



**Cambridge Guided Busway
Preliminary Advice on Quantum based on
Capita Advisory Report October 2016**

PRIVILEGED AND CONFIDENTIAL

1. Introduction

- 1.1 I was instructed by Bircham Dyson Bell LLP to provide an opinion on quantum arising out of the defects identified by the Capita Report dated 11 September 2014 (“the First Capita Report”). My report dated 16 September 2014 advised on the comparative costs potentially arising from the adoption of one or other of the alternatives then presented.
- 1.2 Since that time, Capita has continued with its investigations and has now provided a further report dated 6 October 2016 (“the Capita Report”). This report develops Capita’s previously described options as a result of those additional investigations. The Capita Report relates to specific notified defects on the guided busway superstructure and notified defects to the foundations on the northern section.
- 1.3 This Advice Note is intended to update my earlier advice and considers quantum related to the revised or further options for defects rectification now described by the Capita Report.

2. Overview of the Remedial Schemes

- 2.1 The nature of the defects is set out in some detail in the Capita Report and is not repeated here. The options for remedial works are described at paragraph 164 of the Capita Report. Briefly, they are as follows:
- (a) Option 1: To alter the guideway ladder construction and design by providing restraint to bearings/shims and tying the fixed joints together with a gap to permit rotations and avoid spalling. This approach will require all foundations

to comply with the full NHBC depths. Further, some shimming to limit rocking of the guideway ladders is likely to be required to an unpredictable extent. Lateral restraint at all guiderail joints would be required in addition to the bearing/shim restraint. The nature of these works is indicated in Capita's Drawing Nos 1 to 6 appended to the Capita Report. This is Capita's recommended approach.

- (b) Option 2: Adopt a reactive approach such that the remedial works outlined in Option 1 are only carried out when bearing and/or shim loss and/or rocking of the guideway ladders occurs and/or lateral steps at joints becomes excessive such that emergency works are thereby required.
- (c) Option 3: Adopt a reactive approach to the remediation of the guideway ladders outlined in Option 1 but undertake no remedial works to the foundations (in order to minimise disruption to busway operations). If required, due to settlement of the foundations, a concrete block may need to be installed between the elastomeric bearing pad and the foundation.

- 2.2 As stated at paragraph 170 of the Capita Report, there will be other defects that will require to be addressed irrespective of which remedial option is adopted. This includes repairs to concrete spalling, filling of cracks and drainage work. These further remedial works have been assumed as necessary, and that they will be required for each Option.
- 2.3 Capita also recommends that an inspection regime be implemented based on the adopted remedial option. Inspection would be carried out twice per annum for Option 1 and four times per annum for Options 2 and 3.
- 2.4 Costing of the remedial works has therefore been considered in terms of establishing the costs of Option 1 as a base cost, to which is added the cost of the other defects mentioned above (spalling, cracks, drainage, etc.,) and the costs of the inspection regime. This addresses what is known as the "Grand Unified Defect" ("GUD").
- 2.5 The costs produced in respect of Option 1 have then been utilised to provide a basis for establishing the likely costs of Options 2 and 3. This has been done by factoring requirements for low, medium or high repair intensity against the Option 1 costs given

Capita's inability to predict the precise requirements and incidence, and therefore the sequence, in which works would need to be carried out.

3. Sources of Information

- 3.1 I have been provided with a copy of the calculations previously prepared by Faithful and Gould (F&G) on each of the GUD defects. Their work is based in part on actual costs produced by Ekspan when carrying out emergency maintenance work. This therefore provides a reasonably reliable basis for consideration of the further costs of rectification.
- 3.2 F&G has also considered the sequencing of the rectification work and has identified associated productivity levels.
- 3.3 Whilst F&G's calculations do not correlate exactly with the Capita Report, I have, where appropriate, utilised those calculations as the starting point for my own view of the defects rectification costs.

4. Assumptions

- 4.1 I have assumed that replacement of existing shims and bearings, as described by the Capita Report, are rectified once done, and that any further replacement due to wear and tear is to be regarded as continuing maintenance that would always have been required. The cost of such maintenance work does not therefore form part of the figures I have prepared.
- 4.2 As discussed in my 2014 report, I have assumed that inflation will continue to outstrip credit interest.
- 4.3 My previous advice was to treat the estimate of construction inflation applied to the principal or capital sum arrived at as a net rate. This is because interest rates continue to remain at very low levels and they are probably unlikely to rise significantly in the near future. I continue to recommend that the Council treats costs as not subject to any substantial discount for net present value (NPV) and to allow for the full sums stated under Options 1, 2 and 3.

5. **Option 1**

5.1 This option is described at paragraph 164(i) of the Capita Report. As stated this represents the GUD because it addresses in one operation many of the defects identified in the guided busway. In summary these comprise:

- (a) Defect 267: Guideway joints narrower than design.
- (b) Defect 269 Gaps at Guideway fixed joints (addresses generally by defect 294).
- (c) Defect 279: Displaced beam at Chainage 2308.
- (d) Defects 282 & 283: Step detail between type 1 & 2 beams.
- (e) Defect 284: beams installed with consecutive free ends and without alternative longitudinal restraint.
- (f) Defect 287A: Bearing displacements and consequential guideway vertical displacement.
- (g) Defect 288: Beam joint relative horizontal displacement defects.
- (h) Defect 289: Guideway beam/upstand cracking and guideway durability.
- (i) Defect 290: Horizontal load capacity of Screwfast piles.
- (j) Defect 293: Longitudinal restraint (included in Defect 294).
- (k) Defect 294: Horizontal load of support bracket.
- (l) Defect 295: Non-functioning infiltration drains at Bridge Road Bridge.
- (m) Defect 016A: Guideway shallow foundations.

(n) The Capita Report identifies 833 locations at which foundations are to be remediated. This is substantially more than previous estimates and the costs have been allowed for accordingly.

(o) Additionally the costs for this Option include the estimated costs of rectification of guide rail spalling, the costs of which were not previously provided for by any of the above defects.

5.2 I have assumed for the purposes of Option 1 that closure of each section of the guided busway will be required for up to six months at a time while work is carried out, with an overall programme lasting approximately 4 years commencing in 2018 for three years after completion of necessary design and procurement activities. It will be a matter of judgement for the Council whether and to what extent this is more or less disruptive to the travelling public as a whole than Options 2 or 3.

5.3 My estimated cost of Option 1, including an allowance of 4% per annum construction inflation over the period from now to likely completion, based on discussions with Capita and Faithful & Gould, is approximately £36,500,000.

6. Option 2

6.1 This Option is described at paragraph 164(ii) of the Capita Report. It involves carrying out GUD works described by Option 1 on a reactive basis but only when emergency works are required. It provides for an unplannable repair regime which could be expected to occur over most of the remaining 35-year life of the guideway.

6.2 I have therefore developed three levels of “repair intensity” which I have described as low, medium and high. Low intensity repairs assumes that groups or batches of repairs can be carried out together and provides for the least disruption in working and passenger inconvenience. Medium intensity allows for the works to be carried out in a more fragmented manner, whereas high intensity represents the most fragmented manner of working.

6.3 It will be appreciated that any estimate of the costs involved is sensitive (and vulnerable) not only to the incidence of future failure, but also to construction inflation.

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- 6.4 My estimated cost for Option 2 including an allowance of 4% per annum construction inflation to the mid-point of the programme is approximately £102m to £128m in respect of low and medium intensity respectively, but it might be as high as £164.5m in the event that work is carried out under high intensity conditions.

7. **Option 3**

- 7.1 This Option is described at paragraph 164(iii) of the Capita Report. It too involves carrying out GUD works described by Option 1 on a reactive basis, but only when emergency works are required. However, no remedial works to the foundations would be undertaken under this Option in order to minimise disruption to busway operations. It also again provides for an unplannable repair regime which could be expected to occur over most of the remaining 35-year life of the guideway.
- 7.2 I have computed the costs of this Option in the same manner as for Option 2, using low, medium and high intensity conditions.
- 7.3 As for Option 2, it will be appreciated that any estimate of the costs involved is sensitive (and vulnerable) to not only the incidence of future failure but also to construction inflation.
- 7.4 My estimated cost for Option 3 including an allowance of 4% per annum construction inflation to the mid-point of the programme is approximately £74m to £91m in respect of low and medium intensity respectively but it might be as high as £119m in the event that work is carried out under high intensity conditions.

8. **Summary**

8.1 The comparative costs of each Option are set out in the table below.

Option	Estimated Cost (£)
Option 1	£36,500,000
Option 2 – Low Intensity	£102,000,000
Option 2 – Medium Intensity	£128,000,000
Option 2 – High Intensity	£164,500,000
Option 3 – Low Intensity	£74,000,000
Option 3 – Medium Intensity	£91,000,000
Option 3 - High Intensity	£119,000,000

8.2 I would emphasise the preliminary nature of this advice and the many variables involved. Whilst there is a degree of contingency and allowance for risk included in the estimates, there can be no warranty or reliance attached to these figures, particularly for those involving the "if and when" solutions provided by Options 2 and 3.

8.3 The technical proposals now provided in the Capita Report together with the work undertaken by Faithful & Gould should provide increased confidence in the estimate of likely costs for Option 1.

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