

Infrastructure Projects

Southern



**Anglia LTPP Route Study
Stratford to Orient Way
Capacity Scheme
Pre-GRIP Feasibility Report**

19th June 2015

Issue 1.3



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Version Control

Date	Version	Originator	Checker	Comments
14 th April 2015	1.0	[REDACTED]		Draft first issue with no cost estimation.
16 th April 2015	1.1	[REDACTED]		Draft Issue with Draft Scheme Drawings, no cost estimation.
29 th April 2015	1.2	[REDACTED]		Incorporating Review Comments, no cost estimation.
19 th June 2015	1.3	[REDACTED]		Incorporating cost estimation.

Abbreviations

AC	Alternating Current
AFC	Anticipated final cost
DC	Direct Current
DN	Down
ELR	Engineer's Line Reference
GRIP	Governance of Railway Infrastructure Projects
IECC	Integrated Electronic Control Centre
km	Kilometre
kV	Kilo Volts
LTPP	Long Term Planning Process
LVAC	Low Voltage Air Conditioning
m	metres
mph	miles per hour
no.	number
NR	Network Rail
NW	Northwest
OLE	Overhead Line Equipment
RAM	Route Asset Manager
RCM	Remote Condition Monitoring
ROC	Railway Operations Centre
S&C	Switch and Crossing
SSI	Solid State Interlocking
SSSI	Site of Special Scientific Interest
SW	Southwest
TTC	Two Track Cantilever
UPS	Uninterruptible Power Source
yds	yards

1. Executive Summary

Network Rail Group Strategy has remitted Network Rail Infrastructure Projects Southern who have commissioned Civils Design Group Manchester to undertake a pre-GRIP study to identify the feasibility of providing an electrified third line to the Temple Mills lines from the country end of Stratford platforms 11 & 12 (4m 00ch) to the carriage sidings at Orient Way (5m 58ch).

Capability analysis has indicated that the currently committed CP5 West Anglia Services of providing 4 train paths per hour (tph) and an increase in North London Line services to 10tph in the peak will require consideration for the pathing of empty coaching stock (ECS) from London Liverpool Street to Orient Way carriage sidings.

A pre-feasibility study into the potential for providing a third running line connecting Stratford station platforms 11 and 12 to Orient Way carriage sidings has been investigated and potential options discussed with a view to providing the required outcome. The infrastructure at the end of CP5 has been assumed as the base case and incorporated into the options discussion of this report.

New bay platforms adjacent to the east side of platforms 11 and 12 at Stratford are in the process of development and are likely to be constructed prior to the end of CP5. The development documentation of the bay platforms has been reviewed to ensure that the capability of providing the third line can be incorporated at a future date.

In total, 6 separate options have been considered which when considered separately provide an improvement in the overall capacity of the railway between Stratford Station and Orient Way carriage sidings. The options include providing a new line on the east of the existing railway, a new line on the west side of the railway, remodel Ruckholt Road Junction, provide additional Switch and Crossing equipment at the entrance to Orient Way carriage sidings, provide a third line from Temple Mills East junction to Ruckholt Road Junction and the provision of a new crossover within Stratford Station.

The recommended option is to provide a new line on the east side of the existing railway alignment as the base case because it is believed that this option provides the most benefit to the overall capacity of the railway, however it should be noted that other standalone options should be considered in conjunction with the east alignment option to provide greater flexibility for both line capacity and line speed.

2. Background

The aim of this study is to investigate the options, feasibility and cost of the requirement to provide an electrified third line on the Temple Mills lines from the Country end of Stratford station platforms 11 and 12 to Orient Way Carriage sidings. The study will focus on the following aspects along the length of railway:

- Track layout changes required to allow a third line to be provided.
- Infrastructure enhancements and/or alterations to provide the required space for a third line.
- Line speeds to remain un-affected as a consequence of any works.
- Use of Network Rail owned land where possible and any land take required.
- Affects to existing infrastructure such as overhead line electrification and signalling.

The railway within the study area stretches from Stratford to Orient Way and is approximately 2 miles in length. The railway is overhead electrified with 25kV to all running lines and sidings. Upon departure from Stratford (4m 0000yds), Temple Mills East Junction is located at 4m 1012yds followed by Ruckholt Road Junction which extends between 5m 0154yds and 5m 0374yds. Ruckholt Road Junction is where the connection to Orient Way carriage sidings is located and the switch and crossings also form the London end of the Temple Mills Loop line which extends to Temple Mills West Junction at 5m 1650yds.

The link line from the Stratford Box on High Speed 1 to Temple Mills Eurostar Depot is located on the east side of the railway alignment from approximately 4m 0650yds onwards. The link line passes under the Temple Mills lines at 4m 0528yds and runs parallel with the lines between 4m 0650yds and 4m 1065yds before entering Temple Mills holding sidings which are on the same ground level as the Temple Mills lines.

3. Methodology

This study has been based on a desk study and a site visit (undertaken on the 24th March 2014) in order to establish an understanding of the railway line in question and to identify the existing layout of the infrastructure features on and adjacent to the railway. A number of potential options were considered and the aspects discussed in principal with the relevant leads of the following Network Rail Design Groups:

Design Discipline	Workshop Attendee	Title
Civils Design Group	[REDACTED]	Design Engineer
Signalling Design Group	[REDACTED]	Signalling Design Manager
Track Design Group	[REDACTED]	Senior Design Engineer (Track)
Electrification and Plant Design Group	[REDACTED]	Principal Design Engineer

Ordnance Survey electronic map tiles have been examined and utilised at a scale of 1:1250 covering the length of the study area to show the proposed options available to provide the third line and any alterations required to the track alignment and junction layouts.

For the purpose of the proposed third line, capability analysis have indicated that from an operational and capacity perspective the third line is of most benefit if located adjacent to the up line side of the alignment.

It is noted that the following infrastructure enhancements will have or may have taken place by the end of CP5 and therefore the works have been excluded from this engineering report although the impact of the enhancements have been considered to identify any potential efficiencies that could be developed between the different projects:-

- Stratford Station additional bay platforms adjacent to the east side of platforms 11 and 12.
- Reinstatement of shunt move operations on the Up line behind Signal S716 (LE).

Section 4 details the key issues and constraints associated with the train capacity feasibility works. It should be acknowledged that the following aspects are excluded from this report.

- Aspects of economic modelling and business case evaluations, as it will be the subject of further analysis by Network Strategy & Planning and the economic Analysis Team.
- Train modelling and performance to reflect the proposed track layout and signalling arrangements, these will be produced by the NR Capability Analysis Team.

4. Constraints

This section includes key constraints which have been considered when developing feasible options for providing the third line from Stratford to Orient Way.

4.1 Existing Route Overview

The railway within the study area stretches from Stratford to Orient way and is approximately 2 miles in length. The railway is overhead electrified with 25kV present to all running lines and sidings. Upon departure from Stratford (4m 0000yds), Temple Mills East Junction is located at 4m 1012yds followed by Ruckholt Road Junction which extends between 5m 0154yds and 5m 0374yds. Ruckholt Road Junction is where the connection to Orient Way carriage sidings is located and the switch and crossings also form the London end of the Temple Mills Loop line which extends to Temple Mills West Junction at 5m 1650yds.

Figure 4.1 is an extract from the 5 mile diagram for Stratford to Orient Way which shows the existing signal locations in relation to the junctions and siding connections along the route. The extent of the carriage sidings are not shown on the 5 mile diagram, all of which are located on the right hand side of the Temple Mills loop line.

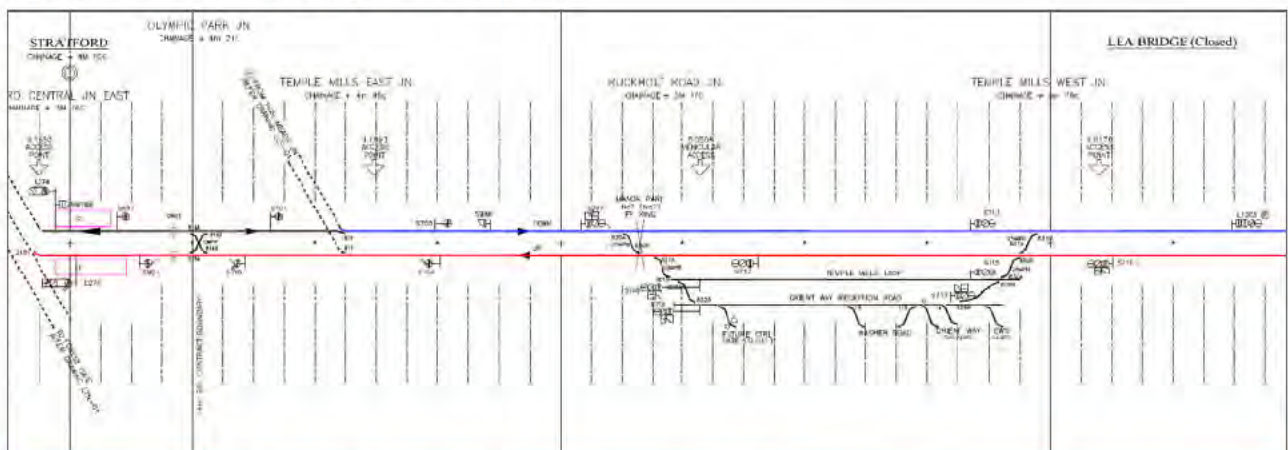


Figure 4.1 Current Stratford Station to Orient Way Layout (5 Mile Diagram)

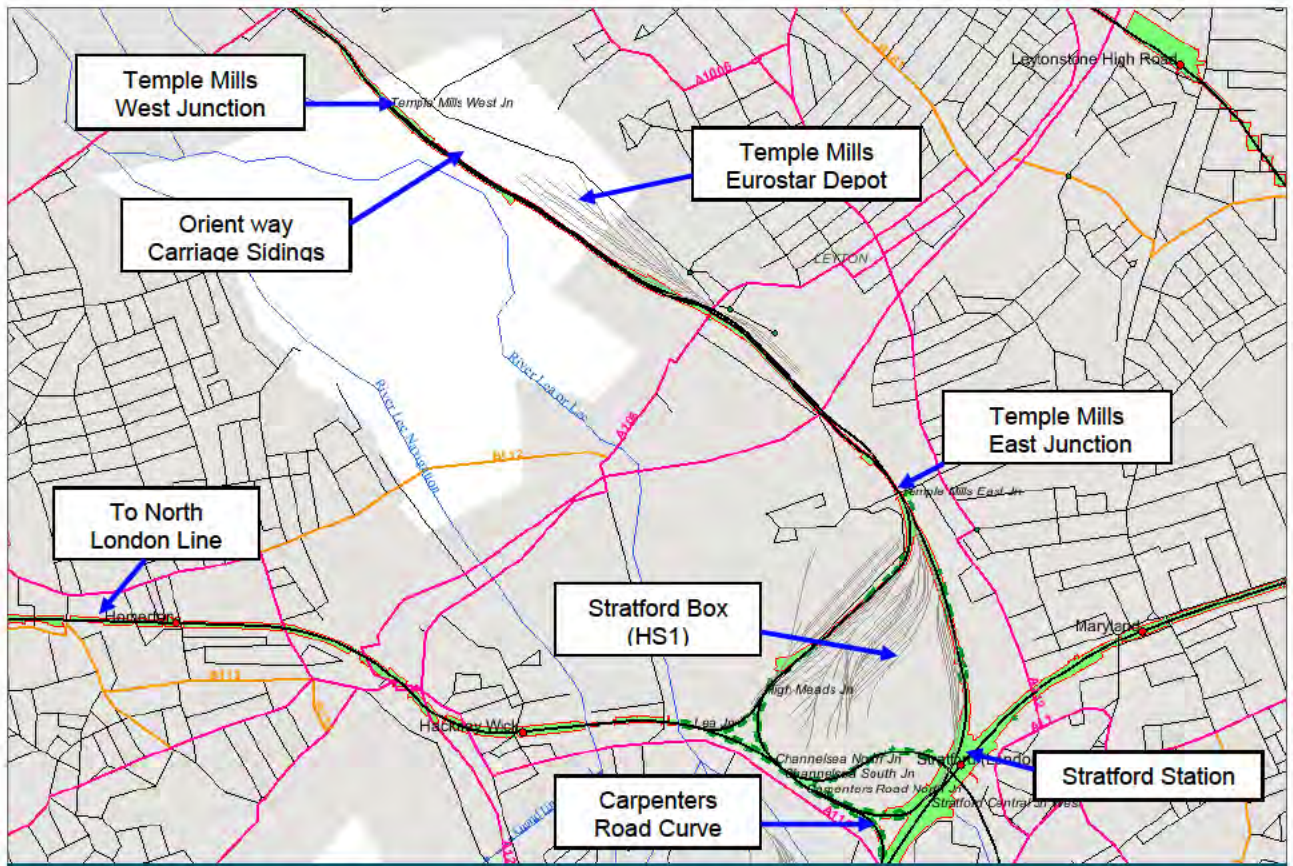


Figure 4.2 Railway Layout Between Stratford and Orient Way Carriage Sidings

4.2 Flooding Risk

National Planning Policy Guidance provides guidelines on development and flood risk. Areas assessed as having between a 1 in 100-year and 1 in 1000-year annual probability of river flooding are classified as being in Zone 2. Areas assessed as having a 1 in 100-year or greater annual probability of river flooding are classified as being in Zone 3.

The Flood Map available from the Environment Agency provides an indicative portrayal of the flood risk envelopes covering Zones 2 & 3. Figure 4.3 provides an overview of the flood risk zones along the route from Stratford to Orient Way.

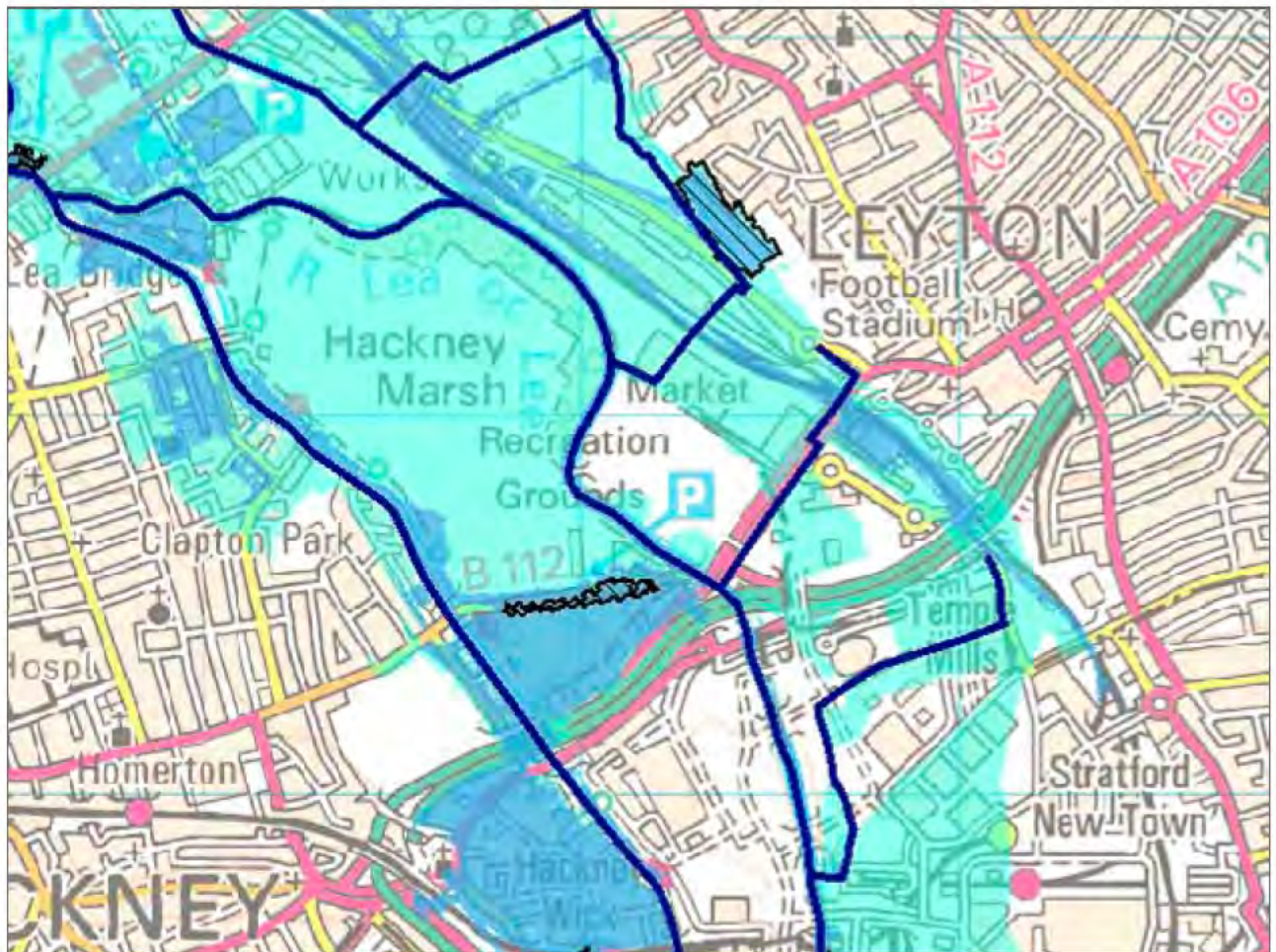


Figure 4.3 Environment Agency flood risk map for the Stratford Area

In the Stratford area, the flood plain of the River Lea encompasses the majority of the study area stretching from Temple Mills East Junction northwards. The entire area of Temple Mills Depot and the carriage sidings are located within Zone 2 flood plains. Flooding risk is not deemed to be a significant issue regarding the development of the third line to Orient Way sidings because the new line will follow an existing railway corridor which appears to be largely unaffected by flooding.

4.3 Buried/Other Services

Applications for buried services have not been made to the Buried Services team as part of the pre-grip feasibility study works. At this stage, we will assume that buried services will not affect the constructability of the third line. Satellite imagery and reference to the hazard directory provides a high level estimate of the affected infrastructure. However, further investigations at later GRIP stages may change this assumption.

4.4 Land ownership/Development

The Network Rail boundary with Temple Mills Eurostar Depot is likely to require amending to provide sufficient alignment space for the new line to be provided. This land was previously railway owned, as such it is highly likely that re-acquiring the land will be incorporated in the deeds/conditions.

The area of land on the west side of Temple Mills East Junction may be affected by the third line proposals due to the highly restrictive overbridge footprint (SDC 658) not allowing for a third line to be installed, it is likely that the land boundaries at this location will require amending to suit the proposals.

It is believed that there is a proposal to construct a new indoor ski slope near to Stratford station adjacent or above the location of the proposed additional bay platforms. Although this development will not directly affect third line proposal, the possible alignment of the bay platforms may be affected which in turn could affect the location of Olympic Park Junction.

4.5 Environmental/Heritage considerations

The GI portal website shows no environmental or heritage considerations are located within the study area.



4.6 Ground Conditions



The extent of the study area is within existing or previous railway alignment space, it is therefore considered appropriate to assume that the ground conditions will be of no impact to the proposed third line construction. It is suggested that the local ground conditions be investigated during the later Grip stages.


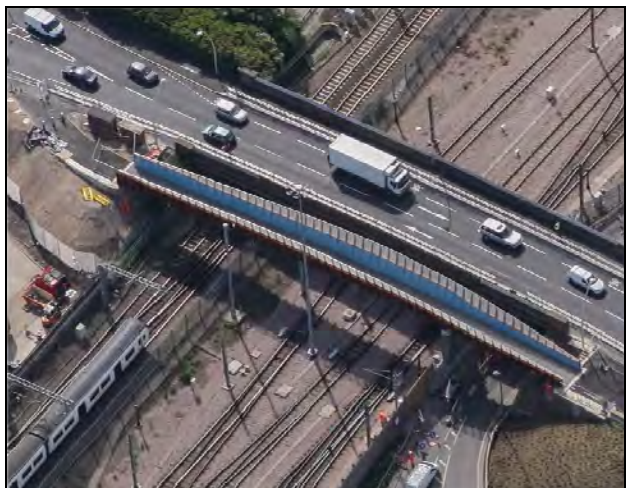

4.7 Railway Structures Overview

There are 7 No. structures within the study area which pass over the railway that may affect the potential to install a third running line adjacent to the existing two track railway. The majority of the structures have recently been rebuilt or newly installed as part of the run up to the Olympic Games in 2012. All of the new or revised structures have been built with adequate lateral clearances to allow a third running line to be provided on either side of the existing railway alignment. Structures SDC 658 and SDC 660 were not altered prior to the Olympic Games and both structures have a limited opening that will or may require amending to allow the third track to be installed. Structure SDC 658 – Temple Mills Lane has a short span length which only provides sufficient alignment space for two running lines. Due to the site constraints at the structure it will be necessary to reconstruct the railway span with a longer span if the third line is to be installed from Stratford to Orient Way (Option 5.5 avoids this issue by starting the third line to the north of Temple Mills Lane

/ Temple Mills East Junction). Structure SDC 660 – Ruckholt Road may have an opening wide enough to provide three running lines through, but this is marginal at best. This will require a detailed dimensional survey to confirm the exact opening dimensions at a later GRIP stage. If a third track does not fit through the existing opening, it will be necessary to provide a third track around the opposite side of the support pier within the Temple Mills Depot area (see picture within the table below).

Structure Identification	Comments	Structure Type	Photograph
SDC 658C Montfichet Road (Approximate Mileage – 4m 0461yds)	A relatively new structure, there is sufficient space to accommodate the third track.	Weathering Steel Girders, Concrete Deck	
SDC 658D Henrietta Street (Approximate Mileage – 4m 0788yds)	A relatively new structure, there is ample space to accommodate the third track	Weathering Steel Girders, Concrete Deck	

Structure Identification	Comments	Structure Type	Photograph Aerial View images sourced from Bing.com/maps
<p>SDC 658 – Temple Mills Lane (Approximate Mileage – 4m 1012yds)</p>	<p>Just to the north of Temple Mills East Junction, this structure will need to be reconstructed to allow for the third line. The Temple Mills Depot Line is behind the concrete wall at a lower elevation as it emerges from Stratford Box.</p>	<p>Pre-stressed Concrete</p>	
<p>SDC 658E – Temple Mills Lane Footbridge (Approximate Mileage - 4m 1036yds)</p>	<p>A single span footbridge which provides sufficient space for the third line between the abutment and the running line.</p>	<p>Weathering Steel Footbridge</p>	

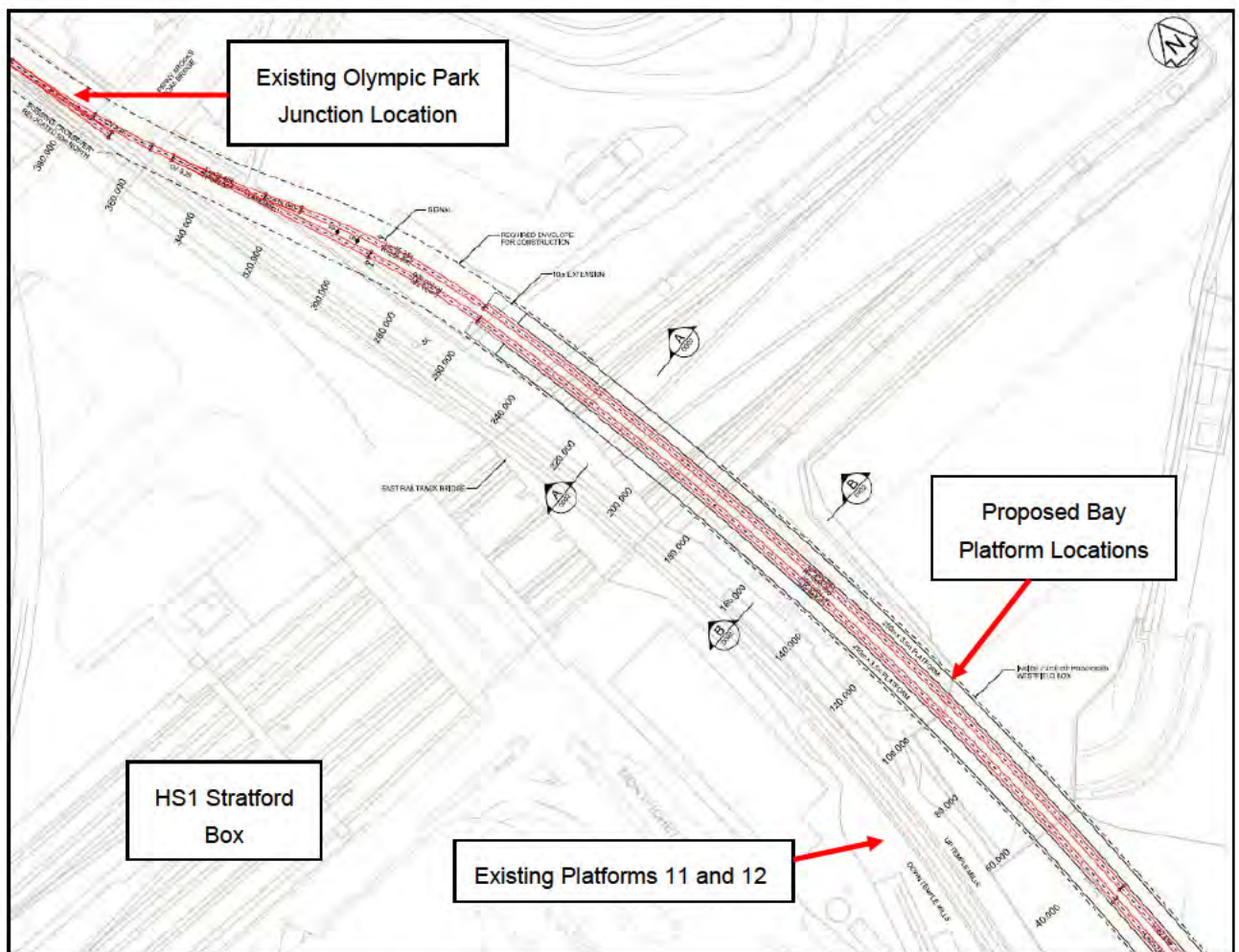
Structure Identification	Comments	Structure Type	Photograph Aerial View images sourced from Bing.com/maps
SDC 659A – A12 (Approximate Mileage – 4m 1566yds)	A relatively new structure, there is sufficient space on the west side to accommodate a third track.	Weathering Steel Girders, Concrete Deck	
SDC 660C – Ruckholt Road Footbridge (Approximate Mileage – 5m 0200yds)	A single span steel footbridge with sufficient space for a third track.	Weathering Steel Footbridge	
SDC 660 – Ruckholt Road (Approximate Mileage – 5m 0220yds)	The dimensions of the structure opening may not be sufficient for a third line, it may be necessary route the third line on the right of the pier on the right within Temple Mills Depot.	Pre-stressed Concrete	

4.8 Level Crossings

There are no level crossings present along the length of the railway within the study area.

4.9 Opportunities

The potential construction of the new bay platforms at Stratford Station between platforms 11 and 10A is proposed to connect onto the Up Temple Mills line at approximately the same location as the existing scissor cross over unit at Olympic Park Junction. The new bay platform connection will require a large degree of alteration works to the existing overhead line and signalling equipment, the opportunity should be taken to provide provision for the third line connection to the north end of the scissors and any beneficial alterations to the track alignment as part of the works.



Indicative Bay Platform Proposals at Stratford Station

The signalling at Temple Mills RRI and its lineside equipment dates from 1982 and is therefore 35 years old and approaching the end of its lifecycle. Due to the extent of the alterations required this may be an opportunity to renew the interlocking as SSI which will make it consistent with the surrounding interlockings at Stratford and Orient Way.

5. Options for Improving Capacity

Options Overview

The options being proposed for providing the third line from Stratford to Orient way carriage sidings will largely focus on the length of railway from Temple Mills East Junction to Temple Mills West Junction. The length of two track railway alignment from Stratford to Temple Mills East Junction is wide enough for an additional track to be provided on either side of the alignment and is therefore considered to have minimal impact upon the options available for the third track. The options have been divided into a number of sub options to cater for the site features and potential benefits. An overview of the sub options are as follows:-

- Third line on the east side (Up) of the alignment – Locate the third track on the east side of the railway alignment adjacent to the boundary fence of Temple Mills depot. The boundary fence with Temple Mills Eurostar Depot will require repositioning for this option.
- Third line on the west side (Down) of the railway alignment – Locate the third line on the west side of the railway alignment making use of the existing network rail boundary and provide the necessary S&C at Ruckholt Road Junction for crossing moves. However, this option provides fewer operational benefits as it will require numerous conflicting moves, therefore this option has been discounted.
- Remodel Ruckholt Road Junction and lengthen the siding reception line – Relocate the turnout on the Up line adjacent to the existing crossover between the down and up lines to reduce the time required to enter the siding reception line.
- Provide an additional S&C Unit at the Entrance to Orient Way Carriage Sidings – Connect the siding line to the Temple Mills Loop at the depot entrance to create a new loop at the depot entrance.
- Commence the third line from the North end of Temple Mills East Junction – Provide a new turn out from the up line on to the new third line and reinstate the crossover at the north end of Temple Mills East Junction between the down and up lines. This option avoids the need to reconstruct bridge SDC 658 and move Temple Mills East Junction.
- Provide a new crossover between the Down and Up Temple Mills lines at the London end of Stratford Platforms 11 & 12 to enable a parallel move into platforms 11 and 10A.

5.1 Third Line on the East Side of the Alignment

Option 1 outlines the proposal to provide a third track on the east side of the existing railway alignment from Olympic Park Junction to connect onto the existing headshunt at Ruckholt Road Junction. The new line will allow an independent running line from Stratford to Orient way carriage sidings which removes empty stock movements from the Temple Mills lines. For an indicative scheme layout, please refer to drawings SOU-141982-EAR-DRG-IAB-SOW-001-004, 141982-TRK-DRG-GA-001-P01 in Appendix B and Section 6.6, Permanent Way. From Stratford Station northwards, it is proposed that the new third line commences at the north end of Olympic Park Junction running within the bare alignment space alongside the Up Temple Mills line. Temple Mills East Junction will require relocating to the west by one track width and overbridge SDC 658 will require reconstructing with a larger span on the west side due to the proximity of the Temple Mills depot connection line to and from the Stratford box on the east side. Figure 5.1 shows structure SDC 658 and the Stratford Box connecting line in relation to Temple Mills East Junction which is located on the left of the picture.



Figure 5.1 Overbridge SDC 658 looking north, Temple Mills East Junction on the left. Eurostar Temple Mills Depot connection on the right.

The pier located between the up line and the Stratford Box connection line will require assessing to determine if there is sufficient capacity to cater for the larger span opening. Consideration should be given to reconstructing the entire bridge with a larger single span across the entire railway corridor, however the location of the London Underground Central Line tunnels beneath the structure will require confirming prior to determining the scope of work for the structure.

From the north end of Temple Mills East Junction, the existing up and down lines will require slewing to the west by one track width prior to merging back into the existing track alignment approximately 250m to the north of the junction. Slewing the track alignment will require the existing OLE cantilever support structures and S&T troughing routes relocating as part of the

works. The OLE could be supported from portal structures to improve the available alignment space as a result of the smaller foundation base sizes.

Once the Stratford Box connecting line is at the same ground level as the Temple Mills alignment, the available alignment space for the third line becomes less restrictive (See Figure 5.2). The boundary fence with the Temple Mills Eurostar depot will require moving to the east to provide the required space for the additional track. 3 No. OLE cantilever structures currently on the east side will require relocating to the west side of the alignment to make way for the new line to be installed between Temple Mills East and Ruckholt Road Junction.

Alternatively, it may be possible to slew the existing alignment to the West rather than expand the land boundary to the east. Referring to drawing SOU-141982-EAR-DRG-SOW-002 in Appendix B, the dashed blue line at the top of the railway alignment shows the potential realignment option between mileages 4m 1315yds and 5m 0035yds. Slewing the running lines to the west over the 480 yards will minimise the land take required within the Eurostar depot and make more efficient use of the available Network Rail alignment space.



Figure 5.2 View from Temple Mills Lane overbridge looking north.

Overhead electrification two track cantilever support structures are located mainly on the down side (west) of the formation between Temple Mills East and Ruckholt Road Junction, See figure 5.2.

Ruckholt Road Junction will be the approximate northern limit of the new third line with the line connecting onto the existing headshunt, see Figure 5.3. Given the current arrangement of the junction a revised junction layout would be beneficial as this would increase the line speed and simplify the operation and movement of trains in and out of the carriage sidings and loop line. Section 5.3 outlines the case for remodelling Ruckholt Road Junction in further detail.

Ruckholt Road overbridge (SDC 660) over the Temple Mills lines may only be wide enough to allow 2 no. tracks to pass through. If necessary it will be possible to fit an additional running line on the opposite side of the bridge pier to the east but this will require land take within the Eurostar Depot. Reconstruction of the bridge to provide a span of sufficient width for 3 lines should be considered if deemed more beneficial compared to routing the new line around the east side of the bridge pier.

The signalling requirements and alterations required under this option are detailed within Section 6.5, Signalling. The nature of the track works and the signalling alterations required suggest this scheme will in effect be a complete resignalling of the affected section of line between the depot and Stratford Station.

Proposed Work Elements, East Side Alignment

(It is assumed that Olympic Park Junction will have been repositioned and the signalling and OLE in the Olympic Park Junction area will be modified as part of the Stratford Bay Platform Works to allow for the future inclusion of the third track).

Proposed Work Element	Construction Discipline	Details / measurables
Adjust NR Boundary fence with Temple Mills Depot	Civils	Relocate approximately 950m of Boundary fencing along the length of the railway on the East side of the alignment.
Slew Service troughs within Temple Mills Depot	M+E	Reposition the service troughing route within Temple Mills Depot located adjacent to the boundary fencing. Approximately 800m in total.
Relocate CCTV cameras and posts.	M+E	Reposition 3 No. CCTV cameras and posts located within Temple Mills Depot sidings as part of the boundary fence works.
Third Line Track Alignment	Track	Install approximately 1 mile of new plain line track.
Reconstruct Bridge SDC 658 West Span	Civils	Reconstruct the western most span of Bridge SDC 658 with a larger span to accommodate 3no. tracks, or provide a new single span structure over all lines in the area.
Temple Mills East Junction	Track	Relocate the Junction and equipment to provide the required space for the third line to be installed.
Amend OLE support structures	E+P	Approx 25 No. existing OLE support structures will require relocating and/or converting into portal structures.
New OLE Support Structures	E+P	Provide new OLE support structures assume 20 No. Cantilever single span structures along the length of the new line.
Amend Existing OLE	E+P	Amend the location of the existing OLE wires if required and provide new wires over the new third line. Approximately 1mile in total.
Relocate Existing and provide new Signals	Signalling	Relocate 2 No. signals and provide 7 No. new signals in conjunction with the third track works.
Amend Under Track Crossings	Signalling, E+P	3No. Existing Undertrack Crossings will require lengthening to allow the required space for the third line.
Relocate Signalling Location Cabinets	Signalling	9No. Signalling location cabinets located within the wide cess area to the North of Temple Mills East Junction which are in the space required for

Proposed Work Element	Construction Discipline	Details / measurables
near Temple Mills East Junction		the repositioned down line.
Remodel Ruckholt Road Junction (Optional, see Option 5.3)	Track	Remodel Ruckholt Road Junction similar to the scenario described within Section 5.3. Relocate the S&C equipment to provide a shorter junction arrangement and remodel the junction with possibly 7 No. new point ends.
Provide new S&C at the Orient Way sidings entrance (Optional, see Option 5.4)	Track	Install new S&C equipment (2No. Point ends, 46m of track and OLE and 1 No. additional signal on the loop line) at the entrance to Orient Way Carriage Sidings to provide an additional holding loop line for trains entering and exiting the sidings. See section 5.4 for descriptions.

5.2 Third Line on the West Side of the Alignment - Discounted

Providing the third line on the west side of the railway alignment for the operation of empty coaching stock movements will require a similar proportion of works as the east side alignment option. The additional running line will be located within the existing Network Rail boundary fence for the majority of its route, with the exception of where the railway passes through structure SDC 658, Temple Mills Lane. If the new running line was to be constructed to the west of the existing running tracks, trains attempting to access Orient Way carriage sidings will have to cross over the existing up and down lines which increases the number of potential conflicting movements.

The requirement to reconstruct bridge SDC 658 and the creation of conflicting movements at Temple Mills East and Ruckholt Road Junctions results in a more restrictive operation compared to existing. This is therefore an inferior option compared to the East side alignment option and will not be investigated further at the Sponsor's request. However, as a result of the initial investigation, a sub-option has been identified whereby the existing down and up lines are slewed to the West with the empty coaching stock line located on the East. This scenario minimises land take which has been overviewed in Option 5.1. Please refer to drawing SOU-141982-EAR-DRG-SOW-002 in Appendix B, the dashed blue line at the top of the railway alignment shows the potential realignment option between mileages 4m 1315yds and 5m 0035yds. Slewing the running lines to the west over the 480 yards will minimise the land take required within the Eurostar depot and make more efficient use of the available Network Rail alignment space.

5.3 Remodel Ruckholt Road Junction

The remodelling of Ruckholt Road Junction in conjunction with the provision of an additional S&C unit at the carriage sidings entrance (see Section 5.4) will reduce the time in which a train entering the carriage sidings blocks the up line to undertake the movement. Currently such movements are allocated a 4 minute slot to undertake the crossing movement from the down line. The distance from the first turnout on the down line to the turn out on the up line is approximately 175m which includes 130m between point ends on the up line itself. If the turnout from the up line into the carriage sidings was to be positioned closer to the existing crossover between the down to up lines, the duration for an empty coaching stock train movement will be reduced further, refer to drawing SOU-141982-EAR-DRG-IAB-SOW-003 in Appendix B for a likely remodelled Ruckholt Road Junction.

Replacement of the existing switch and crossing equipment during the remodelling works should consider the provision of higher turn out speed S&C equipment of approximately 25mph to 40mph. Assuming a train length of 12 cars at 240m (262yds), the time taken for a train to cover its own distance is more than halved to approximately 15 seconds compared to 35 seconds at 15mph.

If the new line is provided from Stratford to Ruckholt Road Junction, the remodelling works are of less significance to the line capacity as the requirement to cross from the down line is removed. Rationalising the S&C equipment on and around the junction area will be of benefit to the track alignment as it will be possible to align the track to the carriage sidings as the through route in place of providing a number of turn outs to be negotiated at lower speed, see figure 5.3 the carriage siding line is located on the right hand side of the train which is occupying the Temple Mills Loop.

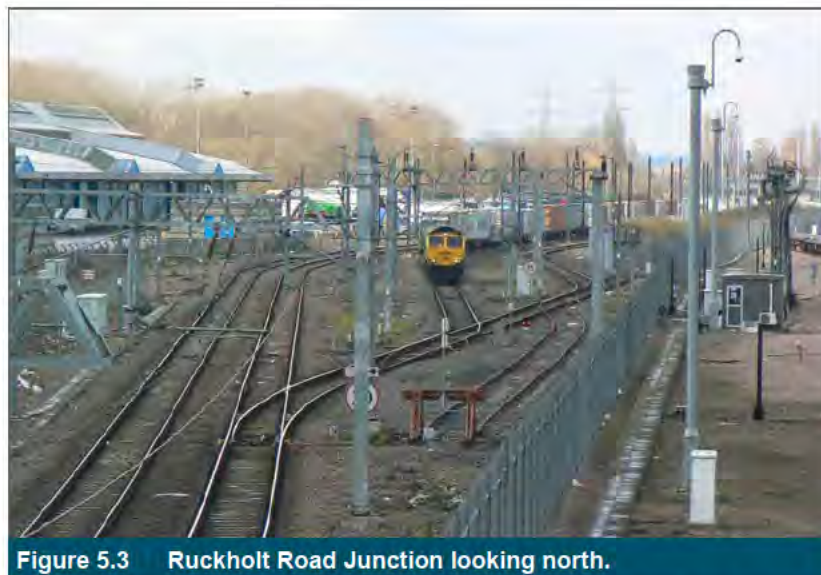


Figure 5.3 Ruckholt Road Junction looking north.

Consideration should be given to relocating Ruckholt Road Junction to be within the straight section of railway to the south of the existing junction and overbridge SDC 660. Refer to drawing SOU-141982-EAR-DRG-IAB-SOW-002 in Appendix B for a suggested relocation of the junction. The relocation will simplify the OLE aspects and also provide a longer Temple Mills loop line if Option 5.4 below is progressed.

5.4 Provide Additional S&C Unit at Orient Way Carriage Sidings

The existing track arrangement at Orient Way carriage sidings requires what appears to be an inefficient use of Ruckholt Road Junction which restricts paths for trains in and out of the carriage sidings. The adjacent Temple Mills loop line could potentially be utilised to form an additional holding line for trains in and out of the carriage sidings through the addition of a new crossover unit near to the entrance to the Carriage Sidings which will significantly improve the use of Ruckholt Road Junction, refer to drawing SOU-141982-EAR-DRG-IAB-SOW-004 in Appendix B. This will allow a train to be stabled in one of the loops prior to entering the carriage sidings or departing onto the main line whilst a second train either enters into or departs from the other loop. The additional loop line provision could be utilised in conjunction with either the east or west side options described within sections 5.1 and 5.2.

The turnout from Ruckholt Road Junction is located at 5m 0367yds and the entrance into the carriage sidings is at approximately 5m 1014yds which equates to 647yds between the two locations. The theory regarding the provision of a second loop line into the entrance of Orient Way carriage sidings allows for the flighting of empty coaching stock movements across the up line, once the end of the train is clear of the track circuits within Ruckholt Road Junction, it will be possible for the corresponding train to commence operating into the second holding loop line approximately 2 minutes sooner than was previously possible assuming 15mph running is achieved for the duration of the move.

The provision of the additional S&C near to the entrance to the carriage sidings will effectively split the Temple Mills Loop line into two sections with the resulting northern most section being approximately 500 - 450m long. The requirement to run freight trains into the loop line may affect this proposal however it will be possible to extend the loop northwards beyond Temple Mills West junction or reposition signal S715 to maximise the available loop length within the existing extents of the layout. The number and frequency of freight train movements will require confirming as it is likely that the freight movements are undertaken during the off peak periods which will have little affect upon the loop availability.

As discussed in section 5.3, the possibility of relocating Ruckholt Road Junction to the south will also provide the opportunity to limit the impact upon the length of the resulting Temple Mills Loop Line. It is likely that the resulting independent loop length could be increased to provide a 775m long loop because the new holding loops could commence further to the south of the existing turnouts within Ruckholt Road Junction. Alternatively, there is sufficient spare alignment space between the Temple Mills loop and the carriage siding line to install a completely independent additional holding loop line which maintains the existing Temple Mills Loop length.

5.5 Third Line from Temple Mills East to Orient Way

The third line proposal could commence from the north of Temple Mills East Junction where the Stratford box connecting line and Temple Mills reception sidings are at the same level as the Network Rail alignment. Temple Mills East junction could be amended whereby the crossover from the down to the up line would be reinstated to its previous position to allow access from the down line onto the new third line.

This option will likely provide less operational benefit compared to providing the third line to/from Olympic Park Junction, however the scale of the works required on the ground will be considerably reduced and therefore will be considerably cheaper to implement. Bridge SDC 658 will not require reconstructing and Temple Mills East Junction will be unaffected apart from the reinstatement of the crossover unit.

Provision of Bi-directional signalling between Stratford Station platforms 11 & 12 and Temple Mills East Junction and Ruckholt Road Junction may provide some level of benefit. The reinstatement of the cross over at Temple Mills East Junction will allow traffic from the High Meads Loop down line to access the new third line if required. The potential remodelling and relocation of Ruckholt Road Junction will also be of benefit to this option as this will provide an alternative access into the carriage sidings rather than relying solely on the connection near to Temple Mills East Junction. Trains will also be able to access the High Meads Loop up line under this option which opens up the carriage sidings to receive empty stock movements to and from the North London Line in the future if required.

Carpenters Road Curve between Carpenters Road South and North junctions and the High Meads Loop lines are relatively lightly trafficked at present. Routing some of the empty coaching stock movements via these routes could effectively utilise the lengths of railway as holding loops until the relevant paths become free to access onto the third line. This scenario would mean that the empty coaching stock movements are diverted around Stratford Station completely at little or no cost to the project.

However given the frequency of service we are looking to support (6tph in each direction for passenger) on a regular service frequency the ability to use the bi-di capability will be limited as the lines will be in fairly frequent use. Therefore line utilisation will be high. While the High Meads loop area does have low utilisation currently, the ECS would be required to travel over the Channelsea Junction which is very busy with London Overground Services from Platform 1&2 and Freight from the GEML. Transport for London also have aspirations to increase the service frequency of Overground services in both the Peak and Off-peak which has been shown to significantly constrain the ability to route ECS over this area. For these reasons, this option has not been priced at the Sponsor's request at this stage, but may be considered at future GRIP stages.

5.6 New Stratford Station Crossover

The provision of a new crossover between the Down and Up Temple Mills line at the London end of Stratford Station platforms 11 and 12 will provide the opportunity to operate a parallel move into platforms 10A and either 11 or 12. Currently it is only possible to undertake a parallel move into 10A and 12, therefore the possibility of also operating into platform 11 offers additional benefits in terms of capacity and flexibility.

The proposal to provide a crossover at the south end of platforms 11 and 12 has the following impact on signalling:

- Standage in platform 12 will be reduced by approximately 55m as L274 signal would need to be relocated in order to allow a move over the crossover reverse with a train stood in platform 12. A solution to this problem could be to extend the platform and move S697 signal northwards.
- L276 signal on platform 11 would need to move approximately 15m northwards to provide a signalled move over the crossover in the up direction and to allow a reversible move. Again this will impact on platform standage but a more detailed assessment of car stop positions and available platform length would be required.
- The crossover will fall within the overlaps of L274 and L276 signals and will therefore prevent the setting of an up direction route into platform 12 when the crossover is in use.

A parallel move over the crossover from the Down Temple Mills line with a move into platform 10A from the Down Main/Up Temple Mills line would be possible.

A crossover unit with a radius in the region of 223m will be required due to the existing track geometry in the area, refer to track drawing 141982-TRK-DRG-GA-003-P01 in Appendix B. The tight radii will result in the crossover extending into the existing operational length of platform 11 which will result in a platform lengthening scheme being required to both platforms 11 and 12.

The existing lengths of platforms 11 and 12 are adequate for 8 car trains (160m approximately). It is envisaged that 12 car trains should be catered for in the long term, as such the provision of the crossover and the new adjacent bay platforms should be designed to cater for the potential 12 car requirement at the north end of the Station.

Platform 11 will require a 87.5m extension for 12 cars and a 7.5m extension for 8 cars. Platform 12 requires a 122m extension for 12 cars and a 42m extension for 8 car train lengths. All of the platform lengthening figures allow for a 15m sighting distance from train cab to the signal, therefore the exact lengthening requirements can be adjusted to suit longer or shorter sighting distances.

6 Construction Considerations

6.1 Construction Sites

The construction site requirements associated with the provision of a new third line could be established at numerous locations along the length of route. At present there are relatively large areas of land that are not developed adjacent to the railway which offer suitable construction sites and compound areas. A site compound near the Temple Mill East Junction should be considered as there may be a requirement to undertake a large volume of works in this area.

6.2 Construction Methodology

The methodology in which the third line could be constructed will require a detailed methodology of works due to the potential affect upon the operational railway during the construction phase. Boundary fences and any services within troughing routes will require amending and relocating where necessary in the first instance to create the relevant alignment space. The overline structures along the route will require adapting or relocating where they affect the proposed third line. Upon completion of the route alignment works, the installation of the new track, new signalling, new overhead electrification and amendments to the affected junction areas can be undertaken.

6.3 Construction Programme

Each of the solutions discussed within this Pre-Grip report have their own specific requirements in relation to programme. The ability to undertake construction work during normal working hours will be of benefit to any programme for the works. Programme and phasing of the works will need to be determined in detail during the later Grip stages to provide the most efficient delivery programme.

Phasing the construction and delivery of the third line could be developed with each individual phase offering incremental benefits in capacity, for example the remodelling of Ruckholt Road Junction and the provision of additional S&C at the entrance to Orient Way sidings could be developed and delivered prior to the remaining extent of the third line being constructed. An additional sub phase could be to provide the third line to the north end of Temple Mills East Junction as per section 5.5 which further improves capacity. The final section of third line from Temple Mills East Junction to Olympic Park Junction requires the most substantial engineering works undertaking due to the requirement to reconstruct overbridge SDC 658, the relocation of Temple Mills East Junction and the associated signalling and overhead line works.

6.4 Electrical System

6.4.1 Background

The SDC (Stratford Central Junction West to Coppermill North Junction Loop) line is electrified with a 25kV AC overhead system, in common with the majority of rest of the Anglia region. It is currently electrified using the Mk3B AT OLE system.

6.4.2 Proposed OLE Alteration Works

Where, for example, a two track area is converted to three tracks, consideration will need to be given to:

- Walkout/REFOS (running edge to face of steel) to existing and new structures – this must be a minimum of 1.624m, and ideally 2.5m.
- The replacement of STC structures with TTCs (Two Track Cantilevers) or, in limited cases, portals in order to support and register the OLE for the extra track.
- The replacement of structures due to additional S&C
- The requirement of additional anchor structures in order to terminate new/extra/modified wire runs

141982-TRK-DRG-GA-001 P01

Relocation of scissors – the new scissors appear to be above/near the High Speed depot line tunnel (TRL2); it may be difficult to place any new structures (if required) in the vicinity of the tunnel, dependent on its method of construction.

141982-TRK-DRG-GA-002 P01

Proposed relocation of crossover – relocating the crossover further towards Overbridge 660 will result in extreme difficulty in wiring the proposed solution; it is recommended to move the crossover towards Temple Mills East Junction/Stratford.

6.4.3 25kV OLE Electrification

An overbridge along the length of route that requires reconstructing as part of the third line works would require physical clearance works in line with the table below, the level of route clearance provided would depend upon the long term strategy for this route if more than the minimum immediate clearance requirements are to be included.

Electrification and gauge requirements	Soffit height	Notes
Minimum bridge soffit for standard UK overhead line wire height of 4700mm and normal UK rolling	5150mm	Overhead line supported by bridge arms or other low encumbrance equipment. Use of this soffit height will degrade the performance of the overhead line (OHL), increase OHL maintenance requirements and place restrictions on track lift

stock.		tolerance for future tamping. Option not recommended.
Nominal bridge soffit for standard UK overhead line wire height of 4700mm and normal UK rolling stock.	6575mm	Free running overhead line. Use of this soffit should allow good OLE performance to be maintained and will minimise maintenance burden due to overhead electrification. Second preferred soffit height.
Minimum bridge soffit for high overhead line wire height of 5000mm required for double deck rolling stock.	5450mm	Overhead line supported by bridge arms or other low encumbrance equipment. Degrades performance and increases maintenance as for 5150mm above. Third preferred soffit height.
Nominal bridge soffit for high overhead line wire height of 5000mm required for double deck rolling stock.	6875mm	Free running overhead line. Use of this soffit should allow good OLE performance to be maintained and will minimise maintenance burden due to overhead electrification. Value derived from figure in GE/GN8573 and not directly quoted in table 9. Recommended minimum soffit height.

It should be noted that table 9 also includes a lower minimum soffit height. Use of this value would restrict the rolling stock that could use the route and might in station locations place the railway foul of the electrical safety requirements set out in BS EN 50122-1.

It should also be noted that the provision of sufficient vertical clearance for double deck stock does not in its self provide sufficient horizontal clearance for vehicles constructed to European gauging practice. Provision of sufficient horizontal clearance should be considered as a separate issue.

6.5 Signalling

The signalling descriptions and proposals for the third line relate solely to the new line being provided on the east side of the alignment due to the operational advantages achieved compared to the west side options.

6.5.1 Operational Requirements Specification

Liverpool Street IECC B controls this line via the Temple Mills Workstation. The method of signalling is TCB.

Orient Way Sidings Control Room controls the sidings via a VDU with a slot interface between Temple Mills Workstation and the sidings. Alterations would be required to Temple Mills Workstation VDU and Orient Way Sidings Control Room VDU as a result of the proposed works.

The fringe between Temple Mills Workstation and Stratford Workstation is at 4¼ miles and Stratford Workstation VDU will be affected by alterations in this area. Depending on what changes are made, alterations may also be required to the track circuit indications to Upminster NLR IECC. Signaller workload and ergonomics assessments will be required as a result.

6.5.2 Interlocking

The Temple Mills interlocking is a RRI, Stratford Interlocking is an SSI and Orient Way Sidings is an SSI. Alterations would be required to the RRI and the SSI to reflect the new signalling arrangement.

Temple Mills RRI and its lineside equipment dates from 1982 and is therefore 35 years old therefore due to the extent of the alterations required this maybe an opportunity to renew the interlocking as SSI which will make it consistent with the surrounding interlockings. The SICA for Temple Mills currently rates its condition as 2 with a renewal date of 2029. An assessment will be required to determine the existing capacity of the affected SSI. An assessment will be required of the existing TFM outputs for additional route indications on affected Stratford signals. Potentially however, this represents a substantial opportunity for the project to minimise disruptive access requirements.

6.5.3 Line Speeds

The existing line speed is a differential of 40mph for passenger trains and 30mph for freight. The aspiration for the loop is 40mph including the turnouts. However, signal spacing calculations may determine that differential speeds may be required for the new loop also. This will be investigated at future GRIP stages.

6.5.4 Capacity

The current operational headway is 3 minutes and the existing signalling is 3-aspect along this stretch of line. It is assumed that the loop and any bi-directional signalling would be 3-aspect.

6.5.5 Signal Spacing

Approximately 7 new signals would be required for the east line option. 2 existing signals (S700 & S701) will require repositioning.

Standage at S700 signal may be reduced as a result of the Stratford Bay platform works such that the longest trains foul Temple Mills East Junction. S701 is to be repositioned so that the longest trains do not foul the repositioned scissor crossover at Olympic Park Junction.

The new line is to be signalled to passenger standards, ideally signal spacing on the new line will be determined by maintaining parallel positioning with signals on the main line but this would be subject to signal sighting requirements. Signal positioning constraints suggest that holding for 2 8-car trains only will be possible on the new line.

Existing signals may require moving laterally to allow for gauge clearances to be realigned with the existing track. New signal gantries across 3 lines may be required to mount parallel signals as a result of the works. 6No. signals, including the proposed new bay platform starters, will require new or additional route indicators. Structural assessments will be required on any signal requiring additional equipment.

The proposed track layout at Ruckholt Road Junction removes the existing headshunt facility. S767 PLGS is to be relocated to a suitable position to provide the same functionality; however, its use would block the new line.

For bi-directional working on the new line a PLS providing the same functionality as S767 is to be provided on the new up direction signal that reads into the depot.

If bi-directional working on the Down Temple Mills is required then S906 LOS will need to be recovered or replaced by a PLGS.

There is an OLE neutral section at 4M 17ch but this does not appear to impact on signal positioning; however, it may be repositioned by the Stratford bay platform project.

Today there are 4, 8 and 12 car-stop boards and a LOS on the Down Temple Mills which presumably allow northbound empty stock exiting the depot at the south to depart northwards. It is assumed that this move will be required in the future.

6.5.6 Signal Sighting

New OLE structures and modifications to existing will be required to electrify the new line and careful consideration is required to ensure that they do not obstruct the sighting of new and existing signals.

New PSR boards will be required for the new turnouts and any other new change in linespeed.

6.5.7 Signal Controls

If 30/40mph turnouts can be provided then free aspects on junction signals can be provided.

New routes and route indicators will be required on S697, S901, S706 and S708 signals. New routes and route indicators will be required on the new bay platform starter signal, however it is envisaged that this element will be undertaken by the bay platform project.

AWS suppression controls will be required on the bi-directional sections.

6.5.8 Train Detection

New track circuits and alterations to existing track circuits will be required.

6.5.9 Point Operating Equipment

10 new point ends will be required – 4 single turnouts and 3 double-ended crossovers.

2 additional point ends may be required at Temple Mills East Junction to allow access for bi-directional signalling on the Down Temple Mills.

The type of track will dictate the type of point operating equipment provided but in-bearer clamp locks may be preferred.

6.5.10 Lineside Equipment

Several new location cases and new or modified cable route will be required. The relocation of existing location cases will be required to make way for the new line which may require enabling works being undertaken ahead of the track works.

An assessment of the existing power feeder will be required but it is anticipated that a new feed will be required due to the increase in electrical load. All new lineside equipment is to be ac immune due to the presence of 25kV overhead electrification.

It is proposed that all new signals are to be LED type lighting aspects. 3-track gantries or 2-track cantilevers would be required to mount parallel signals. A local assessment will be required in the later GRIP stages to determine which signal support structure is most suitable for the required locations as the available alignment space will be a key determining factor.

An assessment of the existing multi-core cables and cable route will also be required to determine if spare capacity exists.

6.5.11 Overrun Risk

The risk score of several signals will increase due to the changes in layout and increase in traffic.

TPWS fitment and careful signal positioning will mitigate any overrun risks.

6.5.12 Level Crossings

Not applicable.

6.5.13 Signalling Equipment Breakdown

The following is a high level summary of the new signalling equipment required for Option 1:

- 4 new signals + AWS (+ 2 new signals for bi-directional on the Down Temple Mills + 2 new signals for bi-directional on the new line)
- 1 new PLGS (or PLS for bi-directional on the on the new line)
- 3 new TPWS fitments (+ for 1 new signal for bi-directional on the Down Temple Mills + 1 new signal for bi-directional on the on the new line)
- 4 new route indicators on existing signals
- 3 new point ends (+ 2 for bi-directional on the Down Temple Mills)
- 12+ new track circuits (additional will be required for bi-directional working)
- 1 3-track gantry structure
- 1 2-track cantilever structure
- New location cases
- New cable route
- VDU alterations to Stratford and Temple Mills Workstations at Liverpool IECC
- RRI alterations to Temple Mills interlocking
- SSI alterations to Stratford interlocking
- Panel alterations at Orient Way Sidings Control Room (more significant for bi-directional on the on the new line)

The following is a high level summary of the new signalling equipment required for Option 3 in addition to the equipment specified for Option 1:

- 7 Point ends
- 1 new PLGS (or PLS if bi-directional provided)

The following is a high level summary of the new signalling equipment required for Option 4 only:

- 1 new Signal + AWS + TPWS fitments
- 1 new Signal + AWS + TPWS +PLS
- 1 PLGS move
- 2 new point ends
- 5 new TI21 track circuits (inc. mods to existing)
- New Location cases
- New Cable Route
- VDU alterations to Temple Mill Workstation at Liverpool IECC
- RRI alterations to Temple Mill interlocking
- SSI alterations to Stratford interlocking
- Panel alterations at Orient Way Sidings control room + alterations to slotting arrangement

The following is a high level summary of the new signalling equipment required for Option 6 in addition to the equipment specified for Option 1:

- 2 new point ends
- 2 signal moves
- Track Circuit alterations

All quantities are approximate.

6.5.14 Summary

The nature of the track works and the signalling alterations required suggest this scheme will in effect be a complete re-signalling of the affected section of line between the depot and Stratford Station.

This may be an opportunity to renew the interlocking as a CBI.

There is separate Temple Mills Run-round scheme at the north end of the depot that is about to commence but it is understood that the capacity scheme will not affect these works.

6.6 Permanent Way

6.6.1 Third Line on the East Side of the Alignment

This option is shown on drawings 141982-TRK-DRG-GA-001 and 141982-TRK-DRG-GA-002. Excluding any remodel of Ruckholt Road junction, the loop in its simplest form is comprised of 2 No. turnouts, one at each end of the loop and approximately a mile of plain line. At Ruckholt Road Junction, drawing 141982-TRK-DRG-GA-002 shows additional S&C as discussed in section 6.1.3 below.

Providing the additional line on the East side of the current railway allows the line to pass Temple Mills East Junction without creating any conflict with other services using the High Meads Loop lines. Trains will also be able to directly enter Orient Way carriage sidings.

In order to locate the loop line Temple Mills East junction would need relocating approximately 2m to the West. Depending on the condition of the existing S&C it may be possible to reuse the existing junction, although it is likely that a full renewal of the double junction would need to be included. There may be an opportunity to align this with the route renewals strategy.

For construction it is envisaged that the plain line for the loop and the S&C at each end would be laid using standard track relaying plant from the adjacent track. It is likely that this could be done in stages through a standard possession regime.

The maintenance requirements for the route will be increased due to the increase in the track asset. This would be additional patrolling of the plain line and inspection of the two new loop turnouts. Consideration should be given to future access to the track asset as introducing a third track will remove or reduce the current position of safety along the route.

6.6.2 Third Line on the West Side of the Alignment.

As with the option for the East side of the alignment, the loop in its simplest form is comprised of 2 No. turnouts, one at each end of the loop and approximately a mile of plain line.

At Ruckholt Road Junction trains would need to cross the Up and Down Temple Mills lines to enter the carriage sidings. This could be done using the existing crossover at Ruckholt Road Junction.

Providing the additional line on the West side of the current railway not only creates a conflict at Ruckholt Road Junction where trains have to cross the main lines into the carriage sidings but it also introduces a conflict at Temple Mills East Junction. The High Meads Loop lines leave the Temple Mills lines to the West so any new loop line would need to cross the High Meads Loop lines. This could either involve a grade separation scheme or 2 No. additional diamond crossings. Using diamond crossings would provide a conflict between trains using the loop and the High Meads Loop lines. This would not only place a constraint on train pathing but would also introduce a collision risk that is not present if the line is constructed to the East. For these reasons, this option has been discounted.

For construction it is envisaged that the plain line for the loop and the S&C at each end would be laid using standard track relaying plant from the adjacent track. It is likely that this could be done in stages through a standard possession regime.

The maintenance requirements for the route will be increased due to the increase in the track asset. This would be additional patrolling of the plain line and inspection of the two new loop turnouts and diamond crossings. Consideration should be given to future access to the track asset as introducing a third track will remove or reduce the current position of safety along the route.

6.6.3 Additional S&C at Orient Way Carriage Sidings.

The additional crossover is shown on drawing 141982-TRK-DRG-GA-002. This comprises of 2 No. S&C units.

For construction it is envisaged that the S&C could be laid using standard track relaying plant. It is likely that this could be done in stages through a standard possession regime.

The maintenance requirements will be increased due to the increase in the track asset. There would be additional inspections of the new S&C. One of the units is located on Network Rail infrastructure whilst the other is located within the carriage sidings so the maintenance liability will be split between Network Rail and the carriage siding owners.

6.6.4 Remodel Ruckholt Road Junction.

The additional S&C is shown on drawing 141982-TRK-DRG-GA-002. This comprises of 5 No. S&C units, excluding the two discussed above, to complete the arrangement to obtain the benefits as described in section 5.3.

For construction it is envisaged that the S&C could be laid using standard track relaying plant. It is likely that this could be done in stages through a standard possession regime.

The maintenance requirements for the route will be increased due to the increase in the track asset. This would be additional inspection of the new S&C. Some of the S&C will fall within the carriage sidings so the maintenance liability will be split between Network Rail and the carriage siding owners. The exact split of this additional maintenance will depend on the agreement of land boundaries.

6.6.5 Third Line from Temple Mills East to Orient Way.

This is a sub option of providing the additional line on the East side of the railway. Excluding any remodel of Ruckholt Road junction, the loop in its simplest form is comprised of 2 No. turnouts, one at each end of the loop and approximately 1100 yards of plain line.

For construction it is envisaged that the plain line for the loop and the S&C at each end would be laid using standard track relaying plant from the adjacent track. It is likely that this could be done in stages through a standard possession regime.

The maintenance requirements for the route will be increased due to the increase in the track asset. This would be additional patrolling of the plain line and inspection of the two new loop

turnouts. Consideration should be given to future access to the track asset as introducing a third track will remove or reduce the current position of safety along the route.

6.7 General Items

6.7.1 Network Change

Network change will be required for the track work layout/configuration alterations and/or changes to the existing published line speed profile.

6.7.2 Impact upon existing maintenance arrangements

All options considered will result in a net increase in infrastructure that requires to be maintained in the long term.

6.7.3 Operational restrictions (gradients, gauge, RA, line speeds)

Track gradients and gauge clearances have not been investigated at this stage of the development. It is understood that all options suggested will have no impact upon the existing gradients or gauge clearances.

6.7.4 Lead RAM buy-in? Providing supporting comments

The Lead RAM for the Stratford to Orient Way capacity scheme will provide comments within the subsequent GRIP stage to determine which option will be progressed to the design phase.

6.7.5 Considerations and assessment of impact on performance

The impact upon performance will be determined in the subsequent GRIP stages.

6.7.6 Timescales

Estimated timescales for this scheme are shown below. The project timescales will depend on the option progressed and the figures below should be verified upon project progression.

- GRIP 0-3: 9 months
- GRIP 4-5: 12 months
- GRIP 6-8: 24 months

7 Risks and Assumptions

The major risks and assumptions for this project are listed below:

- Boundary line alterations at the interface with Temple Mills Eurostar Depot may introduce unknown risks due to the security measures currently on site.
- Services and security camera equipment located within Temple Mills Eurostar Depot requiring diversion.
- Reconstruction of the pre-stressed overbridge SDC 658, Temple Mills Lane may require the complete replacement of the structure rather than just increasing the size of the west span opening.
- The location of the London Underground tunnels in the vicinity of overbridge SDC 658 will require confirming as prior to determining a scope of works for the structure.
- Affects to existing signalling and telecommunication equipment during the construction phase of the works will require consideration.
- Track drainage and water course culverts may affect the design of the revised junctions and new OLE support structure locations.
- Third party land ownership preventing enhancements to the railway.
- Timetable implications for rail services and future timetable aspirations.
- Lack of available possessions or short notice cancellations to allow the line to be upgraded.
- Costs for changing interlocking.
- Line capacity following the introduction of new services operating from the new Stratford Bay platforms will require assessment.
- Pedestrian interface during the construction works.
- Impacts upon the local road network during construction especially associated with the potential reconstruction of overbridge SDC 658.
- Development of the former Olympic village area may result in a more restricted working environment with limited access.
- The development of the additional Stratford Bay platforms may affect the relevant signalling and track alignment at Olympic Park Junction adding further cost to the third line proposal.
- Stratford Box to Temple Mills connection line tunnel infrastructure may affect the location of the revised railway alignment at Olympic Park junction due to the presence of tunnel drainage inspection and pump chamber access points.

8 Conclusions and Recommendations

8.1 Costs

8.1.1 Capital Costs

Based on the options discussed in this report, and on the known data obtained from the desk study, the cost estimates for the capital funding of the discussed options are shown below;

Option	Costs (£)
Option 1 – New Line on the East Side	£ [REDACTED]
Option 2 – New Line on the West Side	Not Costed
Option 3 – Remodel Ruckholt Road Junction	£ [REDACTED]
Option 4 – Provide Additional Crossover	£ [REDACTED]
Option 5 – Reduced Length of New Line	Not Costed
Option 6 – New Crossover At Stratford	£ [REDACTED]

8.1.2 Whole Life Costs

Whole life costs will be established in the later GRIP stages as part of the detailed option selection process. This may include development of indicative maintenance plans for the revised track layouts and associated structure maintenance requirements.

8.2 Technical Feasibility

Providing an additional running line between Stratford Station and Ruckholt Road Junction is technically feasible utilising various options to achieve the required outcome. The exact option in which the third track could be provided will become more apparent within the later Grip stages of the works.

8.3 Network Operations

The new third line will provide additional capacity between Stratford Station and Orient Way carriage sidings which potentially removes a large proportion of conflicting movements within the Stratford area. The provision of future train services operating from the proposed Stratford Bay

platforms will add to the capacity constraints along the length of the railway which potentially provides further justification for providing the third line.

8.4 Economic Viability

The Business Case has yet to be determined. This should be determined once the cost benefit analysis has been completed.

8.5 Discounted Option

The new third line on the west side of the alignment option has been discounted as not a feasible option on the basis that operationally it will be very restrictive. The number of conflicting movements created as a result will be greater than is currently the case due to the requirement to cross two running lines rather than one.

8.6 Recommended Option

The option which is believed to offer the most benefit in terms of capacity creation for the movement of empty coaching stock to Orient Way carriage sidings is Option 1. Option 1 comprises the establishment of a new third line from the north of Olympic Park Junction to the interface with Ruckholt Road Junction. The possibility to include Options 3, 4 and 6 as part of the works provides further capacity flexibility along the length of railway. The anticipated benefits for constructing the new line and reconfiguring existing junction arrangements comprise the following:


- Full operational flexibility in the Stratford area because stock will be able to access the new line from Stratford Station and the High Meads Loop line.
- Temple Mills East Junction could be reused and slewed to the west by one track width.
- Alterations to the existing OLE TTC's will be similar in number compared to the shorter new line (Option 5) which commences to the north of Temple Mills East Junction, assuming that the relocation of Olympic Park Junction as part of the bay platform works considers the possible inclusion of the third line.
- Slewing the down and up lines to the west side of the alignment between Temple Mills East and Ruckholt Road Junction removes the land take requirement associated with the new line on the east side of the alignment.
- Relocating Ruckholt Road Junction to the straight section of track to the south of its current location will improve the speed of trains over the junction and also shorten the length of the junction.
- The High Meads Loop line and Carpenters Curve could be utilised as holding loops to remove stock from the main lines and from having to pass through Stratford Station by utilising Ruckholt Road Junction.
- Relocating Ruckholt Road Junction will simplify the OLE arrangement compared to the existing situation because the S&C will no longer be located under a bridge with a restricted structure opening.

- Installing a new crossover between the carriage sidings line and the Temple Mills Loop line near to the depot entrance will provide an additional holding siding which should improve the flow of trains in and out of the depot.
- The revised Temple Mills Loop line could be configured to provide the same operational requirements for freight train run rounds and also remove the requirement for the locomotive to operate on the main lines as it may be possible to use the carriage siding line.
- The revised Temple Mills Loop line could benefit the operation of ECS to access and exit the carriage sidings from the north if the need requires in the longer term as it will be possible to utilise Temple Mills West Junction.
- Providing the new crossover at the London end of Stratford Station platforms 11 & 12 provides the opportunity to operate trains into platforms 10A and 11 or 12 at the same time from the London direction.

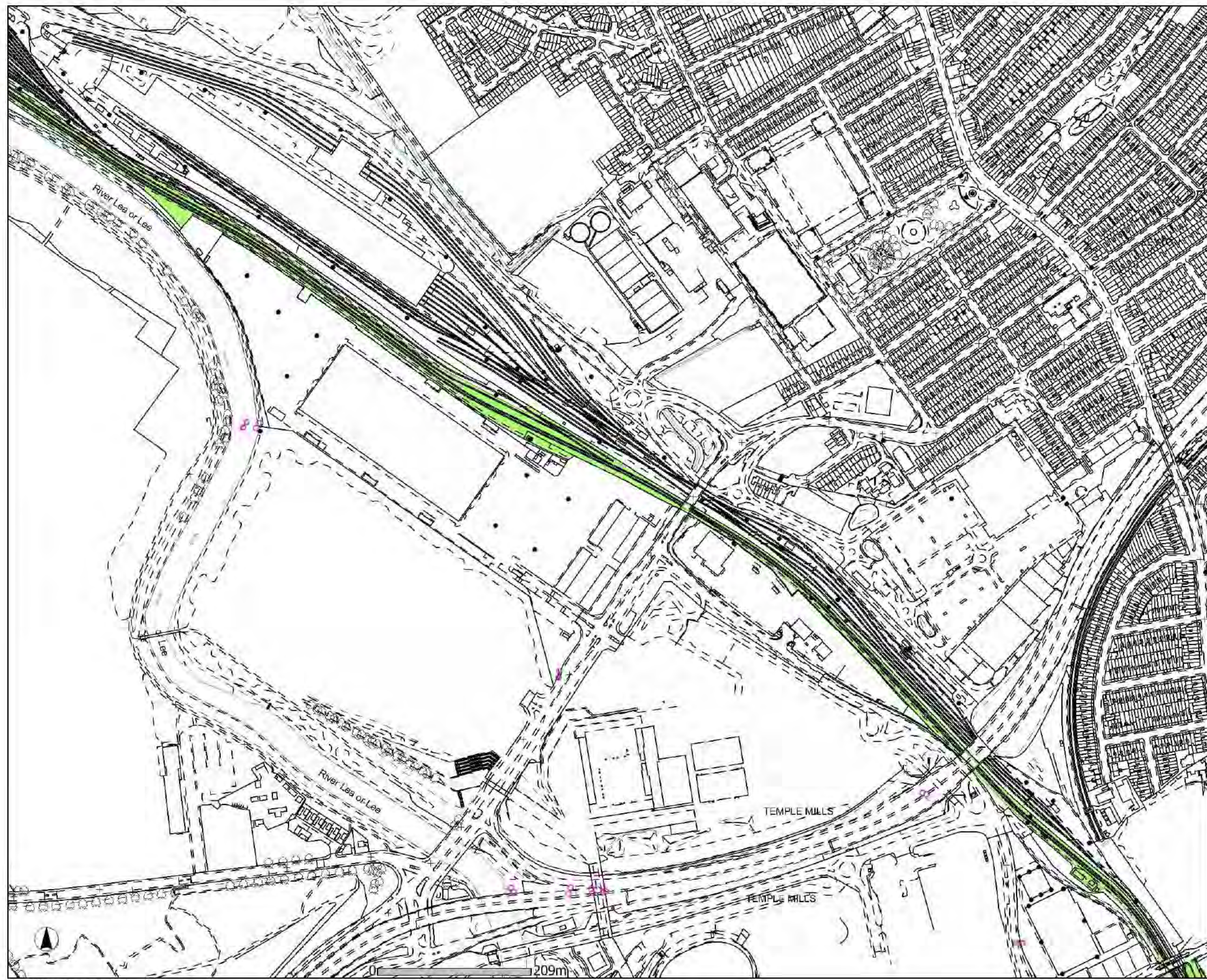
Implementation of the third line should be considered as a single project for inclusion within the future development of the railway. It will also be possible to develop and implement the scheme as a phased development whereby individual aspects could be implemented independently to provide an incremental increase in capacity. For example, the relocation of Ruckholt Road Junction to the south will reduce the time associated with ECS movements blocking the Up line. Providing the new S&C between the Temple Mills Loop and the Carriage siding line could be developed and implemented as a separate project if deemed to offer a capacity benefit following or prior to the relocation of Ruckholt Road Junction. The aspiration to operate approximately 10 No. ECS movements per hour during the peak may result in congestion at the carriage siding entrance, therefore the additional loop could reduce the effect of such an eventuality.

Appendix A – Study Area Overview Map




Plot Scale	1:5000
Plot Date	11/3/2015
	

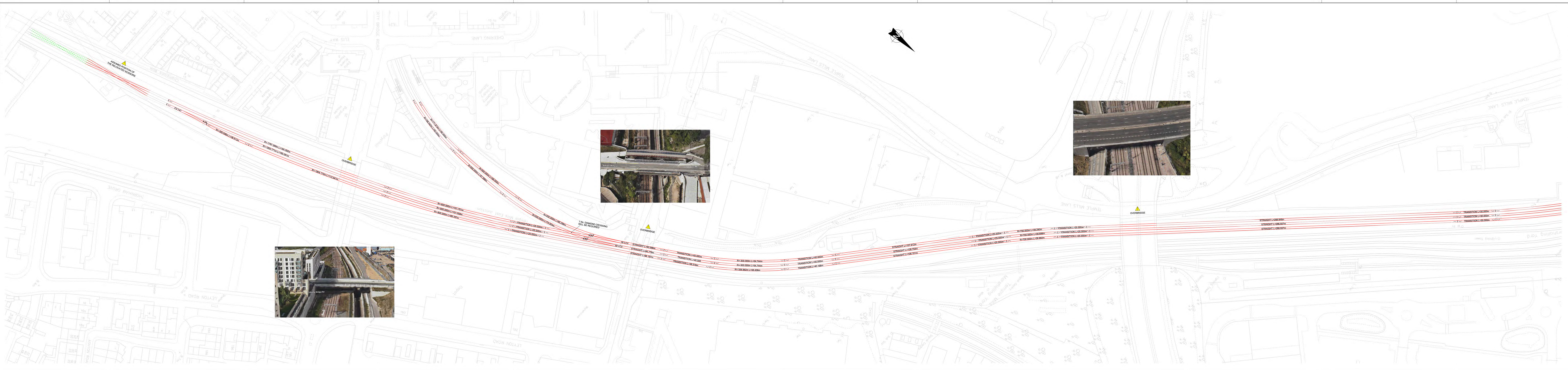
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Centre of Map Window (E,N): 537578, 186035

Plot Scale	1:5000
Plot Date	11/3/2015
	

Appendix B – Stratford to Orient Way Capacity Option Drawings



PROPOSED KEY

- RAIL JOINT STANDARD FISHPATES
- 2 HOLE FLAT FISHPATE ON CONGESTED SIDE
- 4 HOLE FLAT FISHPATE ON CONGESTED SIDE
- TIGHT JOINT FISHPATES
- TIGHT JOINT FLAT FISHPATE ON CONGESTED SIDE FOR USE WITH PARALLEL CHECK RAILS
- RAIL ENDS UNDRILLED (FOR WELDED JOINT)
- 4 HOLE INSULATED FISHPATES DRY
- 4 HOLE CLOSE TOLERANCE INSULATED FISHPATES (BENKLER) DRY
- 6 HOLE CLOSE TOLERANCE INSULATED FISHPATES (BENKLER) DRY
- 4 HOLE INSULATED FISHPATES SHOP GULLED
- 6 HOLE INSULATED FISHPATES SHOP GULLED CHECK RAIL INSULATED FISHPATE UNDRILLED
- DRILLED BOTH ENDS
- CUT TO SUIT
- CAST CENTRELOCK CROSSING
- CAST MONOLOCK CROSSING
- SEMIWELDED CROSSING
- FULLY FABRICATED CROSSING
- LAST LONG BEARER
- TRANSITION POINT CENTRE/GENSIE/ POSITION OF TWIST 1 IN 20 TO VERTICAL
- ADJUSTMENT SWITCH
- HORIZONTAL TANGENT POINT (TP) AND DIRECTION OF CURVATURE
- PARALLEL TRACK INTERVAL
- NEW RAIL
- NEW POSITION OF REALIGNED TRACK
- EXISTING SURVEY AND MATERIALS
- TRACK TO BE REMOVED
- EXISTING IRI TO REMAIN
- EXISTING IRI TO BE REMOVED
- AXLE COUNTER
- SURVEY STATION
- ROAD/PI
- MILEPOST
- LIMIT OF MANUFACTURER'S SUPPLY
- BALLAST RAMP
- THE UNIT FOR SPLIT BEARERS
- POSITION OF HOLLOW BEARERS/SLIPPERS

LEGEND/NOTES:

- The original master copy of this drawing is kept at Network Rail's office in Milton Keynes for audit purposes.
- Associated drawings/reports - 141982-TRK-DRG-GA-002
- Challenges, levels and coordinates are shown in metres. All other dimensions are shown in millimetres, unless otherwise stated. All clearance and site-foot intervals are quoted to running edges (RE).
- This design is based on OD files only. OD map data reproduced by permission of Ordnance Survey Licence number 010000092.
- Track gauge to be nominal 1435mm for plain line and 1432mm for S&C.
- Rail/ quoted are from track centres, unless otherwise stated.
- Clearance sub-tending point (1970mm)-4580mm.
- This drawing specifies an indicative alignment only.
- Further work to be carried out when more detailed information is available.
- Advice should be sought from an installation contractor on installation methodology, staging requirements and track access options.

Designed	Checked	Approved	Sign'd	Date

FOR INFORMATION

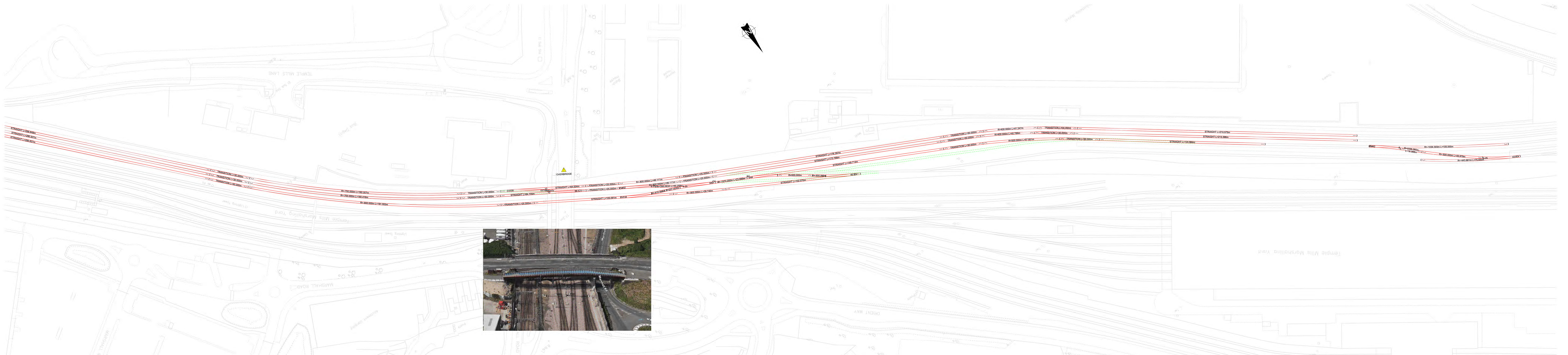
Network Rail

S&C Design Team
Infrastructure Projects (Track)
The Quadrant
Eaton Gate
Milton Keynes
Buckinghamshire
MK9 1EN

Anglia LTTP
Route Study

Stratford to Orient Way
Capacity Scheme
Pre-Grip Feasibility
Study Remit

Scale: 1:500
Sheet: SDC 4m 20ch - 5m 20ch
Drawing Reference: N/A
Revision: 1 of 2
Drawing Number: 141982-TRK-DRG-GA-001
Revision: P01



PROPOSED KEY

- RAIL JOINT STANDARD FISHPLATES
- 2 HOLE FLAT FISHPLATE ON CONGESTED SIDE
- 4 HOLE FLAT FISHPLATE ON CONGESTED SIDE
- TIGHT JOINT FISHPLATES
- TIGHT JOINT FLAT FISHPLATE ON CONGESTED SIDE FOR USE WITH PARALLEL CHECK RAILS
- RAIL ENDS UNDRILLED (FOR WELDED JOINT)
- 4 HOLE INSULATED FISHPLATES DRY
- 4 HOLE CLOSE TOLERANCE INSULATED FISHPLATES (BENKLER) DRY
- 6 HOLE CLOSE TOLERANCE INSULATED FISHPLATES (BENKLER) DRY
- 4 HOLE INSULATED FISHPLATES SHOP GULLED
- 6 HOLE INSULATED FISHPLATES SHOP GULLED CHECK RAIL INSULATED FISHPLATE
- UNDRILLED
- DRILLED ONE END
- DRILLED BOTH ENDS
- CUT TO SUIT
- CAST CENTREBLOCK CROSSING
- CAST MONOBLOCK CROSSING
- SEMIWELDED CROSSING
- FULLY FABRICATED CROSSING
- LAST LONG BEARER
- TRANSITION POINT CENTRE/GENSIDE
- POSITION OF TWIST 1 IN 20 TO VERTICAL
- ADJUSTMENT SWITCH
- HORIZONTAL TANGENT POINT (TP) AND DIRECTION OF CURVATURE
- PARALLEL TRACK INTERVAL
- NEW RAIL
- NEW POSITION OF REALIGNED TRACK
- EXISTING SURVEY AND MATERIALS
- TRACK TO BE REMOVED
- EXISTING IRI TO REMAIN
- EXISTING IRI TO BE REMOVED
- AXLE COUNTER
- SURVEY STATION
- ROAD/PI
- MILEPOST
- LIMIT OF MANUFACTURER'S SUPPLY
- BALLAST RAMP
- THE UNIT FOR SPLIT BEARERS
- POSITION OF HOLLOW BEARERS/SLEEPERS

LEGEND/NOTES:

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- Associated drawings/reports - 141982-TRK-ORG-GA-001
- Challenges, levels and coordinates are shown in metres. All other dimensions are shown in millimetres, unless otherwise stated. All clearance and site-foot intervals are quoted to turning edges (RE).
- This design is based on DG files only. DG map data reproduced by permission of Ordnance Survey license number 2000000922.
- Track gauge to be nominal 1435mm for plain line and 1432mm for S&C.
- Rail/ quoted are from track centreline, unless otherwise stated.
- Clearance pole/obstacle point (1970mm)+450mm.
- This drawing specifies an indicative alignment only.
- Further work to be carried out when more detailed information is available.
- Advice should be sought from an installation contractor on installation methodology, staging requirements and track access options.

Design	Sign	Date
Drawn	Sign	Date
Checked	Sign	Date
Approved	Sign	Date

Rev	Date	Description of Revision	Drawn	Checked	Appr

FOR INFORMATION

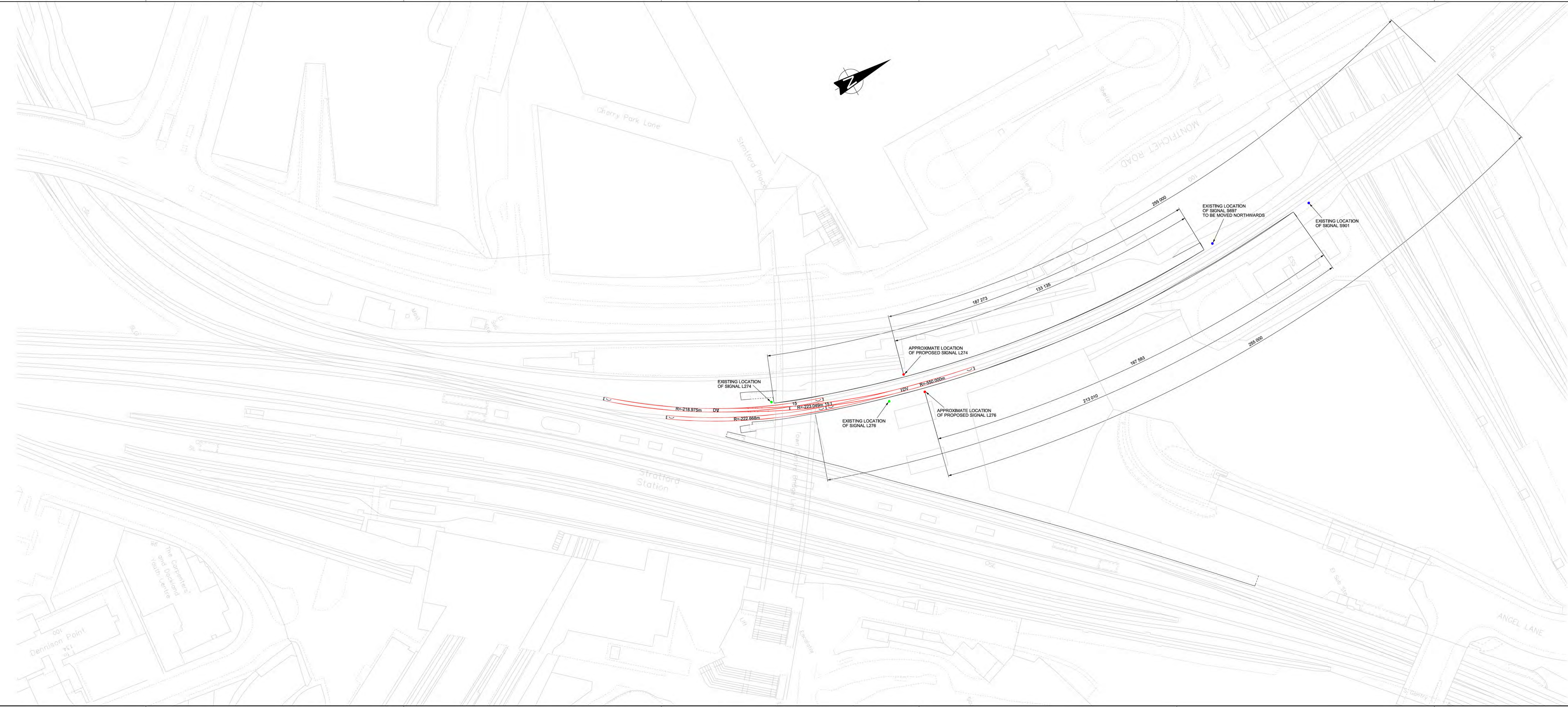
S&C Design Team
Infrastructure Projects (Track)
The Quadrant/MR
Elex Gate
Milton Keynes
Buckinghamshire
MK9 1EN
Project

**Anglia LTTP
Route Study**

Drawing Title
**Stratford to Orient Way
Capacity Scheme
Pre-Grip Feasibility
Study Remit**

Scale: 1:500
Sheet: SDC 4m 20ch - 5m 20ch
Revision: 2 of 2
Drawing Number: 141982-TRK-DRG-GA-002
Revision: P01

LOCATION DIAGRAM



PROPOSED KEY

- RAIL JOINT STANDARD FISHPLATES
- 2 HOLE FLAT FISHPLATE ON CONGESTED SIDE
- 4 HOLE FLAT FISHPLATE ON CONGESTED SIDE
- TIGHT JOINT FISHPLATES
- TIGHT JOINT FLAT FISHPLATE ON CONGESTED SIDE FOR USE WITH PARALLEL CHECK RAILS
- RAIL ENDS UNDRILLED (FOR WELDED JOINT)
- 4 HOLE INSULATED FISHPLATES DRY
- 4 HOLE CLOSE TOLERANCE INSULATED FISHPLATES (BENKLER) DRY
- 6 HOLE CLOSE TOLERANCE INSULATED FISHPLATES (BENKLER) DRY
- 4 HOLE INSULATED FISHPLATES SHOP GLUED
- 6 HOLE INSULATED FISHPLATES SHOP GLUED
- CHECK RAIL INSULATED FISHPLATE
- UNDRILLED
- DRILLED ONE END
- DRILLED BOTH ENDS
- CUT TO SUIT
- CAST CENTREBLOCK CROSSING
- CAST MONOBLOCK CROSSING
- SEMI-WELDED CROSSING
- FULLY FABRICATED CROSSING
- LAST LONG BEARER
- TRANSITION POINT CEN001/CEN001
- POSITION OF TWIST 1 IN 20 TO VERTICAL
- ADJUSTMENT SWITCH
- HORIZONTAL TANGENT POINT (TP) AND DIRECTION OF CURVATURE
- PARALLEL TRACK INTERVAL
- NEW RAIL
- NEW POSITION OF REALIGNED TRACK
- EXISTING SURVEY AND MATERIALS
- TRACK TO BE REMOVED
- EXISTING IRJ TO REMAIN
- EXISTING IRJ TO BE REMOVED
- AXLE COUNTER
- SURVEY STATION
- HAZARD
- MILEPOST
- LIMIT OF MANUFACTURER'S SUPPLY
- BALLAST RAMP
- TIE UNIT FOR SPLIT BEARERS
- POSITION OF HOLLOW BEARERS/SLEEPERS

- LEGEND/NOTES:**
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 2. Associated drawings/reports:-
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 4. This design is based on OS files only. OS map data reproduced by permission of Ordnance Survey licence number 010040692.
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 6. Radii quoted are from track centreline, unless otherwise stated.
 7. Clearance point=fouling point (1970mm)+480mm.
 8. This drawing specify an indicative alignment only.
 9. Further work to be carried out when more detailed information is available.
 10. Advice should be sought from an installation contractor on installation methodology, staging requirements and track access options.

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Approved	Signed	Date

Rev	Date	Description of Revisions	Drawn	Check	Appr

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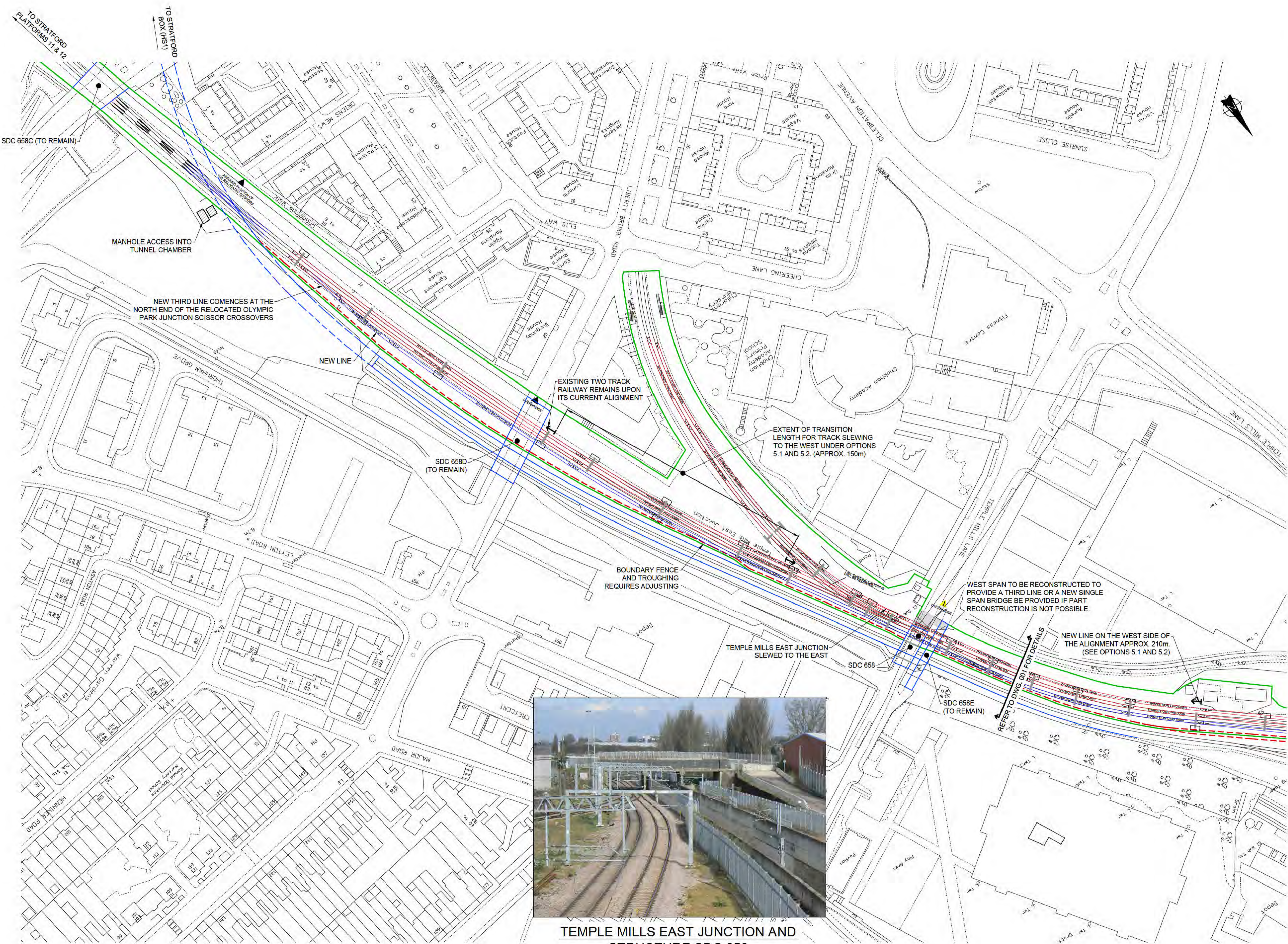
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**Anglia LTPP
Route Study**

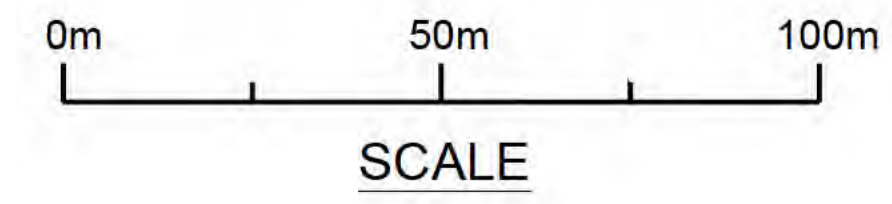
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**Stratford to Orient Way
Capacity Scheme
Pre-Grip Feasibility
Study Remit**

Scale(s)	1:500	ELR & Mileage	SDC 4m 20ch - 5m 20ch
Alternative Reference	N/A	Sheet	1 of 1
Drawing Number	141982-TRK-DRG-GA-003	Revision	P01





TEMPLE MILLS EAST JUNCTION AND STRUCTURE SDC 658



- Legend/Notes
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KEY:

- TWO TRACK CANTILEVER OLE SUPPORT STRUCTURE.
- EXISTING UP+DOWN LINES.
- NEW THIRD LINE.
- OLE PORTAL STRUCTURE.
- SINGLE TRACK CANTILEVER OLE SUPPORT STRUCTURE.

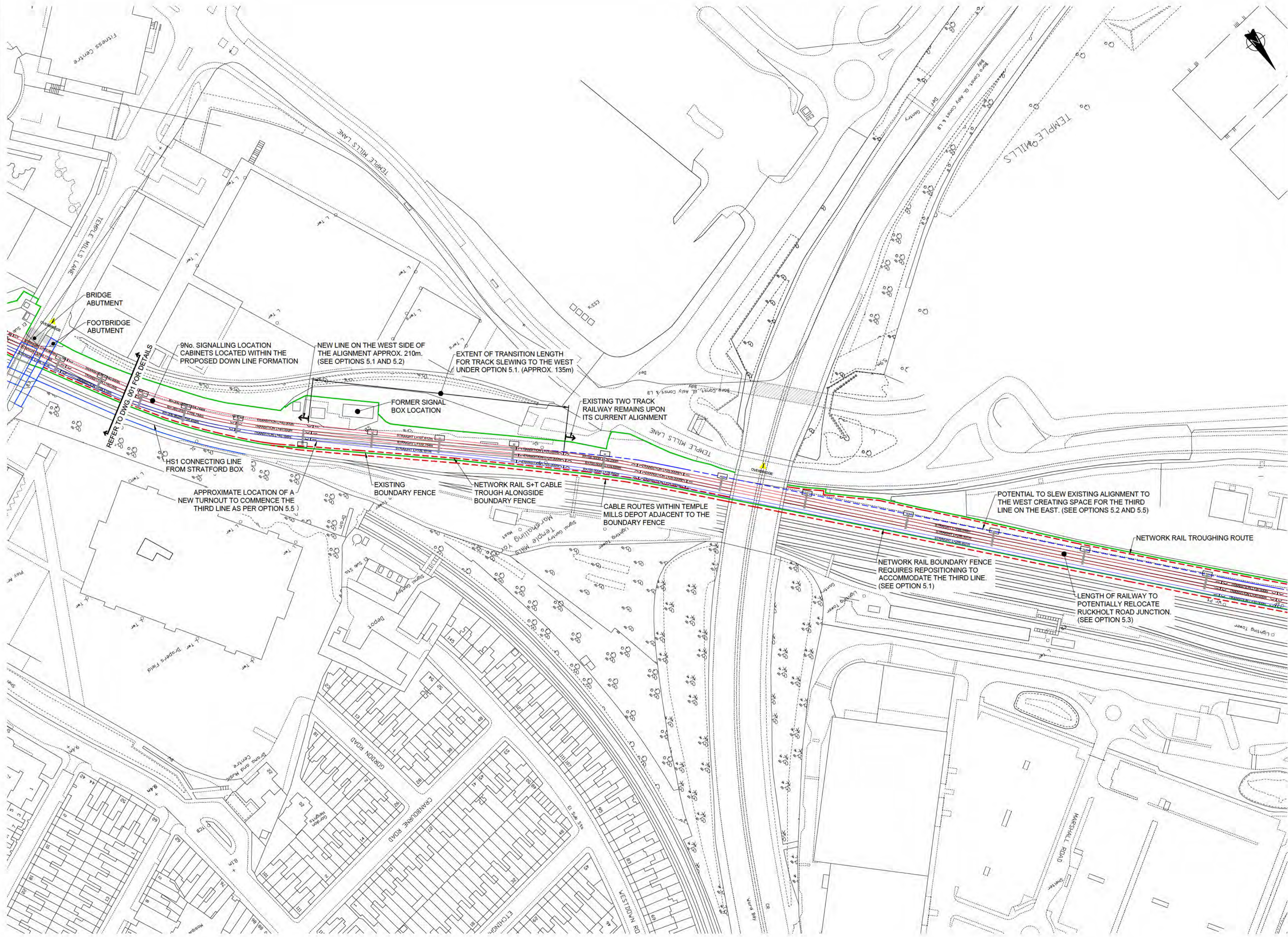
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Status					

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Buildings & Civils
Civils Design Group
Manchester
Square One
4 Travis Street
Manchester
M1 2NY
Tel: 0161 880 3936

ANGLIA LTPP ROUTE STUDY
STRATFORD TO ORIENT WAY
CAPACITY SCHEME

STRATFORD TO ORIENT WAY
(SHEET 1 OF 4)

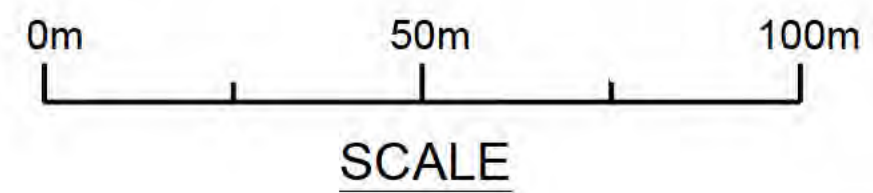
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- OLE PORTAL STRUCTURE.
- SINGLE TRACK CANTILEVER OLE SUPPORT STRUCTURE.



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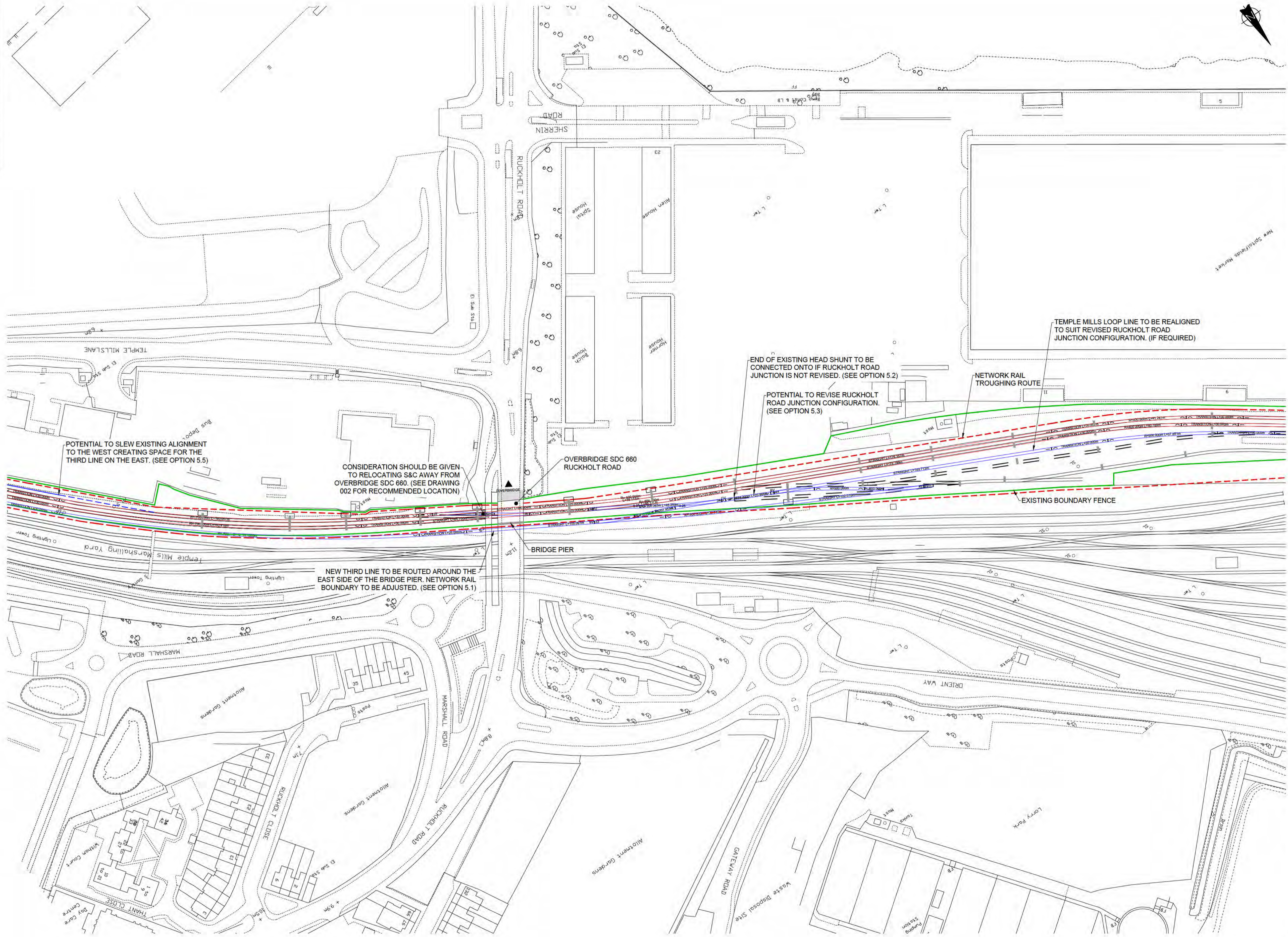
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Civils Design Group
Manchester
 Square One
 4 Travis Street
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 M1 2NY
 Tel: 0161 880 3936



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 STRATFORD TO ORIENT WAY
 CAPACITY SCHEME**

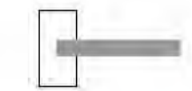




**STRATFORD TO ORIENT WAY
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Checked		Signed		Date	
Approved		Signed		Date	



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KEY:

-  - TWO TRACK CANTILEVER OLE SUPPORT STRUCTURE.
-  - EXISTING UP+DOWN LINES.
-  - NEW THIRD LINE.
-  - OLE PORTAL STRUCTURE.
-  - SINGLE TRACK CANTILEVER OLE SUPPORT STRUCTURE.

Rev	Date	Description of Revisions	GP	RJ	RES
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			Drawn	Chkd	Appr

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Buildings & Civils
Civils Design Group
Manchester
 Squares One
 4 Travis Street
 Manchester
 M1 2NY
 Tel: 0161 880 3936



Project

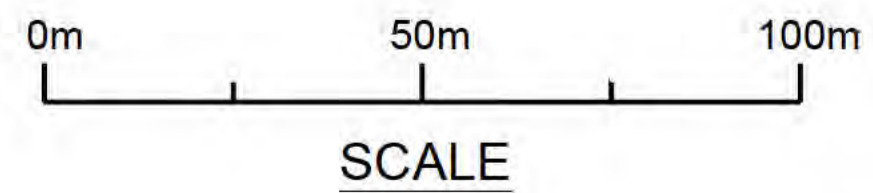
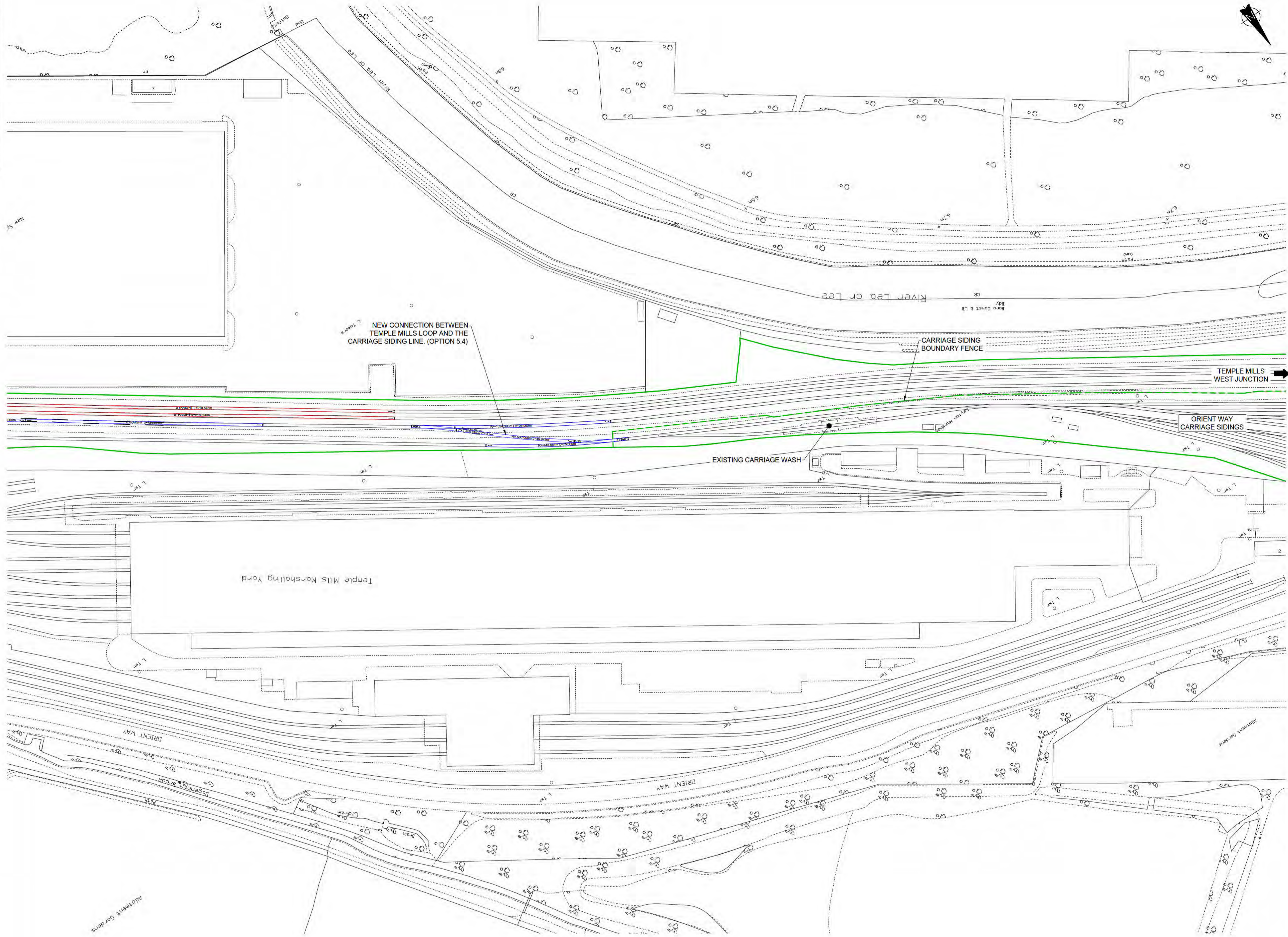
ANGLIA LTPP ROUTE STUDY
 STRATFORD TO ORIENT WAY
 CAPACITY SCHEME

Drawing Title

STRATFORD TO ORIENT WAY
 (SHEET 3 OF 4)

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Approved	Signed	Date

Scales: at A1 Sheet size A1 841 x 841 ELR & Mileage
 ELR : SDC



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P01	24/04/15	FIRST ISSUE			

Designers
**Infrastructure Projects
 Buildings & Civils
 Civils Design Group**
 Manchester
 Square One
 4 Travis Street
 Manchester
 M1 2NY
 Tel: 0161 880 3936



Project

ANGLIA LTPP ROUTE STUDY
 STRATFORD TO ORIENT WAY
 CAPACITY SCHEME

Drawing Title

STRATFORD TO ORIENT WAY
 (SHEET 4 OF 4)

Designer	Signed	Date
Drawn	Signed	Date
Checked	Signed	Date
Approved	Signed	Date

Scale(s) of Plan: 1:1000
 Scale(s) of Profile: 1:100
 ELR & Mileage
 ELR : SDC