Report to Cabinet Member for Highways and Infrastructure

Report title:	Broadland Northway – Lessons Learnt
Date of Briefing:	17 October 2019
Responsible Cabinet Member:	Councillor Martin Wilby – (Cabinet Member for Highways and Infrastructure)
Responsible Director:	Tom McCabe – (Executive Director, Community and Environmental Services)
Is this a key decision?	No

Executive Summary

The Broadland Northway project, one of the largest local authority delivered highways schemes, has been open in full to traffic since April 2018. With the main construction works finished (which represented the biggest risk to the budget) the project is expected to be within the £205 million budget that was reconfirmed in November 2017. Although the project cost is an important measure of success, the long term social and economic value such infrastructure will provide to our county should also be recognised.

This report seeks to confirm the budget position of the project since it was completed and presents the lessons learnt along the way. It is important to look back throughout the life of the Broadland Northway delivery to inform and improve upon future infrastructure projects – something that has already been put into practice with the Great Yarmouth Third River Crossing (GY3RC).

It is recognised that investment in infrastructure has a positive effect on the economy and remains an important part of the council vision. Evaluating the outcomes of the finished Broadland Northway will be covered in a separate paper but here we look at the commercial aspect, addressing some of the factors which impacted the budget throughout the delivery of the project.

Major projects are subject to numerous variables which mean they can often overrun and go over budget. A recent report by Mace estimates 80% of major infrastructure projects globally are over cost or time. Another report by the Institution of Civil Engineers (ICE) found that, in a study of 25 infrastructure projects delivered between 2009 and 2018, the average increase between the tender price and project cost was 79.8%.

The Broadland Northway had to contend with a variety of issues which are covered in this paper. There have been lessons learnt along the way and some best practice to share. These should help close the gap between early estimates and final cost and in turn help us in the planning and delivery of future infrastructure projects. These lessons learnt have already been applied to other major schemes and endorsed by recent audit.

Actions Required

- 1. Note the conclusion of the project is within the revised budget of £205 million.
- 2. Note that the lessons learnt from the delivery of the project are already being applied to the Great Yarmouth Third River Crossing project and will be utilised for future schemes.

1. Background and Purpose

- 1.1. In November 2015, following a budget review that took place before main construction began, the County Council agreed a budget for the NDR of £178.951m. This was more than the estimate of £148.5 made in 2013 and largely down to changes in the construction market and changes in scope, which included design development costs and changes in design standards. The revised construction costs provided by the contractor were deemed reasonable after being assessed by an independent consultant and comparing prices to construction on the A11. The Department for Transport and the Local Enterprise Partnership contributed £10m each to help meet the new budget forecast. The County Council contributed an additional £10.4m.
- 1.2. The main construction started in April 2016 and due to the complex nature of the project there were a variety of risks identified that would ultimately impact the cost of delivery. These included ground conditions, utilities diversions, land acquisition and working near a rail line. These risks, which escalated after the construction commenced, were reported to the Environment, Development and Transport (EDT) Committee in September 2016 and warned of an estimated additional cost of £6.8m should these risks be realised.
- 1.3. In the same month our main contractor provided a more comprehensive out-turn cost forecast which confirmed this financial pressure and the £6.8m budget risk was reported to November 2016 EDT committee. On 20th February 2017, as part of its budget setting process, the County Council resolved to increase the NDR Budget by a further £6.8m to £185.751m to address the risks identified.
- 1.4. The project team continued to monitor the risks throughout construction. In November 2017, Policy and Resources Committee considered a financial management report which included an update on the NDR's financial position and the cost pressures outlined in Table 1 (see below). They resolved to recommend a budget increase to £205m. In December 2017 the County Council resolved to approve this new NDR budget.
- 1.5. In total, the original budget was increased by £26.049m since the budget was set in November 2015, an increase of 14.56%. A report by the Institution of Civil Engineers titled 'Reducing the Gap between cost estimates and outturns for major Infrastructure Projects' found that major infrastructure projects like this are often over the initial budget because of a variety of cost pressures.
- 1.6. A significant cost pressure resulted from delays encountered in the completion of utility diversions, which then had an impact to the main works. There were over 80 utility diversions required for the project, many of which were delivered to plan, but those that were delayed caused notable delays to construction sequencing of the main works whilst awaiting the utility company attendance on site. Unfortunately, regardless of planning and forward works ordering, it was not possible to re-coordinate all works, and works could not be completed by other third parties. We also became aware that there was a national shortage of specialist welders for gas pipe diversion works required at a number of locations, which also delayed things significantly.

1.7. There were also numerous minor changes throughout the project to respond to issues identified relating to environment, landowners, additional traffic management provisions, and safety provisions, all of which also generated impacts to the delivery programme, with associated cost increases to the project. These were detailed in a report to EDT Committee in November 2017 and are summarised in Table 1 below.

On the other side, there were also numerous changes made throughout the project which had a positive effect on cost, including changes to the delivery of the landscaping works.

Environmental	Archaeology, site clearance, testing and other non-specific elements. This includes changes to address a range of environmental issues, extended archaeology requirements (WW2 crash site at Rackheath) and additional testing requirements
Ground conditions and earthworks	Including revisions to topsoil strip (extra depth), backfill to structures, soft spots, contamination encountered, and an increased requirement to mitigate risk associated with unexploded ordinance
Drainage	Changes to sections to avoid clashes with previously unknown utility apparatus and redesign to avoid utility apparatus not at expected levels. Some amendments to improve drainage operation to mitigate future maintenance issues
Fencing and vehicle restraint system	Changes resulting from final agreements with landowners in respect of permanent fencing types, plus other detail changes
General highway details	Changes to surfacing, kerbing, accesses, traffic signs, road markings, tie in details, alignments and as a result of safety audits recommendations
Airport	Revised accommodation works to fencing and works within Norwich Airport
Traffic management	Changes in the planned delivery approach to respond to/minimise disruption to the works and to the public

Table 1: Project Chan	nges
-----------------------	------

1.8.	Table 2 below summarises the effects of the above changes on the cost of the
	scheme.

Cost element	Estimated Value (November 2017 - £m)	Comment	
Rackheath Rail Bridge	£2.764	Delays in getting approval from Network Rail and changes in construction approach.	
Land Costs	£1.506	Final position depends on on- going negotiations with various land agents/owners.	
Earthworks balance	£2.018	Redesign of the earthworks delivery logistics, maximising site won materials.	
Unseasonal rainfall	£1.195	NCC share of weather impacts.	
Utility diversions	£6.151	Outturn cost increases and impact to main works, including accommodation works.	
Managing project change	£1.639	Direct cost to NCC of detailed design and construction changes.	
Ground stability	£3.859	The need to change design to stabilise embankments for structures.	
General construction	£5.274	A range of environmental, drainage, fencing, traffic management and safety issues.	
Changes to bridges	£1.821	Detail design changes, construction sequencing and changes to reinforcement across all the bridges.	
Landscaping	-£0.635	Balance of saving through direct appointment of GYB Services to provide the landscape planting which will be concluded in 2019/20.	
Risk	£0.457	Rebased risk assessment with a transfer from risk to construction.	
Sub-total	£26.049		
Original Budget Total Revised Budget	£178.951 £205.000		

Table 2: Budget Changes

2. Forecast and Final Accounting

- 2.1. The current forecast is that the overall project cost will be £204.817m. However, as negotiation with land agents/owners has yet to be concluded, there remains some risk that may impact on the final cost, as the position could see movement up or down. However, based on completed land costs to date, the allowances made in the budget to cover these costs are considered reasonable. Negotiations are also based on the date of original possession of the land (i.e. 4 January 2016), so this is not impacted by inflation.
- 2.2. Table 3 provides a detailed comparison of the revised budget allocation and the current forecast outturn. This table also details the level of forecast cost remaining in the overall forecast outturn.

Budget Head	Revised Budget Allocation	Actual Cost	Cumulative Forecast
Construction	£128.111	£133.072	£133.630
Statutory Undertakers	£6.837	£6.932	£6.974
Land Cost	£18.706	£11.829	£18.528
Preparation	£14.988	£14.917	£14.921
Risk and Contingency	£5.718	£0.000	£0.159
Supervision	£2.939	£3.034	£3.078
Postwick	£27.700	£27.527	£27.527
Total Revised Budget	£205.000	£197.311	£204.817

Table 3: Revised Budget v Cumulative Forecast

3. Commercial issues (forecasting and final account)

- 3.1. Following the opening of Phase 2 (A140 Cromer Road through to the A1151 Wroxham Road) in December 2017, the contractor re-cast their forecast out-turn costs, which projected a significant increase that would have resulted in the revised budget (at £205m) being exceeded. The significant increase in the contractor's forecast was submitted without any warning or indication that their costs were escalating to the extent forecast. Consequently, confidence from the NCC commercial team in that revised forecast was low.
- 3.2. The contractor's revised forecast, along with other parties cost forecasts were scrutinised and challenged with sizable portions of cost being reduced over time. In addition to this, lengthy negotiations ensued with the contractor, looking at efficiencies and mitigation measures to ensure the project could be delivered within the revised budget. Whilst significant risks remained, the contract and final account negotiations culminated on 14th February 2019 when the final account was agreed and signed. This gave greater confidence that the entire project could be delivered within the revised £205m budget allocation and was reflected in financial reporting to Committee the following month.
- 3.3. As part of the review of the contractor's final account, the assessment and agreement of 361 compensation events was undertaken. Compensation events are submitted by contractors where the cost of work, or the time to complete it, has changed which was no fault of their own. Often this means contractors may

be entitled to more time or money (or both). Since the start of the construction project a total of 1304 compensation events were assessed by the project team. This allowed the team to audit the actual costs to ensure compliance with the contract and prevented incorrect charges coming out of the budget. As a result of these negotiations approximately £2.5m was excluded from the final account agreement.

4. Lessons Learnt

4.1. Major projects are invariably complex, often involving a large supply chain, considerable and varied stakeholder interests, along with detailed specification, contract and commercial considerations. As a result, major projects can be delivered at costs over the initial budget estimates.

The Broadland Northway faced a number of third party, design, and delivery performance challenges, ultimately leading to significant commercial and financial pressures. Some of these were upheld, others successfully challenged. This section captures the key learning points taken from a project review and puts them in context for their application for future projects, notably, the current Great Yarmouth Third River Crossing (GY3RC) scheme.

4.2. Resourcing

- i) A fundamental learning point taken from the Broadland Northway is that early project investment, and therefore resource, is essential in laying the foundations for future development and delivery work. Preparation of suitably robust contracts and specifications should reduce the occurrence of change and avoid the resultant costs of revision and disruption. In turn, projects will benefit from reduced administration costs, a more efficient delivery, and greater predictability of outturn.
- ii) Confirmation of funding drives a major escalation in project development activity. The step-change to detailed planning and construction preparation is significant, and inevitably tied to a demanding programme of delivery goals. In recognition of the challenges faced during the delivery of the Broadland Northway we have resourced our Major Projects delivery team to ensure we are better positioned to meet the needs and demands of these projects.

4.3. <u>Contract strategy</u>

- i) The Broadland Northway project utilised a modified NEC 3 Engineering Construction Contract, based on the target price Option C. The original contract was awarded to Birse Civils Ltd early in 2009, following a procurement process carried out during 2008. Later, the Birse Civils Ltd company title was changed to Balfour Beatty Civils Ltd, which was the parent company, and this didn't affect the terms of the contract. The contract included NCC and the Contractor sharing a pain/gain incentive. Industry feedback continues to support utilisation of the NEC suite of contracts for large highway and civil engineering projects, and accordingly the GY3RC project has utilised the latest NEC 4 revised form.
- ii) There was an extended period of project development as part of the stage 1 (design development) component of the 2-stage contract. This resulted in a longer than anticipated period between the award of contract in 2009 and the instruction to commence the construction works (stage 2 of the

contract) for Broadland Northway at the end of 2015. There was a notable advantage that the contract did allow for the construction works to be delivered in stages and the Postwick Hub junction was commenced separately in 2013 following the conclusion of the statutory processes for this element. However, the delay due to protracted statutory approvals for the main Broadland Northway works (compounded by changes to legislation and a national spending review and need to re-establish project funding), did result in the original terms of the contract being undermined by significant changes in the construction sector over that period. Related implications of this are set out below and addressed in some of the revisions being adopted in delivery of the GY3RC.

- iii) The GY3RC contract is a 'design and build' performance arrangement, reflecting the need for specialist bridge engineering skills, but also giving the contractor ownership and responsibility for the fully integrated design and delivery of the works. This approach reduces NCC exposure to the risks inherent in a project of this nature compared with that experienced with the delivery of the Broadland Northway. The contractor involvement and risk transference relating to responsibility for the design for the GY3RC should reduce the number of unknowns (or identify them at an earlier stage), but regardless will transfer the risks associated to the contractor. At the same time this approach seeks to capitalise on market innovation and expertise.
- iv) The GY3RC procurement strategy was further supported through competitive dialogue with bidders. Considered good industry practice, ongoing bidder engagement helps to ensure that the project objectives are understood and draws out potential issues for early resolution. This approach allows bidders to develop their outline design solution, and at the same time affords flexibility in detailing the final contract and specifications. Ultimately, it is the aim to start the formal contract on a mutually agreed and understood basis; a lesson directly taken from the Broadland Northway.
- v) As used for the Broadland Northway, the GY3RC contract is also incentivised. This is structured to ensure there is bid submission accuracy with initial target cost when developed, and through a target price pain/gain share relating to the cost of construction. This first point is key in that it should remove the potential for a surprise in terms of budget requirements when the target price for construction is developed by the contractor – something that was a key issue for the Broadland Northway target price.
- vi) In addition, linked to this, a price ceiling 'break point' has been included in the GY3RC contract at the target cost stage – something that was not included in the Broadland Northway contract. This enables the consideration of options in the event of the target price exceeding budget. Whilst this is unlikely, this ensures the contractor cannot simply 'name their price' and maintains focus on cost throughout the detailed design stages of the project development.
- vii) Due to the further complexities associated with the GY3RC project and taking learning from the Broadland Northway project in terms of contractor ownership and delivery, the contract for the GY3RC also has a third stage which covers 'operation and maintenance' elements for the project.

Effectively this adds a further incentive, the contractor having a continued 'ownership' of the project once opened, with responsibility for any early life function or operational issues.

viii) There is no provision for an early completion bonus on the GY3RC project. Broadland Northway experience suggests that such an incentive can be a negative driver in terms of commercial behaviour by the contractor, that ultimately are not supportive of the best interests of overall project delivery. The learning from Broadland Northway is that this can generate significant tensions during construction with trying to agree impacts to the delivery programme, as this has such a significant bearing on the possible bonus provisions.

4.4. <u>Commercial</u>

- i) The benefit of investing in the preparation of carefully considered contract documents has been recognised and for the GY3RC project NCC engaged industry specialists to support the contract development and procurement processes. This has provided a firm base for project objectives, reduced the potential for contractual ambiguity and provided the necessary commercial controls to ensure contractor delivery compliance.
- ii) Noting the Broadland Northway issue where a revised forecast outturn cost was significantly higher than expected (and with little warning), the GY3RC documents have been carefully drafted to support the requirements for the contractor to ensure performance in delivery and transparency of documentation and related decision making.
- iii) At the start of the construction stage of the Broadland Northway we engaged a specialist consultant to manage the commercial delivery of the project. This robust approach to commercial management sent a clear message of intent and strengthened our ability to manage costs and provide challenge where necessary. The value provided by the consultant during the construction stages of the Broadland Northway has led to us using the same approach for the GY3RC. However, the additional input during the earlier design and pricing stages of the GY3RC contract has also allowed us to capitalise on the commercial experience already established from the Broadland Northway delivery.

4.5. <u>Risk</u>

- i) Risk is inherent in any major construction project, requiring ongoing evaluation and management. Early third-party issues on the Broadland Northway, namely the interface with Network Rail and the Utility diversions, immediately put the project risk provision under immense pressure, increasing as further problems emerged. Although it is difficult to forecast unknowns, the experience with the Broadland Northway will help inform estimates (for cost and timescales) for similar projects in the future. The GY3RC has a fully valued risk provision clearly identified within the project cost structure. It also has increased focus in relation to the risks around timescales and consideration of options to mitigate these risks.
- ii) Enhanced project governance (see below) also ensures that risk and the valuation associated with risks are properly assessed, reviewed and

considered by the project board. Although risks were monitored throughout the delivery of the Broadland Northway it was recognised that governance could be enhanced. This allows us to consider whether an early additional provision in terms of project budgets should be considered and raised with Members through formal reporting channels.

4.6. Design & Specification

- i) Major construction projects will inevitably carry some potential for amendment, albeit minimised by the strategies and actions identified above. The Broadland Northway was required to meet a wide range of stakeholder accommodations (linked to significant land take) and address emerging issues throughout its construction. The introduction of the need for load transfer platforms during the build illustrates an example of such a challenge, which required the design and installation of additional structures to resolve settlement, third party design constraints, and mitigate project delays.
- ii) The introduction of design change, however borne, carries a range of design, supervision and administration costs in addition to those more directly related to construction or delay. This was experienced during the Broadland Northway delivery as reflected in the budget increases in Table 1. The GY3RC has a 'design and build' approach that requires the contractor to provide an output solution within a set of defined parameters, thereby reducing NCC's exposure to design liability and buildability risks.
- iii) Project delivery milestones for the GY3RC project mean that the Development Consent Order process will run concurrently with the contractors detailed design work. Taking account of our Broadland Northway experience, we are developing our DCO submission to be robust enough to meet consent requirements, but also to allow a degree of flexibility for any minor build accommodations should they be needed once the order is made. This minimises the constraints, and the potential for significant cost increases that can develop if there is limited scope to deal with minor changes.

4.7. Third Parties

- i) Network Rail and Utility related works were sources of considerable cost increase and delay on the Broadland Northway project. Although NCC (and the contractor) had been in discussion with Network Rail for some time, it was not until the build phase commenced that accommodations and working methods were finalised. The associated changes, delays and disruptions led to extensive direct and indirect consequential issues for the project, increasing costs and generating significant delays and contract disputes.
- ii) Utility company arrangements were similarly advanced and widely integrated into the construction programme. National Grid Gas was a particular exception, suffering nationwide problems of limited specialist resources and very long lead in times for materials. These issues were not highlighted at the development stages of the project and therefore generated notable delays during the construction period.

- iii) A notable success for the project was the early delivery of the high pressure gas pipeline diversion from the Bacton Gas terminal. This was delivered in advance of the main works for the Broadland Northway construction, in the main to reduce the risk of related delays to the road construction works, but also to take advantage of planned works by the pipeline operators, which reduced the diversion works costs.
- iv) Repeating the theme of early investment in a project during the development stages and well ahead of construction starting, there are significant benefits to be achieved through the establishment of early third party agreements. To that end, the NCC delivery team and contractor have placed particular focus on early engagement with key stakeholders on the GY3RC project. We are actively engaging with a number of agencies and interested parties to ensure understanding of project objectives and identify the accommodations and works required throughout the life of the project. Third parties and their potential to impact the project are noted as high risks on the project risk registers and are routinely monitored to provide confidence that any issues are being resolved.

4.8. Governance

- i) The project was tested at various stages of its delivery through independent 'gateway review' processes. These are designed to ensure the project is ready to progress to the next stage of delivery and are, in part, completed also to assist the funding approvals process with the Department for Transport (DfT). The last of the reviews for Broadland Northway was completed before the instruction to commence with the construction works, and provided support for the Full Business Case application to DfT. The findings of that review were reported to the project board and all findings were actioned and tracked by the board until completed. These included actions such as reviewing and updating the programme and delivery plan, reviewing project management and governance for construction phase, and reviewing the risk register and communications plans and their management.
- ii) A review identified that the Broadland Northway governance arrangements would be enhanced by refinements to the project board meeting processes and associated records. Although there are commercial and confidentiality issues to be considered, the requirement for greater documented clarity and formalised sign-off of minutes has been recognised for future projects. The changes applied should ensure that all parties have a record of decisions made and concerns raised. This should make any challenges easier to resolve and allow for better risk management.
- iii) In addition, an audit completed to assess the governance of the GY3RC project has been completed to ensure that lessons learnt from the Broadland Northway project have been applied. The opinion of this audit was that the governance in place for the GY3RC was green with 'few or no weaknesses'. The audit found that the following areas have improved as a result of lessons learnt from the Broadland Northway project:
 - The GY3RC contract is a design and build performance arrangement, which transfers design risk to the contractor.

- The GY3RC contract has a price ceiling 'break point' at target cost stage. This means if costs increase significantly before the build begins then the contract can be ended.
- Any changes to the planned design of the bridge must be approved by the Project Board. A detailed construction programme is in place, which is broken down into individual tasks and includes clear target dates for each task
- The Project Team Manager and the Infrastructure Delivery Manager consider the detailed bidding process meant that BAM Farrans have a greater understanding of the project's requirements
- A detailed financial forecast is being produced, providing detailed figures for fees, utilities, land and construction. The budget forecast used to be reported to the Project Board and from March 2019 is being reported to the Pre-Project Board.
- 4.9. Best Practice (What worked well)
 - i) Commercial Management During Construction In spite of commercial pressures, the project construction team worked hard to deliver innovation (such as the pavement design), provide a high quality finish and meet the original construction delivery programme. This is despite a range of challenges previously described – such as the delay with utility diversions.
 - ii) GYB Services

GYB Services were employed directly by Norfolk County Council for the delivery of landscape planting. This direct approach, rather than going through the contractor, resulted in a saving of approximately £0.635m. Opportunities such as this will therefore be considered for future projects.

- iii) Environmental mitigation measures Initiatives used to mitigate the environmental impact including already well-established grass seed verges/ embankments.
- iv) Communications
 Well managed communications, with a more efficient approach using a single point of contact for the project (i.e. working for NCC and Contractor)
- Works Coordination
 Although some disruption is inevitable, works were planned in a way to minimise disruption to traffic and communities. Considering the scale of the project, there were minimal delays to traffic or any notable impacts within communities from construction traffic or construction related activities.

5. Financial Implications

5.1. The project has remained within the budget allocation of £205m and although there are still some costs relating to compensation and land acquisitions to be finalised, it is expected (based upon completed land costs to date) that the allowances made in the budget will cover these costs.

5.2. Implementing the lessons learnt from the Broadland Northway project delivery (as set out in section 4) will ensure there are improved financial and delivery controls on future projects.

6. **Resource Implications**

- 6.1. **Staff:** The Broadland Northway project is now effectively closed. The new road and associated infrastructure are managed, inspected and maintained as part of the business as usual delivery within the Highways service.
- 6.2. **Property:** There remains ongoing negotiations to close out land acquisition processes. These are based on the original possession dates for the project and are not impacted by inflation. All land compensation payments are monitored through land assurance meetings with the NCC corporate property team.
- 6.3. IT: None.

7. Other Implications

- 7.1. Legal Implications: None anticipated.
- 7.2. Human Rights implications: N/A
- 7.3. Equality Impact Assessment (EqIA): N/A
- 7.4. Health and Safety implications: N/A
- 7.5. **Sustainability implications**: Applying the lessons learnt from the Broadland Northway, as set out in section 4, will reduce the risk of making changes further down the line which impact cost and time.
- 7.6. Any other implications: None

8. Risk Implications/Assessment

8.1. The project remained on the corporate risk register until confidence enabled the financial reporting of project delivery within the £205m budget provision. The project delivery is now considered closed and the project has been withdrawn from the corporate risk register.

9. Background Papers

- 9.1. County Council Meeting 6th November 2015
- 9.2. Environment, Transport, Development Committee 16th September 2016
- 9.3. Environment, Transport, Development Committee 11th November 2016
- 9.4. County Council Meeting 20th February 2017
- 9.5. Policy and Resources Committee 27th November 2017
- 9.6. County Council Meeting 11th December 2017

- 9.7. ICE report Reducing the Gap between cost estimates and outturns for major infrastructure projects
- 9.8. MACE A blueprint for modern infrastructure delivery

Officer Contact

If you have any questions about matters contained in this paper, please get in touch with:

Officer name : David Allfrey Tel No. : 01603 223292

Email address : david.allfrey@norfolk.gov.uk



If you need this report in large print, audio, braille, alternative format or in a different language please contact 0344 800 8020 or 0344 800 8011 (textphone) and we will do our best to help.