Agenda Item No: 7

CAMBRIDGESHIRE GUIDED BUSWAY DEFECTS

To:	**General Purposes Committee**
Date:	**7th October 2014**
From:	**Executive Director, Economy, Transport and Environment**
Electoral division(s):	**All**
Forward Plan ref:	**2014/025** *Key decision:* **Yes**
Purpose:	**To consider expert technical and legal advice regarding the rectification of defects in the construction of the Cambridgeshire Guided Busway and the recovery of costs from the contractor Bam Nuttall.**
Recommendation:	**The General Purposes Committee is asked to:**

a) **Note the advice of the Council's expert technical advisers regarding the causes of, and options, for rectification of the defects as set out in the report and Appendices A, B and C.**

b) **Note the advice of Mr Stephen Furst QC regarding the Council's legal remedies and assessment of the strength of case, as set out in confidential Appendix D.**

c) **Note the correspondence received from Bam Nuttall and the discussions that have taken place between Bam Nuttall representatives and the Project Manager.**

d) **Resolve to carry out works to rectify all of the superstructure, foundation and drainage defects in accordance with the assessment of the Project Manager and the advice of the Council's expert technical advisers, subject to securing funds from Bam Nuttall in accordance with the defect provisions in the construction contract or alternative legal argument.**

e) **Instruct Officers to initiate negotiations and any necessary legal proceedings to recover the assessed cost of defect correction in accordance with the contract, consequential losses arising from those defects, and any costs incurred to date and incurred in future in investigating and taking advice on the defects.**

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1. CONFIDENTIALITY

1.1. This report contains confidential advice within a separate appendix (Appendix D). This advice is subject to litigation privilege. If members wish to discuss this advice then it will be necessary for the meeting to be held in closed session.

2. PURPOSE

2.1. To consider the expert technical and legal advice that has been taken regarding the rectification of defects in the construction of the Cambridgeshire Guided Busway and actions to be taken to rectify the defects and recover the costs from the contractor Bam Nuttall.

2.2. The report is structured as follows: background, an overview of the defects, the process and basis for a possible claim, the expert's opinion, recent discussions with Bam, the costs of action, and a summary of the position.

3. BACKGROUND

3.1. The construction of the Busway was subject to considerable delay and cost increases. Following the completion of the Cambridgeshire Guided Busway in April 2011 the County Council took legal action to recover money owed by the contractor Bam Nuttall. The dispute over the final cost of the Busway was settled in September 2013 when the Council agreed to accept a payment of £33 million from Bam Nuttall.

3.2. The Council's legal claim against Bam Nuttall included defects that were known about at the formal contract completion date. The settlement included payment for these defects with three exceptions. These three defects were excluded from the settlement because at the time the full extent of their impact could not be quantified. These defects were 'stayed' in legal parlance; that is the legal action was put on hold for future resolution.

3.3. Since completion of the Busway a number of other defects have come to light; most noticeably the movement of the bearing pads on which the guideway beams rest. This has resulted in a number of instances of 'steps' appearing in the guideway. Bam Nuttall have failed to address this or any other defect notified since completion.

3.4. Following settlement of the final cost claim, considerable effort has been put into investigating the cause of this and other defects. An update on this work was provided to Cabinet in April of this year.

3.5. The Contract Supervisor and Project Manager have followed all of the contractual steps relating to defects. This begins with the Project Manager requesting the Contractor to investigate the cause of the potential defect, and ends with the Project Manager making his own assessment of the cost of correction, which the Contractor is obliged to pay.

3.6. The Council has taken legal advice from Mr Stephen Furst QC, and independent advice on both the technical issues and valuation or quantum of the costs involved. Technical advice in respect of the concrete guideway has been provided by Mr Tony Cort and advice in respect of foundations and drainage by Mr Robin Sanders, both of Capita. Valuation advice has been provided by Mr Chris Ennis of Time Quantum Expert Forensics Limited.

3.7. Mr Furst's advice is attached in confidential **Appendix D**. The technical advice is attached in **Appendix A**, and the valuation advice as **Appendix B**. Legal and technical advice has only been taken in respect of defects with an estimated assessed value of £50,000 or more, in order to limit costs.

4. THE DEFECTS

4.1. The defects that were excluded from last year's settlement related to:

- inadequate drainage at one location on the southern section.
- foundations at a number of locations in the northern section that were not deep enough to minimise the risk of settlement or heave in susceptible clays.
- joints between the guideway beams that were too narrow to allow for thermal expansion of the beams.

4.2. Since completion there have been a number of instances of 'steps' appearing in the guideway. This has occurred because the neoprene pads that act as flexible bearings between the concrete guideway beams and the concrete foundation pads have moved out of position.

4.3. As Bam have declined to investigate the underlying cause of this issue the Contract Supervisor has undertaken his own investigation. This has been combined with an investigation into reports of poor ride quality at a number of locations.

4.4. The neoprene bearing pads and the plastic shims used to give the final adjustment to level are not restrained other than by surface friction. It has been established that these pads and shims do not have sufficient friction to resist slipping as a result of the forces generated by the thermal movement of the concrete guide beams. To this must be added the forces generated by buses accelerating or decelerating, and the change in loading and hence friction as the bus moves along the beam. In some instances this may be further influenced by differential loadings arising from movement of the foundations. The effect is that the bearings are being gradually 'walked' out from under the beams.

4.5. Bearings have been exposed and examined at a number of locations with different foundation types, and at each location some bearings were identified as being out of position.

4.6. In Bam Nuttall's design the longitudinal movement of the beams should be constrained by metal brackets bolted to the foundations and restraining the cross members at every other joint. This being a 'fixed' joint. The other end of each beam being free to take up thermal movement at the alternate 'free' joints. It has been found that neither the brackets nor the cross members are sufficient to resist longitudinal forces and there is evidence of both having moved.

4.7. There is also evidence of lateral (sideways) movement of the guideway. The Works Information requires the guideway beams to be aligned to within 2mm. The entire guideway has been surveyed and a number of lateral steps greater than 2mm have been found. Again analysis has shown that the lateral restraint brackets are not sufficient to resist the design loadings.

4.8. The full list of superstructure defects can be found in Table 1 on Page 8 of Appendix A.

4.9. The solution to these superstructure defects is to fix the guideway beams together in pairs so that the fixed ends are properly fixed and held in alignment both longitudinally and laterally, and to fix the bearings so that they cannot move out from under the beams. This will require each section of guideway to be lifted.

4.10. The foundation defect relates to a unilateral decision by Bam not to follow national guidance in dealing with clay susceptible to heave (expanding), when it is saturated and shrinking when moisture is reduced. Such clays are common in this area of the County and were identified in geotechnical investigations undertaken by the Council and provided to the tenderers.

4.11. Bam were advised that their design in these areas was not acceptable prior to construction but chose to proceed. There was extensive dialogue and discussion with Bam during the construction contract at which they were unable to produce evidence to show that their design satisfactorily dealt with the risk of shrinkage and heave.

4.12. On an annual basis the clay shrinks and swells seasonally, but over the longer term it is affected by tree roots removing moisture. The foundations should have been built sufficiently deep to minimise the risk of either of these occurring, but BAM unilaterally chose to reduce the depth.

4.13. There are a relatively small number of foundations (36) in the Histon area which show clear signs of movement. In places the guideway has risen by as much as 100mm. Changes to the longitudinal vertical alignment are clear to the naked eye and are affecting ride quality. These foundations need to be replaced.

4.14. Monitoring in the susceptible areas, other than at Histon, has not identified any movement to date, but movement can be expected to occur as trees grow and extend their roots into and around the foundations taking up more moisture. Where the trees are within Busway land then a programme of tree trimming or removal and replacement with low water demand species should be sufficient. Where the trees are on neighbouring land and thus outside the Council's control rectifying the defect will require the foundations to be deepened to minimise the risk of movement as trees grow.

4.15. The investigation into defects at Histon has revealed that the foundations of the Busway in this area are permanently saturated. Further investigation of the drainage has shown that it has not been constructed in accordance with the contractors design and further that the design, which relies on infiltration rather than a ppositive outfall, is inappropriate in a clay area.

4.16. In addition to the above the Project Manager has assessed four defects with values exceeding £50,000. These are listed below and total £1,118,907.

These have not been considered by the independent technical or quantum experts, but have been reviewed by Mr Furst QC.

- Incorrectly constructed concrete bagwork culvert headwalls. Assessed cost £135,077
- St Ives Park and Ride - failure to provide drainage for the full 1000 space car park. This had to be addressed when the extension was built in 2012 and has therefore been corrected. Assessed cost £699,546
- Failure of drainage channel cover bedding mortar at St Ives and Longstanton Park and Ride. This has also been corrected as the covers were loose. Assessed cost £152,683
- Failure to provide as built drawings. Assessed cost £131,601

5. PROCESS

5.1. The Project Manager has concluded his investigations into the causes of the defects and has assessed the cost of rectifying the defects. At the time of writing the final assessment of the superstructure defect has been issued to Bam Nuttall, and the assessment of the foundation defect has been issued as a draft allowing Bam Nuttall two weeks to comment.

5.2. As both the superstructure defects and foundation defects require the guideway to be lifted the Project Manager has assessed the cost both on the basis that the guideway is only lifted once to allow all the defects to be corrected, and on the basis that the defects are corrected separately. On the former basis the assessed cost are:

- Superstructure defects: £17,594,278
- Foundation defects £6,102,141

Together with the miscellaneous defects the total assessed cost of defects is therefore £24,798,425.

5.3. In making his assessments the Project Manager has worked on the basis of the Busway being closed one section at a time to allow bus services to be maintained with the minimum of disruption. The work will take around three years to complete. Evening or weekend working is not practical given the scale of the operation. Replacing the foundations will require at least the partial removal and hence closure of the adjacent maintenance track. It may be possible for the maintenance track to remain operational during superstructure works but this will depend on the detailed working methods adopted.

5.4. The legal advisers and the independent experts have reviewed the defects, including correspondence with Bam, against the Contract requirements, and concur with the Project Manager that all of the defects are defects.

5.5. The contract states:

> *If the Contractor has not corrected a notified defect within its defect correction period, the Project Manager assesses the cost of having the defect corrected by other people and the Contractor pays this amount. (Clause 45.1 NEC 2nd Edition)*

5.6. If, as expected, Bam Nuttall do not pay the amounts assessed by the Project Manager they will be in breach of contract and this would be the primary basis on which the Council would commence legal action.

5.7. However, it would be prudent to assume that Bam Nuttall will contend that it is not necessary to rectify all of the defects and that they only need to be dealt with if and when they manifest themselves, and that it is unreasonable for the Council to recover all of the defect correction costs, despite the wording of the contract. The Council will refute this but it is nonetheless prudent to consider whether it is better to rectify all of the defects as soon as possible or adopt a reactive approach.

5.8. The Council also has a second basis for claim against Bam Nuttall for breach of contract for failing to provide the works in accordance with the works information.

> *The Contractor provides the works in accordance with the works information.*
> *(Clause 20.1 NEC 2nd Edition)*

5.9. Under an action for breach of contract the Council is entitled to claim consequential losses, such as loss of access charges, in addition to defect correction costs, but a claim made on this basis would need to show that costs were reasonably incurred.

5.10. In view of the above the technical experts have been asked to consider options for reactive repair, to make an assessment of the likely need for reactive repair, and to give their opinion on the reasonableness of adopting a reactive approach. The quantum expert has then priced these options.

5.11. It should be noted that in addition to cost it is also appropriate to take into account other associated impacts such as the disruption to passengers and maintenance track users of ongoing reactive repairs, the risks to the Council, both that the forecasts might underestimate the volume of repairs and that the volume of repairs at any one time might be too great to effectively manage, and the ongoing management and monitoring of the busway for defects.

5.12. Although it is not reasonably possible to precisely quantify the likelihood of these outcomes occurring, the expert advice has assessed a material risk that a significant number of the potential problems will emerge over the life time of the Guideway. The Council is required to consider and weigh in the balance a range of matters including the following:-

i) the potential future risks of faults emerging over the lifetime of the guideway,
ii) the impacts upon the Busway users and to the Council and indirectly to Council tax payers.
iii) the relative costs of the options for rectifying the defects.

5.13. The Contract allows for either the Contractor or Project Manager to propose that a defect is accepted and not corrected, in which case the prices or programme are adjusted. The Project Manager has been asked to consider whether it would be appropriate to accept any of these defects. The Project Manager's view is that it would not be appropriate given the substantial risks

to the guideway. The Project Manager's full response is provided at **Appendix C**.

6. EXPERT OPINION

6.1. In respect of the superstructure defects, the expert has estimated that there is a 95% probability of between 50% and 65% of the bearings displacing over the 40 year design life of the Busway. The expert also considers that the rate of failure will accelerate over time as the bearing pads become polished.

6.2. Three options for addressing the superstructure defects have been considered and details are provided in the report at Appendix A. Costing information has been prepared by the independent quantum expert and is provided in appendix B. Costs for options 2 and 3 include allowances for construction price inflation.

Option 1 Undertake pre-emptive works to correct defects. This has been costed at £17.5m. This is the option that is consistent with the defect correction requirements of the contract.

Option 2 Reactive remedial measures when necessary. That is to remediate all the defects in a 30m stretch of the guideway, which would cover 12 bearings, whenever a bearing pad becomes displaced. At an average of one per week this would take 30 years but as noted failure rates are likely to increase with the possibility of multiple failures needing to be addressed simultaneously possibly overwhelming the available resources. This has been costed at £158.5m.

Option 3 Reactive repairs when necessary. Replacing bearings as and when they become displaced and correcting lateral deflections when they occur. The cost of this option ranges from £61.5m for a 50% bearing failure rate to £80m for a 65% failure rate.

6.3. The expert concludes that '*We believe therefore that the correct and wisest solution to the inherent problems is to implement Option 1 pre-emptive remedial works. This deals in the earliest possible time (say 30 to 36 months) with the serious flaws that are causing physical damage and will continue to do so. We commend this approach to the Council as the appropriate engineering action in the circumstances.'*

6.4. In respect of the foundations the expert has considered all of the foundations on clay that are susceptible to tree roots. The expert considers that while only a small number of foundations are currently moving some 1,222 foundations do not comply with the national guidance and are therefore at some degree of risk of movement over the design life of the guideway as trees roots grow.

6.5. Bam Nuttall's design considers that the guideway beams can cope with up to 25mm of differential settlement before risk of permanent damage. Using this criteria the expert considers that there are 1,056 foundations at risk of 25mm or more movement. The expert suggests that given the conservative nature of the national guidance this might be a reasonable approach. However, there is a concern that the guideway beams are not as flexible as Bam Nuttall's design assumes and it is therefore considered that it would not be advisable to adopt this relaxation until this can be established.

6.6. Immediate action is recommended in respect of the 36 foundations already moving in the Histon area. For the remaining foundations the expert has considered three options. More detail is provided in Appendix A, with costing information in Appendix B. Options B and C include allowances for construction price inflation.

6.7. **Option A** Pre-emptive works. Consisting of removing trees within the Busway land and replacing with lower water demand trees to remove the risk of tree roots damaging foundations. All the remaining at risk foundations would be deepened. This has been costed at £12.1m on the assumption that it is undertaken at the same time as correction of the superstructure defects. This is the option that is consistent with the defect correction requirements of the contract. Note that sub options A1 and A2 referred to in Appendix A and B relate to the relaxation from the national standard outlined in 6.4 and 6.5.

6.8. **Option B** Selective pre-emptive works combined with reactive works. Removal of trees within Busway land and deepening of the remaining foundations considered to be at very high risk. A reactive approach would be taken to the remainder, which would consist of monitoring the foundations for signs of movement. Once movements exceeded an acceptable level a root barrier would be installed. Root barriers are not 100% effective and have an approximate 20 year life and would therefore need replacing. Monitoring would therefore continue and where root barriers had failed, the foundations would need to be reconstructed. This has been costed at £85m.

6.9. **Option C** Arboricultural work combined with reactive work. Removal of trees within Busway land as A and B. Reactive work on all remaining at risk foundations as described under B. This has been costed at £92.4m.

6.10. The expert states: "*In our view the best engineering solution is Option A as this option remedies the defects in the next few years. Options B and C require frequent closures of the guideway towards the end of its life to reactively remedy defects*. "

6.11. Considering both superstructure and foundation defects together the experts conclude *"In our view Option 1 with Option A represents the best engineering solution. It would avoid the enhanced technical and managerial input on the guideway for the remainder of its life associated with assessing monitoring results and arranging and supervising reactive remedial works at numerous times during the remaining life of the guideway."*

6.12. In summary the technical experts have concluded that it is best to rectify all the defects now and the quantum expert has identified that this is the least cost option. This therefore supports the contractual position in respect of both defect correction and breach of contract for failing to provide the works.

7. MEETINGS WITH BAM

7.1. Throughout the process of investigating and assessing the defects, the Project Manager has kept Bam informed. This has included issuing assessments of costs of correction in draft form for Bam's comments. Bam responded to the issuing of the draft assessment of the superstructure assessment by requesting a meeting with the Supervisor and Project Manager.

7.2. Three meetings have now taken place involving a senior Bam representative and a senior representative of their designers, neither of whom have had any precious involvement in the project. The Bam representatives have put forward an outline proposal to carry out monitoring and analysis work over the next six months. This programme concludes with 'Agree Recommended Technical Resolution'. In these discussions Bam have not accepted liability for any defects nor have they identified who would be responsible for implementing any technical resolution that was identified.

7.3. It should be noted that any contractual obligation on the Council to allow Bam Nuttall to investigate or fix the defects has long since expired; Bam have been fully aware since the settlement that the Council is taking advice on legal action regarding the defects.

7.4. On 25th September Bam Nuttall wrote to the Council referring to their monitoring proposals and seeking a meeting. The letter restates Bam Nuttall's view that '*neither the design nor the construction of the guideway is defective'.* At the time of writing legal advice is being taken on the appropriate response and our independent experts have been asked to comment on the merit of Bam Nuttall's proposals. It is possible that this work may lead to a greater depth of understanding of the failure mechanisms but given the nature of the defects it is unlikely to change the conclusions regarding the need for rectification.

7.5. Prior to allowing this or any other monitoring or investigatory work by Bam Nuttall to take place, agreement would need to be reached as to the terms under which it was carried out. There would be two key elements to this; ensuring that the results were genuinely independent and ensuring that agreeing to monitoring and investigation did not release Bam from their contractual obligations.

7.6. If Committee decide to instruct officers to commence legal action the process will be governed by the pre-action protocol, which encourages the parties to seek ways to settle their differences. This is likely to include discussions between experts for example. An agreed programme of monitoring and investigation would be consistent with this approach. The preparation of the formal claim will in any case take some months.

7.7. It is therefore considered that there is no reason to delay or defer a decision on taking legal action on the basis of Bam Nuttall's discussions with the Project Manager. Should a proposal be put forward by or on behalf of Bam Nuttall to the County Council then the decision can be revisited based on the substance of that or any other proposal.

8. COSTS OF LEGAL ACTIONS

8.1. The Council has set aside from liquidated damages deducted from BAM Nuttall a fund that has been used to date to fund the work on the Busway defects. £4.7m remains in this fund.

8.2. It is hoped that a settlement will be reached by negotiation or mediation, which could be on a cost inclusive basis, but this cannot be guaranteed. A breakdown of the estimated expenditure of preparing for a potential court case is shown in the table overleaf.

1st October 2013 – 23rd July 2014	£1 million pounds (circa)
24th July 2014 – 31st March 2015	£1.4 million pounds (estimated). This covers the period of obtaining continuing advice on the busway defects up until the issue of a letter of claim against Bam.
1st April 2015 – 31st July 2016	£2.9 million pounds (estimated). This covers the period from the issue of the letter of claim up until the commencement of the trial.
	Total estimated expenditure: £5.3 million pounds

8.3. The Council would seek to recover as much of these costs as possible, but typically, with the usual uncertainties in litigation, only 50% to 60% of costs are recovered.

9. SUMMARY

9.1. The total cost of rectifying the Busway defects is estimated at £30.7m.

9.2. Counsel and the independent technical experts agree that the defects are defects under the Contract.

9.3. The Project Manager and the independent technical experts agree that the defects should be corrected given the costs, risks, uncertainties and ongoing disruption of a partially or wholly reactive approach.

9.4. Counsel has advised that in his view Bam are in breach of contract in respect of both the defect provisions and their general responsibility to provide the works. Counsel's detailed advice on the conduct of legal action and the potential outcomes is contained in confidential appendix D.

9.5. Counsel's advice is that if the Council opts to take legal action then the first step is to resolve to rectify the defects.

9.6. Officers' advice is that the risks to the Busway and the potential costs to the Council of adopting a reactive approach to the defects is unacceptable and that the defects need to be rectified. Officers also consider that, based on experience to date, it will be necessary to commence legal action to secure a satisfactory settlement from Bam.

9.7. Litigation is never risk free, and while the facts of the case support the Council's position, the case involves some complexity, particularly around the issue of what is a reasonable course of action. In coming to a decision members will need to balance the risks of litigation against the potential future repair costs of the Busway.

10. ALIGNMENT WITH CORPORATE PRIORITIES

Developing the local economy for the benefit of all

10.1. The report identifies the costs and risks in respect of the defects to the guided busway. The Busway is an important piece of transport infrastructure

supporting the growth of housing and jobs. Ensuring its ongoing availability is therefore important.

Helping people live healthy and independent lives

10.2. The Busway is used to access employment, education and recreation. Ensuring its ongoing availability is therefore important.

Supporting and protecting vulnerable people

10.3. The Busway is used to access employment, education and recreation by people who are unable to drive or cycle, or do not have access to a car. Ensuring its ongoing availability is therefore important for these groups.

11. SIGNIFICANT IMPLICATIONS

Resource Implications

11.1. There are significant resource implications. These are detailed in the report and attached appendices.

Statutory, Risk and Legal Implications

11.2. There are significant risk and legal implications. These are detailed in the report and attached appendices.

Equality and Diversity Implications

11.3. The Busway is used to access employment, education and recreation by people who are unable to drive or cycle, or do not have access to a car. Ensuring its ongoing availability is therefore important for a wide range of people.

Engagement and Consultation Implications

11.4. Undertaking remedial works will require a programme of engagement and communication to advise and inform people regarding disruption to bus journeys and closures of the maintenance track. This would not be possible with an ad-hoc reactive approach.

Localism and Local Member Involvement

11.5. Undertaking remedial works will require a programme of engagement and communication to advise and inform local members regarding disruption to bus journeys and closures of the maintenance track. This would not be possible with an ad-hoc reactive approach

Public Health Implications

11.6. The Busway provides significant public health benefits to both bus passengers and for cyclists and walkers. Undertaking a planned programme of remedial works will be less disruptive and will ensure the longer term availability of both the Busway and maintenance track. An ad-hoc reactive approach is likely in the longer term to have a greater impact in discouraging healthy travel options.

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, 25/1/11, 22/2/11, 15/3/11, 5/4/11, 15/6/11, 5/7/11, 17/9/12, 28/5/13, 18/6/13,2 4/7/13, 9/8/13, 15/4/14	Castle Court 3 floor B wing