

mini roundabouts

good practice guidance



mini roundabouts

good practice guidance

FOREWORD

The modern concept of a mini-roundabout was introduced in the UK in the early 1970s as a means to improve capacity and reduce delays at existing junctions where there was limited scope to introduce other forms of control. Since that time, most local authorities have developed their use to address other issues such as casualty reduction and as a speed-reducing feature within traffic-calmed areas. There are about 5,000 mini-roundabouts around the country and a great deal of experience has been gained in their application.

The purpose of this document is to pull together this wealth of experience so that it can be shared with all those involved in the various aspects of highway management. It is important to note that this document is not intended as a design standard, but rather to provide guidance concerning appropriate locations and situations where mini-roundabouts should be considered.

We would like to thank all those involved in the production of this document for their commitment and hard work. In particular we wish to thank Faber Maunsell, members of the CSS, the Steering Group and the many authorities and organisations that have provided information and examples of good practice.

On behalf of the County Surveyors Society and the Department for Transport, we wholeheartedly commend *Mini-Roundabouts – Good Practice Guidance* to all with an interest in creating safer roads and the management of traffic within our urban streets.



A handwritten signature in black ink that reads "Gillian Merron".

*Gillian Merron
Parliamentary Under-Secretary
Department for Transport*



A handwritten signature in black ink that reads "Mike Allister".

*Mike Allister
Immediate Past President of CSS*

TABLE OF CONTENTS

1. Introduction and Background	1
1.1. General	2
1.2. Purpose of Guidance	2
1.3. Background	2
1.4. Relationship with DMRB	2
1.5. Disclaimer	2
1.6. Structure of Document	2
2. Definition and Use of Mini-Roundabouts	3
2.1. Definition of a Mini-Roundabout	4
2.2. Use of Mini-Roundabouts	5
2.3. Improving the Operation of an Existing Junction	5
2.4. As an Accident Remedial Measure	6
2.5. As a Traffic Calming Measure	6
2.6. As an Access to a New Development	6
3. Site Assessment	9
3.1. General	10
3.2. Early Rejection	10
3.3. Stage 1 Site Assessment	10
3.4. Stage 2 Site Assessment	11
3.5. Visibility	11
3.6. Vehicle Speed	12
3.7. Road Character	13
3.8. Traffic Volume	15
3.9. Number of Arms	15
3.10. Traffic Composition	15
3.11. Vulnerable Road Users	16
3.12. Consultation	17
3.13. Road Network	17
3.14. Noise and Vibration	18

4.	Existing Practice	19
4.1.	Introduction	20
4.2.	Responses to Consultation	20
4.3.	Example Sites	23
	Site: Treffry Lane - B3268	24
	Site: A1134 Brooks Road - Brookfield	25
	Site: Poppyfields	26
	Site: B5259/B5260 junction	27
	Site: Colchester Road - Freebournes Road	28
	Site: Fox Lane - West Paddock	29
	Site: Treswithian Road - Weeth Road	30
	Site: Castle Road - Phillpotts Avenue	31
	Site: The Avenue (north) - The Avenue (south) - St Swithuns Road	32
	Site: Westgate - Sherborne Road	33
	Site: High Road - Falkers Way (east)	34
	Site: A414 Main Road - Well Lane	35
	Site: Kennington Road (north) - Kennington Road (south) - Upper Road	36
	Site: The Glebe - Manor Road	37
	Site: A12 off-skip - Shell Garage Access	38
4.4.	Post Implementation Monitoring	39
4.5.	Maintenance	39
4.6.	Driver Behaviour	39
4.7.	Road User Education	40
4.8.	Frequently Asked Questions	40
5.	Acknowledgement and References	45
5.1.	Acknowledgements	46
5.2.	References	46

1. INTRODUCTION AND BACKGROUND



1. Introduction and Background

1.1. General

Mini-roundabouts have been widely introduced on a variety of roads around the UK, from strategic routes (including trunk roads) to residential roads. Practice regarding the selection and design of mini-roundabouts varies between highway authorities, resulting in a degree of confusion regarding the safety and suitability of mini-roundabouts in some circumstances. There is also a lack of awareness of regulations relating to mini-roundabouts.

1.2 Purpose of Guidance

This document seeks to help practitioners understand what a mini-roundabout is and how it should be used. It explains the legislative basis for mini-roundabouts and establishes current practice based upon real examples of installation and lessons learned.

This document does not explain how a mini-roundabout should be designed; see section 1.4 for further information. The intention is to examine mini-roundabouts in terms of their current use, as a traffic engineering tool. The road markings for a mini-roundabout and related signs are prescribed in the Traffic Signs Regulations and General Directions 2002 (TSRGD). Detailed guidance on the correct use of these signs and markings can be found in Chapters 3 and 5 of the Traffic Signs Manual.

The objectives of this document are to:

- clarify the definition of a mini-roundabout;
- identify what can or cannot be done (i.e. regulations);
- illustrate what could, should or should not be done (i.e. examples of good and bad practice);
- identify issues to consider when thinking about introducing a mini-roundabout; and
- provide a structure to guide the decision and early design processes.

1.3 Background

This document considers the range of factors that may affect the suitability of a site for a mini-roundabout. When making a decision regarding its use, a comparison with other forms of junction will be undertaken. It is important to identify any factors present at a junction that may suggest a mini-roundabout is an unsuitable choice as early as possible in the assessment process. The mini-roundabout can then be discounted and another junction type investigated. The designer should use judgement and experience, as well as available guidance and advice, to decide whether a mini-roundabout is a practicable option.

This document is for use by highway authority engineers, or their consultants, and applies to mini-roundabouts on non-trunk roads.

1.4 Relationship with DMRB

Guidance on the design of roundabouts is provided in TD 16/93. This is to be supplemented with a new TD providing detailed guidance on mini-roundabouts, which is mandatory for trunk roads but advisory for applications on local roads. The design guidance contained in the standard would be applicable to all roads but the guidance on siting and use may differ on local roads, which are different in character to trunk roads.

1.5 Disclaimer

This document is intended as guidance. It does not remove or reduce the requirement for designers to exercise engineering judgement when deciding which standards or advice can be applied, nor does it prohibit the consideration of departures from standards or advice in exceptional circumstances.

Any justification for departures from the available advice and guidance should be recorded and must take into account the general 'duty of care' a highway authority has, in law, to the road user.

Where advice is thought to be safety critical, this is clearly identified. Mini-roundabout layouts will usually be subject to a road safety audit, in accordance with the highway authority's policy.

Although this document contains ranges of variables it is not implied that every combination is acceptable and some combinations may attract adverse comments during a safety audit.

This document is intended to represent current good practice but is not intended to cover all eventualities or situations that may arise during the consideration and design of a particular junction solution.

1.6 Structure of Document

The document is structured to reflect the decision-making process, starting with an understanding of what a mini-roundabout is and leading through the site assessment criteria to design details.

Chapter 2 provides a definition of a mini-roundabout and provides information on how a mini-roundabout can be used. Chapter 3 considers site assessment issues. Chapter 4 includes a review of existing practice, a summary of the results of the consultation exercise and answers frequently asked questions.

2. DEFINITION AND USE OF MINI-ROUNDBABOUTS



2. Definitions and Use of Mini-Roundabouts

A mini-roundabout is effectively a road marking. If the road marking is not in accordance with TSRGD diagram 1003.4 it is not a mini-roundabout.

2.1 Definition of a Mini-Roundabout

A mini-roundabout is a type or form of junction control at which vehicles circulate around a white, reflectorised¹, central circular road marking (central island) of between one and four metres in diameter, as shown in TSRGD diagram 1003.4.

Vehicles entering the junction must give way to vehicles approaching from the right, circulating the central island.²

The central road marking is either flush or slightly raised as a dome³ (no more than 125mm), in order that it can be driven over by larger vehicles that are physically incapable of manoeuvring around it. The dome is also raised to discourage vehicles from driving over the central island⁴. Three white arrows are painted on the carriageway, within the gyratory area, around the central road marking, showing the direction of circulation.

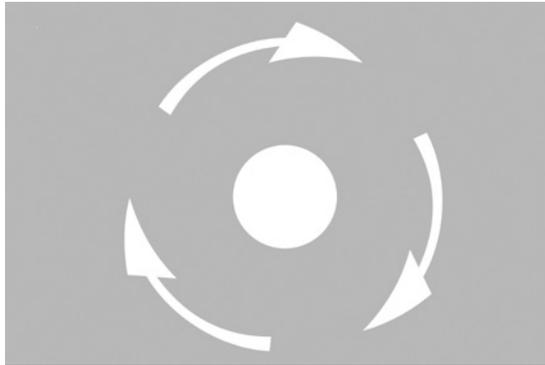


Figure 2.1.1: TSRGD diagram 1003.4

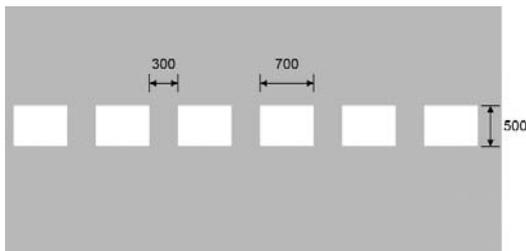


Figure 2.1.2: TSRGD diagram 1003.3

A blue mini-roundabout sign (illuminated if sited within 50 metres of a street lamp within a system of street lighting), as shown in diagram 611.1, precedes the mini-roundabout on each approach. This sign is usually accompanied by the transverse give way marking shown in diagram 1003.3. However, the mandatory give way markings (diagram 1003 and 1023), and give way sign (diagram 602), may be used in addition to diagram 611.1 where appropriate.⁵ Where diagrams

1003 and 1023 are used, diagram 602 should be placed above diagram 611.1 as illustrated below:

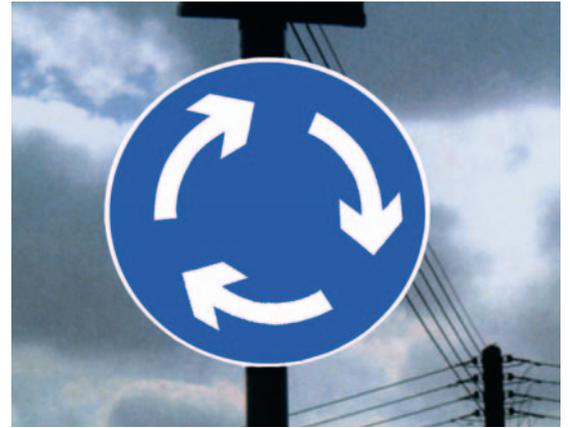


Photo 2.1.1: TSRGD diagram 611.1



Photo 2.1.2: TSRGD diagram 602 and TSRGD diagram 611.1

Warning of the approach to a mini-roundabout can also be provided using the roundabout ahead sign (diagram 510).

When negotiating a mini-roundabout drivers must pass round the central road marking on the left hand side unless the size of the vehicle or layout makes it impracticable to do so.

Research suggests there are considerable variations in construction of the roundabout central island. The central island of a mini-roundabout **does not conform** to diagram 1003.4 if:

- it has a diameter less than one metre or greater than four metres;
- it cannot be driven over;
- it has a surface colouring other than white;
- it is not reflectorised;
- it is constructed of granite setts, block paving or other textured material (unless coloured white);
- it contains street furniture⁶;

¹ TSRGD 2002, Regulation 31(1)

² TSRGD 2002, Regulation 25(5)

³ TSRGD 2002, Regulation 32(2)(c) – see also Section 3.13

⁴ See TSRGD Regulation 16(1) Table item "...a vehicle proceeding through the junction must keep to the left of the white circle at the centre of the marking shown in diagram 1003.4, unless the size of the vehicle or the layout of the junction makes it impracticable to do so."

⁵ See paragraph 8.17 of Chapter 5 of the Traffic Signs Manual, which explains where GIVE WAY signing should be used.

⁶ Traffic Signs Manual Chapter 5 Road Markings, para 8.10

Mini-roundabouts are generally used for one of four main reasons:

- to improve the operation of an existing junction;
- as an accident remedial measure;
- as part of a traffic calming scheme; and
- to provide an access to a new development

- it has a raised kerb (more than 6mm);
- it has non-prescribed road markings such as concentric rings;
- it incorporates road studs.



Photo 2.1.3: Non-conforming concentric rings



Photo 2.1.4: Street furniture on central island creating a small roundabout, not a mini-roundabout



Photo 2.1.5: Street furniture on a domed central island in tarmac creating a small roundabout, not a mini-roundabout



Photo 2.1.6: Non-conforming central marking in setts with white edge marking

2.2 Use of Mini-Roundabouts

Mini-roundabouts were initially developed as a method of improving safety at existing junctions, but are now increasingly included as part of new development proposals. Mini-roundabouts may be introduced at junctions that experience problems with safety or side road delay. They can be used at junctions to break up long, straight sections of road or to achieve a sharp deviation of the main route without the need for low standard radii.

Mini-roundabouts are often considered as an alternative to another junction type due to constrained highway space or because they are perceived to be less costly. Early examples were used as an alternative to traffic signals at very constrained sites where an alternative method of control was needed.

The four main reasons why practitioners consider mini-roundabouts as a potential option are:

- to improve the operation of an existing junction;
- as an accident remedial measure;
- as part of a traffic calming scheme; or
- to provide an access to a new development.

2.3 Improving the Operation of an Existing Junction

Mini-roundabouts are used to replace priority junctions, traffic signal junctions and conventional roundabouts to improve junction operation.

They are usually installed at T-junctions and crossroad junctions (3 or 4-armed junctions). Mini-roundabouts should not be used at junctions with five or more arms.



Photo 2.3.1: Before view of priority junction

Refer to MOLASSES and local accidents records when considering a mini-roundabout



Photo 2.3.2: After view of junction with mini-roundabout

A mini-roundabout can improve the operation of a junction by:

- **Reducing the dominance of one traffic flow**

As the mini-roundabout works on the principle of 'priority to circulating traffic from the right', a minor traffic flow can be given priority over a major traffic flow that would otherwise dominate the junction.

- **Giving priority to right turners**

Again the 'priority' principle of operation has been exploited for right-turning traffic, giving it priority over ahead movements from the opposing direction.

- **Facilitating access and reducing delay at side roads**

The 'priority to the right' rule effectively halves the traffic to which side road flow has to yield priority, making it easier for side road traffic to turn.

- **Improving capacity at overloaded junctions**

For a given road space, the mini-roundabout has a higher capacity than most alternatives and is very flexible in coping with variations in both volumes and proportions of traffic flow during the day.

2.4 As an Accident Remedial Measure

Mini-roundabouts are most commonly introduced as an accident remedial measure:

- to reduce the number of accidents at a junction. For 3-arm sites, the mean accident rate for mini-roundabouts is similar to that of priority T-junctions and about 30% less than for signalled junctions.
- to reduce the severity of accidents at a junction. The severity of accidents (percentage of fatal and serious accidents to all injury accidents) at 3-arm mini-roundabout sites is lower than at 3-arm signalled junctions and considerably lower than at 30 mph T-junctions.

Careful consideration should be given to introducing mini-roundabouts as part of a new development

The scope for accident reduction will clearly be dependent on specific junction characteristics, such as traffic flow and geometry, as well as accident types. When considering a mini-roundabout as an option, designers should refer to current guidance on accident numbers such as the MOLASSES database, and locally held records on accident levels.

2.5 As a Traffic Calming Measure

Mini-roundabouts are also used for traffic calming:

- **As part of a traffic calming scheme.** Mini-roundabouts are often considered as part of area-wide traffic calming schemes in which they are sometimes installed at the extremities of the scheme or at all or various junctions within it.
- **Reducing traffic speeds and increasing driver awareness.** The use of a mini-roundabout in isolation as a speed reducing measure is more contentious and has met with mixed success. They have also been used to indicate to drivers that they are entering a more residential area. A well designed mini-roundabout can reduce speeds and a poorly designed one may not.



Photo 2.5.1: Mini-roundabout in traffic calmed area

2.6 As an Access to a New Development

Many Local Authorities accept the introduction of mini-roundabouts as part of new development proposals.



Photo 2.6.1: Mini-roundabout as access to new development

Designers may use numerical criteria to determine whether a mini-roundabout is suitable for access to a new development, with some suggesting side road traffic flows should be not less than 500 vehicles per day (AADT). Some Local Authorities use different criteria. For example, Lancashire, Cheshire and Bedfordshire County Councils prefer to use a ratio, suggesting side road flow should be a minimum of 10-15% of the major road flow.

A lower flow limit is prescribed because difficulties can result from their use at lightly trafficked side roads, where emerging vehicles or turning movements are unexpected; if side road flows are too low then the main road will effectively operate under free flow conditions.

Consideration should also be given to the usual site constraints and design criteria.

On trunk roads it is unlikely that a mini-roundabout would be an acceptable design solution for a new junction.



Photo 2.6.2: Mini-roundabout on new estate road

Note: This and other photos illustrate a common error in the placing of TSRGD diagram 611.1; this one is upside down.

3. SITE ASSESSMENT



3. Site Assessment

3.1 General

Once a practitioner has established that a mini-roundabout may be an appropriate choice, the site needs to be examined to confirm its suitability.

Engineers need to be aware of the complexity of assessing the suitability of a site for the installation of a mini-roundabout. Many variables contribute to its suitability and potential success. Factors need to be quantified and their significance determined, including whether the initial design of the mini-roundabout can be modified to mitigate any potential problems.

3.2 Early Rejection

Mini-roundabouts are unlikely to be an appropriate junction treatment at the following locations:

- on a dual carriageway;
- at a junction with five or more arms; and
- where the 85th percentile speed exceeds 35 mph (see section 3.6 for further information); and
- where there is no scope to reduce approach speeds.

The procedure for assessing site suitability should be undertaken in two stages.

3.3 Stage 1 Site Assessment

As part of the assessment it is recommended that a record is kept of all relevant factors, including details of site surveys, in order that a fully informed decision can be made, and if necessary a comparison between other junction options. Site visits by the designer in daylight and during the hours of darkness are recommended. A sample site assessment form is provided at the back of this document.

The first stage of assessment will include several key decisions:

IS THERE ENOUGH SPACE AVAILABLE FOR THE CONSTRUCTION OF A MINI-ROUNABOUT?

The width of the carriageway and extent of land designated as public highway will determine whether there is enough space available for the construction of a mini-roundabout. Available space at the junction may be sufficient to enable a conventional roundabout to be constructed instead. When investigating if space is sufficient, consideration will need to be given to the availability of private land.

Layouts that do not allow car drivers to negotiate the central island without overrunning are unlikely to be good designs.

Assessment should be undertaken in two parts.

The inscribed circle diameter (ICD) of a mini-roundabout is the diameter of the largest circle that can be inscribed within the junction kerbs. A suggested maximum ICD for a mini-roundabout is 28 metres. Above this dimension a conventional roundabout should be used. Designers should also consider a minimum ICD, taking account of the requirement for drivers to drive around, and not over, the central island. Figure 3.3 below shows the desirable minimum ICD based upon a medium sized car.

Layouts that do not allow car drivers to negotiate the central island without overrunning are unlikely to be good designs.

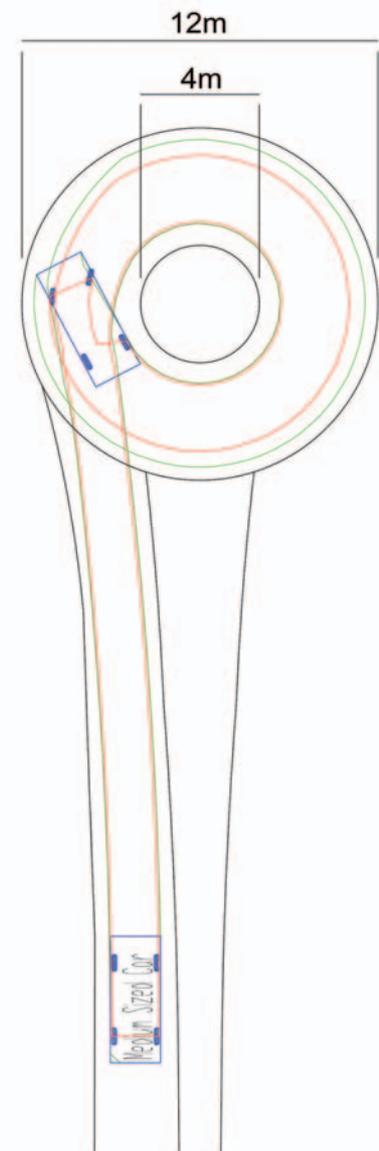


Figure 3.3: Sample Desirable Minimum ICD

A mini-roundabout should not be considered a simple lining and signing exercise.



Photo 3.3.1: Constrained site where all vehicles from side road have to overrun central island

WILL THE INSTALLATION OF A MINI-ROUNDAABOUT ADVERSELY AFFECT THE SAFETY PERFORMANCE OF THE JUNCTION, WHETHER OR NOT THE MINI-ROUNDAABOUT IS BEING INTRODUCED AS AN ACCIDENT REMEDIAL MEASURE?

It is essential that the accident record for an existing junction be investigated in order to predict the effect that a mini-roundabout would have on safety at a particular site.

The improved safety performance of a new mini-roundabout junction is also dependent on the improvements to the general road environment, such as the renewal of lines and signs, a new surface or improved lighting, as well as the change of junction control. However, sustaining this level of benefit will be dependent on regular junction maintenance.

IS A MINI-ROUNDAABOUT LIKELY TO BE AFFORDABLE AND ECONOMICALLY VIABLE?

Mini-roundabouts are often considered because they are perceived to be relatively inexpensive compared to other junction types and it is important that any junction improvement provides an economic solution in addition to improving operational and/or safety benefits.

When considering a mini-roundabout as a safety measure, economic justification is assessed, i.e. the first year rate of return (FYRR) should be calculated.

Whilst not providing a 'perfect' solution, a mini-roundabout may provide sufficient improvement over the existing junction performance to justify installation on a value for money basis.

However, it is also important that the whole life cost of the junction is taken into account. Mini-roundabouts incur ongoing maintenance costs and these should not be overlooked. For example, a domed central island subject to high turning movements by HGVs may be scuffed regularly and will need to be re-painted to maintain conspicuity.

Visibility will place a constraint on the design and measures required as part of the layout.

Consider the whole life costs not just construction costs and accident savings.

The successful design of a mini-roundabout may require:

- carriageway realignment;
- build-outs;
- street lighting (provision and modification);
- new crossing facilities;
- modifications to drainage;
- carriageway resurfacing; and
- traffic islands.

It is essential that these costs are not overlooked. A mini-roundabout should not be considered a simple lining and signing exercise.

The cost of a mini-roundabout can vary greatly depending on the level of work involved. Local authority consultation suggests the range of costs for 3 or 4-arm single mini-roundabouts are (at 2003 outturn prices):

3-arm	£10,000 - £30,000
4-arm	£15,000 - £50,000

3.4 Stage 2 Site Assessment

The second stage of assessment requires engineering judgement in order to ascertain whether a mini-roundabout is an appropriate junction improvement option by evaluating the following factors:

- visibility;
- vehicle speed;
- road character;
- traffic volume;
- number of arms;
- traffic composition;
- vulnerable road users;
- road network; and
- noise and vibration.

Following the Stage 2 Assessment the decision to introduce a mini-roundabout would be confirmed and issues to consider during the design process are identified. The conclusion may be that a mini-roundabout is not the best option.

3.5 Visibility

3.5.1 Visibility of the mini-roundabout

For a mini-roundabout to operate as intended, it is essential that the junction type can be recognised and that drivers have adequate forward visibility of the junction.

Parking on the approaches to mini-roundabouts is a particular problem and consideration should be given to applying parking restrictions on the approach arms.

Local practice regarding signing on the approach and visibility of the give way markings and signs varies.

3.5.2 Visibility of conflicting approaches

Some practitioners have commented that 'excessive' visibility to the right has been a problem, with drivers deciding whether to yield or not on the junction approach and not at the give way line.

However, this is seldom the case at mini-roundabouts with adequate entry angles.



Photo 3.5.3: Site with good visibility on all approaches

Both the speed limit and the approach speeds should be taken into account.



Photo 3.5.1: Site with 'excessive' visibility on raised junction to encourage reduction in approach speeds

Having entered the junction, drivers will require adequate visibility on exit, particularly if there is a pedestrian crossing immediately downstream.



Photo 3.5.2: Site with restricted approach visibility

Observations of visibility and vehicle approach speeds have indicated that where visibility of side road traffic was more than 30 metres from a point 2.4 metres back from the offside give way marking then the speed reducing effect of the mini-roundabout was significantly reduced.

3.6 Vehicle Speed

Mini-roundabouts are not a suitable junction option at locations where vehicles will approach the junction at high speed.

The location and design of the mini-roundabout should ensure that vehicles have slowed down to an appropriate speed prior to reaching the junction, can stop when necessary and should then maintain an appropriate speed around the circulatory carriageway.

The design of a mini-roundabout should also discourage drivers from accelerating through the roundabout and on exit. If, prior to entering the mini-roundabout, a driver can already see that they will be able to negotiate the junction quickly (and due to the small size of mini-roundabout junctions this is often possible) they may be encouraged to maintain a higher speed. Vehicles accelerating on exit may endanger pedestrians and/or cyclists and equestrians at nearby crossing facilities, whether controlled or uncontrolled.

Chapter 5 of the Traffic Signs Manual advises that mini-roundabouts should only be used on roads with a speed limit of 30 mph or less.⁷

Some local authority practitioners believe the speed limits on the approach roads are of less relevance than the actual approach speed of vehicles. Experience has shown that mini-roundabouts can work safely in 40 mph limit areas if the vehicle approach speeds are reduced prior to entry to say 20-25 mph.

In addition to noting existing speed limits and any proposals for changes, it is recommended that the approach speed of all arms is obtained as part of the assessment process. The photos show examples of mini-roundabouts outside 30 mph limits that have proven to operate safely in accident terms.

⁷ Chapter 5 Traffic Signs Manual 2003: "Mini-roundabouts should only be used when all approaches are subject to a speed limit of 30mph or less. Their use on roads with a higher limit is not recommended...", para 8.11

Road characteristics will have an effect on the suitability of a mini-roundabout.



Photo 3.6.1: Example of mini-roundabout within 40 mph speed limit with constrained approach



Photo 3.6.2: Mini-roundabout on national speed limit road – at this site the approach roads are narrow country lanes where the speeds are constrained.

At some junctions, the approach speed of vehicles may be low due to the physical characteristics of the road or existing traffic calming features. At other junctions where a mini-roundabout is to be introduced, speed-reducing measures may need to be included as part of the junction improvements.

At sites where the current speed limit exceeds 30 mph, consideration should be given to changing the speed limit and/or other measures to reduce approach speeds. Simply reducing the speed limit may not affect approach speeds.

Mini-roundabouts are sometimes intended to act as speed control measures. It is important to ensure that the design, including the layout of islands, build-outs and approaches, enables the mini-roundabout to serve as a speed reducing feature without compromising the safety or operation of the junction.



Photo 3.6.3: Mini-roundabout on raised junction

3.7 Road Character

The individual characteristics of the road junction at which a mini-roundabout is being considered will determine the site's suitability.

The following factors relating to road character will therefore be discussed:

- gradients;
- highway status;
- number of carriageways or lanes;
- pedestrian and cycle facilities;
- public transport infrastructure;
- street lighting; and
- urban or rural nature of road.

GRADIENTS

Ideally, mini-roundabouts should be located on level ground or in sags but not at the top of hills. Installations at the bottom of long descents or on steep gradients should be avoided.

Drivers may have difficulty assessing the layout of a junction that they are approaching on an up gradient and there is a risk that large goods vehicles may lose control if approaching a junction on a down gradient.



Photo 3.7.1: Mini-roundabout on hill descent with speed reducing measures on approach

The slope of the mini-roundabout should follow the slope of the junction. Some adverse crossfall will be acceptable, provided approach speed can be controlled.

HIGHWAY STATUS

Particular care should be taken if constructing a mini-roundabout where one or more of the side roads do not form part of the public highway. This may become more common as mini-roundabouts are increasingly used as accesses to new development, e.g. as accesses to supermarket car parks, industrial estates etc.

A mini-roundabout is reliant on drivers adhering to traffic signs and road markings installed on the approaches. Visibility is a particular concern when this is over land not in the control of the highway authority and subsequent development may prejudice safety.

Good practice would suggest that a sufficient length of the approach road in question is adopted to retain control for signing and maintenance purposes.

NUMBER OF CARRIAGEWAYS OR LANES

It is not considered good practice to introduce mini-roundabouts on dual carriageway roads, although, at junctions with single-lane dualling, they may be acceptable.

Care must be taken when designing mini-roundabout junctions with multiple lane approaches as lane discipline may be poor and vehicular paths through the roundabout can vary. Two-lane approaches can encourage drivers to overrun the central island and can impair visibility. Sufficient deflection is difficult to provide and more attention may need to be given to reducing approach speeds.

The number of lanes on the approach to a mini-roundabout should not exceed the number of exit lanes.



Photo 3.7.2: Multi-lane approach

PEDESTRIAN AND CYCLE FACILITIES

The installation of a mini-roundabout may be considered at a junction that has existing pedestrian and cycle facilities such as:

- pedestrian refuges;
- Zebra, Pelican, Puffin or Toucan crossings;
- dropped kerbs and tactile paving;
- off-road cycle tracks;
- cycle lanes.

It is important to ensure the mini-roundabout does not compromise the use of existing facilities by pedestrians and cyclists. In some cases, existing facilities may need to be altered or relocated or new pedestrian and cycle measures introduced as part of the junction improvement. This may result in substantial additional cost.

Crossings located within 20 metres of mini-roundabouts have been shown to operate effectively. This may be due to relatively low speeds through the junction. Where crossings are further away, approach and

exit speed may be unaffected by the mini-roundabout.



Photo 3.7.3: Mini-roundabout incorporating segregated cycle facilities and zebra crossing

PUBLIC TRANSPORT INFRASTRUCTURE

Mini-roundabouts can cause difficulties for buses and it is unlikely that bus lanes can operate safely through a mini-roundabout because of left-turners. See TSM Chapter 5 para 17.10 for guidance on terminating bus lanes on the approach to a roundabout. The presence of a bus stop or bus bay should not result in problems, provided refuges and islands are designed with bus movements in mind.

Careful design is needed where mini-roundabouts are sited near railway level crossings. Designers need to be aware of the dangers of traffic queuing back from the mini-roundabout across the level crossing, or traffic from the level crossing blocking the mini-roundabout. The former situation is particularly dangerous. If a mini-roundabout is being considered at a junction near a level crossing, consultation with the railway authority is essential.



Photo 3.7.4: Mini-roundabout near level crossing

STREET LIGHTING

It is important that mini-roundabout junctions are visible to approaching drivers. If the mini-roundabout is to be installed in an unlit area consideration needs to be given to ensuring the mini-roundabout is conspicuous at night. This may mean improvements to signing or providing street lighting. Where a system of street lighting is provided then it should

Additional street lighting should be considered when introducing a mini-roundabout.

comply with the recommendations in BS 5489, and advice sought from a lighting engineer.

Flush central islands are considered to be more difficult for street lighting to illuminate than domed islands, as they have no profile. Successfully lighting mini-roundabout central islands in wet conditions is particularly difficult. A domed central island is more conspicuous.

The illumination of the 'give way' traffic signs (602 or 611.1) is a requirement where street lighting exists. For advance direction signs, the requirements are that either they are lit or they are reflectorised which also applies to 'New Roundabout Ahead' signs (7014), where used.

It should be noted that the TSRGD do not permit the use of reflective road studs to increase the conspicuity of the central island.

URBAN OR RURAL NATURE OF ROAD

The urban or rural character of a road is not generally considered to predetermine the appropriateness of a mini-roundabout as a junction solution, but consideration needs to be given to the visual impact on the rural environment.



Photo 3.7.5: Mini-roundabout in rural type location

Mini-roundabouts can be used on both rural village and urban roads.

Mini-roundabouts have been increasingly used in rural areas, particularly at busy intersections in villages or as part of rural traffic calming schemes. Some mini-roundabouts have been installed on rural roads away from settlements. There are many potential problems with the use of mini-roundabouts in such locations and their installation is discouraged (see 3.10).

3.8 Traffic Volume

Additional capacity could, under certain circumstances, be provided by the introduction of a mini-roundabout but there will be limits. Practitioners should refer to a capacity assessment programme such as ARCADY to assess capacity implications in greater detail.

It is suggested that 4-arm mini-roundabouts should not be introduced where total entry flows are below 500 veh/hr, or minor road

flows are less than 15% of the major road flow. Mini-roundabouts are particularly suited to handling high proportions of right-turning traffic.

3.9 Number of Arms

Originally, mini-roundabouts were only considered for junctions with three-arms. In 1975, the recommendations changed and mini-roundabouts on trunk roads were allowed at both 3 and 4-arm junctions. Since 1984, these recommendations have not specified the number of arms.

Mini-roundabouts are known to be widely introduced at both 3 and 4-arm junctions.

Adequate deflection may be difficult to achieve with more than three arms. The use of mini-roundabouts to accommodate one-way slip roads or very minor accesses may prove more advantageous than the alternatives.

However, the installation of mini-roundabouts at junctions with more than four arms is not recommended, even on local roads. 4 and 5-arm mini-roundabouts have a variable safety record and may not perform as well as alternative junction types.

Where a junction has five or more arms a double mini-roundabout may be used, although a signal-controlled junction may be more appropriate.

3.10 Traffic Composition

It is not considered advisable for mini-roundabouts to be sited at junctions that are used by a high proportion of heavy goods vehicles, agricultural vehicles or buses and coaches.

Although the design of mini-roundabouts is intended to allow long (or wide) vehicles to traverse the central road marking, the continual overrunning by vehicles will cause tyre scuffing and the rapid deterioration of the mini-roundabout road markings. Without regular inspection and maintenance, the central road marking will lose conspicuity and drivers will not be able to determine the circular path around the roundabout.



Photo 3.10.1: HGV scuffing of central island

Alternative junction types should be considered for 4 or 5 arm junctions.

Also, the overrunning of a domed central island may cause driver (and bus passenger) discomfort, noise and vibrations.

In addition to long vehicles, consideration should also be given to the appropriateness of siting mini-roundabouts on roads with high numbers of pedestrians, cyclists, motorcyclists, equestrians or other vulnerable road users.

It is recommended that the emergency services are consulted about proposals for a mini-roundabout, particularly one with a domed central island, in a location that may affect them on a regular basis.

Due to their size, many emergency service vehicles cannot manoeuvre around central islands and wish to avoid overrunning domed islands (domed central islands can cause difficulties for patients travelling by ambulance). Mini-roundabouts may therefore be perceived as affecting response times.



Photo 3.10.2: Fire engine negotiating mini-roundabout

3.11 Vulnerable Road Users

CYCLISTS

Cyclists are vulnerable at all types of road junction although roundabouts pose particular problems. Cyclists are particularly vulnerable when circulating and entering vehicles fail to yield, especially during hours of darkness, due to their lack of size and conspicuity.



Photo 3.11.1: Cyclists on mini-roundabout

Mini-roundabouts present fewer problems to cyclists than small conventional roundabouts with flared entries and large conventional roundabouts, which may result in high speeds.

Mini-roundabouts can provide useful assistance for cyclists turning right and where speeds need to be reduced.

Mini-roundabouts should be designed to be cycle-friendly, especially where they are on designated cycle routes, or on other roads used regularly by cyclists.



Photo 3.11.2: Mini-roundabout with off-highway cycle facilities

EQUESTRIANS

At junctions where there is regular use by equestrians, it is not felt a mini-roundabout is an appropriate form of junction.

However, provided speeds can be sufficiently reduced, an equestrian crossing facility on an approach has been shown to work satisfactorily.

PEDESTRIANS

If a mini-roundabout is being considered in congested urban areas with large flows of pedestrians, particularly children or elderly and disabled people, controlled crossing facilities should be considered.



Photo 3.11.3: Zebra crossing close to mini-roundabout

Note: The Zebra crossing does not have tactile paving to assist blind and partially sighted pedestrians.

Consider central island dome heights on bus routes to minimise discomfort to passengers.



Photo 3.11.4: Pelican crossing close to mini-roundabout

Signalled crossings on the approach to a mini-roundabout should be used with care to avoid confusion from the green signal and to ensure vehicles queuing back from the crossing do not cause conflict at the junction.

The positive control offered by traffic signals may be a better junction alternative, particularly where co-ordination between junctions and crossings can be provided.

3.12 Consultation

Local consultation will help identify groups of users that may be disadvantaged by the introduction of a mini-roundabout.

3.13 Road Network

In addition to a road's specific characteristics, the character of the local road network will be influential in deciding that a specific junction is a suitable location for a mini-roundabout.

The following network characteristics should therefore be considered:

- existing traffic systems;
- local bus routes and bus priority schemes;
- local cycle and pedestrian routes;
- traffic calming schemes; and
- traffic management schemes.

EXISTING TRAFFIC SYSTEMS

Mini-roundabouts may not be compatible with local junctions if the area has an Urban Traffic Control (UTC) system that relies on the platooning effect of signals or the creation of green waves, or in areas with a high number of unlinked traffic signals.

This issue is particularly relevant at locations where the conversion from a traffic signal junction to a mini-roundabout is being considered.

Conversely, at locations with mostly roundabout junctions in the vicinity, a mini-roundabout may be a more appropriate option than a traffic signal junction, as consistency can help drivers negotiate a series of junctions safely.

A mini-roundabout may cause disruption in an UTC area.

LOCAL BUS ROUTES AND BUS PRIORITY SCHEMES

The location of the central island, and height of dome, should be carefully considered if a mini-roundabout is installed along a bus route due to potential overrunning of, or grounding on the central island by buses.



Photo 3.13.1: Bus at mini-roundabout with severe deflection

It is also important to consider the effect of installing a mini-roundabout within a bus priority scheme as the change may affect bus journey times.

However, in some circumstances mini-roundabouts can be integrated into a package of bus priority measures. One example, at a 3-arm T-junction, is to create a bus bypass lane across the junction if the carriageway width is available.



Photo 3.13.2: Bus bypass at 3-arm small roundabout shows a similar application

Where a bus route involves making a difficult right turn then an option could be to introduce a mini-roundabout to assist this movement and reduce bus delays. The photo above shows a similar application for a small roundabout.

LOCAL CYCLE AND PEDESTRIAN ROUTES

Mini-roundabouts may be considered for junctions that form part of local cycle networks or strategic pedestrian routes including Safer Routes to School. It is important that cycle and pedestrian routes are protected and consideration should be given to providing adequate pedestrian and cyclist facilities as part of the junction improvements.

Cyclists are particularly vulnerable at any road junction and the safety of all vulnerable road users should not be compromised by alterations to a junction.

Domed central islands can cause noise and vibration.



Photo 3.13.3: Off carriageway cycle facilities at a mini-roundabout

TRAFFIC CALMING SCHEMES

Mini-roundabouts are often introduced as part of a wider traffic calming scheme although whether they work as a speed-reducing feature will depend on the design.

The 1990 Road Hump Regulations referred to mini-roundabouts as a speed-reducing feature but the current Regulations are silent on the specifics of a mini-roundabout.



Photo 3.13.4: Traffic calming on approach to mini-roundabout

TRAFFIC MANAGEMENT SCHEMES

It is important to consider how the introduction of a mini-roundabout will affect, or may be affected by, an existing or proposed traffic management scheme.

Careful consideration should be given to installing a mini-roundabout within traffic management schemes in which banned right turns in or out of side roads are located near the junction in question and a mini-roundabout would provide the opportunity for drivers to U-turn (which may or may not be desirable or safe).

Although U-turns are legal at mini-roundabouts, for which possible turning movements are the same as at conventional roundabouts, such movements are infrequent

Designs should take account of possible U-turns.

and therefore usually unexpected. The perceived wisdom is that U-turns at mini-roundabouts are inevitable, and should not be prohibited, but the nature of the junction arrangement often precludes designs that can accommodate U-turns by all but the smallest vehicles, although this will depend on the space available at the junction.

3.14 Noise and Vibration

The overrunning of domed central islands by large vehicles can create noise and ground vibrations. Equally, the extra stopping and starting activities of vehicles caused by a roundabout can create additional disturbance.

Although in some areas additional (and variable) vehicle noise caused by a mini-roundabout may not be intrusive, it is likely to be a cause of complaints in residential areas.

In addition, some soil types are prone to vibration and therefore the type of soil in an area may need to be investigated if vibration is perceived to be a potential problem.

4. EXISTING PRACTICE



4. Existing Practice

4.1 Introduction

In developing this document consultation was undertaken with 23 local authorities across England and Wales with comments also received from other organisations.⁸ The document authors have also met with some local authorities and their officers to discuss issues and sites. This has provided a range of views on mini-roundabouts and examples of sites where they have been implemented.

4.2 Responses to Consultation

“It is easier to design a poor mini-roundabout than a poor set of traffic signals”.⁹ Due to the many factors and options involved in introducing a mini-roundabout there is more scope for poor design.

The following are key issues arising from user experience of which designers should be aware.

4.2.1 Speed Limits

In accordance with current guidance the majority of mini-roundabouts are installed on roads with a 30 mph speed limit. Mini-roundabouts should not be installed on high speed roads, i.e. 85th percentile speed of 35 mph or more.¹⁰ One local authority had examples where the national (60 mph) limit was in force and in both instances the accident record had led to the subsequent provision of a small solid island. It is worth noting that in both cases the original kerb lines were unaltered.

Where limits were greater than 30 mph measures were introduced to change the speed of approach. Some local authorities have successfully installed a limited number of mini-roundabouts on 40 mph roads.

Consideration should be given to the vehicle approach speeds and ensuring that the design will assist in influencing driver speeds. Reliance should not be placed on the central island itself as a speed-reducing feature.

4.2.2 Number of Arms

Generally mini-roundabouts have been implemented on 3-arm junctions with a preference for this number of arms. Equally most local authorities had examples where four had worked. No local authorities had examples of five arms or more, instead relying on double or even triple mini-roundabout junctions to handle such circumstances.

4.2.3. Position of Central Island

This is one of the most critical aspects of the design process. The most usual practice was to determine the position of the central island by the swept paths of turning traffic. This sometimes resulted in an island not at the centre of the inscribed circle and, where traffic might be tempted to pass the ‘wrong’ side of the island, use was made of splitter islands or build-outs to encourage ‘correct’ behaviour.



Photo 4.2.1: Driver passing over central island



Photo 4.2.2: Driver passing over central island

Good practice should ensure that drivers are not encouraged to either consistently pass over the central island, or drive the wrong side.

4.2.4 Domed Central Islands

There is a general practice to dome central islands, although preference was expressed in some cases not to dome in residential areas to avoid noise nuisance from heavy goods traffic. The purpose of the dome, where provided, was for improved conspicuity but it is generally used to encourage circulatory behaviour although in some instances this had resulted in traffic passing the wrong side. However, the few instances of domes being removed resulted from the complaints over noise rather than the behaviour of traffic.

Regulations allow for a maximum dome height of 125mm. In practice the maximum

Good design positions the central island so drivers are not encouraged to drive over, or on the wrong side, of it.

⁸ Responses to the questionnaire received from Cycling Touring Club, British Horse Society and North East Ambulance Service Trust.

⁹ Cambridgeshire County Council.

¹⁰ Two examples have been found of a mini-roundabout on derestricted road, one in Essex and one in Stirlingshire.

height is normally taken as 100mm to reduce unnecessary noise, vibration, and scuffing. In some cases especially where low-floor buses operate this should be reduced to 60mm or less to avoid grounding. In some cases it may be necessary to use flat central islands.

4.2.5 Deflection, Build-Outs and Splitter Islands

All respondents of the contact group felt that deflection was important. In practice many sites reviewed failed to provide adequate deflection. This is a key area, which should be addressed when a mini-roundabout is introduced.

Where deflection was provided this was done by up to three different methods:

- a nearside build-out provided before the Give Way line;
- a nearside build-out within the circulatory area;
- using central splitter islands.

Any combination may be used with the use of splitter islands the most common.

Where a build-out occurred prior to the Give Way line it was observed that overrunning of the central island was likely to be more common and could cause difficulty for cyclists.

Deflection is a key part of good mini-roundabout design.



Photo 4.2.5: Approach deflection with kerb alignment and traffic islands



Photo 4.2.6: Approach deflection through alignment and traffic islands



Photo 4.2.3: No deflection on approach or through junction

(Note: TSRGD diagram 611.1 incorrectly placed above TSRGD diagram 602)



Photo 4.2.4: Deflection through alignment and traffic island

4.2.6 Visibility

Appropriate visibility to the right, and of vehicles within the junction, was regarded as important by the entire contact group. Visibility to the left for turning traffic did not seem to be as critical a factor to satisfactory operation. Nor did approach visibility, with views of the roundabout or give way signing very limited in some examples.



Photo 4.2.7: View from side road at site with poor visibility

Some guidance on visibility design criteria has been developed; in particular the visibility distance to the right and forward visibility. The visibility distance to the right (D) could be considered the minimum sight distance required by a road user approaching the roundabout forward of a point at distance "F" from the give way line, measured along the centre of the offside approach lane. It enables the driver of an entering vehicle to

observe a vehicle coming from the right for 2 or 3 seconds, as appropriate, before it reaches the conflict point. Distance 'D' varies with the 85th percentile 'dry weather' approach speed on the arm to the right of an entering vehicle at 70 metres before the give way line. See Figure 4.1 and Table 4.2.1 below.

Table 4.2.1 Visibility Distance to the Right

85 th percentile speed of arm to right (mph)	D distance (m)	
	For an acceptance gap of 2 seconds	For an acceptance gap of 3 seconds
35	40	55
30	35	50
25	25	40

The 'F' distance should usually be 9 metres so that the first two vehicles in the queue have visibility of traffic from the arm to the right. In difficult circumstances, the 'F' distance may be taken as a relaxation from 9 metres to 4.5 metres on an arm where the traffic flow is less than 300 veh/hr. In exceptionally difficult circumstances, a further relaxation to 2.4 metres is the minimum permissible 'F' distance, as it enables a road user who has reached the give way line to see approaching vehicles without encroaching past the give way line. This will, however, allow only one vehicle at a time to enter safely and requires following drivers likewise to be prepared to stop and look. An 'F' dimension of 2.4 metres must only be used on an arm with a flow of 300 veh/hr or less and where there is no entry arm to the left. In such cases the mandatory give way markings and upright sign (diagrams 1003, 1023 and 602) must be used to require road users to give way to circulating traffic.

Excessive visibility between arms may result in approach and entry speeds greater than desirable, with a tendency for approaching drivers to take a decision too early about whether to give way. Road users approaching a mini-roundabout need to be able to stop if vehicles are circulating or if there is an obstruction on the junction. Although the 'D' distance should always be provided, if this is exceeded it may induce high approach speeds and take the driver's attention away from the immediate junction conditions. Consideration should be given to limiting the visibility to the right of adjacent entries to a maximum 'F' distance of 15 metres back on the approach and to no more than the 'D' distance.

Table 4.2.2 provides suggested forward visibility distances 'E'.

Table 4.2.2 Minimum Stopping Sight Distance

85 th percentile speed of arm to right (mph)	Minimum "E" Distance (m)
35	80
30	70
25	50

4.2.7. Use by Vulnerable Road Users

Moderate use by pedestrians and cyclists caused little concern to the contact group, but large numbers of cyclists, such as occurred at times in university towns, were found to cause safety problems and this has led to the replacement of at least two roundabouts by signals. In those instances, at least three quarters of the accidents involved cyclists. However in these situations the unusually large number of cyclists may have increased their exposure to such accidents.

No such problem has been noted with pedestrians although concern has been expressed that pedestrians could dominate a junction in town centres and signals would offer better positive control in such cases.

Equestrians are not normally present in the sort of situations where mini-roundabouts are used but there is an example in a horse-training town where a signal-controlled equestrian crossing operated satisfactorily on the approach to a mini-roundabout.

4.2.8. Use by Large Vehicles

The use of mini-roundabouts by heavy goods vehicles does not cause any particular problems except the overrunning of the central island at smaller sites. There is some reluctance to use domes on bus routes or where there are large numbers of emergency vehicles and where a noise nuisance could result in residential areas. In addition, a large number of turning manoeuvres by HGVs can lead to the rapid wear of road markings.



Photo 4.2.8: HGV driving through a mini-roundabout

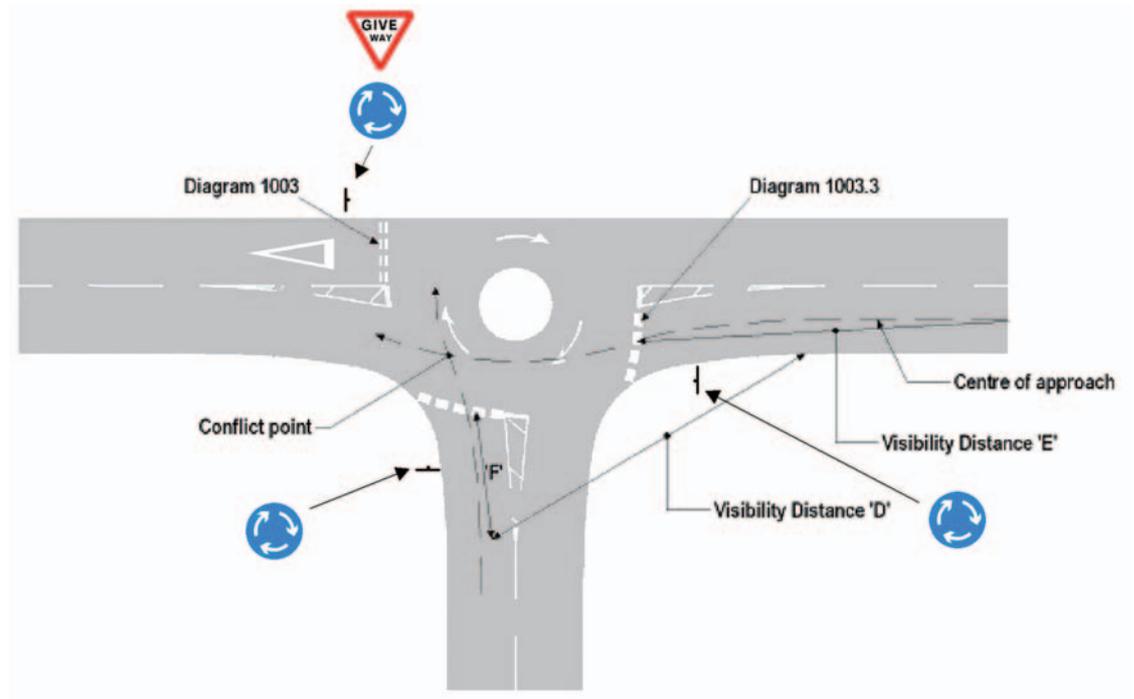


Figure 4.1 Mini-roundabout Visibility Distances

4.2.9. Overrun Areas and Surfacing

The use of overrun areas to permit turns by large vehicles whilst providing guidance for light vehicles was observed on a few occasions. These were constructed of a variety of materials, most commonly red tarmac or anti-skid and most often were applied on the left-turn radius of large or awkward junctions.



Photo 4.2.9: Mini-roundabout with overrun area

Similarly anti-skid, usually red, or buff, was applied on the approach to a roundabout as a result of anticipated rather than recorded problems.



Photo 4.2.10: Mini-roundabout with red anti-skid

4.3 Example Sites

As the process of deciding the suitability of a site for a mini-roundabout is a complex one where a range of variables comes into play, a number of sample sites have been collected to identify the issues involved. These sample sites will assist practitioners understanding of good and bad design issues, including several examples of mini-roundabout signs erected incorrectly.

Site: Treffry Lane – B3268
Location: Bodmin
Highway Authority: Cornwall County Council

Before:



After:



Site Description

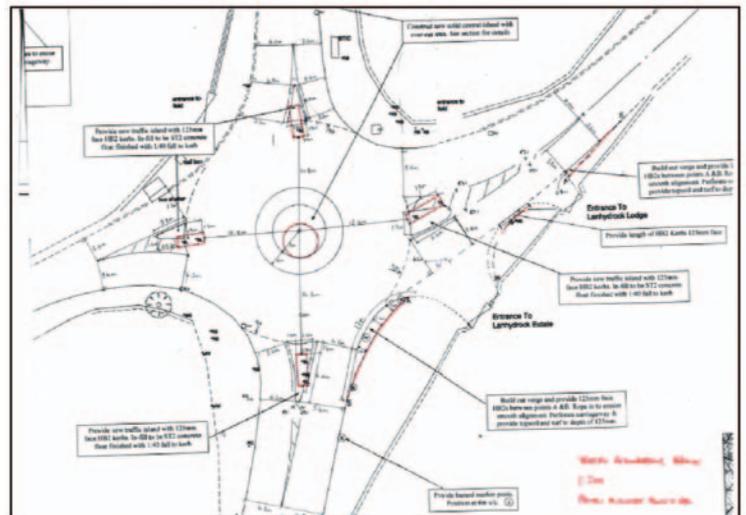
- 4-arm junction
- Derestricted road
- Rural location
- Large junction
- No street lighting

Issues

The County Council had problems with the mini-roundabout layout shown above.

These were:

- Unrestricted road leading to high speeds
- Unlit creating conspicuity problems at night
- Lack of deflection on approaches
- Forward marked give way
- Vehicles driving over central island



The mini-roundabout was removed and replaced with a conventional roundabout.

Site: A1134 Brooks Road - Brookfields
Location: Cambridge
Highway Authority: Cambridgeshire County Council



Brooks Road (north) approach



Brookfields (west) approach

Site Description

- 4-arm junction
- 30 mph speed limit
- Urban location
- Street lighting
- Junction located in university town with large number of cyclists

Issues

The County Council were concerned with the safety of this mini-roundabout due to the high number of accidents involving pedal cyclists.

The mini-roundabout was removed and replaced with traffic signals.

Site: Poppyfields
Location: Alsager
Highway Authority: Cheshire County Council



Site Description

- 3-arm junction
- 30 mph speed limit
- Access to new housing estate
- Street lighting

This mini-roundabout was installed by a developer as the access to a residential development.

Design Characteristics

- The mandatory give way marking and associated road sign have been used on the approach to the right turn.
- A 'Slow' road marking on red surfacing precedes the mandatory give way.

Issues

- The County Council have concerns over the design of this mini-roundabout due to the poor visibility both for and of vehicles emerging from the new estate road.
- The mini-roundabout road markings were repositioned following its installation.

Site: B5259 / B5260 junction
Location: Wrea Green, Kirkham
Highway Authority: Lancashire County Council

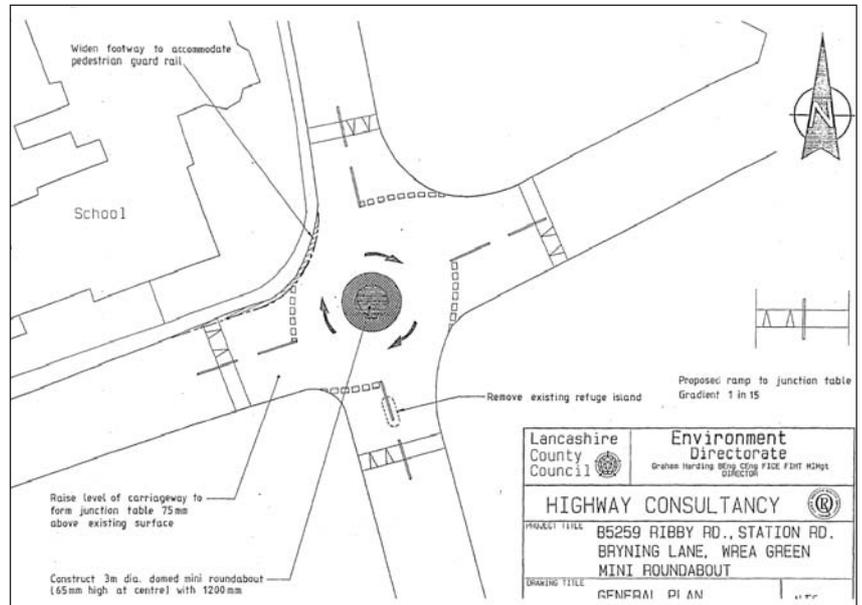


Site Description

- 4-arm junction
- 30 mph speed limit
- Rural location
- Street lighting

Design Characteristics

- The mini-roundabout is located on a raised table.
- The central island has an outer 'overrun' area surfaced in red.



Issues

- The visibility at this mini-roundabout is very good / excessive and the raised table is used to assist slowing vehicles.
- Right-turning vehicles often pass the wrong side of the roundel.

Site: Colchester Road - Freebournes Road
Location: Witham
Highway Authority: Essex County Council



Colchester Road (south) approach



Colchester Road (north) approach

Site Description

- 3-arm junction
- 30 mph speed limit
- Access to industrial estate
- Street lighting

Issues

- HGVs form a high proportion of the traffic using this mini-roundabout.
- Large vehicles driving over the central island have caused the white reflectorised surface of the roundel to deteriorate and lose conspicuity.

Site: Fox Lane - West Paddock
Location: Leyland
Highway Authority: Lancashire County Council

Before:



After:



Fox Lane (east)



Fox Lane (west)

Site Description

- 3-arm junction
- 30 mph speed limit
- Street lighting

Issues

- Private driveways within junction
- Visibility too good / excessive
- Failure to give way to right

The County Council revised the design of this mini-roundabout after it was installed, original layout shown in before photos.

The following features were added:

- Mandatory give way on Fox Lane (East) approach
- Traffic islands with illuminated 'keep left' bollards
- Advisory cycle lane on Fox Lane (west)
- Additional blue mini-roundabout signs
- Wide central hatching on approaches

Comment: Note diagram 611.1 in bottom left photo is incorrect

Site: Treswithian Road - Weeth Road
Location: Camborne
Highway Authority: Cornwall County Council

Before:



After:



Site Description

- 3-arm junction
- 30 mph speed limit
- Street lighting

Design Characteristics

- domed central island
- traffic islands with illuminated bollards
- carriageway realignment / build-outs to provide deflection

Issues

This mini-roundabout was installed as part of a local safety scheme with the intention of:

- calming traffic speeds
- assisting right-turners

Site: Castle Road - Phillpotts Avenue
Location: Bedford
Highway Authority: Bedfordshire County Council



Phillpotts Avenue approach



Castle Road approach

Site Description

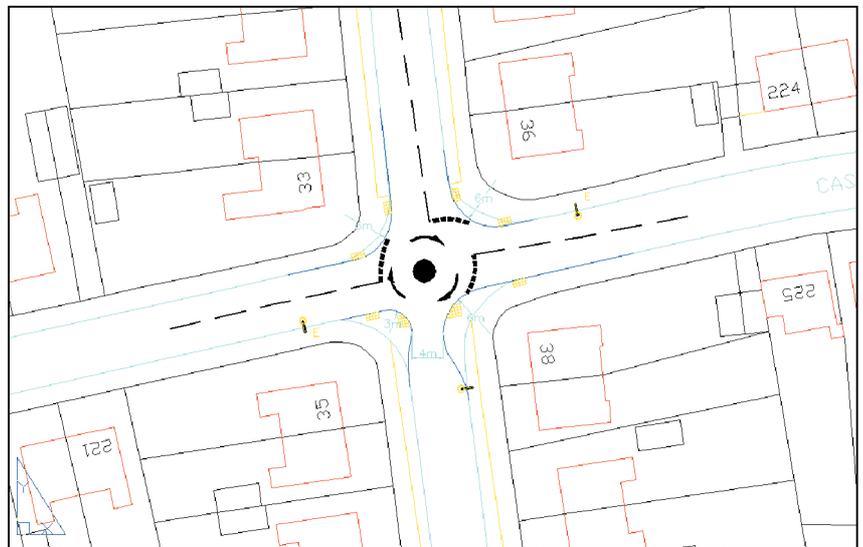
- 4-arm junction (one arm is one-way)
- 30 mph speed limit
- Urban location
- Street lighting

Design Characteristics

- Uncontrolled crossing facilities on each arm.
- Build-outs.

Issues

- Very low side road flows.
- Some drivers fail to give way but there have been no accidents.



Site: The Avenue (north) - The Avenue (south) - St Swithuns Road
Location: Kennington
Highway Authority: Oxfordshire County Council



The Avenue (north) approach



The Avenue (north) approach



The Avenue (south) approach



St Swithuns Road (approach)

Site Description

- 3-arm junction
- 30 mph speed limit
- On a hill
- Street lighting
- Part of traffic calming scheme

Design Characteristics

- Road humps on The Avenue (north)
- Mini-roundabout located on raised table
- Mandatory give ways are used on The Avenue even on the south approach.

Issues

- Poor visibility on The Avenue approaches due to gradient.

Comment: Give Way (diagram 602) should not be used where traffic approaches from the left

Site: Westgate - Sherborne Road
Location: Chichester
Highway Authority: West Sussex County Council



Sherborne Road approach



Westgate approach

Site Description

- 4-arm junction
- 30 mph speed limit
- Street lighting

Design Characteristics

- Buff-coloured overrun areas are used instead of build-outs to encourage deflection.

Site: High Road - Falkers Way (east)
Location: Trimley
Highway Authority: Suffolk County Council



High Road (east) approach



Falkers Way (east) approach

Site Description

- 3-arm junction
- 30 mph speed limit
- Street lighting
- Part of traffic calming

Design Characteristics

- Segregated cycleway/footway across High Road (east).
- Domed central island.
- Use of mandatory give way on High Road (east) approach.
- Build-outs and overrun areas to provide deflection.

Site: A414 Main Road - Well Lane
Location: Danbury
Highway Authority: Essex County Council



Main Road (west) approach



Main Road (east) approach



Well Lane approach

Site Description

- 3-arm junction
- 30 mph speed limit
- On a hill
- Outside a primary school
- Street lighting

Issues

- High traffic flow on side road
- Main Road very busy in peak periods
- Junction is within 50 metres of bus stop outside school on Main Road (west)

Design Characteristics

- Anti-skid surfacing on Main Road (east) approach.
- Mandatory give way on Main Road (west) approach.
- Zebra Crossing on Main Road (west) approach
- Traffic island with keep left signs / illuminated bollards on Main Road (west) approach.

Site: Kennington Road (north) - Kennington Road (south) - Upper Road
Location: Kennington
Highway Authority: Oxfordshire County Council



Kennington Road (south) approach



Upper Road approach

Site Description

- 3-arm junction
- 30 mph speed limit
- Street lighting
- Commencement of traffic calming scheme

This mini-roundabout has replaced a priority junction.

Design Characteristics

- Very small roundel
- Original give way line has been retained.
- Mini-roundabout is located on a raised table
- Mandatory give way on Kennington Road (north) approach

Comment: Non-prescribed sign erected below diagram 611.1

Site: The Glebe - Manor Road
Location: Camborne
Highway Authority: Cornwall County Council



Manor Road (east) approach



Manor Road (west) approach

Site Description

- 3-arm junction
- 30 mph speed limit
- Street lighting

Design Characteristics

- 2-lane approach on Manor Road (east) approach
- Mandatory give way on Manor Road (east) approach

Issues

- Vehicles overtaking cars parked on the Manor Road (west) approach often drive over the central island of the mini-roundabout
- The two lanes on the Manor Road (east) approach appear to be too narrow for two vehicles and therefore this approach tends to be used as a single lane
- Road markings becoming worn by continual overrunning of traffic

Site: A12 off-slip - Shell Garage Access
Location: Colchester
Highway Authority: Essex County Council



A12 off-slip approach



Shell Garage access approach

Site Description

- 4-arm junction
- 30 mph speed limit
- Street lighting

Design Characteristics

- 2 lanes on A12 off-slip approach
- Domed central island
- No circulatory arrows

Post implementation monitoring should include not just accidents but operational factors.

4.4 Post Implementation Monitoring

It is important after implementing a mini-roundabout that post implementation monitoring is undertaken. This is usual where accident remedial schemes are introduced but should be extended to all schemes.

Designers should monitor not only if the scheme is successful in accident terms but in terms of capacity, priority, etc dependent on the original scheme objectives. Experience has shown that it may be necessary to make amendments to a junction where works have been limited.

4.5 Maintenance

The ongoing success of a mini-roundabout is dependent on continued maintenance to ensure the lining and signing and other measures are kept to a good standard. It is clear that maintenance is an issue in some areas and a continued problem with wear can indicate a problem with the design of a mini-roundabout.



Photo 4.5.1: Poor lining maintenance indicating frequent central island overrunning



Photo 4.5.2: White paint wearing on blockwork central island



4.5.3: Well-maintained mini-roundabout

(Note: TSRGD diagram 611.1 incorrectly placed above TSRGD diagram 602)

4.5.1 Carriageway joints

When introducing a mini-roundabout to an existing junction consideration should be given to the existing joints and camber. The path of vehicles negotiating the new junction may direct them over the carriageway joint as shown below leading to maintenance problems. This can be resolved through resurfacing when the mini-roundabout is introduced.

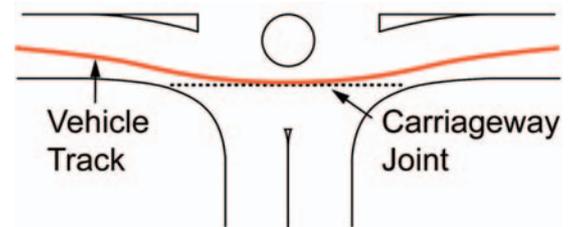


Figure: 4.5.1: Carriageway joints

4.6 Driver Behaviour

It is apparent that many drivers are either confused as to how to use a mini-roundabout or do not attempt to use them correctly. Through consultation with designers and general site observations it has been shown that both road users and Local Authorities are unclear as to the give way rules governing mini-roundabouts.

Although it is an offence for a car driver to disobey the mini-roundabout traffic sign, many drivers:

- overrun the central island;
- do not give way;
- do not indicate;
- do not slow down; and,
- drive to the right of the central island.

It is common for drivers to continue to negotiate a junction according to its layout prior to becoming a mini-roundabout. This is likely to be particularly true when a mini-roundabout is new or where there are few in

the surrounding area. Drivers on the major road often do not treat a mini-roundabout as a junction control mechanism but as an obstacle that must be negotiated.

The Highway Code states that mini-roundabouts should be approached in the same way as normal roundabouts and that 'all vehicles MUST pass round the central markings except large vehicles which are physically incapable of doing so'. It also reminds drivers that there is 'less space to manoeuvre and less time to signal'.

The mini-roundabout sign (611.1) tells drivers to give way to vehicles approaching from their right, as at a conventional roundabout, the transverse road marking (1003.3) informs drivers to give way to circulatory traffic.

The smaller scale of a mini-roundabout makes the 'give way to the right' rule less straightforward due to the short distances between vehicles. In practice, mini-roundabouts usually function well due to negotiation between drivers of vehicles approaching and on the circulatory carriageway.

Although any driver confusion resulting in hesitation is not considered to be a safety problem, it may lead to decreased capacity and longer queues.

Local Authorities appear to be particularly confused as to the use of mandatory give way signs, which are known to be sited at all approaches of some 4-arm mini-roundabout junctions. The correct siting and design of mini-roundabouts may be compromised by misunderstandings as to the correct use of the signs by practitioners. This is explained in detail in Chapters 3 and 5 of the Traffic Signs Manual.

4.7 Road User Education

In areas where a mini-roundabout would be a novel feature, or where a school or old people's home is nearby, it is appropriate to consider road user education and contact should be made with the relevant road safety staff. Budget provision of a small percentage of the construction cost is likely to be adequate.

Local awareness campaigns may also be considered advantageous in order to educate all road users about mini-roundabouts.

4.8 Frequently Asked Questions

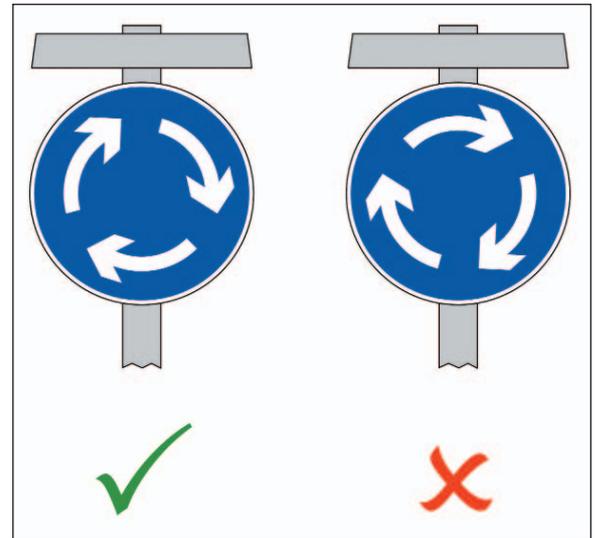
As a result of the consultation work undertaken in compiling this document it is clear that there are a number of issues, which require clarification. We have compiled a response to a number of frequently asked questions below.

Question	Answer
Construction of Mini-Roundabouts	
Must the central island be white?	Yes. The central island of a mini-roundabout must be white (see TSRGD regulation 11 (1) and reflectorised (see TSRGD regulation 31 (1)).
Can the central island be constructed of granite setts, block paving or other textured material?	As the central island must be white and reflectorised (see above), it is not advisable for the island to be constructed of textured material. Any setts, blocks, etc used must have a white, reflectorised surface and there are problems in getting paint, thermoplastic or other materials to adhere successfully and this will create a maintenance issue and potential problems with the conspicuity of the roundabout. Setts or blocks can also result in longer term maintenance problems if overrunning vehicles cause the blocks to move or subside.
Can the central island have raised kerbs?	No. TSRGD does not permit raised kerbs to be used in association with the mini-roundabout road marking. Kerbing has been used with domed central islands as some designers use them as a retaining device for the dome construction, but such kerbs must be flush or have a maximum upstand of 6mm. In this form they are not functioning as kerbs, more as channel blocks.
Can setts be placed around the periphery of the central island?	Good practice suggests they should not be used. However there are examples and, provided the upstand does not exceed 6mm they are not precluded by TSRGD. They can present maintenance issues as overrunning, etc can make them shift.
Can reflective road studs be placed around the periphery of the central island?	No. TSRGD does not permit the use of road studs with the mini-roundabout road marking 1003.4. See TSRGD regulation 31.
Can the central island have an outer 'overrun' area/apron?	Yes. Overrun areas formed of contrasting material can contribute to the conspicuity of a mini-roundabout and this is not precluded by TSRGD. However, the size, colour and construction of such areas vary considerable across the UK. No standard approach is likely to be developed. See also TAL 12/93.
Can concentric circles/annular rings be marked on the road surface around the central island?	No. See Traffic Signs Manual, Chapter 5, Road Markings 2003 para 2.1.
Can a mini-roundabout be located within an area of carriageway with coloured surfacing?	Yes. Coloured surfacing has no significance except increasing conspicuity. The use of surfacing material of a contrasting colour within the junction area can benefit conspicuity of a mini-roundabout but that coloured surfacing should not be laid in any shape or pattern intended to convey a meaning as a road marking. However the visibility of white road markings is greatest when contrasted with a very dark background, not with a light surface.

Question**Answer**

Is there a correct way to mount TSRGD diagram 611.1?

Yes. See figure below:



Can a mini-roundabout be located on a raised table?

Yes. Care is needed to ensure give way markings remain visible to approaching vehicles.

In which order should the give way (TSRGD diagram 602) and TSRGD diagram 611.1 be mounted?

See figure below:

**Use of Mini-Roundabouts**

Can a mini-roundabout be used as an access to a new development?

Yes. However, it is recommended that mini-roundabouts are not used solely to provide access to development where the traffic flows expected to use the development access are <math>< 500\text{ veh/day}</math> (AADT) or minor road flows are less than 15% of the major road flow.

Question	Answer
Are mini-roundabouts cheaper to install than other junction types?	Not necessarily. A mini-roundabout is likely to incur costs as a result of associated measures, such as carriageway realignment and build-outs, street lighting, new crossing facilities, carriageway resurfacing etc. In addition, mini-roundabouts incur ongoing maintenance costs.
Location of Mini-Roundabouts	
Should a mini-roundabout be installed at a junction with five or more arms?	No. Although a mini-roundabout with five or more arms is not unlawful, it is not recommended for safety reasons. Where a junction has five or more arms, a double mini-roundabout may be used, although a signal-controlled junction may be more appropriate.
Can a mini-roundabout be installed where the approach roads have speed limits >30 mph?	Yes. However, the advice is that mini-roundabouts should be installed only on roads with a speed limit of 30 mph or less. Some local authorities have introduced mini-roundabouts in 40 mph areas where low approach speeds ensure drivers are able to use the junction safely. The installation of a mini-roundabout on a local road where the speed limit is >30 mph is acceptable only if the approach speeds are low and can be controlled. See Section 3.6.
What if my local authority has a number of mini-roundabouts on highways with speed limits exceeding 30 mph.	They are not necessarily unsafe as actual speeds are more important than the speed limit. Sites should be checked and, if operating safely, monitored on a regular basis. A local authority may instigate a programme of speed limit reviews to identify reductions in speed limit or may earmark mini-roundabouts for future junction improvement, using a more appropriate junction type.
Operation of Mini-Roundabouts	
What is the give way rule at a mini-roundabout?	The regulatory blue mini-roundabout sign (TSRGD diagram 611.1) requires drivers to cede priority to vehicles coming from the right. The (advisory) transverse road marking to TSRGD diagram 1003.3 requires drivers approaching a mini-roundabout to give way at or immediately beyond the line to traffic circulating on the carriageway of the roundabout. The TSRGD permits the use of TSRGD diagram 1023 with TSRGD diagram 1003.3 markings.
When should mandatory give way signs be used?	Mandatory give way signs (TSRGD diagram 602) may be used on approaches where drivers may not be expecting to give way to traffic to their right, e.g. on the main road approach to a former priority T-junction. Mandatory give way signs should not be used on approaches that have an entry to their left, as it is not intended for drivers at a mini-roundabout to cede priority to vehicles approaching the roundabout from the left, e.g. the stem of a T-junction or any arm of a 4-arm mini-roundabout. Where used the give way sign (TSRGD diagram 602) should be placed above the mini-roundabout sign (611.1).

Question	Answer
Are vehicles allowed to drive over the central island?	Yes, but only vehicles that are physically incapable of manoeuvring around the central island. See Highway Code, RTA 1988 Sect 36 & TSRGD 16(1). Drivers of vehicles that can manoeuvre around the central island are in danger of being prosecuted if they drive across it.
Can drivers U-turn at mini-roundabouts?	Yes. However, the Highway Code warns road users of drivers making U-turns at mini-roundabouts, as this can be an unexpected, and sometimes difficult, manoeuvre. Designers should consider the effect of nearby traffic management or junction arrangements that may encourage U-turning at the proposed mini-roundabout (for example prohibited or difficult turning movements) and try to avoid them.

5. ACKNOWLEDGEMENT AND REFERENCES



5. Acknowledgement and References

5.1 Acknowledgements

The development, drafting and production of this document was undertaken by Faber Maunsell Ltd (Peter Yendall, Project Director and Christian Bodé, Project Manager) on behalf of the CSS and DfT with the co-operation and input of a number of individuals and organisations. Particular thanks to the following organisations:

- Bedfordshire County Council
- Blaenau Gwent County Borough Council
- Buckinghamshire County Council
- Cambridgeshire County Council
- Cardiff County Council
- Cheshire County Council
- Cornwall County Council
- Devon County Council
- East Sussex County Council
- Essex County Council
- Flintshire County Council
- Gloucestershire County Council
- Kent County Council
- Lancashire County Council
- Leicester City Council
- Middlesbrough Borough Council
- Nottinghamshire County Council
- Oxfordshire County Council
- Pembrokeshire County Council
- Powys County Council
- Roads Service - Western Division, Northern Ireland
- Suffolk County Council
- West Sussex County Council
- British Horse Society
- CTC
- North East Ambulance Service Trust
- Jacobs Babtie (Bedfordshire County Council)
- Mouchel Parkman (Essex County Council)

Special thanks to the Steering Group involved in the development and production of this document, which included: Lancashire County Council (Terry Carter, Martin Galloway, Adrian Hanks, and Peter Andrews), Department for Transport (David Williams, Brian Lyus and John Cooper), Highways Agency (Gordon Heath), and Faber Maunsell (Peter Yendall and Christian Bodé).

5.2 References

- Traffic Signs Manual, Chapter 3: Regulatory Signs, 1986, TSO (New edition to be published in 2007)
- Traffic Signs Manual, Chapter 4: Warning Signs, 2004, TSO
- Traffic Signs Manual, Chapter 5: Road Markings, 2003, TSO
- The Highway Code
- Road Traffic Act 1988
- SI 2002 No 3113: The Traffic Signs Regulations and General Directions 2002; TSO
- British Standards Institution BS5489 Road Lighting: Part 4: Code of Practice for Lighting for Single-Level Road Junctions Including Roundabouts (1992)
- SI 1999 No 1025 – The Highways (Road Humps) Regulations 1999: TSO
- SI 1999 No 1026 – The Highways (Traffic Calming) Regulations 1999: TSO
- Traffic Advisory Leaflet 12/93 Overrun Areas

SITE ASSESSMENT FORM



Site Assessment Form

Location: _____ OSGR: _____
 No of Junction Arms: _____ Current Junction Type: Priority / Traffic Signal ICD: _____
 Street Lighting: Yes / No In UTC Region: Yes / No
 Area Type: Residential / Commercial / Industrial / Rural

Arm 1

Road Name: _____ Public Highway: Yes / No
 Classification: _____ Approach Speed (85%ile): _____ Speed Limit: _____
 Flows: _____ No of Approach Lanes: _____
 % HGVs: _____ Carriageway Width: _____ Gradient: _____
 % Pedestrians: _____
 % Cyclists: _____ Bus Route: Yes / No Cycle Route: Yes / No
 Pedestrian Crossing Nearby: Yes / No Distance: _____ Toucan / Puffin / Pelican
 Zebra / Central Refuge
 Additional Comments: _____

Arm 2

Road Name: _____ Public Highway: Yes / No
 Classification: _____ Approach Speed (85%ile): _____ Speed Limit: _____
 Flows: _____ No of Approach Lanes: _____
 % HGVs: _____ Carriageway Width: _____ Gradient: _____
 % Pedestrians: _____
 % Cyclists: _____ Bus Route: Yes / No Cycle Route: Yes / No
 Pedestrian Crossing Nearby: Yes / No Distance: _____ Toucan / Puffin / Pelican
 Zebra / Central Refuge
 Additional Comments: _____

Arm 3

Road Name: _____ Public Highway: Yes / No
 Classification: _____ Approach Speed (85%ile): _____ Speed Limit: _____
 Flows: _____ No of Approach Lanes: _____
 % HGVs: _____ Carriageway Width: _____ Gradient: _____
 % Pedestrians: _____
 % Cyclists: _____ Bus Route: Yes / No Cycle Route: Yes / No
 Pedestrian Crossing Nearby: Yes / No Distance: _____ Toucan / Puffin / Pelican
 Zebra / Central Refuge
 Additional Comments: _____

Arm 4

Road Name: _____ Public Highway: Yes / No
 Classification: _____ Approach Speed (85%ile): _____ Speed Limit: _____
 Flows: _____ No of Approach Lanes: _____
 % HGVs: _____ Carriageway Width: _____ Gradient: _____
 % Pedestrians: _____
 % Cyclists: _____ Bus Route: Yes / No Cycle Route: Yes / No
 Pedestrian Crossing Nearby: Yes / No Distance: _____ Toucan / Puffin / Pelican
 Zebra / Central Refuge
 Additional Comments: _____