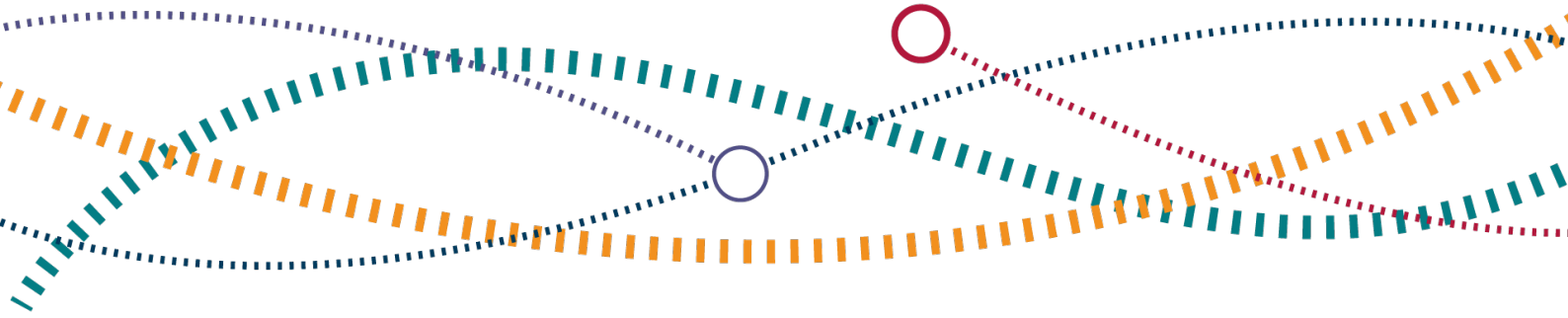
OFFICE OF RAIL AND ROAD

Signalling market study

Update paper

11 May 2021



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Summary

Introduction

We launched a market study into the signalling market in Great Britain ("**GB"**) on 12 November 2020 following an earlier study which closed in April 2020[1].

Signalling systems are fundamental to the safe and efficient operation of modern railways, directing traffic and keeping trains apart to prevent collisions. The purpose of a signalling system is to determine the position of trains on the network, control their direction and signal to the driver when it is safe to proceed to the next section of track. Signalling systems also have a role to play in freeing up capacity on the network, which is already constrained, by allowing more trains to run safely.

This update paper outlines our progress and presents our emerging findings about the market. It also sets out our decision not to make a market investigation reference ("**MIR**") to the Competition and Markets Authority ("**CMA**"). We instead propose to continue the market study and produce our own package of remedies to address the competition issues identified. These remedies will be set out in our market study final report. We welcome responses on this update paper and our proposed actions by 11 June 2021. Chapter 11 of this document sets out details of how to respond.

Purpose

The purpose and scope of the study was set out in the Statement of Scope that we published on 12 November 2020[2].

The value of signalling to the rail industry is significant. Network Rail's annual signalling expenditure is in the region of £0.8-0.9 billion p.a. representing over 10% of its total cost base[3]. We wanted to explore outcomes in this market and ascertain whether any negative impacts we found, such as increased prices or low quality could be attributed in whole or in part to competition issues.

Another significant driver of our interest in this market is the projected growth. 65% of external signalling assets are projected to expire within the next 15 years, leading to a five to six-fold increase in the volume of renewals work as Network Rail looks to replace

[1] We previously launched a market study into the signalling market in January 2020, however, this was closed due to the impact of COVID-19 on our ability to gather the evidence we required. Market study into the supply of signalling systems | Office of Rail and Road (orr.gov.uk)
[2] See https://www.orr.gov.uk/sites/default/files/2020-11/signalling-market-study-november-2020-statement-of-scope_0.pdf.
[3] Network Rail's total cost base in this context including all operations, maintenance and renewals expenditure.

conventional systems with digital alternatives. We are keen to ensure that there are no unnecessary barriers to entering or growing in the market, such that new players and technologies are incentivised and have a fair opportunity to compete, helping Network Rail to drive value and innovation.

Conventional signalling

Signalling systems are made up of several different components. The key, safety-critical component is the 'interlocking'[4]. British Railways ("**BR**") developed Solid State Interlocking ("**SSI**") for use on the GB network in the mid-1980s. Following the privatisation of BR, the right to develop and deploy SSI passed to two companies. Through acquisition, the rights to SSI are now owned by Siemens SA ("**Siemens**") and Alstom AG ("**Alstom**").

Since 2004, major signalling projects have been procured using framework contracts. Frameworks allow competition for the market for a set period. Network Rail has always chosen three framework suppliers; the two companies holding SSI technology and a third player.

Digital Railway

Many aspects of what are referred to as 'conventional' signalling systems already utilise 'digital' technologies. Nonetheless the term 'Digital Railway' has been adopted by Network Rail[5] as an umbrella term for modern signalling systems and train control technology which involve the introduction of alternative approaches to signalling that remove the need for fixed lineside infrastructure and replace it with 'in-cab' signalling. A key objective of this technology is to increase network capacity, reduce delays, enhance safety and drive down costs.

At current levels, the cost of replacing 'conventional' signalling like-for-like is unsustainable. The Rail Sector Deal was published by the Department for Transport ("**DfT**") and the Department for Business, Energy & Industrial Strategy ("**BEIS**") in December 2018 as a response to this challenge. One of the outputs was the Long-Term Deployment Plan ("**LTDP**"), a plan produced to provide a roadmap for the rollout of the Digital Railway.

Network Rail has undertaken a programme of work, Target 190plus, a research and development programme aimed at driving down signalling costs for the Digital Railway. There are a number of workstreams looking at improving processes for designing projects

[4] A system that prevent trains from undertaking unsafe or conflicting movements by only permitting them to proceed past a signal when routes are set, locked and detected in safe combinations. This is described in more detail in Chapter 3.

[5] Digital Railway - Network Rail

and testing products. The Reference CCS Architecture ("**RCA**") project is concerned with engagement with an initiative run by European infrastructure managers to develop common specifications for interfaces between digital products.

Network Rail has also launched the Digital Railway Programme, a cross-industry plan to accelerate the transition to digitally run railways. The East Coast Mainline was the first major digital signalling project in the UK.

Emerging findings

Strength of competition

There are essentially two main players in the GB market for major signalling projects, namely Siemens and Alstom. In recent years these two companies have accounted for an increasing share of Network Rail's major signalling spend. The combined share of Siemens and Alstom has increased from c70% in 1999-2004 to a projected c90% in 2019-2024. This is also reflected in the installed base of technology, that is, signalling equipment present on the network. Almost all (97%) of the (post-1990) current installed base of interlockings has been installed by Siemens, Alstom or one of their predecessor companies.

Competitors have had a degree of success in competing with Siemens and Alstom, initially as 'integrators' accessing Siemens' or Alstom's (or one of their predecessor companies) interlocking technology under licence and increasingly as rival original equipment manufacturers (suppliers with their own interlocking technology). But the available evidence does not show that these competitors have been able to build on this initial success.

Outcomes

Network Rail recognises that it faces a significant efficiency challenge where signalling is concerned. Network Rail has set itself a long-term target of spending £190k, on average, per signalling equivalent unit ("**SEU**") for digital signalling compared to the approximately £412k per SEU it paid for conventional signalling products throughout its last regulatory control period (2014 to 2019).

Our analysis of Network Rail's spend on signalling consistently found that average prices were lower when projects were competitively tendered as opposed to directly awarded to framework holders. This suggests that more competition and more viable players for both frameworks and individual tenders could help Network Rail drive better value.

Barriers to entry and expansion

Market structure and procurement barriers

Alternative suppliers told us that it is difficult to establish a business case to compete for GB frameworks or develop technology without a long term/certain pipeline of work in which to recoup investment.

We are of the view that Network Rail deploys reasonable effort and consideration into optimising its procurement strategy in this market. Whilst issues such as 'boom and bust' and the intervals between major framework competitions undoubtedly affect both potential new entrants and established suppliers and may have overall value for money implications, the specific impact these issues have on competition, in this particular market, is unclear.

However, we do consider that a lack of a sufficiently visible pipeline with committed funding, the use of frameworks with no guaranteed work banks, and any significant increases to the size and scope of frameworks could inhibit potential competitors from entering the market and growing organically. Historically, market entry outside of framework contracts has been important to new suppliers with new technology that have required small or niche projects to establish a toehold in the market.

Balance between long term competition and reliance on existing technology

Network Rail's operational teams are primarily incentivised to maintain the operation of the railway. At framework and regional level there is, perhaps understandably, a reluctance to depart from SSI interlocking technology due to difficulties experienced with past projects. This is in contrast with a recognition by Network Rail more widely of the significant advantages of promoting new technology and competition in this market.

We appreciate that Network Rail needs to take into account a wide range of considerations in its effort to optimise (total lifetime) cost and other objectives. However, we consider that there may be a better balance to be struck between maximising competition between suppliers and optimising other aspects of the value for money equation.

We are particularly concerned about some instances where we have observed, in tender documents and asset management policies, that projects have been specified in a particular way (in some cases explicitly mandating the use of particular products owned and controlled by incumbent suppliers) such that any real competition is rendered impossible. If this practice goes unchecked, we are concerned about the ability of any 'third player' to expand in the market to mount a real challenge.

Ability to develop products for the GB market

Suppliers' shares of the installed base of interlockings show that no alternatives to SSI have gained significant traction. There have been a small number of attempts to introduce new interlockings, however, these have only resulted in their use in either a single or very small number of projects.

There are a number of factors which make it difficult to introduce new products to the GB network. Some of these barriers, with a degree of variation, are common across Europe, such as the need to comply with national signalling principles or develop national expertise. To have a product approved for use on the mainline in GB, the supplier has to find a sponsor, generally one of Network Rail's regional asset managers ("**RAM**s"), who is willing to trial it on a new project. As outlined above, there are few opportunities for such projects, and RAMs may prioritise operational objectives over facilitating the introduction of new technology to the network.

Whilst the time and cost involved in developing a product for the GB market is significant, alternative suppliers have told us that they would be willing to develop products for the GB market, as long as there was the chance of recovering investment through future signalling work.

Interfacing with the installed base

All signalling projects, to some extent, need to interface with the installed base, whether interfacing with existing technology within a project and/or at the fringes of a project.

Of the modest number of renewal projects that have been carried out involving new technologies, a noticeable proportion appear to have encountered at least some interface issues, which, whilst technically resolvable, usually lead to higher costs. Some suppliers have told us that the need to interface with the installed base has prevented them from being able to submit a competitive bid for a project. Network Rail has to some extent recognised this issue and in some projects has taken action to descope interfaces from project design (and procure separately) to ensure a level playing field.

Impact of the Digital Railway

We consider the Digital Railway and the introduction of new signalling technologies has the potential to address some of the barriers identified above, however, this is not possible in isolation. Whilst Digital Rail products are promoted as interoperable, true interoperability will not be possible without the development of, and adherence to, open interface specifications.

A key risk resulting from the rollout of the Digital Railway is the need for suppliers to develop capability in the GB market. This requires confidence for suppliers to invest. Without this, there is a risk that suppliers will focus their efforts on other markets, particularly as demand increases across Europe. Supplier development to date has been limited by the small number of projects implemented in GB.

As noted above, there are a number of market initiatives related to the Digital Railway which may address some of the barriers we identified.

- One aim of the LTDP is to provide more confidence in the market. Alternative suppliers on the whole were positive about the LTDP; however, they stressed that without committed volumes it will still be difficult to make a business case to enter the market.

- The European Initiative to Linking Interlocking Systems ("**EULYNX**") initiative has the potential to address issues around interfaces for technology. However, the success of EULYNX is dependent on the cooperation of suppliers and does not apply to interfaces with conventional products.

- The Target 190 project is looking at improving processes for designing projects and testing products. This should assist in addressing barriers to developing digital products for the GB market.

Decision on market investigation reference and alternative remedies

Market investigations are more detailed examinations into whether there is an adverse effect on competition in the market(s) for goods or services. ORR may make an MIR to the CMA[6] where it finds reasonable grounds to suspect that any feature, or combination of features, of the market under scrutiny prevents restricts or distorts competition.[7] The CMA has a wide range of powers, not available to ORR, to implement legally enforceable remedies aimed at making the market(s) more competitive. Before ORR exercises discretion on whether to make an MIR however, ORR must consider whether a reference would be proportionate, and also have regard to its statutory duties.[8]

We consider that whilst the legal 'reasonable grounds to suspect' test is met, it would not be appropriate to make an MIR to the CMA in this case. We do not think that the CMA's powers to conduct an MIR and potentially implement remedies which interfere with

[6] Section 67(2)(C) of the Railways Act 1993 and section 131 of EA02 set out the powers of ORR to make a market investigation reference to the CMA
[7] Section 131(2) of EA02 sets out what is to be construed as a feature for the purposes of Part 4 of EA02
[8] Section 4 of the Railways Act 1993 sets out ORR's statutory duties

commercial rights are likely to be the most effective means to address the competition problems we have identified.

Our finding is that these markets do not enjoy a 'clean bill of health'. We did not identify any single 'quick fix' to address the entrenched issues we have identified, but there are a series of activities which, if pursued by various players in the market, could potentially improve the competitive situation.

We consider that appropriate resolution of these issues will be most effectively achieved by extended engagement with, and scrutiny of Network Rail and industry. We will do so throughout Phase 2 of our market study by looking at the barriers on the supplier and buyer side, which are overlapping and interrelated.

On the supply side of the market, we will undertake workstreams to address issues with interfaces and access to technology, engaging with Network Rail to explore options to enforce obligations for cooperation between suppliers. We will also challenge industry to play an active role in developing common specifications for digital products. On the buyer side, we will take forward workstreams looking at improving incentives for suppliers to compete in GB, and challenging Network Rail to tackle any conflict between its strategic objective to encourage more competition, and the objectives of operational teams who are more focused on short term benefits (delivery and cost).

The actions arising from each of these workstreams will require a balance to be struck between short term cost/performance risk and increasing longer term competition. We will continue to engage closely with industry throughout Phase 2 of this enquiry to refine that balance. Possible actions that we may ultimately take range from influencing and making recommendations, through to introducing new licence conditions.

Proposed next steps

We intend to continue the market study and to publish our final market study report by 11 November 2021 in accordance with our statutory deadline.[9] The next phase of the study will primarily be directed at seeking to refine a package of remedies to address the issues identified in this update paper. We will continue to engage with stakeholders and propose to hold a number of workshops for this purpose.

[9] Section 131B(4) of EA02, requires a market study report to be published within 12 months of the market study notice being published

1. Purpose of study

Introduction

1.1 The Office of Rail and Road ("**ORR**") is the independent economic and safety regulator for the railways in GB, and the monitor of performance and efficiency for England's motorways and trunk roads.

1.2 ORR is also a competition authority with powers held concurrently with the CMA to apply competition enforcement and markets powers in matters relating to the supply of services relating to railways[10].

1.3 ORR has strategic objectives, which include ensuring: a safer railway; better customer service; and value for money for the railway[11]. ORR also has general statutory duties that it must consider when exercising most of its functions[12].

1.4 In order to ensure the effective delivery of our statutory duties and strategic objectives, we seek to promote and protect the existence of healthy, robust and competitive supply chains for products and services relating to railways.

Previous work

1.5 During 2018/2019, ORR made representations to the European Commission about the proposed Siemens/Alstom merger. We argued that the proposed merger may have a negative impact on the interests of GB passengers and taxpayers.

1.6 The Commission prohibited the merger in February 2019[13]. The key concerns that it set out in relation to the GB signalling market were:

[10] Under section 67 of the Railways Act, ORR has concurrent functions. The supply of services related to railways is defined under section 67(3ZA).

[11] http://orr.gov.uk/about-orr/what-we-do/our-strategy/our-strategic-objectives

[12] Under section 4 of the Railways Act, ORR has to consider which of the statutory duties listed are most relevant to a particular case. Where more than one duty applies, we must weigh the relevant duties and strike an appropriate balance between them. In this case ORR considers these duties to be particularly relevant:

- Promoting improvements in railway service performance;
- Otherwise protecting interests of users of railway services;
- Promoting the use of the railway network in GB for the carriage of passengers and goods, and the development of that railway network, to the greatest extent that it considers economically practicable;
- Contributing to the achievement of sustainable development;
- Contributing to the development of an integrated system of transport of passengers and goods;
- Promoting efficiency and economy on the part of persons providing railway services;
- Promoting competition in the provision of railway services for the benefit of users of railway services; and
- Enabling persons providing railway services to plan the future of their businesses with a reasonable degree of assurance.

[13] Case M.8677 -Siemens/Alstom, Commission Decision 6.2.2019
https://ec.europa.eu/competition/mergers/cases/decisions/m8677_9376_3.pdf

- Siemens and Alstom were the two largest players in the GB market and would obtain significant market power should the merger go ahead;
- Siemens and Alstom controlled access to key interlocking technology, and could potentially use this advantage to stifle and restrict competition from smaller niche providers of signalling products, and prevent new entry; and
- Network Rail was not able to exercise sufficient buyer power to counter these concerns.

1.7 Particularly in relation to interlocking[14] the Commission concluded that the merger *"would cause a significant impediment to effective competition in the market for standalone interlocking projects"*[15]

1.8 Even though the Commission blocked the merger, our involvement in the review suggested to us that there might be a case for looking into the GB signalling market more closely.

Value of the market

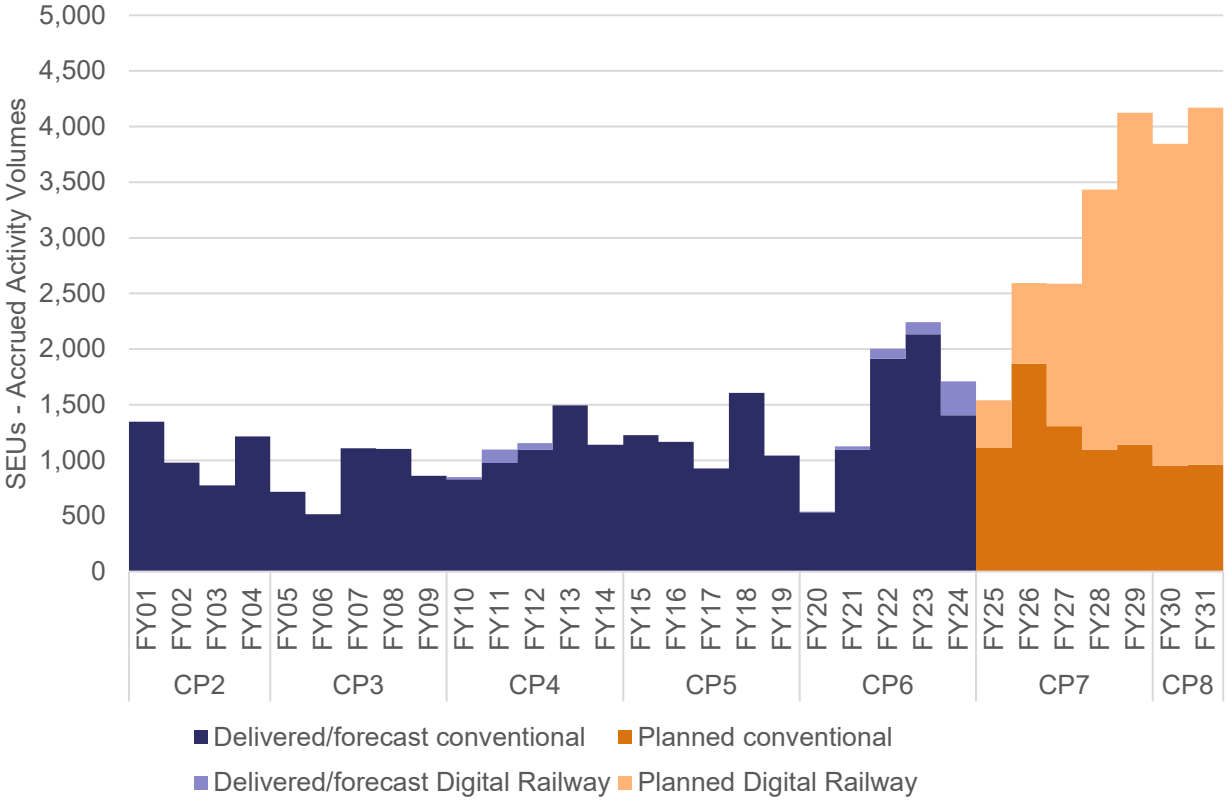
1.9 The value of signalling to the rail industry is significant. During its Control Period 5 ("**CP5**[16]"), Network Rail's signalling expenditure was in the region of £0.8-0.9 billion p.a. This represents over 10% of Network Rail's total cost base. Unit signalling costs rose significantly from CP4 to CP5. We wanted to further explore outcomes in this market and ascertain whether competition issues had contributed to any adverse developments.

Digital Railway

1.10 Another significant driver of our interest in these markets is their projected growth towards the end of CP6 and through CP7 and beyond. 65% of external signalling assets are projected to expire within 15 years, leading to a five to six fold increase in signalling volumes as Network Rail looks to replace conventional systems with digital alternatives. We are keen to ensure that any issues which are hindering competition in the market are addressed, so that they do not impact on the cost and hence the affordability of the Digital Railway.

[14] Interlockings are signalling products. Signalling products are described in more detail in Chapter 3.
[15] Case M.8677 -Siemens/Alstom, Commission Decision 6.2.2019 https://ec.europa.eu/competition/mergers/cases/decisions/m8677_9376_3.pdf, para 938
[16] In this document we refer to control periods as **CP** with the relevant number. The relevant control periods for this document are CP3: 2004–2009; CP4: 2009–2014, CP5: 2014–2019, CP6: 2019–2024, CP7: 2024–2029, and CP8: 2029–2034.

Figure 1.1 Predicted increase in signalling volumes



Source: Network Rail, adapted from Digital Railway Report[17]

1.11 We wanted to understand if there were any factors acting to hinder or restrict competition in the GB signalling market. In light of the roll out of the Digital Railway, we wanted to ensure that there were no unnecessary barriers to entering or growing in the market, so that new players and technologies were incentivised and had a fair opportunity to compete. This allowed us to consider whether Network Rail is better able to drive value and innovation.

[17] The diagram shows actual delivery and forecast volumes. We note that forecasts are subject to change, and the level of work is dependent on the level of funding available (See Chapter 4).

2. Methodology and scope

2.1 This chapter sets out our approach to evidence gathering and analysis.

Market study

2.2 Markets in all sectors work well when firms compete vigorously to win business. When markets work well, efficient firms are rewarded, productivity growth is higher, and customers have confidence that the supply chain delivers good outcomes for them in terms of price, quality, variety, innovation and service. The demand side is also important - well-informed, active buyers can play a key role in driving competition between firms.

2.3 Market studies are one of a number of tools at our disposal to examine possible competition issues and address them if appropriate. They are examinations into whether markets are working well, and possible causes of market failure. Market studies take into account regulatory and other economic drivers in a market, as well as patterns of participant behaviour.

2.4 Market studies have a number of possible outcomes, including declaring a clean bill of health for the market, specifying consumer focused action, making recommendations to business or Government or taking competition enforcement action. A further possible outcome of a market study is for ORR to make an MIR to the CMA, where we find reasonable grounds to suspect that any feature, or combination of features, of the market under scrutiny, prevents, restricts or distorts competition.[18]

Themes and issues explored

2.5 As set out in our Statement of Scope[19], our study has focused on three themes:

- Theme 1: Incentives to compete in the market, with a particular focus on:
    - Ability to compete using alternative technology;
    - Ability to interface with competitors' technology;

[18] For further information on ORR's approach to undertaking market studies and on the criteria for making an MIR see: http://orr.gov.uk/__data/assets/pdf_file/0007/23974/orr-approach-to-monitoring-and-reviewing-markets.pdf

[19] https://www.orr.gov.uk/sites/default/files/2020-11/signalling-market-study-november-2020-statement-of-scope_0.pdf

- Theme 2: Impact of the Digital Railway, with a particular focus on the ability of the supply chain to build up capacity;
- Theme 3: Outcomes, with a particular focus on price

Methodology

2.6 We launched this study on 12 November 2020[20]. This followed an earlier study which we halted in April 2020, in order to allow industry to react to the COVID-19 crisis. We considered that in those circumstances, it would be challenging to gather the required evidence to reach a fair and accurate decision by the legal deadline[21].

2.7 We have consulted a large number of market participants and other interested stakeholders.

2.8 Our primary evidence gathering tool was through information requests to market participants, including Network Rail. We received 29 responses from 18 suppliers across both market studies, and 6 responses from Network Rail. Evidence included significant volumes of confidential material from a range of sources.

2.9 We held over 14 separate meetings with Network Rail, engaging numerous parts of the organisation, including RAMs, the Product Approval Team, and the Central procurement team.

2.10 We held, in total, 21 meeting with 11 different suppliers. We also held two supplier roundtables to discuss the issues and the potential remedies. We met and gathered evidence from the Railway Infrastructure Association ("**RIA**")[22], international regulators and infrastructure managers, and the European Commission.

2.11 We sought comments on our emerging findings from the DfT construction board and the Infrastructure Procurements Authority.

2.12 Throughout the study we have had regular engagement with the CMA.

2.13 We have received a good level of cooperation from Network Rail throughout this study. Whilst we have identified further necessary action to improve competition and outcomes in this market, we recognise that Network Rail is already taking

[20] https://www.orr.gov.uk/monitoring-regulation/rail/competition/market-monitoring/market-study-supply-signalling-systems-november-2020.
[21] https://www.orr.gov.uk/monitoring-regulation/rail/competition/market-monitoring/market-study-supply-signalling-systems.
[22] A trade association for UK-based suppliers of rail equipment and services.

action to try to address the issues, as indicated throughout this document. Network Rail has welcomed this study and is keen to continue working with us to develop further remedial action.

Approach to analysis

2.14 The signalling market contains a range of different products and frameworks. A market study is time limited by statute, and therefore we have taken a proportionate approach to evidence gathering and analysis. We have focused our market study on the projects and products which we had indications of concerns. Notably, we focused on:

- The supply of signalling projects to the GB mainline and hence to Network Rail. The specific concerns that influenced our opening of this study, were primarily applicable to Network Rail. Network Rail is also, by far, the largest procurer of signalling projects in GB. We understand that other market dynamics are in operation for other procurers, including metro operators such as London Underground or other infrastructure managers such as HS2.
- Signalling projects that were classified as "major" and/ or "require the installation of or a requirement to interface with existing or new interlocking or control technology".[23] This does not include projects which only focus on the replacement of trackside equipment or level crossings.

2.15 Further information about our areas of focus can be found in our Statement of Scope[24].

2.16 The primary sources of evidence that we relied on were:

- Meeting minutes;
- Written responses to questions set out in information requests;
- Responses to information requests for data, including financial and volume data;

[23] In CP5 we focused our data gathering on the CP5 MASREF framework. We note that the CP6 delineation between Network Rail's Major and S&T frameworks is not fixed or absolute, and reflects the CP6 mix of signalling works having seen a shift away from large major renewals and enhancement projects and towards smaller renewals and life extension interventions. Therefore, we included the CP6 Major framework and the CP6 S&T framework in our analysis.
Engagement with Network Rail suggested that the most relevant "work types" (see paragraph 4.8) for our analysis were projects involving a full replacement of signalling assets, focusing on interlocking and control respectively in work type 2 ("**WT2**"), and work type 12 ("**WT12**").

[24] https://www.orr.gov.uk/sites/default/files/2020-11/signalling-market-study-november-2020-statement-of-scope_0.pdf.

- Documentary evidence, received in response to information requests, or identified by the team which pertained to this study's areas of focus; and
- Desk research.

2.17 Analysis of the above evidence was primarily undertaken by ORR staff. We also commissioned a report by the consultancy firm, Nichols, the key focus of which was an analysis of the prices obtained by Network Rail when procuring major signalling projects.

2.18 We were careful to maintain confidentiality in conducting this study, having regard to the fact that many stakeholders stressed the need to maintain sound commercial relationships with other market participants, to facilitate working collaboratively on future projects.

2.19 The approach we took was guided by the fact that only a small number of companies had bid for major signalling work. We primarily focused on the evidence of those suppliers, and potential entrants to the market.

2.20 We would like to thank industry participants, who, without exception, have demonstrated high levels of cooperation, and a willingness to work with us to explore the issues in this market.

Structure of this report

2.21 The remainder of this report is structured as follows:

- **Chapter 3: Overview of signalling products.** This chapter provides an overview of the products that make up a signalling system, and how these products interface with each other both now and post-changes introduced by the Digital Railway.
- **Chapter 4: Procurement of signalling projects.** This chapter describes how Network Rail is funded, its approach to procuring signalling projects and the factors which affect its ability to drive competition in the market.
- **Chapter 5: Digital Railway.** This chapter provides an overview of the signalling delivery challenge facing the railway and the planned response to this challenge set out in the Rail Sector Deal. This chapter also provides an overview of Network Rail's approach to procurement of digital products.

- **Chapter 6: Market shares and outcomes.** This chapter sets out emerging findings based on evidence on suppliers' shares of Network Rail's expenditure, and the outcomes Network Rail is able to achieve, with a focus on price and quality.
- **Chapter 7: Barriers to entry and expansion.** This chapter sets out our emerging findings on the barriers to entry and expansion in the market.
- **Chapter 8: Impact of the Digital Railway**. This chapter provides an overview of how the Digital Railway may impact the barriers set out in the previous chapter and outlines the key risks to the rollout of the Digital Railway.
- **Chapter 9: Decision not to make a reference**. In this chapter, we set out the reasons for our decision not to make an MIR.
- **Chapter 10: Proposed next steps.** In this chapter, we set out the case for intervention as an alternative to an MIR and the possible remedial actions that ORR could take.
- **Chapter 11**: **Invitation to comment**

2.22 A glossary of common terms used throughout this report is at Annex A.

3. Overview of signalling products

Introduction

3.1 In this chapter, we provide an overview of the individual signalling products which underpin the delivery of signalling projects and briefly explain how they fit together.

3.2 The interaction of, and interface between, signalling systems is important to our analysis of competition and highlights some of the difficulties faced by potential new entrants to the market.

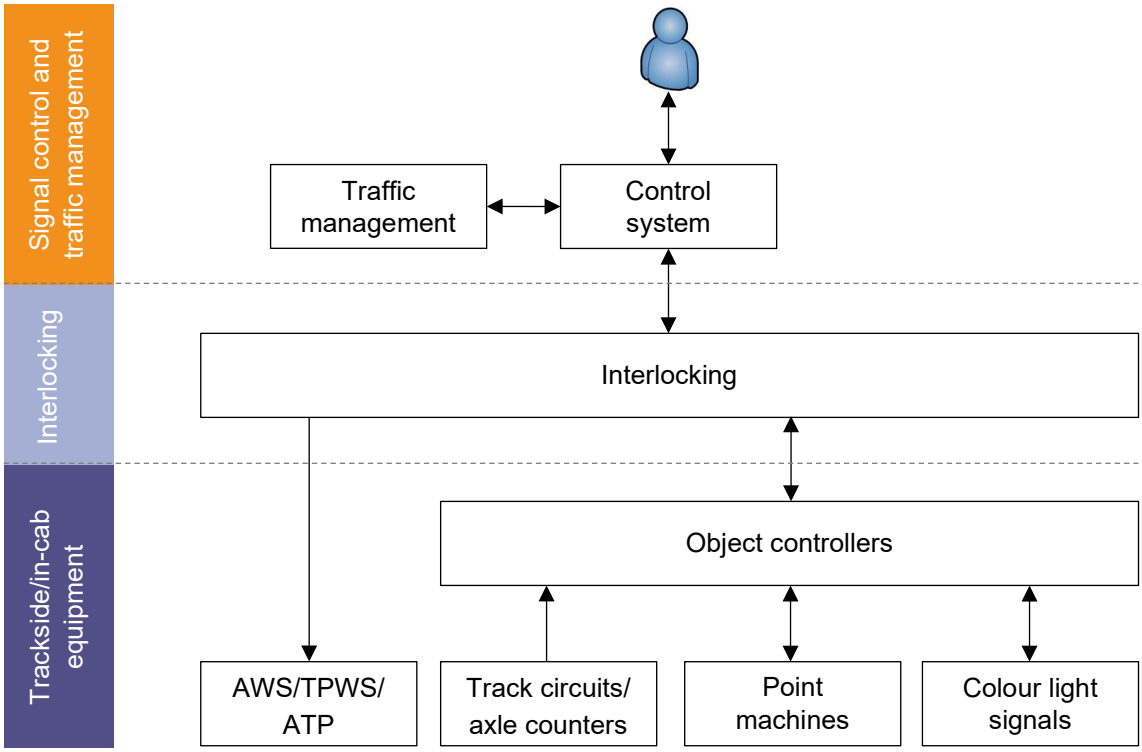
Signalling products

3.3 Signalling systems are fundamental to the safe and efficient operation of modern railways. The purpose of a signalling system is to determine the position of trains on the network, control their direction and signal to the driver when it is safe to proceed to the next section of track. Signalling systems also have a role to play in freeing up capacity on the network, which is already constrained, by allowing more trains to run on the network safely. A key objective of the rollout of the Digital Railway is to increase the efficiency of systems so that trains can run closer together, safely.

Conventional signalling systems

3.4 Signalling systems are made up of several different components. Figure 3.1 below shows the main components of a signalling system and how they interface.

Figure 3.1 Stylised architecture of a conventional signalling system in GB



Interlocking

3.5 The key, safety-critical component of the signalling system is the interlocking. Modern electronic interlockings are specialised computers, running interlocking logic[25]. The function of the interlocking logic is to prevent trains from undertaking unsafe or conflicting movements by only permitting them to proceed past a signal when routes are set, locked and detected in safe combinations.

3.6 By the 1980s, the first generation of electronic interlocking was introduced – Solid State Interlocking ("**SSI**"). SSI was developed by British Railways ("**BR**"), Westinghouse and GEC-General Signal ("**GEC**") as part of a tripartite agreement. Following the privatisation of BR, the right to develop and deploy SSI passed to GEC-Alsthom and Invensys Rail (having acquired Westinghouse). Only the successors of these two companies are authorised to manufacture SSI based on the original design principles. As such, only Siemens' Westlock (having acquired Invensys) and Alstom's Smartlock (having inherited GEC's intellectual property rights to SSI) can be considered SSI derivatives.

[25] To be precise, the interlocking includes the control system through to the tail cables that interface with the trackside apparatus, not just the microprocessors.

3.7 Other companies have independently developed electronic interlockings – known as computer based interlocking ("**CBI**") – which perform the same function, derived from solutions in other countries. The first instance of a non-SSI CBI being installed was in 2000, when Invensys commissioned Westrace.

- In 2002, Siemens installed SIMIS-W CBI at Bournemouth.
- In 2004, Atkins installed Ansaldo's (now Hitachi) ACC interlocking in the Manchester South area as part of the West Coast Main Line modernisation programme.
- In 2018, Hitachi-Linbrooke installed Hitachi's SEI interlocking as part of the Ferriby to Gilberdyke.
- In 2019, Atkins commissioned the ElectroLogIXS ("**ELIXS**") interlocking on the Feltham area re-signalling project. The intellectual property rights for ELIXS was obtained by Alstom through acquisition[26]. This technology is owned by Alstom and licensed to Atkins for exclusive use in GB.

3.8 It is significant that, despite successful attempts to enter the market, the impact on the GB market by companies who do not hold SSI technology has been negligible. This is in comparison to the number of deployments of Smartlock and Westlock interlocking systems post-privatisation.

Control systems

3.9 Alongside SSI, BR developed the Integrated Electronic Control Centre ("**IECC**") – a control system consisting of a computer workstation to aid signallers in setting routes. These are a key interface with the interlocking. IECCs incorporated the first type of traffic management application, known as Automatic Route Setting ("**ARS**"), which stored an electronic timetable and transmitted this to the interlocking to set the appropriate route for a train at the correct time.

3.10 Following the privatisation of BR, the right to develop and deploy IECC was passed to AEA Technology. Resonate (previously DeltaRail) now owns the IECC technology through acquisition of AEA Technology. The current control system deployed by Resonate is known as IECC Scalable. Other suppliers have independently developed control systems and traffic management applications

[26] ElectroLogIXS is a CBI originating from the U.S., developed by General Electric Transportation Systems (GETS), which was acquired by Alstom in 2015.

with similar functions in other geographic markets. Those that are currently deployed on the GB mainline are:

- Siemens' WestCad and Vicos OC;
- Alstom's Modular Control System ("**MCS**")[27]; and
- Hitachi's ACC (combined with the ACC interlocking) and RCC.

Trackside equipment

3.11 The interlocking interfaces with trackside objects via object controllers. This includes colour light signals to grant movement authority; point machines to set a route; and track circuits or axle counters to detect if a section of line is clear. The various train protection systems deployed on the network have trackside and on-board components which also interface with the interlocking, receiving information about the signal aspect or permissible speeds from it.

Digital signalling products

3.12 In 1996 the European Union agreed that the European Rail Traffic Management System ("**ERTMS**") should become standard for all high-speed lines in Europe[28]. ERTMS has a number of components.[29] The component most relevant to this study is the European Train Control System ("**ETCS**") – an automatic train protection ("**ATP**") system to replace national ATP systems. The ATP continuously ensures that the train does not exceed the safe speed and distance. In addition, it provides the relevant information to support the train driver, by displaying movement authorities and speed limits on an in-cab display.

3.13 Network Rail currently intends to deploy ETCS at Level 2 from CP7[30] onwards, as conventional signalling assets come up for renewal. Due to government financial constraints, the government spending review and the impact of COVID-19, this picture may change. This is discussed further in Chapter 5 below.

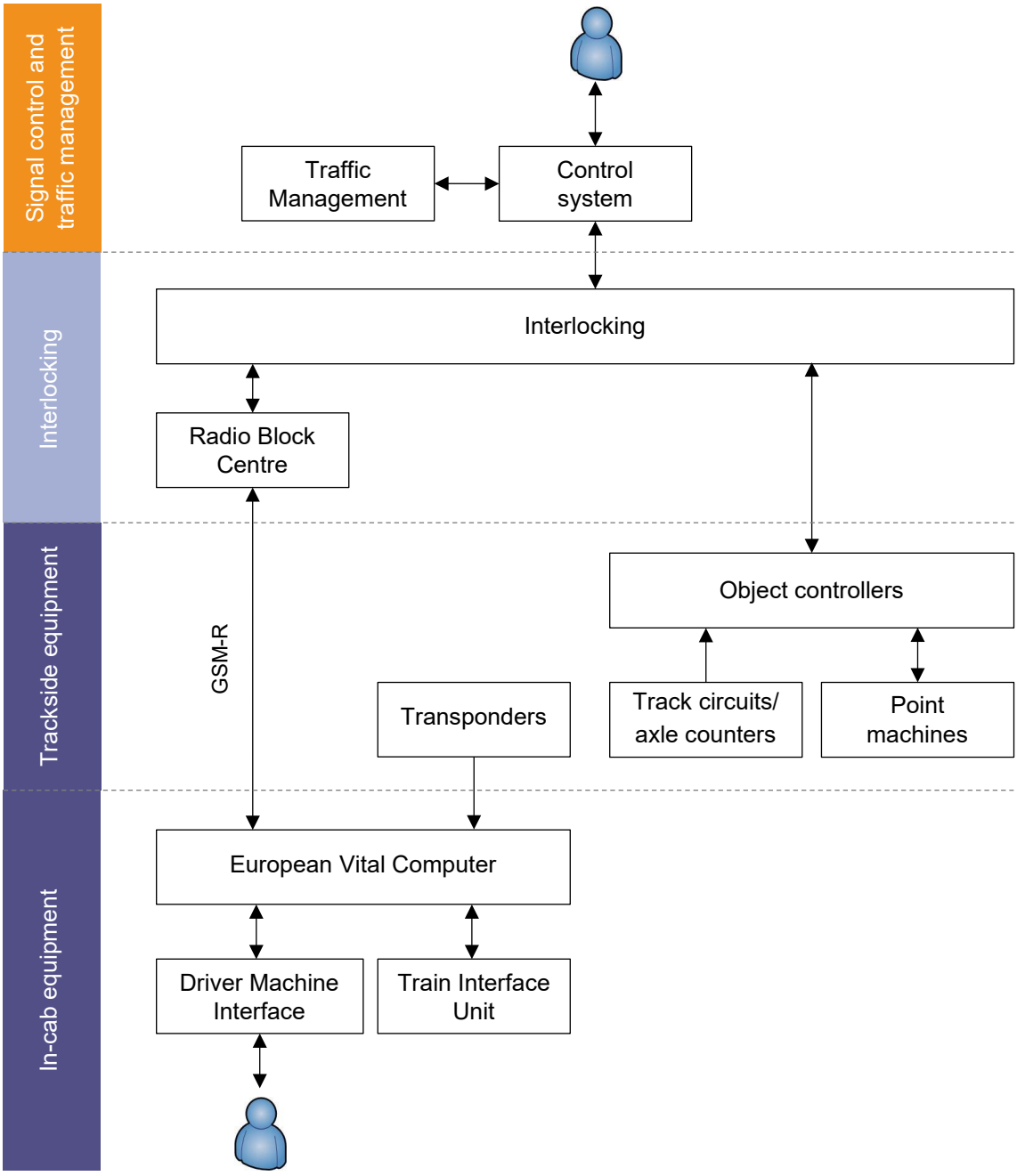
3.14 At all ETCS levels, the interlocking remains the safety-critical heart of the signalling system, retaining much of its conventional functionality. However, at ETCS Level 2 (and above), colour light signals are no longer used to issue movement authority to train drivers. The interlocking instead communicates this via Radio Block Centres ("**RBC**") (using the GSM-R telecoms network) to an on-

[27] The Modular Control System (MCS) workstation control system was developed by Vaughan Harmon Systems, which was acquired by GETS. Alstom acquired MCS when it purchased GETS in 2015.

[28] http://researchbriefings.files.parliament.uk/documents/POST-PB-0020/POST-PB-0020.pdf
[29] http://www.ertms.net/?page_id=40
[30] See chapter 5 of this document.

board European Vital Computer ("**EVC**"). The EVC is the core ETCS trainborne device that relays signal and speed information to the driver on the Driver Machine Interface ("**DMI**"). The EVC replaces existing train protection systems (AWS, TPWS and legacy ATP) by undertaking the on-board monitoring and regulation of train speed and movement authority.

Figure 3.2 Stylised architecture of an ETCS Level 2 signalling system



The need to interface

3.15 As the diagrams above show, the interlocking component is at the heart of the signalling system and must interface with both trackside components and control systems.

3.16 We focused on signalling projects that require the installation of, or a requirement to interface with, existing or new interlocking or control technology. Such projects must, to some extent, interface with the installed base of technology within the boundaries of the project as specified by Network Rail. Analysis of the extent of interfacing between control and interlocking products is set out at Annex B. Signalling projects will replace technology within a set boundary. The technology being installed must also interface with the existing technology, beyond the boundaries of the project. These are referred to as “fringes”.

3.17 This is also true for the ETCS level 2, where the interlocking will still be required to communicate with trackside components and interlockings at the fringes. The majority of European countries opted to first implement ETCS as a parallel system, next to the current signalling system, including the current line side signals. This is referred to as dual signalling and operating companies will purchase the ETCS on board equipment at a later stage. This complicates interfaces as ETCS products will be required to interface with a wide range of conventional and digital products. Network Rail intends to replace signalling assets as they come up for renewal to avoid dual signalling, however, some overlay will be necessary.

Bringing a product to the GB market

3.18 The rules for signalling products are set at both national and international levels. The technical specifications, safety standards and authorization processes are set at the national level. To bring a new signalling product, intended for use on the GB network, it needs to complete the Network Rail product acceptance process and comply with European, national and project specific standards. [31]

3.19 Signalling is a safety critical process. Signalling products are, rightly, subject to the highest level of risk reduction accreditation procedures[32]. The purpose of the

[31] This includes:
Health and Safety legislation in the UK
Railway safety legislation in the UK (e.g. The Railways and Other Guided Transport System (Safety) Regulations 2006)
Interoperability regulations and TSIs (Technical Specifications for Interoperability)
European Directives, as enacted through GB legislation (such as Common Safety Method (CSM -Commission Implementing Regulation (EU) 402/2013) and the requirements of Construction and Design Management Regulations 2015(CDM)
European Standards

[32] Including signalling accreditation under the Railway Industry Supplier Qualification Project (RISQS); requirement to obtain an approved safety licence; and the need for product approvals for both existing and future products.

product acceptance process is to provide Network Rail with the assurance that products are safe, compatible, reliable, fit for purpose and do not import unacceptable risks to Network Rail infrastructure.

3.20 Key signalling products (such as interlocking, control systems, traffic management, and train detection systems) fall into the 'Controlled' asset category due to them asserting control on the infrastructure, and as a result, it is mandatory that the product acceptance process is completed. Products must complete a rigorous evaluation process which tests the product against different criteria[33] .

3.21 To start the product acceptance process, a supplier must obtain a sponsor from within Network Rail (e.g., a Project or RAM to act in a sponsorship capacity and demonstrate that there is a business need - monetary, safety and / or performance benefits) to Network Rail for the new product or change.

3.22 Suppliers need to secure support within all levels of Network Rail, from the asset engineers, through to the central procurement teams and the wider heads of engineering to progress.

3.23 The Network Rail sponsor is accountable for the submission of the initial product application. This requires obtaining evidence from manufacturers against the generic and technical requirements and liaising with the Route and central procurement teams to arrange operational trials.

3.24 For 'Controlled' products, a trial is required to assist in the assessment of a product or system's suitability, (fitness for purpose, reliability, performance) and to assist in the mitigation of safety risk. The sponsor must arrange funding of the trials, including the removal of any temporary equipment or unsuccessful trials from the infrastructure. To secure a trial, there must be an appropriate project that the responsible RAM is willing to test the product on.

[33] https://www.networkrail.co.uk/wp-content/uploads/2020/07/Product-Acceptance-Service-Technical-Services-Guidance-Note-v4.1-June-2020.pdf

4. Procurement of signalling projects

Introduction

4.1 In this section, we describe Network Rail's approach to procuring conventional signalling projects and the factors that affect its ability to drive competition in the market.

4.2 Network Rail is the single largest procurer of mainline signalling projects in GB. A combination of the size of its projects, and the frequency with which it must renew its large asset base, means that Network Rail generates the greatest ongoing revenue streams for signalling suppliers operating in GB. For this reason, we focus on Network Rail's procurement strategies.

Routes to market

4.3 There are two main routes to market for suppliers of signalling projects:

- As original equipment manufacturers ("**OEMs**"), who own the signalling products set out in the previous chapter, OEMs typically access the market for signalling systems by responding to tenders for framework competitions, or competitively tendered projects for major signalling projects as principal contractors.

- As integrators**,** who obtain access to existing technology from OEMs and design and integrate that technology into a signalling renewal project. Integrators can access the market by responding to tenders for frameworks or subcontracting for OEMs.

4.4 The principal contractor for a major signalling project can often contract and project manage smaller suppliers, delivering more specialist equipment or pieces of work. Smaller suppliers of signalling products and projects tend to specialise in specific hardware, software, or delivery competencies.

Approach to procurement

Basis of competition

4.5 For major signalling projects, Network Rail's preferred approach is to procure turnkey solutions[34], as opposed to purchasing and installing individual components using its own workforce. Its appointed contractor delivers an integrated solution for a bespoke project[35] defined by Network Rail.

4.6 Since CP3, most of Network Rail's signalling projects have been procured using framework agreements. These are designed to reduce procurement timescales relative to project-by-project procurement by allowing Network Rail to pre-select supplier(s) to deliver projects within a framework. Each framework agreement is divided into geographical lots, with individual projects packaged into a lot based on its location.

4.7 Suppliers are invited to tender for a place on a framework agreement by bidding for a geographical lot. Network Rail scores tender submissions based on a number of factors[36], and agrees certain price and service variables with the appointed supplier of that lot for the duration of the agreement. When a project arises, Network Rail can instruct the appointed supplier to deliver the project. If the supplier does not have the capacity to deliver the project to the required timescales or at a price acceptable to Network Rail[37], Network Rail can tender the project more widely.

4.8 In general, framework agreements primarily provide competition *for* the market, as a set number of suppliers are chosen to deliver the projects falling within the framework for the duration of the agreement, thereby excluding suppliers that have not successfully gained a place on it. Network Rail has nonetheless retained a degree of competition *in* the market (or at least the threat of it) by holding mini-competitions or tendering projects to the wider market where an appointed supplier cannot deliver to its requirements.

[34] Network Rail contracts a supplier to provide it with a complete solution (design, development, installation and testing), handing the project back to the client when it is in a ready-to-use condition. This means that the contractor purchases all components and sub-systems rather than Network Rail, potentially subcontracting works to other suppliers where it does not have the capacity or capability.
[35] No two projects are the same due to differences in legacy components and systems being replaced, the different life cycles of currently installed components, as well as the fundamental differences in terrain layouts that results in varying arrangements of signalling apparatus.
[36] For CP6, at the pre-qualification stage, Network Rail assessed written submissions from all interested suppliers covering their experience, resource, capacity, competence and a financial review. The shortlisted suppliers were then invited to tender, submitting their proposals on: health and safety; technical and quality; resource and planning; diversity and inclusivity; sustainability; and commercial (including price).
[37] Although SEU rates are agreed, the final price is not, as Network Rail and the relevant supplier will need to agree on the number of SEUs in that job and the price of work not included within the SEU rates.

4.9 The design of framework agreements, running of tenders and selection of suppliers, and management of framework contracts was historically undertaken by a central procurement team. At present, in accordance with Network Rail's devolved structure, the CP6 frameworks are managed by regional teams who deal with awarding, and managing the delivery and technical aspects of individual projects

Generating projects

4.10 Signalling projects are generated from a bottom-up assessment of renewal need for each signalling asset in an interlocking area. Engineers periodically monitor and assess the condition of all signalling assets to determine their remaining lives. As signalling becomes increasingly computer based, it is increasingly common for parts of a system to become obsolete long before the system as a whole.

4.11 The combination of signalling subsystems assessed as in need of renewal within an interlocking area defines the work type for that project[38]. Network Rail also considers the physical extent of a project, potentially combining adjacent signalling asset renewals into one larger project to minimise the risk of disruption, as well as to take advantage of economies of scale.

4.12 RAMs are responsible for developing and managing renewals programmes in their area, including deciding which projects proceed to delivery, and setting the specifications and requirements of those projects. RAMs' objectives are to minimise costs, project delivery timescales and risks to the delivery of the project. Other relevant factors include:

- geographical issues, such as coastal areas with high salt content in the air or areas subject to flooding, may be suited to a particular technology;
- the ability to interface with the installed base (we discuss this issue later in this chapter); and
- difficulties with the ability to manage the new technology.

4.13 RAMs do not have a direct role in appointing a supplier for a project, but they do input into the procurement process through the specifications they set.

[38] For instance, full re-signalling (conventional) which replaces all main components is defined as WT2; partial renewals such as a re-lock which replaces the existing interlocking is defined as WT3, etc. These categorisations reflect the complexity of the project which, in turn, determines the framework type in which that the project will be bundled. We are primarily interested in WT2 and WT12 as these replace the interlocking or control system.

4.14 Renewals planning is formally conducted as part of the periodic review process[39]. Network Rail's route businesses submit strategic business plans to ORR, setting out what outputs they propose to deliver in the upcoming control period and how much it will cost them. ORR assesses these plans and determines the level of funding that Network Rail requires to deliver that planned level of work efficiently. This funding effectively determines how much of the overall pipeline can be delivered in a control period, in turn defining the signalling workbank.

4.15 Network Rail's status as an arm's length public body means that it is subject to a number of spending controls[40]. This means that it must manage its renewals programme within a fixed funding envelope. As such, Network Rail reviews and re-prioritises its renewals programme on an ongoing basis, which can result in projects being pushed back within, or even out of, a control period. When Network Rail invites tenders for its framework agreement, it typically provides anticipated and ceiling values for each lot but, due to its funding constraints, Network Rail typically does not guarantee that any volumes of work will emerge.

Procurement history

4.16 Network Rail's signalling procurement cycles broadly align with its funding periods. Following the appointment of framework suppliers, detailed design work takes place, typically spanning the first two to three years of a control period. The remainder of the control period is where the majority of projects are delivered, with some works spilling over into the beginning of the subsequent control period.

4.17 As Figure 4.1 below shows, for conventional signalling there have been three framework competitions since 2004. More detail on Network Rail's signalling procurement can be found at Annex C.

Figure 4.1 Network Rail's procurement cycles

4.18 In 2010, Network Rail established four framework agreements[41] for its signalling procurement, each differentiated by the value and types of the projects within

[39] This is conducted by ORR and sets Network Rail's funding and outputs usually for a five year 'control period'.

[40] Network Rail was reclassified in 2013 as an arm's length public body of the Department for Transport. As such, it is unable to issue debt under its own name and faces borrowing limits from government. It has limited ability to move funds between years and control periods. It is constrained in its ability to move funds between resource and capital budgets. The implication of this is that Network Rail's renewals programme accommodates its budget constraints rather than its budgets accommodating the volumes to be delivered.

[41] MaSREF, Type C (Minor Works) Framework, IP Telecoms Framework and Level Crossings (LX) Framework.

them. The most relevant to this study is the Major Signalling Renewals and Enhancements Framework ("**MaSREF**"). It commenced in 2012 for two years (the remainder of CP4), with the option to extend on an annual basis to the end of CP5.

4.19 MaSREF was divided into nine geographical lots, with each lot awarded to a primary and secondary supplier (except for Thameslink, which was only awarded to a primary supplier). If the primary supplier could not deliver the works to the required timescales or price, either the secondary supplier would be awarded the contract, or it would be tendered amongst other MaSREF suppliers. To retain a degree of competitive tension 'in the market', the terms of the MaSREF agreement also allowed Network Rail to tender up to 20% of projects competitively.

4.20 Invensys (predecessor of Siemens) was awarded four lots as a primary supplier, including Thameslink, and three as a secondary; Signalling Solutions Limited[42] ("**SSL**") (now wholly owned by Alstom) was awarded three as a primary supplier and five as a secondary; and Atkins was awarded two lots as a primary supplier.

4.21 For CP6, Network Rail established three framework agreements[43]. The most relevant to this study are the Major Signalling Framework and the Signalling and Telecoms ("**S&T**") Framework. These agreements are designed to span CP6 and early CP7. The S&T Framework is let on a five-year term with the option to extend for three years in one-year increments, whilst the Major Signalling Framework is let on a four-year term, with the option to extend for two years in one-year increments.

4.22 In an effort to encourage competition, Network Rail capped the number of frameworks that could be won by suppliers to one geographical lot per supplier on S&T, and two lots per supplier for the Major Signalling Framework. It also ceased awarding secondary suppliers for each lot. Should the awarded contractor not be in a position to deliver a project in its area, projects under that lot will be subject to a secondary mini-competition amongst framework suppliers.

4.23 The Major Signalling Framework consists of five lots, with two awarded to Siemens, two to Alstom and one to Hitachi-Linbrooke. The S&T Framework consisted of six lots, with awards going to Siemens, Atkins and Linbrooke, as well as VolkerRail, Colas and Babcock.

[42] A joint venture between Alstom (who held the SSI interlocking technology) and Balfour Beatty.

[43] Major Signalling Framework, Signalling & Telecoms (S&T) Framework and Minor Signalling Framework

5. Digital Railway

Introduction

5.1 This chapter providers an overview of the delivery challenge currently facing the railway, in respect of signalling projects and summarises how the Digital Railway may help to address that challenge.

5.2 This chapter also provides an overview of Network Rail's procurement of digital signalling to date.

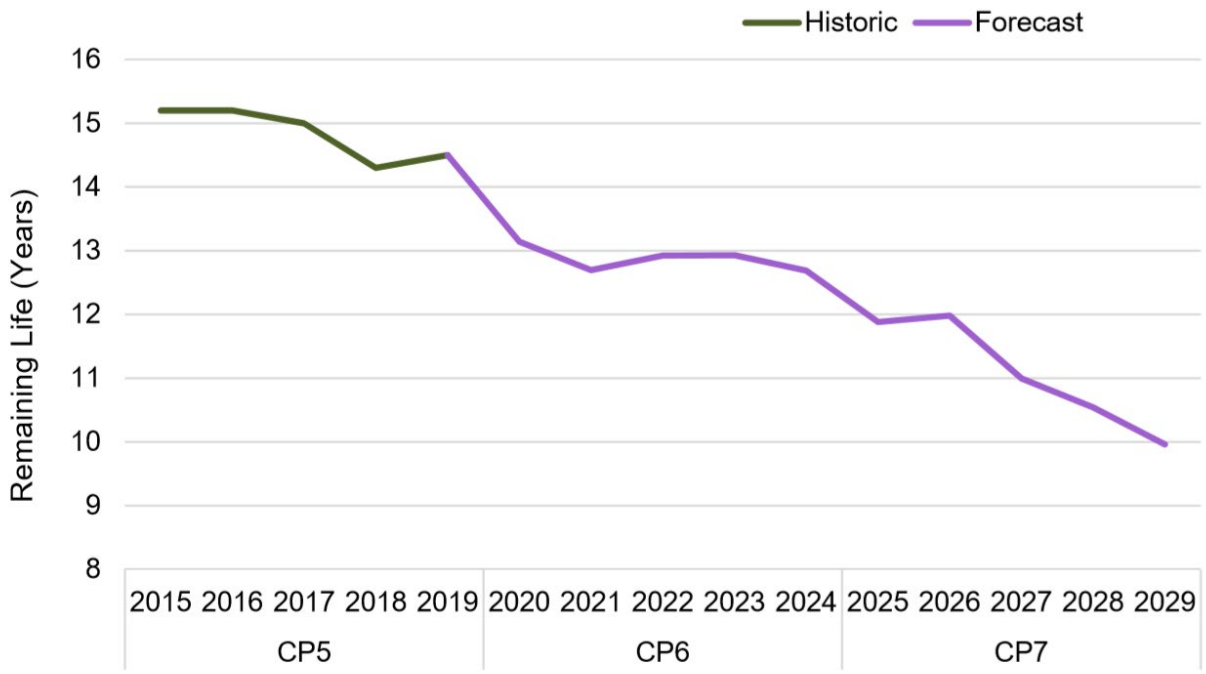
Delivery challenge

5.3 Today there are more than 40,000 signals on the mainline network, controlled by various generations of mechanical, electrical or computer interlocking systems which provide safe train separation. With 65% of external assets expected to be life expired within 15 years (86% in 20 years) and government funding unlikely to be able to rise to meet the costs of conventional signalling renewals, there is a significant delivery challenge.

5.4 The current backlog of renewals is creating a bow wave of activity arising from a combination of a gradual build-up of delayed renewals and the cyclical nature of past infrastructure investments. A key challenge to the rollout of the Digital Railway is the capacity of industry to meet the increase in demand caused by approaching end-of-life renewals.

5.5 Figure 5.1 below shows the average remaining asset life of signalling assets on the network until the end of 2029. It shows that the average age of life left in signalling assets on the mainline network will fall by around one third by the end of CP7.

Figure 5.1 Average remaining asset life of Network Rail's signalling assets



Source: Network Rail

5.6 At current levels, the cost of replacing conventional signalling like for like is unsustainable.

Market initiatives

Rail Sector Deal 2018

5.7 The Rail Sector Deal published by the DfT and BEIS outlined the government's commitment to support the rail sector in return for action from industry. Its key outputs were:

- **Government action to support the rail sector:** Produce a detailed 5-year plan and longer-term roadmap of Digital Railway interventions with a more certain, sustainable investment profile. ***Addressed by the Long Term Deployment Plan published in June 2019.***

- **Industry action to support the rail sector**: By the end of 2025, industry will achieve a whole industry whole system unit cost that is significantly lower than current UK conventional infrastructure only costs (equivalent to European Benchmark Costs). ***Addressed by the Sector Deal Delivery Strategy endorsed April 2020 (Working in partnership with the Target 190plus programme).***

5.8 A brief overview of the LTDP, the Sector Deal Delivery Strategy and the Target 190plus programme is below.

Long Term Deployment Plan

5.9 In March 2018, the DfT wrote to the CEO of Network Rail asking for a long-term digital deployment plan to show how Network Rail will sustain signalling assets using digital technology.[44] In June 2019, Network Rail published the LTDP.

5.10 The LTDP proposed a delivery plan to meet the deliverability constraint. It shows how Network Rail will gradually migrate to digital signalling technology over a 30-year period starting from 2024, with ETCS projects ramping up in CP7.

5.11 In March 2020, Network Rail and DfT put in place the bi-lateral arrangements to allow LTDP to deliver digital signalling starting from Control Period 7 (2024 – 2029).

Sector Deal Delivery Strategy

5.12 The Sector Deal Delivery Strategy is being led by RIA. It proposed a new approach to the procurement of ETCS, building on the lessons from the East Coast Mainline ("**ECML**") procurement (see below). The idea is a collaborative commercial model which encourages long term relationships with suppliers, in order to allow them to recoup a return on their investment.

5.13 The Sector Deal is being delivered alongside the Target 190plus project. The inter-relationship between Target 190plus and the Sector Deal has been described as a 'two-speed' approach:

- Target 190plus is focused on developing the capabilities to deliver ETCS more efficiently in the longer term.
- The Sector Deal is focused on the effective transfer of Target 190plus capabilities to enable deployment of ETCS in the shorter term.

Target 190plus

5.14 The Target 190plus programme is a research and development programme aimed at driving down signalling costs for the Digital Railway. The Target 190plus programme has been described as,

[44] Digital Railway Long-Term Deployment Plan Technical Report Executive Summary (networkrail.co.uk)

"…a Network Rail led Research & Development programme which aims to provide the capability to enable safe, affordable and deliverable signalling to meet the future demands of the railway. European experience indicates that an infrastructure benchmark rate of £190k/SEU (or less) could be achievable".

5.15 Network Rail said that the Target 190plus programme is developing capabilities to facilitate the delivery of the challenges identified within the LTDP.

5.16 The Target 190plus programme encompasses a large number of projects, which include key workstreams in line with the strategy set out in the Sector deal:

- Network Rail is developing a toolkit for GRIP stages 1-3 to improve project planning internally;
- Projects relating to engagement with the supply chain and improving the contracting and delivery model;
- Network Rail is developing a Synthetic Environment to enable the design of testing of signalling projects without the need for access to the live track; and
- Network Rail's involvement in the development of RCA which incorporates EULYNX (see below).

EULYNX

5.17 It has been recognised at a European level that infrastructure managers acting independently are unlikely to be able to realign the supply chain and develop open interface specifications. Since 1999, European infrastructure managers have jointly been looking at ways of developing open standards for signalling interfaces at a European level. Network Rail said that it supported initiatives such as Euro-Interlocking and INESS[45], but that these were unsuccessful, since infrastructure managers and suppliers were unable to align their requirements and supplier interfaces.

5.18 EULYNX launched spring 2014 set up by 10 infrastructure managers.[46] The aim of EULYNX is to standardise interfaces which are seen as crucial. This includes agreeing a common programme for interface definition, and should include the standardisation work itself, and the related test and approval phases and tool

[45] Integrated European Signalling System, see http://www.iness.eu/Context-Objectives.

[46] CFL (Luxembourg); DB Netz AG (Germany); Infrabel (Belgium); Jernbaneverket (Norway); Liikennevirasto (the Finnish Transport Agency); Network Rail (UK); ProRail B.V. (the Netherlands); and SNCF Reseau of France (formerly RFF). At the beginning of 2015 Trafikverket (Sweden) and SŽ (Slovenia) also joined the project.

development. We understand that Brexit does not affect Network Rail's participation in EULYNX.

5.19 EULYNX and the ERTMS Users Group have formed the RCA initiative to coordinate and harmonise future developments and digitalisation programmes. The purpose of this initiative is to create a joint architecture for the Command Control and Signalling ("**CCS"**) field based on radio based ERTMS and EULYNX.

Procurement of ETCS internationally

5.20 The European Commission's 7th rail monitoring report as of April 2020, the ERTMS European Deployment Plan[47] (EDP) (adopted by the European Commission in January 2017) noted that deployment was behind schedule with only 78% of the target for 2019 having been installed[48]. Numerous reasons for the delay were cited in the report, with the most commonly cited reason being insufficient national budgets.

5.21 In 2020, the European Rail Infrastructure Managers (EIM)[49] issued a report that states there are currently five suppliers in Europe, delivering ERTMS to rail infrastructure managers, three of them being European: Siemens, Alstom, and Thales[50].

5.22 The delayed rollout of ERTMS in Europe could create a backlog which would result in an even greater demand on suppliers who can deliver ERTMS technology. It is therefore essential that the GB market is sufficiently attractive to suppliers to ensure competition for digital projects.

Procurement of ETCS in GB

5.23 Network Rail's first ETCS project was a pilot ETCS level 2 project[51] on the Cambrian Line. It was awarded to Ansaldo in CP4 and completed in 2011. Network Rail said that it *"gained valuable experience of developing the operational*

[47] Sets out deadlines for deploying ERTMS on some sections of the Core Network Corridors (CNC) for the period 2017-2023.
[48] https://ec.europa.eu/transport/sites/transport/files/com20210005-7th-rmms-report.pdf
[49] EIM was established in 2002. The role of EIM is to provide a single voice to represent its members (IMs) vis-à-vis to the relevant European institutions and sector stakeholders. EIM said it is the only European railway association representing exclusively rail infrastructure managers. Its members manage 53% of the European Union's railway lines, which between them carry 40% of the EU's rail freight services and 58% of passenger services
[50] ERTMS - A guide for stakeholders 2020-01-30-EIM
[51] ETCS level 2 was installed without lineside signalling. The system was designed to operate with level 2 ETCS, which uses GSM-R for communication between the trackside infrastructure and the trains. ETCS level 2 does not require lineside signals, although some trackside signs are needed.

concept and technical solutions and then managing the implementation of ETCS"[52].

5.24 In 2012, Network Rail awarded an ETCS framework to Ansaldo, Infrasig (previously a Carillion/Bombardier joint venture, then wholly-owned by Bombardier), Invensys Rail and SSL.

5.25 Following the award of the framework, Network Rail designed and commissioned an ETCS National Integration Facility ("**ENIF**"). The purpose of this facility is to carry out testing of the framework suppliers' technology and develop operational scenarios without the need for access to the operational railway, reducing project risk and cost. The technologies tested were:

- Ansaldo is using its own SEI interlocking (based on the installation on the Cambrian project)
- Bombardier's EbiLock interlocking (used by Infrasig)
- Alstom Smartlock 400 interlocking (used by SSL)
- Siemens Westlock interlocking (Siemens)

5.26 Following successful testing at ENIF, the Thameslink project under the CP5 MASREF was awarded to Invensys (now Siemens) as the Primary contractor. Siemens installed ETCS Level 2 technology by overlaying on the conventional signalling system. The project was completed in March 2018.

5.27 The third installation of ETCS was on Crossrail West, which provides ETCS as an overlay for trains going into Heathrow. This was awarded under MaSREF framework to Alstom as Primary contractor.

5.28 Network Rail said that this piecemeal approach to procurement was not delivering value for money, so it developed a strategy to engage suppliers in a more sustained relationship for the East Coast procurement.

Digital Railway programme

5.29 In 2018 Network Rail launched The Digital Railway Programme.

5.30 Whilst many aspects of what are referred to as 'conventional' signalling systems already utilise 'digital' technologies the term 'Digital Railway' has been adopted by

[52] Development & Implementation of ETCS (networkrailconsulting.com)

Network Rail[53] as an umbrella term for modern signalling systems and train control technology which involve the introduction of alternative approaches to signalling that remove the need for fixed lineside infrastructure and replace it with 'in-cab' signalling.

5.31 The Digital Rail programme is a cross-industry plan to accelerate the transition to digitally run railways in order to increase rail capacity and improve network performance sustainably and safely.

CP5 East coast mainline procurement

5.32 The first major project under the digital delivery programme was the ECML. Network Rail developed a procurement approach that consisted of three frameworks;

- Framework Agreement for a Train Control Partner ("**TCP**") to deliver ETCS infrastructure on the ECML. TCP contact had an anticipated value of £900 million;
- Contract for a Traffic Management Partner ("**TMP**") to deliver traffic management systems for these areas. This contract anticipated two lots with a value of £108 million (lot 1) and £72 (lot 2); and,
- Framework Agreement for a Railway Systems Integrator Partner ("**RSIP**") to provide programme management support to the Network Rail client team in the LNE and EM operational routes and to drive business change across the industry. This had an anticipated value of £55m.

5.33 The procurement was launched in September 2018. Network Rail allowed suppliers to bid for all three frameworks, however, it wanted the RSIP to be independent of the TCP and TMP. Therefore, suppliers could not be appointed to the RSIP framework agreement as well as the TCP framework and/or the TMP contract.

5.34 The competitions resulted in Siemens appointed as the TCP and TMP and Atkins as the RSIP.

5.35 Network Rail's approach to procurement on ECML reflected changes proposed by the Sector Deal Strategy as set out above. We note in particular:

[53] Digital Railway - Network Rail

- The agreements for the TCP and TMP are a maximum of 8 years (four years, plus four annual extensions), however, the agreements are accompanied by commission contracts[54] which could result in a potential relationship with suppliers extending across the asset life-cycle for potentially up to 30 years.

- Contracting for whole life outcomes, with a supplier delivering outline and detailed designs to deliver the outcomes. This means the supplier is 'on the hook' via commercial/contractual mechanisms to maintain the system to a specified level of availability and performance.

5.36 Network Rail told us that the key benefits of this approach include: reduced whole life costs (as the model incentivises suppliers over the whole asset life); greater assurance that obsolescence of compute components, software support and technical support are managed adequately; and cost certainty for the duration of the framework and subsequent commission contracts.

[54] TCP commission contracts could include a) professional services and b) design, build and maintain contracts. TMP commission contracts could include a) professional services and b) design, build and maintain c) Managed Service Contract and d) Pure Service covering subscription and performance-based commission contracts

6. Market shares and outcomes

Introduction

6.1 In this chapter, we present measures of the shares of different suppliers of the installed technology base; of key categories of Network Rail's expenditure; and of the bids submitted to supply Network Rail. This information helps us to understand levels of competition in the market and provides context for the discussion of barriers to entry and expansion in the next chapter.

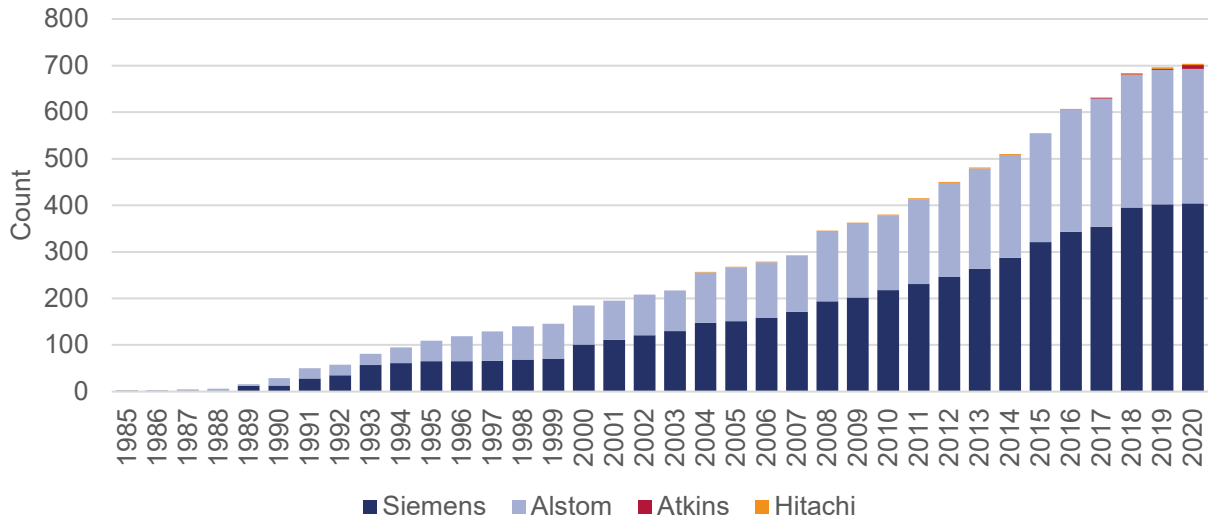
6.2 Evidence on outcomes is important to our study since any observed lack of competition need not, in itself, be viewed as problematic unless it is leading to poor outcomes, such as high prices or low quality products being supplied.

Market shares

Installed technology base

6.3 Figures 6.1 and 6.2 summarise the cumulative shares of the main suppliers for two of the key technologies of GB mainline signalling: interlocking and control systems. The data represents all electronic interlockings installed since 1985 and workstation-type control systems commissioned since 1989.[55]

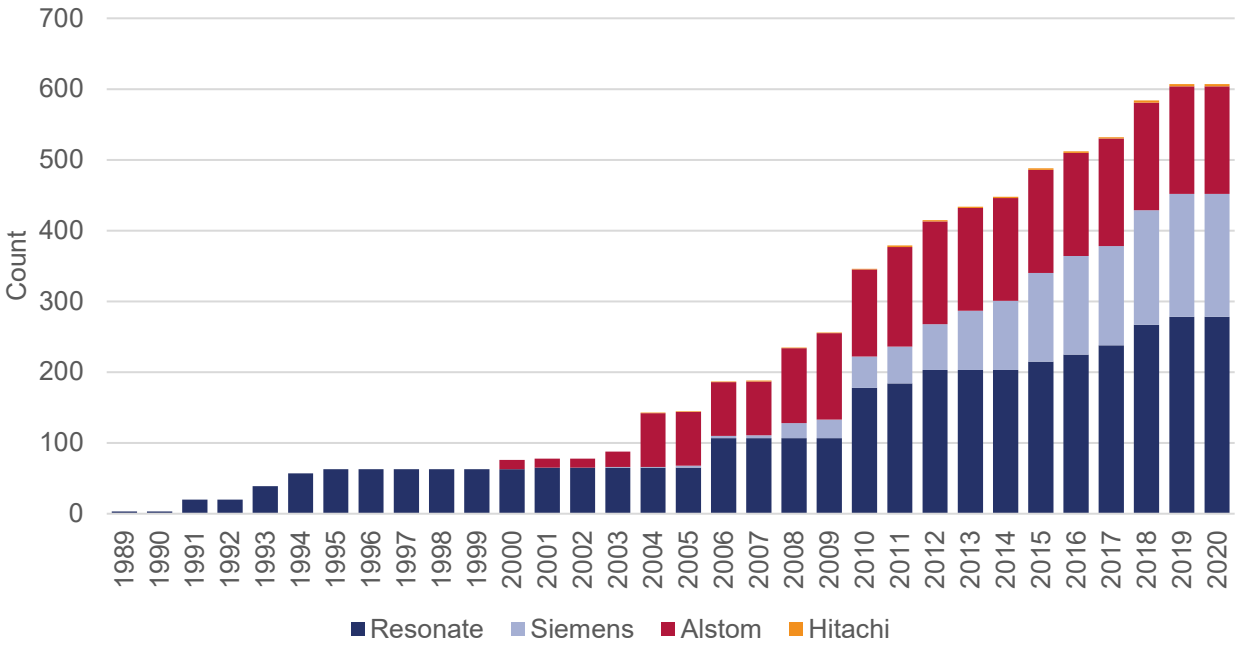
Figure 6.1 SSI/CBI commissions by company (or predecessor) by year



Source: Network Rail's Signalling Projects Asset Data Store (SSADS) supplied to us in October 2020.

[55] It excludes legacy technology that remains a part of the current installed base, namely mechanical and relay interlocking, and lever frame and NX panel control systems.

Figure 6.2 Control system commissions by company (or predecessor) by year



Source: Network Rail's Signalling Projects Asset Data Store (SSADS) supplied to us in October 2020.

6.4 Figure 6.1 shows that 98% of the (post 1990) current installed base has been installed by Siemens, Alstom or one of their predecessor companies. The interlockings installed by Hitachi (or predecessor) and Atkins account for the remaining 2%.

6.5 Figure 6.2 shows that Resonate's predecessors dominated the control market during the 1990s, such that its share of all installations over that decade was 100%. This dominance was largely eroded by the vertically integrated (between signalling and control) OEMs, Siemens and Alstom, over the subsequent 20 years to the extent that, by 2020, their combined share of the installed base is 54%.

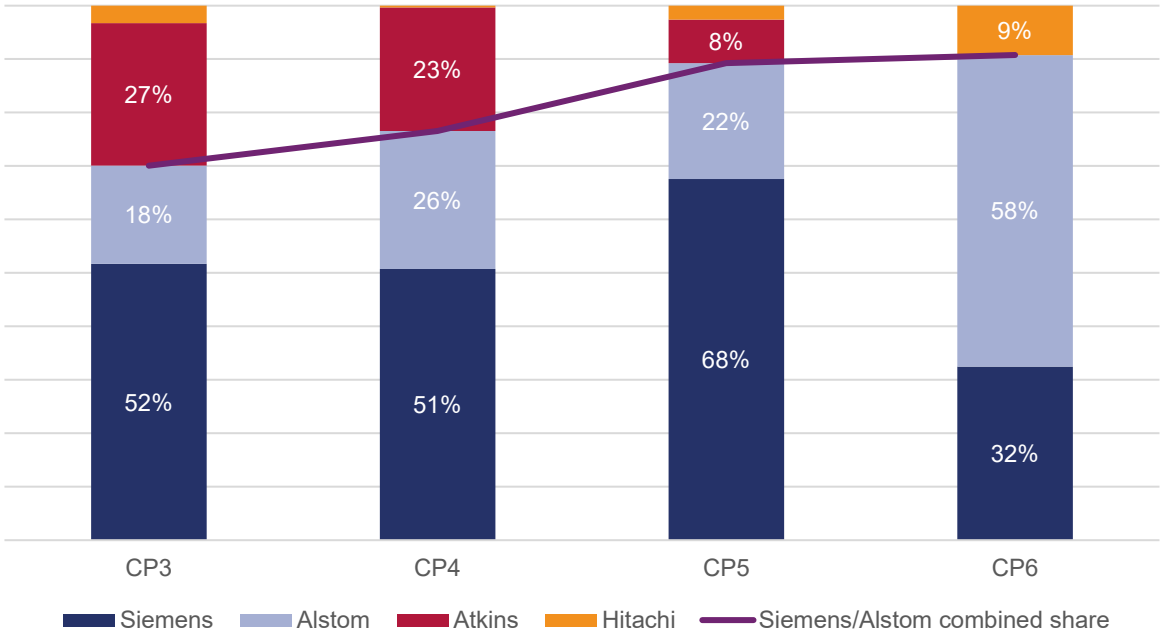
Network Rail's expenditure

6.6 Figure 6.3 provides a breakdown between suppliers of Network Rail's signalling projects expenditure over CP3 to CP6. We focus on the shares of Atkins and the large OEMs (Alstom, Hitachi, Siemens) only, so as to arrive at proxy shares for Network Rail's major signalling expenditure.[56]

[56] Focusing on these four companies only should provide a good proxy for major signalling expenditure since there are no recent examples that we are aware of, of other companies successfully winning work at this level. The data does not reflect the charges paid between signalling suppliers. This, other things being equal, has the impact of over-exaggerating the position of Atkins within the market and under-exaggerating that of Siemens and Alstom, as Atkins is likely to pass on some of its fees from Network Rail to subcontract or simply pay Siemens/Alstom for access to its interlocking technology and personnel.

6.7 The shares in this Figure are based on the payments made directly to suppliers by Network Rail in each financial year and Network Rail's forecast spend in CP6[57].

Figure 6.3 Network Rail's estimated major signalling expenditure



Source: ORR analysis of data supplied by Network Rail

6.8 Figure 6.3 shows that the collective share of Siemens and Alstom has increased from around 70% in CP3 to a projected 90% in CP6. This increase has largely been at the expense of the share of the third player, which was Atkins up to and including CP5, and for CP6, Hitachi. In earlier control periods Atkins enjoyed considerable success in obtaining work in major signalling frameworks as an integrator[58] by accessing the SSI interlocking technology owned by Westinghouse/ Invensys and GEC/Alstom. Up to its first deployment of ELIXS in 2019, the inroads made by Atkins into the market were entirely underpinned by third party interlockings. This model enabled Atkins to capture and retain a significant market share over a number of years, with all of its CP3 and CP4 and almost all of its CP5 revenues being earned using the integrator model. During late CP5 and CP6 Hitachi has emerged as a competitor using the interlocking solution developed by Ansaldo.

6.9 There has been a degree of fluctuation within the Siemens/Alstom block share, with, notably, Alstom performing relatively worse in CP5 than in CP4. Stakeholders

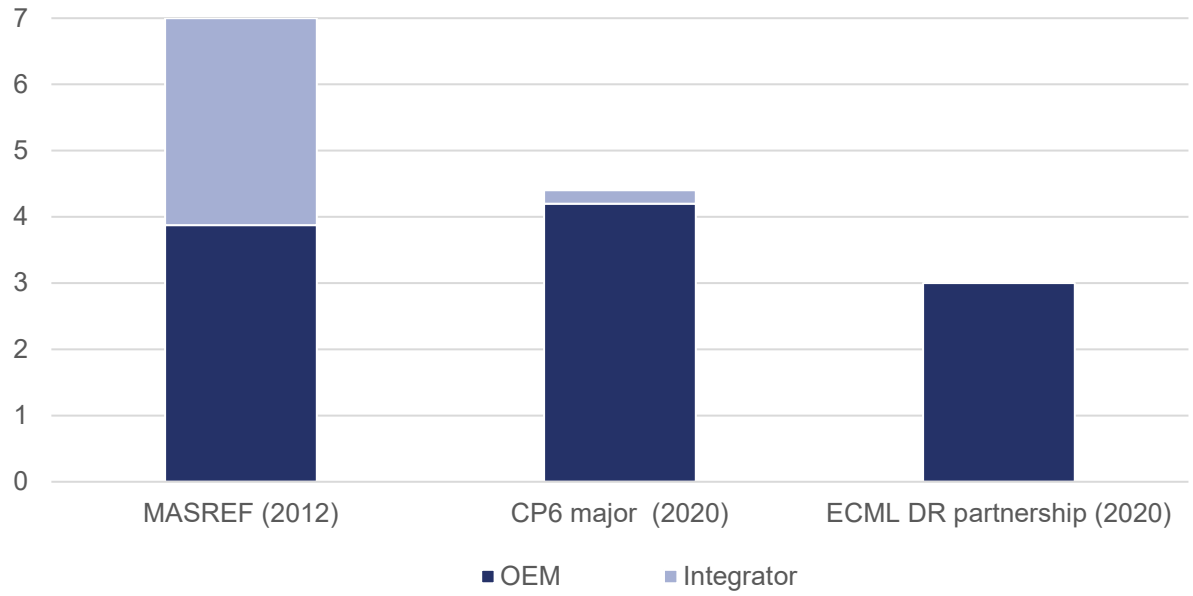
[57] As noted above, forecasts are subject to change and dependent on the level of funding available. We have based our estimates on budgeted estimates for regional frameworks, and assumed that all work within each region is awarded to the nominated framework supplier.
[58] Integrators do not own interlocking products. They access the market through obtaining access to original manufacturers product.

told us that this change had been driven by a relatively high degree of success by Siemens in being awarded projects whilst a secondary rather than primary contractor within an area. This success reflected capacity issues on Alstom's part, and, potentially, also some of the barriers discussed in chapter 7 of this document.

Frameworks

6.10 Figure 6.4 shows the number of bids received by Network Rail for recent iterations of its major signalling frameworks. We include information on bidders for the ECML digital rail partnership, which we would also regard as 'major' in the sense of its financial value and significant capital delivery element, although it should be noted that a smaller number of bidders might have been expected here just by virtue of the fact that this competition by design to only lead to a single award, rather than a number of regional contracts.

Figure 6.4 Number of bidders for key recent major signalling frameworks[59]



Source: Gateway procurement documentation supplied by Network Rail

6.11 This appears to show, since 2012, a clear move towards fewer major signalling framework bids being submitted by integrators, with no compensating increase in the number of OEM bidders.

6.12 For the MASREF framework, with Atkins bidding at the time as an integrator without its own interlocking technology:

[59] In the case of the MASREF and CP6 major frameworks, where the overall award was split into multiple lots on a regional basis, we have averaged the number of bids across each region.

- 25 out of a total 56 bids (spread across eight Network Rail regions) to be on the framework was led by a company without its own interlocking technology (Amey, Atkins, Babcock, Carillion); and
- Of these bids, two in total (both by Atkins) were successful in leading to appointment in a (primary) contractor role.

6.13 For the CP6 Major framework:

- Only one out of a total 21 bids (i.e. about 5%, spread across five Network Rail regions) to be on the framework was led by a company without its own interlocking technology (Babcock); and
- This bid was unsuccessful, meaning that all framework contracts were won by bids led by companies with their own interlocking technology.

6.14 The MASREF and Major Signalling frameworks show a trend towards fewer bidders and increasing dominance by OEMs. We did not observe the same trend with the S&T framework. Notably, in competitions for CP6 S&T framework contracts:

- 15 out of a total 31 bids (spread across six regional lots) to be on the framework were made by integrators without their own interlocking technology (specifically Babcock, Colas, Linbrooke, and VolkerRail); and
- Of these 15 bids, a total of four were successful, compared with a total of 2 of the bids made OEMs

6.15 For the S&T framework, co-operation has, to date, been sufficient to support competition, albeit not without some stakeholder concerns. This co-operation may in part have been a function of the procurement rules put in place by Network Rail, whereby it was made clear in advance that no single bidder would be awarded more than one of its seven framework contracts. Network Rail imposed this restriction for the S&T framework but, significantly, not the major framework.

6.16 We note the existence of agreements reached between Network Rail and OEMs who had successfully bid to be major signalling framework suppliers for CP6. Under these agreements, OEMs are obliged to supply competitors with interlocking technology as required for the delivery of signalling projects. The available evidence does not point towards this obligation playing a very significant role in the market. As of February 2021 the impact of this obligation was untested. Significantly in our view, these obligations were not used as a basis to support any

successful bids for major framework contracts. It is also worth noting that similar obligations existed during CP5 but these obligations did not, based on the major framework bids for CP6, appear to make a significant impact on the market.

6.17 The digital procurements have also been dominated by OEMs, for the ECML procurement:

- In respect of the TCP, Network Rail invited four tenderers to bid. Three of the four[60] bidders were consortiums with a total of eight suppliers. Only one, Siemens, was a single bid. The contract was awarded to Siemens. The procurement appeared to be characterised by a greater tendency for partnership between relatively large firms than had tended to be seen during CP5 and CP6.

- In respect of the TMP, there were two lots. Network Rail invited five suppliers to tender for the TMP. All five submitted a bid. This procurement also seems to have attracted bidders previously not active in GB. Network Rail awarded both framework lots to Siemens.

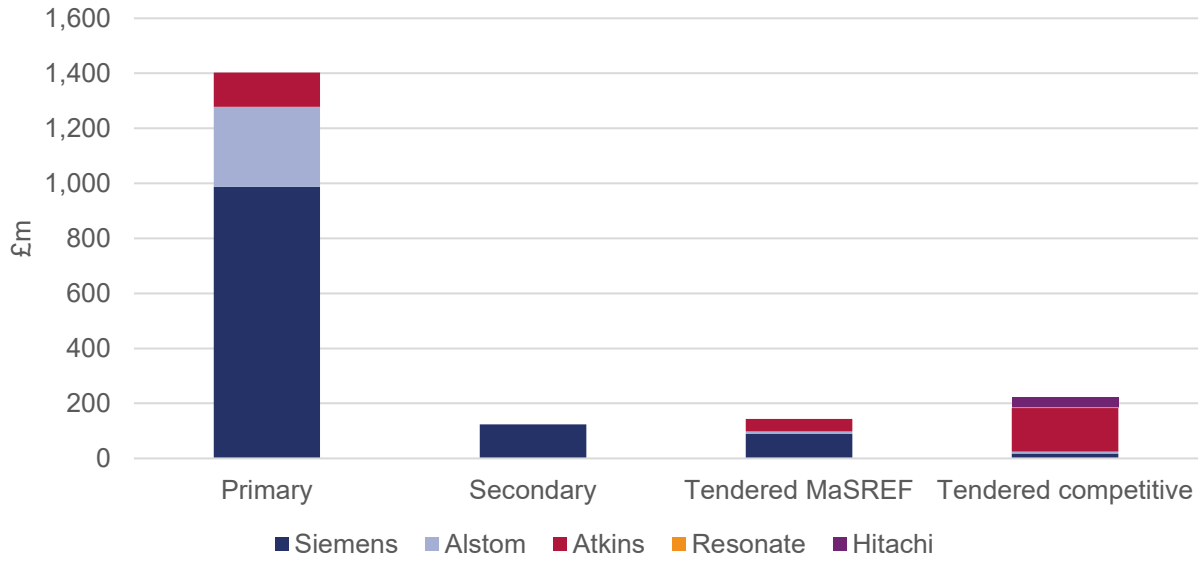
Bidding for individual projects

6.18 In the Figures 6.5 and 6.6 we present evidence on the extent to which competitive tendering was used for CP5 MASREF projects, and the number of bidders that were attracted where tendering was used.

6.19 Figure 6.5 below shows Network Rail awarded 81 contracts in total. Of this, 70% were awarded to the primary supplier, 9% to the secondary supplier, 9% were tendered competitively amongst other MASREF contractors and 12% were tendered competitively to the wider market.

[60] 1) an Alstom-led consortium (comprising Alstom and Jacobs), 2) a Hitachi-led consortium (comprising Hitachi, Ansaldo, Ove Arup and Amey) and 3) Atkins led consortium (compromising Atkins and Thales) 4) Siemens.

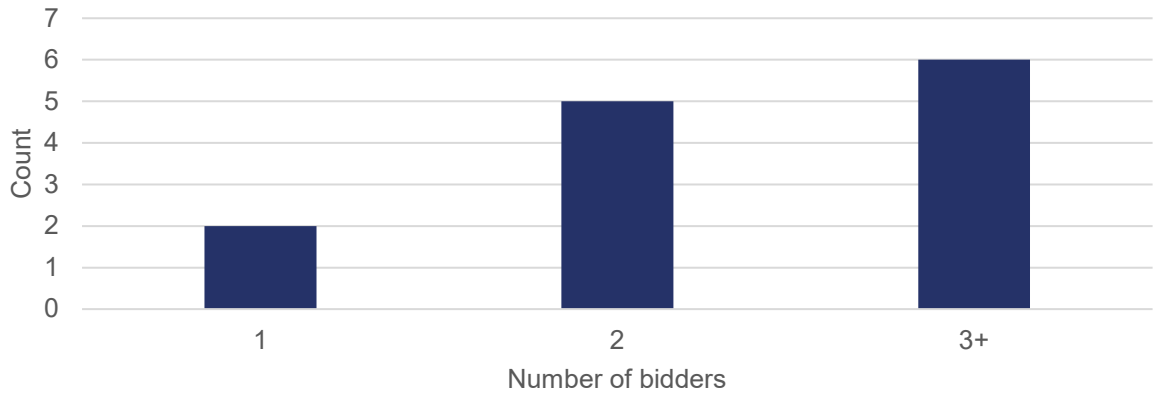
Figure 6.5 MaSREF projects by value won by route to market



Source: Nichols analysis of information supplied by Network Rail

6.20 Figure 6.6 shows the number of final bids obtained by Network Rail for a sample[61] of CP5 MaSREF contracts. It shows Network Rail managed to obtain two or more bidders in 11 out of 13 competitions, and three or more bidders in six out of 13 competitions.

Figure 6.6 CP5/MaSREF project tenders – histogram, number of bids per project



Source: ORR analysis of data supplied by Network Rail

Outcomes

6.21 In this section we set out the evidence about the prices and service quality obtained by Network Rail.

[61] We included all CP5 competitions for which we were able to obtain bidder data.

Quality

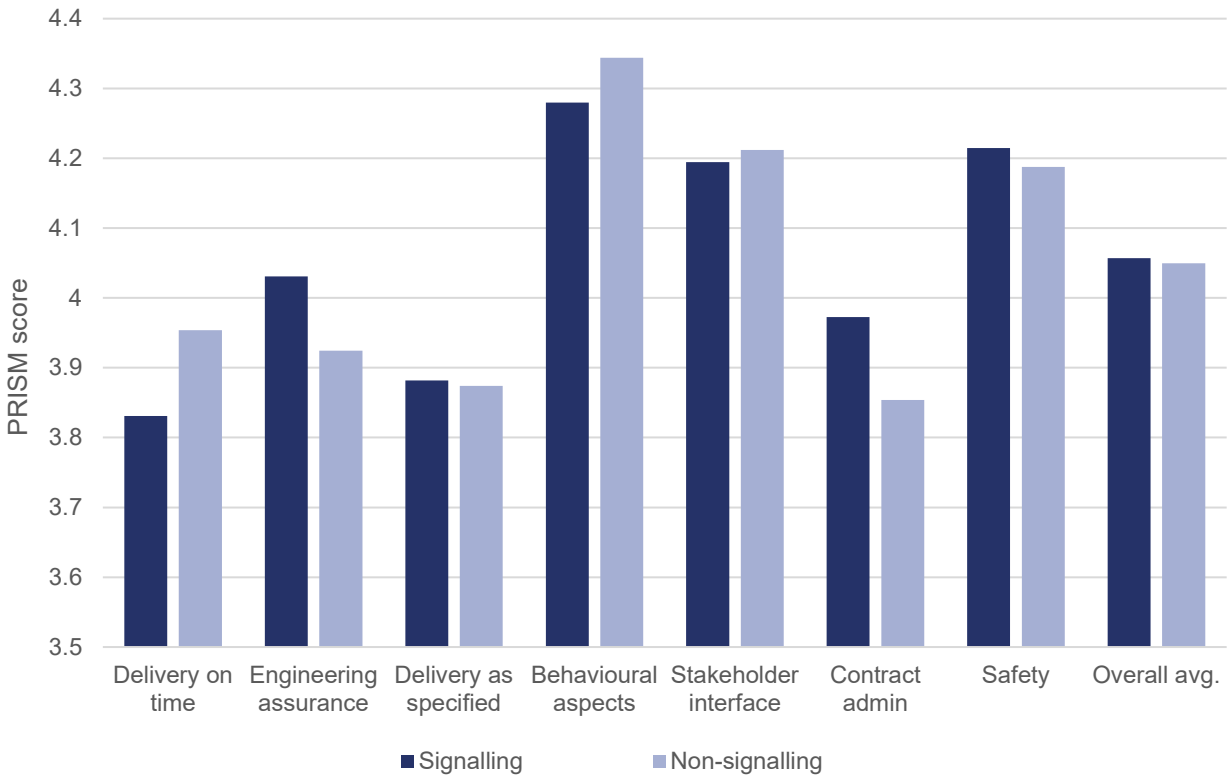
6.22 Signalling projects underpin a crucial element of the railway infrastructure which, ultimately, enables trains to move around the network. 'Service quality' in these markets is potentially multi-faceted, encompassing key variables such as the timeliness of project delivery and the reliability of equipment once installed.

6.23 We assessed the PRISM scores awarded by Network Rail to its suppliers. The PRISM score[62] is a measure which has been used by Network Rail since 2011 to monitor the delivery performance of its contractors. Companies are awarded, on a four-weekly basis, a score of between 1 and 5[63] against a number of different performance criteria.[64] PRISM scoring[65] takes place between Network Rail and all of its principal contractors, defined as contractors working on contracts of at least three months' duration and with financial values in excess of £50,000.

6.24 We compared the PRISM scores which Network Rail awarded to its major signalling suppliers during CP5 with the scores that it awarded to its suppliers on other parts of its asset base over the same period.[66] Overall, we did not find that PRISM scores on average differed significantly between signalling and non-signalling projects. The average overall score of signalling projects was marginally lower than the average overall score within non-signalling projects, with an average of 3.97 out of a maximum 5.0 versus 4.02 for non-signalling projects, a difference of only around 1%. These differences are summarized in the Figure 6.7.

[62] For guidance and copies of Network Rail's PRISM tool and scoring criteria, see https://www.networkrail.co.uk/industry-and-commercial/supply-chain/working-with-us/.
[63] Where 5 represents the best possible performance and 1 the worst.
[64] including: delivery on time; engineering assurance; health and safety; contract administration; and behaviour
[65] Scoring is reciprocal in that scores are awarded both by and to Network Rail both to and from its contractors.
[66] Network Rail provided us with PRISM scores for its 50 largest non-signalling projects over the course of CP5 and we compared these with the corresponding scores for its 55 largest signalling projects over the same period of time.

Figure 6.7 CP5 PRISM scores, signalling vs non-signalling, largest projects



Source: ORR analysis of data for CP5 supplied by Network Rail

6.25 This shows, overall, very similar PRISM scores for signalling and non-signalling projects. The largest differentials, with superior performances of (calculated as a percentage of the lower PRISM score) 5% and 4% respectively for non-signalling projects, were in 'delivery as specified' and 'behavioural aspects'. But the differences in score against other criteria were either smaller or were in favour of signalling projects, as was the case with 'engineering assurance' and 'contract admin'.

6.26 When combined with the stakeholder views that we collected, overall these results are not suggestive to of us of any very significant issues with service quality in Network Rail's signalling supply chain.

The cost and price of signalling projects

6.27 In this section, we provide a summary of the research and analysis that we carried out and commissioned relating to the overall cost of schemes and of the prices that Network Rail pays to the providers of major signalling renewal projects.

6.28 The analysis of prices and/or their relationship with underlying costs, has the potential to provide important insights into the functioning of a market[67]. Other things being equal, we would expect supplier prices and/or profits to be consistently high when compared to relevant benchmarks if there were significant efficiency issues in the market.

6.29 A key consideration is that, whilst the prices paid by Network Rail to suppliers for signalling renewal projects (and the profits that suppliers earn as a result) are a key driver of the value for money that Network Rail obtains, in isolation they can only paint a partial picture. Network Rail told us its own costs typically account for up to around 40% of the initial capital expenditure of a typical re-signalling project. In some cases, Network Rail may be in a position to trade off the fees that it pays to signalling suppliers and its own costs, making a narrow focus on only the former potentially misleading.

6.30 Furthermore, the calculation, and hence analysis, of prices and even costs in signalling markets is not straightforward, given the highly bespoke nature of signalling projects. Projects vary in terms of the scale and complexity of work that they involve and the varying mix of assets (such as interlockings and control) that they involve. Network Rail regularly uses the concept of a SEU whereby it breaks down a planned renewal contract into the hardware that it contains (e.g. interlockings, point controls, signals, level crossings, etc), and translates these requirements into a number of SEUs. This enables Network Rail to forecast the cost of future projects with reference to historical norms.

Trends in overall SEU rates

6.31 As noted above, Network Rail uses SEU rates to measure and forecast the unit costs of its projects[68]. The SEU rate is a measure that is subject to a number of limitations. Any attempts to use SEU rates to make comparisons between individual projects are impacted by factors including variations across projects in the types of work involved, including the extent of re-signalling and recontrol[69]. SEU rates are published as part of Network Rail's yearly financial regulatory statements. They are also widely used and understood within the industry.

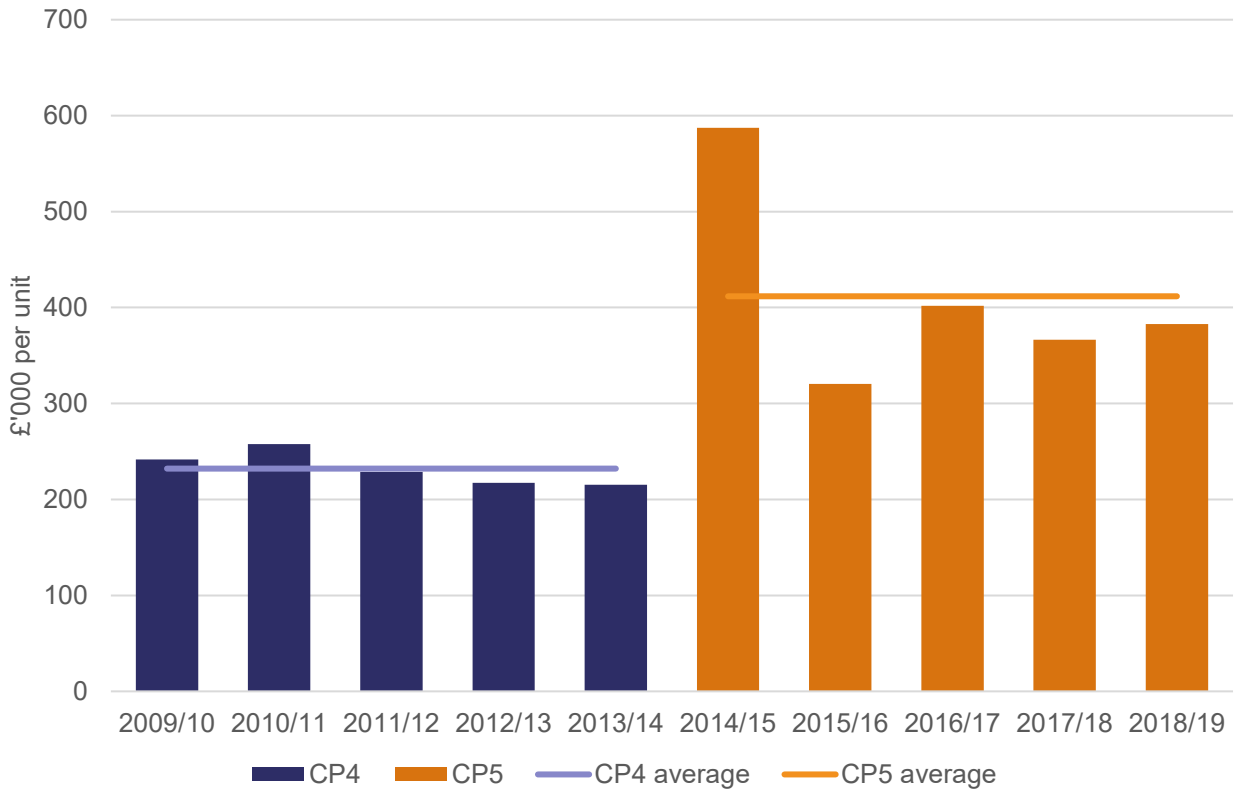
6.32 There appears to be a fairly widespread perception within the industry that GB SEU rates have been increasing over recent years, and that this is contrary to a

[67] E.g. see *Funerals*, market investigation, CMA, 2018-, https://www.gov.uk/cma-cases/funerals-market-study, profitability and price dispersion analysis.
[68] A unit is defined by the scale of the work, and is primarily measured by the number of signalling apparatus and points (where trains switch track) installed/renewed in a project.
[69] There are other important factors. For example, only CapEx is included in the SEU measure, while some project specific costs are excluded from the SEU (eg additional costs incurred due to safety considerations).

general downward trend being observed elsewhere in Europe, albeit with the latter not necessarily calculated on an SEU basis.

6.33 The SEU rates published in Network Rail's Regulatory Financial Statements show a clear upward trend in SEU rates between CP4 and CP5[70]. Whilst caution is required when using SEU rates to make comparisons between individual years or individual projects, the significant level of aggregation involved in comparing entire five year control periods ought to ensure a degree of comparability. The data illustrates that between CP4 and CP5, Network Rail's unit costs for re-signalling work increased in inflation adjusted terms by some 77%, from £232k per SEU to £412k per SEU. These SEU rates reflect Network Rail's total cost of signalling renewals, i.e. the sum of its own costs and the charges paid to signalling suppliers. We recognise that there are a number of factors which may be driving this cost increase unrelated to the number of suppliers in the market, notably increasing scope of projects and new technology costs.

Figure 6.8 Network Rail's full conventional re-signalling unit costs, CP4 to CP5



Source: Network Rail's Financial Regulatory Statements

[70] https://www.networkrail.co.uk/who-we-are/publications-resources/financial/

6.34 The data in this Figure only extends to the end of the 2018/19 financial year, but our discussions with Network Rail did not suggest that there has yet been any significant reversal of the trend shown above.

6.35 Documentation from Network Rail showed concerns about the number of 'abnormals', during CP5, i.e. the number of projects whose particular scope meant that they fell outside the pre-agreed range of prices and services agreed with MASREF suppliers. Network Rail made a series of changes to its procurement approach for CP6 in the light of lessons learned during CP5, with, amongst other things, a reduced focus on pre-agreed all-in rates for specified types of work and a greater focus on the OEM fee rates which are applied to underling costs.

The Target 190plus programme

6.36 The ultimate goal of the Target 190plus programme is to reduce Network Rail's unit SEU rates down to £190,000 i.e. spending £190k, on average, per renewal. This target will apply to digital rail and is intended to cover both Network Rail's own costs and the payments made to signalling suppliers. The target does not include the costs incurred as a result of spending on in-cab equipment[71].

6.37 Network Rail told us that it had arrived at the £190k target by drawing on international experience of unit costs that had been achieved in other jurisdictions and, its forecast of the budget and volumes requirements that it would face during CP7 and beyond. Network Rail told us that it envisaged a 'glide path' from current SEU rates to the target over a number of projects, with the target of £190k only likely to be achievable once Network Rail had engaged in significant 'learning by doing' during early digital rail projects, probably during CP8.

6.38 Network Rail's £190k target was in part informed by an analysis of digital project experience in other countries.[72] The digital nature of these projects mean that their cost would not be directly comparable with Network Rail's historic cost base, but rather be capable of informing a target that could be applicable to future Network Rail projects. ETCS (level 2) is widely accepted within the industry, to have a unit

[71] Unlike the historic rates shown in Figure 6.8 above, the target does not include the costs incurred as a result of spending on in-cab equipment. Network Rail told us that these additional costs could amount to circa £50-£60k per train.

[72] Consultants' analysis dating back to spring 2017 showed that rates below (significantly below in the case of Denmark) £190k had been achieved in Norway and Denmark. We were told that Scandinavian benchmarks, had, at the time of writing, provided the best examples of full national ETCS programs at a national level. In interpreting these benchmarks in a GB mainline context it must be stressed that:

- They represent cost data taken from digital rail projects; and

- They do not take into account the many differences between networks that we as a regulator would normally take into account, or at least acknowledge as sources of unobserved heterogeneity, if carrying out a formal efficiency analysis. Such variables include differences, in terms of factors that can be relatively easily controlled for i.e. network size and train density; and, in terms of other factors, labour market conditions, regulatory structure, and climate

cost advantage over conventional signalling systems, in particular due to digital's lower cost of installing interlockings, as a result of fewer and simpler components.

Analysis of Network Rail's CP5 MASREF renewals

6.39 We commissioned Nichols to carry out an analysis of the prices paid by Network Rail and investigate the variations in the prices obtained by Network Rail during CP5. We set out the approach to this piece of work at Annex D. Nichols found consistent evidence that the use of competitive tendering placed downward pressure on the prices paid by Network Rail, as measured by both SEU rates and the proportionate upward variance between budget prices.

6.40 Some key results of the Nichols analysis are summarized in the table below. The averages cited in both tables refer to simple averages of all projects in our sample rather than, for example, weighted averages which reflected variations in the financial value of projects.

Table 6.1 Price variance, budget vs actual, awarded vs tendered[73] projects (MASREF)

#	Test	Number of contracts in sample		Average price variances		Difference, tendered vs awarded
		Awarded (primary or secondary)	Tendered	Awarded (primary or secondary)	Tendered	
1	Contract award price vs budget price: full sample	75	22	-2%	-22%	-20%
2	Contract award price vs budget price: full sample excluding WT12 projects	64	15	-3%	-8%	-5%
3	Final award price vs budget price: full sample	75	22	+31%	-4%	-35%
4	Final award price vs budget price: full sample excluding WT12 projects	64	15	+33%	+9%	-24%

[73] We use the broad term "tendered" here to refer to projects that were tendered both within MASREF appointees only and openly to the wider market.

Table 6.2 SEU rates, awarded vs tendered projects (MASREF)

#	Test	Number of contracts in sample		Average SEU rate (£k)		Difference, tendered vs awarded (%)
		Awarded (primary or secondary)	*Tendered*	*Awarded (primary or secondary)*	*Tendered*	
1	Average SEU rate, WT2 projects	28	11	300	226	-32%
2	Average SEU rates, WT2 projects, excluding projects identified as outliers by Network Rail	21	6	297	289	-3%

6.41 The data in Tables 6.1 and 6.2 show a set of results that, whilst variable in magnitude, paint a consistent picture of lower average prices being obtained through competitive tendering.

6.42 This finding needs to be interpreted with a degree of care that goes beyond the caveats summarized earlier in this chapter. In particular, it should not be interpreted as implying that project-by-project tendering is a preferable approach to the use of frameworks in all instances. The time, cost, and complexity that would be inherent in such an approach all count against it. Another important consideration is the need amongst suppliers for certainty in the light of capacity constraints. This has been a key theme to emerge from the stakeholder dialogue carried out during this study.

6.43 We do, however, believe the finding has potentially important implications, both in terms of illustrating the potential value of at least an element of competitive tendering alongside the use of framework contracts and, more generally, illustrating the potential value that can be extracted via obtaining bids from multiple suppliers in either a framework or project context. This supports the case for steps to be taken to engage more viable players to compete in the GB market.

Emerging findings

6.44 The available evidence on market shares is suggestive of an increasingly strong position for the ‘incumbent’ suppliers Alstom and Siemens. Focusing on Network Rail’s major signalling expenditure we find:

- Data on the **installed technology base** shows a near duopoly between Alstom and Siemens for the supply of the key interlocking technology;
- Data on **Network Rail's expenditure** shows that Alstom and Siemens have increased their (historically high) collective share over recent control periods with Siemens in particular gaining significant share throughout CP5;
- **Bidding data** shows a fall in the number of bids, particularly from integrators, at the major level.

6.45 We found that overall service quality associated with major signalling projects is broadly on a par with the average from across Network Rail's entire supply chain.

6.46 With regards to the prices paid by Network Rail for signalling projects, we found that evidence from CP4 and CP5 show a clear upward trend in Network Rail's total (i.e. the sum of its own costs and its expenditure with signalling suppliers) unit costs for signalling projects. Network Rail recognises both this trend and the potential for future cost reductions.

6.47 Analysis of Network Rail's CP5 renewals shows a significant variation in the prices paid by Network Rail and whilst variable in the magnitude of the finding, paint a consistent picture of lower average prices being obtained through competitive tendering. We believe that this finding illustrates the potential value of at least an element of competitive tendering alongside the use of framework contracts and, more generally, the potential value that can be extracted via obtaining bids from multiple suppliers in either a framework or project context.

7. Barriers to entry and expansion

Introduction

7.1 In this chapter we set out our findings on the barriers for suppliers players to enter and grow in the GB signalling market.

7.2 We have grouped our discussion of barriers into four categories[74]:

- Market structure and procurement;
- Balance between long term competition and reliance on existing technology;
- Developing products for the GB market; and
- Access to technology

Market structure and procurement

7.3 A common theme running through this set of barriers is the ability to recoup the cost of investment in technology. Suppliers told us that significant investment is required to compete for frameworks and projects in the GB market. In order to incentivise suppliers to compete in the market, suppliers told us that there needs to be sufficient volume and certainty of work in which to recoup that investment.

Opportunities to tender

7.4 Some potential new entrants raised the issue of having limited opportunities to tender for work in GB. We were told that a supplier who does not win a place on a framework is effectively locked out of the market for a long period of time.

7.5 Network Rail told us that its decision to make use of frameworks for major signalling projects strikes a balance between providing supplier certainty, in terms of a likely bank of work over a set period and driving value through head-to-head competition within the market. The framework approach is also advantageous in terms of managing procurement costs on both sides of the buyer-supplier relationship.

[74] We recognise that there is potential for significant overlap between these categories

7.6 We noted that whilst most work was awarded to framework suppliers, Network Rail utilised competitive processes outside of the framework process such as mini-competitions and open tenders. Under the MASREF framework 10 out of 81 signalling projects were tendered to the open market. We were told that this provided an important 'lifeline' in enabling alternative suppliers to gain experience of the GB market.

Framework scope

7.7 We asked suppliers their views on the physical scale of the projects packaged into the major signalling frameworks and the scope of the works covered by framework agreements. None of the respondents to our questionnaire ranked the geographic size of projects as an issue. Two respondents noted that the frameworks, as they are currently structured, favour suppliers with multi-disciplinary expertise, especially if those suppliers have an interlocking product of their own.

7.8 One supplier argued that smaller, specialist companies have no route to market as their specialised nature restricts their ability to enter and compete with firms that offer the full range of signalling products.

Visibility and certainty of demand

7.9 A number of supplier responses highlighted the issue of a lack of visibility of Network Rail's pipeline of signalling renewals over a sufficiently long-term horizon.

7.10 Suppliers highlighted the lack of committed volumes and past history of Network Rail failing to deliver the volumes expected, as key factors which dis-incentivise existing and prospective suppliers from making investments into the market, as there is little firm indication that the future level of work will be sufficient to recoup those investments.

Committed volumes

7.11 Due to its funding arrangements, Network Rail is unable to flex its budgets between control periods, nor can it borrow to cover these costs. This means that, where costs overrun, the chief option available to Network Rail is to reduce volumes. Network Rail said that this means it cannot promise suppliers that specific projects will commence, meaning its frameworks are all technically 'zero value', with no firm commitments to suppliers.

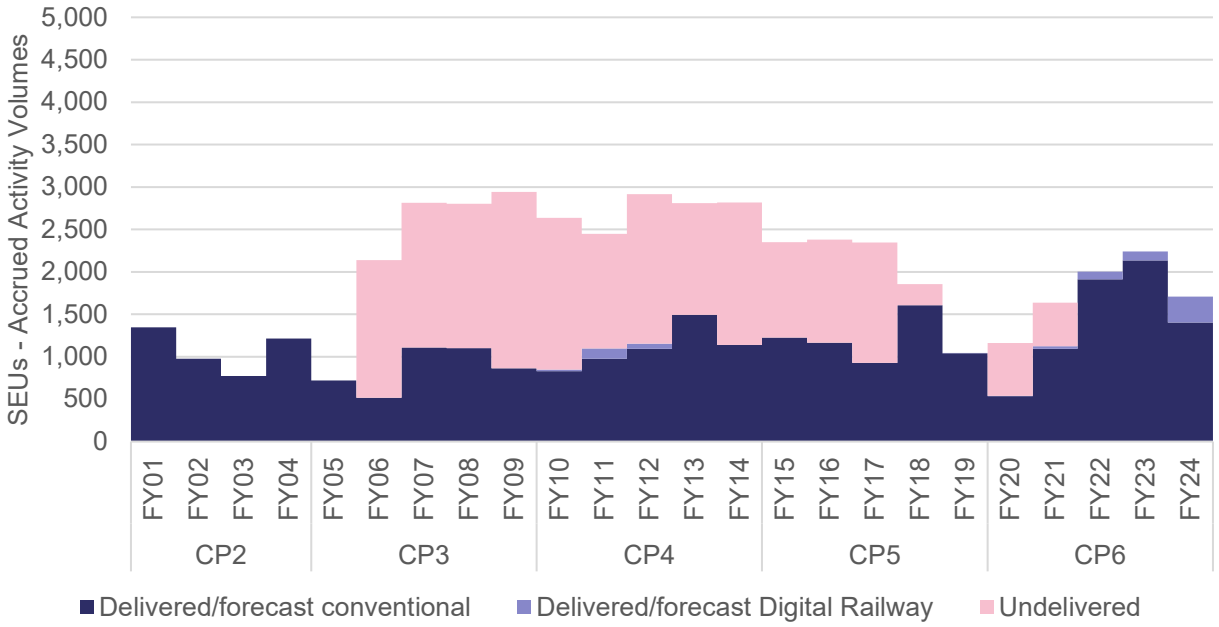
7.12 Suppliers told us they struggle to develop business cases to bid for framework competitions which do not have committed volumes, particularly where there is a need to invest in developing technology. A number of prospective and smaller

OEMs perceive there to be a high risk that technology investments for the GB market may not be recouped.

Previous volumes of work

7.13 As Figure 7.1 below shows, there has historically been a significant shortfall between Network Rail's signalling volumes forecast in Network Rail's Delivery Plans and the outturn volumes. Between 2006-07 and 2020-21, 55% of planned signalling work was unreleased to the market.

Figure 7.1 Historical planned vs. delivered volume of work



Source: Network Rail

7.14 Suppliers told us that to build up their resource and presence in the GB market, they need to have sufficient expectation that there is a sufficient volume of work to make it worthwhile to compete. Network Rail recognises the challenge it faces in order to convince suppliers to invest in the GB market.

Cyclical nature of procurement

7.15 A concern expressed by a number of current and prospective signalling suppliers is that there is a cycle of 'boom and bust' in the industry, whereby a steep ramp-up in work in the later years of a control period is followed by a sudden drop in work towards the end of the control period, and the start of the next period. This issue originates from a combination of Network Rail's management of its renewals programme and its limited ability to flex its funding to smooth its renewals profile within a control period.

7.16 We were told by suppliers that these peaks and troughs in workload impose a cost (driven by artificially tightened labour and resource markets) in having to build up and lose resource, which will be ultimately passed on to Network Rail. One supplier noted that Network Rail's renewals programme profiling displays *"unrealistic hockey stick growth"* which creates *a "bow wave of work not completed that extends into the next control period and consumes future funding on new projects."*

7.17 Issues of boom and bust are not unique to Network Rail's signalling procurement, or indeed to the supply chain of any infrastructure business which is subject to periodic price control reviews. Some suppliers did not regard this issue so much as a barrier but an inevitable issue arising from the structure of the market.

Balance between long term competition and reliance on existing technology

7.18 Network Rail, at a strategic level, recognises the value of having more competition in the market. It has used its ability to competitively tender signalling projects where it has been unhappy with the price from its selected framework contractor. Network Rail structured its CP6 major framework procurement in such a way as to ensure the presence of a third supplier in the market, in addition to the two incumbent holders of SSI technology.

7.19 At an operational and delivery level, Network Rail is incentivised to maintain the operation of the railway. There is a reluctance to depart from SSI technology due to difficulties experienced with past projects introducing new technology. RAMs told us that it is difficult to maintain a number of different technologies. New technology requires additional training for staff, additional spares, and the need to deal with additional suppliers. Signalling engineers need to hold and maintain, through regular use or training, a "competency" for each product they maintain. Engineers can only maintain a certain number of competencies. We understand that signalling engineers are currently struggling to maintain sufficient competencies, therefore, RAMs will want to minimise the number of different types of equipment they have.

7.20 These factors have, in our view, led to a difference between the objectives and decision making of Network Rail's strategic centre – who wish to cultivate more competition – and operational delivery teams who seek reliability and minimal risks.

Specifications

7.21 RAMs told us that they are not able to influence the choice of supplier in procurement competitions directly, but that they are able to influence the choice of supplier indirectly by setting specifications that favour certain technologies. A particularly important cited reason for a preference for a particular technology is the need to interface with legacy equipment or fringes. RAMS often prefer to choose the same technology at the fringes to avoid issues with interfaces[75]. We saw evidence of express preferences for a particular supplier's technology written down in route asset management policies, creating presumptions in favour of the use of a particular technology within a particular area.

7.22 In tenders for individual projects, suppliers told us that specifications based on SSI technology make it hard for suppliers with alternative technology to submit a compliant bid (if the technology is incompatible) or a competitive bid (if the technology requires significant re-design to meet the specifications). Suppliers told us of multiple instances where they declined to tender for a particular competition due to an actual or perceived understanding that Network Rail had a preference for a particular supplier.

Assessment of installed interlockings

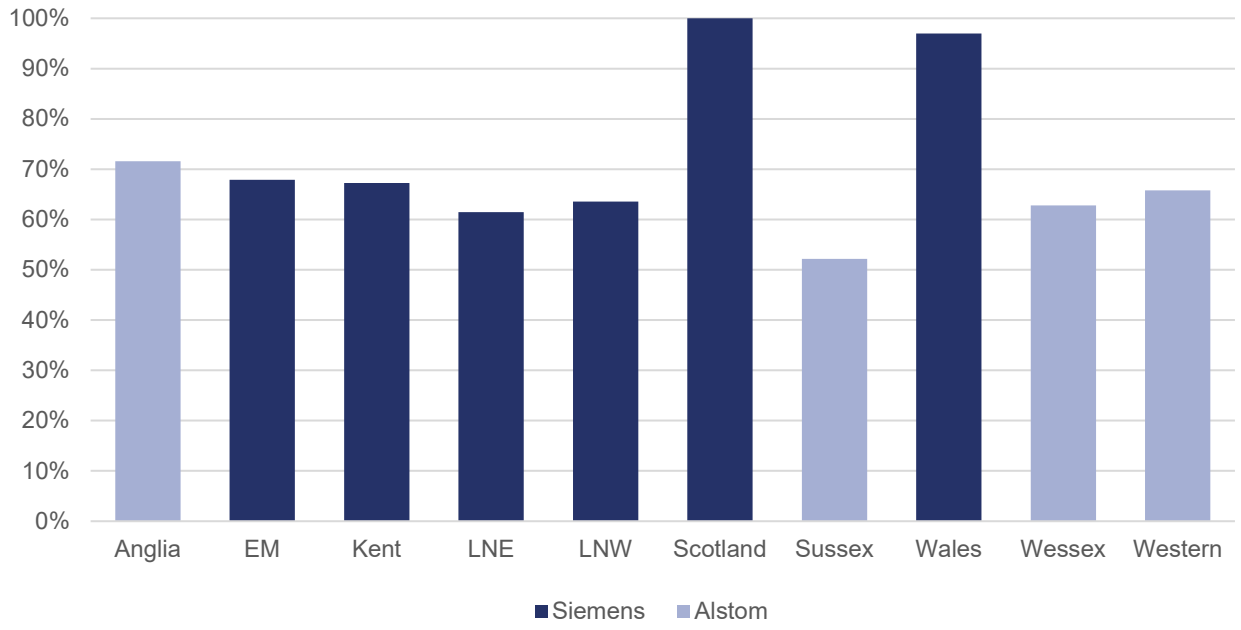
7.23 Our research suggested that Siemens is in aggregate a particular beneficiary of preferences for established technology. A key driver of this is Siemens' high share of the installed base of interlockings.

7.24 Siemens's overall share of the installed base potentially understates the scale of this issue, since in some regions Alstom is the larger of the two incumbent suppliers, making it the potential beneficiary of regional preferences in these areas. A corollary of this is that Siemens' share of the installed base in some regions is significantly in excess of its nation-wide share. The most obvious example of where this applies, as shown in Figure 7.3, is Scotland, where Siemens' share of the installed base is absolute.[76]

[75] See ' Interfacing with the installed base' below.

[76] This Figure gives the proportions of Siemens and Alstom (and their predecessors) interlockings installed and currently in commission in each route between 1985 and 2020. Hitachi and ElectroLogIXS has purposely been excluded, as they have been proportionately very small historically and remain so

Figure 7.2 Installed base of Siemens and Alstom technology across the network



Source: Network Rail's Signalling Projects Asset Data Store (SSADS) supplied to us in October 2020.

Developing products for the GB market

7.25 This set of barriers primarily applies to OEMs, often established in other countries, bringing products to the GB market. Very few alternative interlocking products have been successfully deployed on the GB network.

Bespoke GB signalling principles and standards

7.26 We were told it requires significant investment to adapt signalling products for the GB market, due to the need to meet national signalling principles and configure the product to interface with the local infrastructure. Some suppliers considered the GB signalling principles overly complex, whereas others thought that complexity was always to be expected at a national level.

7.27 Network Rail said it has struggled to introduce products that were originally designed for other European markets. *"Whilst both [interlocking products] were well engineered products which easily met the safety requirements, they required a considerable amount of effort to effectively re-design their software kernels for operation on GB signalling principles".* Network Rail said the complexities are due to the complex nature of the GB infrastructure.

7.28 We understand that Network Rail is working on simplifying and removing barriers arising from signalling principles. The focus appears to be on control system

functionality rather than interlocking at present. We consider this is a step in the right direction.

Development costs

7.29 Overall, while suppliers highlighted the significant time[77] and cost[78] involved in developing a product for the GB market, we were told that they would be willing to develop products for the GB market as long as there was the chance of recovering that investment through signalling work. The key is the ability to secure a trial project and having the ability to rollout the technology following the project in order to recover investment.

7.30 The significance of these development costs can be appreciated when put in the context of the typical margins and project sizes available within the industry. In simplistic terms (e.g. assuming that a company was bidding against companies with established technologies), assuming a profit margin of 10%[79], a workbank of £200m would be required in order to recover an investment of £20m, which, in approximate terms, would require the winning of either a framework contract or else a number of individual projects. As such, these development costs have the potential to impose a significant entry barrier.

Bidding for frameworks

7.31 The majority of suppliers told us that there is no specific requirement for suppliers bidding for framework competitions to have a presence in the GB market, however suppliers do have to demonstrate they have the capacity and resources to deliver signalling projects in the GB market. One supplier said that Network Rail tender evaluations seem to strongly favour incumbents who can provide evidence of previous GB signalling delivery.

7.32 Suppliers who are active in other jurisdictions have found it difficult to prove experience. We have been told that equivalent experience from Europe, GB metro systems or alternative disciplines does not score as well as local legacy experience and the ability to provide in service data, rather than use a theoretical model, which favours incumbents. Stakeholders told us in that the pricing models used by Network Rail to appraise bids for its CP6 major framework contracts were favourable towards bidders using SSI derivative technology. These specifications

[77] Suppliers highlighted that it typically takes two years to develop simple signalling products and 3-5 years for a signalling interlocking product (however we have seen evidence it can take up to 10 years). European counterparts told us that the length for product approval is similar in Europe.

[78] Suppliers stated that the cost can be around £15-20m to adapt an interlocking product for the GB market.

[79] Responses that we received to our consultation questions suggest that, as a target margin, this would be atypically high for a new entrant.

in at least one case contributed to a would-be supplier declining to bid at all for major framework contracts.

7.33 Network Rail told us that is uses a balanced scorecard of evaluation suppliers and always seeks to balance safety, value for money, delivery capability and other factors. It stated that its criteria are not designed to favour any particular supplier, and that it is actively trying to introduce new suppliers into the market taking into account experience in other markets when evaluating supplier capabilities.

Product acceptance process

7.34 Suppliers told us that it can be difficult to find RAMs or engineers within Network Rail who (including as a result of time constraints) are incentivised, to act as a sponsor. RAMs given their particular objectives, do not have an incentive to be the first to introduce a new technology, given the potential for this to result in increased costs and timescales for their area. The introduction of new technology could impact their performance/ delivery record.

7.35 When deciding on the supplier for particular projects, we have seen evidence which shows that Network Rail considers the length of time it will take to achieve product acceptance as a significant risk to project delivery timescales. When evaluating tenders, Network Rail has included weighting for whether a product has already been approved or likely to be within the project timescale. This can impose a significant barrier for a new supplier attempting to introduce a new product to the network through a single signalling project.

7.36 Network Rail told us that it would be difficult for applications to get to a trial site without a sponsor but did however state that the sponsorship process is required to ensure that the process is only started for products that Network Rail has a business requirement for.

Access to technology

7.37 This section sets out the barriers to competing in the market due to the need to access technology.

Integrator model

7.38 The integrator model, whereby companies deliver signalling projects using interlocking technology that has been manufactured by an OEM, has historically played an important part in GB mainline signalling markets.

7.39 During CP6 at least, access to interlocking for the S&T framework did not impose a key barrier to entry, since a number of S&T framework contracts were won using an integrator model. Stakeholders did, however, express some concerns about incumbent OEMs' willingness to provide access to interlocking technology in instances where they saw integrators as potential competitors, in particular criticising the timeliness of OEM offers in the context of bid timetables.

7.40 Suppliers who are currently active in the GB signalling market, but not for major signalling projects, told us that they considered access to interlocking to be a key factor deterring them from bidding for major signalling contracts or framework places. One supplier told us that: *"Our relationship with OEMs has no bearing on our willingness to bid for Minor Signalling and S&T frameworks. The current monopoly that exists for SSI equipment supply excludes [us] from bidding for Major Signalling Frameworks".* This view, namely that access and supplier interactions were not key considerations for those competing for the S&T framework (and were unlikely to be on a prospective basis) but were key for moving up to major signalling work, was echoed by other integrators.

7.41 We note the existence of agreements reached between Network Rail and OEMs who had successfully bid to be major signalling framework suppliers for CP6. Under these agreements, OEMs are obliged to supply competitors with interlocking technology as required for the delivery of signalling projects. The available evidence does not point towards this obligation playing a very significant role in the market. As of February 2021 the impact of this obligation was untested. Significantly in our view, these obligations were not used as a basis to support any successful bids for major framework contracts. It is also worth noting that similar obligations existed during CP5 but these obligations did not, based on the major framework bids for CP6, appear to make a significant impact on the market.

Interfacing with the installed base

7.42 All mainline signalling projects must, to some extent, interface with the installed base of technology, with existing technology within a project and/or at the fringes of a project. This need has the potential to impose entry barriers in cases where proprietary technologies are involved.

7.43 We asked stakeholders to provide us with their views on the impact of interfaces. We received relatively few detailed responses to this question, and in interpreting both the level and detail of the responses, we were obliged to consider the historically concentrated nature of the market in technology and revenue terms.

7.44 Network Rail acknowledged that supplier interactions had the potential to cause issues, noting that certain additional interfaces would be *"beneficial"* and that, *"… from experience… suppliers… will not give away anything that is detrimental to [their] commercial advantage"*. Network Rail's response to us did, however, say that, *"we are not aware of any instances where a supplier was dissuaded from tendering as a result of these issues"*, and that, looking forward, whilst there is, "room for further co-operation", that *"we do not see this as a significant factor that will impact… CP7 competition."*

7.45 Network Rail RAMs described fringes, i.e. instances where an area equipped with one OEM's technology meets an area equipped with that of another OEM, as an area of potential difficulty, leading to issues including cost escalation. We were also made aware of significant homologation issues relating to interfacing even within an OEM's product family.

7.46 We found no clear evidence that concerns about interface issues had very often deterred companies from bidding for contracts or been determinative in Network Rail's contract award decisions. We did, however, find evidence of suppliers withdrawing from a major signalling project tender as a result of concern about interfaces and access to control centre technology. We also found evidence of cost escalation during projects, as a result of interface issues.

Emerging findings

7.47 On the supply side, the structure of the market, the cycle of demand, reduced incentives to invest, and actual and perceived difficulties with introducing new technology to interface with existing infrastructure, may be discouraging new entry and growth on the part of potential competitors. On the buyer side, we suspect that preferences for established reliable technology, notably at a local level, may be inhibiting the introduction and growth of competitors.

7.48 Our key concerns arising from the barriers set out above are:

- **Market structure and procurement.** Some of the barriers cited by suppliers may be an inevitable consequence of how Network Rail is financed and how its demand is likely to arise (which is primarily driven by the deterioration of its asset base). However, considerate does appear there are factors which may be disincentivising alternative suppliers from competing in GB. There is a risk that if major suppliers looking to enter the GB market fail to achieve a sufficient level of volume from which to recoup investment, will deploy their resources outside GB.

- **Balance between long term competition and reliance on existing technology**. As the owner, operator and infrastructure manager of GB's mainline rail network, Network Rail has a wide range of responsibilities. Network Rail's operational teams are primarily incentivised to maintain the operation of the railway. At framework and regional level there is a reluctance to depart from SSI technology due to difficulties experienced with past schemes. We are particularly concerned about instances where we have observed, in tender documents and asset management policies, projects being so specified (in some cases explicitly mandating the use of particular products owned and controlled by incumbent suppliers) that real competition is rendered impossible. If this practice goes unchecked, we are concerned about the ability of an obvious 'third player' to expand in the market and mount a real challenge to the incumbents.

- **Developing products for the GB market.** There are a number of factors which make it difficult to introduce new products to the GB network. There appears to be widespread concern that the costs of bringing a product to market will not be recovered by the rewards of a certain and sufficient work bank.

- **Access to technology.** The integrator model has historically played an important part in GB mainline signalling markets. However, it appears that the medium to long-term future of the integrator model as a means of bidding for and fulfilling major signalling frameworks or contracts is uncertain, with bidding, both successful and unsuccessful, increasingly dominated by OEMs. In respect of interfaces, it appears that interfaces are currently either an actual, or at least a perceived issue in this market with the potential to result in cost escalation. This is exacerbated where incumbent suppliers have the incentive and the ability to impose a barrier to competition.

7.49 We note that Network Rail recognises some of these challenges. In the next chapter we discuss the impact of the Digital Railway and the actions being taken to address some of the barriers identified above.

8. Impact of the Digital Railway

Introduction

8.1 One of the primary drivers of this study was to ensure that the barriers to entry in the market do not persist or hinder competition for the rollout of new signalling technologies as part of the Digital Railway. In this chapter we discuss how the Digital Railway may be affected by, or indeed reduce the barriers set out above.

8.2 We also outline steps already taken by Network Rail and government to promote value for money in digital procurement. We set out below the supplier views on these measures.

8.3 We have used the same categories to describe the barriers and key risks to the Digital Railway, as in the previous chapter, and where relevant we discuss the potential to mitigate the barriers already discussed. The categories are:

- Market structure and procurement;
- Balance between long term competition and reliance on existing technology;
- Developing products for the GB market; and
- Access to technology

Market structure and procurement barriers

8.4 All of the structural and procurement related barriers discussed in the previous chapter apply to the rollout of the Digital Railway.

8.5 We consider that one of the key risks to the Digital Railway is the ability of the supply chain to build up capacity and expertise, to deliver the planned rollout of the Digital Railway. Similar to conventional signalling, suppliers are particularly concerned about factors which dis-incentivise existing and prospective suppliers from making investments into the market, where there is little firm indication that the future level of work will be sufficient to recoup those investments. Particularly relevant to the rollout of the Digital Railway are the lack of opportunities to date.

Opportunities

8.6 There have been limited opportunities for digital suppliers to enter the GB market to date. Since the launch of the Digital Railway programme, there has only been

one significant project, ECML, which was awarded to Siemens. Before that there were only three single projects; the pilot on the Cambrian Line (awarded to Ansaldo), Thameslink (awarded to Siemens) and Crossrail West (awarded to Alstom). Some suppliers have expressed concern about their ability to build up capacity in the market ahead of the rollout Digital Railway in CP7.

8.7 Some suppliers have expressed concern that Siemens' experience gives it a significant advantage in future digital competitions. It is vital for Network Rail to ensure that as it rolls out digital products it generates opportunities for other suppliers to bid for digital projects. Network Rail acknowledges that securing the ECML gives Siemens an *"opportunity for the supplier to demonstrate their capability in ETCS in a real world environment which other suppliers will not yet have had".* It said that *"This position is driven by the ability to gain real life experience of ETCS delivery in the UK rather than any specific technological advantage."*

Delayed/cancelled competitions

8.8 Suppliers we spoke to pointed to a number of delayed, cancelled or scaled back competitions. Suppliers said that digital GB opportunities resulted in huge investments to develop technical solutions. When these competitions are cancelled, particularly after the tender has been submitted by suppliers, it damages market credibility and the confidence of the supply chain to invest in the GB market. This results in suppliers being discouraged from bidding for GB work or investing in capacity, by concerns over high and/or abortive tender costs and uncertainty over the award programme for contracts.

8.9 Network Rail said that *"in our view, there are no known delays or cancelled procurement events that have impacted on our ability to retain a competitive supplier base. We are not aware of any instances where a supplier was dissuaded from tendering as a result of these issues".*

8.10 Network Rail and government recognise the challenge of providing more certainty to the market, and the necessity to generate a visible forward pipeline of work. As outlined below, the response to this issue is through the LTDP.

8.11 Network Rail has also made changes to its procurement of Digital Rail products to address identified barriers to entry. Notably it based its procurement of ETCS on the ECML on a collaborative commercial model with the objective being that successful suppliers would hold a framework supporting a long-term strategic relationship to guarantee a return on investment.

The Long Term Development Plan

8.12 The LTDP is aimed at addressing the market structural issues as described above by setting out a plan for the long-term delivery of the Digital Railway. Overall, suppliers are positive about the LTDP, it was described as a "*a key element to ensuring that the GB market is an attractive market for suppliers to invest"* and *"If managed correctly implementation of the LTDP should provide a robust long-term pipeline view for the supply chain."*

8.13 Suppliers have expressed some concern about the lack of committed funding and the ability of the plan to meet the timescales set out. One supplier said that it is *"highly unlikely that the original objectives, cost and timescale will emerge unscathed".* Also, as set out in the procurement chapter, Network Rail's funding is linked to set control periods, therefore, the long term funding available is uncertain. The current government spending review and the impact of COVID-19 is expected to impact on the funding available for CP7. There is a risk that the LTDP will experience major revisions.

8.14 In addition to committed funding, suppliers have also stressed that open interface specifications are also key to the LTDP being successful in attracting new players to the market. This is discussed under EULYNX below.

Balance of long term competition and reliance on existing technology

8.15 The Digital Railway brings about an organisational change. Network Rail has made significant effort in selling the benefits of ETCS technology throughout the organisation. We note however, that some of reasons underlying preferences for particular technology are unchanged, particularly the need to interface with the installed base of technology. We consider that issues are still likely to arise both where technology needs to interface at the fringes of a project, or where ETCS is overlayed.

8.16 This risk might in part be mitigated by the change in procurement strategy Digital Railway, notably the move to more outcomes based procurement. This will reduce the role that Network Rail plays in specifying the requirements for signalling projects. This risk is also likely to be mitigated by the impact of the EULYNX initiative (discussed below) which creates common specifications for ETCS products.

Ability to develop products for GB market

8.17 Supplier development has been limited by the small number of projects implemented in GB. Other than the investment required, the main barrier suppliers highlighted is detailed knowledge of GB requirements. Suppliers have told us they are concerned only one supplier, Siemens, so far has had the opportunity to build up this knowledge for the GB market.

8.18 Suppliers said that development work to customise systems for GB deployment adds additional cost and discourages potential suppliers from developing products for the GB market. The Digital Railway brings opportunities to use European standardised technology. There is a risk that if GB continues to develop bespoke specifications for signalling projects, suppliers will consider the development costs too high to invest in the market. We consider that it is essential for Network Rail to fully engage in initiatives such as EULYNX, to develop a common European platform.

8.19 We do consider that the difficulties associated with bringing products to the GB market may be partly mitigated by Network Rail's efforts to address the difficulties developing digital products for the GB market, through the Digital Railway programme:

- Network Rail has been selling the benefits of ETCS organisation wide and has set the direction of travel.
- Network Rail has developed a facility to test products without the need for an operational trial on the live track.

8.20 Network Rail is also taking steps through its Target 190plus project to improve the design of signalling projects.

Access to technology

8.21 We were not presented with any evidence to suggest that, at least for ETCS at Level 2, access to interlocking would be any less of a barrier to competition, or that integrators are likely to see a significantly higher level of success when competing for major signalling projects.

8.22 With regards to interfacing with the installed base, the picture is more complicated. ETCS products are promoted as being interoperable, however, what this means is that all products will speak to a common European Platform. Suppliers will still have proprietary products for which they will control the interfaces.

8.23 As set out below, a solution is being developed at European level to address this issue. EULYNX is aiming to create standard interfaces between certain digital signalling products e.g. RBC to control centre.

EULYNX

8.24 EULYNX[80] is designed to create common architecture for Digital Rail products. Overall, suppliers consider that the EULYNX initiative has the potential to increase competition in the market, however, it was stressed that it is key that the GB market fully engages with the initiative which includes specifying projects to EULYNX standards. We note that the digital products procured under the first ETCS framework in 2012 are not interoperable. This was because EULYNX specifications were not available at the time.

8.25 There appears to be fairly widespread concern amongst the supply base that EULYNX will be unable to develop the open interface specifications without suppliers being willing to share their protocols. There is evidence that there is some movement in the supply chain. Suppliers and Infrastructure managers are working together to develop Technical Specifications for Interoperability as part of the Shift2Rail European initiative. Network Rail said that *"This is likely to be the signal to the suppliers that their business model will change and encourage supplier diversification within a defined system architecture."*

8.26 While the majority of suppliers were positive about the impact of open interfaces, one supplier highlighted risks of developing open standards, which included loss of the ability to create bespoke products, reducing customer benefits, security concerns and technical difficulties.

8.27 Stakeholder views on the potential of EULYNX to improve competition were mixed. Stakeholders generally agreed that EULYNX has the potential to mitigate, at least partly, historic interface issues, but a number expressed a degree of caution. In particular, we were told that there is a risk that the need for protocols will create a natural tension between different suppliers products. EULYNX specifications also do not deal with interfaces between conventional products.

8.28 Network Rail intends to replace signalling assets with digital alternatives when they come up for renewal to reduce the extent of overlaying ETCS technology on conventional technology. However, there will be some instances where overlaying is necessary.[81] Where ETCS is overlayed, historic interface issues are likely to persist. Whilst ETCS rules are, in principle, technology agnostic, the protocols

[80] Landing Page (eulynx.eu)
[81] For example, where trains are equipped with GSM-R on a particular route

under which products will operate and the manner in which they interface, will differ between different suppliers products. Competing suppliers will in many cases face weak incentives to interface with other products.

8.29 Network Rail said that EULYNX has the potential to be a market disrupter. The key challenge for Network Rail is its ability to *convince* the supplier market that it is worth investing in the GB signalling market given the past history. As highlighted above, suppliers told us they are unwilling to invest without guaranteed work to recoup the costs of development.

Target 190plus

8.30 The Target 190plus programme is focused on Network Rail's internal processes. It contains a number of projects which have the potential to introduce change within Network Rail and reduce the cost of signalling projects.

8.31 Suppliers welcomed the initiative but questioned whether the target was achievable, particularly if market issues on the supplier side are not addressed.

Emerging findings

8.32 We consider the Digital Railway has the potential to address some of the barriers we identified above, however, not in isolation.

8.33 The key risk to the rollout Digital Railway is the need for suppliers to develop capability in the GB market. This requires Network Rail to create the confidence for suppliers to invest. Without this, there is a risk that suppliers will focus their efforts on other markets, particularly as demand increases across Europe.

8.34 As outlined above, a number of steps have been taken in the right direction to address market structural issues and barriers to bringing digital products to market in the form of the LTDP and the Target 190plus programme. We consider that ORR can play a key role in ensuring this work continues to move forward, with a particular objective of making sure that the benefits of competition are recognised and that deliverables meet the needs of potential/alternative players in the market.

8.35 While Digital Rail products are promoted as interoperable, true interoperability will not be possible without the development of, and adherence to, open interface specifications. We consider that in future, it is key for Network Rail to procure technology with open interfaces, or interfaces which are aligned to EULYNX specifications.

8.36 We consider that the EULYNX and RCA initiatives are the most appropriate way of tackling the issues with interfaces, despite the limitations. Interface issues are common across Europe and a joint approach of all infrastructure managers in Europe is likely to have a greater impact than a GB based initiative, which may risk adding increased national complexity to GB signalling.

9. Decision not to make a reference

Introduction

9.1 This chapter sets out why we have decided not to consult on making an MIR to the CMA.

9.2 A market investigation is a more detailed investigation into whether there is an adverse effect on competition ("**AEC**") in the market(s) for the goods and services referred. In this case this would be the market for the supply of major signalling projects in GB. If any AECs are identified, the CMA would decide what remedial action, if any, would be appropriate. Following a market investigation, the CMA has a wide range of legally enforceable remedies (including legally binding orders), aimed at making the markets more competitive in the future.[82]

9.3 We have power to make an MIR to the CMA when the findings of a market study give rise to reasonable grounds for suspecting that a feature or combination of features of a market or markets[83] in GB prevents, restricts or distorts competition, and an MIR appears to be a proportionate response.[84]

9.4 We received no representations arguing than an MIR should be made in response to our market study notice published on 12 November 2020. We are required to decide by 11 May 2021 whether to begin the process of consulting on making an MIR.[85]

Legal framework

9.5 The legal test for making a reference is a 'reasonable grounds to suspect' test and does not require ORR to have concluded that there are, in fact, features of a market which prevent, restrict or distort competition.[86]

[82] Section 134 of EA02 sets out the questions to be decided by the CMA on an MIR and section 138 of EA02 sets out the CMA's duty to remedy adverse effects
[83] Section 131(2) of EA02 sets out what is to be construed as a feature for the purposes of Part 4 of EA02
[84] Section 67(2A) of the Railways Act 1993 and section 131 of EA02 set out the powers of ORR to make an MIR to the CMA
[85] Under section 131B of EA02, ORR must publish a notice of its decision not to make an MIR within 6 months beginning with the date on which it publishes the market study notice. Sections 131B(2)(a)-(c) of EA02 state that ORR may publish a notice under section 131B(3) EA02, where (i) ORR has published a market study notice; (ii) no representation has been made to ORR within the period specified in ORR's market study notice that an MIR should be made under section 131 of EA02 in relation to the matter specified in the notice; and (iii) ORR has decided not to make an MIR
[86] Convenience Stores v OFT, CAT 36 [2005], paragraph 7

9.6 Where the legal test is met, ORR must then use its discretion to determine whether or not to make an MIR. Guidance on how we should exercise this discretion sets out four criteria to guide our decision making:

- The scale of the suspected problem is such that a reference would be an appropriate response;
- There is a reasonable chance that appropriate remedies would be available;
- It would not be more appropriate to address the concerns through undertakings in lieu of a reference (UILs); and
- It would not be more appropriate to address the competition problems through alternative powers available to the CMA or through the powers of sector regulators.[87]

9.7 We must also, in determining whether or not make a reference, have regard to our obligation to discharge our functions in a matter best calculated to achieve our duties under section 4 of the Railways Act 1993.

9.8 In exercising our discretion and having regard to our legal duties as to whether or not to make an MIR, we recognise the significant impact an MIR would have on the sector, including significant costs, both to participants in the markets under scrutiny, and to the CMA to whom the markets would be referred. We have set out the full legal test and the policy considerations we take into account when exercising our discretion at Annex E.

Assessment of legal test

9.9 For the reasons set out throughout this document, we consider that we have identified areas in which we may have reasonable grounds for suspecting that a feature or combination of features of the signalling market in GB prevents, restricts or distorts competition, such that the discretion to refer this market to the CMA is open to us.

9.10 In summary, we find there are reasonable grounds to suspect there may be features on both the buyer and supplier side of this market, which are driving high levels of concentration.

9.11 On the supply side, we suspect, the structure of the market, the cycle of demand, reduced incentives to invest, and actual and perceived difficulties with introducing

[87] Guidance about the marking of references is set out in OFT 511, paragraph 2.1

new technology to interface with existing infrastructure may be discouraging new entry and growth on the part of potential competitors. On the buyer side, we suspect that preferences for established reliable technology, notably at a local level, may be inhibiting the introduction and growth of competitors.

9.12 We also have a reasonable suspicion that this reduction in potential competition may be leading to purchasers of signalling projects in GB, (principally Network Rail), not being able to achieve best value for money, which ultimately results in lost value for passengers and other users of the railway and taxpayers.

Exercise of discretion

9.13 Whilst the size and scale of the market, and the problems identified therein, would warrant an MIR, we have decided it is not proportionate to make a reference in this case because we consider it would be more appropriate, and indeed efficient, for ORR to address the problems identified using our tools as a sectoral regulator.

9.14 We have had careful regard to our principal objective in opening this study, namely to ensure that incumbent players are not able to exploit their incumbency advantage to restrict new entry and retain dominant market power through the rollout of new signalling technologies as part of the Digital Railway.

Scale of the problem

9.15 As outlined elsewhere in this document, Network Rail spend alone accounts for a very significant monetary sum, around £0.9bn per annum on major signalling projects in CP5. Our work on this study reinforced our view that ensuring effective competition through the rollout of the Digital Railway, in which Network Rail's volume of signalling renewals is projected to increase five to six fold, remains a critical priority to ensure the infrastructure manager is able to effectively drive value for money.

9.16 Our work on pricing indicated consistently that where Network Rail was in a position whereby it could drive competition between at least two bidders, it consistently obtained materially better value for money. Any regulatory intervention that would effectively contribute to increasing competitiveness of signalling frameworks and individual tenders (and/or pertinently increasing the number of viable players from two to three, or possibly more) would therefore have the potential to have an extremely positive economic impact.

9.17 The size of the market, and the scale of the problem would therefore, in our view mean that making a reference could be an appropriate response.

Remedies

9.18 Conversely however, our analysis of the remedies that might be necessary to address the issues we have identified clearly militated against making a reference. As set out above, a market study has a range of possible outcomes. When choosing between the alternative courses of action we consider the following factors:[88]

- The tools available to us;
- How the remedy addresses the barriers and the detriment we have identified;
- How effective and proportionate the remedy, or package of remedies, would be;
- How the different remedies are effective as a package of interventions to help make competition work effectively; and
- How the remedy, or package of remedies, supports other work in the sector.

9.19 Whilst the powers available to the CMA following an MIR, such as ordering divestitures and imposing (for instance) mandatory access remedies, are wider than those available to ORR – we do not consider they are an appropriate means to address the competition problems we have identified in these markets.

9.20 Some of the issues we have identified are longstanding, and in some cases (such as the need to interface with existing interlocking technology and other incumbency advantages) stem back to arrangements made at rail privatisation. There is no 'quick fix' that might be produced by a divestiture order by the CMA. We also consider that any mandatory access remedy, for instance to intellectual property of existing SSI technology, is likely to be overly complex in terms of implementation and management, given the pace of technological change within the market and market developments arising from the implementation of the Digital Railway and initiatives such as EULYNX. It could also have adverse incentives for investment in those technologies which Network Rail relies on for continued improvement of the rail network.

9.21 Rather, appropriate resolution of these more entrenched issues will, in our view, be more effectively achieved by extended work and challenge to Network Rail and industry, supported is necessary by the use of formal regulatory powers. We

[88] e.g. see *ORR's approach to monitoring and reviewing markets*, January 2017, http://orr.gov.uk/__data/assets/pdf_file/0007/23974/orr-approach-to-monitoring-and-reviewing-markets.pdf

consider that, as sector regulator, and in particular through our role in both licensing and the periodic review process (which sets targets and objectives for Network Rail), ORR is well positioned to take this forward. We have set out our proposals on areas we want to explore further in the next stage of our market study. Network Rail has demonstrated strong cooperation with our work to date and has indicated a willingness to work with us to make improvements in competition and outcomes in the signalling market.

9.22 We consider that other issues, such as the preference of Network Rail's RAMs to work with 'trusted' (i.e. existing) suppliers to minimise cost and performance risk, can also be addressed through focussing on Network Rail's processes, and if necessary, having recourse to our ability to create new licence conditions. Such remedial options will require a careful consideration of the balance between short term cost and performance objectives and the longer term benefits that could be achieved through improving competition. Again, as the sector regulator, with a practical understanding of the wider pressures on Network Rail and operation of industry, we consider ORR is best placed to take such remedies forward. We therefore take the view that given the nature of the issues identified, and the likely action required to address them, there is clearly a more appropriate course of action than an MIR to seek to resolve the problems we have identified.

Other factors

9.23 In light of the above, we did not explore the option of undertakings in lieu of a reference, though we note and take account of the fact that Network Rail has exhibited a high degree of cooperation and openness with ORR throughout this study and has indicated a willingness to work with us to improve competition and outcomes in this market.

Conclusion

9.24 Whilst an MIR would facilitate a deeper and more comprehensive investigation into the issues in these markets, and allow the imposition of legally enforceable remedies, such as divestment and access remedies, we do not, on balance, consider that it would be proportionate for us to make an MIR in this case.

9.25 Whilst the size of the market, and potential value of regulatory intervention might justify an MIR, it is clear to us the most appropriate course of action is to address the problems identified using tools available to us as a sectoral regulator.

9.26 As such, ORR will seek to address issues identified by challenging and working with industry, and Network Rail in particular, to develop a package of remedies

targeted at improving competition, and critically, looking at options to ensure actual and potential competitors can enter and grow in the GB signalling supply chain. Our next steps, in this regard, are set out in the following chapter.

10.Proposed next steps

Introduction

10.1 This chapter sets out our proposals for remedial action as an alternative to making an MIR to the CMA.

10.2 At this stage of the study, our aim is to propose a broad direction for further work, rather than to propose a specific set of remedies.

Issues and remedies we propose to explore at Phase 2

10.3 For the reasons outlined above, we consider barriers to entry and expansion, and thus greater levels of competition, exist on both the buyer and supplier sides of the market. These barriers are interrelated and overlapping. For instance, supply side issues such as complexities and commercial issues accessing installed technology and developing interfaces are likely driving buyer side preferences to rely on established technology provided by incumbent suppliers.

10.4 In our view, market issues must therefore be tackled holistically, and as part of a single coordinated initiative to increase competition in the market. The issues are entrenched and progress is likely to be gradual.

Proposed workstreams

10.5 Further detail on the workstreams we propose to pursue will be developed in the early stages of Phase 2 of our study, and informed by representations and responses to this update paper. In order to inform this discussion, at this stage we set out the following areas of work we propose to explore, namely:

- How to better incentivise suppliers to compete in the GB market and develop products for the GB market. This could include:
  - Driving governments and Network Rail to generate proposals to improve incentives for alternative suppliers to invest and compete in GB. A starting point for this work would be to review the LTDP with a view to ensuring the needs of smaller players/new entrants are met by its future deliverables;

- Reviewing Network Rail's recent initiatives including the changes proposed by the Target 190plus programme to ensure the benefits of increasing competition are captured.

- How to address issues with interfacing with the installed base, now and in the future, this could include:
  - Pressing Network Rail and other buyers to continue to play an active role in EULYNX to develop common specifications for digital products;
  - Reviewing Network Rail's approach to enforcing contractual obligations requiring cooperation between incumbents and new entrants in terms of facilitating fair access to technology and enabling interfacing.
  - Proactively engaging the supply chain, and putting in place a system of reporting of instances where access or cooperation is either not forthcoming nor sufficient, and, in such cases, exploring the possible application of competition law; and
  - Challenging Network Rail to consider expanding its approach of removing the cost of interface development from the competitive element of tenders to better facilitate a level playing field for new entrants.

- How to ensure an appropriate balance between encouraging long term competition and minimising short term costs and risks of projects by relying on existing technology. This could include:
  - Looking at the structure of decision making within Network Rail with a focus on identifying ways of promoting its pro-competition strategic objective, and the objectives of operational delivery teams. This will require consideration of trade offs and how to achieve a better balance on short and long term priorities. In our view the potential benefits of competition may be being under recognised at the present time; and
  - Promoting the greater use of 'outcome based' tendering wherever possible. As outlined earlier in this report, we are particularly concerned about the overuse of highly, and sometimes explicitly prescriptive tenders for particular technology or suppliers which prevents any realistic competition from taking place and entrenches incumbency advantage.

10.6 Action in relation to each of these workstreams could range from influencing key stakeholders through to making formal recommendations and, if necessary, the introduction of new licence conditions to control commercial behaviour.

10.7 However, we recognise in relation to all of these potential remedies, there is a need to balance short term cost and performance risk against the longer-term promotion of competition. On the supply side, we particularly recognise the need to balance requirements for access to technology and for cooperation, against incentives on the incumbents to invest in and develop SSI derivatives and other solutions, which, regardless of what competition may emerge, are likely to remain key facets of the GB network for the foreseeable future.

10.8 In undertaking these difficult balancing exercises, we will work closely with Network Rail, engage with industry stakeholders and undertake significant further analysis of available evidence throughout Phase 2 of our market study. Action we take will remain under review.

Next steps

10.9 Following the publication of this update paper, we will continue to develop and refine a package of remedies, broadly following the proposals set out above, to address the market issues we have identified to date.

10.10 We propose to develop these remedies through issuing further requests for information, engaging with stakeholders, and, holding a number of remedy workshops.

11. Invitation to comment

Introduction

11.1 As indicated in Chapter 9, we have decided not to make an MIR at the end of this market study.

11.2 This market study is therefore ongoing. The statutory deadline for completing this market study is 11 November 2021. The second stage of this study will focus on designing a set of remedies to address the key issues identified in this report.

11.3 Following the publication of this update paper, we will continue to engage with stakeholders through:

- Inviting submissions in response to this update paper;
- Holding workshops to discuss our emerging findings with a focus on developing and refining remedies;
- Working with Network Rail to identify solutions; and
- Holding bilateral meetings with key interested stakeholders to discuss our findings with a focus on developing and refining remedies.

How to comment

11.4 Interested parties are invited to make submissions by 11 June 2021 on both the substance of this update paper and the proposed course of action proposed by ORR, outlined in Chapter 10.[89]

11.5 In commenting on this update paper, we ask stakeholders to set out their views on:

- The emerging findings set out in this paper, and, whether you support or disagree with them. You should provide relevant evidence where appropriate to support your arguments;
- The proposed course of action of ORR as a means of addressing the issues we have identified;

89 For the avoidance of doubt, ORR has no duty under section 131B of EA02 to consult interested parties before making a decision not to refer

- Potential remedies to address the issues we identified;
- Likely costs of possible remedies to you or industry in general; and
- Any unintended consequences of any possible remedy.

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