Subject	AO/037: Review of Network Availability Forecasts in SBP - Final		
Date	22 February 2013	Job No/Ref	223767-08

1 Introduction

This technical note reviews the network availability forecasts for CP5 in Network Rail's Strategic Business Plan (SBP), which are described in document SBPT233 version 0.7[1]. Specifically, we give our opinion on three questions:

1. Was Network Rail right not to use NARS when forecasting PDI-P / F in the SBP?
2. Is the alternative forecasting model used for the SBP appropriate?
3. Are the forecasts derived from the model accurate?

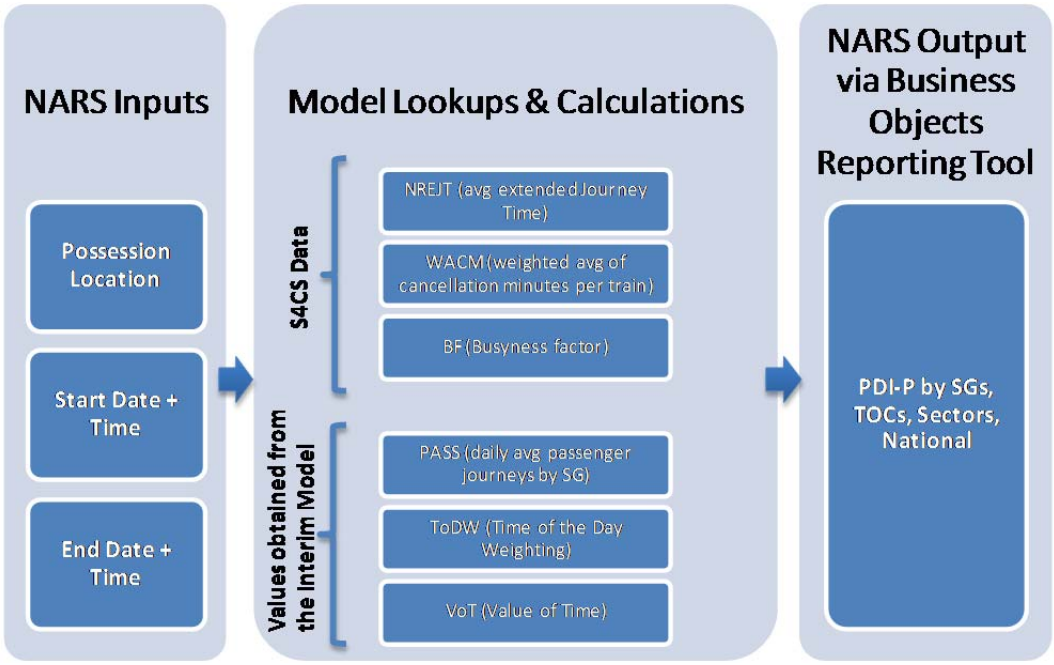
Timescales have not permitted a detailed investigation. Instead our opinion is based on a meeting held with Network Rail on the 6th February 2013 and a review of the supporting spreadsheets and documentation provided.

In this technical note we briefly describe the two methods for forecasting the PDI values of NARS and Network Rail's top down approach, then review the top down models provided by Network Rail, before answering the three questions.

2 NARS

NARS (Network Availability Reporting System) is used by Network Rail to calculate and report historic PDI-P and PDI-F values, and to forecast values over the next 1-2 year horizon. It was developed during CP4 and Arup audited it in 2011 to confirm that its calculations are accurate. The inputs and calculations of the model for PDI-P are summarised in the diagram below.

[1] Access strategy and network availability summary, Network Rail



One of the key inputs is the possessions strategy, requiring information on the location and durations of possessions. At a meeting on the 6th February, Network Rail confirmed that these details of the strategy for CP5 have not yet been developed, given that the current stage of development is a strategic plan and not a delivery plan. Further, they pointed out that there are no set targets in HLOS for PDI-P and PDI-F. They therefore believe that a top down approach to forecasting the PDI values for CP5 would be more suitable in the SBP.

It would be possible to use NARS to calculate the PDI values for the subset of routes that are likely to contribute the most weighting to the national values. This is because of the way that the algorithm works: generally speaking, the London and South East routes have the most influence on the PDI-P values because of the numbers of passengers they carry. This was indeed the approach taken by Network Rail for CP4 when they largely based their forecasts on calculations for approximately 18 flows using a spreadsheet model that was the predecessor to NARS. However, they point out that basing a forecast on such a subset as a proxy for the entire network will introduce inaccuracies.

It would therefore have been possible for Network Rail to develop possessions strategies on the key flows for each year of CP5, and to then use NARS to calculate their PDI-P values. From this, a national PDI-P value could then be estimated. A similar approach might be possible for PDI-F on the key freight flows, though this it is difficult for us to gauge the practicality of doing so on flows that cross route boundaries. We comment further on such an approach in Section 5.

3 Alternative forecasting model used for the SBP

Network Rail have developed an alternative top down approach for forecasting PDI-P and PDI-F which is simpler than NARS. It works by calculating the historic CP4 disruption impact of possessions (in terms of PDI-P and PDI-F) per expenditure spend. It does so by comparing the annual PDI values to the spend in that year by type of work (enhancements, renewals and maintenance) and by route. It then applies this PDI per spend to the planned expenditure levels for CP5 (again by type of work and route) to forecast PDI-P and PDI-F in each year of CP5.

On a minor point, document SBPT233 states that the expenditure to PDI relationship is based on an analysis of data for the first three years of CP4. Whilst this is true for maintenance expenditure (which tends to be cyclical in nature), enhancements and renewals are based on the third year of CP4, namely 2011/12. Network Rail have used this year for these latter two activities because they believe that year's data contains the most complete records split by possession type and they therefore believe it is the most appropriate for the model.

A number of assumptions have been made in the top down approach including the following.

Assumption	**Likely impact**
Efficiency gains arising from the 7-day railway fund after 2011/12 will not be taken into account.	PDI values over-estimated (i.e. over-estimating the disruption of possessions)
No re-balancing of the use of high output machines. These were predominantly used on LNE and Western routes in CP4 but could be used elsewhere in CP5.	Will change individual route PDI values, but overall impact on national PDI values is uncertain
No account has been taken of the new track policy of 20% of track renewals to take place in weekday nights during CP5.	This will reduce the extent of weekend possessions which means that the forecast PDI values will be over-estimated.
Efficiency gains in unit costs from 2011/12 to the end of CP5 are ignored. Network Rail have used the CP5 post-efficient costs in the model.	This will under-estimate the volume of work required during CP5, and so will under-estimate the PDI values.

To some extent the impacts of these assumptions might cancel each other out but it is difficult to judge the net impact.

Our opinion is that a top down approach of this type would be appropriate given the stage of development of the plans for CP5 if it can be demonstrated that it is reasonably accurate. The above assumptions raise questions about accuracy and we explore some of them in the next section.

4 Are the forecasts derived from the model accurate?

4.1 Approach

We have carried out some checks on the data and models provided by Network Rail. We have then carried out two sensitivity tests to start exploring the likely accuracy of the results. These are described in this section.

The models that we have reviewed are:

- CP5 Enhancement source data for CP5 PDI forecast- Dec2012 update.xls
- CP5 SBP Renewals Data for SBP PDI forecast - 14Dec2012.xls
- PDI-P and PDI-F Source data for PDI SBP forecast.xls
- PDI forecast Model for CP5 SBP PDI Forecast Dec2012.xls

These are explained in the Network Rail document 'The CP5 PDI forecast methodology for the SBP.doc', dated December 2012.

4.2 Source Data Checks

A number of checks have been carried out on the source data to ensure consistency with both the dependent calculation sheets, and an independent data source in order to validate the data carried forward. For the data validation exercise for renewals and enhancements, figures were taken from the Tier 0 model received on January 29th 2013. Post efficient costs were used for comparison for both enhancements and renewals as these have been used in the source data and all subsequent calculations.

4.2.1 Maintenance

The top down model simply averages the annual PDI values associated with maintenance activities from 2009/10, 2010/11 and 2011/12 for each route separately. This assumes that the disruption caused by these possessions will continue at this level throughout CP5.

We do not have access to the source data of PDI-P / F associated with maintenance activities that has been used by the model. Instead we have undertaken a simple sense check of the national annual PDI values implied by this data, by comparing them against the reported PDI values in the 2012 Annual Return. This comparison is shown in Table 1 below. There are some small differences, however they are unlikely to be a major concern and we assume they are caused by rounding errors.

Table 1: Comparison of National PDI Values against 2012 Annual Return

Moving Annual Average PDI Value		2009/10	2010/11	2011/12
PDI – P	Implied by model source data	0.65	0.52	0.55
	2012 Annual Return	0.63	0.52	0.54
PDI – F	Implied by model source data	0.82	0.89	0.85
	2012 Annual Return	0.82	0.85	0.82

4.2.2 Enhancements

The enhancements source data taken from the workbook entitled 'CP5 Enhancement source data CP5 PDI forecast – Dec2012' has been checked against post-efficiency figures taken from the Tier 0 model. Anglia, Scotland and Western routes were chosen at random and used as effective 'spot checks' on the data. Four enhancement schemes for each route were chosen at random and assessed. Checks have been carried out for all five financial years in Control Period 5 (CP5). The results are shown below in Table 2.

Table 2: Enhancements Data Check

£m, 2012/13	FY14/15			FY15/16			FY16/17			FY17/18			FY18/19		
	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference
Anglia															
Crossrail	0.61	*0.62*	-1.6%	0.76	*0.73*	4.1%	0.75	*0.58*	22.0%	0.44	*0.30*	31.4%	0.09	*0.10*	-16.8%
Thameslink	3.05	*3.05*	0.0%	1.63	*1.63*	0.0%	0.68	*0.68*	0.0%	0.26	*0.26*	-0.2%	0.29	*0.29*	-0.2%
Service improvements in the Ely area	0.86	*0.86*	0.0%	1.94	*1.94*	0.0%	2.86	*2.86*	0.0%	14.36	*14.36*	0.0%	12.21	*12.21*	0.0%
West Anglia main line capacity increase	0.33	*0.33*	-0.1%	0.45	*0.45*	-0.1%	0.63	*0.63*	0.0%	22.02	*22.02*	0.0%	20.52	*20.52*	0.0%
Scotland															
Edinburgh Glasgow Improvements Programme (EGIP)	189.16	*189.16*	0.0%	141.25	*141.25*	0.0%	98.66	*98.66*	0.0%	60.24	*60.25*	0.0%	0.00	*0.00*	0.0%
Aberdeen to Inverness journey time improvements	52.57	*52.58*	0.0%	103.06	*103.06*	0.0%	113.08	*113.08*	0.0%	11.45	*11.45*	0.0%	0.00	*0.00*	0.0%
Highland mainline journey time improvements (phase 2)	32.16	*32.16*	0.0%	34.80	*34.80*	0.0%	16.18	*16.18*	0.0%	28.28	*28.28*	0.0%	9.60	*9.60*	0.0%
Scottish Network Improvement Fund	12.36	*12.36*	0.0%	12.36	*12.36*	0.0%	12.36	*12.36*	0.0%	12.36	*12.36*	0.0%	12.36	*12.36*	0.0%
Western															
Crossrail	300.98	*305.86*	-1.6%	372.06	*356.67*	4.1%	366.73	*286.22*	22.0%	215.41	*147.72*	31.4%	42.45	*49.81*	-17.3%
Great West electrification	188.12	*188.12*	0.0%	197.50	*197.50*	0.0%	171.45	*171.45*	0.0%	99.73	*99.74*	0.0%	38.92	*38.92*	0.0%
East-West Rail	5.68	*5.68*	0.0%	14.19	*14.19*	0.0%	20.86	*20.86*	0.0%	13.34	*13.34*	0.0%	0.85	*0.86*	0.0%
Oxford - Bletchley - Bedford electrification	2.41	*2.41*	0.0%	12.29	*12.29*	0.0%	12.99	*12.99*	0.0%	12.82	*12.82*	0.0%	9.53	*9.53*	0.0%

The results show some discrepancies in the Anglia and Western enhancement schemes, particularly Crossrail with the biggest being in financial year 2017/18 where the source data is 31.4% higher than the Tier 0 figures for both routes. The consistency in the percentage differences for Crossrail in Anglia and Western suggests that there may be an underlying reason for the difference in the data relating to the Crossrail costs. We suggest that this discrepancy should be investigated further and that a more detailed audit of route level data should be undertaken.

There are also some very minor discrepancies for the West Anglia Main Line Capacity Increase scheme but these are not significant. All the figures for Scotland are 100% accurate.

4.2.3 Renewals

The renewals source data taken from the workbook entitled 'CP5 SBP Renewals Data for SBP PDI forecast – 14Dec2012'has been validated against figures taken from the Tier 0 model. Anglia, Scotland and Western routes were chosen at random and used as effective 'spot checks' on the data. The data is split between track renewals, signal renewals and other renewals and the totals are also displayed. Checks have been carried out for all five financial years in Control Period 5 (CP5). The results are shown below in Table 3.

Table 3: Renewals Data Check

£m, 2012/13	FY14/15			FY15/16			FY16/17			FY17/18			FY18/19		
	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference	Source Data	Tier 0	Difference
Anglia															
Track	59.77	59.52	0.4%	60.17	59.95	0.4%	81.87	81.66	0.3%	58.57	58.80	-0.4%	43.59	43.43	0.4%
Signal	38.32	38.33	0.0%	51.00	51.00	0.0%	67.62	67.62	0.0%	55.84	55.84	0.0%	35.81	35.82	0.0%
Other	112.33	112.34	0.0%	127.12	127.13	0.0%	137.52	137.52	0.0%	133.62	133.63	0.0%	131.38	131.38	0.0%
Total	210.42	210.19	0.1%	238.29	238.08	0.1%	287.01	286.80	0.1%	248.02	248.26	-0.1%	210.78	210.63	0.1%
Scotland															
Track	85.98	85.72	0.3%	105.18	104.94	0.2%	90.68	90.46	0.2%	87.08	87.33	-0.3%	83.98	83.81	0.2%
Signal	63.04	63.05	0.0%	100.39	100.39	0.0%	77.10	77.10	0.0%	32.94	32.94	0.0%	20.66	20.66	0.0%
Other	152.31	152.31	0.0%	158.90	158.90	0.0%	151.15	151.15	0.0%	169.15	169.15	0.0%	177.56	177.55	0.0%
Total	301.34	301.07	0.1%	364.47	364.23	0.1%	318.94	318.72	0.1%	289.17	289.42	-0.1%	282.19	282.02	0.1%
Western															
Track	58.64	58.39	0.4%	63.62	63.39	0.4%	71.87	71.66	0.3%	97.91	98.14	-0.2%	103.68	103.52	0.2%
Signal	156.79	156.79	0.0%	127.39	127.39	0.0%	104.15	104.15	0.0%	58.32	58.32	0.0%	53.03	53.03	0.0%
Other	138.11	138.11	0.0%	142.67	142.67	0.0%	144.00	144.00	0.0%	153.74	153.74	0.0%	156.73	156.74	0.0%
Total	353.53	353.28	0.1%	333.68	333.45	0.1%	320.03	319.81	0.1%	309.96	310.20	-0.1%	313.44	313.29	0.0%

The results show some very minor discrepancies in the data for track renewals which are also reflected in the totals. However, the maximum difference between the track renewal source data and the track renewal Tier 0 data is 0.4 % which is reflected as a 0.1% difference in the total renewal spend. This is not large enough to significantly affect the downstream calculations.

4.3 Calculation Checks

A number of checks have also been carried out on the two worksheets entitled 'PDI forecast Model for CP5 SBP PDI Forecast Dec 2012' (FORECAST) and 'PDI-P and PDI-F Source data for PDI SBP forecast' (SOURCE). These are the sheets that bring all of the source data together and work through to the final PDI-P and PDI-F forecast figures for CP5.

The approach taken has been to take the final PDI-P and PDI-F figures and work backwards towards the source data to ensure all of the calculations are functioning correctly.

The key output tab entitled ' OUPT: CP5 SBP PDI data – Table' in FORECAST has been rigorously checked to ensure all of the individual route tables feed correctly into the national PDI-P

and PDI-F tables split by Maintenance, Renewals and Enhancements, which in turn feed correctly into the final forecast table shown below;

Table 4: Final PDI-P and PDI-F Forecast Figures

	PDI-P MAA (National)				
	FY14	FY15	FY16	FY17	FY18
PDI-P	0.731	0.789	0.913	0.794	0.539
PDI-F	0.854	0.873	0.881	0.748	0.593

In order to perform spot checks on the individual route figures, Anglia and Scotland were once again isolated and the workings traced back through the workbooks. The following sections describe the results of these checks split by Maintenance, Renewals and Enhancements.

4.3.1 Maintenance

For maintenance, the following final figures for Anglia and Scotland were assessed;

	FY14	FY15	FY16	FY17	FY18
Anglia (PDI-P)	0.0349	0.0349	0.0349	0.0349	0.0349
Scotland (PDI-P)	0.0094	0.0094	0.0094	0.0094	0.0094
Anglia (PDI-F)	0.0222	0.0222	0.0222	0.0222	0.0222
Scotland (PDI-F)	0.0100	0.0100	0.0100	0.0100	0.0100

First it was ascertained that these figures have been transferred correctly from the input tab in FORECAST which collates all of the CP4 data entitled 'INPT: CP4 PDI – Table 1'. This data has been collated from a separate spreadsheet entitled 'PDI-P and PDI-F Source data for PDI SBP forecast' (SOURCE) and this has all been read across correctly from the OUTPUT tab in this sheet. This in turn has been checked in relation to the CALC tab in SOURCE and found to be correct. The most complex process in the SOURCE sheet, converting from the raw PDI-P INPUT data into the CALC sheet, has been thoroughly checked. The pivot tables have been shown to be functioning correctly and once this data has been collated for Year1, Year 2 and Year 3, each element has been indexed correctly based on the PDI-P Index 0708 figure found in the REFERENCE tab.

4.3.2 Renewals

	FY14	FY15	FY16	FY17	FY18
Anglia (PDI-P)	0.1011	0.1153	0.1504	0.1150	0.0881
Scotland (PDI-P)	0.0141	0.0179	0.0162	0.0157	0.0155
Anglia (PDI-F)	0.0177	0.0217	0.0281	0.0224	0.0166
Scotland (PDI-F)	0.0190	0.0262	0.0253	0.0195	0.0165

These figures have been cross-checked with those in the 'CALC: CP5 Renewals PDI-P – Table' tab in FORECAST and found to be feeding across correctly. A number of checks were carried out to compare the totals by route and by asset type and these were found to be consistent. For example, the sum of all routes is equivalent to the sum of 'signalling', 'track' and 'other' renewals for each financial year. Finally it was checked that the data in the CALC sheet had read correctly from the INPUT data. This is all collated in a table entitled 'Source data from Finance …' and has been found to be correct.

4.3.3 Enhancements

	FY14	FY15	FY16	FY17	FY18
Anglia (PDI-P)	0.0088	0.0161	0.0275	0.0821	0.0183
Scotland (PDI-P)	0.0035	0.0042	0.0025	0.0019	0.0011
Anglia (PDI-F)	0.0006	0.0010	0.0009	0.0023	0.0003
Scotland (PDI-F)	0.0013	0.0017	0.0013	0.0006	0.0000

These figures have been cross-checked with those in the 'CALC: CP5 Enhancement Spend – Table' tab in FORECAST and found to be feeding across correctly. A series of checks have also been carried out on the SUMIF calculation that translates the INPUT data from the table 'Data Source: SBP Enhancement Spend profile …' into the summary tables in the CALC sheet. These have all been found to be functioning correctly. Checks have also been carried out on the 'INPT:CP4 Enhancement – Table 1' tab with all elements found to be functioning correctly.

4.4 Errors

The only significant error that has been identified during this audit process is replicated in both the FORECAST and SOURCE spreadsheets. In the SOURCE spreadsheet it is located in the INPT; PDI-F data' tab and in the FORECAST spreadsheet it is located in the 'INPT; CP4 PDI – Table 1' tab. The error relates to the way the PDI-F data for CP4 is collated up by route and by work type. The array for all of the SUMIF calculations are fixed one cell to low and hence are not picking up the enhancement data for Scotland, as shown in Figure 1 below.

Figure 1: Example of Error

		PDI-F by Route		
	Route	**2009-10**	**2010-11**	**2011-12**
	Anglia	0.110	0.099	0.057
	East Midlands	0.132	0.105	0.070
	Kent	0.123	0.132	0.154
	LNE	0.071	0.074	0.070
	LNW	0.080	0.074	0.085
	Scotland	=SUMIF($K$25:$K$54,$K16,L$25:L$54)		0.039
	Sussex	SUMIF(range, criteria, [sum_range])	0.090	0.104
	Wales	0.065	0.080	0.074
	Wessex	0.064	0.075	0.092
	Western	0.085	0.087	0.069
	Total	**0.817**	**0.854**	**0.816**
		PDI-F by work type (estimated)		
Enhancement	Scotland	0.004	0.013	0.013
Enhancement	Wessex	0.016	0.019	0.023
Enhancement	Wales	0.016	0.020	0.018
Enhancement	LNW	0.017	0.018	0.019
Enhancement	LNE	0.018	0.019	0.018
Enhancement	Western	0.019	0.019	0.017
Enhancement	Sussex	0.022	0.027	0.031
Enhancement	Anglia	0.028	0.025	0.014
Enhancement	Kent	0.032	0.038	0.041
Enhancement	East Midlands	0.033	0.026	0.018
Maintenance	Scotland	0.004	0.013	0.013
Maintenance	Wessex	0.016	0.019	0.023
Maintenance	Wales	0.016	0.020	0.018
Maintenance	LNW	0.029	0.019	0.029
Maintenance	LNE	0.018	0.019	0.018
Maintenance	Western	0.029	0.029	0.019
Maintenance	Sussex	0.011	0.011	0.010
Maintenance	Anglia	0.028	0.025	0.014
Maintenance	Kent	0.026	0.020	0.031
Maintenance	East Midlands	0.033	0.026	0.018
Renewals	Scotland	0.008	0.025	0.026
Renewals	Wessex	0.032	0.037	0.046
Renewals	Wales	0.032	0.040	0.037
Renewals	LNW	0.034	0.036	0.037
Renewals	LNE	0.036	0.037	0.035
Renewals	Western	0.038	0.039	0.034
Renewals	Sussex	0.043	0.053	0.063
Renewals	Anglia	0.055	0.050	0.028
Renewals	Kent	0.064	0.075	0.082
Renewals	East Midlands	0.066	0.053	0.035
Work	**Route**	**2009-10**	**2010-11**	**2011-12**
	Total	**0.81740339**	**0.85421337**	**0.81554509**

Below shows the results for the Scotland route as they currently stand and if they were to be corrected.

Table 5: Impact of Corrections on Scotland

	PDI-F by Route		
Route	**2009-10**	**2010-11**	**2011-12**
Scotland (Current)	0.013	0.038	0.039
Scotland (Corrected)	0.017	0.050	0.053

It should be noted that this error is confined to the PDI-F calculations and is not replicated for PDI-P. It should also be stressed that the data has been thoroughly scrutinised and no subsequent formulas are dependent on the data in these incorrectly calculated tables. For this reason it has been confirmed that correcting and updating these tables will have no consequence on the final forecast figures, they simply result in an inaccuracy within the internal workings of the spreadsheet that do not contribute to the final results. However, they are potentially useful summary tables which could be of interest in their own right in the future and so should be corrected.

4.5 Sensitivity Checks

4.5.1 Renewals – Change of Baseline Year

The first sensitivity test carried out involved analysing what would happen to the CP5 PDI-P renewal values should a different baseline year from CP4 be used to establish the PDI-P / renewals asset spend ratio. Currently 2011/12 has been used as the baseline and due to data availability constraints only one sensitivity test has been carried out using 2010/11 as the revised baseline. Data was inputted by asset and by route and the revised PDI-P values analysed. Table 6 below shows the results of this sensitivity test.

Table 6: Renewals Sensitivity Test

PDI-P Renewals by Asset – Current Values (2011/12 Baseline)					
	2014/15	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Renewal (Others)	0.0874	0.1000	0.1144	0.0999	0.0821
Signalling renewals	0.0279	0.0231	0.0218	0.0174	0.0134
Track renewals	0.2083	0.2057	0.2424	0.2082	0.1958
Total	**0.3236**	**0.3288**	**0.3786**	**0.3255**	**0.2912**

PDI-P Renewals by Asset – Sensitivity Test Values (2010/11 Baseline)					
	2014/15	**2015/16**	**2016/17**	**2017/18**	**2018/19**
Renewal (Others)	0.1025	0.1187	0.1366	0.1184	0.0964
Signalling renewals	0.0222	0.0205	0.0220	0.0186	0.0134
Track renewals	0.2194	0.2150	0.2536	0.2180	0.2034
Total	**0.3441**	**0.3542**	**0.4122**	**0.3549**	**0.3131**

The sensitivity test has shown that under the lower renewal spend in 2010/11, the ratio of PDI-P / renewals asset spend is higher and therefore the resulting PDI-P values become higher. The total values are between 5% and 10% higher across each of the financial years in CP5, suggesting a reasonably steady relationship between 2010/11 and 2011/12.

4.5.2 Post vs Pre- Efficient Costs

The second sensitivity test carried out tested the effect on the PDI-P and PDI-F results for CP5 if pre-efficient costs were to be used instead of post-efficient costs. Post-efficient costs have been used in the existing models as a conscious decision but the reasoning is unclear. This test will serve to highlight how much of an increase would result on PDI-P and PDI-F were pre-efficient costs used instead.

Analysis of the data in the models against the Tier 0 model has established the following trends;

- Renewal costs for CP5 are approximately 10% lower post-efficient;
- Enhancement costs for CP5 are approximately 6% lower post-efficient;
- There is no data available for post-efficient maintenance data in the Tier 0 model.

Therefore as an estimate for this sensitivity test, and to ensure robustness, all of the post-efficient costs used in the existing model have been uplifted by 10% to represent a pre-efficient model. The results of this test in terms of the outputted PDI-P and PDI-F figures are presented below in Table 7:

Table 7: Post vs Pre-Efficient Costs Sensitivity Test

	Current Model – Post-Efficient Costs				
	FY14	**FY15**	**FY16**	**FY17**	**FY18**
PDI-P	0.731	0.789	0.913	0.794	0.539
PDI-F	0.854	0.873	0.881	0.748	0.593

	Sensitivity Test – Pre-Efficient Costs				
	FY14	**FY15**	**FY16**	**FY17**	**FY18**
PDI-P	0.789	0.853	0.989	0.858	0.578
PDI-F	0.919	0.940	0.949	0.802	0.632

The test has shown that the PDI-P and PDI-F values increase by between 7% and 9% with the introduction of what is effectively a pre-efficient model. This is a significant enough increase to warrant some further thought and discussion about the use of pre or post-efficient costs in the model.

4.6 Summary of Findings

A significant discrepancy has been identified when comparing Crossrail expenditure in the model against the Tier 0 model. A more detailed investigation of route enhancement expenditure should be undertaken.

There are other minor discrepancies have been identified in the source data for maintenance and renewals but these are not a major concern.

In addition, some coding errors have been identified but they have not fed through to the final results. The outputs therefore accurately reflect the method.

The first sensitivity test shows that the PDI values are fairly insensitive to the choice of 2010/11 or 2011/12 for calculating the spend to PDI relationship. This provides some confidence that such a relationship can be extrapolated into the future *all other things being equal (i.e. no changes to work practices and efficiencies).*

The second sensitivity test shows that the results are more sensitive to the use of pre or post-efficiency costs. The use of pre-efficient costs is likely to increase PDI values by about 7%.

5 Conclusions

Returning to the three questions, we believe it makes sense to answer them in reverse order.

5.1 Are the forecasts derived from the model accurate?

The discrepancy identified for Crossrail expenditure indicates that the forecast PDI values are too high (i.e. too disruptive). Given that Anglia and Western contribute the most to the PDI-P forecasts and Western is a high contributor to PDI-F, there is some uncertainty attached to the accuracy of the model's forecasts.

5.2 Is the alternative forecasting model used for the SBP appropriate?

The relative insensitivity of basing the relationship on the 2010/11 figures instead of 2011/12 gives some confidence to the method. We would argue that pre-efficient costs should have been used instead of post-efficient costs because the volume of work is likely to have been under-estimated. That said, the full efficiency gains in working practices made during CP4 and the less disruptive nature of track renewals planned for CP5 have not been taken into account and these will over-estimate the disruptive nature of possessions in the model.

On balance, and in the absence of detailed possession strategies, we believe that this method is appropriate.

5.3 Was Network Rail right not to use NARS when forecasting PDI-P / F in the SBP?

Answering this question really is a judgement on the level of detail required for a Strategic Business Plan. Developing the detailed possessions strategies required for NARS, even on the key flows, would require significant effort. It is our opinion that the additional accuracy gained by doing so on plans that appear not to be specified to this level of detail is unclear. We therefore endorse Network Rail's use of a top down model.