Future Hoo

Rail Design Development Report

July 2022

Shaping the future of Hoo

MEDWAY

Medway Council
Serving You

Rail Design Development Report

1. Introduction and Purpose of the Report

1.1 The purpose of this report is to set out the design development work undertaken on the Council's proposals for rail improvements on the Hoo Peninsula ('the scheme') that has led to a design freeze in early summer 2022. The report will be updated prior to the submission of the planning application for the scheme to evidence the optioneering process followed to reach the application scheme design.

1.2 It describes in high-level terms the options that have been considered for each element of the scheme, appraises them against an optioneering framework (section 3) and presents the recommended design to be taken forward for assessment ('the Assessment Design') (section 4).

1.3 The options considered in this report are options that have been developed throughout the design development of the scheme (including prior to both rounds of consultation), and therefore includes options that were not subject to the public consultation process.

1.4 The matters discussed in this report finalises 'Stage 1' of the Council's preparation work for the application for the scheme through the achievement of a design freeze.

1.5 'Stage 2' will comprise the assessment of the likely scheme effects and the identification of appropriate mitigation (including design development measures where necessary which may mean that the final application design differs from that presented in this report) on the basis of that Assessment Design. This is primarily to be achieved through the Environmental Impact Assessment and Habitats Regulations processes and the production of a Transport Assessment. Following Stage 2, it is intended that an application for a Transport & Works Act Order (TWAO) for the mitigated design will be submitted in March 2023. There will be ongoing engagement with stakeholders during Stage 2.

Scheme development background

1.6 Estimates of population growth in Medway indicates that a substantial amount of new homes will be required by 2037 to accommodate growth within the area. Medway's new Local Plan will guide the locations for these new homes. Progress to date on the

Local Plan (as seen in its consultations to date) has identified opportunities for growth particularly on the Hoo Peninsula, which could potentially deliver at least 10,600 homes through the Local Plan process.

1.7 However, the scale of housing growth proposed on the Hoo Peninsula is dependent on strengthened connections and significant upgrades to transport and environmental infrastructure. This cannot be achieved through piecemeal private sector investment and instead requires upfront public sector commitment.

1.8 Consequently, in 2017, Medway Council put forward an expression of interest for Housing Infrastructure Funding (HIF), a funding source established by the government to bring forward essential strategic infrastructure to unlock land for housing, which would allow Medway to deliver transport and environmental infrastructure on the Hoo Peninsula to support housing delivery.

1.9 Medway Council's expression of interest was followed by the preparation and submission of a formal bid for funding to deliver the rail improvements discussed in this report, including a new railway station at Sharnal Street, improvements to the existing Grain railway line and re-instatement of a passenger mainline connection on the Peninsula. These proposals would realise the potential of the existing freight line for passengers, alleviating pressure on the road network and promoting modal shift. In addition the bid was for significant highways improvements and the creation of blue and green networks to protect existing landscape and ecology designations, providing active travel links and maintaining settlement boundaries as part of a Strategic Environmental Management Scheme (SEMS).

1.10 The application for funding was supported by economic analysis and appraisal of the highways proposals, undertaken in accordance with standard highways project development (known as 'WebTAG'), as requested by Homes England (referred to in this document as 'the Business Case). In making this case, the Business Case considered the impact that the rail proposals could have alongside the highways improvements it identified as necessary.

1.11 The HIF bid demonstrated that significant further housing growth cannot be permitted on the Peninsula without significant highways investment. Additionally, given the number of environmental designations on the Peninsula, environmental improvements, through the delivery of SEMS, would be required to ensure biodiversity and landscape

effects are effectively managed to avoid, mitigate or compensate against the direct and indirect impacts of housing growth. The rail scheme is also proposed, to help to make the Peninsula more sustainable by promoting a modal shift away from the car, whilst also alleviating pressure on the road network and increasing future resilience. In November 2019, the Government announced that Medway Council were successful in their bid for £170m HIF funding, to be spent between across three interventions on the Hoo Peninsula:

- A £63m investment in a new train station at Sharnal Street and a reinstated passenger service on the Grain branch line;
- A £14m Strategic Environmental Management Scheme (SEMS) to deliver large-scale new publicly accessible (where appropriate) open spaces, covering 300 hectares of community parkland, woodland and nature reserves, managed for both wildlife and for public access; and
- An £86m upgrade of the existing road network with the provision of new infrastructure including slip roads, junctions and interchanges on the A228 and A289 and wider highway improvements, as well as a new relief road to access the Peninsula via Woodfield Way.

Need for the scheme

Business Case

1.12 The Business Case evidences the high commuting mode share for residents living on the Hoo Peninsula when compared against the Medway, regional and national averages. 73.8% of residents drive to work, much higher than the averages for Medway (63.5%), Southeast England (60.8%) and England (57.0%). Additionally, the percentage that travel by train, bus, cycle and on foot are all significantly lower than the local, regional and national average, reflective of the Peninsula's island location and limited existing infrastructure.

1.13 The high car mode share for commuting trips leads to significant levels of peak hour congestion. Key congestion hot-spots are currently seen on the A289 corridor at:

- A289 approaches to Four Elms Roundabout
- Approaches to Sans Pareil Roundabout
- Approaches to Anthonys Way Roundabout

1.14 The congestion leads to extended and unreliable journey times and diversion of trips onto unsuitable roads. This has also led to the declaration of Air Quality Management Areas (AQMA), including:

- Central Medway AQMA – Covers Frindsbury Road, Cuxton Road, Strood Centre, Rochester Centre and Chatham Centre, as well as Luton Road, High Street and Rainham Road in Chatham.
- Four Elms Hill – Applies to the section of the A228 through Chattenden.
- Gillingham – An area along Pier Road.

1.15 The Business Case indicates that several junctions operate close to or at capacity in the 2016 baseline and that the number of junctions operating over capacity will increase significantly when committed and outline development plans are brought forward. It indicates that both the A289 and A228 corridors are congested at present, and there is little spare capacity in the network to cope with planned growth. Significant mitigations are therefore needed to facilitate housing growth on the Peninsula.

1.16 The Business Case identifies that highways improvements are necessary on the Hoo Peninsula to support housing growth. These improvements are then complemented by passenger rail, which will reduce the car trip generation and enable more network capacity to be released for up to 2,600 more homes.

1.17 Currently residents of the Hoo Peninsula must travel to Strood, Higham, Ebbsfleet or Gravesend to catch a train, which adds significantly to the cost and travel time, particularly with the traffic congestion in the area. The Business Case reports that Network Rail's Strategic Planning Team highlighted the very limited capacity to accommodate more passengers during peak travel times at these existing stations. The scheme presents an opportunity to relieve capacity at existing stations and provide more capacity in the wider transport network

1.18 The Business Case concludes that although a wide range of highways improvements will be required to accommodate the predicted trip growth from planned housing growth on the Hoo Peninsula, passenger rail services will form an essential and sustainable alternative to the car.

1.19 This is reflected in the emerging Hoo Development Framework document ('the HDF'), which has been produced by the Council to indicate the high level design objectives and infrastructure requirements for sustainable large scale growth on the Peninsula.

That document indicates that the rail proposals will “improve accessibility and unlock the potential of the area adjacent to the station to accommodate a commercial hub serving the Peninsula and higher density residential development. This will help to provide sustainable transport choice, and a profile for Hoo to attract wider investment. Furthermore, the station will include for integrated transport services, with buses, cycle routes and a car park allowing for mixed-mode commuting”.

1.20 The HDF also notes that “New neighbourhoods will bring the critical population mass to support demand for providing new or additional key services and facilities as well as creating employment, particularly around the new passenger rail station. With the proposals in the HDF, in place, including the station, it goes on to state that “Hoo will be an attractive town providing a range of services for residents on the peninsula. Additional new homes along with the new train station will bring opportunities for improved mobility in the area. This includes new or upgraded roads for both vehicles and bicycles, and enhanced bus services across the area.

1.21 Development of the rail scheme is therefore a key component of the delivery of sustainable development on the Hoo Peninsula.

Scheme Development

1.22 Since the award of the HIF funding extensive design and modelling has been undertaken to develop an appropriate scheme. The reporting for this scheme was aligned with the Network Rail Governance of Railway Investment Projects (GRIP) process. Medway Council have submitted GRIP 3 and are currently developing GRIP 4. The GRIP stages are:

- GRIP 1 - Business Case/Output Definition
- GRIP 2 - Feasibility
- GRIP 3 - Option selection
- GRIP 4 - Single option development (Under Development)
- GRIP 5 - Detailed design
- GRIP 6 - Construction, test, and commissioning
- GRIP 7 - Scheme hand back
- GRIP 8 - Project closeout

1.23 The rail scheme comprises four elements:

- Service
- Rail Crossings
- New Station Location and Form
- Passing Loops

1.24 The scheme has also been informed by the feedback obtained through two rounds of public consultation on the Future Hoo proposals. The first undertaken between January and April 2021 and the second between November and January 2022. Medway Council's Future Hoo team has also engaged extensively with stakeholders, including the Hoo Consortium (the consortium of land promoters with potential residential sites located on the Hoo Peninsula), statutory bodies and wider stakeholders, to ensure the scheme supports the sustainable delivery of housing in line with the emerging design principles set out in the consultation version of the Hoo Development Framework (HDF). More detail on consultation and engagement is set out in the "Future Hoo Consultation Cabinet Report".

Scheme Objectives

1.25 The objectives for the scheme have been developed over the same time period as the GRIP process. However, having gone through the GRIP 3 milestone the design is being assessed within this Report against a common set of criteria and an agreed set of strategic objectives. This ensures a consistent approach that has been used by the Future Hoo team to appraise the options, rather than using the GRIP process alone. In developing these strategic objectives, the Future Hoo team has been mindful of the key requirements of the service in light of the identified need, namely that it needs to support sustainable options for all development on the Peninsula by encouraging modal shift; but that in doing so, it shouldn't negatively affect freight services now or in the future.

1.26 The strategic objectives are shown in Table 1.

Table 1: Strategic objectives

SO1	Enable housing growth on the Hoo Peninsula
SO2	Support sustainable economic growth in Medway
SO3	Improve connectivity to and from the Hoo Peninsula
SO4	Improve accessibility and reduce severance on the Hoo Peninsula
SO5	Protect and enhance the built and natural environment

2. Optioneering Framework

2.1 This section of this report outlines the criteria against which the options for each phase of the scheme has been considered (as described in section 3) to determine whether they should be taken forward as the Assessment Design, as part of the design development process for the scheme.

2.2 At this stage of design and baseline environmental knowledge, the assessment of each option against the identified criteria has been necessarily high level. As such, a Red Amber Green (RAG) rating system has been applied. Options have been taken forward on the basis of their overall RAG performance against the identified criteria set out below, with the option that scored the most 'Green' ratings combined with the least 'Red' ratings for each phase being progressed to the Assessment Design stage, save where a criterion is fundamental to the delivery of that phase (as explained where necessary in section 3).

2.3 Table 2 below outlines the criteria that each option has been assessed against and outlines an explanation of the RAG scoring criteria that have been applied for each criteria. An explanation for the specific RAG rating for each option is included in the appraisal tables set out in section 3. Generally, a red rating for any criteria will result in an option being discounted unless there are specific circumstances to the contrary. Other ratings (green and amber) will need to be balanced across the criteria depending on the specific option. The reasons for identifying a preferred option are set out following each summary table. Professional judgement has been applied both in giving the RAG ratings and in balancing ratings across the criteria.

Table 2: Appraisal and RAG scoring criteria

Criteria	Green Rating	Amber Rating	Red Rating
Fit with Objectives	Fully meets at least 3 objectives	Meets at least 1 objective	Meets no objectives
Service Performance [1]	Provides good passenger experience	Provides acceptable passenger experience	Provides inadequate service
Environmental	No potential adverse effects/potential improvement	Potential for adverse effects but needs further investigations	Clear that likely adverse effects will arise
Landtake	Involves the least amount of potential development land or the least amount of third party land overall	Involves the second least amount of development land or third party land	Involves either the highest amount of third party landtake or could lead to high levels of compensation being required
Safety	Meets highest safety standards	Is 'safe' but does not meet the highest standards	Doesn't meet safety standards
Affordability	Cheapest Option	Middle ground option (if applicable)	Most expensive option
NPPF Compliance (the Medway Local Plan was adopted in 2003 and the emerging Local Plan has not yet been consulted on at Regulation 19 stage. Therefore, in the absence of an up to date Local Plan, the NPPF is being used to assess policy compliance)	No NPPF policy issues	Potential for Policy concerns – further evidence would be needed to show compatible	Clear Policy Compliance Issues

[1] In this context a good passenger experience is one in which the passenger can proceed to their destination on modern, uncrowded, rolling stock with minimal changes/waiting time. The ideal passenger experience would be a fast direct service. Subjectively an acceptable passenger experience may include some waiting time or other inconvenience but is not so inconvenient that a passenger would choose an alternative mode of transport. An inadequate service/passenger experience is one that a passenger is unlikely to choose if they had an alternative option.

Criteria	Green Rating	Amber Rating	Red Rating
Buildability	No major buildability issues	Some constraints but likely to be surmountable with further investigation	Insurmountable constraints
Community/Stakeholder (expressed at both consultations and in engagement)	Most Favoured Option	Mean Favoured Option (where relevant)	Most Non-Favoured Option

3. Design Development

Design Development Overview

3.1 The development of the design can be categorised into the specific elements of the Scheme set out in Section 1. This section sets out the options considered for each of those elements.

Service Options

3.2 During the development of the Future Hoo rail programme, a number of different service options have been considered. These have been based on 4 concepts: a Gravesend Link Service, a London Service, a Link Service and a Medway Towns Service. These concepts are explained in more detail later in this report, however in summary terms these are:

- Gravesend Link Service – a shuttle service between the new station and Gravesend to give access to existing rail links to the Medway Towns and London
- London Service – a direct rail link to London from the new station
- Link Service – alternatives to the Gravesend Link Service, providing an intermediate step between the Gravesend Link Service and the London Service
- Medway Towns Service – a direct link to Higham, Strood and on to the Medway Towns, either directly or indirectly by changing at Strood

3.3 Within those four concepts a number of sub-options were considered.

3.4 Each of those sub options has been considered against the above criteria, where they are relevant to that option; with the best performing sub option then taken forward to be compared against the best performing sub option of each of the other concept options.

3.5 All sub-options would involve different requirements for passing loops at Hoo Junction/Cliffe and Cooling St. The options of design for each of these two locations are considered in the section on passing loops later in this report. The impacts from that loop considered in this section can therefore be assumed to be those from the chosen option for each location discussed in that section.

3.6 With the exception of the London service these options would involve a 2 car service, with the station being designed to facilitate a later 4 car service. The London service would involve a 12 car service.

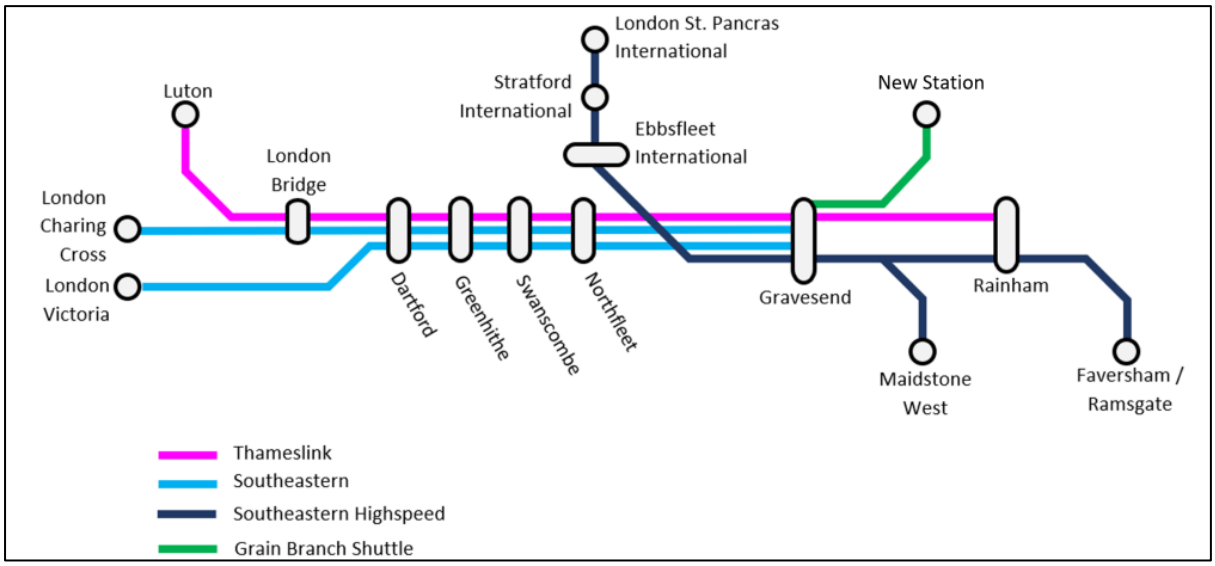
3.7 The service options that have been considered are set out below. All service options require an upgrade of the physical infrastructure and signalling to allow freight and passenger services to both use the Grain line. The nature of the infrastructure will vary depending on timetable considerations. A passenger service will need the 15mph speed restrictions at existing crossings to be removed to give a higher average speed.

Option 1: Gravesend Link Service

- Option 1A: 1 train per hour (TPH) service based on a non-regular service pattern ('non-clockface'), with Cliffe passing loop
- Option 1B: 1 TPH on a regular service pattern (all remaining options include a regular service pattern), with Cliffe and Cooling passing loops
- Option 1C: 2 TPH with Cliffe and Cooling passing loops

3.8 This option involves a turnback facility in platform 2 at Gravesend Station. This will allow a shuttle service to run between the new station adjacent to Sharnal Street, and Gravesend Station. This would require the installation of a new crossover between the Up (towards London) and Down (away from London) Main lines, on the non-London-side of the existing crossover. The existing crossover is unaffected by this proposal.

3.9 In addition to the trackwork, new signalling would be required to account for the new track layout and service.



3.10 The table below sets out the consideration of these options.

Table 3: Gravesend Link service options

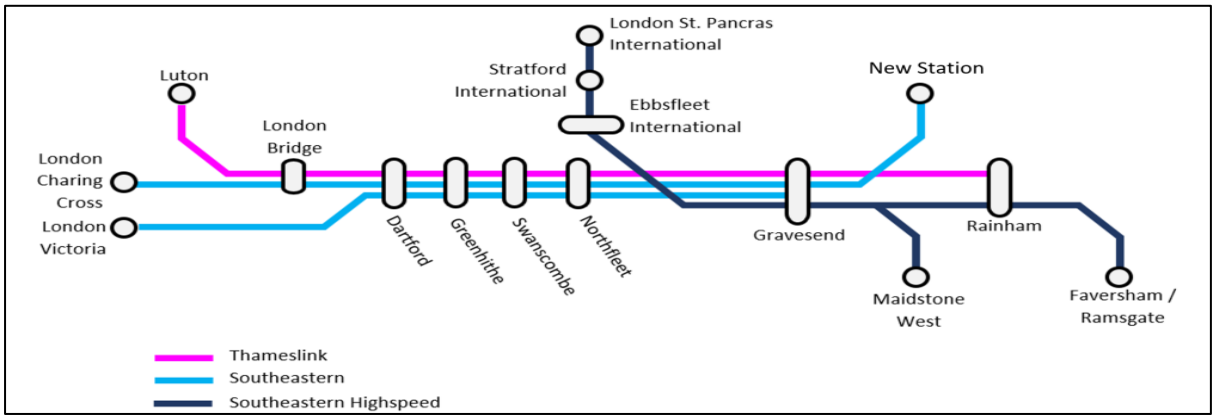
Option	Objectives	Service Performance	Enviro	Land	Safety	Affordability	NPPF	Buildability	Comms
Option 1A									
Option 1B									
Option 1C									

3.11 Option 1A is taken forward for further consideration as it:

- Delivers the passenger service from the new station onto the wider rail network for the lowest cost
- Creates the flexibility to allow for future timetabling changes that could potentially provide a service integrated with departures and arrivals to/from Medway Towns and London
- Whilst the solution would be not have a regular service pattern (‘non-clockface’) and only 1 TPH, timetabling improvements could be made in subsequent years to the North Kent Line to address this. The service therefore provides a viable initial service to start to develop modal shift that could grow as the Hoo community (and thus demand) expands.

Option 2: London Service

- Option 2A: 1 TPH with Cliffe (extended to Cliffe sidings) and Cooling passing loops
- Option 2B: 2 TPH 60 miles per hour service with Cliffe (extended) and Cooling passing loops.



3.12 The table below sets out the consideration of these options.

Table 4: London service options

Option	Objectives	Service Performance	Enviro	Land	Safety	Affordability	NPPF	Buildability	Comms
Option 2A									
Option 2B									

3.13 Option 2B is taken forward for further consideration as it:

- Provides better integration with rush hour services
- Can be downgraded to 2A during off peak hours to reduce running costs

Option 3: Link Service (all options involving either 1TPH with Cliffe loop or 2TPH with Cliffe and Cooling passing loops)

- Option 3A: Ebbsfleet, which would require payments to be made to facilitate track and platform access as the station is owned by HS1 limited.
- Option 3B: Northfleet, which would necessitate a new siding, platform and signalling due to a lack of capacity at the existing station.

- Option 3C: Dartford, which would necessitate a new train needing to be brought into service given the increased service length.

3.14 It should also be noted that the North Kent line as far as Gravesend is safeguarded by Crossrail and consequently, Crossrail could object in principle to all three options unless it could be shown that they would not impact upon future Crossrail services, which is not known at this time. The works required to deliver Option 1 and Option 2 are outside of the safeguarding area for Crossrail.

3.15 The table below sets out the consideration of these options.

Table 5: Link Service options

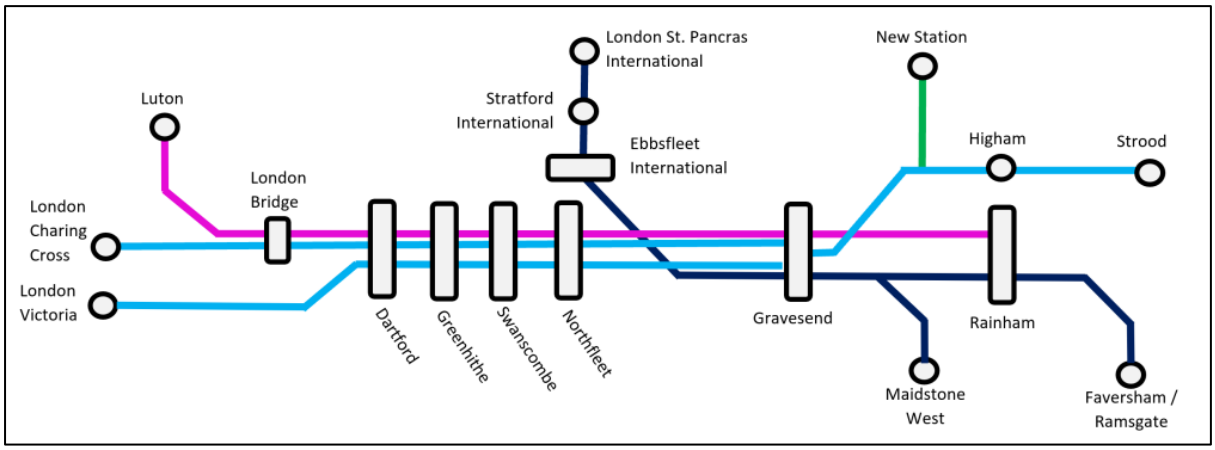
Option	Objectives	Service Performance	Enviro	Land	Safety	Affordability	NPPF	Buildability	Comms
Option 3A									
Option 3B									
Option 3C									

3.16 Option 3B is taken forward for further consideration as it:

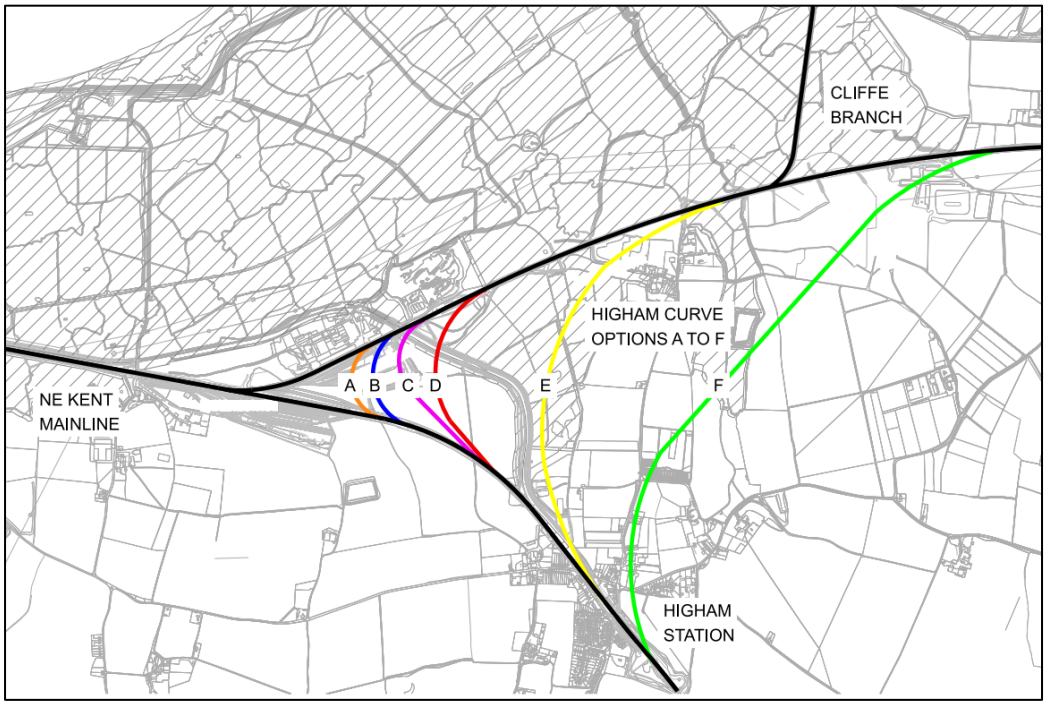
- Does not require additional rolling stock due to the travelled length of the service as would be required for Option 3C.
- Does not require a secondary in cab signalling and vehicle type approval for HS1 as would be required for the Ebbsfleet option.
- The other two options are cost prohibitive, which is the determining factor in not considering these options further.

Option 4: Medway Town Service (all require Higham curve)

3.17 This would facilitate a service between the new station location at Sharnal Street and Higham/Strood (such as through extending the existing Tonbridge to Strood service).



3.18 This would require a new curve at Higham, where six sub-options were considered of varying size, curve A is the longest and F the shortest, these are shown below



3.19 The table below sets out the consideration of these options. Service Performance was not considered for this exercise, as this is a consideration related to physical impacts only at this stage.

Table 6: Medway Towns service options

Option	Objectives	Service Performance	Enviro	Land	Safety	Affordability	NPPF	Buildability	Comms
Option A									
Option B									
Option C									
Option D									
Option E									
Option F									

3.20 Option 4F is taken forward for further consideration as it:

- was perceived to resulted in the least impact to land that has been designated as part of the Thames Estuary and Marshes RAMSAR and SSSI; and
- is noted, however, that this option would still involve works in the Hoo Junction Depot, affecting third party land and commercial operations at this Depot. The route would also require the upgrading of Canal Road bridge.

Train Type

3.21 Separately, as the North Kent line is electrified using third rail and the Grain line is not electrified, consideration was also given to alternative motive power for all options:

- diesel
- battery or battery/bi-modal trains
- alternative fuel bi-modal trains
- works to undertake electrification
- third rail installation
- overhead line.

3.22 Consideration of this matter was undertaken at a high level, on the basis that the associated costs and other impacts would then apply equally to each of the service options discussed above. The use of battery trains was chosen on the basis that:

- Further to consultation feedback and given the environmental feedback, the air quality impacts of diesel trains were sought to be avoided;
- Undertaking overhead line installation would lead to additional cost and land requirements and potential environmental concerns;
- Undertaking third rail installation would lead to additional cost and land requirement and potential safety concerns; and
- Battery trains would be able to be accessed and utilised with comparatively small costs.

Service: Options Appraisal Tables

3.23 The four selected options for each of the concept options were therefore:

- Option 1A: Gravesend link service
- Option 2B: 2 TPH 60mph service
- Option 3B: Northfleet Shuttle service
- Option 4F: Shortest Curve

3.24 The tables set out the detailed consideration of how these four options compare against each other.

Criteria 1: Fit with Project Objectives

Option / Objective	SO1	SO2	SO3	SO4	S05	Overall RAG Score
•Option 1A: Gravesend link service					See Criteria 3	
•Option 2B: 2 TPH 60mph service					See Criteria 3	
•Option 3B: Northfleet Shuttle service					See Criteria 3	
•Option 4F: Shortest Curve					See Criteria 3	

Criteria 2 – Service Performance

Option No	Service performance
•Option 1A: Gravesend link service	Service performance reliant on achieving turnback times at Gravesend. Likely to be acceptable service performance but not good.
•Option 2B: 2 TPH 60mph service	Fastest service with new rolling stock provides best passenger experience.
•Option 3B: Northfleet Shuttle service	Northfleet expected to have low passenger footfall with all passengers accessing the service to/from Gravesend. Ebbsfleet (fast services) accessible only after moderate walk. Therefore, service likely to be acceptable but not good.
•Option 4F: Shortest Curve	The tight curve would be slow and noisy, and not conducive to a good passenger experience. Therefore, performance would acceptable but not good.

Criteria 3 - Environmental

Option No	Environmental
•Option 1A: Gravesend link service	Cliffe passing loop is required for all options. The passing loop runs adjacent to a RAMSAR wetland & SSSI marshland on both sides.
•Option 2B: 2 TPH 60mph service	Requires 2nd passing loop at cooling street and is likely to increasing noise. Requires the line to be upgraded to 60mph and this will create more noise and vibration.
•Option 3B: Northfleet Shuttle service	Northfleet would require building a new platform or extending an existing platform. Whist it was acknowledged that the proposed works were located within the impact risk zone for the Swanscombe Peninsula Site of Special Scientific Interest (SSSI), no impacts upon this conservation designation were anticipated given the urban setting of the scheme. The construction of a new platform would require tree removal, which had the potential to impact upon habitats and species at a local level, including nesting birds and bats. Gravesham Local Plan 2014 states no-net loss of biodiversity habitats or species.
•Option 4F: Shortest Curve	Requires curve which would impact on the Thames Estuary and Marshes Ramsar and SSSI. The Option 4F curve would bring the rail service within close proximity to the St. Mary Hoo conservation area and associate listed buildings This option brings the scheme within closer to residential dwellings, potentially resulting in increased noise and vibration. Increased land take impacts on agricultural land. Depression in terrain within woodland will need significant infill. Selected option minuses these impacts, however has significant impact on depot and potential contaminated land. Impact on woodland area east of Hoo Jctn Depot.

Criteria 4 - Land

Option No	Land
•Option 1A: Gravesend link service	All options have the same land take for the Station Area. No additional land take is required at Gravesend Station. Cliffe passing loop is to be installed within the NR land boundary.
•Option 2B: 2 TPH 60mph service	As base option above. Cooling street passing loop is to be installed within the NR land boundary.
•Option 3B: Northfleet Shuttle service	Northfleet requires a new platform with one solution being constructed on a disused car park potentially owned by a third party. Extending Platform 1 would likely impact on the private sidings to the south of the track. The area is also safeguarded for Crossrail.
•Option 4F: Shortest Curve	As base option above. Higham curve is outside of NR land. This option requires the largest amount third party land. Land required includes agricultural land, woodland, possibly RAMSAR & SSSI & potentially amendments to Hoo Jctn Depot.

Criteria 5 – Safety

Option No	Safety
•Option 1A: Gravesend link service	For all options it is not possible to fully segregate the public from the track at the existing crossings
•Option 2B: 2 TPH 60mph service	For all options it is not possible to fully segregate the public from the track at the existing crossings
•Option 3B: Northfleet Shuttle service	For all options it is not possible to fully segregate the public from the track at the existing crossings
•Option 4F: Shortest Curve	For all options it is not possible to fully segregate the public from the track at the existing crossings

Criteria 6 - Affordability

Option No	Affordability
•Option 1A: Gravesend link service	Lowest cost option.
•Option 2B: 2 TPH 60mph service	Medium cost option. The track quality will need to be improved over the whole length to permit higher speed passenger movements
•Option 3B: Northfleet Shuttle service	Northfleet Station: High capital cost option due to station improvement works required.
•Option 4F: Shortest Curve	High-cost solution due to works required in RAMSAR additional bridge crossing of Canal Rd, replacement of the depot, or any remediation works required to the depot.

Criteria 7 - NPPF

Option No	NPPF
•Option 1A: Gravesend link service	The proposed passing loop (common to all options) runs adjacent to a Ramsar site and SSSI. Paragraph 181 of the NPPF suggests that Ramsar sites should be given the same protection as habitat sites. The Ramsar site and watercourses are also likely to be affected by the embankment widening and track doubling. Paragraph 180 of the NPPF states that development on land within or outside of SSI, and which is likely to have an adverse effect, should usually not be permitted.
•Option 2B: 2 TPH 60mph service	This option runs adjacent to the Ramsar site and SSSI (Para. 180 of the NPPF). It requires the line to be upgraded to 60mph which will lead to increased noise and vibration. Paragraph 175 of the NPPF suggests that development should contribute to enhancing the natural environment, particularly new developments should not contribute to unacceptable levels of noise pollution. Paragraph 185 states that mitigation measures to reduce potential impacts from noise will need to be implemented where appropriate to avoid noise giving rise to significant adverse impacts on health and the quality of life.
•Option 3B: Northfleet Shuttle service	Paragraph 180 of the NPPF states that development on land within or outside a SSSI, and which is likely to have an adverse effect should usually not be permitted. Whist it was acknowledged that the proposed works were located within the impact risk zone for the Swanscombe Peninsula Site of Special Scientific Interest (SSSI), no impacts on this conservation designation were anticipated given the urban setting of the scheme.
•Option 4F: Shortest Curve	Though curves E and F do not directly impact the Ramsar site and SSSI they will likely result in even greater environmental impacts as they require substantial works. Listed buildings are also located near the curve which could potentially be impacted through noise and vibration. Paragraph 199 of the NPPF states that great weight should be given to the conservation of heritage assets. The land required for this option also includes agricultural land and woodland which conflict with paragraph 174 of the NPPF as it aims to conserve and enhance the natural environment, suggesting that development should recognise the benefits from natural capital and ecosystem services of the best and most versatile agricultural land, and of trees and woodland.

Criteria 8 - Buildability

Option No	Buildability
•Option 1A: Gravesend link service	A new cross over at Gravesend needs to be installed on the North Kent Mainline. Existing platform infrastructure is to be used. It is expected that the works to Gravesend Crossover can be completed in a 52-hour possession, with other systems added in later possessions.
•Option 2B: 2 TPH 60mph service	As base option above but the Gravesend crossover is not required. Additional passing loop at Cooling Street needed. This is close to an existing high-pressure gas main, which crosses the line between Station Road Bridge and Cooling Street Bridge. Additional works are required to the Cliffe loop to double the loop into the freight sidings to avoid passenger and freight conflicts on the timetable.
•Option 3B: Northfleet Shuttle service	As base option above. Building a platform extension off Platform 1 at Northfleet Station would require materials to be lifted across the track from the North or it would require access to the private sidings to construct the new platform from the south. Land safeguarded by Crossrail and complex signalling issues.
•Option 4F: Shortest Curve	As base option above but the Gravesend crossover is not required. Environmental constraints due to the proximity of RAMSAR and SSSI sites. High pressure has main located near Hoo Jctn, any works will be impacted by the gas main exclusion zone. A significant amount of fill material will be needed to build the track up to tie into the existing line. A new bridge over Canal Road will need ongoing maintenance and the bridge height restriction will result in a future constraint to the area.

Criteria 9 – Community/Stakeholder

Option No	Community/Stakeholder
•Option 1A: Gravesend link service	Not a preferred option from public consultation
•Option 2B: 2 TPH 60mph service	Direct link to London desired by public
•Option 3B: Northfleet Shuttle service	Least preferred option from public consultation
•Option 4F: Shortest Curve	Public expressed interest in direct link to Medway towns. Also FOC/NR keen on access to head south around London. However, an even longer curve would be required to achieve this.

Summary Options Appraisal Table

Option No	Fit Against Objectives	Service	Env	Land	Safety	Affordability	NPPF	Buildability	Community/ Stakeholder
•Option 1A: Gravesend link service									
•Option 2B: 2 TPH 60mph service									
•Option 3B: Northfleet Shuttle service									
•Option 4F: Shortest Curve									

Conclusion

3.25 Option 1A is the preferred option, using battery trains. The required level of subsidy for Option 2 is not currently affordable. This option takes advantage of the existing infrastructure at Gravesend Station, and therefore minimises cost.

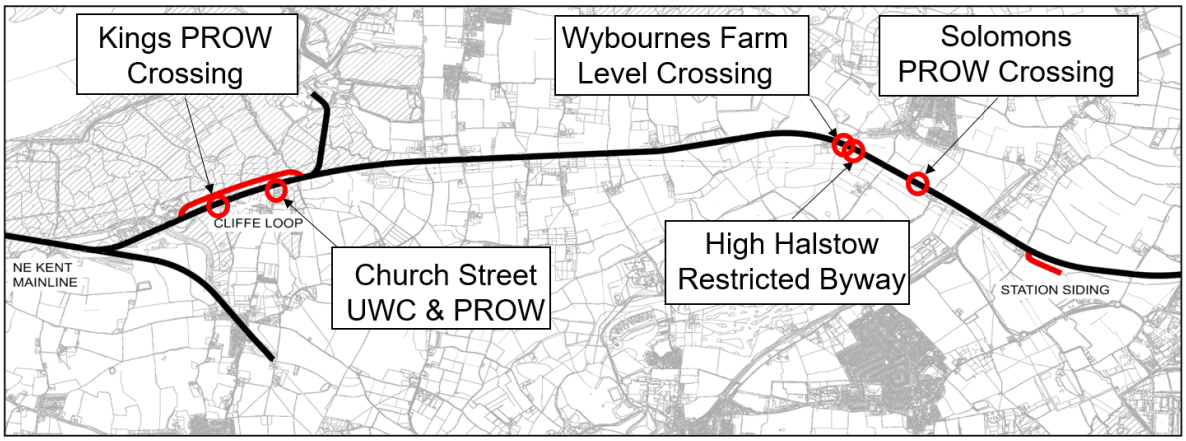
Rail Crossings

3.26 There are five existing rail crossings within the scheme that need to be considered.

3.27 The options for each have been reviewed with the Network Rail National Level Crossing Review Panel, the Network Rail Built Environment Accessibility Panel (BEAP) to assess accessibility and inclusivity, the local authority Public Right of Way Officers for the area, (Kent County Council for Gravesham & Medway Council) and representation from the Local Access Forum

3.28 The location of each crossing is shown in Figure 1:

Figure 1 – crossings under consideration



Kings Crossing

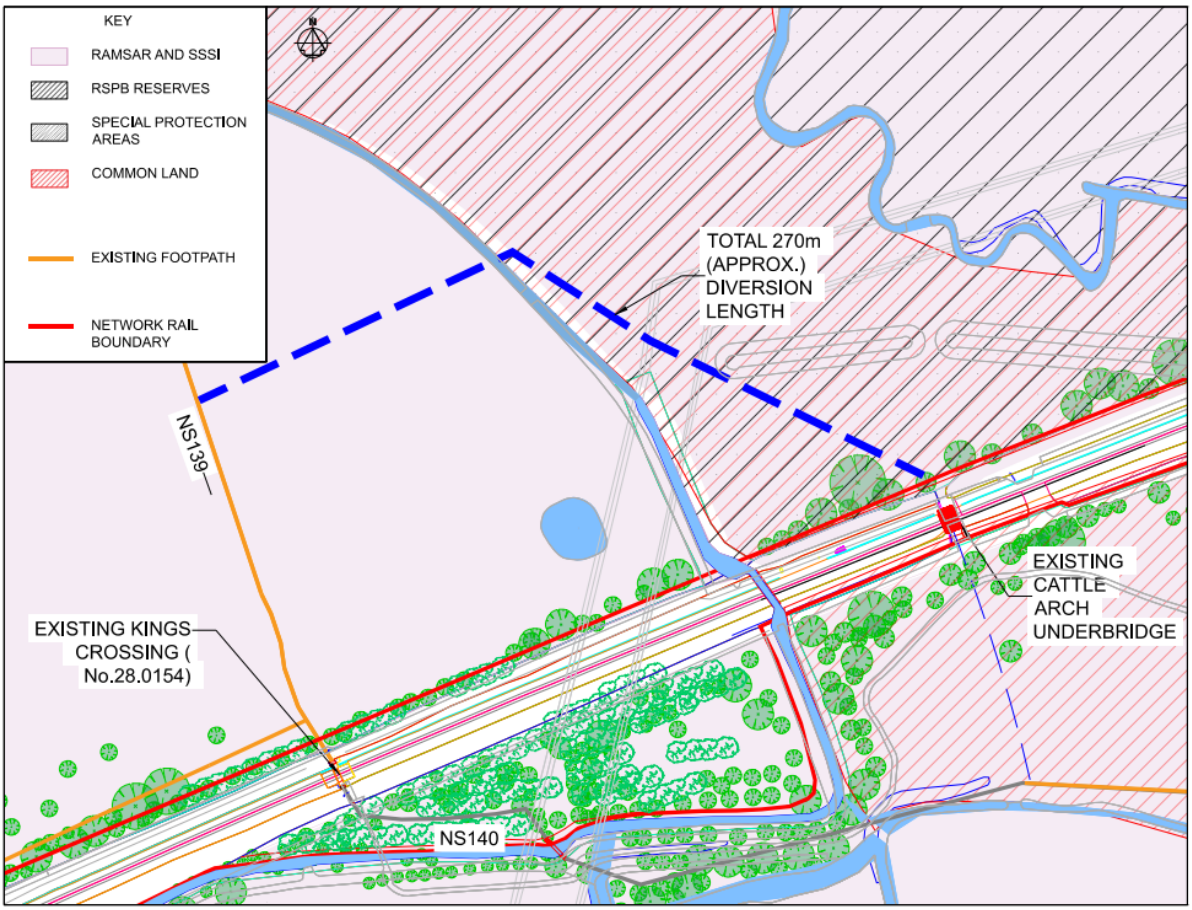
3.29 Kings Crossing is a footpath crossing on an embankment within the proposed Cliffe loop where the line is to be doubled. The crossing is 660m from Church St crossing and consequently, for trains over this length there would be a safety conflict when a train was stopped on the doubled track at Church St on the down line. With a stationary train on the loop a member of the public may wrongly assume that the red light was warning them of that train, and they may cross against the light. However, the approaching passing train is the train the light is warning of. Hence the crossing needs to be closed or relocated. In addition, it is considered that the existing crossing is not accessible to all users, and so the opportunity should be taken to improve this if possible.

3.30 The level crossing survey and report (Existing Level Crossing Options Report 103223-PEL-G3-H01-REP-EST-0002-Jan 2022) predicts crossing usage to be 49 people per day average and 122 peak by 2036.

3.31 The options considered for King's Crossing were;

KX1 - Closure & Diversion to Cattle Arch underpass - Cattle arch is 150m from Kings Crossing and provides the opportunity for a segregated underpass and safe passage across the railway. As part of the overall rail proposals, Cattle Arch railway bridge span is to be replaced as part of the rail Cliffe passing loop works, and the new structure will provide a minimum of 1.85m clearance. In this option, the diversion would be across existing common land to cattle arch and the diversion would eliminate the leg of the existing footpath most vulnerable to flooding.

Figure 2 – KX1 closure & diversion to Cattle Arch underpass

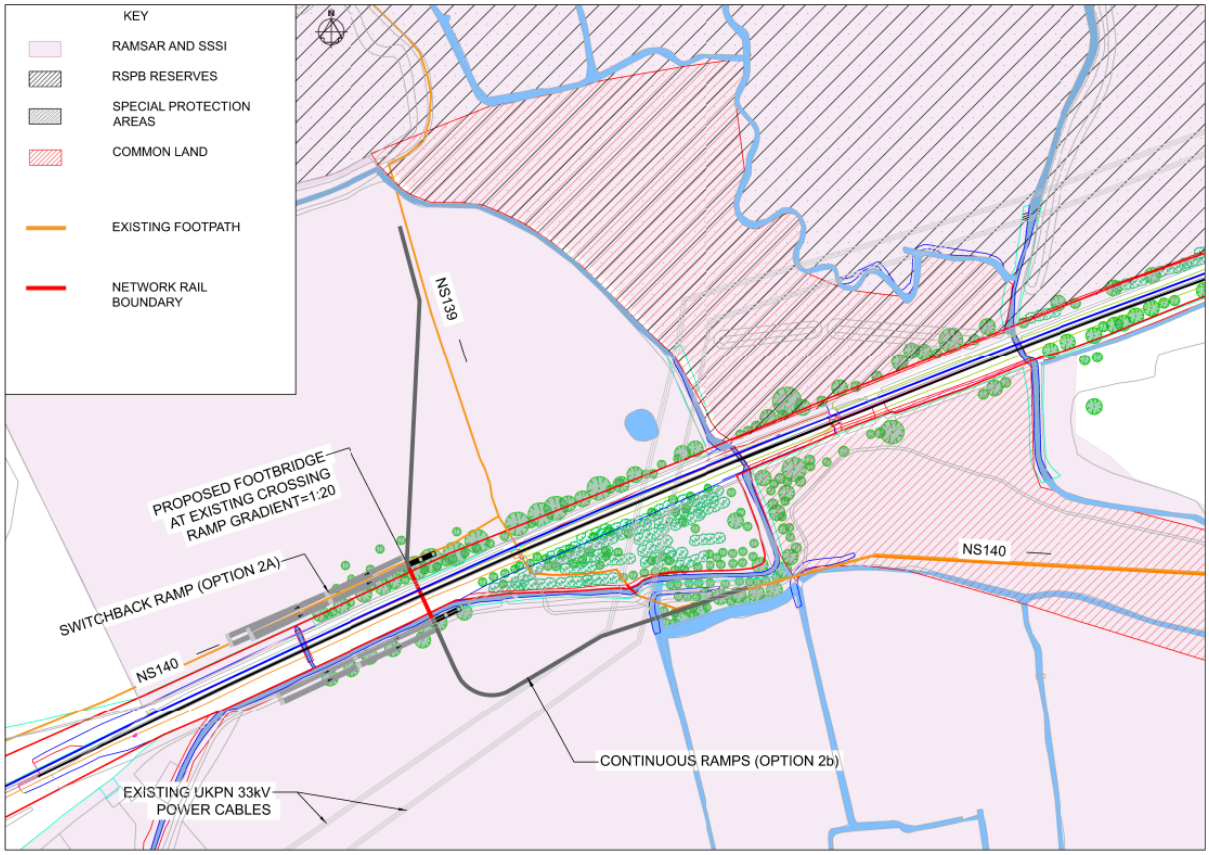


KX2 - Closure & Footbridge provision

This option is to provide a footbridge in the location of the existing crossing. The embankment in this location is approximately 2m high, and with clearance to the rail and the bridge structure height, in this option the overall structure would be approximately 9m high. However, the span of a new footbridge at this location of the existing crossing would be constrained by the Network Rail boundary. For maintenance and inspection purposes, supports would be required to be positioned 2m beyond the Network Rail Boundary. This would require a minimum 40m span at the existing crossing, with abutments or piers located outside of the Network Rail boundary and spanning the open channel drain south of the crossing. The foundations for the structure would need to be in land outside the rail corridor noted to be Ramsar and SSSI.

In addition, for accessibility purposes ramps are recommended for new structures, and if required ramp lengths up to 162m either side of the main span would be required to suit a 1 in 20 ramp gradient.

Figure 3 - KX2 - Closure & Footbridge provision

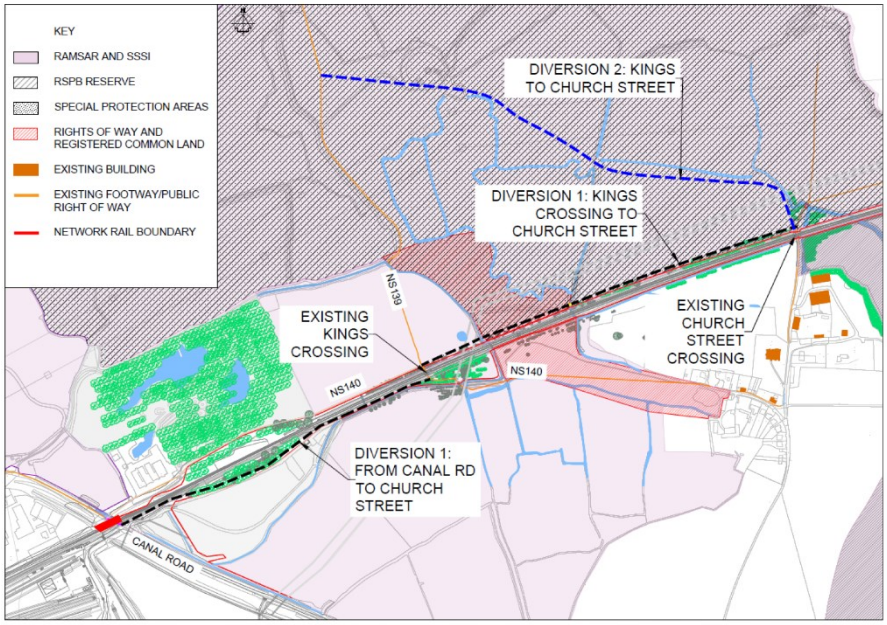


KX3 - Closure and Diversion

The crossing could be closed and diverted to other public rights of way in the area. two diversion options have been considered;

- Diversion Option 1 – Diversion along the railway boundary
    - Route 1- 580m diversion from NS140 on the south side of the existing crossing westwards to Canal Road, south of the railway Diversion to Canal Rd highway underpass. This diversion would require the construction of a new footpath along the south side of the railway to connect with Canal Rd.
    - Route 2- 660m diversion from the junction of NS139-NS140 at the existing crossing, on the north side of the railway eastwards to Church Street crossing. This diversion requires a new PROW on the north side of the railway to reconnect to the existing PROW. This connection will be across a Ramsar and SSSI, and crosses wetland and would require the construction of walkways over existing drainage paths.
- Diversion Option 2 – To divert NS139 450m north of the railway, across infrequently used farm tracks to Church St, with Route 1 above to divert NS140 on the south side of the Railway to Canal Rd.

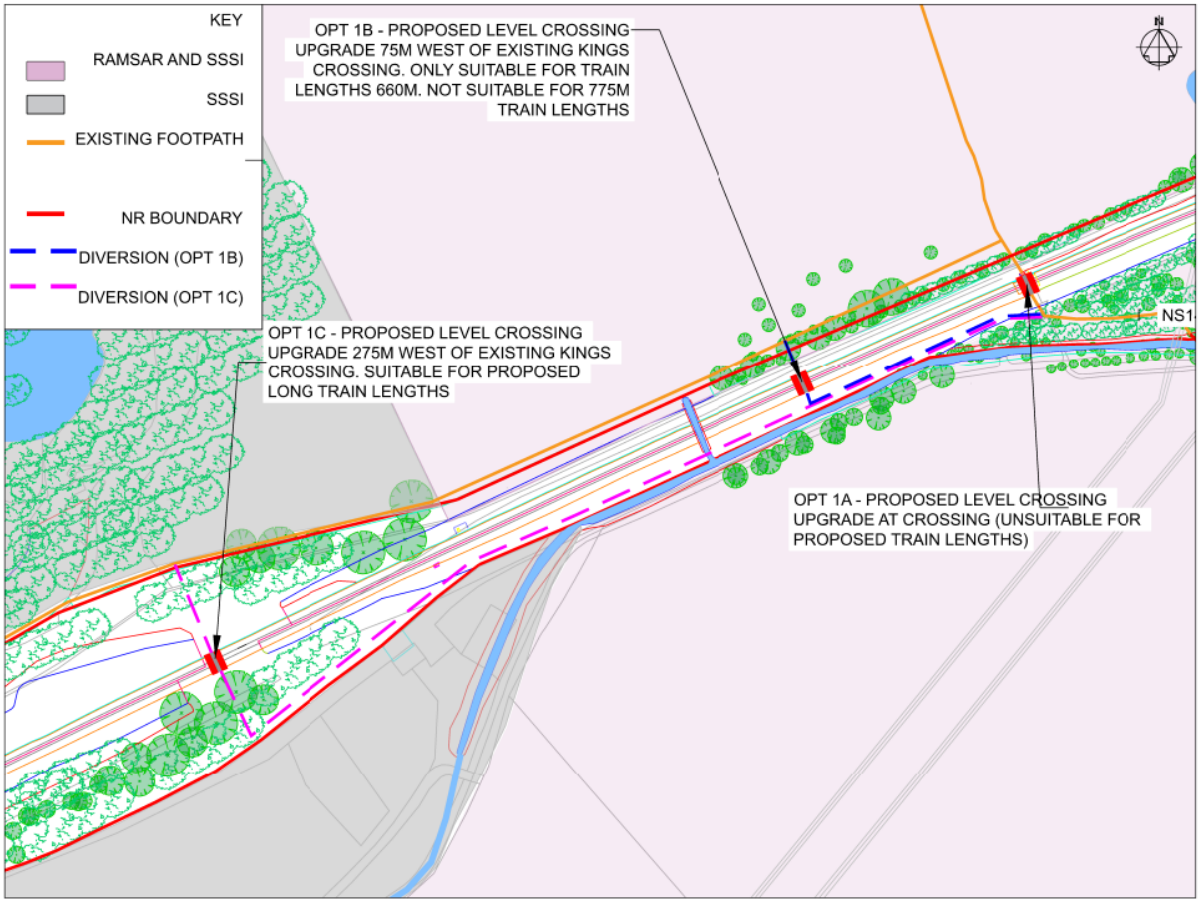
Figure 4 – KX3 - Closure and Diversion



KX4 - Relocation & upgrade

This option proposed a new level crossing located 275m west of the existing Kings crossing with a 280m diversion along the Network rail boundary to allow for the maximum train length of 775m, which is the maximum length of a train that Network Rail have noted that it is possible to operate on the Hoo Branch currently. Diversions would require fencing either side of the footpath to avoid users trespassing onto the railway or falling into a drainage ditch. On the north side the footpath would join an existing footpath.

Figure 5 – KX4 - Relocation & upgrade



KX5 - Upgrade Existing Crossing to Miniature Stop lights

This option proposed an upgrade to the existing level crossing with a miniature stop light (MSL) and associated audible warning which would have no diversions, no additional land take requirements and no ‘hard’ engineering within the environmentally sensitive area. However, an upgrade at the existing site of Kings crossing is not suitable for train lengths of 660m and 775m, proposed by Network Rail. With the proposed train lengths, Kings crossing will be blocked when a train is waiting at the Church St Signal.

Example Miniature Stop Light (MSL) Installation

The Kings crossing options were reviewed and the following RAG assessment of the options was undertaken

Kings Footpath Crossing options: Options Appraisal Tables

3.32 Criteria 1 (Fit with objectives) and Criteria 2 (Service Performance) are not relevant to the consideration of crossing options. Network Rail requires the review of any non-segregated option crossing, regardless of the objectives of the scheme or the service being provided.

Criteria 3 – Environmental

Option No	Environmental
1 close & divert to Cattle arch Underbridge	Major Works to underbridge limited to NR boundary. Vegetation clearance required for footpath has been accepted by Natural England on the basis that it is outside of Ramsar/SSSI. No 'formal' footpaths to be created, natural ground to remain, so no impact to Common land likely.
2 close & install footbridge	Major impact on Ramsar/SSSI due to land take required for the footbridge.
3 close & divert to other PROW's	Diversion requires ditch crossing, which would require mitigation to avoid water and ecological impacts.
4 relocate & upgrade	Relocations may require a ditch crossing depending on the detail of the route
5 upgrade to Miniature Stop Lights (MSL)	Minor intervention within existing within NR boundary and therefore, no/negligible impacts

Criteria 4 - Land

Option No	Land
1 close & divert to Cattle arch Underbridge	All physical works contained on NR land. No third-party land required for physical works.
2 close & install footbridge	Foundations required outside Rail boundary
3 close & divert to other PROW's	Third party land required for new path
4 relocate & upgrade	Third party land required for new path
5 upgrade to Miniature Stop Lights (MSL)	Existing crossing improvements within NR boundary

Criteria 5 - Safety

Option No	Safety
1 close & divert to Cattle arch Underbridge	Solution segregates users from the operational railway
2 close & install footbridge	Solution segregates users from the operational railway
3 close & divert to other PROW's	Solution segregates users from the operational railway
4 relocate & upgrade	Solution not preferred by Network Rail as segregated option available
5 upgrade to Miniature Stop Lights (MSL)	High safety risk associated to users ignoring the MSL and walking around the stationary train across the second track in front of an oncoming train.

Criteria 6 - Affordability

Option No	Safety
1 close & divert to Cattle arch Underbridge	Minor cost impact. Works to cattle arch required as part of Cliff loop
2 close & install footbridge	High-cost solution
3 close & divert to other PROW's	Minor cost impact
4 relocate & upgrade	Medium cost impact
5 upgrade to Miniature Stop Lights (MSL)	Medium cost impact

Criteria 7 - NPPF

Option No	NPPF
1 close & divert to Cattle arch Underbridge	The crossing falls withing a flood zone 3 area. However, the diversion eliminates the leg of the footpath most vulnerable to flooding which is supported by paragraph 159 of the NPPF which sets out that where development is necessary in these areas, the development should be made safe for its lifetime without increasing flood risk elsewhere. The option does not propose significant physical works in the flood plain.
2 close & install footbridge	The foundations for the structure would need to be in land outside the rail corridor and within the Ramsar and SSSI. Paragraph 180 of the NPPF states that development on land within a SSSI should usually not be permitted unless the benefits in the proposed location outweigh the impacts. Paragraph 181 also suggests that Ramsar sites should be given the same protection as SSSIs. Foundations for the structure fall within flood zone 3 (paragraph 159 of the NPPF).
3 close & divert to other PROW's	This option includes the closure of the crossing and diversion to other PRoWs in the area. Two diversion options have been considered. Diversion Option 1, Route 1 requires the construction of a new footpath along the south side of the railway to connect with Canal Rd. Part of this route would be adjacent to the South Thames Estuary and Marshes SSSI and the Thames Estuary and Marshes Ramsar. Paragraph 180 of the NPPF states that development on land outside a SSSI should usually not be permitted where it adversely impacts on the designation. Further assessment is needed to establish if there would be an impact. Diversion Option 2, this option includes a diversion from an existing PRoW across the infrequently used farm tracks to Church St. This option also cuts across the SSSI and Ramsar site and therefore, may be contrary to paragraph 180 of the NPPF, which states that development on land outside a SSSI should usually not be permitted.
4 relocate & upgrade	All options would lead to an increased length of the route. The options may also potentially impact the nearby SSSI and Ramsar site as the diversion options involves routes which are adjacent to these sites. Paragraph 180 of the NPPF suggests that development on land within or outside a SSSI which is likely to have an adverse effect should normally not be permitted unless the benefits in the proposed location outweigh the impacts. This option also falls within a flood zone 3 area, although proposals will not directly impact other than users remaining in the floodplain for longer.
5 upgrade to Miniature Stop Lights (MSL)	There are potential safety concerns with this option, which may be contrary to paragraph 97 of the NPPF, which promotes safety.

Criteria 8 - Buildability

Option No	Buildability
1 close & divert to Cattle arch Underbridge	Minor additional works. Works to cattle arch required as part of Cliffe loop
2 close & install footbridge	Footbridge construction will have significant impact on Ramsar & SSSI for materials delivery and works
3 close & divert to other PROW's	Sustainable ditch crossing and footpath formalisation required
4 relocate & upgrade	Minor works. Footpath formalisation and fencing required. Some works within Ramsar. Crossing improvements within NR boundary
5 upgrade to Miniature Stop Lights (MSL)	Minor additional works. Crossing improvements within NR boundary

Criteria 9 – Community/Stakeholder

Option No	Community/Stakeholder
1 close & divert to Cattle arch Underbridge	During the consultation phase a number of respondents suggested this as a solution
2 close & install footbridge	Bridge structure not acceptable to Natural England due to likely impacts on the SSSI/ Ramsar
3 close & divert to other PROW's	PROW officer had objections to this solution due to increase in path length
4 relocate & upgrade	PROW officer had objections to this solution due to increase in path length
5 upgrade to Miniature Stop Lights (MSL)	During the consultation phase a number of respondents queried why this was not the preferred solution

Summary Options Appraisal Table

Option No	Fit Against Objectives	Service	Env	Land	Safety	Affordability	NPPF	Buildability	Community/ Stakeholder
1 close & divert to Cattle arch Underbridge									
2 close & install footbridge									
3 close & divert to other PROW's									
4 relocate & upgrade									
5 upgrade to Miniature Stop Lights (MSL)									

Conclusion

3.33 Option 1 is the preferred option. Kings Footpath is to be closed and diverted under the upgraded Cattle Arch underbridge. The new structure will provide a minimum of 1.85m clearance and eliminates the leg of the existing footpath most vulnerable to flooding. The preferred option also avoids direct impacts on the SSSI and Ramsar site.

Church St Crossing

3.34 Church St is a farm vehicle crossing known as a user work crossing (UWC) and a footpath Crossing. From the level crossing survey and report the Crossing usage is predicted to be 139 people per day average and 249 peak by 2036. A survey in April 2021 recorded no vehicle usage but it is known that there is occasional usage by the local farmer(s). The current crossing is an accessible and inclusive crossing and this needs to be maintained if possible, however as the line will be dualled at this location the existing crossing must be upgraded.

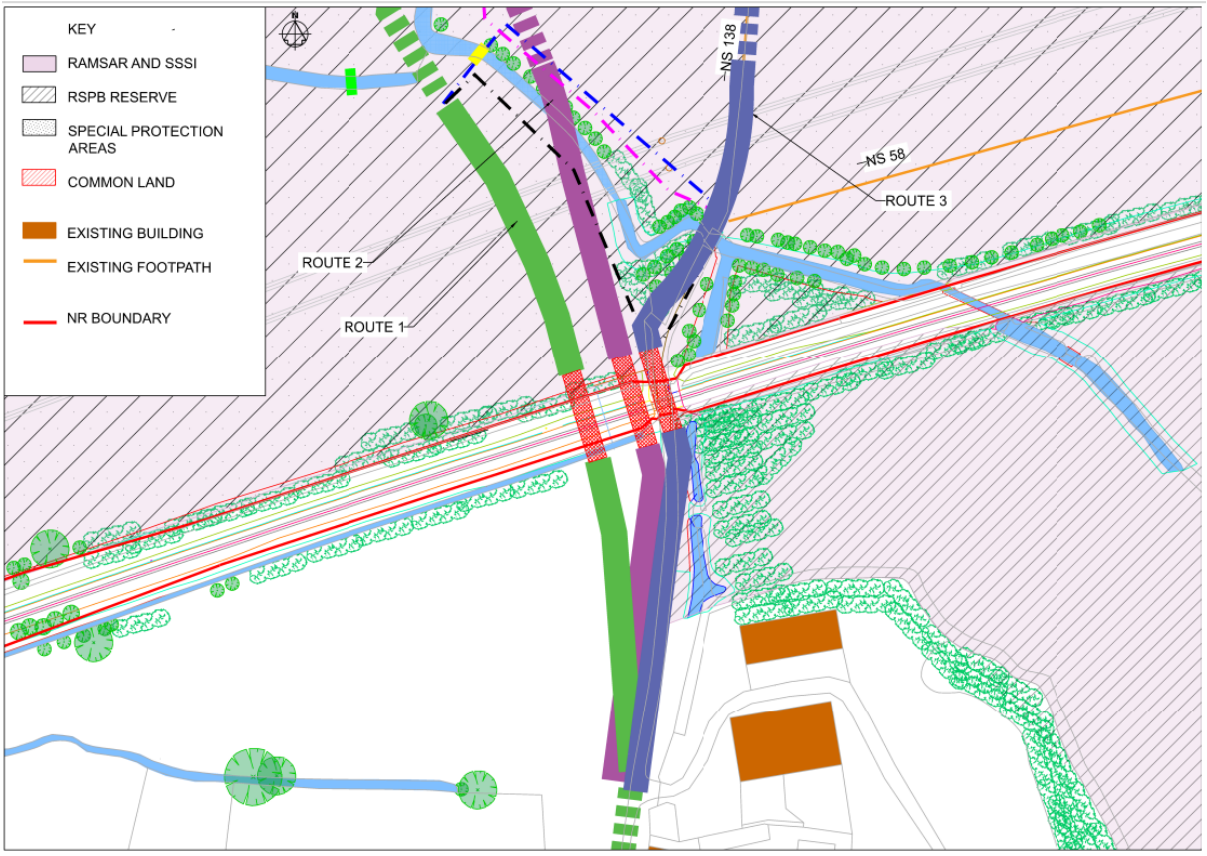
CX1 UWC & PROW Closure & Footbridge

3.35 This proposal involved the slight diversion of the footpath (and extinguishment of its current route) onto a new bridge structure. Given the design requirements and constraints of the site, three alignments for the bridge and approach ramps were considered:

- Route 1 – Bridge span located approximately 25m west of the existing crossing, with straight approaches avoiding watercourse north of the railway.
- Route 2 – Bridge span located approximately 10m west of the existing crossing, with straight approaches incorporating a span over the watercourse north of the railway.
- Route 3 – Bridge span at the existing crossing location, with curved approaches roughly following the same alignment as the existing NS138 footpath.

3.36 All three options would require a 5.2m headroom for trains to pass beneath and consequently require significant lengths of ramp.

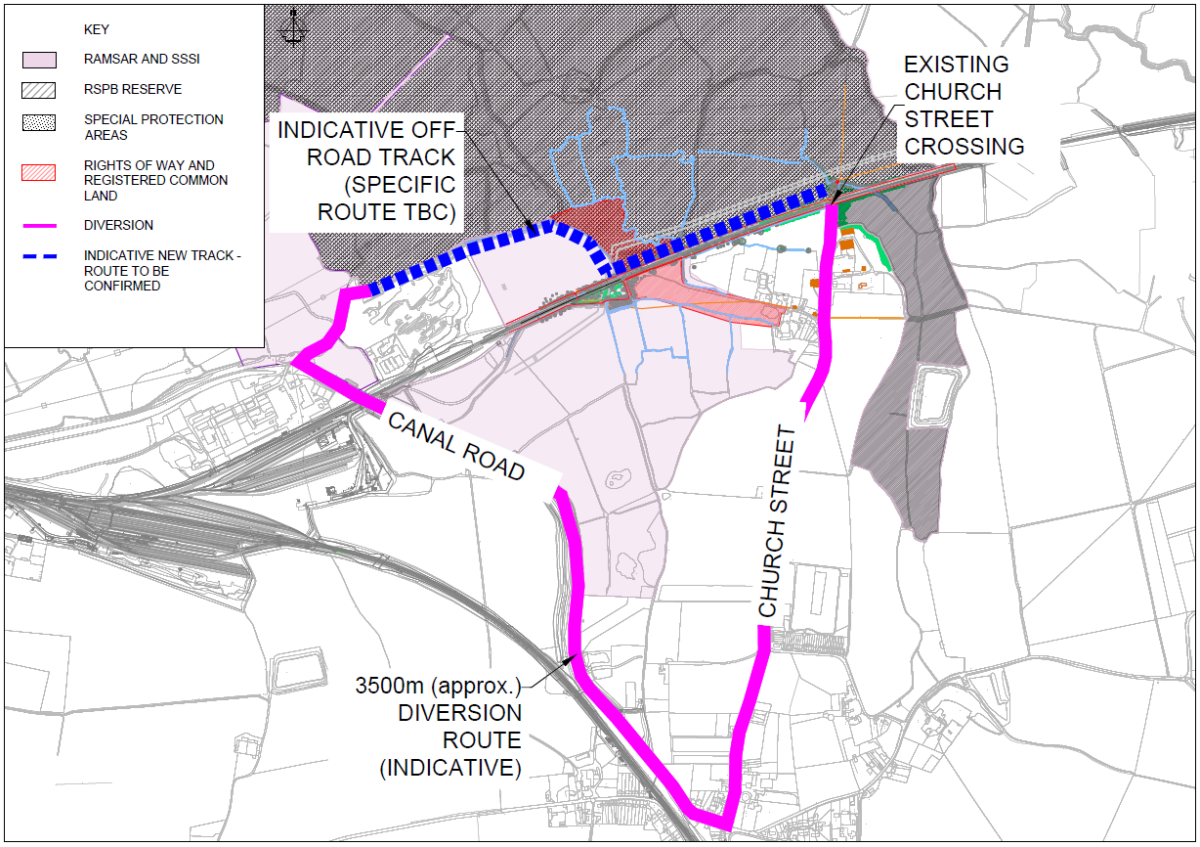
Figure 6 - CX1 UWC & PROW Closure & Footbridge



CX2 UWC & PROW Closure and Diversion

3.37 A diversion for crossing users and Farm vehicles was considered as an alternative option. The most feasible route for a diversion would be via Church Street and Canal Road. An access track (of approximately 1km) would be required from Canal Road to the north of the railway at Church Street. This would be across the Ramsar and SSSI as there is no existing road north of the railway, however existing farm tracks could be employed, increasing the track length to 2km. In total, the diversion is 3.5 - 4.5km long and increases walking time by 40 minutes. The walking time could be significantly reduced if Kings crossing were to remain open. However, the existing circular walking route involving both Church Crossing and Kings Crossing would be disrupted.

Figure 7 - CX2 UWC & PROW Closure and Diversion



3.38 Options CX3 – CX5 were proposals to upgrade the existing Crossing within the Network Rail boundary by various means. This considered:

CX3 Level Crossing Upgrade - UWC & PROW - MSL

3.39 A Miniature Stop Light (MSL) (consisting of red and green lights and an auditory warning) only solution for both elements of the crossing was considered to be not feasible due to conflicted crossing times for the PROW users and UWC users. A longer waiting time on the MSL would be required for vehicle users, however, this would introduce the safety risk of pedestrians becoming impatient and crossing under red aspect.

CX4 Level Crossing Upgrade - UWC & PROW Telephone signaller

3.40 This is the existing system for vehicles to safely cross the railway. It involves telephoning the signaller, who turns the signals to red until the vehicle has crossed the railway and confirmed they are safely across. A telephone only option for both parts of the crossing was considered to be not feasible due to the increased signaller workload and safety risk of users crossing without using the telephone to check whether they are safe to cross.

CX5 Level Crossing Upgrade – UWC solution Telephone signaller and MSL PRoW solution

3.41 In light of the above it was considered that continuing with telephone signals for UWC vehicles, alongside an upgrade to the existing level crossing PROW with an MSL and associated audible warning would also be the safest option which catered for the needs of different users, whilst not increasing the load to signallers.

Church Street Crossing options: Options Appraisal Tables

3.42 Criteria 1 (Fit with objectives) and Criteria 2 (Service Performance) are not relevant to the consideration of crossing options. Network Rail requires the review of any non-segregated option crossing, regardless of the objectives of the scheme or the service being provided.

Criteria 3 – Environmental

Option No	Environmental
1 close & install bridge	Potential major impact on RAMSAR and SSSI. Visual intrusion from bridge structure
2 close & divert to Canal Road	Impact on Ramsar and SSSI through increased route length for farm vehicles to north of Grain line & potential additional ditch crossings
3 MSL for UWC & PROW	Very limited works to existing crossing gate & fencing. Therefore, no/negligible impacts likely.
4 LINESIDE PHONE for UWC & PROW	Very limited works to existing crossing gate & fencing. Therefore, no/negligible impacts likely.
5 LINESIDE PHONE for UWC/MSL for PROW	Very limited works to existing crossing gate & fencing. Therefore, no/negligible impacts likely.

Criteria 4 - Land

Option No	Land
1 close & install bridge	Foundations required outside Rail boundary
2 close & divert to Canal Road	Minimal land take – majority of route existing Network Rail land
3 MSL for UWC & PROW	No additional land take
4 LINESIDE PHONE for UWC & PROW	No additional land take
5 LINESIDE PHONE for UWC/MSL for PROW	No additional land take

Criteria 5 - Safety

Option No	Safety
1 close & install bridge	Solution segregates users from the operational railway
2 close & divert to Canal Road	Solution segregates users from the operational railway, but length of diversion may result in users climbing fences and crossing the railway in an uncontrolled manner
3 MSL for UWC & PROW	Risk considered to be as low as reasonably practicable and accepted by NR
4 LINESIDE PHONE for UWC & PROW	Solution accepted by NR to maintain access for vehicles. It is likely that PROW users will not telephone the signaller and will cross uncontrolled
5 LINESIDE PHONE for UWC/MSL for PROW	Risk considered to be as low as reasonably practicable and accepted by NR

Criteria 6 - Affordability

Option No	Safety
1 close & install bridge	High-cost impact compared with other options.
2 close & divert to Canal Road	Medium cost impact due to diversion length and works required to ensure whole route is brought up to standard
3 MSL for UWC & PROW	Medium cost impact to upgrade crossing
4 LINESIDE PHONE for UWC & PROW	Medium cost impact to upgrade crossing
5 LINESIDE PHONE for UWC/MSL for PROW	Medium cost impact to upgrade crossing

Criteria 7 - NPPF

Option No	NPPF
1 close & install bridge	This option includes three alternative alignments. All three alignments cross the SSSI, a Ramsar site, RSPB reserve and a Special Protection Area (SPA). This may conflict with paragraph 180 of the NPPF, which states that that development on land within or outside a SSSI which is likely to have an adverse effect should normally not be permitted. Paragraph 181 also suggests that Ramsar sites and SPAs should be given the same protection. However, the bridge structures do not fall within the SSSI/Ramsar and therefore, there may not be an adverse impact. The bridge would connect to footpaths that are located in those sites.
2 close & divert to Canal Road	This option involves a 3.5-4.5km diversion across the SSSI and Ramsar site. Paragraph 180 of the NPPF states that development on land within or outside a SSSI which is likely to have an adverse effect should normally not be permitted unless the benefits in the proposed location outweigh the impacts. Development on Ramsar site is not supported by the NPPF as paragraph 181 suggests that Ramsar sites should be given the same protection as SSSIs. However, the bridge structures do not fall within the SSSI/Ramsar and therefore, there may not be an adverse impact. The bridge would connect to footpaths that are located in those sites. The length of diversion may result in users climbing fences and crossing the railway in an uncontrolled manner potentially conflicting with parapraph 97 of the NPPF which promotes safety.

Option No	NPPF
3 MSL for UWC & PROW	The MSL in this option would need to include longer waiting times to accommodate vehicle users. This could lead to the safety risks to pedestrians who may become impatient at the crossing. These safety concerns potentially conflict with paragraph 97 which promotes safety and would need to be addressed.
4 LINESIDE PHONE for UWC & PROW	This option includes a telephone only option which is not considered feasible due to the increased signaller workload and safety risk of users crossing without checking. This option also will not comply with paragraph 97 which promotes safety.
5 LINESIDE PHONE for UWC/MSL for PROW	Does not eliminate the risk of public/train collision and possible conflict with para 97 of the NPPF.

Criteria 8 - Buildability

Option No	Buildability
1 close & install bridge	Footbridge construction required from Railside to minimise impact on Ramsar and SSSI to north
2 close & divert to Canal Road	Construction of ditch crossing within Ramsar and SSSI – Access and plant impact issues
3 MSL for UWC & PROW	System integrated with signalling installation
4 LINESIDE PHONE for UWC & PROW	System integrated with signalling installation
5 LINESIDE PHONE for UWC/MSL for PROW	System integrated with signalling installation

Criteria 9 – Community/Stakeholder

Option No	Community/Stakeholder
1 close & install bridge	Objections from Kent CC PROW Office and Local access forum. Objection from Natural England. Objection at public consultation
2 close & divert to Canal Road	Objections from Kent CC PROW Office and Local access forum
3 MSL for UWC & PROW	Preferred solution by Kent CC PROW Office and Local access forum. NR preferred solution for PROW
4 LINESIDE PHONE for UWC & PROW	Existing system retained, no objections. NR preferred solution for vehicle crossing
5 LINESIDE PHONE for UWC/MSL for PROW	Existing system retained, no objections. NR preferred solution for vehicle crossing

Summary Appraisal Table

Option No	Fit Against Objectives	Service	Env	Land	Safety	Affordability	NPPF	Buildability	Community/ Stakeholder
1 close & install bridge									
2 close & divert to Canal Road									
3 MSL for UWC & PROW									
4 LINESIDE PHONE for UWC & PROW									
5 LINESIDE PHONE for UWC/MSL for PROW									

Conclusion

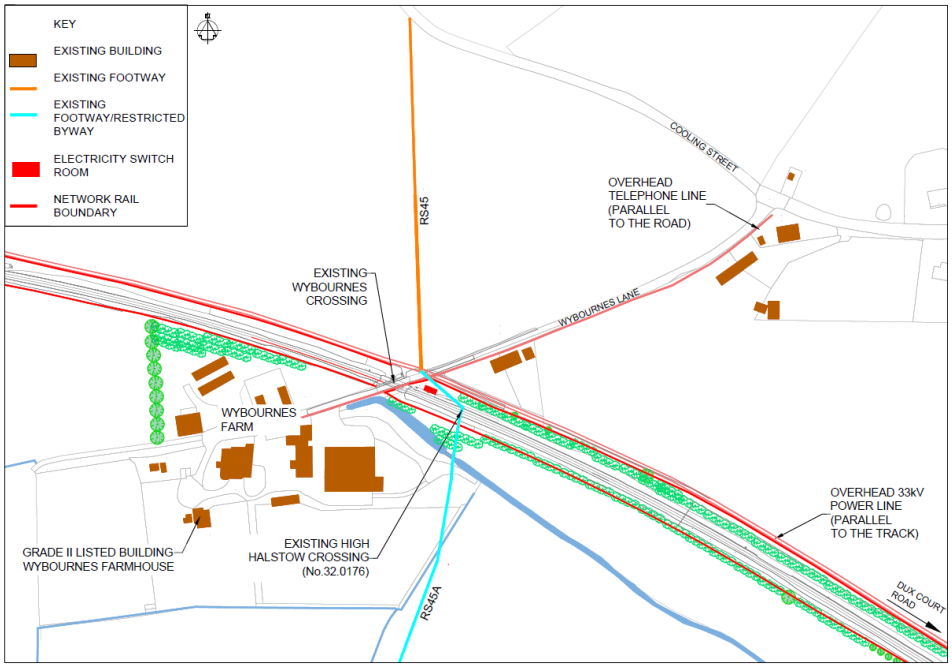
3.43 Option 5 is the preferred option. Church Street Crossing is to be upgraded and miniature stop lights installed for pedestrians, the farmer will continue to use the lineside phone. This upgrade will have no diversions, no additional land take requirements, and no 'hard' engineering within the environmentally sensitive area. The advantage option 5 has over option 4 is reducing the workload on the signaller. The advantage that option 5 has over option 3 relates to the dual use of this crossing (PROW and UWC). The farm vehicles would likely have a longer crossing time than pedestrians, which can be better accommodated using the direct communication with the signaller provided for in option 5.

Wybournes Level Crossing and High Halstow Restricted Byway

3.44 Wybournes level crossing is an automatic open crossing locally monitored (AOCL) highway crossing. From the level crossing survey and report the Crossing usage is predicted to be 100 pedestrians per day average and 237 peak by 2036. Vehicle usage is currently 40 per day average and 50 peak. As the road is a dead end at the farm and it is not expected that there will be significant growth in vehicle usage.

3.45 There are no works to the line in this location, hence no freight length limitations, however the crossing is adjacent to a curve, and the passenger service will need the line speed to be increased from 15mph to 40mph to achieve the service timetable, consequently the risk profile at the crossing will increase. The crossing does however have low usage, as it only serves Wybournes Farm and associated farm dwellings. There is no through route to vehicles beyond the farm apart from the adjacent byway. The current crossing is an accessible and inclusive crossing and this needs to be maintained if possible.

Figure 8 – Existing layout



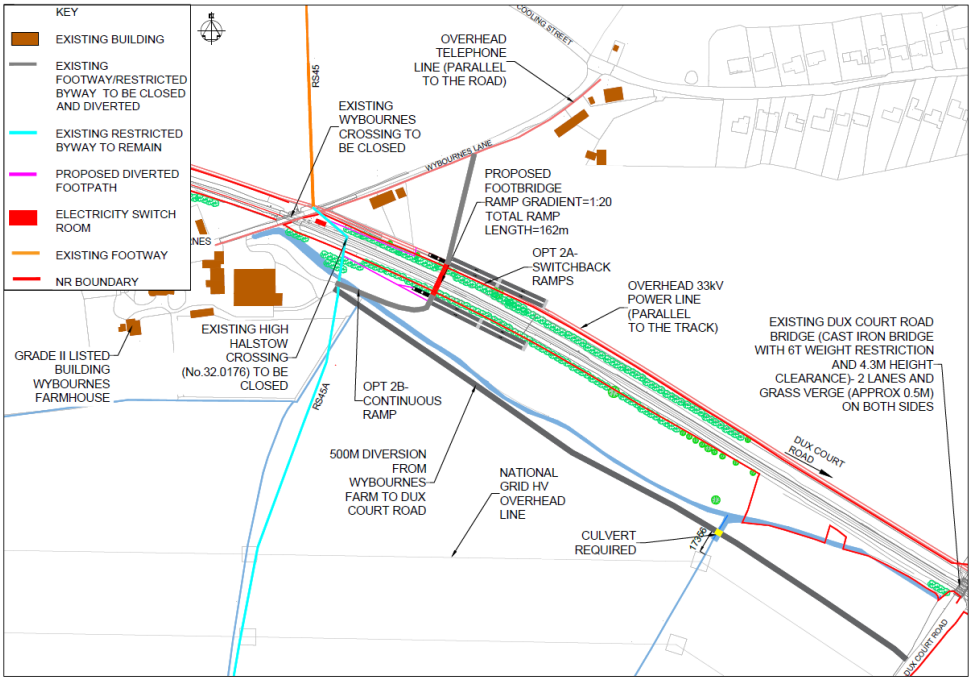
3.46 High Halstow Restricted Byway RS45A is 50m east of the highway crossing and, although a Byway, is limited to an uncontrolled footpath with styles across the railway. Other byway users already use the highway crossing to reach the byway, hence usage is extremely low, predicted to be 5 pedestrians per day average and 15 peak by 2036. It is therefore considered not practical to improve this crossing independently and it is considered within the modifications to Wybournes Crossing.

Photo of High Halstow restricted byway

WX1 Highway & byway Closure & Diversion to Dux Ct Rd

3.47 This option proposed a 580m access road to Dux Court Road from Wybournes Farm to be used by vehicles. A new junction would be provided 60m south of Dux court Road bridge to accommodate for the access road. Dux Court Road bridge is a listed cast iron bridge with a 6T weight restriction and 4.3m height clearance. The structure currently has 2 lane traffic over the railway with 0.5m verges on both sides. If Dux court Rd were the main access to the Farm the existing listed Road bridge would need to be upgraded

Figure 9 - WX1 Highway & byway Closure & Diversion to Dux Ct Rd layout



WX2 Byway Closure & footbridge

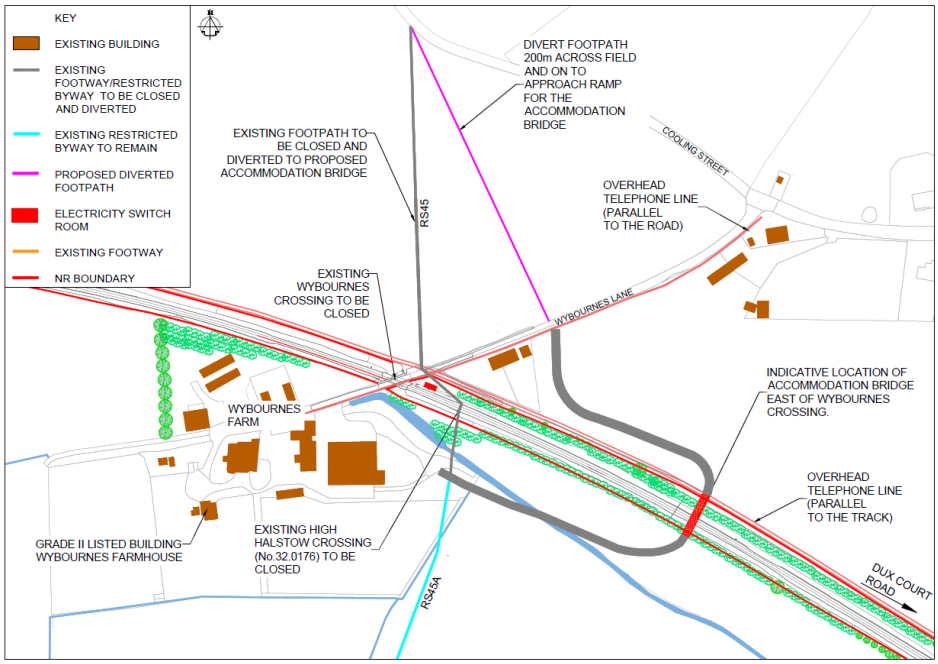
3.48 Whilst vehicular traffic can use the proposed access road to the south, a footbridge (60m east of High Halstow crossing) would be an alternative option for non-motorised users. Restricted byway RS45A would be diverted over the footbridge and return to its current alignment either side of the railway. Network Rail requirements would mean that the abutments would be positioned a minimum 2m outside the existing Network Rail boundary. As a result the span of the proposed bridge would be approximately 27m.

WX3 Highway & byway Closure & Accommodation Bridge

3.49 The proximity of buildings either side of the railway, prevents a replacement road bridge and ramps being provided on the current alignment. Locating a road bridge

200m east of the existing level crossing would, however, be viable, allowing access ramps to be positioned parallel to the railway to minimise land take. For maintenance and inspection purposes, abutments would need to be positioned 2m beyond the Network Rail boundary. As a result, the span of the proposed bridge would be approximately 27m. Consideration was also given to an alternative straighter alignment to provide a more direct route preferred by equestrians. However, the approach ramps for this alignment would obstruct views from Wybournes cottages, causing a greater visual impact to the rural setting. The southern approach ramp would therefore need to be tight curved to join up with Wybournes Farm.

Figure 10 - WX3 Highway & byway Closure & Accommodation Bridge proposed layout



3.50 Options WX4 – WX6 are to upgrade the existing Crossing by various means on the basis that the bridge and closure options are both unacceptable

WX4 Highway Upgrade to Automatic Half Barrier & Byway Closure

3.51 This option upgrades the existing crossing with the addition of half barriers across the road, however, as the line speed has been increased to 40mph, the rail approach is on a curve, and because the crossing will be used by slow moving farm vehicles, this solution was considered unsafe and was rejected by Network Rail. It was therefore consequently discounted from further consideration.

WX5 Highway Upgrade to Manual Controlled Barrier-CCTV & Byway Closure

3.52 This option upgrades the existing crossing by adding full barriers and CCTV. All users would use the level crossing to cross the tracks. A new section of byway would be required to link the level crossing to Restricted Byway RS45a. The CCTV is monitored by the signaller and each time a train needs to pass the signaller checks the crossing is clear before closing the barriers and providing a Green signal to the train. This solution is viable but increases the signaller workload significantly. It was rejected by Network Rail and consequently discounted from further consideration.

WX6 Highway Upgrade to Manual Controlled Barrier -OD & Byway Closure

3.53 This option upgrades the existing crossing by adding full barriers and an obstacle detector (OD). Each time a train needs to pass the obstacle detector checks the crossing is clear before closing the barriers and providing a Green signal to the train. This system is automatic, despite its name, and eliminates the increased signaller workload. This solution is the highest level of safety available apart from closing the crossing. All users will use the level crossing to cross the tracks. A new section of byway will be required to link the level crossing to Restricted Byway RS45a, with the existing uncontrolled High Halstow byway crossing of the tracks closed to avoid an uncontrolled and controlled crossing to operate in close proximity.

Wybournes Level Crossing and High Halstow Restricted Byway Crossing options: Options Appraisal Tables

3.54 Options 4 and 5 were rejected at an early stage by Network Rail and therefore, are not appraised as potential options in the tables below.

3.55 Criteria 1 (Fit with objectives) and Criteria 2 (Service Performance) are not relevant to the consideration of crossing options. Network Rail requires the review of any non-segregated option crossing, regardless of the objectives of the scheme or the service being provided.

Criteria 3 – Environmental

Option No	Environmental
1 close & divert to Dux Crt Road	No significant environmental issues anticipated
2 close, divert vehicles to Dux Ct Rd & install equestrian bridge	No significant environmental issues anticipated
3 close & install accommodation bridge	No significant environmental issues anticipated
4 upgrade (automatic half barrier & byway closure)	Option discounted
5 Upgrade (manual controlled barrier using CCTV & byway closure)	Option discounted
6 Upgrade (full barriers with obstacle detection & byway closure)	No significant environmental impact

Criteria 4 - Land

Option No	Land
1 close & divert to Dux Crt Road	Solution requires significant land take for diverted access road.
2 close, divert vehicles to Duc Ct Rd & install equestrian bridge	Solution requires significant land take for diverted access road and footbridge.
3 close & install accommodation bridge	Solution requires land take for diverted access road and accommodation bridge.
4 upgrade (automatic half barrier & byway closure)	Option discounted
5 Upgrade (manual controlled barrier using CCTV & byway closure)	Option discounted
6 Upgrade (full barriers with obstacle detection & byway closure)	Minor land take outside rail boundary to improve crossing to allow 2-way traffic. Route currently used to cross rail to the restricted byway to be formally dedicated.

Criteria 5 - Safety

Option No	Safety
1 close & divert to Dux Crt Road	Solution segregates users from the operational railway
2 close, divert vehicles to Duc Ct Rd & install equestrian bridge	Solution segregates users from the operational railway, but length of diversion will result in users likely climbing fences and crossing the railway in an uncontrolled manner
3 close & install accommodation bridge	Solution accepted by NR to maintain access for PROW noting that vehicle access must be maintained, hence foot users will use this route. Risk considered to be as low as reasonably practicable
4 upgrade (automatic half barrier & byway closure)	Option discounted
5 Upgrade (manual controlled barrier using CCTV & byway closure)	Option discounted
6 Upgrade (full barriers with obstacle detection & byway closure)	Solution accepted by NR to maintain access for vehicles. Risk considered to be as low as reasonably practicable

Criteria 6 - Affordability

Option No	Safety
1 close & divert to Dux Crt Road	High-cost impact. Expected that bridge upgrade and diversion will make this one of the highest cost options (broadly comparable to options 2 and 3)
2 close, divert vehicles to Duc Ct Rd & install equestrian bridge	High-cost impact. Expected that bridge upgrade and diversion combined with a new equestrian bridge will make this the highest cost options
3 close & install accommodation bridge	High-cost impact Install of new bridge will make this one of the highest cost options
4 upgrade (automatic half barrier & byway closure)	Option discounted
5 Upgrade (manual controlled barrier using CCTV & byway closure)	Option discounted
6 Upgrade (full barriers with obstacle detection & byway closure)	Medium-cost impact in comparison to options 1-3

Criteria 7 - NPPF

Option No	NPPF
1 close & divert to Dux Crt Road	This option would require a new junction to accommodate an access road south of Dux Court Road Bridge, which is Listed. This option would most likely require the bridge to be upgraded to accommodate additional uses. Paragraph 199 of the NPPF states that any harm to, or loss of, the significance of a designated heritage asset (from its alteration or destruction, or from development within its setting), should require clear and convincing justification. This option may conflict with paragraph 174 of the NPPF which recognises the benefits of preserving the best and most versatile agricultural land.
2 close, divert vehicles to Duc Ct Rd & install equestrian bridge	This option proposes a footbridge for non-motorised users which may be considered unsympathetic to the natural landscape of the area, contrary to paragraph 130 of the NPPF which places emphasis on development being sympathetic to the local character of the area. The abutments would also need to be positioned outside the existing Network Rail boundary. As this option would require additional land take there may be some impact on agricultural land. Paragraph 174 of the NPPF seeks to conserve and enhance the natural environment, suggesting that development should recognise the benefits from natural capital and ecosystem services of the best and most versatile agricultural land. Solution segregates users from the operational railway, but length of diversion may result in users climbing fences and crossing the railway in an uncontrolled manner, potentially conflicting with paragraph 97 which promotes safety.
3 close & install accommodation bridge	Similar to the option above, this option will also require additional land take which is likely to be agricultural land. This land is required to accommodate the abutments for the proposed bridge as well as approach ramps which will cut through the field. Therefore, this option may conflict with paragraph 174 of the NPPF which recognises the benefits of preserving the best and most versatile agricultural land. The proposed ramps will also obstruct views from Wybournes cottages which will therefore have an impact on the rural setting and conflict with paragraph 130 of the NPPF part c) which suggests that development is sympathetic to local character and history and landscape setting.
4 upgrade (automatic half barrier & byway closure)	Option discounted
5 Upgrade (manual controlled barrier using CCTV & byway closure)	Option discounted
6 Upgrade (full barriers with obstacle detection & byway closure)	This option includes an automatic system which includes an obstacle detector. Each time a train needs to pass, the obstacle detector checks the crossing is clear before closing the barriers and providing a green signal to the train. This eliminates the increased signaller workload and is therefore considered the safest option (paragraph 97 of the NPPF).

Criteria 8 - Buildability

Option No	Buildability
1 close & divert to Dux Crt Road	Road closures required on busy commuter route
2 close, divert vehicles to Duc Ct Rd & install equestrian bridge	Road closures required on busy commuter route. 600m of access road to construct
3 close & install accommodation bridge	Construction of accommodation bridge in agricultural land not a major buildability issue
4 upgrade (automatic half barrier & byway closure)	Option discounted
5 Upgrade (manual controlled barrier using CCTV & byway closure)	Option discounted
6 Upgrade (full barriers with obstacle detection & byway closure)	widening of crossing and installation of crossing infrastructure not a significant buildability issue

Criteria 9 – Community/Stakeholder

Option No	Community/Stakeholder
1 close & divert to Dux Crt Road	Diversion is significant for PROW. Objection by Medway PROW officer and local access forum
2 close, divert vehicles to Duc Ct Rd & install equestrian bridge	Bridge not preferred by Medway PROW officer and local access Forum. Objection to bridge in rural area at public consultation
3 close & install accommodation bridge	Bridge not preferred by Medway PROW officer and local access Forum. Objection to bridge in rural area at public consultation
4 upgrade (automatic half barrier & byway closure)	Option discounted
5 Upgrade (manual controlled barrier using CCTV & byway closure)	Option discounted
6 Upgrade (full barriers with obstacle detection & byway closure)	NR Preferred solution. Solution acceptable to PROW officer and local access forum

Summary Appraisal Table

Option No	Fit Against Objectives	Service	Env	Land	Safety	Affordability	NPPF	Buildability	Community/ Stakeholder
1 close & divert to Dux Crt Road									
2 close, divert vehicles to Duc Ct Rd & install equestrian bridge									
3 close & install accommodation bridge									
4 upgrade (automatic half barrier & byway closure)									
5 Upgrade (manual controlled barrier using CCTV & byway closure)									
6 Upgrade (full barriers with obstacle detection & byway closure)									

Conclusion

3.56 Option 6 is the chosen option. Wybournes crossing will be upgraded to full barrier with obstacle detection. This system is automatic, despite its name, and eliminates the increased signaller workload. This solution is the highest level of safety available apart

from closing the crossing. High Halstow byway crossing will be closed and diverted to Wybournes LC by a new dedicated track south of the railway.

Solomons PROW Crossing

3.57 Solomons PROW uncontrolled footpath with styles across the railway. From the level crossing survey and report usage at this crossing is extremely low and is estimated to increase to 7 users per day by 2036, although it will be close to the new development and may consequently experience a more significant increase. The existing crossing is not accessible to all users, and therefore this could be improved.

SX1 Crossing Closure & Bridge

3.58 A footbridge to replace the existing crossing was considered. This would require a structure span of 20m, to span the lineside drainage ditch and position abutments 2m beyond the Network Rail boundary. Diversion of the 33kV power line and removal of vegetation in the form of medium sized trees and shrub would also be required.

SX2 Crossing Closure & Diversion

3.59 Two options for Closure and diversion have been considered

A) New footpath link to Dux Court Road along the south side of the railway

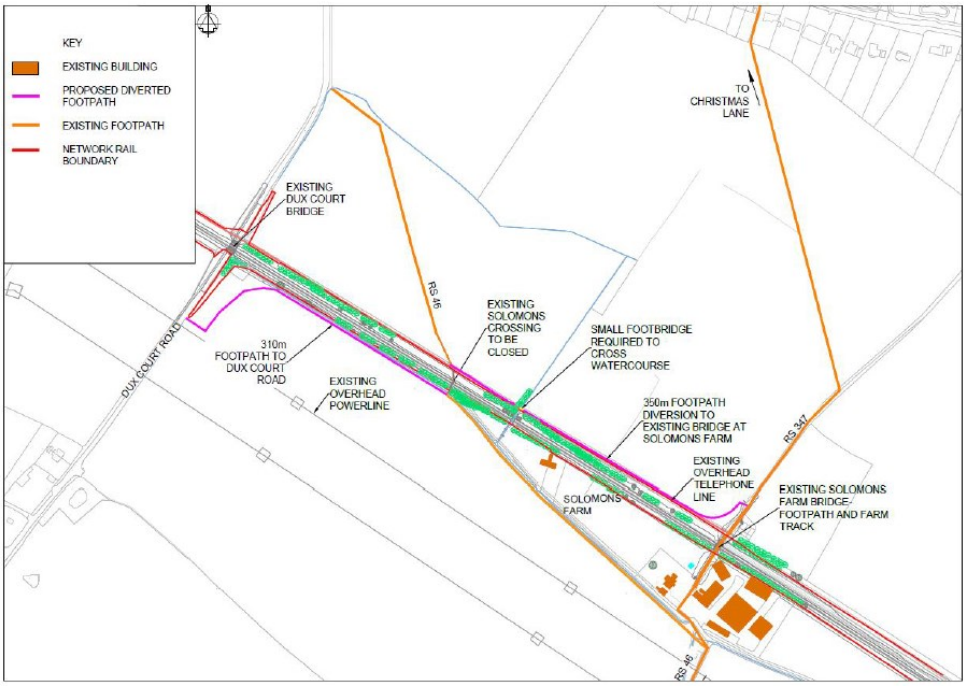
This option has a simple route along the south side of the railway along the edge of an orchard exiting into Dux Ct Rd. However the route then needs to travel north along the highway to join up with the original footpath exiting onto Dux Ct Rd. The humped back bridge on this heavily trafficked route has very poor visibility travelling north and is therefore, considered a safety risk to users. .

B) Divert users to existing overbridge at Solomons Farm

This option uses the existing Solomons Farm bridge which is also an existing footpath to cross the railway. A new 350m long link footpath will then be required along the northside of the railway to link into the existing footpath on the north side of the railway

3.60 Both options are shown in Figure 12 below.

Figure 12 – Closure and Diversion Options



Solomons Crossing and High Halstow Restricted Byway Crossing options: Options Appraisal Tables

3.61 Criteria 1 (Fit with objectives) and Criteria 2 (Service Performance) are not relevant to the consideration of crossing options. Network Rail requires the review of any non-segregated option crossing, regardless of the objectives of the scheme or the service being provided.

Criteria 3 – Environmental

Option No	Environmental
1 close & install footbridge	No significant environmental issues anticipated
2a close & divert to Dux Crt Rd	Users to walk along edge of existing orchard. No significant environmental issues anticipated
2b close & divert to Solomons Farm Overbridge	New footpath 350m long on edge of fields. No significant environmental issues anticipated

Criteria 4 - Land

Option No	Land
1 close & install footbridge	Significant land take particularly if footbridge ramps are required
2a close & divert to Dux Crt Rd	Access route across existing land required
2b close & divert to Solomons Farm Overbridge	Access route across existing land required

Criteria 5 - Safety

Option No	Safety
1 close & install footbridge	Solution segregates users from the operational railway
2a close & divert to Dux Crt Rd	Solution segregates users from the operational railway. Exit onto Dux Ct Rd will require users to cross listed humpback bridge with poor visibility – high risk of vehicle Collison with pedestrians
2b close & divert to Solomons Farm Overbridge	Solution segregates users from the operational railway. Minor risk of users crossing Solomons farm bridge impacting with pedestrians. This route is an existing Medway PROW route

Criteria 6 - Affordability

Option No	Affordability
1 close & install footbridge	High-cost impact
2a close & divert to Dux Crt Rd	Very low cost impact due to reuse of existing path
2b close & divert to Solomons Farm Overbridge	Although a low cost impact, the path for option 2 is shorter and not as complex to deliver. There is also the potential of overland flow and hence more onerous drainage requirements, which impact on cost.

Criteria 7 - NPPF

Option No	NPPF
1 close & install footbridge	This option includes a footbridge to replace the existing crossing and would require the diversion of a 33kV power line and removal of vegetation in the form of medium sized trees and shrub. Paragraph 131 of the NPPF also recognises that trees make an important contribution to the character and quality of urban environments, therefore existing trees should be retained wherever possible. There would also be a visual impact of the footbridge on the character of the local area, with potential to impact negatively on amenity for existing and future users, potentially conflicting with paragraph 130 of the NPPF.
2a close & divert to Dux Crt Rd	This option has poor visibility at the crossing, which is considered a safety risk to users and therefore not compliant with paragraph 97 of the NPPF which promotes safety. The option is also likely to be only suitable for users travelling south along Dux Ct Road and therefore would not be accessible to all which is one of the priorities on paragraph 92 of the NPPF, which supports the development of safe and accessible places.
2b close & divert to Solomons Farm Overbridge	This option uses the existing Solomons Farm bridge to cross the railway and includes a new link footpath to link to the existing footpath on the side of the railway, thus avoiding visual impacts from new bridge. This option is considered to provide better accessibility for users and therefore complies with paragraph 92 of the NPPF.

Criteria 8 - Buildability

Option No	Buildability
1 close & install footbridge	Construction of accommodation bridge in agricultural land not a major buildability issue
2a close & divert to Dux Crt Rd	virtually no construction required apart from minor improvements and signage
2b close & divert to Solomons Farm Overbridge	Simple construction of new footway to improve ground and signage

Criteria 9 – Community/Stakeholder

Option No	Community/Stakeholder
1 close & install footbridge	Bridge not preferred by Medway PROW officer and local access Forum. Objection to bridge in rural area at public consultation
2a close & divert to Dux Crt Rd	Concern regarding safety on Dux Ct Rd raised by local farmer and other members of public on consultation rounds
2b close & divert to Solomons Farm Overbridge	Concern regarding safety on Solomons Farm Bridge raised by local farmer due to increased pedestrian traffic and potential conflict with oversize farm machinery

Summary Appraisal Table

Option No	Fit Against Objectives	Service	Env	Land	Safety	Affordability	NPPF	Buildability	Community/ Stakeholder
1 close & install footbridge									
2a close & divert to Dux Crt Rd									
2b close & divert to Solomons Farm Overbridge									

Conclusion

3.62 Option 2b is the preferred option. Solomons crossing is to be closed and diverted to Solomons farm overbridge, which is preferred for environmental and buildability reasons. It also minimises the impact on third-party land.

The New Station Location & Form

Station Location

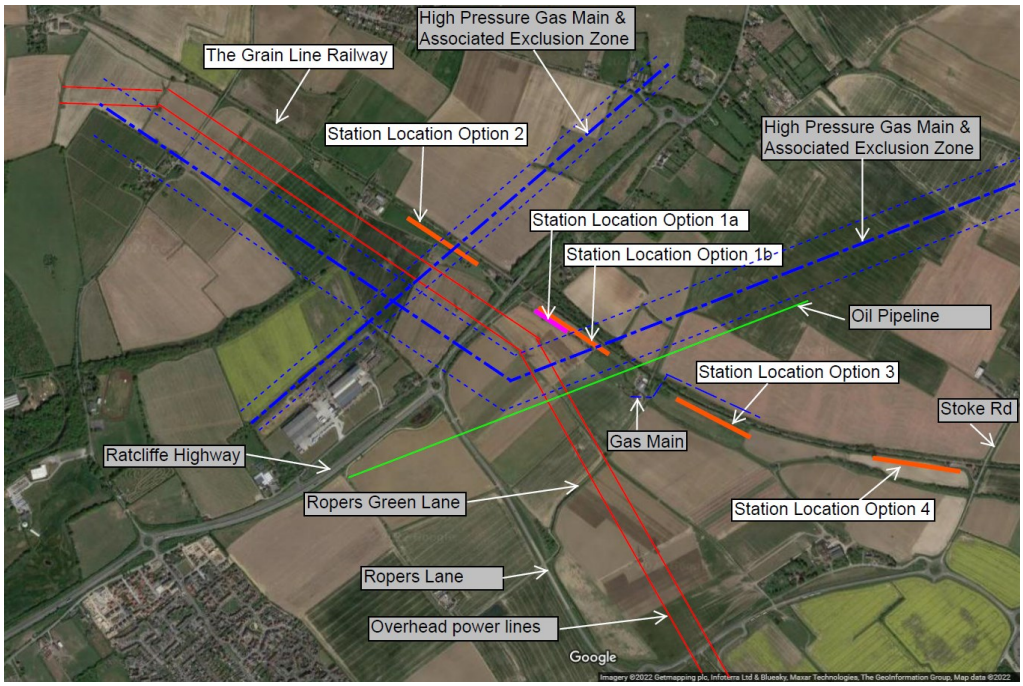
3.63 As explained in the 'Need for the Scheme' section above, the station will be the focus of a sustainable community on the Peninsula; and therefore, needs to be located close to highway links whilst being constrained by needing to be adjacent to the existing Grain line and providing a resilient service.

3.64 As such, four options were considered:

- Option 1 - immediately to the south of Ratcliffe Highway. 4 Car platform
- Option 2 - the site of the old Sharnal St Station on the Grain line north of Ratcliffe Highway,
- Option 3 - Just east of Ropers Green lane
- Option 4 - Beluncle Halt just west of Stoke Rd

3.65 Initially options 1 & 2 were considered. Both options have service constraints, in that 25kv overhead lines and pylons crossed the area and High pressure National gas feeder mains crossed both sites. With these constraints in mind, the location immediately to the south of Ratcliffe highway (Option 1) was selected as it avoided non-vehicular users needing to cross the main Ratcliffe highway to reach the station and it was closer to the primary area of new development.

3.66 As the design developed a key requirement at the time emerged from the train operator to provide passive provision for future expansion. As a consequence of this change the impact of the services was revisited, and it was determined that the High pressure National gas feeder mains, which gives rise to HSE exclusion zones for land used as public open space, constrained both locations to less than 8 car trains. Option 1b on the figure demonstrates the conflict between the station and gas main for an 8 car plus service. As a consequence, to ensure that all options catered for future expansion, alternative locations (options 3 and 4) for the station were investigated.



3.67 The Grain line between Ropers Green lane and Stoke Rd was reviewed to determine the best location for a station, noting that locations too far to the north would be further away from likely development zones, and locations too far to the south would increase journey times to the extent that conflicts could be caused with other passenger and freight services (as well as potentially being far from development zones). As such, two options were formally considered: Option 4, a former station location at Beluncle Halt just west of Stoke Rd, was considered, and Option 3, just east of Ropers Green lane, 500m beyond the initial station location (Option 1). These two options are appraised in the tables below.

Station Location options: Options Appraisal Tables

3.68 The station location options are dictated by proximity to the existing railway line. Therefore, the relative fit with the scheme objectives is not relevant to consideration of the station location. All station options achieve the objectives (and the absence of a station would fail all objectives).

Criteria 2 – Service Performance

Option No	Service performance
1 Site south of Ratcliffe Highway	No discernible difference in the service performance offered by location options 1, 2 & 3, although future passenger experience may be impacted by high pressure gas mains limiting station size.
2 Site of old Sharnel Street Station	No discernible difference in the service performance offered by location options 1, 2 & 3
3 Site south of Ropers Green Lane	No discernible difference in the service performance offered by location options 1, 2 & 3
4 Site west of Stoke Road, Beluncle Halt	Station location is too far East down the Grain Branch Line to provide a sufficient turnaround time for timetabling

Criteria 3 – Environmental

Option No	Environmental
1 Site south of Ratcliffe Highway	Great Crested Newts & water voles in vicinity
2 Site of old Sharnel Street Station	Great Crested Newts & water voles in vicinity
3 Site south of Ropers Green Lane	Great Crested Newts & water voles in vicinity
4 Site west of Stoke Road, Beluncle Halt	Great Crested Newts & water voles in vicinity

Criteria 4 - Land

Option No	Land
1 Site south of Ratcliffe Highway	Greenfield site within housing development area .
2 Site of old Sharnel Street Station	Brownfield / Greenfield Site, outside development area and thus more likely to require compulsory acquisition
3 Site south of Ropers Green Lane	Greenfield site within housing development area.
4 Site west of Stoke Road, Beluncle Halt	Greenfield site in area proposed by the Council to be used for its HIF SEMS scheme.

Criteria 5 - Safety

Option No	Safety
1 Site south of Ratcliffe Highway	Proximity to high pressure gas main and exclusion zone
2 Site of old Sharnel Street Station	Proximity to high pressure gas main and exclusion zone. Substation relocation
3 Site south of Ropers Green Lane	No significant safety risks
4 Site west of Stoke Road, Beluncle Halt	No significant safety risks

Criteria 6 - Affordability

Option No	Affordability
1 Site south of Ratcliffe Highway	Station construction costs are similar for all options. However, the site is within a proposed development area. Consequently land cost is expected to be lower than option 2 as the station supports development
2 Site of old Sharnel Street Station	Station construction costs are similar for all options. However, the site is outside a proposed development area. Consequently, land cost expected to be higher. DNO substation would require relocation
3 Site south of Ropers Green Lane	Station construction costs are similar for all options. However, the site is within a proposed development area. Consequently, land cost is expected to be lower than option 2 as the station supports development
4 Site west of Stoke Road, Beluncle Halt	Station construction costs are similar for all options. However, the site is within a proposed development area. Consequently, land cost is expected to be lower than option 2 as the station supports development

Criteria 7 - NPPF

Option No	NPPF
1 Site south of Ratcliffe Highway	This option falls within flood zone 2 and 3 areas. Paragraph 159 of the NPPF which suggests that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary in such areas (as may be the case with a railway station given locational constraints), the development should be made safe for its lifetime without increasing flood risk elsewhere. This option impacts the HSE exclusion zones for land use associated with a high-pressure gas main. This indicates that there are safety concerns which will likely conflict with the NPPF's paragraph 97 which aims to promote public safety.
2 Site of old Sharnel Street Station	This site was considered to be too far from the proposed new development and therefore would not be easily accessible and hence non-compliant with paragraph 110(b) of the NPPF which states that development should be safe and suitable access to the site can be achieved by all users. The option also resulted in an increased rail journey time.
3 Site south of Ropers Green Lane	This option proposed the shortest journey time to, and most appropriate location for, the emerging new development. This is compliant with paragraph 8 of the NPPF which aims to achieve sustainable development. More specifically the social objective suggests that strong, vibrant, and healthy communities will have accessible services to reflect community needs.
4 Site west of Stoke Road, Beluncle Halt	No NPPF compliance issues have been identified.

Criteria 8 - Buildability

Option No	Buildability
1 Site south of Ratcliffe Highway	Access from Ratcliffe Highway. Proximity to High-pressure gas main – Solution consequently discounted
2 Site of old Sharnel Street Station	Access from Ratcliffe Highway. Proximity to High-pressure gas main – Solution consequently discounted
3 Site south of Ropers Green Lane	Medium pressure gas main and water main. Access to station requires installation of development spine road. Siding adjoins Grain line in cutting earthworks required for solution development
4 Site west of Stoke Road, Beluncle Halt	Access from stoke Rd. Track level with adjacent ground

Criteria 9 – Community/Stakeholder

Option No	Community/Stakeholder
1 Site south of Ratcliffe Highway	General public feedback questioned why the station was on the edge of the development and not more integrated. Concerns likely to be raised by statutory undertakers and HSE.
2 Site of old Sharnel Street Station	General public feedback questioned why the station was on the edge of the development and not more integrated
3 Site south of Ropers Green Lane	General public feedback questioned why the station was on the edge of the development and not more integrated
4 Site west of Stoke Road, Beluncle Halt	General public feedback questioned why the station was on the edge of the development and not more integrated

Summary Appraisal Table

Option No	Fit Against Objectives	Service	Env	Land	Safety	Affordability	NPPF	Buildability	Community/ Stakeholder
1 Site south of Ratcliffe Highway									
2 Site of old Sharnel Street Station									
3 Site south of Ropers Green Lane									
4 Site west of Stoke Road, Beluncle Halt									

Conclusion

3.69 Option 3 is the preferred option. This option is close to the proposed housing development and avoids the high-pressure gas mains located north and south of Ratcliffe Highway. The location is acceptable from a timetabling perspective.

Station Building

3.70 The station concept has been developed by drawing on historical references from the Hoo Peninsula; there is potential to instil a sense of place and presence to the new station at Hoo. The redevelopment of the site will raise the profile of the area and will encourage inward investment.

3.71 In defining a vision for the area, it will generate a sense of civic pride through the new station; a 'shopwindow' for the Hoo Peninsula and a 'gateway' to the new neighbourhoods proposed under Medway Council's development framework.

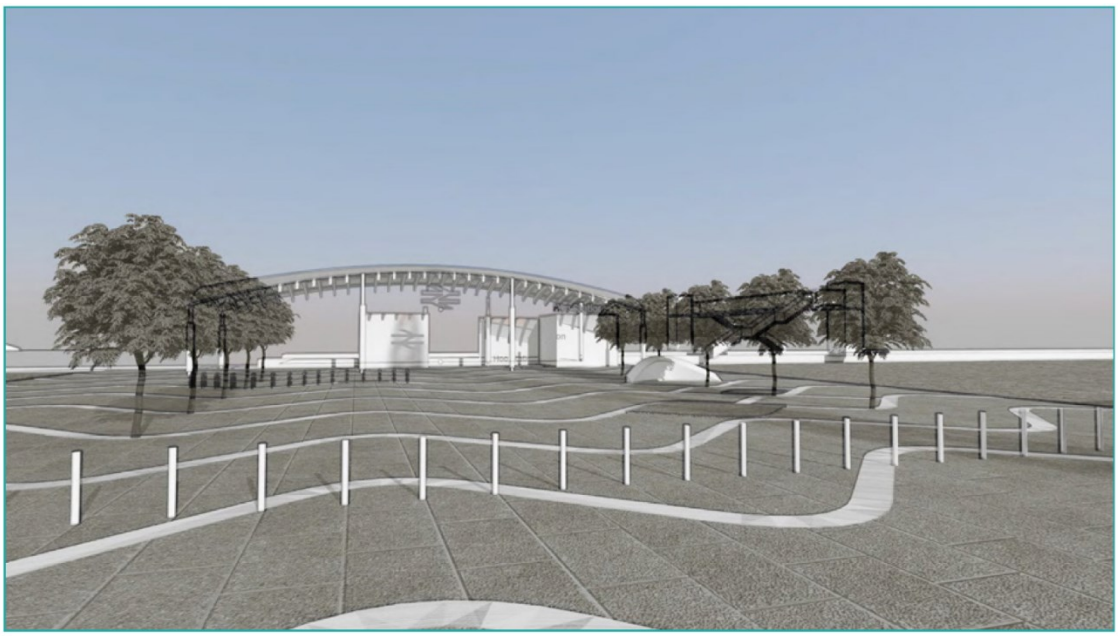
3.72 The solutions proposed drawing on the history of the area, including:

- Nauticality – Link with the Docks and Shipping
- Aviation - Royal Naval Air Service, RNAS, Kingsnorth Airship Station
- Radio Waves – Historic location of key Shortwave radio station
- Rural – The local nature of buildings
- Verticality - Kingsnorth Power Station, now demolished

3.73 Two options were developed based upon the above for further development.

3.74 Option A proposed an open environment under a canopy that evokes the barns and ship hulls found throughout Hoo. By limiting the amount of solid walls and internal fit-out to just the first structural bay, this option enables an economical approach, accommodating toilets and welfare facilities in accordance with the train operator's requirements, and space for the station to grow into the open structural bays to the west.

3.75 Option B proposes an open environment with a contemporary form, loosely recalling the organic form of air ships or waves. The station canopy could be formed from a tensile membrane, or grass roof, subject to Medway Council's planning department's preference.



3.76 Both options meet the technical specification for the station building and are similar in affordability, environmental impact and buildability terms. The barn style solution was noted as preferred through public consultation and on this basis is the solution taken

forward. However, the 'wavey' lines in the hard landscaping outside the station has been dropped from the design following consultation with accessibility groups.

3.77 The Future Hoo team is continuing to develop the designs for the space in and around the station car park, working with landowners/ developers and in the context of the Hoo Development Framework. Further information will be provided with the application for a Transport and Works Act Order.

Passing Loops

3.78 The Grain line is a single bi-directional railway line which when originally constructed in 1812 had passing places for passenger services at a number of stations along the line. The stations along with these passing places were lost when the line was closed to passenger services, and the line only now takes freight services timetabled so only one train uses the line at any one time. Timetabling exercises confirm the line has capacity for passenger and freight services on the Grain Line provided passing loops are provided.

3.79 The proposed new station is halfway along the Grain line, hence the study only considers this area.

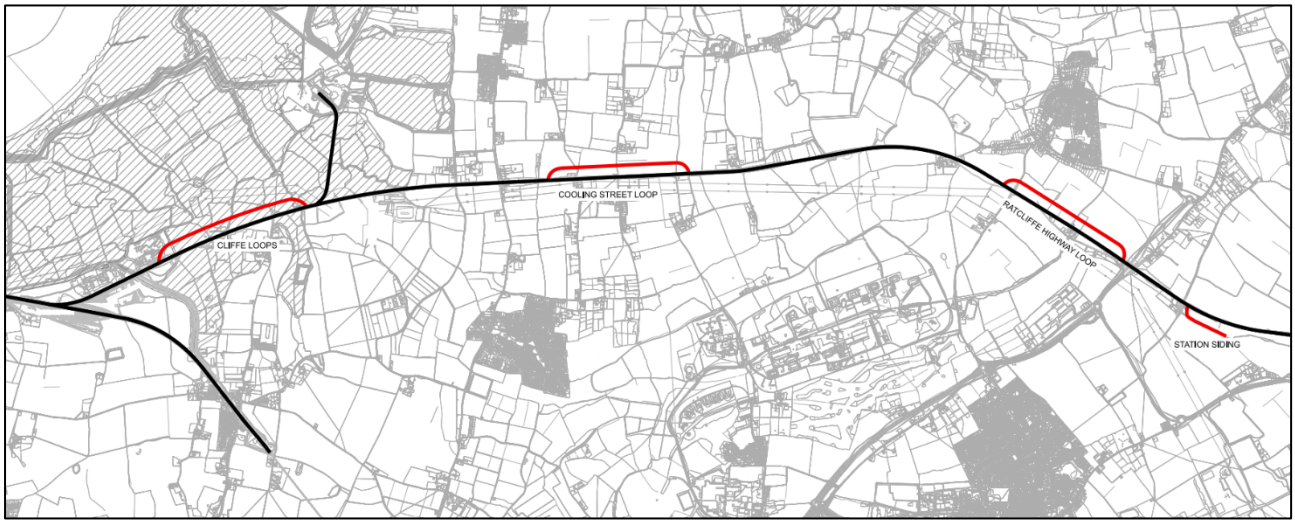
3.80 Key areas along the line are:

- Cliffe sidings which provide sea dredged gravel and have a high volume of freight traffic hence is a critical location for a passing loop west of Cliffe Junction
- The section between Cliffe sidings and the new station location where a second passing place may be required and
- The new station. The provision of the new station in a terminal siding provides a passing place for passenger services and freight travelling to Grain Port at the end of the line

3.81 To achieve the timetable for the passenger service it is necessary for passenger services to be given priority over freight services on the Grain line, in addition, to avoid the need for concurrent passenger services passing on the grain line and a conflicting freight service being present, it is necessary for passenger services to pass each other on the North Kent Mainline. In considering the service options discussed earlier in this report, the timetabling work also found that for some service solutions an additional passing loop is required.

3.82 Finally, it is noted that the current Grain line as a single line can cater for the 775m long maximum length freight train permissible on the railway to prevent a constraint on freight services. Consequently, the passing loop needs to be capable of holding this length of train.

Figure 13 - Passing Loops

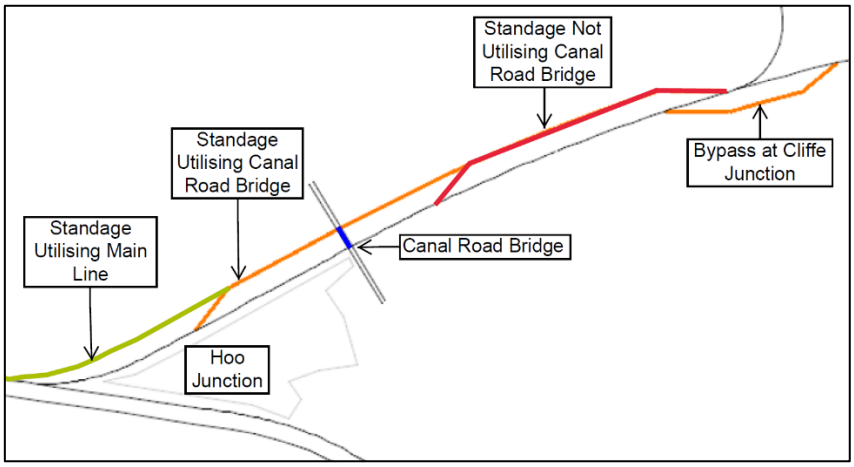


Cliffe Loop Options

3.83 The first passing loop is considered between Hoo Junction and Cliffe Junction, by providing a double-track arrangement which returns to the branch line. The location, length and arrangement were determined based on the proposed timetabling of the services using the line. Three options of varying lengths were considered to determine the length required to ensure a timetabling solution could be achieved. The options were:

- **Option 1: East of Canal Road Bridge to Cliffe Junction**
  Doubling of the branch line to allow standage of suitable length whilst maintaining operational availability of the line. The track connections will be located to the east of Canal Road (existing bridge) and West of Cliffe Junction.
- **Option 2: West of Canal Road Bridge to Cliffe Junction**
  An extension of Option 1 to the West beyond Canal Road bridge, connecting to the branch line at both ends.
- **Option 3: Main Line to Cliffe Junction**
  A further extension of Option 1 & Option 2 to the West with a connection to the mainline at Hoo Junction.

Figure 14 - Cliffe Loop Options



3.84 The standage element of the passing loop options to allow trains to pass consists of a length of additional track to the North of the existing line, within the NR land boundary. A key element of this option is that the eastern extent must join or be as close as possible to Cliffe Junction to prevent slow moving freight from blocking the line for long periods when exiting the loop. Hence each option is for a progressively longer loop.

3.85 An additional sub-option consisting of a short bypass, approximately 400m, long located to the South of Cliffe Junction was considered alongside each of the three main options. This provides a separate path for trains passing into the Cliffe Marine sidings thus avoiding conflict with trains entering or exiting the sidings. This additional loop requires land outside of the current NR boundary and has several constructability issues associated with it.

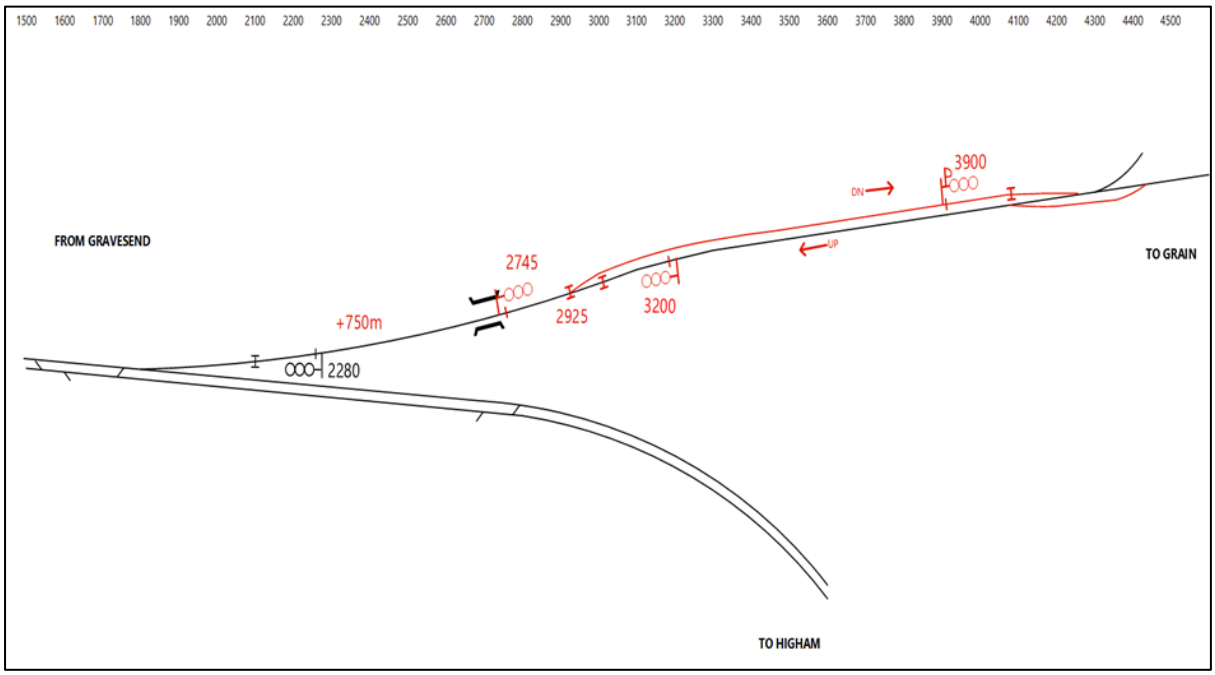
Option 1: East of Canal Road Bridge to Cliffe Junction

3.86 This option has the benefit of avoiding any alteration to Canal Road Bridge removing the need for remediation of the second span of the bridge structure and hence is beneficial for the project in terms of cost and programme, but it is less flexible operationally because the loop is the shortest of the options, although it still provides sufficient standage for a 775m freight train.

3.87 The proposed doubling including for signalling stand back and clearances will be approximately 1300m long, ending before the existing Cliffe Junction avoiding any impact on the sidings turnout. This eliminates the need to realign the junction which would impact the adjacent RAMSAR Protected Wetland site and siding operation.

However, this has the disadvantage that freight on the loop has to re-join the mainline to undertake the movement into the sidings occupying the mainline for a period.

Figure 15: First Passing Loop - Option 1 East of Canal Rd Bridge to Cliffe Junction

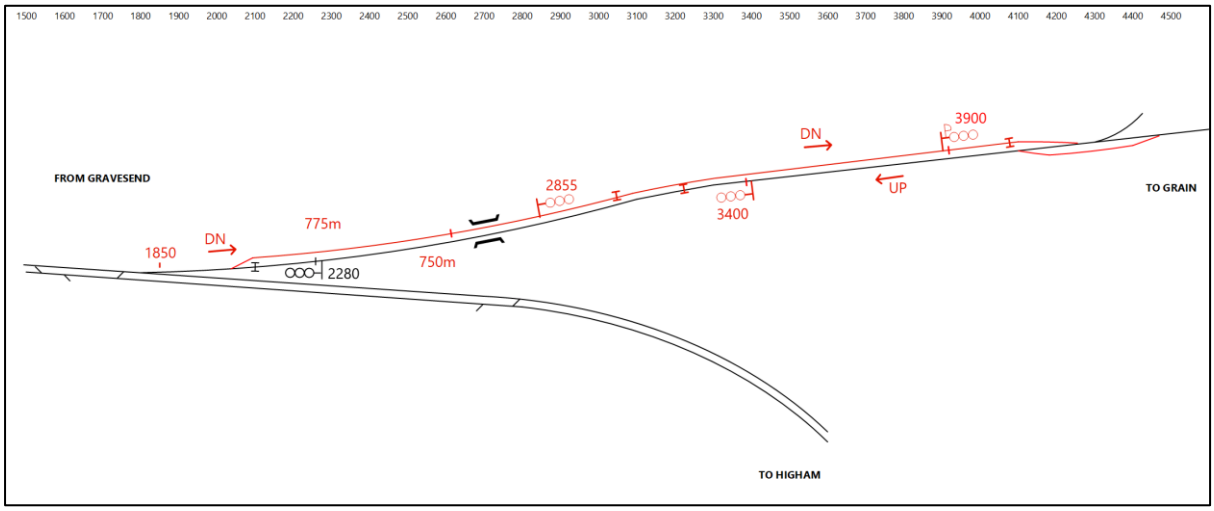


3.88 Note that the figure above includes the considered bypass to the South. However, the findings of the timetabling study have confirmed that this option is viable without the southern bypass at Cliffe Junction.

Option 2: West of Canal Road Bridge to Cliffe Junction

3.89 Option 2 extends the Option 1 loop to the west of Canal Rd bridge to provide increased flexibility but avoids a new junction on the Down North Kent mainline. The option utilises an unused span on the existing Canal Rd bridge, but this would require strengthening works to support the load of two freight trains simultaneously crossing the structure.

Figure 16: First Passing Loop - Option 2 West of Canal Rd Bridge to Cliffe Junction



3.90 Note that the figure above includes the considered bypass to the South. However, the findings of the timetabling study have confirmed that this option is viable without the southern bypass at Cliffe Junction.

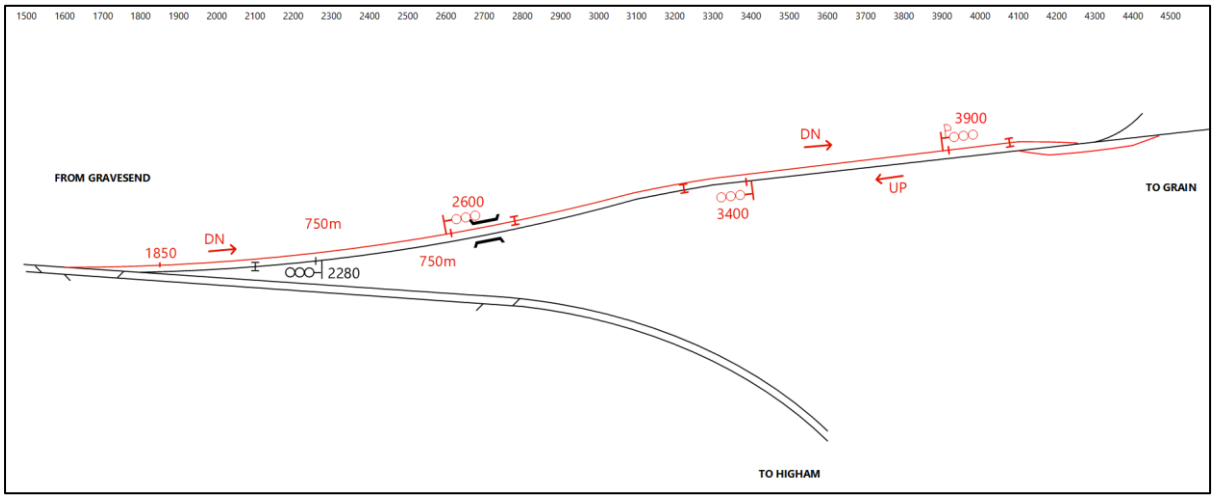
3.91 The civil engineering required to widen the embankment on the north side is challenging due to the proximity of an adjacent industrial estate at a lower level. At the western end, existing ponds are present, these will require retaining structures to allow the embankment to be constructed. However, depending on when the works proceed, the entire industrial estate and adjacent land to the west are due to be redeveloped and as part of this, the site will be raised by approximately 2m eliminating much of the level difference. Negotiations with the landowner would therefore be required to determine if the schemes can be dovetailed to reduce the overall costs of construction. This would then be a constraint on the construction programme.

Option 3: Main Line to Cliffe Junction

3.92 Option 3 extends option 2 to provide dualling from the mainline by including a new connection in the Down North Kent mainline. This provides maximum operational flexibility of all the options, as it allows for parallel moves on and off the Grain branch.

3.93 The embankment works adjacent to the ponds are significantly increased and include a large ditch to the north of the mainline, but these are also part of the proposed development referred to in option 2 above.

Figure 1: First Passing Loop - Option 3 Main Line to Cliffe Junction



3.94 Note that the figure above includes the considered bypass to the South. However, the preliminary findings of the timetabling study have confirmed that this option is viable without the southern bypass at Cliffe Junction.

3.95 The proposed option adds a turnout on the mainline but retains the existing grain line connection for the up movement. It is known that this connection is in poor condition and due for replacement by Network Rail in 2025. As an alternative, a new double junction could be installed to both rationalise and improve the junction onto the grain line, however this would be high cost and is not critical to the delivery of passenger service.

3.96 This option requires significant works to the mainline not required for options 1 & 2 including track works, signalling, and interlocking systems. The cost of this works adds significantly to the overall project costs. For complete flexibility the main Grain line and the loop, bi-directional signalling is proposed, and this option is taken forward for comparison.

Cliffe Loop Summary

3.97 The freight to Cliffe siding is approximately 50% of the total freight on the Grain line, creates hence a passing loop in this west of Cliffe Junction is essential.

3.98 The findings from the timetabling study have confirmed that option 1 doubling of the line from East of Canal Rd to Cliffe Junction is viable without the additional southern loop at Cliffe Junction. Both the Existing Grain line and passing loops are to be bi-directional for maximum operational flexibility.

3.99 Therefore and for the reasons set out in the options appraisal tables below, the recommended option for the Cliffe passing loop is Option 1. This option has the advantage of having the shortest length of loop to be built, and the shortest length of embankment stabilisation and widening to be carried out, having the least ecological impact on the existing environment. It doesn't require major upgrading works to Canal Road bridge or any works to the North Kent Mainline, and has the lowest construction cost out of the recommended options. As the shortest loop is suitable for service there is no benefit to the passenger service in considering the longer loop options.

Central Loop

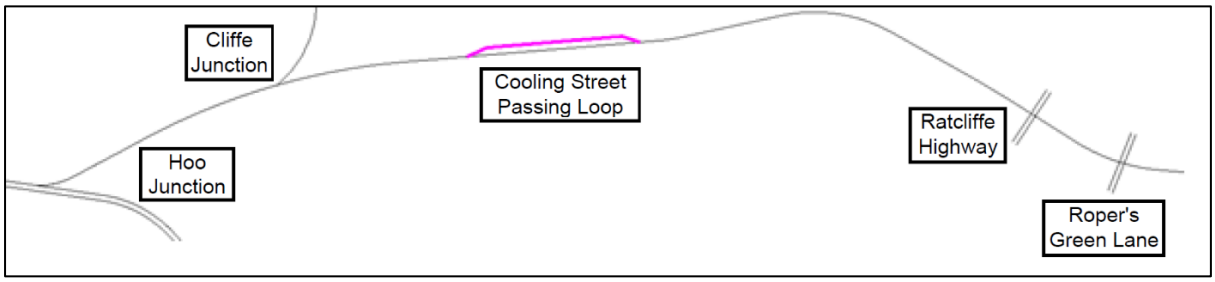
3.100 To enable a greater frequency of service, possible locations for a second passing loop were investigated. From a timetable perspective, an additional passing loop has the greatest benefit when located at the midpoint between the first passing loop and the new station. Two options were considered for the Central Loop; a loop at Cooling Street and an alternative at Ratcliffe Highway.

Option 1 - Cooling St Loop

3.101 The Cooling St loop is within the area of Cooling Street and is located on the North side of the existing line, within the existing NR land boundary, and would be approximately 1200m long. The Cooling loop location is fixed to the west by a high-pressure national feeder gas main and constrained to the east by a steep track gradient of 1in 66 rising to the east.

3.102 The passing loop line will be bi-directional, allowing freight to stand in the loop while the passenger train passes at full line speed.

Figure 17: Second Passing Loop - Cooling Street



3.103 The passing loop would start between Station Road, & Cooling St with the new track installed parallel to the existing line for 1000m using the available railway corridor. This avoids the adjacent rising gradient to the east.

3.104 The doubling will pass over Well Penn Rd bridge & Cooling Street bridge both were originally constructed to take dual tracks, the abutments and wingwalls exist but the second track and bridge span was not constructed, hence new bridge decks on each will be required for the loop line.

3.105 The greatest risk of train derailment is where the train in entering the loop and consequently the switch is positioned so that if a train derailed as it passed the switch, it will have already passed the gas main travelling into the loop, it would be moving away from the gas main. Alternatively, if a train is travelling through the switch from the loop, the train is less likely to derail due to the switch arrangement, the train would be travelling at a much lower speed if derailed, hence, limiting the risk to the existing gas main.

3.106 The exact position of the loop is driven by the gradients and other features, as described above.

3.107 The line speed of the loops is 40 mph with bi-directional signals to give maximum flexibility.

Option 2 - Ratcliffe Loop

3.108 A passing loop was considered near Ratcliffe Highway. However, this was rejected as it likely had limited benefit as it would be too close to the station and the track gradients in this location are sub-optimal for a passing loop. Any other location is either too close to the station or Cliffe Junction to provide benefit.

Central Loop Summary

3.109 Cooling St is the best location for a second loop being most effecting from a timetabling perspective and as set out in the options appraisal tables below. Timetabling shows the Cooling Loop is not required for all services but is required if the service frequency or train length is increased, as discussed in the Service options considered above. The loop is therefore being taken forward to further stages of design.

3.110 The recommended solution, where the additional loop is required, is for a passing loop at Cooling Street on the Northside of the existing railway. The passing loop will require works to the Cooling Street bridge as well as the Well Penn Rd bridge structure.

Passing Loop options: Options Appraisal Tables

3.111 The service performance considerations associated with the loop options are considered in the Service section of this report.

Criteria 1 – Fit with Objectives

Option / Objective	SO1	SO2	SO3	SO4	S05	Overall RAG Score
Cliffe Passing Loop						
1 East of Canal Road Bridge to Cliffe Junction					See criteria 3	
2 Ext' west of Canal Road Bridge to Cliffe Junction					See criteria 3	
3 Ext' to Main Line to Cliffe Junction					See criteria 3	
Central Passing Loop						
1 Cooling Street Loop					See criteria 3	
2 Ratcliffe Loop				Limited benefit as to close to station		

Criteria 3 – Environmental

Option No	Environmental
Cliffe Passing Loop	
1 East of Canal Road Bridge to Cliffe Junction	Track bed and embankment adjacent to RAMSAR, SSSI, SPA & RSPB reserves. Vegetation and tree removal required.
2 Ext' west of Canal Road Bridge to Cliffe Junction	Track bed and embankment adjacent to RAMSAR, SSSI, SPA & RSPB reserves. Vegetation and tree removal required. Impacts a potential reptile habitat.
3 Ext' to Main Line to Cliffe Junction	Track bed and embankment adjacent to RAMSAR, SSSI, SPA & RSPB reserves. Vegetation and tree removal required. Impacts a potential reptile habitat. Proximity to pond, retaining structures required between pond and track bed potential impact on species. Potential to disturb asbestos.
Central Passing Loop	
1 Cooling Street Loop	Track moved close to residential properties, potential for an increase in noise pollution
2 Ratcliffe Loop	Close to confirmed water habitat but no adverse effect expected.

Criteria 4 - Land

Option No	Land
Cliffe Passing Loop	
1 East of Canal Road Bridge to Cliffe Junction	Permanent works will fall within the NR land boundary, some temporary works/site compounds may require third party land. Alternations to Kings Crossing and Church St Crossing required.
2 Ext' west of Canal Road Bridge to Cliffe Junction	Due to the height of embankment either side of Canal Road bridge increasing the width will impact on the industrial estate. Third party land potentially required
3 Ext' to Main Line to Cliffe Junction	Small section of third party land likely to be required to accommodate track.
Central Passing Loop	
1 Cooling Street Loop	Permanent works are within NR land boundary
2 Ratcliffe Loop	Permanent works are within NR land boundary

Criteria 5 - Safety

Option No	Safety
Cliffe Passing Loop	
1 East of Canal Road Bridge to Cliffe Junction	Option designed to be safe
2 Ext' west of Canal Road Bridge to Cliffe Junction	Option designed to be safe
3 Ext' to Main Line to Cliffe Junction	Option designed to be safe
Central Passing Loop	
1 Cooling Street Loop	Option designed to be safe
2 Ratcliffe Loop	Option designed to be safe

Criteria 6 - Affordability

Option No	Affordability
Cliffe Passing Loop	
1 East of Canal Road Bridge to Cliffe Junction	Least expensive of the Cliffe Loop options
2 Ext' west of Canal Road Bridge to Cliffe Junction	Additional works required to Canal Road Bridge
3 Ext' to Main Line to Cliffe Junction	Most expensive of the Cliffe Loop options, includes costly works to the main line.
Central Passing Loop	
1 Cooling Street Loop	Cost of central passing loop options would be comparable
2 Ratcliffe Loop	Cost of central passing loop options would be comparable

Criteria 7 - NPPF

Option No	NPPF
Cliffe Passing Loop	
1 East of Canal Road Bridge to Cliffe Junction	The track bed and embankment are adjacent to Ramsar, SSSI, SPA & RSPB reserves. Paragraph 181 of the NPPF suggests that Ramsar sites should be given the same protection as habitat sites. Paragraph 180 of the NPPF states that development on land within or outside a SSSI, and which is likely to have an adverse effect should usually not be permitted.
2 Ext' west of Canal Road Bridge to Cliffe Junction	This option would require engineering works to widen the embankment. There are also existing ponds towards the west which will require retaining structures to accommodate the construction of the embankment. This option would therefore potentially result in ecological impacts. Paragraph 179 of the NPPF aims to protect and enhance biodiversity and geodiversity.
3 Ext' to Main Line to Cliffe Junction	Similar to the option above, this option will also result in ecological impacts and therefore would require mitigations measures to comply with paragraph 179 of the NPPF which aims to protect and enhance biodiversity and geodiversity.
Central Passing Loop	
1 Cooling Street Loop	Track moved closer to residential properties, potential for an increase in noise pollution impacting negatively on amenity for existing and future users. This would conflict with paragraph 130 of the NPPF. Paragraph 185(a) of the NPPF refers to noise and seeks to ensure that development is appropriate for its location taking into account the likely effects (including cumulatively).
2 Ratcliffe Loop	Based on the information available no NPPF compliance issues have been identified.

Criteria 8 - Buildability

Option No	Buildability
Cliffe Passing Loop	
1 East of Canal Road Bridge to Cliffe Junction	Reinforced earth embankments required, works to Cattle arch underbridge. No major buildability issues
2 Ext' west of Canal Road Bridge to Cliffe Junction	Significant works required to Canal Rd Bridge
3 Ext' to Main Line to Cliffe Junction	Significant works required to the North Kent Line installing a new switch and crossover. Possession availability likely to be an issue
Central Passing Loop	
1 Cooling Street Loop	Works to retain and widen existing cut slope required No major buildability issues.
2 Ratcliffe Loop	Gradients are not ideal for the loop and would require works to reduce the gradient and tie back into the track.

Criteria 9 – Community/Stakeholder

Option No	Community/Stakeholder
Cliffe Passing Loop	
1 East of Canal Road Bridge to Cliffe Junction	No significant stakeholder concerns
2 Ext' west of Canal Road Bridge to Cliffe Junction	No significant stakeholder concerns
3 Ext' to Main Line to Cliffe Junction	No significant stakeholder concerns
Central Passing Loop	
1 Cooling Street Loop	No significant stakeholder concerns
2 Ratcliffe Loop	No significant stakeholder concerns

Summary Appraisal Table

Option No	Fit Against Objectives	Service	Env	Land	Safety	Affordability	NPPF	Buildability	Community/ Stakeholder
Cliffe Passing Loop									
1 East of Canal Road Bridge to Cliffe Junction									
2 Ext' west of Canal Road Bridge to Cliffe Junction									
3 Ext' to Main Line to Cliffe Junction									
Central Passing Loop									
1 Cooling Street Loop									
2 Ratcliffe Loop									

Station Siding

3.112 The station is to be located in an area of single track. If the station were located on the Grain line a further passing loop would be required, to allow freight trains to pass whilst the passenger service is stabled at the station. The only viable option therefore, was to provide a terminal siding for the station on an alignment that would allow the siding to be extended to form a loop in the future if passenger services were to extend beyond the New Station. This provides a cost-effective solution while maintaining passive provision for future expansion of the passenger service

4. Assessment Design: Design to be taken forward for Assessment

4.1 The aim of the overall scheme is to reinstate a passenger service along the Grain Branch Line to service a proposed new station to the North of the town of Hoo. A sift analysis has been undertaken at GRIP 3 and the selected systemwide option is a new 3-Car Link Service from the new station to Gravesend Station operating at one train per hour.

4.2 To achieve this, the following options have been selected:

- A battery train service between Gravesend and the new station with a full stabling, train servicing and maintenance package.
- Track and signalling works to enable a reverse movement at Gravesend.
- The introduction of a passing place on the existing Hoo to Grain Branch Line to allow the new passenger service and existing freight traffic to operate together.
- An upgrade of the existing signalling system to remove the legacy token block system which currently introduces delays to freight routed to the Isle of Grain.
- Ride quality improvements to the existing single track.
- A new station building, single platform, car park and associated facilities.
- Safety improvements to level crossings affected by the new passenger service.

Engineering Design

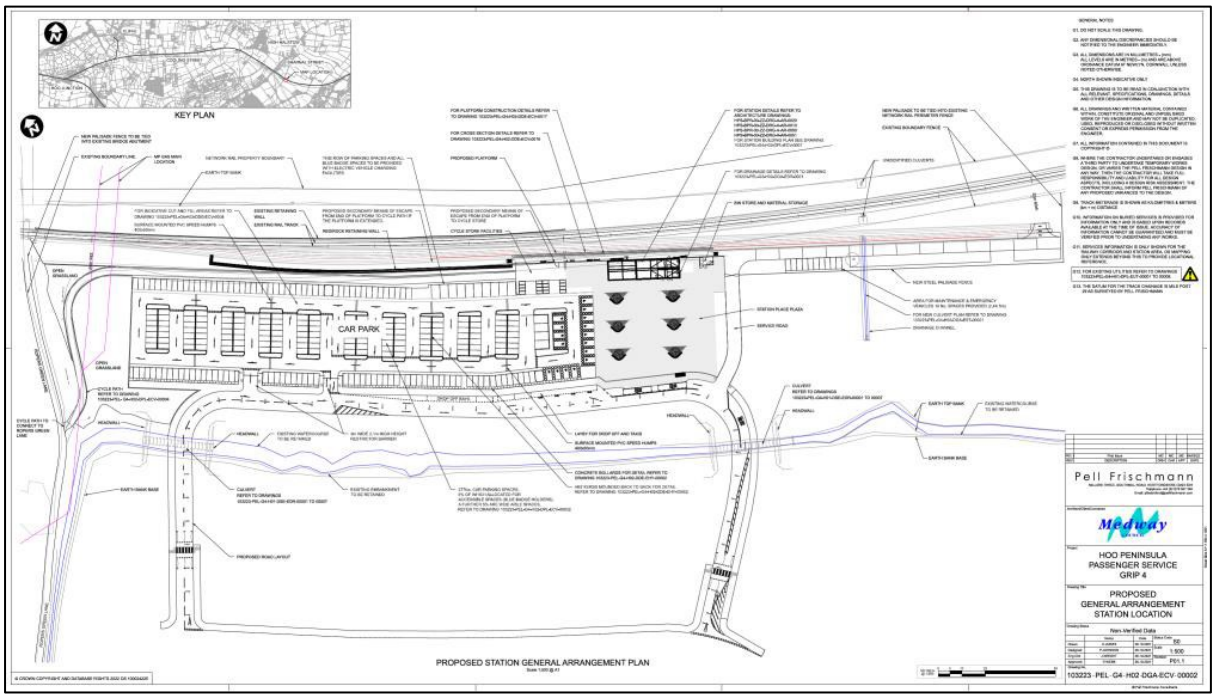
4.3 The proposed station is to be located to the south of the existing HTG line, east of Roper's Green Lane. The station location has been determined based on several factors, principally, the proximity to the proposed housing developments and the need to avoid existing buried services and their associated exclusion zones.

4.4 An offline siding arrangement is the most practical solution to allow flexibility of construction and allowing freight trains to pass whilst the passenger service is stabled at the station. It also addressed the issue of excessive track gradient which is a safety concern for passengers if the platform long fall is too steep.

4.5 As explained above, the Future Hoo team is continuing to develop the designs for the space in and around the station car park, working with landowners/ developers and in

the context of the Hoo Development Framework. Further information will be provided with the application for a Transport and Works Act Order.

Figure 18: Proposed Station General Arrangement



4.6 The station has been positioned close to the existing line to minimise cost and land take. The shuttle service to Gravesend requires a passing loop between Hoo junction and Cliffe Junction on the Grain Line. The existing embankment needs to be widened over the length of the passing loop. Vegetation clearance and tree removal will be part of this. All the level crossings between Canal Road Bridge and the new station location will be upgraded or closed. The passing loop, adjacent to the RAMSAR is to be constructed within the Network Rail Boundary. It is possible that some culvert headwalls will fall outside of the Network Rail Boundary due to the location of the existing watercourses/ditches. No additional land is required at Gravesend and the new switch is to be constructed in the existing 6foot (referring to the central area between two tracks), there are no environmental/ecology impacts from this.

4.7 Further environmental impacts from the proposed scheme will be considered through the Environmental Impact Assessment (EIA) process and mitigation proposed as necessary.

5. Next Steps

5.1 The next step is for the Future Hoo team to assess the likely impacts of the design outlined in this report, principally (but not exclusively) through the continuation of the Environmental Impact Assessment, Habitats Regulation Assessment and Transport Assessment processes.

5.2 The Future Hoo team will look for opportunities to further enhance the scheme through these assessment processes. Options for further mitigation will be explored where significant adverse effects are identified and, where appropriate, these will be embedded in the design.

5.3 The team will continue to engage with stakeholders as appropriate during this assessment stage.

5.4 The final scheme will also be subject to ongoing consideration of the station layout and car parking design.

5.5 Following completion of the assessments, an application for a Transport and Works Act Order will be prepared and submitted in March 2023 seeking authorisation for the scheme from the Secretary of State for Transport.