marking shall have the significance assigned to YIELD sign R2. (YIELD sign R2 includes any and all derivations of sign R2).
- 2 This has the effect that, in the event that a YIELD sign R2 at a road junction or pedestrian crossing has fallen down, or is temporarily missing, the YIELD LINE marking RTM2 shall have the full significance of YIELD sign R2. A YIELD LINE marking RTM2, when marked across a turning lane demarcated by GUIDE LINE marking GM2, within a junction which is controlled by traffic signals, shall have the full significance of YIELD sign R2 without the use of such sign.
- 3 YIELD LINE markings RTM2 shall only be used in conjunction with YIELD sign R2, YIELD TO PEDESTRIAN sign R2.1, or YIELD AT TRAFFIC CIRCLE sign R2.2, or as indicated in paragraph 7.2.2.2. YIELD LINE markings shall be used at any location, which is not controlled normally by a traffic signal, where regular but short term point duty is performed by a traffic officer or a scholar patrol. (See Subsections 7.2.1, 7.2.3 and 7.2.4).
- 4 A YIELD LINE shall comprise a broken white line with a minimum width of 300mm in urban areas and 500mm in rural or other areas. YIELD LINES, which have been warranted, shall extend across the full width of that portion of all surfaced road junction approaches used

7.2.2 Toegeestrepe

- 1 'n TOEGEESTREEP-reëlingsmerk RTM2 stel 'n verpligte vereiste aan bestuurders van voertuie dat by die punt aangedui deur die streep waar hulle reg van voorrang moet toegee:
 - (a) aan alle verkeer op die pad wat aansluit by die pad waarop hulle ry;
 - (b) aan alle spoorweg verkeer op die spoorlyn wat deur die pad waarop hulle ry, gekruis word;
 - (c) aan voetgangers en/of fietsryers wat die padbaan oorsteek, of wag om die padbaan oor te steek by 'n oorgang wat gemerk is met VOETOORGANGSTREPE-merk RTM3, en/of BLOKVOETOORGANG-merk RTM4;

EN sodanige merk die betekenis het wat aan die R2-TOEGEE-teken toegeskryf word. (TOEGEE-teken R2 sluit ieder en elke afleiding van die R2-teken in).
- 2 Dit het tot gevolg, dat ingeval 'n TOEGEE-teken R2 by 'n padaansluiting of 'n voetoorgang omgeval het, of tydelik ontbreek, 'n TOEGEESTREEP-merk RTM2 die volle betekenis van die TOEGEE-teken R2 moet hê. 'n TOEGEESTREEP-merk RTM2, as dit dwarsoor 'n draailaan gemerk is wat met GIDSSTREEP-merk GM2 gemerk is binne 'n aansluiting wat d.m.v. verkeerseine beheer word, moet dieselfde volle betekenis as die TOEGEE-teken R2 hê, sonder die gebruik van sodanige teken.
- 3 TOEGEESTREEP-merke RTM2 moet slegs saam met TOEGEE-teken R2, TOEGEE VIR VOETGANGERS-teken R2.1 of TOEGEE OP VERKEERSIRKEL, of gebruik word, of soos in paragraaf 7.2.2.2 aangedui is. TOEGEESTREEP-merke moet op enige plek gebruik word wat normaalweg nie d.m.v. 'n verkeersein beheer word nie en waar gereelde maar korttermyn puntdiens deur 'n verkeersbeampte of 'n skolierpatroolie gedoen word. (Sien Onderafdelings 7.2.1, 7.2.3 en 7.2.4).
- 4 'n TOEGEESTREEP moet uit 'n onderbroke wit streep met 'n minimum breedte van 300mm in stedelike en 500mm in buitestedelike of ander gebiede bestaan. TOEGEESTREPE, wat geregverdig is, moet strek oor die volle breedte van daardie gedeelte van alle bedekte

TRAFFIC CIRCLE
VERKEERSIRKEL

COLOURS / KLEURE:

PERMANENT

Triangle: Red retroreflective
Symbol: Black semi-matt
Background: White retroreflective

TEMPORARY

Triangle: Red retroreflective
Symbol: Black semi-matt
Background: Yellow retroreflective

PERMANENTE

Driehoek: Rooi terugkaatsend
Simbool: Swart halfdoof
Achtergrond: Wit terugkaatsend

TYDELIKE

Driehoek: Rooi terugkaatsend
Simbool: Swart halfdoof
Achtergrond: Geel terugkaatsend

W201



For dimensions
vir afmetings
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3.3.1

TW201



3.3.1 Traffic Circle

- 1 The TRAFFIC CIRCLE warning sign W201 is to warn road users that a traffic circle is ahead. The direction of movement within a traffic circle shall be clockwise and in conformity Section 94 of the Act. (See also Section 2.2.4).
- 2 The sign should be displayed in advance of a traffic circle at a distance in accordance with the design speed of the road and the safe speed at which the traffic circle can be negotiated. Figure 3.1 should be used to determine the appropriate distance.
- 3 The sign should normally not be displayed on an approach to a traffic circle where a MAP-TYPE TRAFFIC CIRCLE JUNCTION sign GD8 is displayed.
- 4 The sign shall not be displayed on any approach to a traffic circle which is not operating under the normal priority control system applicable to traffic circles. (MAP-TYPE direction signs should be used especially if RIGHT OF WAY signs IN7 have been displayed on the principal approaches to the traffic circle.)
- 5 Temporary warning sign TW201 may be used under the same circumstances as a permanent TRAFFIC CIRCLE warning sign when a temporary traffic circle be created to deal with traffic on a roadworks detour.

3.3.1 Verkeersirkel

- 1 Die VERKEERSIRKEL-waarskuwingsteken W201 is daar om padgebruikers te waarsku dat daar 'n verkeersirkel vorentoe is. Die rigting van beweging binne die verkeersirkel moet klokgewys wees en in ooreenstemming met Afdeling 94 van die Wet. (Sien ook Afdeling 2.2.4).
- 2 Die teken behoort voor 'n verkeersirkel vertoon te word op 'n afstand wat in ooreenstemming is met die ontwerpspoed van die pad en die veilige spoed waarmee die draabeweging om die verkeersirkel uitgevoer kan word. Figuur 3.1 behoort gebruik te word om die toepaslike afstand te bepaal.
- 3 Die teken behoort in die reël nie vertoon te word op 'n nadering tot 'n verkeersirkel waar 'n KAARTTIPE VERKEERSIRKELAANSLUITING-teken GD8 vertoon word nie.
- 4 Die teken moet nie vertoon word op enige nadering tot 'n verkeersirkel wat nie werk volgens die gewone voorrangbeheerstelsel wat op verkeersirkels van toepassing is nie. (KAARTTIPE-riigtingteken behoort gebruik te word, veral indien RYVOORRANG-teken IN7 op die hooftoerings na die verkeersirkel vertoon word.)
- 5 Die tydelike TW201-waarskuwingsteken mag in dieselfde omstandighede as die permanente VERKEERSIRKEL-waarskuwingsteken gebruik word as 'n tydelike verkeersirkel geskep word om verkeer by pad-werkverleggings te hantoeer.

HAZARD MARKER

3.5.1

COLOURS/KLEURE:

PERMANENT
Red retroreflective
on white retroreflective

TEMPORARY
Black semi-matt
on yellow retroreflective

PERMANENTE
Rooi truakaatsend
op wit truakaatsend

TYDELIKE
Swart halfdoof
op geel truakaatsend

DANGER PLATES/DELINEATOR PLATES
GEVAARPLATE/DELINIEERPLATE

W402



W401

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3.5.1



TW402



TW401

3.5.1 Danger Plates/Delineator Plates

- 1 The DANGER PLATE warning signs W401 and W402 and the DELINEATOR PLATE temporary warning signs TW401 and TW402 are to warn road users of an obstruction or temporary obstruction, in the roadway, or alteration or temporary alteration, in the roadway alignment to the right or left side of the roadway.
- 2 Signs W401 and W402 should be displayed at all hazardous obstructions that occur within the shoulder or verge of a roadway such as bridge abutments, culvert head-walls or posts without guardrail protection. Sign W401 should be used on the left side of the roadway so that traffic passes to the right of the plate. Sign W402 should be used on the right side of the roadway so that traffic passes to the left of the plate.
- 3 Open ditches, high embankments and ill-defined curves, particularly where roadside space is limited in urban areas may be demarcated using a number of DANGER PLATE hazard markers. (See Subsection 3.5.3 on page 3.5.4.)
- 4 Sign W401 or W402 shall be mounted horizontally with the arrow pointing downwards on an overhead structure on each side of HEIGHT LIMIT sign R204 when such sign is used to regulate the use by traffic of a structure which has limited vertical clearance. (See Subsection 2.4.4.)
- 5 Signs TW401 and TW402 should be displayed at all obstructions at roadworks sites which are potentially hazardous. Sign TW401 should be used on the left side of the roadway so that traffic passes to the right of the plate. Sign TW402 should be used on the right side of the roadway so that traffic passes to the left of the plate. In addition delineator plates should be used to indicate temporary road alignments which occur at roadworks sites. 200 litre, or similar drums shall not be used for this purpose.
- 6 DANGER PLATES and DELINEATOR PLATES should have a minimum size of 600mm height and 150mm width. The ratio of height to width should be maintained at 4 to 1 up to a maximum size of 1 200mm x 300mm, which size should be used to indicate bridge

3.5.1 Gevaarplate/Delinieerplate

- 1 Die GEVAARPLAAT-waarskuwingstekens W401 en W402 en die tydelike DELINIEERPLAAT-waarskuwingstekens TW401 en TW402 is daar om padgebruikers te waarsku van 'n versperring of tydelike versperring in die padbaan, of om hulle te waarsku van 'n verandering of 'n tydelike verandering in die padbaan belyning aan die regterkant of linkerkant van dié padbaan.
- 2 Die W401- en W402-teken behoort vertoon te word by alle gevaarlike versperrings soos brughoofde, duikerkopmure of pale sonder skramrelings wat binne 'n padbaanskouer of -soom val. Die W401-teken behoort aan die linkerkant van die padbaan gebruik te word sodat verkeer regs van die plaat verbybeweeg. Die W402-teken behoort aan die regterkant van die padbaan gebruik te word sodat verkeer links van die plaat verbybeweeg.
- 3 Oop sote, hoë opvullings en onduidelik gemerkte draaie, veral waar die padkantruimte in stedelike gebiede beperk is, mag afgebaken word deur die gebruik van 'n aantal GEVAARPLAAT-gevaarmerkers. (Sien Onderafdeling 3.5.3 op bladsy 3.5.4.)
- 4 Die W401- of W402-teken moet horisontaal aan weerskante van 'n HOOGTEPERK-teken R204 aan 'n oorhoofse struktuur bevestig word sodat die pyl na onder wys, waar so 'n teken gebruik word om verkeer by 'n struktuur met vertikaal beperkte vry hoogte te reël. (Sien Onderafdeling 2.4.4.)
- 5 Die TW401- en TW402-teken behoort op padwerkterreine, by alle versperrings wat potensieel gevare is, vertoon te word. Die TW401-teken behoort aan die linkerkant van die padbaan gebruik te word sodat verkeer regs van die plaat verbybeweeg. Die TW402-teken behoort aan die regterkant van die padbaan gebruik te word sodat verkeer links van die plaat verbybeweeg. Delinieerplate behoort ook nog gebruik te word om tydelike padbelynings wat op padwerkterreine voorkom, aan te dui. 200-liter-, of soortgelyke dromme moet nie vir hierdie doel gebruik word nie.
- 6 GEVAARPLATE en DELINIEERPLATE behoort 'n minimum grootte van 600mm hoog en 150mm breed te hê. Die verhouding van hoogte tot breedte behoort 4 tot 1 te bly, tot 'n maksimum grootte van 1 200mm x 300mm, en hierdie grootte behoort gebruik te word om

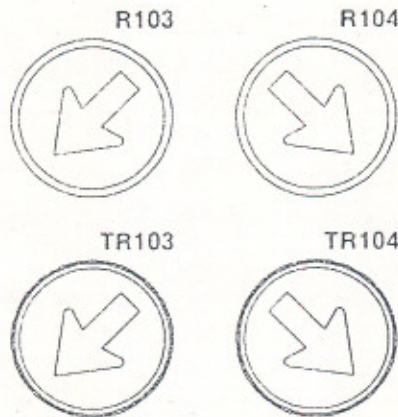
2.3.4

BEVEL

KEEP LEFT - KEEP RIGHT
HOU LINKS - HOU REGS

For dimensions
vir afmetings
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2.3.3
2.3.4



COLOURS/KLEURE:

PERMANENT

Border & arrow: White retroreflective
Background: Blue retroreflective

TEMPORARY

Inner border
& arrow: Black semi-matt
Background
& outer border: Yellow retroreflective

PERMANENTE

Rand & pyl: Wit truikaatsend
Agtergrond: Blou truikaatsend

TYDELIKE

Binnerand
& pyl: Swart halfdot
Agtergrond
& buiterand: Geel truikaatsend

2.3.3 Keep Left and Keep Right

- 1 The KEEP LEFT and KEEP RIGHT regulatory signs R103 and R104 impose a *mandatory requirement that the driver of a vehicle shall pass only to the left-hand side or the right-hand side, as indicated by an arrow, of an obstacle in the roadway on which the sign has been placed.* Signs R103 and R104 may be displayed as a SELECTIVE RESTRICTION sign in conjunction with a secondary message indicating a class of vehicle to which the mandatory requirement applies. (See Section 2.7).
- 2 Signs R103 and R104 must be displayed with extreme care, so that the arrow shall point downwards at an angle of approximately 45° towards the side on which traffic must pass. If the arrow is incorrectly aligned the meaning of the sign could be altered to that of the PROCEED LEFT ONLY, PROCEED RIGHT ONLY or PROCEED STRAIGHT ONLY signs R105, R106 and R107.
- 3 The signs should normally be displayed with their lower edge 750mm above the surface of the roadway. The height of display should, however, take into account the vertical alignment of the roadway. If the sign is located just beyond a crest curve it should be further elevated to improve visibility. Sign R103 is commonly used to indicate the beginning of a median island. In this case it may be mounted lower in combination with a DANGER PLATE hazard marker W402, on one post, to indicate that traffic must pass the sign to the left. The sign does not need to be repeated at subsequent openings in an otherwise continuous median island unless special conditions require the repetition of the message. Sign R103 may, for instance, be displayed on the end of a median island to the left of a NO ENTRY sign R3, when there is a risk of traffic entering the opposing roadway.
- 4 Signs R103 and R104 SHALL NOT be displayed side by side on a channelising island which traffic may pass either to the left or right of, even if by doing so traffic will reach the same destination e.g. a pedestrian refuge in a one-way roadway. Such a device should be signed using SHARP CURVE CHEVRON hazard marker

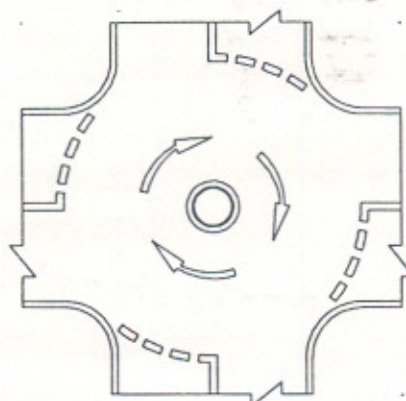
2.3.3 Hou Links en Hou Regs

- 1 Die HOU LINKS- en HOU REGS-reëlingstekens R103 en R104 stel 'n *verpligte vereiste aan 'n bestuurder van 'n voertuig dat daar slegs aan die linkerkant of die regterkant, soos deur 'n pyl aangedui, verby 'n versperring op die openbare pad waarop die teken geplaas is, beweeg moet word.* Die R103- en R104-teken mag as GEDEELTELIKE BEPERKING-teken vertoon word saam met 'n sekondêre boodskap wat die voertuigklas waarop die verpligte vereiste van toepassing is, aandui. (Sien Afdeling 2.7).
- 2 Die R103- en R104-teken moet met uiterste sorg vertoon word, sodat die pyl met 'n hoek van ongeveer 45° na onder in die rigting wys waarlangs verkeer moet verbystek. Indien 'n pyl verkeerd belynd word, kan die betekenis van die teken gewysig word na dié van die RY NET LINKS-, RY NET REGS-, of RY NET REGUIT AAN-teken R105, R106 en R107.
- 3 Die teken behoort in die reël vertoon te word met hulle onderkant 750mm bokant die padbaanoppervlak. Die vertoonhoogte behoort egter die vertikale padbaanbelyning in aanmerking te neem. Indien die teken net na 'n kruinboog geplaas word, behoort dit nog hoër gelig te word om sigbaarheid te verbeter. Die R103-teken word gewoonlik gebruik om die begin van 'n mediaaneiland aan te dui. In hierdie geval mag dit laer en saam met 'n GEVAARPLAAT-gevaarmerker W402 aan een paal gemonteer word om aan te dui dat verkeer links van die teken moet verbyry. Die teken hoef nie by opeenvolgende openinge in 'n andersins aaneenlopende mediaaneiland herhaal te word nie, behalwe as besondere toestande die herhaling van die boodskap vereis. Die R103-teken mag byvoorbeeld by die einde van 'n mediaaneiland en links van 'n GEEN INGANG-teken R3 vertoon word as daar 'n risiko bestaan dat verkeer die teenoorgestelde padbaan kan ingaan.
- 4 Die R103- en R104-teken MOET NIE langs mekaar op 'n kanaliseereiland geplaas word waar verkeer of links of regs daarvan mag verbyry nie, selfs nie as verkeer wat dit doen dieselfde bestemming, bv. 'n voetganger-eiland in 'n eenrigtingpadbaan, sal bereik nie. So 'n voorwerp moet van SKERP DRAAI-CHE-

TRAFFIC CIRCLE MANDATORY DIRECTION ARROWS
 VERKEERSIRKEL VERPLIGTE RIGTINGSPYLE

COLOURS/KLEURE:

Arrows	Yellow
Outer circle	White
Inner circle	Yellow
Pyle	Geel
Buite sirkel	Wit
Binne sirkel	Geel



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7.2.19 Traffic Circle Mandatory Direction Arrows

- 1 The TRAFFIC CIRCLE MANDATORY DIRECTION ARROWS regulatory markings RM15 indicate a mandatory requirement that drivers of vehicles shall only proceed in the direction indicated by the arrows. When a raised channelising island is not provided at a traffic circle a painted traffic island shall be marked in the appropriate position relative to the design of the traffic circle, which shall indicate a mandatory requirement that drivers of vehicles shall drive their vehicles in such a manner as to pass to the left of the circle and to not fully cover the circle or pass to the right of it.
- 2 TRAFFIC CIRCLE MANDATORY DIRECTION ARROWS shall be marked on the road surface in yellow, in sets of three arrows, at all traffic circles where the size of the circle is such that the full circular roadway created can be seen by approaching drivers. The three arrow markings shall be equally spaced but may be positioned to best suit the number and angle of intersection of the approach roadways.
- 3 The provision of a painted traffic island, round which traffic is required to drive in a clockwise direction, is an alternative to a raised channelising traffic circle and is particularly appropriate for use in mini-circles. If a raised island is not constructed a painted traffic island shall be provided at a junction intended to operate as a traffic circle. The marked circle is a form of PAINTED ISLAND marking RM5. The circumference of the circle should comprise a white boundary line with a minimum width of 200mm. The central portion may be marked with a solid yellow markings so that there is a minimum gap of 150mm between the central area and the boundary line.
- 4 A minimum diameter of 1,2m and a maximum diameter of 4m are recommended for marked circles. It is recommended that the road surface be raised but mountable by traffic over the area of the marked circle. Central channelising islands may be defined by mountable or un-mountable kerbing depending on the dimensions of the traffic circle and the junction.

7.2.19 Verkeersirkel verpligte rigtingspyle.

- 1 Die VERKEERSIRKEL VERPLIGTE RIGTINGSPYLE reëlingsmerke RM15 dui op 'n verpligte vereiste aan bestuurders van voertuie dat hulle net in die rigting wat deur die pyle aangedui is, moet voortgaan. Wanneer 'n opgeligte kanaliseringseiland nie voorsien word by 'n verkeersirkel nie, moet 'n geverfde verkeersirkel gemerk word in die toepaslike posisie relatief tot die ontwerp van die verkeersirkel. Dit moet aandui dat 'n verpligte vereiste aan voertuigbestuurders gestel word dat voertuie sodanig bestuur moet word dat die voertuie aan die linkerkant van die sirkel sal verbystek en nie bo-oor of aan die regterkant van die sirkel verbygaan nie.
- 2 VERKEERSIRKEL VERPLIGTE RIGTINGSPYLE moet op die padoppervlak in geel gemerk wees, in stede van drie pyle, by alle verkeersirkels waar die grootte van die sirkel sodanig is dat die volle sirkulêre padbaan deur aankopende bestuurders raakgesien kan word. Die drie pyle moet eweredig gespaseer wees, maar mag sodanig geposisioneer wees dat die beste hoeveelheid en beste hoek van interseksie op die aankomende bane bewerkstellig word.
- 3 Die voorsiening van 'n geverfde sirkulêre verkeerseiland waar daar van verkeer vereis word om in 'n kloksgewyse rigting om die eiland te beweeg, kan as 'n alternatief vir 'n verhewe (opgeligte) kanalisering verkeersirkel. Minisirkels word hier gebruik. Indien 'n verhewe eiland nie voorsien word nie, moet 'n geverfde verkeerseilandvoorsien word by 'n interseksie wat soos 'n verkeersirkel optree. Die gemerkte sirkel is 'n vorm van die GEVERFDE EILAND RM5. Die omtrek van die sirkel kan uit 'n wit kantlyn met 'n minimum wydte van 200mm bestaan. Die middelste gedeelte mag uit 'n geel vermerk bestaan met 'n minimum gaping tussen die kontrole gedeelte en die kantlyn van 150mm.
- 4 'n Minimum diameter van 1,2m en 'n maksimum diameter van 4m word aanbeveel vir gemerkte sirkels. Dit word aanbeveel dat die padoppervlak gelig word maar nog steeds toeganklik vir verkeer moet wees by die area van die gemerkte sirkel. Sentrale kanaliseringseilande mag gedefinieer word deur oprybare of nie-oprybare randstene afhangende van die fisiese dimensies van die sirkel en die aansluitings.