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Building the Northern Powerhouse: Infrastructure delivery models

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Report 4 of 4



Introduction

Delivering transformational infrastructure services is central to the aspirations of the Northern Powerhouse, yet the recent experience of UK infrastructure delivery has raised concerns. In the North, the successful delivery of the Metrolink network discussed in Paper 1 contrasts with the failure of the North West Electrification Programme rail upgrade between Preston and Manchester and the ensuing disruption for passengers. We analysed the challenges of shaping investment projects in the North in Papers 1 and 2, and identified the crucial role of infrastructure owners in shaping and delivering those projects in Paper 3. In this final Paper we focus on the commercial interface between the owner and its suppliers on the investment project identified in the Three Domains of Infrastructure Development model in Paper 3. That is, we focus on the *infrastructure delivery models* that will ensure success.

There is widespread agreement that a crucial way forward for the performance of the infrastructure sector is collaborative working². We will build on the recent work by a number of UK infrastructure owners collectively dubbed Project 13 to develop recommendations for the development of Northern Powerhouse infrastructure. We will also review the implications of the collapse of Carillion for collaborative working which suggests the importance of capable owners carefully managing their collaborative arrangements across the commercial interface. Focusing specifically on the North, we will then address the issues around the supply of the skilled workforce that will be required to deliver transformative infrastructure developments.

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Our recommendations for the delivery of infrastructure development programmes in the Northern Powerhouse will be that:

- Capability development for Northern Powerhouse infrastructure delivery stresses the development of owner capabilities more strongly to complement those for the supplier domain;
- Northern Powerhouse infrastructure owners further develop the capability to accept the risks that financially fragile suppliers cannot and then closely manage those delivery risks with their own resources;
- The pan-Northern infrastructure coordination body recommended in Paper One take on the task of ensuring the adequate supply over time of the skills required for Northern Powerhouse infrastructure development from level 3 to level 7 and in particular that a regionally-based project leadership programme be developed quickly;
- The collaborative delivery model principles of Project 13 underpinned by strong owner capability be adopted for Northern Powerhouse infrastructure asset development programmes;
- Early consideration should be given to the delivery model for NPR in the light of the early deliberations on the ownership model recommended in Paper 3.

² McKinsey Global Institute (2017). Reinventing Construction through a Productivity Revolution. MGI.

Rethinking Infrastructure Delivery

Traditional relationships between owners and suppliers across the commercial interface have focused on lowest price in competitive bidding with a destabilising effect on the supply chain³. In particular, suppliers often attempt to bolster the margins they shaved during tender by over-charging for changes in the specification, and generating claims for disruptions to delivery. As a result, infrastructure owners do not necessarily realise the best value from their investments and face high levels of dispute with suppliers when risks materialise⁴. The dynamic is one which inevitably generates adversarial relationships with constructors and over-engineering by designers in the manner shown in Figure 1. The upper cycle shows that insistence by owners on competitive tendering on a lowest cost basis obliges suppliers to trim their margins to win, which then generates opportunistic behaviour during project delivery. In turn this obliges the owner to increase levels of audit and control – all generating additional transaction costs. Competitive tendering requires a complete specification from the designers to avoid later changes. This prevents construction specialists from contributing to the design – for instance by providing constructability advice – and tempts designers to over-engineer to avoid the risk of litigation generated by constructors' opportunistic behaviour. More generally, it stifles the potential for innovation to reduce production cost by constructors. Again, this drives costs into the delivery process by generating transaction costs and closing off reductions in production costs.

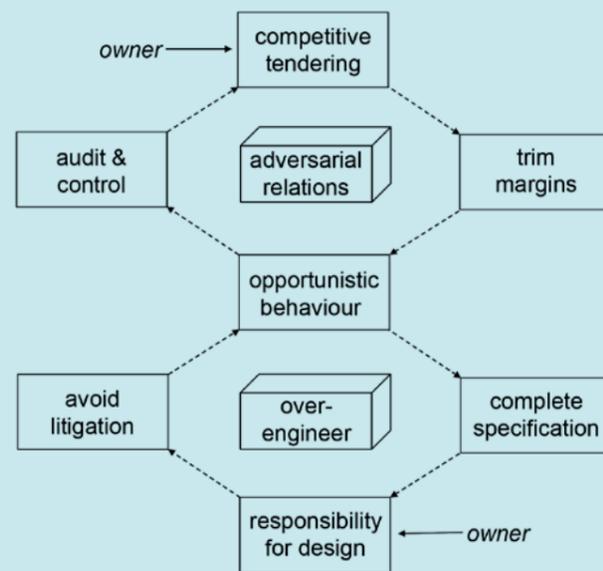


Figure 1: The Dynamic of Adversarial Relations in Infrastructure Delivery⁵

Calls to reform the infrastructure delivery industry to address this dynamic of adversarial relations date back at least 30 years. Two reports in particular, the Latham Report⁶ and the Egan Report⁷ were influential in the UK and beyond as they highlighted the industry's poor performance in delivering value for money and revealed unsatisfactory business relationships throughout the supply chain between constructors, materials suppliers, designers and owners. The Latham report of 1994 recommended "partnering" across the commercial interface between the owner and the constructors on the supply side and stressed that the owner had a significant role in achieving a successful project. However, take-up of the recommendations in the report was patchy and partnering rarely went beyond the first tier of the supply chain⁸.

In a similar spirit, the Egan report of 1998 proposed a radical transformation of the UK sector and identified five key drivers of change in this regard: committed leadership, a focus on the customer, integrated processes and teams, a quality driven agenda, and a commitment to people.

Subsequently, a Strategic Forum was formed in 2001 to oversee the Rethinking Construction reform movement which was tasked with delivering these changes. While some progress was made in overcoming overt adversarial practices within the construction industry, the uptake of recommendations has been slow and patchy and the recession of 2008 led to a reversion to lowest cost tendering⁹. The most recent initiative is Construction 2025¹⁰ which reiterated these concerns, while also stressing the importance of digital technologies, moving towards low carbon construction in both process and product, and increasing exports of construction products and services. This initiative is supported by the Construction Sector Deal¹¹ under the Industrial Strategy, but significant reservations remain regarding the extent of transformation to date across the commercial interface¹².

Despite these expressions of frustration, significant progress is being made, particularly in the infrastructure sector¹³ – see Panel A. These reform initiatives helped to shape the delivery of the highly successful infrastructure developments at Heathrow Terminal 5 and Heathrow East, and the delivery of the London 2012 Olympics. They also underpin Anglian Water's highly successful @one Alliance which has reduced investment costs by 30% over 10 years¹⁴, halved the carbon embodied in new infrastructure over five years and reduced the accident rate (> 7 days) to zero over 10 years. As panel A shows, the use of the NEC form of contract – now NEC 4 – means that significant contractual disputes across the commercial interface are less frequent. However, the challenges on the delivery of the Elizabeth Line and North West Electrification Programme reviewed in Paper 3 and the

collapse of Carillion – discussed below – suggests that more needs to be done in the infrastructure sector if the Northern Powerhouse is to be successful in developing its infrastructure owners from the intelligent client to the capable owner as defined in Table 2 of Paper 3.

Panel A: Collaboration in the UK Infrastructure Sector¹⁵

In the UK, high profile projects such as the London Velodrome and other venues for the London 2012 Olympics, the Elizabeth Line, and the Thames Tideway Tunnel have all used the NEC3 Engineering and Construction Contract (Option C), a suite of construction contracts intended to promote collaboration between the constructor and the owner.

In terms of structure, NEC3 Option C is a target cost contract which is subject to a pain/gain share mechanism by reference to an agreed target cost built up from an activity schedule. As it is structured, it introduces a mechanism enabling the constructor and/or the designer team, to share in the benefits of cost savings, but also to bear some of the cost when there are overruns. The focus is therefore on collaboration, sharing risks and analysing opportunities together.

All of the listed projects sought to encourage the development of social norms of collaboration with suppliers and between individual suppliers. The Tideway organisation, for example, included behavioural considerations in its procurement process and particularly, a behavioural assessment exercise that identified a willingness to accept and conform to the collaborative approach championed by the Tideway organisation.

³ Wolstenholme, A. (2009) Never Waste a Good Crisis. Constructing Excellence. Farmer, M. (2016) Modernise or Die: Time to decide the industry's future. Construction Leadership Council.

⁴ HM Government (2018). Industrial Strategy: Construction Sector Deal. HM Government.

⁵ Developed from Figure 6.7 in Winch, G.M. (2010) Managing Construction Projects. Oxford, Wiley-Blackwell.

⁶ Latham, M (1994) Constructing the Team. HMSO.

⁷ Egan, J (1998). Rethinking Construction. Construction Taskforce.

⁸ Wolstenholme, A. (2009) Never Waste a Good Crisis. Constructing Excellence.

⁹ Wolstenholme, A. (2009) Never Waste a Good Crisis. Constructing Excellence.

¹⁰ HM Government (2013) Construction 2025. HM Government.

¹¹ HM Government (2018). Industrial Strategy: Construction Sector Deal. HM Government.

¹² Farmer, M. (2016) Modernise or Die: Time to decide the industry's future. Construction Leadership Council.

¹³ Infrastructure and Projects Authority (2017) Transforming Infrastructure Performance. Cabinet Office.

¹⁴ Project 13 research

¹⁵ Source: Drews, F. (2018). Designing meta-organisations: an empirical study of boundary setting in large infrastructure projects. PhD Thesis, University of Manchester.

Towards Collaborative Infrastructure Delivery Models

Collaborative delivery models in infrastructure delivery have been given many different names, including project partnering, project alliancing and integrated project teams. The Construction Industry Institute defines partnering as a long term legal relationship based on trust, dedication to common goals, and an understanding of each other's individual expectations and values¹⁶. In the UK, project alliancing was first developed in the Cost Reduction in the New Era initiative in the North Sea oil and gas sector, where BP's Andrew Project was ground-breaking¹⁷. However, the performance of North-Sea-type alliancing is relatively poor in terms of scheduled and budget escalation¹⁸ and the apparent reason for this is highly relevant to our analysis.

The success of the Andrew Project encouraged oil and gas companies to run down their in-house projects and engineering capabilities as owners, and to place much greater reliance on their suppliers. The outcome was that as investment programmes ramped up with a rising oil price, oil and gas sector owners lost control of a number of projects, with significant overruns as a result. At the same time, many of their suppliers lost their most experienced people due to natural wastage and redundancies during the downturn¹⁹. We would strongly argue that a capable owner is a prerequisite for effective collaborative working – see Paper 3 - and that "suppliers cannot do owners work"²⁰. Project 13 has recently developed a framework that enables this.

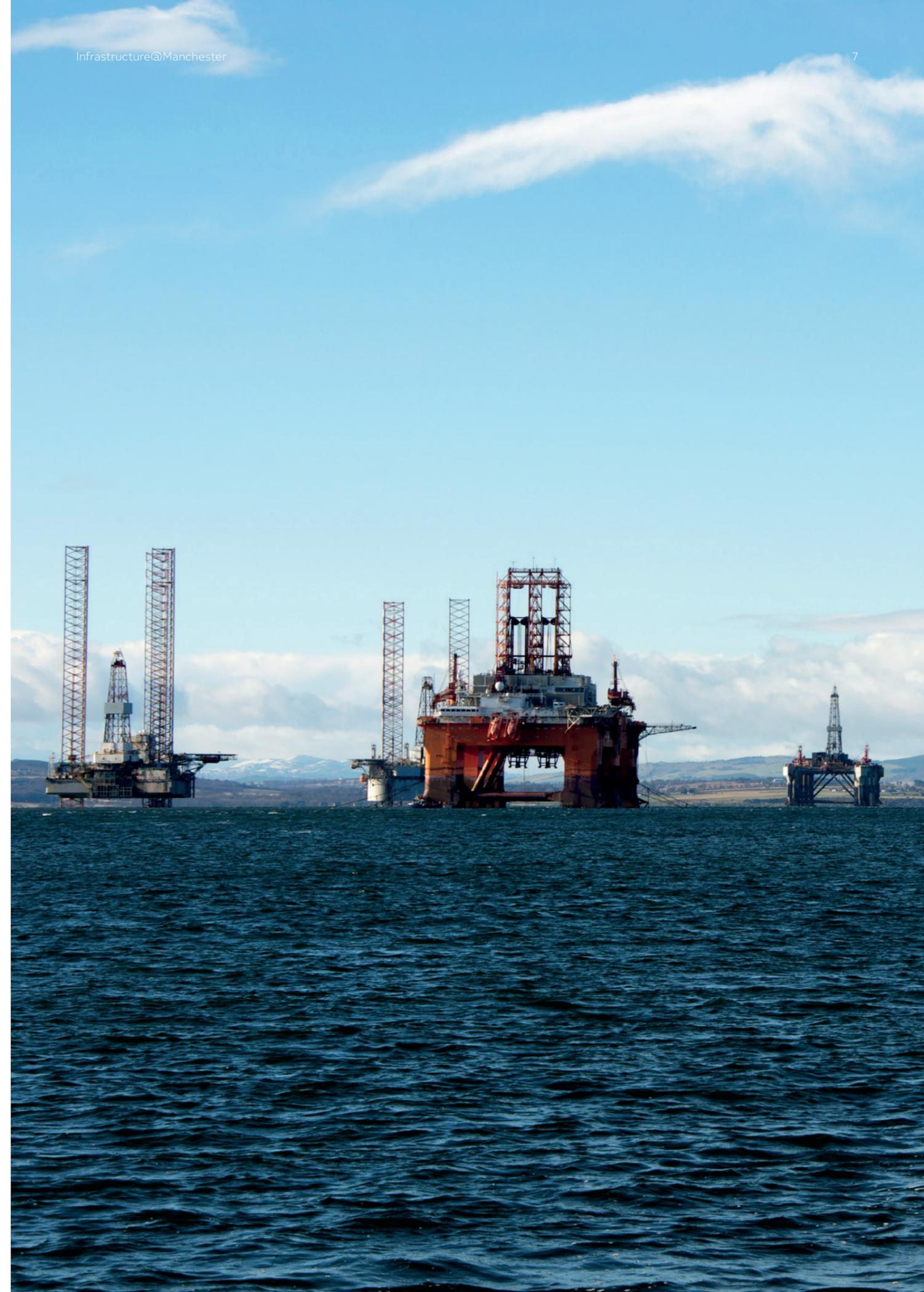
¹⁶ Construction Industry Institute (CII) (1996): Model for Partnering Excellence. Austin, Texas: Construction Industry Institute.

¹⁷ Knott, T. (1996) No Business as Usual: An Extraordinary North Sea Result. British Petroleum plc.

¹⁸ Merrow, (2011) Industrial Megaprojects. Wiley.

¹⁹ These insights are taken from conversations with a number of senior oil and gas industry representatives over the years on Executive Education programmes at Alliance Manchester Business School.

²⁰ Merrow op cit.



Project 13²¹

Panel B: The Six critical commercial principles underpinning Project 13²²

- 1 Alignment** – where commercial performance measures are aligned to the delivery of outcomes to the owner and its customers.
- 2 Reward** – where reward mechanisms in the enterprise structure are based on value-added in exceeding the outcomes, not competition for the lowest cost for a component.
- 3 Risk** – where risks that the infrastructure owner and its investors are accountable for are not transferred to the supply chain.
- 4 Engagement** – where the enterprise model comes together at a much earlier stage in the asset enhancement/creation lifecycle.
- 5 Scale** – where the enterprise model yields the greatest benefits when applied across asset systems/portfolios.
- 6 Time** – where the relationships between organisations last over a more extended period.

Project 13 seeks to shift the delivery model of the infrastructure sector from one based on project-based transactional relationships to one based on creating sustainable collaborative enterprises. As discussed in Paper 3, this transformation is underpinned by the capable infrastructure owner and espouses six critical commercial principles as illustrated in Panel B. These are critical to creating the most effective commercial interface between owners and suppliers.

In contrast to the traditional, adversarial, way of doing things, reward in the Project 13 delivery model is based on value added to the overall project outcomes, not the output of a functioning asset. As such, the commercial incentive is for collaboration to mitigate risk jointly and not to transfer it down the supply chain. Thus, the Project 13 delivery model encourages a more collaborative approach to the commissioning, design and delivery of construction projects. As can be seen from the case study in Paper 3, Highways England has enthusiastically adopted the principles of Project 13, and those principles also underpin infrastructure development for owners across the infrastructure sector such as Heathrow, TfL, Tideway, Anglian Water, and the Environment Agency for developing flood defences.

The P13 delivery model includes the owner who is central to defining long-term value and leads the investment programme; investors concerned with the financial viability of the programme; and key suppliers and key advisors who are experts in their subject area to support the owner. The investor is identified separately by P13 from the owner because on public sector projects, the source of finance is usually HM Treasury, while the role of owner is undertaken by a variety of entities including Network Rail and Highways England. The novelty of the P13 delivery model is the identification of the crucial role of the (systems) integrator which acts as the interface between the owner and its various suppliers and advisors. Although Project 13 does not mandate a particular form of contract, in practice the NEC forms are widely used.

Key suppliers and advisors, the owner, and the integrator work as one team in which the integrator is the linchpin that holds the Project 13 delivery model together. Integrators employ a 'systems thinking' approach which links individual capabilities to the attainment of programme or project outcomes. Integrators also bring in appropriate suppliers and advisors at relevant points within the delivery process. Coupled with greater understanding of cost drivers and risk across all organisations on the programme, the introduction of an integrator is intended to foster longer term relationships between all actors in infrastructure delivery. The Project 13 delivery model has, therefore, the potential to encourage significant investment in innovation and skills that are more productive and thereby to deliver better value to infrastructure owners and their customers.

A crucial question in the design of the Project 13 delivery model is whether the integrator is part of the owner organisation – a projects and engineering function at the heart of the owner – or whether it is outsourced to the supply side. Heathrow opted for the in-sourcing option for the highly successful Terminal 5 project. There are two collaborative options for outsourcing the integrator role. The first is in a long-term alliance – for instance the @one alliance has been evolving for running for nearly 15 years between Anglian Water and its partners. This works best when there is a sustained programme of work across a defined range of technologies which is greatly facilitated by the five year planning cycles of regulated infrastructure utilities – this is the "enterprise" to which Project 13 refers.

Where investment projects are relatively large compared to the rest of the programme, or even one-off, then different arrangements are more appropriate. Both the Olympic Delivery Authority for London 2012 and Transport for London for the Elizabeth Line used a delivery partner model – CLM and Crossrail Ltd respectively. In the case of HS2 and Tideway, special purpose vehicles were established which combine the owner and integrator. While a delivery partner as integrator can carry much of the owner burden, the owner needs to retain the governance functions – the governance problems on the Elizabeth Line discussed in Paper 3 attest to that.

²¹Project 13 is an initiative of the Infrastructure Clients Group which works under the auspices of the Infrastructure and Projects Authority. It is coordinated by the Institution of Civil Engineers: <http://www.p13.org.uk/>.

²²Source: Institution of Civil Engineers (2018). P13 Blueprint. ICE.

Re-defining project performance

The move from a transaction model towards the delivery model outlined by Project 13 requires that those in the infrastructure industry challenge their understanding of good performance in infrastructure project shaping and delivery²³. Under Project 13, performance is centred on a definition of value agreed between the owner and the investor and criteria are drawn from corporate objectives, government policy objectives, or particular challenges to be addressed²⁴. This performance baseline is important in this regard as it will determine the selection of advisors and suppliers; the link between the risk profile and reward mechanisms; and the commercial design of the delivery model.

The performance baseline is different to the target cost baseline currently used in target cost commercial agreements because it considers not only capital and whole life cost elements, but it can also include benefits associated with other areas of performance too. It is not intended to replace the cost-benefit ratio or the Green Book appraisal guidance discussed in Paper 2 – instead it sets a clear mandate and outcome level scope for a programme at the outset and applies benchmarks to determine the expected level of performance²⁵. Crucially, Project 13 encourages owners and investors to move beyond viewing value as the reduction of initial price or CAPEX cost. Instead, value should be recognised and appraised based on a broad spectrum of long-term outcomes and encompass a long-term holistic vision that benefits a wide range of stakeholders.

²³Infrastructure and Projects Authority (2017) Transforming Infrastructure Performance. IPA.

²⁴Institution of Civil Engineers (2018). P13 Commercial Handbook. ICE.

²⁵The methodology is based on original research undertaken as part of Project 13 development along with drawing on existing bodies of best practice including from the National Audit Office, Major Projects Association, Infrastructure and Projects Authority and Construction Leadership Council.



The Lessons of the Failure of Carillion²⁶

In January 2018 Carillion plc entered into voluntary liquidation following a first profit warning in July 2017. At the time it was the second largest construction company in the UK, and the sixth largest supplier to UK government which accounted for a third of its turnover. It supplied a combination of constructor services both directly and as part of PFI projects, and operational services as a support services contractor across the mainstream construction and infrastructure sectors. There are a number of lessons to be gained from reviewing the collapse of one of the leading UK infrastructure supply side players.

Carillion was one of the leading integrators and first tier constructors in the UK infrastructure sector. Its major infrastructure projects ranged from the Aberdeen Western Peripheral Route to two packages on HS2 Phase 1, as well as many support services contracts for road and rail. The Aberdeen by-pass was posting losses of £91m in 2017, as were two PFI hospital contracts posting a total of £131m. Where Carillion had full joint venture (JV) partners, they were legally obliged to take on the responsibilities of the contract, which required them to raise additional capital. Where second tier suppliers had contracts with Carillion – which had become notorious for late payment of its suppliers – they suffered significant losses in proportion to turnover and a secondary wave of company failures swept the industry during 2018. The two PFI hospitals also stalled and will now be delivered years late.

UK government had to commit at very short notice over £150m to ensure the continuity of various public services that were being delivered operationally by Carillion and it will also be liable for the net costs of the liquidation estimated at a similar amount. While most contracts were sold on to other suppliers, and public sector customers face paying a 20% premium charged by the liquidators to cover their costs. There were also significant increases in the budgets for some projects upon retender, particularly the PFI hospitals which are now directly government funded.

Carillion's collapse was the result of a growing crisis in its business model over a number of years. Since at least 2014, it had been growing revenues as a constructor (in distinction from its support services business) but with falling margins on those revenues. This suggested it was "buying" work in order to maintain cash flow – a traditional strategy associated with constructors for decades, if not centuries. It was then using that cash to pay dividends rather than re-invest in the business. This trend was masked by the use of "reverse factoring" in payments to its suppliers.

From reviewing Carillion's approach to supply side infrastructure delivery, there are a number of lessons for the Northern Powerhouse:

- Infrastructure owners in the public sector had already managed much of their risk by ensuring that they contracted with a properly structured JV of which Carillion was part, rather than Carillion alone. This meant that the JV partners took on Carillion's liabilities under the contract. While this is an important tool of risk management across the commercial interface, it is not entirely reassuring for owners. The collapse of one partner increases the financial obligations of the other partners and risks a domino effect across the JV²⁷ and, indeed, the infrastructure sector more widely.
- Carillion was the most serious example of the financial state of a number of support service providers and constructors during 2018, prompting UK government concern. The business model of tier one constructors which are typically in the best position to act as integrators leaves them financially fragile – Carillion had virtually no recoverable assets which is why the UK government needs to pay for the liquidation. The central insight of Project 13 that risks that suppliers cannot manage should not be transferred to them is sound. However, if these risks are not transferred, then they need to be managed by the owner – no other party can do this for them. This implies that greater capability is required by infrastructure owners for the management of their development projects than is presently customary.
- Portfolio management across all the projects that a supplier has with an owner is vital, as signs of financial weakness which manifest on one project (e.g. late delivery of materials) can then be shared across all projects in the portfolio and proactive risk management stepped up. Again, this is an owner capability issue.
- Fundamentally, the conclusion is that little has changed in the UK infrastructure sector, and that the supply side has great difficulty in leading change towards collaborative working. This is clearly an owner responsibility.

²⁶ Principal Sources: S&P Global Market Intelligence (2018) Carillion's Demise: What's At Stake? Standard & Poor's; National Audit Office (2018) Investigation into the government's handling of the collapse of Carillion. NAO.

²⁷ For instance, Galliford Try was obliged to raise £158m through a rights issue in March 2018 as a result of the collapse of Carillion.

The Supply of Talent

As shown in Figure 2 in Paper 3, the principal responsibility of the supplier domain is to provide the human resources required by the temporary project organisation across the resourcing interface to deliver the infrastructure asset. There are important questions regarding whether the supply of such resources in the Northern Powerhouse area are sufficient to sustain raised levels of investment, particularly associated with HS2 phase 2b and Northern Powerhouse Rail. London and the South East has a deep pool of such resources, which is easily augmented by people coming from the rest of the EU – over 50% of the London construction workforce is not UK born, and roughly half of these are from EU countries²⁸. Even in London there are challenges; for instance, Siemens were asked to increase from the planned 30 SCADA installation technicians to 160 on the Elizabeth Line but failed to recruit more than half of that number²⁹.

The North presently struggles to attract sufficient labour from beyond the region, and possible limitations on the free movement of EU citizens may provide further barriers to accessing skilled labour, yet increased infrastructure investment will inevitably require significantly increased quantities of competent and diverse human resources to deliver it³⁰. The National College for High Speed Rail³¹, located in Doncaster and Birmingham, is an important initiative founded in 2017, but is presently only producing a small proportion of the thousands of additional people required to deliver infrastructure developments across the UK, with an intake target of 1,000 students per year by 2022. The Tunnelling and Underground Construction Academy in Ilford was founded by Crossrail Ltd in 2011 and now partners with Transport for London and Tideway, but again its output is limited against the demand and it is not favourably located for the supply of skills to the Northern Powerhouse. Strategic attention the specific needs for specialist infrastructure delivery skills is required at the earliest opportunity, yet the locally focused Local Enterprise Partnership (LEP) structure can militate against such a regional perspective. In their very nature, infrastructure resources are geographically mobile, and strategy needs to be formulated at the regional level of the Northern Powerhouse rather than at the LEP level.

The challenges of adequate supplies of skilled craft labour and site management (levels 3 and 4) are well known in the construction sector generally³²; the challenge of adequate supplies of appropriately skilled professional and managerial staff (levels 5 to 7) is less widely discussed. Engineering design can be done largely remotely, so it will be relatively easy for the Northern Powerhouse to pull on the deep pools in London or internationally, but this is less true of managerial staff responsible for delivery. There is significant anecdotal evidence that the transformative infrastructure projects in the London area have been led by a growing "cadre" of managers who have moved together from project to project over the recent decades. Many are now working on Tideway and HS2. This cadre is unlikely to be available for investments in the Northern Powerhouse. The difficulties in moving this cadre out of the South East were demonstrated by the high number of severance payments made to senior staff when the headquarters of HS2 moved from London to Birmingham in 2016³³.

A significant increase in infrastructure investment in the Northern Powerhouse is likely to draw significantly on the existing resources for project and programme management of the region's infrastructure owners such as Highways England and Network Rail. It is also likely to draw heavily on the resources of the nuclear sector, particularly Sellafield, and leading advanced manufacturing companies in the region such as BAE Systems. This could generate a negative regional ripple effective throughout the region in infrastructure delivery performance and beyond unless a strategic approach at Northern Powerhouse level is developed. A further issue identified in Paper 3 is whether the current professionally-based skills sets are the most appropriate for creating complex infrastructure systems. The region's universities can help with both of these problems.

²⁸ Rolfe, H. & Hudson-Sharp, N. (2016) The impact of free movement on the labour market: case studies of hospitality, food processing and construction. National Institute for Economic and Social Research.

²⁹ National Audit Office (2019) Completing Crossrail. NAO.

³⁰ National Skills Academy for Rail (2017) Strategic Transport Apprentice Task Force: Baseline Study. NSAR.

³¹ It is presently considering changing its name to the National College for Advanced Transport and Infrastructure.

³² Farmer op cit.

³³ National Audit Office (2017) Report of the Comptroller and Auditor General on the 2016-17 Accounts of High Speed Two (HS2) Limited. NAO.

Recommendations

- Reform initiatives in the UK infrastructure sector, and construction more generally, have had mixed results over the last 30 years. We argue that the weaknesses in collaborative working which are widely perceived are more a symptom than a cause of poor performance in infrastructure delivery and that the underlying cause is lack of capability in infrastructure owners. We recommend that future reform efforts stress the development of owner capability more strongly.
- An important lesson from the collapse of Carillion is that the lack of asset backing for UK infrastructure suppliers (unlike many of their international competitors which are also infrastructure owners) means that risks need to be largely held by the infrastructure owner. We therefore recommend that infrastructure owners further develop the capability to accept and then closely manage such delivery risks.
- The launch of transformative infrastructure investments such as NPR and HS2 phase 2b will draw deeply on the skills already deployed in infrastructure development in the North. This problem is clearly a regional one rather than one at LEP level. We therefore recommend that the pan-Northern infrastructure coordination body recommended in Paper One take on the task of ensuring the adequate supply over time of the skills required from level 3 to level 7. In particular, we recommend the development of a Northern-based project leadership programme open across the sector to both public and private sector owners.
- Finally, we recommend that the collaborative delivery model principles of Project 13 underpinned by strong owner capability be adopted for Northern Powerhouse infrastructure investment programmes. Early consideration should also be given to the delivery model for NPR in the light of the early deliberations on the ownership model recommended in Paper 3.

Conclusion

The call to transform the infrastructure sector is not restricted to the North. There has been a consistent call to shift the infrastructure sector from a transactional commercial interface to collaborative one between a capable owner, its systems integrator, and its specialist suppliers and advisors. A stronger and more sustainable infrastructure delivery model will enable the North to achieve its aspirations, and it will allow the UK to exploit its strengths in the expanding global construction market, and increase exports of construction products and services. Realising these benefits will require more significant investment in innovation and skills that are more productive and deliver better value to infrastructure owners and their customers.

Investing in collaborative relationships can deliver real cost reduction throughout the project life cycle. We have argued that the development of collaborative infrastructure delivery models in the North should be championed by capable infrastructure owners. However, the supply side also has a role to play by moving beyond passing risk down the supply chain and instead demonstrating how it could create additional economic, social and environmental value through innovation and collaboration working³⁴. The role of government – nationally and regionally – is to create an environment that incentivises innovation and supports the collaborative process in the context of the strategy of the National Infrastructure Commission and with the oversight of the Infrastructure and Projects Authority. Transforming infrastructure delivery models for the Northern Powerhouse requires system wide efforts and should be approached in this spirit.

³⁴ Wolstenholme, A. (2009) Never Waste a Good Crisis. Constructing Excellence.



Connecting the Northern Powerhouse: Ordsall Chord³⁵

The Ordsall Chord is 300m of rail track which reconfigures the rail network of the Northern Powerhouse. It provides a direct rail link between Manchester Victoria and Manchester Piccadilly thereby allowing trains from Yorkshire and the North East to access Manchester Airport without reversing at Piccadilly. In doing so, it frees up significant capacity at Manchester Piccadilly. It is part of the Great Northern Rail Project which also includes the completed North West Electrification Programme and the Transpennine Route Upgrade currently under way between Manchester, Leeds, and York. Although short, the Chord is complex and much of the work had to be done during blockades of the busy railway during holiday periods, especially over Christmas and New Year 2016/17. It includes two bridges across the River Irwell and Manchester's Inner Ring Road united in a "flowing ribbon" concept. The Chord was part of a wider multi-disciplinary project that included extensive widening of existing viaducts, track re-modelling and re-signalling of much of central Manchester's rail network, and associated electrification. Another key part of the project was the careful restoration of Grade 1 listed heritage assets from the original 1830 Manchester to Liverpool railway. The iconic 89m Irwell Bridge is of a type new to the UK, and indeed, is the world's first asymmetric network arch bridge. The first train ran across the Chord in December 2017.

The Ordsall Chord project started when architects BDP and engineers WSP were commissioned directly by the owner, Network Rail, to prepare a concept design in 2011. On the basis of this work, regulatory procedures were completed in 2015; meanwhile Network Rail had moved to selecting its delivery suppliers and the Northern Hub Alliance (NHA) was formed. The NHA is an innovative form of "pure" alliance which had only been used on UK rail once before. It was chosen due to the size, complexity, and multi-disciplinary nature of the project on a constrained inner city site. A pure alliance does not rely upon existing forms of contract such as NEC3/4 where the alliance agreement is an appendix to the main contract, but on the establishment of a single temporary "enterprise" to deliver the project through a multiparty Project Alliance Agreement (PAA). The Owner Participant (OP) in NHA was Network Rail, and the Non-Owner Participant (NOP) suppliers were Skanska BAM Nuttall JV (civil engineering); Siemens (signalling); and Amey Sersa (track).

The JV was selected competitively on a value basis by Network Rail with a weighting predominantly geared towards collaborative working, while the other suppliers were already in partnering arrangements with Network Rail for their specialisms. Thus the Alliance was not self-selected before tendering. The steelwork was on the critical path, highly complex and carried significant risk, accounting for around a quarter of the project value. So the fabricator, Severfield, was procured through a competitive value-orientated process which assigned a weight of 80% to collaborative potential and 20% to price "back-to-back" with the PAA. Severfield then accepted an invitation to join the PAA although they were not designated a NOP and were formally subcontractors to Skanska BAM Nuttall. The engineering designers, AECOM Mott MacDonald, also acted as subcontractors to Skanska BAM Nuttall but were reimbursed conventionally on a fee basis. Other suppliers, including many SMEs, were outside the PAA and managed in the normal way.

The PAA is a self-accounting project delivery vehicle based on principles embodied in the Alliance Charter which include:

- "When we win we win together, when we lose we lose together": there were to be no win-lose outcomes across the participants.
- "One risk register; one pot of money": the Anticipated Final Cost (target cost – AFC) was determined at the P50³⁶ level with a joint risk register and very few risks solely retained by Network Rail.
- Pain and gain around the AFC was capped. For the OP, gain was only payable to the NOPs if "earned" and not, for instance, the result of a fortuitous drop in the price of an input. For the NOPs, pain was capped at their overhead and profit thereby guaranteeing they always recovered their project costs irrespective of the outcome against the AFC.
- Appointment to roles from amongst the Participants was on a "best for programme" basis.
- Participants could not sue each other.

The PAA was provided with strategic leadership by an Alliance Leadership Team (ALT) on which sat senior managers from the five participant organisations. Reporting to it was the Alliance Management Team (AMT) led by the Alliance Manager from the OP which managed the project. Roles within the AMT were function and discipline based. Below the AMT was the Alliance Project Team responsible for actual delivery of the Chord in a matrix organisation by function and specialist delivery team. Network Rail retained its usual structure so its Senior Executive Responsible (Project Sponsor) from the Route business sat outside the PAA. The PAA also appointed an independent auditor of the project.

The NHP was formed as the outline design was concluded, enabling early constructor involvement. Based upon this design the NHP was integral in supporting Network Rail's funding submission for the project utilising PAA programmes, methodologies and estimates. Once funding was secured, the AFC was finalised and agreed at £306m in line with the funding determination, maintaining the win/win, lose/lose principle from the PAA in March 2016. Only what the ALT judged to be a "significant event" was outside the AFC, and this had to be agreed on a mutual basis. From October 2015 on, the entire team, including Severfield, was co-located on the Ordsall site. Collaborative working was also facilitated by the advanced use of Building Information Modelling – for instance the design for the foot and cycle bridge under the rail bridge existed only in a 3D model which was then used to control the steel cutting machinery, thereby cutting four weeks from the design programme. The Ordsall Chord was delivered on budget and schedule.

The NHA faced a number of important challenges from which lessons can be learned. One source of cost growth within the budget was associated with the contribution of the engineering consultants due to the significant number of relatively small design changes which were a reflection of the complexity of the project. These consultants were outside the PAA and paid by the NHA on the traditional reimbursable basis and so these increases were shared by all the Participants. A second challenge is that the early costs of the PAA (contractually the "preliminaries") are perceived to be relatively high compared to similar projects. Although this investment is fully returned later in delivery, it can be difficult to justify to senior owner management. For this reason, senior leadership support is required – particularly within the owner, but from amongst the suppliers as well. Finally, a PAA alliance is not suited to all projects because overheads are often above national benchmarks due to the investment in front end definition which is most clearly rewarded on larger, more complex projects, and also because the pain cap requires a sophisticated owner to take the risk confidently.

The Northern Hub Alliance was considered to be successful for all the parties, and the PAA principles have been taken forward to the Transpire Alliance (BAM; Amey; Arup) which is presently delivering the Transpennine Route Upgrade. Transpire learned at least one important lesson from NHA and included the engineering consultant (Arup) as a Participant.

³⁵ Sources: Interview, Brian Walton, BAM, 30/07/19; Davies, J. and Havercroft, R. (2018) Ordsall Chord: Manchester's Missing Link. Mercury Group.

³⁶ In other words, at a 50% probability of the outturn cost being less than this figure.

Appendix - Glossary

Advisor: Under Project 13, the provider of consultancy services to the owner for the shaping and delivery of the project.

Infrastructure Delivery Model: the commercial arrangements selected for the delivery of a particular infrastructure asset.

Investor: Under Project 13, the organisation(s) that provides the finance for the investment in the infrastructure asset. It may be a separate organisation such as HM Treasury which takes considerable interest in the performance baseline of the investment or it may be a direct investor in the owner such as a pension fund of shareholders and rely on the owner board as its agents to determine the performance baseline.

Integrator: Under Project 13, the organisation, alliance or joint venture that plans and delivers the infrastructure asset. It manages the suppliers and advisors, coordinates planning, and oversees design and construction. It may also be involved in maintenance and operations if required by the owner. The relationship between the Integrator and the Owner is the key design feature of an infrastructure delivery model.

Key Advisor: Under Project 13, a specialist consultant retained by the owner to provide technical skills and to reinforce the capability of the owner organisation during both shaping and delivery.

Key Supplier: Under Project 13 a specialist supplier of particularly important technologies required for asset development and operation.

Owner: The organisation in the public or private sector that owns and operates the infrastructure asset, promotes the investment in the infrastructure asset, and moves the completed asset into beneficial use by supplying infrastructure services thereby generate the funding to repay the finance. See Figure 1 in Paper 3.

Performance Baseline: Under Project 13 this captures the benefits and outcome performance measures for the whole project. It thereby identifies the targets against which the performance of the project can be measured holistically. It includes direct and indirect benefits, capital costs, and costs of maintenance, operations and disposal, as well as performance measures such as schedule, embedded carbon, and safety.

Project 13: P13 is an initiative of the Infrastructure Clients Group working under the auspices of the Infrastructure and Projects Authority which has developed an innovative approach to the design of infrastructure delivery models. It is coordinated by the Institution of Civil Engineers: <http://www.p13.org.uk/>.

Project Alliancing: A commercial arrangement that encourages project participants to work as an integrated team by tying the commercial objectives (i.e. profit) of all the parties to the actual outcome of the project. In this arrangement all decisions are made "best for project" and not "best for individual" since the alliance either wins or loses as a group.

Supplier: Project-based organisations which provide the human and material resources required by the temporary project organisation to deliver on behalf of the Owner.

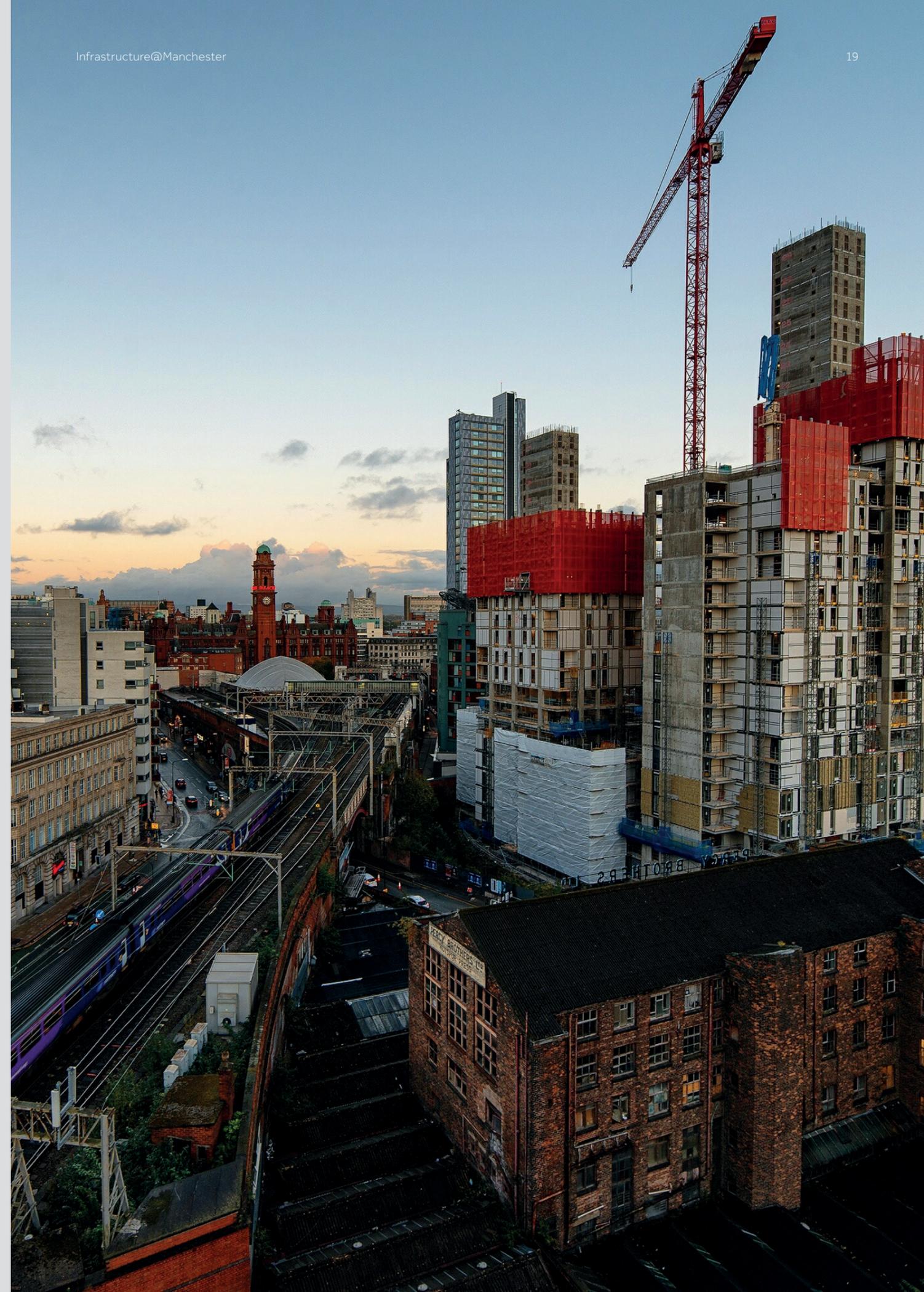
Supply Chain: The contractual relationships between the different constructors, advisors and specialist suppliers that are contributing to the overall project under the auspices of the commercial arrangement.

Target Cost: Generally associated with incentive contracts. It specifies the agreed cost enabling the principal constructor or Integrator to share in the "gain" of cost savings with the Owner, but also to share the "pain" of the Owner when there are overruns.

Variation: An alteration to the scope of works in a construction contract in the form of an addition, substitution or omission from the original scope of works. A variation alters the agreed target cost.

³⁷ See P13 (2018) Blueprint. ICE.

³⁸ See P13 (2018) Commercial Handbook. ICE.



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