HM TREASURY

Infrastructure UK

Infrastructure Cost Review:

Main Report

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Preface

The June 2010 Budget announced that Infrastructure UK would carry out an investigation into how to reduce the cost of delivery of civil engineering works for major infrastructure projects to report by the end of 2010.

This Main Report sets out the conclusions and recommendations from the investigation. A Technical Report, which contains the detailed analysis and technical annexes, can be downloaded from the HM Treasury website.

The investigation has been led by Infrastructure UK in collaboration with wider government, the Institution of Civil Engineers (ICE) and industry. It was carried out between August and December 2010, over which period an Infrastructure UK team, supported by industry secondees, has gathered evidence on civil engineering infrastructure delivery from over 300 organisations, including over 120 interviews in this country and abroad. The review has been supported by a Steering Group chaired by Terry Hill of Arup. The investigation has also taken advice from an independent Stakeholder Reference Group, hosted by ICE, which included representatives from across the public and private sectors.

A list of members of the Steering Group, the ICE Independent Stakeholder Reference Group and a list of other contributors is at Annex A.

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Foreword

This is not the first study to highlight the excessively high costs of constructing infrastructure in the UK. There should be little surprise that this study confirms that very substantial savings are achievable – at least 15 per cent, or an estimated £2 to 3 billion annually, on the costs of building and maintaining the UK's infrastructure. That is £20 to 30 billion over the next decade.

What is different about this report is that it has involved a very wide group from across the industry, with the construction firms at the heart of the work; and, critically, that it has identified a clear programme of action which will be driven through by the Government and industry continuing to work together.

This will enable taxpayers and utility bill payers to obtain more for less. It will also strengthen the UK's construction supply chain in a way that will help the industry to be an even fiercer competitor, both for business in the UK but also around the world.

Over the next few months, Infrastructure UK, part of HM Treasury, will work with other parts of government and with industry to develop a detailed implementation plan. This work will be integrated with the construction strand of the Government's recently announced Growth Review, which will report at Budget 2011.

I would like to extend my gratitude to Terry Hill of Arup for chairing this investigation and to members of the Steering Group, the Institution of Civil Engineers and industry for contributing to this important study.

Lord Sassoon

Executive summary

The Government's National Infrastructure Plan 2010, published in October, describes planned investment in infrastructure of £200 billion over the next 5 years. Between £15 billion and £20 billion will be spent each year directly on renewals and capacity enhancement projects and programmes – principally civil engineering works.

The ability to deliver infrastructure investment priorities efficiently and effectively is crucial to achieving the UK's growth objectives. The weight of evidence confirms that the UK is more expensive than its European peer group and demonstrates that there are significant opportunities to reduce costs in the delivery of infrastructure.

There is no single overriding factor driving higher costs. However, the investigation has identified that higher costs are mainly generated in the early project formulation and pre-construction phases and provided evidence of a number of contributing factors including:

- stop-start investment programmes and the lack of a visible and continuous pipeline of forward work;
- lack of clarity and direction, particularly in the public sector, over key decisions at inception and during design. Projects are started before the design is sufficiently complete. The roles of client, funder and delivery agent become blurred in many public sector governance structures;
- the management of large infrastructure projects and programmes within a quoted budget, rather than aiming at lowest cost for the required performance. If the budget includes contingencies, the higher total becomes the available budget;
- over-specification and the tendency, more prevalent in some sectors than others, to apply unnecessary standards, and use bespoke solutions when off-the-shelf designs would suffice;
- interpretation and use of competition processes not always being effective in producing lowest outturn costs, with public sector clients in particular being more risk averse to the cost and time implications of potential legal challenges;
- companies in the supply chain typically investing tactically for the next project, rather than strategically for the market as a whole; and
- lack of targeted investment by industry in key skills and capability limiting the drive to improve productivity performance.

Over many years in the UK there has been fragmentation of the construction industry and a significant shift towards the use of subcontracting. Compounded by the problems of infrastructure pipeline uncertainty and overly complex procurement approaches, this has increased transaction costs and deterred industry from a more strategic approach to investment in skills, technology and innovation.

The immediate challenge is to find ways for government and other infrastructure providers to work effectively with the construction supply chain to develop new business models that will improve productivity, achieve better supply chain integration and promote innovation.

Addressing these issues effectively will help reduce the costs of infrastructure and deliver significant benefits in performance and value for money. There is a clear opportunity to realise savings of at least 15 percent, which can deliver sustainable benefits of £2 to 3 billion per annum. This is £20 to £30 billion over the next decade.

While several industry and government reviews have recognised the need for change, few of the targets and recommendations set out in these reports have been fully met or implemented. The Government will develop the actions and proposed programme set out in this Report into a detailed implementation plan by March 2011.

Building on this initial report, the implementation plan will be designed around five key interlinked objectives to:

- create **better visibility and continuity of the infrastructure investment pipeline**, through publication of the future investment programme in the National Infrastructure Plan;
- implement **effective governance of projects and programmes**, particularly in the public sector, by ensuring clear accountability for key project decisions;
- instil **greater discipline in the commissioning of projects and programmes** by ensuring greater objective challenge of the specification of requirements and cost estimates;
- develop **smarter ways to use competition** by improving risk-based assessment of procurement options; and
- create an environment that **encourages industry and the advisory community to invest in efficiency and reduce the direct costs of construction** by developing cost effective delivery solutions.

The Government has identified a range of actions to meet these objectives and will consider how these will be taken forward in the implementation plan. Key actions that have been identified include:

- examining ways to extend planning and funding cycles for non-contentious maintenance and renewals;
- finalising and implementing a new assurance process for all major projects and programmes; and
- reviewing the ways in which contingency is assessed, allowed for and managed.

Infrastructure UK would be please to receive views on issues raised and proposals made in this document via e-mail: InfrastructureCost@hm-treasury.gov.uk

1 The cost of delivering infrastructure

Economic and industry benchmarks

1.1 The UK is an expensive place in which to build infrastructure. The weight of evidence confirms that costs are higher than in other European countries and demonstrates that, irrespective of its comparative position, there are significant opportunities to reduce costs in the delivery of infrastructure.

1.2 Economic indicators and independent industry benchmarks have consistently ranked the UK amongst the most expensive in Western Europe.[1]

1.3 Top-down analysis of benchmarks across sectors where comparative data were available, including high speed rail, roads, onshore wind and tunnelling all indicated higher relative outturn costs in the UK, ranging from a factor of 10 per cent to over 100 per cent difference. These are high level benchmarks and the analysis of specific project comparisons, whilst generally reinforcing the indication of higher costs in the UK, provides a more complex picture. Previous project based benchmarking studies, for example the High Speed 2 cost report and similar studies in roads and metro systems provide further evidence of higher costs in the UK. [2]

Project specific and input cost benchmarks

1.4 Project specific analysis was undertaken in respect of high speed rail, rail stations, roads and tunnelling.

1.5 Examination of seven high speed lines across Europe indicated that the construction costs for the UK examples were significantly higher. When compared to the four most directly comparable projects, the Channel Tunnel Rail Link (CTRL) 1 construction cost was at least 23 per cent higher.

1.6 Comparisons of major station development costs indicate that the UK is 50 per cent more expensive, for example, than Spain. However, UK stations serve a significantly higher peak passenger demand (up to 2.7 times in certain cases).

1.7 Benchmarking of eight roads projects between the UK and the Netherlands indicated that the UK examples were on average 10 per cent higher, based on the unit costs per lane kilometre. A previous study undertaken on behalf of the Highways Agency in 2009 had indicated that the UK was up to 32 per cent higher than the Netherlands per lane kilometre, although this was based on tendered prices rather than actual costs.[3] The UK and the Netherlands are both in the upper quartile of costs for roads in Europe based on other studies. Notwithstanding these benchmarks, the Highways Agency has identified project efficiencies of 20 per cent, where it is able to adopt a programme approach to delivery across schemes.

[1] *International Construction Cost* Survey, Gardiner & Theobald, February 2010; EC Harris, 2007; and *International Construction Cost* Index, Faithful and Gould, 2007

[2] *HS2 Cost and Risk* Model, High Speed Two (HS2) Limited, March 2010; *European Cost Comparison - Cost differences between English and Dutch Highway Construction*, EC Harris and TRL, December 2009; and *Comparison of Capital Costs per Route-Kilometre in Urban Rail*, Bent Flyvbjerg, March 2008

[3] *European Cost Comparison - Cost differences between English and Dutch Highway Construction*, EC Harris and TRL, December 2009. Note that this study makes a series of technical and cultural adjustments to the UK costs which reduces the difference to something more in line with the IUK analysis and if all the adjustments are taken into account the differences in cost are marginal.

1.8 Analysis of tunnelling contract outturn costs indicated that the civil engineering costs for tunnelling are comparable to European costs. However, the total costs for infrastructure projects that involve significant amounts of tunnelling are more expensive than comparators in European countries – suggesting that the higher costs are more likely to be a result of pre-construction and other indirect costs.

1.9 Comparison of labour, plant and material input costs with Northern European countries indicate the UK is generally comparable and that input costs are not a significant driver of higher infrastructure costs.

Whole life and maintenance costs

1.10 As set out in the National Infrastructure Plan 2010, the Government remains committed to ensuring that whole life principles are adopted in making effective and smarter use of existing assets. The analysis undertaken for the Infrastructure UK investigation is focused mainly on infrastructure capital costs and not whole life costs, in part due to the lack of central data available.

1.11 In some sectors higher construction capital costs are, in part, a result of whole life considerations. However, while not analysed in detail, there is some evidence that suggests that infrastructure maintenance costs are higher in the UK. For example, annual analysis of international metro renewal and maintenance benchmarks, undertaken by the Office of the PPP Arbiter, indicate higher costs in relation to track maintenance. The weighted average cost of the non-UK peer metro systems in the 2010 benchmarking exercise was 46 per cent lower than the average for UK metro lines (excluding Tube Lines).

Potential savings

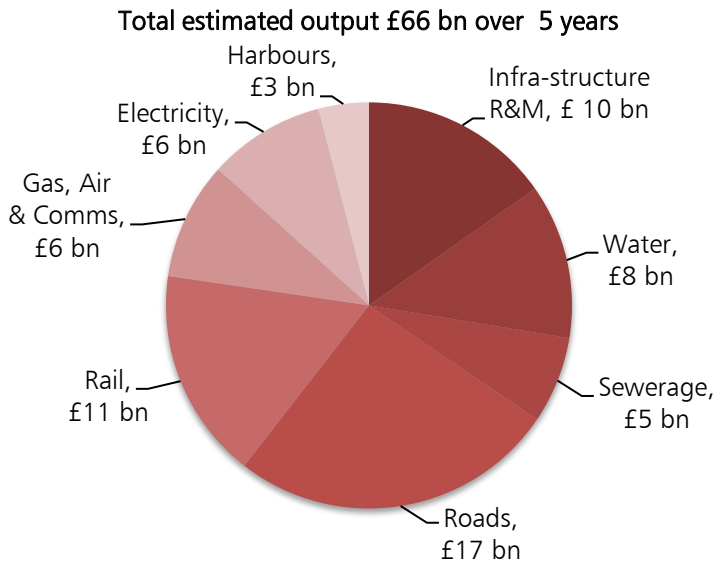
1.12 The National Infrastructure Plan 2010 describes planned investment of £200 billion over the next five years – with investment in the energy sector almost doubling between 2010 and 2015.

1.13 As a component of this, forecasts based on Office for National Statistics (ONS) construction output data (see Chart 1.A) suggest that infrastructure renewals and capacity enhancement over the next five years will be in the order of £66 billion in total, i.e. £13 billion per annum. Other forecasts of infrastructure construction output over the same period (2011-15) indicate a slightly higher figure of £75 billion (£15 billion per annum).[4]

1.14 These estimates are probably conservative when taking into account the possibility of an undervaluation of civil engineering construction output in some regulated sectors (specifically water and energy) within the ONS construction output data. Infrastructure UK's estimates of total investment in water and energy, taken from industry and regulator data, are respectively a factor of three and ten times the ONS construction output figures. For the purposes of this investigation, a conservative estimate for infrastructure renewals and capacity enhancement output of £15 billion per annum has been assumed.

[4] Experian construction demand/capacity model (July 2010 update for ERG)

Chart 1.A: Infrastructure construction output forecasts 2011-15



Source: Based on ONS construction output data and Experian price indices

1.15 The conclusion of the review is that infrastructure costs can be reduced by at least 15 per cent. Based on the estimated infrastructure construction output of £15 billion, this would deliver annual savings or additional investment capacity of £2 billion to £3 billion per annum, or in excess of £20 billion over ten years.

1.16 In the short-term, it is likely that the greatest efficiencies will be delivered by targeting renewals and repetitive programme based infrastructure investment, in particular by removing some of the obstacles that have prevented some infrastructure sectors (notably road, rail and flood management) from replicating the scale of efficiencies delivered in parts of the regulated asset base. Construction output data suggests that infrastructure repair and maintenance costs are roughly a fifth of the total civil engineering construction output. Sector specific evidence in transport suggests a slightly higher ratio of renewals, ranging from 40 to 50 per cent of total public spending on rail and roads infrastructure.

1.17 Evidence from the Scottish Government's long-term road maintenance contracts, lasting up to 10 years, indicates that significant savings can be achieved through giving contractors a pipeline of work that incentivises investment in year-on-year improvement, for example, reducing labour cost through improving productivity by 20 per cent. The *Rijkswaterstaat* in the Netherlands generated similar savings of 20 per cent in roads, by extending contract terms from 1-2 years to 5-7 years and by bundling more maintenance activities together in the same contract.

1.18 There are potential upward pressures on civil engineering infrastructure costs in the short to medium term. These include: forecast year on year construction indexation, which some benchmarks indicate may be as being as high as four to five percent each year on average across the next five years, as the economy moves back into a period of growth; potential costs of carbon reduction measures; and transition costs in adopting new design Eurocodes. It is essential, therefore, that measures are taken that will have an immediate impact in tackling the waste and inefficiency, in order to meet the investment aspirations set out in the National Infrastructure Plan 2010 and mitigate against these upward pressures.

2 Understanding the drivers of higher costs

2.1 As part of this investigation, a survey by Infrastructure UK and the Institution of Civil Engineers targeted over 300 public and private sector organisation from a cross-section of industry clients, consultants, academics and contracting firms; conducted over 120 structured interviews; and collected a wide range of data to understand the reasons for underlying higher costs in the UK.

2.2 The cross-industry survey ranked *client leadership*, *poor design/specification* and *overly complicated procurement practice* as the top three most significant areas for reducing costs. The detailed interviews and project benchmarking also supported the view that higher costs for infrastructure are mainly generated in the early project formulation and pre-construction phases.

2.3 The reasons for higher costs are summarised below under three general headings:

1 policy and systemic issues;

2 funder/client issues; and

3 supply chain delivery issues

2.4 Further detail and evidence of the impact of these issues on the cost of infrastructure is provided in a separate technical report published on the HM Treasury website. The technical report includes a detailed analysis of the cost and non-cost benchmarking data and findings from the 120 interviews completed.

Policy and systemic issues

Urban density and nature of infrastructure assets

2.5 In some instances, higher relative capital costs can be attributed to greater intensity of use in the UK. This is caused by factors such as greater density of population, compounded by higher land costs and the ageing asset base.[1] However, these unavoidable factors do not fully account for the high cost in the UK.

Planning and consultation processes

2.6 Planning lead-times and inconsistencies between different areas of the country have become particularly onerous. Uncertainty and time-lags due to the planning system contribute significantly to delays and have been cited in the evidence gathered as key reasons why major scheme outturn costs are in excess of those seen in other European countries. Early constraints imposed through planning and consultation processes can also lead to lost opportunities to benefit from contractor innovation, for example through design innovation or the use of pre-fabricated components.

2.7 As set out in the National Infrastructure Plan 2010 the Government continues to work towards ensuring the presumption in favour of sustainable development and the incentivisation of local communities to accommodate new infrastructure. The Government is also committed to

[1] Over 70 per cent of infrastructure capacity enhancement in the UK is on 'brownfield' land as opposed to just over 50 per cent in the rest of Europe. 70 per cent of Network Rail bridges are over 100 years old compared to 26 per cent average across Europe.

the development of National Policy Statements for the major infrastructure sectors and to abolishing the Infrastructure Planning Commission and the creation of a new Major Infrastructure Planning Unit.

Regulatory compliance and third party influences on cost

2.8 There is strong consensus amongst clients and industry within the evidence gathered that the UK is incurring significantly greater costs than the rest of Europe as a result of our approach to addressing environmental and ecological concerns, in particular.

2.9 Complex, overlapping and unclear compliance and consents regimes adversely impact on the delivery of public and private sector investments. While these systems are individually designed to protect the environment, heritage, the rights of citizens and ensure high quality, safe infrastructure, the cumulative cost impact is considerable.

2.10 Network Rail estimate that they spend well in excess of £10 million per annum on the preservation of protected species including newts, badgers and bats. In a further example, work on part of a £53 million rail bridge project is to be delayed until the autumn after the discovery of a colony of 11 great-crested newts.

2.11 In other regulated sectors, the statutory obligations on utility providers to replace old iron gas mains have been estimated to cost in the order of £100 to £200 million per life saved.

2.12 Contractors have suggested that for road construction, compliance with environmental regulations and related third party constraints can add as much as 10 to 15 per cent to the cost of the infrastructure. On one specific project example quoted, in the North West of England, a £2.1million variation made to address archaeology issues ended up costing an additional £5 million. The UK also implements regulatory requirements such as aggregate tax and pollution licences that are not currently evident in some other western European countries.

2.13 While the UK should be proud that it has the best construction safety record in Europe, there is a consistent view being put forward by industry that the paperwork involved with the "*demonstration of compliance*" is not cost-effective.

Wider construction market issues

2.14 The UK construction market has become the smallest of the big five European countries. Sustained uncertainty and the cyclical nature of infrastructure investment in the UK has contributed, over several decades, to a significant shift from fixed to variable resources, relative to many European contractors, i.e. there is a greater use of subcontracting and less direct investment in construction, the former driven in part by a move to greater specialisation within the supply chain. Eurostat measures of relative capital intensity also show that the UK construction industry is investing less in its operations than France or Germany. However, this may be a function of the higher levels of sub-contracting in the UK.

2.15 The UK construction industry for infrastructure has tended towards a relatively large number of medium sized construction companies acting as main contractors. This is in marked contrast with Europe where, based on European data, only two UK companies appear in the top 20 (none in the top 10). The largest UK contractor has one third of the turnover of the largest European contractor.

2.16 The difference in the structure of the supply chain and the relative size of the major contracting companies contributes to the fact that UK contractors are less active in Europe than their counterparts in France, Spain and Germany. This is in direct contrast to the UK market, which has a range of European suppliers actively engaged. However, there is also anecdotal evidence that there are still significant barriers to entry to UK contractors in some of these countries.

2.17 Lower capitalisation and the higher levels of subcontracting increase the internal transaction costs in the UK, in particular through the premium cost of risk transfer down the supply chain to second and third tier supply chain providers. In some cases, the evidence suggests that second and third tier suppliers are not always effectively integrated at an early enough stage but are often providing the bulk of the construction capability. There are positive benefits of subcontracting, to industry and clients, for example through specialisation and labour allocation in the supply chain, however, the negative impacts need be addressed through more effective business models that encourage better industry collaboration.

Low carbon agenda

2.18 The report on *Low Carbon Construction* published in Autumn 2010 by The Innovation and Growth Team (within The Department of Business Innovation and Skills) sets out an action plan for improving the sustainability of construction. The report recognises that infrastructure is seen as critical to supporting a more energy efficient society, but that carbon reduction does not seem a priority in the design and construction of those facilities.

2.19 The key themes and recommendations of this report are consistent with the *Low Carbon Construction* objectives. In particular, innovation including standard assets, off-site fabrication and improved logistics would support the objectives of achieving carbon reduction through the design and construction process as well as leading to reduced costs.[2]

Funder and client issues

Stop-start investment

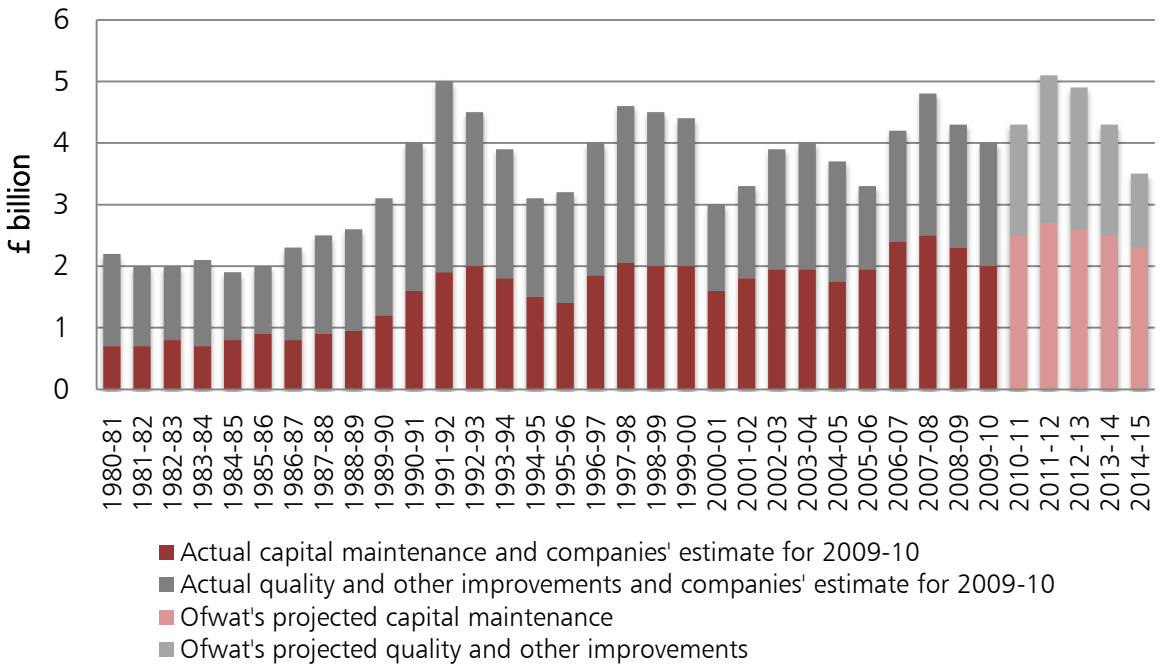
2.20 Infrastructure UK's analysis provides clear evidence that the lack of a visible and continuous pipeline of forward work flow, together with stop-start investment programmes by commissioning clients, leads to higher costs. This is one of the biggest issues to address. It is a driver behind many of the other reasons for higher costs in the UK.

2.21 The lack of a visible and continuous pipeline results in poor incentivisation within industry to invest in people (training, permanent employment and career development), develop innovative processes or purchase plant and equipment. Greater long-term certainty provides more opportunity to clients and the supply chain for innovation across projects, efficient transfer of project knowledge and the ability to plan work more efficiently, for example by sharing plant and equipment assets within the supply chain and across projects or purchasing material and components in advance.

2.22 Particularly in the utilities sector, significant savings have been delivered as a result of the greater continuity in the pipeline for infrastructure renewal and investment. This has been achieved through five yearly cycles of investment planning. However, even in the regulated sectors, the five yearly reviews are creating a line of uncertainty in investment around the review point which means that potential efficiency savings continue to be lost. Chart 2.A shows this effect in the water industry, where this generates inefficiencies across the five year period, estimated by one water company to be in the order of 10 to 15 per cent, as the supply chain gears up and down accordingly.

[2] Innovation and Growth Teams (IGT) are Government initiated and Industry-led projects that seek to look at significant market opportunities to ensure that the UK is positioned to benefit as a result of changing conditions in a given area. Recent IGTs have included: automotive and industrial biotechnology.

Chart 2.A: Stop-start investment in the water industry



Source: Ofwat

2.23 Within the Birmingham Highways Maintenance PFI, the ability to plan long-term provided certainty of requirement for 1million tonnes of asphalt which allowed them to procure this more effectively, reducing supplier and subcontractor costs by at least 10 per cent. In rail, the longer-term planning and partnering strategy adopted for the Great Western track renewals programme helped achieve 22 per cent reduction on unit costs, while increasing quality and reducing health and safety incidents; and helped the contractor by achieving a five-fold increase in business volumes, with sustained profit margins facilitating significant new investment in skill and new plant. There is also evidence that waste occurs when projects or programmes are restructured or cancelled.

2.24 International comparisons indicate that many Western European countries set out and successfully adhere to long-term infrastructure investment plans. For example, Germany, Austria, Denmark and Italy produce 10-15 year federal transport plans to develop coherent long-term investment programmes and in Singapore the implementation of a 10-15 year Land Transport Masterplan, managed by the Land Transport Authority, is facilitating similar delivery efficiencies and reduced construction costs through a rolling-programme.[3]

Poor governance and ineffective incentivisation of cost control

2.25 Evidence indicates that a major driver of higher outturn costs is a lack of clarity and direction, particularly in the public sector, over key decisions at inception and subsequent design change points. The roles of client, funder and delivery agent – which are often clearly and separately defined in private sector projects and programmes – tend to become blurred in many public sector governance structures.

2.26 Outturn costs rise because the processes of budget preparation, approval and management do not provide effective incentives to minimise the outturn costs. In particular, insufficient consideration is given to the assessment, placement and management of contingency and risk budgets.

[3] The Land Transport Authority (LTA) is a statutory board under the Ministry of Transport that spearheads land transport developments in Singapore.

2.27 Many large infrastructure projects and programmes tend to be managed within a quoted budget, rather than aiming at lowest cost for the required performance. Often, projects are managed within an affordability envelope which is based on the cost budget plus contingencies (including optimism bias). The total affordability envelope is then viewed as available project budget. As a result, there is no culture of managing costs down and all the available money within the affordability envelope is spent, including the contingencies.

2.28 Successfully managed projects, such as the Olympics, tend to share common characteristics including:

- the funder's clear commitment to expenditure;
- a clear and fixed timescale;
- accountable, knowledgeable and incentivised leadership;
- single-point responsibility for delivery to budget and a strong culture and incentives to reduce costs; and
- effective placement and control of contingency and risk budgets.

2.29 Within the Olympics programme, there is a very clear delineation of accountability for cost control and the management of contingency budgets. All contingency is clearly identified as either 'project' or 'program' and either 'in-scope' (available to the project) or out of scope (funder's contingency is not viewed, as is often the case, as available budget). A strong governance structure is built around the process for allocating contingency which, combined with effective incentivisation at all levels, has instilled a culture of cost awareness and accountability. The achievement of cost and risk reductions at the delivery level frees contingency for reassignment within the programme, subject to justification and approval by the Government Olympic Executive (GOE). Success has in part been driven by the clarity of decision making and by the commitment to ensuring that the GOE was set up as an effective and properly empowered client organisation.

Poor asset information and cost data

2.30 The National Infrastructure Plan 2010 set out Government's intention to improve the quality of, and access to, infrastructure data to support more informed decision making.

2.31 Poor asset records and condition data can lead to inefficiencies in the transfer of risk for its upkeep and replacement. This is manifest in the high costs of external due diligence required to update and compile asset data prior to putting work out to external competition, and in the risk premium placed by the supply chain on work where asset data is incomplete or unwarranted. This also applies to the provision of utilities asset data, the absence or inaccuracy of which is a frequent cause of variations and cost overruns.

2.32 The variable quality and lack of central visibility of infrastructure outturn cost and project performance data has been a material obstacle to this and many other attempts to undertake benchmarking of infrastructure costs. In some regulated and public sector bodies much is being done to improve the availability and effective use of benchmarking but there is little evidence of coordination of this activity, or the outputs, across sectors.

2.33 The lack of transparency is not unique to the UK and Infrastructure UK will consider, as part of its own programme of work, improving the accessibility and use of international infrastructure benchmark data, both for direct use by projects and in support of central scrutiny and challenge processes.

2.34 Within some parts of the water industry and public sector there are attempts to understand how costs are incurred through the stages of constructing and operating infrastructure assets. Building on experience in the water industry, other public and regulated

bodies are also attempting to use this data more effectively in setting target costs or affordability thresholds. Highways Agency commercial intelligence and data systems have already allowed them to save 14 per cent in negotiating the target cost on one major project, and £70 million over three schemes. The tunnelling benchmark data compiled from the Infrastructure UK work has already been used to reduce cost estimates for High Speed 2 by £400 to £800 million.

2.35 Improving the quality, understanding and transparency of infrastructure cost modelling and benchmark data is an essential prerequisite to effective use of alternative contracting approaches, in particular the use of target cost contracting and partnering models.

Specification, design and standard assets

2.36 There is a strong belief among UK and non-UK organisations consulted that the UK has a tendency, more prevalent in some sectors than others, to over-specify, apply unnecessary standards, and use bespoke solutions when off-the-shelf designs would suffice.

2.37 Where those commissioning the projects and programmes have been able to define the requirement clearly in output terms – leaving the industry to design the most effective way to meet the outputs required – this leads to more cost-effective solutions. However, end-use specifications frequently leave the client with less control over the final product, which can be an issue for aesthetics, durability, maintenance and consequently, approvals.

2.38 Principal reasons given for over-specification are: those responsible for setting and safeguarding standards are not incentivised to concern themselves with cost; written standards tend not to keep up with the times, innovation, new products etc; and designers tend to be more focused on quality than cost. There are, in addition, systemic reasons, for example more stakeholders and approval bodies to satisfy.

2.39 There is a high level of consensus from the interviews that clients in the UK tend to have less in-house technical capability than in other countries and are consequently less able to lead, discuss, challenge or interrogate designs either in technical or aesthetic terms.

2.40 Through effective incentivisation and the creation of a less risk averse culture, Anglian Water, over a period of six years, has successively reduced the cost of one particular water treatment asset from £73,000 to £27,900. Furthermore, by having the units manufactured as standard products, off-site performance has also been enhanced. Conversely, the UK rail lifts standard specification results in additional costs of £59,000 per unit over the cost of a non-rail equivalent asset.

Commercial issues and procurement processes

2.41 The UK's interpretation and use of competition processes, particularly in the public sector, is not always effective in producing lowest outturn costs. The evidence gathered revealed a widely held view that public sector clients are more risk averse to the cost and time implications of potential challenges, and processes are overly complex and too much of a "box-ticking" exercise.

2.42 Outturn costs are higher as a result of the burden of money and time that industry and the authority bears in preparing for and participating in competitions, the competition process itself stifling innovation and because the evaluation criteria for selection are insufficiently defined to select the bidder that will deliver the lowest-cost outcome (not necessarily the lowest price bid).

2.43 There are often timetable pressures that result in some projects starting competition or in some cases awarding construction contracts before the output requirements and design are sufficiently complete. This raises the risk of claims and additional costs arising as a result of variations and rework during construction.

2.44 Early contractor involvement can shorten the time for construction and introduces innovation. Comparisons of Early Contractor Involvement (ECI) on Highways Agency projects demonstrate a lower price and up to 50 per cent shorter time for construction. However, competition law and interpretation of procurement rules can inhibit effective use of early contractor involvement.

2.45 Most continental European countries follow the Civil Law system which codifies the legal framework for contracts in written laws and manuals. This reduces both the length of the contracts and, in many cases, the need for extensive use of legal advisors. As a result, there is less use of bespoke contracts. In Sweden, for example, there are only two standard forms of contracts which are used by 95 per cent of clients for construction.

2.46 In the UK, the NEC3 suite of contracts is being used to deliver many infrastructure projects, although by no means universally.[4] Government, through the Construction Clients' Board, specifies that public sector organisations use the NEC3 contracts when procuring construction. Most contractors reported that significant variations in the approach to risk transfer and amendment of the NEC3 standard forms added to costs for both clients and the supply chain.

2.47 Where smarter competitions have been used – both in the public sector and private utilities sector – there is evidence that increased confidence of potential bidders has led them to respond innovatively and devise solutions that deliver the required outcomes cost effectively. Dwr Cymru (Welsh Water) put together a strategic alliance leadership team that encompassed client, contractors, their respective supply chains and stakeholders including regulators. The alliance delivered the Asset Management Programme ahead of time and for 26 per cent less cost. Collaborative procurement also saved them £0.5 million per annum. Other alliances in the private and regulated sector have achieved similar levels of efficiencies,

2.48 Many clients, consultants and contractors interviewed highlighted the importance of having the right client capability to manage complex contracting models effectively. Achieving a successful outcome using more complex models, such as the NEC target cost and partnering approaches, requires strong leadership, commercial capability and cost awareness (and data) within the client commissioning team.

2.49 The construction industry still exhibits a more contractual approach than other countries (although there are some fundamental differences in the legal structures of different countries that, in part, explain this behaviour), and there is concern that the current economic climate may exacerbate this approach and a return back to a culture of low bid and increased claims.

Insurance

2.50 Most major infrastructure projects are insured via an Owner Controlled Insurance Programme (OCIP), although the contractors typically also carry their own insurances for Public Liability, Employers Liability and Professional Indemnity. OCIP insurances frequently do not cover the designers' Professional Indemnity. The study interviews suggest that the cost of project insurance is typically higher than in other western European countries, principally in response to higher risks of third party claims (both in terms of numbers and magnitude) and a view that UK projects in general put less emphasis on risk management. In France, for example, Employer's Liability insurance is not required as injured workers would be dealt with via their Workers' Compensation scheme, the costs of which would not be included in an analysis of the cost of a project.

[4] NEC is an integrated set of contract documents overseen by a panel of the Institution of Civil Engineers. NEC3 has also been used as the basis for development of the NHS Procure21+ national frameworks.

2.51 There is some evidence that Professional Indemnity (PI) insurance may result in risk-aversion on the part of designers. If this is the case, it is likely to be driven, at least in part, by the relative large amounts of PI cover demanded in the UK compared with other European countries which tends to make designers a large target for potential claims in projects where problems occur.

Supply chain delivery issues

Poor supply chain integration

2.52 The need for integration of the whole supply chain was a common theme among those interviewed. Previous reports on the construction industry have highlighted the importance of new industry partnering models to drive change and release expertise and efficiency from the supply chain.[5] Much of the specific expertise in delivery efficiency, associated with product development and component implementation, lies in the second and third tiers of the supply chain. However, incentivisation for cost savings under target cost contracts is not always passed down the supply chain, representing lost opportunities for innovation.

2.53 Evidence and examples from the investigation indicate that when objectives can be aligned between clients and through all levels of the supply chain, innovation can be harnessed, reducing out-turn costs to clients and safeguarding profits for industry, for example, the British Airports Authority's partnering model for Heathrow Terminal 5.

2.54 Combined supply chain capability can only be leveraged if there is a business model that forces this expertise into the project at an early stage. Developing a common procurement approach that forces supply chain integration (in appropriate circumstances), would enable focused development of capability and skills across the public sector and provide a consistent approach for industry to engage with.

Investment in innovation

2.55 Compared to Europe, the UK tier 1 supply chain has typically invested tactically for the next project, rather than responding to the market as a whole. The use of greater modularisation and off site manufacture, which can be evidenced to reduce unit costs, requires investment. The current levels of fragmentation of the industry, compounded by infrastructure pipeline uncertainty and overly complex procurement approaches, militate against a more strategic investment or integrated approach to innovation.

Skills and training

2.56 A key development area for the supply chain is the investment in skills, particularly at site supervision level. There is evidence of individual programmes developing and implementing in house programmes to plug the gap, such as the tunnelling academy established for Crossrail, or the National Skills Academy for Railway Engineering but these are not usually designed to be transferable between sectors, and are not initiated by the supply chain.

2.57 Attraction, retention and training of key talent in engineering and management is hampered by the stop-start nature of the pipeline, as is the ability to keep high-performing teams together. Sectors with stable pipelines progressively up-skill over time.

2.58 There was some evidence to suggest that European engineers are trained to take a multidisciplinary engineering leadership approach, leading to smaller, cheaper project teams that need not rely on over-conservative design codes.

[5] *Rethinking Construction*, Department of Trade and Industry, July 1998 and *Never Waste a Good Crisis*, Constructing Excellence, November 2009

Low productivity

2.59 The data available on relative construction industry productivity is inconclusive. There was a small but relatively strongly held view from some UK and non UK organisations that construction labour productivity in some sectors was comparatively poor, but no specific project based evidence has been provided to support this. The UK may suffer from lower productivity of professional staff and labour as a result of the relative geographic inflexibility of people, poorer career progression and poorer perception of engineering as a career.

2.60 In certain sectors, there is an emphasis on maintaining service delivery during construction that has a negative impact on the productivity of civil engineering works. For example, rail maintenance and renewal is usually undertaken overnight and through weekend closures rather than more intensive but longer closures that cause a greater interruption to services.

2.61 Numbers of professional staff in project teams have risen in recent years, exacerbated by delivery teams man-marking across the client and supply chain boundaries, leading to a higher internal transaction cost.

Logistics

2.62 Improving the management of logistics on complex programmes is seen by a number of industry respondents as a driver for improved productivity, and this provides a mechanism for driving greater supply chain integration. Experience from complex projects, such as Heathrow Terminal 5, points to a common logistics process as a fundamental aspect of reducing project risk. The London 2012 Olympics programme has successfully implemented logistics centres, with dedicated expertise to manage materials to and from a constrained site with multiple contracts. For programmes that require a significant use of plant and equipment, cost can be saved by finding creative ways of sharing it, such as through a central pool.

3 Actions to reduce cost

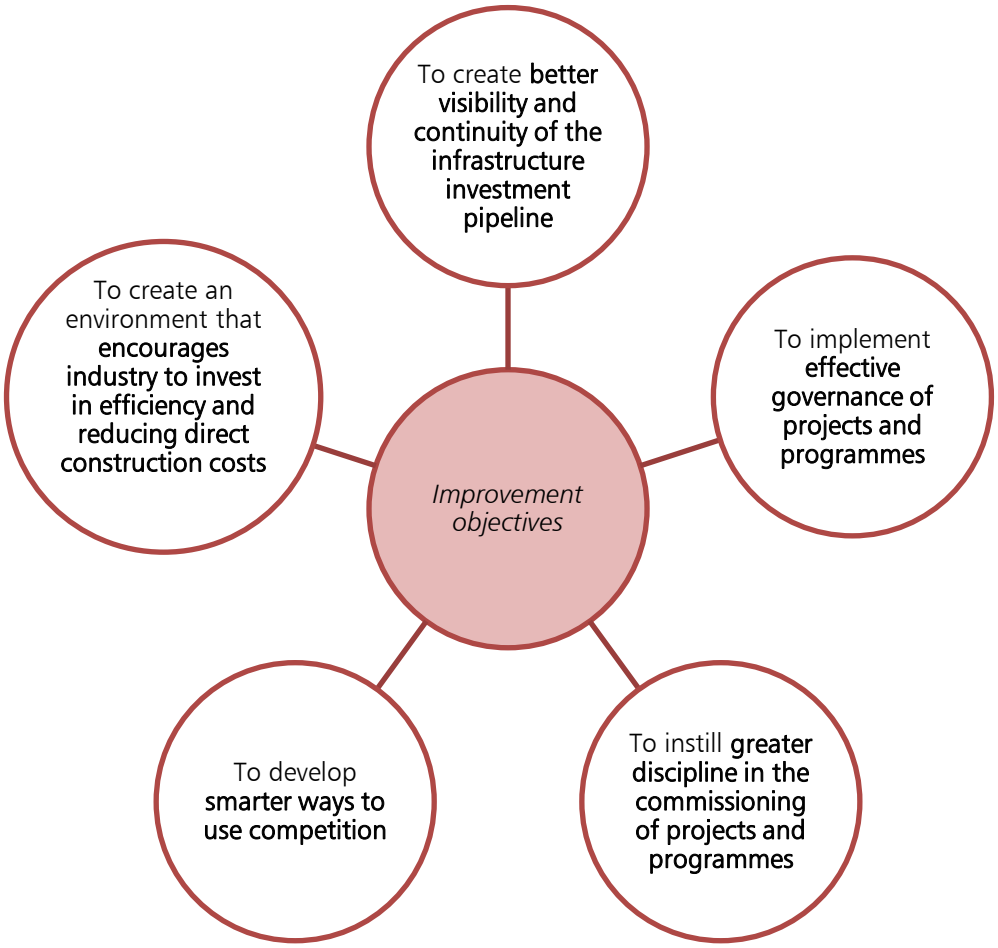
3.1 There is no single reason for the higher costs of infrastructure. Achieving the potential benefits of £2-3 billion per annum requires a sustained and multi-faceted approach, with a programme of activity supported by improved data and a central capability within Government that can oversee its delivery.

3.2 Evidence from the consultations with industry and their clients suggests a high degree of consensus that efficiency improvements can be achieved and that the infrastructure construction industry will respond positively to client side improvements in planning, commissioning and procurement of projects and programmes.

3.3 Clients will respond in turn to improvements in industry by becoming more efficient and transparent. In the public sector, Departments have already been set tough efficiency targets in capital spend, which the actions in this report will help them to deliver.

3.4 The proposed actions from the investigation are aimed at meeting five interrelated objectives as described in Figure 3.A.

Figure 3.A: Improvement objectives



3.5 Set out below are the main areas where actions are needed to deliver these objectives and realise the cost savings identified. Many of the issues are already well recognised and understood but will require concerted action between the Government, regulated companies, regulators and industry to deliver. There is also a need to take account of the findings from the recently published Innovation and Growth Team report on low carbon construction and Sir Roy McNulty's rail VFM interim findings study and to consider ways in which meeting these objectives will contribute to the Government's plans for economic growth.

3.6 Infrastructure UK will work with these stakeholders and with the Efficiency and Reform Group in the Cabinet Office to finalise a prioritised programme for implementation of the actions considered in this report, to be announced in March 2011.

To create better visibility and continuity of the infrastructure investment pipeline

3.7 To allow industry greater confidence to plan investment, innovate and develop stronger supply chains, the Government is considering the following areas for action:

- working with the regulated infrastructure sectors, as part of the Infrastructure UK wider regulatory review and ongoing reviews within the energy, water and rail sectors, to examine opportunities to create greater long-term investment certainty by extending the planning and funding cycles or varying the frequency of settlement periods for non-contentious renewals and maintenance investments;
- encourage consideration of mechanisms within Government departments to extend planning and funding cycles for non-contentious renewals and maintenance of publicly funded infrastructure and address disincentives to their use, in conjunction with clear cost reduction targets. In highways this will be undertaken in conjunction with the review of the operation and structure of the Highways Agency;
- introducing a new mechanism to incentivise better work planning and use of end year flexibility;
- produce supplementary Green Book guidance on creating the business case for bulk buying of engineering asset components; and
- in the National Infrastructure Plan 2011 (and subsequently), provide improved transparency to the markets of the forward pipeline of infrastructure investment, including key milestones for approval and funding decisions.

3.8 The delivery of these actions requires considered changes to a range of regulatory planning cycles and controls.

To implement effective governance of projects and programmes, particularly in the public sector

3.9 Where major public projects have created a clear governance structure, with role separation between client, funder and delivery agent functions comparable to that seen in the private sector, this has helped to develop positive tension between decisions on design specification and cost, which can reduce outturn cost.

3.10 The Government intends to extend this approach into wider public sector projects and programmes to encourage greater cost discipline in decision making across sectors. To help achieve this the Government is considering the following areas for action:

- finalising and implementing a new integrated assurance process, currently being developed by the Efficiency Reform Group in the Cabinet Office, and ensuring in particular that all major projects and programmes are established with clear lines of accountability and

decisions vest through individuals or bodies capable of discharging their function as a 'single controlling mind' with appropriate delegated authority and suitably incentivised to optimise cost and programme outcomes;

- developing a standard form delivery framework agreement for use between public sector stakeholders on major infrastructure projects and programmes;
- reviewing the ways in which contingency is assessed, allowed for and managed in the process of budgeting for and delivering infrastructure projects and programmes. Any review will include investigation of the benefits of separate management of elements of contingency allowances independent of the delivery body, consider the potential to manage individual project risks centrally and publish revised guidance on the principles for the structuring and management of contingency allowances to incentivise efficient management between stakeholders; and
- working through the Cabinet Office Civil Service Accountability and Transparency Programme, help develop clearer accountability and responsibilities for civil servants in making effective decisions and embed a cost conscious approach.

3.11 This objective also requires a review of some existing common project processes and governance arrangements, including considering the benefits of revising the ways in which optimism bias is currently applied in the budgeting process. These new approaches will be trialled on selected pilot projects.

To instil greater discipline in the commissioning of projects and programmes

3.12 To ensure that infrastructure projects and programmes meet the required output at the minimum sustainable cost, the Government will consider the following areas for action:

- introducing measures to ensure that assurance regimes for projects and programmes provide for objective challenge, at an early stage, of the key decisions that will impact on outturn costs;
- improving the managed coordination of infrastructure cost data and the extended use of benchmarking and enhanced cost-modelling capability across infrastructure sectors that will support more effective use of target costs and alliancing contracting models and support objective challenge;
- reviewing the completeness and accuracy of information on the condition of UK infrastructure assets – including those held by the public sector and regulated markets – and developing processes to improve the quality and transparency of this data to ensure that future maintenance and renewal risks are effectively priced and managed;
- reviewing the way in which codes and standards are managed and applied to infrastructure projects. The review will include consideration of the reconciliation or removal of standards that duplicate Eurocodes, establish a transparent basis for cost: benefit assessment of standards and consider ways in which regulatory bodies and public authorities can be made more accountable for the cost consequences of their requirements; and
- developing a means to ensure the capture of post project cost information and improve access to international data.

3.13 This will require change to the processes used to evaluate and determine the scope and specification of projects and programmes, to encourage outcome based specifications, removal of unnecessary prescription and to ensure that value for money is always considered.

To develop smarter ways to use competition

3.14 As part of its objectives to improve procurement and fairness the Government has already issued guidance on the use of competitive dialogue, mandated use of fair payment regimes for sub contractors and developed the use of standard pre-qualification processes.

3.15 To help achieve the maximum benefit from competition in the delivery of infrastructure, realise cost savings through the whole supply chain and minimise wastage in the procurement process, the Government will consider the following actions:

- developing a framework and guidance to encourage a more risk-based approach to the selection of procurement options and use of competition;
- publishing guidance on the selection of an effective contract type for different categories of infrastructure projects and programmes that properly takes account of clients' risk appetite and commercial capability through the use of competency frameworks;
- developing mechanisms to encourage greater alignment of interest between the supply chain and clients/commissioners in reducing costs and managing risks, including:
    - review the use of NEC3 form and other standard contracts used for infrastructure and make recommendations for further areas where standardisation may be effective; and
    - the potential to develop a standard form public sector partnering agreement that will improve supply chain integration; and
- reviewing the ways in which certain construction risks, for example cost inflation risks, are currently analysed and allocated in contracts and consider the value for money benefits of adopting alternative approaches.

3.16 Infrastructure UK is already working with the Efficiency and Reform Group in the Cabinet Office to develop the implementation of these recommendations.

To create an environment that encourages industry to invest in efficiency and reducing the direct costs of construction

3.17 The earlier objectives have focussed on the client side issues of commitment and improved pre-contract activity. These things are all capable of being undertaken or, in the case of private sector utilities, influenced by Government. However, the full benefit of available cost savings can only be achieved if industry responds in turn.

3.18 There has been strong industry engagement in undertaking this cost investigation, which has given visibility of the issues to be addressed and added to the credibility of the public sector in seeking to address them. To help maintain and develop the relationships with industry, the Government will consider the following actions:

- publish, in collaboration with industry and the principal infrastructure and engineering bodies, a charter which in particular will set out a basis for improved communication channels between Government and the construction industry and encourage better engagement of the UK construction industry with the European Commission and standards bodies; and
- encouraging collaboration and joint venturing business models as a means to driving change through all levels of the supply chain, specifically:
    - as part of a wider review of infrastructure delivery models consider how the benefits of supply chain integration can be incorporated into procurement approaches and contracting models; and

- issuing guidance on the procurement process for infrastructure that encourages early contractor involvement and other means by which industry can put forward innovative variant proposals for standardisation, the use of off-site fabrication and other means of improving efficiency.

3.19 While Government can take steps to create the right environment and encourage such behaviour, it relies on industry to respond positively and to co-operate with infrastructure clients in achieving lower cost outcomes by increasing productivity and reducing the direct costs of construction.

3.20 Industry will be challenged to invest resources in the development of new skills and innovation, and to respond to the new technologies required to deliver cost effective solutions in the delivery of infrastructure across all sectors – energy, water, transport, waste and telecommunications. Government will look to industry leaders to establish clear and effective communications links, identify market leaders to work with the Government in developing the initiatives set out in this report and implement business models that will enable greater integration of the supply chain and the required investment in new skills.

Implementation and next steps

3.21 The actions set out in this report represent a considerable challenge. While some of the activities are already in hand, involving Infrastructure UK, the Efficiency Reform Group and wider stakeholders across Government and industry, other elements will take longer to implement.

3.22 To support the realisation of the significant savings available through the reduction in costs of delivery, Infrastructure UK will take the lead in bringing together the key stakeholders across Government, regulators and industry to finalise and prioritise the detailed programme and implementation plan. The final plan will be published by the end of March 2011

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