SERIES OF POSSESSIONS FOLLOW-ON WORK

Summary report of methodology and results of analysis

Technical Report

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Prepared for:

Schedule 4 Policy Group

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A INFORMATION PREVIOUSLY SUPPLIED TO THE POLICY GROUP

1. EXECUTIVE SUMMARY

1.1 Analysis has been conducted on three possible methods for categorising 'series of possessions'. The three methods are:

- Schedule 4 payments as a percentage of annual revenue at the service group level;
- Duration of possessions at the service group level; and
- Duration of possessions at a service group-strategic route section combination level. (Location method).

1.2 The duration method at the service group level was found to produce unsatisfactory results. The two main problems were:

- Very large triggers were required to reduce the number of possessions captured to a practical level; and
- The variety of service groups captured was very limited

1.3 The revenue method was found to have some positive features

- Using both a 13 and a 3 rolling period measure it captured three major projects in the dataset.; and
- It is simple to implement in that all the data needed is readily available.

However there are some issues with this method:

- The large nature of service groups means that sometimes possessions might be included in a series when this is not appropriate; and
- In cases where schedule 4 payments are incorrectly low and bespoke compensation is desirable this might not be picked up using this method since schedule 4 payments are part of the trigger.

1.4 The location method was found to also have significant positive features:

- It captured two of the major projects that the revenue method captured;
- The more granular nature of the service group-strategic route sections means that less unrelated possessions were captured; and
- Since it is not based on schedule 4 payments, it is more likely to capture situations where schedule 4 payments are too low.

The location method does seem to be very promising; however, there are significant implementation issues:

- Strategic route sections are not currently in the S4CS database;
- Strategic route sections are unlikely to be introduced into S4CS in the future; and
- Therefore, a mapping would be needed from the available geography in PPS. This would either have to be a modification of an existing mapping or a completely new mapping.

1.5 The analysis conducted on large individual possessions found that the boundary of 120 hours originally proposed as too low. A boundary of nearer 200 hours was required to reduce the number of possessions captured to a practical level.

2. INTRODUCTION

Aim

2.1 The aim of this report is to summarise work undertaken for the schedule 4 Policy Group on series of possessions. The work follows on from a larger study for the policy group which reviewed potential mechanisms to compensate passenger train operators for revenue lost as a result of possessions.

2.2 This report is intended to fulfil two roles:

- Firstly, it collates the findings of the various presentations and memos that have been presented to the client. As such it is a summary and for the full detail of results the reader is referred to the documents listed in Appendix A.
- Secondly, it is an opportunity to detail the precise modelling approach taken and to set out definitions of the key measures used in the model.

Background

2.3 A key recommendation of the larger study was the categorisation of certain collections of possessions as a 'series of possessions'. The categorisations proposed are as set out below:

- Over 300 hours of possessions at a particular location in a service group over 3 periods.
- Over 700 hours of possessions at a particular location in a service group over 7 periods.

2.4 It was suggested that these 'series of possessions' together with possessions of over 120 hours length should be eligible for bespoke compensation arrangements.

2.5 The schedule 4 Policy Group agreed that large individual possessions and series of possessions should be eligible for bespoke compensation but remained unconvinced by the categorisations proposed for series of possessions. They therefore asked Steer Davies Gleave to construct a model which would allow different categorisations to be tested on a two year S4CS dataset. The results would then be used to inform, the practicality of any categorisation proposed.

Structure

2.6 The structure of the report is as follows:

- Chapter 2 details the methodology, assumptions and definitions of the modelling undertaken
- Chapter 3 Presents the key findings of the analysis undertaken
- Chapter 4 provides some conclusions on the suitability and practicality of the different categorisations tested.

3. METHODOLOGY, ASSUMPTIONS AND DEFINTIONS

Handling the data

3.1 Two of the key issues for the construction of the model were data related. The first issue was the size of the dataset, over 45,000 rows in an excel spreadsheet. To create a model that was of a manageable size, two data input files were created. One data file was created for RTP possessions and another for non-RTP possessions.

3.2 The second issue was the calculation of duration times for the RTP possessions in the S4CS database. Nearly a quarter of possessions in the S4CS database were RTP possessions. In the S4CS database the start and end times of RTP possessions are included (if at all) in the location fields. It was possible to extract duration information for just over 50% of RTP possessions from the location fields. However, for the remainder we had to estimate the duration based on the length of the possession in days.

3.3 For the RTP possessions where there was not sufficient information on duration we created a random distribution of durations. To do this we took the average possession duration from the non-RTP possessions, segmented by the number of days of possession. We have then assigned durations to RTP possessions based on a uniform distribution around these averages. An example of how this works is as follows:

- The average duration of non-RTP possessions over 2 days is 11.89 hours. (a possession from 12/04/2007 22:00 to 13/04/2007 03:00 counts as a 2 day possession, hence the low number of hours).
- Based on this average each RTP possession over 2 days has been assigned a duration based on a random number drawn from a uniform distribution with a lower boundary of 5 and an upper boundary of 17.

3.4 The distributions used could be varied (e.g. change boundaries of uniform distribution or possibly use a normal distribution) to provide some sensitivities. However, we don't believe that this is likely to fundamentally change the results.

3.5 The method used to extract times from the RTP possessions relied on some assumptions to extract durations. This was necessary due to the inconsistent way in which the start and end times were recorded. As the analysis was conducted some cases were uncovered in which the assumptions produced incorrect results and revisions of the RTP durations were carried out accordingly. There were two stages of revision, the first being an amendment to the formulae during our analysis at the service group level (which included setting RTP possessions carried out over two days or less to 8 hours duration) and the second involved manual intervention carried out when we conducted the strategic route section analysis

3.6 In this report all the results presented are based on the final RTP durations and as such may differ from previous analysis presented.

An important definition

3.7 In the S4CS database, possessions are recorded at a service group and payments date level (some possessions have staggered payment over a number of days). This means

that for each possession there is a row in the dataset for each service group and payment date. Since we were also conducting the analysis at a service group level it seemed consistent to classify a possession as a *service group possession*. Therefore, a possession that affected three service groups, for example, has been classified as three separate service group possessions. In the rest of the report where we refer to the number of possessions this refers to the number of service group possessions unless otherwise stated.

Construction and capability of the model

Input parameters

3.8 The model has been constructed to take the following input parameters

- Possessions under a defined duration can be excluded from counting towards a series of possessions. This duration is a parameter which can be varied in the model.
- The model can categorise series of possessions by a duration or a revenue method. When using the duration method a series of possessions is assessed on a rolling period basis. If the number of hours of possessions for a service group goes over a trigger level then all the possessions for that service group in that rolling period are classified as a series of possessions. The trigger is defined as a number of hours over the rolling period. In the model both the length of the rolling period (in terms of rail periods) and the trigger level of hours are parameters which can be varied.
- The revenue method also works on a rolling period basis and the length of the rolling period can again be altered. In the revenue method the possessions in a rolling period are classed as a series of possessions if the sum of the resultant schedule 4 compensation is greater than a given percentage of the annual service group revenue. This percentage is a parameter which can be altered in the model.
- There are three possible ways of categorising individual possessions in the model. These are:
  - If a possession is over a defined amount of hours;
  - If the schedule 4 compensation as a percentage of service group revenue is over a defined percentage; and
  - If the schedule 4 compensation is over a defined amount.

3.9 For each of these methods the trigger level is a parameter which can be varied.

Model Outputs

3.10 We set the model up with several different output sheets. In this section we cover the key outputs which were used in the analysis. The outputs can be divided into two groups, summary outputs and service group and TOC output.

Summary Outputs

3.11 The model produces some summary statistics for the whole two years of the S4CS dataset available, summed over all service groups. The statistics produced are as

follows:

- The number of possessions captured in the series of possessions category (absolute and as a percentage of the total).
- The total duration of all possessions captured in the series of possessions category (absolute and as a percentage of the total).
- The total schedule 4 payments of all possessions captured in the series of possessions category (absolute and as a percentage of the total).
- The number of rolling period-service group combinations that qualify as series of possessions.
- The number of individual possessions captured in the large individual possessions category (absolute and as a percentage of the total).
- The total duration of all individual possessions captured in the large individual possessions category (absolute and as a percentage of the total).
- The total schedule 4 payments of all individual possessions captured in the large individual possessions category (absolute and as a percentage of the total).

Service Group and TOC outputs

3.12 The following statistics are broken down by service group and by TOC:

- Number of rolling periods qualifying as series of possessions.
- Number of individual possessions captured as part of a series of possessions
- Total schedule 4 payments of possessions captured as part of a series of possessions.
- Total duration of possessions captured as part of a series of possessions.
- The number of individual possessions captured in the large individual possessions category.
- The total duration of all individual possessions captured in the large individual possessions category.
- The total schedule 4 payments of all individual possessions captured in the large individual possessions category.

3.13 All of the series of possessions statistics by service group and TOC are outputted on a rolling period by rolling period basis. There is also some limited information at the aggregate level on a rolling period by rolling period basis.

3.14 Note that the model used in the strategic route sections analysis does not have as many outputs and only works over a 13 period rolling period.

4. RESULTS OF ANALYSIS

Duration categorisation results

4.1 Figure 4.1 shows how the number of individual possessions that are part of a series of possessions varies with rolling period length and duration trigger level. (The figure is presented as a percentage of total possessions). Possessions under 8 hours are excluded.

FIGURE 4.1 DURATION METHOD RESULTS EXCLUDING POSSESSIONS UNDER 8 HOURS – PERCENTAGE OF INDIVIDUAL POSSESSIONS CAPTURED

Trigger level (service group possession hours)	Number of rail periods in rolling period											
	2	3	4	5	6	7	8	9	10	11	12	13
Number of hours in rolling	1,344	2,016	2,688	3,360	4,032	4,704	5,376	6,048	6,720	7,392	8,064	8,736
1,000	10.02%	19.46%	24.52%	27.46%	30.29%	32.06%	33.17%	33.90%	34.54%	35.16%	35.40%	35.50%
2,000	3.22%	6.61%	9.23%	13.81%	18.26%	21.23%	23.47%	25.08%	25.71%	26.95%	28.08%	29.57%
3,000	0.55%	3.29%	5.31%	7.68%	8.52%	10.67%	15.30%	17.80%	20.05%	21.58%	23.47%	24.41%
4,000	0.00%	0.74%	3.04%	4.84%	6.12%	6.97%	8.18%	8.60%	11.48%	13.08%	16.66%	18.40%
5,000	0.00%	0.02%	0.95%	2.72%	4.08%	5.39%	5.83%	6.11%	7.64%	8.33%	9.44%	11.88%
6,000	0.00%	0.00%	0.10%	1.28%	2.91%	3.73%	4.30%	4.73%	5.07%	5.29%	6.16%	8.42%
7,000	0.00%	0.00%	0.00%	0.23%	1.95%	2.86%	3.65%	4.05%	4.62%	4.93%	5.03%	5.20%
8,000	0.00%	0.00%	0.00%	0.06%	0.26%	1.88%	3.23%	3.57%	4.26%	4.63%	4.86%	5.07%
9,000	0.00%	0.00%	0.00%	0.00%	0.10%	0.31%	2.27%	2.89%	2.95%	4.03%	4.62%	4.87%
10,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.23%	0.36%	2.43%	2.92%	2.96%	3.29%	3.78%
11,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.27%	0.41%	1.49%	2.94%	2.96%	3.28%
12,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.11%	0.30%	0.50%	1.85%	2.94%	2.98%
13,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.35%	0.52%	1.80%	2.96%
14,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	0.27%	0.41%	0.55%	2.07%
15,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.11%	0.30%	0.49%	0.56%
16,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.34%	0.53%
17,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.27%	0.41%
18,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.11%	0.30%
19,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%
20,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

4.2 Trigger level and rolling period length combinations that capture less than 1% of individual possessions are shaded in green. The figure demonstrates that the trigger level required to reduce the number of possessions captured as part of a series of possessions, to a practical level (around 1%), is very high. The minimum number of hours needed is 3,000 hours.

4.3 Further analysis of the service groups and TOCs being captured indicated that the number of service groups being captured was quite small and that key major projects (e.g. Portsmouth resignalling) were not being picked up.

4.4 The main issue with this method is that the total duration of possessions across a service group is strongly correlated with its size as well as the level of possession activity. Therefore, there is a bias towards the selection of large service groups.

Revenue categorisation results

4.5 The following table shows how the number of possessions that are part of series of possessions varies with rolling period length and trigger level. (The figure is presented as a percentage of total possessions).

4.6 Figure 4.2 shows how the number of individual possessions that are part of a series of possessions varies with rolling period length and trigger level. (The figure is presented as a percentage of total possessions). Possessions under 8 hours are excluded.

FIGURE 4.2 REVENUE METHOD RESULTS EXCLUDING POSSESSIONS UNDER 8 HOURS – PERCENTAGE OF INDIVIDUAL POSSESSIONS CAPTURED

Trigger level (service group possession hours)	Number of rail periods in rolling period											
	2	3	4	5	6	7	8	9	10	11	12	13
1.00%	3.60%	6.46%	8.82%	10.98%	13.51%	16.10%	17.94%	18.97%	20.57%	22.54%	23.32%	24.52%
2.00%	1.30%	2.27%	3.51%	4.64%	6.29%	7.46%	8.23%	8.87%	9.81%	11.72%	13.73%	15.34%
3.00%	0.65%	1.19%	1.98%	2.30%	2.79%	3.32%	3.73%	4.00%	5.60%	6.84%	7.39%	7.85%
4.00%	0.52%	0.82%	1.06%	1.39%	1.85%	2.61%	2.83%	3.18%	3.43%	4.06%	4.32%	4.86%
5.00%	0.38%	0.66%	0.99%	1.20%	1.34%	1.45%	1.54%	2.08%	2.50%	2.81%	3.01%	3.21%
6.00%	0.36%	0.49%	0.68%	0.85%	1.06%	1.25%	1.38%	1.59%	1.77%	2.12%	2.44%	2.69%
7.00%	0.31%	0.39%	0.66%	0.77%	0.92%	1.00%	1.24%	1.39%	1.65%	1.76%	1.86%	1.97%
8.00%	0.27%	0.32%	0.52%	0.69%	0.82%	0.97%	1.03%	1.15%	1.41%	1.74%	1.83%	1.96%
9.00%	0.27%	0.32%	0.35%	0.53%	0.76%	0.86%	0.90%	1.08%	1.18%	1.30%	1.37%	1.66%
10.00%	0.10%	0.32%	0.35%	0.50%	0.61%	0.74%	0.78%	0.90%	1.07%	1.26%	1.34%	1.42%
11.00%	0.03%	0.32%	0.35%	0.38%	0.56%	0.69%	0.75%	0.81%	0.95%	1.05%	1.14%	1.35%
12.00%	0.03%	0.27%	0.33%	0.38%	0.41%	0.63%	0.75%	0.80%	0.83%	0.95%	1.03%	1.20%
13.00%	0.03%	0.27%	0.33%	0.35%	0.41%	0.43%	0.68%	0.75%	0.80%	0.88%	0.97%	1.18%
14.00%	0.03%	0.27%	0.33%	0.35%	0.38%	0.42%	0.46%	0.72%	0.75%	0.83%	0.96%	1.04%
15.00%	0.00%	0.03%	0.33%	0.35%	0.38%	0.42%	0.46%	0.72%	0.75%	0.81%	0.93%	1.01%
16.00%	0.00%	0.00%	0.28%	0.30%	0.33%	0.35%	0.43%	0.43%	0.49%	0.50%	0.85%	0.94%
17.00%	0.00%	0.00%	0.00%	0.30%	0.33%	0.35%	0.36%	0.36%	0.38%	0.47%	0.49%	0.52%
18.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.35%	0.36%	0.36%	0.38%	0.39%	0.48%	0.51%
19.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.38%	0.39%	0.41%	0.44%
20.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.44%

4.7 In Figure 4.2 combinations that produce an individual possession count of between 0.5% and 1% of total possessions are highlighted in green. We can see from this table that the trigger level required to bring the number of individual possessions down to a manageable level is again very high. However, the variety of service groups and TOCs captured was larger than that for the duration method and some detailed analysis of possessions captured using a 3 and 13 period method as undertaken.

Series of possessions captured using the 13 rolling period measure:

4.8 Series of possessions were captured for the following TOCs:

- SWT
- Northern Rail
- Merseyrail

4.9 The following table shows the possessions in the SWT series of possessions starting 01/05/2006.

TABLE 4.1 POSSESSION LOCATIONS INCLUDED IN THE SOUTH WEST TRAINS SERIES OF POSSESSIONS IN THE 13 RAIL PERIOD ROLLING PERIOD BEGINING 01/04/2006

From-To location	Number of possessions
Fratton-Portsmouth and Southsea	53
Petersfield-Portsmouth Harbour	9
Fratton to Portsmouth Harbour	6
Farnborough-Winchester	5
Winchfield-Winchester	4
Arundel-Barnham	4
Haslemere-Havant Jn	4
Botley-Fareham	3
Hove-Arundel Jn	3
Haslemere-Portsmouth Harbour	3
Barnham-Havant	3
Farlington Jn-Portsmouth Harbour	3
Fareham-Portcreek Jn	3
Worting Jn-Salisbury Tunnel Jn	2
Brighton-Worthing	2
Petersfield-Portcreek Jn	2
Petersfield-Havant Jn	2
Havant-Portsmouth Harbour	2
Chichester-Havant	2
Eastleigh West Jn-Fareham	2
Fratton to Portsmouth Harbour -Amended Timetable in Operation	2
Patersfield-Portsmouth Hbr	1
Ford Jn-Chichester	1
Arundel Jn-Chichester	1
Bedhampton LC-Bedhampton LC	1
Haslemere-Portcreek Jn	1
Eastleigh West Jn-Brockenhurst	1
Eastleigh West Jn-Millbrook	1
Eastleigh South Jn-Fareham	1
New Malden-Byfleet Jn	1
12 more possessions at different locations…..	1

4.10 The possession locations in this table are primarily in the Portsmouth area. However, due to the coarse nature of the service group there is also a long tail of unrelated possessions.

4.11 A very similar picture emerged for Northern Rail. Some major works taking place between Crewe and Manchester were picked up, but again there was a long tail of locations.

Series of possessions captured using a 3 rail period rolling period

4.12 Series of possessions were captured for the following TOCs:

- SWT
- Northern Rail
- Merseyrail
- One
- GNER
- Chiltern
- FSR

4.13 Below is some analysis displaying the main points of interest.

Northern Rail

TABLE 4.2 POSSESSION LOCATIONS INCLUDED IN THE NORTHERN RAIL SERIES OF POSSESSIONS IN THE 3 RAIL PERIOD ROLLING PERIOD BEGINING 01/04/2006

From-To location	Number of possessions
Crewe North Jn-Cheadle Hulme Jn	3
Dore West Jn-Edgeley Jn No. 1	2
Romiley Jn.-Hyde Jn.	1
Crewe North Jn.-Cheadle Hulme Jn	1
Crewe North Jn.-Cheadle Hulme Jn.	1
Crewe North Jn.-Manchester Piccadilly	1
Basford Hall Jn-Sydney Bridge Jn.	1
Crewe North Jn-Holyhead	1
Crewe North Junction-Cheadle Hulme Junction	1
Crewe North-Cheadle Hulme	1
Crewe North-Cheadle Hulme LN	1
Dore Station Jn-Chinley North Jn	1
Chinley East Jn-Chinley South Jn.	1
Hadfield-Manchester Piccadilly East Jn	1

4.14 The 3 rolling period measure in this case has picked up some of the same possessions as the 13 rolling period measure. The tail of unrelated possessions is less, but there are still some quite geographically disparate possessions.

Chiltern

4.15 The Chiltern series captured the Gerrards Tunnel collapse.

GNER

4.16 The GNER series demonstrated the problems that can arise when there is a very large service group with possessions captured ranging from Stevenage to Dunbar with no concentration at a particular point. This is shown in the following table:

TABLE 4.3 POSSESSION LOCATIONS INCLUDED IN THE GNER SERIES OF POSSESSIONS IN THE 3 RAIL PERIOD ROLLING PERIOD BEGINING 24/07/2005

From-To location	Number of possessions
WOOD GREEN-STEVENAGE	2
Dalmeny Jn-Inverkeithing South Jn	2
Drem Jn-Longniddry	1
Dunbar-Longniddry	1
Grantshouse-Dunbar	1
Inverkeithing Central Jn-Aberdour	1
Lanark Jn-Garriongill Jn	1
Larbert North-Dunblane	1
Longniddry-Monktonhall Jn	1
Prestonpans-Monktonhall Jn	1
Shaftholme Jn-Balne LC	1
Stevenage-Wood Green South Jn	1
Welwyn Garden City-Stevenage	1
Wood Green South Jn-Stevenage	1

Major projects Picked Up

4.17 The revenue method picks up three major projects, Portsmouth, and Crewe (which we believe is linked to the West Coast mainline upgrade) and Liverpool South Parkway (the Merseyrail series). Interestingly, although moving to a shorter rolling period picks up more 'series' with less 'noise', the extra series appear to sometimes, at least, result from unrelated groupings of possessions, not appropriate for bespoke compensation.

4.18 From the information available on MPNs it appears that some major projects that might have been missed are the Project Evergreen and North Manchester Business Park projects. However, we do not have definite dates for when these major projects took place so it is not possible to be definitive.

4.19 As well as running the model excluding possessions under 8 hours, runs were completed, excluding possessions under 24 hours. For the revenue method this did result in an increase in the number of service groups and variety of TOCs captured as

series of possessions. However, excluding possessions under 24 hours provides a perverse incentive for Network Rail to utilise 24 hour possessions regardless of the day of the week. Therefore detailed analysis was not carried out for these results.

Location method results

4.20 One problem with the duration and revenue methods as outlined is that service groups are relatively large entities. As a solution to this problem we investigated using service group-strategic route section combinations.

4.21 In parallel to this project Steer Davies Gleave has undertaken a project for the ORR to identify KPIs for network availability against which Network Rails performance can be measured. As part of this work a version of the S4CS database which mapped possessions to strategic route sections was created. In this version of the database the location fields are matched to TIPLOCS and then a mapping developed for the ICM is used to get to strategic route sections. We were able to use this modified database to investigate the use of service group-strategic route section combinations.

4.22 In the S4CS data there are possessions affecting 116 service groups and 257 strategic route sections. Together these create 1848 service group-strategic route section combinations. In this new approach we used a trigger level that was set at a service group-strategic route combination level rather than at the service group level as in the previous analysis. This enabled a much more granular approach to be taken.

Methodological and Data issues

4.23 As already mentioned, due to the large size of the dataset the excel model constructed for the service group level analysis was correspondingly large. With the introduction of more a more granular level of analysis, it was necessary to take the old model, strip out a lot of the functionality and then run a less comprehensive analysis than previously.

4.24 We set up the new model to assess series of possessions over a rolling period of 13 rail periods in length. We used the duration categorisation exactly as described earlier except that the trigger level was defined at a service group-strategic section level rather than a service group level.

4.25 Finally, in light of previous problems with large possessions distorting the duration method results we also set up the model to exclude possessions over a certain threshold. In the results presented in the report we exclude possessions over 200 hours.

4.26 It is important to note that if this approach is taken, it must be consistent with the large individual possession category to avoid the possibility of missing some possessions. i.e. the duration trigger for individual large possessions must not be larger than the minimum duration of possessions excluded from the series of possessions analysis.

Results

4.27 We conducted some analysis using the methods as described, excluding possessions equal to and under 8 hours and possessions over 200 hours. We found that a trigger

level of 2,500 hours captured approximately 0.7% of total service group possessions. Table 4.4 shows the service group-strategic route section combinations and TOCs that experienced series of possessions using this categorisation:

TABLE 4.4 SUMMARY OF WHERE SERIES OF POSSESSIONS WERE FOUND USING THE SERVICE GROUP-STRATEGIC ROUTE SECTION CATEGORISATION METHOD

service group-strategic route section combination	Affected TOC	Number of series of possessions
ED10-22.01	Northern Rail	10
EA03-23.01	Transpennine Express	10
HL02-13.05	Arriva Trains Wales	4
HY07-03.06	South West Trains Ltd	1

4.28 The much lower trigger level than previously encountered in the duration method was encouraging and the variety of TOCs captured was also greater than for the duration and revenue categorisations over the same length rolling period. In view of this we conducted some more in-depth analysis of the individual series of possessions that had been identified. We conducted this for each TOC (equivalent to looking at each service group-strategic route section in this case).

South West Trains

4.29 South West Trains experienced one set of possessions that qualified as a series of possessions. This was for the period from 01/04/2006 to 01/04/2007.

4.30 The table below summarises the possessions that were captured in this period for the SG-SRS combination involved, by location (as stated in the S4CS file). Note that possessions less than and equal to 8 hours and possessions over 200 hours are excluded.

TABLE 4.5 POSSESSIONS CAPTURED IN THE SWT SERIES OF POSSESSIONS BY TO-FROM LOCATION

To-From location	Number of possessions
Fratton-Portsmouth and Southsea	53
Petersfield-Portsmouth Harbour	9
Fratton to Portsmouth	8
Haslemere-Havant Jn	5
Farlington Jn-Portsmouth Harbour	3
Bedhampton LC-Bedhampton LC	3
Guildford-Haslemere	2
Petersfield-Portcreek Jn	2
Havant-Portsmouth Harbour	2
Haslemere-Portsmouth Harbour	2
Shalford Jn-Havant Jn	1
Liphook-Petersfield	1
Patersfield-Portsmouth Hbr	1
Haslemere-Portcreek Jn	1
Haslemere-Petersfield	1
Portsmouth Harbour Signalling System Failure-Emergency Timetable in Operation	1
Shalford Jn-Haslemere	1

4.31 As for the revenue results the possessions captured in the South West Trains series are primarily located round the Portsmouth area. Also, since the service group-strategic route section is at a more granular level there is not the tail of unrelated possessions that existed in the case of the revenue method.

Northern

4.32 Northern (through the ED10-22.01 SG-SRS combination) qualifies as a series of possessions for ten of the 14 rolling periods that cover the two years of the dataset. The table below details the possessions included in the series beginning 24/07/2007

TABLE 4.6 POSSESSIONS CAPTURED IN THE NORTHERN SERIES OF POSSESSIONS BY TO-FROM LOCATION

To-From location	Number of possessions
Crewe North Jn-Cheadle Hulme Jn	5
Crewe North Jn.-Cheadle Hulme Jn	4
Crewe North-Cheadle Hulme LN	1
Crewe North Jn.-Manchester Piccadilly	1
Crewe North Jn-Cheadle Hulme	1
Crewe North Jn.-Edgeley Jn No. 1	1
Crewe North Jn-Holyhead	1
Crewe North Junction-Cheadle Hulme Junction	1
Crewe North-Cheadle Hulme	1

4.33 Again, this is similar to the series picked up for Northern by the revenue method.

Transpennine Express

4.34 The results for Transpennine Express were very similar to that for Northern. What was essentially captured was one very lengthy series of possessions between Grange-over-Sands and Dalton Jn.

Arriva Trains Wales

4.35 The results for Arriva Trains Wales were not as clear cut as for the other TOCs but were still acceptable. A larger number of possessions were captured and rather than a single series of possessions, large clusters of possessions at some locations were captured along with a number of other possessions. However, it seemed possible that the combined effect of the possessions captured would be similar to that of a series of possessions.

Overall success of method

4.36 The location method has captured two major projects compared to three for the revenue method (Portsmouth and Crewe). However, the Transpennine Express series captured demonstrates the potential of the method to capture projects that, while not major projects, serially disrupt a market and potentially merit bespoke compensation.

4.37 Crucially the location method is not reliant on schedule 4 and therefore has the potential to capture series of possessions where schedule 4 payments underestimate the true cost of possessions. This is a major problem for the revenue method which relies on schedule 4 payments to at least be of the right order of magnitude.

Implementation issues

4.38 One potential issue with the location method is the ability to alter current systems to output strategic route section information for possessions.

4.39 Currently the possessions planning system (PPS) works off a geography based on sectional appendix references which can be mapped to engineer line references which are currently in the PPS. However, there are questions over the accuracy of the mapping to ELRs, there can be multiple ELRs listed for each possession, and the information is not currently captured by S4CS.

4.40 Further, ELRs can be mapped to strategic route sections (SRSs) using a mapping developed for the NMF. However, this mapping is also not complete.

4.41 In the Network KPI work undertaken by Steer Davies Gleave for the ORR in a parallel project KPIs have been developed that are calculated at an ELR level. It is likely that this will require ELRs to be directly recorded in the PPS and readily available in output. Since S4CS uses an extraction from the PPS, it is possible that ELRs could become part of the S4CS extraction process. However, this is not certain and as part of the move to ITPS from Train Plan it is possible that the base geography in PPS (sectional appendix references) could change.

4.42 Viewed in total it is clear that there are implementation risks if the location approach is used. To use the location method as it is currently formulated it is a pre-requisite to have strategic route sections present in the S4CS database. Since the location information in S4CS is currently extracted from the PPS, either strategic route sections or a geography that maps to strategic route sections must be present in PPS. Also, it needs to be possible to extract this information from the PPS. It appears that recording strategic route sections in PPS is not an option, therefore, there are two alternatives:

- Map from ELRs to SRSs in the S4CS database. This however, relies on the assumption that ELRs will be recorded in the PPS in the future and will be extractable. Also the mapping from ELRs to SRSs would need to be audited to ensure that it was sufficiently complete and anomalies removed, for example where ELRs map to more than one SRS.
- Map from sectional appendix references to SRSs, bypassing ELRs. However, as far as we are aware this mapping would have to be created from scratch. Also, it is possible that sectional appendix references will be replaced in the PPS with the move to ITPS which creates a high degree of uncertainty.

4.43 One last point to note is the large number of alternative geographies currently in use by Network Rail. The geographies mentioned here are by no means the complete set, with different geographies used for other purposes. Geography appears to be an extremely complex area, and if the location method was to be considered a full understanding of the systems and processes in place would need to be obtained and clarified with Network Rail.

Large individual possessions

4.44 In addition to the series of possessions analysis we carried out a small exercise to determine what would be a suitable trigger for the categorisation of some individual possessions as ‘large possessions’. The results of this analysis are fully presented in the questions and clarification memos issued on the 14th and 18th December 2007. However, it is clear that from a Network rail planning perspective, a categorisation method is easily the best option. Therefore, in this report only the results for this

method are presented.

TABLE 4.7 NUMBER OF INDIVIDUAL POSSESSIONS CATEGORISED AS 'LARGE' OVER THE TWO YEARS OF THE S4CS DATASET, BASED ON A DURATION CATEGORISATION

Duration Trigger (hours)	Number of possessions captured	As percentage of total possessions
100	431	2.33%
120	289	1.57%
140	273	1.48%
160	208	1.13%
180	96	0.52%
200	83	0.45%

4.45 The key finding from our analysis, as the above table demonstrates, is that the 120 hour trigger proposed in the initial report is too low. A trigger of at least 180 hours is required to ensure less than 1% of possessions (actual, *not* service group possessions) are captured in the large individual possessions category using this categorisation.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Analysis has been conducted on three possible methods for categorising 'series of possessions'. The three methods are:

- Schedule 4 payments as a percentage of annual revenue at the service group level.
- Duration of possessions at the service group level.
- Duration of possessions at a service group-strategic route section combination level. (Location method).

Duration Method

5.2 The duration method at the service group level was found to produce unsatisfactory results. Very large triggers were required to reduce the number of possessions captured to a practical level and the variety of service groups captured was relatively limited.

5.3 The main issue with this method is that the total duration of possessions across a service group is strongly correlated with its size as well as the level of possession activity. Therefore, there is a bias towards the selection of large service groups.

Revenue Method

5.4 The revenue method, while requiring a surprisingly high trigger to reduce possessions captured to a practical level, was an improvement on the duration method.

5.5 Using both a 13 and a 3 rolling period measure it captured three major projects in the dataset. These were the Portsmouth resignalling works, The Crewe works associated with the West Coast mainline upgrade and Liverpool South Parkway.

5.6 However there are some issues with this method:

- The large nature of service groups means that sometimes possessions might be included in a series when this is not appropriate.
- In cases where schedule 4 payments are incorrectly low and bespoke compensation is desirable this might not be picked up using this method since schedule 4 payments are part of the trigger.
- There is a bias *against* large service groups in that significant possessions over part of a large service group might not show up due to the large total revenue of the service group.

5.7 In light of this last point, if this method was to be used there would have to be some consideration as to if some large service groups (e.g. Cross Country) need to be split down to a more granular level.

5.8 There also needs to be some consideration of the negotiation process once a service group has been identified as a series of possessions. In many of the series we have identified there are possessions included in the series which are unrelated to the main engineering work that has triggered the series. Will all possessions in the service group in the relevant period be eligible for bespoke compensation or will there be scope to negotiate out possessions unrelated to the main work?

Location Method

5.9 The location method was found to also be successful in capturing major projects. It captured both the Portsmouth and Crewe works that the revenue method captured although it did not capture the Liverpool South Parkway work. However, some of the latter would have been captured in the large individual possessions category anyway.

5.10 The two major advantages of this method are:

- The more granular nature of the service group-strategic route sections means that less unrelated possessions were captured
- Since it is not based on schedule 4 payments, it is more likely to capture situations where schedule 4 payments are too low.

The location method does seem to be very promising; however, there are significant implementation issues:

- Strategic route sections are not currently in the S4CS database.
- Strategic route sections are unlikely to be introduced into S4CS in the future.
- Therefore, a mapping would be needed from the available geography in PPS. This would either have to be a modification of an existing mapping or a completely new mapping.

Length of rolling period

5.11 Once a method has been chosen there remains the choice of rolling length over which series of possessions need to be assessed. Analysis of the revenue method has shown that shorter rolling periods result in the identification of more series of possessions. Shorter rolling periods also have the advantage of picking up less unrelated possessions to the main works.

5.12 However, the revenue method analysis also showed that a rolling period of 13 rail periods was capable of capturing as many major projects as shorter rolling periods. The key consideration is whether the additional series captured by a shorter rolling period are desirable or not.

5.13 The location method has only been analysed over a 13 period rolling period. It is possible that additional series identified by this method using a shorter rolling period, would be more interesting than those identified by the revenue method.

Large individual possessions

1. The analysis conducted on large individual possessions found that the boundary of 120 hours originally proposed as too low. A boundary of nearer 200 hours was required to reduce the number of possessions captured to a practical level.

APPENDIX A

INFORMATION PREVIOUSLY SUPPLIED TO THE POLICY GROUP

A1. PRESENTATIONS

'Categorising Series of Possessions follow on work' – presented 23/11/2007

A1.1 This presentation documented the initial findings from the duration and revenue method analysis at service group level. See the next two presentations for updates/corrections to this presentation.

'Categorising Series of Possessions follow on work' – circulated 23/11/2007

A1.2 This presentation provided some additional revenue method information and some modifications to the duration work

'Categorising Series of Possessions follow on work' – circulated 29/11/2007

A1.3 This is essentially the first presentation but with some minor errors in two of the tables corrected.

'Categorising Series of Possessions follow on work – Preliminary Results from strategic route analysis' – circulated 05/12/2007

A1.4 This presents the results from the analysis we conducted using service group-strategic route section combinations.

A2. MEMOS

'Questions memo' – circulated 14/12/2007

A2.1 This memo contains answers to the questions raised in Tim Griffiths email (13/12/2007), along with some individual possessions analysis.

'clarification memo' – circulated 18/12/2007

A2.2 This memo addresses some issues raised at the meeting held on the 17/12/2007 at ORR.

A3. EXCEL FILES

'detailed results' – circulated 18/12/2007

A3.1 This contains the detailed possessions level analysis of the revenue method and location method including possessions over 200 hours.

'SerialPossessions_Modelv2.6 – circulated 18/12/2007

A3.2 This is a copy of the model used for the analysis.

About SDG

Steer Davies Gleave is an independent consultancy working worldwide across the transport industry. It is one of the most influential and respected consultancies in the industry; always at the core of the transport debate - be it on planning, policy, governance, climate change, charging or funding.

Since its formation in 1978, SDG has been involved in a wide range of high-profile projects; it has been instrumental in the Arsenal and Wembley stadium projects, assisted railway operators all over Europe, advised on airport privatisations and assisted Government offices on transport policy. Steer Davies Gleave was lead transport advisor on London's successful 2012 Olympic bid, Canary Wharf and other major regeneration projects, the transformation of transport in Dublin, TransMilenio Bus Rapid Transit in Bogotá, the revitalisation of Manchester Metrolink and is now developing London's Cross River Tram project. The firm has successfully supported PPP projects on all modes of transport all over the world, created innovative transport strategies and led the field in implementing travel behaviour change programmes and sustainable development.

In 2007, for the second year, Steer Davies Gleave was rated 18th out of more than 600 firms in the Best Companies to work for in the UK, and was also awarded the prestigious NCE/ACE Consultant of the Year prize. Our independence guarantees impartiality and ensures our efforts are closely focused on meeting client needs. Since its formation Steer Davies Gleave has remained an employee-owned company. Over 90% of staff now own shares in the company.

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