Report

Wisbech to March: Potential for Light Rail

December 2021

Authorisation

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Document version control				
Date	**Version**	**Editor**	**Approver**	**Description / Change Reason**
12/11/21	1.0	Alex Dodds	**SC**	Initial draft for client review
13/12/21	1.1	Alex Dodds	**SC**	Final document for issue

Executive Summary

The seven-mile March to Wisbech railway, located in North Cambridgeshire, England (see Figures 1A to D below) was opened in 1847 with passenger services operating until 1968. Freight services continued to run until 2000. Since 2000 the line has remained in a mothballed, non-operational condition. Network Rail's Light Rail Knowledge & Development team has been requested to assess the potential for reopening rail passenger services on the line using light rail technology.

This report summarises the findings of that assessment.

Network Rail's light rail team considered the options for adopting suitable light rail technology and operational solutions. This was done without a constraint of complying with current national rail design and operating standards – other than at any interface with the current rail network.

The study concludes that there is potential for a light rail passenger operation between March and Wisbech. The assessment of suitable rolling stock types concludes that Tram; Tram Train; or Very Light Rail (VLR) vehicles could be used. The choice of rolling stock being subject to the specification of the short and long term service aspirations.

The factors influencing the choice of light rail vehicle include:

- Requirement to operate on the national rail network (e.g. to Peterborough, Ely, Cambridge);
- The multiplicity of level crossings on the route and vehicle's suitability to create a cost effective solution at each
- Opportunity to operate into Wisbech town centre using the highway network
- Future extension of the service to serve the Wisbech Garden Town development
- Consideration of passenger demand and thus vehicle size.

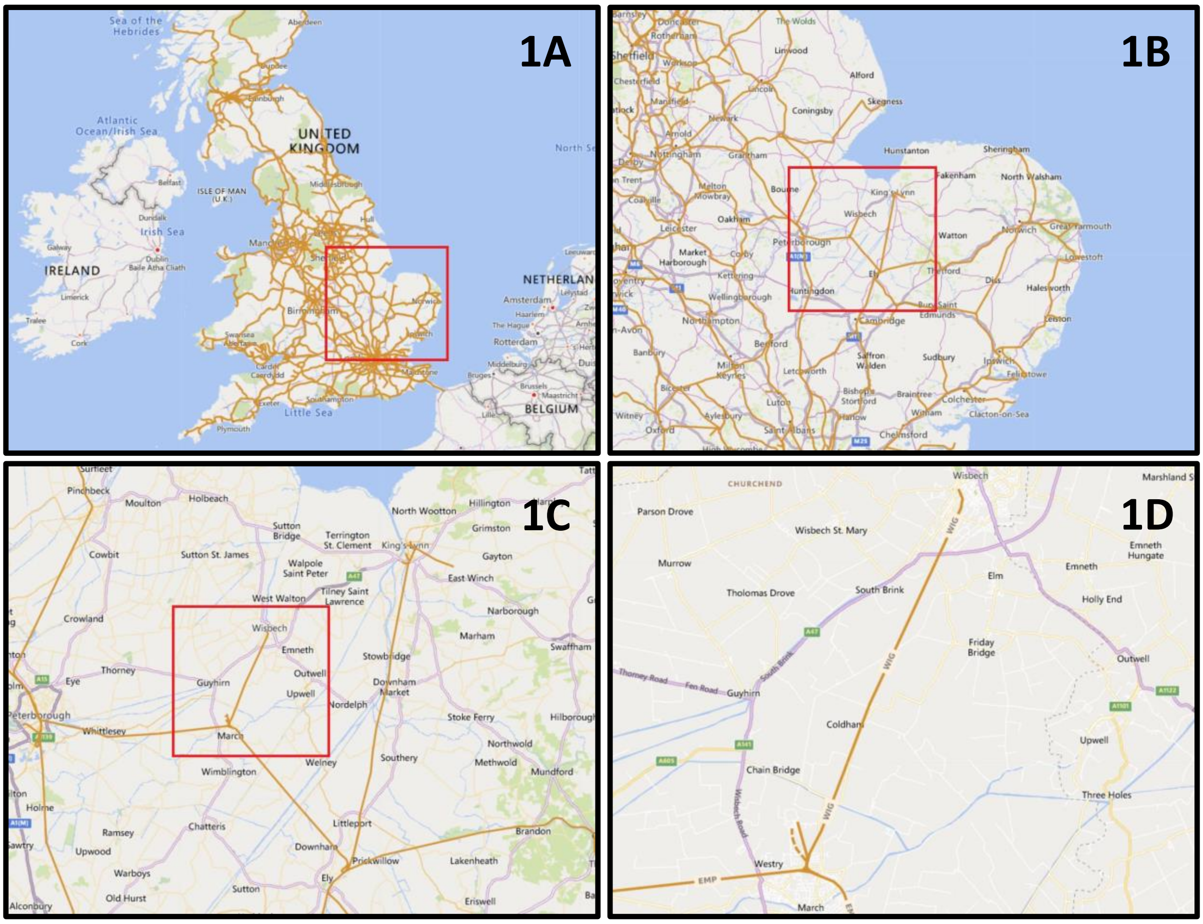
The study concludes that in consideration of the client's specification a Tram Train solution appears the best credible light rail option. Tram Train would enable future operation on both the national rail network and any on street operation into Wisbech town centre or to the Garden Town.

The next generation of Very Light Rail vehicles are an emerging technology, with the first demonstrator vehicle being showcased in Autumn 2021. Further development and engagement is needed with the manufacturers to explore the full potential, and limitations, of this new vehicle.

Key infrastructure aspects considered by the review include:

- The cost effective solutions for the numerous level crossings under light rail operation
- Options for an on street route into Wisbech town centre
- The location of a terminus station at Wisbech
- The required alterations at March Station and connections to the main line

At the client's request the report is largely a qualitative assessment of the potential for light rail on the March to Wisbech line. On the basis that light rail is considered a credible and feasible option further work is recommended to examine the options in more detail and to develop cost estimates to assist the business case for reopening the line.



Figures 1A to 1D – Map Series Showing the March-Wisbech Line in a UK, Regional, Area and Local Context

Contents

1 Introduction

Network Rail's Eastern Region directorate has requested the company's Light Rail Knowledge & Development team to assess the potential for reopening rail passenger services on the former March to Wisbech line using light rail technology. This report summarises the findings of that assessment.

The seven-mile March to Wisbech railway (known as the Bramley Line) was opened in 1847 with passenger services operating until 1968. Freight services continued to run until 2000. Since 2000 the line has remained substantially in Network Rail ownership in a mothballed, non-operational condition.

The reinstatement of rail passenger services between Wisbech and March (and possibly further afield) has been the subject of various local campaigns and studies. These given greater emphasis in recent years in the context of improving connectivity; reducing road congestion and tackling climate change through transport decarbonisation.

Recent studies to reinstate the rail connection have looked at options for conventional railway and light rail solutions, including on-street tram operation in Wisbech. To date the estimated cost of these solutions has been a limiting factor in the success of the case for reopening.

As part of the continuing evaluation of the case to reopen the line Network Rail's light rail team was asked to provide a high-level assessment of the "art of the possible" for light rail solutions. This assessment took a fresh look at the potential for light rail technology to enable a reconnection between March and Wisbech.

Network Rail's light rail team considered the options for adopting suitable light rail technical and operational solutions. This without constraint of current national rail design and operating standards – other than at any interface with the current rail network.

2 Background

The former March to Wisbech railway ran for approximately seven miles (10km) through the Cambridgeshire Fenland linking the two towns at either end.

The line was opened as a double track railway in 1847 with one intermediate station at Coldham (which closed in 1966). At one time the route continued beyond Wisbech to Watlington (on the line to Kings Lynn) and beyond March to St Ives.

The station at Wisbech was subsequently renamed Wisbech East to differentiate it from another station located at the north of the town on the former Midland and Great Northern line. Passenger services on the line ceased in 1968. The route was subsequently shortened with the Wisbech East station location being lost to residential development. Freight services continued until 2000, serving the Nestlé Purina and Metal Box facilities. Following the cessation of freight services, the rail corridor remains in Network Rail ownership. However following land acquisition by Nestlé (for expansion of its factory) the railway owned corridor terminates just beyond Weasenham Lane on the outskirts of the town.

Given the topography of the Fenlands the route had numerous level crossings for highways and footpath and farm access.

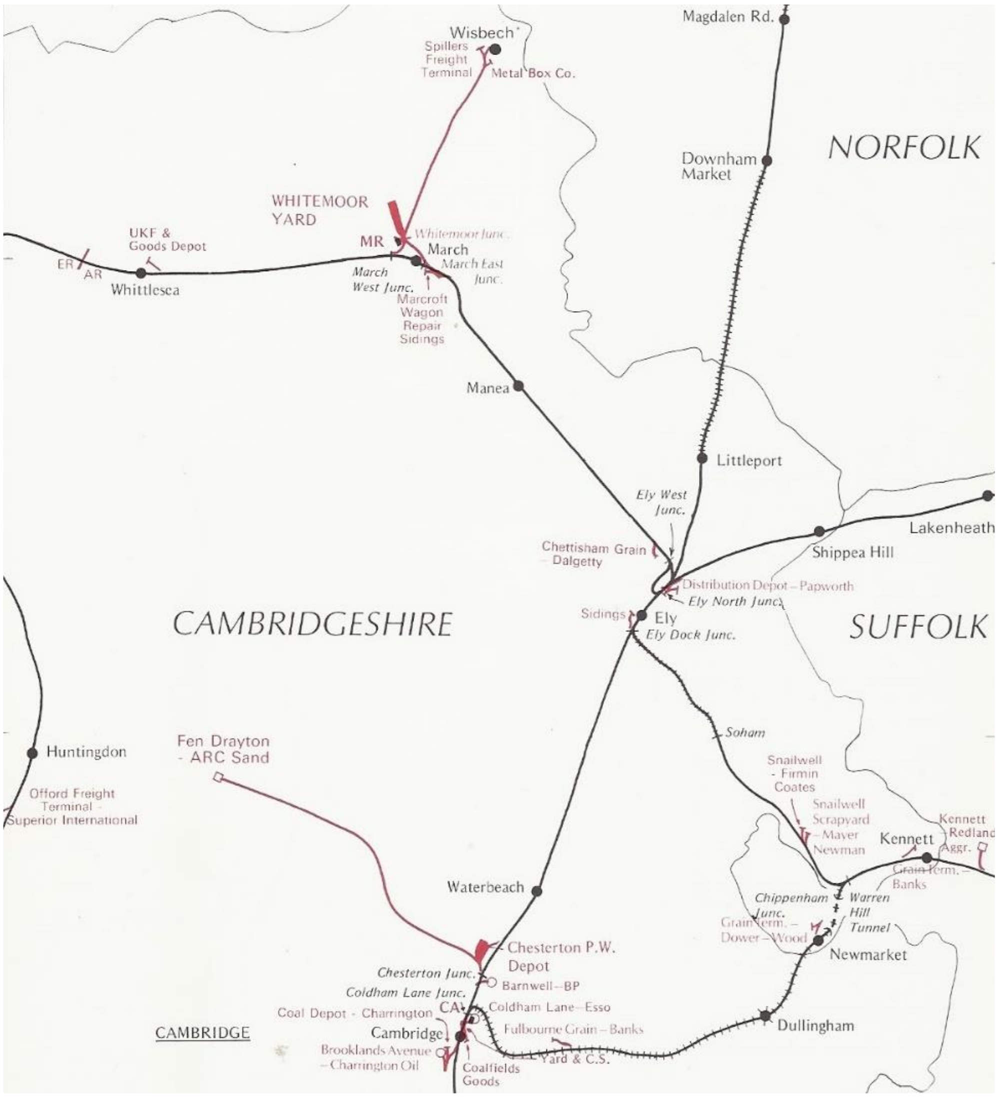


Figure 2: Map of Cambridgeshire late 1980s rail network (Source: Rail Atlas Great Britain & Ireland, Baker, 1988)

Figure 2 shows the residual March to Wisbech route from the late 1980s. Note the station is shown as having "unadvertised/excursion" status.

The reinstatement of rail passenger services between March and Wisbech has been the subject of various campaigns and studies in recent years.

These include:

- Wider Economic Benefits of a Rail Service Between March and Wisbech, Mott MacDonald & Cambridgeshire County Council (2014)
- Study into Re-Opening of March to Wisbech Rail Link, Outline Business Case, Mott MacDonald & Cambridgeshire County Council (2015)
- March-Wisbech Transport Corridor Low Cost Alternative - Tram-Train, Mott MacDonald (2019)
- March to Wisbech Transport Corridor Options Assessment Report, Mott MacDonald (2019)
- March to Wisbech Transport Corridor Full Business Case, Mott MacDonald (2020)

These studies have contributed to understanding the feasibility and options for reinstatement of rail passenger services (including assessment of light rail). These studies have included consideration of extending reinstated Wisbech services beyond March to Cambridge and Peterborough. However, there is limited or no capacity on the mainline for these additional services. It is understood that further investment on the existing network would be required to provide the capacity for new Wisbech services to operate through to Ely and Cambridge.

The most recent business case work concluded by discounting a Tram Train option in favour of a heavy rail solution with through running to Cambridge. However, the network capacity issues noted above are considered to make this option either too costly or impractical in the short/medium term.

Between 2009 and 2018 Network Rail, working with local partners, designed and implemented the UK's first Tram Train operation between Sheffield and Rotherham. From this experience Network Rail created a team as a dedicated centre of excellence for light rail knowledge. This team supports colleagues and stakeholders in the development of light rail schemes on or interfacing with the national rail network. This team brings a wealth of experience from delivering the Tram Train service and is using this to assess the case for delivering low cost innovative railway solutions.

In 2021 Network Rail's light rail team was invited to take a fresh look at reinstating rail passenger services to Wisbech in the context of the potential for light rail solutions. This to take the form of a high level consideration of "the art of the possible" and without constraints of conventional railway solutions. The assessment would concentrate on the creation of a dedicated service between March and Wisbech while commenting on the potential for that solution to enable through services to Peterborough and/or Cambridge.

3 Scope

The scope of the study was discussed with Network Rail's Eastern Region Strategic Planning team and agreed as:

- Examine the possibility of providing a rail service between Wisbech and March using light rail technology.
- Service options of 1 or 2 trains per hour in each direction.
- Services to be considered as self-contained to the route in short/medium term.
- Consideration for future through operation to either Peterborough or Cambridge and what infrastructure/vehicle/operating alterations may be required over the base solution.
- Study to consider suitable terminating location(s) in Wisbech.
- Output to be a short report reviewing the route and high level options to reinstating it using light rail technology. Report to provide a broad conclusion on the likely feasibility of a light option(s) and, where appropriate, indicate a preferred form of light rail solution.
- Report should highlight areas of opportunity where a light rail solution might enable a more cost-effective solution compared to heavy rail.
- Report should highlight any assumptions and risks in the solutions identified – for example in relation to compliance/deviation from industry standards.

4 Discussion and Findings

4.1 Service provision

Previous studies have identified a baseline service of 2 tph between March and Wisbech, which is the Client's base requirement. This is likely to be the maximum a heavy rail option would support. A Tram Train/light rail option could support additional service options depending on the final selection of route into the town centre and the location of the stops:

- A terminus at Weasenham Lane/the Purina factory could support 2, 3 or 4 tph depending on demand and location of passing facilities
- A terminus in the town centre at/near the Horsefair bus station could support up to 4 tph (subject to demand and passing facilities).
- The provision of a Park and Ride (P&R) facility at the A47 crossing could enable a supplementary service between the P&R stop and Wisbech town centre providing an opportunity to significantly reduce traffic into town. The combination of through and P&R shuttle services could provide up to 8 tph with 2, 3 or 4 going through to March
- The town centre operation would require significant traffic management to optimise the passage of the light rail service and enable a robust timetable.
- Through services to either Cambridge or Peterborough, although technically feasible with Tram Train, would require capacity upgrades on the Peterborough – Ely – Cambridge route. It should be noted that there are already existing services competing for limited train paths within the Peterborough-Ely-Cambridge corridor, and it may not be possible to deliver all of these without significant enhancements in route capability. This is however outside the scope of this report.

All the above options require further work to assess the overall timetable feasibility and the likely demand over the next 20-30 years to select the best option. A proposed "garden town" on the North side of the River Nene would provide further extension opportunities for the tramway, however these should be the subject of a separate study as part of the development of that scheme.

4.2 Infrastructure

The infrastructure requirements have been based on the following assumptions for Tram Train operation:

- Whitemoor Junction to Wisbech is designated as a tramway
- Whitemoor Junction to March remains heavy rail
- A railway to tramway operational rules interface is provided on the Wisbech side of Whitemoor Junction
- Tram Train services will use a reinstated Platform 3 at March station with option to reinstate the main line connection at the Ely end of the station
- The route will be a segregated tramway except in Wisbech where if required it would be an on-street tramway to the bus station terminus
- All level crossings on the original branch line will be designated as tramway crossings with appropriate highway controls

The formation and track bed are extant from Whitemoor Junction to Weasenham Lane on the outskirts of Wisbech and could be restored to double track for all or part of the route depending on initial and future timetable demands. While the formation for the most part seems in good basic condition, a full survey will be required to check the state of the embankments, particularly as most of the route is bounded by deep drainage ditches which may have resulted in scouring over the years out of use. Key requirements will be:

- Clear vegetation from track bed and trackside where sight lines may be compromised e.g. road crossings
- Restore drainage and prepare track bed
- Replace underbridge decks – the only underbridges on the route are over watercourses
- Relay track to tramway standards – note while 80lb rail would be suitable, Network Rail only bulk buys 113lb rail
- If double track, consider number and position of turnback crossovers to manage service perturbation
- All crossings will be tramway crossings with appropriate highway and tramway signalling control and with standard tramway signage
- All crossings should comply with LRG 1.0 – Tramway Principles and Guidance (TPG) (LRSSB, 2021) and associated light rail standards
- Any on-street sections should have embedded grooved rail and consideration given to innovative designs which minimise the need to move utilities
- Integrated highway and tramway signalling, and control will be required for the on-street sections
- The light rail vehicles are most likely to be high floor (to match those at March Station) and careful consideration is required for the location of on-street stops in Wisbech
- With exception of March Station, the other stops could be basic tram stops with 915mm high platforms.
- The platform/vehicle interface at all locations will be RVAR compliant and allow unaided level boarding to maximise accessibility. Foot crossings will be acceptable for any new stops on the original route.
- Consideration should be given to restoring double track from Whitemoor Junction into the disused platforms at March station with associated works to replace the missing tracks and possibly the former Junction at the East end.
- Signalling for the new layout will need to be installed which will require some changes to the existing scheme plan
- A new accessible footbridge is recommended at March. This will enable the service to offer end to end accessibility
- A servicing depot could be provided in the former engineers' sidings area at March alongside Platform 4

4.3 Rolling stock

There are numerous light rail rolling stock types and suppliers, with some vehicles currently in production/operation, and others in various stages of development. Given the status of vehicles in operation, and the flexibility of operation it offers, a Tram Train vehicle is considered the most appropriate light rail mode for the route. This is subject to confirmation of demand and desired journey time, as well as the type of service offered (e.g. segregated shuttle vs hybrid interface to adjacent urban centres). Tram Train enables operation on a line of sight tramway route, with passive provision to safely operate on heavy rail main lines in the future.

The current UK Tram Train vehicles in service are the Stadler Citylink Class 399 (low floor) in South Yorkshire; and the Stadler Citylink Class 398 (high floor) on order for Transport for Wales. Other manufacturers supplying Tram Train vehicles include Alstom and Siemens.

Figure 3 – Class 399 Citylink Low Floor Tram Train Operating in Sheffield (Photo: Ian Ambrose)

Figure 4 – Class 398 Citylink High Floor Tram Train Under Construction for Core Valley Lines (Source: Transport for Wales)

The March to Wisbech service is likely to have a journey time of between 15 and 20 minutes which will require 2 vehicles for the baseline service and up to 6 plus an operational spare for the maximum potential service frequency. This assumes a maximum speed of 60mph and suitable traffic management in Wisbech town centre to avoid congestion delays. This is a small order and better economy of scale might be achieved by joining with other Tram Train orders. The vehicle capacity will depend on the loading forecasts and the current vehicle length of 37-40m should be sufficient and the interior seating layout can be adapted to suit the customer preference. The route is sufficiently short to consider battery self-power rather than full electrification. Fast battery charging facilities to be provided at March and possibly the Wisbech terminus.

While Tram Train vehicles offer the greatest potential for service flexibility, alternative vehicle options should be considered in the context of efficiency, connectivity and cost of operation. The first of these is a standard tram vehicle. This would have lower capital cost than a Tram Train and still offer potential for street running. Tram does not offer the ability for future operation on the main line railway. Using a standard tram may require additional control measures for the shared running between Whitemoor Junction and March station. Existing standard tram vehicles are available from multiple manufacturers, with designs built to accommodate various urban rail gauges. These come in both low and high floor configurations, offering the flexibility to accommodate pre-existing infrastructure constraints, such as high floor platforms. This has already been applied successfully in Manchester, where existing heavy rail lines have been converted to tramways.

Figure 5 – Bombardier M5000 High Floor Tram Operating in Manchester (Source: Tom Page/Creative Commons)

Another alternative vehicle is Very Light Rail (VLR). The 'first generation' of VLR vehicle was the Parry People Mover used on the Stourbridge Branch in the West Midlands. Multiple second generation vehicles are under development, with the focus of VLR innovation centred in the West Midlands. One of these is the 'Revolution' VLR vehicle, intended for use on lines like the Stourbridge Branch, where a low capacity/low cost shuttle service is implemented on a segregated heavy rail alignment. The vehicle is exceptionally light weight, with potential consequential savings on track form[1] and structures. Such a vehicle could be an alternative for the Wisbech branch if the operation were to be limited to a segregated shuttle between March and Wisbech.

One potential limitation of VLR over a tram vehicle is its inability to operate on street alignments. However the vehicles may require modification to do so, such as fitting of skirting, roll-under protection, and track brakes[2]. Without these modifications, it is likely that a VLR vehicle would be restricted to segregated operation on the Wisbech line. The vehicle's small size may be an issue, dependent on the passenger demand anticipated, and interface with existing connecting services from March. Like standard trams, the vehicles are unlikely to be able to interwork on heavy rail main line, confining them to operate a segregated shuttle between Wisbech and March. This would not preclude some form of limited exemption to operate over the short distance between Whitemoor Junction and March Station. There is the issue of level crossings on the route to consider, with VLR vehicles potentially requiring different levels of protection infrastructure, dependent on the extent

[1] Note any potential savings on track/track form may be offset against Network Rail's bulk buying for standard 113ib rail see Section 4.2

[2] A similar French design includes these features

of alterations made to the standard vehicle design[3]. Recent discussions with the manufacturer of the 'Revolution' VLR vehicle have indicated the potential to incorporate market requirements into a production vehicle. This could include various design amendments for the vehicle to be classed as light rail/tram or a Tram Train and operate under line of sight regulations.

Figure 6 –Revolution VLR High Floor Demonstrator Vehicle (Source: Simon Coulthard)

4.4 Level Crossings

Based on the number of level crossings on the route and when compared to a traditional heavy rail solution a full or hybrid light rail operation could cut the cost of project implementation and operation by a considerable factor. Many sites would be considered substandard for a regular interval heavy rail passenger operation, and with 7 active sites identified alongside 12 passive ones, the cost of crossing interventions/improvements alone could make or break the project business case. A detailed description of the status of each crossing is included in Appendix B.

A light rail option would permit application of lower cost minimum intervention installations, or retention of automatic installations at current sites. A full Tram Train option would offer the potential to remove standard railway crossing controls altogether and install signalised traffic light junctions at every hybrid light rail/road interface. This would however be subject to localised vegetation clearance and suitable risk assessment of each location on an individual basis.

[3] Given the assumptions on infrastructure in 4.2, designating the VLR vehicle as a tram train would overcome most of the issues as the route can be built to tramway standards. This will also simplify the vehicle approval process

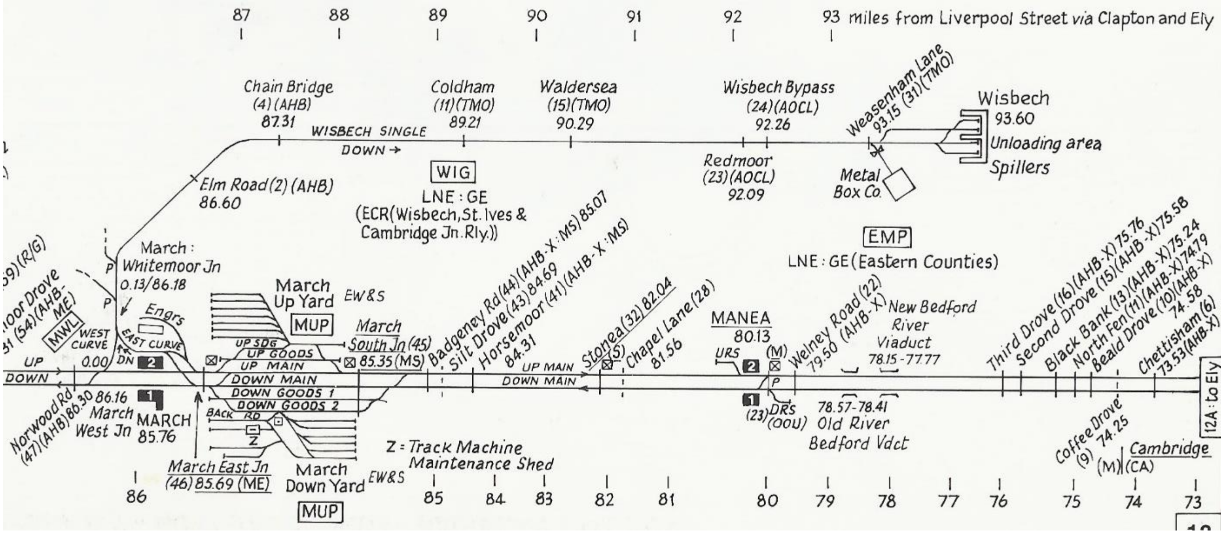


Figure 7 – Line Diagram of Wisbech Branch (Quail Map Company, 1998)

The nature of interventions required can be broken down into three specific crossing types:

- Active crossings intersecting major roads
- Active crossings intersecting minor roads
- User Worked Crossings

The level of infrastructure intervention required can be broken down for each in detail, however this would largely depend on the type of vehicle selected to operate the service, and the nature of modifications undertaken to accommodate locally specific infrastructure.

Active crossings Intersecting Major Roads

An example of this arrangement would be the Wisbech Bypass (see Figure 7 above). This was formerly an AOCL located on a busy main road. Such an arrangement would no longer be acceptable as a heavy rail solution, as the road has seen significant traffic growth, with high usage by HGVs. One option would be to create a grade separated solution in this location. Grade separation would be costly and add complexity. If this were to be undertaken, it is anticipated that the road would require elevating above the rail alignment. Not only would this cause significant disruption to road traffic during construction, but would also require substantial land take for the approach structures and significant aggregate for use as filler material. Concrete approach structures require less aggregate fill however these are generally more expensive to build, and raise environmental considerations from the increased use of synthetic material.

Application of a Tram Train or Tram option may offer a potential compromise solution. Tram vehicles fitted with track brakes already operate on a line of sight basis in urban and suburban areas, intersecting with major roads. Where an interface is created, road traffic lights are incorporated with tram signals to create a standard highway junction. This is treated just like any other road junction, with the exception that trams are often given priority over road traffic when approaching the site. Creation of a standard highway junction on the Wisbech bypass may be possible, and even practical utilising the powers of a light rail order for street interface operation. There is a need to clarify the legal status of the current crossing and the ability to reactivate a crossing at this location. Consultation with stakeholders such as the highways authority will be important.

Application of a VLR option may have a significant effect on the type of road crossing provided. By way of an example, an unmodified Revolution VLR vehicle would likely require some form of active crossing control at major road interfaces. Dependent on how such a vehicle was categorised (e.g. heavy rail, hybrid light rail, etc.), this could introduce a minimum requirement for road warning lights and half/full barrier protection. This has the potential to affect the type of solution implemented on the Wisbech Bypass, given a standard rail crossing us unlikely to be feasible in the current context. Such installations could however be suitable for use at less busy sites such as Elm Road in March or Station Road in Coldham.

Low cost, simplified level crossing equipment is used on continental rail networks. Many European countries apply simplified barrier mechanisms at automated crossings effectively, without compromising on the operation of the railway and providing a suitable level of safety based on anticipated risk. Such equipment is occasionally imported for use in a UK context, however for non-railway applications, such as barriers protecting car parks, secure installations and lifting bridges. Siemens, Schweitzer Electric and Unipart Dorman, all offer some form of simplified modular signalling/crossing control arrangement, as part of their wider international supply portfolio. It is anticipated that with some limited development, this technology could be applied for use in a UK context, operating with light rail vehicles and speeds comparable to many secondary heavy rail passenger lines. An example of the Schweizer Electronic Flex crossing system, currently in use on the continent is shown in Figure 8 below.

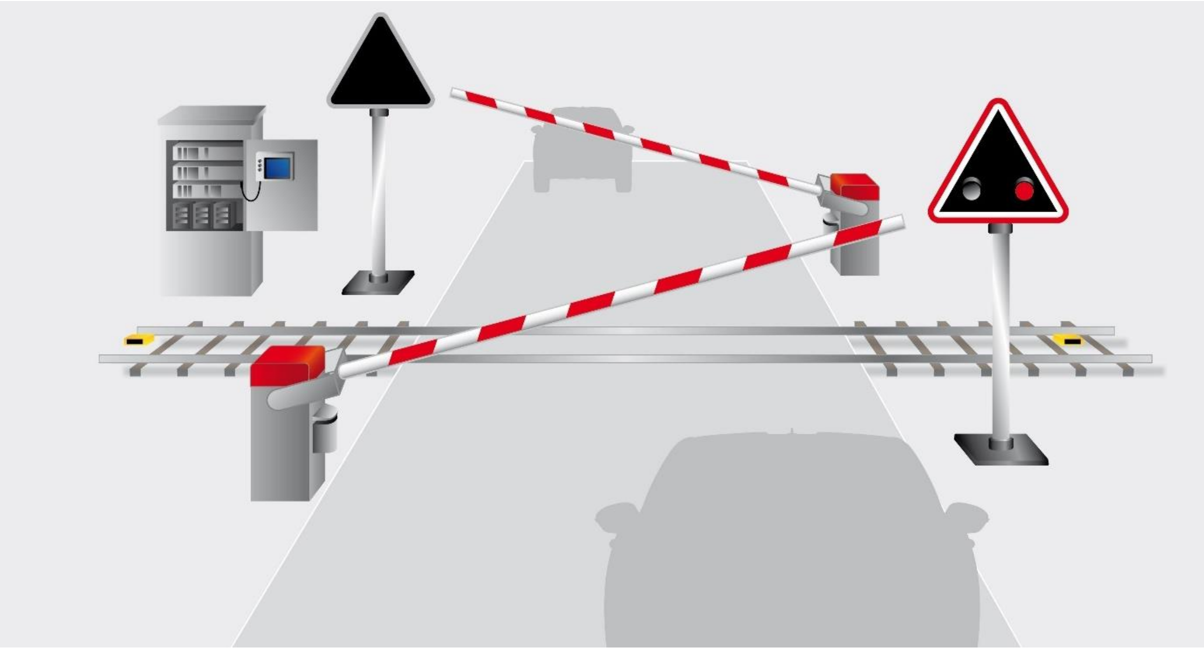


Figure 8 – Schweizer Electronic Flex Crossing System (Source: Schweizer Electronic)

Active crossings Intersecting Minor Roads

An example of this arrangement is Redmoor (see Figure 7). This was formerly an AOCL located on a quiet semi-rural/residential road.

Application of a Tram Train or Tram option offers the simplest road/rail interface solution in this instance. Given the poor sighting at the Redmoor crossing, it is anticipated that traffic lights would be required to facilitate a suitable interface. This would be treated as a standard road junction under current highway regulations. At locations where good sighting distance is available in both directions, it may be possible to incorporate a formalised road junction, without the need for an active traffic light system. Tram vehicles would operate on a line of sight basis over such crossings, with cars required to give way to approaching tram vehicles. This would be subject to individual risk assessment at specific sites, based on key local characteristics.

In the example of Redmoor, application of a VLR vehicle option would require more substantial crossing infrastructure. As per the major road example, this is assumed to be a form of active warning road lights as a minimum. Requirements for provision of barriers would require specific risk assessment for each location, largely dependent on local characteristics, anticipated rail vehicle line speed, and road usage. A simple categorisation would be application of the same active warning lights as major road interfaces, minus provision of barriers. This does not however mean projects would be limited to a single type of warning light arrangement, as several types currently exist for different crossing applications. One example of this is the Schweizer Electronic Vamos crossing system, currently in use in the UK at User Worked Crossing installations (see Figure 9 below).

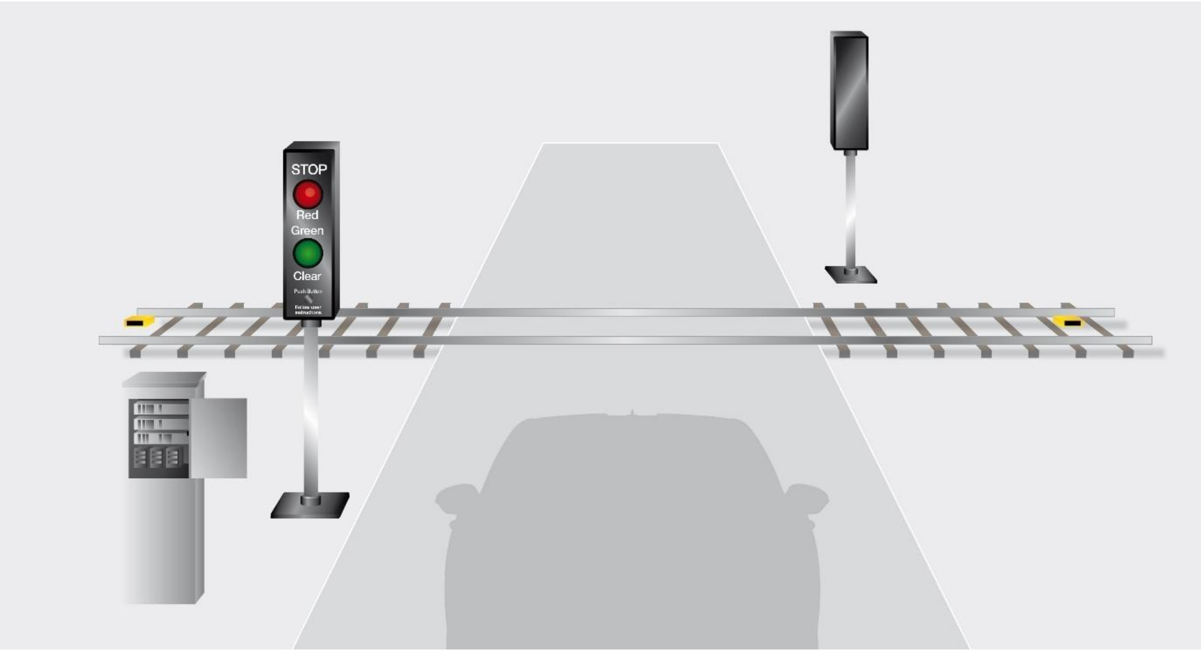


Figure 9 – Schweizer Electronic Vamos Crossing System (Source: Schweizer Electronic)

User Worked Crossings

An example of this arrangement would be Clarkes User Worked Crossing (see Appendix B1.2). This was a basic occupation crossing equipped with passive signage and metal gates. It is located on private land inaccessible to the public and connects agricultural land on one side of the crossing to a farm complex on the other.

Application of a Tram Train or Tram option could allow application of a basic signage based road interface solution, with give way indications for road vehicles. This would be dependent on current/anticipated usage of the adjacent fields, as there could be a risk of livestock accessing the rail alignment. Where fields are to be used for the purpose of grazing, etc. user worked gates would be a minimum requirement. Where gates are provided, it is anticipated that basic give way signage would be replaced with usage signage instructions, including details of penalties for not closing gates.

User Worked Crossings are standard on heavy rail infrastructure and it is not anticipated that such arrangements would differ greatly where a VLR vehicle option is applied on the route. There would need to be consideration of modifications to the VLR vehicle in terms of driver visibility, braking capability and impact protection. A worst case scenario would be a crossing with poor visibility in both directions, utilised regularly by long/slow vehicles. In a heavy rail context, this would normally be managed through the provision of telephones. Telecoms requirements add additional cost/complexity to projects, requiring alternatives to be considered.

One option is to provide a control centre/signal box number for users to call via a mobile phone. Given most of the crossing in question operate with nominated users, as opposed to general public, it would not be unreasonable to expect users to be equipped with mobile phones. Another covers use of remote GSM-R public call technology. This concept uses standalone solar/battery powered

GSM-R handsets installed at crossings, to provide contact with the signaller/controller in the event of poor mobile phone coverage. This technology is already in use successfully at several locations on the UK heavy rail network.

Figure 10 – Typical UWC installation on Wisbech Branch Route (Photo: Alex Dodds)

5 Optioneering

5.1 Minimum Intervention

Option Overview

Baseline optioneering for a light rail proposal assumes the Client base specification of up to 2 services each way per hour. To allow for expansion as allowance has been made for up to 3 services per hour. This assumes an approximate 20 minute journey time incorporating any additional intermediate stops. Requirements for infrastructure provision will ultimately be dependent on the attained journey time and service schedule, however as a minimum this would include a single/double platform station/tram stop on the edge of Wisbech town centre and an intermediate mid-point passing loop on an otherwise single track route.

The route would be largely self-contained, with a signalised interface at the southern end, where the freight only line to Whitemoor connects with the Peterborough-Ely through lines at March Station. Given this limited heavy rail interface, it is assumed that the service would be implemented as a Tram Train/hybrid light rail operation. With the heavy rail interface limited to a single interlocking transition, scope for utilising Very Light Rail vehicles may be possible, subject to application of route separation/lockout arrangements[4] provided in the Whitemoor Junction/March Station area. However, Tram Train rolling stock offers greater flexibility for service extension onwards from March on existing heavy rail.

Proposed Infrastructure

[4] Designation of the VLR vehicle as a tram train may avoid the need for this

The minimum intervention option reduces the cost of initial construction through limiting the infrastructure requirement. It is proposed that a station site located on the edge of Wisbech town centre be utilised for commencement of service. This option would require minimal land take and would run through a former industrial corridor up to a site south of the Nestlé Purina factory. The station would be located on the existing factory site staff car park. This would require relocation of these facilities elsewhere, however this would not be unfeasible due to the varying industrial land uses around the site (with some adjacent plots being semi-derelict at the time of writing).

It is recommended that the station site incorporates a single platform, limited light rail signalling infrastructure, a singe track and platform, with associated light rail based facilities. This initial option is outlined in Figure 11 below. As noted in the Option Overview, in the event a minimum intervention station option was not sufficient to meet anticipated demand, or proposed service schedule, scope exists for a second platform on the same site. It is recommended that provision be made for conversion of the single platform into an island, should future demand warrant (see Figure 11 below). This would require the initial build to be of a suitable width, possibly with platform copers pre-installed.

Provision of parking facilities is also recommended, due to the station's location within the wider urban area, and the potential for use of the town as a railhead for outlying rural areas in the vicinity. Options for a car park on the site are shown in Figure 11 and Figure 12. An alternative option to provide sufficient parking for rail users avoiding additional traffic through the town is to include a park and ride stop at the A47 crossing

One of the disadvantages of the Nestlé Purina site is the potential impact on pedestrian connectivity. In this instance the proposed site offers significant potential for enhanced pedestrian connectivity, with only minor intervention. There are five potential pedestrian corridors that could be constructed/enhanced to provide pedestrian connectivity in all geographic directions from the station. These are listed in clockwise order as follows:

- North footway skirting Nestlé Purina factory (main pedestrian connection to town centre)
- East connection to Victory Road and east side residential areas
- South connection to Weasenham Lane and industrial/commercial district
- South West pedestrian access via Oldfield Lane
- West connection to Cromwell Road through existing footway adjacent to Nestlé Purina factory

Figures 11 and 12 outline pedestrian access provision in brown, with potential light rail style pedestrian crossings denoted in yellow.

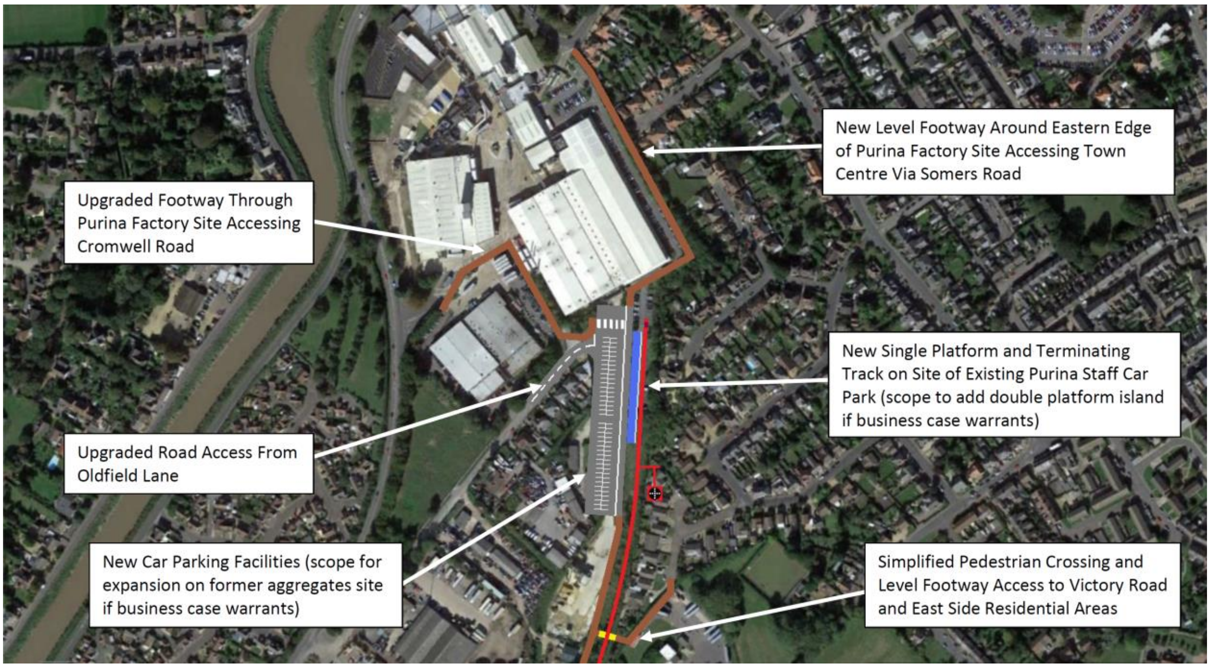


Figure 11 – Proposed Purina Factory Car Park Station Site

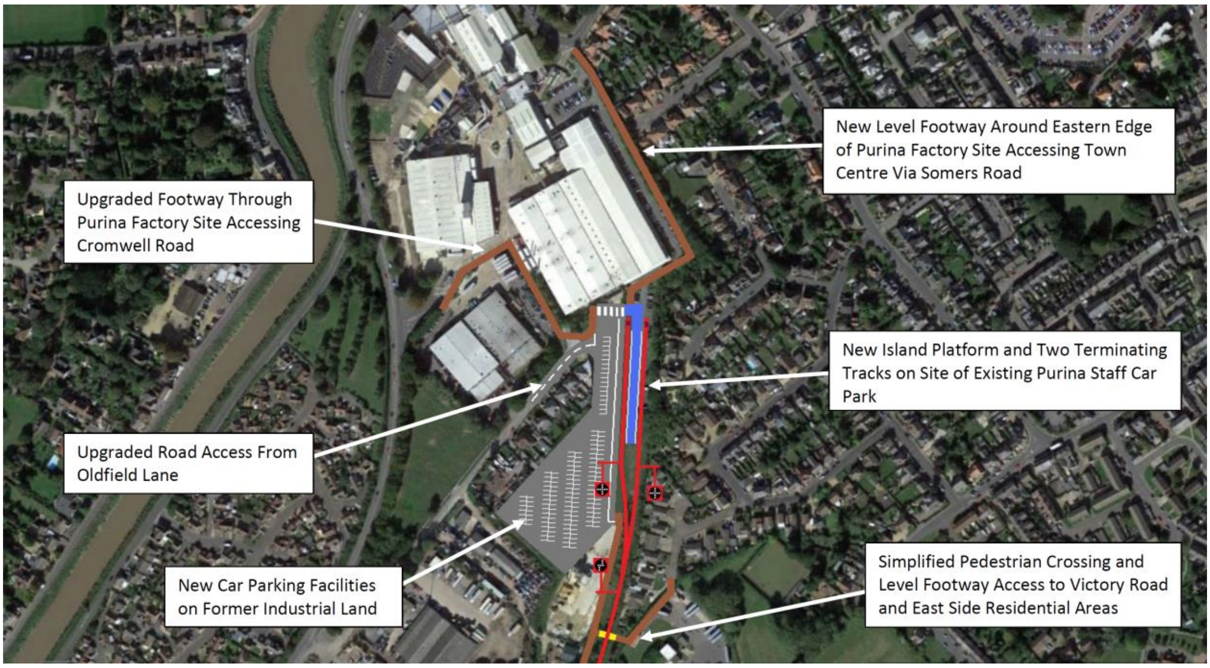


Figure 12 – Proposed Purina Factory Car Park Station Site

Regarding core route infrastructure a minimum light rail intervention for the route would incorporate a single track with a mid-point passing loop (outlined in Figure 13 below). This would allow for a minimum 20 minute peak service provision, assuming that trains would be scheduled to pass in the loop on an out and back basis. If additional contingency time, or extended layovers were required at Wisbech, a second platform would be required for operational flexibility and to accommodate potential service disruption. Signalling interventions include a simplified light rail based single line occupation system. This is similar to examples seen on tram networks throughout the country, with a specific example being the single track Meadowhall Interchange line on the Sheffield Supertram network (see Figure 14 below).

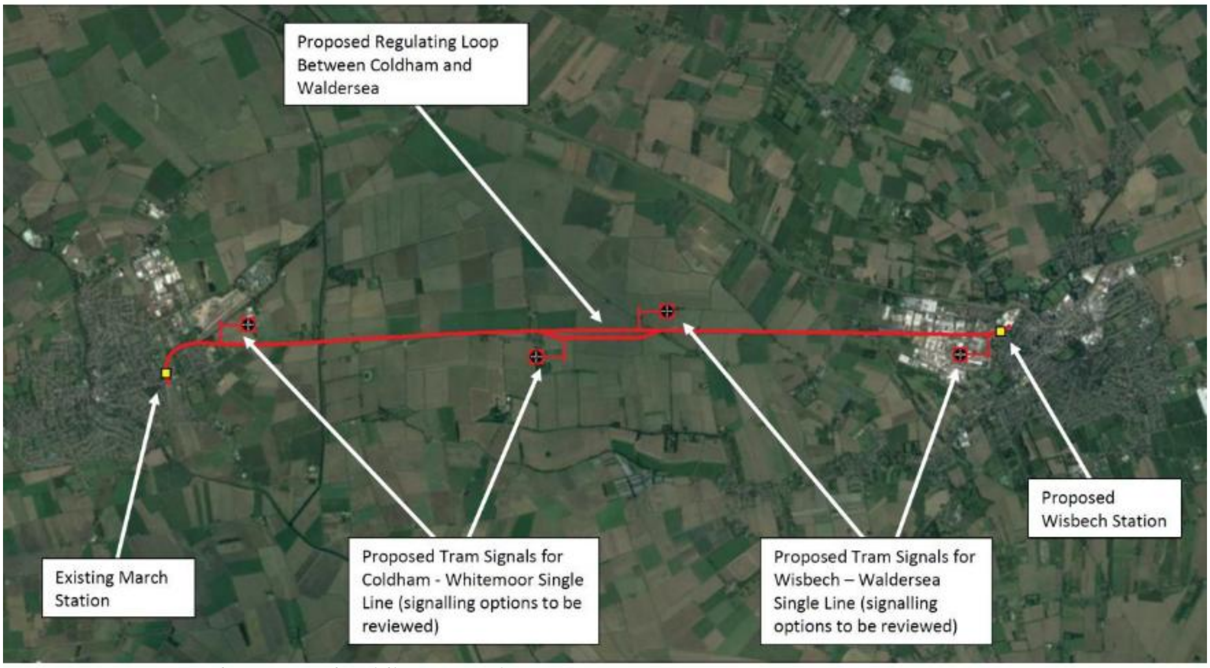


Figure 13 – Proposed Route and Coldham Regulating Loop Location

Figure 14 – Example Single Line Occupation Tramway Controls at Meadowhall Interchange, Sheffield (Source: Ian Ambrose)

Where light rail and heavy rail lines interface a signalling arrangement like that on the Tinsley Chord Tram Train connection in Sheffield is recommended. This incorporates a single main aspect signal on the approach to Whitemoor Junction. This would be designated as the transition point from light rail to heavy rail infrastructure. A corresponding train crew instruction sign would be provided in the opposing direction at the signal denoting 'Start of Line of Sight Infrastructure'. This would be the point that drivers switched to the light rail line of sight operation on the single track section. This arrangement is outlined in Figure 15.

It is recommended that an approach berth or annunciation be provided on the single line, to advise the Network Rail signaller of approaching light rail vehicles. Figure 17 outlines the simplified transition arrangements applied by the Sheffield Tram Train project. It is assumed that in this case, drivers would receive a cautionary aspect for movements towards light rail infrastructure, as is the case on Sheffield Tram Train. The ownership, operation and maintenance responsibility of the light rail infrastructure will need to be agreed. With formal boundaries established if the light rail section is not the responsibility of Network Rail.

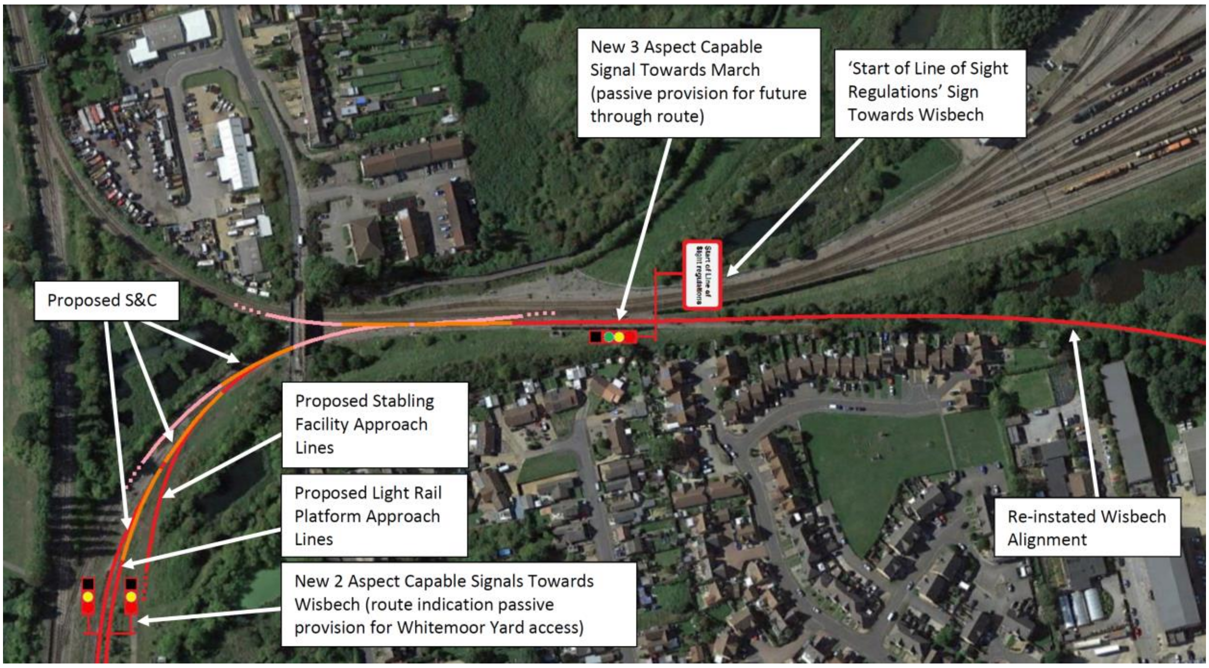


Figure 15 – Proposed March East Curve Connection

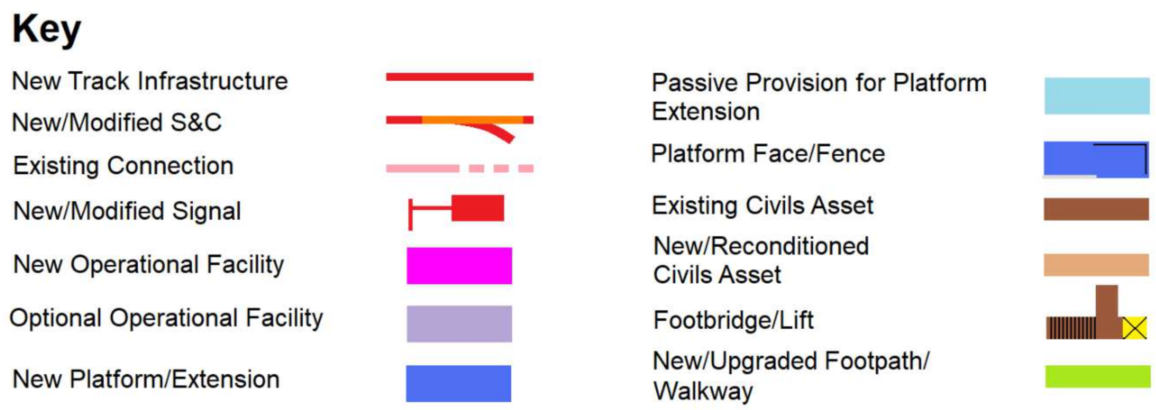


Figure 16 – Key to Aerial Image Overlay Diagrams (Figures 14, 18, 22, 24 and 25)

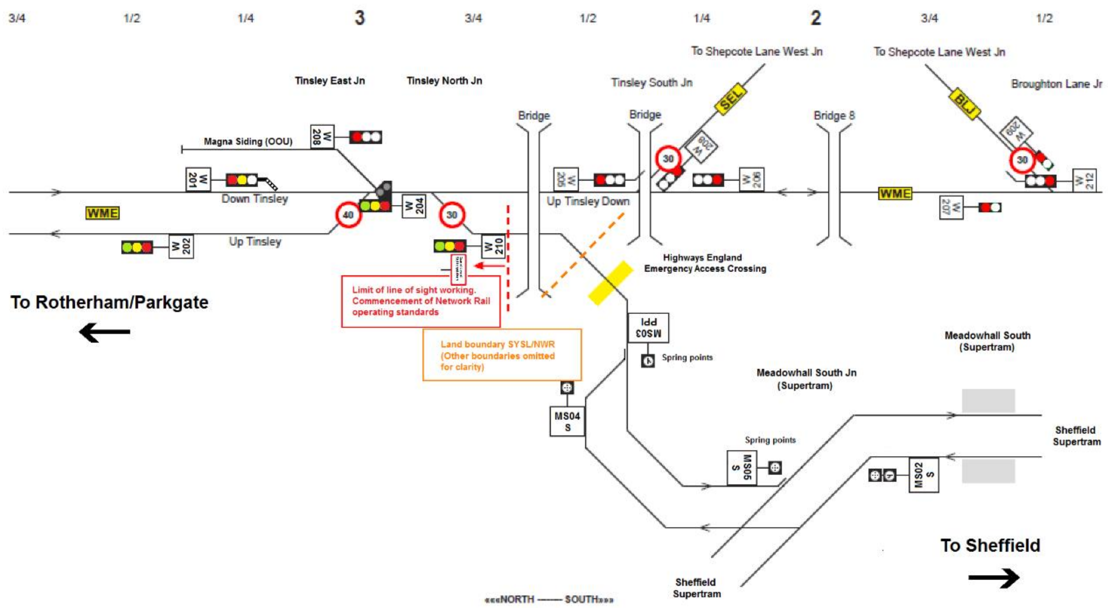


Figure 17 – Simplified Heavy Rail Interface Signalling at Tinsley Chord on Sheffield Tram Train Extension

Access to March Station is assumed to be via the existing West Curve connection to/from Whitemoor Yard. This would require limited shared running on heavy rail infrastructure, with the integrity of the interlocking providing suitable light rail vehicle separation. In addition to re-instating existing S&C towards the Wisbech alignment, a new turnout would be required from the curve towards a proposed platform and depot facility in the current disused area of March Station. Figure 18 shows the indicative layout for two platforms on the disused through alignment. Potential cost savings could be made through temporary frangible decking over the eastern end (shown in yellow), to permit passenger circulation and level access to the north side car park, without re-instating the currently disused portion of station footbridge.

Figure 18 makes provision for two platform lines; however one may be acceptable to reduce cost or align with the service specification. This would require as a minimum, full reconditioning of the current disused platform faces (dark blue) and associated remedial work to structures adjacent to circulation areas. A recent site visit noted severe deterioration in station canopies and supporting metalwork, which may require addressing separately as part of a wider package of station enhancements[5]. Passive provision is made for future platform extensions (light blue) if the business case warranted, or a single extended platform to hold up to two 35-40m vehicles. Signals shown are two aspect with route indication, however the latter may be dispensed with if only one route is to be made available towards the Wisbech branch.

The current land area north of the station site appears to be utilised by Network Rail/contractors for storage of materials and vehicle access. This may permit the optional construction of a two road stabling area for light rail vehicles, and optional maintenance shed (highlighted in pink in Figure 18). This would require re-allocation of maintenance/operational use into a smaller compound area east of the existing site. A standard Ground Position Light signal is assumed to be acceptable for such a facility in this instance

[5] Upgrade work to March station has been approved and is underway. Proposed access to the island platform needs to be confirmed

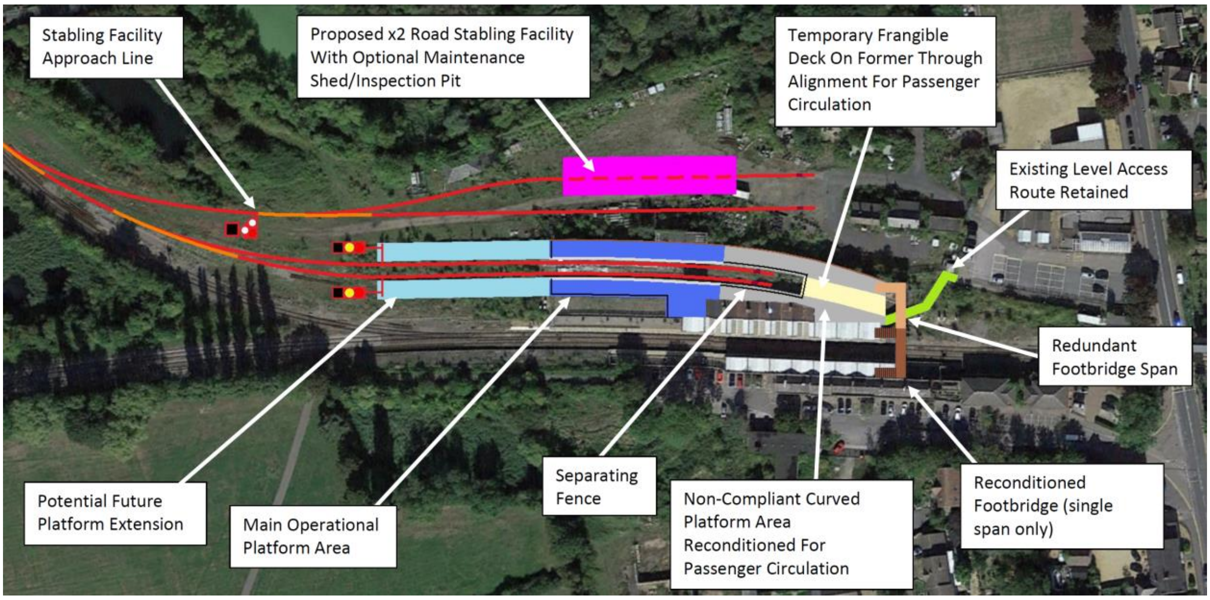


Figure 18 – Proposed March Station Terminating Platforms

Additional Requirements

Additional considerations for the proposed route include level crossings outlined separately in Section 4. Light Rail optioneering offers significant potential cost savings over heavy rail, due to the greater reliance on vehicle capability for managing road rail interfaces. Vehicles intended for tramway operation are normally fitted with track brakes, enhanced standard braking capability, improved driver visibility, and crash energy management. As such, level crossing equipment provision can be substantially reduced over equivalent heavy rail options. None of the existing level crossing equipment provided on the route would be satisfactory for a modern passenger operation, and it is proposed that each crossing be re-assessed for operation with a light rail hybrid service.

A minimum provision on tramway networks is un-signalled crossings. These simply incorporate advisory signage and assume standard road junction compliance. This may be acceptable for several of the user worked crossings on the route, however it is recommended that gates be retained for control of livestock from adjacent fields. Telephones are not normally provided on tramway crossings, however in this instance individual risk assessment may require some form of permission based crossing, in the event of frequent slow traffic/poor sighting/visibility. Technology exists to provide remote GSM-R solar powered communications to rural crossings, which may assist in improving safety without a disproportionate impact on cost. It should be noted that Signal Post Telephones are not proposed for light rail infrastructure, with all traffic based communications being managed by radio, preferably from a central control. Further detail on level crossing interventions can be found in Section 4.4.

Examples of light rail and simplified crossings are shown in Figure 19 (traffic light control interlocked with tram signal indicators) and Figure 20 (simplified light weight barriers).

Figure 19 – Standard Tramway Traffic Light Road Junction Crossing (Source: YouTube/MrCrompton 33012)

Figure 20 – Simplified Light Rail Barrier Crossing on Isle of Man Steam Railway (Source: YouTube/Perryd Pelle)

For a self-contained light rail service (March-Wisbech only) traction power is assumed to be battery. This would require as a minimum, charging points at both terminus stations, and provision of shore supply in any depot facility constructed. Two options are available for charging facilities including four foot mounted charging grids and overhead conductor bars. Currently no UK market Tram Train vehicles are equipped for four foot mounted charging grids, however the two vehicle types currently in production (Class 398 and Class 399) are both capable of overhead charging.

If a self-contained network is preferred other potential rolling stock could include Very Light Rail (VLR) vehicles. Examples such as the Revolution VLR can be provided with both battery and diesel powerpacks and are proposed to accommodate fast charging from lineside infrastructure.

5.2 Wisbech Town Centre Interchange

Option Overview

The application of light rail vehicles offers the opportunity for the service to run closer into Wisbech town centre. This would require street running to access a more central location and would potentially extend journey times beyond the assumed 20 minutes of a segregated edge of town station alignment. If the aspiration was to assume a minimum of 2, 3 or 4 tph (see section 4.1) this would require additional route capacity in the urban area to accommodate the extended journey time. Requirements for flexibility of operation, brought about by issues over service reliability/road traffic interface, may dictate a need for additional passing loops/double track infrastructure in the main route corridor.

As per the Minimum Intervention Option outlined in Section 5.1, the core route would be largely self-contained, with a signalised interface at the southern end, where the freight only line to Whitemoor connects with the Peterborough-Ely through lines at March Station. Given this limited heavy rail interface, it is assumed that the service would be implemented as a Tram Train operation, accounting for the extended street tramway interface at the Wisbech end of the route. This would also offer greater flexibility for service extension onwards from March on existing heavy rail if the business case warranted.

Proposed Infrastructure

The required infrastructure for a Wisbech town centre tramway connection would largely mirror that outlined in the Minimum Intervention Option in Section 5.1. The core route infrastructure and March Station options would be the same, excepting potential capacity based interventions associated with the operation of a street tramway service. The most notable difference is the addition of approximately 1.1 miles of unidirectional embedded rail double track street tramway between Weasenham Lane and Horse Fair Shopping centre (see Figure 21 below). This alignment has been identified as the most direct to the main shopping precinct however is only enabled by direct incorporation of the rail alignment into the existing two lane roadway.

Formal signalisation will be required at each major road junction dissected by the tramway alignment, with corresponding tram signal indicators specifically for light rail vehicle movements. There is scope for tram stops to be added along the line of route, in both high level and low level platform configuration. High level platforms offer greater flexibility for onward connection and are slightly more complex to implement in an urban environment. Space does exist in certain locations (such as land in front of the Nestlé Purina factory), where tracks could be gauntleted to provide a segregated high level platform stopping point for light rail vehicles in each direction.

One of the most significant interventions of this proposal would be the construction of a two platform terminus station at the Horse Fair Shopping Centre. This would break off from the street alignment, avoiding the Horse Fair Roundabout and terminating in the ground level of the existing Horse Fair multi-storey car park. Two platforms are assumed to be the minimum intervention in this instance due to the potential performance impact associated with street running discussed in the Option Overview.

A scissors crossover would be required to regulate traffic between the two platforms, and this would need to be clear of the active roadway, to avoid damage to the S&C. The only suitable alignment in this instance runs through part of the current Job Centre site, which would need to be partially re-developed to facilitate a segregated alignment. It is assumed that tram signals and points indicators would be installed as per standard installations for tramways in other mainland UK cities. Additional traffic management interventions, such as road traffic lights, junction stand backs and yellow box hatching would be required on the approach to Horse Fair Roundabout, to ensure adequate traffic management in an already congested part of the town.

The existing Horse Fair multi storey car park structure may not incorporate suitable vertical clearance for Tram Train style vehicles. Thus, potential partial or full reconstruction of the upper parking deck to accommodate Tram Train vehicles below may be required. Construction of buildings and car par structures above active tramways is not uncommon, and scope may exist for incorporating 'air rights' development above the station site and above the partially demolished Job Centre site.

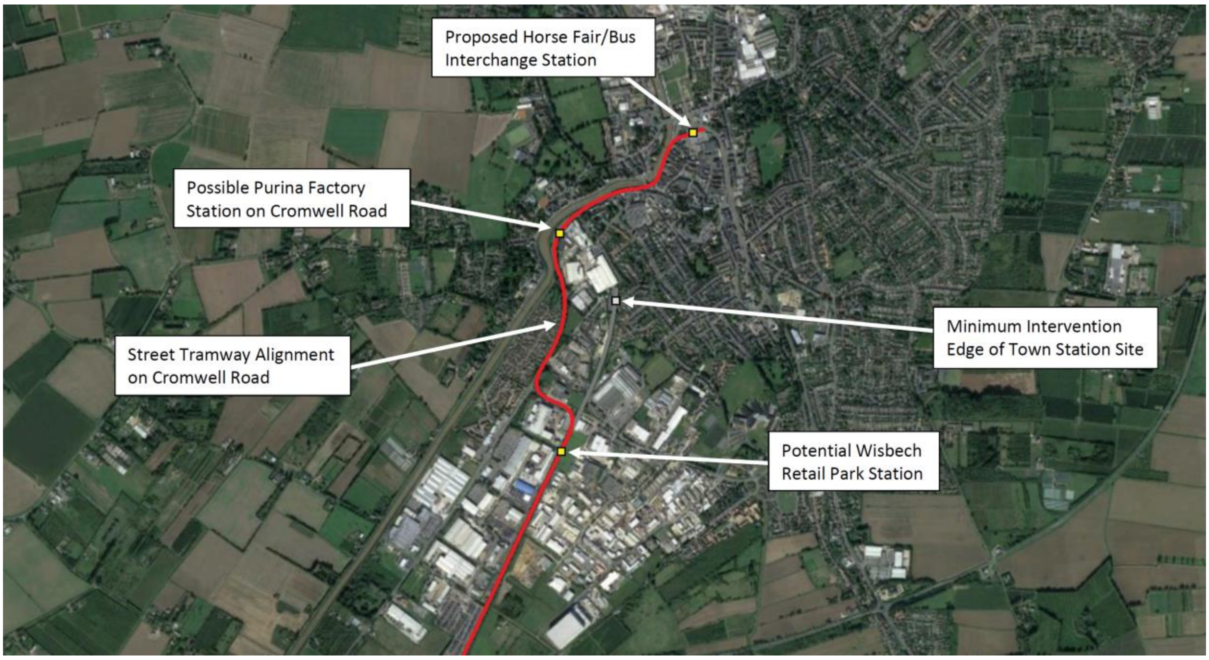


Figure 21 – Proposed Wisbech Street Tramway Route Alignment to Horse Fair Interchange

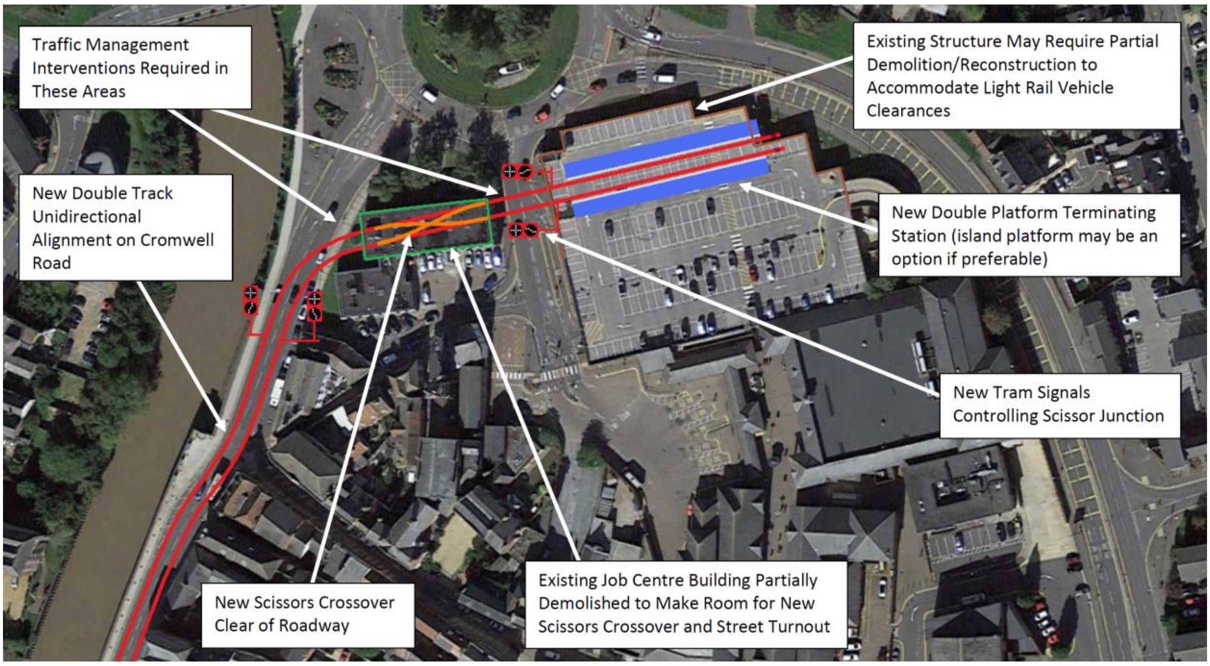


Figure 22 – Proposed Horse Fair Interchange Town Centre Station

As noted earlier in this section additional track infrastructure along the core line of route may be required, to provide enhanced service resilience for interface with a street tramway. It is assumed this would take the form of at least two regulating loops in each direction, between Chain

Bridge/Coldham South and Waldersea/Redmoor (see Figure 23 below). This would provide capacity to pass services at one third intervals along the route, and could be utilised both for contingency pathing, and future enhanced service if the demand warranted.

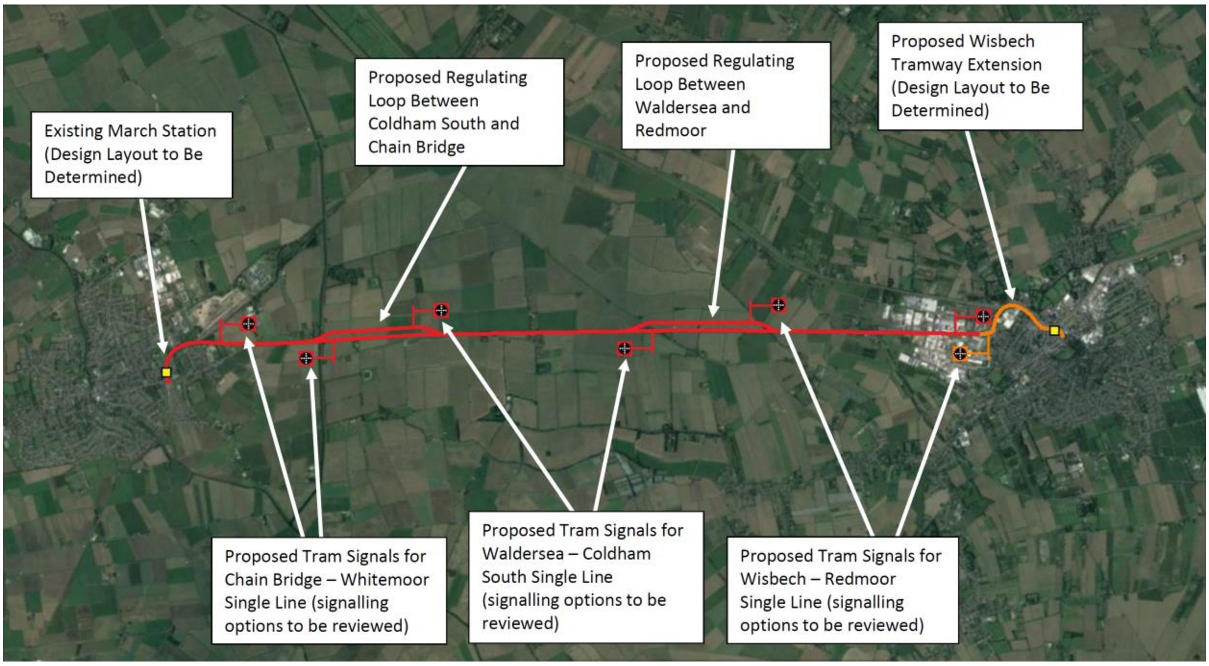


Figure 23 – Proposed Route and Chain Bridge/Waldersea Double Regulating Loop Location

Additional Requirements

Additional considerations remain largely the same for this proposal, as per the Minimum Intervention Option covered in Section 5.1. One of the key differences is anticipated to be the use of embedded rail on the street running sections of route. This would need to be taken into consideration from a procurement and installation perspective, as well as for long term maintenance of the asset. Such a small amount of a very specific infrastructure may add cost/complexity to the project, however larger combined procurement initiatives may be possible through industry organisations such as UKTram. The ownership, operation and maintenance of the on-street sections would need to be established.

Another key difference from the Minimum Intervention Option concerns rolling stock. Integration of a street tramway into the system operation requires the use of a tram or Tram Train type vehicle. For a self-contained network, some form of modified 'off the shelf' tram design may be adequate for the limited interlocking segregation proposed at the Whitemoor Junction. An example being the M5000 tram design used in Manchester. Where onward heavy rail connectivity is being considered in the long term the available option is a Tram Train

6 Future Considerations

6.1 Increase in Service Provision

Heavy Rail Connectivity Beyond March

While the client's baseline requirement is for a dedicated shuttle service between March and Wisbech there is the opportunity, and longer term aspiration, to extend the service beyond March to Peterborough, Ely and/or Cambridge. This section discusses the potential requirements at March to enable such a service extension.

As noted in Section 5 Optioneering, such service extension places a limitation on the type of rail vehicle that can be used in all feasible scenarios, namely Tram Train. Loading gauge restrictions and a lack of electrification limits any chosen vehicle to a battery hybrid option. Due to the presence of electrification on the fringes of the route (Ely-Cambridge, and Peterborough), it is recommended that consideration be given to a 25kV charging capability from overhead catenary. This does not rule out alternative ground based charging provision previously discussed, with charging grids installed in the four foot at the respective terminals. Alternative options exist for onward heavy rail operation beyond March; however these are limited to the semi segregated mode of operation outlined in the Minimum Intervention Option in Section 5.1.

March Station

An extended service enables opportunities for stabling and maintenance of Tram Train/light rail vehicles at existing depot facilities. This would avoid the stabling/maintenance facilities shown in Figure 25. Figure 25 highlights the key changes required to permit light rail vehicle access to the main running lines east of the station. It is assumed that the existing east end freight connection would remain in situ, with the platform lines being designated for Tram Train use only. This would require reconfiguration of the existing level access arrangements for the north side Platform 2.

As a minimum, this proposal recommends significant rehabilitation of the existing footbridge structure (shown in dark brown), which is not PRM compliant and in poor condition. To obtain full PRM compliance lifts would be required. This proposal recommends the construction of a new central footbridge on the site of the existing long stay car park, and former terminating bays in the central island (shown in light brown with lifts in yellow). This would provide a significant enhancement in overall station accessibility, in addition to PRM compliance, and may permit removal of the existing footbridge structure if the asset condition is poor enough to warrant[6].

More complex signalling arrangements would also be required for the new routes created, with a new single lead spur from the existing main lines connecting to up to two platform lines. In order to accommodate the new S&C on approach to the level crossing, the existing crossover S&C may require partial re-alignment to permit parallel movements. It is assumed that the platform spur would be served by an additional crossover east of the level crossing, within the limits of the existing goods loops. A minimum of two new two aspect signals would be required as starters for the proposed additional platforms, with consideration given to application of standard heavy rail overlaps. It should be noted that this would require changes to the main line interlocking along with additional indications/approach controls on signals controlling westbound movements towards the station.

The layout shown in Figure 24 covers future service provision eastbound towards Ely and Cambridge. It is recommended that consideration be given to service provision towards Peterborough. The site constraints of the existing station, and its defined location make the

[6] This may be partially resolved in the current station refurbishment programme. The plans for the footbridge need to be confirmed

question of westbound connectivity somewhat of a challenge. Figure 25 below outlines two potential proposals for a Peterborough service, with both requiring additional infrastructure intervention and potential operational compromise.

The first and most technically complex option would be for an additional spur line connecting one or more of the proposed re-instated through platforms at the western end of the station. This would require a platform reversal in March Station for services proceeding towards Peterborough. This would potentially add additional time to schedules and tie up a platform for the duration of the change procedure. The west chord would connect at the existing March West Junction, in order to utilise the existing crossover for the single lead freight curve and shorten the junction lead times on the main line. This would require enhancement to the basic proposed signalling provision, with one or more west facing signals requiring full aspect sequence and route provision.

It should be noted that while a second platform connection may be desirable in flexibility/ performance terms, this has the potential to add technical complexity/maintenance issues to the intervention. This is due to the requirement for up to two non-standard cast crossing diamonds on an existing track curve.

The second option covered in Figure 25 covers installation of a separate platform on the existing West Curve freight alignment to Whitemoor Yard (shown in blue). This would potentially free up capacity in the main station area for Cambridge services and terminating shuttles from Wisbech, while also permitting through journeys not requiring a reversal. This option would permit fewer signalling infrastructure interventions to enable a Peterborough service, with only minor alterations to the existing freight line required to install TPWS/AWS/overlaps to passenger standards. A walkway could be constructed across apparently unused land to reach the main station site, with PRM compliant access to the main station assumed to be via the proposed new footbridge structure in the centre of the site. An optional connection could also be included to Norwood Road to improve station accessibility if the business case warranted.

It should be noted that for the West Curve platform connection, standards limitations on station design may require some form of deviation or may limit application entirely. One of the key issues concerns platform stepping distances. These would be non-standard for any platform structure installed on a curve of that specific radius. It is however anticipated that any light rail vehicle used for the service would incorporate some form of retractable step system to mitigate this issue. This would render the platform unfit for use by standard heavy rail vehicles. Another standards issue to consider would be the issue of wayfinding within the station site. The West Curve is located some distance away from the main station complex, and even with a PRM compliant walking route, the location may be difficult to find for customers not used to the arrangements. Signage and wayfinding innovations can mitigate against such issues, however the distance between the two sites may be a challenge for persons with reduced mobility in general.

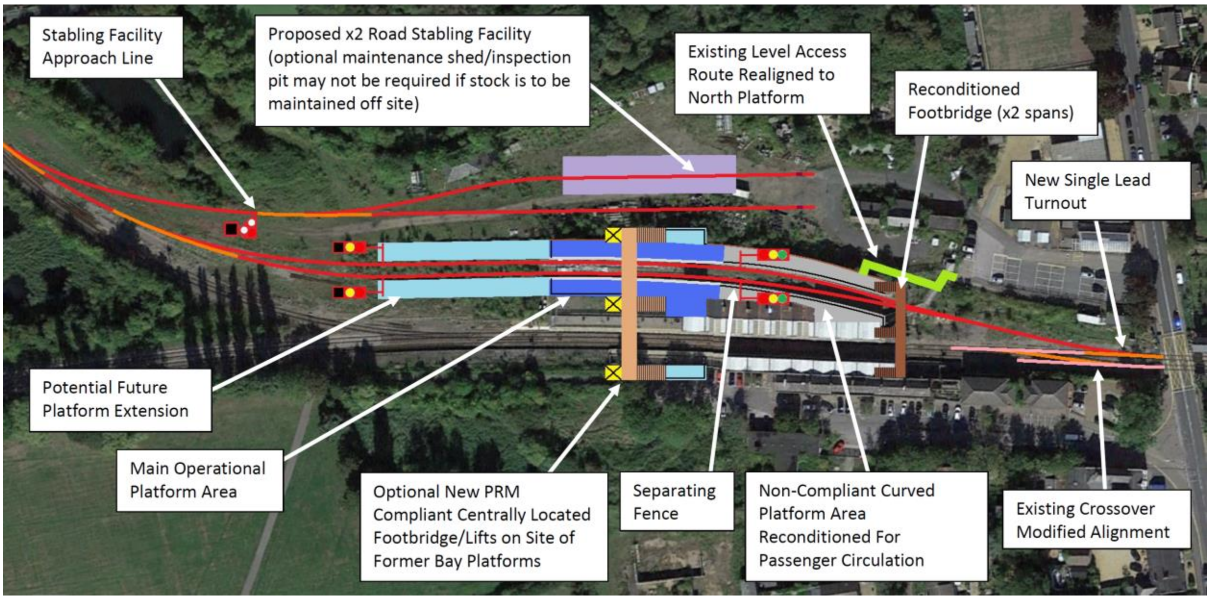


Figure 24 – Proposed March Station Additional Through Platforms

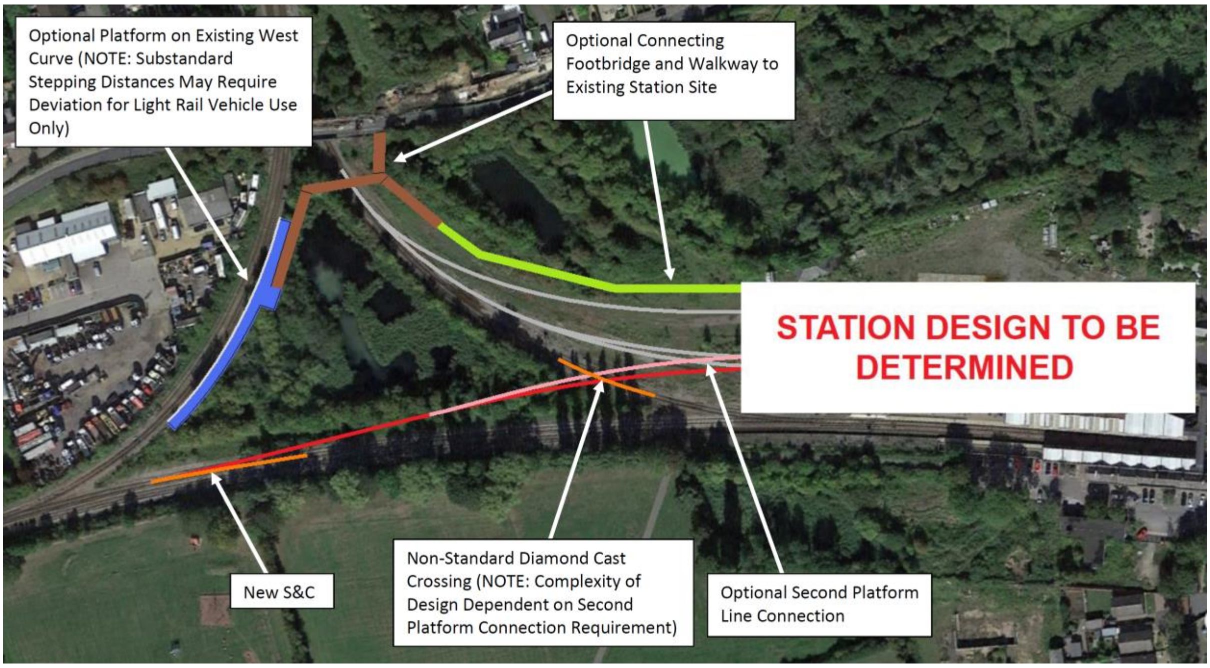


Figure 25 – Proposed March Station West End Access

Additional Considerations

A key consideration is the potential impact of the future West side Garden Town development proposed in Wisbech. The impact is currently difficult to quantify as detailed proposals are not advanced, however it is evident that passive provision for a western connection would be prudent. Figure 26 below outlines several potential high level route options, placed in the context of the detailed versions outlined in Section 5 Optioneering. From the West side Garden Town development perspective, this includes three potential routings for either a 'Y' shaped connection, separate terminating spur, or combination of the two to form some sort of 'loop' arrangement. This introduces the question of additional station stop provision on these routes and whether the business case for these would be enhanced by some additional requirement for route interchange.

It should be noted that Options 2A, 2B and 3A in Figure 26 all cover some form of tramway based street running as part of the high level proposal, limiting them to tram/Tram Train based vehicle applications. Option 1 (Core) and Option 3B do offer potential for other VLR/light rail vehicle types. This is covered with the caveat of a limitation on existing urban area penetration and does not rule out safeguarding of a segregated route through the proposed garden town district.

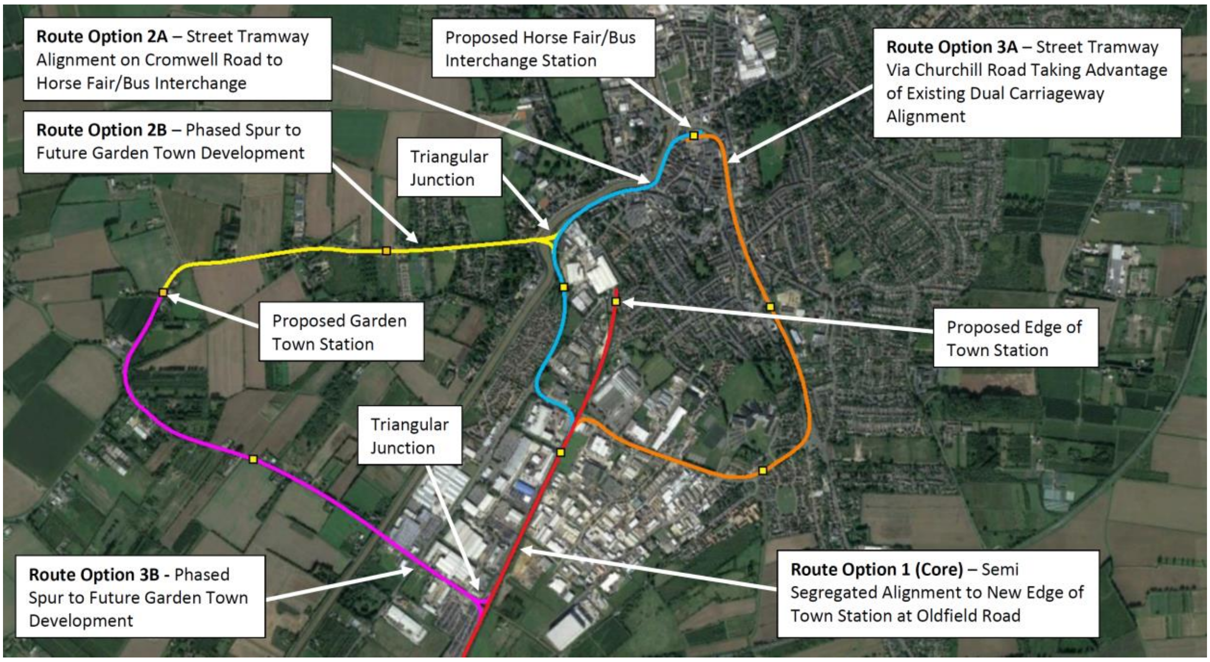


Figure 26 – Summary of Potential Wisbech Area Route Options

6.2 Heavy Rail Option

This section provides a summary of the requirements for a heavy rail solution. Its intent is to highlight the key areas of difference with the light rail options discussed elsewhere.

Operational standards and practices differ considerably between light and heavy rail systems, and this is particularly pertinent for train control and level crossings. The cheapest heavy rail option would be one that limits signalling intervention, which could be achieved through a system of One Train Working. One Train Working systems by nature are not suited to frequent passenger operations and could limit service options to hourly at best (assuming a 20 minute end to end journey time between March and Wisbech).

Adding additional capacity to a heavy rail single line would require formal signal interlocking protection where intermediate loops are provided. This could include some form of token working, or a fully track circuited single line section. Regardless, this would require provision of full heavy rail lineside signalling and supporting infrastructure such as TPWS and AWS. This in turn requires a robust signalling power supply to support system operation, along with a complex and extensive lineside cabling arrangement. There is also no guarantee that additional infrastructure would offer significant gains in capacity, due to the more stringent standards for train speeds and braking distances applied to heavy rail signalling design.

A crucial consideration when evaluating heavy rail options for route re-openings/re-instatements is the issue of level crossings. Current practice within the heavy rail sector is to seek closure/replacement of road/rail crossing interfaces where possible. Where crossings are retained as part of reopening projects, ORR best practice recommends application of full barrier crossings on main roads and/or urban/residential neighbourhoods. An example of such an arrangement is shown in Figure 25 below. There are seven active warning crossing sites on the Wisbech branch. Most are of the TMO/AOCL variety which are either considered non-preferred by modern day regulatory standards, or unsuitable for passenger service operation. There may be scope to retain the two semi-intact AHB crossings on the route, subject to suitable risk assessment. Standard practice however is currently to install MCB-OD full barrier crossings, in lieu of older automatic types. These are some of the most expensive and technically complex crossings in the national portfolio, second only to crossings equipped with remote CCTV control.

Figure 27 – Typical Full Barrier Heavy Rail Level Crossing (Source: NR Media Centre)

Additional factors to consider cover station design and construction, largely driven by heavy rail accessibility compliance. Light rail station stops are generally cheaper to build and are subject to differing design standards and guidance. Within the station fabric, integrated CIS systems, help points, station phones and TRTS. There are also end of route infrastructure requirements to consider such as heavy rail compliant buffer stops, compliant overruns, train crew walking routes and lighting. Finally, train control is an important long term requirement of any project, and where this takes place from will have a significant impact on cost, complexity and level of impact/disruption to existing infrastructure. In the case of the Wisbech Line, March East Junction Signal Box would be a reasonable assumption for initial line control. This location is however planned for future re-control into a ROC facility, and as such any signalling changes applied would need to be incorporated as part of future re-signalling schemes.

6.3 The Role of Technology

Improvements in battery technology within the last decade have enabled electric rail vehicles with practical ranges available to the mass market. Within the rail industry, VivaRail has a simple battery vehicle with a stated range of approximately 40 miles between charges. Further developments are currently in progress and an enhanced battery system with a 60 mile range is anticipated at the time of writing. Additionally, most tram manufacturers offer battery hybrid options which currently charge from the OLE, and alternatives are under consideration.

Other manufacturers are developing rail based battery systems, with Stadler leading innovation on inductive charging systems for the new MerseyRail fleet of vehicles. In parallel, infrastructure companies have been developing methods of safely delivering charging current to rail vehicles, and Furrer & Frey is known to be developing at least two of these. One is an overhead retractable charging system, currently being trialled for use on the Coventry VLR scheme, with the other being a four foot track mounted unit, currently being developed for use with the Revolution VLR vehicle.

One of the most important developments in the field of battery technology, after range, is the charging time capability. New ‘fast charging’ systems are currently being trialled or are under development in this field, with VivaRail currently offering an option for its battery vehicles capable of fully charging a unit in 10 minutes. Charging time is critical when considering service provision/options, as this greatly affects turnaround times and service recovery, in the event of disruption.

As the development of battery charging technology is moving apace with differing methods being trialled it will be important to understand the optimum solution as the vehicle and infrastructure specification is developed.

An important technological development within the rail industry relates to the future capability for interoperation of different types of rail vehicles. The current Level 2 crashworthiness standards for light rail vehicles have allowed operators like Tyne & Wear Metro/Stagecoach Supertram to run light rail services on shared infrastructure with heavy rail services. Both examples run with enhanced legacy signalling control provisions and associated safety systems ensuring traffic separation. Future developments in the field of Digital Railway technology are anticipated to bring additional flexibility to the control of legacy routes. One aspect of this covers application of ETCS operation to manage light/heavy rail vehicle separation. In effect, traffic separation on cab signalled vehicles could be ‘programmed’ based on vehicle type, with a ‘virtual buffer’ being placed around lower category light rail vehicles operating in the area. It is unclear at this stage how such technology would affect VLR vehicle operation on Network Rail main lines, however it may offer a practical/cost effective solution for limited heavy rail interfaces for future projects.

Another area of consideration is the current decarbonisation drive being promoted by the government. Rail has a potential role to play in transfer of freight. Early concepts have already been proposed for Freight VLR/Freight Tram Train vehicles, and consideration is already being given to practical routes these could be operated on. Light rail vehicles offer greater scope for urban penetration at an acceptable cost over heavy rail alternatives. Issues arise when interfacing with heavy rail main lines, and this highlights the need for effective transload capability and cargo transfer solutions. The Revolution VLR is being considered in a freight variant (see Figure 28 below).

Figure 28 – Proposed Freight VLR (Source: Transport Design International)

Further study will be needed to understand the feasibility of operating a VLR freight service on the Wisbech line, including any transhipment requirements at either end of the route.

7 Conclusion

This study has considered the suitability of light rail technology for the provision of passenger rail service between March and Wisbech. The study concludes that a light rail operation is feasible with several options of vehicle type available.

The potential vehicle options have been identified as:

- Very Light Rail
- Tram
- Tram Train
- Heavy Rail

Each vehicle option is dependent on the required service specification and influenced by the following key elements:

- Urban penetration within Wisbech town/Garden City development
- Location of Wisbech railhead
- Complexity of train control/signalling infrastructure
- Complexity of level crossing infrastructure/engineering intervention
- Provision of loops/regulating facilities within the corridor
- Station design/compatibility with existing infrastructure at March
- Cost/constructability considerations
- Onward connectivity to adjacent urban centres, e.g. Cambridge, Peterborough, etc.

Figure 29 is a summary of a comparative qualitative assessment of each vehicle option against the key elements. The RAG status provides an indication of the comparative complexity/degree of difficulty/whole system cost of each option. Note that VLR technology is at an earlier stage of development compared to the other modes. Further research is required to enable a greater level of assurance on the benefits of VLR compared to the other vehicle options.

	Tram	**Tram Train**	**Very Light Rail**	**Conventional Train**
Ability to access Wisbech town centre				
Compatibility with a future Garden Town extension				
Ability to service an edge of town Wisbech Station				
Comparative complexity of signalling control required				
Comparative complexity of level crossing interventions				
Complexity of station design/integration				
Ability to operate on the main line				
Comparative indicative capital cost				
Comparative indicative operating cost				

Figure 29: Indicative comparative analysis of possible rail vehicle types for deployment on the Wisbech to March line.

The comparative analysis indicates Tram Train as having the best potential for a light rail operation on the route. This is supported by the following key conclusions:

- The base service specification has a limited interface with heavy rail operations. This combined with the potential for a street tramway operation into Wisbech centre and the future possibility of for service extension onwards from March suggests a Tram Train would be an optimum solution.
- The number of level crossings on the route may make a full or hybrid light rail operation cheaper than a comparable heavy rail solution. Many of the current level crossing locations are considered substandard for a modern regular interval heavy rail passenger operation.
- Light rail vehicles operating on tramways are designed for highway interfaces (including track brakes and enhanced forward visibility). For these vehicles level crossing design can be optimised and the level of infrastructure required substantially reduced over equivalent heavy rail options.

The two development options outlined in Section 5 cover potential implementation of each light rail option identified, excluding heavy rail as outside the scope of this document. The Minimum Intervention option proposed in Section 5.1 is compatible with all light rail vehicle types assessed. This is due to its segregated nature and limited requirements for interoperation with heavy rail services. This would require novel operational process development and offers the most cost effective solution for enabling an initial service between March and Wisbech.

The use of any one vehicle type at commissioning should not preclude the future use of another. For example, initial deployment of a VLR vehicle would not preclude later application of a Tram Train. This assumes that a single floor height is selected for any vehicles used on the route. The Minimum Intervention option does not offer full urban penetration or connectivity with the existing bus interchange. This requires consideration of walkability of the station site from the town centre and how this and the applicable pedestrian routes are managed. This does avoid potential traffic congestion on the main north-south corridor into the town centre. It does not preclude phased development of additional light rail connections, as future travel needs are identified.

The Wisbech Town Centre Interchange option, proposed in Section 5.2 offers full urban penetration to the existing bus interchange. This is intended to take full advantage of light rail operational capability, and primarily focusses on application of a Tram or Tram Train vehicle solution. Further assessment is required of the capability of VLR technology to understand the potential of this mode to operate into the centre of Wisbech. The Tram Train option is a proven technology with the capability to operate on the main line, segregated light rail and on-street tramway routes. While this option may be more costly in initial outlay it offers greater flexibility for future system expansion.

8 Next Steps

This report has identified several actions that are recommended to be adopted as next steps in future development. These are summarised below:

Recommended Next Step 1

The legal status of all the former level crossings on the March to Wisbech line should be confirmed. Confirmation is required if the legal status needs to change if the route is to be used by light rail vehicles.

Establishing the existing rights and liabilities at each crossing will help inform the appropriate solution for each vehicle option.

Recommended Next Step 2

Options for the ownership, operations and maintenance responsibility for the route need to be identified and resolved prior to further development. This includes any on street system into Wisbech town centre or the extension to serve the Garden Town.

While Network Rail retains the freehold of the former railway alignment and associated land there are various options for the long term reinstatement of the route and service. Any extensions beyond the existing Network Rail land boundary create options for the delivery, operation and ownership of any assets.

Recommended Next Step 3

A detailed asset condition survey is required of the entire route. This will assist to confirm the level of remedial work required to reinstate any form of rail infrastructure. This survey to include March Station and the required alterations to create a fully accessible route to the Wisbech platforms.

The former railway infrastructure has not been fully maintained since the line was mothballed. A full asset condition survey will enable greater clarity on the scale and costs of any reinstatement of railway infrastructure.

Recommended Next Step 4

Continued analysis of the light rail rolling stock market and the opportunity for further development in areas such as stored energy and very light rail.

There are continuing technological developments in light rail that may provide further opportunities for the Wisbech to March route. The very light rail market is still emergent and the fully capability (and limitations) of this mode are not yet fully understood.

Recommended Next Step 5

Consider the requirements of providing a double track route between Wisbech and March.

The ability to provide a full double track route will confirm the maximum capacity of the route and determine the degree to which any future-proofing works are required should the initial phase of reopening be less than double track.

9 Appendices

Appendix A: Glossary

Acronym	Meaning
0m 00ch	Miles and Chains
ABCL	Automatic Open Crossing Locally Monitored
AC	Alternating Current
AOCL	Automatic Barrier Crossing Locally Monitored
AHBC	Automatic Half Barrier Crossing
AWS	Advanced Warning System
CIS	Customer Information System
DC	Direct Current
DfT	Department for Transport
DMU	Diesel Multiple Unit
DNO	Distribution Network Operator
EMU	Electric Multiple Unit
ETCS	European Train Control System
GRIP	Governance of Rail Investment Projects
GSM-R	Global Standard for Mobile communications - Railway
FOC	Freight Operating Company
FPC	Footpath Crossing
FTN	Fixed Telecoms Network
LRSSB	Light Rail Safety and Standards Board
MCB	Manually Controlled Barrier crossing
MCB-CCTV	Manually Controlled Barrier crossing – Closed Circuit Television
MCB-OD	Manually Controlled Barrier crossing – Obstacle Detector

OLE	Overhead Line Equipment
ORR	Office of Rail and Road
OTW	One Train Working
PRM	Persons with Reduced Mobility
ROC	Railway Operating Centre
ROGS	Railway and Other Guided transport Systems (Safety) Regulations
RSSB	Rail Safety and Standards Board
SEU	Signalling Equivalent Unit
S&C	Switches & Crossings
TfW	Transport for Wales
TMO	Traincrew Manually Operated (crossing)
TOC	Train Operating Company
tph	Trains per hour
TPWS	Train Protection Warning System
TRTS	Train Ready To Start
TSI	Technical Specifications for Interoperability
ULR	Ultra Light Rail
UWC	User Worked Crossing
VfM	Value for Money
VLR	Very Light Rail
WMG	Warwick Manufacturing Group

Appendix B: Route Level Crossing Assessment

B1 Level Crossings

This appendix provides a review of each of the main level crossings on the Wisbech line. The review is based on historic data and from a site visit conducted in June 2021. The site visit was a visual only survey of the current condition. The intent of this appendix is to provide an overview of the differing crossing types it is not a formal engineering assessment of current condition or future potential.

B1.1 Significant Road Crossing Interfaces

Elm Road Automatic Half Barrier (AHB) Crossing (WIG 86m 60ch)

This installation is located on the B1101 secondary road that runs between the Norwoodside district of March up to the Wisbech ring road. It should be noted that in this location the road name is Elm Road, however this changes multiple times on the alignment north of Friday Bridge.

An initial site assessment taken from historical imagery captured in 2018 identifies an elderly 'all in one' AHB installation, possibly from the 1970s, in poor condition. Original wooden laminate barrier arms are missing along with the entire Down side entry 'penguin' unit. The remaining incandescent light installations are in reasonable original condition. The "bomac" surface appears to have been recently removed and replaced with a patched tarmac fill. The rails remain in situ either side of the crossing with some light vegetation encroachment. Examination of imagery notes a former lineside speed sign on the Wisbech side of the crossing, denoting a former line speed of 25mph at this location.

The B1101 in this location appears in average surface condition with full road markings and standard lane width. The road has straight approaches on both sides of the crossing with street lighting either side. The road speed is 60mph at the crossing location and is bordered by a 30mph zone on the south side. Current good practice guidance for installation of new/upgraded level crossings for heavy rail project interventions, would likely recommend a full barrier MCB-OD Mk2/CCTV installation for this location as a minimum requirement. This would be subject to bridging/closure/diversion being discounted as practical options.

Figure AB1 – Elm Road Site Overview

Figure AB2 – Looking South Along B1101/Elm Road Towards March

Chain Bridge Automatic Half Barrier (AHB) Crossing (WIG 87m 31ch)

This installation is located on the B1101 secondary road that runs between the Norwoodside district of March up to the Wisbech ring road. This is north east of the Elm Road AHB crossing and intersects with an unclassified road at this location.

An initial site assessment identifies another elderly ‘all in one’ AHB installation, similar to the example at Elm Road, albeit in slightly better condition. Original wooden laminate barrier arms are partially/fully intact along with both integrated ‘penguin’ units. The incandescent light installations remain intact in reasonable original condition. The “bomac” surface also remains in situ, in remarkably good condition considering the time elapsed since abandonment. The rails remain in situ either side of the crossing with some light vegetation encroachment. This location presents a unique constraint being situated immediately next to the Twenty Foot River waterway. This restricts crossing equipment on the March side into a narrow strip between the road and riverbank, with the adjacent rail bridge running directly off the B1121 road.

The B1121 in this location appears in good surface condition with full road markings and standard lane width. The road has straight approaches on both sides of the crossing transitioning to a sharp diverging bend on the south side approximately 200m from the crossing. The road speed is 60mph at the crossing location, and lower advisory speeds may apply for the diverging bend on the south side. Current good practice guidance for installation of new/upgraded level crossings for heavy rail project interventions, would likely recommend a full barrier MCB-OD Mk2/CCTV installation for this location as a minimum requirement. This would be subject to bridging/closure/diversion being discounted as practical options.

Figure AB3 – Chain Bridge Site Overview

Figure AB4 – Looking South East Along B1101 Towards Wisbech

Coldham Traincrew Manually Operated (TMO) Crossing (WIG 89m 21ch)

This installation is located on the unclassified Station Road that connects with the B1101 at Coldham village. This is situated approximately half-way on the alignment between March and Wisbech, around 1.9 miles north of Chain Bridge AHB.

An initial site assessment identifies a former TMO crossing installation in remarkably good condition, considering the period of disuse. Both manual wooden gates and concrete posts were fully intact as of 2018, albeit somewhat overgrown. The original wooden "bomac" surface remains in situ, also in reasonable condition, with some historic light tarmac patching up to the outer sides of the rail. The rails remain in situ either side of the crossing with moderate to heavy vegetation encroachment. The Stop Boards relating to the TMO crossing operation also remain in place on their original posts. This location presents an interesting constraint being situated immediately next to residential properties in Coldham village. The two houses closest to the alignment appear to be relatively new build in comparison with other properties in the area. It is however unclear whether these sites were developed subsequent to formal route abandonment. The presence of these properties could present a restriction on development of a formalised remote/automatic crossing layout, with lights/barrier equipment possibly encroaching on their party land.

Station Road in this location appears in average surface condition, with minimal road markings and narrow lane width. Most of the markings are in poor faded condition, with the crossing stop marker on the Up side having been lost under a recent resurfacing effort. The road has straight approaches on both sides of the crossing however markings on the Down side only apply for 50m immediately before the crossing itself. The road speed on the Coldham village side is 30mph with the speed increasing to the 60mph national limit on the north side of the crossing immediately beyond the gates. Current good practice guidance for installation of new/upgraded level crossings for heavy rail project interventions, would likely recommend a full barrier MCB-OD Mk2/CCTV installation for this location as a minimum requirement due to the residential nature of the location. This would be subject to closure/diversion being discounted as practical options.

Figure AB5 – Coldham Site Overview

Figure AB6 – Looking West Along Station Road

Waldersea Traincrew Manually Operated (TMO) Crossing (WIG 90m 29ch)

This installation is located on Long Drove unclassified Road connecting Ring's End and Friday Bridge. This is situated approximately one mile north of the Coldham TMO crossing on the geographical rail alignment.

An initial site assessment identifies a former TMO crossing installation in remarkably good condition, considering the period of disuse. Both manual wooden gates and concrete posts were fully intact as of 2018, albeit somewhat overgrown. The Down side gate appears in markedly better condition than the Up side as the adjacent site is used by a heritage organisation.

The original alignment appears to have been installed with dock tramway style check rails with no "bomac" surface present. This arrangement remains in original condition however the flangeways have become degraded and blocked with debris over time. The rails remain in situ either side of the crossing with moderate to heavy vegetation encroachment north of the crossing. The south side remains clear, presumably due to intervention from the heritage operation. The Stop Boards relating to the TMO crossing operation also remain in place on their original posts. The sharp angle of this crossing could present a restriction on development of a formalised remote/automatic crossing layout, with lights/barrier equipment potentially located some distance from the actual alignment.

Long Drove Road in this location appears in average surface condition, with no road markings and substandard lane width with passing places. The road has straight approaches on both sides of the crossing however there is a slight kink on the Up side alignment, that could present a challenge for sighting unless some level of vegetation clearance was applied. The road speed is assumed to be a 60mph national limit in the absence of any other evident restriction signage. It is unclear what good practice guidance would recommend for this location, given the unclassified nature of the road and the immediate rural surroundings. As noted earlier any MCB-OD Mk2/CCTV installation at this location would require significant work to alter the alignment of the roadway and may have been one of the factors for not installing an AHB/AOCL originally. As referenced previously, any crossing control intervention would be subject to bridging/closure/diversion being discounted as practical options.

Figure AB7 – Waldersea Site Overview

Figure AB8 – Looking North East Along Long Drove Road

Redmoor Automatic Open Crossing Locally Monitored (AOCL) (WIG 92m 09ch)

This installation is located on the unclassified Redmoor Lane that runs between the South Brink district of Wisbech down to Begdale. This is approximately 2 miles north east of the Waldersea TMO crossing.

An initial site assessment identifies an elderly ABCL installation in moderate to poor condition, and with most original equipment largely intact. All four incandescent light installations remained intact as of 2018, in reasonable original condition. The original AOCL indicator lights are also intact in both directions. The "bomac" surface has been completely removed as part of recent resurfacing, with the edge kerb stones being all that remain as an outline. The rails appear to have been severed on both sides as part of this work. Beyond the severed points, the rails remain in situ either side of the crossing with some light vegetation encroachment. This location presents another unique constraint being situated immediately next to a form of drainage culvert on the north side of the crossing. This restricts crossing equipment on the Wisbech side into a narrow strip between the road and the edge of the culvert, with the adjacent rail bridge running directly off Redmoor Lane. The original REB installation is still present on the Wisbech side of the alignment however, this is not in a secure condition and appears to have been gutted of operational equipment.

Redmoor Lane in this location appears in moderate to poor surface condition with partial road markings in similar condition and narrow lane width. The road has straight approaches on both sides of the crossing. The road speed appears to be a 60mph national limit on both sides of the crossing, however the presence of residential properties in the area suggests that lower advisory speeds may be aspirational at some point in the future. Current good practice guidance for installation of new/upgraded level crossings for heavy rail project interventions, would likely recommend a full barrier MCB-OD Mk2/CCTV installation for this location as a minimum requirement. This would be subject to bridging/closure/diversion being discounted as practical options.

Figure AB9 – Redmoor Site Overview

Figure AB10 – Looking West Along Redmoor Lane

Wisbech Bypass Automatic Open Crossing Locally Monitored (AOCL) (WIG 92m 26ch)

This installation is located on the A47 Wisbech Bypass road that runs around the east side of Wisbech town. This is approximately 0.5 miles north of the Redmoor AOCL crossing.

An initial site assessment identifies the remains of another elderly ABCL installation in very poor condition, with most original equipment missing. All four incandescent light installations were missing as of 2018, with only the combination AOCL indicator light post and fittings remaining. The "bomac" surface has been completely removed as part of a recent resurfacing effort, with most traces of the original alignment being limited to a tarmac patch outline. The rails appear to have been severed on both sides as part of this work. Beyond the severed points, the rails remain in situ either side of the crossing with some moderate to heavy vegetation encroachment. The original REB installation is still present on the March side of the alignment and appears to be in a secure condition (although condition of interior components is unknown).

The A47 Wisbech Bypass in this location appears in moderate to good surface condition with full road markings, as would be expected of a major A road. The road has reasonably straight approaches on both sides of the crossing with the east side approach curving gently off to the north, without affecting sigh lines. The road speed is 60mph on both sides of the crossing, and direct observation indicates the route is used by several commercial and heavy goods vehicles. Current good practice guidance for installation of new/upgraded level crossings for heavy rail project interventions, would likely recommend a full barrier MCB-OD Mk2/CCTV installation for this location as a minimum requirement. This would be subject to bridging/closure/diversion being discounted as practical options. Given the A47's current designation, it may well be possible that a new heavy rail crossing installation would be unacceptable from a risk ranking point of view.

Figure AB11 – Wisbech Bypass Site Overview

Figure AB12 – Looking East Along A47 Wisbech Bypass

Weasenham Lane Traincrew Manually Operated (TMO) Crossing (WIG 93m 15ch)

This installation is located on Weasenham Lane unclassified Road connecting the B198 in the west to Churchill Road in the east. This is situated in an industrial estate area approximately one mile north of the A47 Wisbech Bypass AOCL crossing, on the geographical rail alignment.

An initial site assessment identifies a former TMO crossing installation in moderate to poor condition in line with the period of disuse. A single manual wooden gate and concrete posts remained intact on the Up side as of 2018. The Down side gate is missing completely, and no traces of the original post locations remain.

The original alignment crossing the roadway has disappeared completely, and there is no evidence of tarmac patching at the crossing site itself. This suggests that the road was resurfaced in its entirety at this location, since the original crossing structure was removed. The status of the rails south of the crossing is unknown due to substantial overgrowth between industrial units, however these are assumed to remain based on analysis of satellite imagery. The rails have been removed to the north of the crossing site, with only a dirt track and corrugated barrier indicating where the original alignment led. No other visible infrastructure remains, although this could feasibly be obscured by vegetation growth on the south side of the crossing.

Weasenham Lane in this location appears in average surface condition, with full road markings and standard lane width, albeit the markings are somewhat faded. The road has straight approaches on both sides of the crossing, however there is a gentle curve to the south on the Up side alignment which would not likely affect sighting. The road speed is assumed to be a 30mph limit for a built up industrial area, in the absence of any other evident restriction signage. Current good practice guidance for installation of new/upgraded level crossings for heavy rail project interventions, would likely recommend a full barrier MCB-OD Mk2/CCTV installation for this location as a minimum requirement due to the heavily commercialised/industrial nature of the location. This would be subject to closure/diversion being discounted as practical options.

Figure AB13 – Weasenham Lane Site Overview

Figure AB14 – Looking West along Weasenham Lane

B1.2 User Worked/Footpath Crossing Interfaces

Clarkes User Worked (UWC) Crossing (WIG 86m 48ch)

This location falls between Whitemoor Junction and Elm Road AHB. Analysis of satellite imagery indicates the presence of gates either side of the rail alignment and wooden crossing boards spanning the track. It is unclear if these are still actively maintained by the rail authority. The crossing appears to connect a local farm on the Up side of the alignment to adjacent fields on the Down side. The nearest identifiable landmark defined on Ordnance Survey map resources is Three Corner Cut.

Figure AB15 – Unnamed User Worked Crossing Site Overview

Sheldrach User Worked (UWC) Crossing (WIG 87m 10ch)

This location falls between Elm Road and Chain Bridge AHB crossings. Analysis of satellite imagery indicates the presence of gates either side of the rail alignment and a dirt road alignment spanning the track. It is unclear if these are still actively maintained by the rail authority. The rails appear to remain in situ. The crossing appears to connect a local farm on the Up side of the alignment to the

B1101 Elm Road on the Down side. This appears to be the primary vehicular access for Elm Tree Farm as defined on Ordnance Survey map resources.

Figure AB16 – Unnamed User Worked Crossing Site Overview

Fishers User Worked (UWC) Crossing (WIG 87m 54ch)

This location falls between Chain Bridge AHB crossing and Coldham TMO crossing. Analysis of satellite imagery indicates the presence of gates either side of the rail alignment and a dirt road alignment spanning the track. It is unclear if these are still actively maintained by the rail authority. The rails appear to be missing or buried under dirt. The crossing appears to connect a local farm on the Up side of the alignment to adjacent fields on the Down side. This appears to be secondary vehicular access for Chain Bridge Farm as defined on Ordnance Survey map resources.

Figure AB17 – Unnamed User Worked Crossing Site Overview

Ballast Pit User Worked (UWC) Crossing (WIG 88m 21ch)

This location falls between Chain Bridge AHB crossing and Coldham TMO crossing. Analysis of satellite imagery indicates the presence of gates either side of the rail alignment and a dirt road alignment spanning the track. It is unclear if these are still actively maintained by the rail authority. The rails appear to remain in situ. The crossing appears to connect a local farm on the Up side of the alignment to adjacent fields on the Down side. This appears to be secondary vehicular access for Rutlands Farm as defined on Ordnance Survey map resources.

Figure AC18 – Unnamed User Worked Crossing Site Overview

Crellins and Heads King User Worked (UWC) Crossings (WIG 89m 69ch and 90m 21ch)

These locations fall between Coldham and Waldersea TMO crossings. Analysis of satellite imagery indicates the presence of gates either side of the rail alignment and a dirt road alignment spanning the track at both locations. It is unclear if these are still actively maintained by the rail authority. The rails appear to remain in situ, although are heavily overgrown at the northernmost site. The crossings appear to connect a local farm on the Down side of the alignment to adjacent fields on the Up side. These appear to be secondary vehicular access for Fourscore Farm as defined on Ordnance Survey map resources.

Figure AB19 – Unnamed User Worked Crossings Site Overview

Co-Op No. 1 and No. 2 User Worked (UWC) Crossings (WIG 90m 42ch and 91m 00ch)

These locations fall between Waldersea TMO crossing and Redmoor Lane AOCL. Analysis of satellite imagery indicates the presence of gates either side of the rail alignment and wooden crossing boards/dirt road alignment spanning the track. It is unclear if these are still actively maintained by the rail authority. The rails appear to remain in situ at both locations. The crossings appear to connect local farms and Bet Drove on the Up side of the alignment to adjacent fields on the Down side. The nearest identifiable landmarks appear to be Lillypool House, and Jew House Cottages as defined on Ordnance Survey map resources.

Figure AB20 – Unnamed User Worked Crossings Site Overview

Crooked Bank Road and Holly Bank User Worked (UWC) Crossings (WIG 91m 32ch and 91m 42ch)

These locations fall between Waldersea TMO crossing and Redmoor Lane AOCL. Analysis of satellite imagery does not indicate gates or crossing infrastructure at either location; however the southernmost site is heavily overgrown. The rails appear to remain in situ at both locations. The crossings appear to connect local farms and Belt Drove on the Up side of the alignment to adjacent fields on the Down side. The two crossings appear to serve formally defined tracks, these being Crooked Bank and Narrow Drove respectively, as defined on Ordnance Survey map resources.


Figure AB21 – Unnamed User Worked Crossings Site Overview

Broad Drove User Worked (UWC) Crossing (WIG 91m 78ch)

This location falls between Waldersea TMO crossing and Redmoor Lane AOCL. Analysis of satellite imagery indicates the presence of gates either side of the rail alignment and wooden crossing boards spanning the track. It is unclear if these are still actively maintained by the rail authority. The rails appear to remain in situ. The crossing appears to connect local farms on both sides of the alignment along a local dirt road known as Broad Drove. The nearest identifiable landmark appears to be Whitehouse Farm on the Down side, as defined on Ordnance Survey map resources.


Figure AB22 – Unnamed User Worked Crossing Site Overview

New Bridge Lane Footpath (FPC) Crossing (WIG 92m 44ch)

This location falls between the A47 Wisbech Bypass AOCL and the Weasenham Lane TMO crossing. The site appears to be a former road alignment that was historically downgraded to permit foot/cycle traffic only. Bollards and concrete blocks have been installed to restrict vehicle access, which appear to be a recent addition, possibly installed when the rail alignment was tarmacked over. This crossing is not listed on the historical Quail map shown in Figure 2, so the downgrade may have occurred on construction of the A47 Wisbech bypass, with traffic diverted accordingly.

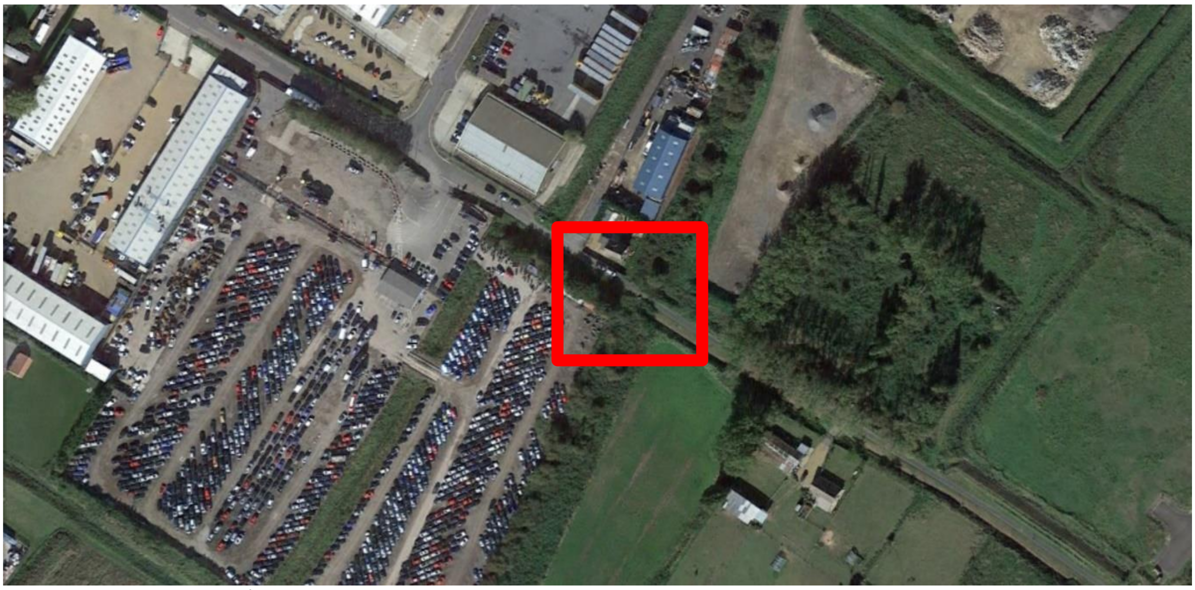


Figure AB23 – New Bridge Lane Site Overview

Figure AB24 – Looking East Along New Bridge Lane