ROLLING STOCK LEASING MARKET INVESTIGATION

Substitutability working paper

Summary

1. In this working paper we put forward the following views:

(a) Differences in lease dates resulting from the franchising process have an important impact on the availability of rolling stock at any given franchise re-let. We considered how these timing differences between lease dates can be overcome so that supply can match demand. We found that sub-leases do not provide a mechanism to overcome timing difficulties such as to place a price constraint on the ROSCO. We also considered that if a TOC is to take a short-term lease so it can switch to alternative rolling stock, the alternative rolling stock must provide an additional benefit to the TOC to at least match the price premium on the short-term lease, or the additional cost must be effectively underwritten by the DfT in the franchise invitation to tender (ITT).

(b) Market definition differs depending on the starting point for the hypothetical monopolist test and the effect of technical, operational, economic and franchise requirements of different franchises. Our analysis of substitutability shows that operational characteristics impose a considerable constraint on the extent of substitutability of alternative rolling stock classes for the incumbent fleet of rolling stock.

(c) We do not intend to define relevant markets in a precise manner at this stage but will assess substitutability in relation to each fleet of rolling stock at each lease negotiation.

(d) A number of relevant markets are likely to exist in relation to incumbent rolling stock. At their narrowest, these markets consist of each fleet of incumbent rolling stock on a franchise owing to a lack of available alternatives. However, wider

markets comprising available types of used rolling stock with similar characteristics, for example available Class 15x rolling stock, may also exist.

(e) The constraint on ROSCOs' incumbent rolling stock in some cases appears to come from new rolling stock rather than alternative used rolling stock. This reflects the possibility that there are capacity constraints for certain types of used rolling stock such that new rolling stock is the only available alternative.

(f) Market definition for new rolling stock will vary depending on the suitability of used rolling stock in any given situation. At its narrowest, the relevant market is a market for the right to lease each fleet of new rolling stock. Given that new rolling stock competitions are conducted in this way, this seems the most practical approach to take. However, alternative used rolling stock may also be part of the same market if it is a credible alternative to new rolling stock.

(g) The geographic market does not extend beyond Great Britain due to technical incompatibilities of rolling stock from outside Great Britain.

Introduction

2. In this working paper we set out our approach to considering market definition for this inquiry.

The hypothetical monopolist test

3. In defining markets, the CC uses[1] the concept of the hypothetical monopolist test—if there were only one supplier of a product (a hypothetical monopolist), would it be able to sustain a small but significant non-transitory increase in price (SSNIP) profitably? This hypothetical monopolist test starts by considering each product (narrowly defined) in the market reference (the 'candidate' product(s)). The relevant market is normally defined as the smallest group of products for which a hypothetical

[1] *Market Investigation References: Competition Commission Guidelines, CC3*, June 2003, paragraphs 2.1 and 2.2.

monopolist could sustain a SSNIP profitably. The key to market definition is substitutability—the extent to which customers can readily switch between substitute products (demand-side substitution), or suppliers can readily switch their facilities between the supply of alternative products (supply-side substitution).

4. In applying the hypothetical monopolist test, it is helpful to understand what goods and services are provided by rolling stock lessors. Our terms of reference identify the 'leasing of rolling stock for franchised passenger services and the supply of related maintenance services' as the reference goods and services. This is most easily broken down into the supply of two types of services:

   (a) the supply of rolling stock to TOCs through leases; and

   (b) the supply of maintenance services to a TOC.

5. We consider *(a)* in this working paper. We consider *(b)* in the Maintenance working paper. We also make an assessment of the relevant geographic market before setting out the parties' views on market definition, and making comments on these approaches.

Leasing rolling stock

6. In this section we consider demand-side substitution[2] in terms of the options available to a TOC when considering what rolling stock to lease for use on a franchise.

7. We have observed[3] that the vast majority of demand for rolling stock takes place at the point of a franchise re-let.[4] First submitted that 'markets for rolling stock leases

[2]We consider supply-side substitution in paragraphs 58 to 62.
[3]We have conducted a full assessment of switching in the competitive analysis working paper. This showed that switching is confined to a small number of classes and most switching is determined at franchise re-let.
[4]By franchise re-let we mean the situation where a new franchise has been let and new leases agreed. In some cases this has involved amalgamations of other franchises or changes in the routes included in the franchise.

only take place from time to time—generally according to the franchise letting process … there is a substantial temporal element to competition'. This pattern is generally driven by two factors:

(a) the DfT's requirement that short-listed bidders should lease rolling stock for the length of a franchise to achieve a level of cost certainty during the bidding stage and to fulfil the operational requirements of running a particular franchise;[5] and

(b) the ability of a TOC to break the terms of a lease (and hence switch rolling stock mid-lease) is very limited because break penalties may be invoked.[6] Five TOCs [✂] stated that they had not switched rolling stock mid-lease. Several TOCs stated that break penalties had restricted switching. However, two TOCs ([✂][7] and [✂])[8] noted that mid-lease switching had occurred where the ROSCO was able to increase the total number of vehicles on lease. This evidence suggests that the break clauses contained in many leases lead to opportunities for switching away from rolling stock during the term of a lease being rare.

8. Our focus is, therefore, on the choices facing a TOC at franchise re-let. At franchise re-let, a TOC can either:

(a) lease each fleet[9] of incumbent rolling stock[10] on a franchise for the duration of the franchise; or

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[5]HSBC submitted that some franchisees have requested options to lease rolling stock beyond a particular franchise, either to use it on the same franchise if it were to win again or to use it elsewhere. This activity was prevented by the Strategic Rail Authority on the basis that it might distort the franchising process and under the Direct Agreements ROSCOs cannot do this without the DfT's prior permission.

[6]The original MOLA leases contained a termination provision so that the lessee could terminate the lease at any time during the lease period but was obliged to pay the ROSCO the present value of the remaining lease rentals less the present value of any future lease rentals (or sale proceeds) which the ROSCO could achieve for the rolling stock over the same period. This meant that if the rolling stock was handed back by the TOC and immediately leased elsewhere the terminating TOC would incur no additional costs over and above the normal costs of switching. Angel has informed us that all of their leases include this provision.

[7][✂]

[8][✂]

[9]A 'fleet' is a group of rolling stock of the same class owned by a single ROSCO that is leased to a particular franchisee. So, for example, if a TOC leases the same class from two ROSCOs on a franchise then this would comprise two fleets. The extent of substitutability in relation to each may differ depending on fleet size and available alternatives.

[10]A '*fleet of incumbent rolling stock*' is a class of rolling stock, owned by a particular ROSCO, that has been used on a franchise prior to that franchise being re-let. Leasing of incumbent rolling stock includes the leasing of both MOLA stock and the leasing of non-MOLA stock that has previously been leased. There is no difference in principle between the process of leasing either used MOLA or used non-MOLA stock—in each case the ROSCO negotiates a new lease price with the TOC.

(b) lease alternative used rolling stock[11] for the duration of the franchise; or

(c) lease each fleet of incumbent rolling stock for the first part of the franchise on a short-term lease before switching to alternative used or new rolling stock.

9. We have observed that the vast majority of incumbent rolling stock (*(a)* above) has been leased on the same franchise at franchise re-let for the duration of that franchise (see Figure 1 in Annex 2).

10. We have also observed that initial leasing of new rolling stock is different from leasing of incumbent rolling stock. In the case of incumbent rolling stock, the asset is already being used on a franchise and is owned by the ROSCO. For new rolling stock, the ROSCOs and other potential new lessors bid for the right to supply a TOC/the DfT with new vehicles. Where new rolling stock is leased, it is usually required or encouraged by the DfT to be included in franchise bids. As a result, the sensitivity of demand to a change in price for new and for incumbent rolling stock may be asymmetrical, for example, if new rolling stock constrains the price of incumbent used rolling stock, this does not necessarily mean that used rolling stock constrains the price of new rolling stock.

11. In relation to the hypothetical monopolist test, we therefore consider two 'candidate' services:

(a) the leasing of each fleet of incumbent rolling stock to a TOC (for example, the leasing of ROSCO A's Class 150s to TOC B); and

(b) the initial leasing of each fleet of new rolling stock to a TOC (for example, the initial leasing of ROSCO A's new Class 390 Pendolinos to TOC B).

12. We consider each of *(a)* and *(b)* in turn.

[11] Used rolling stock is rolling stock that has already been leased before.

13. In applying the hypothetical monopolist test to *(a)* and *(b)*, the CC's Guidelines state[12] that 'the Commission does not regard market definition as an end in itself, but rather as a framework within which to analyse the effects of market features'. We do not intend to define relevant markets for leasing of rolling stock in a precise manner at this stage, but instead consider it more useful to assess substitutability for each fleet of rolling stock at each lease negotiation to provide a framework for our competitive analysis. We set out in this working paper why we consider this to be the case.

Incumbent rolling stock

14. In this section, we assess the 'candidate service' of leasing of each fleet of incumbent rolling stock to a TOC.

15. In assessing substitutability for each fleet of incumbent rolling stock, we have considered the extent to which a TOC can lease alternative rolling stock to that of the incumbent rolling stock (as identified in *(b)* and *(c)* of paragraph 8). This is determined in part by the availability of suitable alternative rolling stock.

16. In order to determine whether leasing alternative rolling stock is a viable proposition for a TOC, we need to consider:

    (a) whether such rolling stock is *available* at the point at which a TOC requires it (such that demand can be matched by supply); and

    (b) whether such rolling stock is *suitable*[13] for a given route or set of routes on a franchise.

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[12] *Market Investigation References: Competition Commission Guidelines, CC3*, June 2003, paragraph 2.2.

[13] We explain what we mean by suitability in paragraph 35. Suitability covers technical and operational considerations, economic considerations (ie responses to changes in price) and franchise considerations.

17. We consider first the issue of timing and availability before assessing what alternative rolling stock is suitable.

Timing and availability

18. The ability for a TOC to lease alternative used or new rolling stock instead of the fleet of incumbent rolling stock on a franchise is determined by the availability of suitable alternative rolling stock at the point at which a TOC requires it.

19. The rolling stock available at the point of any franchise re-let will vary considerably. For example, the type of rolling stock off-lease at any moment in time changes as some rolling stock is returned to service and some withdrawn.[14] The ORR noted that this could mean that 'the extent to which suppliers of rolling stock face competition from rival firms can vary significantly from transaction to transaction (i.e. at the point in time at which the need for rolling stock arises)'. These differences are primarily caused by the fact that most franchises, and therefore leases, terminate at different points in time. We consider in this section how the timing difference between lease dates might be overcome so that supply can match demand.

20. In the absence of mid-lease switching, there are only two ways in which a TOC can overcome timing differences between lease dates:

(a) the TOC can sign a short-term lease so that the lease ends at the same time as the alternative rolling stock[15] becomes available;[16] or

(b) the TOC can sub-lease rolling stock on a short-term basis to or from another TOC.

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[14]See the analysis in the Capacity working paper for variations in off-lease roiling stock.
[15]This may be used or new rolling stock. New rolling stock may take time to become available, because of lead times in building new vehicles.
[16]HSBC submitted that stock that may become surplus within a couple of years of commencement of a new franchise may also act as a competitive constraint, as a TOC could take a short lease on the incumbent stock, subsequently replacing it when the other stock came off lease elsewhere.

21. We consider each of these in turn.

Short-term leases

22. A short-term lease[17] gives rise in principle to the possibility that a TOC could overcome the timing difference between lease dates.

23. Short-term leases have been used for four main purposes:

(a) to coincide with the term of the extension of franchises by two or three years;

(b) to allow for the phasing out of rolling stock that has reached the end of its economic life and the introduction of new rolling stock in its place;

(c) to take account of lead times on new rolling stock; and/or

(d) to facilitate a switch or a cascade[18] by ensuring lease end dates coincide.

24. Our initial analysis has suggested that the majority of short-term leases listed by ROSCOs related to franchises being extended (ie situation *(a)*) rather than in cases where they might facilitate the introduction of new rolling stock (ie situations *(b)* and *(c)*) or switching (situation *(d)*).

25. The incentives for a TOC to use a short-term lease to overcome timing differences between lease end dates may be weakened if the TOC has to incur an additional price premium over a long-term lease. In their responses to our questionnaire, TOCs noted that significant premiums may be charged by ROSCOs for short-term leases compared with leases that last for the franchise term. Angel and HSBC submitted that higher rentals on short-term leases are required because increased residual value risks[19] exceed the lower credit risks generated by the shorter lease period.

[17]We define a short-term lease as one that lasts for less than the full franchise term. We include leases related to franchise extensions as short-term leases.
[18]We define switching and cascades in the competitive analysis working paper.
[19]The rolling stock is secured on lease for a shorter period hence rental incomes are less certain for a greater period in future.

Angel submitted that it had tended to apply a sliding scale of rental adjustments based on a [✂] lease being [✂] per cent higher than an equivalent long-term lease and [✂] leases being [✂] per cent higher respectively. On the other hand, Porterbrook submitted that a premium was not usually charged on short-term leases.

26. This suggests that if a TOC chooses to take a short-term lease in order that it can switch to alternative rolling stock, that alternative rolling stock must provide an additional benefit to the TOC to at least match the price premium on the short-term lease, or the additional cost must be effectively underwritten by the DfT in the franchise ITT.

Sub-leases

27. Angel noted that sub-leases allowed TOCs to switch to alternative rolling stock. All three ROSCOs submitted that sub-leasing was a common occurrence between TOCs. We noted that, typically, TOCs have the right to sub-lease rolling stock for up to 28 days without the consent of the ROSCO. We understand that sub-leases have commonly been used to cover short-term demand for one or two units (for example, to cover fleet modification programmes, infrastructure upgrades, repairs after accidents and additional passenger demand, such as 'football specials'). There have been few sub-leases that cover a large number of vehicles for a period of more than six months. This suggests that only a small number of units rather than large fleets are usually available for sub-leasing in practice.

28. Sub-leases will almost always be at a premium over the rental in the main lease and, most importantly, the price to the ROSCO and the amount supplied remains unchanged. We therefore consider that sub-leasing does not act as a constraint on prices charged by the ROSCO and is not a part of the relevant market.

Our assessment of availability

29. Annex 2 presents the initial findings of our analysis on the availability of alternative classes of rolling stock. It shows that availability imposes a major constraint on the ability of ROSCOs to actually offer alternative classes to TOCs for inclusion in franchise bids.

Conclusion on timing and availability

30. Our assessment in this section suggests that differences in lease dates resulting from the franchising process have an important impact on the availability of alternative rolling stock at any given franchise re-let. We considered how these timing differences between lease dates can be overcome so that supply can match demand. We found that sub-leases do not provide a price constraint on the ROSCO. We also considered that if a TOC chooses to take a short-term lease so that it can switch to alternative rolling stock, that alternative rolling stock must provide an additional benefit to the TOC to at least match the price premium on the short-term lease, or the additional cost must be effectively underwritten by the DfT in the franchise ITT.

Suitability of alternative rolling stock to incumbent rolling stock

31. In this section we assess whether rolling stock is an alternative to each fleet of incumbent rolling stock on a franchise by considering whether it is suitable for a given route on a franchise.[20]

32. As noted in paragraph 8, substitution opportunities away from incumbent rolling stock arise from two sources:

(a) used rolling stock; and/or

[20]We explain suitability in paragraph 35.

(b) new rolling stock.

33. We consider each in turn.

34. In considering the hypothetical monopolist test, one difficulty is that the existing price may be significantly above (or below) the price level that would result from a fully competitive market. If prices are above competitive levels, then the application of the hypothetical monopolist test by reference to current prices might result in an erroneously wide market definition.

Substitution from incumbent rolling stock to used rolling stock

35. We have identified four factors that determine whether a specific class of used rolling stock is a suitable alternative to another specific fleet of incumbent rolling stock. We consider these in detail in Annex 1 but summarize them here:

(a) Technical substitutability—whether a particular class of rolling stock is physically capable of running on a particular stretch of track. We identified five main features which determine technical substitutability: (i) gauge and wheel spacing, (ii) structure and loading gauge, (iii) electrification, (iv) axle weight, and (v) signalling and communications systems.

(b) Operational substitutability—whether TOCs' business requirements for certain rolling stock features limit substitutability. We identified five key characteristics: (i) matching capacity and demand (particularly in relation to fleet size), (ii) whether the rolling stock requires certain performance levels (for example, speed), (iii) door or seat configurations, (iv) coupling compatibility, and (v) safety considerations.

(c) Economic substitutability—whether some classes of rolling stock would not be substituted for others (even at the margin) in response to a lease price increase

because of a significantly greater leasing and operating cost, making them unattractive alternatives.

(d) Franchise specificity—the extent to which the DfT's ITTs directly or indirectly restrict the type of rolling stock that can be used on a particular franchise, or whether in practice the DfT may be prepared to accept alternative possibilities to its initial proposals.

36. Angel, HSBC and Porterbrook all agreed with the proposition that the technical and operational characteristics of rolling stock place some limits on the interchangeability of certain classes of rolling stock. In the remainder of this section we set out our approach to considering rolling stock substitutability.

Our approach to assessing rolling stock substitutability

37. In assessing substitutability, we consider factors *(a)* to *(d)* above for each fleet of incumbent rolling stock. The following example illustrates why it is necessary to carry out our analysis on a case by case basis and why it is not possible to draw any general conclusions:[21]

(a) On the Midland Mainline franchise, Class 222 Meridians were used. The ROSCO owning these Class 222s considered that Class 180 Adelantes and High Speed Trains (HSTs) were the only suitable alternative used rolling stock based on technical *and* operational requirements. A hypothetical monopolist test might therefore lead to a market comprising Class 222s, Class 180s and HSTs (although we make no judgement at this stage on whether this is the case).

(b) If we now consider the Class 180 Adelantes used on First Great Western, conducting a hypothetical monopolist test might lead to a different market definition. The owning ROSCO in this case considered that the HSTs and class

[21]This example is illustrative, based on each ROSCO's responses, and does not take into account the availability or otherwise of the alternatives, or whether the alternative rolling stock was actually proposed by the TOC as an alternative.

220s, 221s and 222s were suitable alternatives for this rolling stock based on technical *and* operational considerations. The relevant market in this case might therefore comprise class 180s, 222s and HSTs, as in (a), but would also include class 220s and 221s.

(c) In the two scenarios described above, market definition differs. We could not therefore conduct a competitive analysis on each of the Class 180s and Class 222s using the same market definition because it differs in each case.[22]

38. This example highlights that substitutability differs depending on the starting point for the hypothetical monopolist test due to different technical, operational, economic and franchise requirements. This means that it is unlikely to be appropriate to adopt an approach to defining markets by categorizing certain classes of rolling stock together into types[23] of rolling stock.[24]

39. We asked the ROSCOs, the DfT and the TOCs to list technical and operational alternatives for each fleet of rolling stock on each franchise. Annex 2 presents the initial findings of our analysis of rolling stock substitutability based on these responses. It shows that operational characteristics impose a considerable constraint on the extent of substitutability of rolling stock classes.

Substitution from incumbent rolling stock to new rolling stock

40. In this section we assess the extent to which new rolling stock can be an alternative for incumbent rolling stock. Although rolling stock must be capable of running on the required route, we do not consider the same four factors in paragraph 35 because new rolling stock can be made and designed as the TOC requires. Accepting that

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[22]We consider chains of substitution in paragraph 70.
[23]A 'type' of rolling stock is one which categorises a number of classes according to their features, such as 'high speed inter city', 'low speed EMU suburban', etc.
[24]Angel noted that 'each re-franchising exercise and each leasing transaction is unique and turns exclusively on its own facts'. Angel also noted that 'specific competitive pressures can only be captured on a case-by-case basis, rather than through formal market definition'.

switching to new rolling stock may be possible, we therefore consider whether the price of new rolling stock acts as a constraint on the price of the fleet of incumbent rolling stock.

41. At privatization, prices for incumbent rolling stock were set using indifference pricing. The Information Memorandum produced when selling the ROSCOs stated that:

> In the absence of an active leasing market in passenger rolling stock in Great Britain, the method for calculating the initial lease prices was based on the finance lease rental of equivalent replacement rolling stock adjusted to reflect the revenue and cost characteristics of existing rolling stock and to include operating lease premia. Discounts of between 10 and 20 per cent, depending on the vehicle type, were imposed on the likely purchase price of the replacement [rolling] stock in order to anticipate possible future reductions in the price of rolling stock. The objectives of this approach to pricing were to establish reasonable relationships between the lease prices of different types of [rolling] stock; to avoid discouraging investment in new rolling stock or premature scrapping of older [rolling] stock; and to represent a reasonable approximation to the prices which would pertain in the longer term in a competitive market, thereby encouraging the development of a competitive market in the supply of rolling stock.

42. The use of indifference pricing was important because it effectively placed a ceiling on incumbent rolling stock prices. Indifference pricing at privatization did not consider alternative used rolling stock prices because a market for used stock did not exist.

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43. If a market in used rolling stock has emerged since privatization, then alternative used rolling stock prices would act as a constraint on incumbent rolling stock prices. We would expect the lease rentals of used rolling stock to be determined by the interaction of supply and demand so that they are priced according to the marginal rolling stock. By 'marginal' rolling stock we mean rolling stock for which some spare capacity exists. In the absence of spare capacity for alternative used rolling stock, we would expect to see new rolling stock instead of alternative used rolling stock acting as the constraint on incumbent rolling stock prices. As the extent of spare capacity for alternative used rolling stock has been determined in the past, our assessment of spare capacity for alternative used rolling stock is therefore important for understanding market definition.

44. Evidence from the ROSCOs suggests that in some cases the price of new rolling stock does provide the constraint on pricing of incumbent rolling stock:

(a) Angel submitted that the threat of new rolling stock was always present, for example on Class 317s on Greater Anglia and Class 465/6s on Southeastern.

(b) HSBC highlighted the importance of its indifference pricing methodology for incumbent rolling stock, which takes account of potential competition from new rolling stock: '[The] price for lease renewal is constrained by having regard to the price and utility of new trains—which serves as a ceiling price for any lease renewal'. [✂]

Summary of our view on leasing of each fleet of incumbent rolling stock

45. In relation to leasing of each fleet of incumbent rolling stock, we consider that:

(a) Market definition differs depending on the starting point for the hypothetical monopolist test and the effect of technical, operational, economic and franchise requirements of different franchises. Our analysis of substitutability shows that operational characteristics impose a considerable constraint on the extent of

substitutability of alternative rolling stock classes for the incumbent fleet of rolling stock.

(b) We do not intend to define relevant markets in a precise manner at this stage but will assess substitutability in relation to each fleet of rolling stock at each lease negotiation.

(c) A number of relevant markets are likely to exist in relation to incumbent rolling stock. At their narrowest, where there is a lack of available alternatives, these markets consist of each fleet of incumbent rolling stock on a franchise. However, wider markets, comprising available classes of used rolling stock with similar characteristics, may also exist.

(d) The constraint on ROSCOs' incumbent rolling stock in some cases appears to come from new rolling stock rather than alternative used rolling stock. This reflects the fact that there are capacity constraints for certain classes or types of used rolling stock such that new rolling stock is the only available alternative.

New rolling stock

46. In this section we consider the 'candidate service' of leasing of each fleet of new rolling stock to a TOC.

47. For new rolling stock, the ROSCOs and other potential new lessors bid for the right to supply a TOC/the DfT with new vehicles.[25] Constraints on new rolling stock prices arise at the point at which new rolling stock is proposed by a TOC/the DfT. A 5 per cent price increase might lead to switching to used rolling stock (or not purchasing new vehicles) if used rolling stock is seen by TOCs and the DfT as a viable alternative. However, in cases where new rolling stock is required by the DfT there is

[25]At present this tender process is conducted by each TOC, but for the Intercity Express Programme this process will be run by the DfT.

unlikely to be an alternative to the new rolling stock. This may also be the case if alternative used rolling stock is at the end of its useful economic life or is unavailable.

48. Market definition for new rolling stock will therefore vary depending on the viability of alternative used rolling stock. At its narrowest, the relevant market is a market for the right to lease each fleet of new rolling stock. Given that new rolling stock competitions are conducted in this way, this seems the most practical approach to take. However, alternative used rolling stock may also be part of the same market if it is considered to be a credible alternative to new rolling stock.

49. Angel and Porterbrook both noted that market definition should take into account alternative forms of supply of new rolling stock, through other funding arrangements. However, as noted in Annex 2 of the Entry working paper, the timing and extent of any proposed alternative funding arrangements remain uncertain. At present, we have not seen any evidence on the extension of such practices to other rolling stock and its competitive effect on leasing therefore remains speculative.

Geographic market

50. In relation to geographic market, the ROSCOs each operate across Great Britain with no operations in Northern Ireland. Rolling stock cannot be transferred between Great Britain and Northern Ireland without major modification.[26]

51. The ROSCOs agreed with the statement that leasing companies active outside Great Britain could not enter the Great Britain market through using rolling stock that has

[26]Northern Ireland (and the Republic of Ireland) have a track gauge of 1,600mm rather than the 1,435mm (or 'standard gauge') in Great Britain and much of the rest of the world.

previously been used outside Great Britain. This is due to a lack of interoperability with European rolling stock.[27]

52. Third parties also supported this view:

(a) None of the TOCs considered using rolling stock which had previously been used outside Great Britain to be a viable proposition due to physical and technical differences (principally the larger loading gauge on overseas railways, but also differences in power supply and signalling system interfaces, as discussed in Annex 1).

(b) The DfT stated that used rolling stock from other countries would generally require prohibitively expensive capital investment in order to make it suitable for the Great Britain market.

53. We therefore consider that the geographic market definition does not extend beyond Great Britain due to technical incompatibilities of rolling stock from outside Great Britain.

The parties' views on market definition

54. In this section, we set out how the parties have defined the relevant market(s) and note where we disagree with their approaches. We consider the views of:

(a) the ROSCOs;

(b) the ORR; and

(c) the DfT.

ROSCOs

55. The ROSCOs each submitted that the relevant market is a single market for the leasing of rolling stock in Great Britain.[28] As set out above, we do not agree with a

[27]Angel pointed out that it was possible to convert certain non-British-built rolling stock to operate in Great Britain, but that this

market for all types of rolling stock as this would ignore issues of timing and technical and operational substitutability.

56. The ROSCOs raised four further issues in relation to market definition:

(a) supply-side substitution;

(b) critical loss;

(c) self-supply; and

(d) chains of substitution.

57. We consider each of these in turn.

Supply-side substitution

58. Supply-side substitution occurs when a price rise prompts other firms to start supplying, at short notice, an effective substitute to the product in question. We discuss entry by other financial institutions into rolling stock leasing in the Entry working paper. Given issues of technical and operational substitutability, this is not possible for many types of rolling stock without major modifications being made.[29] These modifications may be extensive interior reconfigurations to address operational issues or more fundamental conversions (for example, to dual voltage) to address technical issues. These types of conversions can be costly and take considerable time.

59. We considered examples of some of the conversions that have taken place or have been proposed on fleets of used rolling stock to enable the vehicles to operate on other routes.

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would be unlikely to happen in the short term.

[28]Angel took the view that there is 'a single market for the supply of rolling stock to operators of passenger railway services in Great Britain'. We discuss self-supply in paragraph 63.

60. We found that certain conversions take considerable time and cost to complete. In particular:

(a) Conversion to dual voltage has only occurred in the context of Angel's Class 350s and this was not a conversion of a vehicle already in service but a re-specification prior to the units being built. No other vehicles have been converted to dual voltage and quotes that have been sought suggest that the cost and time of doing so are onerous. HSBC converted its Class 365 fleet from DC to AC operations. This took place within a relatively short timescale and at relatively low cost on a per-unit basis. However, the cost across the 16-unit fleet was [✂].

(b) Other conversions to interiors have occurred and have mostly taken in excess of 12 months and considerable cost on a per-unit basis.

61. This suggests that supply-side substitution is not a particularly relevant constraint on the fleets of incumbent used rolling stock. Rolling stock is unlikely to be considered a viable alternative, in response to a 5 per cent price increase, if it requires anything more than minor modifications (eg the driver cab modifications on the Class 508s converted for use by Silverlink), given the extensive cost and time it would take to enable that rolling stock to be used.

62. Angel and Porterbrook submitted that supply-side considerations supported a Great-Britain-wide rolling stock market given that the activity of operating leasing is essentially the same across rolling stock types and across franchises and there are few, if any, differences in suppliers across rolling stock type. However, even if a ROSCO acts as a lessor across types of rolling stock, this does not confirm that these rolling stock types are supply-side substitutes; it only tells us that there may be some benefits to holding a portfolio of types of rolling stock. For example, we would

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[29]Even after these modifications, TOCs must still demand the alternative (demand-side substitutability) in order for it to act as a constraint on price.

not consider that HSTs are a supply-side substitute for Pacer DMUs (and are therefore in the same market) solely on the basis that the same ROSCOs own these classes of rolling stock.

Self-supply

63. Porterbrook submitted that self-supply by a TOC would be in direct competition with the services supplied by the ROSCOs and hence may be a demand-side substitute. We have considered self-supply in Annex 1 of the Entry working paper and noted its very limited scope and the economic reasons why TOCs do not engage in self-supply to any material extent. We have noted that it was not a significant competitive constraint on ROSCOs and may only provide a constraint on certain classes of rolling stock through some form of negotiating power. We consider the extent of this negotiating power in the Customer Behaviour working paper.

Critical loss analysis

64. In assessing the competitive constraints created by alternative rolling stock, Angel presented a critical loss analysis to show that a competitive threat to only a small portion of one of its fleets is sufficient to place the whole fleet under significant price pressure.

65. Angel's analysis highlighted the additional costs of rolling stock being off-lease (increased residual value risk, opportunity cost of lost rentals, and warm or cold storage costs, as explained in the Capacity working paper). Porterbrook also noted that 'given the storage and opportunity costs associated with having off-lease [rolling] stock … there are strong incentives on ROSCOs to ensure that the [rolling] stock they own is in use'. Angel suggested that these costs lead to 'a situation where,

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conceptually, the marginal costs of leasing a piece of rolling stock can be regarded as being negative'.

66. Using the [✂] as an example, Angel submitted that the additional cost of not leasing (the negative marginal cost of leasing) would be around £[✂] per vehicle per day (£[✂] per month) for warm storage. Table 1 shows Angel's critical loss calculation based on these costs.

TABLE 1 **Angel's critical loss analysis for its** [✂]

	£ per month
Revenue	
Warm storage costs (marginal costs)†	
Price-cost margin	
Price cost margin (m) (%)	✂
Critical loss for 5% price increase (%)*	
Number of vehicles in fleet	
Critical loss (vehicles)	

Source: Angel's responses to ORR's additional questions of 24 August 2006, Annex.

*Critical loss for a 5 per cent increase is derived using the formula 0.05/(m+0.1) where m is the initial price-cost margin. It assumes linear demand.
†Angel noted that marginal costs from leasing might exist but they were likely to be negligible. Maintenance costs are covered by separate non-capital charges.

67. Although Angel accepted that the example was highly stylized, it submitted that the calculation in Table 1 illustrated that a hypothetical monopolist would not be able to increase prices by 5 per cent profitably if any more than [✂] per cent of the fleet, or [✂] vehicles, were to go off-lease.

68. The DfT rejected the critical loss approach (although it did not have sight of Angel's calculations) on the following grounds:

(a) A monopolist will charge what the market will bear, not the marginal cost.

(b) Only in conditions of effective competition will a supplier have to price at the level of its hypothesized (low) marginal costs.

(c) A ROSCO would be perfectly capable of offering targeted discounts which would induce a TOC to lease the entirety of a fleet rather than just a proportion of it.

69. We consider that Angel's critical loss analysis is uninformative given the characteristics of leasing of rolling stock. Rolling stock is an example of a durable good.[30] There are few short-run marginal costs, because costs are driven by the initial capital expenditure on the asset. Consequently price is not set at marginal cost.[31] Instead, the price-setting problem for rolling stock lessors relates to average costs (recovering the initial outlay and any marginal costs that they may subsequently incur). In this context, any critical loss analysis based on marginal costs can be misleading.

Chains of substitution

70. HSBC noted that the competitive conditions for one fleet of rolling stock can have an effect on other fleets of rolling stock across the country. This appears to be an argument suggesting that there are chains of substitution between rolling stock that may not be direct substitutes. In other words, if Class 150s are a direct substitute to Class 153s and 142s, but Class 142s are not a direct substitute to Class 153s, a chain of substitution may run from Class 153s to 150s to 142s. Despite not being direct substitutes, Class 142s and 153s may be considered to be in the same market if they are constrained by their common relationship with Class 150s. Whilst this is possible for some classes of rolling stock, it is highly likely that breaks and asymmetries will occur in any chain of substitution because of the very different technical and operational nature of different classes of rolling stock. As noted above, we will be considering substitutability on a fleet by fleet basis to reflect these differences.

[30]A durable good is a good which yields services or utility over time rather than being completely used up when used once.

[31]Angel suggested that marginal cost may even be negative, such that if price was set at marginal cost, the ROSCO would be paying the TOC to take the rolling stock.

ORR

71. The ORR's 1998 investigation into rolling stock leasing did not include an analysis of market definition. It did, however, (whilst not discussing this within a formal market definition framework) allude to the possibility of dynamics that would suggest the existence of more than one market in the way that it, for example, considered whether the ROSCOs might have market power '… in respect of all of their activities or, for example, only some types of rolling stock …'.[32] In its reference to the CC, the ORR opted not to undertake a formal market definition exercise. Instead, it progressed to a direct assessment of the competitive conditions faced by each of the ROSCOs.

72. We agree with the ORR's statement that 'even a firm that has a relatively small share of the total combined volume of a particular type of stock may find itself able to exercise market power in a situation where most or all [rolling] stock of this type is committed to other uses at the time of re-franchising'. This is why we have conducted our analysis by examining the competitive constraints on each fleet of rolling stock at each lease negotiation.

73. However, the ORR took the view that the market is 'likely to be characterised by distinct product markets split by type of [rolling] stock'. We accept that substitutability may lead to some markets that are characterized by, say, 70mph suburban DMUs, but we consider that this definition cannot be applied across all classes of rolling stock that fall into such categories owing to the complexities of technical and operational substitutability and issues of timing. This means that although a fleet of rolling stock may be an alternative on one franchise, it does not mean it is also an alternative on another franchise.

[32]See ORR's Review of the Rolling Stock Market, Report to the Deputy Prime Minister, May 1998.

DfT

74. The DfT proposed that the leasing of rolling stock is 'discontinuous' and 'not really a single market at all, but rather a series of markets which are only active for a comparatively short period. These individual markets are markets to provide rolling stock for particular rail franchises'. 'The markets only exist for the leasing of rolling stock at the times that franchises are being re-let.'

75. The DfT also produced a table with rolling stock split into three categories: 75mph branch line, 90–100mph interregional and 125mph intercity. However, the DfT saw 'no value … in refining [the table] in an attempt to develop a definitive market segmentation which applies in all circumstances'. In addition, 'the actual set of competing rolling stock needs to be considered on a case by case basis at the time of each franchise renewal given the specific circumstances pertaining to that situation, including the availability of alternative rolling stock'.

76. Angel submitted that the DfT's approach of separate markets for the provision of rolling stock for each franchise was 'internally inconsistent': 'since franchisees often offer a number of different types of service, using a variety of different types of rolling stock, [the market would be] both potentially narrower than a single franchise and potentially broader since most types of rolling stock are used on a number of different franchises across the network'.

77. Our approach to substitutability differs from the DfT's in that it accepts that markets can be narrower than a single franchise (because of different fleets of rolling stock on a franchise) or broader (where alternative rolling stock on other franchises can act as a constraint).

Our approach to rolling stock substitutability

1. The aim of this annex is to introduce and explain the factors that influence demand-side substitutability of types of rolling stock on the rail network of Great Britain.

2. We first identify the high-level characteristics of the Great Britain rail infrastructure and explain the key factors that govern the operation of rolling stock. We then consider the high-level characteristics of Great Britain rolling stock and set out the fundamental technical factors that permit or prevent substitutability. We then consider these two aspects together to reveal the extent to which substitutability is limited by technical constraints—ie whether a particular type of rolling stock is physically capable of running on a particular route.

3. Having established the technical constraints on substitutability, we then briefly consider other ways in which rolling stock substitutability may be restricted:
   (a) Operational substitutability—which examines the interplay between TOCs' business requirements and rolling stock features, such as whether the rolling stock requires certain performance, door or seat configurations, capacity, or coupling compatibility in order to deliver business requirements.
   (b) Economic substitutability—which considers whether some types of rolling stock would not be substituted for others (even at the margin) in response to a lease price increase because of significantly greater costs of leasing or operation.
   (c) Franchise specificity—which assesses the extent to which the DfT's franchise ITTs restrict directly or indirectly the rolling stock that can be used on a particular franchise.

The Great Britain rail infrastructure

4. Rail infrastructure comprises all assets and associated systems other than rolling stock and includes track, bridges, tunnels, signals, electrification equipment, stations, depots etc.

Who operates the infrastructure?

5. Most Great Britain rail infrastructure is owned, managed and maintained by Network Rail.[33]

6. There is a small incidence of franchise operations (eg Chiltern Railways) extending on to routes operated by London Underground Limited (LUL) and requiring specific modifications to the rolling stock as a result[34] or on to private railways such as Dartmoor Railway. However, this has negligible impact on substitutability due to the very low incidence.

7. As a result, most Great Britain rolling stock operates on infrastructure built and managed to a common set of Network Rail or industry standards, albeit with very different technical features, as we discuss below.

Technical features

8. Compatibility of rolling stock to operate on a given part of the infrastructure is a function of the characteristics of both the infrastructure and the rolling stock and of the way in which those characteristics interact. However, for any part of the Great Britain infrastructure there are certain fundamental characteristics that govern its use by any particular type of rolling stock. Compatibility with these fundamental

[33]A notable exception is the Channel Tunnel Rail Link (CTRL) which is owned by London and Continental Railways (LCR) and is managed and maintained by Network Rail (CTRL) Ltd, a wholly owned subsidiary of Network Rail. The CTRL provides a high-speed rail route between London St Pancras and the Channel Tunnel, Ashford, Ebbsfleet and Stratford.
[34]The LUL signalling system requires rolling stock to be fitted with 'trip cocks' which apply the brakes if a stop signal is passed.

characteristics must be satisfied regardless of any business or other considerations. These are considered here as technical features:

(a) The spacing between the two rails—referred to as the 'gauge'. All railway managed by Network Rail in Great Britain has the same gauge, nominally 1,435mm. The major part of the railway network in the rest of Europe also has this same gauge.

(b) Axle weight limit—the maximum load that can be supported by the track and particularly any bridges and viaducts over which it passes. Axle weight limits for the Great Britain rail network are indicated in Network Rail's 2004 Technical Plan.[35]

(c) The clear space around the railway corridor through which rolling stock can pass without striking tunnels, bridges, signals or station platforms—referred to as the 'structure gauge'. In Great Britain the structure gauge is generally smaller than in other countries—including the rest of the European rail network—and it is a significant constraint on freight and passenger capacity because trains cannot, therefore, be made wider or taller. The structure gauge is not the same throughout Great Britain. Some routes have been expanded for handling larger rolling stock, such as containerized freight traffic. The CTRL has been constructed to accommodate a larger European structure gauge.

(d) The electrification system, where provided, from which trains can collect power. In Great Britain two systems are in use: a 'third rail' alongside the track supplying 660/750v DC and an 'overhead line' above the track supplying 25kV AC.[36,37] Some 13,000km (40 per cent) of the Great Britain rail network is electrified, with two-thirds using overhead line and one-third using third rail. Broadly the intercity routes between London and Birmingham, Liverpool, Manchester, Leeds,

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[35]Network Rail's 2004 Technical Plan, Section 11 Network capability: www.networkrail.co.uk/documents/3150_2004businessplannetworkcapability.pdf).

[36]Alternating Current, single phase as in domestic household supplies but at a significantly higher voltage.

[37]A small amount of electrification at 1,500v DC is provided for Sunderland Metro, but this is considered to have a negligible impact on the assessment of substitutability.

Norwich, Edinburgh and Glasgow are electrified with overhead lines, as are commuter routes around Glasgow, Greater Manchester, Birmingham and North and East London. The rail network south of London is largely electrified with third rail as is the Merseyrail network. Electrification on the Great Britain rail network is indicated in Network Rail's 2004 Technical Plan.[38] The third rail electrification system is unique to Great Britain whilst the overhead line system is used across much of the rest of Europe, albeit with significant technical differences preventing direct compatibility with Great Britain.

(e) The signalling and communications systems which detect the location of trains and control their movement to deliver the timetable and ensure safety from collision. With the exception of the CTRL, Great Britain railways are mainly fitted with trackside signals—either mechanical semaphore or multiple-aspect colour light signals which operate on a relatively common basis. However, in parts of East Anglia, north and west Scotland and the Cambrian Line, Radio Electronic Token Block (RETB) signalling is used. RETB confers by radio absolute use of a particular section of track to a single train, thus avoiding the need for trackside signalling. To reduce the reliance on drivers acknowledging and interpreting the trackside signals, further automatic systems are fitted to trains and infrastructure (eg Automatic Train Protection (ATP);[39] Train Protection and Warning System (TPWS)[40]). The CTRL is fitted with a TVM 430 system[41] that displays signals in the driver's cab. Technical interaction with the rolling stock is required in all signalling systems in Great Britain.

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[38]Network Rail's 2004 Technical Plan, Section 11 Network capability: www.networkrail.co.uk/documents/3150_2004businessplannetworkcapability.pdf.

[39]A system to monitor the train speed and intervene with an application of the brakes if the driver fails to respond appropriately to signals advising that speed should be reduced. ATP is fitted on the Chiltern Line and the Great Western Main Line.

[40]The report into the 1988 Clapham incident recommended the national implementation of ATP. In 1994 the decision was taken to develop TPWS instead of implementing either of the pilot ATP schemes.

[41]Transmission Voie-Machine (track to train transmission) continuous cab signalling and speed supervision system installed on the CTRL.

9. In practice, of technical features *(a)* to *(e)*, it is primarily *(c)* and *(d)* that cause issues of compatibility for rolling stock within the Great Britain rail network since the others are broadly standard.

Operational factors

10. The use of the rail network for varied passenger and freight traffic leads to further operational characteristics, such as:

(a) *Line speed*. The maximum speed at which traffic can operate on the route is set by such parameters as the curvature, the track substructure[42] and the standards to which the track is maintained. Different maximum speeds are often set for different types of rolling stock: for example, heavy freight trains may be restricted to a lower speed whilst tilting trains such as Pendolinos may be permitted to travel at higher speeds (where the infrastructure is fitted with the appropriate tilt control system). Line speeds for the Great Britain rail network are indicated in Network Rail's 2004 Technical Plan.[43]

(b) *The timetable*. The whole variety and density of traffic using a route will determine the moving slot that may be occupied by any given train, and hence will dictate the performance capabilities (such as station dwell time,[44] acceleration, top speed etc) it must have in order to avoid disrupting the other traffic.

(c) *Platform lengths*.[45] The physical length of the station platform, the track layout and, more critically, the signalling system dictate the length of train that can be

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[42]The foundations, drainage, permeable membranes etc underneath the track.
[43]Network Rail's 2004 Technical Plan, Section 11 Network capability: www.networkrail.co.uk/documents/3150_2004businessplannetworkcapability.pdf.
[44]The time for which a train is stationary during a station stop; including the time for releasing door locks, opening the doors, closing the doors, dispatch safety procedures, releasing the brakes, engaging the drive system, as well as the period allowed for passengers to board and alight.
[45]The height of platforms and their distance from the track are standard in Great Britain although many platforms do not conform. As a result, the compatibility of rolling stock with all platforms on a proposed new route must be verified and ensured prior to operation.

accommodated on any particular part of the network without causing disruption to other services.

Great Britain passenger rolling stock

11. Passenger rolling stock has changed significantly over the last 20 years. The traditional concept of a locomotive powered by steam, diesel or external electrical power hauling an assembly of many (up to perhaps 14 or 15) unpowered carriages has been largely superseded. In its place have emerged two principal types of train: *(a)* fixed formation train sets, and *(b)* multiple units. Examples of these types are set out in Table 1.

TABLE 1 **Train types**

	Diesel	*Electric*		
		Third rail (660/750v DC)	*Overhead line (25kV AC)*	*Dual voltage (third rail & overhead line)*
Fixed formation train sets	Examples: HST, Class 67 with trailer coaches and driving trailer	Examples: None	Examples: IC 225, Pendolino, Class 90 with trailer coaches & driving trailer	Examples: Eurostar
Multiple units	Examples: Turbostar, Adelante Diesel Electric Multiple Units Examples: Voyager, Meridian	Examples: Desiro	Examples: Juniper	Examples: Electrostar

Source: CC analysis.

Fixed formation train sets

12. Fixed formation train sets may be electric or diesel powered and they include High Speed Trains (HST or Intercity 125), Pendolinos, Intercity 225s (IC225) or semi-permanent formations comprising a locomotive, a driving trailer vehicle[46] and a number of trailer coaches in between. In the case of HST sets, IC225 sets or locomotive and coach formations, individual intermediate vehicles may be added or removed easily to alter the train length or for maintenance or overhaul purposes.

[46]A locomotive provides the traction and auxiliary power for the train and has a driving cab at one or both ends to control the locomotive and train functions. A driving trailer vehicle has a driving cab at one end and the controls required to operate the locomotive and train functions whilst located apart from the locomotive—usually at the opposite end of the train.

However, the fixed formation train set is, for practical purposes, operated as if permanently coupled. Although much of the equipment is concentrated in one or more locomotive vehicles (which contain little or no passenger accommodation as a consequence), the formation has a driving cab at either end and can be driven in either direction—reversing quickly at terminal stations—regardless of from where within the train the power is provided.

13. Electric locomotives draw electrical power from the third rail or overhead line equipment and, under the driver's control, deliver traction power to the wheels to haul the train and usually, in the case of passenger trains, auxiliary power to the train for lights, air conditioning, catering and other facilities, such as passenger information systems, toilets, etc. Diesel locomotives deliver traction and auxiliary power from diesel fuel carried on board the locomotive using a diesel engine.

14. Trailer coaches are unpowered vehicles relying on a locomotive for traction and auxiliary power and those operating currently on the Great Britain rail network have been built in a number of generations. Mark I coaches were built during the 1950s and early 1960s with a 20m-long non-structural steel body on a robust structural steel underframe (or chassis) to carry the weight and accommodate the longitudinal loads. This vehicle design was also used for Mark I Electric Multiple Units (see paragraph 18*(a)*) which were the subject of a major Mark I train replacement programme in the late 1990s and early 2000s. Mark I vehicles offer poor collision protection and have now been withdrawn from service except for small numbers—mainly in heritage and charter operations. Mark II coaches are also 20m long and were built during the mid-1960s to mid-1970s on a semi-integral steel body concept with wrap-around body ends and improved facilities including, on later models, fluorescent lighting and air conditioning. The Mark II fleet has also largely been withdrawn except for relatively small numbers. In the 1970s Mark III coaches employed an integral 23m-long steel

body design offering greater strength and collision protection. Mark IV coaches employed an integral 23m body design in aluminium with power operated doors. Built between 1989 and 1992, the Mark IV coaches are confined to operation in the IC225 trains.

15. HST sets incorporate specially-adapted Mark III coaches operated between an HST 'power car' (locomotive) at either end. Although structurally similar to normal Mark III coaches, HST trailer coaches are not interchangeable without significant and expensive modification.

16. We have considered here the principal fixed formation train sets in common use. There are also relatively small numbers and varied types of locomotives and coaches available and in use but which have not been included.[47] Locomotives and coaches may be used at the margin to supplement or substitute for services for which we would consider fixed formation or multiple unit rolling stock to be the principal candidates.

Multiple units

17. In multiple unit trains, each unit[48] can operate individually, or a number of similar units may be coupled together and operate as a single longer formation. The bulk of the equipment (eg traction system, auxiliaries, control equipment etc) is distributed among the vehicles within the multiple unit and placed below floor level rather than being concentrated on a single vehicle. As a result, the space to carry passengers is maximized but in many cases it becomes impossible to remove individual vehicles without the unit becoming inoperable.

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[47]For example, the Anglo-Scottish and West Country sleeper trains comprise Mark II and Mark III (sleeper) coaches and are hauled by locomotives.
[48]A unit describes the normal discrete formation and comprises a number of vehicles between one (in the case of Class 153 only) and eight.

18. There are two types of multiple unit:

(a) Electric Multiple Units (EMUs) rely on an external source of electrical energy which is transmitted to the train through the third rail or the overhead line (see paragraph 8*(d)*). Some classes of EMU will operate on both AC and DC power whilst others still are equipped to operate on one or other but have the facility pre-installed from build to be modified easily for dual-voltage mode. EMUs with AC electric power or dual voltage are all class numbers beginning with 3xx. EMUs with DC electric power are all class numbers beginning with 4xx or 5xx.

(b) Diesel Multiple Units (DMUs) derive all power required from diesel engines and fuel carried on board; accordingly the operation of DMUs is not constrained by the need for electrification infrastructure and DMUs can be substitutable for other DMUs or for EMUs or fixed formation train sets. Diesel Electric Multiple Units (DEMUs) such as Class 220, 221 and 222 are a subset of the DMU type, having an electrical transmission system on-board. However, this feature does not affect their basic substitutability for other DMUs. DMUs are all class numbers beginning with 1xx; DEMUs are all class numbers beginning with 2xx.

Technical factors

19. As for the rail infrastructure, there are corresponding fundamental characteristics for rolling stock that govern its compatibility with the infrastructure:

(a) The spacing between the wheels. All Great Britain main line rolling stock is constructed to operate on the same common Great Britain rail gauge (1,435mm).

(b) The 'kinematic envelope'. This is the complete profile at each point along the track that will contain the extremities of a particular type of rolling stock as it traverses the route normally—essentially it is the physical height and width of the train, including any sway or bounce on its suspension and overhang on curves. The kinematic envelope is a function of a number of factors: the static profile of the rolling stock (historically referred to as the 'loading gauge'), the length of each

vehicle, the suspension characteristics, the geometry of the track and the speed of the train—since all these factors will influence the extension of the rolling stock towards the infrastructure alongside, above or below as it passes or towards other rolling stock passing on adjacent tracks.

(c) *The electrification system.* Great Britain rolling stock may be fitted with third rail electrification, overhead line electrification, both types of electrification, or in the case of diesel rolling stock neither. Many modern EMUs fitted with AC or DC electrification have been built with the facility to be converted easily at a later stage for dual-voltage operation. In the past, some main line rolling stock has been built to operate both on DC electrification and independently using a diesel engine carried on board: for example, Class 73 locomotives. However, this capability is not present in any rolling stock currently used on franchised passenger services.[49]

(d) *Axle weight.* This is a function of the weight of the vehicle and the number of axles on which it is supported. Most passenger vehicles are significantly lighter than locomotives and freight vehicles, for which the track is generally designed, and they generally have four axles per vehicle. However, Class 67, 90 or 91 locomotives that may be employed to haul passenger trains are much heavier and have much higher axle weights. Articulated rolling stock[50] such as the Eurostar has fewer axles per vehicle and therefore the axle weight is usually increased. It should be noted that the weight of the rolling stock has other implications for compatibility besides axle weight (see paragraphs 33 and 40).

(e) *The signalling and communications systems.* For operation on the Great Britain rail network, the signalling and communications systems such as TPWS are fitted throughout the range of main line rolling stock. In order to operate on the Great

[49]Some Class 73 locomotives may still be used for depot shunting, maintenance and breakdown recovery duties.
[50]Articulated rolling stock is designed to share running gear (axles, wheels, suspension etc) between adjacent vehicles therefore increasing the loads on each set of running gear but reducing the total amount of running gear.

Western Main Line and the Chiltern Line, the rolling stock has been fitted with ATP.

20. Of technical features *(a)* to *(e)*, it is primarily *(b)* and *(c)* that cause differences in the rolling stock used in Great Britain.

21. Great Britain rolling stock has many similarities with rolling stock operating elsewhere in the world and especially in the rest of Europe, particularly in the design concepts, the operating principles and the equipment used. For example, Class 373 Eurostar sets built to operate between London and Brussels, Paris and further on to the French rail network have operated in regular service on GNER routes out of Kings Cross.[51] However, there are important limitations. The critical difference is that of kinematic envelope and structure gauge. Great Britain rolling stock built for the smaller Great Britain structure gauges could potentially operate elsewhere but other wider and taller rolling stock will not easily operate in Great Britain.

Implications of technical characteristics for rolling stock substitutability

22. Taking track characteristics and rolling stock characteristics together reveals the extent to which substitutability is limited by technical constraints, ie whether a particular type of rolling stock is physically capable of running on a particular stretch of track. In this section we consider each of the technical factors identified above and how they interact with one another to limit substitutability:

- gauge and wheel spacing;
- structure and loading gauge;
- electrification;

[51]The Eurostar rolling stock and completion of the Channel Tunnel preceded the CTRL and the trains were built to operate on the Network Rail domestic routes between Folkestone and London in the interim. The fleet also includes Regional Eurostars built to operate through to Great Britain destinations as far afield as Glasgow. Accordingly Eurostars are compatible with Great Britain structure gauge, both third rail and overhead line electrification and signalling systems.

- axle weight; and
- signalling and communications systems.

Gauge and wheel spacing

23. There are no issues with this technical feature because there is no variation in Great Britain for either gauge or wheel spacing.

Structure and loading gauge

24. The kinematic envelope for the rolling stock must fit within the structure gauge for the proposed routes, with a margin of clearance. The Great Britain structure gauge is a major constraint on the effort to accommodate more passengers and equipment on-board the rolling stock and, as a result, most classes of rolling stock have been built as large as possible for the specific routes intended so as to maximize the use of the available structure gauge. Therefore multiple combinations of vehicle length, width, tapered ends,[52] etc have emerged in the range of modern rolling stock and a given rolling stock type does not necessarily have universal clearance to operate on all potential routes. A strict process[53] (part of the overall Route Acceptance Process) with Network Rail exists to verify the clearance for each type of rolling stock on the proposed route. This said, certain classes of rolling stock having reasonably generic (usually shorter) bodies (such as Class 150 DMUs or Class 313 EMUs) or having fulfilled a wide range of operations during their life (such as HSTs) have accumulated extensive route clearance.

[52]A vehicle will overhang the track on curves—at the middle of the vehicle on the inside of the curve and at the ends of the vehicle on the outside. Tapering the ends of the vehicle body slightly can allow a longer vehicle to operate within the same structure gauge by reducing the overhang at the ends.
[53]The process involves comparing a software model of the rolling stock kinematic envelope either with a software model of the structure gauge (Absolute Gauging) or with the kinematic envelope of a reference vehicle that is known to be compatible with the structure gauge (Comparative Gauging) to verify that the necessary clearance is achieved.

Electrification

25. As might be expected, AC electric rolling stock is constrained to operate on AC electrified routes. Similarly DC electric rolling stock is constrained to operate on DC electrified routes. Dual-voltage rolling stock can operate on either electrification system and may even switch systems mid-journey provided the necessary change-over facilities are in place; for example, the Class 313 units operating on the Great Northern route to and from London Moorgate switch between third rail and overhead line electrification at Drayton Park. The Class 395 units which will operate shortly on the CTRL between London St Pancras and Ebbsfleet on overhead line and then switch to third rail for the onward journey on the Kent rail network.

26. Diesel-powered rolling stock is not constrained by the availability of electrification at all and can operate on electrified routes as well as non-electrified routes, subject to compatibility in all other respects—although there may be other constraints such as the availability of fuelling facilities or on tunnel working due to the potential accumulation of diesel fumes.

Axle weight

27. For most passenger rolling stock axle weight is unlikely to prevent technical compatibility with the infrastructure and hence constrain substitutability. Where passenger rolling stock is hauled by a locomotive (such as a Class 67), the axle weight of the locomotive could prevent operation over certain routes (particularly rural routes such as the Cambrian, Central Wales or West Highland lines) where the axle weight limit for the route is exceeded. However, this would arise with only a small

proportion of passenger rolling stock arrangements and in the event an alternative locomotive haulage arrangement might be found (such as a Class 37[54]).

Signalling and communication systems

28. The signalling systems on the Great Britain rail infrastructure demand interaction with the train. The TPWS system is largely universal in Great Britain and may be considered as being already fitted to all rolling stock. However, where more restrictive signalling systems are in place on the infrastructure, such as ATP fitted to parts of the Great Western Main Line and the Chiltern Line, the rolling stock must be so fitted also.[55] The TVM 430 cab signalling system on the CTRL requires that rolling stock using the CTRL be so fitted—presenting a significant hurdle for substitute rolling stock (notwithstanding the challenging performance capability that would also be required to use this route).

Other factors affecting rolling stock substitutability

29. Once the fundamental technical factors regarding technical substitutability have been addressed, there are three further factors that must be considered: operational substitutability, economic substitutability and franchise specificity.

Operational substitutability

30. There are five key operational issues:

- matching capacity and demand;
- performance;
- interior layout;
- coupling; and

[54]A Class 37 locomotive has a lower axle weight due to having six axles (a Class 67 has only four). However, only a small number of Class 37 locomotives have the facility to supply the lighting and heating requirements on the train.
[55]Due to the safety benefit perceived with the use of ATP, the withdrawal of such a benefit by permitting the operation of rolling stock not so fitted would be difficult to justify.

- safety.

Matching capacity and demand

31. The rolling stock must be capable of delivering the basic business requirements. The passenger capacity of the train fulfilling any service should be matched to the demand as far as possible to avoid causing overcrowding on the one hand or carrying excessive surplus capacity on the other. Multiple units go some way to addressing this requirement by facilitating shorter or longer trains to be formed, even for only a part of the journey if necessary. The capacity of many fixed formation sets (such as HST and IC225 sets) can be altered to some degree by adding or subtracting trailer vehicles, and some multiple units such as Class 150 and 158 DMUs can be re-formed to create shorter or longer units. However, there are definite constraints such as reduced performance if additional trailer vehicles are added and a limited number of vehicles with a driving cab to form the end of the set or unit.

Performance

32. The performance delivered by the rolling stock is a package of maximum speed; installed power (to accelerate from station stops and climb hills); braking; and station dwell time (driven by the ease of passenger boarding and alighting, the door operations and other response times). The performance must be compatible with the overall pattern of traffic using the route (as determined by the infrastructure manager) and with the business requirements of the operator (desired journey time etc). As an example, the introduction of the modern Voyager fleet (Class 220/221), offering high installed power and power-operated doors, has provided a significant increase in the performance capability of the rolling stock operating on the Cross Country services.

33. The rolling stock axle weight combined with the dynamic forces arising from the movement of the vehicle cause wear and tear on the track and it is quite usual for

heavier vehicles to have speed restrictions imposed upon them to limit the track damage that they cause. Recent builds of passenger rolling stock have seen vehicle weights increasing generally as a consequence of pressure for greater collision protection, accessibility and additional passenger facilities. As a result, passenger vehicles, although well within axle weight limits, are at risk of having speed restrictions applied to them and hence having their performance constrained (see also paragraph 40).

Interior layout

34. The interior layout and door configuration must also be appropriate to the operation. For example, a vehicle with few toilets, wide sets of doors at the one-third and two-thirds positions (ie one-third and two-thirds of the way along the carriage) and small, low seats with extensive standing room and large vestibule areas (such as the recently refurbished Class 455 units on South West Trains) would be well suited to metro and inner suburban duties but would be poorly suited to long-distance high-speed intercity duties. The interior layout and door configuration also affects the station dwell time; the seating layout and narrow, end door configuration of a Class 158 DMU or Class 390 Pendolino would extend station dwell times significantly if used on a metro duty because it would take time for passengers to move down the vehicle when boarding and alighting from the train.

35. In recent builds, rolling stock has been specified in detail to match the operational requirement as closely as possible. This is partly due to the rail network being highly capacity-constrained and partly due to the need to maximize revenue. The result is multiple combinations of first and standard class; airline and table seating; standing space; catering facilities; air conditioning; luggage space; toilet and door width; and configuration within different classes of rolling stock intended for broadly similar types of duty.

Coupling

36. For multiple unit operations, it is generally necessary for the units to be capable of coupling and operating together to secure the benefits of redeploying the total available passenger capacity. However, franchise fleets are not always formed of a single type of rolling stock and there is no universal coupling interface between all types of multiple unit. Therefore coupling compatibility between rolling stock types can be crucial to the operation. The Class 14x, 15x and 170 generations of DMU have full coupling compatibility between classes. Similarly EMU Classes 317, 318, 319, 320, 321, 322 and 323 have coupling compatibility between classes, as do EMU Classes 375, 376 and 377. However, coupling compatibility among other classes is largely constrained to within the class.

Safety

37. A further compatibility factor worthy of mention is the general area of safety management. Issues can arise with the use of certain types of rolling stock on certain sections of infrastructure. As an example, tunnel evacuation requirements in the event of derailment or fire might dictate that rolling stock with access doors on the end faces of the train is used. This alone might preclude the use of a proposed rolling stock type for a given operation if it has no such end access doors.

38. Electrical ‘noise’ from all types of rolling stock has the potential to interfere with the signalling systems. Therefore, as part of the process of verifying the compatibility of a given type of rolling stock with a section of infrastructure, electrical interference must be measured and mitigated.

39. Operation of trains through extended stretches of tunnel (such as the long CTRL tunnels) requires the rolling stock to be built with materials that are non-combustible or prevent the spread of fire.

Economic substitutability

40. Different rolling stock types will result in different costs for the TOC through:

(a) differing capital rentals, reflecting different capital costs to the ROSCO;

(b) differing non-capital rentals, as some classes of rolling stock require more maintenance attention and spare parts than others, due to poor design or outdated technology or simply the type of equipment fitted (eg diesel engines generally require more maintenance than electric traction systems); and

(c) differing operating costs, for example fuel or electricity costs or Track Access Charges.[56]

Franchise specificity

41. Franchise ITTs will normally specify the number of services on each route together with the minimum capacity, journey times and stopping patterns. The DfT stated that service specifications in ITTs can narrow choice but that these are minimum service levels and are a vital part of the franchised service. The DfT considered this specification as 'legitimate and necessary in the context of the Government's duties with regard to train services'. In addition to service specifications, the DfT also adds rolling stock specific requirements in cases where:

(a) Section 54 undertakings are in place and require rolling stock to be used on the franchise. However, the DfT noted that in some cases where the ITT specification is determined by a section 54 undertaking, the specific requirements of the service are such that the lack of choice would be the same even if no stipulations were made.

(b) Franchise competitions are being run simultaneously (as in the case of the East Midlands, West Midlands and new Cross Country franchises in 2007) and the DfT seeks to resolve rolling stock conflicts between successful bids. However, this

[56]Network Rail sets charges for the use of the infrastructure using a formula that includes axle weight and operating speed.

direction of stock to certain franchises occurs following an initial round of bidding without such specification.

(c) The DfT does not wish bidders to consider new-build rolling stock because it considers the incumbent rolling stock to be sufficient (for example, the Greater Western ITT).

(d) The DfT specifies that TOCs take new-build rolling stock (for example, as it will once the new Intercity Express Programme has been finalized or when it requires services to be upgraded).

42. Seven out of eight TOCs [✂] considered that the specificity of current franchises and the short bid timescales[57] limit the rolling stock choices available to the TOC.

43. We have considered franchise specificity in detail in the customer behaviour working paper.

[57]First and Serco NedRailways commented on the short bid timescales and the effect this has (or can have) on choosing the incumbent stock versus alternative stock. Govia also commented on the 'short timescales between franchise award and start of franchise operation and the effect this has on choosing the incumbent [rolling] stock versus alternative [rolling] stock'.

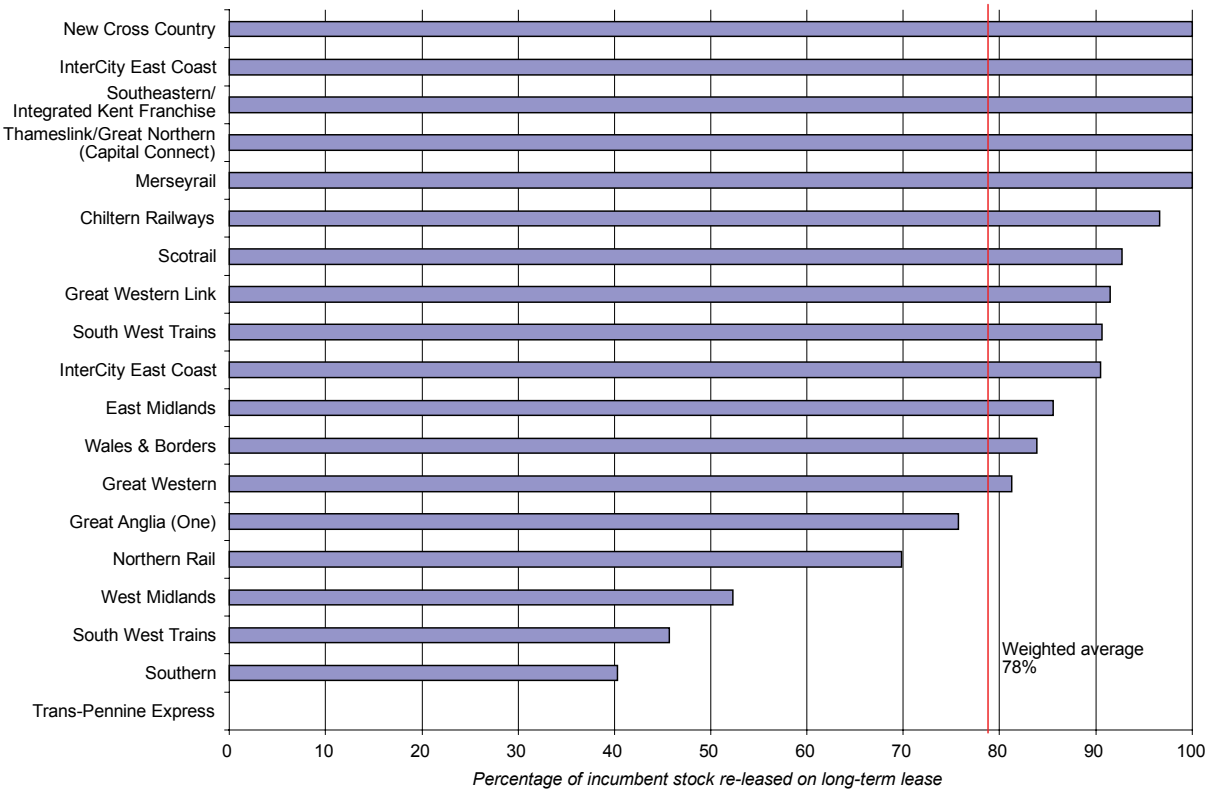
Our analysis of rolling stock substitutability

1. The aim of this annex is to assess the extent to which an incumbent fleet of rolling stock can be substituted by alternative used rolling stock.

2. Figure 1 shows the extent to which incumbent rolling stock has been leased on long-term leases at franchise re-let. Based on data submitted by the DfT, a weighted average of 78 per cent of incumbent vehicles have been leased at franchise re-let on the new franchise, with 22 per cent of vehicles either retired or switched to another franchise.

FIGURE 1

Extent of incumbent rolling stock leased at franchise re-let



Source: CC analysis of ROSCO data.

3. Given the extent to which incumbent rolling stock is leased at franchise re-let, we have undertaken analysis of the extent to which alternative rolling stock was available at franchise re-let.

4. To conduct our analysis of the substitutability of rolling stock we have gathered the views of the ROSCOs, the DfT and TOCs on the extent to which each considered that alternative rolling stock to incumbent stock could be used:

   - We gathered information from the ROSCOs regarding their views on the extent to which there were classes of rolling stock that were alternatives to the fleet of incumbent rolling stock at the time of the various franchise re-lets.[58]
   - Responses from TOCs were not comprehensive and so we have been unable to use these.
   - The DfT provided us with alternatives provided by TOCs rather than its opinion.

5. We have had to rely on the ROSCOs' interpretation of substitutability at this stage. While we consider that these views are likely to give a reasonable approximation of the extent of substitutability for different incumbent rolling stock fleets on individual franchises, we are mindful of the fact that this information is based on the ROSCOs' opinions. Therefore, it does not necessarily represent an independent and unbiased assessment of the possible alternatives available.

Data collected

6. The ROSCOs were asked to state which classes of rolling stock they considered to be alternatives to *each incumbent fleet* at *each franchise re-let* since privatization.[59]

[58] Covering franchise re-lets only and not the original franchise awards.
[59] A fleet of incumbent rolling stock is a class of rolling stock that has been used on a franchise prior to that franchise being re-let. Where a class is owned by more than one ROSCO, we have considered these to be separate fleets.

7. The observations in our analysis, therefore, are for each incumbent fleet owned by a particular ROSCO at a given franchise re-let. This leads to multiple observations for:

- each franchise re-letting process, because these typically involve a number of different classes of rolling stock;
- many classes of rolling stock, because:
  - they can generally be used on more than one franchise;
  - a number of franchises have gone through more than one franchise re-letting process already; and
  - classes on a given franchise can be owned by more than one ROSCO and , if so, are counted as separate fleets.[60]

8. For each fleet of rolling stock at each franchise re-let, ROSCOs were asked to list classes of rolling stock under four headings (*(a)* to *(d)* below). We combine the data from the ROSCOs' questionnaire responses with information from the DfT on what rolling stock was actually included in TOCs' bids (*(e)* below). We label these five stages of alternatives:

(a) technical alternatives;

(b) operational alternatives;

(c) available alternatives;

(d) offered alternatives; and

(e) alternatives in bids.

(a) Technical alternatives

9. First, ROSCOs were asked what classes of rolling stock they considered to be alternatives to the incumbent fleet based on 'technical considerations'. These include

[60]For example, our data set includes 13 observations for Class 158s. These have been used on nine different franchises. On three of these (East Midlands, Northern and Great Western), Class 158s are owned by two different ROSCOs, so these are treated as separate fleets. In addition, the South West franchise was re-let in 2004 and again in 2007, so these are counted as two separate observations.

factors such as gauge, wheel spacing, loading gauge, power source (ie diesel, overhead line AC or third rail DC) and axle weight.[61] This assessment of alternatives ignores any restrictions imposed on the franchisee.

(b) Operational alternatives

10. ROSCOs were then asked to list rolling stock classes that they considered to be alternatives to the incumbent fleets based on 'operational considerations'. These include factors such as capacity (such that the trains can cater for expected demand), performance (eg maximum speed, installed power, braking and acceleration taking account of stopping patterns and station dwell times), interior layout and door capacity.[62] While this assessment would ignore direct restrictions on specific fleets of rolling stock imposed by the DfT, it would be affected by the DfT's specification of services in franchises. This list of alternatives will generally be shorter than the list based solely on technical considerations, as operational factors are likely to limit the number of alternatives.

(c) Available alternatives

11. Thirdly, ROSCOs were asked to list which of the classes of rolling stock that they considered to be operational alternatives were available at the time of franchise re-let. Again, this list is generally shorter than the preceding list, as not all operationally feasible alternatives are likely to be available/off-lease at the time of franchise re-let.[63]

(d) Offered alternatives

12. Finally, ROSCOs were asked to list the classes of rolling stock that they offered to franchise bidders in relation to each franchise re-let.

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[61] Technical factors affecting substitutability are outlined in more detail in Annex 1 of this working paper.
[62] Operational factors affecting substitutability are outlined in more detail in Annex 1 of this working paper.
[63] See the discussion on issues of timing in this working paper.

(e) Alternatives in bids

13. We have combined the data gathered from the ROSCOs with information received from the DfT, outlining the rolling stock put forward by TOCs in their franchise bids.

14. We consider that both franchise specificity and economic substitutability (as discussed in Annex 1) are reflected in the alternatives put forward in *(b)* to *(e)* above.[64]

Analysis of the data

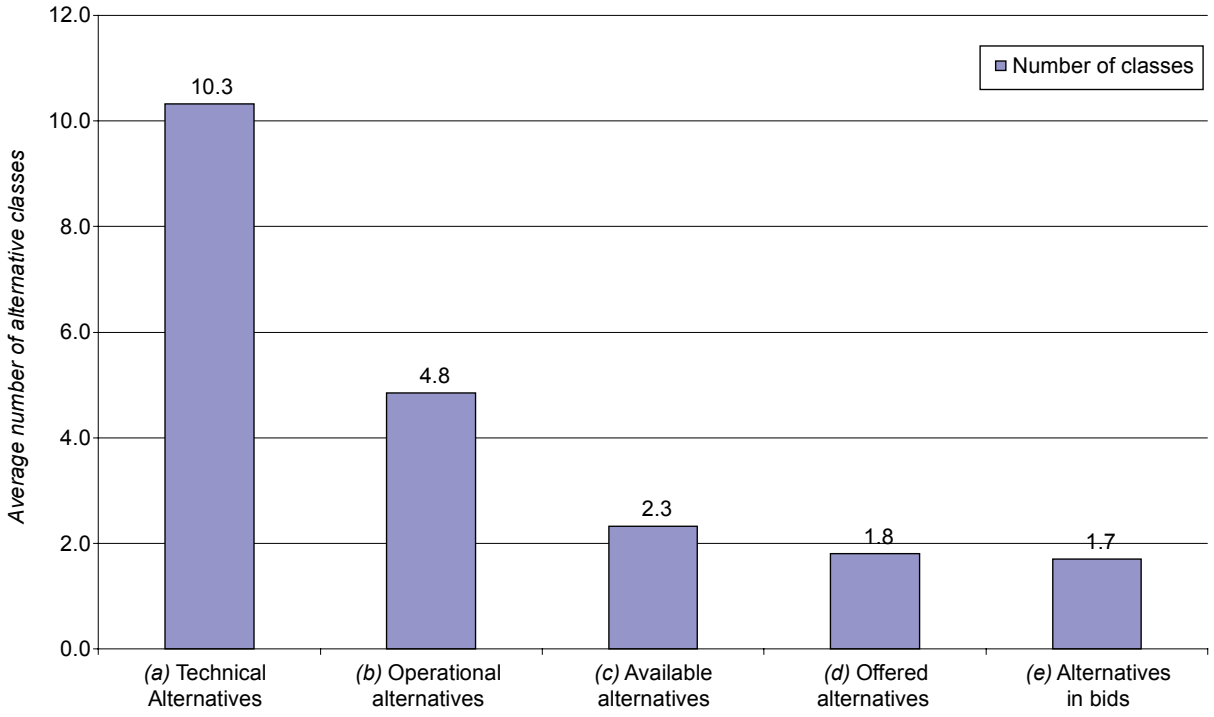
15. Figure 2 presents the average number of rolling stock classes listed in response to each question on alternatives, as well as those that were included in TOCs' bids to the DfT. In our analysis below, the number of alternative classes in all cases includes the incumbent rolling stock fleet, such that one alternative class actually means that there is no alternative *other than the incumbent fleet*; four alternative classes, for example, refers to a situation where there are three additional rolling stock classes that act as alternatives to the incumbent fleet. As described in this working paper, we use each incumbent fleet as the 'candidate service', such that we need to consider whether other classes or other fleets of the same class are potential substitutes for the incumbent fleet of rolling stock.[65]

[64]There appears to be some inconsistency in the ways in which some ROSCOs interpreted parts of our questionnaire. Specifically, in responding to our questions on technical and operational alternatives, one ROSCO appears to have considered only the possible alternatives from among its own fleets, whereas the other two seem to have listed potential alternatives regardless of which ROSCO owns the fleets. In addition, two ROSCOs, when looking at the available alternatives, seem to have considered only those from among their own fleets, whereas the other ROSCO seems to have listed potentially available alternatives regardless of which ROSCO owns the fleets. We do not consider that this will materially change the conclusions of our analysis at this stage. However, we will be addressing any inconsistencies after the publication of Emerging Thinking.

[65]After Emerging Thinking, we will consider whether other fleets of the same class are, in fact, available. Where they are not, this would reduce the number of alternatives by one.

FIGURE 2

Average number of alternative rolling stock classes



Source: CC analysis of ROSCO data.

16. We have labelled our five stages of alternatives *(a)* to *(e)*. To show the sequential nature of these stages, we have labelled the changes in the number of alternatives between each stage as:

(i) Difference due to operational factors: *(a)* technical alternatives to *(b)* operational alternatives.

(ii) Difference due to availability: *(b)* operational alternatives to *(c)* available alternatives.

(iii) Difference between available and offered: *(c)* available alternatives to *(d)* offered alternatives.

(iv) Difference between alternatives offered to TOCs and those included in TOCs' franchise bids to the DfT: *(d)* offered alternatives to *(e)* alternatives in bids.

(i) Difference due to operational factors

17. Figure 2 shows that operational considerations reduce the number of viable alternatives quite substantially. The average number of alternative classes drops by more than half when operational considerations are taken into account alongside technical factors. In the ROSCOs' responses to our questionnaire, common reasons for this reduction in alternative rolling stock classes included insufficient vehicle capacity or unsuitability for suburban routes (due to seating layout or door configuration), lack of specific features necessary for particular services (eg maximum speed, provision of first class carriages or catering facilities), as well as various other reasons, such as the necessity on some services for driver-only operation (DOO).[66]

(ii) Difference due to availability

18. Figure 2 also shows that the actual availability of potential technical and operational alternatives reduces the number of alternative classes, with the number falling by more than half from the average number of operational alternatives. This decrease between those classes considered as alternatives for operational reasons and those considered available by the ROSCOs may be due to the very small amount of surplus stock that is both serviceable and off-lease at any given time and the fact that there are relatively few co-terminous franchises.

(iii) Difference between available and offered

19. The difference between alternatives considered available by the ROSCOs and classes actually offered is quite small. The difference may be caused by one ROSCO

[66]It is evident from some of the ROSCOs' responses that there is, in a small number of cases, a slight inconsistency in how we have classified technical and operational considerations and how some of the ROSCOs have interpreted the difference between technical and operational alternatives. Having said this, we do not consider that these small inconsistencies will affect the overall validity of the analysis of rolling stock substitutability presented here. Again, we will consider these inconsistencies after the publication of our Emerging Thinking.

considering a class of rolling stock owned by a different ROSCO as available, when in fact this may not be the case.

(iv) Difference between offered and bid

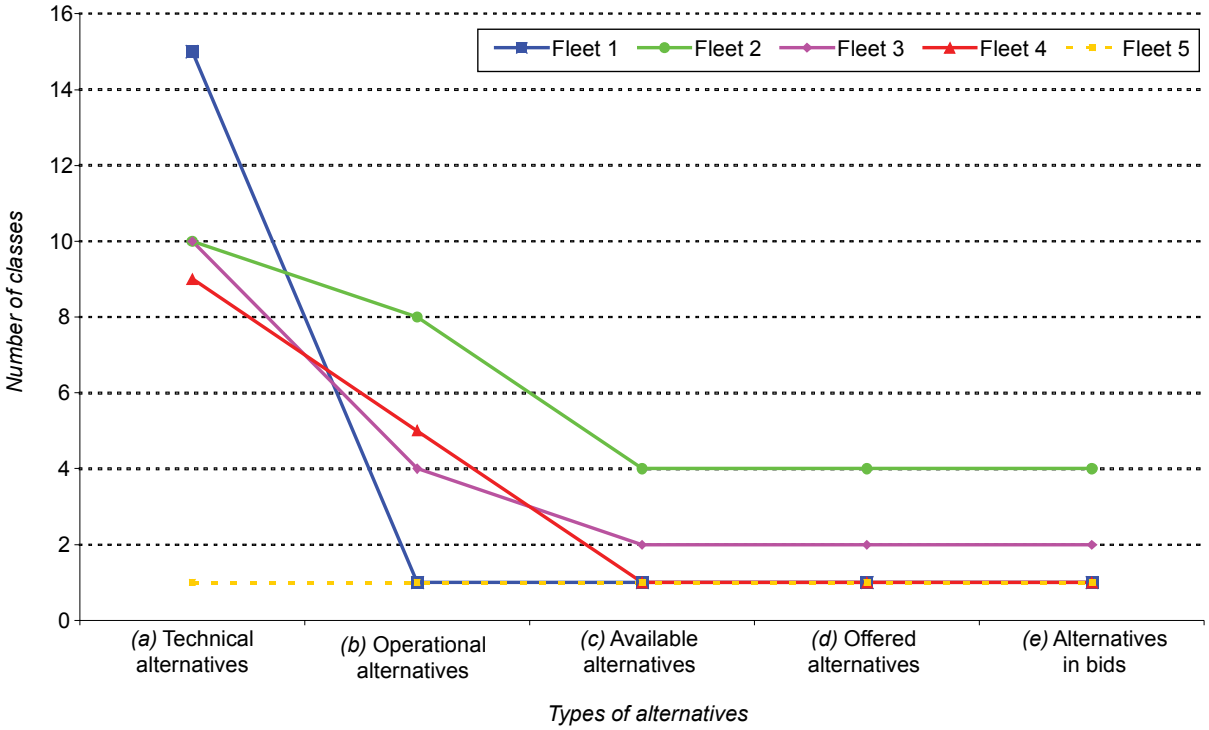
20. The average number of alternative classes offered by the ROSCOs (1.8) is almost equal to the average number of classes included in franchise bids to the DfT (1.7). This slight difference may be because TOCs themselves do not consider all the rolling stock classes offered by ROSCOs as being suitable for the services in question or they may not consider them as being likely to be acceptable to the DfT. Some of the alternatives offered to TOCs may also be rejected on cost grounds.

21. These average number of alternatives in Figure 2 masks large differences in the number of alternatives for each incumbent fleet. It also fails to capture the considerable variations for each fleet in the size of the changes in alternative numbers as we move from alternatives based on technical considerations to those based on operational considerations and so on. The size of these changes varies considerably across different incumbent fleets.

22. To illustrate these variations between fleets, Figure 3 takes five incumbent fleets as examples and presents, for each fleet, the number of alternative classes under each of the stages *(a)* to *(e)*. We have chosen these five fleets to demonstrate the degree of heterogeneity across fleets in our data set. These examples are purely for illustrative purposes.

FIGURE 3

Number of alternative classes of rolling stock for five sample incumbent fleets



Source: CC analysis of ROSCO data.

23. In relation to Figure 3:

(a) Fleet 1 [✂] on the [✂] franchise at the [✂] franchise re-let is shown above as an example of an incumbent fleet for which there were considered to be a large number (15) of technical alternatives, but very few operational alternatives. In fact, the owning ROSCO [✂] was of the opinion that '[a]ll the technical alternatives require fitment of ATP and trip-cocks[67] before they can be approved to safely run over [✂] lines'. This therefore reduced the number of suitable alternatives to the extent that the incumbent fleet [✂] was considered to be the only suitable class.

[67]ATP is the system installed in some trains in order to help prevent collisions through a driver's failure to observe a signal or speed restriction. A trip-cock is a safety devices fitted to LUL trains and some mainline fleets that use single track tunnels or operate on LUL lines. It is designed to prevent accidental signal overruns.

(b) Fleet 2 [✂] on the [✂] franchise at the [✂] franchise re-let are included as an example of a fleet for which a number of operationally suitable alternatives were available, were offered to TOCs and were included in franchise bids to the DfT. While operational factors (primarily the fact that 'the ride quality on [✂] stock would need substantial improvements to meet the Fleet 1 [✂] requirements') and availability reduced the number of suitable alternatives, there were still four alternative classes of rolling stock that were operationally suitable, available, offered to TOCs and included by TOCs in the their franchise bids to the DfT.

(c) Fleet 3 [✂] on the [✂] franchise at the [✂] franchise re-let are close to the average for our data set as a whole in terms of the number of alternatives reported for *(a)* to *(e).* Operational factors reduce the number of suitable alternatives by over half, which the owning ROSCO [✂] stated was due to the fact that 'Fleet 3 [✂] are 90mph vehicles with air conditioning and therefore operational suitability is limited to rolling stock with a maximum speed of at least 90mph and air conditioned units'. Only two of these were considered available and so two classes (including Fleet 3 itself) were offered to TOCs and two classes were subsequently included in TOCs' franchise bids to the DfT.

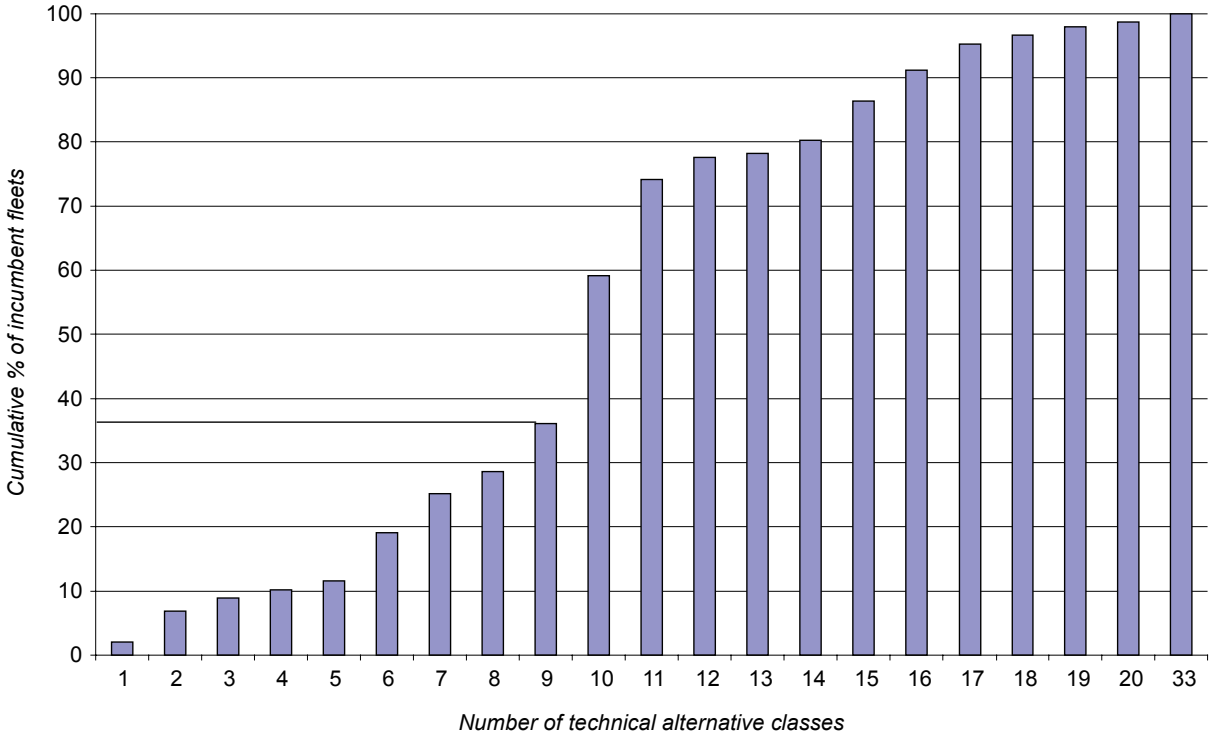
(d) Fleet 4 [✂] on the [✂] franchise at the [✂] franchise re-lets are included as an example of an incumbent fleet where operational factors and availability of suitable alternatives each significantly reduced the number of alternative classes from ten to one—the incumbent fleet itself. [✂] The owning ROSCO stated that the primary factors constraining the number of operational alternatives were the failure of some technical alternatives to meet 'stop/start and dwell times requirements and that '[r]estrictions apply on use of diesels at some London stations'. A further four alternatives were ruled out due to lack of availability, with only one class—the incumbent stock—being offered to TOCs and included in franchise bids to the DfT.

(e) Fleet 5 [✂] on the [✂] franchise at the [✂] franchise re-let are included as an example of an incumbent fleet that were considered, by [✂] the owning ROSCO, to have no alternative of any kind.

24. Figure 4 presents the cumulative percentage of incumbent fleets for which there were at least this number of technical alternatives. To help interpret the chart, we see that for 36 per cent of the incumbent fleets in our data set, there were considered to be nine or fewer classes that were technical alternatives.

FIGURE 4

Cumulative percentage of incumbent fleets for which there are at least X technical alternatives



Source: CC analysis of ROSCO data.
Note: Scale of the horizontal axis jumps from 20 to 33, as there are no observations in the range.

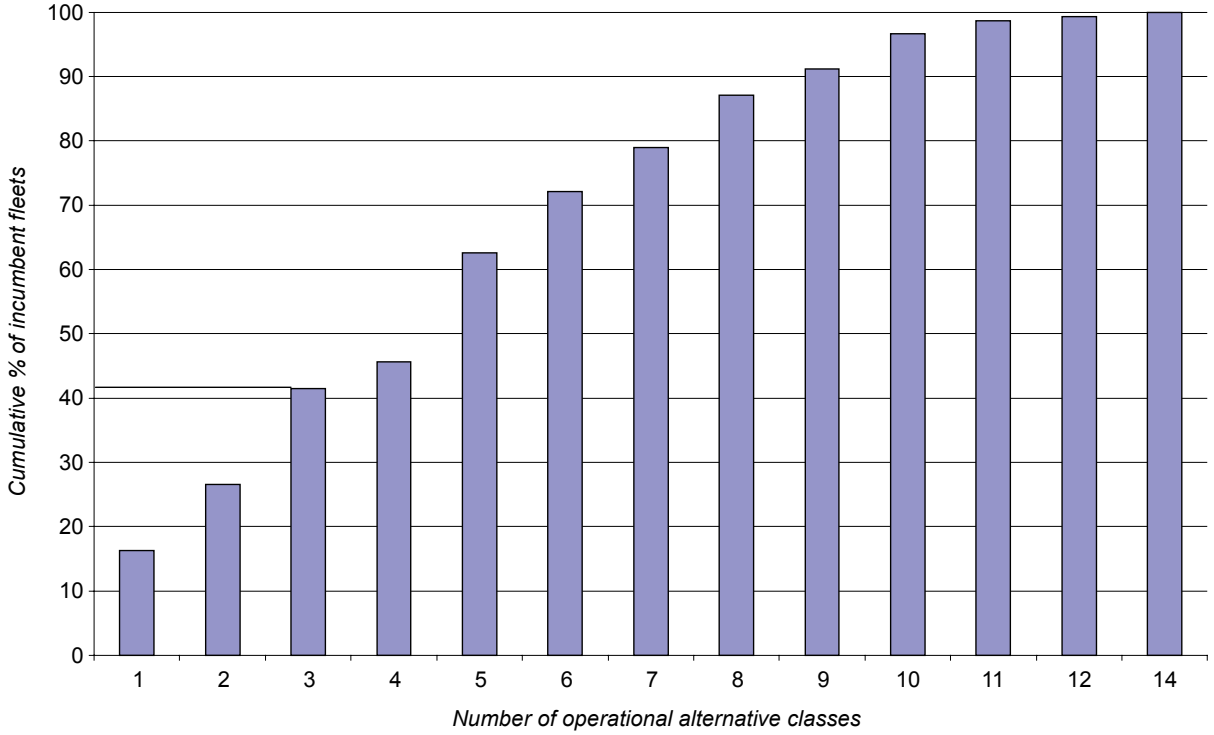
25. Figure 4 illustrates that there is considerable variation in the number of technical alternatives that exist for different incumbent fleets. For most fleets there are a large number of classes that are technical alternatives. Only 2 per cent of incumbent fleets

were considered to have just one alternative, ie the same class as the incumbent fleet itself.[68]

26. Figure 5 presents the cumulative percentage of incumbent fleets for which there were at least this number of operational alternatives. From the chart, we see that for 41 per cent of the incumbent fleets in our data set, there were considered to be three or fewer classes that were technical alternatives.

FIGURE 5

Cumulative percentage of incumbent fleets for which there are at least X operational alternatives



Source: CC analysis of ROSCO data.

27. Figure 5 illustrates that there is also considerable variation in the number of operational alternatives that exist for different incumbent fleets. Whilst for a majority of fleets there are a large number of classes that are operational alternatives to the

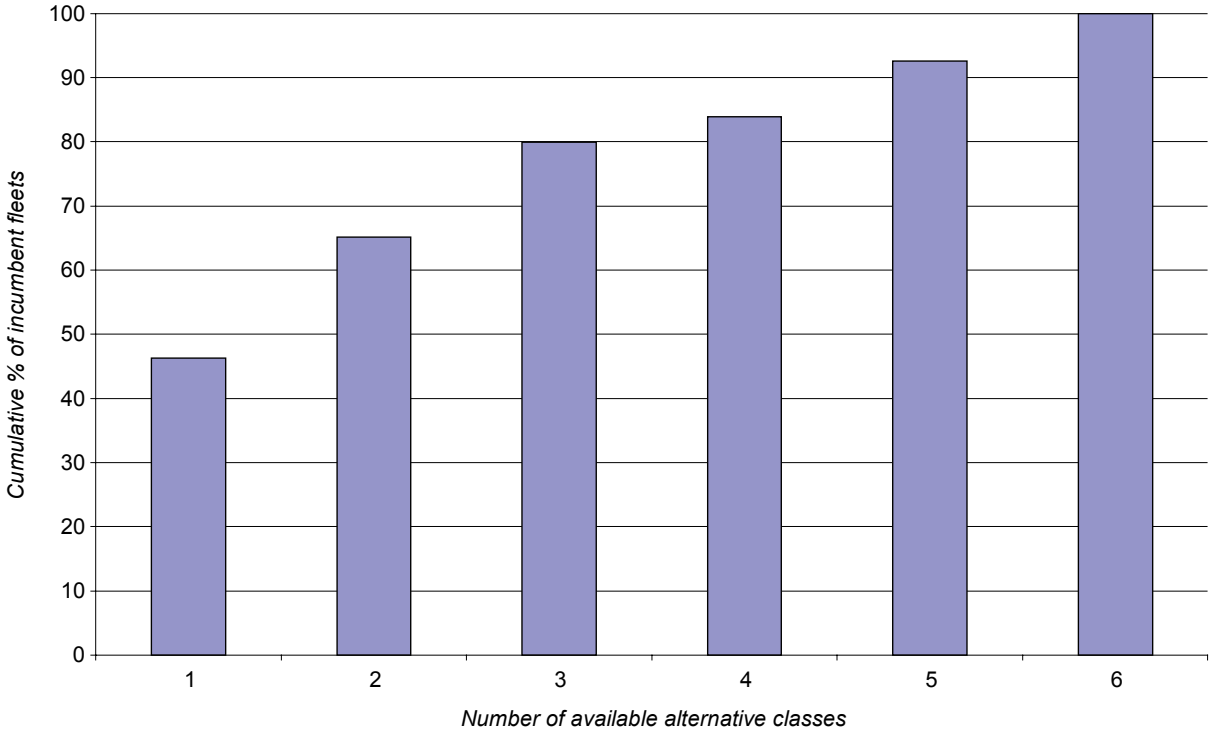
[68]In some cases, there may not be any vehicles in this class on other franchises, so no alternatives would exist. We will be developing our analysis further to reflect this.

incumbent fleet, 16 per cent of incumbent fleets were considered to have no alternative to the incumbent fleet. This is a considerable increase from the case for technical alternatives, where the figure was just 2 per cent.

28. Figure 6 presents the cumulative percentage of incumbent fleets for which there were at least this number of available alternatives. From the chart, we see that for 46 per cent of the incumbent fleets in our data set, there were considered to be just one available operational alternative—the incumbent fleet itself.

FIGURE 6

Cumulative percentage of incumbent fleets for which there are at least X available alternatives



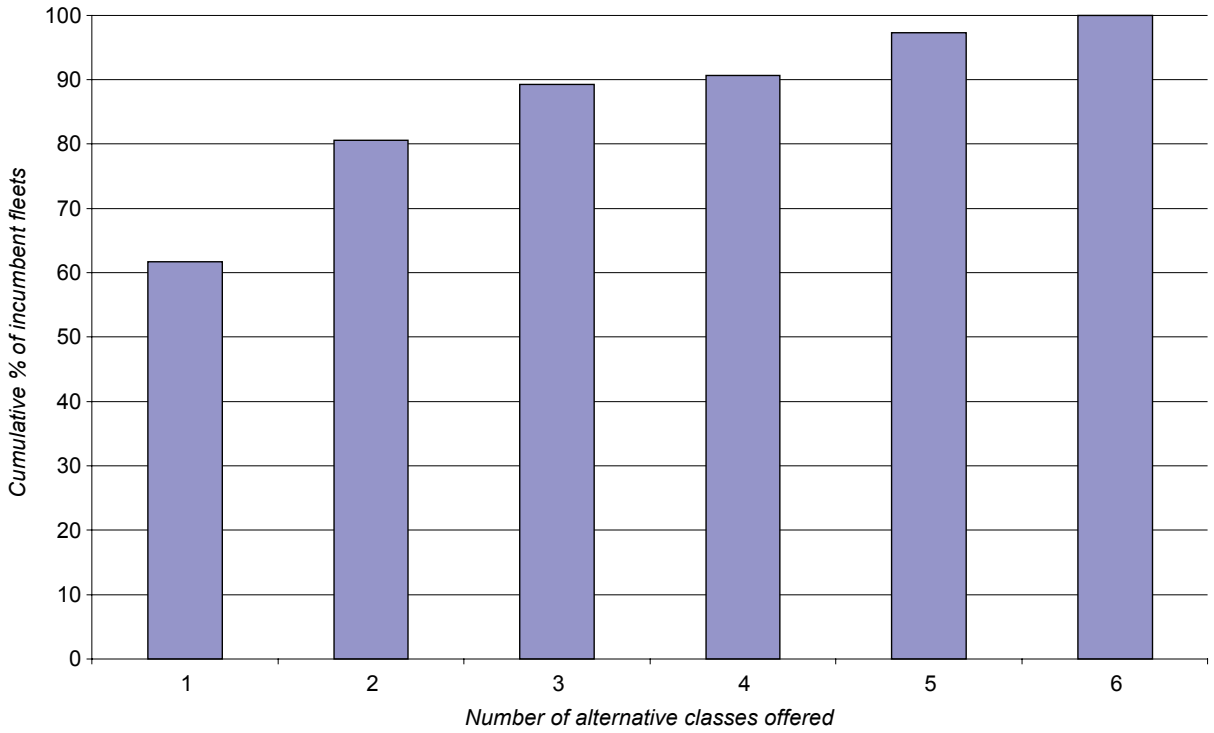
Source: CC analysis of ROSCO data.

29. Figure 6 shows that, for a majority of incumbent fleets, there were available alternatives other than the fleet itself. However, Figure 6 shows a much lower number of substitutes than in Figures 4 and 5, suggesting that for most fleets availability imposes a significant constraint on the number of alternative classes.

30. Figure 7 presents the cumulative percentage of incumbent fleets for which there were at least this number of alternatives offered to TOCs.

FIGURE 7

Cumulative percentage of incumbent fleets for which there are at least X alternatives offered to TOCs



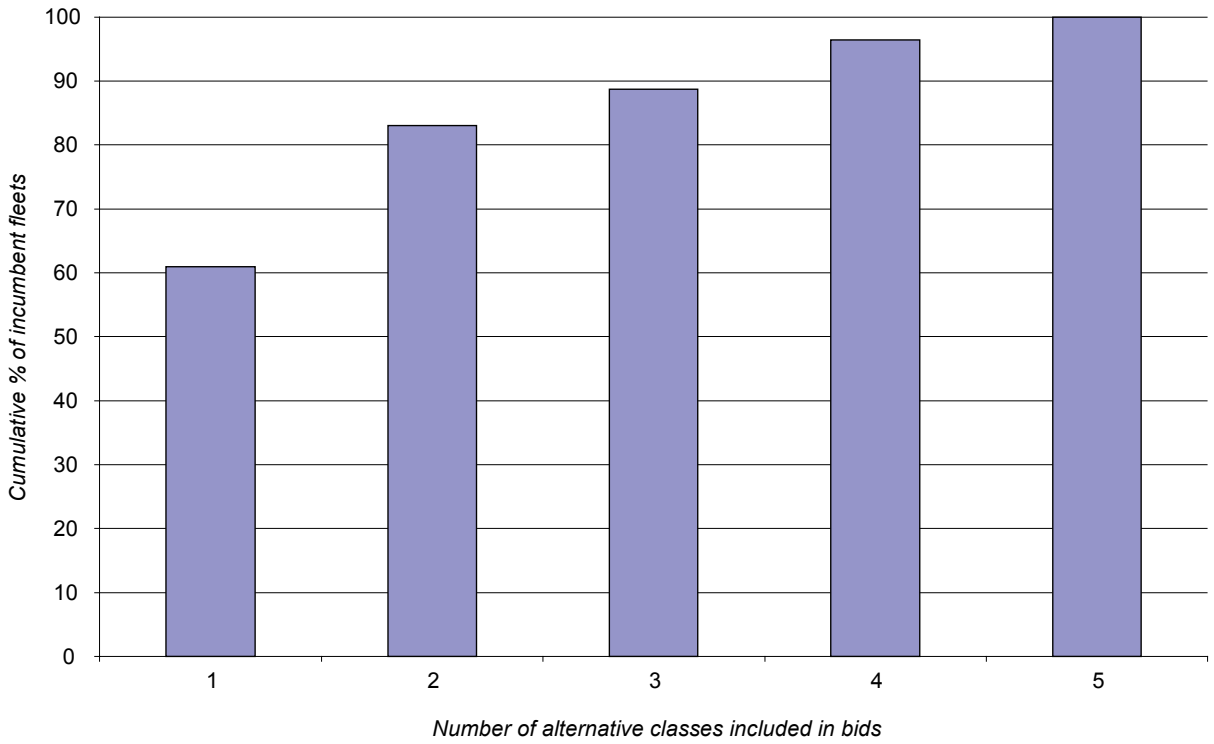
Source: CC analysis of ROSCO data.

31. Figure 7 illustrates that for the majority of incumbent fleets (62 per cent) only one class of rolling stock was offered to TOCs. In the vast majority of cases (89 per cent) the number of classes offered was three or fewer—meaning that TOCs were offered at a maximum the incumbent class plus two alternative classes.

32. Figure 8 presents the cumulative percentage of incumbent fleets for which there were at least this number of alternatives included in franchise bids to the DfT.

FIGURE 8

Cumulative percentage of incumbent fleets for which there are at least X alternatives offered to TOCs



Source: CC analysis of ROSCO data.

33. Figure 8 is very similar to Figure 7, showing that for most incumbent fleets (61 per cent) only one class of rolling stock was included by TOCs in their bids to the DfT. In the vast majority of cases the number of classes offered was three or fewer—meaning that TOCs included the incumbent class plus one or two alternative classes.

The DfT's data on substitutability

34. The DfT submitted an analysis of rolling stock substitutability, from which Table 1 is taken.

TABLE 1 **Percentage of incumbent fleet at franchise re-let**

	%
Total percentage of incumbent fleet re-leased for the full franchise term	81
—Section 54 or ITT specified	31
—No realistic alternatives to the existing fleet	45
—Very limited realistic alternatives to the existing fleet	3
—Alternatives available, but incumbent stock chosen	3
Total percentage of incumbent fleet not re-leased for the full franchise term	19
—Life expired	11
—Replaced by existing alternatives	2
—Replaced by new rolling stock	4
—Surplus not retained	1

Source: DfT calculations

35. It found that 81 per cent of incumbent rolling stock (in terms of vehicle numbers) was leased for the duration of the new franchise term at franchise re-let. The DfT found that in relation to this incumbent stock:

- for 45 per cent there was 'no realistic alternative';
- for 3 per cent there were 'very limited realistic alternatives';
- for 3 per cent there were realistic alternatives, but the incumbent stock was chosen;
- for 31 per cent Section 54s applied or specific mention was made in the ITT.
- for 2 per cent of incumbent vehicles failed to be leased on long-term leases due to their displacement by existing alternatives; and
- 4 per cent was replaced by new rolling stock.

Our views on substitutability

36. The above analysis of alternative rolling stock classes raises two key issues.

37. First, operational characteristics impose a considerable constraint on the extent of substitutability of rolling stock classes. These operational considerations are largely due to the type of services that are to be provided by the franchisee, eg a suburban frequent-stopping service with a specified timetable, which implies particular dwell

times, speed, braking and acceleration capabilities, will clearly only be possible using a fairly limited number of classes of rolling stock.

38. Second, the availability of alternative classes imposes a major constraint on the ability of ROSCOs to actually offer alternative classes to TOCs for inclusion in franchise bids. The number of alternative rolling stock classes decreases by over half, on average, when availability is taken into account. This is consistent with our analysis that showed there was a very small amount of surplus stock that is both serviceable and off-lease at the time of a given franchise re-let and there are relatively few co-terminous franchises.