

CAMBRIDGESHIRE GUIDED BUSWAY

To: Cabinet

Date: 25th January 2011

From: Acting Executive Director: Environment Services

Electoral divisions: The Hemingfords and Fenstanton, St Ives, Papworth and Swavesey, Willingham, Cottenham, Histon and Impington, Waterbeach, East Chesterton, King's Hedges, Petersfield, Trumpington, Gamlingay.

Forward Plan ref: Not applicable *Key decision:* No

Purpose: This report advises Cabinet of progress towards completion of the Cambridgeshire Guided Busway and sets out proposals for dealing with defects that are at this time expected to be unresolved by the Contractor at completion.

Recommendation: Cabinet is asked to:

- a. note that BAM Nuttall did not achieve their target of completion by 17th December;
- b. approve the proposed defect mitigation action in respect of the narrow expansion joints between beams if the Busway Contractor fails to correct this defect within 28 days of completion;
- c. agree to take no action in respect of the shallow foundations if the Busway Contractor fails to correct this defect within 28 days of completion, but note that this defect will remain the liability of BAM Nuttall; and
- d. note that the defect in respect of the risk assessment for the rubber tyre backfill is expected to be closed before completion.

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1 BACKGROUND

- 1.1 As reported to Cabinet on 14th December 2010 the Cambridgeshire Guided Busway construction contract is approaching the point where the Project Manager will be able to certify completion. As anticipated in that report, BAM Nuttall (BNL) did not complete the works and produce the necessary certification by their own target date of 17th December. The latest programme from BAM Nuttall shows works complete on 4th February 2011. It is hoped that the Project Manager will be able to certify completion shortly after that date.
- 1.2 Proposals to open the section of Busway from Cambridge to St Ives in November 2009 foundered because the Contractor BAM Nuttall (BNL) refused to address six key defects. On 14th December 2010 Cabinet agreed actions in respect of three of these six defects. One of the remaining three defects is expected to be closed and this report therefore recommends appropriate courses of action for the two remaining defects.

2 PROGRESS

- 2.1 BAM Nuttall had previously stated that they would complete all work and submit all the necessary certificates by 17th December, the start of their Christmas break. As anticipated this was not achieved. Work on Addenbrooke's Bridge, landscaping and the maintenance track access at Long Road being incomplete, while only 55% of southern section construction certificates were submitted.
- 2.2 BAM Nuttall's current programme, issued on 7th January, shows Addenbrooke's Bridge complete by 31st January and landscaping by 4th February. The programme also show the final construction certificate, which would be for Addenbrooke's Bridge, submitted by 31st January.
- 2.3 The report to Cabinet on 21st September 2010 raised concerns that BAM Nuttall would leave the submission of construction certificates until very late in the contract, contrary to previous commitments to provide these as each section of the work was finished. BAM Nuttall subsequently stated their intention to deliver all the construction certificates by 17th December but did not achieve this.
- 2.4 BAM Nuttall have continued to submit construction certificates and at the time of writing 171 (94%) out of a total of 182 certificates for the whole project had been submitted.
- 2.5 Atkins on the County Council's behalf have been checking the certificates as they are submitted. At the time of writing 96 certificates have been returned to BAM Nuttall, of which 42 (43%) have been accepted and 54 (56%) have not been accepted. Where certificates have not been accepted comments have been provided. At the time of writing BAM Nuttall have resubmitted 48 of the not accepted

certificates. These will be checked and will be accepted if the comments have been satisfactorily addressed.

- 2.6 It will be seen from the above that formal Completion will not be achieved in January and is likely to be dependent on the submission, resubmission and checking of the certificates. If BAM Nuttall maintain their current progress and achieve their programme then it should be possible for completion to be certified in mid February.

3 DEFECTS

- 3.1 The report to Cabinet on 14th December summarised the definition of a defect and the options available to the employer under the contract should these not be rectified. This is repeated below for ease of reference.

- 3.2 A defect is defined in the contract for the Guided Busway as work which does not comply with the works information (the specification) or which is not in accordance with the Contractor's accepted design.

- 3.3 The Contractor has four weeks after the Project Manager certifies completion to correct notified defects. After this time the employer has three options:

- Rectify the defect themselves and deduct the cost from the retention monies;
- Take no action over the defect, in which case it remains a defect. If action is subsequently needed then the Contractor would be invited to rectify at their own cost and if they failed to do so the cost of rectification would be recovered from either the retention or the performance bond, both of which last for ten years from completion, reducing annually;
- Accept the defect with a suitable reduction in the target price, in which case the Works Information is changed and it is no longer a defect. The reduction in target price can either be agreed with the Contractor or assessed by the Project Manager on the basis of the amount saved by the Contractor in not carrying out the work correctly.

- 3.4 Members will recall the six key defects which prevented sectional completion of the Busway between Cambridge and St Ives are:

- 1 River Great Ouse Viaduct Expansion Joints;
- 2 St Ives Park and Ride (Park & Ride) surface ponding;
- 3 Maintenance track flooding;
- 4 Guideway shallow foundations;

- 5 Thermal expansion gaps between the guideway beams;
- 6 Rubber tyre infill between the guideway beams.
- 3.5 Details of these have been reported to previous meetings.
- 3.6 Cabinet agreed on 14th December 2010 to rectify the first two of these and to develop proposals for rectifying the third, assuming no action by BAM Nuttall. Cabinet were also advised that appraisals were being undertaken of the risks to the Busway of the guideway shallow foundations and the inadequate thermal expansion gaps between guideway beams, and that a revised Designer's Risk Assessment had been received in respect of the rubber tyre infill.
- 3.7 The appraisal work has been completed and the findings are set out below.
- 3.8 The rubber tyre infill risk assessment has been accepted. To close the defect BAM Nuttall will need to submit a formal Contractor's Proposal, which can now be accepted.

Guideway shallow foundations

- 3.9 BAM Nuttall have constructed some sections of Busway without an accepted design for the foundations. These are areas, amounting to 3.8km, where the particular type of clay is known to be susceptible to shrinking in dry weather and expanding (or swelling) in wet weather. BAM Nuttall's designs for these areas did not demonstrate that the foundations would be sufficiently deep to minimize the probability of shrinkage and heave occurring greater than the 6mm of vertical deviation from the design alignment allowed in the specification.
- 3.10 This issue was raised with BAM Nuttall before these sections of Busway were built in the first half of 2008 and formally raised as a defect early in 2009. Following lengthy discussions with BNL and their designers, BNL undertook additional borehole surveys in May 2010. These were carried out at thirteen locations which were considered to be at greatest risk of movement as a result of both soil conditions and the presence of high water demand trees, which could exacerbate shrinkage in drought conditions.
- 3.11 Following these surveys BNL's designers produced a report early in September 2010. This report concluded that at most locations the soils were not as susceptible as had been thought and that the adjacent trees were having little impact on moisture content. Regrettably, and for reasons that they have not disclosed, BAM Nuttall have declined to provide this report with a formal design certificate. Without such a certificate the report has no status under the contract.
- 3.12 The first half of 2010 was significantly drier than normal and it is considered that any significant problems of clay shrinkage affecting the

Busway would have become manifest. BNL carried out level surveys in October 2009 and repeated these surveys in May and July 2010. Atkins repeated the surveys on our behalf in October 2010.

- 3.13 In eleven of the thirteen locations the results show no significant movement of the Busway, indicative of shrinking or swelling, over the four surveys carried out over the twelve month period. At the remaining two sites the survey results are anomalous. More detailed analysis of these results indicate that they are more likely to be the result of survey or construction issues rather than movement of the Busway due to shrink or swell as there is a consistent variance between the different sets of readings.
- 3.14 At one of the sites the survey results show that the alignment is close to the design alignment. The surveys at the other location, which is between the Impington Stop and Bridge Road Bridge, showed that it was outside the specified alignment, and had been since at least October 2009. This is before the dry period in 2010 and therefore more likely to be a result of incorrect construction or permanent settlement rather than shrinkage movement. BAM Nuttall adjusted this section of Busway in December 2010 to bring it back into specification.
- 3.15 In view of the fact that despite the borehole and level surveys BAM Nuttall have not produced the information necessary to close this defect, Atkins' geotechnical expert has been asked to review all the information and assess the probability of significant movement of the Busway affecting the operation.
- 3.16 The assessment concludes that the combination of information from the geotechnical surveys and the level monitoring surveys through the dry weather earlier this year indicate that there is a very low probability of shrinkage or heave movement resulting in structural damage to the guideway.
- 3.17 The possibility of movement affecting ride quality cannot be entirely ruled out but the probability of this affecting more than 500m in total out of the 3.8km is low.
- 3.18 In the event that shrinkage did occur it would be necessary to jack and pack the sections that had sunk. It might also be necessary to reverse the process when the clay expanded in subsequent wet weather. To be certain that this did not occur, it would be necessary to rebuild all the sections about which there is uncertainty with deeper, possibly piled foundations. This would be a major and expensive item of work.
- 3.19 It is considered that no action should be taken at this time to rectify this defect. The need for future adjustment of the Busway as a result of dry weather cannot be completely ruled out. However the risk is not considered to be sufficient to justify the disruption of rebuilding these foundations.

- 3.20 Contractually the foundations will remain a defect. Should movement occur in future then the liability remains with BAM Nuttall.

Thermal expansion gaps between the guideway beams:

- 3.21 Check surveys undertaken in 2008 on the recently completed section of guideway between Longstanton and Cambridge showed that a number of joints between track sections were narrower than the design. A review of the design also established that the full range of temperatures required by BNL's chosen relevant national standard had not been provided for. It is therefore the case that the Contractor has not constructed the joints in accordance with their design and that the design is not in compliance with the works information. Further sample surveys have identified that around 10% of joints on the northern section may be substandard in width.
- 3.22 BAM Nuttall's position is to deny that this is a defect but also to claim that the beams will creep, that is move longitudinally, when thermal expansion is greater than allowed for by the joints. This may well be what will occur and BNL have therefore been invited to demonstrate that the track can withstand the resultant stresses without damage. They have declined to provide such calculations.
- 3.23 In view of BNL's inability to provide information to demonstrate the robustness of their design, Atkins' structural engineers have been asked to assess the probability of thermal stresses resulting in damage to any part of the Busway.
- 3.24 Atkins conclusion is that overall, the various elements of the guideway track, beams, spacers, foundations and the fixings between them will withstand the effects structurally, but there is a likelihood of spalling occurring at the top of the guide kerb upstand. Spalling is the shearing off of the surface face of the concrete.
- 3.25 If the beam ends are perfectly parallel then as the ends come in to contact the expansion forces will be applied over the whole surface area of the beam end without damage. However if there is the slightest amount of settlement or misalignment at the joint then the upper parts of the beam upstand will come into contact initially. The expansion forces will then be transmitted through a small area at the top of the guide kerb generating shear forces close to the surface of the concrete that will likely cause localised spalling. Some of this spalling will occur on the guide kerb face and may extend into the area on which the guidewheels run affecting ride quality.
- 3.26 This damage would be repairable but would require closure of the Busway, while the repair was carried out and the material reached its full strength. Specialist quick setting concrete repair materials are available but it is likely that closures of at least 48 hours would be needed to ensure the material had reached full strength.

- 3.27 Although the full extent of the potential problem cannot readily be quantified, see the above section on possible settlement, it is considered that spalling is likely to occur at narrow joints in very hot weather and sample surveys show that around 10% of joints are at risk. However this risk could be substantially reduced if not eliminated by grinding the narrow joints to provide the necessary gap.
- 3.28 It is considered that grinding the joints at the guide kerb upstands will be a relatively simple and quick operation and could be undertaken prior to the busway opening to avoid a bigger problem occurring in the future. A few millimetres would be removed from the face of the joint. This can generally be done without risk to the reinforcing steel as the cover to the steel at the beam ends is greater than the minimum requirement. As the work can be carried out at the same time as the other defect correction work it should not further delay the opening of the Busway.
- 3.29 It is therefore recommended that this work should be undertaken in the event that BAM Nuttall take no action to remedy this defect. The costs will be deducted from the retention money and BAM Nuttall will remain liable for any other defects with the guideway construction that might arise in future.

4 Summary

- 4.1 As anticipated BAM Nuttall did not complete their work by 17th December.
- 4.2 If BAM Nuttall maintain their current progress and achieve their programme then it should be possible for completion to be certified in mid February.
- 4.3 The rubber tyre infill risk assessment has been accepted and subject to contractual formalities will be closed.
- 4.4 It is considered that the risks and consequences of possible movement of the Busway in areas that may be susceptible to clay shrinkage in dry weather are not sufficient to justify the considerable work necessary to strengthen the foundations.
- 4.5 It is considered that the risks and consequences of damage to the guide kerb face arising from the joints between track sections being too narrow are sufficient to justify grinding the joints to the correct width.

5 IMPLICATIONS

Resources and Performance

- 5.1 Finance and risk management – the report sets out the latest progress towards the opening of the busway. It proposes actions in respect of the correction of defects with recommendations made on an assessment of the risks and consequences.

5.2 **Statutory Requirements and Partnership Working**

5.3 There are no significant implications for any of the headings within this category.

5.4 **Climate Change**

5.5 The busway will provide a good alternative to use of the car for travel into Cambridge, St Ives, Huntingdon and other villages along the route. When operational, it is expected to significantly increase the bus patronage in this corridor and as such assist in our objectives to reduce the emission of greenhouse gasses from vehicles.

5.6 The busway should also have a high quality track alongside that is available for pedestrians and cyclists and this again will increase its environmental benefits. This is already being used unofficially and usage will increase when the scheme is formally open.

5.7 **Access and Inclusion**

5.8 The busway will provide good public transport and cycle/foot links between St Ives, the intervening villages and Cambridge. This will open up travel opportunities by increasing the quality of bus services in those communities and benefit particularly those without use of a car.

5.9 **Engagement and Consultation**

5.10 There are no significant implications for any of the headings within this category.

Source Documents	Location
Agenda and Minutes, Cabinet 1/3/2005, 7/2/06, 13/6/06, 11/7/06, 16/10/07, 16/12/08, 29/9/09, 16/3/10, 27/4/10, 25/5/10, 15/6/10, 5/7/10, 7/9/10, 28/9/10, 26/10/10, 16/11/10, 14/12/10	CGB Team Office, Old Police House, Shire Hall, Cambridge
Cambridgeshire Guided Busway Order	
Cambridgeshire Guided Busway Contract Documents	