From: Ian Roberts  
Sent: 21 March 2018 16:52  
To: Poole, Liz <liz.poole@norfolk.gov.uk>; davina.galloway@highwaysengland.co.uk  
Cc: Alex Adams <alexadams@quantumgroup.org.uk>; nigel.harriss@Broadland.gov.uk; Robin Meakins <robin.meakins@bartonwillmore.co.uk>; Julian Shaffer <js@quantumgroup.org.uk>  
Subject: FW: 5111: Memorial Hall, Brundall

Dear Liz/Davina

Thank you for your email of 20\textsuperscript{th} February setting out your colleagues and Highway England’s comments on the suggested improvement works to the A47, Brundall roundabout.

I have now received the relevant accident data from your colleague at NCC and have further considered your and Davina’s comments and set out my further analyses for both your consideration.

**Accident Rate**
The personal injury accident (PIA) data has been obtained from Norfolk Council covering the latest 36 month period (attached).

This identifies that there has been 11 PIA's at or near to the Brundall roundabout. The PIA printout is attached for your information and records. The accidents consisted of the following details.

- Rear end shunt – 3 No. (one PIA driver testing positive)
- Motorcycle slipped on wet surface – 1 No.
- Vehicle in wrong lane turning right at roundabout – 3 No.
- Vehicle left carriageway – 2 No.
- Cause unknown – 2 No.

None of the accidents recorded involved failure to give way on entry. Three accidents involved circulatory carriageway incidents involving vehicles in the incorrect lane.

Three accidents involved rear end shunts albeit one of which involved a drunk driver.

Whilst the development proposed will add traffic movements to the roundabout such movements are minimal and represent an increase of just 1.4% during both morning and evening peak hours.

Nevertheless, in order to expedite matters and reduce these areas of conflict, white lines indicating new concentric spiral markings have been illustrated on the attached plan 5111/1002 Rev. A.

The proposed white lines would help to reduce the type of accidents that currently occur at this junction.

**Approach Lanes**
The arrow markings at the approach arms of Yarmouth Road and Cucumber Lane have been removed.

The road improvements do not alter the existing give way markings, as such sideways visibility is unaffected. Currently during the peak hours vehicles wait at the give way lines on both Yarmouth Road and Cucumber Lane side by side within the flared section of the arms.
The improvement proposed would not alter this aspect of the junction. See attached plan 5111/1002 Rev. A and photos taken during the morning peak hour.

Cucumber Lane is currently marked with left and right turn arrows for each lane.

The right turn flare length along Cucumber Lane has been increased in length to that which currently exists and the approach width widened reducing the risk of eastbound drivers overtaking queueing westbound traffic.

Analyzes
Whilst the Junction 9, Arcady TRL computer model is utilised extensively throughout the Country, and can, with caution, be used where flare lengths exceed 30m, we have undertaken the comparison exercise of “with” and “without development” scenarios utilising Arcady 9 lane simulation option, which allows for a more accurate assessment of the lane usage. Arcady 9 does take into account the relationship of adjoining arms. This is modelled within the input geometry data for the angle of conflict or entry angle. As such, the relationship of Yarmouth Road and Cucumber Lane is taken into consideration within the model.

Such model assessment was considered acceptable by NCC for the Broom Boat application which gained consent.

The Arcady 9, lane simulation analyses of the roundabout is attached and considered the ‘do nothing’ and ‘with development’ scenarios to identify the difference in impact on the junction.

Table 1: Results of Modelled Period

<table>
<thead>
<tr>
<th>Arm</th>
<th>‘Do Nothing (Existing)’ Maximum Delay (secs)</th>
<th>‘With Development’ and Improvement Maximum Delay (Secs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A47 (East)</td>
<td>7.92</td>
<td>10.01</td>
</tr>
<tr>
<td>Yarmouth Road</td>
<td>35.17</td>
<td>10.70</td>
</tr>
<tr>
<td>Cucumber Lane</td>
<td>107.67</td>
<td>51.06</td>
</tr>
<tr>
<td>A47 (West)</td>
<td>3.42</td>
<td>5.22</td>
</tr>
</tbody>
</table>

The results indicate that the junction would operate better with the improvements plus Memorial Hall development than it would in a ‘do nothing’ scenario without development.

It can be seen for the design year under the existing junction layout with committed development, there is excessive delay at Cucumber Lane. This can be compared to the improvements with Memorial Hall scheme where the delay on Cucumber Lane is reduced by more than 50% (51 seconds compared to 107 seconds) and similarly delay at Yarmouth Road is reduced three fold (35 seconds to 11 seconds). The remaining results are not altered materially.

Notwithstanding the above analysis using the ‘Lane Simulation’ option within Arcady, we have also undertaken a further exercise of microsimulation of the roundabout using VISSIM model.

The results of this analyses confirms the findings of the Arcady lane simulation model runs.
The table below highlights the findings of the VISSIM run.

<table>
<thead>
<tr>
<th>Arm of Roundabout Junction</th>
<th>Max. Q (metres)</th>
<th>Max. Q (metres)</th>
<th>Cars remaining</th>
<th>Max. Q (metres)</th>
<th>Max. Q (metres)</th>
<th>Cars remaining</th>
<th>Max. Q (metres)</th>
<th>Max. Q (metres)</th>
<th>Cars remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>A47 east</td>
<td>107</td>
<td>156</td>
<td>228</td>
<td>159</td>
<td>192</td>
<td>154</td>
<td>157</td>
<td>0</td>
<td>154</td>
</tr>
<tr>
<td>Yarmouth Road</td>
<td>117</td>
<td>178</td>
<td>67</td>
<td>181</td>
<td>25</td>
<td>36</td>
<td>62</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Cucumber Avenue</td>
<td>112</td>
<td>113</td>
<td>0</td>
<td>113</td>
<td>0</td>
<td>10</td>
<td>42</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>A47 west</td>
<td>0</td>
<td>44</td>
<td>0</td>
<td>14</td>
<td>0</td>
<td>17</td>
<td>9</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>Total Queue (metres)</td>
<td>336</td>
<td>2261</td>
<td>1769</td>
<td>217</td>
<td>270</td>
<td>233</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Queue (metres) of all four lanes of A47</td>
<td>107</td>
<td>1568</td>
<td>1325</td>
<td>171</td>
<td>166</td>
<td>191</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The full VISSIM model runs are also attached with this email.

**Road Safety Audit, Stage 1**

Further to your request we have instructed a Stage 1 road Safety Audit to be undertaken which I attach together with my Designers Response.

I therefore trust that you agree with the findings of the analyses undertaken and can inform the Local Planning Authority that not only does the impact accommodate the Memorial Hall scheme satisfactorily but also provides benefit in reducing delay and improves safety for existing road users at this junction.

It has been shown that the suggested improvements are of benefit and do not result in a severe impact on the network.

Should you have any further queries please call me at your convenience.

Kind regards
Ian Roberts

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