Appendix O Scheme GRIP3 Report (Dec 2012)

GRIP3 Interim Option Selection Report

Bolton to Blackburn Capacity Improvements

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List of abbreviations used

AOCL	Automatic Open Crossing, Locally monitored
ATS	Automatic tram stop
AWS	Automatic warning system
BR	British Rail(ways)
CCTV	Closed circuit television
CDM	Construction Design and Management Regulations 2007
CP3	Control Period 3 (April 2004 to March 2009)
CP4	Control Period 4 (April 2009 to March 2014)
CWR	Continuous welded rail
EAS	Engineering Access Statement
EMC	Electromagnetic Compatibility
GRIP	Guide to Railway Investment Projects
LC	Level crossing
LSI	Line speed improvement
MCB	Manually controlled barrier(s)
MCB-CCTV	Manually controlled barrier(s) – closed circiot television
NX	Entrance / exit, a type signalling control panel
OPS	Outline project specification
OROR	Outside rules of the route (also OROTR)
REB	Relocatable equipment building
ROTR	Rules of the route
S&C	Switch and crossing (points)
SCC	Signal control centre
SORA	Signal overrun risk assessment
SPAD	Signal passed at danger (heavy rail term)
SPT	Signal post telephone
SRT	Sectional Running Time
SSI	Solid state interlocking
TFM	Trackside functional modules (part of the SSI)
tph	Trains per hour
TPR	Timetable Planning Rules
TPWS	Train protection and warning system
TRT	Theoretical Running Time
UWC	User Worked Crossing

1. Executive summary

1.1. This report details the findings of work undertaken within GRIP 3 examining the interventions identified in the GRIP 2 report.

1.2. The GRIP 2 report identified 9 possible interventions to improve the capacity of the line between Bolton and Blackburn, one of which had 3 sub-options. These were assessed in relation to their affordability and the scale of the benefit that they were anticipated to provide. 5 of these were considered worthy of further investigation, as follows:

> **Intervention 1 –** extend the Darwen loop approximately 1 mile in each direction, retaining existing line speeds;
>
> **Intervention 1a -** extend the Darwen loop approximately 1 mile in each direction, increasing line speed to 60mph within the loop;
>
> **Intervention 5 –** raise the linespeed over Turton level crossing to 60mph by upgrading the crossing;
>
> **Intervention 8 –** raise the linespeed through the Darwen loop to 60mph;
>
> **Intervention 9 –** raise the linespeed to 60mph between 23m0ch and 24m08ch (single line section north of Darwen to Blackburn Bolton Jn).

1.3. Development works have been undertaken in two phases. Phases 1 comprised performance modelling to ascertain the impact of each intervention to determine more accurately the benefit that each would provide. From this work 2 interventions were taken forward for further development, having calculated that they provided sufficient overall benefit at the most affordable cost.

1.4. The two interventions taken forward for further development were **Intervention 1** and **Intervention 5**. With the introduction of the additional off-peak services, these interventions together provide a reduction in delay per train of c. 9.4%.

1.5. Development work on Intervention 5 demonstrated that an acceptable solution is not readily available at the anticipated cost. This is a reflection both of the requirements for the crossing if 60mph running is to be permissible, and of the fact that track works would also be required if the increased linespeed were to be achieved.

1.6. Further analysis identified that the implementation of Intervention 1 alone when the additional off-peak services are introduced provides a reduction in delay per train of c. 5.4%. Further development of Intervention 5 has therefore been put on hold.

1.7. The revised estimate for the implementation of Intervention 1 has been calculated to be £13.816m, including contingency and uplift for residual factors.

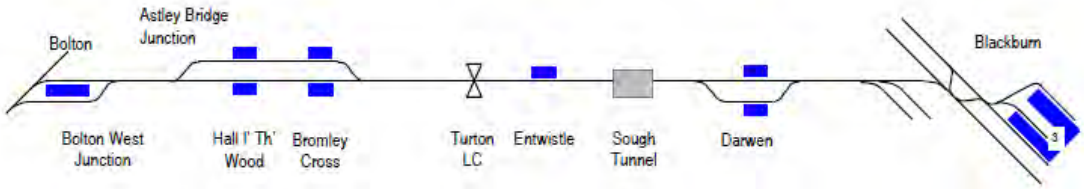
2. Introduction

2.1. Background

The GRIP 2 study reviewed and built on work carried out for Blackburn with Darwen Council which had been undertaken to illustrate in simplistic terms the viability of implementing a half-hourly, off-peak rail service between Manchester and Blackburn. That work had concluded that it was not possible to run a reliable and robust increased off-peak service with the current infrastructure.

2.2. Layout and operation

The track layout is a mixture of double track and single line laid on a former double track formation.



Working in the Down direction, the line is single from Bolton West Jn. (10m 1100y) to the Astley Bridge Junction at the north end of Tonge Viaduct (11m 1434y). The double track then continues for a little over two miles to 13m 1650y, passing through Hall I' Th' Wood and Bromley Cross stations.

The line then returns to single track, passing through Entwistle station and continuing for just over six miles to 20m 110y. Here the line divides to form Darwen loop. Darwen station has two side platforms. The loop returns to single line at 20m 990y and then runs for three miles to Blackburn Bolton Branch Junction.

The Bolton end of the line (to 14m 440y) is controlled by Manchester Piccadilly Signal Control Centre (MPSCC) and the northern section by Preston Power Signal Box (PSB). The signalling is a mixture of two and three aspect colour light signals operated under track circuit block arrangements.

The line climbs from Bolton to a summit at the south end of Sough Tunnel (17m 880y) at a gradient of around 1 in 75, and then descends to the 21½ milepost at around 1 in 80. The line is then gently graded towards Blackburn. Current permissible speeds (PS) are typically 60 mph, with lower speeds at the connections single to double connections. Turton level crossing (at 15m 396y) is an automatic open crossing locally monitored (AOCL) and has a 10 mph PS in the Down direction and a differential of 10 over 25 mph in the Up direction. These low speeds are required to allow the train driver to observe that the crossing is clear before proceeding, and the curvature of the line reduces the sighting distance available.

The Clitheroe to Manchester Victoria service is in the bottom half of the performance league table for Northern Rail, although it is improving, with public performance measure (PPM) moving annual average (MAA) at 91.09%. Right time performance MAA for is 79.50%.

It is acknowledged by the industry that the single line sections contribute to reactionary delays, with trains awaiting access to the single line, whether the root cause of delay is train crew, fleet or infrastructure failures.

3. Review of GRIP 2

3.1. GRIP 2 identified and examined a range of possible interventions that might be expected to generate performance benefits. These fell into two categories: increasing the length of double track sections between Bolton and Blackburn, thus providing additional capacity; and improving linespeeds which would allow a performance buffer so long as they were not reflected in reduced journey times.

3.2. Table 1, below summarises the interventions identified, together with the potential time savings (where identified at GRIP 2), and their estimated cost (at Q1 2010 prices).

Table 1: Summary of interventions identified at GRIP 2

No.	Summary	Time saved (down)	Time saved (up)	Scope identified at GRIP 2	AFC (£000s)
1	Extend Darwen loop			▪ 3200 m of new track and formation works ▪ 2 new turnouts ▪ Signalling works ▪ Widen UB 42 (Turncroft) ▪ Re-deck UB 47 (Cotton Hall St.)	14,246
2	Double track from Bromley Cross (13m70ch) to Darwen station (20m 5ch)			▪ 9600 m of new track and formation works ▪ 1 new turnout ▪ Signalling works ▪ Re-deck UB16 (Knowles Cattle Creep) ▪ Strengthen UB28 (Bradshaw Brook Viaduct) ▪ Additional platform at Entwistle ▪ Remove or replace Turton LC (see 5.) ▪ Doubling through Sough Tunnel ▪ Cutting works at Sough Tunnel	42,886
3	Double track from Bromley Cross (13m70ch) to Sough tunnel (17m 40ch)			▪ 5600 m of new track and formation works ▪ 1 new turnout ▪ Signalling works ▪ Re-deck UB 16 (Knowles Cattle Creep) ▪ Strengthen UB28 (Bradshaw Brook Viaduct) ▪ Additional platform at Entwistle ▪ Remove or replace Turton LC (see 5.)	21,504

4	Double track from Darwen (20m 40ch) to Blackburn Bolton Junction (23m 60ch)			▪ 5200 m of new track and formation works ▪ Signalling works ▪ Re-deck UB47 (Cotton Hall St.) ▪ Widen UB53A (M65) ▪ Rebuild FB63 (Kitty Lowe) ▪ Realignment of existing track	27,198
5	Raise Turton AOCL Level Crossing from 10 / 25 mph to 60 mph.	60s	45s	▪ 5a - Renew as MCB-CCTV ▪ 5b - Replace with highway bridge ▪ 5c – Downgrade to a UWC.	1,570 4,716 550
6	Raise linespeed from 35mph to 60 mph between 11m 66ch and 11m 70ch (Astley Bridge Junction)	8s		▪ Track upgrade works ▪ Relay single lead as 60 mph ▪ Signalling works	2,472
7	Raise linespeed from 40 mph to 60 mph between 13m 71ch and 13m 75ch (junction to north of Bromley Cross)	8s		▪ Track upgrade works ▪ Relay single lead as 60 mph ▪ Signalling works	2,472
8	Raise linespeed from 30/40 mph to 60 mph through Darwen Up Loop and connections	30s		▪ Major track upgrade works ▪ Two new 60 mph turnouts ▪ Signalling works	4,279
9	Raise linespeed from 30 mph to60 mph between 23m 40ch and 24m 08ch (Blackburn Bolton Junction)	35s	35s	▪ Track upgrade works, ▪ Signalling works ▪ Strengthen UB 65 (A666) Bolton Road	3,198

3.3. Following discussion at the Pennine Lancashire Rail Projects Board, a further option was identified, combining intervention 1 and intervention 8. This is referred to as intervention 1a.

3.4. The options were assessed in relation to their affordability and the scale of the benefit that they were anticipated to provide. 5 of these were considered worthy of further investigation, as follows:

Intervention 1 – extend the Darwen loop approximately 1 mile in each direction, retaining existing line speeds;

Intervention 1a - extend the Darwen loop approximately 1 mile in each direction, increasing line speed to 60mph within the loop;

Intervention 5 – raise the linespeed over Turton level crossing to 60mph by upgrading the crossing;

Intervention 8 – raise the linespeed through the Darwen loop to 60mph;

Intervention 9 – raise the linespeed to 60mph between 23m0ch and 24m08ch (single line section north of Darwen to Blackburn Bolton Junction).

4. Scope of GRIP 3 works

4.1. The scope of grip 3 for the project is to further refine the identified interventions to provide Blackburn with Darwen Borough Council with sufficient information to allow a preferred option (or options) to be identified and developed further. The refined cost estimate(s) are to form the basis of a submission for funding of the scheme to implementation and commissioning.

4.2. In order to avoid unnecessary work, and associated expense, it was agreed that GRIP 3 should be taken forward in stages. The first of these, Phase 1, comprised performance modelling of each intervention to assess the extent to which it provided the necessary performance benefit under 'real' operating conditions.

4.3. From the results of the modelling, the list of 5 interventions could be further reduced, so that only the most effective interventions should be developed further. This stage is Phase 2.

4.4. Since the GRIP 3 work started on this scheme, the scope of GRIP 3 in general has been increased to incorporate development to AIP level. This will be Phase 3 of GRIP 3 for this project, and will proceed following confirmation of funding from Blackburn with Darwen Borough Council.

5. Phase 1 of GRIP 3

5.1. Phase 1 of GRIP 3 had two objectives. Firstly, to confirm (or otherwise) that an off-peak service of 2tph can be timetabled to run between Bolton and Blackburn. And secondly to assess the effectiveness of the various interventions identified above in mitigating against the performance worsenment that would be expected if the additional services were to run.

5.2. The existence of a 2tph peak service indicated that it was probable that 2tph should be capable of being timetabled off-peak between Bolton and Blackburn with the existing infrastructure, and the timetabling exercise confirmed this.

5.3. The timetabling exercise did not consider the detail of timetabling the additional services between Bolton and Manchester. Whilst vacant paths exist along this route it is likely to require a recast of other services. The vacant paths do not currently align with running the additional service equally spaced between the existing services. The suggested implementation date of the additional services (December 2016) has been suggested by the DfT as it coincides the major timetable revision associated with the Northern Hub at that date.

5.4. Performance modelling was then undertaken for each intervention, based on actual performance data for a 3½ month period in 2011. The modelling initially calculated the performance impact of introducing the additional off peak services on the existing infrastructure. The analysis was then re-run with the inclusion of each intervention in turn, to assess the benefit that it would provide.

5.5. Table 2, below, summarises the performance modelling conclusions, measured in 'reactionary delay minutes'.

Table 2: Estimated reactionary delay minutes (for 2tph) for each intervention

	Reactionary delay minutes			
Infrastructure	**Down services**	**Up Services**	**Total**	**Delay minute benefit**
Current	957	970	1928	n/a
Intervention 1: extend Darwen Loop	544	632	1176	752
Intervention 5: Raise Turton AOCL Level Crossing from 10 / 25 mph to 60 mph.	704	933	1638	290
Intervention 8: Raise linespeed from 30/40 mph to 60 mph through Darwen Up Loop and connections	957	970	1928	0
Intervention 9: Raise linespeed from 30 mph to 60 mph between 23m 40ch and 24m 08ch (Blackburn Bolton Junction)	957	773	1730	197
Combine Intervention 1 and Intervention 5.	442	632	1074	854

5.6. As the Table shows, Intervention 8 did not provide any performance benefit, and Intervention 9 was the least effective of the other interventions modelled. It was agreed that these two options should not be developed any further, recognising that the amount of benefit provided did not represent good value for money when compared to the other options.

5.7. As was expected, the introduction of the additional off-peak services causes overall delay to increase for all infrastructure scenarios. Simplistically, this reflects the fact that there will be more services to be disrupted, and a greater likelihood of delays to one train causing consequent delay to another.

5.8. Table 2 does not, however, show the performance benefit provided to the existing 2tph peak services as a result of any of the interventions. This is assumed to be proportionate in scale to that found by the off-peak modelling.

5.9. Using the findings of the performance modelling, the impact on the performance of services individually was calculated, to assess the impact on service punctuality. Based on theses findings and the assumption outlined above, the impact of combining intervention 1 and intervention 5 is to reduce the delay per train by 9.4%. On this basis, the combined Interventions are considered to be an effective mitigation to the performance impact of the introduction of additional services.

5.10. Subsequent development work identified that the cost of providing an acceptable solution to raising the linespeed at Turton Level Crossing (Intervention 5) was significantly greater than had been assumed at GRIP 2. Further analysis was undertaken which demonstrated that the impact of Intervention 1 alone is to reduce the delay per train by 5.4%. Whilst clearly not as effective as the combined intervention, this remains an effective mitigation to the performance impact of the introduction of additional services.

5.11. Development work is therefore continuing with the intention of taking forward the extension of the Darwen loop (Intervention 1), whilst the development of a solution to increase linespeeds through Turton Level Crossing is, for now at least, no longer being pursued.

6. Phase 2 of GRIP 3

6.1. Turton Level Crossing

6.1.1. The GRIP 2 report identified the possibility of downgrading this crossing to a User Worked Crossing (UWC) at a reasonably modest cost of £550k. Subsequent discussions with signalling engineers suggested that an Automatic Half Barrier Crossing (AHB) would be preferable, and might be provided for slightly more than the cost of downgrading to a UWC. These options were agreed to be taken forward to GRIP 3.

6.1.2. Subsequent discussions at a national level with the Office of Rail Regulation led to the conclusion that neither of the options suggested for Turton would be acceptable.

6.1.3. The project has reviewed the other types of crossing that might be provided, and identified that none could be delivered at a cost of the same magnitude as that envisaged for a UWC or AHB. The cost of such options is estimated to be at least £1.5m.

6.1.4. Further investigation of the area has also identified that track works will be required in the Turton area if an increase in linespeed is to be achieved. This would add to the cost of any overall solution at Turton.

6.1.5. The possibility of closing the crossing has also been examined. The crossing does not have a history of misuse or of safety incidents, and does not therefore feature on the Network Rail priority list of level crossings to be closed

6.1.6. At GRIP 3 the cost of replacing the crossing with a road bridge was estimated at £4.716m, which was discounted on the grounds of cost.

6.1.7. The possibility of providing an alternative road access from the west of the crossing has also been considered. Blackburn with Darwen Borough Council are examining, at a high level, the likely cost of building the necessary road.

6.1.8. In the light of the issues noted above, the possibility of removing Turton Level Crossing from the scope of the project has been examined. Further analysis of the performance modelling data has shown, as noted in paragraph 5.10, that an acceptable level of performance is achievable without increasing the linespeed at this location. It has therefore been agreed that development work on increasing the linespeed at this location would be stopped.

6.2. Extension of Darwen loop

6.2.1. Phase 1 of GRIP 3 identified that extending the Darwen loop by approximately 1 mile in each direction will provide sufficient additional capability to allow the introduction of one additional off-peak service per hour without negatively affecting overall train performance.

6.2.2. The extension is planned to be of 1430 yards at the south end of the loop, and of 1210 yards at the north end. This is a marginal shortening of the GRIP 2 proposal, reflecting the fact that an FTN base station has been erected in the interim, blocking the potential alignment of the additional track. The cost of relocating the mast is considered to be disproportionate to the benefit of the additional short section of double tracking. Appendix A shows a schematic diagram of the layout.

6.2.3. The track bed on this section of route originally encompassed a double track railway. However the existing single track sections have in places been slewed away from the original alignment. This in turn means that in places the existing infrastructure will require to be moved to create space for the additional line to be laid.

6.2.4. This is particularly relevant on a number of bridges on the route, which have been amended and maintained to allow for a single track, and will therefore require work to accommodate the additional track.

6.2.5. Other aspects of the infrastructure, such as drainage, have also been maintained so as to support the alignment of the existing single track, and will require improvement and/or adjustment to support the double track alignment.

6.2.6. The infrastructure works currently identified to provide the extension are as follows:

6.2.6.1. Abolish the existing single lead junctions and trap points designated 784A&B, 785 and 786.

6.2.6.2. Remove signal PN466 on the DN line and PN467 on the UP line associated with the above junctions.

6.2.6.3. Add revised signalling to the two extended loop sections of the UP line (extensions each side of Darwen Station) and to control the new junctions, including the approach removal/repositioning of existing signals on the existing single line that is to be doubled.

6.2.6.4. Make good formation works for the extent of the new lengths of track comprising the extended double track sections, including track drainage.

6.2.6.5. Additional Signalling assets in order to control traffic on the revised track infrastructure, particularly on the new loop to allow multiple train occupancy.

6.2.6.6. Additional telecoms and E&P assets in support of the main works, including points heaters to all new S&C.

6.2.6.7. Reinforcement of retaining wall between bridges 40 (Barton St 19m 1320yds) and bridge 41 (Redearth 19m 1458yds) approx length of works 138yds.

6.2.6.8. Underbridge bridge 42 (Turncroft 19m 1518yds) Missing bridge span to be reinstated.

6.2.6.9. Overbridge bridge 43 (Sudell Rd 20m 0110yds) Remove waste spoil material blocking proposed alignment of second track under bridge and existing unknown concrete foundation structure.

6.2.6.10. Underbridge 47 Robin Bank (Cotton Hall St) This bridge was due for replacement in January 2013 as a single span bridge. Discussions with the structures engineer have led to an agreement to defer the replacement until early 2014, with an amended design. It will now be designed such that a second span can be added when required by this project.

6.2.6.11. Overbridge 49 (Snape St), It is considered possible that the extra line can be accommodated within span 1 of the bridge (adjacent to the existing track). It is more likely, however, that the DN line will take on a new alignment through the second span, with the existing track becoming the UP loop alignment. In this case there will be a need to install train collision protection to the bridge support between the two lines.

6.2.7. Track design work is on hand to determine the exact alignment of the additional line, and (where relevant) the revised alignment of the existing track. This is particularly important in relation to the replacement of Underbridge 47: the design of the bridge and of the track are interdependent, and will affect the track design through bridges 48 and 49. In order to minimise the constraints imposed by the bridge, it is being designed such that it will be capable of being moved laterally at a future date, if required.

6.2.8. Signalling for the extended loop will provide an additional signal in each direction on the extended loop, to allow better use to be made of the additional capacity that it provides.

6.2.9. Wherever possible, existing assets will be retained and/or re-used by the scheme to provide a cost effective solution.

7. Cost Estimate

7.1. The revised estimate for GRIP stages 4-8, for extending the Darwen loop as detailed above, is **£13.816m**. Appendix B provides more detail of the estimate, together with the exclusions and assumptions used. Development of the project to AIP will enable this estimate to be refined further.

7.2. Changes to the operational layout, access arrangements and disruptive possession planning will require consultation with the train and freight operating companies (TOCs and FOCs). The project as a whole will be subject to approval under the Railway and Other Guided Transportation Systems Regulations (ROGS).

8. Conclusion and Recommendations

8.1. Intervention 1, the extension of the Darwen Loop, has been found to be both realistic and affordable, whilst providing an acceptable level of additional robustness to train operations between Bolton and Blackburn.

8.2. Further development is required to refine the design of this option, and can be undertaken once Blackburn with Darwen Borough Council has secured appropriate funding. This will, in the first instance, take the scheme to Approval in Principle (AIP). Further consultation with stakeholders will form an important part of this stage, with the aim being to reach agreement regarding Network Change at least in principle.

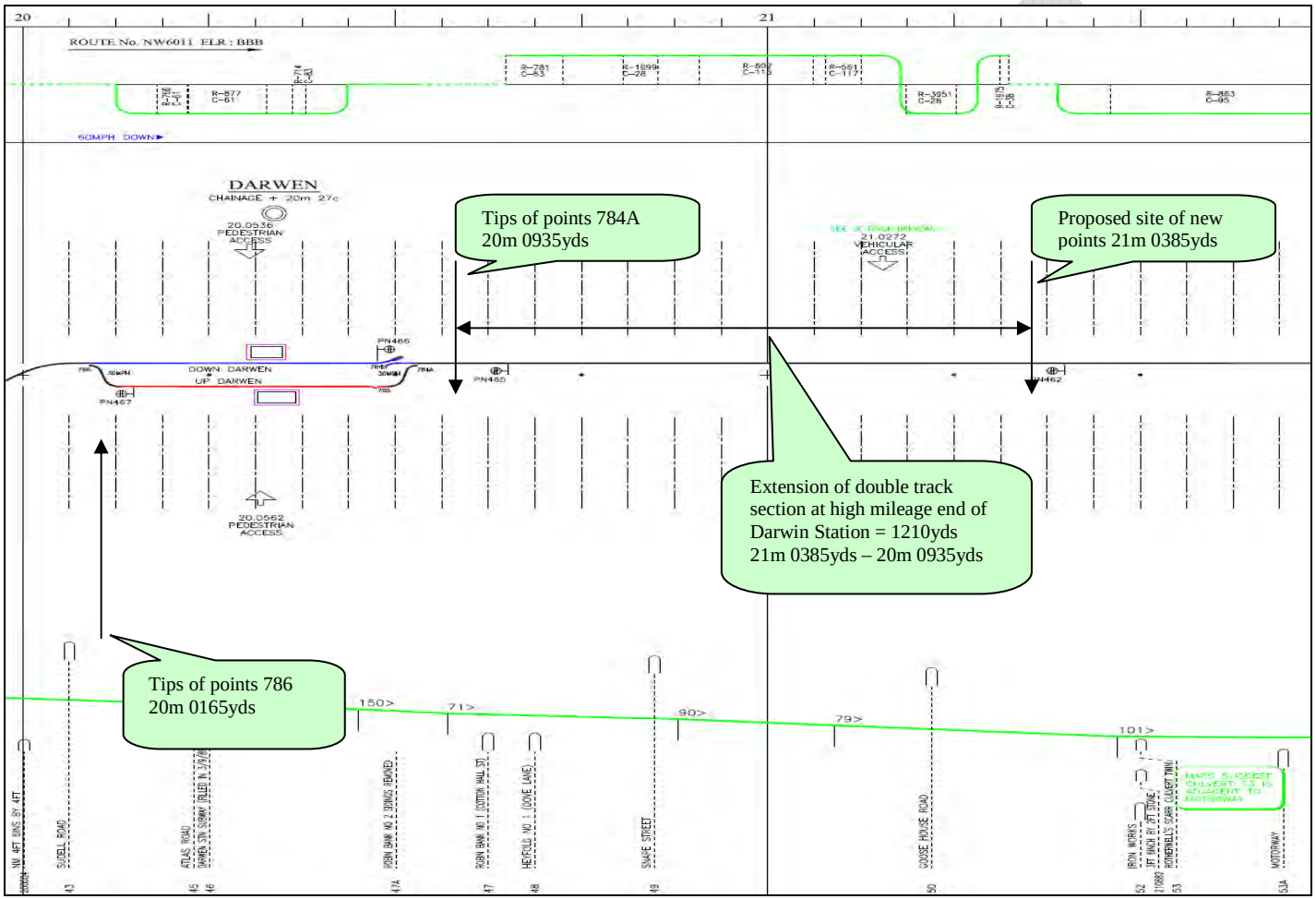
8.3. Once AIP has been achieved, the appropriate delivery method can be agreed. In simple terms, the two main options are to either develop the scheme further through GRIP 4 before appointing a contractor to implement the scheme via a design and build contract; or to opt to go directly to a design and build contract.

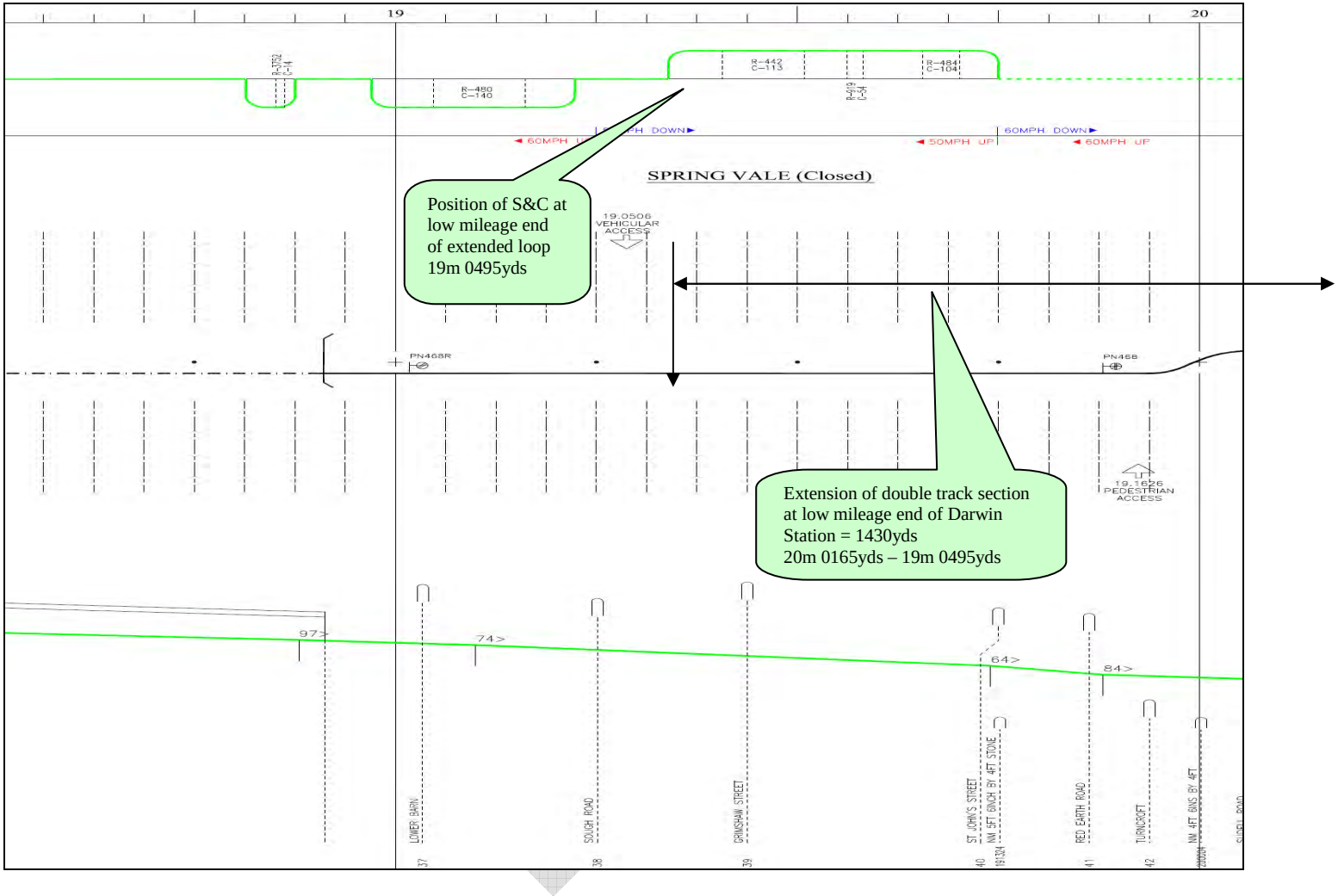
8.4. Opportunities to accelerate the delivery of the scheme will be examined, but will depend on the timely availability of funding.

8.5. The timing of the introduction of the additional services will also be driven by the availability of suitable rolling stock and train crew, which will be provided by Northern Rail or their successors. It will also be influenced by the need to recast the timetable: the existing December 2016 target date is based on the opportunity to co-ordinate with the planned timetable changes at that time.

Appendix A: Track layout schematic

Total loop extension = 1430 yds at south end + 1210 yds at North end = 2640 yds = 1.5 miles




19
20
SPRING VALE (Closed)
60MPH DOWN
50MPH UP
60MPH UP
19.0506
VEHICULAR ACCESS
PN468R
PN468
19.1626
PEDESTRIAN ACCESS
Position of S&C at low mileage end of extended loop 19m 0495yds
Extension of double track section at low mileage end of Darwin Station = 1430yds
20m 0165yds – 19m 0495yds
97>
74>
64>
84>
LOWER BARN
SOUGH ROAD
GRIMSHAW STREET
ST JOHN'S STREET
RED EARTH ROAD
TURNSCROFT

APPENDIX B: Cost estimate for GRIP 4-8

Item	
Total (m)	3200
Total (miles)	1.9884
Preliminaries	1,686,154.00
Design	852,303.00
Test and Commission	355,901.00
NR management & Sponsor	998,439.00
Schedule 4 costs	242,926.00
NDS - Possession/Isolation Management	166,407.00
Indirect Costs	4,302,130.00
Signalling	695,882.00
Electrification and Plant	-
Track	4,990,380.00
Telecomms	20,000.00
Operational Property	-
Structures	520,000.00
General Civils	-
Utilities	-
Direct Costs	6,226,262.00
Point Estimate	10,528,392.00
Uplift for Residual Factors	3,287,517.00
AFC	13,815,909.00

Price per mile	6,948,254.38

Notes/Assumptions/Exclusions -

Signalling
Signalling quantities supplied by Mott Macdonald
Signalling heads assumed to be 3 aspects (SL35) type
Cables: 15m of tail cable allowed for new equipment
Power cable taken as 2c 35mm cable and is assumed to at a 1/3 of the length of intervention - 1056m
Troughing route taken as 30% of intervention length - 960m
2nr LOC case (1nr full size and 1nr half size) taken for every point machine
LOC cases assumed to be SSI
Allowances included for panel and interlocking modifications and train describer data modification

Stageworks and lift and shift included
Existing power supplies are sufficient to power the new REB's, no allowance for new ones

Track
New S & C requires matching recoveries - 2nr taken
New track taken as CEN56, servicable rail with concrete sleepers, clips and insulators and 250mm bottom ballast
Turnouts taken as SG (60mph)
Realigned track is existing track slued and ballast cleaned 1000kg of new ballast (inc pads clips, nylons, restressed)
Cess Walkways length taken as length of new track - assumed work comprise of timber edgings and fill only. No requirements for retaining walls have been made
Cable route taken as length of new track, assumed sufficient slack in cable to permit slweing with regards to cables i.e no cutting and jointing
Catchpits taken at 30m centres

Structures
Provisional Allowance for demolishing existing UB42
UB47 Cotton Hall Road has been removed from the scope of intervention 1, being delivered by Infrastructure Projects as part of the renewals workbank.

Telecoms
1nr SPT allowed for every signal
1nr PZT allowed for