



Rail technical background

November 2020

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1. Introduction

1.1 This report provides technical background on the rail measures considered by the South East Wales Transport Commission (SEWTC). It provides an overview of the different areas considered and more detail on how they have been determined.

1.2 The rail network in South East Wales is as shown in Figure 1.1. Key features of this network are noted in the diagram as being the following:

- South Wales Mainline (SWML)
- Branch lines and other routes serving various regions
- Core Valley Lines (CVL)

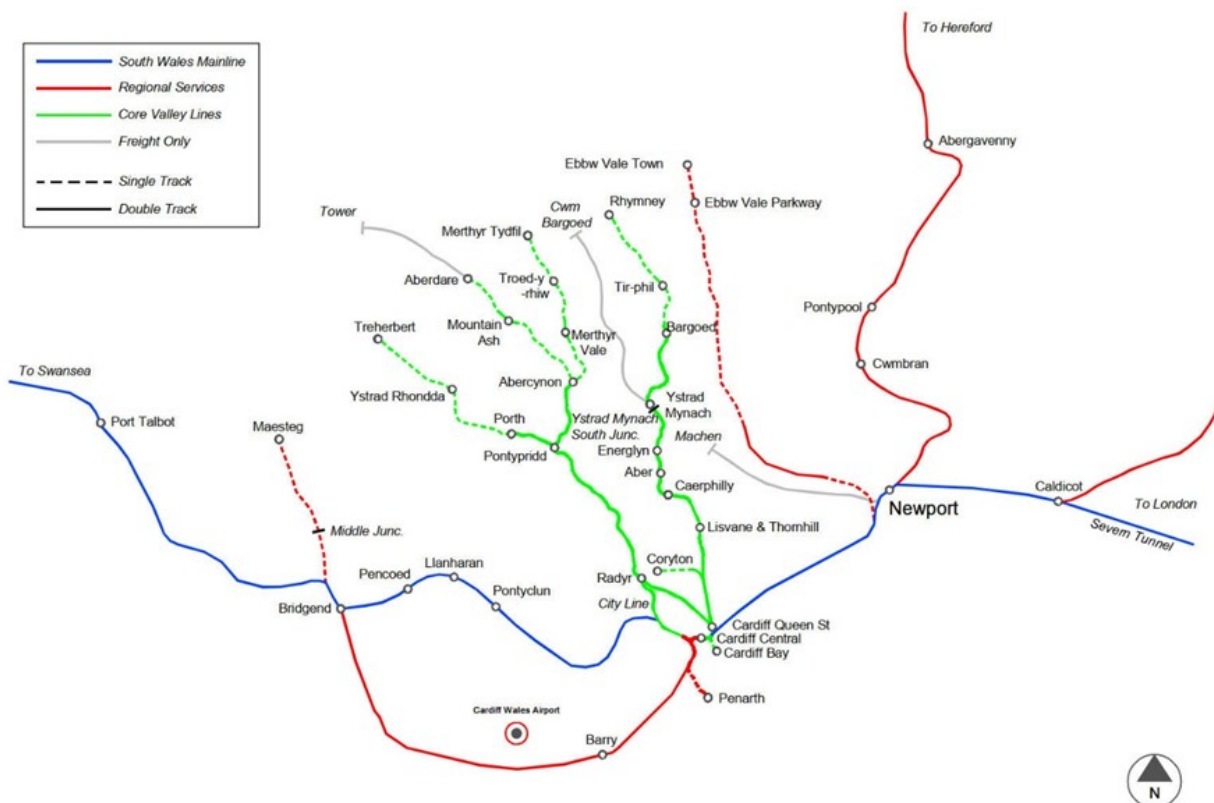


Figure 1.1: South East Wales Rail Network

Source: Mott MacDonald

1.3 The SWML is the main rail artery route in South Wales and broadly runs parallel to the M4. The potential role for rail and the SWML in reducing traffic flows along the M4 was identified early in the process.

1.4 Network Rail owns the majority of the UK rail network and is the infrastructure manager for the SWML and other routes shown in red in Figure 1.1. It is responsible

for maintaining the railway at an agreed level, and where it can do so, upgrade the network to facilitate more trains running. It is also responsible for delivering an acceptable level of performance - the level at which is agreed with the DfT.

- 1.5 The Welsh Government has now taken ownership of the CVL from Network Rail, with plans to run faster, more frequent and greener services on all CVL routes. The responsibility for delivering this is with Transport for Wales (TfW) who are responsible for both the upgrade of the CVL and the operation of the Wales and Borders rail service.
- 1.6 The CVL comprises a network of railway lines that connect communities along the South Wales Valley corridors. The geography of the Valleys is such that the economic and social wellbeing of the area is heavily dependent on efficient transport links between the Valleys and centres of economic activity along the M4 and A465 corridors. The CVL can be interpreted as a self-contained suburban rail network (that is well placed to compete with road transport).
- 1.7 Welsh Government have a number of aspirations and proposals for the SWML. Outside of the CVL, the Welsh Government ambitions for rail¹ include a number of different potential services on the SWML alongside various other routes in South East Wales. The timeline and phasing of these are to be determined but would have a major impact on road traffic on the M4 and other key transport routes in Wales.

¹ <https://gov.wales/south-wales-main-line-rail-network-map>

2. Existing Infrastructure

- 2.1 The SWML is the arterial route connecting Cardiff with destinations across England and Wales. At Severn Tunnel Junction, the separate two track railways from Bristol and Gloucester merge to form a four-track railway.
- 2.2 This four-track railway then runs to Cardiff Central Station and is paired by direction between Severn Tunnel Junction and Bishton Flyover (MP 149.0 – MP 153.0) and then by function through Newport to Cardiff Central station. The Relief Lines occupy the southern pair of tracks and the Main Lines the northern pair (MP 153.0 – MP 170.25).
- 2.3 At present, passenger services tend to use the northern pair of Main Lines, with freight services using the southern pair of Relief Lines. The signed line speeds of the Relief Lines are generally lower than the Main Lines due to a number of reasons including track condition and operational restrictions (due to the number of freight connections).

Track

- 2.4 The existing Relief Line track is Track Category 3 or 4, but this assumption has not been confirmed at this stage. Details of the existing track components and age, maintained by means of the Network Rail GeoRIMN database, has not been fully reviewed for this study. However, the existing plain line track appears to comprise generally of CEN56 rail on concrete or timber sleepers. Short sections of CEN60 rail may be present about NR60 Mk 1 Switch and Crossing (S&C), that has been installed at various locations.
- 2.5 Switches and crossings located on the Relief Lines comprise of both CEN56 and NR60 Mk1 geometric designs types, of varying ages.
- 2.6 Three long-timbered bridges have been identified in the Severn Tunnel Junction to Cardiff section.
- 2.7 Details of Network Rail's proposals for domestic plain line and switch and crossing renewals planned for CP6 and CP7 have not been reviewed for the purpose of this study.

Signalling

- 2.8 The signalling from Severn Tunnel Junction to Cardiff is considered to be in excellent condition due to its recent installation. The area from Cardiff to Newport was re-signalled under the Cardiff Area Signalling Renewals project (CASR) which finished in 2017. Under this project 300 signals were replaced with a modern like for like equivalent, increasing the reliability and capacity of the Cardiff area. The area from Newport to Severn Junction was re-signalled under the Newport Area Signalling Renewals project (NASR) which was finished in 2011.

Structures

- 2.9 A review of Network Rail's Civils Asset Register and Reporting System (CARRS) has identified 148 underbridge structures between Severn Tunnel Junction and Cardiff, 99 of which are culverts, 46 of which are underbridges and 3 viaducts. Overbridges have not been reviewed as part of this study as it is assumed that the recent Great Western Electrification programme (GWEP) has assessed these from a clearance and condition perspective.
- 2.10 The bridge examination and detailed assessment reports have not been reviewed for this study. Previous route assessment reports (Severn Tunnel Junction to Cardiff Relief Lines – Line Speed Enhancements 664360-PRE-FS-620 July 2007 and 3.1.2 SWML Linespeed improvements 141982-CAR-ERP-CV-312111 June 2015) suggest that the strength of the existing structures on the route are sufficient, but that the 2No. existing Longitudinal Timber Bridges on the Relief Lines at 154m 70ch and 156m 30ch should be replaced with either ballasted deck bridges or a direct fastening bridge decking system. It is noted in these reports that similar bridges on the Main Lines had their decks replaced previously.

Overhead Contact System (OCS)

- 2.11 As part of GWEP, an OCS has recently been installed and commissioned on the SWML as far as Cardiff Central.
- 2.12 It is expected that the OCS would not require significant modifications as part of any line speed proposals other than adjustments from a height and stagger point of view or S&C modifications.

Non-Traction Power and Telecoms

- 2.13 The SWML corridor between Severn Tunnel Junction and Cardiff Station has a number of existing Distribution Network Operators (DNO) intakes and other trackside services in the area which may be impacted by proposals to enhance capacity / line speed on the Relief Lines.
- 2.14 The following Principal and Auxiliary Supply Points (PSPs and ASPs) have been identified along the SWML: Leckwith PSP; Newtown PSP; Wentloog ASP; Ad Yard PSP; Newport West ASP; East Usk Yard PSP; Magor ASP and Severn Junction Tunnel PSP.
- 2.15 It should also be noted that the SWML corridor is covered by a telecoms network serving the various assets within the corridor. As noted previously, it is assumed there is sufficient telecoms network capacity to accommodate the changes in data communication for new stations and modifications to signalling infrastructure

SWML Infrastructure Review - Line Speed

- 2.16 This section looks at where potential line speed enhancements may be possible. It should be noted that the assessment applies to the Up and Down Relief Lines only. A track condition assessment has not been carried out for either the existing service or potential future service levels.
- 2.17 The schematic in Figure 2.1 **Error! Reference source not found.** is an initial guide as to where interventions may be required to achieve the operational line speed improvements on the Relief Lines.

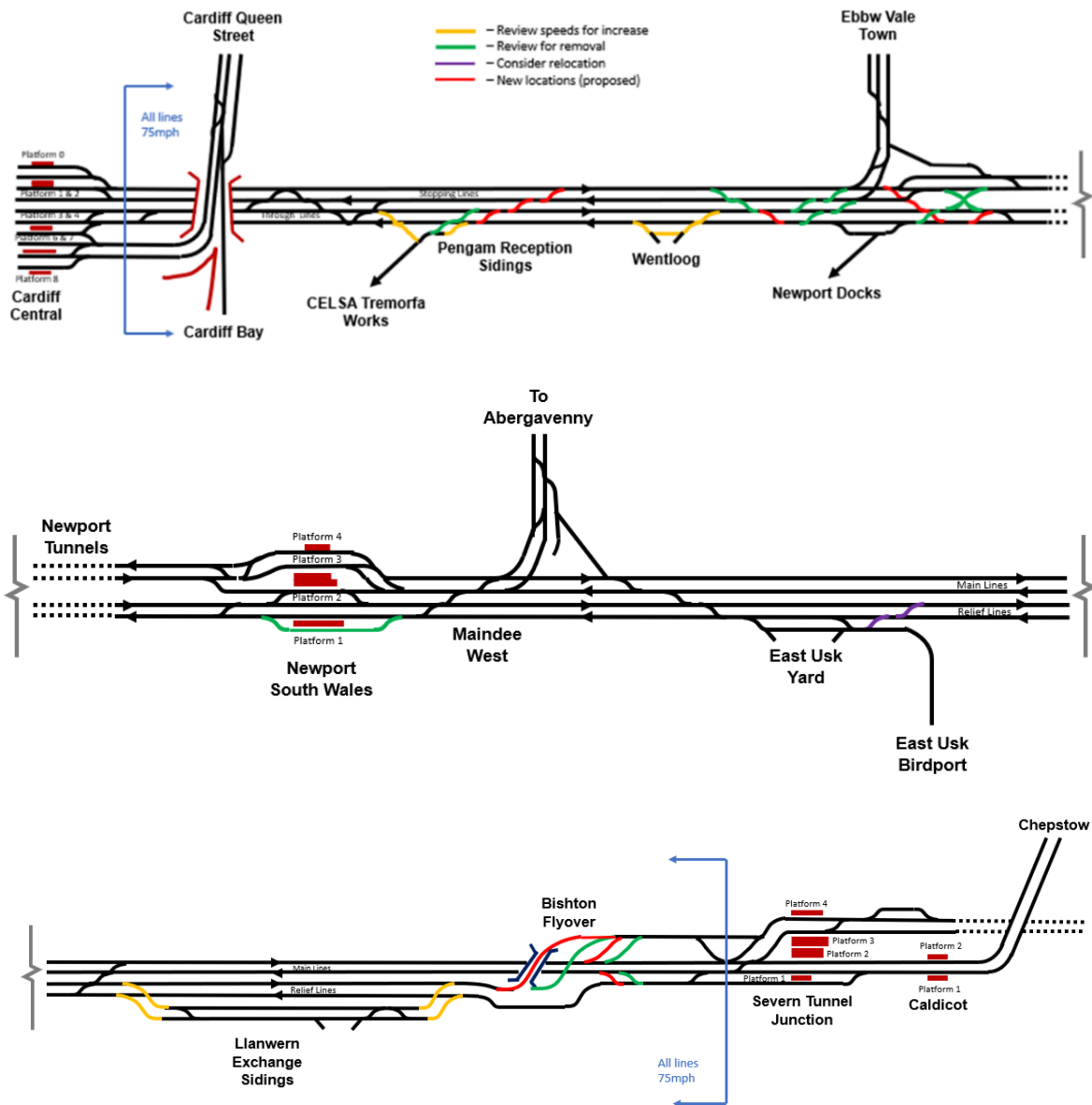


Figure 2.1: Proposed Operational Schematic

Source: Mott MacDonald

2.18 For the study, a line speed of 75 mph was used as the maximum practical speed targeted for the Relief Lines, based on the infrastructure that exists today. This speed is the maximum speed permitted on through routes with S&C design speed of 25 mph used with signal controls with flashing aspects. For line speeds of 80 mph and above, 40 mph S&C would be required to be compliant for flashing aspects. Below the threshold speeds 'Main Approach from Red' (MAR) signalling controls would require trains to brake to a speed of less than 25 mph or a standstill on the approach to junction signals, which would have a significant impact on capacity for the Relief Lines. As the majority of S&C that exists today on the route is 25 mph or less, and

replacement costs to upgrade these to 40 mph would be high, 75 mph was the target speed used.

Track Review

2.19 In the following text, alterations to the existing infrastructure are described in the direction of increasing mileage, irrespective of the normal direction of running.

Severn Tunnel Junction to Magor Closed Station (MP 149.0 – MP 151.25)

- 2.20 The tracks are paired by direction over this section, with the Down Lines being located on the southern side of the corridor. The railway was originally built with twin tracks before increasing to four tracks in the 1940s. The original tracks are the central pair (Up Relief and Down Main) with the additional tracks being added on either side. Structures were extended, with the existing abutments remaining in the space between each of the new Up and Down Lines, and island platforms provided at Magor station.
- 2.21 As a result of the greater separation required at the overbridge structures and former platforms, the Relief Lines are located on a more restrictive alignment than the Main Lines. This section would therefore require more extensive realignment and re-canting to achieve the target speed of 75mph.
- 2.22 Whilst it has generally been possible to retain the revised alignment within 100mm of the existing track centrelines, maximum slews through this section are in the order of 800mm, albeit over relatively short sections. However, the alignment designs are indicative and could be refined to reduce the slew magnitude at a later design stage.
- 2.23 Some additional separation between the Main and Relief Lines in both directions may be possible to increase the width of the proposed new Main Line platforms at Magor and Undy new station. Due to the realignments proposed in the Magor area, which requires re-canting of the track, the existing crossovers in the area require replacement. They are currently located on curved track and the proposal would be to move them west to the next section of straight track.
- 2.24 Gradients are generally flat within this section, with the maximum gradient being 1 in 300 about the former Undy station site.

Magor Closed Station to East Usk Junction (MP 151.25 – MP 156.75)

- 2.25 The tracks are paired initially by direction over this section, with the Down Lines being located on the southern side of the corridor. At Bishton Flyover, the Up Relief Line crosses over the Main Lines on a structure and relocates between the Down Relief and Main Lines, with the tracks now being paired by function (Main and Relief) onwards to Cardiff.
- 2.26 The existing alignment for both Relief Lines about Bishton Flyover has been assessed and concluded that it could potentially be increased to 50 mph (existing speed is 40 mph). This could be achieved by increasing transition lengths and the provision of additional cant, with both tracks remaining on their existing formations.
- 2.27 Alternatively, an option has been developed to provide 75 mph alignments on both Relief Lines around Bishton Flyover. This would require a revised alignment on the Down Relief Line with slews estimated at 1.5 m at various points along the alignment. This would require formation widening and replacement of at least one bridge over a water course.
- 2.28 For the Up Relief Line, a new alignment, served by a new flyover structure located to the west of the existing bridge would be required with flatter curves and new earthworks. The proposed alignment has been designed to fit between existing constraints of Llandevenny Road overbridge to the east, and the Bishton Road underbridge and level crossing to the west.

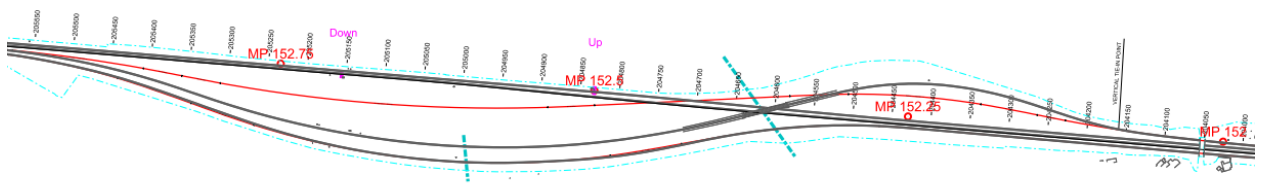


Figure 2.2: Indicative 75mph Up Relief Line alignment (Existing in grey, new alignment in red)

Source: Mott MacDonald

- 2.29 Consideration was given to increasing the Relief Line speed to 90 mph to match the existing High-Speed Train (HST) limit on the Main Lines. However, the presence of the flyover, for which the practical maximum speed limit is 75 mph, does not make this option viable. A line speed of 75 mph is deemed to be feasible over this generally straight section of track, however some realignment of the Relief Lines may be

required. This is due to the long straight being essentially a number of shorter straight elements connected by flat radii curves to facilitate the change in bearings.

- 2.30 Gradients remain generally flat and undulate over this section, with the maximum gradient being 1 in 290, both at Llanwern East Junction and on the approach to Llanwern West Junction.

East Usk Junction – Usk Yard West Junction (MP 156.75 – MP 157.50)

- 2.31 The line speeds are 40 mph on both Relief Lines, with a section of 60 mph on the Down Relief Line between Llanwern West Junction (c. MP156.0) to Usk Yard West Junction (c. MP 157.5).
- 2.32 The Relief Lines continue on a parallel alignment to the Main Lines until the A455 Spytty Road overbridge, near East Usk Junction, where they deviate to pass round the intermediate bridge abutment pier, located between the Relief and Main Lines.
- 2.33 The existing alignment contains a crossover (8060 pts) between the Relief Lines located on curved and canted track. As it is not deemed practical to provide additional cant to accommodate a 75 mph through alignment speed, revised alignments have been developed for both Relief Lines, taking the opportunity to provide a suitable length of straight on which to relocate the crossover. A 75mph through alignment would therefore be feasible, continuing from the Llanwern area through East Usk Junction as far as Usk Yard West Junction at mileage 157M 53ch.
- 2.34 The gradients generally rise over this section, with a summit at MP 156.75. The gradient then falls toward East Usk Junction before rising again to Maindee East Junction. The maximum gradient falls at 1 in 200, on the approach to Usk Yard

Usk Yard West Junction to Newport Station East (MP 157.5 – MP 158.5)

- 2.35 The existing line speed on both Relief Lines is 40 mph through this section, which is the same as that of the Main Lines.
- 2.36 The crossover (8070 pts) between the Relief Lines, which provides an Up direction connection to Usk Yard, is located on a curve that would require realignment and re-canting in the event of speed increases. As the relocation of the crossover was not deemed possible due to a number of underbridge structures in the area and insufficient space, and retaining the crossover with increased cant was deemed not practicable, it was concluded that the current crossover be retained.
- 2.37 No line speed improvement is therefore proposed for this section, noting they would be identical to the Main Lines through this section

Newport Station East to Newport Tunnel East (MP 158.5 – MP 159.0)

- 2.38 The existing line speed on both Relief Lines remains at 40 mph through this section, with 20 mph through the platform loops.
- 2.39 Line speed improvement are not proposed on the Relief Lines through this section, which would remain at 40 mph. This is driven by the fact that the curvature through this area is tight and all trains are proposed to stop at the station.
- 2.40 Alterations to Newport Station are proposed.

Newport Tunnel East – Gaer Junction West Crossovers (MP 159.0 – MP 160.75)

- 2.41 The existing line speed on both Relief Lines is 40 mph from Newport station to approximately MP 160.5 at the site of Newport West Station, where it increases to 60 mph, once clear of Ebbw West crossovers.
- 2.42 The existing gradient rises towards through Newport Old Tunnel, with a maximum gradient of 1 in 331 to a summit towards its west end and then falls through Gaer, Alexandra Dock Yard and Ebbw Junctions and Ebbw crossovers to the limit of this section at MP 160.75, on a maximum gradient of 1 in 150 at Gaer Junction.
- 2.43 There is a lot of S&C through this section, much of it historic and no longer required for the operation of the proposed timetable under normal conditions.
- 2.44 The target for speed improvement for this section is 60 mph. This is deemed to be achievable with a certain amount of realignment and re-canting, particularly on the curved track section from the Tunnel West to Gaer Junction. In order to achieve the increase in speed, it would be proposed to remove the crossover connections located on curved track, which would effectively remove connections between the Relief and Main Lines in this section.

Gaer Junction West Crossovers – Rumney River Bridge Junction (MP 160.75 – MP 167.75)

- 2.45 The existing line speed on both Relief Lines is 60 mph from Ebbw West crossovers to 167M 49ch near Rumney River Bridge Junction, where it reduces to 40 mph through the S&C connections to Pengam Yard.
- 2.46 A proposed line speed of 75 mph is deemed to be feasible over this generally straight section of track, however some realignment of the Relief Lines may be required. This is due to the long straight being essentially a number of shorter straight elements connected by flat radii curves. Increasing the line speed may require alterations to

these curves to ensure the track geometry parameters remain within normal track geometric limits.

Rumney River Bridge Junction - Cardiff East Junction (MP 167.75 - MP 170.25)

- 2.47 The existing line speed on both Relief Lines continues at 40 mph from Rumney River Bridge Junction to Cardiff East Viaduct Junction, apart from a short section of 75 mph on the Down Relief Line between Moorland Road and Newton Junction, which permits the Down direction crossover at Moorland Road Junction to operate at the Main Line speed of 75 mph through this section. Line speeds reduce from 30 mph at East Viaduct Junction to 15 or 20 mph within the station limits.
- 2.48 A proposed line speed of 75 mph, continuing from Rumney River Bridge Junction, is deemed to be feasible as far as the eastern end of the S&C at Newton Junction, from which the existing 40 mph speed would be retained towards Cardiff Central Station.
- 2.49 Line speed improvement over this section would require realignment and re-canting of the Relief Lines at Rumney River Bridge Junction with two crossovers and one turnout being relocated onto the revised alignment.
- 2.50 The existing vertical alignment remains on a flat, undulating geometry through most of this section, but starts to rise towards Cardiff Central station at MP 169.75. The maximum gradient approaching Cardiff Central station is 1 in 80.

Signalling Review

- 2.51 A signalling assessment determined the maximum permitted line speed by braking distance and gradient along against the existing signal to signal distances and compare this against Railway group standard GKRT0075 (Requirements for Minimum Signalling Braking and Deceleration Distances).
- 2.52 The conclusions to draw from this work is that the line speed enhancements proposed are likely to be possible without significant modification to the existing signalling system. The significantly higher achievable speeds show that trains on the Relief Lines are considerably over-braked resulting in underutilisation in terms of capacity.

Structures Review

- 2.53 A preliminary review of the implications of the proposed increases in Relief Line speeds on structures between Severn Tunnel Junction and Cardiff Central has been carried out.

- 2.54 The Section Appendix for the route notes that the route is satisfactory for RA8 (Route Availability 8) live loading and hence each structure is currently satisfactory for at least RA8 loading at the present line speed. Increasing the line speed, however, would increase the dynamic factor on the live load and result in increased total design load on the structure. Referring to the information from the CARRS database it is noted that the RA ratings are given for some of the underbridge and viaduct structures and vary between RA8 and RA15. The structures rated as RA15 would likely have ample reserve to allow for increased line speed, but the structures at RA8 could require strengthening.
- 2.55 It is recommended in the next stage of the design to obtain the assessment reports in order that the structure requirements may be clearly established. To provide an indication approximately 10% of the structures concerned have been reviewed. The main conclusions drawn from this limited assessment is that a number of structures are likely to have more than 20% increase in live load and such are more likely to require further assessment and possible strengthening.

SWML Infrastructure Review - Junction Interventions

- 2.56 This section focuses the junctions across the route and the options to increase capacity and support the line speed proposals above. This has primarily focussed on track alignment, with input from signalling where applicable.
- 2.57 Existing S&C will need to be inspected for condition, including ballast depth, as it will need to meet the requirements of Track Category 1 or 2 in the event of the Relief Lines operating additional trains at a higher speed. The implication is that the older S&C in the study area may require replacement on a like-for-like basis to satisfy Track Category or minimum condition requirements. This will apply even if the particular unit does not need to be relocated on realigned track to enable the higher line speeds.

Severn Tunnel Junction

- 2.58 The existing line speeds on through alignments and S&C were deemed to be satisfactory for the purpose of line speed improvement. Increasing speeds through the branch routes of S&C was not deemed to provide a significant benefit for the current operational concept.

Magor Crossovers

- 2.59 Two options were considered for the track realignment necessary to achieve higher speeds and accommodate a new station in the area. Both options would provide crossover speeds of 40 mph. The evaluation of a preferred solution is subject to further study.
- 2.60 Option 1 relocated the crossovers 50m to the west, with the Relief Line turnouts being placed on a straight section of track enabled by the realignment of the Relief lines at Magor. This would however result in the Down Main Line turnout being located partially under an overbridge, which may have implications on maintaining a compliant clearance offset to the intermediate bridge pier located between the Down Main and Down Relief Lines.
- 2.61 Option 2 relocated the crossover onto a straight, parallel alignments 560m from their existing position.

Bishton Flyover

- 2.62 The previous section presented two options for enhancing the speed of the Relief Lines:
- Increase speeds from 40mph to 50mph by re-canting on the existing formation; and
 - Constructing a new flyover structure to the west to provide higher speeds of 75mph
- 2.63 The cost benefit analysis of these solutions to select a preferred option would be subject to further study.

Llanwern Exchange Sidings East Connection

- 2.64 The existing double junction has been relayed approximately within the last 10 years with a CEN56 CV or DV double junction on concrete bearers. No alterations are proposed to this junction from a track perspective, subject to future confirmation of condition and compliance with track category for the expected tonnage.

Llanwern Exchange Sidings West Connection

- 2.65 The existing double junction is thought to be a CEN56 CV double junction on timber bearers. On this basis it is likely to be more than ten years old. This condition of this

junction will need to be assessed and may need to be replaced on a like for like basis if the condition dictates.

- 2.66 There is a desire to increase entry speeds into Llanwern Exchange sidings from 15mph to 25mph at both ends to free up capacity on the Relief Lines. However, there are MAR restrictions on the route from signal NT1245 to NT6019 which is a permanent stop board located within the siding facility. This MAR restriction is driven by the fact the sidings themselves are restricted to 15mph and the permanent stop board locations are located just within the facility which requires trains to start braking on the Relief Lines in order to stop at the board.
- 2.67 MAR is a restrictive form of junction control designed to impose a speed reduction such that a low speed divergence can be safely negotiated. In practice a train that is routed in to Llanwern Exchange siding from Severn Tunnel will be shown a red signal at NT1245. When the train has occupied the berth track circuit for a period of time the signal will step up to a yellow and the Position Light Junction Indicator (PLJI) will illuminate, allowing the driver to proceed.
- 2.68 In order to lift the MAR restrictions on signal NT1245, the feasibility of changing this to a yellow flashing aspect sequence was investigated. Unfortunately, because the siding is classed as a terminal line and all trains will have to stop, the proposal contravenes the signalling standard "Requirements for colour light signalling" NR/L2/SIG/19609 chapter 10.1.1-C.
- 2.69 With MAR restrictions having to be retained another option was explored whereby an extra signal is installed within the siding to create another block section so that a train could enter the siding on a yellow flashing sequence. However, there is insufficient length to install this block section.
- 2.70 Based on the current configuration and not undertaking significant modifications within the sidings themselves, the remaining option is to speed up the process of allowing trains off the Relief Lines. Currently trains need to occupy track circuit DBJ after signal NT1243 for 54 seconds before the signal will step up and allow the train to proceed into the siding. By cutting the time that the track circuit needs to be occupied, potentially 20-25sec could be saved. This option would also require the need to insert new train detection section splitting up the current long DBJ track circuit.

2.71 The issues highlighted above for the eastern entrance into Llanwern Exchange sidings also apply to the western entrance in terms of principles. As these sidings are owned by TATA Steel, TATA are responsible for what happens in their yard.

East Usk Junction

2.72 The existing S&C is thought to comprise a 30 mph CEN56 crossover and a pair of CEN56 25 mph turnouts on timber bearers (signed for 10mph). The age of the S&C is thought to be more than ten years.

2.73 New S&C is proposed for the crossover and turnout connections from the Relief Lines to the Up and Down Uskmouth Line, which serves as a reception road. This is due to the proposed realignment and re-canting of the through alignments to achieve higher speeds. The proposed S&C has been designed to fit on straight alignments provided by the Relief Line realignment proposed about this section of track with a design speed for the S&C being 25 mph.

Usk Yard West Junction

2.74 As it is not proposed to increase the Relief Line speed in this section, no alterations are proposed for the existing S&C in this section, with replacements being carried out on a like for like basis if condition requires.

Maindee East and West Junction and Crossovers

2.75 As this junction is located on the Main Line side of the tracks and not impacted by proposals to increase the Relief Line speed, no alterations are proposed for any S&C in this section.

East Usk yard signalling

2.76 The entrance to East Usk Yard is MAR controlled which will need to remain in place. However, all moves into the sidings are shunt moves i.e. there are no Main Line moves into the sidings. In practice it is more restrictive to enter East Usk Yard, as trains will have to come to a complete halt at signal NT1253, then the position light signal will illuminate in conjunction with the miniature indicator allowing the train to proceed into East Usk yard.

2.77 It is possible that signal NT1253 can be moved closer to the yard turnout which would minimise the distance travelled at 15mph for any shunt moves to free up capacity on the Relief Lines. The signalling plan S1224-2-1 Magor – East Usk does not

show where these shunt moves terminate, however it is assumed there they terminate on the individual reception lines within the siding.

- 2.78 Another safety reason for the current low linespeed into the yard is that handpoints exist in the yard. These require the driver of the train to exit the train and crank the points over to the desired position before traversing the points. It may be possible to change these to motorised switches to reduce shunting time.
- 2.79 Unless there are significant modifications made to the yard itself, due to the fact that there are only shunt moves into the siding, speeds cannot be raised above 15mph. However, there is no reason why the speed cannot be increased to 25mph when exiting East Usk yard.

Newport station signalling

- 2.80 The only modifications proposed in the Newport Station area relate to the Down Passenger Loop. The existing S&C is thought to comprise of a 20 mph CEN56 turnout on concrete bearers at the east end and a 20 mph NR60 Mk1 turnout at the west end. The proposal is to remove the loop to facilitate higher entry speeds for Intercity services stopping at the station. Therefore, both turnouts would be replaced with plain line. The age of the S&C is thought to be less than ten years.
- 2.81 The proposed removal of the bi-directional loop will require the recovery of signal NT1366 and for it to be moved to the new platform location on the Down Relief Line. All other signalling equipment that is currently on the platform loop will need to be recovered and moved to the new platform location too, Signal NT1369 would be entirely abolished as there is no appropriate location to move this signal to.

Gaer, Ebbw Junction and Ebbw West Crossovers Area

- 2.82 Extensive alterations to the existing S&C are proposed in this section, with much of the S&C that provides crossover connections between the Relief and Main Lines being removed, in order to enable the Relief Line speed to be increased from 40 to 60 mph, which would facilitate a valuable journey time improvement through this section.
- 2.83 Without the removal of S&C on curved track, the proposed line speed improvement would not be feasible, as it would not be possible to provide the transition lengths required for the higher speed and retain the existing S&C footprint.
- 2.84 As a result of the removal of the Main and Relief Line crossovers, movements between these lines would be as follows for the wider Newport area:

East of Newport station:

- Up Main to Down Relief ladder in the Up direction: existing crossovers located between Usk West and Maindee East Junction (20 mph - both directions)
- Up Main to Down Relief ladder in the Down direction: crossovers between Maindee East Junction and Newport Station East (20 mph - Up and 30 mph – Down directions)

West of Newport station:

- Up Main to Down Relief ladder in the Up direction: crossovers located on straight track to the east of Ebbw Junction (40 mph - both directions)
- Up Main to Down Relief ladder in the Down direction: no crossovers will remain. However, if movements in this direction are required to be retained, then a new ladder at a higher speed could be located on the straight track section to the west of MP 161.5

Wentloog East Junction

- 2.85 The existing S&C is thought to comprise CEN56 25 mph S&C on timber bearers, signed for 20 mph. The age was not determinable from the available information.
- 2.86 The possibility of 25 mph connections into the Freight Terminal was evaluated. The length of track between the crossover and turnout is not suitable for the follow-on distance, which would apply to trains leaving the terminal in the Up direction and using both the turnout and crossover. This is unless exceptional range design values are deemed to be acceptable for this situation by Network Rail. Otherwise the crossover would require relocating 10m to the east to achieve practical compliance.

Wentloog West Junction

- 2.87 The existing turnout is thought to comprise CEN56 25 mph unit on timber bearers and signed for 25 mph. It is proposed that the turnout remains as existing, subject to condition.

Wentloog Junction review by Signalling

- 2.88 The existing route into Wentloog siding is a shunt move from signal CF2209 to the permanent stop board CF7003 within the siding. Raising of the speed of this turnout is advised against due to the short braking distance between the set of points (9003) and the stop board within the sidings. There are two hand points that would need to

be in the correct position for the train to enter the siding as well as a Shunters Acceptance Plunger.

- 2.89 An option exists to change the hand points to motorised switches to reduce track occupation time to release capacity but would not enable the speed of the turnouts increase. However, there is no reason why the speed cannot be increased to 25mph for trains that are leaving the yard on to the main lines.
- 2.90 It should be recognised that Wentloog is privately owned and outside of the Network Rail maintenance boundary. Any change to the layout or speed of the route into the siding would ultimately be futile if the line speed within the siding was not also increased. This would need to be agreed to by the siding owner.

Rumney River Bridge Junction

- 2.91 The S&C at Rumney River Bridge Junction provides connections between the Main and Relief Lines and Pengam Yard and Cardiff Tidal Sidings, via a short branch. The existing S&C arrangement is thought to comprise of the following:
- A NR60 Mk1 crossover on concrete bearers between the Main Lines
 - Two CEN56 S&C crossovers on timber bearers between the Down Main & Up Relief Line and Relief Lines respectively
 - Followed by a CEN56 turnout on timber bearers from the Down Relief Line to Pengam Yard
- 2.92 All S&C is thought to be designed for 25 mph, but the turnout is signed for 15 mph. The NR60 S&C is thought to be newer than ten years old, with the CEN56 S&C probably older than ten years.
- 2.93 Due to realignment of the Relief Lines to achieve a 75 mph line speed, the CEN56 S&C would require replacement, with the Down Main to Up Relief crossover requiring both replacement and relocation to the east to accommodate an alignment transition. The NR60 Main line crossover is thought to unlikely to require replacement, subject to condition.

Pengam Junction

- 2.94 The S&C at Pengam Junction provides a connection between the Relief Lines and the west end of Pengam Yard. As the S&C is located on straight track, its geometry will not be affected by the proposed line speed improvement to 75 mph. Any

replacement would be subject to condition and compliance with the requirements for S&C at Track Category 1 or 2.

Cardiff Central Approach

- 2.95 S&C located between Moorland Road Junction and Cardiff East Junction comprises modern NR60 Mk 1 units and has probably been installed in conjunction with the Cardiff Area Re-signalling project, which is due to be completed in 2020.
- 2.96 Some of the S&C shown on the 2013 lidar survey and images used for this assessment has been removed and other units have been included in the layout.
- 2.97 Most of this S&C is located on straight track, so would not be affected by potential line speed improvements, and where located on curved and canted track, these are the beyond the limit of the proposed 75 mph line speed improvement so would not be impacted.

3. Further Impacts Outside of SWML Operational Scope

3.1 This infrastructure study has focused on the required SWML track modifications and associated signalling and structures implications to meet the operational aspirations stated at the beginning of this report. However, there are also potential wider implications of these proposals on other lines and nearby stations, as briefly explained below.

Maesteg Branch

3.2 The current loop at Garw, is currently out of use. To enable the 2tph on the branch, this loop will need to be reinstated, (along with a possible relocation of Tondu station to improve performance by enable the calling point to be within a passing location) and lengthened at both ends.

Ebbw Vale Branch

3.3 As part of the new Wales and Borders service, there is a planned additional service operating on the Ebbw Vale branch between Ebbw Vale Town and Newport. To deliver this increase in service frequency, requires the following alterations:

- A doubling of the track between Park North Jn and Rogerstone
- The Ebbw Vale Frequencies Enhancement Scheme (a proposed extension of the existing passing loop by 7 miles)
- A loop between Cwm and Ebbw Vale Parkway

These changes may be subject to alteration depending on what timings are proposed for services on and off the branch, and the service interval applied.

Marches Line

3.4 The South Wales Metro concept provides the opportunity to meet some long-held aspirations on the Marches route. These aspirations include:

3.5 Enhanced service frequencies through the introduction of a half hourly local stopping service to Abergavenny or Hereford.

3.6 Journey time reductions for long distance services to Manchester and Holyhead through the removal of intermediate stops south of Hereford.

3.7 The provision of additional station calls at new or re-opened stations.

3.8 If these additional services are to terminate at Abergavenny the following are required:

- The reinstatement of a Cardiff facing bay platform
- New signalling and track to connect the bay platform to the Marches line

3.9 If these services are to terminate at Hereford the following is required:

- Additional intermediate block signals in the Little Mill Area to provide the required track capacity for increased passenger services, and existing freight traffic

Infrastructure Summary

3.10 This high level infrastructure review has concluded that from a track horizontal geometry perspective, line speed improvements over existing speeds on the Relief Lines are likely to be viable over large extents of the route between Severn Tunnel Junction and Cardiff Central. This viability review supports the operational aspirations presented as part of this study. However, several track interventions are required to achieve these aspirations.

3.11 A summary of the potential speed changes on the Relief Lines are as follows in Table 3.1. All changes are based on the Down Relief line with only subtle changes to the below for the Up Relief. Red indicates where line speed improvements are proposed.

From		To		Existing Down Relief	Proposed Down Relief
Miles	Chains	Miles	Chains	Speed (mph)	Speed (mph)
149	14	149	24	70	70
149	24	149	74	40	75
149	74	156	05	60	75
156	05	157	46	40	-
156	05	157	57	-	75
157	46	160	30	40	-
157	57	158	64	-	40
158	64	159	60	-	60
159	60	169	46	-	75
160	30	167	49	60	-
167	49	168	69	75	-
168	69	169	53	40	40
169	53	170	08	25	25
170	08	170	20	15	15

Table 3.1: Proposed Relief Lines Speed Increase

Source.: Mott MacDonald

3.12 Releasing capacity to run Intercity services amongst Freight services on the Relief Lines however, largely relies on improved connection speeds into the various sidings and freight facilities. The infrastructure review has concluded that this presents some challenges from a signalling perspective which may only be overcome through more extensive remodelling works. This needs to be explored further as part of further design work, along with assessing the ability to still meet the operational aspirations based on current restrictions.

New and Existing Stations

- 3.13 As part of this study, analysis was undertaken to identify the main commuter flows along the M4. These flows were overlaid against the rail network in order to determine where high origin and destination journeys align with current or proposed rail stations.
- 3.14 This SWML corridor study has considered the identified stations in more detail to review the technical feasibility of them.



Figure 3.1: Potential and Existing Station Locations

Source: Mott MacDonald

4. Newport West Station

- 4.1 The SEWTC have considered a potential new station located to the West of Newport. This section looks at the possible station location and layout, the track and civils infrastructure and local access arrangements.

Station Characteristics and Location

- 4.2 The purpose of Newport West station is to create a transport hub. This would enable a modal shift from car to rail, providing improved public, shared and active travel connections to and from the station.
- 4.3 **Error! Reference source not found.** shows the population and employment density in 2030 for the surrounding area of Newport West which has been adjusted to take into consideration the nearest station for passengers.

	Within 2k (2030)	Within 5k (2030)
Population	15,000	25,000
Employment	High	High

Table 4.1: Nearby population / employment density (2030)

Source: Office of National Statistics, factored to 2030

- 4.4 The station is expected to include a local bus service. The existing bus service along the A48 (Docks Way) only operates every two hours in each direction (Routes 35 and 36). The introduction of Newport West station could therefore justify a more frequent bus service.
- 4.5 Proposals for the station include a small car park for short stay and disabled parking. Electric vehicle charging points could also be incorporated as part of the hub. Secure cycle parking to accommodate 50 bicycles was also recommended, with cycle hire included as a possibility to support a core network of hubs across Newport.
- 4.6 At Newport West, the SWML is a four-track railway that is currently paired by function, with the Relief Lines occupying the southern pair of tracks and the Main Lines the northern pair (153m 0ch - 170m 25ch). As shown by the sectional appendices section in Figure 4.1, the four SWML tracks in the scope area are unidirectional. The area of interest is located between approximately 160m 0ch and 160m 40ch SWM2, where the existing line speed is 75mph on both Main Lines from Newport station to approximately 160m 40ch. Moving southwards, the Main lines

speed then increases to 75 / HST 95mph heading towards 167m 49ch near Rumney River Bridge Junction.

4.7 Along this section of route, there are a number of junctions. The Ebbw Vale branch junction is on the west side of the SWML and the Alexandra Dock freight connections to the east side of the SWML. There are 2 overbridges located at Lime Kiln bridge (160m 15ch) and for the A48 (160m 18ch). There is also an underbridge at 160m 20ch where the SWML crosses the Ebbw River.

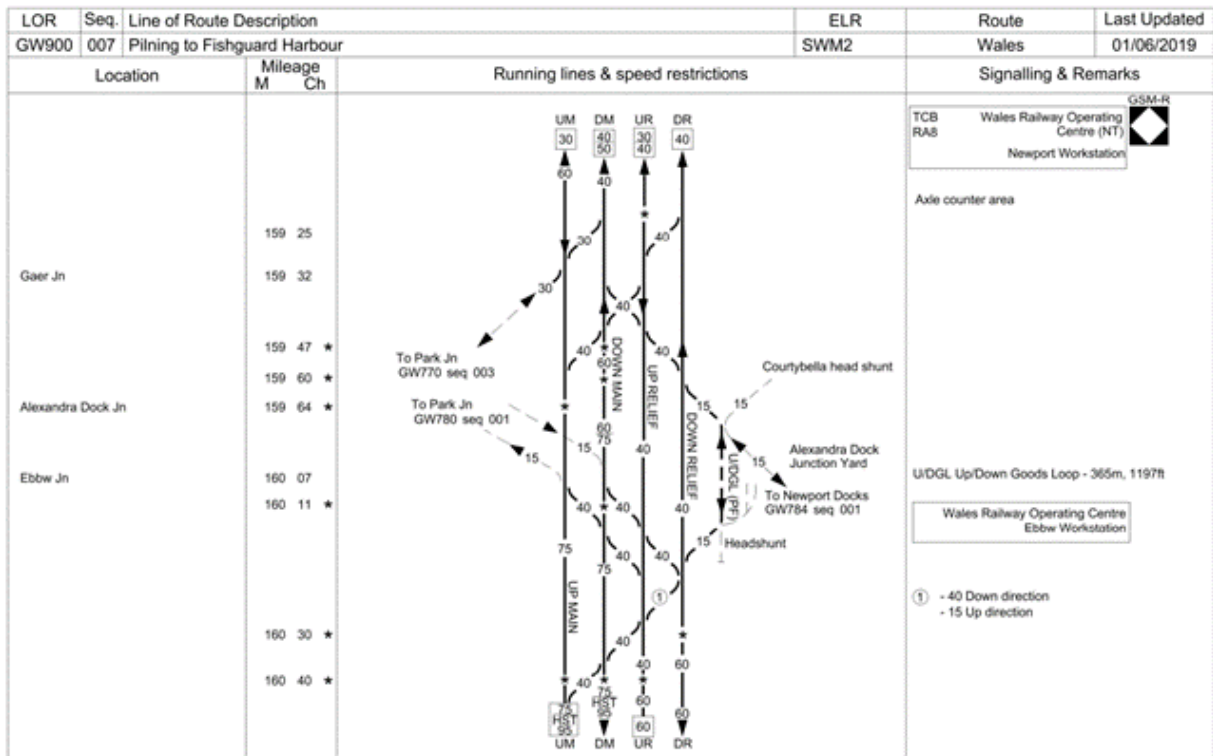


Figure 4.1: Western route Sectional Appendix WR2

Source: Network Rail

4.8 As part of the operational concept, the proposed station at Newport West would be located on the northern pair of lines, serving the stopping services only. This means the services calling at Newport West and coming off the Ebbw branch would not conflict with the operation of the intercity services. The station is planned to be served by 4tph with the indicative timetable produced suggesting these services include the:

- Miskin to Gloucester Services
- Bridgend to Bristol Parkway Services
- Maesteg to Ebbw Vale Services
- Engineering Considerations

Track

- 4.9 For a platform to be introduced between the main lines on the SWML, slewing of the Up Main will be required. There are two overbridges, in proximity to a potential station, which prevent slewing due to the bridge piers located on the west side of the Up Main. This could impact the length of platform, line speeds and track with the alignment potentially having to be slewed over to the access road to the west of the SWML
- 4.10 The actual length of tracks slews will depend on the type and number of platforms needed. Line speeds will also need to be considered, with higher speed lines requiring longer sections to be altered.
- 4.11 A station at the bottom of the Ebbw Vale Branch will impact on the operation of Ebbw junction. With numerous switch and crossings (S&C) in the area, certain platform arrangements might benefit from the removal / relocation of some units
- 4.12 Any new S&C will also be constrained in certain areas, such as the Ebbw Vale branch due to the horizontal curves. New connections around the overbridges would also be an issue as it introduces a derailment risk next to the structures.
- 4.13 Slewing towards the track access road could result in the need to replace Ebbw River underbridge as the loads introduced by the passing of trains may be higher than its current capacity.
- 4.14 Any track slew could also impact on two of the nearby Relocatable Electrical Building (REB). These buildings house various equipment for the operation of the railway and would require planning to not impact on the operational railway.

Signalling

- 4.15 A new station could impact the existing signalling in the area with three signal gantries within close proximity. Where possible, platforms should be placed on the approach to existing signals rather than directly afterwards. Platforms should also be kept outside of signal overlaps, to prevent the need for relocating existing signals.
- 4.16 By placing platforms closer to junctions, more potential issues are likely to arise, resulting in more alterations, i.e. relocating / introduction of new signals. Ideally, the introduction of new signals should be kept approximately 190m from turnouts / clearance points to meet signal overlap requirements.

Overhead Contact System (OCS)

- 4.17 A review of the existing OCS is necessary to identify the changes required to introduce a station in this area and to determine the impact the OCS infrastructure has on the platform locations. The new station will affect the existing OCS heights as a 3500mm electrical clearance is required from the live part of the pantograph to the platform. The contact wire will need to rise from the current height passing under A48 overbridge and Lime Kiln overbridge, to provide the necessary electrical clearance from the live part of the pantograph to the platform. The permissible gradient at which the contact wire can be raised from the bridges to the station is based on the track speed and will determine the minimum distance required between the bridges and the station's platforms.
- 4.18 If there are any canopies present at the station, they must be electrically clear of any live OCS and bonding checks will be required.

Option Review

- 4.19 A number of options were considered for the location of the station and its platforms. Following an initial review, 3 options were selected for more detailed assessment. Figure 4.2 shows the general arrangements of each of the selected option, showing how the existing railway infrastructure could be impacted by the proposals.

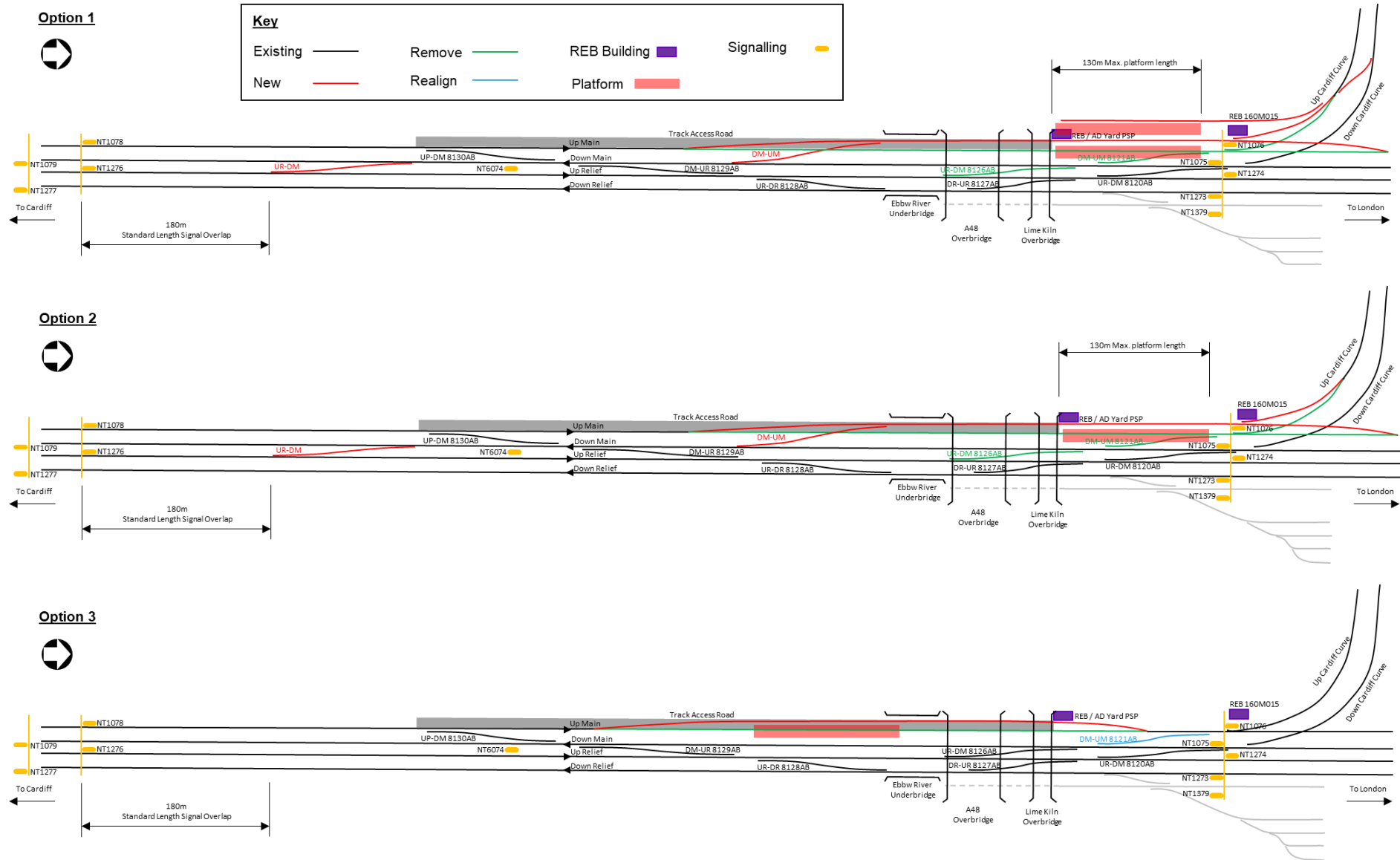


Figure 4.2: Arrangement of Selected Options

Source: Mott MacDonald

Track Review

4.20 The following track analysis is based on Five Mile Diagrams and aerial imagery.

Option 1

- 4.21 This proposal has significant impact on the Ebbw Junction and may result in operational deficiencies and increased infrastructure changes including S&C renewals and bridge reconstruction to achieve.
- 4.22 The Ebbw connection and the Island Platform serving the Ebbw Bay line and the Up Main has relatively little impact on the Track alignment as whole but would import complexity to the ongoing maintenance. The additional spur to serve the bay platform requires an additional connection to be installed on a tight radius curve.
- 4.23 A switch diamond arrangement would not be acceptable due to the curvature; therefore, this connection would need to encompass a crossover to connect the Down Cardiff Curve. This would still represent an operational risk (from failures) and a maintenance burden due to the curvature. Therefore, running services bi-directionally closer to Park Junction where there is a length of straight should ideally be considered instead.
- 4.24 The location of the island platform will require the REB adjacent to the DB Cargo access bridge to be relocated, which will take significant planning to avoid impacting on the operational railway. However, this will be further impacted by the Island Platform which will have significant impact on the overall junction.
- 4.25 The new Island Platform serving the Down Main line would require the Up Main line be relocated by approximately 3m to the west. This would account for the platform width (3.5m assuming fencing and platform furniture) and the structure clearance to the rear of the platform for the Up Relief Line. This relocation of Up Main would require the connection to the Up and Down Cardiff Curves to be replaced which may result in tightening up the curves on the approach. This realignment will require the REB located adjacent to this junction to be relocated. Additionally, the through line speed of 75mph would not provide the opportunity to locate an island platform of any useable length north of the bridge, and to achieve a compliant alignment tie in, prior to the bridges. This distance between the existing Cardiff Curves connection on the Down Main to the DB Cargo access bridge is approximately 180m.

- 4.26 The Up Main would therefore need to pass through the third spans of both the DB Cargo access bridge and the A48 overbridges. It would then pass over the Ebbw River underbridge along the route of the track access road, which is currently used as a maintenance access road, this is also where the REB described above is located.
- 4.27 While there appears to be suitable clearance through the overbridges, they are relatively modern, the Ebbw River underbridge is an aged box girder construction. As the bridge previously took two railway lines, there is potential the bridge could still be sufficient for a single line. A full condition assessment would be required to determine if this bridge is suitable for the loading and a cost / benefit analysis undertaken of refurbishment versus replace.
- 4.28 The relocation of the Up Main would also affect the associated S&C ladder (UR-DM 8126AB and DM-UM 8121AB) with both crossovers requiring to be relocated south of the Ebbw River underbridge. The revised transit time through the junction will need to be compared with current junction margins to identify if the margin needs increasing. If it does this will reduce capacity at the junction. Points 8129AB and 8130AB may need to be moved further south, further impacting on the operation of the junction.
- 4.29 Additionally, the island platform would interface directly with the crossover between the Down Main and Up Relief (UR-DM 8120AB). While there is precedent for S&C to be located within platforms, this would impact on the operation of the railway at this location. This would also require additional offsets in the coper edge to account for dynamic movement of trains (end throw), adding risk to the travelling public and requiring deviation from Railway Group Standards and potentially affecting the safety case of the station.
- 4.30 The revised Up and Down Cardiff Curves connections may provide opportunity for this crossover to be relocated north of the station, subject to further review. If this cannot be accommodated, it is likely to require the Relief to Main (UR-DM 8120AB) and Relief to Relief (DR-UR 8127AB) connections to be located south of the bridges as there is no opportunity for it to be relocated to the north.

Option 2

- 4.31 The proposal for the island platform between the Main lines in this option would include the issues as described in Option 1, although the island platform

configuration would require the Up Main to be moved north by approximately 5.5m to achieve minimum compliant useable width.

- 4.32 This option has reduced impact on the Up and Down Cardiff curves. While the connections with the Up Main would need to be revised for the new alignment, there is not the addition of the complex switch and crossing works associated with a Bay Platform

Option 3

- 4.33 This proposal would locate the Up Main along the route of the track access road as described in the above options in order to accommodate the island platform to the south of the Ebbw River bridge. This will require the Ebbw River bridge to be assessed and potentially replaced and the REB adjacent to the DB Cargo access bridge to be relocated. (as per Options 1 & 2).
- 4.34 The revised alignment is also likely to impact on the Cardiff Curve connections and the Up Main to Down Main crossover (DM-UM 8121AB) will need to be replaced, but the overall footprint of the junction will be unaffected and operational affect will be negligible.
- 4.35 The Ebbw Junction will still be impacted by the new station regarding the southern ladder near the Ebbw River Bridge. The Mains crossover (UP-DM 8130AB) and Down Main to Up Relief crossover (DM-UR 8129AB) would need to be relocated south should a 200m platform be specified.
- 4.36 There is less than 200m from the Ebbw Bridge to the point where the dynamic affect associated with the Up Relief to Down Main crossover (UR-DM 8126AB) would affect the Down Platform and may restrict any movement across the ladder while the platform was occupied. A shorter platform could be accommodated without affecting this S&C.
- 4.37 The offset of the Up Main in relation to the Down Main to accommodate the Island Platform will require the Up Main to Down Main crossover (DM-UM 8121AB) to be replaced. This is due to the 75mph line speed which will require the tie-in to the existing alignment to extend beyond the footprint of the existing S&C.
- 4.38 Additionally, the existing Road Rail Access Point would need to be recovered and potentially relocated elsewhere.

Signalling Review

Option 1

- 4.39 A connection from the Cardiff Curve into a Bay platform in Option 1, which will include a crossover from the Down Cardiff Curve to Up Cardiff Curve, may require signalling alterations to Park Junction interlocking. The signal Box at Park Junction is currently an electro-mechanical installation. Network Rail is in the process of decommissioning the signal box and incorporating its functions into the Wales Rail Operating Centre (WROC) in Cardiff.
- 4.40 The Up Direction signals on the main and relief lines can remain in their present longitudinal positions.
- 4.41 Signal NT1076 on the Up Main would ideally be 20m off the end of the station platform to give adequate sighting standback, this would restrict platform length to around 130m before the Lime Kiln Overbridge (DB Cargo Access road) to the South.
- 4.42 It may be possible to retain the signalling gantry structure across Ebbw Junction with the realigned Up Main track, however Signalling REB 160m 15ch, adjacent to the gantry and the junction would need to be relocated.
- 4.43 In the Down direction (running towards Cardiff), the proposed platform on the Down Main is within the overlap of Signal NT1075. This would be the worst position from a headway/route capacity perspective as it results in a train occupying two signal section during the time it is stopped at the station.
- 4.44 Depending on the chosen track configuration for the altered Main to Relief ladder crossovers, there may be scope to relocate the Down Direction Signals NT1075 (Down Main) and NT1273 (Down Relief) to the South of the platform immediately before the Lime Kiln overbridge (which could reduce the platform length by around 20m). However, this configuration would not be ideal for the Goods Loop Down Signal NT1379, which would no longer be parallel.
- 4.45 Alternatively, a solution to move the Down signals around 170m north of their present location could be looked into, but the current spacing appears to be optimised for 75mph on the Main lines, and a reduction in that spacing would mean reducing the speed, or imposing restrictive aspect sequences.
- 4.46 If the Down direction signals remain north of the station, with NT1075 on the approach to the station stop, there is a risk of Start on Yellow, Signal Passed at

Danger (SOYSPAD) occurring after the station stop due to the distance of 1100m and curved approach to the next signal NT1079.

- 4.47 Any crossovers relocated South of the river Ebbw should ideally be clear of the signal overlaps, at least 180m north of the Up direction Signal Gantry near 160 $\frac{3}{4}$ Milepost.
- 4.48 To accommodate the realigned Up Main, the signalling power 'AD Yard PSP' REB type building, adjacent to the DB Cargo access road bridge would need to be relocated, as would cable routes alongside the track, possibly including new Under track crossings (UTX).

Option 2

- 4.49 This option, without the bay platform, has similar signalling constraints described in Option 1.

Option 3

- 4.50 With this option the station would be sited more than 300m away from any existing main signal positions.
- 4.51 Track changes to the crossovers Down Main – Up Relief (8129 AB), and Down Main – Up Main (8130AB) south of the station site should ideally be incorporated without impinging on the overlap of route setting signal NT1078 on the Signal Gantry near 160 $\frac{3}{4}$ Milepost. Independent Position Light signal NT6074 on the Up Relief may need to be relocated.
- 4.52 Subject to a detailed track design, it may be possible to retain the signalling gantry structure across Ebbw Junction with the realigned Up Main track.
- 4.53 To accommodate the realigned Up Main, the signalling power 'AD Yard PSP' REB type building, adjacent to the DB Access road bridge would need to be relocated, as would cable routes alongside the track, possibly including new UTX.
- 4.54 Departing from the station on the Down Main, there could be a possible risk of SOYSPAD occurring due to a distance of around 700m and curved approach to the next signal NT1079. Departing on the Up Main, the shorter distance to the next signal, NT1076, will limit the achievable speed before the sighting point.

Operations

Option 1

- 4.55 The single track sections on the Ebbw branch constrains the times that services can operate onto and off the branch. As such services generally have to be timed to pass on the two track section at the southern end of the branch.
- 4.56 This option is only relevant if we change the way services operate on the Ebbw Vale branch. Currently services operate though to Cardiff (or Maesteg) and in the future additional services are also planned to go through Newport. This is also the case with our indicative timetable for the SEWTC.
- 4.57 Option 1 would introduce a different operation in that services would shuttle back and forth on the branch between Ebbw Vale Town and Newport West. This would have a disbenefit in terms of an interchange for passengers travelling off the branch, but it would have a benefit in that it would mean that the Ebbw Vale services are not using capacity on the SWML and freeing up capacity.
- 4.58 Overall, this proposal introduces a significant operational change on the Ebbw Vale services.

Option 2

- 4.59 The proximity to Newport station will mean a larger capacity impact due to train braking and accelerating into/out of the stations.
- 4.60 The revised ladder connections, to enable services from the southern pair of lines to access the Ebbw Vale branch, may increase junction margin requirement for any move, reducing capacity when compared to today.
- 4.61 The lack of a separate bay platform does mean that no service will be able to terminate from the branch, and thus all services will be through services to and from Cardiff.

Option 3

- 4.62 The impact of a station call will be less for this options, given the revised location compared to options 1 and 2, and the increased distance to Newport.

Other Scheme Requirements

Platform Arrangements

- 4.63 Based on the proposed services stopping at the station, the suggested train formation stopping at a platform would be the 4-car Stadler Flirt with a total length of 88.2m. RIS-7016-INS requirement for through platforms is to have a 4m allowance for inaccurate stopping (could be reduced to 2m where physical constraints preclude the construction of a platform). For terminal platforms, a 7m allowance would be needed for inaccurate stopping and a buffer stop stand back. Therefore, depending on the option taken forward, the proposed services could require platform lengths of between 90.2m and 95.2m.
- 4.64 A number of new stations in South Wales have adopted platform lengths of 150m i.e. Pye Corner and Ebbw Vale Town. The platform length for this station may need to be consistent with other stations. For options 1 and 2, space is limited to 130m due to constraints in regards to the track slewing. This means that options 1 and 2 would introduce additional constraints.
- 4.65 Network Rail standards require a clear width of 2.5m on platforms, providing sufficient space for shelters, lighting, signage, and other platform infrastructure. To meet this requirement, island platforms have been assumed to be a minimum of 5.5m wide and single face platforms to be a minimum of 3.5m. These figures will be subject to station capacity assessments at a later stage.

Flood Risk Assessment

- 4.66 The National Resources Wales (NRW) online interactive flood risk maps indicated that the site is in close proximity to Ebbw River with areas at 'High' risk of flooding. 'High risk' means the area has an annual equivalent probability of flooding of greater than 3.3%. There is also a flood defence located on the western side of Ebbw River, near the A48 roundabout. The site is not shown to have flooded in the past by the NRW online interactive map, "Historic Flood Map".
- 4.67 While the platforms themselves will be at the same level of the existing SWML, aspects of the station environmental will need careful consideration during design to account for the impact on flooding.

Summary

- 4.68 The purpose of Newport West station is a mini transport hub, enabling a modal shift from car to rail, providing improved public, shared and active travel connections to and from the station. Potentially only a small number of parking spaces should be provided at the station to discourage driving to the station.
- 4.69 Options 1 & 2 are largely similar in respect to the track impact as they both would require changes to the Ebbw Junction, extending parts of the junction south. Option 3 will also see the revised alignment likely impacting the Cardiff Curve connections and the Up Main to Down Main crossover will need to be replaced, but the overall footprint of the junction will be unaffected, reducing impact.
- 4.70 Options 1 and 2 have similar signalling constraints with signalling alterations to Park Junction interlocking likely (or the WROC). Both nearby REB's would also require relocating. Option 3 will see the station located more than 300m away from any existing main signal positions, reducing impact. Subject to a detailed track design, it should be possible to retain the signalling gantry structure across Ebbw Junction with the realigned Up Main track, and only require one REB to be relocated.
- 4.71 Overall, Option 1 has a significant operational impact on the Main Lines. For Option 2, line capacity will still be an issue, but the lack of a separate bay platform does reduce the number of conflicting moves, as well as improving the ability to regulate services onto and off of the Main Line. Option 3 will have a reduced impact on operations given its location compared to Options 1 and 2 and the likely distance to Newport.
- 4.72 Option 3 is likely to be cheaper than Options 1 and 2 because of the reduced infrastructure alterations required. However, station costs are subject to further assessment.
- 4.73 Although the Ebbw River, adjacent to the site, is at 'High' risk of flooding. Provided the new platforms, car park and access routes are placed at the same or higher ground than the current SWML rail level than the operational impact will be minimal.

5. Somerton Station (Newport East)

- 5.1 The site in Somerton is located within a residential area and is therefore well located for potential passengers, providing improved public and active travel connections to and from the area.
- 5.2 Table 5.1 **Error! Reference source not found.** shows the population and employment density in 2030 for the surrounding area of Somerton Station which has been adjusted to take into consideration the nearest station for passengers. It should be noted that the data has only been adjusted for the existing station and does not take account of other proposed stations (for example, Llanwern).

	Within 2k (2030)	Within 5k (2030)
Population	38,000	39,000
Employment	Medium	Medium

Table 5.1: Nearby population / employment density

Source: Office of National Statistics, factored to 2030

- 5.3 It is intended that local residents would walk/cycle to Somerton station with parking spaces limited to discourage driving. There is the option to incorporate secure cycle parking and hire to support a core network of hubs.
- 5.4 The station is likely to require a local bus service. The existing bus service along Somerton Road only operates every two hours in each direction (Routes 74A and 74C). The introduction of a new station could therefore justify a more frequent bus service.

Station Location and Characteristics

- 5.5 The proposed station will be in East Newport, South Wales, and will be situated on the SWML which connects Cardiff with destinations across England and Wales. At Somerton Road overbridge, the SWML is a four-track railway that is currently paired by function, with the Relief Lines occupying the southern pair of tracks and the Main Lines the northern pair (153m 0ch - 170m 25ch).
- 5.6 Due to the proposed separation of services, it has been assumed that the station at Somerton will be located on the northern pair of lines, serving the

stopping services only, thus limiting any conflict with the operation of the intercity services.

- 5.7 Based on the SEWTC service pattern proposal, the station would be served by 4tph. These planned services are likely to be the 2 tph Gloucester-Miskin service and the 2 tph Bristol Parkway-Bridgend service.

Platform Arrangement Options

- 5.8 The area surrounding the rail corridor is built-up on both sides, reducing the available space to locate new platforms. The most viable location for the station is at Somerton overbridge, here the horizontal alignment is desirable and there is potential space available for platforms.
- 5.9 There is limited opportunity to slew any of the tracks to create additional space, due to the reduced width of the rail corridor as it passes under Somerton Road overbridge. This means that an island platform is not possible at this location and two single face platforms have been considered instead.

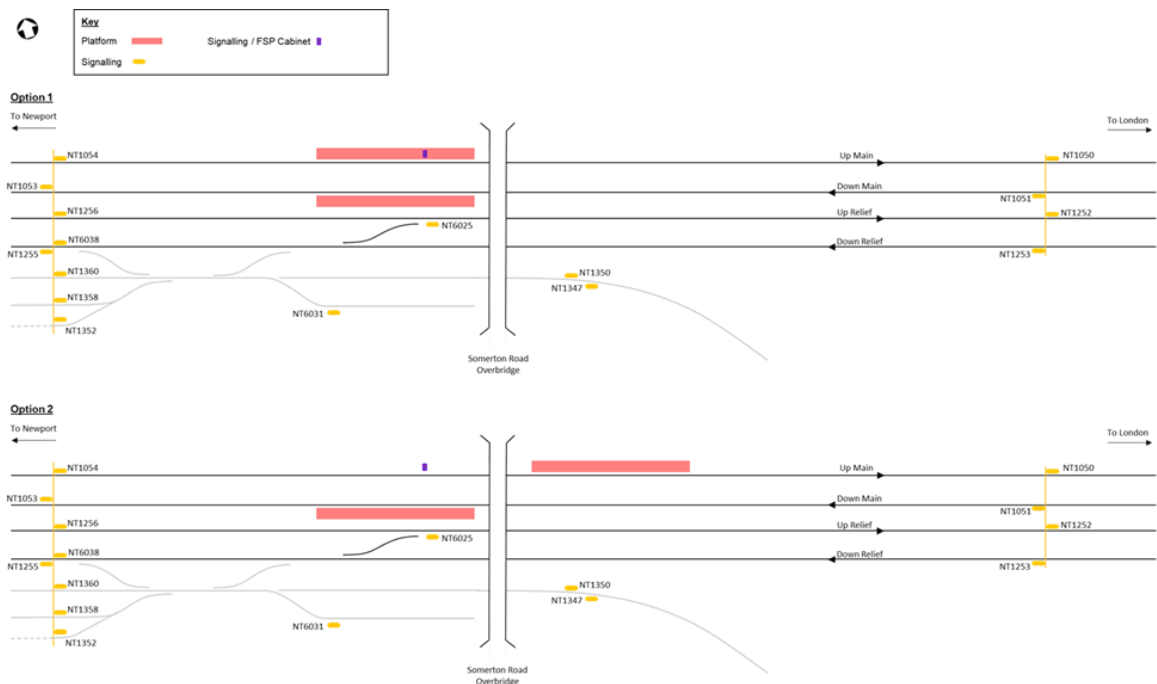


Figure 5.1: Somerton Station Options

Source: Mott MacDonald

- 5.10 Option 1 uses the only space that is available to introduce a platform to serve the Down Main Line, west of Somerton Road overbridge, between the Down

Main Line and the Up Relief Line. The Up Main Line platform is then located on the north side of the track opposite the Down Main Line platform, with both platforms west of Somerton Road overbridge.

- 5.11 Option 2 (similar to Option 1) uses the same Down Main Line platform. The Up Main Line platform is then located on the north side of the track, east of Somerton Road overbridge, resulting in staggered platforms

Track Review

- 5.12 The following track analysis is based on Five Mile Diagrams and aerial imagery.
- 5.13 Option 1 does not require significant realignment of the track. However, the vertical and horizontal alignment does indicate potential issues for stopping services.
- 5.14 The site appears to be on a 1 in 200 gradient in which case the gradient would be non-compliant to railway group standards for the provision of a new station. This is as shown in the latest Five Mile diagram and the actual gradient may vary slightly from this figure. However, gradients of this size are not uncommon on the network and does not rule out the possibility of a derogation for a station at this location.
- 5.15 The proposed platforms appear to be located on a section of straight horizontal alignment. However, immediately east of Somerton Road, the track runs into a geometric and cant transition. Stopping services would cause increased wear on the low rail, due to services running below the designed line speed for the transition. This will also potentially impact on stepping clearances between the train and platform edge, affecting access/egress for passengers with mobility issues and the cant may be uncomfortable for passengers.
- 5.16 Option 2 has the same issues as Option 1, but with the additional issue of the Up Main platform being located on the transition. However, significant track realignment is also not anticipated to allow for this option.

Signalling Review

- 5.17 The proposed platform positions assume that the signal gantry to the east of Somerton Road Bridge (156m 42ch) and the signal gantry to the west of Somerton Road Bridge (157m 12ch) remain in their existing positions. The two gantries are shown in **Error! Reference source not found..**

- 5.18 In regard to Option 1, there is a Signalling Location Cabinet 'LOC157M001' and a Functional Supply Point (FSP) electrical cabinet located approximately 58 metres west of the overbridge. Tail-cables from this signalling cabinet cross both Up and Down Main Lines at track level to equipment on the Relief Lines. In the 'ten-foot' between the Down Main and Up Relief Line, there is a minor cable route and various cable disconnection boxes associated with Relief Lines Shunt signal NT6025, axle counters and crossover 8060A/B. This equipment and the cable routes are likely to require repositioning to enable platforms to be constructed here. If required, there may be scope to reposition the Location Cabinet and FSP closer to the Overbridge, but still within a 200m cable length limit to serve 8060B points.
- 5.19 From initial investigation, the Down Main track from the proposed station approaching NT1053 signal appears to be straight, so the risk of SOYSPAD should be low.
- 5.20 For the Up Main platform, a SOYSPAD assessment would need to be carried out after NT1054 Signal displays a single yellow approaching the platform for stopping trains which then accelerate towards NT1050 Signal at Llanwern West Junction.
- 5.21 Up Main Signal NT1050 is approached on a left-hand curve and Up Relief Signal NT1252 mounted on the same gantry comes into view before NT1050, so there is potentially a risk. A Signal Sighting review could require banner repeater signals being provided
- 5.22 For Option 2, the Down main platform is in the same position as with Option 1, so the minor cable route and cable disconnection boxes located in the 'ten-foot' between the Down Main and Up Relief line may need to be repositioned.
- 5.23 The Up Main platform east of the overbridge avoids the Signalling Location Cabinets, although the main signalling and telecoms cable route, running along the north side of the Up Main Line, may need to be diverted to allow construction.
- 5.24 A SOYSPAD risk assessment and Signal Sighting review would be required for the Up Main platform, as potentially Up Relief Signal NT1252 will be in view from a train in the platform while NT1050 could be obscured beyond the left-hand curve.

Operations

- 5.25 As both options are broadly similar there are no real differences to how services would operate and the timing of the calls.
- 5.26 Similar to Newport West station, the proximity to Newport station will mean a larger capacity impact due to train braking and accelerating into/out of the stations.

Overhead Contact System (OCS)

- 5.27 The new station will affect the existing OCS heights with a 3.5m electrical clearance required from the live part of the pantograph to the platform. The minimum contact wire height to achieve this clearance from the platform is 4.675m on horizontal track. This value increases if the track is canted towards the platform, but according to Five Mile Diagrams, the platform locations include no/minimal cant. However, a clearance of 4.7m has been used for this review to provide a more conservative estimate.
- 5.28 The bridge heights have been estimated using available planning drawings for the recent reconstruction of Somerton Road bridge, where the minimum bridge height was found to be 5.51m. This clearance would allow for the bridges to be wired 'free running' (no attachments to the bridge soffit) with a contact wire height of 4.7m and a reduced catenary wire height. If there are attachments to the bridge, the contact wire height of 4.7m would remain, with a further reduced catenary wire height.
- 5.29 Based on the above statements, there appears no restrictions due to the bridge to achieve compliant clearances at both the bridge and platform.

Other Scheme Requirements

Platform Arrangements

- 5.30 As mentioned for Newport West, the majority of new stations in South Wales have standardising a platform length of 150m i.e. Pye Corner, Ebbw Vale Town. The platform length for Somerton would also need to be consistent with other stations and proposed stations on those routes. A platform length of 150m has been assumed to provide maximum future operational flexibility.
- 5.31 Network Rail standards require a clear width of 2.5m on platforms, providing sufficient space for shelters, lighting, signage, and other platform infrastructure. To meet this requirement, single face platforms have been assumed to be a

minimum of 3.5m. These figures will be subject to station capacity assessments at a later stage.

Flood Risk Assessment

5.32 The NRW online interactive flood risk maps indicated that site is not at risk of flooding from rivers or the sea. The site is not shown to have flooded in the past by the NRW online interactive map, "Historic Flood Map". However, there are areas to the northern end of the site which is shown to be at low, medium and high risk of flooding from surface water.

Summary

- 5.33 The site is well located to capture potential passengers with 12,226 people living within an 800m walk of the proposed station. The purpose of Somerton station is to enable a modal shift from car to rail, providing improved public and active travel connections to and from the area. Potentially only a small number of parking spaces should be provided to discourage driving to the station.
- 5.34 For both Options 1 and 2, significant realignment of the track is not required. However, the vertical and horizontal alignment does provide issues for stopping services and would cause increased wear on the low rail, due to services running below the designed line speed for the transition. Option 2 also has an additional issue due to the Up Main platform being located on a transition.
- 5.35 Option 1 requires the repositioning of Signalling Location Cabinet 'LOC157M001' and tail-cables crossing both Main Lines, with Option 2 only needed the diversion of cables during construction.
- 5.36 The addition of a call at Somerton looks to be achievable with little overall operational impact. There still however needs to be a wider resolution of train service provision on the SWML and this extends beyond the four-track section of line between Cardiff Central, Newport and Severn Tunnel Junction.
- 5.37 Both options 1 and 2 are likely to be of similar cost due to only minor differences in the infrastructure alterations required. However, station costs are subject to further assessment.

6. Impacts on Other SWML Station Proposals

6.1 The following new stations have also been reviewed as part of determining the infrastructure impact of the proposed operational concept:

- Miskin
- Rover Way
- Cardiff Parkway
- Llanwern
- Magor and Undy

6.2 It should be noted that these stations are currently being developed outside of the SEWTC and the current development plans won't be aligned to the work being carried out as part of this study. The following notes the potential impact on those stations from the proposed operation concept.

Miskin

6.3 This proposed station is on the SWML between Cardiff Central and Pontyclun, just south of M4 junction 34. Separate to the SEWTC, a WelTAG stage 2 has recently been completed for the station on behalf of the Vale of Glamorgan Council, with an accompanying GRIP1-2 technical report.

6.4 The existing infrastructure at the site include passing loops (presently 774m long) on both sides of the SWML. These loop lines are uni-directional and serve as overtaking facilities for freight services in both directions given the mix of passenger and freight services that use the line between Cardiff and Bridgend. The WelTAG Stage 2 proposal is for through platforms on these loops, although reference is made to possible changes to track configurations to provide a turnback facility for services operating to Cardiff.

6.5 As part of the SEWTC, the operational concept proposes that the new station will serve a mix of through and terminating services, these being the Bristol Parkway to Bridgend and Gloucester to Miskin services. This would require the track changes suggested in the WelTAG Stage 2, in order to support those services terminating and turning back.

Rover Way

- 6.6 Cardiff Council Transport White Paper 'Transport Vision to 2030' proposes an extension of Metro services through the bay and Cardiff docks utilising freight lines that run to the east of Cardiff. The proposal suggests 4 services an hour could be introduced sometime after 2028. The Metro services are shown initially as terminating where the freight line connects into the SWML, although the white paper suggests they could be extended to Cardiff Parkway and onto Newport as part of a future phase.
- 6.7 The SEWTC proposed measures for operating the slower stopping services on the current Main Lines mean the services that could operate through to the bay would be on the wrong side of the SWML. Crossing over to access the lines through to the bay will have a major impact on the operational concept as it would introduce conflicting moves and reduce capacity.
- 6.8 The impact of the SEWTC proposals for through services operating to the bay needs to be considered in more detail. An alternative arrangement could see Rover Way becoming an interchange services for passengers to transfer across to the other services that go through the docks to Cardiff Bay. Whether those bay services terminate at Rover Way or are able to continue to Cardiff Parkway (alongside the faster intercity services) would need to be assessed.

Cardiff Parkway

- 6.9 The site for the proposed Cardiff Parkway is located to the south of St Mellons Business Park and is a part of a wider development site covering approximately 44 hectares. The station is currently being developed outside of the SEWTC and is understood to be developing towards GRIP4 with further details expected later this year.
- 6.10 If the current proposals for Cardiff Parkway incorporate platforms across all 4 railway lines than there may be minimal changes due to the SEWTC planned services. Platform lengths (including signalling and track) and location of some station facilities would be impacted by the SEWTC measures.

Llanwern

- 6.11 There are a number of potential options for the proposed Llanwern station. The current proposal has the platforms situated adjacent to the new Glan Llyn housing estate on the SWML relief lines. The SEWTC measures would mean that

this could potentially have to change to the other lines to match the proposed stopping service.

Magor and Undy

- 6.12 The proposed station is located centrally between the two neighbouring villages of Magor and Undy. Magor and Undy form a small but growing community situated between Newport and Chepstow. Proposals for a new station at Magor and Undy have been developed by Magor Action Group on Rail (MAGOR) and Monmouthshire County Council.
- 6.13 The current proposals include for new platforms where the B4245 runs closest to the SWML. At this location the relief lines are on the outside lines of the SWML, the MAGOR proposals included for stations on the outside lines on those lines.
- 6.14 Similar to Llanwern, the SEWTC measures would mean that this could potentially change to the platforms needing to be on the inner lines. The track configuration means there are some opportunities and challenges for this at the current location.

7. Existing SWML Stations

7.1 The following existing stations could potentially be impacted by the SEWTC proposals:

- Cardiff Central
- Newport
- Severn Tunnel Junction
- Abergavenny
- Bridgend

Cardiff Central

7.2 The new operational plan proposed for the SWML would alter how Cardiff Central operates, resulting in services calling at different platforms compared to the current situation. This could impact the arrangements and functionality of the station due to certain amenities such as 1st class waiting lounge and concessions being located on the wrong platforms. Also at Cardiff Central, there is currently limited space for additional platforms.

7.3 It should also be noted that passenger projections are expected to increase in future years. The Network Rail Welsh Route Study 2016 predicts a 69% growth in passengers up to 2043 around Cardiff alone. The SEWTC proposals for increasing capacity and service frequency would also contribute to and potentially increase these numbers further. The different platforms and access routes would need to be checked for the type and number of services being proposed.

7.4 Plans are being developed for Cardiff Central station, with £5.8m initially being released to Transport for Wales for progressing the designs to improve access and capacity. Exact details of these improvements are not covered in this report and are subject to a separate business case.

Newport

7.5 Under the SEWTC proposal the Down Platform Loop (Platform 1) at Newport Station would become one of the platforms where Intercity services would be planned to stop. The turnout connections for this loop have been re-laid in the last 10 years at a line speed of 20mph. This 20mph connection is not optimal for Intercity services, and the retention of two non-platformed tracks through the station was not assessed as necessary.

- 7.6 An alignment inspection confirmed that it would not be possible to provide higher speed connections without a reduction in platform standage, insufficient signal overlaps and impact on existing S&C, particularly at the east side of the station. Therefore, to facilitate improved capacity and journey times for Intercity services, it is proposed to remove the 20mph Down Platform Loop serving the existing Platform 1 at Newport Station. Platform 1 would then be widened to sit adjacent to the Down Relief Line, thus enabling a 40mph track alignment to serve a Down direction platform on the Relief Lines.
- 7.7 As part of this widening, all existing infrastructure associated with Platform 1 would require modification or replacement. This includes CCTV, CIS, Public Announcement speakers, lighting, Car Stop Boards, cable management, canopies etc. As part of any modification / replacement, there is a risk that existing systems may be non-compliant to current design standards and such wider replacement could be required.
- 7.8 The predicted passenger number increases may impact the operation of the existing station, similar to the issue identified above for Cardiff Central.

Severn Tunnel Junction

- 7.9 Severn Tunnel Junction does not require any specific modifications as a result of the operational proposals. The services will largely be calling at the same platforms as currently planned with platform capacity not generally a problem. However, historically the station used to have a London facing bay platform (the space for which can still be seen today) with the formation at the Cardiff side also being wide enough to accommodate a new bay platform for terminating services if required in the future.
- 7.10 Severn Tunnel Junction has a limited population within walking distance; however, it serves a wide rural population, including much of Monmouthshire. Access to the station by car is through narrow residential roads with a number of improvements planned to improve accessibility to the station.

Abergavenny

- 7.11 The operational proposals include services that turnback at Abergavenny. While current track layouts do permit a turnback, the turnback operation is time consuming and does not work with the proposed timetable. One option is the reinstatement of the bay platform to the east side of the station along with the associated track work required. This could be achieved by extending the

existing siding by the signal box into the platform and the reinstatement of a crossover.

Bridgend

7.12 The operational concept requires a number of services to turnback at Bridgend station. There is limited ability to use the existing platforms without impacting on other services. Therefore, the current station at Bridgend could potentially incorporate turnback services by either of the following:

- A new Cardiff facing bay; or
- Track changes to support access to the existing Cardiff facing bay. Alternatively, subsequent studies may consider changes to the service pattern and the potential to run some of the services beyond to Bridgend