Independent Reporter Mandate CN015

Operational Analysis of Network Rail's Train Service Performance

First Capital Connect Analysis Report

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Rev No	Comments	Checked by	Approved by	Date
1	Draft for Review	JW	JW	18/01/12
2	Final for release	JW	HC	24/01/12

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Job No 60237700 Reference: ORR Rail Reporter – NR Performance January 2012

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1 Introduction

1.1 Background

Current train performance by First Capital Connect is not meeting the CP4 output targets agreed between Network Rail and the ORR. This has led to a number of concerns being raised by stakeholders, and the ORR is therefore carrying out a performance investigation into First Capital Connect.

As part of the Independent Reporter mandate CN015, to contribute to this investigation we have been asked to consider the following "exam question":

- What will the effect be on First Capital Connect of the sum of the JPIPs of the principal operators on its routes?
- Will the JPIPs of the principal operators together help to improve First Capital Connect performance and are there specific things that have to be done to improve performance?

After consultation with the ORR, we have been asked to carry out three specific areas of analysis which will help to address this overall question. These are as follows:

1. Is there any evidence to suggest that First Capital Connect is always the "poor relation" on each route? Carry out some high-level analysis, comparing the delay profile by route for First Capital Connect and the lead operator.
2. How has the Further Improvement Plan (FIP) performance forecast been derived? How much of the forecast is made up from Network Rail initiatives and how much is from First Capital Connect initiatives?
3. How good are the assumptions behind the FIP – in particular those that relate to the Network Rail initiatives, as captured in the Performance Action Tracking (PAT) system? How have the estimates of performance benefits been derived? How have the estimates been shared between operators?

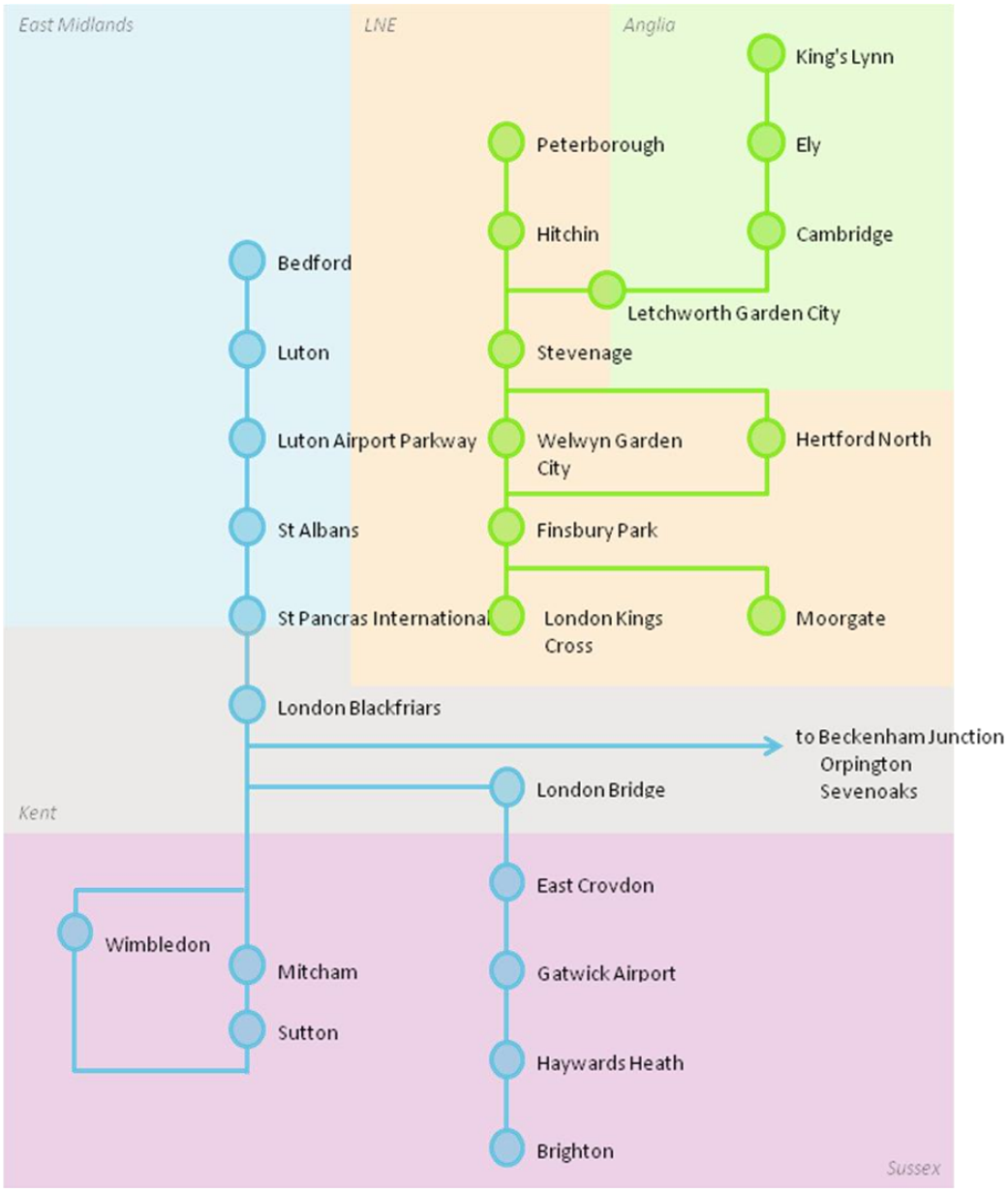
The rest of this report summarises our analysis in these three areas. There is also a supporting technical appendix in Excel which contains further details of the analysis.

1.2 Summary of Conclusions

1. We have not found any conclusive evidence that First Capital Connect suffers on any of the five routes over which it operates as result of not being the lead operator.
2. The FIP forecast is built up from a "baseline" taken from historic delay minutes, and overlaid with assumed delay minute savings from various Network Rail and TOC performance initiatives. The Network Rail initiatives make up 83% of the forecast improvements, and TOC initiatives 17%. If these delay minute savings are all achieved, we have calculated that the PPM at the end of 2012 will be 90.3% (rather than the 90.9% original JPIP target).
3. We have carried out spot checks on some of the Network Rail performance benefit estimates that have gone into the First Capital Connect FIP. These checks have all been on initiatives from the East Midlands Route, as we have not yet had time to carry out any spot checks on initiatives from other routes. The conclusion from the checks is that the benefit estimates appear to be reasonable and robust as far as we can tell although the work being carried out as part of mandate CN015a into performance planning best practice will add more certainty or otherwise to our conclusion.

2 Is FCC the “poor relation” on any of the routes over which they operate?

First Capital Connect operates over five different routes, but is not the lead operator on any of these routes:



Our first piece of analysis considers whether there is any evidence that First Capital Connect receives a poorer service from Network Rail, or does not receive a proper focus for managing performance as result of not being the lead operator.

We have plotted trends in performance by route and operator, and looked for differences between First Capital Connect and the lead operator. From these charts, we have looked to answer the following questions:

- Do both operators show the same general trend in performance, or does the lead operator see an improvement that is not reflected in First Capital Connect?
- In periods of poor performance, does First Capital Connect seem to be more adversely affected?
- What are the absolute levels of delay like when normalised by train miles? Are there differences by operator?

All of the charts are included in the Excel Appendix to this report. It should be noted that the train miles data we had available is known to be inaccurate, and so the normalised delay minutes may not be correct in absolute terms, although any trends should still be valid.

We have not found any conclusive evidence that First Capital Connect suffers as result of not being the lead operator. The plots which come closest to suggesting that there may be evidence of this occurring are shown below. From Figure 1, during the periods of poor performance in Autumn/Winter 2010/11, First Capital Connect suffered more Network Rail delay per train than East Coast on the LNE route. We have drilled down to the Great Northern Area (Figure 2) but do not have the data to normalise by train miles. However, the level of delay suffered by both TOCs on the area is comparable, and shows the same trend in bad periods.

Figure 1 – Network Rail Minutes per 1000 Train Miles on LNE Route

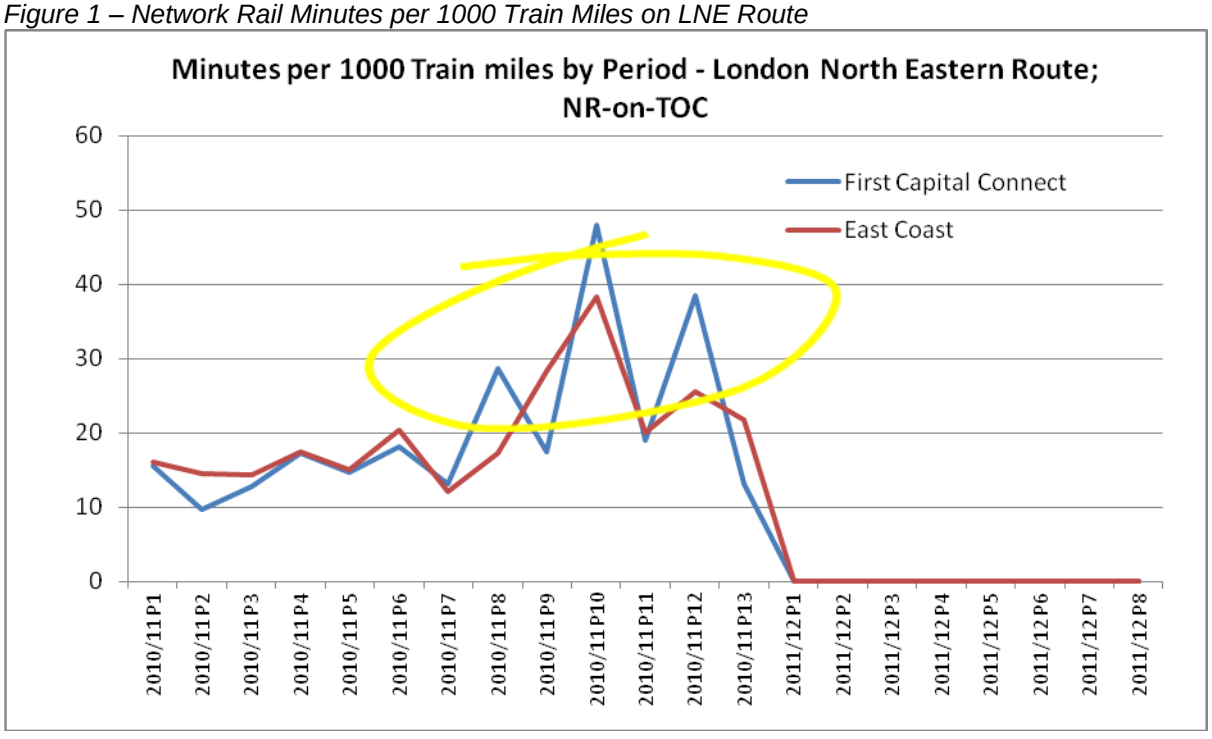
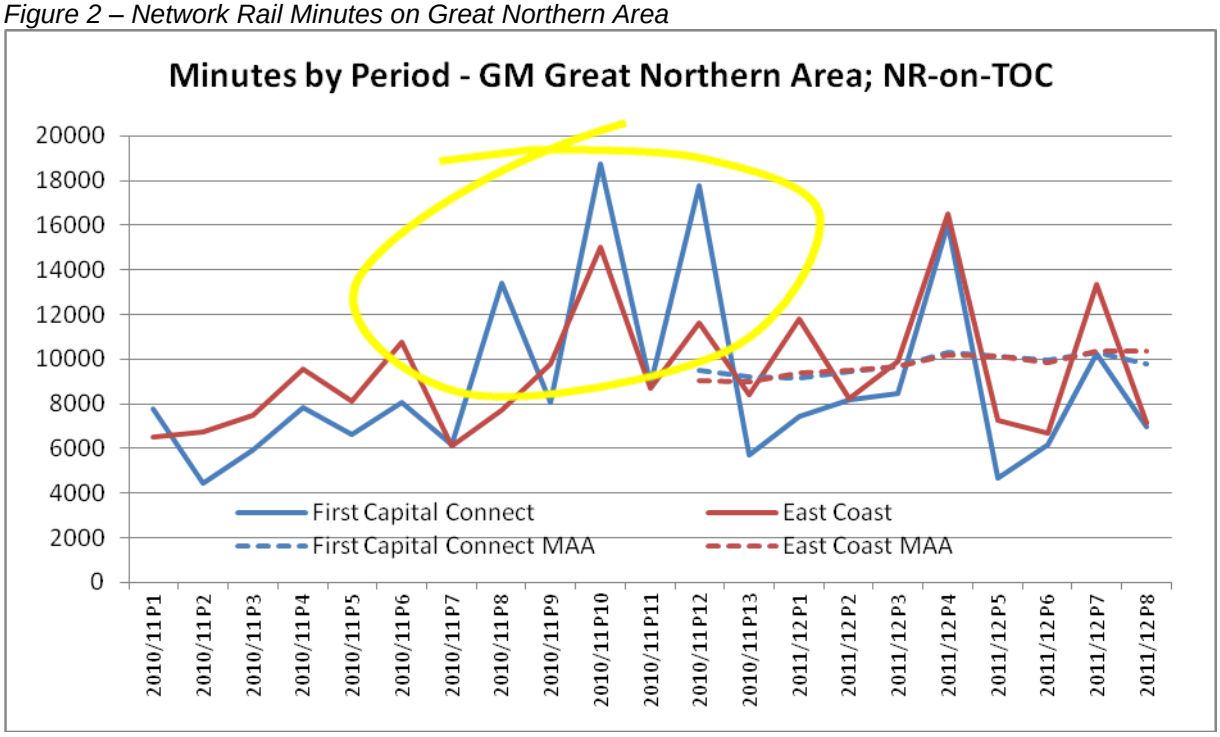


Figure 2 – Network Rail Minutes on Great Northern Area



3 How has the FIP performance forecast been derived and how much is made up by NR initiatives?

3.1 The Further Improvement Plan

Network Rail and First Capital Connect have produced a Further Improvement Plan which states the performance that they jointly expect to deliver by the end of 2011/12 (see Figure 3):

Figure 3 – First Capital Connect Further Improvement Plan

	End of Year Target	End of Year Forecast
Network Rail Delay Minutes	240,000	265,000
TOC-on-Self Delay Minutes	129,970	122,970
TOC-on-TOC Delay Minutes	64,000	68,000
PPM	90.9%	90.9%
CASL	3.0%	3.5%

We have investigated the assumptions behind this plan, and below we summarise how the figures have been derived.

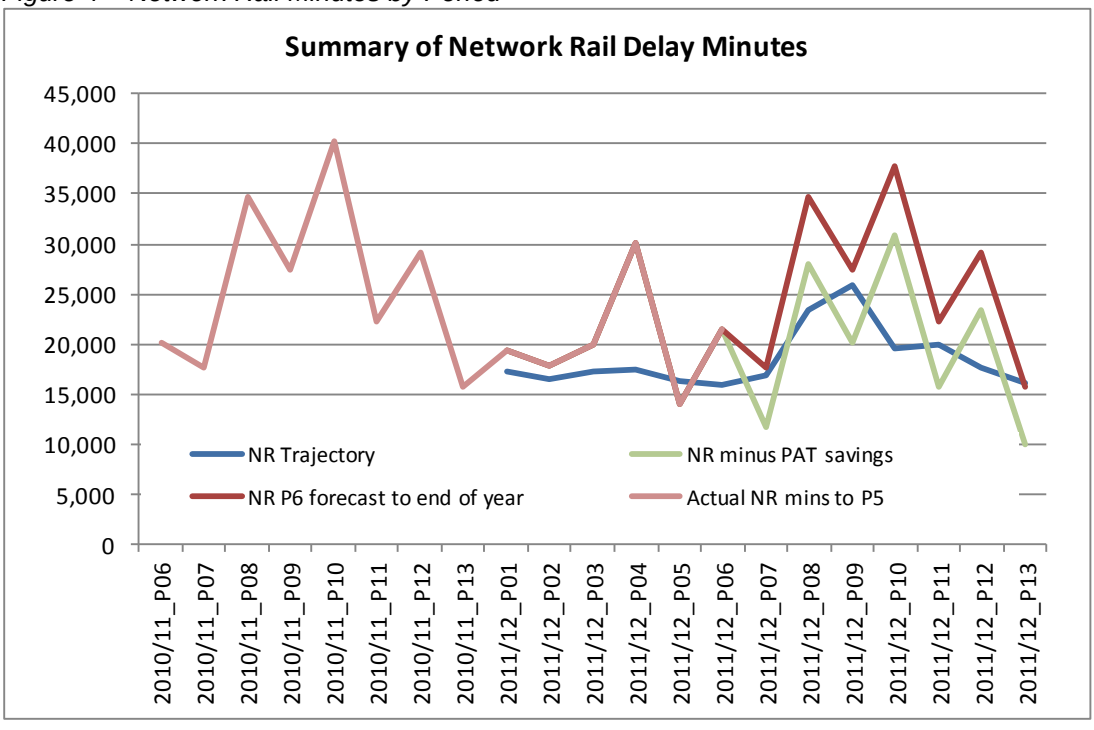
3.1.1 Calculation of a baseline

We have seen the calculation of the Network Rail Delay Minutes baseline. This was based on historic delay to Period 6, and then assumed that period-on-period delay to the end of the year would be as in the previous year (2010/11). The only exception was Period 10 which included a 'winter reversal' to remove the effect of the unusually severe winter in 2010/11. Our view is that these assumptions give a reasonable baseline.

3.1.2 Calculation of performance savings from initiatives

Figure 4 shows how the performance forecast has been derived for Network Rail. The blue line (NR Trajectory) is the original JPIP forecast. The pink line shows the historic Network Rail delay minutes suffered by First Capital Connect. These have been extended to give the red baseline, as described above. A series of forecast performance savings has then been subtracted from the baseline to arrive at the green line. These savings are also captured within Network Rail's PAT database.

Figure 4 – Network Rail Minutes by Period



We have not seen the equivalent figures for the TOC-on-Self or TOC-on-TOC delay minutes. However, if we make equivalent assumptions to the Network Rail minutes in order to generate a baseline for the TOC minutes, we can calculate the implied savings in delay minutes by the TOC if the FIP target is to be met. These are summarised in Figure 5, but more detail of the calculation is given in the Excel Appendix to this report.

Figure 5 – Assumed Delay Minute Savings from the Further Improvement Plan

	Baseline	Forecast	Saving	% of Total Saving
Network Rail Delay Minutes	307,450	265,000	42,450	83.4%
TOC-on-Self Delay Minutes	129,654	122,970	6,684	13.1%
TOC-on-TOC Delay Minutes	69,744	68,000	1,744	3.4%
Total	506,848	455,970	50,878	100%

Whatever assumptions have been made about TOC initiatives, the assumed savings from the Network Rail initiatives are far more significant, as over 80% of the required delay savings come from these.

3.1.3 Conversion to PPM

At the time of producing the FIP, First Capital Connect was 0.1% behind its target PPM MAA for Period 6. The overall PPM target for the end of the year of 90.9% had originally been derived using Network Rail's Delay/PPM regression model. However, in recent periods there had not been a strong relationship between achieving the period delay minute targets and the period PPM targets. This suggested that the delay/PPM relationship had changed, and so in producing the FIP Network Rail and the TOC assumed that as they were only slightly behind their current PPM target, they would be able to meet the original end of year PPM target.

Network Rail has now provided an updated version of the Delay/PPM model and we have checked that it gives the correct PPM for Period 6. We have applied the updated model to the FIP forecasts under four scenarios (Figure 6):

Figure 6 – Estimate of PPM Resulting from Assumed FIP Delay Minutes

	Baseline	Network Rail initiatives only	TOC initiatives only	All initiatives (as FIP)
Network Rail Minutes	307,450	265,000	307,450	265,000
TOC-on-Self Minutes	129,654	129,654	122,970	122,970
TOC-on-TOC Minutes	69,744	69,744	68,000	68,000
Total	**506,848**	**464,398**	**498,420**	**455,970**
PPM%	89.4%	90.1%	89.5%	90.3%

Under the baseline scenario (with no further performance initiatives), PPM at the end of the year is forecast to be 89.4, which is approximately the same as it is as present (89.3%).

As we would expect given that over 80% of the delay minute savings are expected to come from Network Rail initiatives, the PPM if only Network Rail deliver their initiatives is nearly at target, but the PPM if only the TOCs deliver their initiatives is not much different to the baseline.

In conclusion, if both NR and the TOCs deliver their initiatives, the current delay/PPM model gives an end of year forecast of 90.3% PPM MAA, rather than the 90.9% as assumed in the FIP.

4 How have estimates of delay minute improvements been derived?

4.1 Network Rail Delay Saving Assumptions

It is clear that the most significant assumptions in the development of the FIP forecasts are around the delay savings arising from Network Rail initiatives, as captured in the PAT. There are two stages in deriving these performance savings:

- Estimating the overall delay minute savings resulting from the initiatives by route.
- Sharing the delay minute savings between the operators affected.

A quick summary of the current PAT suggests that there are some 400 initiatives which are expected to impact First Capital Connect. Clearly, it is not feasible to investigate the assumptions behind all of these in the time available for this mandate. Therefore we have carried out a small number of 'spot checks' to understand the principles behind the delay saving estimates.

PAT initiatives are estimated and entered by the route. Although there is some consultation across routes, particularly for common initiatives, in the main routes carry out their calculations independently.

4.2 East Midlands Route Spot Checks

We randomly selected the three initiatives detailed in Figure 7 for further investigation:

Figure 7 – Total Performance Benefit by Operator from P7 to P13 of 2011/12 for Selected Initiatives

Initiative	Title	FCC	East Midlands Trains	Cross Country	South-eastern	F/Liner Heavy Haul	DB Schenker	Total
38777	Bender Remote Condition Monitoring - Bedford DU Area	1561	1141	420	133	182	245	3682
38037	EM Installation of Armoured Cable at West Hampstead	762	576					1338
38357	EM Camera Technologies for OLE Inspections	588						588

4.2.1 Bender Remote Condition Monitoring - Bedford DU Area

This was a new initiative introduced for the FIP calculation (i.e. not in the original JPIP trajectory).

The RCM of the cables detects power leakage and is therefore assumed to prevent any large failures where the power totally fails as a result of steady condition worsenment. However, it is not assumed that it will prevent all power failures, as there will be some minor power losses for various reasons no matter how good the monitoring and corrective actions. Therefore any delay savings are only assumed to be from large incidents within the "IE" (Power Failure) reason code. Note that this code would not include incidents such as the cable being cut, as this would be attributed to vandalism or similar. As the remote condition monitoring is only installed in critical places close to the core, any delay savings are also assumed to be from incidents initially caused within the Bedford DU area.

The overall performance benefit was estimated by listing all incidents in the Bedford DU area attributed to reason code IE over the last year, and ranking by total delay minutes. Any incidents causing over 1000 minutes delay were assumed to be prevented in the future by this initiative. This totalled 6837 minutes over the year or an average of 526 minutes per period. Summing the saving over periods 7-13 of this year gives a saving of **3682** minutes.

The total number of minutes was shared out between the relevant TOCs on a train mileage basis, using the standard PAT apportionment methodology. This resulted in most of the delay minute savings (about 75%) being

apportioned to First Capital Connect and East Midlands Trains. The rest are distributed between 4 other TOCs and FOCs, and would be expected to be realised as savings in reactionary delay.

4.2.2 East Midlands (EM) Installation of Armoured Cable at West Hampstead

This was an initiative whose performance saving was included in the original JPIP trajectory. However, the initiative slipped and the benefit was not realised when originally intended. At the time of calculating the FIP forecast, this initiative was reviewed, and the estimated performance checked to ensure it was still realistic.

Any incidents over the past 13 periods which were a result of the cables from Harpenden and West Hampstead feeders being damaged, cut, faulty or unable to supply power for any other reason were identified. This selection was on the basis of the incident location and the following reason codes:

- IE – Power Failure
- IF - Train Describer/Panel/ARS/SSI failure
- IH - Electronics/TDM failure/remote control failure
- XZ - Other external causes the responsibility of Network Rail

This gave a total of 9809 minutes based on 2009/10 data. These minutes were used to find an average per period, and were shared out equally between two similar initiatives (one at Harpenden and one at West Hampstead) as it was difficult to determine which feeder caused the historic delay.

When the analysis was repeated with more recent performance data, a slightly higher total delay minutes was found using the same criteria, and so the original estimate was considered to still be valid. The maintenance team determined that 60% of such delays would be saved in the future as a result of this initiative being in place. This proportion was determined on the basis of engineering judgment.

The benefits from the rescheduled initiative were assumed to cut in from period 8, giving 6 periods of savings to the end of the year, totalling **1338** minutes.

These minutes were apportioned manually between First Capital Connect and East Midlands (rather than by using the standard PAT “train miles apportionment” calculation).

4.2.3 East Midland (EM) Camera Technologies for OLE Inspections

This initiative was also included in the original JPIP trajectory. It was assumed that the new camera would prevent one large OLE fault over the course of a year. Any relevant OLE incidents with more than 500 minutes delay in the past 13 periods of data were identified, and the average delay per incident found. The initiative was assumed to save one such large incident over the next year, and the performance saving was assumed to benefit only First Capital Connect services.

4.3 General Observations

4.3.1 Need for judgment

On the East Midlands route all performance benefits are estimated with reference to historic TRUST data. The route performance manager was unable to confirm whether this would necessarily be the case across all routes.

Although savings are determined by examining historic data and calculating how much of the delay would not have occurred had the initiative been in place, there is still a large element of engineering judgement required. However, the level of judgment varies depending on the type of initiative being assessed. If the first two examples above are compared, the estimate for the RCM of the cables was based on a case-by-case consideration of potential incidents which could be saved. The only judgment was in determining that 1000 delay minutes was a suitable cut-off for a large incident which could potentially be avoided in the future. The installation of the armoured cable was based on a similar identification of relevant incidents, but applied a more general 60% saving.

"Softer" types of initiatives would presumably require an even greater degree of judgment. For example, on the East Midlands route, there are schemes to allow incident response teams to use bus lanes in Bedford and Leicester area. Savings from these initiatives were estimated using an arbitrary (but conservative) estimate of a 2% saving on all incidents in the relevant locations.

Our view is that some degree of engineering judgment is inevitable, particularly in estimating certain kinds of performance benefits. However, the judgment needs to be on the basis of some knowledge, rather than being completely uninformed.

4.3.2 One-off incidents

The approach of identifying a large population of historic incidents, deciding which would be mitigated by the initiative and then assuming a delay saving equal to some proportion (possibly 100%) of these incidents seems in general to be a reasonable and robust methodology. However, it is more questionable when applied to very specific initiatives designed to prevent one-off incidents occurring again.

For example, suppose a large incident occurred because faulty equipment was provided by a supplier, and when installed failed to operate correctly. One initiative may be to require the supplier to introduce a new check in their manufacturing process to prevent the equipment being delivered in the same faulty manner in the future. Is it then appropriate to assume that this large incident would never occur again? It may be true that the specific scenario could not arise again, but it is likely that at some point in the future a similar large incident will occur again for some reason that has not currently been envisaged.

Either a careful and conservative approach needs to be applied when assuming delay savings for specific initiatives targeting one-off incidents, or some form of overlay must be applied to the forecasts, to reflect the probability of other one-off incidents occurring in the future.

4.3.3 Apportioning the benefits between operators

There appear to be two possible methods for sharing the estimated performance benefits between operators. The first is an automatic process which takes a set of historic data and shares the benefits in the same proportion as the train miles. The second is a manual override of the automatic process. We were unable to determine how much of the performance savings in the PAT had been applied to the operators using each of the methods. As far as we are aware there is no field in the PAT recording the basis on which the apportionment has been carried out. Our recommendation is that going forwards there is some way of capturing and recording this information.

Clearly in using the automatic method, there is a possibility that performance savings could be assigned to an operator as a result of an initiative, when common sense suggests that the operator could not possibly benefit.

Although we have not thoroughly been through every initiative in the PAT, from the checks that we have made, we have not found many examples of this for First Capital Connect. The only possible case we identified was initiative 6179 “Amberley Bridge Beams” on Sussex route, which estimates 20 minutes delay saving per period for First Capital Connect. Assuming that Amberley Bridge is by Amberley station, then First Capital Connect operate sufficiently remotely from this infrastructure, that the assumed savings are difficult to explain with confidence.

Figure 8 shows the total performance savings in the current version of the PAT for periods 7 to 13. These are not exactly the same as the total minutes assumed in the FIP, presumably due to the PAT being updated since the FIP was created. However, the figures are the right order of magnitude, and when broken down by route do not show that First Capital Connect expects to benefit from initiatives on routes where they do not run (except for 72 minutes from initiatives on LNW relating to reactionary delay).

Figure 8 – Total Performance Benefit by Route from P7 to P13 of 2011/12 for First Capital Connect

Route	Planned Minutes Improvement
East Midlands	17,903
London North Eastern	14,388
Sussex	5,924
Kent	4,799
Anglia	830
London North Western	72
Total	43,916

The fact that we have not found any real evidence of initiatives which are clearly badly apportioned, suggests the current methods for checking and overriding the automatic apportionment are working adequately. This conclusion is however based on a very small sample size.

Where the automatic method has been overlaid with a manual apportionment, there is potentially a need for more care when considering reactionary delay. In the first example of Bender Remote Condition Monitoring, the overall benefit was distributed between six operators based on historic data (Figure 7). The proportion of delay to be saved by each operator seems plausible given the relative traffic volumes, and propensity for reactionary delay. In the second example (installation of armoured cable), the benefit has only been shared between First Capital Connect and East Midlands Trains. If the original estimate of the benefits was only based on historic delay suffered by these two operators, then this is a valid assumption. However, if the original estimate was based on historic delay including reactionary delay suffered by other operators, the performance benefit expected for First Capital Connect is potentially overestimated. Therefore although a manual apportionment may appear more accurate, unless the apportionment is done in a way that is consistent with the spread of delay in the original overall estimate, this may not be the case.

4.3.4 Checking that the forecast was valid

From talking to the route performance manager, we understand that there are good controls in place for checking that implementation of an initiative is progressing as planned. If the initiative is delayed for some reason, the cut-in date is altered, and the delay minutes forecast is updated to reflect this.

It would seem that it is also standard procedure to check that the initiative is actually “doing” something. For example, on the East Midlands route, the RCM of the cables is known to have identified problems which have corrected before they develop into major faults. Similarly the OLE camera has identified faults which have been repaired, and it is known that the bus lanes in Bedford and Leicester have been used by incident response teams.

Although there are checks that initiatives are in place and providing a performance benefit, there is no standard or systematic procedure to check that the original delay saving forecast was correct. Of course, this may not actually

be possible in every case. For example, it would be very difficult to determine whether the use of bus lanes by incident response teams is specifically delivering 2% less delay per incident. However, in the example of the remote condition monitoring of cables, it would be quite easy to check that there are no incidents attributed to reason code "IE" in the Bedford DU area with more than 1000 minutes over the next year.

We are aware that there has been some analysis of this type by the central performance team, looking at whether PAT initiatives actually deliver the performance benefit that was originally estimated. The importance of collecting this information will be in identifying whether it is necessary to introduce some form of "optimism bias" correction to the estimates coming from the routes.

4.3.5 Consistency between routes

From what we have seen on the East Midland route, the methods for estimating the performance benefits of initiatives seem reasonable and robust. Estimates are always based on historic delay minutes, and where possible are formed from analysis of historic data rather than relying solely on expert judgment.

As we have only had time to talk to one route performance manager, we have been unable to assess whether this is necessarily the case on all routes. By way of comparison, we would like to ask the LNE route performance manager about the estimation of the performance benefits of the following initiatives:

Initiative	Title
43517	FIP GN OLE Pole Mounted Cameras
43377	FIP GN Remote Condition Monitoring for Track Circuits
41617	GN Bender Units Installation
40317	GN Hitchin MOMs to be equipped with Blackberries

We would be interested to see whether initiatives 43377 and/or 41617 have been estimated in a similar way to the Bender remote condition monitoring example on the East Midlands route. Similarly, we would like to compare 43517 to the East Midlands camera technologies example.

Initiative 40317 sounds like a "softer" type of initiative for which it would be difficult to establish a performance benefit, so we would be interested in understanding what data analysis is behind this estimate.

We note that there are significant delay minute savings assumed on the LNE route as a result of initiatives to tackle cable theft. We would also like to ask about these types of initiatives, and how their performance benefit has been calculated.

4.4 Next Steps

Subject to agreement from the ORR, we suggest that our next steps following on from this analysis are as follows:

- Compare our observations on initiatives from the East Midlands route with the same type of spot checks on some initiatives on the LNE route (as described above)
- Take the emerging conclusions from this study and feed them through into the wider CN015a mandate, to inform the relevant steps in the JPIP process.

Appendix A

The Excel Appendix that belongs with this report covers the analysis behind the first two questions:

1. Is there any evidence to suggest that First Capital Connect is always the “poor relation” on each route? Carry out some high-level analysis, comparing the delay profile by route for First Capital Connect and the lead operator.
2. How has the FIP performance forecast been derived? How much of the forecast is made up from Network Rail initiatives and how much is from First Capital Connect initiatives?