GRIP *Governance for Railway Investment Projects*

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Approved By: **Andrew Holley, Sponsor**
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Value Engineering Review Report

MetroWest Phase 1 Value Engineering Study for a Staged Approach

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Project	MetroWest Phase 1
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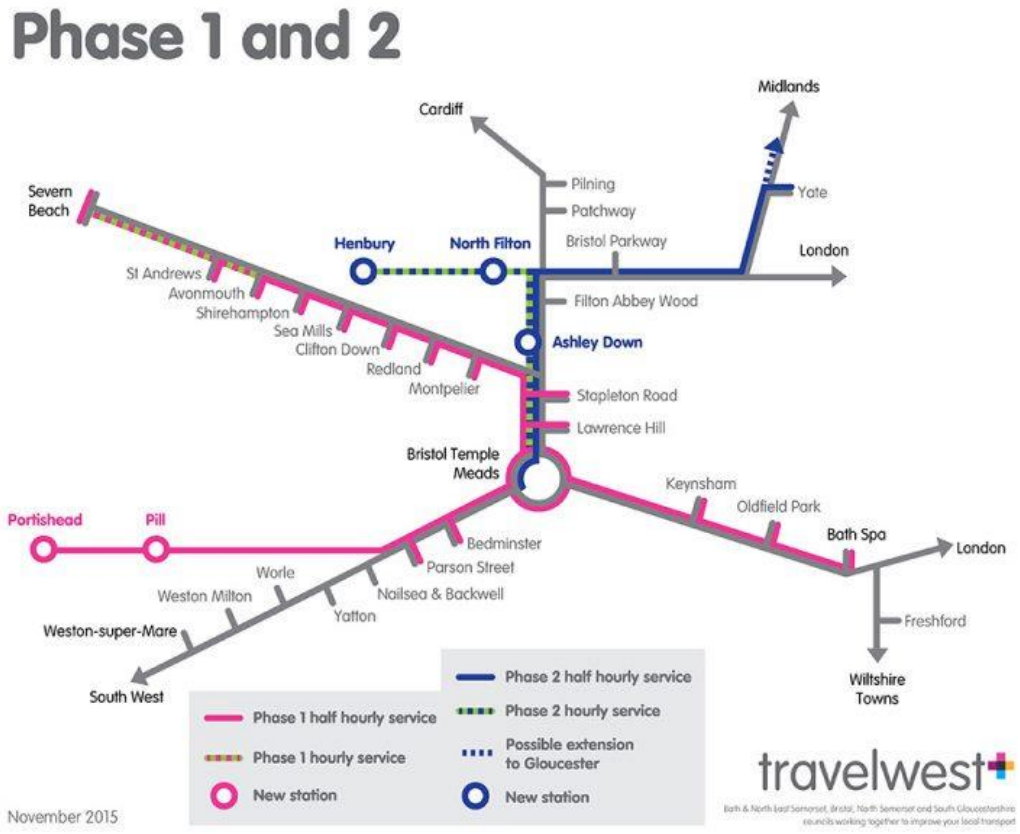
Version Control			
Version	**Description**	**Updated By**	**Date**
V1.0	Initial review following VE workshop and further Engineering Studies.	Simon Laird	19th April 2017
V2.0	Updated with Interim RAILSYS Outputs and Track Regression Assessment.	Simon Laird	8th May 2017
V2.1	Minor updates.	Simon Laird	
V2.2	Updated VE report following final Railsys Capability Modelling Output for Stage B.	Deborah Elliott	1st June 2017.
V3.0	Updated VE report following comments from N.Maher, A.Holley and J.Masters. All tracked changes incorporated and revision uplifted to V3.0.	Deborah Elliott	5th June 2017.
V3.1	Minor updates following AH review.	Deborah Elliott	6th June 2017.
V3.2	Issued to ARUP for pricing. No changes from V3.1.	Deborah Elliott	9th June 2017.
V3.3	Updated with Client Comments and cost Indicators	Nick Maher	21 June 2017
V3.4	Minor updates	Andrew Holley	22th June 2017

Section 01 Exec Summary

Exec Summary

Network Rail (NR), on behalf of its Client, North Somerset District Council (NSDC), has completed a GRIP 3 Outline Design for the Phase 1, 2 Train Per Hour (2 tph), scheme as shown below. Following a substantial increase in the cost of this scheme, an alternative staged approach to delivery has been identified. This proposed that Phase 1 is split into three stages, known as Stage A, B and C. Stage A is the introduction of a half hourly service between Severn Beach and Bath Spa, Stage B focuses on reopening the disused railway from Pill to Portishead, and upgrading the existing railway from Pill to Bristol Temple Meads for an Initial Passenger Train service to be introduced. Stage C would be a future upgrade after delivery of Stage A & B to enable operation of a 2 Trains Per Hour (2 tph) service with cross-Bristol connectivity, to ultimately achieve the full scheme concept.



NSDC have issued an instruction to NR to conduct a value engineering review for the Stage B works, assessing the infrastructure changes required to deliver the Initial Passenger Train service (1tph) Outline Design. As part of this Railsys Modelling has been undertaken to provide network capability, to test a number of train service options

and provide timetabling outputs.

The central option for the initial Passenger Train service is 1 tph operating all day six days a week (with a more limited service on Sundays). In additional there is an option to operate every 45 minutes during the AM and PM peaks, with an hourly service off-peak. The Railsys modelling provisionally indicates there is no difference in the railway infrastructure required for the two options. The main difference is a requirement for additional train operating resources for the enhanced peak option, which is a business and operational funding issue for the Client. In addition further work will be required to understand the interface with future main line services between Parson Street and Bristol Temple Meads. For simplicity the rest of this report refers to the Stage B Initial Passenger service as 1tph, however, the service could be delivered as 1tph+.
The output of the review is to identify a potential cost reduction from the Governance for Railway Investment Projects (GRIP) Stage 3, 2 tph cost estimate for a Stage A and Stage B scheme combined.

NSDC are keen to realise a viable Stage A and B combined project with a total target AFC of £100m inclusive of their own Client costs for land, highways and the Development Consent Order.

An Instruction from NSDC to proceed with the new GRIP 3 re-run before July 10th, 2017 would allow the top Risk of Ecology to be mitigated if the 2021 date it to be achieved.

Early technical discussions indicated a potential alignment between the Value Engineering (VE) review and NSDC aspirations for the scheme. A cost reduction indication as a range has been provided by NR to support the VE output as detailed in Appendix P. The cost reduction range for the rail element of the project (Stages A&B) is £80m - £92m inclusive of risk, inflation and sunk costs. This compares to the 2 tph cost estimate range at the end of GRIP 3 of £100m - £130m. These figures are a cost reduction indicator only and a final GRIP 3 estimate figure can only be provided on completion of a validated Outline Design for the 1tph scheme.
As part of the VE review, residual asset life for existing infrastructure has been reviewed, along with the associated change to maintenance requirements.

The principle output of the VE review is to identify maximum possible scope reductions to support a 1 tph service under Stage B. It is noted that some VE options may require derogation from Railway Standards to enable their implementation, and some VE options may not be desirable for the Client to implement. The Client is aware that any VE option which is not implemented has the potential to increase the cost of the scheme and hence the overall cost of achieving the 2TPH for the Portishead Line. A cost reduction can only be validated via an approved Outline Design.

Section 02 Project History

Project History

The Single Option Development Work (known as GRIP Stage 3) for the original Metro West Phase 1 (MWP1) remit completed on the 10th February 2017.
This was presented to the Client (NSDC) on the following dates:

- 24th January 2017 with a validated GRIP 2+ estimate.
- 5th April 2017 with a validated GRIP 3 estimate.

The cost estimate range was higher than the current available budget for the scheme. NSDC's aspiration is still to realise a viable project and subsequently NR have been instructed to proceed with a VE exercise looking into the efficiencies associated with a descoped project and the potential cost savings that this could bring, with particular focus on Stage B.

It was noted that the largest cost element associated with the implementation of the 2 tph scheme is for track infrastructure, for the line speed increases and associated change in track alignment through the Avon Gorge, and also for the upgrade from freight to passenger, taking account of passenger comfort requirements. This report has primarily targeted the efficiencies that could be generated from these areas of the scheme and has used Railsys Modelling to assist with generating this output.

The Client has expressed a need for Stage A and B to be delivered as one scheme with one business case, but with some flexibility on the commissioning timescales for each stage. However funding approval won't be achieved until after the DCO has been issued by the Secretary of State, which is scheduled for late 2019. The assumed commissioning timescales are late 2020 for Stage A and late 2021 for Stage B. Stage C remains undetermined at this time. The current train operator GWR has indicated a desire to implement Stage A of the scheme in 2019, however without funding approval this aspiration appears to present some difficulties.

VE Process

The Value Engineering review has been undertaken on the 2 Train per Hour GRIP 3 design that was completed in January 2017. The review has focused on identifying the rail infrastructure that would support the delivery of an Initial passenger service between Bristol Temple Meads and Portishead. The adopted approach has been to identify the infrastructure that can be removed from the original 2 Train per Hour design and / or identify additional design scope to be developed, to support a 1 Train per Hour service. Cost indicator figures have been produced as a range for a combined Stage A & B to support the identified change; however these costs can only be validated following the completion of a 1tph Outline Design.

An initial project workshop was held in NR Offices Swindon (SN1 Building) on 31st January 2017. The remit of the workshop was to provide a peer reviewed evaluation of the 2 tph designed output, and the corresponding Council instruction to identify a reduction in scope to 1 tph for Stage B, that could materially impact the estimate to produce a viable project within the budget available.

As part of the overall review the project has carried out the following subsequent activities:

- Railsys Modelling
- Track Geometry Regression Analysis
- Civils Scope Review
- Signalling Scheme Sketch Production (for options)
- Interface Meetings with Route Asset Manager (RAM) and Maintenance Teams.
- Estimator Engagement
- Review of GRIP 3 External Validation Reports
- Descoping Options for the Client which include the Level Crossing (LX), Footbridges and Stations.
- LX Risk Assessment.
- Consultation with the Portishead Rail Action Group (see Appendix J).
- Stakeholder engagement with Bristol Port, Train Operating Companies (TOC's) / Freight Operating Companies (FOC's).
- Engagement with internal Operations Department.

This report summarises the findings of the VE Process and has identified areas of potential efficiency, categorised by asset type.

Whilst a cost reduction indication as a range has been provided by NR to support the VE output, all VE options will be subject to further validation (with any further actions being taken, such as applications for derogation against standards) at their appropriate later GRIP stage. Interim cost indicators will be provided as the project continues through its future lifecycle.

The recommendations which have been made during the VE exercise are based on good engineering judgement and knowledge gained during the GRIP 3 design. No detailed engineering assessments or designs have been carried out over and above the original 2 tph remit to inform the proposed 1 tph reduced scope.

All NR Standards have been reviewed in conjunction with the application for a 1 tph scheme with only derogations against these Standards which are likely to be approved included in the recommendations.

Some intermediate drawings and instructions have been produced to allow the VE cost data to be provided by the Estimator.

Section 03 Project Definition

Required Output
The output of the VE review is to provide an assessment of the infrastructure required to deliver a Stage A and Stage B passenger service. This includes the changes required to deliver a 1 tph service in each direction as a variation from the original 2 tph remit and provide an order of magnitude cost reduction indicator for Stages A and B in order to realise a viable scheme.

Location
Stage A limits are from Severn Beach to Bathampton via Bristol Temple Meads, providing a turn-back facility at Bathampton along with associated signalling works. Stage B limits are from Portishead to Bristol Temple Meads, via the Avon Gorge. There is a section of disused line from Portishead to Portbury Dock Junction / Pill to bring back into operational use. There is an existing freight line from Portbury Dock Junction / Pill to Parson Street Junction to be upgraded to accommodate a passenger train service. The route joins the main line at Parson Street Junction to access Bristol Temple Meads Station, and includes the provision of the Down (Relief) Line freight loop and a turn-out at Bedminster. New Stations are proposed as Portishead and Pill. There are two Sites of Special Scientific Interest (SSSI) and one Special Area of Conservation (SAC) located along the project route within the Avon Gorge corridor. There are many ecological and botanical constraints to take into consideration with the Avon Gorge ecosystem supporting an exceptional number of nationally rare and scarce plants. There is also a Town and Village Green located at Pill. There are two freight interfaces, one at Pill for Portbury Docks and one at Parson Street for the Liberty Lane Bristol Rail Port freight depot.

Interfaces and Dependencies

The scope of work being reviewed by the NR project team has a direct impact on NSDC deliverables and their associated costs, these include:

- The Development Consent Order process
- Land assembly
- Environmental Mitigations
- Construction and Permanent Compounds, car parks and works to pedestrian, cycle paths and public rights of way
- The extent of Highway alternations required, including consideration of alternative access into the Ashton Vale Industrial Estate.

The project will require new definition to integrate within the wider Western Route Signalling commissioning plans, these include:

- Bristol East Junction Renewals (BEJR) in 2019/20.
- Bristol Area Signalling Renewals (BASR) Stage 3 commissioning works due w/c 2nd April 2019.
- Bristol Area Signalling Renewals (BASR) Stage 4 commissioning works due Easter 2018 (w/c 31st March 2018).
- Bristol Area Signalling Enhancements (BASE) Stage 4 commissioning works due Easter 2018 (w/c 31st March 2018).

There is a planned maintenance renewal of S&C at Bedminster scheduled in 2019 however the alternative programme timescales for MW1 mean that the opportunity for shared track access and resources is potentially lost, which has been considered within the cost indicators

Exclusions

The works currently planned to reinstate the permanent way on the disused section of line from Portishead to Pill are required for both the 1 tph and 2 tph service specifications. Therefore this infrastructure has generally been excluded from the VE study. However, consideration has been given to options for Portishead Station and Trinity Footbridge together with the construction methodology.

It has been assumed that the infrastructure required delivering the Stage A timetable does not differ from that identified for the 2 tph service design. This assumption needs to be considered as a risk until the Stage A Railsys modelling is completed in July 2017. The infrastructure costs of Stage A are included within the cost indicator range.

Section 04 Estimate and Financial Feasibility

Estimate Information & Railsys Modelling

Operational and Railsys modelling requirements have been reviewed.

Stage A

The proposed Stage A works, comprising the Severn Beach line / Bath Corridor element of MWP1 brings together a number of possible options previously identified but not developed.

- An extension of the MWP1, 2 tph service specification on the Bath Corridor line to Westbury (essentially removing Bathampton turn back).
- The opportunity to rationalise the future services in the Bath Corridor from a 4-tier to a 3-tier service.
- The early provision of a MetroWest service which more closely aligns with the original start of service dates.

The extension of the service to Westbury has previously been raised with the Department for Transport (DfT) as an opportunity for avoiding the Bathampton Turnback facility, indicated at serval million to construct. However, the extension of the service to Westbury has not yet been tested within the Railsys Modelling and as a result there is no understanding at present of any infrastructure interventions which might be required until July 2017.

Possible restrictions include:

- Signalling headways between Bathampton and Westbury.
- Capacity at Westbury Station.
- The requirement for at least one additional train unit.

From the DfT perspective, the change provides an opportunity to have three services running on the route; Intercity Express Train (IET), Regional Cardiff to Portsmouth and also the local Metro West stopping services. The extension to Westbury would potentially allow for the local stops at Freshford and Bradford on Avon to be removed from the regional service and included in Metro West.

Great Western Railways (GWR) are interested in starting a Stage A service in May 2019 and have developed a draft concept timetable, which is based on train diagramming considerations. This does not presently extend to Westbury, nor consider junction capacity at Bristol East. It also has an extended layover time at Avonmouth rather than Severn Beach (the GRIP Stage 3 developed option) -: requiring signalling alterations at Avonmouth while not quite meeting the Council's clock face service aspirations. At the joint meeting held between NSDC, GWR and NR on the 28th April 2017, it was agreed to commission further Railsys Modelling works for Stage A from the Capability Analysis team. This will build on the draft Stage A GWR timetable and include an option for the extended service to Westbury. This modelling will test the infrastructure questions which have been raised.

Appendix A contains a brief summary report on the Avonmouth Signalling alterations and the changes required at St Andrew's Signal Box.

Stage B

The Railsys modelling commissioned for the 1tph scheme, as part of this VE study, has provided a number of infrastructure options for Portishead line route.

The modelling assumes a 1 tph shuttle service using a single train unit, running between Bristol Temple Meads and Portishead in accordance with the Client's requirements. The final report is attached in Appendix B.

The modelling concludes that it is possible to run a 1 tph service utilising the existing freight line infrastructure layout, inclusive of Parson Street Junction. Testing this to achieve the 1tph service with a single train unit requires one of the following options to be implemented:

- Alteration to existing freight paths.
- Freight line Infrastructure or Line speed improvements (combination of increases).

  "It was found that an Indicative Train Service Specification (ITSS) comprising one passenger service per hour alongside two freight paths on the Portishead Branch Line was possible, albeit operating on minimum Train Planning Regulation (TPR) margins on current infrastructure layout but assuming updated signalling from the current token-based system. A reduced ITSS of one passenger of one passenger service and one freight path per hour would be more performance resilient.

  In order to operate an hourly passenger service in each direction using one train unit, one of the following is necessary, either: a junction at Pill or line speed increases between Portishead and Pill, or decreasing the number of freight paths to one per hour in one direction."

To help achieve NSDC's remitted preference of utilising a single unit for the MWP1 service, the opportunity to achieve an alteration to the current freight train pathing to one per hour in one direction has been investigated with NR National Freight Operation's team as the minimum infrastructure option. However an initial response suggests that planned future freight flows increases make this option unlikely. The Client's preference is therefore the provision of the Pill Junction double track layout option which whilst potentially having the next lowest incremental cost also has the added benefit for being suitable for supporting a future Stage C.

The ITSS also appears to provide sufficient time for the two existing freight shunting moves that take place between the Bristol Rail Port facility at Liberty Lane, and the Up Relief Line to be maintained. The available shunting periods

shown within the ITSS have been discussed with the NR Operations Department and are considered to be acceptable.

The impact of the ITSS on Ashton Junction LX is included within this report.

A meeting was held at the Bristol Port offices on the 10th April 2017 to discuss freight train operations on the Portbury Freight Line and within Portbury Docks. Copies of the notes are included in Appendix C. Discussions with Bristol Port Authority concluded that the Down (Relief) Line freight loop at Bedminster, originally proposed as part of the 2 tph MW1 service specification, is still required for the 1 tph service. The Relief line is required to regulate late running freight trains entering the branch line and also to maintain performance resilience by providing an alternative loop location for freight trains awaiting acceptance by the Bristol Port Authority Person In Charge (PIC).

Assumptions

For Stage A, the infrastructure assumptions are the provision of the Bathampton Turn Back facility and a requirement for signalling alterations at Avonmouth.

For Stage B the engineering assumptions to deliver a 1tph service are summarised below.

Track / S&C

- The existing Parson Street Junction layout does not requires any capacity alterations. However, the works to the Up Relief Line has been included in the cost range in accordance with the 1 tph Railsys Report option.
- The existing track layout / speeds from Parson Street to Pill can remain unchanged, the new junction is not required at the Clifton Suspension Bridge. However, double tracking at Pill will be required as an alternative to the freight path reduction option identified in the Railsys modelling report.

  Discussions have been held with the Bristol Port Company. They have confirmed that they are able to stable freight trains within their own Dock's network. The Down (Relief) Line freight loop will be reinstated at Bedminster, with a turn out onto the Down Main to accommodate freight operations and to provide regulating capacity on the route.
- The existing double track section between Parson Street Junction and Ashton Junction is sufficient for 1tph. There is no requirement to extend the double track section to a new junction at Clifton, under a 1 tph scheme there is no longer an operating 'pinch point' at this location.
- The Railsys modelling report has identified an option for line speed increase between Parson Street Junction and Pill Tunnel as an alternative to the removal of a freight path or the provision of double track at Pill. However this option has not been considered in the cost indicators.

- Increasing the line speed between Pill Tunnel and Portbury Docks to 30mph to be considered for 1 tph but will be the subject of further noise assessment.
- Liberty Lane Freight Depot – Existing shunting moves Parson Street Junction onto the Up Relief Line will be possible under the 1 tph scheme. Buffer stop and trap points are required at the depot entrance / within the sidings.
- The Avon Gorge freight line section – the considerable slues required to attain the required 50 mph alignment for a 2 tph are assumed not to be required under a 1 tph scheme which retains a line speed of 30 miles per hour.

  A track alignment regression analysis has been undertaken. This has found that the existing track geometry is mostly compliant for the 1 tph specification, with the main issues presenting as inconsistent existing cant and non-compliant transitions over 5-10% of the overall section. Targeted interventions will be required to address these issues. There are also areas of poor formation where targeted formation treatment will be required. A summary of the work required to the existing track is provided in Appendix E and F.
- Tamping is included for the freight line to rectify any alignment issues that have been identified. For other areas of the existing track where alignment is to be altered, and / or transitions added, engineering judgement has been applied to perform and intervention reduction, allowing the estimator to use cost indicators under the Railway Method of Measurement (RMM). Note that no tamping is permitted in Pill Tunnel.
- The existing S&C Units Numbers 749,750,751 at Parson Street Junction and Ashton Junction are considered by Maintenance to be a potential future performance liability for a 1tph passenger service and need to be replaced to ensure that future service performance is achieved.

Signalling

- Indicative scheme sketches have been produced by the Network Rail Signalling Design Group for the 1 tph scheme, these allow the project to potentially realise a cost reduction associated with less signalling equipment being installed along with the associated cabling, loc suites and troughing and power requirements.
- Current assumption is to keep commissioning costs as per the 2 tph scheme due to the indicative level of information available at present and the low confidence factor with the commissioning strategy. This can be reviewed at the end of the GRIP 3 re-run and treated as an opportunity for future estimates when more signalling definition and information as to the commissioning strategy is known.
- Electrical & Plant (E&P) scope remains unchanged from the 2 tph scheme,

but there will be an appropriate pro-rata applied.

Telecoms

- Fixed Telecoms Network (FTN) scope remains unchanged from the 2 tph scheme.
- GSMR coverage remains unchanged from the 2 tph scheme.

Buildings / Stations

- Parson Street Station. The new passenger service will stop at Platform 3. This will require the minor coper adjustments needed to achieve gauge compliance, originally proposed for the 2tph service.
- Pill Station – assumes that the existing disused platform will be brought into use as per the 2 tph scheme.
- Portishead Station – assumes that a Type F station with a minimal building is to be provided at this location, with foundations only to suit this requirement priced.
- Station forecourt and car parking provision at both Pill and Portishead remain unchanged from the 2 tph scheme.

Structures

- Ashton Vale Level Crossing (LX) – The requirement for the provision of the pedestrian ramp needs to be further reviewed. The cost of the ramp is within the NDSC cost estimate however there are potentially additional NR costs associated with relocating LX and British Telecom Fibre optic equipment.
- Some track interventions including limited track slues are still required under a 1 tph service through the Avon Gorge resulting in changes in load patterns across existing structures. It is assumed that some minor strengthening works are still required at the end of the GRIP 3 for a 1 tph scheme.
- Valley Underbridge – noted that strengthening to the arch barrels will still be required.
- Miles Dock Underbridge – noted that strengthening works will still be required.
- Pill Viaduct - noted that masonry and strengthening repairs will still be required.
- There is a table provided in Appendix L which shows the impacted structures and the proposed scope difference between the 2 tph and the 1 tph model.
- Trinity Footbridge – this was originally removed under the 1 tph scheme review, but due to the location within Portishead linking Trinity School and the new housing developments this infrastructure has been reinstated into

the 1 tph scheme and the baseline cost.

Earthworks / Drainage

- Parson Street Station – Drainage works associated with passenger traffic stopping at Platform 3 under the 1tph scheme are required.
- Parson Street Junction – Earthworks are no longer required under a 1 tph scheme, as there is no change of alignment. However, earthworks may be required in the future to facilitate a drainage renewals scheme.
- Ashton Gate Disused Station Cutting and Rownham Hill Cutting – Earthworks are no longer required under a 1 tph scheme.
- Pill Viaduct – earthworks associated with the provision of a new junction at the Bristol end are required under a 1 tph scheme as part of the Pill Jct works.

Level Crossings

- Ashton Vale LX – no changes are required. The LX will remain open. Closed Circuit Television (CCTV) at this LX will remain as there are no plans to downgrade the LX status, and this also supports Thames Valley Signalling Control (TVSC) ergonomic requirements. No alternative highway access is required, supported by the LX Risk Assessment detailed in Appendix K.
- Barrier down time has been modelled within the Railsys report. It is noted that a freight service will follow the passenger service in the Down direction.
- NSDC are exploring highway options which contribute to lowering the risk associated with keeping the LX open. These include a stacking lane on the Winterstoke Road, and maximising options with red and green times on the existing highway traffic light systems. It is noted that this LX is used by football supporters on match days when passenger numbers on both the road and the existing rail network peak in this location. To help mitigate any risk the pedestrian ramp may need to be retained, see above (in Structures).
- Baron's Close Foot Crossing – it is assumed that the temporary closure of this crossing, following Metro Bus works will become a permanent closure. This is being pursued by the NR LX team as a stand-alone item (Not MWP1) and it is anticipated that the closure will be achieved ahead of MWP1 implementation. If this is not achieved, it may become necessary to include this item in the Development Consent Order (DCO).

Off Track

- Maintenance Access Points, Line-side fencing, vegetation managements and line-side drainage remain unchanged from the 2 tph scheme.
- The assumption is that temporary land required to deliver MWP1 are unchanged from the 2 tph scheme and in accordance with the DCO Red

Line drawing being developed.

- It has been assumed that ecology requirements remain unchanged from the 2 tph scheme.

Maintenance

With a higher volume of the existing freight line assets being retained under the 1 tph proposals, there will be an increased Maintenance requirement to maintain passenger train performance and safety standard requirements.

This increased requirement will need to be included within the cost of the project until the end of Control Period 6 (2019-2024 NR Funding Determination Timescales)

As part of the VE review, residual asset life for existing infrastructure has been reviewed, along with the associated change to maintenance requirements and included within the cost indicators.

Cost Indicators for the VE work and Risk

Intermediate designs and instructions from the Engineering team have been used to further the existing GRIP 3/VE and inform the estimator of a reduction in the initial scheme. This work is not a fully integrated design for the new 1 TPH scheme, and cannot be relied upon to issue a formal estimate. However, based on the VE work, cost indicators/adjustments to the 2tph scheme that reflect the probability of the project costs can be offered due to the GRIP 2/3 work that has used strong engineering principles. These are offered in the appendices, together with a table of how that may be affected by quantity should the integrated design modify the baseline assumptions used. Key to the achieving the indicators would be to ensure the VE work is controlled tightly and any modification to scope, timing, and baseline assumptions are assessed with formal change control and the VE report being used as the basis for the CRD and aligned RRD.

To help inform the design, and construction risks further studies have been made with the in track assessments and, and geographic areas of the project to complement the existing TBI's completed and interim designs made. The scheme unknowns are generally mature and similar to GRIP 3. The largest unknown being the estimating uncertainties as per the designs being incomplete. However with the further VE reviews and design checks undertaken to the GRIP 3, an opportunity exists that the scheme has mapped many design risks into the baseline model – i.e. areas of the scheme are not going to change from the assured and estimated GRIP 3 design, Portishead, Bathampton, bridges, life expired assets

and also a large reduced track intervention program, Therefore the council could interpret the risk orders of magnitude to be a mixture of new and old QCRA risk percentages that have not considered in the cost indicators.

NSDC therefore need to consider the cost indicators in conjunction with the GRIP 3 QCRA for a full understanding of risk allocation to the scheme AFC that offers a +/ - opportunity to the base cost.

To maximise opportunities and minimise risks it is an aspiration of NR that interim estimating reviews take place within GRIP stages where key milestones are outlined that Estimate the areas of most sensitivity when the designs become available. These milestones for Track, Civils and Signalling are now contained in the future GRIP 3 program.

The table of cost indicators are contained within the appendices, along with the assumptions that support these.

Section 04 Conclusion and Recommendations

Conclusions

Conclusions for further discussion and or assessment

- The Value Engineering review has identified the proposed outline engineering requirements that would deliver a 1tph passenger service between Bristol Temple Meads and Portishead. The assessed cost indicator range and assumptions to deliver the identified infrastructure requirements for a Staged approach are contained in Appendix P – Cost Indicators and Assumptions, and summarised below:

		Potential Impact of Value Engineering		
	GRIP 3 (k)	Minimum	Most Likely	Maximum
Works	82,000k	55,000k	60,000k	64,000k
Total exclusive of Risk/Contingency	**82,000k**	**55,000k**	**60,000k**	**64,000k**
Risk	24,000k	16,000k	18,000k	19,000k
Inflation	4,000k	3,000k	3,000k	3,000k
Total inclusive of Risk/Contingency	**110,000k**	**74,000k**	**81,000k**	**87,000k**
Sunk Costs (as at December 2016)	5,000k	5,000k	5,000k	5,000k
Potential Cost Limit	**115,000k**	**80,000k**	**86,000k**	**92,000k**

The Potential Impact of Value Engineering on the cost of the works has been assessed taking revised indicative quantities and applying a greater level of uncertainty to the rates to take account of the maturity level of the design and implementation approach at this point in time.

- As the base case the existing layout at Pill can remain unchanged with no new junction required at the Bristol end of Pill Viaduct under a 1 tph scheme. However, double tracking at Pill will be required as an alternative to the freight path reduction option identified in the Railsys modelling report. The third alternative option is to increase line speed increases. The double tracking at Pill is an example of where a necessary design output is required and therefore outlines the need for an indicated range.

- It is understood that the Client's costs including the cost of work to date (except GRIP costs are approx. £30m, including risk, inflation and fees.
- Reference is made to the Appendices contained within this report, as substantial work has been undertaken to support both the 2 tph and the 1 tph proposals.
- Both peer reviews and Railsys Capability Modelling have contributed to the 1 tph scope determination.
- The analysis between a 2 tph and a 1 tph scheme now allows for minimal interventions throughout the route, with the largest cost saving arising from the reduced track scope. However, the smaller cost savings will also contribute to reducing the overall delivery programme and easing the construction method and associated logistics.
- The Railsys Modelling concludes that a reduction in freight paths would result in no line

speed increases being required through the Avon Gorge and no additional requirement for double tracking through Pill and Parson Street above and beyond the existing infrastructure layout. However from discussions within the freight industry potential future increases in freight flows have been identified and this option has been discounted with preference given to providing the Pill Junction options. The majority of passenger service track improvement works to the freight line can be achieved using the existing formation with isolated adjustments to the existing track alignment, increased ballast depth and limited formation treatment works.

- An alternative option to the freight path reduction and the double tracking through Pill involves some level of line speed increase and associated track bed works to the freight line. This has not been included within the cost indicator range for the VE study. If the line speed increase option is selected, further Track Bed Investigation (TBI) is recommended to be undertaken as part of the GRIP 3 re-run to refine the extent of the track scope.
- A full construction review will also be undertaken during the 1 tph GRIP 3 as previous assumptions may be impacted by a future increase in freight flows both in terms of track access and opportunities to utilised Bristol Port land as a temporary construction facility.
- Possession strategy has been based primarily on:
    - Rules of the route
    - Provisional one month total shut down of the POD line (agreed in principal with the Bristol Port Authority).
    - High street environment for the currently disused section
- It is noted that there are a number of large infrastructure cost items which would need to be implemented under a 2 tph Stage C scheme. NR recommend that NSDC evaluate the business models to synchronise funding patterns and test the economic sensitivity of these larger cost items over a multi-year time frame. NSDC may wish to consider the future aspirations for MW1 Stage C, and if funding allows then considerations should be given to some of these items to ease the implementation and efficient delivery of Stage C in future years. In particular, the delivery of Pill Junction as part of Stage B of the scheme would provide some future proofing if Stage C is pursued as later scheme. It would effectively mean that the incremental infrastructure interventions for Stage C would not involve any enhancement works between Portishead and Pill. All the enhancement works would be limited to works through the Avon Gorge and works through Bower Ashton to Parson Street Junction. NR is able to offer further advice on this if necessary.

Appendices

Appendix A – Stage A Summary report for Avonmouth Signalling Alterations.

Appendix B – Railsys Capability Report

Appendix C – Minutes of meeting between Bristol Port Authority and NR 10/04/2017.

Appendix D – Areas of Potential VE savings (With Commentary) – Technical only

Appendix E – Track Regression Analysis Report from Track PE)

Appendix F – Track Regression Analysis

Appendix G – Scheme Sketch for 1tph (Pill Junction)

Appendix H – Scheme sketch for 1tph (Portbury Junction)

Appendix I – Design Alterations Map (DPE produced)

Appendix J – Portishead Rail Action Group Consultation

Appendix K – Ashton Gate LX Risk Assessment.

Appendix L – List of Structures and Impacted Works.

Bridge No	Bridge Name	Location	2 tph Scheme	1 tph Scheme	Comments
S33	Chilcott Road Underbridge	120m 54ch	Pattress Plates	No Intervention	End of GRIP 3 verification
S26	Valley Underbridge	122m 34ch	Pattress Plates Barrel Pinning	Barrel Pinning	End of GRIP 3 verification
S25	Underbridge	122m 40ch	Pattress Plates	No Intervention	End of GRIP 3 verification
S22	Quarry Underbridge 2	122m 74ch	Strengthening (box culvert?)	Strengthening (box culvert?)	Strengthening or replacement is required due to poor structural form.
S21	Quarry Underbridge 3	123m 11ch	Pattress Plates	No Intervention	End of GRIP 3 verification
S20	Quarry Underbridge 4	123m 23ch	Pattress Plates	No Intervention	End of GRIP 3 verification
S19	Quarry Underbridge 5	123m 34ch	Pattress Plates	No Intervention	End of GRIP 3 verification
S18	Quarry Underbridge 6	123m 64ch	Pattress Plates	No Intervention	End of GRIP 3 verification
S15	Miles Dock Underbridge	124m 08ch	Pattress Plates Barrel Pinning Repointing Re-Casing Spalling Repairs Stitching	Barrel Pinning Repointing Re-Casing Spalling Repairs Stitching	End of GRIP 3 verification. Poor structural form. Majority of works still likely to be needed.
S14	Underbridge	124m 44ch	Pattress Plates	No Intervention	End of GRIP 3 verification
S12	Miles Underbridge	125m 27ch	Rod Drainage	Rod Drainage	N/A
S10	Pill Viaduct	126m 00ch	Pattress Plates Barrel Pinning Filling Voids Repointing Spalling Repairs Stitching	Barrel Pinning Filling Voids Repointing Spalling Repairs Stitching	End of GRIP 3 verification. Poor structural form. Majority of works still likely to be needed.
-	Avon Road Underbridge	126m 29ch	Replace with new wider structure.	Possible replacement. Repairs / Strengthening works.	Poor structural form. Dependent upon track alignment over the bridge.
-	Cattle Creep Underbridge	126m 64ch	Bridge Infill	Bridge Infill	Disused Section

-	Retaining Walls	Various	Localised areas of rebuilding / localised areas of strengthening.	Localised areas of rebuilding / localised areas of strengthening.	End of GRIP 3 verification. Extent of **any** retaining wall interventions is likely to be extremely limited.

Appendix M – NR Project Team Organogram.

Appendix N – List of Abbreviations.

ABBREVIATION	FULL MEANING
1 tph	1 Train Per Hour
2 tph	2 Trains Per Hour
AIP	Approval In Principle
BASE	Bristol Area Signalling Enhancements
BASR	Bristol Area Signalling Renewals
BEJR	Bristol East Junction Renewals
CCTV	Closed Circuit Television
DCO	Development Consent Order
DfT	Department for Transport
DR	Down Relief
DM	Down Main
E&P	Electrical & Plant
FOC's	Freight Operating Companies
GRIP	Governance for Railway Investment Projects
GWR	Great Western Railways
IET	Intercity Express Train
ITSS	Indicative Train Service Specification
LX	Level Crossing
MLN	Main Line
MWP1	Metro West Phase 1
NSDC	North Somerset District Council
PIC	Person In Charge
POD	Portishead Line
RAM	Route Asset Manager
RMM	Railway Method of Measurement
S&C	Switches and Crossings

SAC	Special Area of Conservation
SSSI	Site of Special Scientific Interest
TBI	Track Bed Investigation
TOC's	Train Operating Companies
TPR	Train Planning Regulations
TVSC	Thames Valley Signalling Control
Type F Station	One of 6 categories for railway stations in Great Britain. Type F is a small unstaffed station with a footfall figure of under 250,000 per annum.
VE	Value Engineering

Appendix P – Cost Indicators and Assumptions

		Potential Impact of Value Engineering		
	GRIP 3 (k)	Minimum	Most Likely	Maximum
Works	82,000k	55,000k	60,000k	64,000k
Total exclusive of Risk/Contingency	**82,000k**	**55,000k**	**60,000k**	**64,000k**
Risk	24,000k	16,000k	18,000k	19,000k
Inflation	4,000k	3,000k	3,000k	3,000k
Total inclusive of Risk/Contingency	**110,000k**	**74,000k**	**81,000k**	**87,000k**
Sunk Costs (as at December 2016)	5,000k	5,000k	5,000k	5,000k
Potential Cost Limit	**115,000k**	**80,000k**	**86,000k**	**92,000k**
		The Potential Impact of Value Engineering on the cost of the works has been assessed taking revised indicative quantities and applying a greater level of uncertainty to the rates to take account of the maturity level of the design and implementation approach at this point in time.		

- The RAM approved VE work shall be reflected into the CRD and RRD to ensure limited deviations to the scope through project execution.
- The Council has accepted the VE report for instructing the new scheme.
- Intermediate designs and instructions from the Engineering team have been used to further the existing GRIP 3/VE and inform the estimator. These are not a fully integrated design, **and cannot be relied upon to issue a formal estimate**.
- The PORT does not require any new infrastructure to shunt, as this is contained in the port.
- Network Rail's governance system allows for the contracting strategy proposed within this execution guideline.
- RAILSYS report dated 15/5/2017 does not change without formal change control to update the schedule cost impact.
- NSDC agree to the proposed programme and fund the DSA's and Early works to enable the NR execution model.
- New GI's for earth works and other Ecological Survey's will be carried out in the new GRIP 3 instruction to de-risk the program and remove AFC costs.
- The current GRIP 3 risk report is now outdated and not to be relied upon. However, without an updated design and risk, shall be used to assess similar risks to the new cost Indicators.
- The current GRIP 3 dependency register shall be used to assess risks to the new programme.
- Sufficient Contractors are available and have core competence to carry out the scope of the work.
- Market conditions in the local area are not overheated and NR's estimation benchmarks are consistent with NR price indices and inflation indexes.
- Network Rail and Supply Chain have no National strategic project that limits availability of resources, and the machinery is available at a fixed price.
- Competitive bidding shall be used on the P-WAY.
- Due to the nature of the minor earth works and minor civils scope, Tier 2 contractors shall be available for the earth and bridge works to maximize the efficiencies of the supply chain and project structure.
- Council is responsible for all Consents that are not dependent upon NR unique application.
- Council is responsible for all land acquisition costs, and land preparations.
- Council has considered all consent risks, and will meet the programme for all required permitting.
- Council will supply all necessary interfaces and dependencies to the NR schedule and registers. Should these dates be missed, the change process shall apply to cover extensions of time, and costs escalations.
- The Council has all train operating costs within their scope of supply.
- NSDC will accept full responsibility for all client risks recorded.
- Suitable resources required for the project are available.

- No Product approval is required.
- Severe/Adverse weather is considered as force majeure.
- Buried services will not impact the works;
- Archaeological requirements will not disrupt the work.
- Asbestos and other contaminants will not disrupt the work.
- All necessary Authorities agree to the scheme, designs and construction methodology as outlined by NR.
- TOC/FOC/Maintenance/OPS STAFF shall be available to support the scheme and for training when required.
- Ashton Gate will be allowed to stay open with no modifications.
- ASBO/NOBO will be satisfied with NR standards to prove assurance