Project: **Bury St Edmunds Vision 2031: Infrastructure Study:**		Job No:	**60275221/ M001.002**
Subject: **Results of the Study**			
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1. Introduction

1.1 This Technical Note reports the findings of a study carried out by AECOM on behalf of Suffolk County Council into the transport infrastructure required to support the development envisaged in the Bury St Edmunds Vision 2031 Development Plan Document.

1.2 In response to a request from Suffolk County Council, AECOM have examined the potential impact of traffic generated by the Vision 2031 development sites at eleven locations around the town, regarded as potential problem locations.

1.3 The Key Plan attached to this document shows the extent of the study area and identifies the development sites and problem locations examined. The locations examined were:

A: A14 Junction 42;
B: A14 Junction 43;
C: A14 Junction 44;
D: A14 Junction 45;
E: Newmarket Rd/ Westley Road junction;
F: Compiegne Way/ Tayfen Rd junction;
G: Parkway/ Risbygate junction;
H: Parkway/ Westgate junction;
I: Rougham Road/ Rougham Hill junction;
J: Southgate Green junction;
K: Cullum Rd/ Nowton Rd/ Wilks Rd junction.

1.4 Suffolk County Council's agenda was stated as being:

- In respect of the A14 junctions, to provide enough traffic capacity to satisfy the Highways Agency that development in Bury St Edmunds on the scale proposed will not cause queues of traffic to tail back to the A14;
- In respect of the junctions within the town, to provide measures that will allow motor vehicle traffic to be managed and facilities for pedestrians and cyclists to be improved,

1.5 The County Council's position is that a calculated overcapacity of up to 15 – 20% can be managed by a combination of:

- Town-wide adoption of 'smarter choices' measures; including improved pedestrian and cycling facilities.
- Urban Traffic Management and control (UTMC), including the use of metering/ gating peak hour traffic flows as they enter the town.

1.6 The schemes developed in response to this Brief are therefore to be one component part of a broader strategy, including the 'smarter and softer' measures listed above; and are to contribute towards realising a more sustainable, less car-dependent pattern of travel.

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2. Method of Analysis

2.1 In response to this, AECOM developed a town-wide spreadsheet-based traffic forecasting model. This took as its basis a set of June 2011 traffic flow surveys. An Assessment Year of 2031 was adopted. Traffic growth was derived from TEMPRO, adjusted to reflect the fact that traffic flows likely to be generated by the development sites in the Vision 2031 document were modelled separately.

2.2 It should be noted that this method was intended to quantify the cumulative impact of all the strategic development sites coming forward. However, no attempt was made to quantify the impact of relocating the Hospital, since this was considered to be less certain and further into the future than the residential and employment sites.

2.3 Allowance was made in the modelling for the following features:

- Sustainable travel initiatives likely to be applied to the new development areas;
- Trip matching between trips generated by residential sites and those attracted by employment sites;
- The local reassignment effects of link roads already being considered in connection with the strategic development sites.

2.4 The resulting 'design flows' were then run through various traffic capacity models, ARCADY, PICADY and LINSIG, as appropriate to the junctions being examined, to establish the performance of the existing junctions under future year conditions; and to assess the impact of the scheme options being considered.

2.5 It is important to acknowledge the limitations of the method adopted. A spreadsheet-based growth factor model will assume that existing road users broadly maintain their current travel patterns; they travel to the same destinations, at the same times of day, by the same routes. No allowance has been made for redistribution, re-timing or reassignment of existing trips in response to the changing conditions likely to be brought about by the pattern of development proposed. This is because the model cannot readily take such effects into account. In order to do so, a town-wide multiple route assignment model using software such as SATURN of VISSUM would be required.

2.6 There is therefore a risk that the modelling reported here may have over stated the impact of development traffic in already-congested areas; and under stated the potential reassignment to less heavily trafficked routes around the fringe of the study area. The findings of this study must be understood with this caveat.

3. Results of the traffic capacity assessments

A14 main line

3.1 The capacity assessment of the A14 main line indicates that, by 2031, several sections of the A14 in and around Bury St Edmunds will have exceeded the design capacity (1,600 veh/hr/ lane) of a dual 2-lane carriageway. However, in all but one case this threshold is exceeded with the addition of background growth and is not attributable to the addition of development traffic.

3.2 In addition, none of the sections examined exceed the absolute capacity of a dual 2-lane carriageway, which is generally taken to be in the order of 2,100 veh/hr/lane.

3.3 There is therefore no indication that any widening of the A14 should be linked to the release of development sites contained in the Vision 2031 document.

A14 junctions

A: A14 Junction 42.

3.4 The ARCADY model of the existing junction under current traffic flows appears to show few if any capacity problems. Local knowledge suggests that there is actually a problem on the A14 westbound off-slip, which the model is not reporting. This could result from, for example, high circulating speeds around the large diameter roundabout or congestion on the exit towards Bury St Edmunds.

3.5 For this reason, we have examined a layout (Drawing 60275221-A-1) which would convert this arm to traffic signal control. This would provide a suitable means to manage this queue. Together with a TOUCAN crossing across the A14 eastbound on-slip, it would also facilitate a pedestrian/ cyclist route across the A14 at this location.

3.6 The LINSIG model indicates that the resulting layout would operate well within capacity through to 2031 with the development envisaged.

3.7 The merge-diverge assessment indicates that the A14 eastbound merge would benefit from being upgraded from a Type A Taper to a Type B Auxiliary Lane merge.

B: A14 Junction 43.

3.8 The LINSIG model of the existing layout shows that, with growth to 2031 significant problems are expected with:

- A14 westbound off-slip (AM peak);
- Circulatory carriageway at its junction with the A14 westbound off-slip (AM & PM peaks);
- Single lane exit into Compiegne Way (south) (AM & PM Peaks);
- A14 eastbound off-slip (PM peak).

3.9 The proposed layout (Drawing 60275221-B-1) would convert the A14 eastbound off-slip to traffic signal control; add a short third lane on both A14 off-slips and provide local widening to Compiegne Way (south) to achieve two full lanes on both the entry and exit to this arm as far as (but not across) the bridge over the River Lark.

3.10 The LINSIG model predicts that this would deliver significant improvements to the junction's capacity. Releasing capacity on the A14 slip roads results in a deterioration in the capacity of Compiegne Way (north). However, this is not regarded as critical to the network as a whole, since the next upstream junction is some distance away.

3.11 The merge-diverge assessment indicates that the A14 eastbound merge should be upgraded from a Type A Taper to a Type B Auxiliary Lane merge.

C: A14 junction 44

3.12 The LINSIG model of the base case indicates problems with the A14 eastbound and westbound off slips and Bedingfield Way (PM peak). Local knowledge suggests that there is actually a problem on the Bedingfield Way approach in the AM peak, which the model is not reporting. This is also not evident in the queue length data the model was validated against. This problem could result from, for example, the A14 eastbound off-slip being give priority to enter the junction at the expense of the priority given to Bedingfield Way.

3.13 The proposed layout (Drawing 60275221-C-1) would add a short third lane to both A14 off-slips and to the A134 (south) entry, together with local widening of the circulatory carriageway, whilst retaining the existing pedestrian/ cyclist facility. The LINSIG model predicts that this would deliver significant improvements to the junction's capacity.

3.14 Widening of the Bedingfield Way entry to the junction is not regarded as feasible on account of the sharp radius turn on the junction approach and the Sainsbury petrol station positioned nearby. However, the creation of additional capacity on the A14 slip roads and on the roundabout would present the opportunity to re-optimise the traffic signal timings to favour Bedingfield Way over the arms that had received more physical capacity.

3.15 The merge-diverge assessment indicates that both A14 merges should be upgraded from a Type A Taper merge to a Type B auxiliary lane merge.

D: A14 Junction 45.

3.16 In order to accommodate the traffic flow increases resulting from major development to the east of the town, Junction 45 should ideally be upgraded from its current 'Compact Grade Separated' layout to a full grade separated junction. We understand that plans have already been prepared by Mott MacDonald to achieve this on the north side of the A14.

3.17 On the south side of the A14, the current slip roads should be upgraded by the provision of auxiliary merge and diverge lanes to minimise the disruption to A14 traffic associated with the low-speed corner radii on the connector roads. In addition, PICADY runs of the existing junctions between the slip roads and the local road indicate that these junctions should be upgraded from priority T-junctions to either roundabout or traffic signal control. The Mott MacDonald scheme is understood to comprise a roundabout on the north side of the A14 and this should be matched on the south side with either a roundabout or traffic signals.

Town junctions

E: Newmarket Road/ Risbygate/ Westley Road.

3.18 This is a three-arm mini-roundabout junction. No controlled pedestrian facilities are provided at the junction. The ARCADY model of this existing mini-roundabout junction shows it as coming under pressure on both main road arms even under current traffic flow conditions. With the addition of growth to 2031 and development traffic, conditions would have deteriorated to the extent that the junction would be significantly (up to 30%) over capacity in the westbound direction in the PM peak.

3.19 AECOM's preferred solution here would be to provide an additional traffic lane to accommodate right turns from Newmarket Road (eastbound) turning right into Westley Road. This would

improve the operation of the junction and could potentially facilitate signal controlled pedestrian crossings. To accommodate this would require land to be taken from the petrol station on the corner of Westley Road and/or widening onto the verge in front of the high masonry boundary wall to the former Barracks site. Neither of these options were deemed acceptable. AECOM's view, however, is that a scheme that would accommodate the design flows in full would require acquisition of some third party land at this location.

3.20 In order to examine the potential of options that could be achieved within the current highway boundary, a signal controlled layout without a right turn lane (Drawing 60275221-E-1) was drawn up. However, this results in a significant deterioration in the junction's capacity, with a predicted future year LINSIG result showing the junction to be significantly over capacity in both peak periods. An alternative layout without controlled pedestrian crossings at the junction (Drawing 60275221-E-2) achieved a better capacity. However, the option which performed best in traffic capacity terms (Drawing 60275221-E-3) was to retain the existing mini-roundabout and create zebra crossings for pedestrians wishing to cross Risbygate or Westley Road at this location.

F: Compiegne Way/ Northgate Street/ Tayfen Road

3.21 This is a standard four-arm roundabout junction. The ARCADY model indicates an increasing capacity problem on the approach from Compiegne Way (east) and it is suspected that queues on this arm are already causing problems for traffic exiting A14 Junction 43 into Compiegne Way towards the town centre.

3.22 AECOM's preferred solution here would be to provide an additional traffic lane on the approach from Compiegne Way (Drawing 60275221-F-3). The ARCADY model suggests that this would provide sufficient additional traffic capacity to accommodate the forecast increase in flows. However, this would provide no improvement to pedestrian and cyclist links between the railway station and areas to the east of the town centre.

3.23 An alternative layout comprising a signal controlled crossroads was therefore drawn up. This layout would require the removal of the existing trees within the central island of the roundabout and their replacement with new trees and planting in the corners of the junction.

3.24 An initial layout (Drawing 60275221-F-1) providing 'straight-across' pedestrian and cyclist crossings across all four junction arms was examined. This layout, however, fell well short of providing sufficient capacity to accommodate the design flows.

3.25 An alternative layout (Drawing 60275221-F-2) was therefore considered, providing staggered pedestrian and cyclist crossings across Compiegne Way and Tayfen Road, but requiring pedestrians to cross Northgate Street and Out Northgate at existing uncontrolled refuge-type crossings. The predicted future year LINSIG result shows the junction to be up to 70% over capacity in the AM peak, although in the PM peak, the overload is smaller, at around 10%. The main issue with this layout is the large volumes of right turners, which are difficult to accommodate at a signal controlled crossroads.

3.26 As a sensitivity test to current traffic patterns, the impact on such a junction of banning the right turn from Fornham Road into Station Hill could be considered. However, since the junction was already predicted to be significantly over capacity, the addition of further traffic displaced from Station Hill would be expected to exacerbate the problems already identified.

3.27 Further work aimed at optimising the performance of the junction would be possible. However, the results of this study suggest that a roundabout-based solution, with local widening of Compiegne Way to increase the capacity of the critical approach, would be the most effective solution here.

3.28 Such a roundabout would also appear to have the potential to accommodate additional traffic that may divert as a result of access changes into Station Hill from Fornham Road and Tayfen Road.

G Parkway/ Risbygate

3.29 The ARCADY model suggests that this junction will come under capacity pressure on the approach from Parkway (north) in the future year. It was observed on site to have some difficulties with the operation of the left turn from Risbygate (west) into Parkway (north), where the exit is constrained by a particularly well-used pedestrian crossing.

3.30 Pedestrian facilities around the junction are not ideal, with only a staggered crossing across Parkway (north) which requires users to divert significantly from their desire line.

3.31 An alternative layout (Drawing 60275221-G-2) comprising a signal controlled crossroads has therefore been drawn up. This layout would require the removal of the statue of Saint Edmund from the central island of the roundabout and its relocation elsewhere.

3.32 Because of anticipated difficulties with traffic capacity, this layout is shown with staggered pedestrian crossings across Parkway only. The smaller number of pedestrians wishing to cross Risbygate in this vicinity would be accommodated at the uncontrolled refuge-type crossing some 50m to the west. On Risbygate, between Parkway and the town centre, traffic speeds and volumes are much lower and arguably a crossing is un-necessary.

3.33 The LINSIG model indicates that the resulting junction would be over capacity by some 9% (AM peak) and 15% (PM peak) on the critical arm relative to the forecast design flows.

3.34 This would represent a level of overcapacity that could conceivably be managed, for example through the implementation of UTMC.

3.35 On this basis, conversion of this junction to traffic signal control could be recommended for further, more detailed, scrutiny.

H: Parkway/ Westgate

3.36 This double mini-roundabout appears to work acceptably well under current traffic conditions. The ARCADY model suggests that this could continue into the future.

3.37 Pedestrian facilities around the junction are not ideal, with only a staggered crossing across Parkway which requires many users to divert from their desire line.

3.38 An alternative layout comprising a signal controlled crossroads has therefore been drawn up. It has been assumed that existing kerb lines would be followed because of the constraints imposed by the adjoining buildings.

3.39 An initial layout (Drawing 60275221-H-1) providing 'straight-across' pedestrian and cyclist crossings across all four junction arms was examined. This layout, however, fell well short of providing sufficient capacity to accommodate the design flows.

3.40 An alternative layout (Drawing 60275221-H-2) was therefore considered, providing staggered pedestrian and cyclist crossings across Parkway and Cullum Road, but requiring pedestrians to cross Out Westgate at the existing uncontrolled refuge-type crossing 30m to the SW. On Westgate, between Parkway and the town centre, there is a signal controlled pedestrian crossing which could be retained. The predicted future year LINSIG result shows the junction to be up to 28% over capacity in the AM peak and up to 56% over capacity in the PM peak.

3.41 A further alternative (Drawing 60275221-H-3) comprising the retention of the double mini roundabout and the addition of a controlled pedestrian/ cyclists crossing some 20m to the south was also examined. This was tested in ARCADY and appeared to show little detriment to the junction's overall capacity.

I: Rougham Road/ Rougham Hill junction

3.42 This roundabout would have to be adjusted to provide access into the proposed link road serving the SE Bury development area.

3.43 The ARCADY assessment suggests that the approach along Rougham Road from Southgate Green would reach capacity in the future year and that further capacity could be provided by elongating the approach flare, as far as (but not across) the bridge over the River Lark.

3.44 A layout (Drawing 60275221-I-1) providing such an improvement has been drawn up and capacity-tested. It shows a clear benefit in terms of its ability to accommodate the predicted traffic flows.

J: Southgate Green (Rougham Road/ Sicklesmere Road)

3.45 The ARCADY model suggests that this junction will come under capacity pressure on the Rougham Road and Cullum Road approaches by around 15% in the future year.

3.46 This larger roundabout would lend itself more readily to conversion to a signal controlled roundabout than to a crossroads. A layout (Drawing 60275221-J-1) providing additional pedestrian crossings – including links across the central island – has been drawn up.

3.47 The LINSIG model shows this layout as operating very close to capacity in the design year, particularly in the PM peak. However, this is a significant improvement on the predicted performance of the current layout and it includes a substantial increase in pedestrian and cycle facilities.

3.48 Further work would be possible to improve the capacity of the critical arm (Rougham Road) by investigating the extension of the approach flare.

K: Cullum Road/ Nowton Road/ Wilks Road

3.49 The ARCADY model indicates the current junction exceeding its capacity on the approach from Southgate Green by up to 20% in the future year; and marginally on Wilks Road.

3.50 Pedestrian facilities around the junction are not ideal, with only a mid-block crossing across Cullum Road between this junction and Southgate Green.

3.51 The generally open aspect of the approaches to this junction lends itself to providing additional traffic lanes on the junction entries and exits. This could include locally widening Cullum Road to dual carriageway between this junction and Southgate Green to maximise the effective use of the approach capacity to both junctions.

3.52 A layout option comprising a signal controlled crossroads has been drawn up. This layout (Drawing 60275221-K-2) is shown with 'staggered' pedestrian crossings across all arms of the junction. The LINSIG model indicates that it would be over capacity by up to 30% relative to the forecast design flows. The main problem is the high volume of right turns, particularly from Southgate Green into Cullum Road.

3.53 Further work aimed at optimising the performance of the junction would be possible. However, the results of this study suggest that a roundabout-based solution, rather than a signal controlled crossroads, would be the most effective solution here.

3.54 An alternative layout comprising the retention of the current roundabout layout; the provision of additional pedestrian crossings across Nowton Road and Wilks Road; and local widening to dual carriageway between this junction and Southgate Green (Drawing 60275221-K-3) was therefore tested. This showed as having sufficient capacity to accommodate the design flows, with one arm in each peak approaching its theoretical capacity.

4. Summary of cost estimates

4.1 The cost of constructing the scheme options featured in the current set of layout drawings is estimated to be as follows.

Junction	Option	Cost
A14 Junction 42	60275221-A-1	£ 194,105
A14 Junction 43	60275221-B-1	£ 555,147
A14 Junction 44	60275221-C-1	£ 522,539
Risbygate/ Westley Road	Signal controlled (60275221-E-2)	£ 62,870
Compiegne Way/ Northgate St	Signal controlled (60275221-F-2)	£ 1,445,796
Compiegne Way/ Northgate St	Roundabout option (60275221-F-3)	£ 484,822
Parkway/ Risbygate	60275221-G-2	£ 1,111,519
Parkway/ Westgate	Signal controlled (60275221-H-2)	£ 542,332
Parkway/ Westgate	Roundabout option (60275221-H-3)	£ 55,821
Rougham Road/ Rougham Hill	60275221-I-1	£ 21,412
Southgate Green	60275221-J-1	£ 755,366
Cullum Road/ Nowton Road	Signal controlled (60275221-K-2)	£ 1,781,346
Cullum Road/ Nowton Road	Roundabout option (60275221-K-3)	£ 499,459
Upgrade to merge tapers (x4)		£ 242,730
Total Cost	Signal controlled Options	£ 7,235,165
Total Cost	Roundabout-based Options	£ 4,505,792

Notes on Cost Estimates

- Estimates are subject to change once detailed design is completed.
- The lighting cost could vary considerably depending on material/spacing etc
- The traffic signal design is all based on assumptions of the position of the signals and how many will be needed. The number of pedestrian signals and push buttons has all been assumed.
- Inflation has not been included due to unknown construction start date.
- The pavement rates for carriageway and footway include site clearance, earthworks and the necessary layers for pavement construction.
- 1m hardstrip used for merge lane. DMRB standard for rural all purpose roads.
- Costs of statutory undertakers diversions are not included.
- These cost estimates are based on the acquisition of third party land not being necessary and they therefore do not include land costs.

5. Conclusions

5.1 The traffic capacity assessments appear to show that, in general, the adjustments to the A14 junctions 42, 43 and 44 examined would operate within capacity and, indeed, achieve some significant improvements in capacity. At A14 junction 45, it is understood that a developer is already examining a scheme that would result in a junction more able to accommodate the traffic flows likely to wish to use it.

5.2 There are some locations on the main line of the A14 where the future year traffic flows indicate that an upgrade from dual-2 lane to dual-3 lane would be appropriate. However, these are in general triggered by background growth to 2031 and not by the addition of development traffic.

5.3 There are some locations on the A14 at which an upgrade to merge tapers would be recommended in order to accommodate the volume of traffic joining the A14 without disrupting the free flow of traffic along the Trunk Road. However, the slip roads themselves appear adequate to provide for forecast levels of flow.

5.4 At the town junctions, the achievement of better facilities for pedestrians and cyclists comes at the expense of a reduction in the capacity available for motor vehicle traffic; however these facilities are required to support sustainable transport options to reduce traffic demand in the future. Whilst the provision of signal control can benefit buses, this is only beneficial if the junction has sufficient capacity overall.

5.5 The junction layouts initially considered provided a range of results. In some cases, achieving an ideal result for pedestrians and cyclists resulted in a junction that would fall well short of providing adequate capacity to support the design flows adopted. Where this was the case, an alternative scheme was developed to provide a better balance between the needs of these user groups.

5.6 The resulting options should be seen as a ‘first pass’ or ‘order of magnitude’ exercise in identifying the level of infrastructure required. It will be possible for many of them to be further adjusted to maximise the potential of the underlying layouts and increase capacity.

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