

Rail Value for money study
Rolling stock whole life costs
Final Report

Arup, March 2011

Table of contents

Section	Pages		
1. Executive summary	3 – 18	Appendix A: Details of evidence base, supporting our analysis	92 – 99
2. Context, brief and approach to this assignment	19 – 33	Appendix B: Glossary of terms	100 – 101
3. Rolling stock lifecycle issues and cost drivers	34 – 37	Appendix C: Details of advisory team	102– 104
4. Analysis of perceived problems associated with UK rolling stock whole life costs	38 – 65	Crown copyright	105
5. Problems and evidence to solutions and strategy	66 – 77		
6. Key actions for rolling stock strategy	78 – 82		
7. Benefits	83 – 88		
8. Implementation	89 – 91		

1. Executive summary

Context, brief and approach

- In January 2010, the Secretary of State for Transport announced a study led by Sir Roy McNulty (‘the McNulty review’) into the value for money of GB rail, jointly sponsored by the Department for Transport (DfT) and the Office of Rail Regulation (ORR). The study’s Terms of Reference were “to examine the overall cost structure of all elements of the railway sector and to identify options for improving value for money to passengers and the taxpayer while continuing to expand capacity as necessary and drive up passenger satisfaction.”¹

- As part of the McNulty review, the Rail VfM team has identified whole life costs of rolling stock in Great Britain as an area where there may be potential for government and industry to benefit from cost reductions. In this context, the term ‘rolling stock’ refers primarily to the totality of passenger rolling stock used on the railway. This is because the vast majority of cost and public money is focused on passenger services and broadly speaking, the freight railway can be considered to be operating satisfactorily from a whole life cost perspective.² ‘Whole life costs’ refers to a broad range of industry costs associated with rolling stock, detailed further in the main body of our report. It was beyond the scope of this study to consider the impact of improving whole life costs on passenger revenues.³

- Our approach to managing this assignment involved the creation of a simple framework to “funnel” a broad range of existing analysis and expertise towards a set of evidence-based conclusions and recommendations. It can be summarised as follows:

- **Gathering evidence** – We reviewed existing literature and submissions provided to the Rail VfM team by interested parties. We supplemented that information by undertaking a range of meetings and structured interviews with parties from across industry, and by contributing our experience from previous relevant assignments.

- **Reviewing and analysing evidence** – We managed a series of issue-based workshops to discuss the evidence base as a single body and identify emerging themes and proposals to be tested further with key stakeholders.

- **Testing emerging findings** – We tested our emerging findings with interested parties within industry and government.

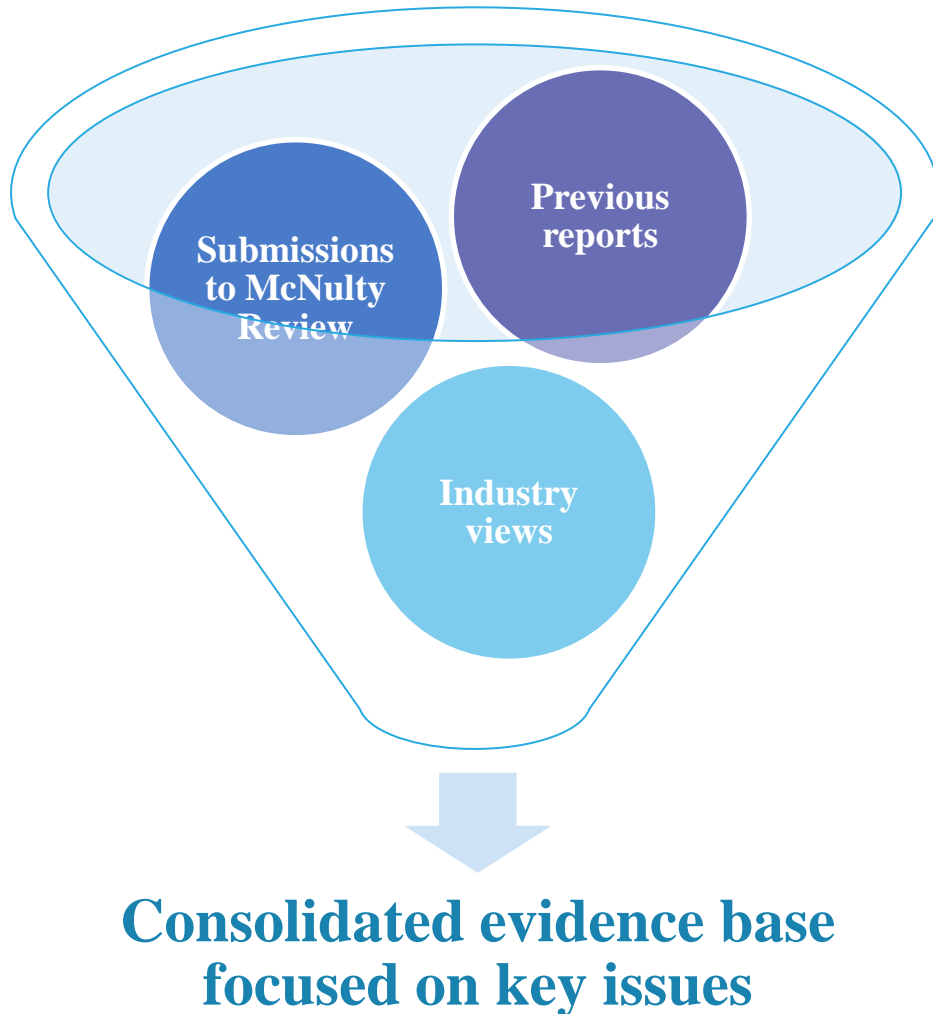
- **Finalising conclusions** – We took feedback and new information into account before finalising our conclusions.

- **Estimating benefits** – We analysed those initiatives that we considered could make the most significant contribution to achieving reduced costs.

- Outline details of the evidence base on which our work drew are provided overleaf, with further details set out in Appendix A to our report.

Evidence base - methodology

Figure 1.1 : Evidence base



- In reviewing issues relating to rolling stock whole life costs, we have drawn on the following range of quantitative and qualitative data:

- Previous work undertaken for the McNulty Review (e.g. Atkins' report on the supply chain and Civity's benchmarking analysis).

- A wide range of other relevant publicly available reports including the Sir Andrew Foster Review of the Intercity Express Programme (IEP), the Competition Commission's reports following its investigation of the rolling stock leasing market, previous strategy papers published by the SRA and DfT, and papers published by the Association of Train Operating Companies (ATOC) and the Rail Safety and Standards Board (RSSB).

- Submissions made to the McNulty Review by a broad range of industry parties.

- Interviews which our team held with parties from across industry.

- Analysis undertaken by our team and other parallel VfM workstreams (e.g. international benchmarking of rolling stock capital costs)

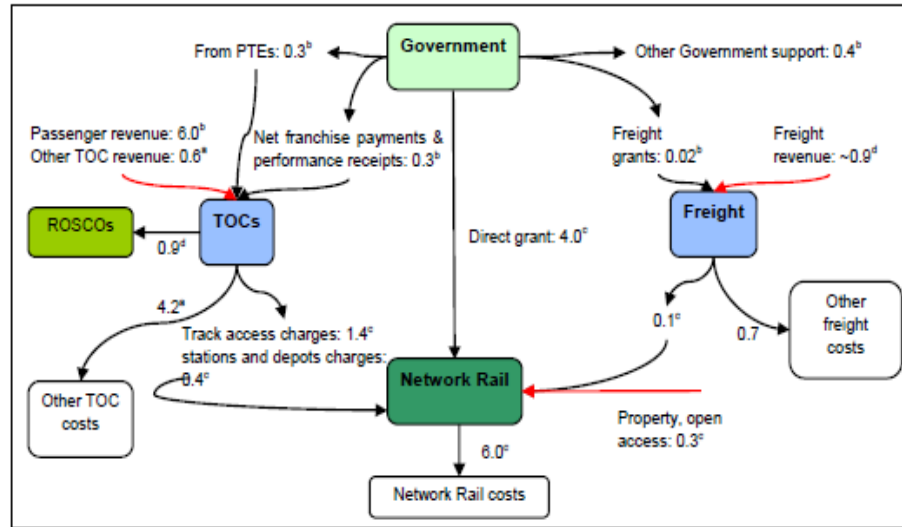
- Our team members' experience on relevant rolling stock projects and transactions.

- Feedback on drafts of our reports from industry parties directly engaged in the McNulty Review.

- Appendix A provides details of the documents we reviewed and the people with whom we spoke during this assignment.

Industry context: GB rail financial flows

Figure 1.2: Financial flows in GB rail 2008/09 (£ billion, 2008/09 prices)



Source: DfT/ORR, Rail Value for Money Scoping study report, Version 1.1, March 2010

• Figure 1.2 shows the present industry structure and financial flows between the parties. The industry depended on DfT for 37% of its funding in 2008/09, with a further 2% of funding coming from the publicly-funded Passenger Transport Executives (PTEs). Much of this is channelled directly to Network Rail (NR) rather than through the Train Operating Companies (TOCs) or Freight Operating Companies (FOCs).⁴ The extent of public financial support required and the history of cost control since rail privatisation perhaps helps to explain why central government considers it is justified in intervening and managing matters directly in the rail industry.⁵

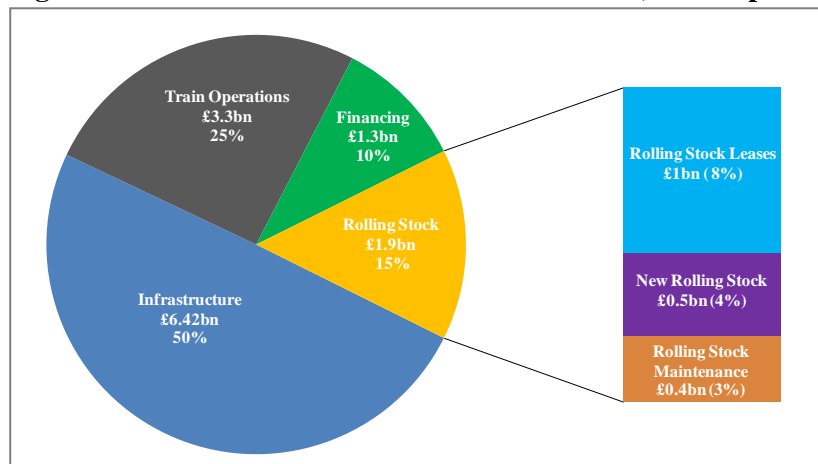
• At the same time in setting up the McNulty review, central government has indicated that it believes opportunities exist to improve efficiency, not least because of the affordability constraints that the public sector is facing more widely and continuing challenges of the present arrangements.

• Experience from other industries (e.g. regulated utilities), indicates that moving nationalised (or quasi-government controlled) industries to a successful private sector delivery model can deliver significant reductions in operating costs and improvements in productivity.⁶ The major difference between GB rail and nearly all other utilities is of course its continued dependence on significant amounts of public resource. Since privatisation, central government has become increasingly involved in shaping the day-to-day delivery of passenger rail services. In the context of rolling stock, this has included bringing franchise specification and management “in house” (to DfT) as well as major rolling stock procurement exercises (such as the Intercity Express Programme (IEP) and Thameslink) .

• This paints a picture of an industry in which the private sector is tasked with delivery, but is constrained in its ability to manage down costs by a high degree of central government influence over the detail of day-to-day operations (e.g. specifying timetables and on-board systems). This sets the context for the increase in unit costs of 19% since privatisation despite rising passenger demand, in contrast to the consistent efficiency gains witnessed in other UK privatised industries.⁷

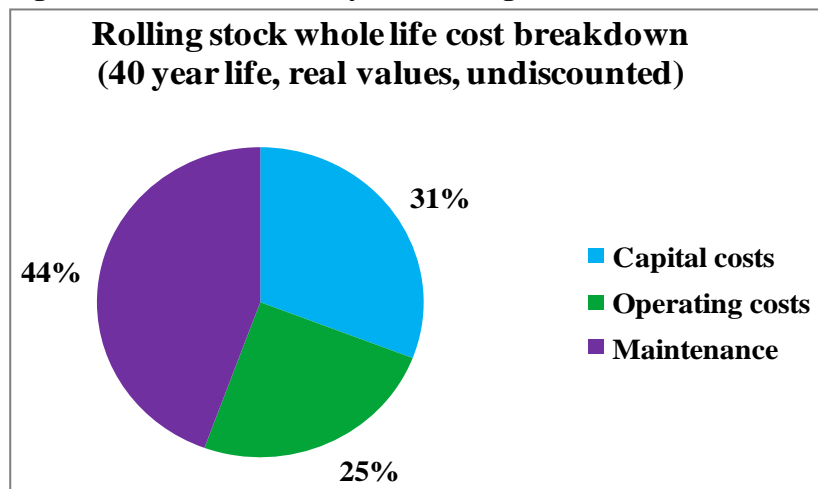
GB rail rolling stock costs: evidence on level and composition

Figure 1.3: Total GB rail cost breakdown 2009/10 (2009/10 prices)



Source: DfT data, Atkins analysis

Figure 1.4: Illustrative analysis of rolling stock whole life costs



Source: Confidential project data, Arup analysis

- As shown in figure 1.3, total UK rolling stock costs (including capex, opex and financing) have been estimated by Atkins in their work for the Rail Value for Money team at around £1.9 billion per annum, accounting for 15% of total rail industry costs in any given year. Those estimates draw on DfT data, although we note a degree of uncertainty in relation to their accuracy and granularity. Data availability and reliability is one of a number of issues identified in the course of our work as an area in which much improvement is required to support better understanding of whole life costs for rolling stock. This is discussed in more detail in the main body of our report.

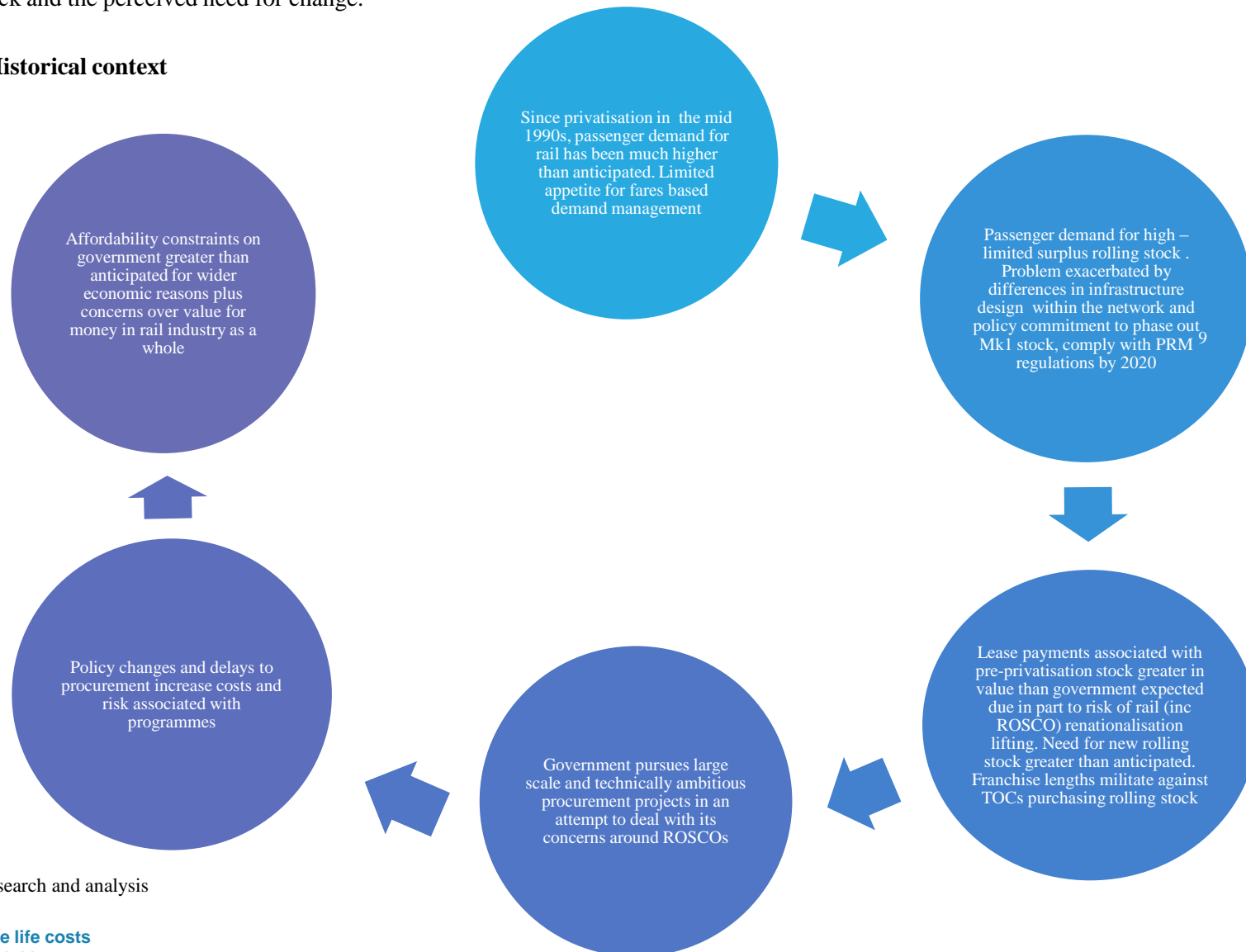
- It is however evident that the key driver of whole life costs for rolling stock is initial capital expenditure. Figure 1.4 indicates that capital costs account for 31% of the whole life costs for an illustrative fleet on an undiscounted basis. However, translating that figure into lease costs whereby the capital costs are financed over (typically) the life of the asset, can take that figure up to around 60% - depending on how the costs are discounted. Decisions taken during the early “lower costs” stages of the rolling stock life cycle (what we refer to as “needs specification” or selection of a procurement model) also have a material impact on whole life costs. Choices around asset complexity, reliability and maintainability (collectively known as “RAMS”⁸) are prime examples of decision areas that have long term whole life cost implications for an asset.

- Evidence on rolling stock whole life cost trends is very limited. From the data we have reviewed, it is evident that historical costs of UK rolling stock orders are not significantly higher than equivalent costs in other countries and that they have not risen dramatically since rail privatisation. However, there is evidence to suggest that there are significant opportunities to improve value for money in the UK (as detailed in this report) and whole life cost management. Furthermore, recent signs (e.g. the IEP and Thameslink procurements) indicate that UK rolling stock capital costs may be on the rise – possibly steeply - and that affordability presents a significant challenge for government and the industry.

GB rolling stock affordability: selected historical context

- Figure 1.5 provides a summary of what we consider to be the key drivers and events since rail privatisation, underpinning the overall problem of affordability for GB rolling stock and the perceived need for change.

Figure 1.5: Historical context



Source: Arup research and analysis

Parties and roles: summarising our view of where problems exist

Table 1.1 summarises our view of where problems exist which drive inefficiency in relation to rolling stock costs. In this table, ‘High’, ‘Medium’ and ‘Low’ refer to the **degree of influence** which we believe a party has **on costs** in any given area. The **colours** indicate whether we believe there are issues to be addressed in relation to that party’s role, with those coloured **red indicating areas in which we believe the most serious problems exist**. For example, **the bottom left cell** indicates that we believe manufacturers presently have a relatively low degree of influence over the process through which the industry’s rolling stock needs are established, and that we believe this is a serious problem (i.e. our view is that manufacturers should be given a greater role in that process). The evidence and analysis supporting these views are set out in the main body of this report.

Table 1.1: Matrix of parties, roles and perceived problems

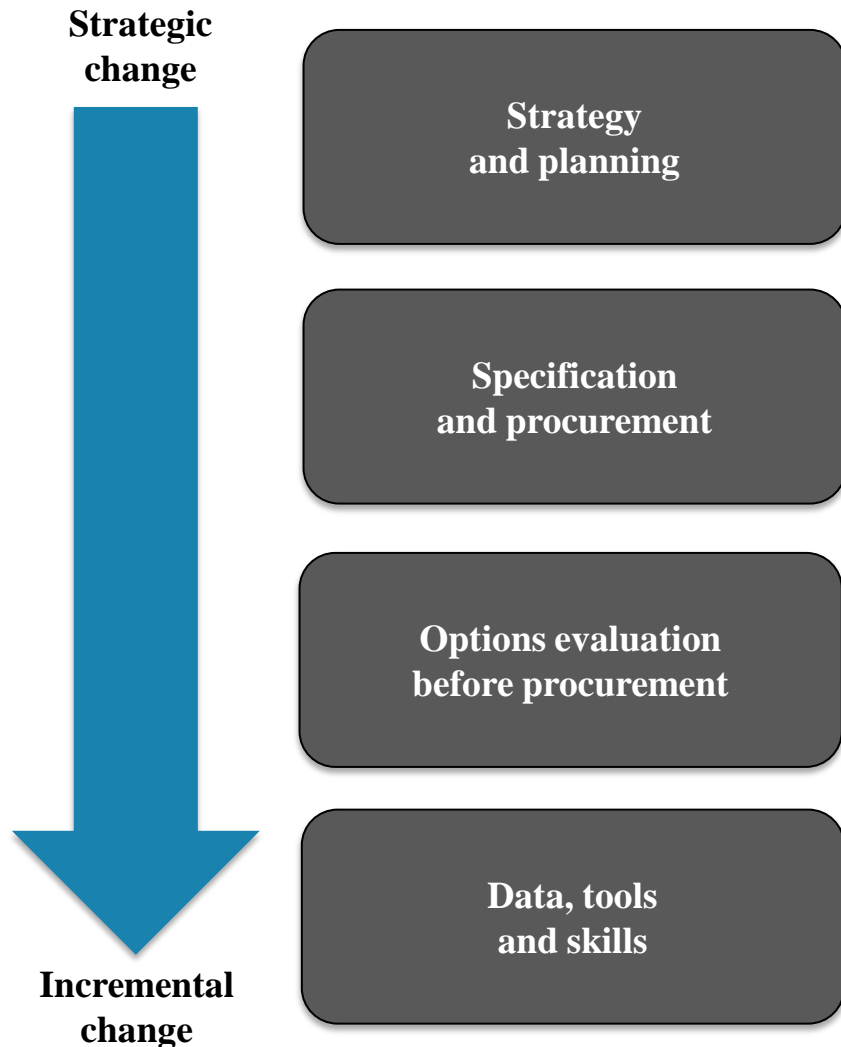
Party	Need requirements	Procurement process	Vehicle production	Testing and commissioning	Operational period	Decommissioning
DfT	High	High	High	Low	Medium	Low
TOCs	Medium to High	Medium to High	Low	High	High	Low
ROSCOs	Low to medium	Medium	Low to Medium	Low	Low to Medium	High
NR	Low	Low	Low	High	Medium	Low
Manufacturers	Low	High	High	High	Medium	Low



Source: Arup research and analysis

Areas for action

Figure 1.6: Areas identified for change



• Having identified a set of problem areas in which we believe there is significant scope for reducing costs, we have articulated the need for change across four areas, as set out in figure 1.6 :

• **Strategy and planning** – This refers to DfT’s tendency to change policy and investment plans in ways which drive higher costs (e.g. changing the intended destination of trains on the network after vehicle production has begun, and recent sudden changes in relation to future electrification and high speed rail plans).

• **Specification and procurement** – This refers to DfT’s approach to specifying rolling stock requirements, whether directly (e.g. IEP) or indirectly (e.g. through franchise specifications). The high degree of detail in DfT specifications constrains industry’s ability to deliver cost-effective solutions.

• **Options evaluation before procurement** – This refers to the lack of evidence that DfT undertakes any strategic appraisal of options for meeting passenger demand, prior to launching or triggering significant procurement exercises. In particular, it appears that limited consideration has been given to the potential for further life extension of existing fleets.

• **Data, tools and skills** - This refers to the poor quality of data available to support whole life cost decisions, or the fact that the data available in various parts of industry appear not to be available to decision-makers prior to key planning decisions.

Changes to pursue in relation to industry structure

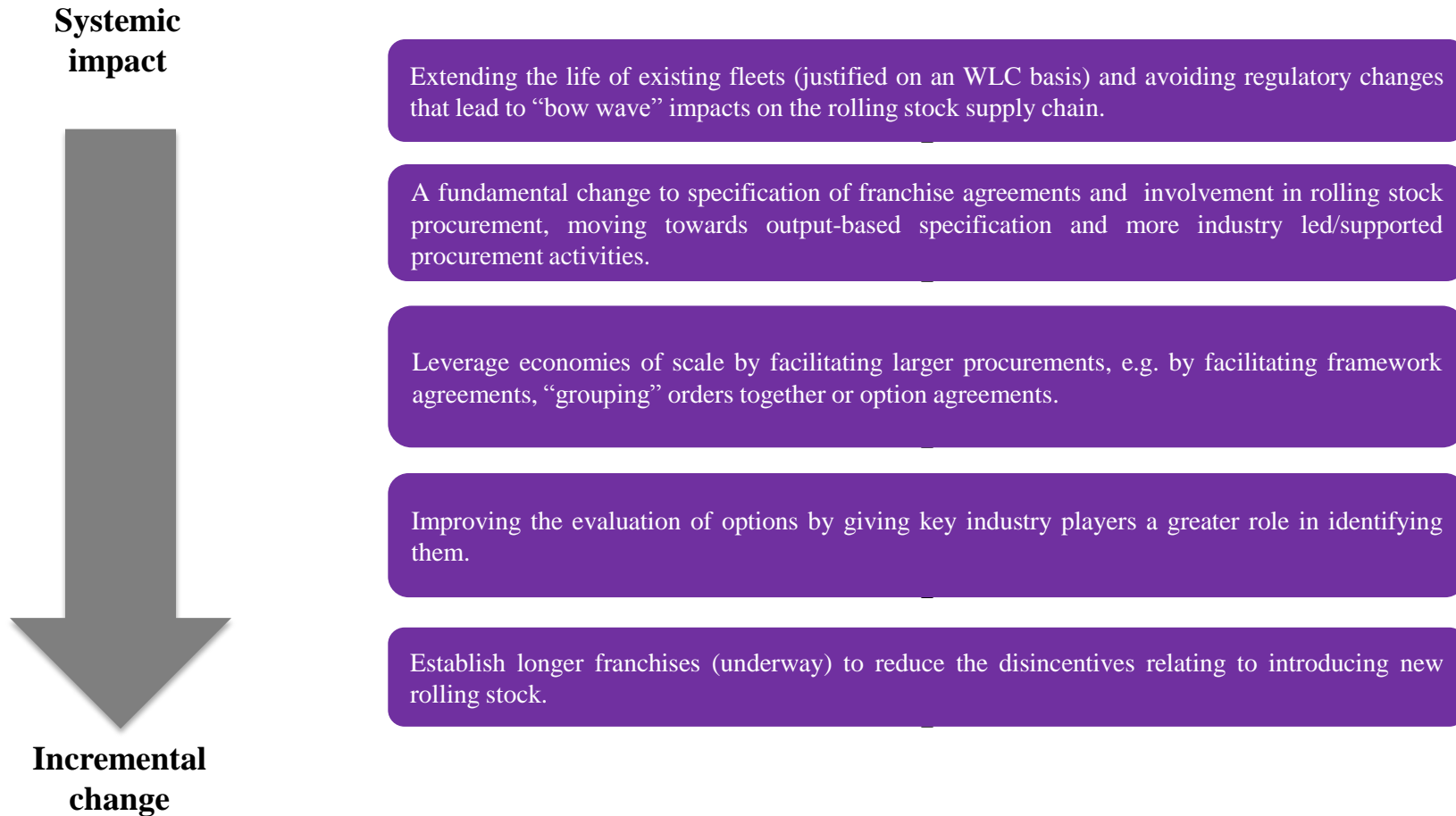
The following three pages summarise potential solutions we propose in order to address the problems identified. The potential solutions are grouped into three categories. Below we set out proposed changes to industry structure, whilst those on the following two pages set out proposed changes relating to processes, and then people, skills and decision tools.

Figure 1.7: Changes relating to industry structure



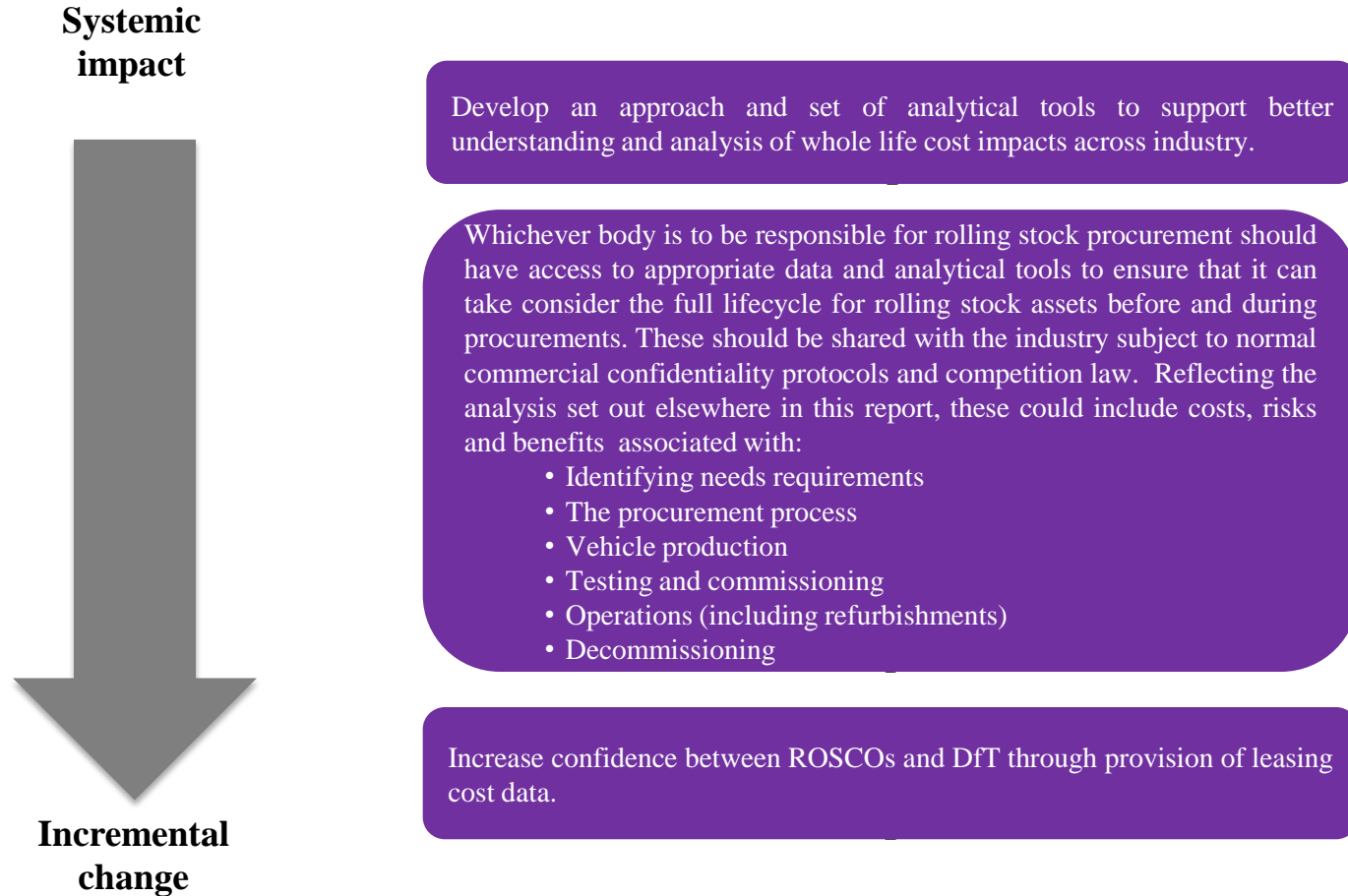
Changes to pursue in relation to industry processes

Figure 1.8: Changes relating to industry processes, option evaluation



Changes to pursue in relation to data, tools and skills

Figure 1.9: Changes relating to data, tools and skills



Benefits

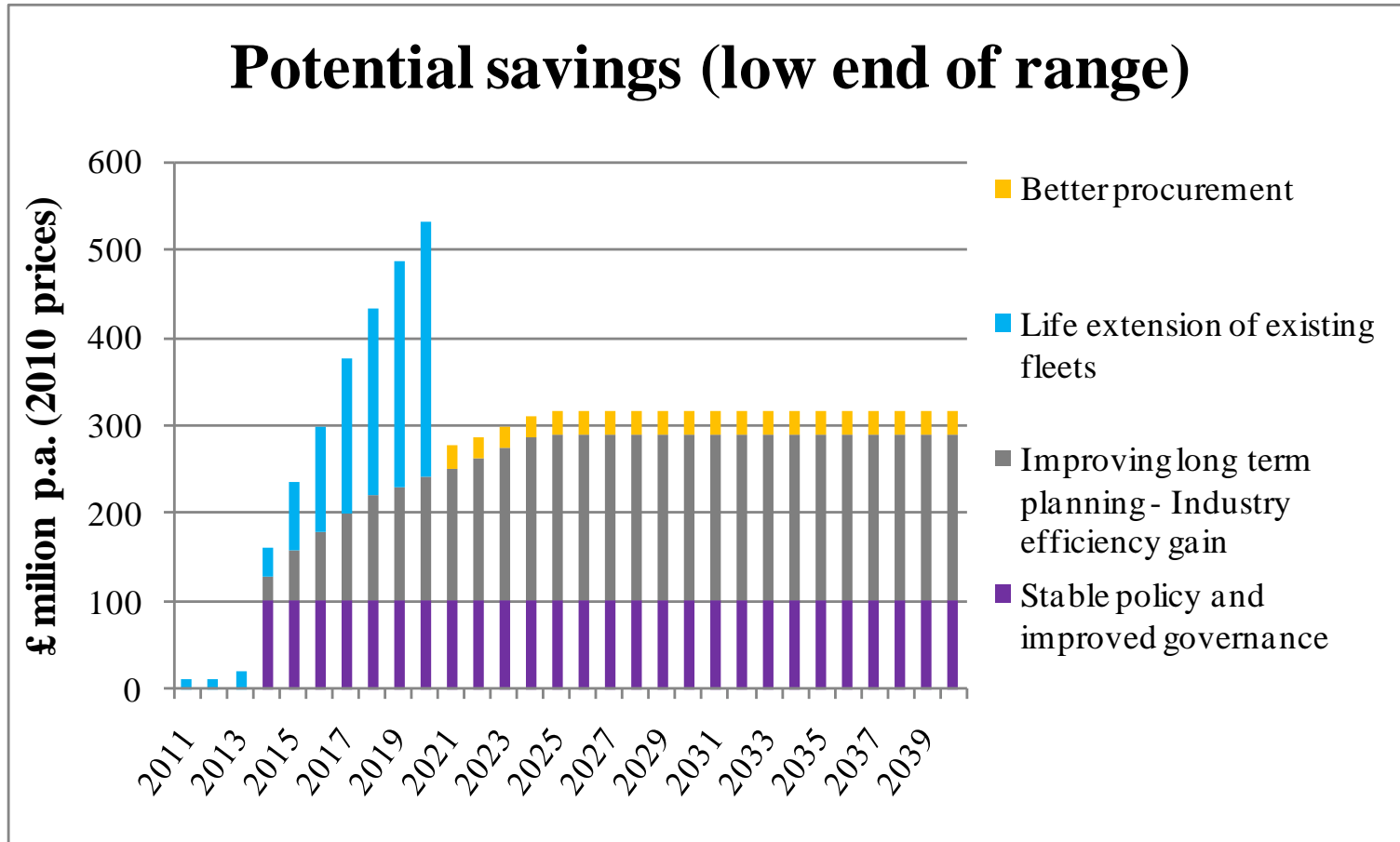
Table 1.2 below describes the extent of the financial benefits we believe could be realised if the four problem areas we have identified were addressed effectively. Figures 1.10 and 1.11 illustrate the range and timing of achievable benefits described here.

Table 1.2: Financial benefits of proposed changes (indicative)

	Strategy element	Quantification
1	Strategy and planning	<ul style="list-style-type: none"> • £100m annual saving by reducing central government’s ability to change policy and investment plans • £191m to £382m annual cost reduction from industry efficiency gains, achieved by 2025
2	Specification and procurement	<ul style="list-style-type: none"> • Average annual cost reductions of £25m to £50m, achievable in years when new stock is being procured
3	Options evaluation before procurement	<ul style="list-style-type: none"> • Short to medium term savings growing to between £292m and £388m per annum through life extension of existing rolling stock and deferment of IEP (or its industry led equivalents to 2020). “Low” benefits assume IEP, Thameslink (and Crossrail) proceed. “High” IEP or its equivalent(s) delayed until 2020.
4	Data, tools and skills	We do not ascribe any additional quantified benefits to making progress in this area, but believe that this set of improvements will be necessary to support delivery of the other benefits outlined above.
	Totals	Total long term savings between £316m per annum (17%) and £532m per annum (28%)

Source: Arup research and analysis

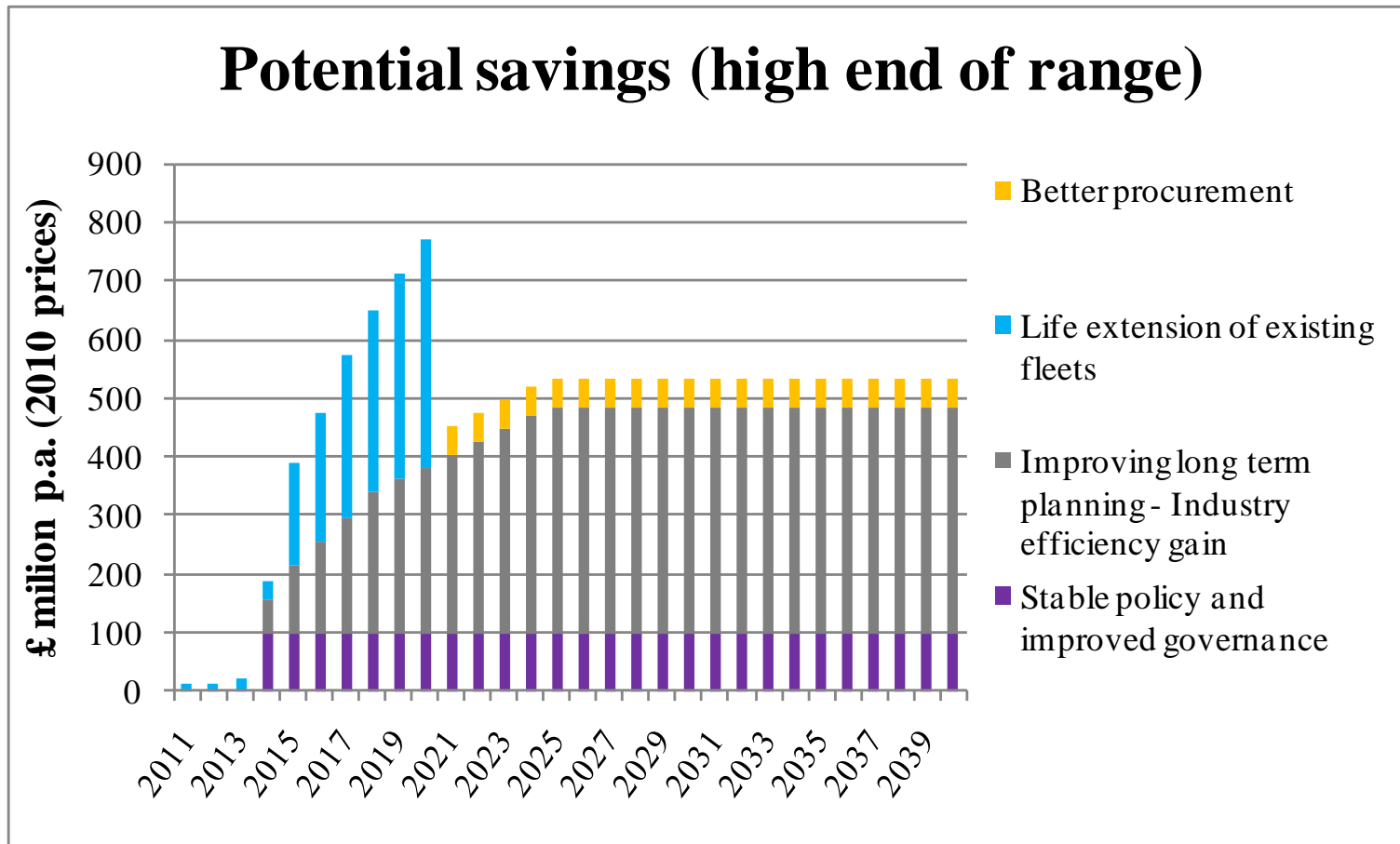
Figure 1.10: Illustration of potential savings (low end of range)



Source: Arup research and analysis

Breakdown of benefits: high case

Figure 1.11: Illustration of potential savings (high end of range)



Source: Arup research and analysis

Implementation plan and overall timescales

Table 1.3: Implementation timeframe

	Strategy element	Implementation – steps and timing
1	Strategy and planning	<ul style="list-style-type: none"> • Likely to require primary legislation to deliver changes to industry structure, so full implementation unlikely until 2014 or later
2	Specification and procurement	<ul style="list-style-type: none"> • Change may be too late to influence IEP, Thameslink (Crossrail?) Benefits unlikely to begin until 2014, or later if life extension option is pursued
3	Options evaluation before procurement	<ul style="list-style-type: none"> • Industry led life extension of existing rolling stock starting immediately with benefits accruing to 2020
4	Data, tools and skills	<ul style="list-style-type: none"> • Work to build capacity anticipated to take two to three years, and only likely to deliver full benefits under changed industry structure

References (Executive Summary)

1. Department for Transport: Improving value for money from the railway – Terms of reference, December 2009
2. See for example the Rail Freight Group (RFG) submission to the Rail Value for Money Study, July 2010
3. For example, in simplified terms, saving money by not replacing rolling stock may have an impact on the fares passengers are willing to pay. We recognise this is an important consideration that would need careful consideration before implementing measures to reduce whole life costs
4. FOCs account for a modest component of total government support in GB rail. As was outlined in their submission to the Rail Value for Money Study of July 2010, FOCs were sold outright at privatisation and have been able successfully to shape their businesses on generally normal commercial terms, free from central government constraint. Therefore the focus of our report is very much on the passenger sector. Reforms such as deregulation might well provide benefits to freight operators too – as outlined in the RFG’s submission.
5. Department for Transport: Reforming Rail Franchising, July 2010
6. For example, see Saal D.S. and D. Parker, (2000) The impact of privatisation and regulation on the water and sewerage industry in England and Wales: A Translog Cost Function Model, Managerial and Decision Economics, also Water Industry Commission for Scotland (November 2005), The Strategic Review of Charges 2006-2010, the final determination and Ian Murray: No way to run a Railway: Lessons from British Rail Privatization, 2005
7. Rail Value for Money Study, Interim Submission to Secretary of State, September 2010
8. Reliability, Availability, Maintainability, Safety (or sometimes Sustainability)
9. Persons with Reduced Mobility
10. As the Rail Freight Group puts it in its submission to the Rail Value for Money Study (dated July 2010) “...We consider that to deliver efficiencies comparable to those in the freight sector, the franchise contracts must be deregulated and allowed to act more commercially. Central government designed service and operational specifications must be much reduced or eliminated, and TOCs should be fully exposed to changes in the variable access charge.

...Again using the freight model, we suggest that they [the TOCs] should be grant aided specifically using something akin to the Mode Shift Revenue Support grant. This would enable much closer scrutiny of costs and benefits and permit regular review of support levels (for freight, maximum contract length is 3 years). This would enable local and national government to protect the services they wish to have yet enable a much more commercial view of overall service provision.”

2. Context, brief and approach to this assignment

2.1 Brief and approach

Context and brief

- In January 2010, the Secretary of State for Transport announced a study led by Sir Roy McNulty ('the McNulty review') into the value for money of GB rail, jointly sponsored by the Department for Transport (DfT) and the Office of Rail Regulation (ORR). The study's Terms of Reference were "to examine the overall cost structure of all elements of the railway sector and to identify options for improving value for money to passengers and the taxpayer while continuing to expand capacity as necessary and drive up passenger satisfaction."¹

- As part of the McNulty review, the Rail VfM team has identified whole life costs of rolling stock in Great Britain as an area where there may be potential for government and industry to benefit from cost reductions. In this context, the term 'rolling stock' refers primarily to the totality of passenger rolling stock used on the railway. This is because the vast majority of cost and public money is focused on passenger services and broadly speaking, the freight railway can be considered to be operating satisfactorily from a whole life cost perspective.² 'Whole life costs' refers to a broad range of industry costs associated with rolling stock, detailed further in the main body of our report. It was beyond the scope of this study to consider the impact of improving whole life costs on passenger revenues.³

- Regulatory requirements (from safety standards through to passenger facilities):

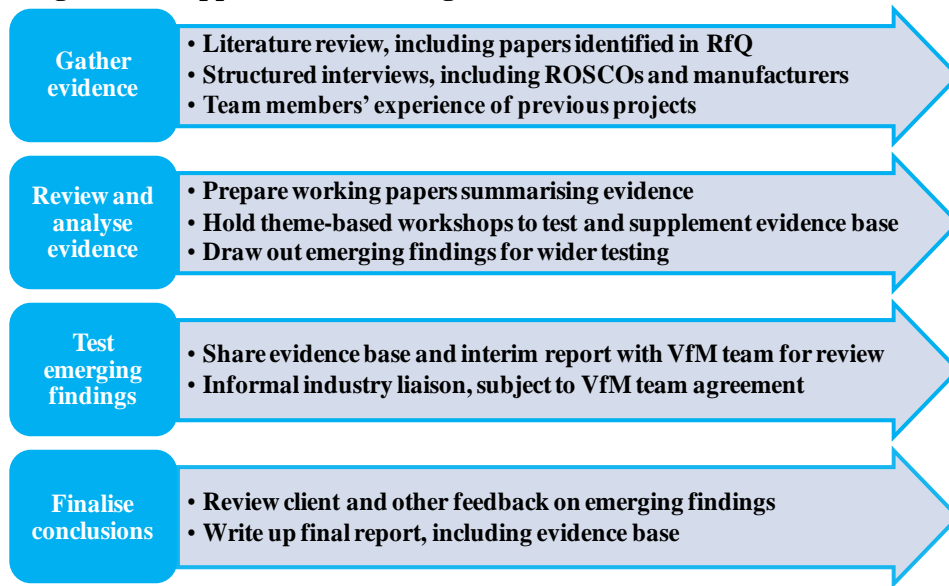
- Design and manufacture.
- Introduction to service – testing, acceptance and approvals.
- Operations – Track Access Charges, fuel and staff.
- Outage and unavailability.
- Poor performance and breakdown.

- Cleaning, servicing and maintenance.
- Overhaul and refurbishment.
- Modification and conversion.
- Life extension.
- Disposal.
- Records and documentation (licences, registers, design authority etc).
- Cost of finance.
- Costs borne elsewhere in the industry, and particularly within the management of railway infrastructure.

- There is a range of issues not directly related to construction and asset management, yet still relevant to a full appraisal of the costs and benefits relating to rolling stock value for money. These include levels of train staff and revenue generated a whole range of passenger comforts and services that may be increase the capital and operational cost of rolling stock. These elements which have been researched and assessed over many years (in the form of the contents of the Passenger Demand Forecasting Handbook (PDFH) for example) lie beyond the scope of this study.

Approach

Figure 2.1: Approach to this assignment



• Our approach to managing this assignment involved the creation of a simple framework to “funnel” a broad range of existing analysis and expertise towards a set of evidence-based conclusions and recommendations. It can be summarised as follows:

• **Gathering evidence** – We reviewed existing literature and submissions provided to the Rail VfM team by interested parties. We supplemented that information by undertaking a range of meetings and structured interviews with parties from across industry, and by contributing our experience from previous relevant assignments.

• **Reviewing and analysing evidence** – We managed a series of issue-based workshops to discuss the evidence base as a single body and identify emerging themes and proposals to be tested further with key stakeholders.

• **Testing emerging findings** – We tested our emerging findings with interested parties within industry and government.

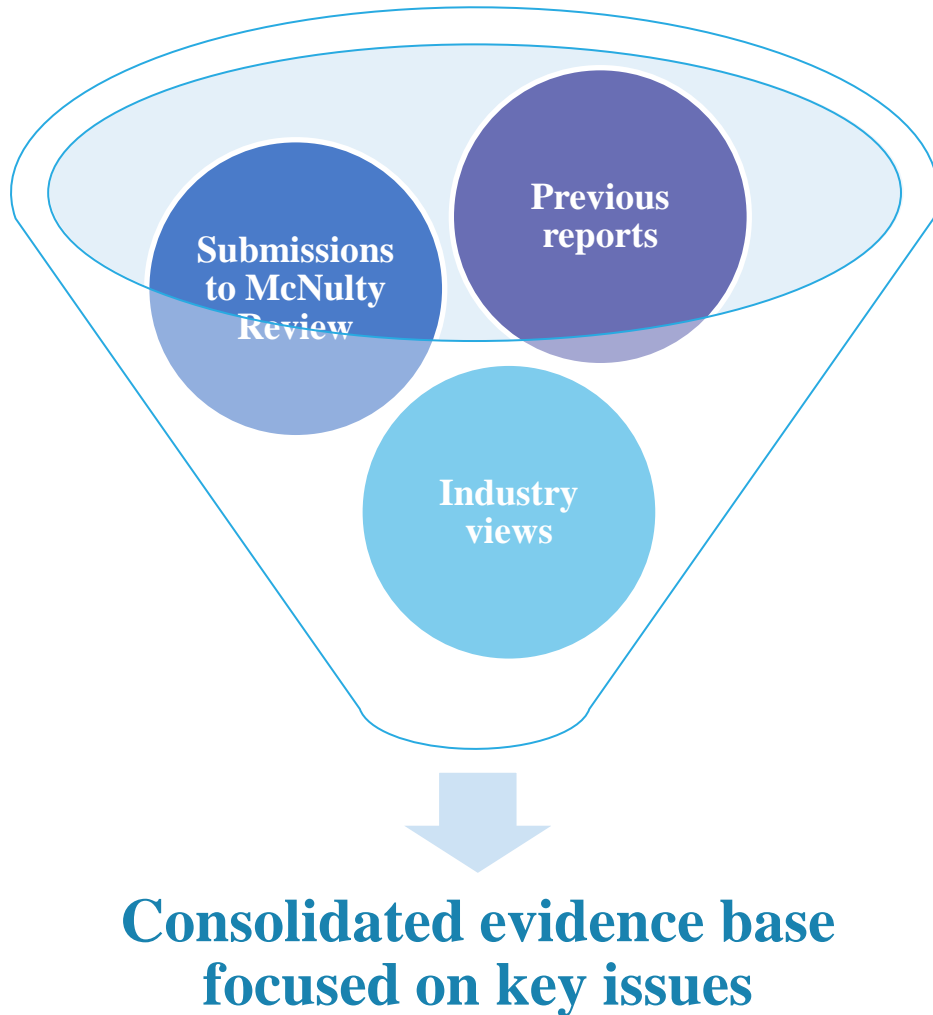
• **Finalising conclusions** – We took feedback and new information into account before finalising our conclusions.

• **Estimating benefits** – We analysed those initiatives that we considered could make the most significant contribution to achieving reduced costs.

• Outline details of the evidence base on which our work drew are provided overleaf with further details set out in Appendix A to our report.

Evidence base

Figure 2.2: Evidence base



• In reviewing issues relating to rolling stock whole life costs, we have drawn on the following range of quantitative and qualitative data:

- Previous work undertaken for the McNulty Review (e.g. Atkins' report on the supply chain and Civity's benchmarking analysis).

- A wide range of other relevant publicly available reports (including Sir Andrew Foster Review of the Intercity Express Programme (IEP), the Competition Commission's reports following its investigation of the rolling stock leasing market, previous strategy papers published by the SRA and DfT, and papers published by the Association of Train Operating Companies (ATOC) and the Rail Safety and Standards Board (RSSB).

- Submissions made to the McNulty Review by a broad range of industry parties.

- Interviews which our team held with parties from across industry.

- Analysis undertaken by our team and other parallel VfM workstreams (e.g. international benchmarking of rolling stock capital costs).

- Our team members' experience on relevant rolling stock projects and transactions.

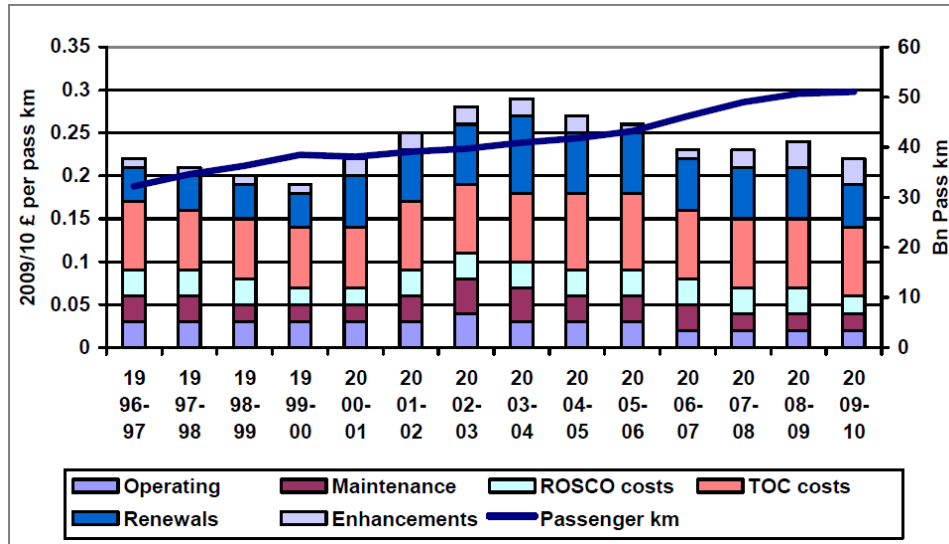
- Feedback on drafts of our reports from industry parties directly engaged in the McNulty Review.

- Appendix A provides details of the documents we reviewed and the people with whom we spoke during this assignment.

2.2 The context for UK rolling stock costs

Trends in GB rail costs - costs

Figure 2.3 : Industry expenditure per passenger 1996/97-2009/10 (2009/10 prices)



Source: Rail Value for Money Study, Interim Submission to Secretary of State, September 2010

- Our report has been prepared for and in the context of the McNulty Review of UK rail industry costs. The Review was announced by the then Secretary of State alongside the Pre-Budget Report in December 2009. Its Terms of Reference included examining the overall cost structure of all elements of the railway sector, and identifying options for improving value for money.

- The McNulty Review’s *Scoping Study* reported in June 2010. It concluded, *inter alia* that:

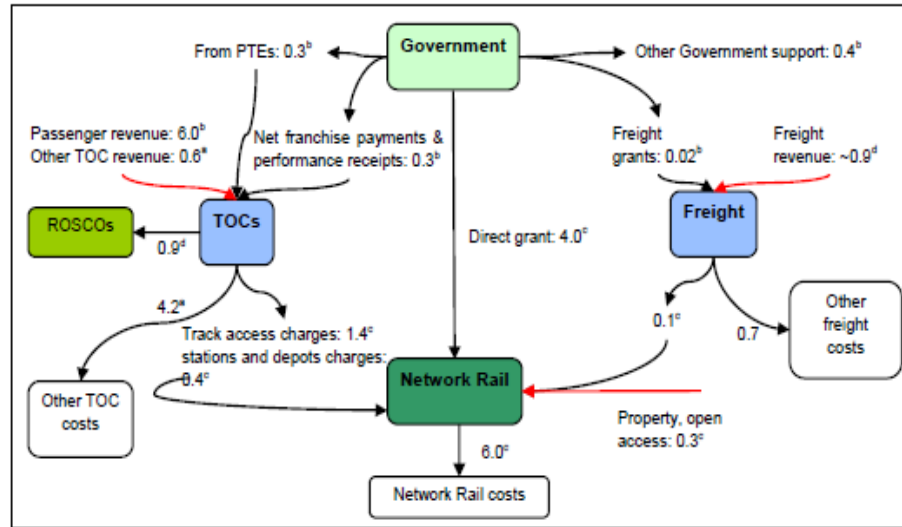
- The overall cost of running the railway had increased over the previous 10 years but income from users had not kept pace – increasing the call on the taxpayer.

- In real terms the costs of train operations have risen by 19% per train kilometre since 1996/97.

- The McNulty Review’s *Interim Report* showed analysis of historical costs within the UK rail industry as set out in figure 2.3. Although total industry costs appear to be lower now in absolute terms than they were five years ago, costs per passenger km travelled appear to have risen steadily since privatisation, as indicated above.

Industry context: GB rail financial flows

Figure 2.4: Financial flows in GB rail 2008/09 (£ billion, 2008/09 prices)



Source: DfT/ORR, Rail Value for Money Scoping study report, Version 1.1, March 2010

• Figure 2.4 shows the present industry structure and financial flows between the parties. The industry depended on DfT for 37% of its funding in 2008/09, with a further 2% of funding coming from the publicly-funded Passenger Transport Executives (PTEs). Much of this is channelled directly to Network Rail (NR) rather than through the Train Operating Companies (TOCs) or Freight Operating Companies (FOCs).⁴ The extent of public financial support required and the history of cost control since rail privatisation perhaps helps to explain why central government considers it is justified in intervening and managing matters directly in the rail industry.⁵

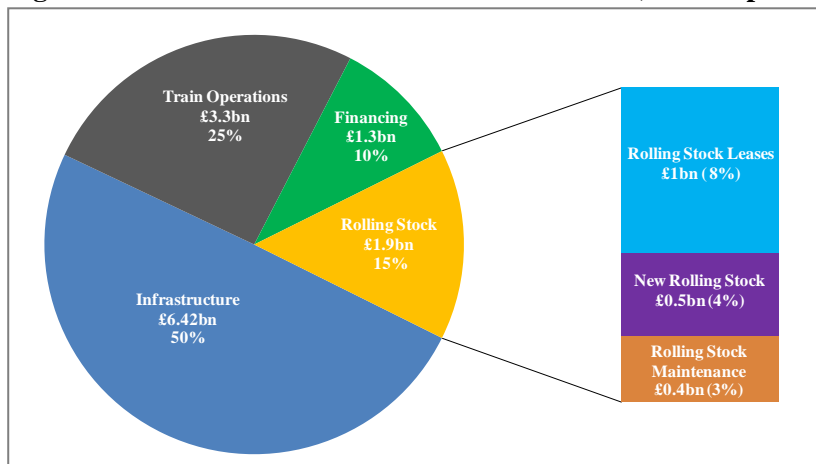
• At the same time in setting up the McNulty review, central government has indicated that it believes opportunities exist to improve efficiency, not least because of the affordability constraints that the public sector is facing more widely and continuing challenges of the present arrangements.

• Experience from other industries (e.g. regulated utilities), indicates that moving nationalised (or quasi-government controlled) industries to a successful private sector delivery model can deliver significant reductions in operating costs and improvements in productivity.⁶ The major difference between GB rail and nearly all other utilities is of course its continued dependence on significant amounts of public resource. Since privatisation, central government has become increasingly involved in shaping the day-to-day delivery of passenger rail services. In the context of rolling stock, this has included bringing franchise specification and management “in house” (to DfT) as well as major rolling stock procurement exercises (such as the Intercity Express Programme (IEP) and Thameslink) .

• This paints a picture of an industry in which the private sector is tasked with delivery, but is constrained in its ability to manage down costs by a high degree of central government influence over the detail of day-to-day operations (e.g. specifying timetables and on-board systems). This sets the context for the increase in unit costs of 19% since privatisation despite rising passenger demand, in contrast to the consistent efficiency gains witnessed in other UK privatised industries.⁷

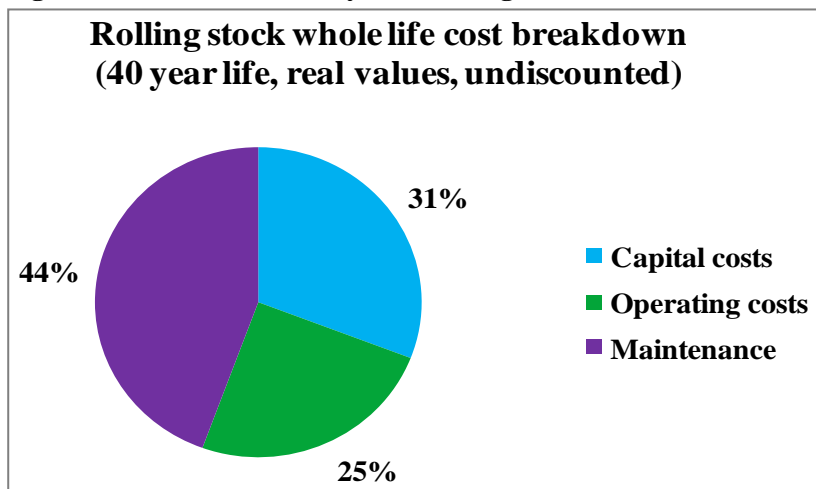
GB rail rolling stock costs: evidence on level and composition

Figure 2.5: Total GB rail cost breakdown 2009/10 (2009/10 prices)



Source: DfT data, Atkins analysis

Figure 2.6: Illustrative analysis of rolling stock whole life costs



Source: Confidential project data, Arup analysis

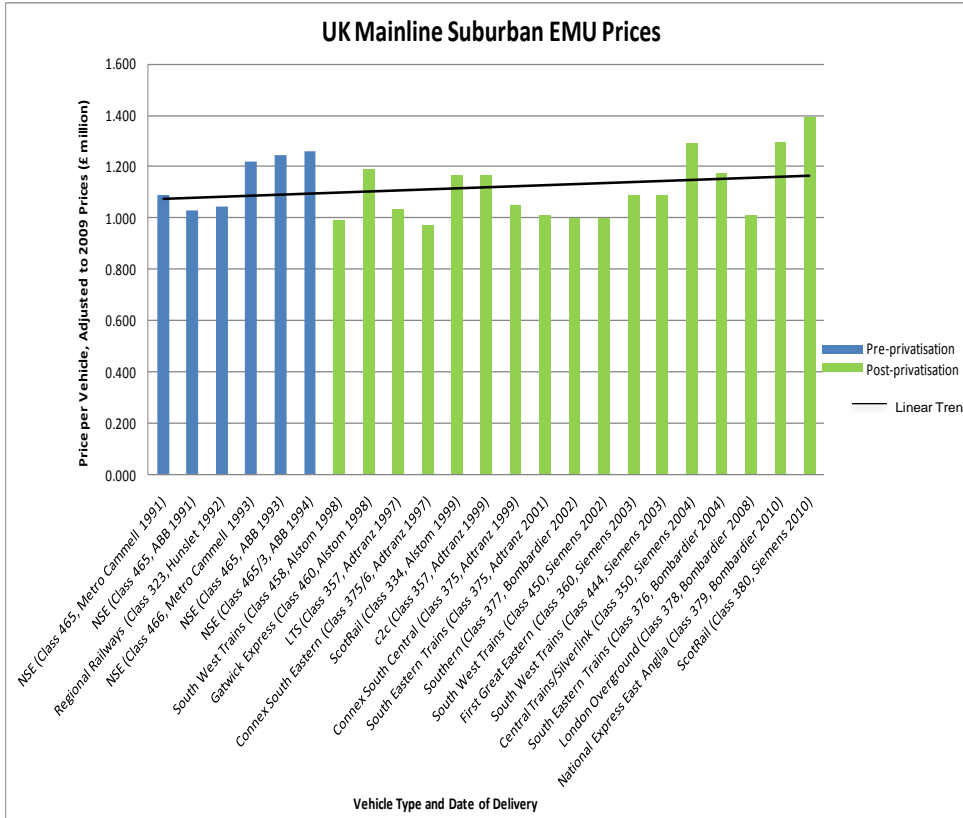
- As can be seen in figure 2.5, total GB rolling stock costs (including capex, opex and financing) have been estimated by Atkins in their work for the Rail Value for Money team at around £1.9 billion per annum, accounting for 15% of total rail industry cost in any given year. Those estimates draw on DfT data, although we note a degree of uncertainty in relation to their accuracy and granularity. (The “new rolling stock figure” is an annualised estimate of expenditure required to renew the GB rolling stock fleet on an ongoing basis). Data availability and reliability is one of a number of issues identified in the course of our work as an area in which much improvement is required to support effective future management of whole life costs for rolling stock.

- It is however evident that the key driver of whole life costs for rolling stock is initial capital expenditure. Figure 2.6 indicates that capital costs account for 31% of the whole life costs for an illustrative fleet on an undiscounted basis. However, translating that figure into lease costs whereby the capital costs are financed over (typically) the life of the asset, can take that figure up to around 60% - depending on how the costs are discounted. Decisions taken during the early “lower costs” stages of the rolling stock life cycle (what we refer to as “needs specification” or selection of a procurement model) also have a material impact on whole life costs. Choices around asset complexity, reliability and maintainability (collectively known as “RAMS”⁸) are prime examples of decision areas that have long term whole life cost implications for an asset.

- Evidence on rolling stock whole life cost trends is very limited. As shown on the following pages, it is evident that historical costs of UK rolling stock orders are not significantly higher than equivalent costs in other countries and that they have not risen dramatically since rail privatisation. However, there is also evidence to suggest that there are significant opportunities to improve value for money in the UK and whole life cost management. Furthermore, recent signs (e.g. IEP and Thameslink procurement) indicate that UK rolling stock capital costs are on the rise – possibly steeply - and that affordability presents a significant challenge for government and the industry.

Historical trends in the cost of GB rolling stock procurement

Figure 2.7: Historical data for Electric Multiple Unit (EMU) rolling stock orders in Great Britain 1991/92-2009/10



Source: Arup Rail VfM team research and analysis

• In figure 2.7, the price paid per unit (in 2009 prices) for Electric Multiple Unit (EMU) orders is shown. EMUs account for the vast majority of new passenger rolling stock procured since the 1990s. The blue bars represent procurements completed prior to privatisation of the rail industry, while the green bars show procurements completed since then. The dark line shows the trend in costs.

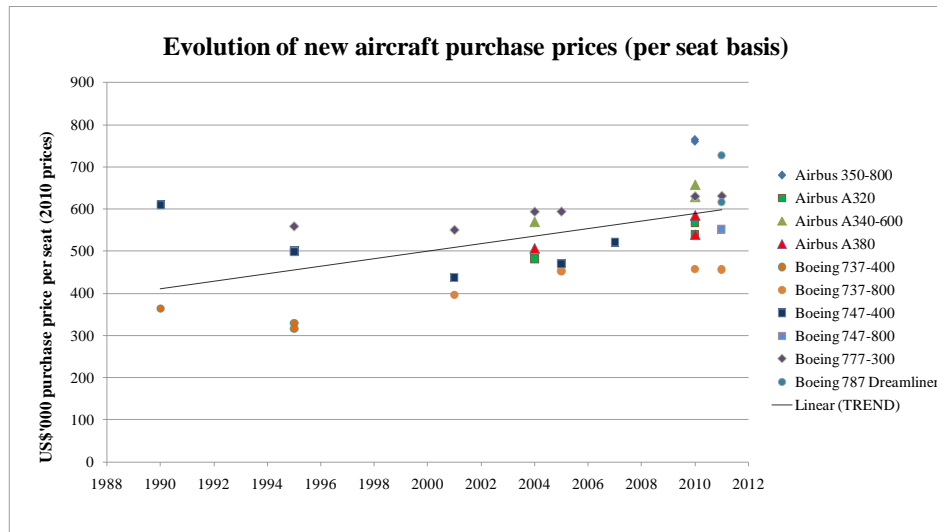
• It can be seen that prices did not grow in the period immediately following industry privatisation (as noted by the SRA’s 2003 rolling stock strategy).⁹ In fact, unit costs appeared to – if anything – fall in that period. Costs may well now be on the rise. It is understood that the costs of both Thameslink and IEP rolling stock are likely to be significantly higher when compared on a similar basis to those shown in figure 2.7. Furthermore, in whole life cost terms, IEP in particular has generated affordability concerns. The Sir Andrew Foster review of the IEP programme¹⁰ provided a clear statement that the government was surprised by the size of the bids it received, and that the IEP programme faces a serious affordability challenge. The figures themselves are commercially sensitive and not publicly available (as is the case with Thameslink). However, we understand from DfT that if they were to be plotted on the chart opposite, the unit costs for IEP would be well above the top end of the scale shown.

• Industry parties with whom we spoke during our work – together with the recent experience of members of our advisory team – have told us that prices for very recent and ongoing procurements are indeed significantly higher in real terms than for historical orders.

• Benchmark data should be regarded with a degree of caution. They often involve implicit or simplifying assumptions around factors such as service quality in different countries, different vehicle lengths, changing interest rates and exchange rates.

GB rolling stock trends: comparisons with other assets

Figure 2.8: Aircraft costs per seat - 1988-2012 (2010 prices)

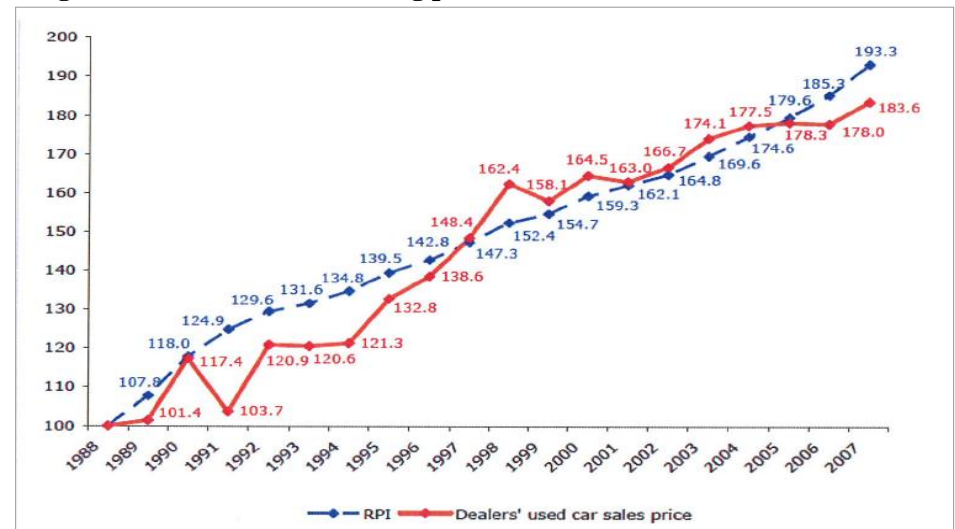


Sources: Airline World Magazine June 2001, Aviation Week website, Boeing website, Massachusetts Institute of Technology Annual Review 2001, Massachusetts Institute of Technology Historical Trends in Aircraft Performance, Cost and Emissions 2000, Spiegel website, Aircraft Value Analysis website, Arup analysis

- In figure 2.8, the price paid per unit (in 2010 prices) for aircraft orders by type of equipment and normalised on a per seat basis is shown for the period 1988-2012 (includes placed orders, yet to be delivered). The straight line shows the linear trend in costs. It can be seen that broadly speaking, costs on a per seat basis have increased in real terms over time and on a linear basis by around 46%.

- Figure 2.9 provides an historical time series for used car prices in the UK. On the basis that this is a reasonable proxy for new car prices (all things being equal, second hand car price trends will, over the long term track those

Figure 2.9: UK used car selling prices and RPI - 1998-2007



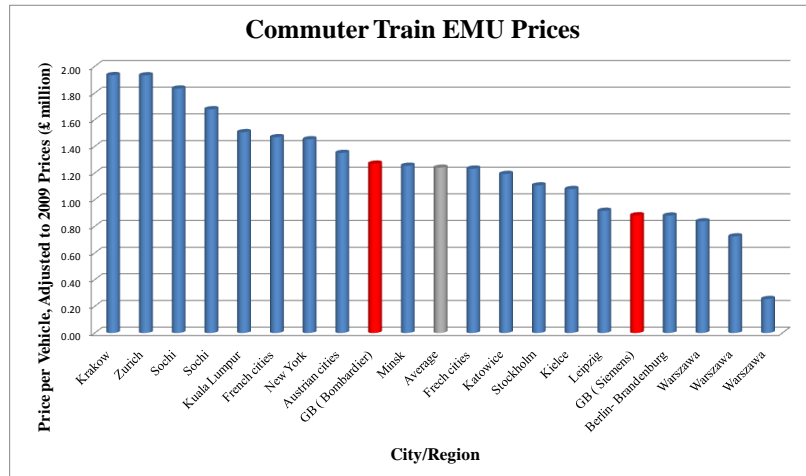
Source: BCA Used Car Marketing Report 2009 in Cooke, Peter, The UK Automotive Industries Status, Economic Recovery and Expectations, prepared for the SMMT, 2009

of new cars), it can also be seen that there is some evidence of long term real increases in price that are not hugely out of line with RPI.

- In very broad terms therefore, it can be argued that new rolling stock costs since privatisation are not hugely out of step with the evolution in prices of the other assets presented here. On the pages overleaf we show data comparing new GB rolling stock costs with those of other countries.

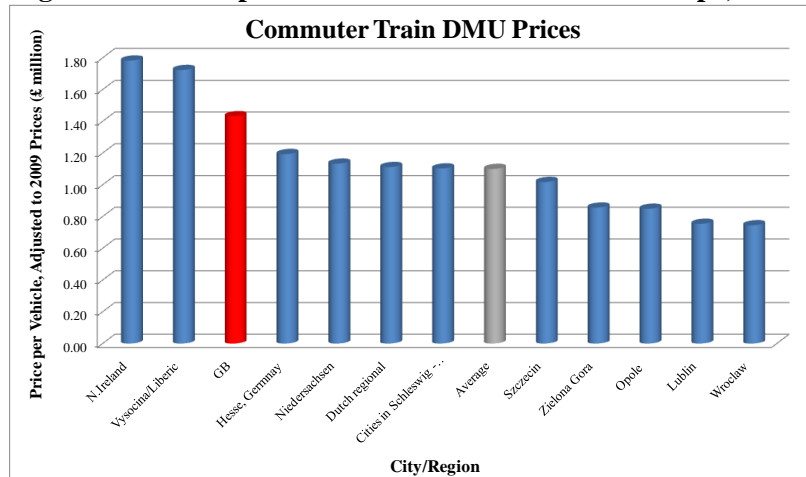
Benchmarking GB rolling stock costs

Figure 2.10: Comparative data for EMU costs in Europe, 2009



Source: Metro report international 2010, Arup analysis

Figure 2.11: Comparative data for DMU costs in Europe, 2009



Source: Metro report international 2010, Arup analysis

- To supplement the work undertaken by Civity (a consultancy also undertaking work for the VfM study (summarised on the following page)), we have undertaken additional benchmarking analyses of order costs for commuter EMU and DMU stock in the UK and a range of other European countries.

- The results of this analysis can be seen in the two charts opposite. They show benchmark analysis of DMU (above) and commuter EMU (below) capital costs per vehicle, in 2009 prices. Figures for GB are shown in red, with the average across the two datasets shown in grey.

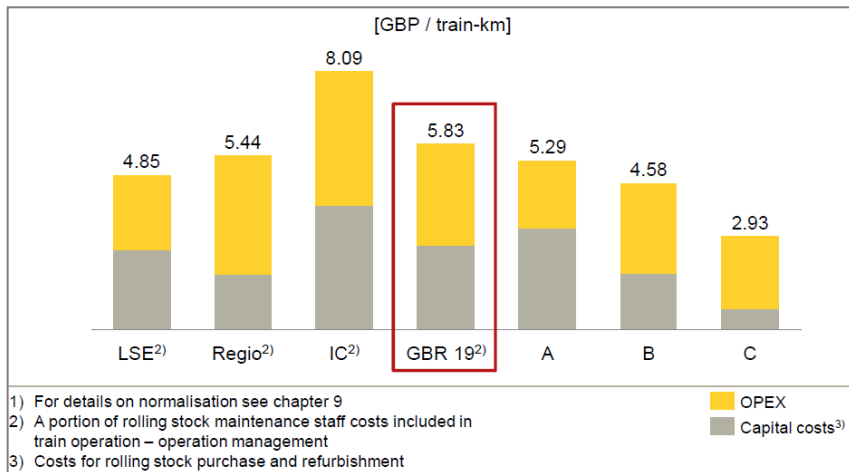
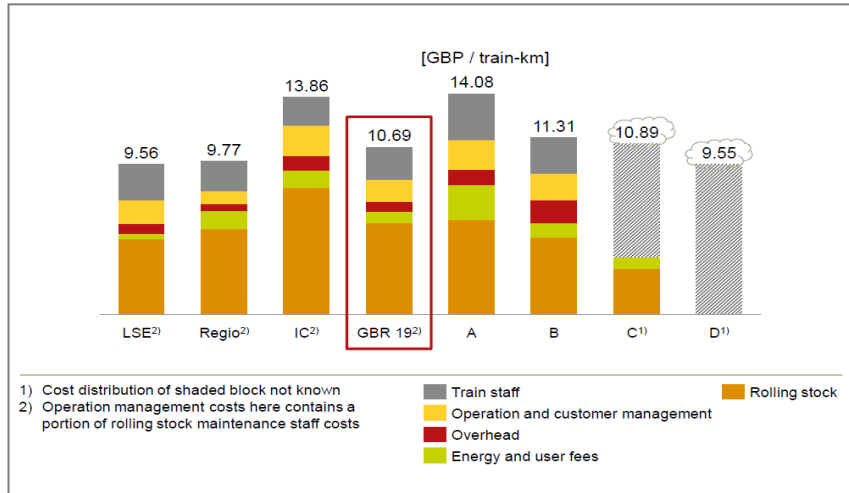
- The data shown in the upper chart indicate that GB unit costs for commuter EMUs around or below average for the year in question. The unit costs shown for the UK orders are however 22% greater than the lowest unit cost observed (excluding the outlier at the extreme right of the chart).

- The data shown Figure 2.11 indicate that GB unit costs for Diesel Multiple Units are significantly (around one third) above the average observed for the group and around twice as high as the unit cost for the cheapest comparators observed.

- Benchmark data should be regarded with a degree of caution. They often involve implicit or simplifying assumptions around factors such as service quality in the different countries, different vehicle lengths, changing interest rates and exchange rates. In addition, we note that the prices analysed are per vehicle prices but in many continental European markets, rolling stock is articulated.

Benchmarking GB rolling stock costs...contd

Figures 2.12; 2.13 : Comparative data for “total” TOC costs including rolling stock; rolling stock capital and opex costs



Source (both figures): Civity report for McNulty Review, 2010

- Figures 2.12 and 2.13 have been drawn from analysis undertaken by Civity to support the McNulty Review.

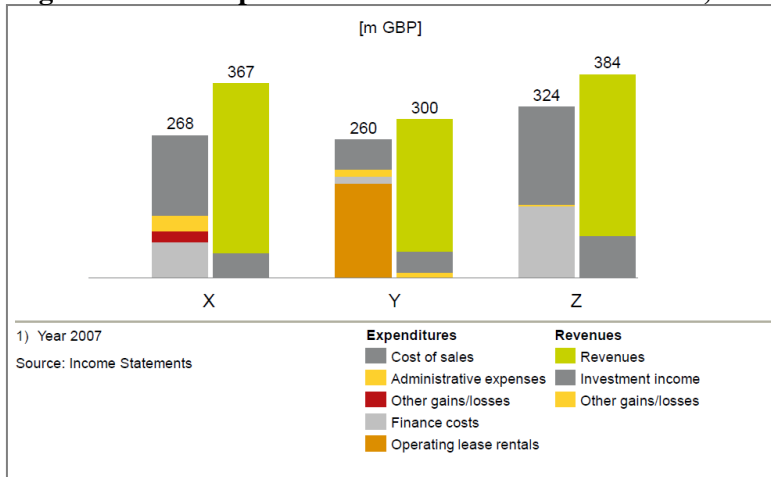
- The upper chart sets out a comparison of UK TOC costs with those observed in a group of non-UK (state owned) rail businesses. The analysis indicates that GB total train operating costs including train a staff are at the lower end of the spectrum. (Note ‘LSE’ refers to London & South East operators; ‘Regio’, regional TOCs and ‘IC’, Intercity and the letters ‘A’, ‘B’, ‘C’ and ‘D’ refer to Civity’s anonymised International comparators)

- In figure 2.12 , Civity’s analysis suggested that GB rolling stock capital costs were within the range observed in that comparator group (although at the upper end if the outlier ‘C’ is not omitted). However, Civity’s analysis shows opex for UK rolling stock to be higher than each of the three comparators.

- Having reviewed the benchmark analysis set out both opposite and on the previous page, it is not possible to draw an unequivocal conclusion that the costs of procuring and maintaining rolling stock in the UK are significantly higher than those borne by other countries. However, as was noted earlier, there are concerns about the trend and expected costs of rolling stock going forward. In addition, as can be seen in the remaining sections of this report, there appear to be genuine opportunities to improve rolling stock value for money over the medium to long term.

Rolling stock lease payments

Figure 2.14: Comparative financial data for ROSCOs, 2007



Source: Civity report for McNulty Review, 2010

- Lease payments are an important element of rolling stock costs. Capital investment (or initial purchases of assets) is recouped through rolling stock lease charges along with non-capital elements that may be payable for maintenance etc. Lease payments form a significant component of the ongoing financial commitments for train operators. In 2009/10 they are estimated to amount to some £1bn; approximately 50% of rolling stock costs, based on Atkins estimates – as shown on page 18 of this report. They account for just under 8% of total rail costs based on the same base estimate.

- Figure 2.14 shows analysis undertaken by Civity for the McNulty Review. The analysis indicates the profitability of the top three ROSCOs in 2007. Civity’s analysis suggests that all three ROSCOs were profitable in the year in question.

- ROSCO profitability and their level of market power have been the source of much debate and controversy since rail privatisation. This culminated in

the two year long Competition Commission enquiry that reported in 2009.¹¹ In the course of its investigation into the rolling stock leasing market, the Competition Commission drew on a broad range of analyses of ROSCO costs and profitability provided by parties including central government (which precipitated the CC investigation) and the ROSCOs themselves.

- An important factor behind the ROSCOs’ strong historical financial performance lies in the fact that at the time of rail privatisation, their fleets were valued based on an assumption that the rolling stock sold would not be used beyond the end of what was then assumed to be the assets’ useful life (around 30 years). In reality, the ROSCOs have been able to extend the life of their vehicles beyond that point. Furthermore, increasing passenger demand in the period since privatisation have meant that the degree of competition in the rolling stock leasing market now appears to be more limited than government believed it would be at the time of privatisation. Through our discussions with those involved in the privatisation of the ROSCOs, we also understand that political uncertainty in the form of the Labour Party’s threat to renationalise the rail industry also drove out competition for the ROSCOs and the prices bidders were willing to pay.¹²

- The fact that all three ROSCOs have been sold since 2008 means that analysis of their historical financial performance before those three sales cannot be viewed as an indicator of how profitable they might be today or in the future. The ROSCOs’ historical profitability will have been factored into the valuation of the businesses when they were re-sold, and that value would have been extracted by the previous owners in those transactions. We would now expect the businesses to have levels of debt which restricted future rates of return to levels typical of core infrastructure businesses.

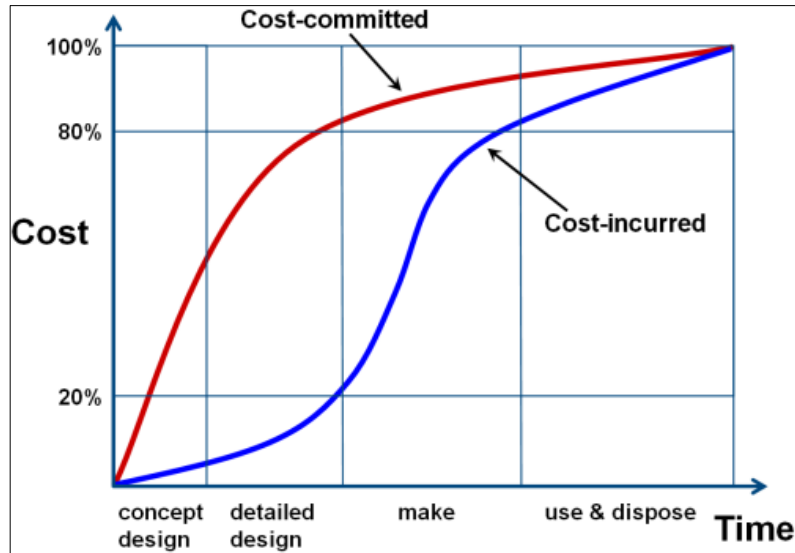
Summary of analysis: GB rolling stock costs

- Total GB rolling stock costs are presently estimated at around £1.9 billion per annum accounting for 15% of total rail industry cost in any given year (2010 prices).
- Available data suggest that the unit cost of new rolling stock orders fell slightly in the years following privatisation, although there have been some modest increases in real terms over the last five years. The trend in rolling stock prices is not out of line with those for aircraft or the second hand UK car market.
- Whilst limited benchmarking suggest that the historical costs of UK rolling stock orders are not significantly higher than equivalent costs in other countries, there is evidence to suggest that there are significant opportunities to improve value for money.
- Perhaps not surprisingly, the key driver of whole life costs for rolling stock is the initial capital expenditure, accounting for an estimated 30% to 60% of whole life cost depending on how the asset is financed.
- Debates around historical ROSCO profitability have persisted since rail privatisation 1990s. The Competition Commission enquiry which concluded in 2009 reviewed the rolling stock leasing market and made a number of recommendations (discussed later in this report). Part of the reason for ROSCOs' profitability can be put down to the threat of renationalisation not materialising (in 1997) which depressed valuations and bid prices at the time of privatisation. Furthermore, demand for passenger rail services – and rolling stock – has continued to grow persistently, leading to a lack of surplus stock for the network.
- “Low cost” parts of the rolling stock life cycle value chain (such as needs specification phase and the procurement process adopted) can have a lasting impact on rolling stock whole life cost (this is discussed further in later parts of this report)
- There is evidence of upward pressure on GB new rolling stock costs and that these are anticipated lead to materially higher unit costs for procurement programmes that are still underway (specifically IEP and Thameslink). GB new rolling stock costs may rise sharply and affordability constraints present a significant challenge for government and the industry as a whole.

3. Rolling stock lifecycle issues and cost drivers

Rolling stock: lifecycle issues and cost drivers - introduction

Figure 3.1: Relationship between cost influence and cost committed



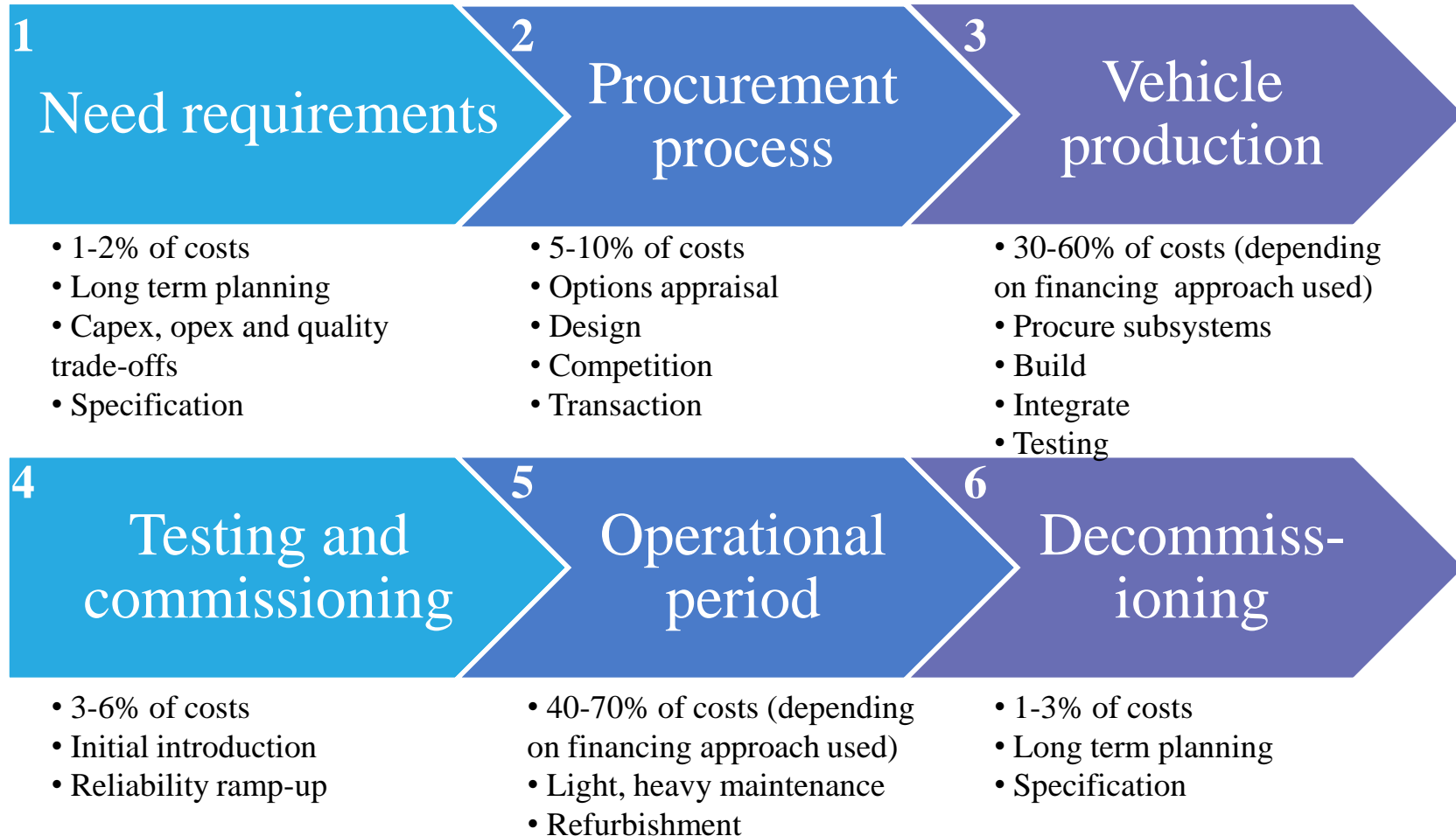
Source: DfT / ORR Rail VfM team

- This section describes our view of the asset lifecycle for rolling stock, from initial articulation of need through to the ultimate decommissioning of the assets when they reach the end of their useful life.
- The figures on the following two pages set out:
 - The costs and tasks associated with each stage of the asset lifecycle.
 - The degree of influence which each of the parties has on the costs incurred during each stage in this process.
- As was noted earlier in the report, costs committed at one point in the cycle can have significant influence on costs incurred later on in the process. For example needs specification have a clear and lasting impact on production and maintenance costs. Figure 3.1 provides a stylised overview of this relationship.

Rolling stock: lifecycle roadmap and costs

Figure 3.2. presents a high level view of the activities and considerations associated with each stage of rolling stock asset lifecycle along with our estimate of whole life costs associated with the different lifecycle stages.

Figure 3.2: Indicative cost estimates for rolling stock life cycle stages



Source: Arup VfM team research and analysis

Rolling stock lifecycle: parties' current degree of influence on costs

The extent to which stakeholders drive whole life costs incurred during each part of the rolling stock lifecycle process is summarised below. This analysis broadly reflects current roles and industry structure.

Figure 3.3: Indicative cost estimates for rolling stock life cycle stages

Party	Need requirements	Procurement process	Vehicle production	Testing and commissioning	Operational period	Decommissioning
DfT	High	High	High	Low	Medium	Low
TOCs	Medium to High	Medium to High	Low	High	High	Low
ROSCOs	Low to Medium	Medium	Low to Medium	Low	Low to Medium	High
NR	Low	Low	Low	High	Medium	Low
Manufacturers	Low	High	High	High	Medium	High

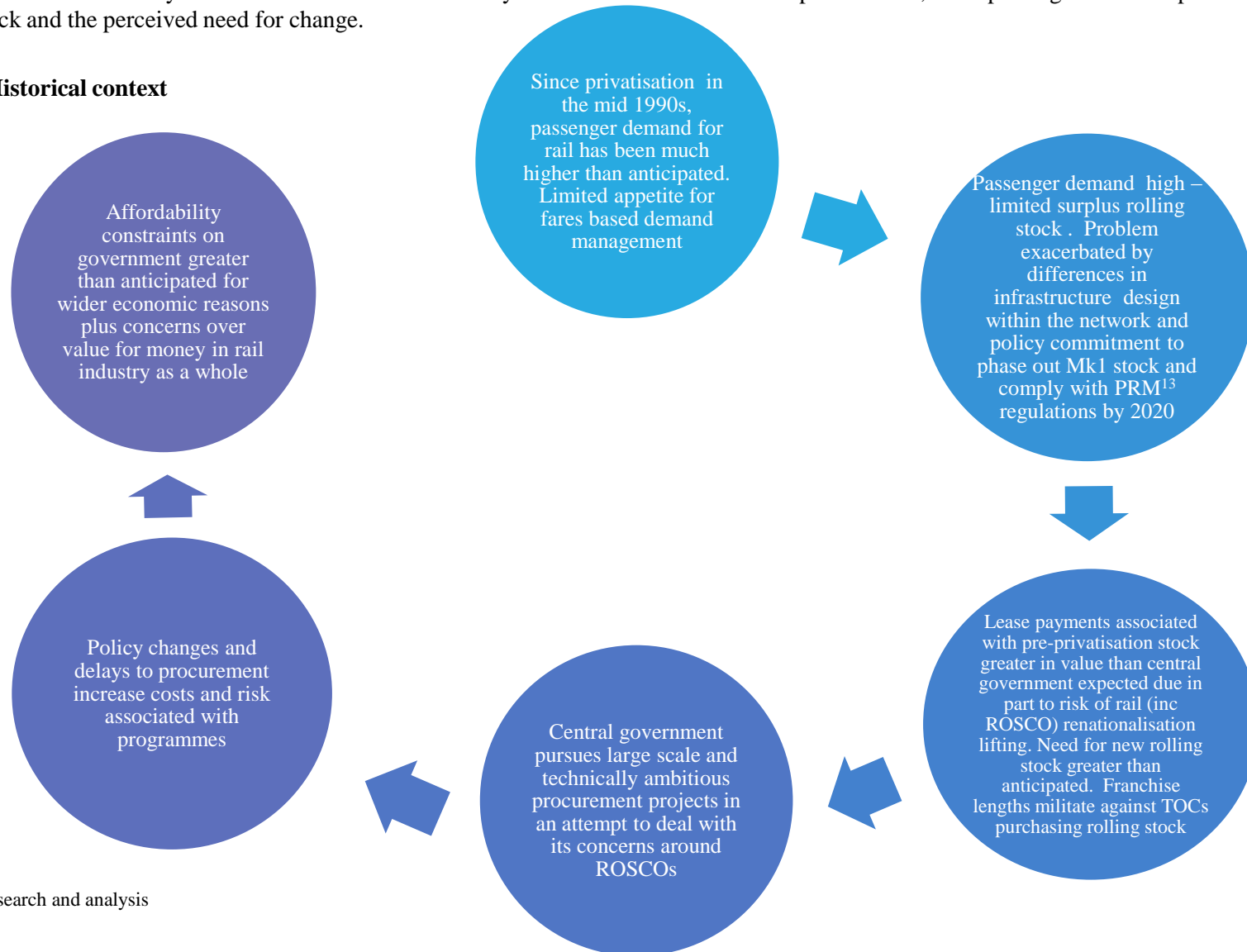
Source: Arup research and analysis

4. Analysis of perceived problems associated with UK rolling stock whole life costs

GB rolling stock affordability: selected historical context

- Figure 4.1 provides a summary of what we consider to be the key drivers and events since rail privatisation, underpinning the overall problem of affordability for GB rolling stock and the perceived need for change.

Figure 4.1: Historical context

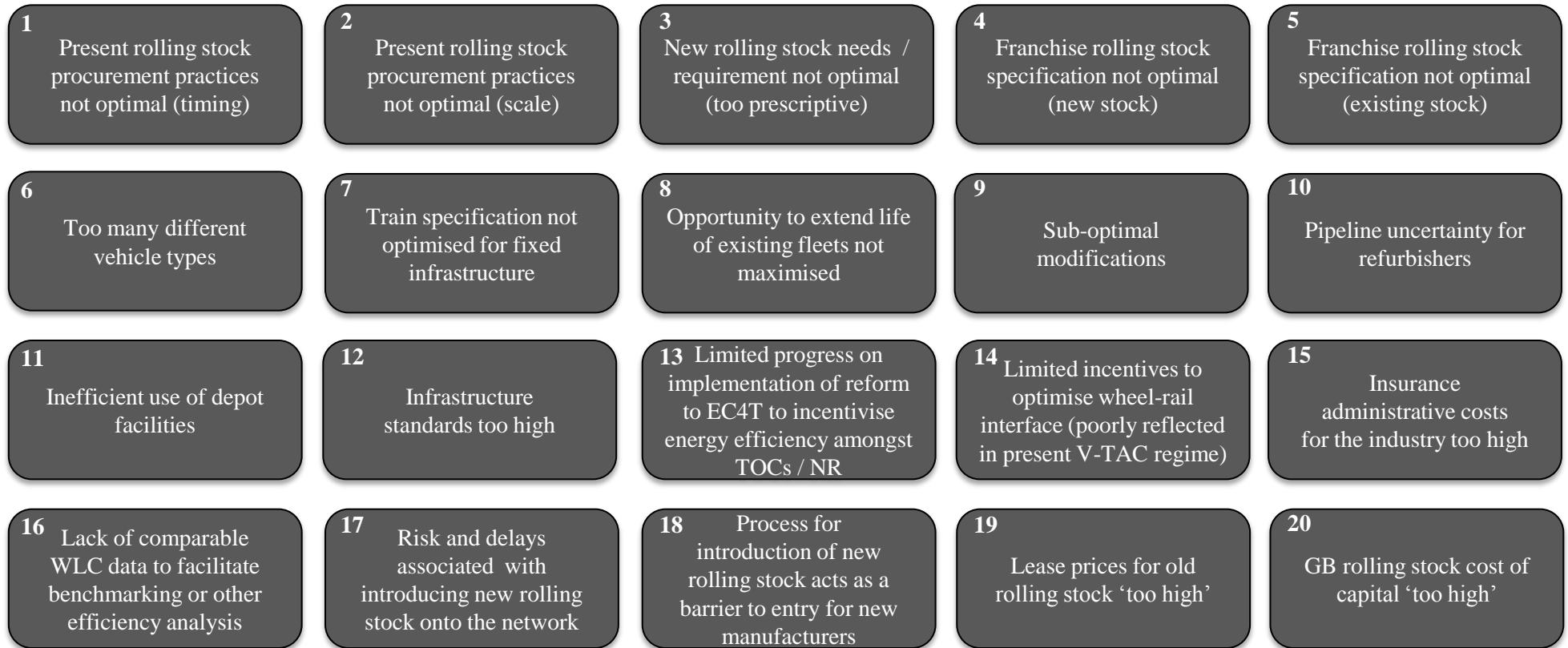


Source: Arup research and analysis

Perceived problems reviewed

In the course of our work we reviewed 20 perceived problems relating to cost associated with rolling stock in the UK, identified both by our client and the wider group of industry parties with whom we spoke. These are set out and numbered below. The tables on the following pages then summarise the evidence base relating to each of the problems.

Figure 4.2: Perceived problems reviewed



Source: Arup research and analysis

Analysis of causes and impacts of perceived problems

The table below describes the perceived problems presented to us in the course of our work, noting their possible causes. The circles and arrows indicate instances where perceived problems may be driving costs at different stages in the assets' lifecycle.

Table 4.1a: Analysis of perceived problems' impacts

Analysis of perceived problems' impacts								
Perceived Problems	Description	Causes	Needs / Requirements	Procurement Process	Vehicle Production	Testing & Commissioning	Operation and Maintenance	Decommissioning
1. Present rolling stock procurement practices not optimal (timing)	Stop-go ordering, (constant change / uncertainty)	Level of DfT involvement, complexity, price uncertainty						
2. Present rolling stock procurement practices not optimal (scale)	Piecemeal orders (feast/famine)	Level of DfT involvement, franchise length and size						
3. New rolling stock needs / requirements not optimal (too prescriptive)	Technically challenging / risky, poor cost certainty, lack of standardisation (5%-10% vehicle production cost)	Level of DfT involvement (passenger demand and needs into rolling stock technical requirements, franchise length)						
4. Franchise rolling stock specification not optimal (new stock)	Reduced rolling stock deployment flexibility, maintenance efficiency, revenue maximisation.	Level of DfT involvement, franchise specification, infrastructure constraints						

Source: Arup research and analysis

Analysis of causes and impacts of perceived problems...contd

Table 4.1b: Analysis of perceived problems' impacts

Analysis of perceived problems' impacts								
Perceived Problems	Description	Causes	Needs / Requirements	Procurement Process	Vehicle Production	Testing & Commissioning	Operation and Maintenance	Decommissioning
5. Franchise rolling stock specification not optimal (existing stock)	Cascading impact on deployment of rolling stock, maintenance costs and revenue	Level of DfT involvement, franchise specification, infrastructure constraints						
6. Too many vehicle types	Reduced rolling stock deployment flexibility (cascading), maintenance efficiency (restricts opportunity for independent maintainers / lack of coupling compatibility	Legacy / technical characteristic of network						
7. Train specification not optimised for fixed infrastructure	New UK train weight increasing, leading to increased track maintenance / renewal costs (long term)	Whole life cost impacts on infrastructure not reflected in business case						
8. Opportunity to extend life of existing fleets not maximised	New rolling stock being commissioned when existing rolling stock could be life extended further	Level of DfT involvement, Government's poor relationships with ROSCOs						

Source: Arup research and analysis

Analysis of causes and impacts of perceived problems...contd

Table 4.1c: Analysis of perceived problems' impacts

Analysis of perceived problems' impacts								
Perceived Problems	Description	Causes	Needs / Requirements	Procurement Process	Vehicle Production	Testing & Commissioning	Operation and Maintenance	Decommissioning
9. Sub-optimal modifications	Decision-making process for modification complicated and longer because of separation of heavy and light maintenance responsibilities, leading to missed whole life cost reduction opportunities	Industry fragmentation						
10. Pipeline uncertainty for refurbishers	Uncertainty leads to less efficient market for UK refurbishment sector. Sending work overseas leads to increased transportation costs	Uncertainty and continual change around DfT life-extension plans						
11. Inefficient use of depot facilities	Practical / commercial restrictions on depot access for third party TOCs due to inflexible contractual arrangements	Franchise / industry structure						
12. Infrastructure standards too high	NR applies mainline railway standards to rail infrastructure within depot "envelope"	Network Rail standards						

Source: Arup research and analysis

Analysis of causes and impacts of perceived problems...contd

Table 4.1d: Analysis of perceived problems' impacts

Analysis of perceived problems' impacts								
Perceived Problems	Description	Causes	Needs / Requirements	Procurement Process	Vehicle Production	Testing & Commissioning	Operation and Maintenance	Decommissioning
13. Limited progress on implementation of reform to EC4T to incentivise energy efficiency amongst TOCs / NR	Progress with rolling stock metering and implementation of regenerative braking very slow	Contractual incentives on TOCs (pass through charge at present), and weak NR incentives						
14. Limited incentives to optimise wheel-rail interface (poorly reflected in present V-TAC regime)	Wheel-rail interface complex and not fully understood. Evidence to justify investment (e.g. vehicle / rail modification) limited	Contractual dynamic between TOCs and NR / regulatory regime						
15. Insurance administrative costs for the industry too high	Missed opportunity around pooling insurance approvals process for maintainers and suppliers	Industry fragmentation						
16. Lack of comparable whole life cost data to facilitate benchmark or other efficiency analysis	No WLC data for servicing, heavy maintenance, modification, EC4T, V-TAC, ETC to inform investment/ policy decisions.	Industry fragmentation						

Source: Arup research and analysis

Analysis of causes and impacts of perceived problems...contd

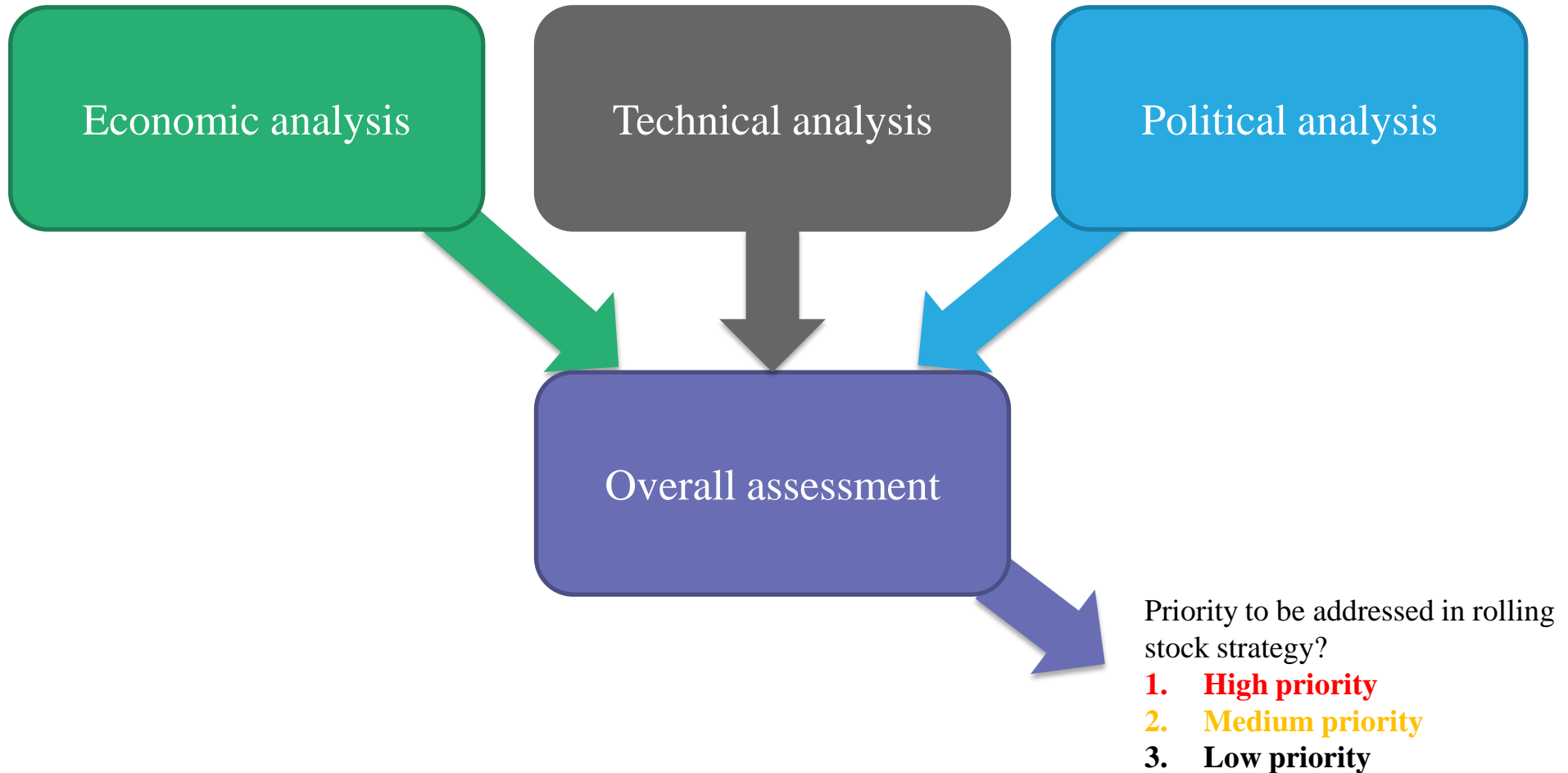
Table 4.1e: Analysis of perceived problems' impacts

Analysis of perceived problems' impacts								
Perceived Problems	Description	Causes	Needs / Requirements	Procurement Process	Vehicle Production	Testing & Commissioning	Operation and Maintenance	Decommissioning
17. Risk and delays associated with introducing new rolling stock onto the network	Excessive time taken to introduce new stock, abortive costs associated with consequential late changes to rolling stock design. Creates material risks to TOCs' ability to introduce new stock	Industry fragmentation, distribution of industry skills, engagement with infrastructure manager too late						
18. Process for introduction of new rolling stock acts as a barrier to entry for new manufacturers	Complexity and costs of process, problems with quality and availability of infrastructure data	Short franchise length, lack of incentive on NR to improve process						
19. Lease prices for old rolling stock too high	Government not satisfied historically that re-lease transactions have provided value for money	Impact of political uncertainty on ROSCO valuation at privatisation, lack of government visibility of ROSCO re-leasing costs						
20. GB rolling stock cost of capital too high	Unnecessarily high cost of capital in UK rolling stock market	Lack of long term certainty with regard to deployment of rolling stock						

Source: Arup research and analysis

Analysis of perceived problems

The following pages summarise our analysis of the problems identified in the previous section. To enable a more holistic analysis, we have reviewed them from an economic, technical and political (public policy) perspective before producing our overall assessment.



Analysis of perceived problems: 1-2

Rolling stock procurement is too “stop-go”, suffers from “feast and famine ordering”. **Priority 1 - High**

Political analysis - Changes in central government policy and (understandably) concerns over affordability are important factors. For example, the policy change to pursue “in-fill” electrification has been cited with its consequent impact on the government’s Intercity Express Programme and DMU procurement exercises. Slippage and delay as a result of reviews/concerns over affordability and technical risk also occur (the Thameslink project and its rolling stock component, for example). Politically, being seen to cancel orders for new trains may well be unattractive due to adverse reaction from the general public not least because of its link to overcrowding. The “bow wave” of replacement stock for old “slam door” MK1 assets in 2001 and 2002 is quoted as an example of “feast” ordering. At the other end of the spectrum, no new rolling stock orders have been placed for nearly two years (IEP and Thameslink delays). This problem appears to be largely driven by policy (including commitment to comply with safety or access standards by “drop dead” dates - leading to large orders) as well as central government concerns on affordability (as procurement exercises progress).

Economic analysis - Evidence suggests that the industry has experienced a high level of abortive or significantly delayed orders. Atkins’ earlier work cites the fact that other countries (including France and Germany) have framework agreements in place to deliver assets over a number of years and this provides better value. Our analysis suggests that costs per vehicle can be between 20%-60% higher for orders of less than 200 vehicles (because of non-recurring costs). Part of this problem stems a bow wave generated by BR’s 1950s modernisation programme that is still affecting the profile of orders today for some classes of rolling stock. Today, this issue appears to be more of a problem for UK based production rather than overseas manufacturers supplying other markets. With the current lack of visibility of workload, heavy maintainers cannot realistically optimise their capacity to deal with potential forward workload.

Technical analysis - Economies of scale are cited as the advantages associated with bigger orders with greater certainty associated with longer production runs. The key question is the extent to which larger orders bring savings (that can be shared with the manufacturer) when delivered over an economic timescale to make best use of high fixed cost production line assets. Reducing the range of rolling stock types on the network may be necessary for these benefits to be realised. There are possible drawbacks associated with inflexible longer term orders, for example “stifling” innovation and product differentiation.

Overall assessment – Our view is that this is a significant problem area that needs to be addressed. A more stable and incremental “technical policy” horizon would help, irrespective of who was responsible for its implementation. It is important not to exchange “stop-go” for large scale, long term orders of trains if there is material uncertainty as to whether they are needed, fitness for purpose or affordability. In many instances, train operators and ROSCOs are best placed to make decisions on when to buy trains but they need stability in their investment horizons to do this, driven in part by stable central government policy. Stable policy should be characterised by less central government involvement in detail, coupled with greater financial independence from central government for the railway as a whole. Within acceptable limits this means a move to a more deregulated passenger rail sector with much longer franchises as a minimum requirement. With these in place, ROSCOs and TOCs should be able to make increased use of successful procurement techniques (such as having options on ordering additional assets) if they prove to be reliable and economic to maintain. South West Trains’ ‘Desiros’ and TfL Overground Electrostar procurements are examples of these.

Analysis of perceived problems: 3,4

Too much central government involvement in rolling stock specification. **Priority 1 - High**

Political analysis - Government remains a significant funder of the railway (40%) and understandably has concerns about value for money. With the abolition of the OPRAF (and subsequently the SRA) and its long standing concerns about ROSCOs, it has increasingly become involved in the technical detail and specification of new rolling stock programmes. This has been on the grounds that under the present industry structure, only government can take a whole system, whole life view of what represents best overall value for money and that amongst other things it allows the government to get the best use out of existing rolling stock.

Economic analysis - Prescriptive rolling stock requirement is reported by most industry parties to drive higher design costs for manufacturers. It also impedes the ability of the industry to produce more standard products or find ways to improve efficiency. Funding costs tend to increase when new or unproven technologies are specified. The railway is unique in having this level of central government involvement (apart from the defence sector). Its locus in rail largely comes from the level of public funding committed to the industry and its unwillingness to “let go” given events since privatisation. With the current lack of visibility of workload, heavy maintainers cannot realistically optimise their capacity to deal with potential forward workload.

Technical analysis - Specific examples of lack of standardisation included the bi-mode traction capability of IEP, cabling-related standards, heavier batteries, and vehicle design standards. In the context of Thameslink, ATO signalling will be implemented in addition to ERTMS and traditional AWS/TPWS. Controversially, “permanent” twelve car sets are understood to have been selected for all service patterns to improve reliability – for peak and off peak running. There are also concerns around TOC-specific requirements. These may include different vehicle lengths and door configurations. One manufacturer stated that there are now 20 variants of its stock being maintained in the UK. In Germany, a much smaller set of vehicle designs is adhered to. These are coupled to a long-term delivery framework, which is deployed when the operator secures an operating concession.

Overall assessment - From a technical and cost of production perspective, this appears to be an area which merits considerable attention. We consider that the best way to tackle this problem is to push technical specification decisions towards ROSCOs and TOCs. As with problems 1 and 2, this is most likely to happen with “permanent” TOCs (or at the very least longer franchises). ROSCOs and TOCs should be encouraged to make commercial decisions around their rolling stock needs, as is the case with other sectors. In the absence of more radical policy, a new arm’s length body could facilitate this process whilst at the same time protecting the tax-payer’s interest (see also problem 5).

Analysis of perceived problems: 5

Too much central government involvement in determining how rolling stock fleets are cascaded.

Priority 2 - Medium

Political analysis – For reasons such as the introduction of new vehicles coming on line, government is closely involved in allocating (cascading) used rolling stock between TOCs. Its preferred approach may not always align with the best whole life cost option for operators or other players. Government understandably wants to be seen to be deploying stock where it is needed most from a passenger perspective (e.g. relieving overcrowding).

Economic analysis For some TOCs, having mixed fleets “imposed” upon them, leads to higher maintenance, depot and operational costs. A variety of train types typically demands a range of equipment, training and technical solutions to fix problems. Industry parties with whom we discussed this issue told us that this may add as much as 15-20% to maintenance and other costs. In the medium to long term, the commercially optimal solution is typically focused around rationalising asset types – as is seen in the aviation, bus and road haulage sectors.

Technical analysis - For historical reasons, different types of rolling stock have not been able to operate freely on the GB rail network. There are few “go anywhere” classes of rolling stock. To a large extent, technical legacy issues mean that more vehicles types are required. Notwithstanding this, industry stakeholders believe that opportunities for rationalising rolling stock deployment more cost effectively are being missed. In the longer term, this problem will only be tackled through fewer new types of rolling stock entering in to service.

Overall assessment – Technical variations in the rail network’s fixed infrastructure are likely to persist for the foreseeable future, not least for affordability reasons. However, if TOCs and ROSCOs were more closely involved in cascade planning, there may be opportunities to optimise rolling stock deployment more cost effectively. Over the longer term we consider the solution lies in providing the industry with more of an opportunity to invest over the long term (eg through much longer franchises). Whilst there is likely to be a need for some regulation of rolling stock types this should arguably only be undertaken when there is an adverse impact on the industry’s whole life cost profile – and where that would lead to unjustifiable increased costs for passengers or taxpayers. The application of TSIs will go some way to helping standardise stock over the longer term.

Analysis of perceived problems: 6

Too many vehicles types on the network. **Priority 2 - Medium**

Political analysis – From a political perspective, the number of train types should not in itself be an issue. To the extent that allowing many different types of rolling stock to populate the network leads to avoidable costs - that are then picked up by passengers or the taxpayer – there is clearly a legitimate public interest concern. To some extent, government procurement risks compounding this problem.

Economic analysis - In some circumstances (as noted already in relation to problems 4 and 5) there may be a commercial case for a drive towards rolling stock consistency - because of its beneficial impact on production costs (economies of scale) and maintenance. Offset against this is the fact that more bespoke rolling stock may generate increased revenue for an operator, as it is better designed to meet a TOC's specific needs. The Competition Commission noted that differences in infrastructure design within the network were a factor in reducing the choice of rolling stock available to TOCs, with a consequent impact on levels of price competition. A move towards fewer platforms may lead to benefits in the cost of production that can be shared with purchasers/operators

Technical analysis - From a technical perspective there is a considerable body of opinion in favour of standardising rolling stock, particularly within a given franchise, or on a route shared by more than one TOC. This may extend to operating characteristics and couplings for example. Even in 2004, it was reported that there were 46 train designs in existence and 13 different designs ordered since privatisation. Again, from a technical perspective, greater use of modular and off-the-shelf products are cited as being attractive. However, in some instances, rolling stock with "embedded" systems may be more reliable.

Overall assessment – As with problem 5, we consider the optimal solution lies in providing the industry with the opportunity to invest over the long term (e.g. through longer franchises). Whilst there is likely to be a need for some regulation of rolling stock types this should arguably only be undertaken when there is an adverse impact on the industry's whole life cost profile, and where that would lead to unjustifiable increased costs for passengers or taxpayers. The application of TSIs will go some way to helping standardise stock from over the longer term.

Analysis of perceived problems: 7

Train specification not optimised for new infrastructure. **Priority 3 - Low**

Political analysis - Rail policy observers suggest this is symptomatic of a fragmented railway. However, from a political perspective, safety standards and additional passenger features/facilities for persons of reduced mobility are likely to remain priorities over vehicle weight for government.

Economic analysis - Increasing train weights can be justified from a commercial (and regulatory/political) perspective (as noted above). There are mixed views over the extent to which heavier trains lead to materially higher increases in costs for Network Rail. This is most likely to be the case where incremental increase in train weight does not change the maintenance "band" within which track sits.

Technical analysis - For both Intercity and multiple unit sets, data appear to show increasing train weight on a per metre basis. From an engineering perspective this is cited as an example of one part of the railway not being integrated from a systems perspective and imposing increased wear and tear on fixed infrastructure. Train weight has grown for a number of reasons. These include: crash-worthiness design (collision resistance) the introduction of sealed toilets, extensive amounts of wiring for systems and passenger services and air conditioning units. Design and safety standards would need to be revisited to allow reductions in weight to take place (e.g. use of wireless systems, composite materials , etc).

Overall assessment – Rolling stock weight appears to have been increasing for reasons that are understandable from a regulatory and commercial perspective. They are one of a range of train design factors that can lead to increased wear and tear on fixed infrastructure. Considerable efforts are being made across the industry to make components of the track access charging regime more cost reflective and incentivise more “track friendly” rolling stock design. When combined with improvements to the procurement process noted under 1-4 this problem should be possible to address relatively straightforwardly.

Analysis of perceived problems: 8

Opportunity to extend life of existing fleets not maximised.

Political analysis – From our discussions with officials in the course of this assignment, it is clear that government has not yet been able to satisfy itself that it will derive value for money from paying for leases on life extended stock. Instead it has tended to pursue a policy of procuring new rolling stock through alternative procurement models. This has in itself created new risks and difficulties around technical complexity and affordability. Although some industry parties indicated support for delaying compliance with Persons with Reduced Mobility (PRM) legislation where compliance will introduce additional costs (either through refurbishment or procurement of new stock), government appears presently to remain committed to meeting regulations for disabled access or safety improvements. These can however lead to much increased whole life costs, as assets are retired “prematurely”.

Economic analysis - This issue is closely linked with those in which we discuss the procurement of new rolling stock. Very considerable savings may be achievable; lease rates for life extended rolling could be as low as one third of that for new assets. ROSCOs in particular advocated life extension as a means to deliver reductions in whole life cost. From an affordability perspective, life extension is an attractive short to medium term alternative, and has potential to help avoid future ‘bow waves’ of rolling stock procurement (including around the PRM compliance deadline in 2020). It could also be used a means to complement the pattern of new rolling stock orders (to avoid "feast famine" etc).

Priority 1 - High

Technical analysis -As was noted under items 1-2, regulation (such as "drop dead" obligations) can make life extension which would otherwise be technically and commercially attractive, unviable. Indeed, part of the case for IEP was centred around the need to withdraw existing rolling stock that will be non-compliant with the Persons with Reduced Mobility Regulations. The government has committed to a date of 2020 for compliance. From a technical perspective, life extension can provide good whole life value for money as it is typically applied to proven, mature assets and can generate reliability and environmental benefits.

Overall assessment –The government presently faces a serious affordability challenge, both in relation to procurement of new rolling stock and across the public sector. Against that backdrop, life extension of existing fleets presents a significant opportunity to reduce GB rail costs in the short to medium term. We identify this as a high priority issue to be addressed, but note that choices would need to be made around compliance with PRM and other relevant legislation. In addition, if government (as the industry’s key funder) is to be expected to pursue this course, it will have to be able to gain greater confidence in the extent to which re-leases of life extended stock represent acceptable value for money.

Analysis of perceived problems: 9

Separation of light and heavy maintenance leads to missed opportunities for whole life cost reduction. **Priority 3 - Low**

Political analysis – No significant political issues identified.

Economic analysis - Typically, particularly for ROSCO-owned fleets, TOCs are responsible for light maintenance and ROSCOs for heavy maintenance. Whole life cost management for vehicles is at risk of not being integrated effectively. The decision-making process for modifications that could reduce whole life cost is also more complicated and potentially more tortuous than if all interventions were dealt with by a single party.

Technical analysis –

The procurement process for new rolling stock has resulted in a wide variety of vehicle classes and sub-classes being procured by the various operators, often in small batch quantities. This variability makes it difficult to derive technical benefits from what otherwise might be standard platforms for vehicles. In addition current market requirements (e.g. for insurance cover) limit the facility for independent maintainers to enter the market for day to day maintenance of rolling stock. This means that the only real choice for a TOC is to undertake these services in-house, or to contract for them with Original Equipment Manufacturers (OEMs), or to contract them to another TOC. This reduces the scope for increasing competition for provision of these services.

Overall assessment – There is already a degree of co-ordination for maintenance activities in Britain, led by ATOC on behalf of the operators. An example of a coordinated programme is the ‘ReFocus’ programme (successor to the ‘NFRIP’). This has generated substantial benefits (in this instance in fleet performance). The scope of coordinating activities could be extended to incorporate heavy maintenance and refurbishment. Inputs by rolling stock owners, operators and maintainers would enable a much better understanding of issues throughout the industry, providing a platform for more wide-ranging improvement processes covering availability and reliability issues, as well as national workload planning.

The development of a maintenance VfM work stream could be used to pass on best practice between organisations and also evaluate the performance of sub-suppliers and components that are common across the industry. Prospective new rolling stock suppliers would also have access to the data to assist in the selection of sub-suppliers for new trains, and to develop maintenance regimes for new rolling stock. We would expect this approach would improve initial service performance and eliminate unnecessary maintenance activities which (in our experience) are often found in sub-supplier proposed maintenance plans.

Analysis of perceived problems: 10

Uncertainty around future work demands for UK -based refurbishers leads to inefficiently high industry costs. **Priority 3 - Low**

Political analysis - Uncertainty with respect to government policy on life extension (related in part to IEP) and delay on new orders (such as Thameslink) are factors driving perceived problems in the technical and economic/commercial areas. The prospect of GB rolling stock being sent overseas for refurbishment work would no doubt be politically unattractive, as would be the loss of GB refurbishment capability.

Economic analysis - With the current lack of visibility of workload, heavy maintainers cannot realistically optimise their capacity to deal with potential forward workload. Because the ROSCOs are waiting for the DfT to authorise or signal life extension, there is no certainty about future workload. As a result, these maintainers may either carry excess capacity with resultant increased costs, or they may downsize to current demand profiles. Downsizing leads to under-capacity in the market if a project such as HST life extension were to commence, with an associated impact on price and programme.

Technical analysis - The work that is not undertaken by TOCs (major overhauls and refurbishments) is often relatively involved and is carried out in programmes on a fleet by fleet basis, giving rise to significant step changes in workload as each programme is commenced or completed – with the winning or losing of individual programmes potentially governing the commercial viability of some of these businesses. In our experience, they are not well placed to respond to cyclical demand, due to the wide range of specialised skills and plant required. In the short term, unpredictable demand results in increased costs. In the longer term it could ultimately lead to a loss of these services in GB, with industry having to rely on an overseas supply. Increased transportation costs associated with accessing overseas suppliers may well be incurred. Programme based work on a fleet by fleet basis would be logistically attractive to suppliers. With uncertainty, optimising forward workload is more difficult - eg in retaining skills and investment in or maintenance of specialised plant and equipment.

Overall assessment – Greater stability (and visibility) in rolling stock procurement would help to address this problem. To some extent, the diversified base of refurbishment companies means they are not overly dependent on the rolling stock sector. We consider this issue would best be tackled through addressing the systemic problems (around central government involvement for example), which we have identified elsewhere in this report.

Analysis of perceived problems: 11

Inefficient use of rolling stock depot facilities. **Priority 3 - Low**

Political analysis - No significant political issues identified.

Economic analysis – In the case of regulated depots, in our experience, depot access arrangements are relatively inflexible in application, and can increase the cost of maintenance as they do not readily enable flexible commercial apportionment of costs. Performance penalties attached to modern TSA regimes do not lend themselves to the sharing of depot facilities, where substantial penalties for failure of a train to enter service would generally be disproportionate to the subcontracted services, which will usually be of relatively low value.

Technical analysis - The move towards manufacturer-led maintenance has generated a significant number of new, high-specification, unregulated maintenance facilities throughout GB, configured for a specific fleet, generally to the benefit of that fleet in terms of reliability and availability. However, access to these facilities by other fleets is limited due to the nature of ownership and contractual requirements. Some of the most modern assets cannot be accessed at all, in practice, by many rolling stock fleets.

Overall assessment - Whilst depots are licensed to ensure third party access under provisions of the 1993 Railways Act, in reality, depot access arrangements can be inflexible in application and can increase the cost of maintenance, as they do not allow for a flexible apportionment of costs. Performance penalties associated with modern Train Service Agreement Regimes do not encourage/incentivise depot sharing.

It is possible that with longer investment horizons, incentives to make additional investments in depot would be greater. Furthermore, the rationalisation of rolling stock types which longer term planning would be anticipated to bring, may also help to address this matter.

Analysis of perceived problems: 12

Network Rail infrastructure standards around depots too high.

Political analysis - No significant political issues identified.

Economic analysis - Securing permission from Network Rail for depot improvement works can be a lengthy and expensive process. Our experience of works at depots is that in some instances, NR applies main line railway standards to rail infrastructure within depots, which in practice could be relaxed for the less onerous environment of depot operations.

Technical analysis - The argument is made that excessively high standards and over engineering of depot infrastructure takes place. There are some "high profile" examples such as Exeter depot. Another example quoted is around depth of ballast being excessive. In the course of our work, NR told us that standards do allow lower specification, but that generally work is done to the higher standard. NR commented that this indicates a problem with the wider industry's understanding or application of standards, as opposed to a problem associated with the standards themselves.

Priority 3 - Low

Overall assessment – Standards (or industry's understanding of standards) relating to infrastructure works around depots could be reviewed to ensure that they do not impose any unnecessarily onerous cost burdens on those undertaking the works. Secondly, where the approvals process requires Network Rail input, such input should be incentivised to ensure that timescales and costs can be minimised.

To some extent this problem may be symptomatic of a lack of commercial dynamic in the relationship between Network Rail and the TOCs. That in turn is driven by the industry's structure. Changes to that structure which increased the direct accountability of Network Rail to the TOCs may help to solve these sorts of problems. Notwithstanding this, Network Rail indicated to us that it is aware of the need for a more appropriate depot track standard and has an initiative identified to deal with this.

Analysis of perceived problems: 13

Limited progress on implementation/reform of reform to EC4T to incentivise energy efficiency.

Priority 2 - Medium

Political analysis - A degree of political sensitivity may exist from a "green agenda" perspective, although trains are generally perceived to be more environmentally friendly than other forms of transport. There are EU-wide obligations to progress energy related technical changes such as regenerative braking (under TSIs).

Economic analysis – EC4T is bought from Network Rail who in turn buys from British Energy-EDF. Annual expenditure is in the region of £200m. Consumption is estimated for each TOC by Network Rail. This process attempts to take into account usage by each TOC on shared areas of the network, together with other users such as freight, electricity leakage and consumption efficiencies such as regenerative braking. The price of electricity is typically fixed for the next 12 months and 50% for the following 12 months. EC4T may account for 5% -10% of TOC's cost base.

Since fixed costs make up such a significant proportion of a TOC's turnover, the opportunity to control relatively modest cost items is of considerable value from a profitability perspective. Present arrangements provide limited incentives to employ energy saving technologies or practices (such as load-shedding or conservative driving). RSSB estimates the annual saving potential in the short term at £68m per annum for all energy efficiency measures across the railway, of which EC4T savings will form a part.

Technical analysis - From a technical perspective, incentives to reduce energy consumption need to be facilitated with the use of train metering (so that operators only pay for the energy actually used) and technical capabilities such as regenerative braking and load-shedding. Driver training is another way to reduce energy costs.

Overall assessment - Owing to the relatively modest value associated with savings, this is not a major commercial priority for the industry as a whole. Whilst TSI standards will help to address this problem over the medium to long term, there may be a role for an arm's length rail body to encourage/facilitate faster adoption of measures to improve incentives for energy efficiency if they can be justified on a whole life basis.

In order to unlock opportunities to reduce costs that cross the divide (between Network Rail and TOCs) –it may well be necessary to revisit the regulatory and contractual regimes covering these businesses, for example, to facilitate/encourage "alliancing" and the sharing of benefits between the parties. As noted earlier, it may be that access charge "certainty" beyond a single Control Period may be needed to help make the business case for these types of investment.

Analysis of perceived problems: 14

Limited incentives to optimise wheel-rail interface.

Priority 3 - Low

Political analysis - As long as this does not become a safety issue this is likely to be a relatively low priority issue from a political perspective. However it is sometimes cited by commentators as being symptomatic of the problem of a vertically separated railway.

Economic analysis - The savings associated with changes to wheel-rail interface and V-TAC are expected to be modest in the scheme of total railway cost. NR advises that TOCs making track-friendly modifications to their vehicles will be eligible for a reduction in their V-TAC. Network Rail will benefit from these vehicle modifications because they will result in less track damage and thus a reduction in renewals and rail grinding costs. Under the Track Friendly Trains project the SWT Siemens Desiro fleet is being modified to reduce track damage in exchange for a lower V-TAC.

Technical analysis - The wheel-rail interface is complex and despite significant research over the last 40 years, the scientific relationships are still not fully understood. Implementing a sophisticated V-TAC requires clear evidence of the relationships between rolling stock design and track renewal and maintenance costs. Some of the variables of rolling stock design include articulated bogies, bogie stiffness, steerable suspension, unsprung mass, wheel flange lubrication, wheel profile, regenerative braking and distributed or non-distributed power. The work of the Vehicle Track Systems Interface Committee (VTSIC) has furthered the knowledge of the industry parties enormously but it is not fully certain how all of these design options impact infrastructure cost (except in very general terms), nor how the supposed benefits might be evaluated cumulatively and so progress needs to be made with some caution. We are aware that the V-TAC route is being used to support the Track Friendly Trains project. As part of this project NR is working with TOCs (and the ORR) to facilitate vehicle modifications that will result in less track damage e.g. changes in suspension / wheel profile.

Overall assessment – The V-TAC charging regime should be refined as understanding develops of the impact of vehicle design and maintenance factors in order to ensure that all incremental changes in the characteristics of rolling stock could be reflected in lower charges. This would help support the business case for changes to train design which were effective from a whole system cost perspective.

Vehicle owners and operators could then be more incentivised to focus on design solutions which could reduce degradation of track infrastructure, in return for reductions in access charges. An example would be addition of rolling stock flange lubrication to reduce rail head wear (as well as wheel wear). The operators could be provided with the facility to have the access charge for rolling stock re-evaluated when they implement any improvements in the train maintenance regime or design which are intended to reduce long term infrastructure costs. Similarly if NR found that the actions of the (rolling stock) maintainer were increasing rolling stock's impact on the infrastructure, the track access charge could be increased to cover NR's additional maintenance costs.

Analysis of perceived problems: 15

Insurance related administrative costs for the rolling stock sector too high. **Priority 3 - Low**

Political analysis - Not found to be a major issue. However, it might also be cited as symptomatic of problems associated with a vertically separated railway industry.

Economic analysis - The industry presently spends large amounts of money in assessing the competence of its suppliers for both commercial and safety reasons. Simplifying and formalising this process through the existing arrangements perhaps presents an opportunity for reducing costs. The Railway Industry Supplier Approval Scheme (RISAS) has been introduced to try to address the issue of multiple audits of suppliers and a Supplier Assurance Project coordinated by RSSB is currently under way.

Technical analysis – This is not an area of noteworthy concern from a technical perspective.

Overall assessment - The industry currently spends significant sums in assessing the competence of its suppliers for both commercial and safety reasons. Simplifying and formalising this process through the existing arrangements such as RISAS is likely to assist in reducing these costs. However, issues such as provision of third party insurance, which every maintainer and major supplier is required to hold, could be reduced if a common insurance fund was set up that ‘approved’ suppliers jointly contributed to would help reduce insurance costs. Such a common fund would also allow new maintenance entrants to more easily access the market without substantive fixed start-up costs. If an independent assessment body were used for these evaluations the data could be used by multiple TOCs and the vehicle owners could use the same data to confirm asset condition and maintainer competence. The independent assessments would also be used as a part of the industry wide maintenance VFM process.

Analysis of perceived problems: 16

Lack of comparative rolling stock centric WLC data to facilitate benchmarking or other efficiency analysis.

Priority 1 - High

Political analysis - Improving the quality, availability and transparency of data would be attractive, particularly in relation to whole life cost assessment and decision-making. Compared to other sectors, the quality of data appears very poor.

Economic analysis – The sharing of existing cost and revenue data inevitably raises competition and commercial sensitivity issues. Examples of this sensitivity would include franchise bid processes or new rolling stock procurements. However as long as these concerns can be met, the potential impact on efficiency for comparatively modest cost is anticipated to be very attractive.

Technical analysis - Whilst certain technical matters are researched and analysed in considerable depth, there appears to be a distinct absence of modelling or research aimed at bringing it together in a "whole life cost" model that allows key players to better understand the financial and cost implications of asset orientated decisions. Analytical tools do exist already to support this type of analysis (e.g. NR has developed its Vehicle Track Interface Strategic Model (VTISM) and Overhead System Loading Simulation Package (OSLO), both of which enable some whole life cost analyses.

Overall assessment – A league table of GB train fleets and their whole life costs, broken down into component parts: such as servicing and light maintenance, heavy maintenance, modifications, EC4T charge, V-TAC charge, lease cost (or a suitable proxy) etc; which was published and reviewed monthly would help to develop a focus on WLC. Such a league table would help to expose the key data to allow comparisons between fleets to be made effectively and to promulgate best practice in minimising WLC.

Enhancing the quality and availability of whole life cost data (and bringing together existing research and analysis) could help to improve value for money over the longer term. Whilst this may be a less high profile initiative than some others, it has the capability to generate significant benefits for major industry players and, over time, the tax payer.

Analysis of perceived problems: 17, 18

Risk and delays associated with introducing new rolling stock are as a barrier to entry for new manufacturers. **Priority 3 - Low**

Political analysis - New rolling stock seen "sitting around" in the sidings is problematic - as was the case with the introduction of trains to replace the MK1 stock in the south east of England. As with some other issues it is seen as "stick to beat" the government with over fragmented rail structure.

Economic analysis - At the margin, the more risky this process is seen to be, the more likely inefficient costs are being incurred or the deterrent effect on potential new entrants. This problem may act as a disincentive for TOCs to introduce new rolling stock even if it would otherwise make commercial (whole life cost sense). For shorter franchise periods, this risk will be accentuated.

Technical analysis - Some specific technical requirements such as platform gap standards are cited as particularly challenging for manufacturers to comply with. Other standard issues are either "unwinding" with the move to compliance against European TSI regulations or are not new - for example loading gauge and vehicle length. Some of these constraints are unlikely to change for the foreseeable future because they are technical characteristics of the fixed railway infrastructure.

Overall assessment - We understand that there are at present no trains awaiting "acceptance" and that Network Rail has been involved much earlier in the Thameslink and Crossrail procurement processes. At the margin, this issue may present a barrier to entry for new manufacturers and measures to improve the process would therefore be worth pursuing. However compared to other costs - such as building trains to deal with other UK specific (known) requirements and costs associated with a high level of abortive bids, it is unlikely to be very significant. Furthermore, it is unusual for fewer than three bidders to tender for rolling stock orders in the UK and new entrants (such as Hitachi) have come in to the GB market in recent years.

Analysis of perceived problems: 19, 20

Lease prices for old rolling stock too high; GB rolling stock cost of capital too high.

Priority 2 - Medium

Political analysis - The government reviewed the structure and organisation of the rail industry in 2004. It concluded that competition for the leasing of passenger rolling stock had not developed as envisaged at the time of privatisation. Following the CC investigation, the CC made three recommendations in relation to the DfT for England and Wales and an identical set of recommendations to the Scottish government. The three recommendations were as follows: (i) introduce longer franchise terms of 12 to 15 years or longer; (ii) assess the benefits of alternative new or used rolling stock proposals beyond the franchise term when evaluating bids; (iii) ensure that franchise invitations are specified in such a way that franchise bidders are allowed a choice of rolling stock. In January 2011, the government announced revised policy. Bidders will be able to compete for franchises of between 15 and 22.5 years which effectively accepts the CC's first recommendation. This represented a departure from the DfT response to the CC report which was more inclined to shorter franchise lengths. The government also announced that it will make greater use of residual value mechanisms to allow operators to make investments with a pay back period beyond the length of the franchise period (e.g. by receiving an agreed payment for investments at the end of the contract period). This can be interpreted as acceptance of the CC's second recommendation. In relation to the third, the government has signalled its agreement in principle but also its desire to maintain much discretion in how and when it will intervene with direct instructions on rolling stock or pointers that would tend to limit a bidder's discretion.

Technical analysis - The CC identified a range of technical factors that it considered were likely to limit the choice of rolling stock available for lease at the point when franchises are let. These include differences in infrastructure design within the network, and costs and other risks associated with changing rolling stock or introducing new assets. These have been highlighted elsewhere in our analysis.

Economic analysis - The Competition Commission Report of 2009 found that: there was a shortage of rolling stock options available to TOCs, the interaction of the franchising system and leasing of rolling stock is an important determinant of the structure of the market, ROSCOs have weakened incentives to compete on lease rentals, there are barriers to entry to the market (especially in regard to supply of used rolling stock), TOCs have limited incentives to negotiate with ROSCOs. The CC adopted two remedies that affected the ROSCOs. One was the removal of a non-discriminatory code of practice. This had been introduced when Stagecoach acquired Porterbrook in 1996, as it already owned South West Trains. It was designed to prevent Porterbrook offering Stagecoach favourable rates when bidding for (other) franchises and thus distorting the market. As there is no longer any vertical integration between ROSCOs and TOCs, the CC has taken the view that the removal of the undertaking would be beneficial. The second recommendation requires ROSCOs to provide supplementary information to Lessees whenever they are asked to provide lease rental quotations. This information covers rolling stock particulars, details of heavy maintenance, details of proposed modifications, capital and non-capital rent, the maintenance reserve charge, and a formula for calculating short term lease premia (where applicable).

Overall assessment - Strongly held, divergent views exist over the extent to which there is a significant problem in the rolling stock leasing market. All parties agree that passenger demand growth since privatisation means a lack of surplus rolling stock is available, alongside which government appears to have limited confidence that ROSCOs are providing value for money, particularly on existing rolling stock, including life extended assets. In addition, government also believes the three main ROSCOs lack the financial capacity to fund the totality of future rolling stock requirements for GB rail. How to attract further resources in to the supply of rolling stock on a vfm basis is a key question for development of any future rolling stock strategy.

Problems reviewed: priority areas to address in rolling stock strategy

This page recalls the full list of problems reviewed. We have highlighted the problems as follow; those identified as high priority to be addressed are coloured red, and those identified as medium priority areas are coloured amber.

Figure 4.3: Identification of priority areas for action



Source: Arup research and analysis

Parties and roles: summarising our view of where problems exist

Table 4.2 summarises our view of where problems exist which drive inefficiency in relation to rolling stock costs. In this table, ‘High’, ‘Medium’ and ‘Low’ refer to the **degree of influence** which we believe a party has **on costs** in any given area. The **colours** indicate whether we believe there are issues to be addressed in relation to that party’s role, with those coloured **red indicating areas in which we believe the most serious problems exist**. For example, the **bottom left cell** indicates that we believe manufacturers presently have a relatively low degree of influence over the process through which the industry’s rolling stock needs are established, and that we believe this is a serious problem (i.e. our view is that manufacturers should be given a greater role in that process). The evidence and analysis supporting these views are set out in the main body of this report.

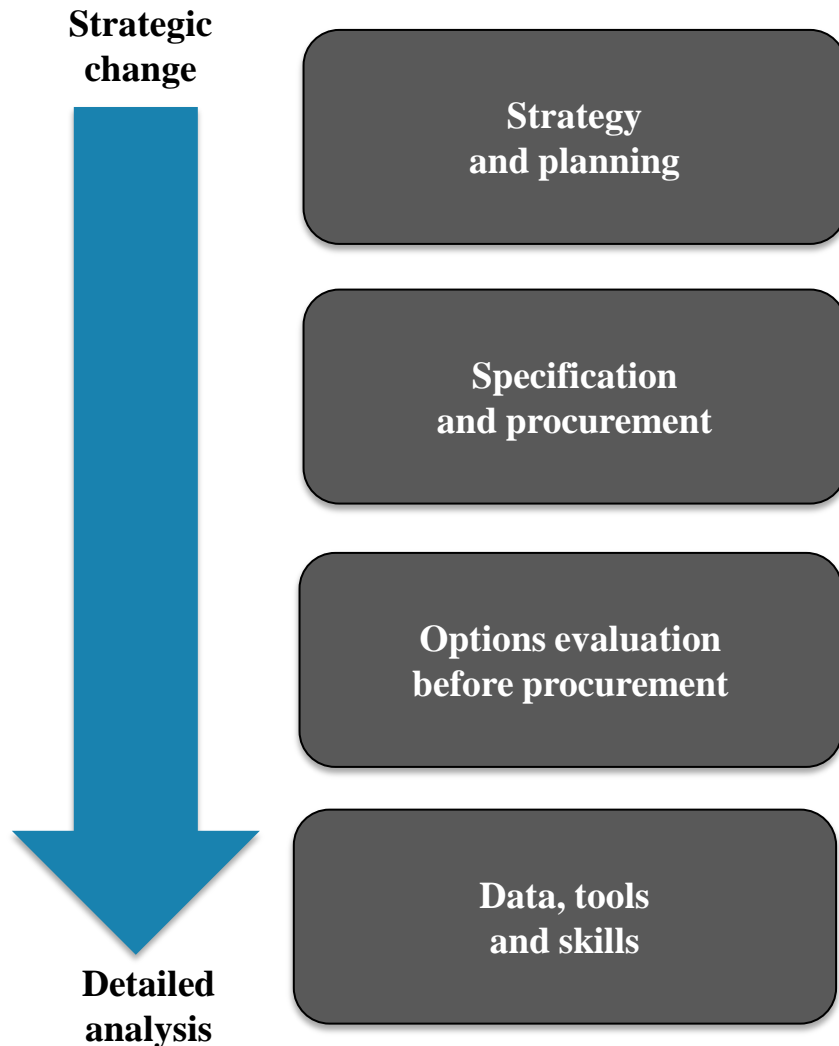
Table 4.2: Matrix of parties, roles and perceived problems

Party	Need requirements	Procurement process	Vehicle production	Testing and commissioning	Operational period	Decommissioning
DfT	High	High	High	Low	Medium	Low
TOCs	Medium to High	Medium to High	Low	High	High	Low
ROSCOs	Low to medium	Medium	Low to Medium	Low	Low to Medium	High
NR	Low	Low	Low	High	Medium	Low
Manufacturers	Low	High	High	High	Medium	Low

Source: Arup research and analysis

Areas for action

Figure 4.4: Areas identified for change



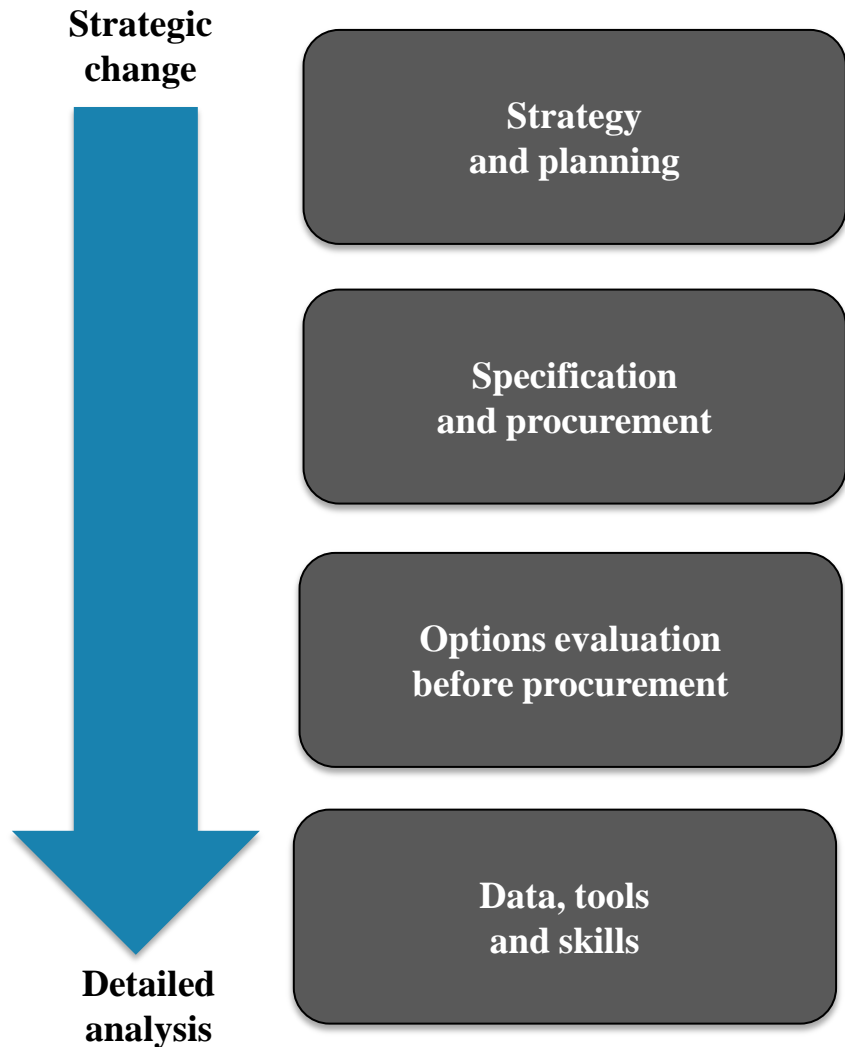
• Having identified a set of problem areas in which we believe there is significant scope for reducing costs, we have articulated the need for change across four areas, as set out in figure 4.4:

- **Strategy and planning** – This refers to DfT’s tendency to change policy and investment plans in ways which drive higher costs (e.g. changing the intended destination of trains on the network after vehicle production has begun, and recent sudden changes in relation to future electrification and high speed rail plans).
- **Specification and procurement** – This refers to DfT’s approach to specifying rolling stock requirements, whether directly (e.g. IEP) or indirectly (e.g. through franchise specifications). The high degree of detail in DfT specifications constrains industry’s ability to deliver cost-effective solutions.
- **Options evaluation before procurement** – This refers to the lack of evidence that DfT undertakes any strategic appraisal of options for meeting passenger demand, prior to launching or triggering significant procurement exercises. In particular, it appears that limited consideration has been given to the potential for further life extension of existing fleets.
- **Data, tools and skills** - This refers to the poor quality of data available to support whole life cost decisions, or the fact that the data available in various parts of industry appear not to be available to decision-makers prior to key planning decisions.

5. Problems and evidence to solutions and strategy

Solutions: identification and appraisal

Figure 5.1: Framework for identifying solutions



- The four key problem areas to be addressed by a rolling stock strategy are recalled in the image opposite for ease of reference.

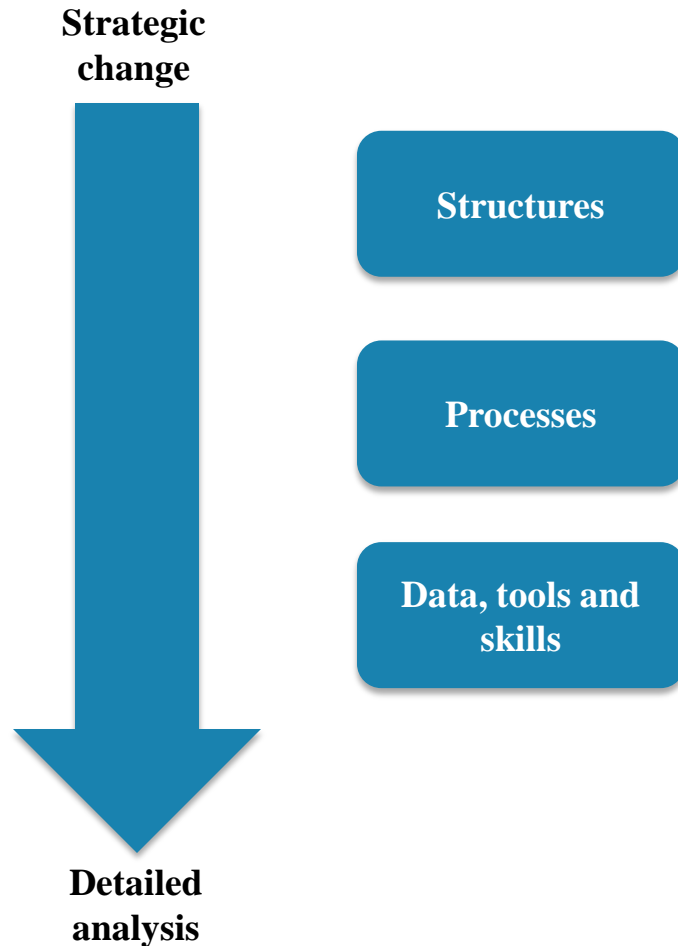
- The remaining pages of this section take each problem area in turn, setting out key items of evidence relating to the problem, and the solutions which correspond to them. Solutions recommended are related to three potential levels of intervention:

- Structures
- Processes
- Data, skills and tools

- We conclude by identifying summarising the solutions which we recommend should be considered in developing any future rolling stock strategy.

Types of solutions considered

Figure 5.2: Relationship between cost influence and cost committed



- Broadly speaking, we see three different types of solution, as shown in the image opposite. The top of the image illustrates a more strategic group of solutions (e.g. changes to industry structure or parties' roles). The lower end of the image represents more bottom-up solutions to the detailed problems identified (e.g. completion of databases or measures to address any important skills gaps).

- The image opposite is repeated subsequently in this report, to support mapping and identification of the potential solutions we have put forward.

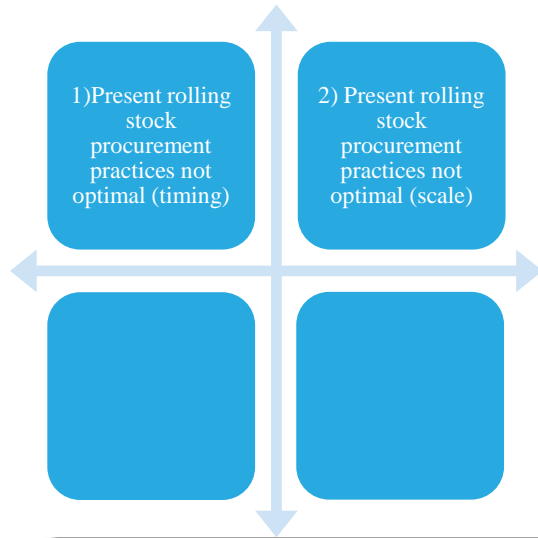
- The types of solution identified could be expected to perform differently in the context of our appraisal of the options available, with regard to their:

- Scale of financial impact
- Degree of technical or political complexity
- Timescales for implementation

- An appraisal of the possible solutions considered against the criteria identified in the three bullets above is shown later.

Strategy and planning: evidence of problems

Changes in central government policy and investment plans damage the UK rail industry's credibility and increase industry costs (e.g. abortive bid costs).



July 2007

IEP development was progressing in the context of a strategy which made it clear that major network electrification or high speed lines were not being pursued. "...it would not be prudent to commit now to "all-or-nothing" projects, such as network-wide electrification or a high-speed line, for which the longer term benefits are currently uncertain and which could delay tackling the current strategic priorities such as capacity."

Source: Department for Transport, (2007) *Delivering a Sustainable Railway - White Paper CM 7176*, p9

In the course of our work, NR provided examples of instances in which they felt that earlier engagement of the infrastructure manager in rolling stock planning could have avoided programme delays. These included cases in which DfT and a ROSCO procured a vehicle of a length which was ultimately incompatible with the rail infrastructure, and another in which a proposed exhaust system designed without NR's involvement had to be reworked due to the potential for damage to trackside equipment.

Source: Written submission from Network Rail, February 2011

July 2009

Secretary of State announces plans to electrify portions of the rail network, with a knock-on effect for the procurement of new diesel units: "This electrification programme radically affects the requirements for rolling stock over the next decade...the previously-planned procurement by the government of new diesel trains has now been superseded. We will accordingly publish a new rolling stock plan in the autumn..."

Source: DfT, *Britain's Transport Infrastructure: Rail Electrification*, July 2009, para 27

September 2010

"The Coalition...is reviewing all transport spending in the context of reducing the overall budget deficit. It is not yet clear what the future will be for either Diesel Trains Ltd or the rail electrification programme."

Source: Butcher, Louise, (September 2010), *Railways: Rollingstock*, p14-15

An industry party told us that they believed the recent cost to government itself of poorly thought-through policy decisions was probably in excess of £100m per annum. Examples cited included changing the intended destination for new rolling stock after vehicle production had begun, and placing orders for new stock without agreeing any long term maintenance contracts. In addition, they commented that industry has also suffered significant abortive costs as a result of this type of policy change.

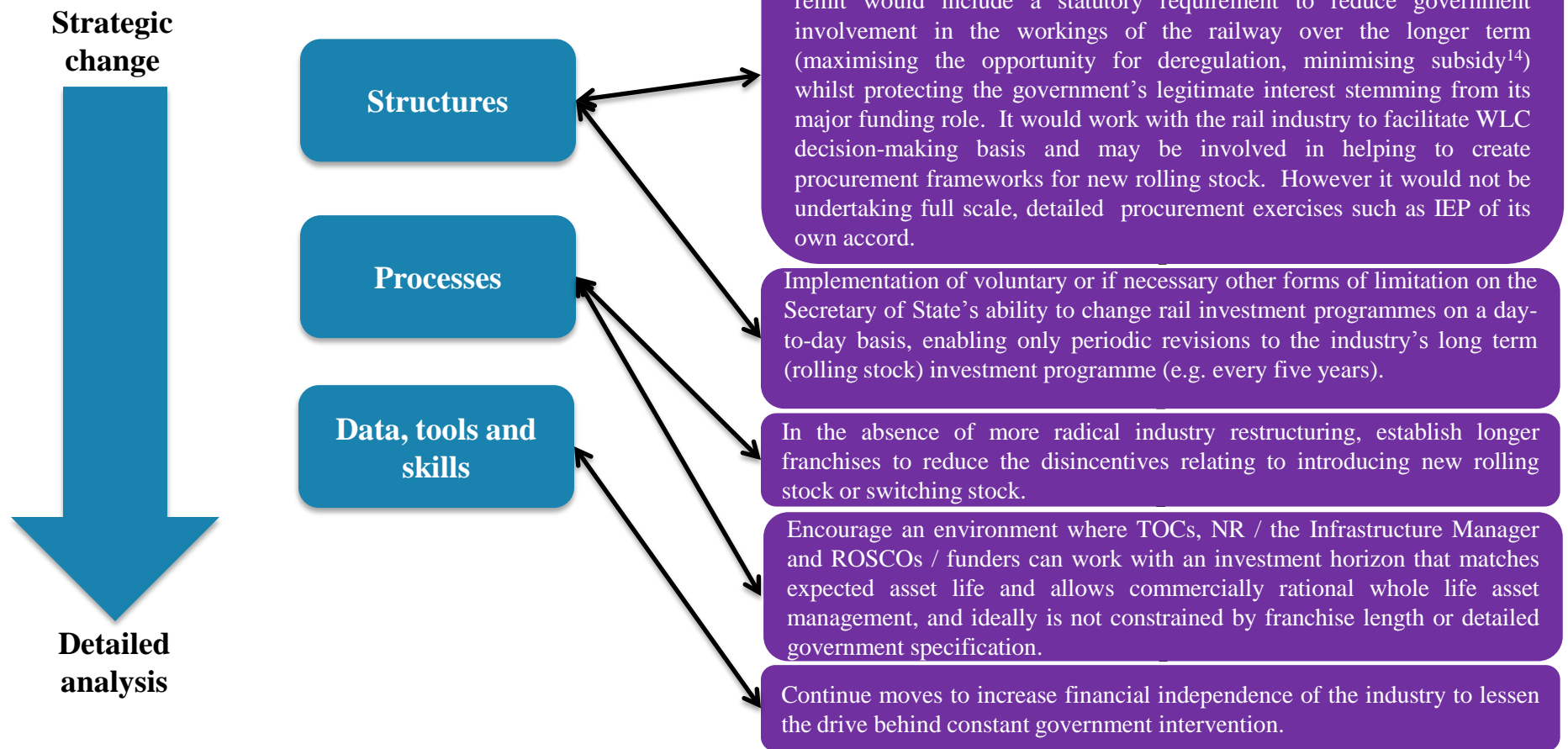
Arup interview, December 2010

Strategy and planning: solutions

The aims of these solutions are to:

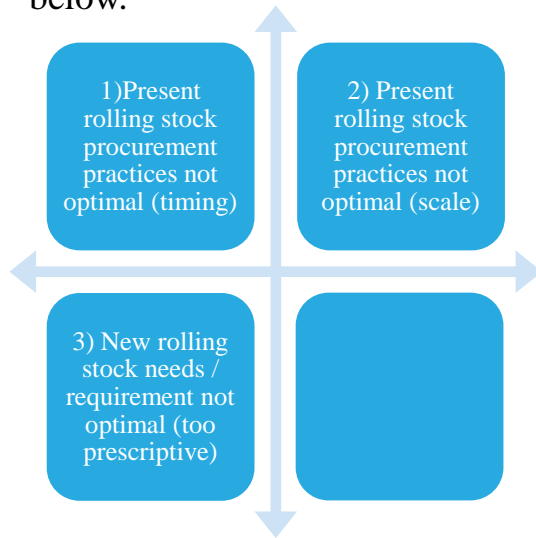
- Avoid short term actions and changes of policy or direction which have undesired reputational and cost consequences.
- Allow the industry as a whole to deliver manage assets and deliver services in the context of clear and stable long term objectives (e.g. around the size of the sector, budgets available, investment programme).
- Ensure that the regulatory and commercial framework within which the industry operates, supports delivery of government’s strategic objectives (including cost control).

Figure 5.3: Solutions addressing problems relating to planning and strategy



Specification and procurement: evidence of problems

Changes in central government policy, poor cost and risk estimation, combined with wider constraints on affordability and too much government involvement in technical detail, has led to significant problems with GB rolling stock procurement as detailed below.



“Overall we have found that government struggles to set the right level of specification, stick by it and see it appropriately delivered through the industry.”

Atkins, Rail Value For Money Study 2010, p.16

“...these diesel generator vehicles will be IEP specific...costs of developing them can only be spread across IEP which puts a question mark over value for money... There was evidence of unnecessary complexity and over-prescription...There was evidence and consensus that the industry struggles to innovate in an environment where timetables, rolling stock allocation and operational requirements are prescribed by the DfT. This leaves operating companies in a situation where they are competitively bidding for rail franchises with little room to drive efficiency.”

Sir Andrew Foster, (June 2010) A review of the Intercity Express Programme Annex, p.13,14

An industry party commented to us that although most orders were completed relatively smoothly in the period following privatisation, many procurements have been delayed since DfT took over responsibility for franchising.

Arup interview record, January 2011

An industry party expressed concern that manufacturers were tiring with the procurement process in GB. It had been described to them as antiquated, expensive and sub-optimal with politically-driven solutions. They cited IEP and the need to provide dual fuel trains because of the lack of electrification north of Edinburgh and the political insistence that passengers should not be made to change trains. The manufacturer classified DfT as an ‘uninformed buyer.’

Arup interview record, December 2010

Following their management buy out, Chiltern procured some rolling stock of their own specification (Class 170s). Although these were initially limited in volume (12 vehicles), the success of the design later allowed the manufacturer to sell a further 76 of the same vehicles to Chiltern, and hundreds more to other operators. This provides an historical example of the success of TOC-specified rolling stock procurement, without government involvement.

Discussion with Adrian Shooter, Chiltern Rail, February 2011

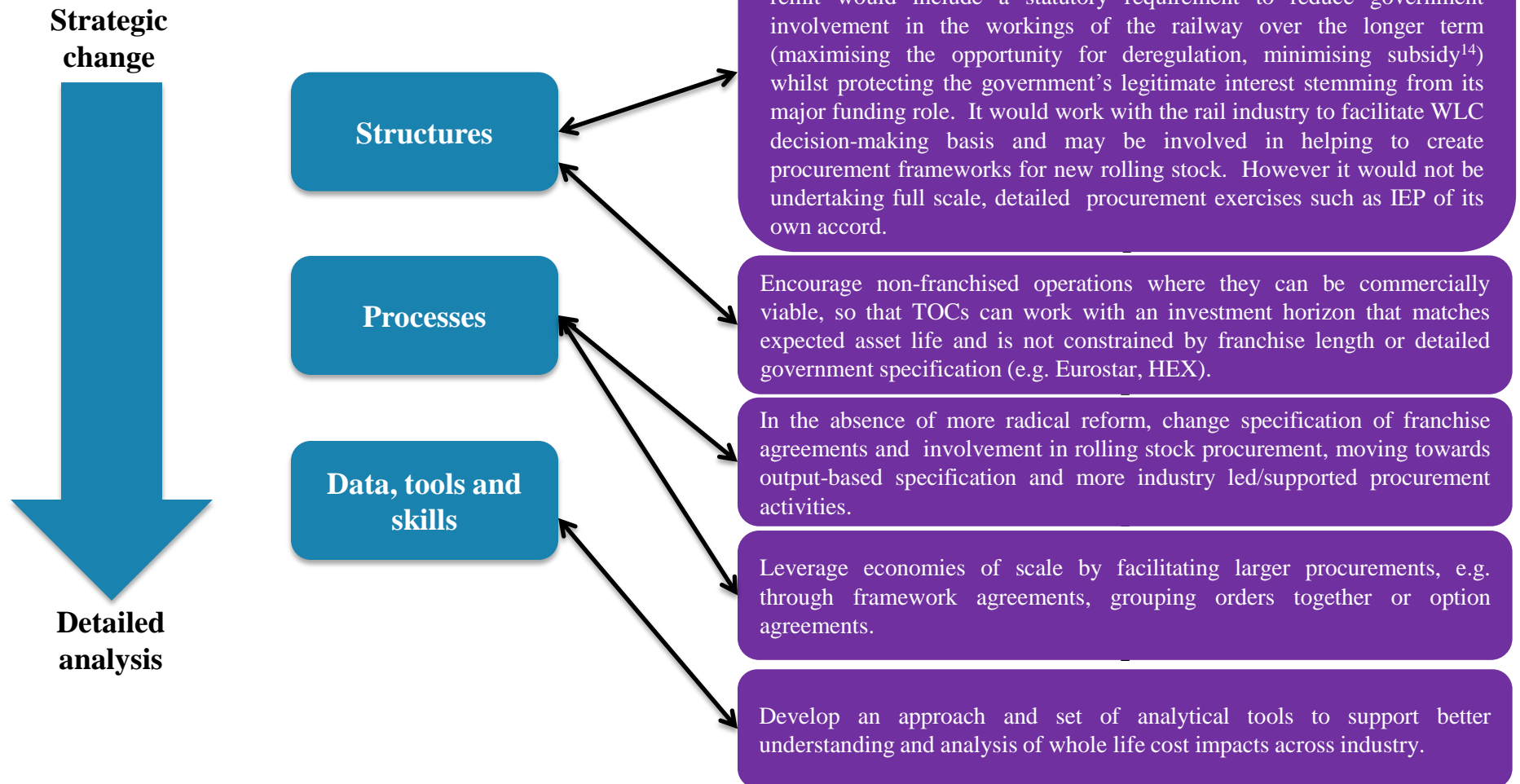
“The specification... has driven features within the design that have been questioned and may well be unnecessary (e.g. the requirement to have a small diesel generator to power the train in the event of a loss of electricity)...“There are no long-distance high speed Intercity bi-mode trains operating anywhere in the world and the UK industry does not appear to be supportive of the concept....and therefore imports risk”

Sir Andrew Foster, (June 2010) A Review of the Intercity Express Programme Annex, p11, 12

Specification and procurement: solutions

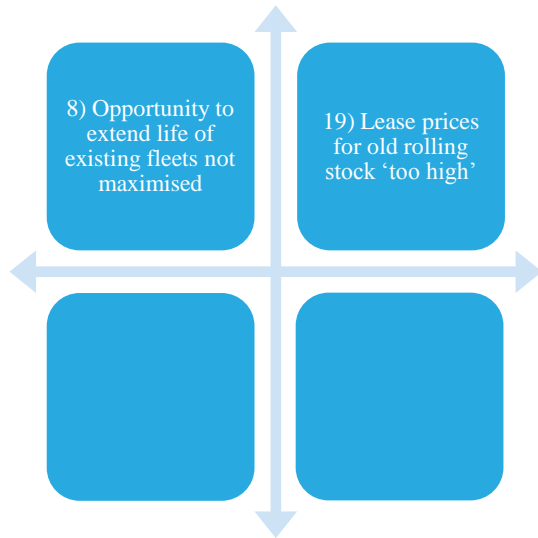
The aim of these solutions is to reduce the whole life costs of rolling stock by reducing the degree of government prescription, reducing the number of small and separately-specified orders, and avoiding stop-start procurements.

Figure 5.4: solutions addressing specification and procurement problems



Options evaluation (prior to procurement): evidence of problems

This page sets out key evidence supporting our conclusion that government risks missing an opportunity to reduce costs by extending the life of existing rolling stock.



In the present market lease costs for new rolling stock are in the region of three times as high as lease costs for old rolling stock.

Arup advisory team transaction experience

In the course of this assignment, ROSCOs have shared analysis with us setting out their view of the scale of potential cost reductions associated with life extension of existing assets. One ROSCO's analysis suggests that depending on the extent to which government was prepared to delay planned future procurements of new stock, the potential cost reductions could be up to £169m per annum. We understand that ROSCOs have also shared this information with the DfT.

ROSCO submission to McNulty Review, December 2010

In the course of our discussions with industry parties, both Network Rail and ROSCO representatives told us that they believed they could identify opportunities to reduce costs or mitigate risks if they were involved earlier in the evaluation of rolling stock option development.

Arup interview records, January 2011

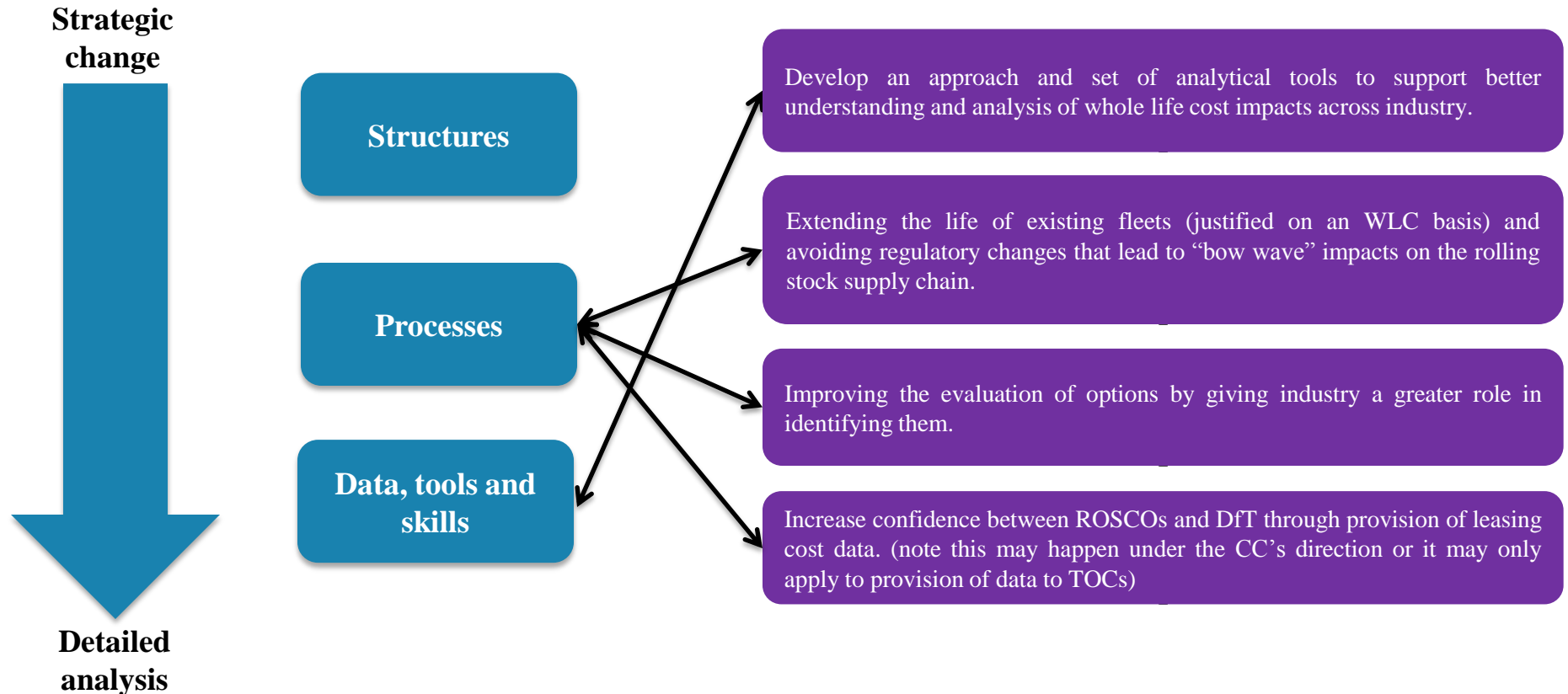
An industry party told us that it believed government had concluded too quickly that the 2020 deadline for compliance with PRM legislation would best be satisfied by purchasing new rolling stock for the network, and that this strategic approach now risks committing the industry to unduly high future lease costs.

Arup interview records, February 2011

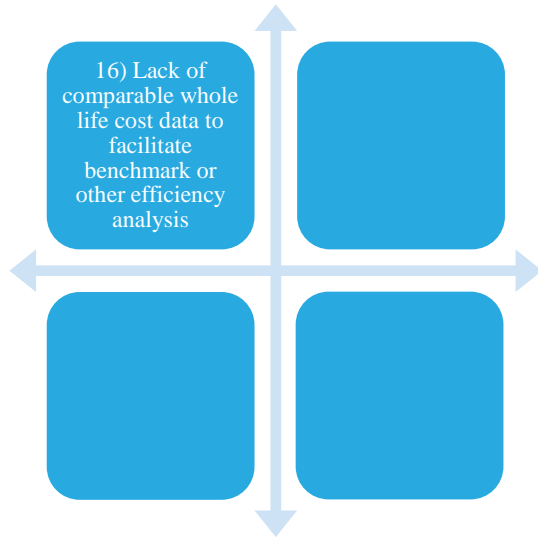
Options evaluation (prior to procurement): solutions

The independent “arm’s length” body responsible for implementing rail policy should assess a wider range of options from a value for money and whole life cost perspective before commencing any procurement exercise for new rolling stock.

Figure 5.5: solutions addressing options evaluation problems



Data, tools and skills: problems



“RSSB stated that looking at the industry as a whole there are good processes and tools for optimising safety, reasonable processes for optimising performance (PPM) but virtually no processes and tools for considering cross industry optimisation of wider business risks. Given the industry focus on safety and performance (PPM) from the top this would be expected. No evidence was found of the DfT possessing or using processes and tools to optimise investment and whole-life activities”

Source: Atkins, Rail Value For Money Study 2010, p.22-23

An industry party told us that their experience of analysis of rolling stock transactions was that reliable technical data on whole life costs was impossible to source.

Arup interview notes, November 2010

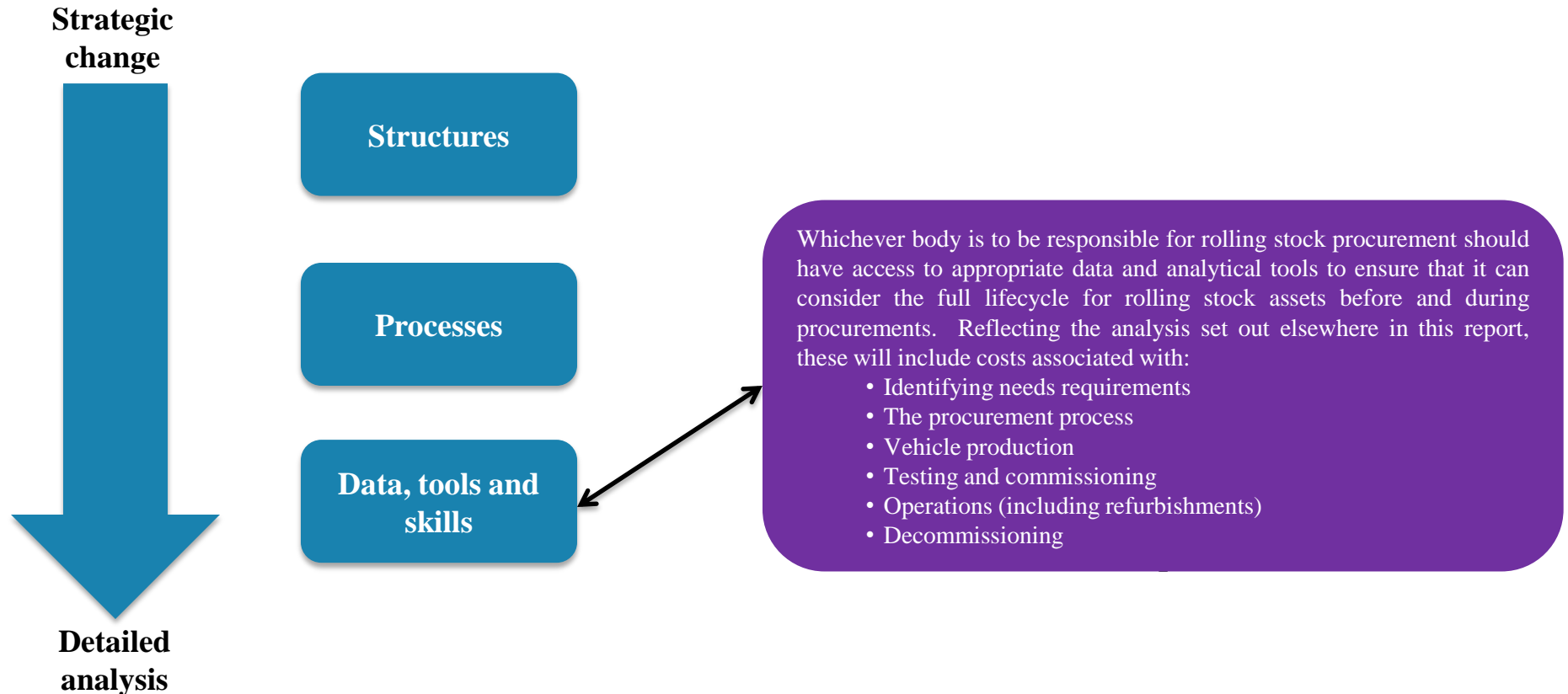
In the course of undertaking this study, we have been struck by the dearth of data to allow whole life cost and benefit analysis for rolling stock. It is possible that this information exists within some organisations but there is no effective mechanism in place for harnessing it in such a manner as to meet the collective, legitimate needs of the industry and its funders. This is in striking contrast to some other transport industries, including the aviation and automotive sectors.

Arup advisory team

Data, tools and skills: solutions

The aim of these solutions is to ensure that government and / or industry have appropriate data, tools and skills to undertake whole life cost analysis in a way which allows it to deliver improvements against the other priorities identified in this report.

Figure 5.6: solutions addressing data and decision-tools problems



Summary of recommended solutions

Figure 5.7: full list of recommended solutions

Establish an “arm’s-length” body with its own powers and duties to take over responsibility for implementing government rail policy from DfT. Its remit would include a statutory requirement to reduce government involvement in the workings of the railway over the longer term (maximising the opportunity for deregulation, minimising subsidy¹⁰) whilst protecting the government’s legitimate interest stemming from its major funding role. It would work with the rail industry to facilitate WLC decision-making basis and may be involved in helping to create procurement frameworks for new rolling stock. However it would not be undertaking full scale, detailed procurement exercises such as IEP of its own accord.

Implementation of voluntary or if necessary statutory forms of limitation on the Secretary of State’s ability to change rail investment programmes on a day-to-day basis, enabling only periodic revisions to the industry’s long term (rolling stock) investment programme (e.g. every five years).

Enable a commercially sustainable environment where TOCs, NR / the Infrastructure Manager and ROSCOs / funders can work with an investment horizon that matches expected asset life and allows commercially rational whole life asset management, and ideally is not constrained by franchise length or detailed government specification.

Extending the life of existing fleets (justified on an WLC basis) and avoiding regulatory changes that lead to “bow wave” impacts on the rolling stock supply chain.

A fundamental change to specification of franchise agreements and involvement in rolling stock procurement, moving towards output-based specification and more industry led/supported procurement activities.

Leverage economies of scale by facilitating larger procurements, e.g. by facilitating framework agreements, “grouping” orders together or option agreements.

Improving the evaluation of options by giving key industry players a greater role in identifying them.

Establish longer franchises (underway) to reduce the disincentives relating to introducing new rolling stock.

Develop an approach and set of analytical tools to support better understanding and analysis of whole life cost impacts across industry.

Whichever body is to be responsible for rolling stock procurement should have access to appropriate data and analytical tools to ensure that it can take consider the full lifecycle for rolling stock assets before and during procurements. These should be shared with the industry subject to normal commercial confidentiality protocols and competition law. Reflecting the analysis set out elsewhere in this report, these could include costs, risks and benefits associated with:

- Identifying needs requirements
- The procurement process
- Vehicle production
- Testing and commissioning
- Operations (including refurbishments)
- Decommissioning

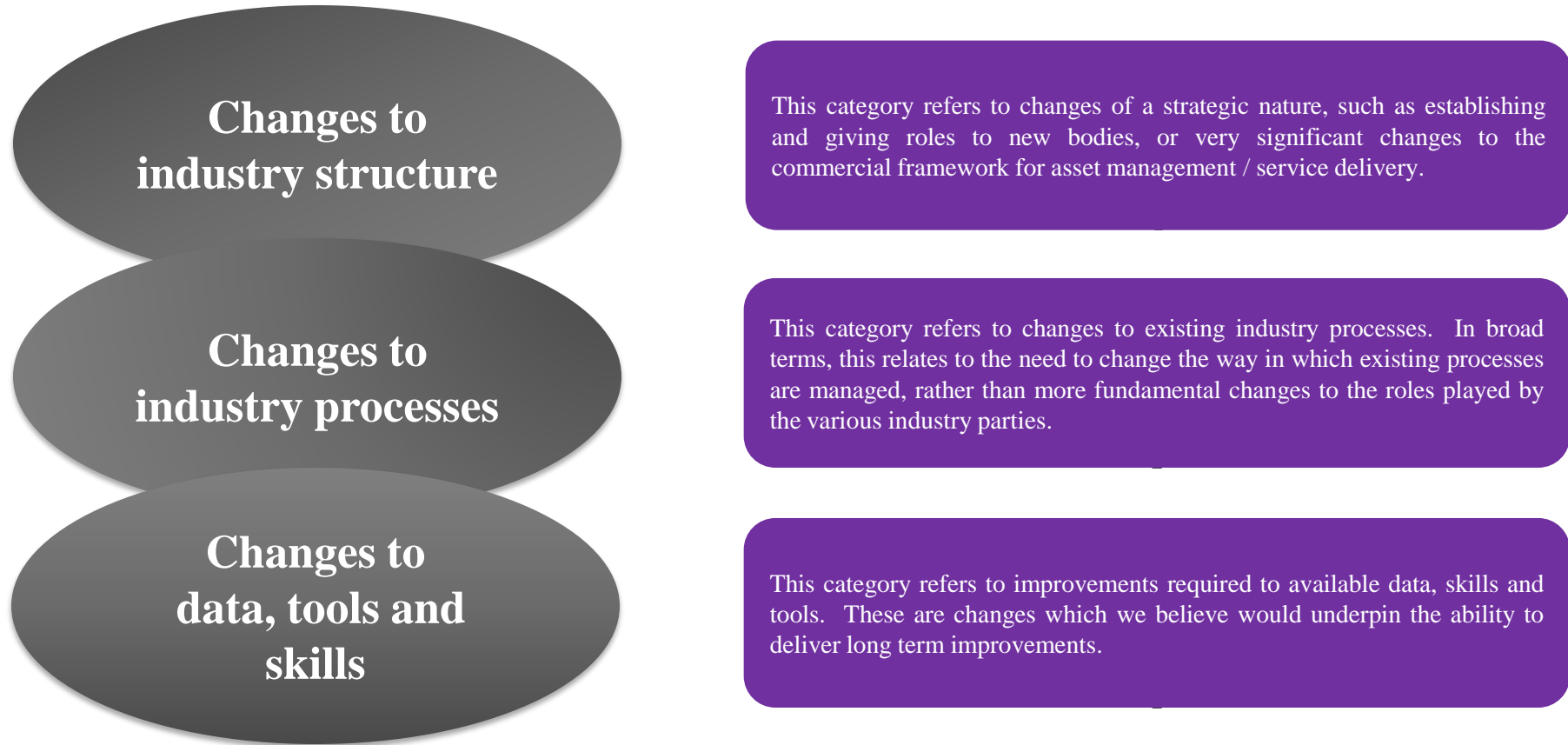
Increase confidence between ROSCOs and DfT through provision of leasing cost data.

6. Key actions for rolling stock strategy

Types of changes proposed for rolling stock strategy

The following pages summarise the changes we propose should be pursued in the context of any future rolling stock strategy. We present the proposed changes in three categories, as illustrated in Figure 6.1.

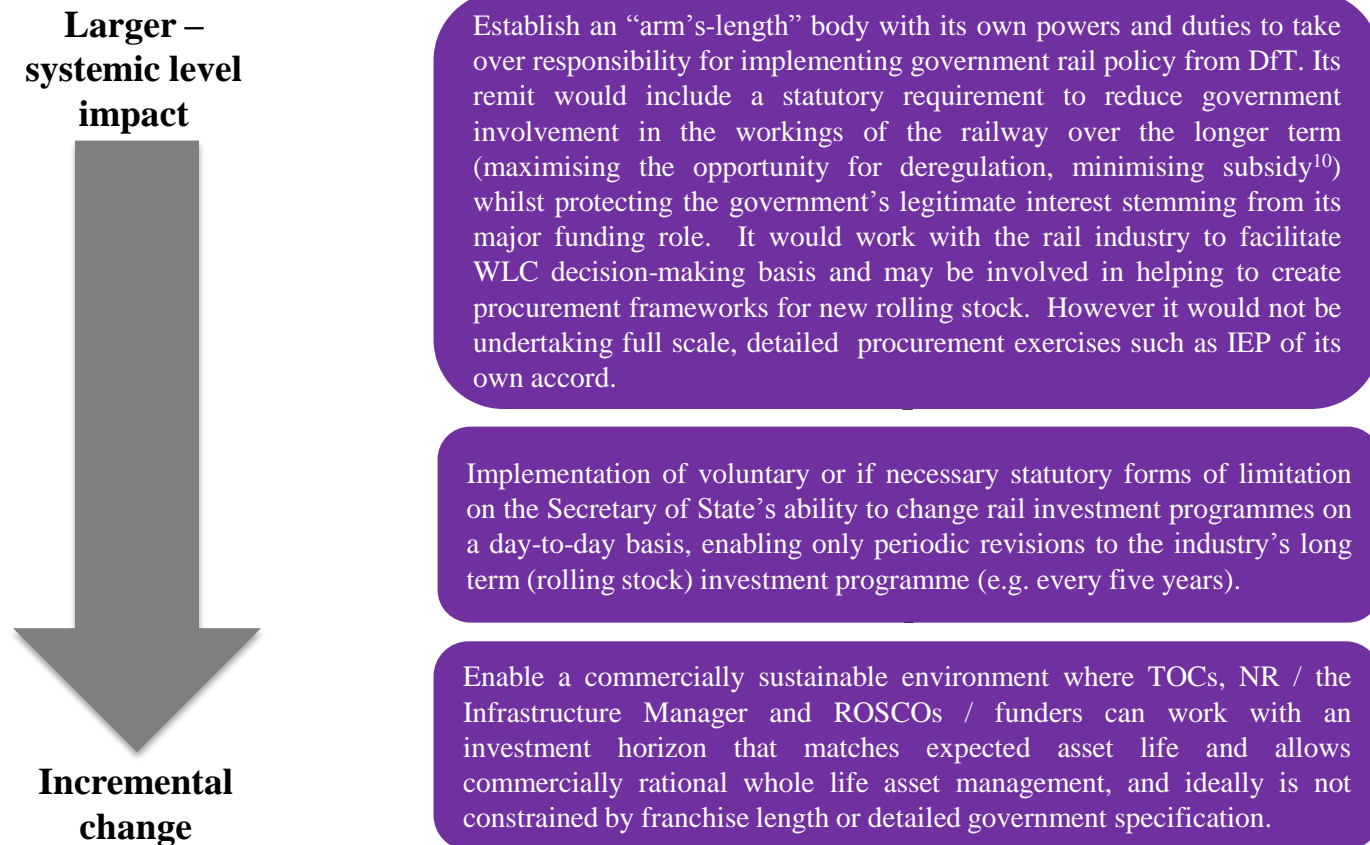
Figure 6.1: types of changes proposed for rolling stock strategy



Changes to pursue in relation to industry structure

As set out in more detail on pages 69 and 71, a key theme we believe needs to be addressed is the impact on industry costs of DfT's excessive interference. The proposed changes grouped together below seek to address that theme by transferring DfT responsibilities to a new body with its own statutory identity (i.e. a body genuinely independent of DfT), limiting (through law) DfT's ability to intervene in industry on an ad hoc basis, and enabling a commercially sustainable environment in which the rationale for government interference (i.e. public subsidy) is removed on particular routes.

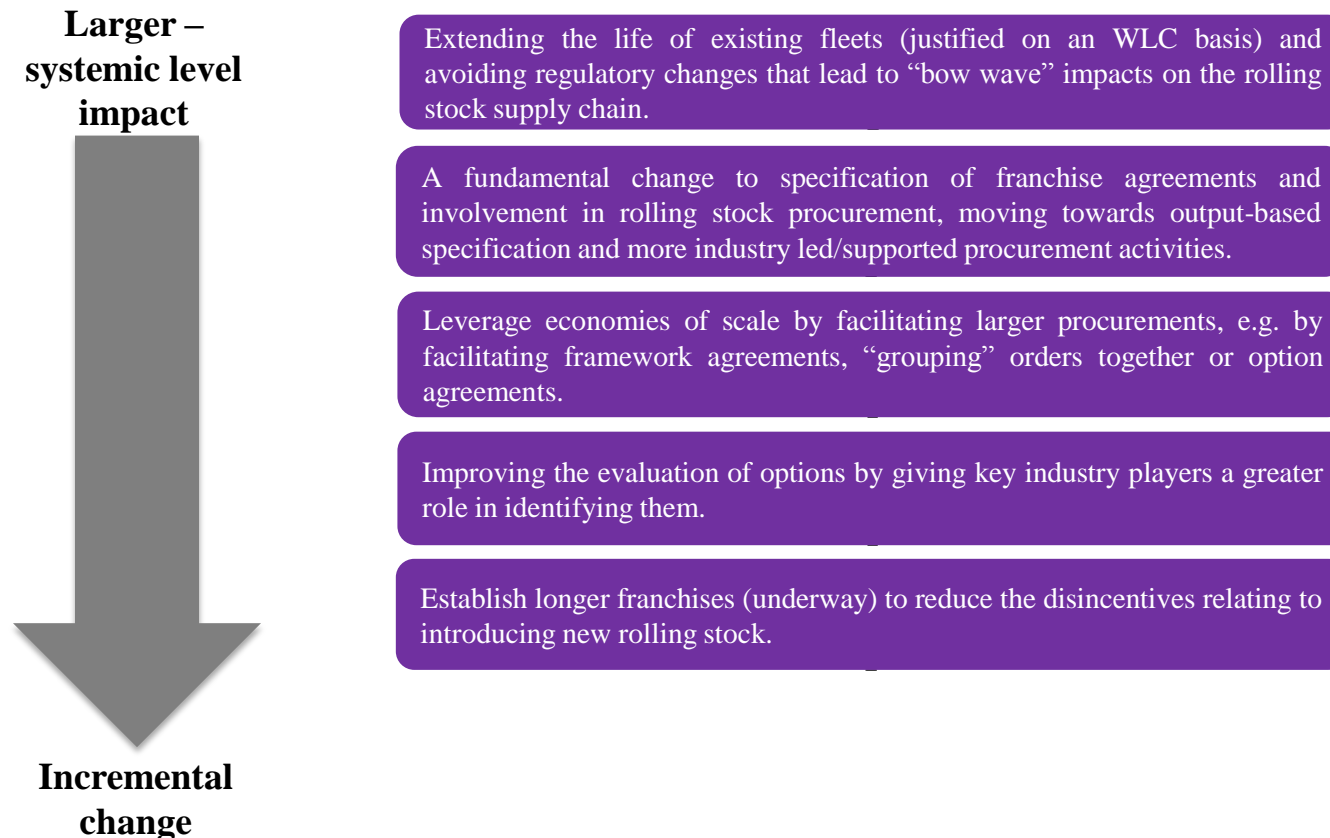
Figure 6.2: proposed changes to industry structure



Changes to pursue in relation to industry processes

In the course of our work, we have reviewed and identified a broad range of specific issues, raised with us either by our client or other industry parties. Our findings in relation to those issues are set out in more detail in Section 4 of this report. Where we have identified particular practices as driving unnecessarily high costs, the proposed changes grouped together below seek to address those practices directly. These changes could be delivered irrespective of which parties undertake which roles, so can be considered separately from those set out on page 80.

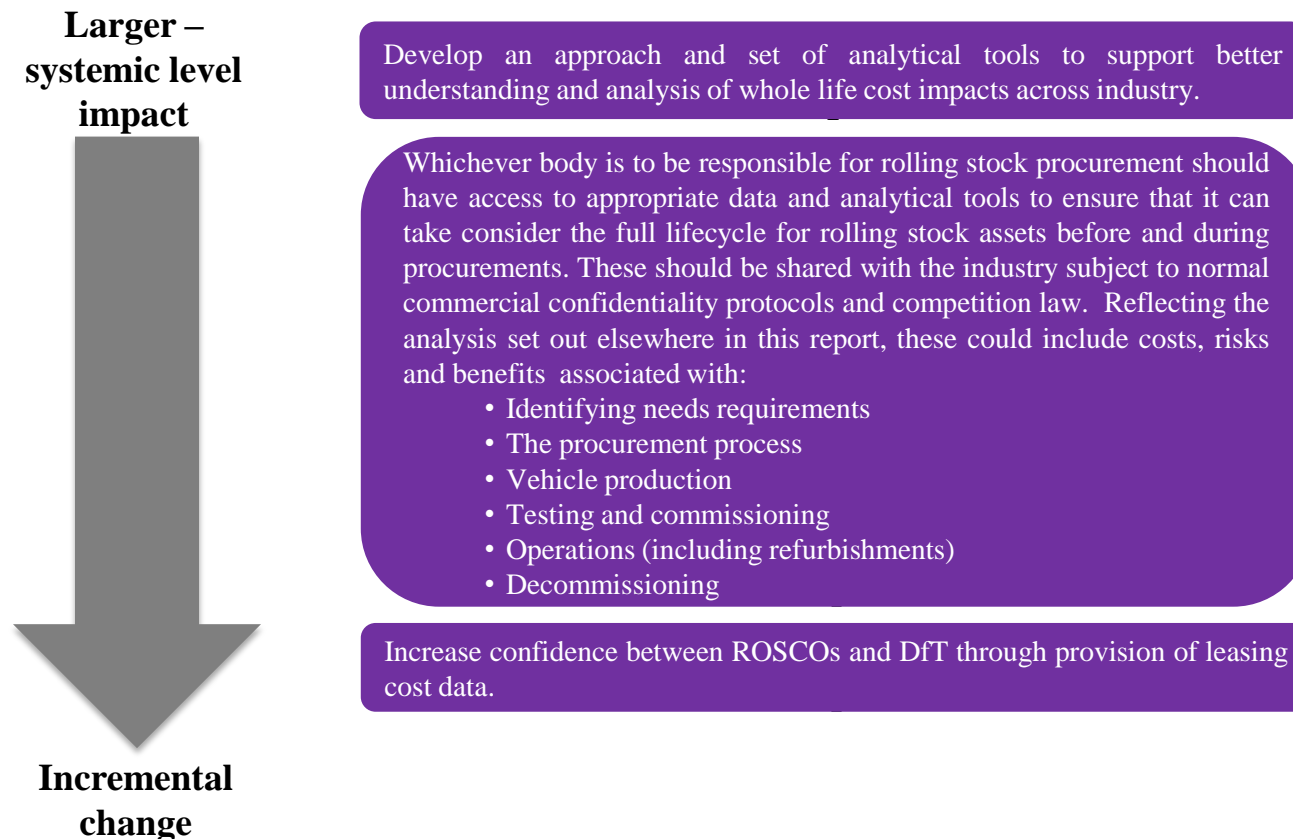
Figure 6.3: proposed changes to industry processes



Changes to pursue in relation to people, skills and decision tools

In the course of our work, we have identified the availability of high quality data and analytical tools as a key area for improvement. The analysis supporting that conclusion is summarised on page 60. The aim of the changes grouped together below is to ensure that future decision-makers across industry (irrespective of who they are), can take decisions which are informed by an appropriate understanding of decisions' implications for whole life costs.

Figure 6.4: proposed changes to people, skills and decision-tools





6. Benefits

Approach to quantifying potential benefits

- The ‘base case’ against which benefits are articulated is the £1.9 billion which Atkins has previously estimated as the present costs of rolling stock for GB rail, including the annual long term costs associated with the expected needs for fleet replacement.
- The nature of each set of savings is described below, together with an explanation of how we have arrived at our estimation of the benefits:

1. Strategy and planning – This refers to potential savings which can be achieved by reducing the extent and frequency of government involvement in the detail of industry planning and delivery. We have broken this category of savings into two distinct parts, as set out below.

- **Stable policy and improved governance** – This refers to the potential to eliminate the direct impact of frequent and sudden changes in government policy on the industry’s cost base. In line with the views expressed to us by industry parties in the course of this work, we believe this source of savings could contribute up to £100m per annum.
- **Industry efficiency gains** – This refers to the potential to create an industry structure which eliminates inefficiencies which we believe go hand-in-hand with the present level of influence government exercises over the rail industry. To estimate the potential scale of these benefits, we have drawn on data from the regulated infrastructure sector (particularly the UK water industry, where a broad range of ownership structures have co-existed under the same regulatory regime for over 20 years). Those data suggest that appropriately-incentivised private sector entities can reduce unit costs by up to 20% over time. In our estimate, the high end of the range achieves that 20% reduction in costs, whereas the low end of the range shows only a 10% reduction in costs.

- 2. Specification and procurement** – This refers to the ability to reduce the costs of future procurements of new rolling stock, by avoiding smaller orders and specifying requirements to industry at a higher level of detail. Based on the analysis and benchmarks available and our discussions with industry parties, we believe that more effective procurement may be able to reduce unit costs by between 5% and 10%. Those two figures are reflected in the low and high cases, respectively, and have been calculated as reductions against the £500m smoothed cost of replacement rolling stock estimated by Atkins in their previous work for the McNulty Review.
- 3. Options evaluation before procurement** – This refers to the ability to defer the costs of procuring new rolling stock by extending the life of existing rolling stock. To estimate the low end of the range shown, we have assumed that life extension will be applied to rolling stock other than HSTs, IEP, Thameslink and Crossrail. To estimate the high end of our range, we have assumed that in addition to the life extension implied by the low end of the range, IEP will be delayed until 2020. To avoid any ‘double counting’ of benefits (alongside analysis of potential savings associated with future procurements, we have assumed that these benefits fall away once the life-extended stock comes to the end of its extended life (in 2020).
- 4. Data, tools and skills** – We view the improvements set out in this area as important in supporting the other improvements described above, but have not quantified any additional benefits in relation to improvements in data quality and analytical tools.
- 5. Calculation of totals** – The low end of our range shown adds up the lower of the figures quoted against each of the categories above, whereas the high end of the range shown is the total of the higher of the figures shown against each category.

Approach to quantifying potential benefits...*contd*

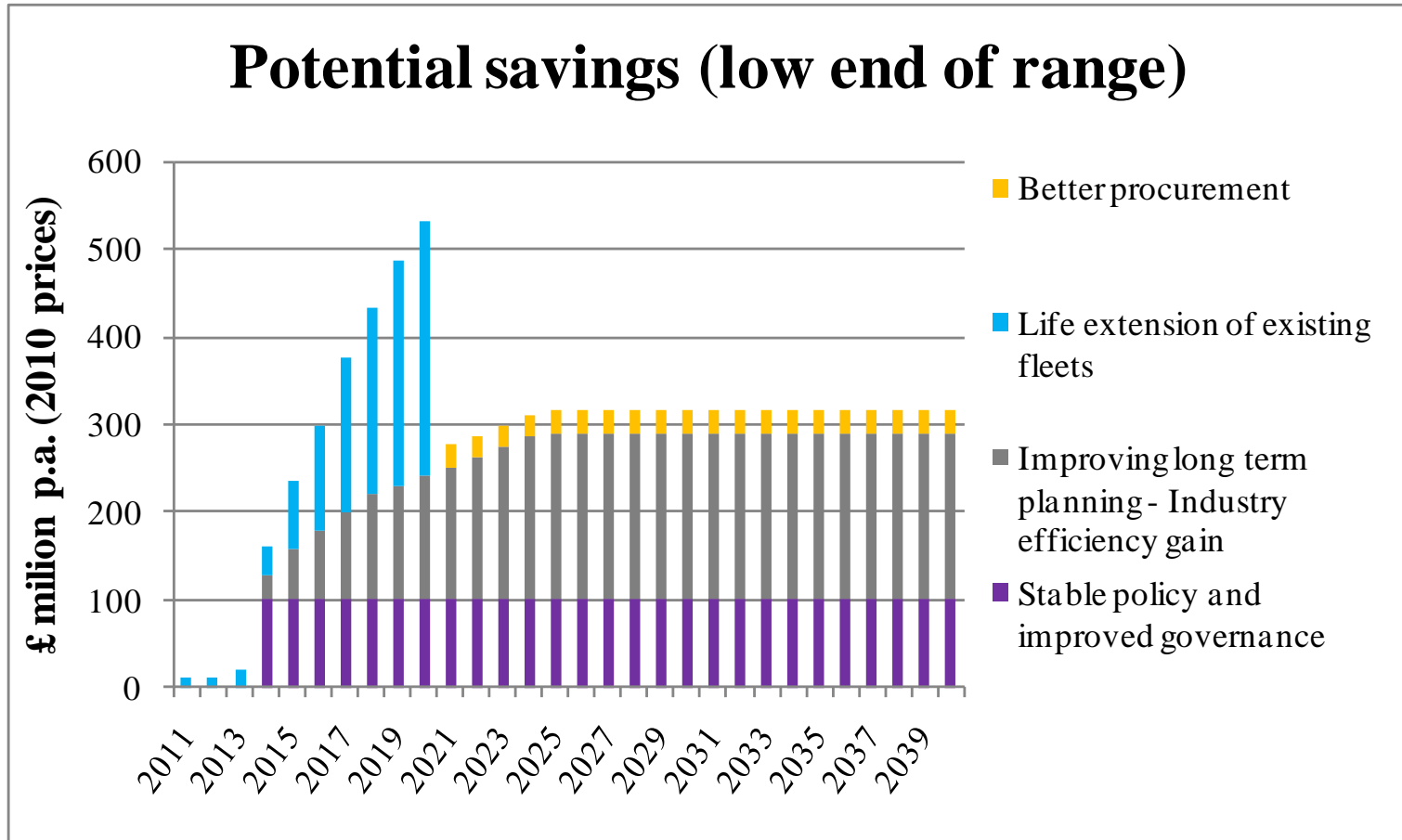
- Note that although the approach described above draws on evidence encountered in the course of our work, the extent of the data available to inform some of the judgements we have made is limited. The estimates should therefore be treated with a significant caution.
- Furthermore, the extent to which these benefits can be delivered will depend heavily on the steps taken by government and industry to deliver the changes proposed. In particular, we place a strong emphasis on the need for government to remove itself from the detail of industry planning and investment decisions. Without that step, it is highly unlikely that even the degree of benefits estimated to represent the low end of the range can be delivered.
- The following pages include tables and charts to illustrate our quantification of the benefits.

Benefits: summary

Table 6.1: Description of benefits

	Strategy element	Quantification
1	Strategy and planning	<ul style="list-style-type: none"> • £100m annual saving by reducing government’s ability to change policy and investment plans • £191m to £382m annual cost reduction from industry efficiency gains, achieved by 2025
2	Specification and procurement	<ul style="list-style-type: none"> • Average annual cost reductions of £25m to £50m, achievable in years when new stock is being procured
3	Options evaluation before procurement	<ul style="list-style-type: none"> • Short to medium term savings growing to between £292m and £388m per annum, depending on whether or not IEP is delayed
4	Data, tools and skills	We do not ascribe any additional quantified benefits to making progress in this area, but believe that this set of improvements will be necessary to support delivery of the other benefits outlined above.
	Totals	Total long term savings between £316m per annum (17%) and £532m per annum (28%)

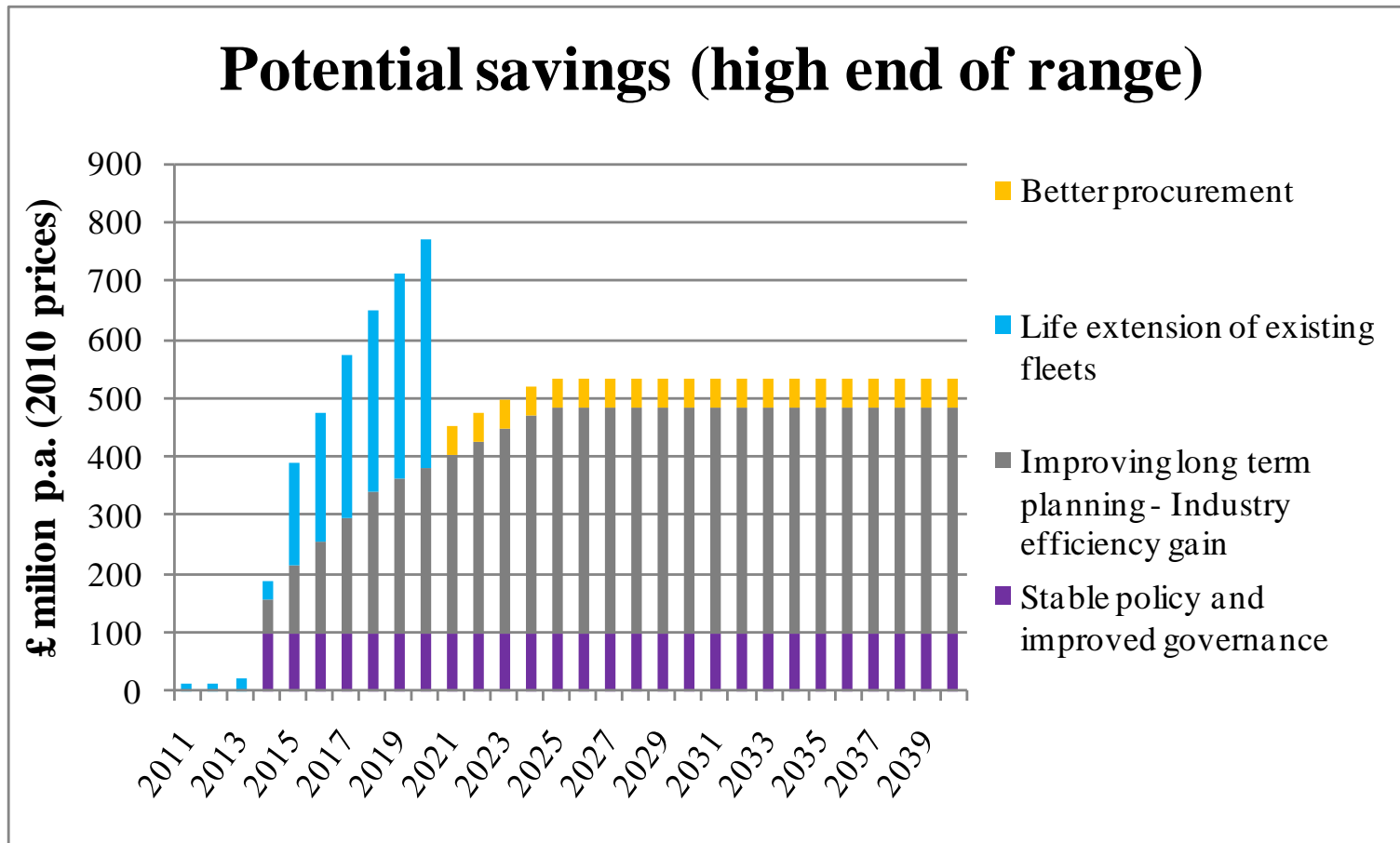
Figure 6.1: Illustration of potential savings (low end of range)



Source: Arup research and analysis

Breakdown of benefits: high case

Figure 6.2: Illustration of potential savings (high end of range)



Source: Arup research and analysis

7. Implementation

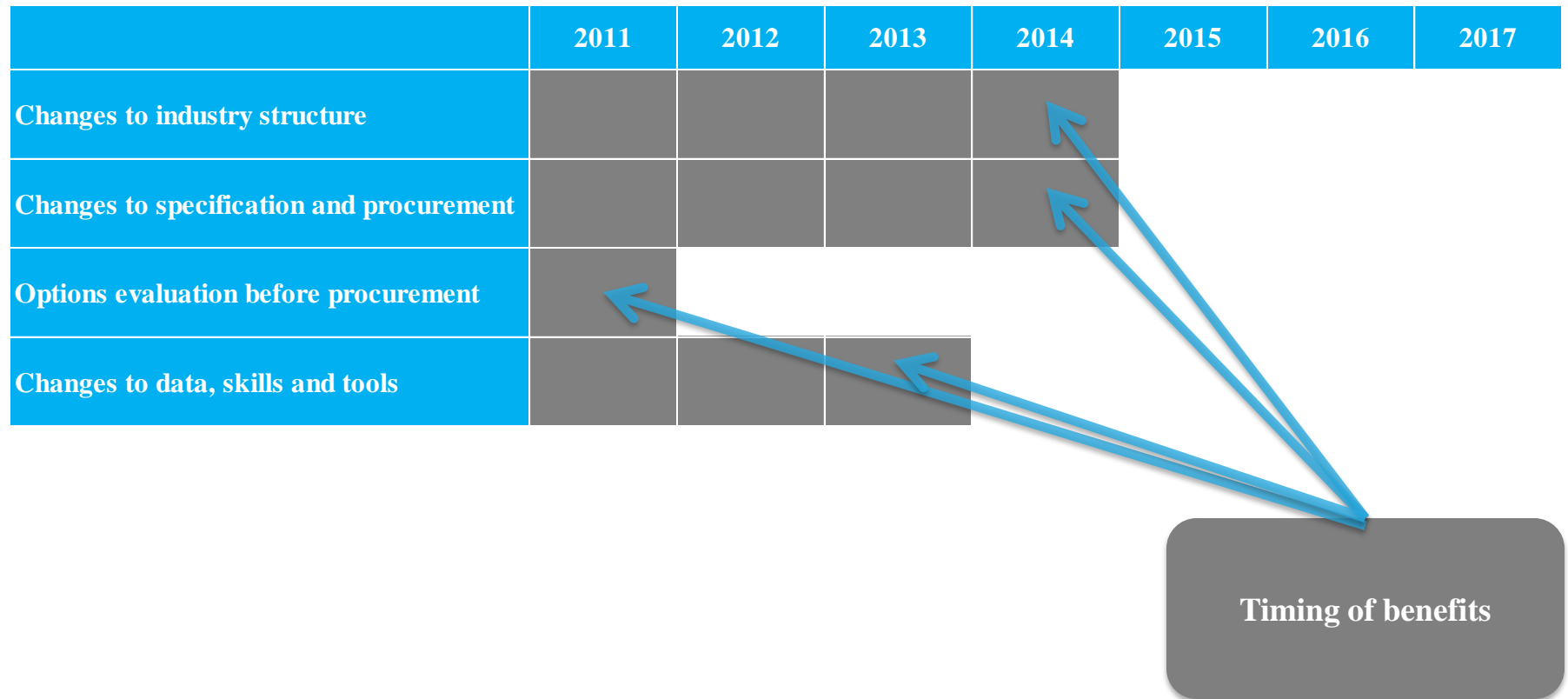
Implementation plan

Table 7.1: Description of implementation timetable

	Strategy element	Implementation – steps and timing
1	Strategy and planning	<ul style="list-style-type: none"> • Likely to require primary legislation to deliver changes to industry structure, so full implementation unlikely until 2014 or later
2	Specification and procurement	<ul style="list-style-type: none"> • Change may be too late to influence IEP, Thameslink or Crossrail. Benefits unlikely to begin until 2014, or later if life extension option is pursued
3	Options evaluation before procurement	<ul style="list-style-type: none"> • Present delays in procurements mean this benefit is being delivered already
4	Data, tools and skills	<ul style="list-style-type: none"> • Work to build capacity likely to take two to three years, and only likely to deliver full benefits under changed industry structure

Implementation plan

Figure 7.1: Implementation timeline and realisation of benefits





Appendix A: Details of supporting evidence base

References (main body of report where not cited in commentary)

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2. See for example the Rail Freight Group submission to the Rail Value for Money Study, July 2010
3. For example, in simplified terms, saving money by not replacing rolling stock may have an impact on the fares passengers are willing to pay. We recognise this is an important consideration that would need careful consideration before implementing measures to reduce whole life costs
4. FOCs account for a modest component of total government support in GB rail. As was outlined in their submission to the Rail Value for Money Study of July 2010, FOCs were sold outright at privatisation and have been able to successfully shape their businesses on generally normal commercial terms, free from government constraint. Therefore the focus of our report is very much on the passenger sector. Reforms such as deregulation might well provide benefits to freight operators too – as outlined in their submission.
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specifications must be much reduced or eliminated, and TOCs should be fully exposed to changes in the variable access charge.Again using the freight model, we suggest that they [the TOCs] should be grant aided specifically using something akin to the Mode Shift Revenue Support grant. This would enable much closer scrutiny of costs and benefits and permit regular review of support levels (for freight, maximum contract length is 3 years). This would enable local and national government to protect the services they wish to have yet enable a much more commercial view of overall service provision.”

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Details of the parties interviewed by our team

- ✓ Alstom – Piers Wood
- ✓ Angel – Malcolm Brown, George Lynn, Tim Dugher, Kevin Tribley and Dave Jordan
- ✓ ATOC – Richard Davies
- ✓ Bombarider – Jon Seddon
- ✓ Chiltern Railways – Adrian Shooter
- ✓ Cross Country – Andy Cooper
- ✓ CSRE – David Shipley
- ✓ DfT – Peter Randall and Caroline Low
- ✓ EIB – Tom Barrett
- ✓ Eurostar – Tim Jackson
- ✓ Eversholt – Simon Purves
- ✓ First Group – Clive Burrows
- ✓ Goldman Sachs – James Wardlaw
- ✓ Hitachi – Ali Dormer
- ✓ NR – Paul Plummer, Andy Doherty and Glenn Leighton
- ✓ ORR – Mike Holmes and Paul Hooper
- ✓ Porterbrook – Paul Francis, Keith Howard and Alex White
- ✓ RIA – Jim Lupton
- ✓ Royal Bank of Canada – Hugo Parker
- ✓ Siemens – David Wilson
- ✓ SMBC – Tony Mitton
- ✓ Société Générale – Markus Froelich and Stephen Fowler
- ✓ Southern Trains – Alex Foulds
- ✓ Virgin Trains – Tony Collins



Appendix B: Glossary of terms

Glossary of terms

- ✓ ATO – Automatic Train Operation
- ✓ ATOC – Association of Train Operating Companies
- ✓ AWS – Automatic Warning System
- ✓ BR – British Rail
- ✓ CC – Competition Commission
- ✓ DfT – Department for Transport
- ✓ DMU – Diesel Multiple Unit
- ✓ EC4T – Electricity Current for Traction
- ✓ EMU – Electric Multiple Unit
- ✓ ERTMS – European rail traffic Management System
- ✓ ETCS – European Train Control System
- ✓ HEX – Heathrow Express
- ✓ HS2 – High Speed 2
- ✓ IEP – Intercity Express Programme
- ✓ NAO – National Audit Office
- ✓ NFRIP – National Fleet Reliability Improvement Programme
- ✓ NR – Network Rail
- ✓ OEM – Original Equipment Manufacturer
- ✓ OPRAF – Office of Passenger Rail Franchising
- ✓ ORR – Office of Rail Regulation
- ✓ PPM – Public Performance Measure
- ✓ PRM – Persons of Reduced Mobility
- ✓ PTE – Passenger Transport Executive
- ✓ RISAS – Railway Industry Supplier Approvals Scheme
- ✓ ROSCO – Rolling Stock Company
- ✓ RSSB – Rail Safety and Standards Board
- ✓ SRA – Strategic Rail Authority
- ✓ TOC – Train Operating Company
- ✓ TPWS – Train Protection & Warning System
- ✓ TSA – Train Services Agreement
- ✓ TSI – Technical Specifications for Interoperability
- ✓ VfM – Value for Money
- ✓ V-TAC – Variable Track Access Charge
- ✓ VT SIC – Vehicle Track Systems Interface Committee
- ✓ WLC – Whole life cost

Appendix C: Details of advisory team

Advisory team

Alexander Jan works in Arup's Transaction Advice team, leading on transport related work. Previously he was a Director with Scott Wilson Business Consultancy where he specialised in transaction and technical advisory work in the transportation sector. He was previously Head of Business Planning & Performance Improvement for Metronet Rail (BCV) Ltd., and Transport Liaison Manager providing advice to the Mayor of London and London Assembly on TfL related transport matters. Alex's recent advisory roles have included advising lenders on Thameslink rolling stock and Eurotunnel's refinancing.

John Vale advises clients including Morgan Stanley, Société Générale, 3i, and Star Capital on rolling stock issues. His recent roles include advising Eversholt Investment Ltd, on their successful acquisition of Eversholt Rail. John's previous roles include positions as Business Development Director at Angel Trains and Adtranz (formerly ABB Transportation and British Rail Engineering Ltd, now owned by Bombardier).

Dan Phillips is a transport specialist within Arup's Transaction Advice team, and advises private equity and other investors on transport and infrastructure deals. His recent roles include managing rail assignments for Goldman Sachs, Eurotunnel and Qatari Diar. Prior to joining Arup Dan worked at the DfT, where his work included roles relating to Crossrail sponsorship and the restructuring of London and Continental Railways.

Phil Shepherd's international railway consultancy interests span infrastructure systems, rolling stock, institutional change and due diligence work for financial institutions. He was formerly Director of Operations at a major British railway consultancy with executive responsibility for signalling, electrification, E&M, rolling stock, civil, structural, track engineering and operational railway safety.

Malcolm Wilson has extensive experience in the operating railway, having held a range of technical and general management positions within a variety of TOCs and ROSCOs. He has international knowledge and experience through involvement in European cross acceptance and standards harmonisation, and particular rail projects in Northern Ireland, Kenya and Abu Dhabi. Malcolm has comprehensive rolling stock engineering, operating and performance knowledge and experience gained in multiple consulting and project roles for clients such as HSBC Rail, the Competition Commission, manufacturers and TOCs..

Neil Heaton is a consultant focused on rail vehicle maintenance. He works for suppliers and operators in Europe and Asia, assisting with procurement, franchise bids and development of maintenance strategy. He has worked for all of the UK operating groups and several large European operating groups on franchise bids, rolling stock procurement and maintenance. His other recent roles have covered projects in the UK, Europe, Asia and South America. His previous roles have included Head of Rolling Stock Maintenance for Siemens in the UK, Maintenance Engineer responsible for the Virgin Intercity fleet and other roles within British Rail.

John Cartmell has 35 years experience of railway consulting and contracting with skills in scheme evaluation, system design, business development, tendering and tender evaluation of major projects including those financed through PPP/PFI. His roles have included acting as Strategic Adviser to the Metro Express Consortium in their bid for Dublin Metro North, Project Director of the Bombela Consortium which was awarded the \$3.4 billion Gautrain project in South Africa and design and multi-contract structure roles of the Hong Kong Mass Transit Railway.

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