

## INTRODUCTION

This report contains the results of a Stage 1 Safety Audit carried out on the above scheme. The Audit was carried out at the request of Norfolk County Council Highways Group .

The Audit Team membership was as follows:-

Tim Young BSc, MCIHT, MSoRSA  
(Audit Team Leader)

Engineer,  
Network Analysis + Safety  
Norfolk County Council

Kevin Allen BEng(Hons), I Eng, MCIHT, MSoRSA  
(Audit Team Member)

Project Engineer,  
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Norfolk County Council

### Specialist Advisors:-

Andrew Micklethwaite

P2W Casualty Reduction Officer  
Norfolk County Council

John Thomas

Engineer ITS  
Norfolk County Council

The Audit took place at County Hall on 09 November 2011. The audit comprised an examination of the Safety Audit submission document (see attached contents list) and a site inspection by the Audit Team Leader.

The terms of reference are as described in Environment, Transport and Development Highways Service Manual Procedure SP03-07. The Auditors have examined and reported only on the road safety implications of the scheme as presented and have not verified the compliance of the design to any other criteria.

## **ITEMS RAISED AT PREVIOUS AUDIT**

All issues raised at the previous audits have been resolved.

## **ITEMS RAISED AT THIS STAGE 1 AUDIT**

### **1.0 General**

#### **1.1 Problem – Scheme 2 Right turns into properties on the northern side of Hardwick Road**

Performing a right turn into the properties on the northern side of Hardwick Road is difficult given the existing road layout. The scheme proposes extensive widening of the carriageway to the northwest of Scania Way which will make this even more difficult and the risk of conflict even greater.

#### **Recommendation**

Could the designer please show how a right turn into properties on the northern side of Hardwick Road, especially Wests Garage is either to be performed or prevented within the proposed new layout.

#### **1.2 Comment – Scheme 11 operation of bus gate**

The audit team were concerned that without a physical deterrent, the bus gate on Campbell's Meadow would be open to abuse. Please provide details of how the bus gate will operate at stage 2.

### **2.0 Alignment**

#### **2.1 Problem – Scheme 11 Hardwick Road/Hansa Road direct taper length**

Direct taper lengths for both the right turn into Hansa Road and the left turn into Campbell's Meadow scale as 5m on the supplied drawing. This is appropriate for a 30mph speed limit whereas the existing speed limit is 40mph. Sharp tapers such as these force drivers to make late braking manoeuvres and can cause tail end collisions or loss of control.

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Recommendation

Provide direct taper lengths for the existing speed limit of 40mph, this should be 15m.

2.2 Problem – Scheme 11 Risk of high sided vehicles tipping on roundabout

The audit team were concerned that the proposed geometry of the Campbell's Meadow roundabout would give rise to high sided HGV's tipping whilst manoeuvring, especially from the southern arm to the north eastern arm.

Recommendation

Provide auto track runs to show that an HGV can safely manoeuvre around the roundabout.

2.3 Problem – Scheme 7 QE2 Hospital roundabout entry path curvature from the B1145

Scaling from the drawing it would appear that the entry path curvature (entry radius) is greater than that specified within TD16/07. This gives rise to high entry speeds and reduces the likely hood that drivers will give way to circulating vehicles, increasing the risk of side swipe collisions and loss of control.

Recommendation

The designer should check that the proposed junction geometry conforms to TD16/07 and adjust if necessary.

2.4 Problem – Scheme 7 QE2 Hospital roundabout exit radii on A149

The exit radii on both A149 arms of the roundabout appear to be very large which encourages drivers, especially those performing left turns from Gayton Road and Lynn Road, to do so at a higher than desirable speed. This increases the risk of failure to give way to already circulating vehicles and also of side swipe type accidents at the merge of the A149 exits.

## Recommendation

The designer should check the geometry of the exit radii to ensure it conforms to TD16/07 and reduce it as necessary to encourage lower exit speeds and reduce the risk of circulatory conflict.

### 3.0 Junctions

#### 3.1 Problem – Scheme 2 Hardwick Rd/Scania Way capacity and development of right turn lane

The proposed right turn lane for Hardwick Road/Scania Way signals develops from the third straight ahead lane. Prior to this there is a very wide (scaling at 5.5m) combined straight ahead lane. The development of the right turn lane is ambiguous and could lead to hesitation and confusion for drivers as they manoeuvre into it. In addition the audit team were concerned that there was not sufficient capacity within the right turn lane for the volume of traffic. Scaling from the plan it would appear that only 4 HGV's could be accommodated before the lane is filled and then access to the adjacent straight ahead lane is blocked. This could lead to vehicles manoeuvring into the adjacent lane and coming into conflict with other straight ahead traffic.

## Recommendation

Redesign the lining at the junction to incorporate a longer right turn lane with bifurcation arrows and an appropriate hatch taper. The ahead lanes should develop from the centre lane at the exit of Hardwick Roundabout to avoid confusion.

#### 3.2 Problem – Scheme 1 private access adjacent to proposed roundabout Scania Way

An existing access is immediately south of the proposed roundabout on Scania Way. It has been provided a non standard right turn lane as part of the exit taper from the roundabout. Whilst this non standard right turn lane is acceptable due to the expected low use of the junction, the audit team were concerned that if traffic queued back from

the roundabout then drivers waiting the in the right turn lane would become frustrated and attempt potentially risky right turns in the face of on coming vehicles.

#### Recommendation

Provide an appropriate 'Keep Clear' road marking to cover the junction and reduce the risk of right turn conflict.

### 3.3 Problem – Scheme 1 Scania Way link road right turn lane

A new right turn lane is proposed for the northern spur on the link road. However the geometry of the right turn scales from the drawing as being substandard for a 30mph speed limit. Measuring a 10m long turning length from the centre of the side road as required in TD 42/95 results in a substandard deceleration lane length, which should be 25m including a 5m diverge taper.

#### Recommendation

Check the right turn lane geometry and adjust as required to bring it to TD42/95 standard for a 30mph speed limit.

### 3.4 Problem – Scheme 6 A10 exit from Hardwick Roundabout adjacent field access

The proposed widening for the A10 exit reduces the verge width on the eastern side of the roundabout. At this point there is an access present for an adjacent field with a setback gate. By reducing the verge width here it reduces the available width for a driver who wishes to access the field with the possibility that they may be forced to stop partially blocking the carriageway. This increases the risk of conflict with and between other road users. The widened A10 exit also poses a problem for vehicles exiting the field and entering the roundabout as now they will be required to cross 4 lanes of traffic; there is additional risk as it is likely that vehicles exiting the field will be slow moving.

## Recommendation

Ensure that sufficient setback of the gate is retained to allow a driver to pull fully off the carriageway whilst opening the field gate. Also please clarify what type vehicle and how often the gate will be used.

### **4.0 Non-motorised Users**

#### **4.1 Comment – Scheme 4 Scania Way signalised crossing**

Please provide details of the type of vehicle detection to be used on the signalised crossing on Scania Way. In addition the crossing is shown to be a toucan type suitable for both pedestrians and cyclists; however the drawing is only marked as having shared use facilities on the western side. Can the designer please confirm that shared use facilities will be available on both sides of Scania Way?

#### **4.2 Comment – Scheme 5 Scania Way continuity of pedestrian crossing facilities**

A new zebra crossing is proposed on Scania Way to the north of the new roundabout. While to the south of the roundabout a signalised crossing is proposed. Consistency of crossing type within a short distance of one another is important to avoid confusing drivers and pedestrians. It would therefore be beneficial to provide either 2 of the same type of crossing, i.e. both signalised to recognise the crossing needs of cyclists or to omit the northern zebra crossing, unless there is a compelling need for it as part of the scheme.

#### **4.3 Problem – Scheme 5 Scania Way radius adjacent to signalised crossing**

The existing radius immediately south of the proposed signalised crossing on Scania Way is large and encourages left turning drivers to approach Scania Way at an oblique angle. This forces them to look back over their shoulder and less likely to observe the signalised crossing. Therefore the risk is that a driver will emerge from the access not looking forward but behind and could come into conflict with a pedestrian crossing.

#### Recommendation

Tighten the radius of the adjacent access to force drivers to approach Scania Way more toward 90 degrees, which will in turn force them to look toward the signalised crossing to see if it is safe for them to proceed.

#### 4.4 Problem – Scheme 1 new link road lane width adjacent to refuge

The lane widths adjacent to the proposed pedestrian refuge on the new link road scale at 3.5m. Guidance in LTN 2/95 suggests that at lane widths below 4m vehicles should not be encouraged to try and pass a cyclist on carriageway. At 3.5m the lane width creates confusion to whether the gap is wide enough to pass a cyclist which could result in intimidation or a tail end collision.

#### Recommendation

Discourage drivers from attempting to over take a cyclist on carriageway by increasing the width of the pedestrian island. This will have the added benefit of encouraging use of the refuge by cyclists by giving them greater shelter whilst waiting to cross the link road.

#### 4.5 Problem – Scheme 1 new link road footway level difference

With reference to designer's notes L24 and L26, by steepening an adjacent bank or having a 900mm level difference this increases the hazard to pedestrians or cyclists of injury if they should slip or loose control.

#### Recommendation

Assess if an appropriate pedestrian/cycle barrier is required to reduce the likelihood of a pedestrian or errant cyclist tripping/falling down the bank/level difference.

#### 4.6 Problem – Scheme 6 A10 exit of Hardwick Roundabout pedestrian vehicle intervisibility

By widening the A10 exit of the roundabout to improve capacity the result is a reduction in verge width, with an associated relocation of pedestrian crossing

equipment, which reduces its conspicuity. This will also increase exit speed and reduce pedestrian/vehicle intervisibility at the crossing (due to the presence of trees within the verge on approach).

#### Recommendation

Undertake crown raising or tree removal as required to increase intervisibility between pedestrians and vehicles. This will also ensure that signal heads remain un-obscured too.

## **5.0 Signs, Lighting and Markings**

### **5.1 Problem – Scheme 1 New A149 roundabout spiral markings**

Spiral markings have been proposed as part of the new A149 roundabout. These are to aid drivers manoeuvring round what will be a wide 3 lane circulatory carriageway. However, the two lane A149 entry on the south western side of the roundabout will only encourage higher than desirable entry speeds. This could result in loss of control type accidents as seen on the roundhouse roundabout on the A11 in Norwich. In addition the guidance that the spiral markings give is ambiguous which could result in drivers being unsure of which lane they should be in and therefore coming into conflict with other circulating vehicles. Side swipe accidents may also occur at the exits to the roundabout as drivers make sudden lane changes.

#### Recommendation

Provide hatching on the south western side of the circulatory carriageway to encourage better lane discipline and lower entry speeds on the southern and western arms of the roundabout. It would also be beneficial to provide lane destination arrows to guide drivers on approach and on the circulatory carriageway.

### **5.2 Problem - Scheme 1 New A149 roundabout merge in turn markings**

No merge in turn markings have been provided on the new roundabout on the A149, whereas they have at other junctions on the local A-class road network. Merge in turn

markings help to guide drivers as the carriageway reduces from 2 lanes back to 1 and discourages inappropriate overtaking on the exit of a roundabout.

#### Recommendation

Provide appropriate merge in turn markings on the exits of the proposed A149 roundabout. In addition to the guidance the markings will provide they will also be consistent with other roundabout layouts proposed as part of this scheme.

### 5.3 Problem – Scheme 7 QE2 Hospital roundabout vehicle guidance

The wide 3 lane circulatory carriageway provided as part of the scheme will be confusing to drivers whilst negotiating it and could lead to sudden lane changing manoeuvres and nervous or uncertain driver behaviour which results in vehicle conflicts on the circulatory carriageway and at the exits to the roundabout.

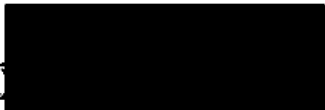
#### Recommendation

Provide destination arrows on the circulatory carriageway to aid driver guidance while they manoeuvre across the roundabout.


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**AUDIT TEAM STATEMENT**

We certify that this audit has been carried out in accordance with Norfolk County Council Environment, Transport and Development Procedures.

Signed (ATL)  Tim Young

Dated 30/11/11

Signed  Kevin Allen

Dated 8<sup>th</sup> November 2011

## RESPONSE SHEET

Problem (para no.)	Agree/ Disagree	Reasons/Proposals

To:- Team Manager (Network Analysis + Safety): fao Tim Young

From.....

Signed.....Project Engineer      Dated: .....

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