
To: Cambridgeshire and Peterborough Combined Authority &
Greater Cambridge Partnership

Date: 25 March 2019

Author: Edward Leigh

Subject: Combined Authority Board meeting 27 March 2019, agenda item 4.2 on
Cambridgeshire Autonomous Metro Strategic Outline Business Case

Contact: 01223 312 377 / edward@smartertransport.uk / [@SmarterCam](https://twitter.com/SmarterCam)

Smarter Cambridge Transport offers the following observations and questions regarding the Strategic Outline Business Case (SOBC) for the Cambridgeshire Autonomous Metro (CAM), authored by Steer.

We have deep concerns about the economic case for CAM, which relies on a highly unconventional methodology to demonstrate value for money. Using the Department for Transport's standard appraisal method, CAM represents 'poor value for money'. But we believe this does not take into sufficient account the huge technical, engineering, management and operational risks that could well result in spiralling costs and delays. For these reasons **we strongly recommend the strategic outline business case be peer reviewed**, using the remaining budget for the SOBC, before proceeding to commission an Outline Business Case. We further recommend that the company selected to do this should be outside the UK transport consultancy ecosystem to avoid conflicts of commercial interests and loyalties.

Should that review confirm our concerns, we recommend a reconsideration of options.

When assessing the case for CAM, it should be borne in mind that CAM is a response to failures of public transport, in particular buses. As Greater Cambridge's residential and working population increases, so the demand to travel increases. There are two solutions: build more capacity or use existing capacity more efficiently. CAM will add capacity to cope with peak demands, but at vast expense. Combined Authority and Greater Cambridge Partnership schemes to date have barely examined the options for increasing transport efficiency, even though it would lead to wider benefits in the urban realm and public health. In light of the weak economic case, huge cost (£3.7–4.5 billion, up from £1.5–1.7 billion in the Mass Transit Options Assessment), and high uncertainty over cost and time scale, we do not believe that CAM, on the scale currently envisaged, is an appropriate use of public money.

CAM will not open until 2029 at the earliest. It is therefore not a solution to the problems Cambridge faces today – or for the next ten years at least. What will we do in that time? How will that change the requirements for CAM? We urge the Combined Authority to engage with the public urgently to develop a complete vision and strategy for the short- to long-term.

General observations

The Strategic Outline Business Case (SOBC) lacks detail and clarity in many crucial respects, and fails to justify many of the assumptions and decisions that have led to the recommendations it makes.

1. The content of the SOBC is almost entirely derived from desk-based research, repackaging information readily available in the public domain. There is little in the way of detailed interpretation or tailoring to the brief; little in the way of technical detail; key assertions are not evidenced and referenced; calculations do not show crucial inputs and assumptions. **Has the board had sight of supporting documentation, workings and evidence sufficient to satisfy itself that it can make a fully informed decision to proceed to an Outline Business Case?**
2. At around £500,000, this report appears to represent even poorer value for money than the Mass Transit Options Assessment report (£153,525). **Is the board satisfied that represents good value for taxpayers' money?**
3. There is a lack of clarity about the opening year: 3.84 states 2029, but Figure 6.1 shows mid 2030. **What is the range of expected opening dates, allowing for all uncertainties?**
4. The key component of CAM is the tunnels; without those, there is access only to Cambridge and Cambridge North stations. The tunnels are not due to be completed until, at the earliest, 2029. **Even if CAM is the right long-term solution, what is the solution for the next ten years? To what extent will the medium-term solution obviate the need for at least some of CAM?**
5. The Waterbeach New Town branch of CAM connects to Cambridge North, replicating a mainline rail connection. **What is the justification for creating competing infrastructure?**
6. The Mildenhall branch of CAM connects runs parallel to the Cambridge–Ipswich mainline, which is due to be upgraded as part of East-West Rail. Kennett station is just 8km (5 miles) from Mildenhall, and would be an obvious railhead to use. **What is the justification for creating competing infrastructure?**

Design and operational safety

CAM is based on a unique combination of technologies and engineering challenges, such as optical guidance at speed and in tunnels, platooning of passenger vehicles, and high-frequency merging and crossing of vehicles at underground junctions. There are large time and cost risks associated with any project depending on this degree of innovation. These should be acknowledged and quantified before proceeding further.

7. The claim that “optical guidance systems are well-proven, and the technology has been in operation in several European cities since the early 2000s, including Rouen, Nimes, Bologna, Castellon and Essen,” may be overstated. We are unaware of any application of optical guidance at the top speed proposed for CAM (88kph) and in tunnels. Siemens' Optiguide

(which seems to have been discontinued) and CRRC's ART both have top speeds of 70kph.

Which specific proven guidance technology is Steer benchmarking performance and costs against?

8. One of the advantages of rail-based transport in tunnels is that they can run to very tight tolerances, reducing the required tunnel diameter, and hence cost. Any tyre-based vehicle will require some kind of physical guidance mechanism, at least as a backup (e.g. in the event of failure of the guidance or steering system, or a tyre deflation). **Has this design requirement been considered and costed?**
9. There is no mention of the hurdles and risks relating to safety certification for an optical guidance system that would be the first of its kind in the UK. There will be particular scrutiny of the performance and backup protection systems when operating in tunnels. **Why does the report omit these significant project risks?**
10. Any vehicle operating in a tunnel must have a safe means of evacuation. Under current safety regulations, that means having a walkway alongside the track/roadway. **What tunnel diameter has been specified as part of costing construction?**
11. The tunnels will require ventilation and filtration systems (the particulates from tyre and brake wear now being a suspected health hazard) to maintain a safe atmosphere and temperature. **Are costs for this included in the estimates?**
12. 2.143 indicates that 36 vehicles per hour will pass through the inner core. This is equal to the frequency of trains on the Victoria Line in London. That requires the most advanced Automatic Train Operation system in the country. It is also a single line with no trains merging at junctions. In 2.157, it is further claimed that CAM could carry up to 60 services per hour. **Has the specification, design and implementation of a suitable path control system for CAM been included in the costs?**
13. 2.146 states that interchange at the city centre station "will be achieved via a same-platform interchange". This implies that there will be just two tunnels between the city centre station and Cambridge railway station. This also means that services will be merging and potentially crossing paths at the underground junctions. **Will these junctions be split-level to avoid vehicles crossing? If so, has the construction cost been factored in? If not, has the performance constraint been factored in?**
14. 2.157 indicates that CAM will initially use 18m single-decker articulated vehicles. Until the tunnels are open (in 2029 at the earliest), these will have to run on the surface, mixing with ordinary traffic, cycles and pedestrians. No bus stops in the Cambridge are designed to accommodate articulated buses. Many of the streets are narrow with tight corners, making dangerous conflicts with people walking and cycling inevitable. **Why does the report make no mention of these safety concerns?**
15. There is no detail of the route alignments, in particular of the tunnels, and associated constraints. New buildings have been consented or planned at Cambridge and Cambridge North stations, Waterbeach, Cambourne and elsewhere. **Is the board satisfied that the**

locations identified for stations and portals are secure from obstructive development in the short term?

16. The population within walking distance of the 19 stations shown on indicative route maps is a fraction of the region's population. **Will more stations be added, to serve intermediate villages? How will this affect the cost?**
17. There is no mention of how CAM will integrate with other transport modes and hubs, in terms of physical interchanges, intermodal ticketing, timetabling and information. **These are all essential, but are they costed?**
18. There is no mention of climate change and how CAM is part of a response to that, and how its design will be adapted to cope with more frequent extreme weather events, such as floods and sustained high temperatures. **What are the cost implications of incorporating this resilience?**

Economic appraisal

The core scheme construction cost is estimated at £1.55 billion. Operating and maintenance costs are estimated to be £25–30 million/year. Revenues are forecast to be £30–35 million by 2031, based on 15–18 million one-way trips per year. The core social benefits are estimated to be £520–645 million/year (2010 prices).

This appears to give a benefit-cost ratio (BCR) of 0.34 for the core scheme, and 0.28 with the 'outer corridors'. Core social benefits of around £3 for every £10 spent are 'poor value for money' by HM Treasury's ranking. The 'Level 2' benefits raise the BCR to, respectively, 0.64 and 0.53, which is still below break-event. The 'Level 3' benefits are highly speculative.

19. The reference case should be based on a reasonable assessment of what would happen if CAM did not go ahead, which would most likely include transition to all-electric buses, development of rural travel hubs, congestion charging, bus franchising, bus priority schemes, expansion and intensification of the local cycle network, etc. **What in detail is the scenario against which CAM is being assessed?**
20. 3.77 indicates that the GCP 'inner corridor' schemes are excluded from the costs and benefits used to assess CAM. **How have benefits been apportioned between CAM and 'inner corridors'?**
21. The 'initial' or conventional BCR is not stated anywhere, but appears to be in the region of 0.3, i.e. £3 of social benefit for every £10 spent. **Could the value calculated by Steer be revealed, along with the component benefits?**
22. The Level 2 benefits are estimated at almost 100% uplift. By comparison, Crossrail's Level 2 benefits amounted to only a 57% uplift.¹ **Has Steer provided supplementary evidence**

¹ [Crossrail Business Case Update – Summary Report, July 2011](http://www.crossrail.co.uk/route/wider-economic-benefits) – available from <http://www.crossrail.co.uk/route/wider-economic-benefits>

- supporting the optimistic forecast? In particular, what agglomeration elasticity has been used?**
23. Workers are significantly more productive in London than elsewhere in the country.² Therefore, the productivity increase accruing to agglomeration around Cambridge should be offset by a reduction in productivity for those workers moving from London. **What allowance has been made for productivity losses for job displacement from London?**
 24. The methodological basis for the huge Level 3 benefits claimed is highly contentious. WebTAG provides no framework for appraising international effects. It recommends that additionality models are appropriate only for small-scale schemes, and must be sensitivity-tested against a wide range of assumptions. **Has the Department for Transport or HM Treasury reviewed the methodology?**
 25. WebTAG does not admit 'Level 3' benefits into the calculation of a BCR. They are to be used exclusively for 'switching value analysis' or 'what if?' scenarios. **What exceptional justification is there for including these in the BCR?**
 26. The optimism bias of 66% used in the appraisal is based on analysis of similar projects already completed. CAM is unprecedented in many ways, with many unquantifiable 'unknown unknowns', possibly warranting a higher uplift. Allowance must also be made for uncertainty about the timescale for delivery. **What risk analysis has Steer conducted, and what are the estimated confidence intervals for costs and timescales?**
 27. Construction of CAM, especially the tunnels and converting the guided busway, will be highly disruptive, at huge economic and social cost over many years. **Have these costs been factored into the appraisal (under Transport Economic Efficiency)?**
 28. The report includes no mention of the robustness or sensitivity of the modelling to exogenous events, such as Brexit, economic recession, climate change, large-scale floods, etc. For a project of this scale, these risks are highly significant. **What sensitivity tests has Steer conducted?**
 29. The carbon 'cost' of building CAM is substantial and must be offset against future carbon 'savings'. **What is CAM's net carbon footprint?**

Financial case

30. The financial case simply sets out options with no proposal for how these might be assembled into a package adequate to finance the construction and any operating subsidy requirements for CAM. **What is the likelihood that a viable, long-term funding package can be assembled?**
31. 3.138 states that "operating costs and incremental revenues for the 'Greater Cambridge' network broadly balance." 3.26 sets out the proposed service level: "Core Monday to Saturday operating hours of 5AM to Midnight, with a service of at least six services per hour

² Subregional labour productivity indices, available from [ONS](#).

at every CAM stop (except for the first and last hour of operation).” To run an extensive, highly available rural service without subsidy would be unprecedented, probably anywhere in the world. **What evidence is there that CAM will be profitable?**

Alternatives

Some elements of CAM are likely to be desirable in the long term, but the brief must be right. Spending at least £1m to develop an Outline Business Case for a scheme that has no hope of economic viability would be wasteful of precious public money. The brief should be rewritten in light of all the evidence available and opportunities identified to date.

32. The Mass Transit Options Assessment³ and this report failed to follow Section 2.8 of WebTAG: *The Transport Appraisal Process*⁴ by only assessing large-scale infrastructure solutions. Other options exist, in particular bus franchising and technology could transform public transport provision and integration far more quickly than CAM. **Will the board commission a comparative review of CAM that considers options that may be delivered more quickly and cheaply?**

33. The Eddington Transport Study,⁵ referenced in WebTAG, is still relevant, in particular these extracts:

1.42 As transport contributes around a quarter of UK emissions and is the fastest rising source of carbon emissions within the economy in the near term, addressing the challenge of climate change has important implications for any long-term transport strategy. I support Stern’s⁶ conclusion that **urgent action is needed, through pricing, technology and innovation policy, and promoting behavioural change, to influence the behaviours and consumption choices of society....**

1.99 Figure 11 [below] highlights that, typically, **smaller projects offer the highest returns**, since they can be targeted at specific bottlenecks on the transport system at relatively low cost.... Furthermore, **such projects often have lower noise and landscape impacts, so their environmental impact can be considerably less than a new piece of infrastructure....**

1.101 ... ‘better use’ measures can offer economic benefits, including schemes to **manage traffic flow and enhance the use of existing capacity on the strategic and urban road network**, e.g. through high-occupancy vehicle lanes and urban traffic control centres. ... the schemes that have been analysed do suggest considerable potential, with wider BCRs above 5:1. Smart measures also have the potential to offer high returns....

³ Greater Cambridge Mass Transit Options Assessment Report by Steer Davies Gleave, published January 2018.

⁴ [WebTAG](#) is the Department for Transport’s guidance on the appraisal (pre-opening evaluation) of transport schemes, an overview of which is set out in [TAG Transport Appraisal Process](#).

⁵ The [Eddington Transport Study](#), commissioned by HM Treasury and the Department for Transport and published in 2006, examines transport’s role in sustaining the UK’s productivity and competitiveness.

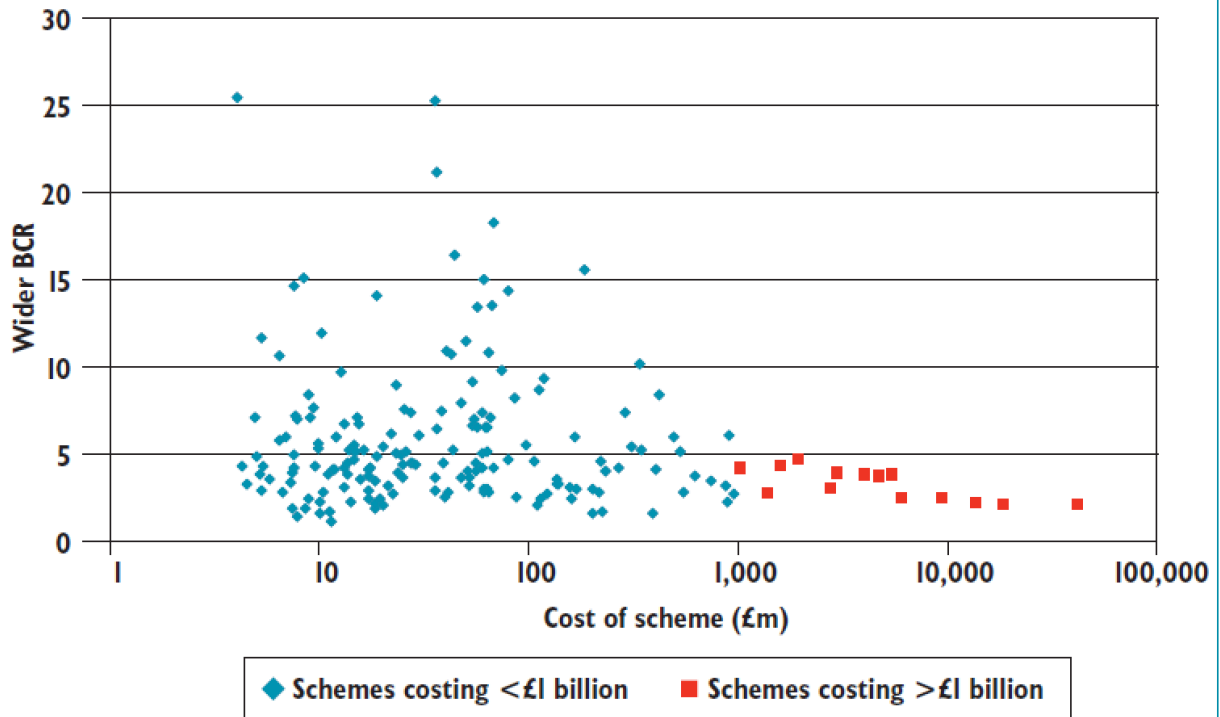
⁶ [Stern Review on the Economics of Climate Change](#)

- 1.145 ... government needs to get the prices right across all modes – especially **congestion pricing on the roads** and environmental pricing across all modes;
34. Franchising,⁷ integration and increased subsidy of bus services can transform the usability and quality of provision more quickly and cheaply than any other intervention.
 35. The existing road capacity is, in most places, adequate to current and future needs; it just needs to be used more efficiently. If about 15% of trips currently made by car were instead made on foot, cycle, bus or train, there would be very little road congestion.
 36. 24% of car trips are under 2 miles, and 58% are under 5 miles.⁸ Most of these trips could be made on foot, cycle or bus.
 37. The claim in 2.114 that “Cambridge’s rail station will remain ... a bus journey along a congested corridor with little further potential to enhance journey times or reliability (Hills Road)” is untrue. It would be possible to re-route general traffic in such a way as to reduce congestion between Station Rd and Regent St. Not only would this be desirable to improve bus reliability, it would make possible a great improvement to the urban realm along this stretch of Hills Rd.

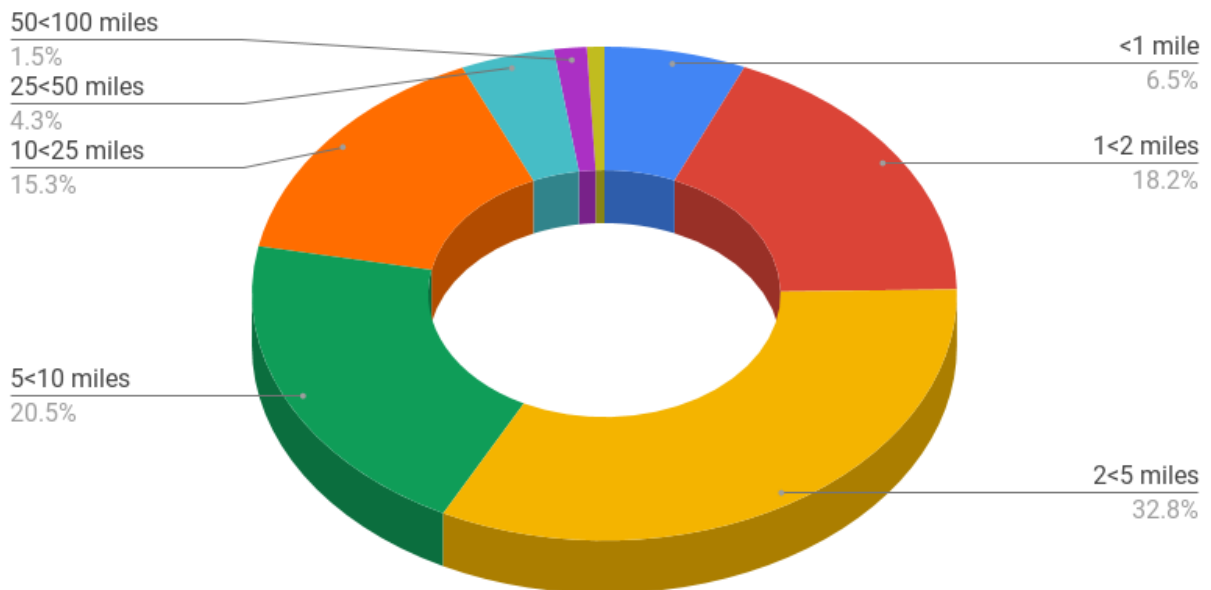
⁷ See Department for Transport guidance [Bus Services Act 2017: bus franchising creation](#)

⁸ Department for Transport [National Travel Survey 2017 NTS0308](#)

Figure II: Economic returns of smaller schemes relative to larger schemes (greater than £1 billion)^a



^a Costs are on a log scale
Source: DfT.



Trips by car broken down by trip distance (Department for Transport NTS0308)